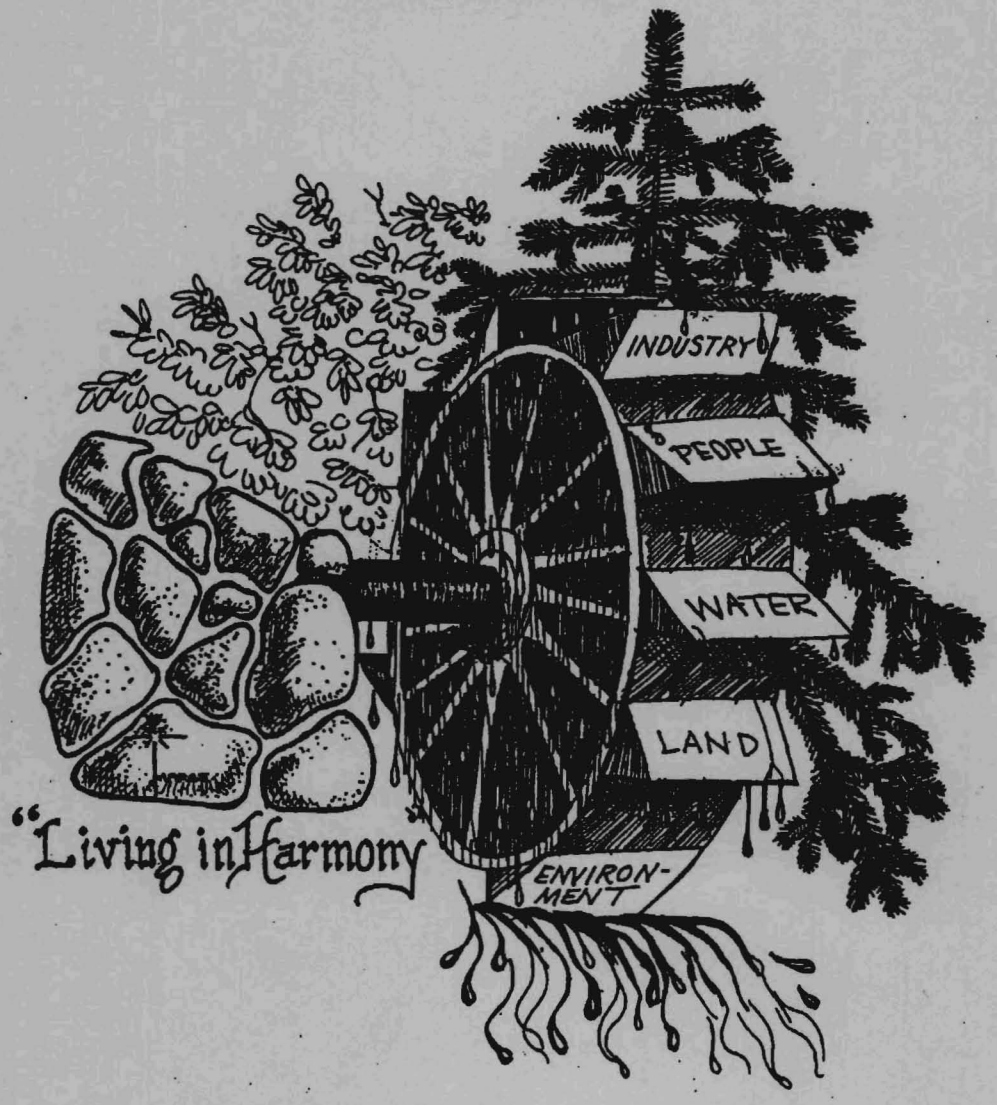
PINE CREEK WATERSHED ASSESSMENT

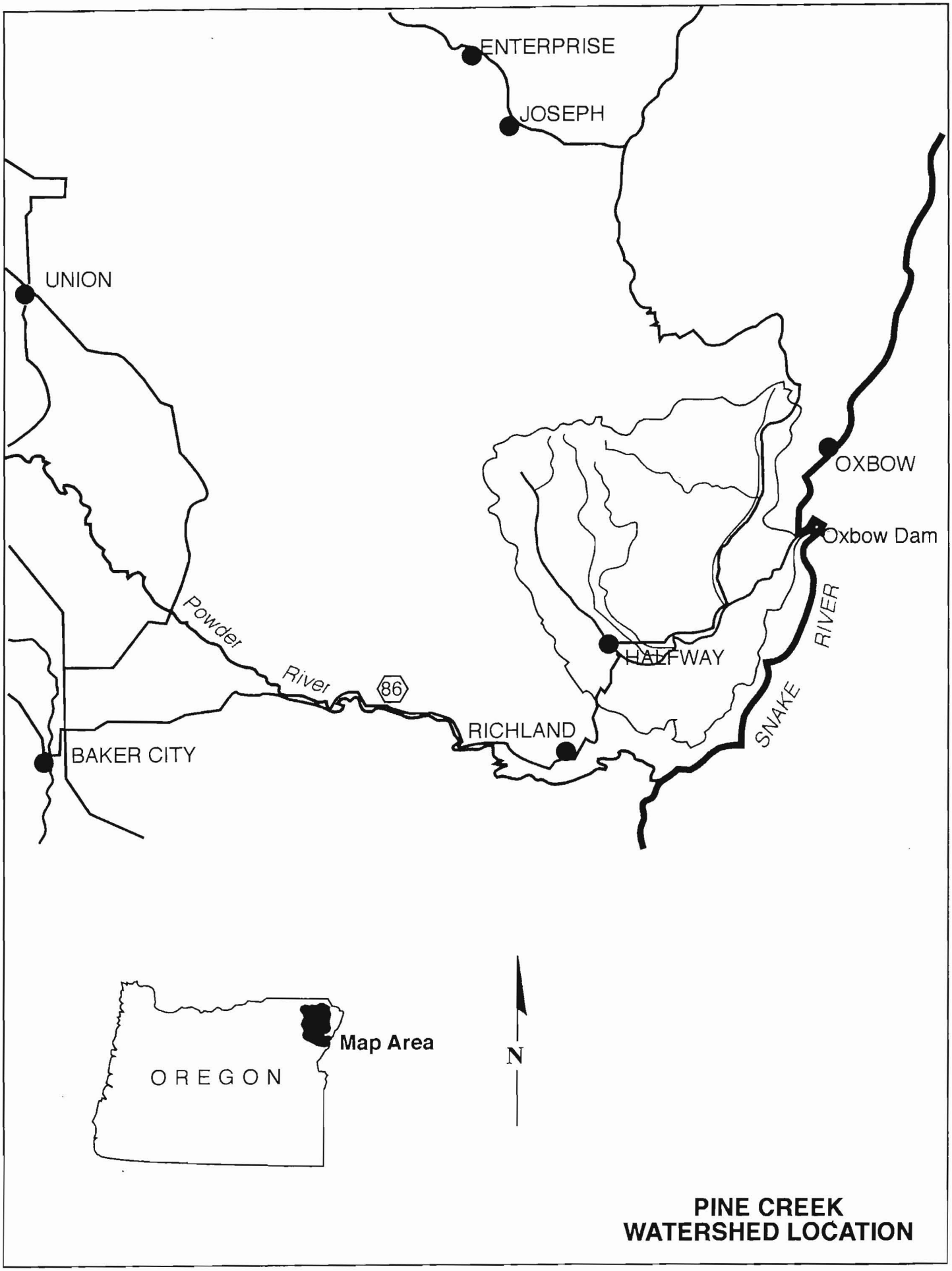
OREGON

Volume 1 of 2



Prepared for the
Powder Basin Watershed Council
Baker City, Oregon

August 2000



PINE CREEK WATERSHED LOCATION

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APPENDICES

ACRONYMS

AUM	Animal Unit Month
BLM	United States Bureau of Land Management
BMP	Best Management Practices
CAFO	Confined Animal Feed Lot Operation
cfs	cubic feet per second
Council	Powder Basin Watershed Council
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPF	Forest Practice Foresters
FAR	Functioning at Risk
gpm	gallons per minute
GPS	Geographic Positioning System
GWEB	Oregon Governor's Watershed Enhancement Board
HU	Hydrologic Unit
HUC	Hydrologic Unit Code
HUD	Housing and Urban Development
msl	mean sea level
mmbf	million board feet
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Dishcharge Elimination System
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
ODA	Oregon Department of Agriculture
ODEQ	Oregon Department of Environmental Quality
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ORS	Oregon Revised Statutes
OSAC	Oregon State Agriculture College
OSU	Oregon State University
OWEB	Oregon Watershed Enhancement Board
OWRC	Oregon Water Resource Commission
OWRD	Oregon Water Resources Department
PFC	Proper Functioning Condition
RHCA	Riparian Habitat Conservation Area
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service (*Forest Service*)
USGS	United States Geological Survey
WAA	Water Availability Analysis
WAB	Water Availability Basins

WPCF	Water Pollution Control Facility
WQLW	Water Quality Limited Water
WQMP	Water Quality Management Plan
WWNF	Wallowa-Whitman National Forest

SUMMARY

Pine Creek Watershed

The *Pine Creek Watershed Assessment* consists of two volumes: Volume 1 - Report; Volume 2 - Letters of Comment. This is Volume 1 and includes information on the condition of basic resources in the watershed and on watershed health issues.

The goal of the Powder Basin Watershed Council (Council) is to assist local stakeholders in the Pine Creek watershed to develop a watershed action plan from this assessment. Prior to the development of that action plan, local stakeholders will be asked to evaluate and prioritize the watershed health issues in this assessment, and to define objectives for additional assessments and watershed improvement needs.

The Council has agreed upon a Vision Statement and a list of Watershed Health Concerns for the Powder Basin (see appendix A).

Pine Creek Watershed Health Issues

1. Issues from the Council's Basinwide List

- **Water Quality Impaired Streams on 303(d) List:** Source: Oregon Department of Environmental Quality (ODEQ). Water quality impaired streams for the Pine Creek Watershed are shown in table 8 on page 53 (stream segment, parameter).
  - Validation of streams/parameters on ODEQ 303(d) list
  - Total Maximum Daily Loads (TMDL) for temperature, and Water Quality Management Plan scheduled for year 2005
  - Assessment of watershed condition and water quality for listed stream segments, including consideration of related politics
  - Loss of riparian ecosystems and stream channel stability
  - Water quality impacts to aquatic resources

- **Bull Trout:** Source: U.S. Fish and Wildlife Service (USFWS)
  - Listed under Federal Endangered Species Act (ESA) in 1998
  - Activities on Federal lands controlled under ESA Section 7
  - Activities on non-Federal lands controlled under ESA Section 10
  - Status of population — moderate risk of extinction

- **Fish Screens:** Source: Oregon Department of Fish and Wildlife (ODFW)
  - Fish mortality due to unscreened irrigation diversions

- Fish screen requirements:
  (a) for stream diversions under 30 cubic feet per second (cfs), fish screens are encouraged
  (b) for stream diversions of 30 cfs or more, fish screens can be required under State law

- **Noxious Weed Invasions:** Source: Tri-County Weed Manager
  - Ecological and economic impacts from weeds are expected to worsen over the long term, even with increased public awareness and weed control.
  - Some weeds are difficult to control; most will be impossible to eradicate.
  - Weed infestations could decrease economic value of land.
  - Weeds compete with native forage species used by livestock and wildlife.

- **Over-Appropriation of Water from Streams:** Source: ODFW, Oregon Water Resources Department (OWRD), and Wallowa-Whitman National Forest (WWNF)
  - Advocates of consumptive water use and instream water use define over-appropriation differently.
  - Water is unavailable to all junior water right holders (e.g., irrigation) as streamflow declines, not just out of stream consumptive users.
  - Streamflow does not fully support desired aquatic resources during some time periods in some stream reaches where exercise of surface water rights (April - October) and storage of water in reservoirs (October - April) greatly reduces streamflow.
  - ODFW instream water right applications are still pending due to questions about the appropriation process for instream flows.

- **Unauthorized Water Use:** Source: OWRD
  - Potential exceedence of rate and duty limitations due to lack of regulated water measurement devices on irrigation diversions.
  - Potential reactivation of surface water rights that have been forfeited due to five or more years of nonuse but have not been canceled.

2. Issues Identified by Assessment Committee

- **Potential Additions to 303(d) List:** Source: ODEQ and WWNF
  - Streams and parameters of concern on ODEQ 303(d) list decision matrix
  - Other streams/parameters on Federal land that Forest Service/Bureau of Land Management (FS/BLM) are monitoring may indicate are not in compliance with water quality standards (re: FS/BLM protocol)
  - Potential to list streams using insufficient data and/or inaccurate tests
  - Water quality standards that may exceed those that the basin can naturally meet

- **Fish Passage:** Source: ODFW and WWNF
  - Dams, irrigation diversions, and stream crossing structures (culverts, etc.) may not provide adequate fish passage.

- **Reservation of Surface Water for Future Economic Development:** Source: Oregon

Department of Agriculture (ODA) and OWRD

- The location and development of dam sites and/or enlarging existing reservoirs may have potential benefits or negative impacts on stream morphology, riparian areas, water quality, etc.
  a) potential for 6,000 acre-feet of additional surface water storage in Clear Creek subwatershed
  b) potential for 4,000 acre-feet of additional surface water storage in East Pine Creek subwatershed

- **Riparian Area Health:** Source: Interior Columbia Basin Ecosystem Management Project
  - Past and current land management practices, mining, and recreation have led to some riparian degradation.

- **Hydrologic Function:** Source: Interior Columbia Basin Ecosystem Management Project and Wallowa- Whitman National Forest
  - Alteration of natural streamflow which may **benefit or degrade** watershed due to:
    a) storage and release of stored water
    b) diversion of water for irrigation and mining
    c) reduced ground cover due to wildfire, grazing, timber harvest, roads, and mining
    d) extension of drainage network by roadside ditches, road ruts, gullies and irrigation and mining ditches
    e) floodplain confinement by dikes, road fills, and gullies
    f) 1997 flood, which was natural condition, altered floodplains, riparian wetlands, and hydrologic function of many streams
    g) siltation in some streams from past mining practices and other activities has affected the fish spawning and rearing capabilities in those streams; high turbidities occur in some streams

- **Soil Productivity:** Source: Interior Columbia Basin Ecosystem Management Project
  - Reduction in soil productivity due to:
    a) soil displacement, mixing or compaction associated with timber harvest, road construction, mining, agriculture, and urban development
    b) soil erosion as evidenced by gullies, rills and sheet erosion in roadside ditches, stream channels, and uplands
    c) ecosystem changes due to aggressive noxious weeds

3. Issues Identified by Others

- **Effects of Uncontrolled Runoff:** Source: M. Kerns, Rancher from Haines, Oregon
  - Uncontrolled snowmelt causes erosion, turbidity, and sedimentation.
  - Reservoir could be used to capture sediment and improve water quality.

