INSTREAM WATER USE INVENTORY
FOR THE BEAR CREEK BASIN
A Portion of the "2050" Regional Water Resources Plan

Prepared By
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EXECUTIVE SUMMARY
INSTREAM WATER NEEDS INVENTORY - BEAR CREEK BASIN

PURPOSE
This report compiles existing data relating to instream needs and flows and determines, where possible what those flow needs are in the "2050" Bear Creek Basin Study area.

INSTREAM USES
The major instream uses include that for fish and wildlife, water quality, recreation (including education) and aesthetics. These needs vary by use, stream, stream segment, and time of year. Flow needs also vary by fish species.

DATA INVENTORY
The major documented flow requests are the instream water rights for salmonid fish requested by the Oregon Department of Fish and Wildlife and the flows to mitigate water quality problems listed by the Department of Environmental Quality. The largest need appears to be for fish which need adequate flow for migration, spawning, egg incubation and juvenile rearing. It is assumed that meeting the instream needs for fish and water quality will also meet recreational and aesthetic needs.

The instream water right request for fish is based on the "Oregon Method" which has been controversial due to its relatively high flow findings for fish. It is, however, the best data available and may represent an upper limit of instream flow needs.

A summary of the various instream flow requests for Bear Creek, its tributaries and other streams in the Bear Creek Basin are shown on Table 4 of the report.

FINDINGS: INSTREAM REQUESTS AND AVAILABLE FLOWS

Instream flow requests can be compared to existing instream flows to determine how much additional water is needed to meet various needs. The only stream for which adequate instream flow records exist is Bear Creek's main stem.

Bear Creek Main Stem - Instream Requests and Available flows

This report compares the largest instream flow request (Table 4) with recorded stream flows and estimates of "natural" flows. Flow data are calculated using exceedance flows; for example the 50% exceedance streamflow is the streamflow that is exceeded by 50% of the other recorded flows. Table 1 compares flow requests with available flows.
**TABLE 1**

**MAXIMUM INSTREAM FLOW REQUEST AND AVAILABLE FLOWS**

**BEAR CREEK AT MEDFORD 1958 – 1987 (cfs)**

<table>
<thead>
<tr>
<th>MONTH</th>
<th>INSTREAM REQUEST</th>
<th>INSTREAM GAGED FLOW</th>
<th>NET REMAINING</th>
<th>NET BELOW DIVERSION</th>
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<tr>
<td></td>
<td></td>
<td>Exceedance</td>
<td>50% 80%</td>
<td>Exceedance 50% 80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAN</td>
<td>170</td>
<td>104 48</td>
<td>-66 -122</td>
<td>-66 -122</td>
</tr>
<tr>
<td>FEB</td>
<td>170</td>
<td>131 65</td>
<td>-39 -105</td>
<td>-39 -105</td>
</tr>
<tr>
<td>MAR</td>
<td>170</td>
<td>146 86</td>
<td>-24 -84</td>
<td>-24 -84</td>
</tr>
<tr>
<td>APRIL</td>
<td>170</td>
<td>188 77</td>
<td>+18 -93</td>
<td>-12 -123</td>
</tr>
<tr>
<td>May 16-30</td>
<td>100</td>
<td>108 63</td>
<td>+8 -37</td>
<td>-22 -67</td>
</tr>
<tr>
<td>JUNE</td>
<td>100</td>
<td>65 36</td>
<td>-35 -64</td>
<td>-65 -94</td>
</tr>
<tr>
<td>JULY</td>
<td>100</td>
<td>45 29</td>
<td>-55 -71</td>
<td>-85 -101</td>
</tr>
<tr>
<td>AUG 1-15</td>
<td>100</td>
<td>50 31</td>
<td>-50 -69</td>
<td>-80 -99</td>
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<tr>
<td>Aug 16-30</td>
<td>170</td>
<td>50 31</td>
<td>-120 -139</td>
<td>-150 -169</td>
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<tr>
<td>SEPT</td>
<td>170</td>
<td>54 31</td>
<td>-116 -139</td>
<td>-146 -169</td>
</tr>
<tr>
<td>OCT</td>
<td>170</td>
<td>34 24</td>
<td>-136 -146</td>
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<td>170</td>
<td>45 32</td>
<td>-125 -138</td>
<td>-125 -138</td>
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<tr>
<td>DEC</td>
<td>170</td>
<td>83 29</td>
<td>-87 -141</td>
<td>-87 -141</td>
</tr>
</tbody>
</table>

(AF/yr) 111,325 64,000

Total of Deficits (annual AF) 50,000 77,805 60,000 90,600

Additional Flow needed (ave. cfs) 68 106 82 124

The following findings can be made based on the above data:

* **Critical low flow locations and periods:**
  Bear Creek below Jackson St. Dam in Medford -
  April to October when 30 cfs average irrigation withdrawals (12,600 AF/season) can exceed existing stream flow and October to early December after irrigation season until the start of winter rains

(Note: a second, critical, low flow area is between Emigrant Reservoir and Ashland from Oct to April when winter rains are stored for future irrigation).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Exceedance</th>
<th>50% 80%</th>
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<td></td>
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<td>Exceedance 50% 80%</td>
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* **Bear Creek average annual discharge**
  Medford gage (1958-1987) (AF) 64,000 33,500
  Average flow 88 cfs 46 cfs
  below Jackson St. Dam (AF) 51,400 20,900
  (minus 12,600 AF April-Oct) 71 cfs 29 cfs

* **Instream requests (111,325 AF/yr) exceed available flow volumes by almost 50,000 AF annually at the Medford gage and over 60,000 AF below Jackson St. dam**
Bear Creek Main Stem - "Natural" Flow Estimates

The Oregon Water Resources Department has prepared estimates of "natural" streamflow characteristics which would exist if there were no artificial storage or consumptive withdrawals. Table 2 summarizes this data for Bear Creek's main stem.

**TABLE 2**

**COMPARISON OF NATURAL FLOW ESTIMATES WITH EXISTING FLOWS ON BEAR CREEK AT MEDFORD 1958 - 1987 (CFS)**

<table>
<thead>
<tr>
<th>Month</th>
<th>Recorded Flows</th>
<th>OWRD Nat. Flow Est.</th>
<th>Difference</th>
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<tr>
<td></td>
<td>50%</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>JAN</td>
<td>104</td>
<td>48</td>
<td>216</td>
</tr>
<tr>
<td>FEB</td>
<td>131</td>
<td>65</td>
<td>265</td>
</tr>
<tr>
<td>MAR</td>
<td>146</td>
<td>86</td>
<td>241</td>
</tr>
<tr>
<td>APRIL</td>
<td>188</td>
<td>77</td>
<td>182</td>
</tr>
<tr>
<td>May</td>
<td>108</td>
<td>63</td>
<td>168</td>
</tr>
<tr>
<td>JUNE</td>
<td>65</td>
<td>36</td>
<td>101</td>
</tr>
<tr>
<td>JULY</td>
<td>45</td>
<td>29</td>
<td>40</td>
</tr>
<tr>
<td>Aug</td>
<td>50</td>
<td>31</td>
<td>24</td>
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<td>SEPT</td>
<td>54</td>
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<td>NOV</td>
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</tr>
<tr>
<td>DEC</td>
<td>83</td>
<td>29</td>
<td>153</td>
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**AF/YR**

| 64,000 | 33,500 | 91,000 | 48,300 |

Total of Deficits (- months) - 524  - 277
Addit. flow needed in deficit periods (ave.cfs) 75  40
Additional annual water need, deficit period (cfs x 2 x # days of deficit) (AF/yr) 31,500  16,800
Additional water needed below dam (AF/yr) 43,100  29,400

**additional water needed to meet estimates of "natural" conditions (50%) at Medford**

Replacing deficit months only (50%) 27,000 AF *

**Bear Creek Main Stem - Combining Flow Requests With Estimates of "Natural" Flows**

If the lesser ODF&W request during the high flow months of Jan - April, then the instream need calculations for the 50% exceedance level are reduced to:

* at Medford gage (50%) 18,720 AF (26 cfs)
* below diversion dam (50%) 31,320 AF (43 cfs)
Bear Creek Main Stem - Summary

Bear Creek at the Medford Gage (1958-87); 50% exceedance:
- Average annual recorded discharge 64,000 AF/yr
- ODF&W Instream Water Right Request 111,325 AF/yr
- OWRD Estimate of "Natural" conditions 91,000 AF/yr

Additional water needed to meet ODF&W Request 47,325 AF/yr
Additional water needed to meet "Natural" Flows 27,000 AF/yr
Additional water needed to meet the combination of the ODF&W Request and "natural" conditions 18,720 AF/yr

(Note: Add 12,600 AF/yr to these figures to compensate for the water withdrawn at the Jackson St. Dam below the Gage).

The combination of the lesser of the ODF&W request and the estimates of "natural" conditions may represent the least amount of additional flow need which actually meets the most critical (fish and wildlife) instream flow requirement.

Figures 1 A and 1 B compare Bear Creek annual discharge measurements with the ODF&W Instream flow requests from Table 1 and the OWRD "natural" flow estimates (Table 2) above and below the diversion dam. The calculations are based on 1958 - 1987 data. The combination of the ODF&W request and the OWRD "natural" estimate is also shown.

Bear Creek Tributaries and Other Basin Streams

The total request for all tributaries is similar in volume to that requested for the main stem. It is not possible to determine the additional water needed to meet the requests because of the lack of adequate stream flow data. There is a wide discrepancy between the instream flow request and estimates of natural flow conditions. Emigrant, Jackson, Wagner and Griffin Creeks are the tributaries with the largest request for additional instream flows.

The Little Butte Creek area data indicate there are adequate stream flows to meet existing instream needs, however, the peak water temperatures are too high for salmonids.

SUMMARY

The application of estimates of "natural" conditions generally requires less water than existing water right requests. The combination of the instream water right request and the estimates of "natural" conditions may represent the most attainable instream flow amount which addresses the most critical instream need, that for fish.
FIGURE 1A
BEAR CREEK DISCHARGE SUMMARY
(Acre Foot per Year)

FIGURE 1B
BEAR CREEK INSTREAM WATER NEED
(50% Exceedance Level: AF/Yr.)
INVENTORY OF INSTREAM WATER NEEDS

A Part of the Bear Creek Area Water Resources Plan

I INTRODUCTION

A. Purpose

The purpose of this report is to 1) inventory existing data relating to instream needs and flows, 2) determine, if possible, what those flow needs are and 3) recommend data improvement opportunities. The report also describes efforts to utilize estimates of "natural" stream flows in determining instream flow needs.

This inventory is part of an effort to determine all water needs within a study area and to then work toward equitable solutions to meet those needs in the future.

This information will become part of a public education effort covering the overall water resource setting in the Bear Creek Basin.

Note: The research findings contained in this report show that existing data are not adequate to determine exactly what the various instream flow needs are for every stream. The best recorded information, provided by Oregon Fish and Wildlife, is based on the "Oregon Method" which has been challenged because its results indicate more water flow than verifiable by historic observations.

IT IS THEREFORE LIKELY THAT THE INSTREAM FLOW NEED FINDINGS CONTAINED IN THIS REPORT MAY BE HIGHER THAN FINDINGS OF FUTURE STUDIES.

B. Background

Recent efforts at long term water resource planning in Jackson and neighboring counties began in the late 1980's with efforts by the Rogue Valley Council of Governments (RVCOG) to bring regional water interests together to address a growing drought crisis.

A "2050" committee was formed to study current and long term water needs in the Bear Creek area (Fig. 1). Subcommittees began specific investigations in 1992 to determine:

1) the amount of water available to the study area
2) the amount of water needed for municipal uses
3) the amount of water needed for agriculture
4) the water needed for instream uses
Research is underway in each of these areas with completed reports available for agriculture and ground water (part of the municipal needs). This report addresses the instream water needs within that study area (Figure 1).

Once these water needs are estimated and totalled, the committee, now called the Bear Creek Watershed Council, will help various water users work together to plan for the most effective distribution of limited water supplies.

C. Approach

This report summarizes and assesses the existing data available concerning instream flows within the study area and the instream use requirements for fish, riparian, water quality, recreation and aesthetic needs. This report will also note where any additional information will be necessary to determine the various needs.