Information Needs

Information that is not available and could be essential to the development of an Action Plan is listed below:

- Location and development of location map for irrigation diversions and dams that do not provide for fish passage.
- Pine Creek watershed water rights summary of groundwater, surface water, and reservoir in cubic feet per second, acre-feet, and acres served.
- A list of irrigation ditches with OWRD approved measuring devices.
- Information on economic benefit value of resources that are dependent upon water as a necessity of life.
- Knowledge of actual amounts of water that is imported into Pine Creek basin.
- Consider the potential for adding additional storage space to Sugarloaf Reservoir. Partnerships with the holders of those water rights could provide additional water flow during low flow periods in Clear Creek and possibly East Pine Creek. Opportunities such as this should be explored with all reservoirs (Paul Joseph, landowner in Halfway area).
- Obtain water quality information for drainages where information is minimal or nonexistent.
- Study needed to determine if fish screens improve fish survival.
- Reaches of streams that are dewatered by human activities.
- The Federal Ditch Bill [1](1986) regarding permanent easements on public lands. Determine which irrigation ditches are affected that require the installation of fish screens.
- Define watershed indicator species of ecosystem health.
- Studies should be conducted to determine if toxins do exist in Lake Fork Creek and also determine whether there are mine leachates and cyanide residuals in Upper Pine Creek.
- A list of potentially over-appropriated streams in the Pine Creek basin.
- Identify Confined Animal Feed Lot Operation (CAFO) sites in the Pine Creek basin or feed lots not covered by CAFO which are causing problems.

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

- Information on private land grazing practices.

- Timber Harvest — There is a need for specific year-by-year data and specific site location of sales. A table of sale volume by year for each creek drainage would be helpful in deciding how logging may be affecting the watershed.

- Fire Locations — The same type of analysis as used for timber harvest would be helpful in deciding how fires may be affecting the watershed.

- Need to find out how, where, why, and how often flood flows have damaged irrigation diversions and canals.

- Abandoned groundwater wells in the Pine Creek watershed should be identified and closed to prevent potential of polluting groundwater.

- More temperature data is needed to correlate with bull trout life histories, persistance, and survival.

- How far, if at all, are stream temperatures above historical natural highs and at what locations (J. Spriet, OWRD).

- The effects of the existing reservoirs upon water temperatures should be analyzed.

- Identification of underground storage tanks.

- The extinction of bull trout cannont be estimated without long-term population counts and the establishment of trends. This requires at least a 10-year study and perhaps much longer.

- Determine what part of bull trout stream habitat is located in areas that are grazed. There is a need for a breakdown of grazing allotments by stream.

  Determine what portions of streams are not grazed. A grazing trend graph would be helpful along with a location map.

- If fish populations require adequate year-round streamflows of silt free water at an acceptable range of temperatures, what effect would a large wild fire have on these populations of listed fish.

- What is the total fish mortality (yearly) that is caused by unscreened irrigation diversions? Does the amount of water being diverted, in cubic feet per second (cfs), effect the amount of this mortality?

- Determine what part of bull trout habitat is located in areas that are burned over from both wildfire and prescribed burning.

- The total miles of streams by class (size, type, etc.).
- The total miles of riparian fencing along the streams.
- Identify and show on map the miles of roads within the watershed by condition and type and within 200 feet of a stream. The condition of the roads and location in relation to the riparian areas are important. The type of road: dirt, gravel, paved, etc., is very important as each impacts the watershed differently.
- Actual use of BLM and USFS allotments as compared to what is used on an annual basis.
- Suggest listing the percent of the watershed in each of the major plant communities. A GIS map would also be appropriate. The ODF Vegetative Inventory would be a source of this information for private and BLM lands. Wetlands and upland vegetation could also use information from the ODF Vegetative Inventory.
- Maps — Several maps in the assessment do not have a logical connection to the analysis. For example, the road map shows a number of roads without delineating road type (gravel, dirt, paved).

  Information on maps can be used to communicate issues and their location to watershed residents. For this reason, it would be beneficial for the maps to have general locators, such as, land boundaries and stream names. It is important to put land management jurisdictions on the maps because that may help with interpretation and targeting actions. The "Water Quality Limited Streams" map is an example of a map that should have ownership and stream name delineated.
- Why are dead fish not found in stretches of some streams that become "dewatered" during low flow periods? Do the fish migrate upstream or downstream when the low-flow periods start?
- What exactly are the land management practices that degrade riparian areas? To what extent do any of the land management practices exist in the Pine Creek basin?
- Some reaches of streams are dewatered by irrigation water withdrawal and some are dewatered naturally. The reach of upper Pine Creek above the mouth of East Fork is a good example. This ¼ to ½ mile of creek bed frequently appears dry in the fall of the year. There is considerable water above this area but it simply appears to disappear into the creek bed. It reappears at the mouth of East Fork. What happens to the fish?
- What are the specific land use activities that have caused the siltation affecting fish spawning and rearing? To what extent do these activities exist in Pine Valley?
- There should be a link tying together the effects to the forest land ecosystem and large insect populations (Arvid E. Anderson).

Key Findings

A. Water temperatures of several stream reaches are above the thresholds established by ODEQ for certain fish species, including bull trout, during the warmer time of the year (e.g., Pine Creek, Clear Creek, East Pine Creek, Lake Fork Creek). Several other streams in Pine Valley probably exceed the established water temperature thresholds.

B. Late summer streamflows are often insufficient to satisfy irrigation water demand, even with release of stored water.

C. Irrigation water management in Pine Valley is a concern. The Pine Creek Decree allows application of up to 7.0 acre-feet per acre (further defined in text), which greatly exceeds consumptive use. There are few lined ditches, pipelines, or sprinkler systems in Pine Valley.

D. Water measurement devices are used in Pine Valley; most ditches have Parshall flumes and there are some rectangular flumes. More measuring devices are needed.

E. Fish passage or bypass is lacking on many streams when irrigation diversion structures that hinder fish passage are in use (i.e., Pine Creek, East Pine Creek, Fish Creek). Bypass is prevented by stream dewatering and/or physical barriers. Some dams are seasonal or year-long barriers to fish passage. Long-term fish population recovery will require fish passage improvements.

F. Fish screens are lacking on most irrigation diversions.

G. Bull Trout:

1. Two unscreened irrigation points of diversion are known to exist within the known occupied range of bull trout habitat in the watershed. One diversion is on Meadow Creek Ditch in upper Clear Creek; the other diversion is at the head of Hooker Flat Ditch on Aspen Creek in upper Elk Creek.

2. Several ongoing or proposed projects in the watershed on national forest lands are considered "likely to adversely affect" bull trout. These projects include the Clear Creek Timber Sale, West Pine Valley Allotment, East Pine Valley Allotment, Norway Mine, Outfitter Guide Special Use Permit, and Road Maintenance (U.S. Fish and Wildlife Service, 1999). The U.S. Fish and Wildlife Service (USFWS) concluded that these projects were not likely to jeopardize the continued existence of the Columbia River Basin population of bull trout. The Forest Service must monitor each project and report to the USFWS annually.

3. Summer bull trout distribution is well documented (Buchanan, et.al. 1977), and pre- and post-spawning movements have been documented (Chandler, et. al. 1999 [draft]). The amount of connectivity between the local populations in upper Pine Creek, Clear Creek, East Pine Creek, and Elk Creek subwatersheds is unknown. Some observations of bull trout have been recorded in the Hells Canyon Reservoir, and some use of the mainstem of Pine Creek

and North Pine Creek has been documented (Chandler, personal communication, 1999).

H. Noxious weeds are spreading in the watershed and are a serious environmental and potential economic threat, especially in rangelands. Weeds of greatest concern are knapweeds and Dalmation toadflax in East Pine Creek and rush skeleton weed.

I. The city of Halfway is updating its "National Pollutant Discharge Elimination System" (NPDES) permit to include land application of sewage lagoon effluent during the summer to eliminate all summertime discharge into Pine Creek.

J. More complete information is needed on several key topics:
   1. Fish species present/absent in streams with N/S status in table in appendix H
   2. Water diversion, conveyance, and storage facilities where fish bypass, fish screens, and/or water measurement devices are lacking and are needed
   3. Water rights that have been abandoned
   4. Opportunities to provide more late summer streamflow through improved water use efficiency, diversion management, etc.
   5. Proper Functioning Condition (PFC) information for streams and wetlands

K. Through the action plan process, direct and indirect effects upon the bull trout populations should be identified. This would then point to possible restoration plans.

L. The Baker County watermaster has indicated there have been unauthorized irrigation uses in the Pine Creek watershed. When the watermaster becomes aware of unauthorized users, steps are taken to correct the problem (within resource limitations).

M. Fifteen irrigation diversions are located on national forest lands.

N. In many of the over-appropriated streams, the instream water rights are so junior that they would be ineffective at protecting streamflow for instream values.

O. Potential additions to the 303(d) list would have to be reviewed to determine if they have other issues that need to be addressed.

P. Forest insects and disease are having a significant role in forest health.

Q. The city of Halfway is subject to flood water damage from Pine Creek and overland flow from the area immediately to the west, where irrigation canals intercept and concentrate the runoff.

R. Barring a major increase in the level of management on national forest lands, the potential for future stand replacement fires will likely increase as fuel loading continues to build across the watershed. Such fires could significantly affect short- and long-term water quality.

S. Siltation of streams caused by past and current land use activities has affected fish spawning and rearing capabilities of streams.

T. Some mine tailings that were washed directly into Pine Creek still remain in the riparian area of Pine Creek. These tailings are listed as hazardous waste by ODEQ.

U. County road authorities and the Oregon Transportation Department have constrained stream channels in the watershed. These constraints resulted in down cutting; thus affecting natural floodplain function and water quality.

V. Irrigated agriculture has economically benefitted the watershed.

W. Sediment discharge is a natural and beneficial function of streams, providing for channel maintenance and floodplain productivity. On-channel reservoirs disrupt these processes.

X. The release of water from storage for use by water users with a storage right can increase the flow of the stream to the point of withdrawal. In many cases, even without any diversion of water, there would be no streamflow late in the season if there was no storage. Storage water releases keep more water in a stream later in the summer than natural streamflow would. This maintains stream bank water storage longer. The release of stream bank water storage helps keep water in the stream longer in late summer months than natural streamflow would.

Next Step - Action Plan

The Assessment Committee offers the following suggestions:

1. Develop the Pine Creek Watershed Action Plan following the guidelines outlined in *Guidelines for Watershed Councils,* Vol. 2, Final Report to the Legislature, Oregon Watershed Health Program, 1995. (Particular attention to guideline numbers 6, 7, and 10.)

2. Use a collaborative planning process that solicits input from all major landowners and all interested residents of the Pine Creek Watershed.

3. Objectively study and evaluate the watershed health issues, key findings, and information needs described in this assessment. Ask the Assessment Committee to explain anything that is unclear.

4. Prioritize major information needs, and set goals and time lines for obtaining critical information needed for the planning process.

5. Prioritize the issues, after considering funding opportunities, and goals and time lines of state and Federal regulatory agencies, including OWRD, ODFW, ODEQ, and USFWS. For example, ODEQ should begin the TMDL process in the year 2005. USFWS may have earlier deadlines for accomplishing actions needed to protect bull trout (and other species that may be listed in the near future, e.g., lynx).

6. Develop potential actions for all issues. Consider focusing the plan on one or more issues with a high probability of implementation in the first few years after the plan is completed. Deferred action and no action may be appropriate for some issues, depending on risk and responsible agency or private interests.

Funding could be obtained through the Oregon Watershed Enhancement Board (OWEB) grants, other grants, land owner, local entity, and/or agency (local, state, and Federal) cost share.

Assessment Committee

This document was made possible by funding from the Oregon Watershed Enhancement Board and through in-kind services by Assessment Committee participants representing various entities or as private citizens.

The Pine Creek Watershed Assessment was accomplished by the Assessment Committee at the request of the Council. The Assessment Committee members are:

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INTRODUCTION

Powder Basin Watershed Council

The Powder Basin Watershed Council (Council) began in 1991 as the Baker County Water Advisory Board. The board's main function was to advise the Baker County Court on water issues particularly relevant to the county. The board advised the County Commission on many water-related issues, including needs for water storage, water management, fish screens, fish by-passes, groundwater problem areas, and watershed improvements.

In 1995, the advisory board was reorganized into a Watershed Council under provisions of Oregon House Bill 2215 (1993). Under HB 2215 and its subsequent successor, HB 3441 (which further defined the structure and functions of Watershed Councils), the State of Oregon authorized the formation of watershed councils as experimental attempts to include grassroots knowledge and cooperation in addressing Oregon's environmental issues. Baker County has convened and legally recognized this Council as empowered to advise the county officials regarding retaining, restoring, and enhancing the health of its watersheds.

The focus of the Council has been to develop a sustainable organization capable of dealing with the issues of local watershed health. These issues include:

- Assessment of the watershed's natural and human resources
- Prioritization of environmental needs
- Development of an Action Plan addressing those environmental needs

Recent Activities

In 1996, the Council completed a preliminary assessment of basinwide watershed interests and concerns represented by Council members.

The Pine Creek watershed was chosen as the first assessment area because a substantial amount of information was available from existing assessments by the Wallowa-Whitman National Forest (WWNF) and the Oregon Department of Fish and Wildlife (ODFW), and because the strongest bull trout population in the Council's area of influence may be located in this watershed.

In 1998, the Oregon Department of Environmental Quality (ODEQ) completed a state-wide Unified Watershed Assessment which prioritized watersheds for restoration, including eligibility for funding under the Federal Clean Water Action Plan. The WWNF and the Bureau of Land

Management (BLM) Vale District have completed basin and biological assessments for Federal lands in the Pine Creek watershed.

Following completion of the preliminary assessment for the Powder Basin drainage, the Assessment Committee subdivided the Powder Basin into 10 watersheds, and prioritized these watersheds for assessment. These watersheds listed in order of priority are: Pine Creek, North Powder River, Upper Powder River (Sumpter), Upper Powder River (Baker), Eagle Creek, Lower Powder River, North Fork Burnt River, West and South Forks Burnt River, Burnt River, and Snake River.

The Assessment Committee recommends that this assessment be viewed as a document that will be periodically updated to meet Council and local community needs. The content of this assessment requires review and approval by the Council before the Council, and the landowners in the watershed will begin developing an action plan for the Pine Creek watershed.

OVERVIEW OF THE PINE CREEK WATERSHED

Location

Pine Creek is located in Baker County in northeast Oregon, close to the Idaho border. The largest town is Halfway, located about 50 miles east of Baker City. The Pine Creek watershed covers approximately 195,800 acres, ranging from valley land along the Snake River up to subalpine forest at 7000 feet elevation. About 58 percent of the watershed is public land administered by the WWNF, 31 percent is private land, and the remaining 11 percent is public land administered by the BLM, State of Oregon, and Baker County.

Pine Creek originates in the Eagle Cap Wilderness at Pine Lakes. Most of the subwatersheds begin high on the Imnaha Divide and converge into Pine Creek near where lands in agricultural production surround the community of Halfway. From there, Pine Creek flows through a narrow canyon past its major tributary North Fork Pine Creek and flows to the confluence with Hells Canyon Reservoir on the Snake River. The Pine Creek watershed U.S. Geologic Survey (USGS) map is figure 1, page 5.

Subwatersheds

There are two subwatershed maps for the Pine Creek watershed. The new 1999 draft map consists of 15 subwatersheds ranging in size from about 6,000 to 19,000 acres (figure 2). Coding is numeric instead of alpha-numeric, and is from upstream to downstream.

An interagency Federal/state task group is now mapping 5th-code (see text box) hydrologic units in Oregon. It is anticipated that Pine Creek will remain a 5th-code watershed. Following completion of this project, an interagency group must agree on a 6th-code subwatershed map for Pine Creek. The new 1999 map in this report will be the starting point for that discussion.

The original or old map dating from 1991 consists of 12 subwatersheds ranging in size from about 9,000 to 30,000 acres (figure 3). Several subwatersheds on this map do not comply with new national watershed mapping standards. Some problems include the need to change subwatershed coding, remove Long

Identifying Watersheds

Hydrologic Unit (HU). *An area of land upstream from a specific point on a stream (designated as the mouth or outlet), which is defined by a hydrologic boundary that includes all of the source area that could contribute surface water runoff directly or indirectly to the designated outlet point. The HU may also contain associated surface areas such as unconsolidated, non-contributing, and trans-basin diverted associated with the certain designated outlet point. It may also have one or more of the same level hydrologic units completely contained within the upstream drainage area.*

Earlier versions of the Watershed and Subwatershed delineations may have utilized administrative boundaries such as state and county or project lines to define Hus. The HU boundaries must be determined solely upon hydrologic principles to obtain a homogeneous national seamless digital data layer.

Hydrologic Unit Code (HUC). *The identifier of a specific HU. It is determined by an established system of assigning numbers and alpha characters in a specified order and in different fields of a composite code (Watersheds and Subwatersheds, 10 and 12) that represents specific subdivisions of the nations drainage at different levels of detail or size. The following is composed of the USGS FIPS standard for identifying the first four levels of delineation plus a continuation of the FIPS standard method for the next two levels of sub-division.*

Subwatershed. *A delineated HU depicting the location of a drainage area that is typically 10,000 to 40,000 acres in size; although it can be as small as 3,000 acres. The 6th division level of the nation's drainage. Represented by extending the 10-digit HUC to 12-digits.*

Watershed. *The 5th level of HU delineation. Continues the 1974 Water Resources Council / USGS 4th level hierarchy of Hucs to the next smaller useful size. This is represented by extending the 8-digit HUC to 10-digits. Typical size is 40,000 to 250,000*

Branch Creek from subwatershed 15G, split out McMullen Slough from subwatershed 15K, move the lower boundary of subwatershed 15L to McMullen Slough, and delineate Deer Creek and Fourmile Creek from subwatershed 15F.

New interpretation 15 subwatersheds (1999 map)	Old interpretation 12 subwatersheds
01 – Upper Pine Creek - Mile 18	15A – Pine Creek - mouth
02 – McMullen's Slough	15B – Lower North Pine Creek
03 – Pine Creek - Mile 15	15C – Lake Fork Creek
04 – Clear Creek	15D – Elk Creek
05 – Deer Creek	15E – Upper North Pine Creek
06 – East Pine Creek	15F – Pine Creek - Canyon
07 – Dry Creek	15G – Fish-Long Branch Creeks
08 – Pine Creek - Mile 8	15H – East Pine Creek
09 – Fourmile Creek	15I – Dry Creek
10 – Fish Creek	15J – Clear Creek
11 – Upper North Pine Creek	15K – Pine Creek - Valley
12 – Lake Creek	15L – Upper Pine Creek
13 – Elk Creek	
14 – Lower North Pine Creek	
15 – Lower Pine Creek	

Individual subwatershed maps (1999) may be found in appendix B.

PINE CREEK WATERSHED
USGS 7.5 Minute Quads

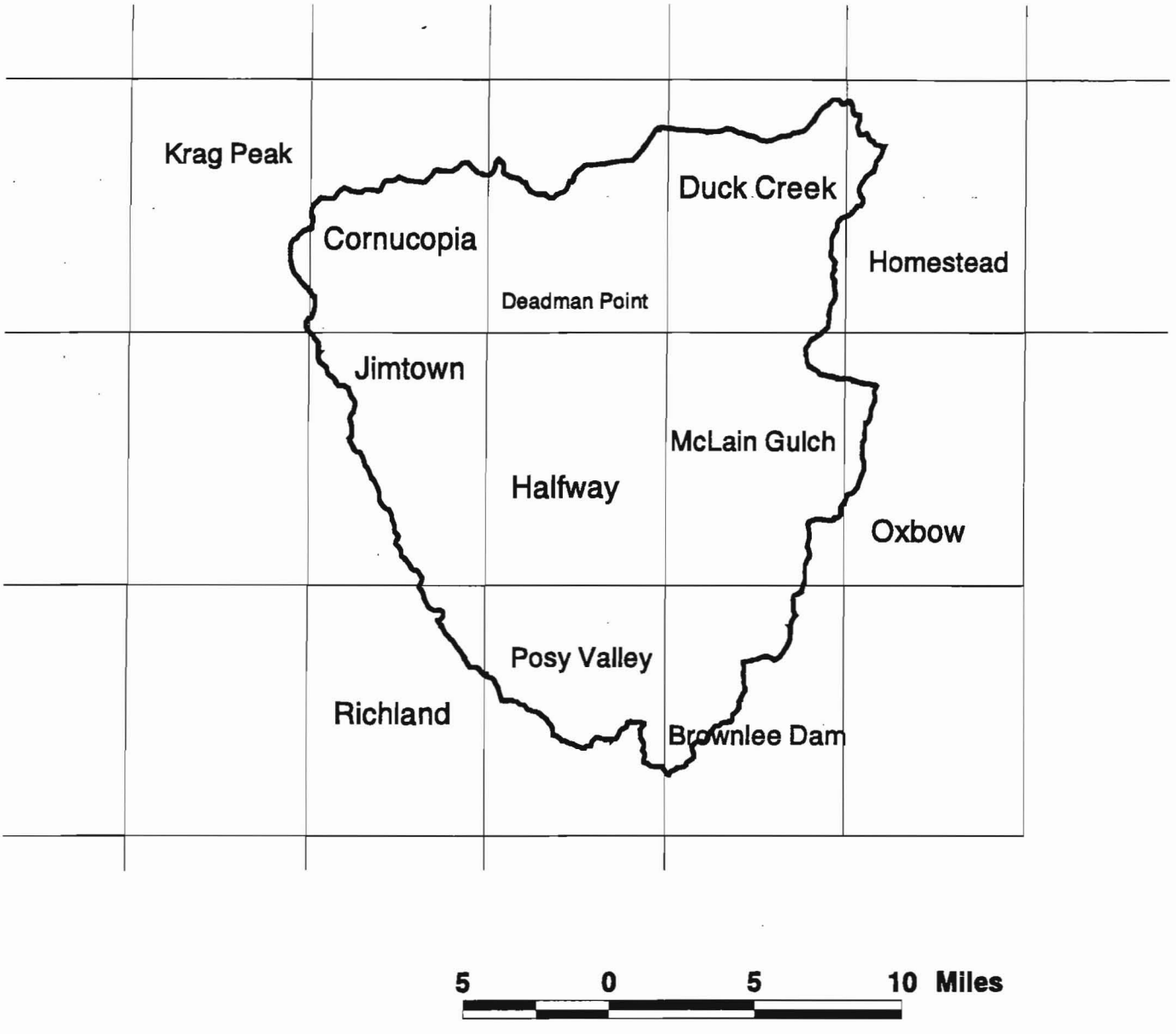
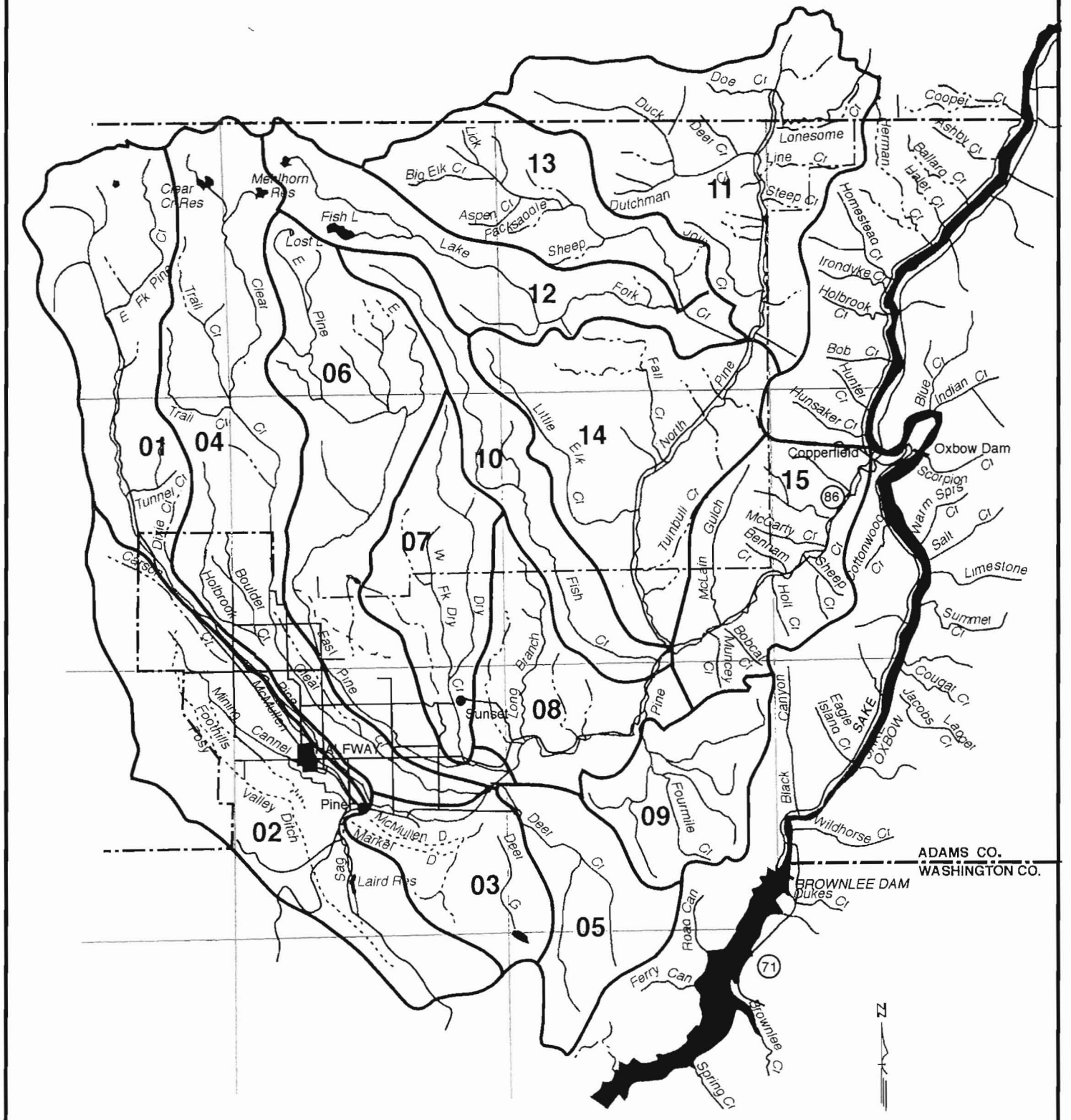


FIGURE 1



PINE CREEK SUBBASIN HYDROLOGIC DESIGNATIONS

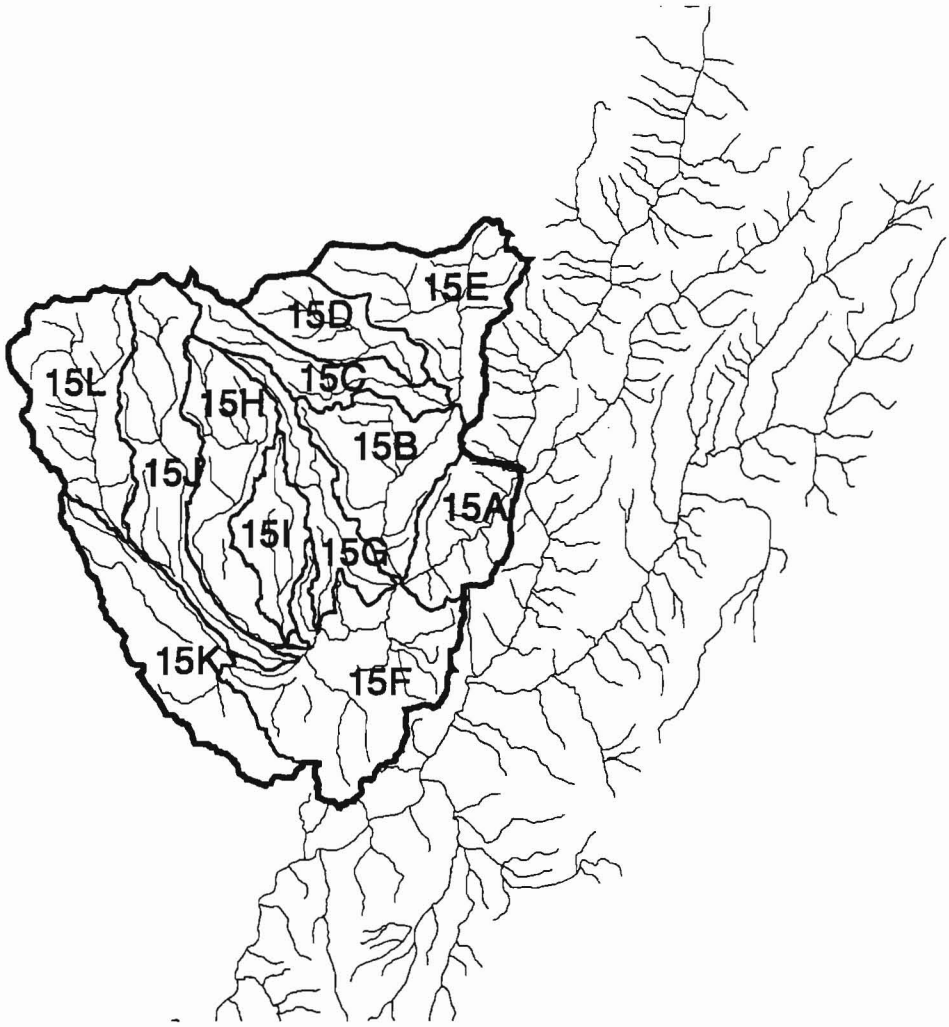
01 - Upper Pine Cr-Mile 18
02 - McMullen's Slough
03 - Pine Creek-Mile 15
04 - Clear Creek
05 - Deer Creek
06 - East Pine Creek
07 - Dry Creek
08 - Pine Creek-Mile 8
09 - Fourmile Creek
10 - Fish Creek
11 - Upper North Pine Creek
12 - Lake Creek
13 - Elk Creek
14 - Lower North Pine Creek
15 - Lower Pine Creek

0 6 Miles

PINE CREEK SUBWATERSHEDS

FIGURE 2

PINE CREEK WATERSHED
Old Subwatersheds
(with 100k streams)



Ws15 = Watershed Boundary
Sws15 = Subwatersheds
- 15A
- 15B
- 15C
- 15D
- 15E
- 15F
- 15G
- 15H
- 15I
- 15J
- 15K
- 15L
- Streams

5 0 5 10 Miles

N
W E
S

FIGURE 3

Subbasins

The Powder Basin includes three subbasins shown on the 1974 U.S. Water Resources Council Hydrologic Unit Map for the State of Oregon. These are also referred to as 4th-code watersheds. Pine Creek is a 5th-code watershed that is located within the Brownlee Reservoir Subbasin (17050201) or 4th-code watersheds.