This report was prepared under the guidance and review of the Instream Committee of the Bear Creek Watershed Council which recently adopted the following mission statement:

"To determine the physical characteristics in and along Bear Creek which are necessary to maintain a healthy human environment, viable populations of native anadromous and trout fisheries, and appropriate recreational opportunities - and to develop strategies to meet these needs - considering the creek's current and historical circumstances."

This committee and many other agencies and individuals were consulted in preparing this report (see acknowledgements).

Members of that committee stress the value of relating adequate instream flows to the resulting quality of life in and around the riparian corridor and the region.

D. Historical Setting

The Bear Creek Basin has grown tremendously since its settlement in the mid 1800's. The available water resources support a strong agricultural and tourism economy. There are over 50,000 acres of irrigated farm land in the basin. The Rogue valley is known nationwide for its fishing and other natural resource attraction. A more detailed description of the cultural history and natural history of fish is found in Attachments 1 A and 1 B.

Demands for water have grown to the point where there is not enough to satisfy all needs, particularly instream needs. A history of water resource development and needs is found in Attachment 1 C.
II CURRENT SETTING

A. Geographic Setting

The Bear Creek Basin (Fig. 1) area is the home of about 120,000 people living in both rural and urban settings. The climate has definite seasons with winter daytime high temperatures in the 30's and summer highs over 100 degrees F. A detailed geographic description is included in Attachment 2.

B. Water Resource Uses

Water resources in the Bear Creek Valley study area are used for municipal and industrial, agricultural and the instream uses for fish and wildlife, water quality, education, recreation, aesthetic and power generation purposes.

C. The Nature of the Bear Creek Valley Water System

Average annual discharges for Bear Creek are shown in Figure 2 A. The region's precipitation pattern is shown in Fig. 2 B. Drought conditions have been apparent recently as shown by the 1983 - 94 annual precipitation summary (Fig. 2 C).

Agricultural interests began to develop water storage facilities in the 1920's to provide irrigation water in the summer and fall when it is needed most. Table 1 lists the location of those facilities and the relationship to the irrigation district service areas.

Approximately 52,000 AF of water is imported from Hyatt and Howard Prairie Reservoirs located in the Klamath watershed. The USGS gage in Medford shows a long term average discharge of 80,000 AF, but this gage does not record summer irrigation water distributed via canals. Irrigation canals, Bear Creek and its tributaries are used to convey this stored water to irrigation district customers in the summer and fall. It is conceivable that the growing water demands in the Klamath Basin may affect future water importation.

The importation of water for agriculture adds to stream flows in the summer and fall when natural flows would have been depleted. The high demand for water would cause Bear Creek to be dry around mid June were it not for this water stored and distributed by irrigation districts.

According to the Oregon Water Resources Department (OWRD), Bear Creek has been closed to further appropriation since 1959 due to excessive water demands. All existing water rights are listed in Table 2. The overall water demands in the summer on the Bear Creek system exceed the supply available during all but the wettest of years.
The long term annual discharge of Bear Creek is illustrated in Figure 2a. Figure 2b shows the distribution of precipitation by monthly percentages at Medford (OWRD Rogue Basin Plan, 1985). Figure 2c illustrates the actual precipitation recorded from 1983-1992 (Mail Tribune).

FIGURE 2a HISTORIC FLOWS IN BEAR CREEK AT MEDFORD
(Annual discharge in acre feet *)

* (1cfs = about 2 AF/day)

FIGURE 2b
PRECIPITATION DISTRIBUTION (%)
<table>
<thead>
<tr>
<th>DATA</th>
<th>EAGLE POINT</th>
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<th>ROGUE RIVER VALLEY</th>
<th>TALENT</th>
<th>(TOTAL)</th>
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<td>Irrigation Season Allowed</td>
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<td>4/1 - 10/31</td>
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<td>Acreage Served</td>
<td>(Proof Survey) 1979 - 1980 8,260</td>
<td>(Proof Survey Underway)</td>
<td>(Proof Survey Underway) 8,221 (Total 8854)</td>
<td>(Proof Survey Underway) 17,700 (15,560 irrigated)</td>
<td>43,674 irrigated</td>
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<tr>
<td>Frost Control Acreage (Feb 15 - Mar 31)</td>
<td>-</td>
<td>1000 AC</td>
<td>375</td>
<td>-</td>
<td>1,375</td>
</tr>
<tr>
<td># Parcels</td>
<td>500+</td>
<td>2,171</td>
<td>1000 Accts.; 802 users</td>
<td>3,143</td>
<td>6,616 irrigated</td>
</tr>
<tr>
<td>Average Parcel Size (Ac)</td>
<td>16 AC</td>
<td>5.8 AC</td>
<td>8.8 AC</td>
<td>4.3 AC</td>
<td>6.8 AC</td>
</tr>
<tr>
<td>Water Sources Available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Storage: Capacities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peninsular - Total Capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Award Prairie 60,000 **</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyatt 16,180</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emigrant 39,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agate 4,671</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourmile 16,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish 7,836</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total 143,687</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Annual Capacity</td>
<td>117,492**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Stream Flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Assuming Average Precipitation Runoff)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Butte Cr. (88 cfs available)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal: 42,000 AF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Available (Surface Water Sources)</td>
<td>42,000 AF/Season (37,664 actually available)</td>
<td>42,091</td>
<td>27,716 AF</td>
<td>81,113</td>
<td>192,920</td>
</tr>
<tr>
<td>Other ***</td>
<td></td>
<td>+4000 AF return flows 46,091</td>
<td>+3000 AF return flows (-7000 AF)***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

* Frost control water delivered by irrigation districts to customers with temperature control stream flow water rights = 4,671 AF

** Howard Prairie Canal connection limits transfer of water to 36,000 AF per year; 2,195 AF assigned to Ashland & Talent municipal uses

*** MID and RRVID utilize 7,000 AF of return flows increasing inter-district efficiencies (does not affect total calculations)

Other sources: The U.S. Geological estimates 3,000 AF of Ground Water is used for irrigation county-wide, perhaps 2,000 AF in the Bear Creek Basin
Figure 6
Irrigation District Boundaries
<table>
<thead>
<tr>
<th></th>
<th>IRR</th>
<th>DOM</th>
<th>STK</th>
<th>MUN</th>
<th>IND</th>
<th>FISH</th>
<th>WLDLF</th>
<th>MIN</th>
<th>PWR</th>
<th>TEMP</th>
<th>REC</th>
<th>FIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bear Cr.</strong></td>
<td>69.194</td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.45</td>
</tr>
<tr>
<td><strong>Ashland Cr. and misc.</strong></td>
<td>5.164</td>
<td>.10</td>
<td></td>
<td>28.542</td>
<td>.7</td>
<td></td>
<td></td>
<td></td>
<td>54.0</td>
<td></td>
<td></td>
<td>.224</td>
</tr>
<tr>
<td><strong>Emigrant Cr. and misc.</strong></td>
<td>60.048</td>
<td>.795</td>
<td>.10</td>
<td>.05</td>
<td>.25</td>
<td></td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Griffin Cr. and misc.</strong></td>
<td>78.467</td>
<td>.07</td>
<td></td>
<td>.03</td>
<td>1.0</td>
<td></td>
<td></td>
<td>2.5</td>
<td>.25</td>
<td>.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wagner Cr. and misc.</strong></td>
<td>35.196</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.20</td>
<td></td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td><strong>Walker Cr. and misc.</strong></td>
<td>8.712</td>
<td>.272</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.52</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bear Cr. misc.</strong></td>
<td>304.457</td>
<td>1.436</td>
<td>.15</td>
<td>2.035</td>
<td>.15</td>
<td>.421</td>
<td>9.604</td>
<td>11.73</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Umpqua R. and misc.</strong></td>
<td>3.425</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.32</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>564.663</td>
<td>2.673</td>
<td>.26</td>
<td>30.577</td>
<td>1.85</td>
<td>2.351</td>
<td>1.77</td>
<td>15.804</td>
<td>55.5</td>
<td>30.0</td>
<td>.974</td>
<td>.10</td>
</tr>
</tbody>
</table>

1) 11/1 to 5/1
D. Instream Water Management

Instream water uses typically access the water left over after other demands have been met. Water rights with the oldest priority dates are first in line for available water. Recent legislation has allowed representatives of instream uses such as Fish and Wildlife and the Department of Environmental Quality to file for instream water rights. These water rights, however, are junior to all pre-existing right and therefore have little real chance to access water especially on over appropriated streams such as Bear Creek.

Bear Creek is not a good example of a natural stream. While the imported water used by agriculture for irrigation helps augment instream flows in certain stream reaches, the withdrawals of the water result in significant flow reductions downstream as well as extreme variations in flow patterns during the April through October irrigation season.

Of particular significance are the 30 to 40 cubic feet per second (cfs) decreases below the three major irrigation diversion structures found in Ashland, Talent and Medford. The generalized summer and winter flow patterns for Bear Creek are shown in Figure 4.

FIG. 4 Bear Creek Flow Characteristics

Typical Flow Profile for Bear Creek
Comparing Irrigation Season to Non-Irrigation Season
III CONSIDERATIONS AND ASSUMPTIONS

A. Relationship Among Instream Uses

The four major instream uses (fish habitat, water quality, recreation and aesthetics) are all interrelated. Increasing instream flows to improve fish habitat will also improve water quality. Providing flows for water quality will benefit both recreational and aesthetic needs.

B. Considerations in Determining Instream Flows

The following factors must be considered when determining instream flows:

1. Time of year - In some cases minimum flows for certain fish species need only be present for a short period of time. Water quality and recreational flows may be needed at other times.

2. Location - A healthy stream naturally has increasing flow volumes in the downstream direction and minimum flows may change accordingly. There may also be critical locations such as below a dam where a specific flow is needed for fish passage.

3. Inadequate water supplies - The determination of minimum instream needs will not provide the water to meet those needs where water supplies are inadequate.

4. Available data - The data available may not be adequate to determine the precise quantity, location and time flow needs for each instream use.

Flow data are not adequate to determine long term flow characteristics for any stream except Bear Creek. It is therefore difficult to calculate the additional water needed to meet instream flow needs.

5. It is difficult to determine what stream conditions should be used as the goal for minimum flow needs. It could be estimates of ideal flows for fish, estimates of historical flows or estimates of "natural" conditions which would exist without storage or water withdrawal impacts.

As a practical matter, efforts to enhance instream flows for any beneficial use will be working within a system that is not likely to return to the "natural" conditions found here 500 years ago.
C. Assumptions

The following assumptions are used in this inventory:

1. A given flow can satisfy more than one instream flow need simultaneously.

2. Different fish species will require different instream flows for an ideal habitat and these flow needs can conflict.

3. The instream use requiring the most water at a given time and location would be the minimum need listed. It is possible that a flow needed for one use is too much for another such as fish spawning.

4. It is possible (and beneficial) to determine "natural" instream flow characteristics by calculating what the flows would be if water were not withdrawn from the stream by water right users.

5. Providing adequate flow for tributaries will help to enhance flows for the main stem provided these tributary flows are not withdrawn on the way.

6. In order to determine additional water needed to meet instream benefits, a comparison must be made between existing flows (if known) and either the formal instream flow request or flows estimated to be characteristic of the natural conditions.

7. Any additional water obtained to meet instream flow needs must also meet existing water quality standards.
IV DETERMINATION OF INDIVIDUAL INSTREAM NEEDS

Instream uses in the study area streams include water needed for fish and riparian habitat, water quality, recreational and aesthetic uses. The determinations of instream flow needs are discussed for each use in this section by 1) purpose, 2) amount needed, 3) time of year needed, 4) location, if noted and any qualifications or other considerations.

A. Instream Needs For Fish and Wildlife

1. Existing Fish habitat - Description

According to the Oregon Department of Fish and Wildlife (ODF&W) publication, "Status of Anadromous Salmonids" (1992), the Rogue River is habitat for the following salmonid species:

* Coho Salmon
* Summer Steelhead
* Winter Steelhead
* Spring Chinook
* Fall Chinook
* Searun Cutthroat

The Oregon Department of Fish and Wildlife estimated approximately 1,000 anadromous fish are found in the Bear Creek system. According to past fish inventory data, "Bear Creek & Tributaries Anadromous and Trout Fish Stocks - Existing Documented Information" (RVCOG, 1994), the following fish species exist or have existed in the Bear Creek system and other study area streams:

* Coho Salmon
* Summer Steelhead
* Winter Steelhead
* Rainbow Trout
* Spring Chinook
* Fall Chinook
* Cutthroat Trout

(Note: the Rogue Basin Plan (OWRD, 1985) does not list Spring Chinook for the Bear Creek system in the ODF&W list; however research by the Rogue Valley Council of Governments (Marc Prevost, personal communication Dec. 8, 1994) did find a reference to Spring Chinook in an Oral History.)