Climate

The climate of the Pine Creek watershed is continental with very dry summers and low annual precipitation. Precipitation amounts vary from over 70 inches in the high elevations of the Wallowa Mountains to 10 inches near the Snake River (see figure 4, page 12). Average annual precipitation is 27.6 inches. Winters are severe and summers are warm in the high mountains; while winters are mild and summers are hot closer to the Snake River. Most of the precipitation across the watershed falls as snow. Only about 10 percent of the watershed is above 6000 feet elevation, where most of the snowpack occurs.

The Halfway Weather Station temperature, precipitation, and water balance data is shown in table 1, page 11.

Geology

The glaciated Wallowa Mountain uplift and the fault block valley of Upper Pine Creek characterize the geomorphology of this watershed. The total relief is 7315 feet, ranging from 2240 feet mean sea level (msl) near the confluence of Pine Creek with the Snake River to 9555 feet msl on Red Mountain. The northern portion of the watershed is a steeply mountainous forested area. Glaciation has been common, leaving much debris in the form of moraines, outwash gravels, and valley fill. The southern part of the watershed is a fault block valley-plateau area with open rangeland vegetation, considerable shallow soil, and bedrock exposure. Pine Valley lies in the transition zone between these two dissimilar areas. The Pine Creek Watershed Geology Map is figure 5, page 13.

Pine Valley is the result of a down-dropped block in the Columbia River Basalt which has been subsequently filled with glacial outwash sediments. Several faults cross the area and delineate these block zones.

Infrequent rain-on-snow events or prolonged periods of heavy springtime rainfall contribute to periodic landslides. Some landslides (slumps, earthflows, and debris avalanches) are evident, particularly in the upper reaches of the watershed. These have taken place in areas where road construction and timber harvest have occurred, as well as, in areas without active management activities.

Table 1. Halfway Station Temperature, Precipitation, and Water Balance Data

Halfway Station
Baker County

Long. 117° 05' W to 117° 07' W
Lat. 44° 52' N to 44° 53' N
Elev. 2600 to 2675 feet

Calendar Period	Temperature Data* °F				Precipitation and Water Balance Data* Inches						
	Avg Max	Avg Min	New Avg	Avg	Avg P	New Avg	Avg PE	Surplus P - PE	Deficit PE - P	Cum Surplus	Cum Deficit
Jan	31.6	8.6	23.6	20.1	2.6	3.3		2.6		8.2	
Feb	40.4	16.4	29.7	28.4	3.1	2.3		3.0		11.2	
March	48.9	23.7	38.4	36.3	1.3	1.9	0.6	0.7		11.9	
April	62.9	31.3	46.4	47.6	1.5	1.4	2.0		0.5		0.5
May	71.4	37.7	54.0	54.6	1.7	1.4	3.1		1.4		1.9
June	76.3	41.9	61.5	59.1	1.8	1.3	3.9		2.1		4.0
July	89.3	45.9	67.9	67.6	0.3	0.5	5.1		4.8		8.8
Aug	88.8	43.7	66.8	66.3	0.2	0.7	4.7		4.5		13.3
Sept	80.2	37.2	58.0	58.7	0.4	0.9	2.8		2.4		15.7
Oct	64.6	30.9	47.6	47.8	1.5	1.3	1.7		0.2		15.9
Nov	47.3	24.9	35.9	36.1	2.6	3.0	0.2	2.4		2.4	
Dec	37.2	20.1	25.7	28.7	3.2	3.5		3.2		5.6	
Annual	61.7	30.2		45.9	20.2	21.5				11.9	15.9
Record Period*	10 yrs	10 yrs		10 yrs 1941-42 dis.						Total March	Total October

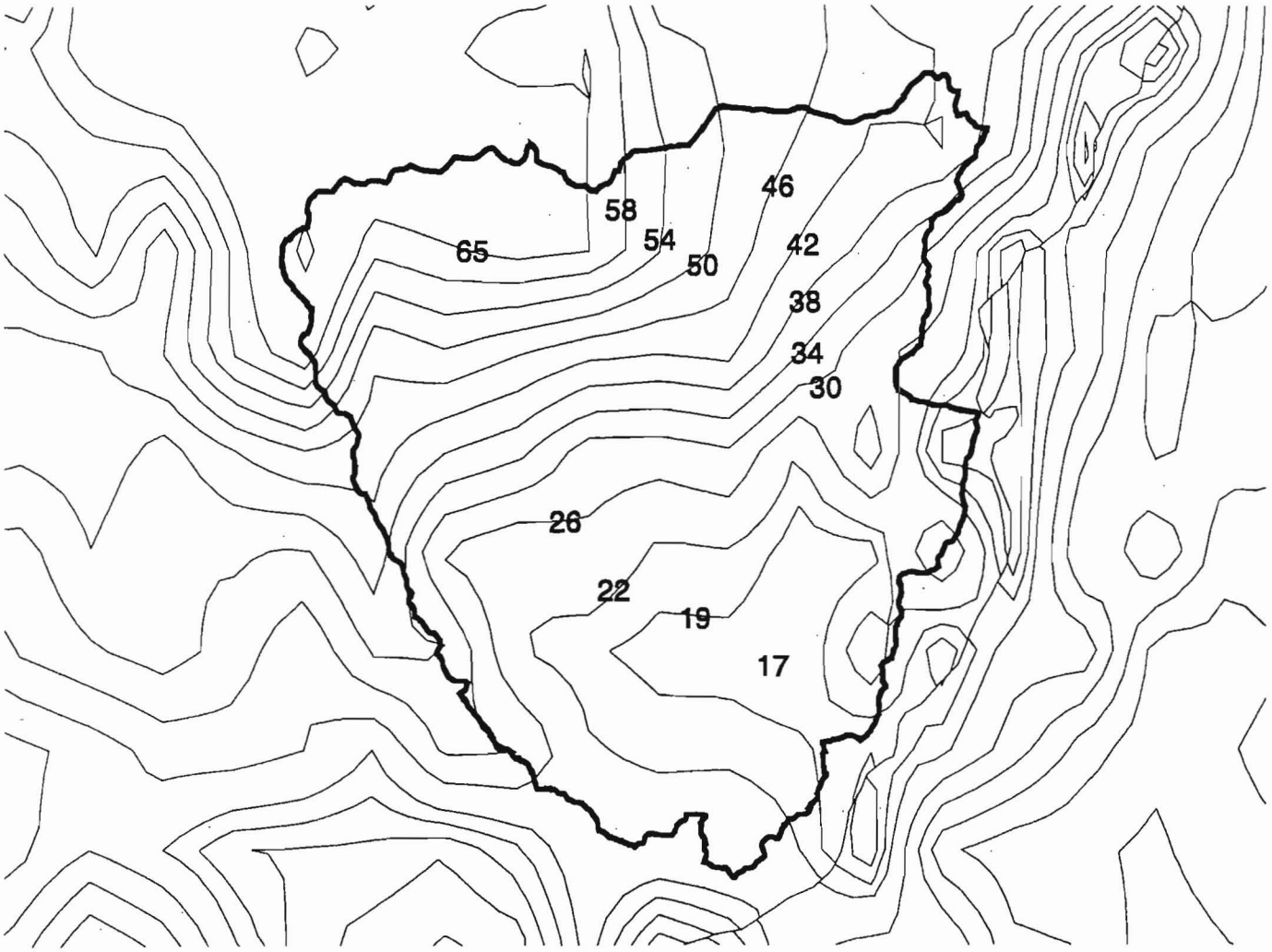
Avg FFS (32°)*
Avg FFS (28°)*

PE of FFS (32°)
PE of FFS (28°)

Notes:

1) New average temperature and precipitation data for 1961-1990 period of record, for comparison with the original data and calculations summarized in a 1963 Oregon State University (OSU) publication.
2) All other temperature and precipitation data shown in the table was copied from the 1963 OSU publication, and was for the 1941 to 1952 period of record.
3) Water balance data in the table was based on the Thornthwaite-Mather equation.
4) P = Precipitation
5) PE = Potential Evaporation
6) Max = maximum; Min = minimum; Cum = cumulative
7) FFS = frost free days; no dates were provided in the original document to FFS.

PINE CREEK WATERSHED
Precipitation Map



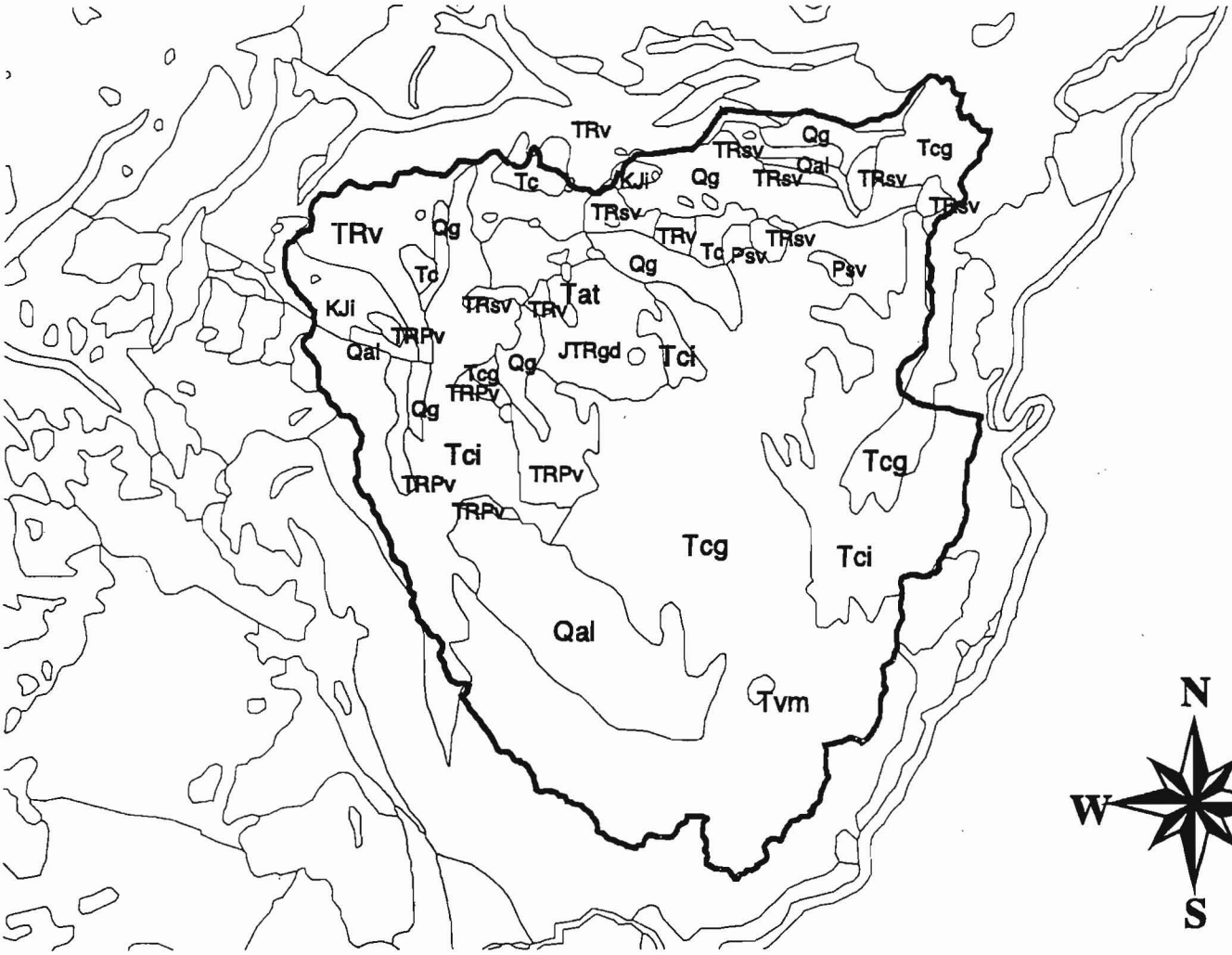
5 0 5 10 Miles

Ws15 = Watershed Boundary
Precip_clip = Precipitation (inches)

N
W E
S

FIGURE 4

PINE CREEK WATERSHED
Geology Map



Ws15 = Watershed Boundary
Orgeol = Geology

5 0 5 10 Miles

Granitics = KJi, JTRgd
Metasedimentary = PSV, TRsv
Metavolcanic = TRv, TRPv
Mafic Volcanic Flows = Tc, Tcg, Tci, Tvm
Alluvium = Qal
Glacial Drift = Qg
Pyroclastic = Tat

FIGURE 5

Soils

The soils of the watershed can be grouped into four geomorphic categories: bottom land soils, fan and terrace soils, foot slope soils, and upland soils. The cultivated areas of the valley consist of bottom land soils, fan and terrace soils, and foot slope soils. The remainder of the watershed is predominantly upland soils.

The upland soils in the southern section of the watershed were developed from basic igneous rocks. Soils in the Wallowa Mountains to the north originated from a mixture of acid igneous, basic igneous, and metamorphic rocks. Almost all the soils developed on the alluvial fill of the oval-shaped Pine Valley are well-drained. Applegate soils occur on the terraces and Langrell soils occur on the flood plains, both are well-drained. Approximately 2,500 acres of the flood-plain soils, Robinette and Hershal, have poor drainage.

Water Resources

Hydrology and Water Budget

Pine Creek is a 36-mile-long, 195,800 acre watershed on the southeast flank of the Wallowa Mountains. Average annual precipitation in the watershed is about 27.6 inches. The hydrologic cycle of this watershed is controlled mostly by the seasons: spring rains and snowmelt, dry summers, fall rains, and winter snow. Infrequent winter rain-on-snow events can produce very high stream flows. Most of the annual streamflow is produced by snowmelt. Most of this streamflow is produced by Pine Creek, Clear Creek, and East Pine Creek which enter Pine Valley, and by North Pine Creek. The snowmelt period typically occurs from mid-February through mid-June, with annual peak flow occurring in May or June. Annual low flow usually occurs in August or September.

Streamflow was measured at a gage on Pine Creek near Oxbow from November 1966 to September 1995. A statistical summary of streamflow from USGS open file report 90-118 (table 2, page 15) for 1967 through 1987 indicates an average discharge of 273,900 acre-feet/year, 1,191 acre-feet/square mile per year, a peak discharge of 7,110 cubic feet per second (cfs) on February 21, 1968, and a minimum discharge of 10 cfs from August 17-24, 1977. The gage was not in operation during the January 1997 rain-on-snow event. Comparison with the Imnaha River gage records where flow was about double the historic peak flow during that event, suggests stream flows in North Pine Creek and Lower Pine Creek may have been of similar magnitude.