The time of year when these varieties of fish are present is shown on Figure 5. (ODF&W, 1970).

A detailed inventory of anadromous salmonids found in Bear Creek and tributaries also exists in a 1979 Environmental Impact Statement on the maintenance of Reeder Reservoir (Attachment 7).

The Oregon Department of Fish and Wildlife (ODF&W), the Federal Water and Power Resources Service and the EPA provided the three documented references for fish related instream flow needs as discussed below.
2. Oregon Department of Fish and Wildlife Information

a. Bear Creek and Tributaries

1. purpose

ODF&W lists the following purpose(s) in their Instream Water Rights Applications submitted in Dec. 1993 for Bear Creek (Attachment 3):

Bear Creek mainstem - "Providing required stream flows for coho and fall chinook salmon, cutthroat trout, and winter and summer steelhead for migration, spawning, egg incubation, fry emergence and juvenile rearing."

Bear Creek tributaries - The requirements are the same as for the mainstem except that for Emigrant Creek coho is not listed and for the other tributaries neither coho nor fall chinook are listed.

2. amounts

The minimum flow amounts requested by ODF&W for the Bear Creek and study area systems by month and stream or tributary location as listed in the Instream Water Right Applications are included in Attachment 3 and summarized in Table 4.

3. locations

Bear Creek - river mile 0 to 27
Emigrant Creek - river mile 0 to 3.6 (Emigrant Reservoir dam)
Griffin Creek - river mile 0 to Hartley Creek
Jackson Creek - river mile 0 to Horn Creek
Wagner Creek - river mile 0 to 8.0
Walker Creek - river mile 0 to 1.0.

The ODF&W instream water right requests for streams outside the Bear Creek drainage but inside the study area are shown in Table 4b (ODF&W, 1993).

b. Other study area streams

The Oregon Department of Fish and Wildlife instream water right applications for Antelope Creek, Dry Creek, and the North and South Forks of Little Butte Creek are found in Attachment 3b, and summarized in Table 4c.
c. qualifications - data analyses

The data used to generate these flow amounts were based on historic flow calculations using the "Oregon Method". This method has become controversial because people who are knowledgeable about the streams have often stated that the flow findings using the Oregon Method are much higher than historic flow records or personal experiences can verify.

The ODF&W would like to refine the flow estimates for all streams using the newer "Instream Flow Incremental Methodology" (IFIM) technique. This is the current "state of the art" for determining the relationship between flows and physical habitat according to Jerry Vogt, STEP Biologist for ODF&W (Attachment 4).

It is likely that such a study would take into consideration the impact on flows caused by the three major diversion structures on Bear Creek and note any modifications which could be made to mitigate fish habitat impacts in place of flow increases.

Until the resources can be found for an IFIM study, ODF&W must rely on information contained in the Instream Water Rights application as found in Attachment 3a and b. This is the best data available and may represent the upper limit of flow needs for fish.

3. Water and Power Resources Service Information

The Water and Power Resources Service branch of the U.S. Department of the Interior (Bureau of Reclamation as it existed in 1980) prepared a study of the feasibility of bringing water from the Rogue River up the Bear Creek Valley to augment Bear Creek flows for a variety of beneficial uses including fish habitat enhancement. A planning aid document, "The Medford Division Rogue Basin Project" was completed in 1980 (Attachment 5).

a. purpose

The report notes the following fish related purpose for the additional water:

"There is a need for improvement of anadromous fish spawning and rearing habitat throughout the Rogue River system. This could involve establishing and maintaining minimum flows in selected streams during critical periods, improving water quality, and providing passage where barriers exist."
Lack of adequate flows in small streams for fry and smolt migration is a common problem. Fry and smolt are often trapped in small ponds when flows are interrupted prematurely by diversion or drought conditions. The fish enhancement potential that could be realized with improved flows in selected streams is displayed in Table 3 [also Table 3 of this report].

Of the streams listed for possible flow augmentation, those considered to be the most important are Big Butte, Little Butte, Antelope, Kane, Sam's, Foots, Wagner, Emigrant, and Bear Creeks. These streams are particularly important as steelhead spawning and rearing habitat."

b. amounts and locations

The amounts listed by the Water and Power Resources Service for Bear Creek, its main tributaries and other streams in the study area are summarized in Table 3 of Attachment 5. Also included is an estimate of the fish enhancement potential which could be realized. The fish enhancement flows listed in Table 3 of Attachment 5 are assumed to be for the entire stream reach.

c. qualifications, data analyses

(Note: reviewer comments on the fish enhancement potential (Attachment 5 Table 3) indicate that the figures in last column should only be considered a rough estimate.)

4. Environmental Protection Agency Information

a. purpose

In May 1979 the Environmental Protection Agency (EPA) released a Draft Environmental Impact Statement (EIS) summarizing findings related to the maintenance and operation of Reeder Reservoir in Ashland.

The purpose of the study was to determine the nature and extent of the impacts of the reservoir cleaning on the receiving streams and to minimize those impacts.

Fish species were inventoried and their ecological needs, including water flow needs, were noted. An excerpt from that report including both flow and water quality needs for fish by species is found in Attachment 6.
b. amounts and locations

The report listed the minimum stream depth, water velocity and temperatures needed by the various species of fish existing in Bear Creek and other study area streams. Generally the conditions involve 0.5 to 0.8 foot of depth and 1-3 feet per second velocities. This information along with other needs are summarized in Tables 6 a,b and c.

c. qualifications, data analyses

Unfortunately, these figures do not correlate easily with the cubic feet per second (cfs) criteria used by DEQ or ODF&W in their minimum flow calculations. The slope, width and cross sectional area of the stream will govern the water depth and velocity figures noted above. An example of the relationship can be calculated as follows:

A stream width of 50 Ft. x 0.8’ depth = 40 sq. ft. x 2 ft/sec velocity = 80 cubic feet per second.

The natural width of Bear Creek given the existing flow patterns is that point where neither erosion or deposition is dominant. Ed Weber, District Conservationist with the Soil Conservation Service, estimates the natural width of Bear Creek to be approximately 50 feet in mid reach (personal conversation, 1986).

Streams with less drainage area than Bear Creek could achieve these conditions through less width and higher velocities from steeper slopes.

The Rogue Valley Council of Governments is currently funding an investigation into Bear Creek flows. The data gathered will help determine the relationship between flows and flow depth in the Bear Creek Valley.

5. Summary of data for instream flows for fish and Wildlife

The instream water flow needs proposed by ODF&W are usually the largest amount listed at any given time. These amounts are not necessarily ideal for all species of fish.

A summary of all instream water needs data is shown for comparison on Table 4a for Bear Creek, 4b for Bear Creek tributaries and 4c for other streams in the study area.
B. Instream Needs For Water Quality

1. Description

An excerpt from the Rogue Basin Plan (OWRD, 1985) quotes ODF&W as follows:

"The Oregon Department of Fish and Wildlife indicates that water quality is the major problem affecting fish life in Bear Creek."

The documented information on the instream needs for water quality includes data prepared by the state Department of Environmental Quality (DEQ) and ODF&W above.

2. Department of Environmental Quality Information

The Department of Environmental Quality, by agreement with EPA, is the State agency responsible for water quality in Oregon Streams. In 1987 DEQ declared Bear Creek a "Water Quality Limited Stream" because of the following water quality problems:

* fecal bacteria (a human and/or animal waste indicator) from point and non-point sources
* sediment, particularly fine "turbidity" from natural and non-point runoff
* nutrients, including nitrates, ammonia and phosphates from point and non-point sources resulting in occasional low dissolved oxygen levels well as extreme daily variations in oxygen concentrations
* excessive water temperatures due to hot summer climate, limited shade and inadequate flow volumes

A summary of the water quality setting prepared by DEQ as part of the "Total Maximum Daily Load" process in the late 1980's is included in Attachment 7a.

Critical periods for instream water quality are at the beginning of the irrigation season when accumulated material is "flushed" through the system, and just after irrigation season ends when low flows reduce dilution potential and allow increased temperatures.

a. purpose

The purpose of instream flows for water quality is to provide enough flow to dilute water quality pollutants to meet water quality standards and to reduce excessive temperatures in the stream which in turn promotes nuisance algae growth. Instream flows for water quality are intended to complement efforts to reduce stream pollution sources and improve other habitat conditions.
The goal of the DEQ effort is to improve stream water quality by establishing water quality standards as shown in the Oregon Administrative Rules (OAR 340-41-385) for Bear Creek (Attachment 7b). Table 3 lists the rules used to meet those standards.

**TABLE 3**

**OREGON ADMINISTRATIVE RULES - BEAR CREEK**

<table>
<thead>
<tr>
<th></th>
<th>Low-Flow Season</th>
<th></th>
<th></th>
<th>High Flow Season</th>
<th></th>
<th></th>
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<tr>
<td></td>
<td>May 1 through November 30*</td>
<td></td>
<td></td>
<td>December 1 through April 30*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Instream Five Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia Nitrogen</td>
<td></td>
<td>Biochemical Oxygen Demand (mg/l)*</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen as N (mg/l)</td>
<td>0.25</td>
<td>3.0</td>
<td>0.08</td>
<td>1.0</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

b. amounts and locations

"Minimum perennial streamflows" were originally proposed to the Water Policy Review Board by DEQ jointly with ODF&W in 1983. These were not adopted due partly to the fact that the amounts requested greatly exceeded the water flows in the subject streams.

More recently, DEQ has been working to establish instream flow amounts as part of the "Total Maximum Daily Load" (TMDL) calculations relating to the nutrient levels in Bear Creek (Attachment 7a).

A summary of existing instream flow requests for water quality is found in Table 4 page 26.
C. Instream Needs For Recreation and Education

1. Description

The Bear Creek corridor and natural tributaries are all valuable recreational assets to the community. People are able to enjoy the open space, appreciate nature, fish and learn about the environment in these natural riparian zones. Riparian zones need a viable stream and adequate flows to support its needs.

The Bear Creek Greenway provides access and recreational activities along the riparian corridor using walking, bicycling and horse trails. Much of the recreation is in the form of visual appreciation of these riparian areas.

Stream corridors are valuable educational assets for the community as well. The Bear Creek corridor is available for field trips and resource studies at all educational levels. The results from these studies will help us learn more about this unique riparian area.

2. Purpose

The purpose of instream flows for recreational needs is to provide adequate water flows and quality, perhaps sufficient to allow water contact activities, as well as passive activities such as riparian habitat viewing and research. Assuring adequate water quality for human contact may be impractical for such an open, vulnerable system, but it should remain a long term goal.

3. Amounts and locations

There are no data specifically listing the instream water needs for recreation. Water contact activity and fish habitat (fishing) are the two recreational uses requiring the most water flow.

4. Qualifications, data analyses

Because of inadequate data, this report will use the minimum flow needed for fish and water quality to satisfy the instream recreational needs excluding water contact. See the water quality section and Table 4 for those amounts and locations.
D. Instream Needs For Aesthetics

1. Description

The Bear Creek Corridor provides a visual buffer to growing urbanization particularly where the stream travels through cities. There are places where stagnant water ponding exists due to inadequate flows. Such areas are unsightly and also tend to increase water temperature causing more algal growth which in turn adds to the poor aesthetics.

2. Purpose

The purpose for instream water flows for aesthetics is to eliminate those areas where low flows result in visible, stagnant conditions and where high phosphate levels result in unsightly algae blooms indicating an unhealthy creek. Enhanced stream flows will help dilute pollution concentration and may keep the phosphate concentrations below critical levels. This will complement efforts to improve the image of local streams and improve the quality of life, particularly in urban areas.

3. Amounts

There are no specific data available to quantify the amount of instream flows needed to address aesthetics alone. After discussing this situation with Marsha Danielson, Medford Urban Renewal Agency and Karen Smith, Jackson County Greenway (personal communication 6/27/94), it was agreed that the best approach would be to use the fish and water quality instream flow needs described above as the aesthetic minimum.

4. Locations

Bear Creek and its riparian "Greenway" corridor has the most public access and therefore the most aesthetic needs. The critical areas are below the three major irrigation diversion structures (Ashland, Talent and Medford) and at Jackson Street in Medford as discussed above (Figure 4).

For example, thousands of people view Bear Creek at Jackson St. in Medford every day. They see stagnant pools with high turbidity and excessive algal growth. Part of the reason is a diversion dam which soon will be altered to improve the stream flow velocity and reduce stagnation. However, additional stream flows will be necessary to enhance the local aesthetics and complement the dam modification effort.
V INTEGRATING INSTREAM FLOW NEEDS

A. Factors To Consider In Integrating Instream Flow Needs

The various instream needs detailed above may be combined into one flow volume that can be applied to a given stream reach at a certain time of the year. The highest volume need will usually satisfy the other needs at that time and place as well, provided the water quality is adequate. While it is possible that a high flow need for water quality might be too high for fish habitat, it appears from Table 4 that this does not happen in our study area.

There are other factors to consider in arriving at those flow volumes. The most significant are related to the two main instream needs, fish and water quality.

1. Habitat and ecology

The ecological health of a stream depends not just on adequate quantity and quality of instream flows, but also on natural shade to keep water temperatures down, and stream channel diversity to provide natural habitat. If a riparian zone has been significantly altered, by stream channel modifications, tree removal, pollution and urban encroachment, then more and more instream flows will be needed to overcome these other problems. There will be a point where increased instream flow will not solve all the other problems.

Habitat limitations in the Bear Creek system were summarized in a paper entitled "Bear Creek Habitat and Temperature Study 1990-91" completed in 1992 by ODF&W, Rogue River National Forest and the Rogue Valley Council of Governments. The report lists the limiting factors for salmonid fish in the following excerpt:

"We have found the following factors limiting salmonid in the Bear Creek Valley streams:

1) high water temperatures - probably the single most important factor limiting the production of salmonids in the Bear Creek system

2) artificial flow regimes - Bear Creek flows do not follow a natural pattern:

   a) major diversions disrupt basic flow continuity
   b) irrigation water distribution alters flow volumes, sometimes daily
   c) return flows of intensively used water contain high temperature levels
   d) low flow situations increase potential for excessive temperatures
3) stream channel conditions and fish habitat

a) Bear Creek is an open straight channel which is subjected to maximum solar exposure raising temperature.
b) Bear Creek has been simplified to provide an efficient conduit for water. The lack of instream features (logs, boulders) limits habitat diversity for salmonids.
c) There is less than ideal tree cover and fallen logs to accommodate salmonid species.
d) Warm, unnatural conditions have allowed redside shiner to out-compete and replace salmonids.

The figures from that report illustrating the excessive temperatures (Fig. 3) and distribution of maximum temperatures (Fig. 4) are shown in Figures 6 and 7 on the following pages.

Similar findings were listed by Bob Bessey in memo form (Bureau of Land Management, 1985).

2. Approach to habitat considerations

Since the ideal habitat for various fish species all have different instream flow needs, it may be more beneficial to seek historic "natural" conditions. The Oregon Water Resources Department has prepared estimates of stream flow characteristics which would exist if there were no storage or withdrawal activities along selected streams (see Section VI of this report).

The determination of minimum flows for any instream use should note, if possible, where other habitat improvement activities will achieve the same goals without relying on additional flows alone.

Natural streams do not provide perfect habitat conditions for all fish species along the entire stream reach or at all times. Streams with good habitat, however, do provide timely flows for a given activity and respite areas away from harsh conditions. Habitat improvements need to recognize these conditions in order to reduce impractical flow needs.

B. Summary of Instream Flow Requests

A summary of the available data for all instream requests discussed above is shown in Table 4a (Bear Creek mainstem), 4b (Bear Creek tributaries) and 4c (other study area streams). Instream flow requests for fish habitat appears to require the most water at all times of the year.
FIGURE 6  Averaged Maximum and Minimum Water Temperatures in Bear Creek

- Oregon Department of Fish and Wildlife
- Rogue Fly-Fishers
- Rogue Valley Council of Governments
- Rogue River National Forest
- Crater High School

Legend:

- Absolute Max
- Absolute Min

Scale: 1/2" = 1 mile

- : Fishing site
- X: Max/min temp site
- /: Irrigation canal

Temperature data points:

- 68 70 69 61 62
- 62 64 68 62 63
- 62 64 59 53 60
- 70 70 69 62 73
- 62 64 59 53 60
- 71 71 68 62 74
- 63 63 61 59 51
- 73 73 70 65 70
- 63 64 62 55 73
- 75 73 72 64 71
- 61 60 58 52 71
- 74 71 70 64 76
- 61 62 58 51 71
- 72 72 71 68 70
- 61 61 55 50 70
- 73 79 72 70 76
- 64 61 60 59 76
- 70 X X 70
- 60 X X 60
- 69 71 70 65 70
- 55 56 56 56 50
- 58 X X X 58
- 50 X X 50
- 49 71 67 66 76
- 56 55 55 52 50
- 44 40 40 40 44
- 57 58 59 54 54
- 72 73 X X 72
- 55 57 X X 57
- 73 70 76 69 76
- 56 58 52 47 70
- 74 76 X X 78
- 56 57 X X 57
- 72 73 X X 72
- 55 57 X X 57
- 67 69 X X 70
- 55 56 X X 55
- 71 72 69 66 76
- 61 59 53 50 50
- 60 64 73 73 76
- 54 54 63 63 52

Bear Creek

- Crater Creek
- Murphy Creek
- Little Bear Creek

Data points range from 68 to 76 degrees.
FIGURE 7

Fish Distribution and Maximum Temperatures in Bear Creek
Summer 1991
# TABLE 4A

DATA SUMMARY: INSTREAM FLOW REQUESTS & CRITERIA - BEAR CR. (MAIN STEM)

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* 50' wide stream, 0.8' depth = 40 sq. ft. x 2 feet per second = 80 cu. ft. / second flow
### Table 4B

**DATA SUMMARY: INSTREAM FLOW REQUESTS & CRITERIA - BEAR CREEK TRIBUTARIES**

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* Largest request for that stream (cfs) (See also Table 6a for depth & velocity)
TABLE 4C
DATA SUMMARY: INSTREAM FLOW REQUESTS OTHER STUDY AREA STREAMS

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</table>
C. Assessment of Available Data

Existing data are not adequate to determine precisely all instream flow needs in the Bear Creek system. For example, there are no data relating to instream aesthetic needs. The following findings relate to the data needs of the largest instream flow needs of fish and water quality:

1) The data needed to support instream flows for fish were generated using the "Oregon Method" which has been controversial due to concerns about the relatively high flow results. Officials from ODF+W recommend an Instream Flow Incremental Method ("IFIM") study as the current "state of the art" technique be done for key salmonid streams in the study area.

2) Additional data are needed to determine the extent to which overall habitat improvement activities and changes in stream morphology will help reduce instream water needs.

3) A hydrologic study is needed on Bear Creek to verify the variations in flow patterns and to relate flow depths to discharge (in cfs). In this way the DEQ and ODF&W data can be correlated.

4) Additional data on the nature of salmonid and trout populations in area streams are needed to update current and historical information.

5) Additional stream flow data are needed on ungaged streams in the study area.
VI RELATIONSHIP OF INSTREAM REQUESTS TO AVAILABLE STREAMFLOWS

It is possible to determine the additional instream water amounts needed to satisfy the instream flow request if adequate instream flow data exist such as that available for Bear Creek' main stem.

A. Bear Creek - Main Stem

Bear Creek stream flow has been monitored by the U.S. Geological Survey (USGS) at a gaging station in Medford since 1915 (Attachment 8). The long term average discharge recorded (1915 - 1993) is approximately 80,000 acre feet (AF); 110 cfs. This information can be misleading since it includes times when there was no upstream storage. Also flood flow volumes are so large that "average" calculations may be unrealistically high.

A more meaningful calculation involves the use of 50% or 80% exceedance flows. A 50% exceedance flow, for example, is the streamflow that is exceeded by 50% of the other streamflows recorded over a given period (an 80% level is less since it is exceeded by 80% of all other records).

Exceedance flow data from 1958 - 1987 are compared with instream flow requests in Table 5. The Instream request column is the largest request recorded for each month of the year (see Table 4a).

Significant withdrawals downstream from the Medford gaging station must also be considered. The Rogue River Valley Irrigation District is permitted and, on occasion does divert all streamflow at the Jackson Street diversion dam in Medford to the Hopkins Canal leaving Bear Creek occasionally dry below the dam.

The average flow diverted at Jackson St. into Hopkins Canal is about 30 cfs or about 12,600 AF during the April to October irrigation season (Jim Pendleton, personal communication 7/20/94). The last column on Table 5 reflects this withdrawal.

Data in Table 5 show that there is a verifiable need for significant flow increases to meet instream requests in Bear Creek. An illustration of these relationships is found in Fig. 8 on page 35.

Another critical low flow area is along Emigrant Creek between Emigrant Reservoir and upper Bear Creek above Ashland (Fig. 1). According to the Talent Irrigation District Manager, releases from Emigrant Reservoir stop during the winter months to allow for winter storage (Hollie Cannon, personal communication Dec. 94). This causes a significant reduction in flows in Emigrant Creek between November and April of each year.
# TABLE 5

MAXIMUM INSTREAM FLOW REQUEST AND AVAILABLE FLOWS (cfs)
Bear Creek at Medford (1958 - 1987)

<table>
<thead>
<tr>
<th>MONTH</th>
<th>INSTREAM REQUEST</th>
<th>GAGED FLOW Exceedance</th>
<th>NET REMAINING Exceedance</th>
<th>NET BELOW Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAN</td>
<td>170</td>
<td>104</td>
<td>48</td>
<td>-66 -122</td>
</tr>
<tr>
<td>FEB</td>
<td>170</td>
<td>131</td>
<td>65</td>
<td>-39 -105</td>
</tr>
<tr>
<td>MAR</td>
<td>170</td>
<td>146</td>
<td>86</td>
<td>-24 -84</td>
</tr>
<tr>
<td>APRIL</td>
<td>170</td>
<td>188</td>
<td>77</td>
<td>+18 -93</td>
</tr>
<tr>
<td>May 16-30</td>
<td>100</td>
<td>108</td>
<td>63</td>
<td>+8 -37</td>
</tr>
<tr>
<td>JUNE</td>
<td>100</td>
<td>65</td>
<td>36</td>
<td>-35 -64</td>
</tr>
<tr>
<td>JULY</td>
<td>100</td>
<td>45</td>
<td>29</td>
<td>-55 -71</td>
</tr>
<tr>
<td>AUG 1-15</td>
<td>100</td>
<td>50</td>
<td>31</td>
<td>-50 -69</td>
</tr>
<tr>
<td>Aug 16-30</td>
<td>170</td>
<td>50</td>
<td>31</td>
<td>-120 -139</td>
</tr>
<tr>
<td>SEPT</td>
<td>170</td>
<td>54</td>
<td>31</td>
<td>-116 -139</td>
</tr>
<tr>
<td>OCT</td>
<td>170</td>
<td>34</td>
<td>24</td>
<td>-136 -146</td>
</tr>
<tr>
<td>NOV</td>
<td>170</td>
<td>45</td>
<td>32</td>
<td>-125 -138</td>
</tr>
<tr>
<td>DEC</td>
<td>170</td>
<td>83</td>
<td>29</td>
<td>-87 -141</td>
</tr>
</tbody>
</table>

(AF/yr) 111,325 64,000
Total of Deficits (annual AF) 50,000 77,805 60,000 90,600
Additional Flow needed (cfs) 68 106 82 124

The following findings can be made based on the above data:

* **Critical low flow locations and periods:**

  Bear Creek below Jackson St. Dam in Medford -
  April to October when 30 cfs average irrigation
  withdrawals (12,600 AF/season) can exceed existing
  stream flow and October to early December after
  irrigation season until the start of winter rains

<table>
<thead>
<tr>
<th>Exceedance</th>
<th>50%</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* **Bear Creek average annual discharge**
  Medford gage (1958-1987) (AF) 64,000 33,500
  Average flow 88 cfs 46 cfs
  below Jackson St. Dam (AF) 51,400 20,900
  (minus 12,600 AF April-Oct) 71 cfs 29 cfs

* **Instream requests (111,325 AF/yr) exceed available flow volumes by almost 50,000 AF annually at the Medford gage and 60,000 AF below Jackson St. dam)**

* **stream flows (50%) would have to increase over 80 cfs (50%) to meet the instream flow request below the dam.**
B. Bear Creek Tributaries and Other Study Area Streams

Flow data for Bear Creek tributaries and other streams in the study area do exist but are not adequate to determine long term flow characteristics. It is not appropriate to base instream need calculations on flows altered by winter storage or summer irrigation distribution practices.