Water enters the watershed mostly as rainfall and snowfall. However, water rights records indicate some streams have been diverted into the watershed, including the Eagle Creek tributaries, Little Eagle Creek (1.5 cfs; Cert. 2195) and Summit Creek (2.0 cfs; Cert. 10816), and an Imnaha River tributary, Blue Creek (2.48 cfs; Certs. 38001 and 38317). Status of these diversions and related water uses was not investigated for this assessment.

Table 2. Pine Creek Near Oxbow, OR (13290190)

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 for the Period 1967-1987

Table 2a. Monthly and annual statistics based on mean daily discharge, in cfs

Month	n	Minimum	(year)	Maximum	(year)	Mean	Standard Deviation	Percent of annual runoff
October	20	39	1978	135	1983	75	20	1.7
November	21	65	1977	491	1974	142	92	3.1
December	21	58	1979	619	1974	238	159	5.3
January	21	51	1979	962	1974	297	244	6.7
February	21	65	1977	1040	1986	417	264	8.5
March	21	69	1977	1140	1972	627	288	14.0
April	21	64	1977	1010	1974	656	265	14.2
May	21	94	1977	1600	1971	921	306	20.6
June	21	67	1977	1930	1974	845	442	18.3
July	21	20	1977	541	1983	221	177	4.9
August	21	14	1977	95	1983	52	24	1.2
September	21	20	1987	119	1978	57	24	1.3
Annual		55	1977	674	1974	379	137	100.0

n = number of values used to compute statistics

Source: USGS open file report 90-118, page 61

Table 2. Pine Creek Near Oxbow, OR (continued)

Table 2b. Flow Duration Statistics Based on Mean Daily Discharge																
Percent of time discharge equals or exceeds monthly discharge		95%	90%	85%	80%	75%	70%	60%	50%	40%	30%	25%	20%	15%	10%	5%
Month	**n**	**Monthly discharge in cubic feet per second (cfs)**														
October	20	38	48	52	55	58	61	66	71	76	83	88	94	101	109	129
November	21	61	67	70	74	82	87	97	106	124	143	156	173	198	234	339
December	21	59	68	81	91	99	108	135	161	192	242	278	331	395	488	696
January	21	56	71	89	101	110	121	144	170	205	250	281	332	426	579	892
February	21	70	113	140	154	167	181	215	264	332	412	455	514	628	850	1380
March	21	130	243	281	311	338	373	442	522	616	723	780	846	952	1220	1540
April	21	189	291	339	372	401	430	501	599	709	810	870	950	1030	1130	1290
May	21	214	411	504	575	631	678	781	875	971	1100	1160	1230	1340	1500	1790
June	21	77	166	266	391	470	532	657	790	937	1080	1170	1280	1410	1530	1830
July	21	26	34	39	44	50	58	81	114	153	227	283	380	492	648	803
August	21	21	27	29	31	33	34	37	42	48	60	68	77	86	96	111
September	21	21	27	30	32	34	38	48	54	61	67	73	80	90	98	112
Annual	21	32	44	55	63	72	83	112	169	278	455	564	685	822	1010	1300
n = number of values used to compute statistics																

Source: USGS open file report 90-118, page 61

Water exits the watershed in a network of ephemeral, intermittent and perennial streams, springs and lakes, and as groundwater. No information is available on groundwater outflow. Water also exits the watershed as evapo-transpiration. Water evaporates from lakes, reservoirs, streams, soil, rocks, plants, and other surfaces; it also evaporates from ice and snowpacks. Water is transpired by native vegetation growing in the watershed; this water use is highly variable, from rangelands to forests to wetlands. Water is also held in plant tissues until the plants die. Water cycling through this part of the hydrologic cycle varies from year to year based on timing, type and amount of precipitation, length of growing season, changes in vegetation, and other factors.

The natural hydrology of the watershed has been highly altered by several activities. Water from Blue Creek and other creeks is diverted into the Pine Creek watershed. Water is stored in dozens of reservoirs from fall through spring for later summer use. Water releases for irrigation use from ten of these reservoirs (table 3, page 22, except for Red Mountain) increase stream flows above historical flows prior to irrigation withdrawals from several streams during the late summer, including but not limited to Pine Creek, East Fork Pine Creek, Clear Creek, East Pine Creek, Fish Creek, Bearwallow Gulch, Sag Creek, and Deer Gulch. Water diversions from streams reduce natural streamflow, with summertime dewatering of reaches of many streams, such as East Pine Creek, Fish Creek and Lake Fork Creek on WNNF. Irrigation is believed to enhance groundwater return flows to streams and late summer stream flows in some stretches.

OWRD maintained a water level observation well (State Observation well #6) near Halfway from 1962 to 1993. The observations (figure 6, page 19) indicate the local aquifer is maintaining a natural pattern of depletion and recharge with the change in seasons and seasonal water use. There likely is more than one aquifer in Pine Valley, and each aquifer would have different depletion/recharge patterns. At this time there is no evidence that groundwater withdrawals from wells in Pine Valley cause aquifer depletion. The January 1, 1990, measurement is suspect based upon other readings. Pine Valley does not have many irrigation wells.

Limited Water Supplies for Economic Development and Environmental Improvement

Limited surface water supplies have reduced opportunities for economic development in the agriculture, mining, and recreation industries in the watershed, and also have reduced opportunities for improvement of fish and wildlife habitat, fish stocks, fish passage, and water quality.

The economic base of the watershed is irrigated agriculture. Economic development for irrigated agriculture has been limited by water availability since the late 1800's to early 1900's. Six strategies have been used to obtain water for late season shortages and to develop new acreage in Pine Valley for irrigated agriculture. They are:

1. Divert water from streams outside the Pine Creek watershed into the watershed (i.e., Blue Creek in the Imnaha River drainage).
2. Divert water from one subwatershed to another subwatershed within the Pine Creek watershed (i.e., Lake Fork Creek to Fish Creek).
3. Divert water to a place of use within a subwatershed (i.e., Fish Creek).

4. Develop water storage projects (table 3, page 22) that may employ distribution strategies like number 2 or 3 above.
5. Develop groundwater resources (i.e., city of Halfway wells).
6. Improve irrigation water use efficiency of delivery and application systems.

Additional water developments are needed for late season crop growth in many areas and for cropping of undeveloped arable lands. However, recent water availability analyses for ODFW instream water rights indicate insufficient water is available to support desired fisheries resources and to improve fisheries-related water quality problems in streams on the ODEQ 303(d) list. In other words, there is not enough water to support all desired beneficial uses of water during part of the year, which is the summer/autumn period.

Opportunities to obtain more water for desired beneficial uses during periods of water shortage appears to be limited to the following:

- Storage during winter/spring months
- Surface water use during winter/spring months, including groundwater connected to surface water
- Groundwater not connected to surface water, for year-long use
- Improve water use efficiency during the summer/autumn period

Opportunities for new storage and surface water rights are discussed in the following section; also see appendices C and D. No information on groundwater availability was found. An observation well in the valley monitored by OWRD indicates groundwater levels are not dropping; however, this does not mean groundwater supplies are abundant. NRCS, OWRD, and Eagle Valley Soil and Water Conservation District have information on how to improve water use efficiency.

OWRD Water Availability Studies

Water Availability Analyses (WAAs) have been completed by OWRD for 7 Water Availability Basins (WABs) in the Pine Creek Watershed, see figure 7 on page 20 (Rick Cooper, OWRD, Water Availability Program Leader). These analyses were done to estimate water availability for new applications, including consumptive surface water and storage, instream water rights, and reservations for future economic development. The stream name, WAB number, and analysis point are listed below:

Stream	Old WAB#	New ID#	Analysis Point
Pine Creek	01	13290190	above Snake River
North Pine Creek	0101	241	above Pine Creek
Pine Creek	0102	70863	above Long Branch Creek
East Pine Creek	01021	70870	above Pine Creek
Clear Creek	01022	235	above Pine Creek
Clear Creek	010221	72170	above unnamed stream
Pine Creek	01023	70864	above Fuller Creek

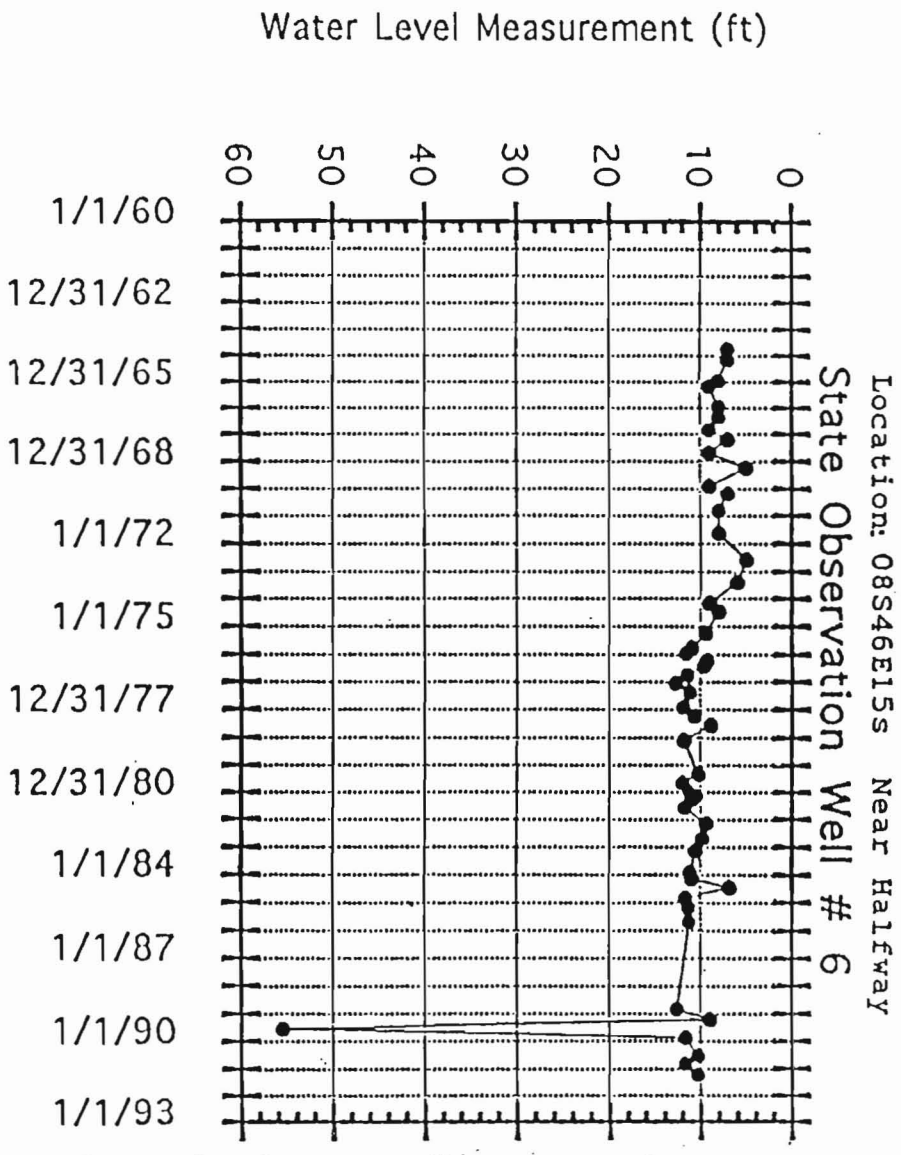


Figure 6. State Observation Well #6, Water Level Measurement

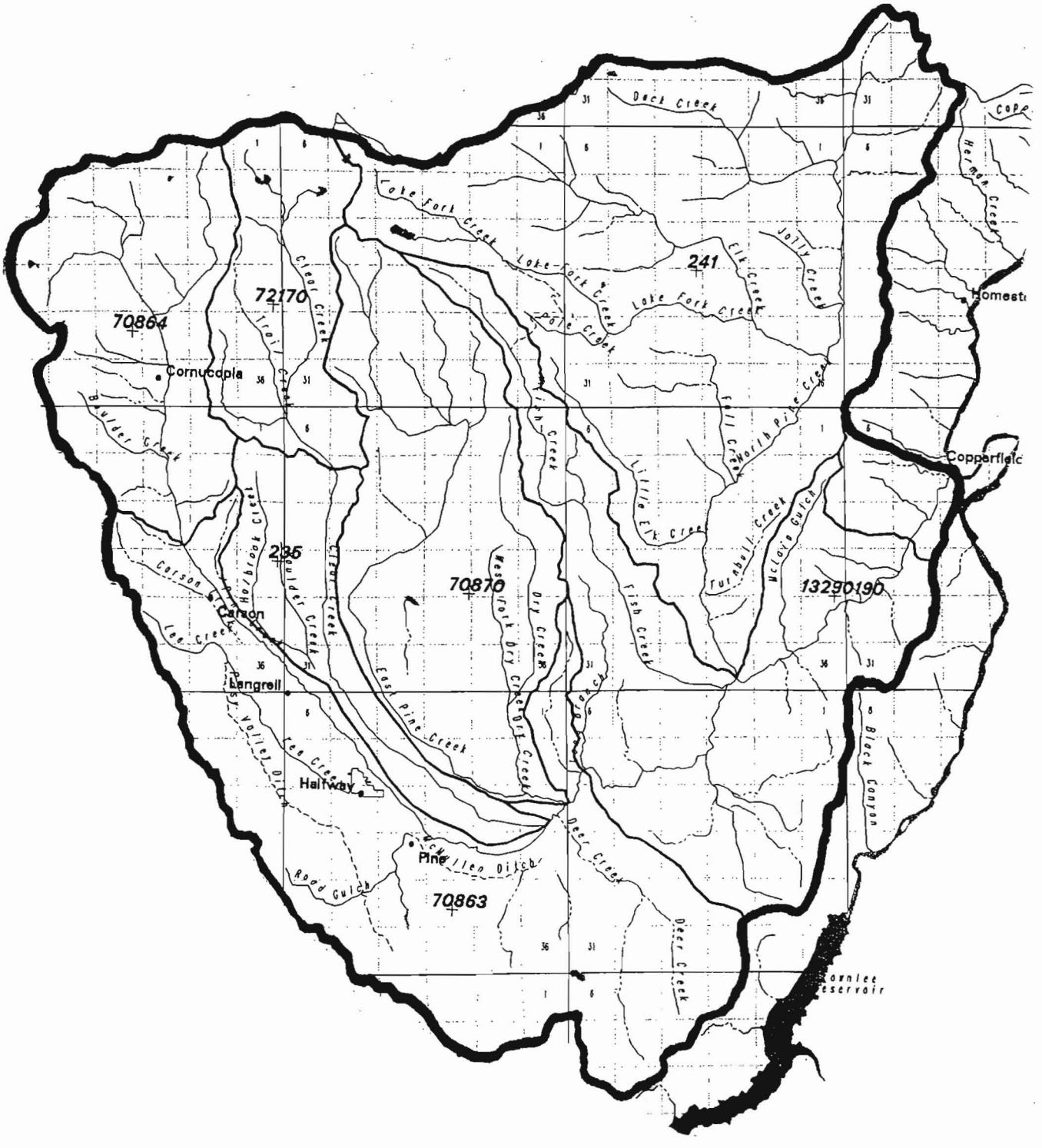


Figure 7. - OWRD Water Availability Basins (WABs) Pine Creek Watershed
(New 8-digit numbers for WABs)

Fifty (50) Percent Exceedence

This is an estimate of the flow of water available 50 percent of the time on a monthly basis. Appendix C contains the OWRD 50 percent exceedence flow tables for the 7 streams listed above.