The Bureau of Reclamation has flows in Little Butte Creek in a recent report on the opportunities for improving local irrigation facilities including those within the study area (Bureau, 1990). A quote from the section covering Little Butte Creek states:

"Historical flows of record (1965-88) show that the flows in the North Fork of Little Butte Creek exceed the recommended streamflow levels by a significant amount from March through September. In the remaining months the flows are only slightly higher than the recommended flows. The streamflow of the South Fork of Little Butte Creek and Little Butte Creek below Eagle Point are high in the spring and low during the mid- to late summer."

The Bureau report includes graphs of the historic flows and suggested flow levels (Bureau, 1990). It appears from this work and the limited stream flow data available that the Little Butte Creek system has enough water for existing instream uses.

Oregon Fish and Wildlife officials, however, have noted that the peak summer water temperatures exceed the upper range for salmonid habitat. (Jerry Vogt, personal communication November 8, 1994).

Another approach to this issue is to simply work toward achieving "natural" conditions regardless of what is happening today. This approach is described in the next section.
VII DETERMINATION OF NATURAL CONDITIONS

Natural conditions which existed before the streams characteristics were altered by storage and withdrawals provide an alternate reference for estimating instream flows needs. Such conditions provided an ecological habitat for historically successful fish and wildlife to occupy. This "natural" setting was not ideal for any one species.

The Oregon Water Resources Department (OWRD), has estimated the natural flow characteristics for many local streams using procedures described in a 1993 report to the Legislature (OWRD, 1993). This work was applied to streams on which instream water rights were filed and summarized in Attachment 9 provided by Richard Cooper, OWRD Hydrologist. An analysis of that information follows.

A. Data Summary - Bear Creek Main Stem

Natural flow estimates are calculated using exceedance flows; for example the 50% exceedance streamflow is the streamflow that is exceeded by 50% of the other stream flow records. These flows can be compared with recorded flows on Bear Creek tabulated for 1958 to 1987 in Table 6a.

<table>
<thead>
<tr>
<th>Month</th>
<th>Recorded Flows</th>
<th>OWRD Nat. Flow Est.</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>JAN *</td>
<td>104</td>
<td>48</td>
<td>216</td>
</tr>
<tr>
<td>FEB *</td>
<td>131</td>
<td>65</td>
<td>265</td>
</tr>
<tr>
<td>MAR *</td>
<td>146</td>
<td>86</td>
<td>241</td>
</tr>
<tr>
<td>APRIL *</td>
<td>188</td>
<td>77</td>
<td>182</td>
</tr>
<tr>
<td>May</td>
<td>108</td>
<td>63</td>
<td>168</td>
</tr>
<tr>
<td>JUNE</td>
<td>65</td>
<td>36</td>
<td>101</td>
</tr>
<tr>
<td>JULY</td>
<td>45</td>
<td>29</td>
<td>40</td>
</tr>
<tr>
<td>Aug</td>
<td>50</td>
<td>31</td>
<td>24</td>
</tr>
<tr>
<td>SEPT</td>
<td>54</td>
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</tr>
<tr>
<td>NOV</td>
<td>45</td>
<td>32</td>
<td>62</td>
</tr>
<tr>
<td>DEC</td>
<td>83</td>
<td>29</td>
<td>153</td>
</tr>
</tbody>
</table>

AF/YR 64,000 33,500 91,000 48,300

Total of Deficits (- months) - 524 - 277
Addit. flow needed in deficit periods (ave.cfs) 75 40
Additional annual water need, deficit period (cfs x 2 x # days of deficit) (AF/YR) 31,500 16,800
Additional water needed below dam (AF/yr) 43,100 29,400

* Applying the lower ODF&W water right request (170 cfs) during these months, then AF/yr=
  below diversion dam, (AF/yr) 18,720 16,800
B. Data Analyses - Bear Creek Main Stem

The information on Table 6 A and Table 5 shows:

- Annual Instream Water Right request volume: 111,325 AF
- USGS recorded discharge at 50% exceedance annually (Medford gage 1958 - 1987): 64,000 AF
- Additional volume needed to meet instream water right request at Medford gage: 47,325 AF *
- OWRD Estimated "natural" annual discharge (1958 - 1987; 50 % exceedence): 91,000 AF
- Additional water needed to meet estimates of "natural" conditions (50%) at Medford: 27,000 AF *
- Replacing deficit months only (50%): 31,500 AF *

* add 12,600 AF to compensate for summer irrigation withdrawals via Jackson St. Dam just below the Medford gage.

Significantly less additional water would be needed to achieve "natural" stream flows on Bear Creek than that needed to meet the requested instream water right.

Approximately 10% more water is needed to meet the water needs during the deficit months compared to annual average calculations because the surplus water flowing during the months when flows exceed needs is not available during deficit months.

It is possible to combine the ODF&W Instream Water Right Request with the OWRD estimate of "natural" conditions. According to Bob Hunter, Waterwatch, the least critical time for instream flows for fish is during the winter high runoff period. The ODF&W instream request is less than the estimates of "natural" conditions from January through April (Table 6).

If the lesser ODF&W amounts are applied during those high flow periods, then the instream need calculations for the 50% exceedance level are reduced to;

* at Medford gage (50%) 18,720 AF (26 cfs)
* below diversion dam (50%) 31,320 AF (43 cfs)

The combination of the lesser of the ODF&W request and the estimates of "natural" conditions may represent the least amount of additional flow need which actually meets the most critical (fish and wildlife) instream flow requirement.

Figures 8 A and 8 B compare Bear Creek annual discharge measurements with the ODF&W Instream flow requests from Table 5 and the OWRD "natural" flow estimates (Table 6A) above and below the diversion dam. The calculations are based on 1958 - 1987 data. The combination of the ODF&W request and the OWRD "natural" estimate is also shown.
FIGURE 8A

BEAR CREEK DISCHARGE SUMMARY
(Acre Foot per Year)

- 50% Exceedance: 64,000
- 80% Exceedance: 51,000
- ODF&W Instream Request: 33,000
- OWRD Estimated "Natural" Flow Condition: 20,900
- Bear Creek @ Medford: 111,325
- Bear Creek Below Dam: 91,000

FIGURE 8B

BEAR CREEK INSTREAM WATER NEED
(50% Exceedance Level: AF/Yr.)

- ODF&W Water Right: 47,300
- OWRD "Natural": 40,000
- Combination of ODF&W and OWRD Need: 31,320
- Bear Creek @ Medford: 18,700
- Bear Creek Below Dam: 27,000

Additional Water Needed to Meet Desired Instream Flows
C. Data Summary - Other Study Area Streams

Tables 6 b and c compare the total amount of water needed annually for the instream requests with the estimates of "natural" conditions calculated from Attachment 9.

**TABLE 6 b BEAR CREEK TRIBUTARIES**

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Natural Discharge (Est. AF/YR)</th>
<th>Min. Flow Request (AF/YR)</th>
<th>Difference (AF/YR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackson Cr</td>
<td>4,672</td>
<td>18,250</td>
<td>-13,578</td>
</tr>
<tr>
<td>Griffin Cr</td>
<td>3,650</td>
<td>13,566</td>
<td>-9,916</td>
</tr>
<tr>
<td>Wagner Cr</td>
<td>7,154</td>
<td>15,817</td>
<td>-8,663</td>
</tr>
<tr>
<td>Walker Cr</td>
<td>15,476</td>
<td>14,052</td>
<td>1,424</td>
</tr>
<tr>
<td>Emigrant Cr</td>
<td>17,885</td>
<td>47,815</td>
<td>-29,930</td>
</tr>
<tr>
<td>Total (AF)</td>
<td>48,837</td>
<td>109,500</td>
<td>-60,663</td>
</tr>
</tbody>
</table>

**TABLE 6 c OTHER STUDY AREA STREAMS**

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Natural Discharge (Est. AF/YR)</th>
<th>Request (AF/YR)</th>
<th>Difference (AF/YR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antelope Cr</td>
<td>14,819</td>
<td>22,326</td>
<td>7,507</td>
</tr>
<tr>
<td>Lake Cr</td>
<td>4,088</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&quot; Little Butte Cr</td>
<td>154,760</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&quot; N. Fork</td>
<td>28,762</td>
<td>17,338</td>
<td>11,424</td>
</tr>
<tr>
<td>&quot; S. Fork</td>
<td>83,220</td>
<td>67,342</td>
<td>15,878</td>
</tr>
</tbody>
</table>

D. Data Analyses - Tributaries To Bear Creek And Other Streams

The lack of adequate stream flow data limits the comparison with existing recorded flow characteristics. Note, however, that the total annual volume requests for Bear Creek tributaries (109,500 AF) is approximately equal to that requested for the main stem (111,325 AF).

The Little Butte Creek system data verify the conclusions of the Bureau of Reclamation that there is currently enough water for instream uses in that system. Peak summer temperatures remain too high for salmonid habitat.
VIII SOURCES OF ADDITIONAL WATER

Sources of additional water to meet instream needs include expanded storage, construction of small ponds by individuals, conservation and technology, reapplication of reclaimed water and water transfer from other uses.

According to a recent inventory of agricultural water supplies, there is the realistic potential for about 50,000 AF of additional water which can be accessed in the future (Dittmer, 1993). Sources include:

- Enlargement of Agate Reservoir: 13,000 AF
- Construction of small ponds: 2,000 AF
- Conservation and technology: 5,000 AF
- Reclamation: 30,000 AF

Total: 50,000 AF

According to the Bureau of Reclamation, increasing Agate Reservoir from 4,000 AF to 8,000 AF will actually benefit the system by 13,000 AF because of its utility as a regulating reservoir.

These estimates can now be refined to include new information relating to specific project proposals effective in the short term. A project to reuse reclaimed water from the Medford Regional Reclamation Facility is already under consideration. At 1994 treatment plant processing volumes, approximately 10,000 AF of reclaimed water can be made available for agricultural and instream needs.

Many storage facilities were built in accordance with approved water rights for other beneficial uses, this water is not likely to become available unless the beneficial use categories are modified.

It is also possible for the Medford Water Commission to expand its service area and access more of their water right from the Rogue River and Lost Creek Reservoir to bring in more water for domestic uses. This could allow water exchanges freeing up other sources for comparable instream uses.

The Little Butte Cr. system could receive additional water from storage upstream or by modifying the agreement with the Medford Water Commission for release exchanges with the Eagle Point Irrigation District.

Recent legislative changes now allow for water now used for out of stream benefits to be transferred to instream uses by mutual agreement.

It is important to note the possibility that the 50,000 AF of water now imported from the Klamath Basin could be reduced or eliminated due to increased water needs in that watershed.
IX FUTURE INSTREAM NEEDS AND FLOWS

A. Projected Changes in Instream Needs

Actual instream flow needs are not likely to change. However, our understanding of those needs will change and the data in this report may need refining in the future if:

* new data becomes available (e.g., from an IFIM study)
* a new instream use is proposed (such as water contact activity or power generation) which needs a higher flow
* habitat improvement projects are successful and reduce the instream flow needs; or, conversely, if additional population growth adds to pollution levels, more instream flow may be warranted
* new water quality standards are established

B. Projected Changes in Instream Flows

Instream flows may change considerably in the future. Factors that might lead to changes in instream flow are:

1. Population growth; urbanization of land now irrigated

According to a report on the water needs for agriculture in the study area (Dittmer, 1993), the amount of irrigated agricultural land in the study area will decrease dramatically as population growth pressures increase urban development.

If population in the study area continues to grow at about 2% per year and growth continues to be encouraged in existing urban areas, virtually all the 48,000 acres of irrigated land (1992) could be replaced by urban uses by the year 2050.

Water resources now used by agriculture might become available for other uses, including instream.

2. Climate

The relatively low precipitation over the last ten years has reduced instream flows significantly. Should this trend continue, stream flows will decrease further. If precipitation increases and water supplies exceed out of stream needs then instream flows could increase.