OWRD uses 50 percent exceedence flows to determine water availability for new water right applications for storage (table 4, page 23) and instream water rights (table G.1, appendix G). The tables in appendix C show storage opportunities exist in all WABs, but only during the winter/spring period.

Eighty (80) Percent Exceedence

This is the flow of water available 80 percent of the time on a monthly basis. Appendix D contains the OWRD 80 percent exceedence flow tables for the 7 streams listed above.

OWRD uses 80 percent exceedence flows to determine water availability for new water right applications for new surface water and groundwater connected to surface water (both out-of-stream and instream uses). The tables in appendix D show opportunities to obtain surface water rights exist in all WABs, but only during the winter/spring period.

Storage

The tables in appendix C show storage opportunities in the Pine Creek watershed for analysis points shown in table 4, page 23. Numbers are not additive. The tables in appendix C only show annual storage opportunities. Monthly storage opportunities require additional analysis such as is being done for the reservation of water for future economic development for the Powder Basin, discussed elsewhere in this assessment. Feasibility of storage opportunities depends on several

How To Interpret OWRD Exceedence Tables

After the first public meeting in Halfway, Council members requested an explanation of how to interpret the OWRD exceedence tables in appendices C and D. An explanation is provided below for appendix pages C-17 through C-21 (also designated as pages 6A through 6E of the water availability tables). This Water Availability Subbasin (WAB) is named *Clear Creek above unnamed stream* (also referred to herein as upper Clear Creek). The analysis point for this WAB is near the site modeled for the Reservation of Water for Future Economic Development (page 90). The following explanation will serve as an example of how to interpret the other tables.

Evaluations of the upper Clear Creek WAB requires analysis of information for 4 water availability subbasins: the upper Clear Creek WAB and 3 downstream WABs. The *Water Availability Table* at the top of page C-17 (page 6A) identifies the 4 subbasins as Items 1,2,3, and 4. Reading to the right, this table indicates the months that water is unavailable for new water rights by the word *NO*. Note there are more months with NOs as one goes from Items 1 to 4. The lowest analysis point on a stream is always Item 1; the highest analysis point along a stream is always the last Item. The upper Clear Creek WAB is Item 4.

The locations of the 4 subbasins are briefly described in the *Stream Names* table in the middle of page C-17. Item 1, or the first line in the *Water Availability Table*, is the same as the first line in the *Stream Names* table or *Pine Cr @ mouth*, and so forth.

The *Limiting Water Availability Subbasins* table shows which of the 4 subbasins is most limiting for each month and for storage. Note that there is negative water available for July through November. This is an accounting procedure indicating the stream is over-appropriated (see pages 89-92) with respect to 50 percent exceedence. It does not mean the stream is dry in those months. The *NOs* in this table are for the same subbasins and months shown in the *Water Availability Table*.

The other tables are organized as follows. Page C-18 (page 6B) is detailed information for the lowest analysis point, or Item 1 on the *Water Availability Table*. Page C-19 (page 6C) is the next lowest analysis point, or Item 2 on the *Water Availability Table*, and so forth to page C-21 (page 6E) which is for upper Clear Creek. Looking at page C-18, the *Detailed Report on ISWRs* at the bottom of the page is a summary of instream water rights or applications for the WAB analysis point. This data also appears in the *Detailed Report of Water Availability* at the top of the page under the column entitled Instream Water Rights. Looking at the numbers to the left and right of the Instream Water Rights column, note when they are subtracted from the column to the left, negative numbers appear for two months to the right. These same months are shown as *NOs* in the *Water Availability Table* on page C-17. To summarize, the *Water Availability Table* shows an estimate of natural streamflow, from which estimated consumptive use for water rights (not diversion rights for water rights), storage rights, and instream water rights are subtracted to show how much water is available for new appropriations. The most limiting Net Available Water figure for any month from among the 4 *Water Availability Tables* on pages C-18 through C-21 appears in the *Limiting Water Availability Subbasin* table on page C-17.

factors including cost of planning for storage facilities, construction costs, and environmental issues such as bull trout recovery and water quality limited streams.

Table 3. Major Reservoirs
(Storage Capacity of at least 5 acre-feet)

Subwatershed (Hydrologic Designation)	Reservoir Name	Storage Capacity (acre-feet)	Name of Stream Diverted or Impounded	Dam Location (township, range, section)	Comments
Upper Pine Creek (01)	Pine Lake, Upper	175	Pine Creek tributary	T6S, R45E, Sec 19	Located on WWNF
Upper Pine Creek (01)	Pine Lake, Lower	45	Pine Creek tributary	T6S, R45E, Sec 19	Located on WWNF
Upper Pine Creek (01)	Red Mountain	5	Middle Fork Pine Creek tributary	T6S, R45E, Sec 8	Located on WWNF; no outlet
Upper Pine Creek (01)	East Lake	90	East Fork Pine Creek tributary	T6S, R45E, Sec 10	Located on WWNF
McMullens Slough (02)	Laird	68	Sag Creek	T8S, R46E, Sec 28	Sited on private land
Clear Creek (04)	Clear Creek	257	West Fork Clear Creek	T6S, R45E, Sec 12	Located on WWNF; 2 dams
Clear Creek (04)	Melhorn	165	East Fork Clear Creek	T6S, R46E, Sec 7	Located n WWNF; 2 dams
East Pine Creek (06)	Lost Lake	45	East Pine Creek	T6S, R46E, Sec 17	Located on WWNF
East Pine Creek (06)	Bear Wallow	180	Bear Wallow Gulch	T7S, R46E, Sec 21	Located partially on WWNF; 2 dams
Pine Creek-Mile 15 (05)	Crow	51	Deer Gulch	T8S, R47E, Sec 31	Sited on private land
Lake Fork Creek (12)	Sugarloaf	260	Lake Fork Creek	T6S, R46E, Sec 5	Located on WWNF; 2 dams
Lake Fork Creek (12)	Fish Lake	825	Fish Lake Branch of Lake Fork Creek	T6S, R46E, Sec 16	Located on WWNF

Table 4. Water Available for Storage by Pine Creek Water Availability Subbasin

Stream	Water Availability Subbasin Name	Water Availability Subbasin Code	Potential Storage (acre-feet)	Analysis Point
Pine Cr.	Lower Pine Creek	0100	163,000	at gauge near Snake River
N. Pine Cr.	North Pine Creek	0101	51,900	at mouth
Pine Cr.	Middle Pine Creek	0102	85,300	above Long Branch Creek
E. Pine Cr.	East Pine Creek	01021	17,000	at mouth
Clear Cr.	Lower Clear Creek	01022	16,500	at mouth
Clear Cr.	Upper Clear Creek	010221	9,430	above NE Sec 8, unnamed stream
Pine Cr.	Upper Pine Creek	01023	26,000	Fuller Creek

Consumptive Water Rights or Out-of-Stream Uses

The primary consumptive use of water in the watershed is for irrigation. Other uses include domestic, livestock, mining, and other uses related to road, forestland, and rangeland management. There are decreed water rights in Pine Valley as early as 1870.

There are numerous water developments in the Pine Creek watershed. Some developments are recorded as water rights, some are registered as exempt uses, and some qualify as exempt uses that do not require registration at this time. A summary of all of these developments was beyond the scope of this assessment. Information on wells was not readily available. Some readily available information on surface water and storage water rights was summarized from records in the County watermaster's office.

An inventory of diversions shown on water rights maps produced a list of about 250 stream diversions (appendix E) and 8 reservoirs with storage capacity of 68 acre-feet or greater (table 3, page 22), in the Pine Creek watershed. OWRD is working on updating the appendix E part of the diversion list. The 250 diversions are mostly for irrigation and mining water use. It is likely that some of the diversions on the list in appendix E are no longer used; it is also probable that other diversions should be added to the list. The watermaster provided a list of 53 regulated irrigation diversions (appendix F). The watermaster stated that his office regulates 88 diversions; a list of the other 35 diversions is not available at this time.

There were water rights of record for irrigation of 18,224 acres in 1997. Water diversion allowances in water rights are usually 1/40th cfs for diverted streamflow and water released from storage, and 1/80th cfs for water pumped from wells. The annual duty allowed in the Pine Creek decree is 1.5 acre-feet per acre per month in April, May, and June; 1 acre-foot per acre per month in July and August, and 0.5 acre-feet per acre per month in September for a total of 7.0 acre-feet which is the maximum quantity of water that can be beneficially used without waste. A comment was made at

the Council's February 2000 public meeting in Halfway that 7 acre-feet diverted equals 4.5 acre-feet on the land. This would result in a 2.5 acre-foot/acre or 35 percent water transmission loss. This is close to the 3.0 acre-foot/acre duty allowed in decrees and more recent water rights in Baker County, which supports the premise in the Assessment that water is not being used efficiently. OWRD thought it was important to clarify that the diversion rate in a water right is the amount authorized to be taken at the authorized diversion point. Diversion rate is in cubic feet per second (cfs) or gallons per minute (gpm) and duty is in acre-feet per acre per year.

The Assessment Committee has researched the Pine Creek Decree and state law and has compared the Pine Creek Decree with other Decrees in the area. Weather plays a role in water usage anywhere, so this is not an issue. The diversion rate in the Pine Creek Decree is the same as the other decrees: one-fortieth of a cfs per acre irrigated. However, the duty for the irrigation season from April 1 through October 1 is about double that allowed in other decrees. Duty in the Pine Creek Decree would be expected to be about the same as other decrees in Baker County with similar irrigation seasons, crops and soils. Consumptive use for native pasture, grain and alfalfa is less than the 3.0 to 3.5 acre-foot duty allowed in the other decrees. As stated on page 23, the Pine Creek Decree allows 1.5 acre-feet in April, 1.5 acre-feet in May, 1.5 acre-feet in June, 1.0 acre-foot in July, 1.0 acre-foot in July, 1.0 acre-foot in August, and 0.5 acre-foot in September for a total of 7.0 acre-feet. The Pine Creek Decree states on Decree page 41, "at no time shall more water be diverted than may be applied to beneficial use." Seepage losses and return flows do not constitute beneficial use, nor does nonuse of water rights in April and May due to adequate rainfall. All of this suggests to many water conservation experts that "diversion allowances in the Pine Creek Decree greatly exceed consumptive use."

This Assessment did not indicate 7 acre-feet of usage; it references the annual duty allowed by the Pine Creek Decree of 7.0 acre-feet. Data presented in the Assessment also indicates that a 1/40th cfs diversion rate applied to 18,224 acres of irrigation would be a cumulative diversion rate of 455.6 cfs. This would occur if there was enough water to exercise all surface water rights at the same time.

The best data available on consumptive water use was developed by OWRD, and was presented in appendix C, on page C-2 (page 1B of the OWRD 50 Percent Exceedence tables). The top table on page C-2 includes estimates of consumptive use in cfs by month, plus storage. This data has been converted to acre-feet, as shown in the following table, using the following formula.

$$\frac{(x \text{ cubic feet/second})(86{,}400 \text{ seconds/day})(y \text{ days in month})}{(43{,}560 \text{ cubic feet/acre-foot})}$$

Using the data from the table, one can estimate average consumptive use as follows:

$$\frac{47{,}102.5 \text{ acre-feet consumptive use}}{18{,}224 \text{ acres of irrigation}} = 2.58 \text{ acre-feet/acre/year}$$

These calculations suggest that average consumptive use is only 37 percent (2.6 /7.0) of the 7 acre-foot duty in the Pine Creek Decree. If the benefits of storage are excluded

from the analysis, average consumptive use would be halved to about 1.3 acre-feet/acre/year or 18 percent of the 7 acre-foot duty in the Pine Creek Decree.

The Assessment Committee recommends this data be used to develop a water conservation strategy for the Action Plan. Perhaps the landowners could use this information as rationale for expansion of irrigated acreage under conserved water use statutes (ORS 537.455-.500) and rules (OAR 690-18), and so forth.

MONTH	ESTIMATED AVERAGE MONTHLY CONSUMPTIVE USE IN CFS FROM OWRD WATER AVAILABILITY TABLE, APPENDIX PAGE C-2	ESTIMATED AVERAGE MONTHLY CONSUMPTIVE USE IN ACRE-FEET FROM OWRD WATER AVAILABILITY TABLE, PLUS STORAGE, APPENDIX PAGE C-2
January	1.05	61.6
February	2.10	116.6
March	8.20	504.2
April	42.80	2,546.8
May	56.71	3,487.0
June	67.54	4,018.9
July	83.56	5,137.9
August	61.15	3,760.0
September	42.75	2,543.8
October	22.43	1,379.2
November	1.03	61.3
December	1.06	65.2
Subtotal		23,682.5
Storage		23,420.0
Total		47,102.5

Supplemental water rights, e.g., ponds, sumps, and wells are limited to 3 acre-feet per acre during the irrigation season. For irrigated lands, this suggests water diversion rights of 455.6 cfs. Irrigation storage rights for the 12 largest reservoirs in the watershed are 2,166 acre feet (table 3, page 22). There are municipal water rights for the cities of Halfway and Cornucopia. The city of Halfway, population 340, has water rights to 2.59 cfs from three wells and all of the flow from two springs on the WWNF west of town. Two primary wells provide water to the municipal system. One is located within the city limits; the other and a nearby storage reservoir are located within the urban growth boundary. Alternate sources include a well located within the city limits and possibly Leep Springs, located west of town. Leep Springs is undeveloped at this time; a private irrigation water right was recently granted for this source (Permit S-52308; 0.22 cfs) and could not be exercised if the city decided to use the source in the future. Expected need for an estimated 400 residents by the year 2005 would be 0.28 cfs. The city's water rights are adequate to meet current and future needs. There is also a 0.5 cfs municipal water right that is being used by a few residents of the Cornucopia town site.

Information on Halfway's water supply source, point of diversion, quantity, and priority date is included below:

Supply	Zoning at Halfway	Quantity (cfs)	Priority
Spring	PF	all	1882C
Well	City	0.250	1965C
Well	UGB	1.340	1989P
Well	City	1.000	1990P
Total		2.590	

Industrial water rights in the watershed have increased from 2.6 to 2.8 cfs from 1966 to 1997. Mining water rights show a decline from 95.5 cfs to 43.23 cfs for the same time period.

Although mining water rights have been and may still be treated mostly as nonconsumptive, it is well known that mining water use has never been completely nonconsumptive, less so now than in the past. When water quality regulations were applied to mining operations in the late 20th century, mining use became more consumptive. Water at ore processing sites is now required to be stored in sediment ponds to prevent discharge of polluted water into streams. Water evaporates from these ponds, as well as from supply ditches.

Water rights of and water usage by the USFS and BLM is discussed in agency rules and management plans. Issues affecting water resources management on Federal lands include timber harvest, road construction and maintenance, mining, fish and wildlife, endangered species, livestock grazing, soils and watersheds, floodplains, wetlands, recreation uses, and fire.

Nonconsumptive Water Rights or Instream Uses

OWRD established minimum stream flows for Pine Creek, Clear Creek, East Pine Creek, and North Pine Creek in 1970 based on a request from ODFW. These recommended flows were included in a 1970 update of OWRD's Powder Basin Program, then were converted to instream water rights by the Oregon Legislature in the 1980's (see OAR 509). In 1990 and 1992, ODFW

also applied for instream water rights for these and other streams in the watershed (appendix G). Water right certificates have been issued for some of these applications. Other applications are still being reviewed by OWRD due to protests from local residents. The applications were protested over a variety of technical and philosophical issues. The 1992 applications are senior to the requested reservations of water for future economic development by a few months. Instream flows became more of an issue when several streams in the watershed were listed as water quality limited for temperature-summer (for bull trout) on the 1994/1996 303(d) list, when temperature listings were increased on the 1998 303(d) list (table 5, page 29), and when bull trout were listed as a threatened species in 1998.

Instream water rights are junior to all but a few water rights, so the deficiencies shown in appendix C will occur in normal to dry years. Water to meet instream flow needs can come from senior surface water and storage rights through OWRD programs that allow lease, purchase, or transfer senior water rights to instream uses. Watershed health enhancements can also assist in meeting instream flow needs, as well as delivery and application system improvements, and/or better management of the resource.

Senior water rights are not legally affected by new applications. OWRD Division 33 rules affect new applications filed after July 17, 1992, that restrict direct (live) flow withdrawal from April 15 to September 30. New diversions or live flow water rights will be permitted during this period, if they qualify as an exception or meet other conditions described in the rules. Some allowed uses include domestic, off channel livestock watering, emergency use, multi-purpose storage, or other projects with significant public benefits.

Water Quality

Groundwater

Pine Valley is a closed groundwater basin filled with glacial outwash sands and gravels with clay interbeds. These deposits reach a maximum known thickness of 350 feet in the south-central part of the valley and may be considerably thicker. There are no known water quality problems from mass use of groundwater.

No critical groundwater areas have been identified in the Pine Creek watershed by OWRD.

Surface Water

The watershed topography, streamflow distribution, water development and use practices, and historical land use practices have caused some water quality problems. 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). There is also concern about flow modification below irrigation withdrawals.

Information is needed to determine if (a) recent information on mine leachates is needed to verify whether it continues to be a problem, (b) city of Halfway treatment of sewage effluent is in

conformance with HPOS permit, (c) septic systems are functioning properly, and (d) best management practices (BMP) are being implemented and are effective.

Vegetation

There are many different plant communities in the watershed. The southern and eastern parts of the watershed are mostly rangeland and shrubland communities; the rest of the watershed is mostly forestland. Most of the plant communities in the watershed occur on drier sites referred to as uplands. A small but important group of plant communities, referred to as wetlands or riparian areas, occur mostly along streams and around lakes.

The distribution of plant series (such as the ponderosa pine or big sagebrush series) and plant communities (such as grand fir/pinegrass) in the watershed are influenced by several factors, including climate (i.e., precipitation, temperature), elevation, aspect, depth to groundwater, floodplain characteristics, soil type, noxious weed invasions, and past land, water, and vegetation management practices.

ODF has a vegetation inventory particularly for private lands which includes data for percent of acres in each of the different plant categories; stand characteristics such as crown closure, species composition, size class, riparian areas, wet mix, dry mix, etc.

Table 5. Pine Creek Watershed ODEQ Listing Status

Stream	Segment	Parameter						
		Temperature		DO	Sediment	Modification		Toxics
						Habitat	Flow	
		Oregon bull trout (50 °F)	Rearing (64 °F)					
Aspen	Mouth to headwaters	L						
Beecher	Mouth to headwaters		L					
Big Elk	Mouth to headwaters	L						
Clear	Mouth to Trail Cr.			ND			ND	
Clear	Mouth to RM9		ND					
Clear	RM9 to headwaters	L						
Deer	Mouth to headwaters		ND		ND	ND		
Dry	Mouth to headwaters				ND		ND	
Duck	Mouth to headwaters		ND					
Elk	Mouth to headwaters	L						
Lake Fork	Mouth to headwaters				ND			ND
Lake Fork	Mouth to Pole Cr.		L					
Lee	Mouth to headwaters		ND	ND			ND	
Long Branch	Mouth to headwaters				ND	ND		
Meadow	Mouth to Schneider Meadows	L						
Okanogan	Mouth to unnamed stream at Sec. 35 NW1/4		L					
Pine	Mouth to headwaters	L						
Pine	Mouth to Clear Cr.		L					
Pine	Clear Cr. to East Fork Pine Cr.		L					
Pine	Clear Cr. to headwaters			ND			ND	
Pine	East Fork to headwaters	L						
East Pine	Mouth to Trinity Cr.			ND			ND	
East Pine	Mouth to Okanogan		L					
East Pine	Okanogan to headwaters	L						
Trail	Mouth to headwaters	L						
Trinity	Mouth to West Fork		L					

Notes:

L = Listed

ND = Need data

Wetlands

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support which normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands in the Pine Creek watershed include marshes, shallow swamps, lakeshores, peatlands, wet meadows, and riparian areas.

There are two general settings for wetlands in the watershed. Wetlands located along streams and lakeshores are referred to as "lotic" or "riparian" wetlands. Marshes, swamps, peatlands, and wet meadows are referred to as "lentic" wetlands. Most wetlands in the watershed are stream-associated riparian wetlands.

The riparian areas along the lower reaches of Pine Creek (located mostly on private land) consist of a combination of native cottonwood, aspen, alders, and willow species. In some areas, native vegetation has been removed and replaced with cultivated agricultural crops such as alfalfa, domestic pasture grasses, and other livestock feed crops. Some pondersoa pine trees which used to be common in riparian areas remain along the stream system. Cottonwood galleries are in decline in Pine Valley.

Riparian areas along the upper reaches of Pine Creek and its northern tributaries (located mostly on National Forest land) are dominated by conifers, including pondersoa pine, Douglas fir, grand fir, Engelmann spruce, and subalpine fir. Cottonwood galleries are uncommon in these tributaries, except in the lowest elevations of North Pine Creek. Meadow environments in the tributaries are also uncommon. Hardwoods commonly found along the streams include black cottonwood, quaking aspen, red osier dogwood, thinleaf alder, mountain alder, willows of various species, currant, black hawthorn, western service berry, and mock orange.

The ODF vegetation inventory has information on wetlands.

Upland Vegetation

Existing stand structures and associated species composition vary with landform, elevation (see figure 8, page 32), aspect, geology (figure 5, page 13), soil conditions, and precipitation. Some of the subwatersheds within the Pine Creek watershed have many different plant communities due to variability of density, landform, aspect, geology, soil conditions, and precipitation.

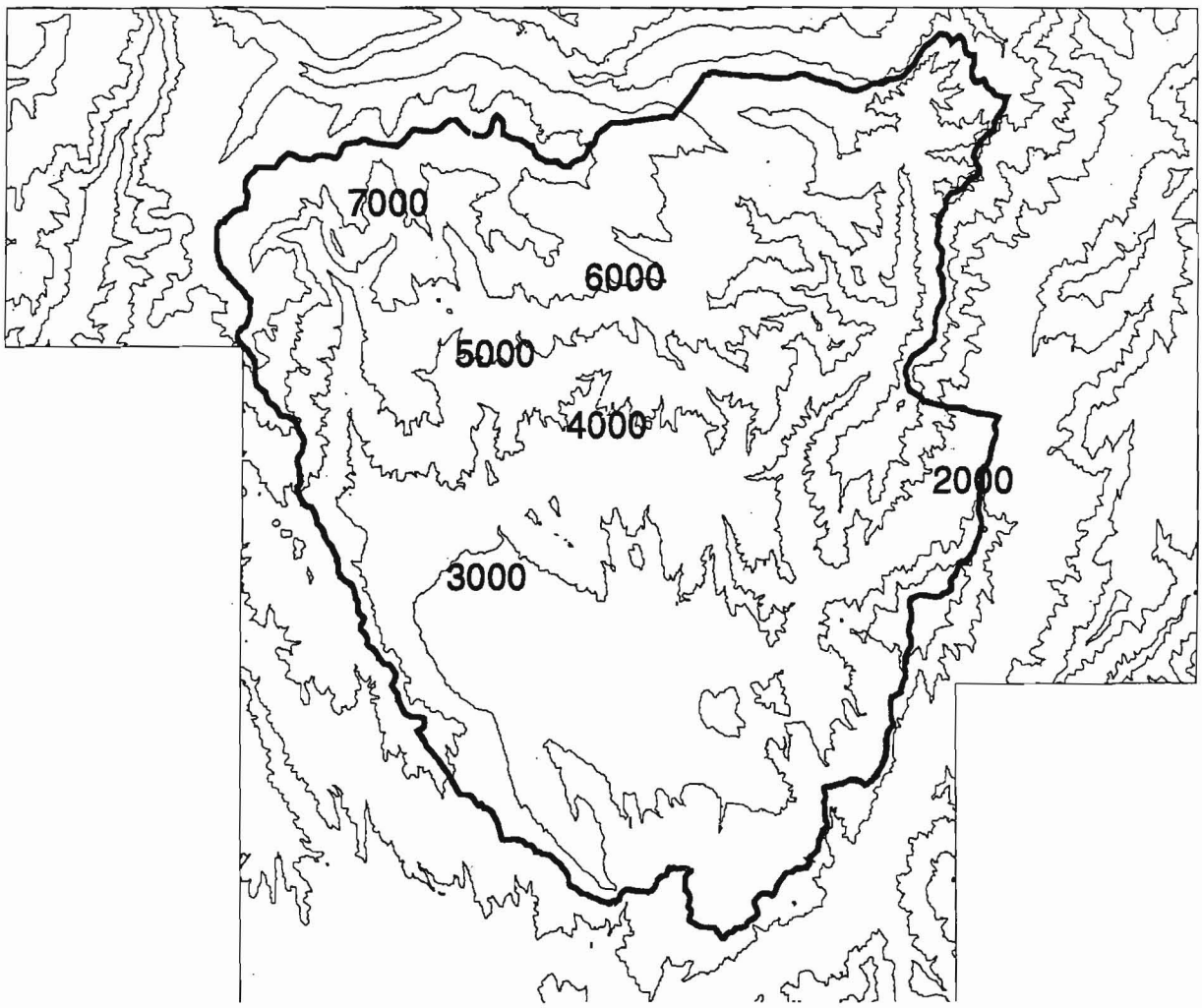
The upslope forested vegetation of the Pine Creek watershed ranges from cold/moist subalpine fir ecotypes to the hot/dry ponderosa pine types. Included in these ecotypes are subalpine fir, lodgepole pine, grand fir, Douglas fir, and ponderosa pine climax plant communities. Western larch occurs as a seral component to many subalpine fir and grand fir plant communities. Quaking aspen, black cottonwood, and curl leaf mahogany are the only hardwood tree species. Individual stand species composition varies with landform, elevation, aspect, soil, precipitation, and past management practices.

The high elevation band from 6000 to 7200 feet has alpine grasslands and meadows. This vegetation type occupies less than 1 percent of the watershed. Between the elevations of 4200 to

7300 feet, vegetation consists of subalpine fir, Engelmann spruce, and lodgepole pine plant associations that can include Douglas fir, grand fir, and western larch in combination with understory shrubs and grasses. These plant associations occupy the more mesic portions of the landscape. Just below the previous elevation band, at an elevation range of approximately 3200 to 6400 feet, is the grand fir association which includes Englemann spruce at the upper elevations and Douglas fir, western larch, and ponderosa pine at lower elevations. The Douglas fir plant associations occupy an elevation band from 2500 to 6000 feet. Conifer species diversity narrows as elevation reduces, with Douglas fir and ponderosa pine being the only species represented. Below this band is the ponderosa pine plant association, which is limited to ponderosa pine and a reduced variety of shrubs, grasses, and other herbaceous species.

The ODF vegetation inventory has information on upland vegetation.

PINE CREEK WATERSHED
Elevation Map (feet)
(Note: 2000-foot line near mouth of creek not shown)



5 0 5 10 Miles

Ws15 = Watershed Boundary
Elev_band = Elevations (feet)

N
W E
S

FIGURE 8

Wildfire

Because much of the upper-elevation forested catchment area of the Pine Creek watershed is on the south-facing slopes of the Wallowa Mountains, daytime solar warming causes frequent convective storms. The result is one of high incidence of late-afternoon and early-evening electrical storms.

Individually, the resultant forest fires tend to be small and most go out naturally during subsequent rain showers that fall from the same clouds that generated the lightning. Collectively, such (less than 10 acres each) lightning-caused forest fires have had the cumulative effect of periodically burning off litter and small thickets of conifers over a limited portion of Pine Creek's catchment basin.

Fire statistics show an average of 14 fires (10 acres or less) per year over the last 24 years.

ODF fire statistics for the past 24 years show a total of 316 fires (less than 10 acres each), for a total burned area of no more than 3,160 acres of the Pine Creek watershed (about 1.6 percent). In contrast USFS data dating back to 1971 indicates that 12,284 acres have burned on USFS lands, for a total of 6.3 percent of the watershed. Since 1971 there have been 11 wildfires on private forest lands protected by ODF. Each of these fires were less than 100 acres in size.

Prior to European settlement and, particularly prior to USFS aggressive fire suppression, such summertime lightning fires were part of the ecosystem which favored fire-resistant trees (larch, ponderosa pine, Douglas fir) at mid-elevations (4000 to 6000 feet), and fire dependent trees (lodgepole pine) at higher elevations (6000 feet to treeline at 8000 feet).

Early settlers' accounts suggest, that for eons proceeding European settlement, natives intentionally set fire to the forest floor during the early fall months in order to destroy brush for the purposes of improving hunting opportunities for deer, elk, etc., and to provide better growing conditions for opportunistic post-fire berry crops (mostly huckleberries). However, many fires were caused by lightening and burned unchecked from mid-July to snowfall.

The net and cumulative result of aggressive fire suppression during the past century has been a gradual accumulation of flammable ground litter and considerable increase in the growth of understory thickets of thinner-barked "true" firs which are not as fire-resistant as the thicker-barked larch, ponderosa pine, and Douglas fir. The precise effects of this gradual change in the fire-suppression related composition of upland flora are still incompletely understood. Fires which "escape" initial control/containment efforts tend to burn hotter and expose more soil to subsequent erosion and may cause more "fine" silts to be transported downstream.

Agriculture

A reconnaissance survey indicates that 119,600 acres (62 percent) in the Pine Creek watershed are used for the production of crops and livestock. Of this acreage, 55,600 acres are grazed forest land, 46,900 acres are grazed rangeland; and 17,100 acres are cropland. Most cropland is irrigated, with hay and pasture occupying 97 percent of the area. The remaining area is planted in grain and corn, or is used for orchards or pasture.

The primary economic industry in Pine Valley is agriculture. Water use is necessary for the survival of livestock, crops, and the farming operations.