The 1993-94 water year, for example, resulted in only 40% of the normal rainfall (Fig. 3).
3. Conservation and technology

The application of conservation practices and new technology by out of stream water users reduces water consumption. Conservation practices include sprinkler conversions from flood irrigation in agriculture and following watering guides for urban lawn watering.

Technology includes the use of sophisticated weather monitoring stations to determine exact plant needs thus reducing the potential for over watering. Anticipating the water needs of customers helps irrigation districts to improve their distribution efficiencies.

The combination of conservation practices and new technology now in effect in the Bear Creek Valley have reduced water use significantly and helped the area survive recent drought years.

Conserved water could be used to enhance instream flow if it is not used by other out of stream users. Realistically, conserved water is more available to other out of stream water right holders and is not usually returned to streams. Existing state law, however, does provide that 25% of water conserved by adoption of "best management practices" must be left in streams.

4. Regional Water Management

Changes in the overall water management practices in the area could add to instream flows. There are new opportunities for various water users to coordinate resource use which can be mutually beneficial.

For example, if agriculture can use reclaimed water from local waste water reclamation plants, then agricultural water stored high in the watershed could be exchanged for other purposes such as instream flows.

The use of reclaimed water can add to instream flows. The Medford Regional Water Reclamation Facility currently processes about 15 million gallons of water a day (mgd). Ashland's treatment plant runs about 3 mgd. This represents about 55 acre feet of water a day or 28 cfs. An expected doubling of the population in next 50 years will double these flows.

New storage opportunities are limited. However, Agate Reservoir can be enlarged by 4,000 AF (from 4,000 to 8,000 acre feet) which, according to the Bureau of Reclamation, is a cost effective project which would increase the effectiveness of this key regulating reservoir (Bureau of Reclamation, 1990).
A. Stream Flow Need Data

In order to determine the instream flow needs more precisely, it is recommended that:

1. an Instream Flow Incremental Methodology (IFIM) Study be done for the Bear Creek system

2. a temperature model should be developed for Bear Creek showing the extent of the problem and the likely benefits resulting from alternatives available for reducing those temperatures

3. an anadromous fish and trout distribution study be done on those streams in the study area known to have supported those fish in the past

4. an investigation be done to determine the potential reductions in instream flows that might be realized from various habitat improvement projects

5. A Bear Creek Management Plan should be prepared listing and prioritizing activities which will improve the habitat and possibly lower the instream water needs of local streams.
XI SUMMARY

This report inventories existing data on instream water needs and offers some preliminary findings related to needs. Except for Bear Creek which has good long term flow data, there is a serious lack of adequate data to determine exactly what the instream needs are for ungaged streams.

This inventory verifies that there are significant unmet instream flow needs in the Bear Creek system.

* Approximately 60,000 AF of water would be needed annually to meet the instream flow requests for Bear Creek (below Jackson St. Dam) and its tributaries.

* Approximately 40,000 AF of water would be needed annually to meet estimates of "natural" flow conditions.

* Approximately 30,000 AF would be needed to meet a combination of the instream water right request and estimates of "natural" conditions below The Jackson St. dam on Bear Creek.

* The results of an Instream Flow Incremental Methodology (IFIM) Study will help refine these numbers.

* Until an IFIM Study can be done, the application of natural flow estimates can provide a lower flow need target for instream flow restoration efforts.

This report includes recommendations for data improvements, a summary of additional water sources and future needs projections.

Instream water flows have been seriously reduced by the past and present demands for out of stream water use. Water rights requests can, in fact, exceed the water available. Instream water rights are a recent attempt to begin to address instream needs.

Estimates of "natural" flow conditions require less additional flows and may be a more logical goal for restoring instream flows sufficient to meet all needs.

The quality of a stream and its riparian ecology is the result of a process which we all need to recognize. Simply adding water to satisfy one need may not achieve the need if other vital elements of the process are not present.

Some ideal goals for Bear Creek may not be achievable given the existing water demands and the growing urbanization pressures.

This information can be used to help work toward improvements in stream flow and will become part of an overall inventory of water needs to help in long term water resource planning in the region.
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ATTACHMENTS
Cultural History Introduction

Long before the first Euro-Americans entered the Rogue Valley, Native Americans lived in the natural corridor of Bear Creek, fished its waters, and camped along its banks. This area was shared by two tribes. The Shasta tribe ranged along the southern reaches of Bear Creek above what is now Talent, and the Takelma tribe ranged from Talent to the north.

Both peoples lived on processed acorns, camas, other bulbs, and berries, as well as deer, fish, and small game. They moved seasonally to where food was available. They stored food for the winter, which they spent in villages along Bear Creek.

Their first contact with Euro-Americans occurred in 1827 when Peter Skene Ogden led a group of trappers from the Hudson Bay Company into the valley in search of beavers. It wasn't until the 1850s that settlers and miners, spurred by the Donation Land Claim Act of 1850 and lured by tales of fertile land and gold bearing streams, arrived in large numbers. They then began the process of dispossessing the Native Americans of their lands and eliminating their food sources.

Gold mining operations polluted the streams, and killed the fish. Settlers fenced and cultivated the bottom land, depriving the Indians of areas where they had previously hunted and gathered camas and acorns. Small game was over-hunted, and tree-cutting destroyed much wildlife habitat.

The Indians unsuccessfully resisted the loss of their lands and retaliated against frequent incidents of mistreatment in the uprisings of 1851, 1853, and 1855-56. The treaties that followed each skirmish progressively restricted Native American presence and finally moved them entirely to a reservation on the Oregon coast.

Settlers planted wheat, hay, and potatoes; raised cattle; and grew other crops to support their needs. In the 1880s, however, the arrival of the railroad caused major economic change and a shift in agriculture from grains and forage crops to fruit.

There were many orchards planted throughout the valley and early success was achieved with apples, peaches, and pears. These orchards required more water than annual rainfall could supply, so large irrigation systems were developed during the first half of this century. Today, the Talent Irrigation District provides the water through canals from Emigrant, Hyatt, and Howard Prairie reservoirs, and the Medford Irrigation District delivers irrigation water from the Rogue River. The production of pears now greatly exceeds that of apples and peaches.

Though the early miners found little gold in Bear Creek, it has supplied recent generations with the gravel used to construct the highways that parallel Bear Creek. The ponds along the trail are the result of these gravel operations.
HISTORY OF BEAR CREEK

A. Water Development

Bear Creek Valley was first impacted by settlers in the late 1800's, and Bear Creek was probably used to float logs and rafts of materials downstream as most other valley streams were used before road transportation was developed.

Early settlers depended on Bear Creek’s natural flow for their overall water needs. As the population grew, the flows decreased with increasing demand, particularly for agriculture. Bear Creek typically went dry in the late summers from 1918-1920.

Agricultural water users joined together with the Bureau of Reclamation to build Hyatt, Howard Prairie, and Emigrant Reservoirs in 1925. They were expanded in 1960. About half of Bear Creek total annual flows are from this upstream storage (Howard Prairie and Hyatt Reservoirs are in the Klamath Basin).

Most of the water in Bear Creek is used by agriculture for row crop, pasture, and orchard irrigation. There is also a growing number of small farms requesting irrigation. Other beneficial uses include domestic needs (City of Talent), industry, recreation, fish, and riparian uses.

B. Fish Population

Bear Creek once meandered across much of the present flat areas of the valley, resulting in a longer stream channel. Beaver, otter, waterfowl, and other riparian animals were abundant in this wetland habitat of backwater areas and willow-lined sloughs. Cutthroat trout, Coho Salmon, and steelhead were the dominant salmonid species with fall Chinook Salmon using the lower and middle sections.

Low and middle elevation complex valley habitat, so important to the cutthroat/coho salmon/beaver association, was greatly reduced in the Bear Creek Valley soon after settlement began. It is possible that the tremendous habitat area afforded by the interior valleys of Bear Creek, Little Butte Creek and Elk Creek actually supported a coho salmon run nearly the size of the famous chinook salmon run of today. Approximately 95% of the cold water and complex stream habitat for coho salmon was eliminated by the early 20th century while mainstem river conditions have remained more stable.
WATER RESOURCES IN JACKSON COUNTY

Rainfall, storage wells, springs, irrigation, runoff, evaporation, canals... these are all terms that can be used in describing the single-most important resource in Jackson County: water. Water is rarely available exactly when and where it is needed. Storage and transportation facilities are common techniques used to meet growing demands.

The highest water demand in Jackson County occurs in the Bear Creek Valley where approximately twenty (20) inches of rain falls annually. This contrasts with the mountains in the northwest part of the County where, according to the National Weather Service, over sixty (60) inches of annual rainfall occurs. Transport and storage are therefore critical aspects to Jackson County's water management.

The history of water development provides an example. The Rogue River Valley Irrigation District, according to Manager Dave Smith, first provided water to customers in the Agate Desert area in 1902. Population growth and increasing irrigation activity began to stress available Bear Creek Valley supplies around 1915. Bear Creek began to run dry in the late summers. With assistance from the Bureau of Reclamation, local irrigation districts constructed Hyatt Reservoir around 1925 and Howard Prairie Reservoir around 1960. These were the first major storage facilities in Jackson County. Canals carried the water to Emigrant Lake and into the Bear Creek Valley. Today, over half of the water in Bear Creek is imported from the Klamath Basin.

Other storage facilities were also built. Ashland constructed Reeder Reservoir, the City's main water supply to this day, in 1928. Then later, Lost Creek Lake was built in the north part of the county, in 1978, and Applegate Lake in the west, in 1980.

Today, residents in urban areas of the County generally receive their water from surface storage, springs or rivers. Rural residents depend primarily on wells. Agriculture is dependent upon surface storage and canal distribution via irrigation districts.

Irrigated agriculture and domestic consumption are the major water uses. Other beneficial uses in Jackson County include that for municipal, industry, power, recreation and wildlife purposes.

Most of these users recognize the value of the resource and work to minimize waste. Agricultural users in the Bear Creek Valley are a good example. Irrigation water is reused many times between Emigrant Lake and the Rogue River. In fact, both the Medford and Rogue River Valley Irrigation Districts depend upon the upstream irrigation district runoff for portions of their water supply.

A concern is the increasing parcelization of what was once large commercial farms and ranches into smaller, less efficient five to twenty acre units. Irrigation district managers state they are now...
providing significantly more water to the same acreage because of the
tendency toward using more water per acre on smaller parcels. The
concern is not only the increasing demands on water, but also the
adverse effects on water quality from increasing runoff and the
potential for pollutants through each use.

Today there is continuing emphasis on developing new storage to
capture more of the winter rains for summer use. Very few potential
storage sites remain. Elk Creek, now under construction, is possibly
the last of the major storage sites. The City of Ashland is also
considering additional storage in the Ashland Watershed to meet
anticipated population growth.

What about our ground water? Ground water resources are difficult to
access. It is hidden from view and the complicated subsurface
geology in Jackson County results in extreme variety in well
production. Ground water is dependent on rainfall and surface
percolation to recharge what is extracted from wells. Recharge areas
are generally in surrounding elevated areas that receive more
rainfall.

There are indications that our ground water resources are being
affected by increasing demands. Well drillers report increasing
requests for well deepenings. Observation wells are indicating some
lowering of water tables. There is a problem in determining long
term trends in ground water due to the lack of adequate and accurate
well data. For example, well logs were not required until 1955 and
most well logs do not provide enough information on well location.

The complicated geology in Jackson County makes it difficult to
predict ground water availability, let alone trends. Adjacent wells
can have widely differing static water levels and 600 foot dry holes
occur near 100 foot wells with good production.

Ground water is a fragile resource that needs to be protected. Once
contaminated, it is virtually impossible to cleanse. Well water
quality is becoming increasingly important in Jackson County. More
people are having their water tested rather than assuming it is
good. There are areas of high fluoride, arsenic, hardness, boron,
iron and other water problems that occur in Jackson County.
Inadequate well construction can allow surface pollutants to
contaminate not only the well, but also the fresh water bearing
layers. Some people haul their own drinking water due to water
quantity or quality problems.

The general perspective for water resources show urban area supplies
adequate well into the future. Ground water resources are less
definite, but current data is not adequate for accurate assessments.
Demands exceed supply for agricultural surface water users.

The cost of developing new storage and transportation facilities is
so high that water conservation will be increasingly important.
Conversion to sprinkler and drip irrigation, for example, can
conserve water and increase agricultural productivity. The "best management practice" also has the side benefit of less runoff and therefore less potential for water pollution. There are irrigation districts that meter water, seal canals and even invest in pipe conveyance improvements to better control evaporation and excess use.