Agriculture in the Pine Creek watershed has been an enduring industry since about 1870. There are about 118 farms in the watershed. Agriculture has meant livestock (cattle and sheep) grazing as well as forage and crops necessary to sustain animals. Production of hay and grain for supplemental winter feeding has been a necessity due to the 140-day growing season, seasonal grazing opportunities, and heavy winter snowpacks.

Beef Cattle Bring in $5.1 million to Pine Valley in 1999[1]

In 1999 there were 55 beef producers who sold over $5.1 million worth of beef cattle from Pine Valley. A total of 5,608 beef cows were maintained in 49 herds varying in size from 700 cows down to less than 5 cows per herd. There were 2,466 transient summer yearlings purchased and brought into the valley by 100 producers to be sold in the fall. Four producers had both a cow herd and transient summer yearlings. About two-thirds of the spring calves are held over during the winter and sold the next fall as long yearlings.

The beef cattle industry continues to be the number 1 industry throughout Baker County generating $29.2 million in 1999 according to the Oregon State University Extension Service. Improved market conditions during 1999 resulted in a 14 percent revenue increase over the $27 million reported in 1998.

Other livestock sold from Pine Valley during 1999 included 40 horses ($60,000), 767 lambs ($59,826), and 28 bison ($55,000). Additional economic benefit was derived from hay and pasture necessary to support an additional 440 horses, 277 bison, and 50 llamas that were not for sale. This amounted to $182,350 for the year.

The total economic benefit to the Pine Creek Watershed area (Pine Valley) from the livestock ranching industry in 1999 was $5.5 million. Livestock ranching is the only significant agricultural activity in this watershed. The production of hay and pasture to support the livestock is highly dependent on the availability of irrigation water. Without irrigation water only a fraction of the above listed livestock could be supported.

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[1]Survey by G.W. Summers with advice and guidance by Jay Carr, OSU Extension Agent for Baker County. March 2000.

1999 LIVESTOCK INVENTORY - PINE VALLEY		
Beef Cattle	5,608 cows	49 producers
	2,466 transient summer yearlings	10 producers
note: adding the spring calf crop and the ranch raised yearlings held over the winter increases the total number of beef animals to over 16,000 head.		
Gross Beef Cattle Sales in 1999: $5,142,676		
Sheep	548 breeding ewes	13 producers
767 lambs sold in 1999: $59,826		
Horses	480 head (includes mules)	76 owners
10 horse breeders raise and train horses for sale 40 horses sold in 1999 for $60,000		
Bison	305 head	2 producers
28 head sold in 1999 for $55,000		
Llamas	50 head	1 producer
Goats	53 head	
Value of hay and pasture to maintain 440 horses ($132,000), 277 bison ($46,500), and 50 llamas ($3,850) that were not for sale.		
Total economic benefit of livestock to Pine Valley in 1999: $5.5 million		

Beef Herd Size

Number of Cows	Number of Producers
700	1
425	1
300-399	4
200-299	4
100-199	8
50-99	11
20-49	10
less than 20	10

The feed production segment of the agriculture industry relies on dependable water sources. A system of privately owned reservoirs and ditches has been constructed to store and deliver water from high snowpack areas to Pine Valley throughout the growing season. Ditches, canals, and the artificial application of water to land has altered the natural drainage patterns and groundwater tables in Pine Valley.

The ODFW and Natural Resources Conservation Service (NRCS) provide technical assistance and work with private landowners to improve management techniques.

Fish and Wildlife

Fish and wildlife are valuable resources because they provide an economic value in the number of dollars spent in the local economy by sports enthusiasts and for the quality of life their presence provides to local residents.

> The ecological system for resident species has evolved for the past 130 years as irrigated agriculture evolved due to water diversion and reservoir storage and increased water use in Pine Valley. The ecological system for nonresident species has been in place for about 45 years or since the first Hells Canyon Dam on the Snake River was constructed. The remainder of this section discusses the adverse effects of out-of-stream water uses which may be the case before settlement of the watershed; however, it is doubtful there has been much change in species numbers after irrigation and the dams were established (M. Kerns, rancher).

Pine Creek before construction of the Hells Canyon Dam (1967) contained runs of spring chinook and steelhead. Currently, the basin contains resident populations of native bull trout and redband/rainbow trout as well as numerous species of nongame fish. Several species of non-native game fish (bass and catfish) are also know to occur.

The Pine Creek watershed is inhabited by several cold water fish species, some of which have unique habitat requirements. Bull trout require cold, clean water for spawning and rearing. Scientific literature indicate spawning occurs when water temperatures are 40 to 50 °F; adult densities are highest at about 54 °F. Local studies indicate the upper limit of preferred bull trout rearing temperatures is about 58 °F. Redband/ rainbow trout prefer water temperatures below 55 °F for spawning, and rearing temperatures below about 68 °F. Nonsalmonid fish species can tolerate warmer water; these fish species are more common from about elevation 3000 feet downstream due to warmer summertime water temperatures.

Most larger perennial streams contain resident redband and/or rainbow trout. Some perennial streams have natural or man-made fish barriers that block habitat access. Bull trout are known to live in the Upper Pine Creek, Clear Creek, East Pine Creek, and Elk Creek subwatersheds downstream from fish barriers and upstream from habitat-limiting water temperatures. Some migration probably occurs into the lower reaches of the tributaries, main stem Pine Creek, and the Snake River (Hells Canyon Reservoir) during the fall, winter, and spring when water temperatures are cold. East Pine Creek is also home for rainbow trout, northern pike, minnow, suckers, and shiners; these fish are also present in other streams. Streams, lakes, and reservoirs have been stocked with brook trout and rainbow trout by ODFW; however, this program is being modified and

the stocking of brook trout discontinued to reduce conflicts with bull trout conservation. Anadromous salmon and steelhead (and perhaps river run bull trout) no longer enter Pine Creek due to Hells Canyon Dam. One of Idaho Power Company's relicensing requirements for the Hells Canyon Project is to determine if bull trout migrate between known habitat on National Forest land and the Snake River. Angling for stocked native species, non-native species, and wild fish is popular.

Studies by the WWNF indicate that ditches on National Forest lands in the Clear Creek and Elk Creek subwatersheds adversely affect bull trout habitat by blocking migration, dewatering streams, or stranding fish in irrigation ditches.

A wide variety of wildlife habitats are found in the Pine Creek watershed including alpine meadows, mixed conifer forests with an old-growth component, recent large-scale forest fire sites, riparian corridors, small aspen clones, agricultural lands of Pine Valley, and shrublands and grasslands. These habitats support big game, upland game birds, small game, furbearers, amphibians, reptiles, and waterfowl. Old-growth dependent species such as Northern goshawk and pileated woodpecker are known to regularly nest in the watershed. Riparian dependent species like the tailed frog are also common, and habitat generalists such as the red tailed hawk and coyote are common. Other species that occur include river otter, beaver, golden eagle, many species of neotropical migrant song birds, and several species of bats. Mule deer, Rocky Mountain elk, cougar, and black bear are very common throughout the watershed. Whitetail deer are also found in Pine Valley. Big game hunting is a popular activity in the watershed with a 10-year average of 174 deer and 258 elk harvested annually. Waterfowl hunting occurs in the lowlands of Pine Valley and turkey hunting is becoming very popular. Upland bird hunting (chukar, Hungarian partridge, blue and ruffed grouse) is common in the fall and winter.

Due to irrigation water appropriations, some streams have been impaired in their ability to maintain adequate flow to provide viable habitat for fish, aquatic life, and wildlife. Although Pine Creek watershed has lost its anadromous fish population due to the barrier created by Hells Canyon Dam, the remaining fish population and aquatic life require adequate stream habitat. In an effort to protect stream flows to support these and other public benefit uses, instream water rights requests have been filed with the OWRD. To date, all of the technical reviews have been completed for the requested instream flows. A preliminary list of fish-bearing streams in the Pine Creek watershed has been included in appendix H.

Appendix I contains a list of proposed endangered and threatened species and candidate species that is specific to and may occur on the Pine Ranger District.

Land Ownership and Management

Private lands comprise approximately 31 percent of the watershed, with relatively few parcels located within the National Forest boundary. The majority of private land within the forest boundary is located at the southern interface with Pine Creek and Dry Creek Valleys. Approximately 10 percent is comprised of BLM, and State and county ownership comprise 1 percent (figure 9, page 40).

Past and/or present activities that have occurred on private land in the watershed include domestic livestock grazing and related agricultural activities, timber harvesting, irrigation of fields, home construction and landscaping, gravel crushing, mining, and spring development. The cattle numbers on the forest during the 1950's and 1960's have declined approximately 50 percent to the current level. The USFS has information on the exact number of cattle on grazing permits during the past 50 years.

Early commercial timber harvest records date back to the late 1950's with minor harvest associated with mine improvements and early agricultural establishment occurring in the 1880's.

Individual landowners are responsible for the management and protection of soil, riparian, and other natural resources. County, state, federal, and private landowners are subject to a variety of regulations, from County land use and zoning ordinances to consultation with the USFWS.

ODF regulates forestry operations on non-federal forestland. Landowners and operators are subject to the Forest Practices Act when they conduct any commercial activity relating to the growing and harvesting of trees. The objectives of the Forest Practices Act are to: "encourage economically efficient forest practices that assure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land, consistent with the sound management of soil, air, water, fish and wildlife resources, and scenic resources within visually sensitive corridors...that assures the continuous benefits of those resources for future generations of Oregonians." (ORS 527.630 Policy, Oregon Forest Practices Act).

The forest practice rules are designed to address these issues. Individual rule divisions govern timber harvesting, forest road construction and maintenance, reforestation, treatment of slash, chemical use, protection of water and sensitive resource sites, and threatened and endangered species sites on private forest lands.

Landowners and/or forest Operators are required to provide a written notification to the State Forester that an operation will take place prior to commencing a forest operation. Additionally, when sensitive areas and resources may be impacted by an operation, such as operations within 100 feet of a fish bearing stream, a written plan outlining protection measures must be approved by the department before the activity may begin.

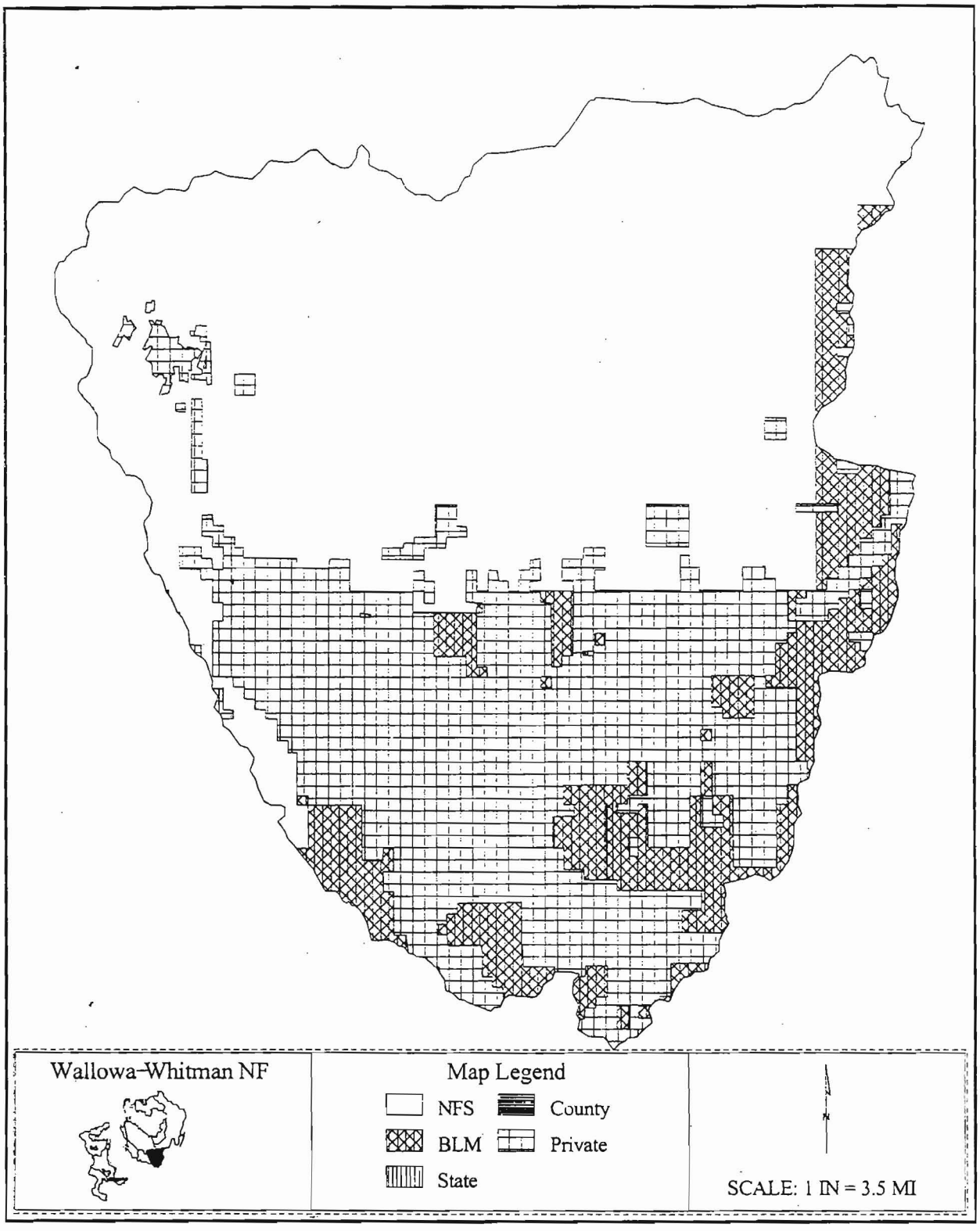
The Forest Practices Act and rules are considered a BMP program. BMP's are defined as practices selected by an agency that are practical and effective at reducing nonpoint source pollution to standards compatible with water quality goals. Once an agency's BMP's are approved by the state water quality regulatory agency, they are certified as the water quality management plan (WQMP) for landowners that implement them.

A WQMP illustrates how a landowner will achieve acceptable water quality. The Oregon Department of Environmental Quality (ODEQ) has approved the Oregon Forest Practices Act and Rules as an acceptable BMP program. When forest

landowners properly implement BMP's they are actually implementing an approved WQMP, designed to maintain water quality.

The ODF achieves BMP compliance through a balanced program of rule education, technology transfer and enforcement. Through a series of inspections and site visits, Forest Practices Foresters (FPF) work with landowners and operators to facilitate proper implementation or compliance with the forest practices rules. FPF's prioritize operations to determine inspection schedules. When rules are not properly implemented, and resource damage results from noncompliance, enforcement action is taken (ODF).

The Oregon Forest Practices Act governs timber harvesting, forest road construction, reforestation, slash disposal, and chemical application on private forestland. Landowners and/or forest operators are required to provide a written notification to the State Forester that an operation will take place prior to conducting that forest operation. Additionally, a written plan, outlining protection measures, is required when an operation is within 100 feet of certain streams and sensitive resource sites. The State Forester, prior to commencing an operation must approve those plans (Paul Joseph).



Land Ownership in the Pine Creek Watershed.

FIGURE 9