Water conservation will likely become increasingly important in the home as well. How often do we let the cold water run until it's hot? It is so easy to take our water resources for granted when it is there at the turn of a tap.

Perhaps an emphasis on water conservation will allow for additional beneficial uses not available now. Certainly more land can be irrigated. And what about additional flows in our stream for fish and wildlife enhancement? Fish are returning to Bear Creek and other spawning areas. These streams would benefit from additional flows.

Decisions on use of water resources are difficult and have always been controversial. Still, these decisions will continue to be critical as Oregon and Jackson County grow. The current succession of dry water years only serves to illustrate our dependence upon water and the kind of problems that occur when expected supplies dwindle.

The future for water resources everywhere lies in the knowledge that surface and ground water supplies are not infinite. Conservation and protection of the resource critical in assuring future viability
ROGUE RIVER BASIN STUDY

January, 1985

WATER RESOURCES DEPARTMENT
William H. Young, Director
for recreation is an important use of water in

9. Ground water does not represent a significant
   of water.

10. Storage of winter runoff represents an impor-
     A potential reservoir site on Walker Creek has been identified for
     future consideration.

11. There are serious water quality problems in the Bear Creek Basin.

SUBBASIN INVENTORY - BEAR CREEK BASIN

GENERAL DATA

Basin Description

Located in the extreme southeast corner of the Rogue River Basin, Bear
Creek flows down the western slopes of the Cascade Divide and joins
the Rogue River at river mile 127. The Bear Creek Basin is the
smallest of the seven hydrologic divisions in the Rogue drainage.
Bounded on the east by the Little Butte Creek Basin, and on the west
by the Applegate River Basin, this 341 square mile basin is entirely
within Jackson County.

Geology

Topography and Drainage

Bear Creek Basin lies almost entirely within the Klamath Mountains
physiographic province, which has the oldest rocks in Western Oregon
and may contain some of the oldest formations in Oregon. The Klamath
Mountain region is typically rugged with narrow canyons and much lower
than the peaks of Cascade Range. Local differences in elevation range
from 2000 feet to 5000 feet, and slopes of 30 degrees are common in
the mountains. Elevations within the watershed range from 7533 feet at
the summit of Mt. Ashland down to 1160 feet at the confluence of Bear
Creek and the Rogue River, a difference of 6373 feet.

The major feature of the watershed is the Bear Creek Valley. The
valley is oriented from southeast to northwest, is about 25 miles long
and ranges from two to six miles wide. Upper Bear Creek Valley lies
between the Siskiyou Mountains on the southwest and the Western
Cascades on the northeast and opens to the Rogue River Valley on the
northwest. Although the Bear Creek Valley has more expanse of
agricultural lands than any other valley in the Rogue River Basin,
two-thirds of its area is unsuitable for farming due to mountainous or
forested terrain and urbanization.

The rocks of the rugged Siskiyou Mountain region of the Klamath
Mountains province southwest of Bear Creek are nearly all structurally
complex metamorphic and intrusive rocks. Rocks in the valley and the
more subdued Western Cascade Highlands to the northeast are gently
dipping sedimentary and volcanic rocks. The oldest rock units in the
basin are exposed south and west of Medford and progressively younger rocks are found toward the northeast.

The gradient of Bear Creek is rather mild compared to other streams in the Rogue River Basin, averaging just over 30 feet of drop per mile. The slope of Ashland Creek, however, one of Bear Creek's major tributaries, is over 400 feet per mile. Bear Creek and its extension, Emigrant Creek, flow in a northwest direction and enter the Rogue River near river mile 127, while most of its tributaries flow generally towards the north or the south depending on which side of Bear Creek they rise.

**Stratigraphy**

The board Bear Creek Valley separates the eastern part of the Klamath Mountains province from the Western Cascades province. The Siskiyou Mountain region is located in the southern portion of watershed. The valley floor itself is overlain by alluvium, consisting of sand, silt, and gravels deposited by water in recent times.

The foothills and mountains to the north and east of Bear Creek are geologically younger than those to the south and west and are considered to be in the Western Cascades region.

**Soils**

The soils of the Bear Creek Valley represent a transition between soils derived from the volcanic rocks of the Cascade Range and those derived from the granitic and metamorphic rocks of the Siskiyou Mountains. Alluvial material from both mountain ranges are washed down Bear Creek and its tributaries to form deep soils which are intensely used for agriculture and homesites. Many of these soils are affected by a high water table within 2-3 feet of the surface. This water table limits agricultural production to crops with shallow root systems, or requires the installation of tile drains. Additionally, septic tank drain fields may have severe problems.

Soils on the higher alluvial terraces are generally not affected by the water table and support a valuable and diversified agricultural industry. Some of these soils do contain a high proportion of clay which may restrict drainage, but proper irrigation management and the use of sprinkler irrigation systems have greatly reduced the problem.

Many of the agricultural fields have been converted to homesites for the expanding population. Where large septic tank drainfields have been constructed to compensate for the drainage problems, few problems have been encountered. In some cases, however, inadequate drainfields have been built, which may contribute to the water quality problems. Additionally, as the housing density increases, these soils may become fully saturated with septic tank effluent, causing additional pollution.
Climate

The Bear Creek Basin has a moderate climate with marked seasonal characteristics. Late fall, winter and early spring months are damp, cloudy and cool under the influence of marine air. Late spring, summer and early fall are warm, dry and sunny due to the dry continental nature of the prevailing winds that cross the area. The average frost-free period in the lowlands varies from 140 days to 165 days. Low humidity and high temperatures are common in July and August.

Air temperatures at Medford airport vary from an average of 38°F in January to 72°F in July. Average monthly temperatures and precipitation for Medford airport, Ashland and Green Springs Power Plant are displayed in Table 41.

TABLE 41

BEAR CREEK BASIN
AVERAGE MONTHLY TEMPERATURE (°F) and PRECIPITATION (in) at:

<table>
<thead>
<tr>
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<td>1.0</td>
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<td><strong>Green Springs Power Plant</strong></td>
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<td>0.9</td>
<td>1.9</td>
<td>3.2</td>
<td>4.1</td>
<td>22.8</td>
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Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration
History

Although agricultural opportunities brought the first settlers to the Bear Creek Basin, the discovery of gold near Jacksonville was the primary catalyst for the settlement of this area. The population of Jacksonville grew rapidly until 1883 when the Oregon and California Railroad bypassed Jacksonville and went through Medford.

The railroad provided transportation to outside markets for the agricultural and timber products. Thus, Medford and the surrounding communities in the Bear Creek Basin became an industrial and marketing center. Agricultural products such as pears were brought to Medford, processed and shipped to outside markets by train. Similarly, timber was brought to Medford, made into wood products and shipped to other states.

From this industrial base, the economy and settlement of the basin has continued to expand. Support services such as medical facilities, banking and retail trade have added to the economy.

Population

The commercial and industrial opportunities in the Bear Creek Basin have been responsible, in part, for the large population concentration in the basin. The population of this basin exceeds 100,000 people and is the largest in the entire Rogue River Drainage.

Medford is the largest city with a population of 39,603. Other cities and the 1980 census populations include Ashland - 14,943, Central Point - 6,357, Talent - 2,577, Phoenix - 2,309 and Jacksonville - 2,030. All of these cities experienced population growth during the last ten years. Ashland had the slowest rate of growth with 21 percent increase between the 1970 and 1980 census. Talent experienced the largest growth rate at 82 percent, followed closely by Phoenix at 78 percent.

Additional growth has occurred in the unincorporated areas of the basin. Many of the large farms have been divided into smaller parcels of 10-20 acres suitable for part time farming or hobby-type farms.

Economy

The economy of the basin is dominated by the industrial base. Central to this base is the wood products industry. Drawing on the timber resources from throughout the Rogue River drainage, lumber, plywood, veneer and furniture products are manufactured. Employment in the wood products sector of the economy has been declining since 1978. Lumber production has shown a gradual decline since 1960 and plywood production has decline greatly since 1977.

The services sector is the second largest part of the economy. Included in this category are regional medical services, financial services and numerous motels, restaurants and shops catering to the increasing recreation and tourist market. Interstate Highway 5 passes through the center of this basin bringing in many tourists. Many of
Date: December 21, 1993

OREGON WATER RESOURCES DEPARTMENT

SATISFACTORY REPORT OF TECHNICAL REVIEW

FOR AN INSTREAM WATER RIGHT APPLICATION

OBJECTIONS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 70993

2. APPLICATION INFORMATION

Application name/address/phone:

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207 503/229-5400

Date application received for filing and/or tentative date of priority: 12/7/90

Source: Bear Creek tributary to the Rogue River

County: Jackson

Proposed use: Providing required stream flows for coho and fall chinook salmon, cutthroat trout, and winter and summer steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

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<td>67</td>
<td>170</td>
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To be maintained in:

BEAR CREEK FROM WALKER CREEK AT RIVER MILE 27.0 (SWNE, SECTION 12, TOWNSHIP 39 S, RANGE 1 E WM); TO THE MOUTH AT RIVER MILE 0.0 (NWNW, SECTION 20, TOWNSHIP 36 S, RANGE 2 W WM)
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

The minimum flow requirements for adult fish only ensure that fish have physical freedom to move in the stream. Several times greater flow requirements are necessary to stimulate and maintain upstream migration of anadromous fish, including migratory freshwater trout. (See 1984 Report.) Although flows listed by the applicant in early reports indicated that the minimum flows for some streams seemed adequate for present fish populations, subsequent review of these flow recommendations caused the applicant to modify the original listing. (See Fish and Wildlife Resources of the Rogue Basin, Oregon, and Their Water Requirements (April 1972.)

Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

5. PROPOSED CERTIFICATE CONDITIONS

(The following proposed conditions will apply to water use and will appear on the face of the certificate.)

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

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<tr>
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<td>20</td>
<td>24</td>
<td>62</td>
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</table>

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water-right reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum poetual stream flow.
OREGON WATER RESOURCES DEPARTMENT

OBJECTS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 70988

2. APPLICATION INFORMATION

Application name/address/phone:
Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207 503/229-5400

Date application received for filing and/or tentative date of priority: 12/7/90

Source: Emigrant Creek tributary to Bear Creek

County: Jackson

Proposed use: Providing required stream flows for coho salmon, cutthroat trout, and winter and summer steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

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</table>

To be maintained in:
Emigrant Creek from Emigrant Lake Dam at River Mile 3.6
SE 1/4, SEC 20, T 39 S, R 2 E, W.M. to the mouth at River Mile 0,
SE NE, SEC 12, T 39 S, R 1 E, W.M.
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

The minimum flow requirements for adult fish only ensure that fish have physical freedom to move in the stream. Several times greater flow requirements are necessary to stimulate and maintain upstream migration of anadromous fish, including migratory freshwater trout. (See 1984 Report.) Although flows listed by the applicant in early reports indicated that the minimum flows for some streams seemed adequate for present fish populations, subsequent review of these flow recommendations caused the applicant to modify the original listing. (See Fish and Wildlife Resources of the Rogue Basin, Oregon, and Their Water Requirements (April 1972.)

Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

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</table>

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.
OREGON WATER RESOURCES DEPARTMENT

SATISFACTORY REPORT OF TECHNICAL REVIEW

FOR AN INSTREAM WATER RIGHT APPLICATION

OBJECTIONS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 71200

2. APPLICATION INFORMATION

Application name/address/phone:

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207  503/229-5400

Date application received for filing and/or tentative date of priority: 1/16/91

Source: Griffin Creek tributary to Bear Creek

County: Jackson

Proposed use: Providing required stream flows for cutthroat trout, and summer steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

<table>
<thead>
<tr>
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<th>JAN</th>
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<td>15.0</td>
<td>26.0</td>
</tr>
</tbody>
</table>

To be maintained in: GRIFFIN CREEK FROM HARTLEY CREEK. SWNW, SECTION 11, T 38 S, R 2 W; TO THE MOUTH, RIVER MILE 0.0. SENW, SECTION 34, T 36 S, R 2 W.
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

The minimum flow requirements for adult fish only ensure that fish have physical freedom to move in the stream. Several times greater flow requirements are necessary to stimulate and maintain upstream migration of anadromous fish, including migratory freshwater trout. (See 1984 Report.) Although flows listed by the applicant in early reports indicated that the minimum flows for some streams seemed adequate for present fish populations, subsequent review of these flow recommendations caused the applicant to modify the original listing. (See Fish and Wildlife Resources of the Rogue Basin, Oregon, and Their Water Requirements (April 1972.)

Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

5. PROPOSED CERTIFICATE CONDITIONS

[The following proposed conditions will apply to water use and will appear on the face of the certificate.]

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
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<td>2</td>
<td>7</td>
</tr>
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</table>

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or live-to-consumption.

The in-stream flow allocated pursuant to this water right is not in addition to other in-stream flows created by a prior water right or beneficial instream flows created by the public.
OREGON WATER RESOURCES DEPARTMENT

SATISFACTORY REPORT OF TECHNICAL REVIEW
FOR AN INSTREAM WATER RIGHT APPLICATION

OBJECTIONS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 71201

2. APPLICATION INFORMATION

Application name/address/phone:

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207 503/229-5400

Date application received for filing and/or tentative date of priority: 1/16/91

Source: Jackson Creek tributary to Bear Creek

County: Jackson

Proposed use: Purpose and/or use: Providing required stream flows for cutthroat trout and summer steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
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<td>34.0</td>
</tr>
</tbody>
</table>

To be maintained in:

JACKSON CREEK FROM HORN CREEK (SWSW, SECTION 15, T 37 S, R 2 W); TO THE MOUTH, RIVER MILE 0.0 (SWNE, SECTION 28, T 36 S, R 2 W)
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

The minimum flow requirements for adult fish only ensure that fish have physical freedom to move in the stream. Several times greater flow requirements are necessary to stimulate and maintain upstream migration of anadromous fish, including migratory freshwater trout. (See 1984 Report.) Although flows listed by the applicant in early reports indicated that the minimum flows for some streams seemed adequate for present fish populations, subsequent review of these flow recommendations caused the applicant to modify the original listing. (See Fish and Wildlife Resources of the Rogue Basin, Oregon, and Their Water Requirements (April 1972.)

Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

5. PROPOSED CERTIFICATE CONDITIONS

[The following proposed conditions will apply to water use and will appear on the face of the certificate.]

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

   JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
   14  17  14  9  5  1  1  1  1  1  1  2  9

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flow created by a prior water right or designated minimum stream flow.
OREGON WATER RESOURCES DEPARTMENT

SATISFACTORY REPORT OF TECHNICAL REVIEW
FOR AN INSTREAM WATER RIGHT APPLICATION

OBJECTIONS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 71206

2. APPLICATION INFORMATION

Application name/address/phone:
Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207 503/229-5400

Date application received for filing and/or tentative date of priority: 1/16/91

Source: Wagner Creek tributary to Bear Creek

County: Jackson

Proposed use: Providing required stream flows for cutthroat trout, and summer and winter steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

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<tr>
<th>Month</th>
<th>1st ½</th>
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<tr>
<td>DEC</td>
<td>31.0</td>
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</tr>
</tbody>
</table>

To be maintained in:
WAGNER CREEK FROM BASIN CREEK, RIVER MILE 8.0 (NESW, SECTION 23, T 39 S, R 1 W); TO THE MOUTH, RIVER MILE 0.0 (SESE, SECTION 23, T 38 S, R 1 W)
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

The minimum flow requirements for adult fish only ensure that fish have physical freedom to move in the stream. Several times greater flow requirements are necessary to stimulate and maintain upstream migration of anadromous fish, including migratory freshwater trout. (See 1984 Report.) Although flows listed by the applicant in early reports indicated that the minimum flows for some streams seemed adequate for present fish populations, subsequent review of these flow recommendations caused the applicant to modify the original listing. (See Fish and Wildlife Resources of the Rogue Basin, Oregon, and Their Water Requirements (April 1972.)

Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

5. PROPOSED CERTIFICATE CONDITIONS

[The following proposed conditions will apply to water use and will appear on the face of the certificate.]

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

<table>
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<tr>
<th>JAN</th>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water right reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.
OREGON WATER RESOURCES DEPARTMENT

SATISFACTORY REPORT OF TECHNICAL REVIEW
FOR AN INSTREAM WATER RIGHT APPLICATION

OBJECTIONS TO THE PROPOSED INSTREAM WATER RIGHT TECHNICAL REVIEW REPORT, AS DESCRIBED BELOW, MUST BE RECEIVED IN WRITING BY THE OREGON WATER RESOURCES DEPARTMENT, 3850 PORTLAND ROAD NE, SALEM, OREGON 97310, ON OR BEFORE 5 PM: March 4, 1994.

1. APPLICATION FILE NUMBER - IS 71207

2. APPLICATION INFORMATION

Application name/address/phone:

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, Oregon 97207 503/229-5400

Date application received for filing and/or tentative date of priority: 1/16/91

Source: Walker Creek tributary to Bear Creek

County: Jackson

Proposed use: Purpose and/or use: Providing required stream flows for cutthroat trout, and summer and winter steelhead for migration, spawning, egg incubation, fry emergence, and juvenile rearing.

The amount of water (in cubic feet per second) requested by month:

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<tr>
<th></th>
<th>JAN</th>
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To be maintained in:

WALKER CREEK FROM COVE CREEK, RIVER MILE 1.0 (NWNW, SECTION 7, T 39 S, R 2 E); TO THE MOUTH, RIVER MILE 0.0 (SENW, SECTION 12, T 39 S, R 1 E)
4. REPORT CONCLUSIONS

The proposed water use, as conditioned, passed this technical review. The information contained in the application along with the supporting data submitted by the applicant indicate that the flow levels set out in this report are necessary to protect the public use.

The supporting data states that the recommended flows are necessary to meet the biological requirements for the passage, spawning, egg incubation and larval development and rearing of salmonids. Consideration of habitat type, stream depth and water velocity were considered by the applicant in development of the flow levels. (See Determining Minimum Flow Requirements for Fish, ODFW Report January 20, 1984.) The recommended flow volumes are necessary to ensure appropriate levels of dissolved oxygen, turbidity, pH and temperature.

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Minimum stream flow recommendations developed from the 1970 survey are intended to provide enough suitable environment during appropriate seasons to perpetuate minimum desirable fish populations. Optimum flows set out in the 1972 report would more nearly maximize production. The applicant has stated that enhancement of production would require further evaluation. (See 1970 Report.)

5. PROPOSED CERTIFICATE CONDITIONS

(The following proposed conditions will apply to water use and will appear on the face of the certificate.)

1. The right is limited to not more than the amounts, in cubic feet per second, during the time periods listed below:

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<tr>
<th>JAN</th>
<th>FEB</th>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>16</td>
</tr>
</tbody>
</table>

2. The water right holder shall measure and report the in-stream flow along the reach of the stream or river described in the certificate as may be required by the standards for in-stream water rights reporting of the Water Resources Commission.

3. This instream right shall not have priority over human or livestock consumption.

4. The instream flow allocated pursuant to this water right is not in addition to other instream flows created by a prior water right or designated minimum perennial stream flow.
August 10, 1994

Dear Eric:

Enclosed is the information you requested concerning flows in the Little Butte Creek System. I have included copies of our Application For Instream Water Right for Dry Creek, Antelope Creek, North Fork Little Butte Creek, and South Fork Little Butte Creek. We do not have new applications filed for Lake Creek or Main Stem Little Butte Creek. These applications are based on optimum flows for fish habitat. I also included a portion of a table titled "Recommended Minimum Flows For Fish Life" from the Basin Investigations Report, 1970, and a table titled "Little Butte Creek Basin, Minimum Perennial Streamflows" that show minimum flows that were established in 1969. The flows in both of these tables were based on minimum flow needed to provide some fish habitat. As you can see, the flows specified in each of the documents varies considerably depending on the quality of habitat they were intended to provide. I do not have copies of certificates of those water right that we have already been granted, so I do not know exactly what they are.

If you have any questions about this information, let me know.

Sincerely,

David R. Haight
Assistant District Fisheries Biologist

cc: Bob Mullen
IWR Application # ___________________ Certificate # ___________________

STATE OF OREGON
WATER RESOURCES DEPARTMENT

Application for Instream Water Right
by Oregon Department of Fish and Wildlife

There is no fee required for this application.

Applicant: Randy Fisher for Oregon Department of Fish and Wildlife, PO Box 59, Portland, OR 97207

1. The name of the stream of the proposed instream water right is Dry Creek, a tributary of Rogue River.

2. The public use this instream water right is based on providing required stream flows for cutthroat and rainbow trout.

3. The amount of water (in cubic feet per second) needed by month for each category of public use is as follows:

   USE(S): Migration, spawning, egg incubation, fry emergence, and juvenile rearing.

   JAN   FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
   10    10   10  10/6  4    4    4  4/6  6  6/6  10

4. The reach of the stream identified for an instream water right is from (upstream end) an unnamed tributary, within the NE quarter of Section 36, Township 34S, Range 2W W.M., in Jackson County...

   Downstream to the mouth, within the SE quarter of Section 5,
   Township 35S, Range 1W W.M., in Jackson County.

5. Technical data relied on in this application are published in the Rogue River Basin Investigation report. This report was submitted to the Oregon State Water Resources Board in 1972. These data are based on instream flow studies conducted by Oregon State Game Commission personnel in 1967.

   The method used to determine the requested flows was "the Oregon Method" as described in Determining Minimum Flow Requirements for Fish, ODFW, 1984, a document previously submitted to Water Resources Department, Salem, Oregon.

6. When were the following state agencies notified of the intent to file for the instream water right?
Although the ODFW has not investigated the effects of the operation of the irrigation system on the outmigration of salmonid smolts, the complex flow patterns within the system may cause an increase in travel time of salmonid smolts, resulting in an increased time of exposure to high water temperatures within the system and predation from birds and warmwater fish. Before entering the saltwater environment juvenile salmonids must undergo a physiological change known as smoltification. This process cannot be completed nor can the smolt condition be maintained at water temperatures above 59°F (15°C) (Zaug, Adams and McLain, 1972). Since mean monthly temperatures in Bear Creek at Medford approach 59°F (15°C) in May (RVCOG, 1976), a delay of the outmigration of juvenile salmonids during this period may cause desmoltification and prevent successful outmigration.

A 1970 Stream Habitat Inventory of the Bear Creek Drainage (ODFW, 1970) identified fish habitat losses due to man-made changes. Damage to stream habitat within Bear Creek included chemical pollution from orchard spraying and domestic sewage, siltation of the streambed and high turbidity throughout the 27 miles of stream due to land use practices and 14 miles of man-caused channel changes and 10 miles of stream bank habitat destroyed. A survey of the tributary streams also revealed a general destruction of fish habitat due to man-made changes. Identified were 22 miles of chemical pollution due to orchard spraying, 11 miles of man-made channel changes, 6 miles of stream bank habitat destroyed, 39.5 miles of streambed silted, 62.5 miles of high turbidity due to land use practices and 4 miles of man-caused channel drying.

Sediments originating in Ashland Creek are a contributing factor in turbidity and siltation during sluicing or dredging of Reeder Reservoir, and sediments discharged from the reservoir may remain in Bear Creek for some period thereafter. The effects of dredging Reeder Reservoir following the 1974 flood on the salmonid fisheries of Bear Creek were documented in the Upper Rogue District Monthly Report, August 1974 for the ODFW:

"The bed of Bear Creek between the mouth of Ashland Creek and the Jackson Street diversion in Medford is choked with decomposed granite, up to 10 inches deep in areas, following dredging of Reeder Reservoir by the City of Ashland. Four 100-yard sections of stream were examined on August 1 and 2, and steelhead fry were found to be absent, as are most species and age classes of insects."

Based on field sampling conducted during 1974, the ODFW concluded that virtually all of the fall chinook, coho salmon and winter steelhead spawn was lost due to sediment release.
from Reeder Reservoir. Summer steelhead fry survived until they returned to Bear Creek in the summer as flows in the tributaries decreased. They died after reentering Bear Creek (Haight, pers. comm.). Although no sampling was conducted subsequent to 1974, it is assumed by the ODFW that the silting of the mainstem of Bear Creek had a residual adverse impact on salmonid production within the basin, although the duration and magnitude of the impacts is not known (Jennings, pers. comm.).

Salmon and steelhead reared in the Bear Creek Basin are caught by both sport and commercial fishermen in the ocean and the Rogue River (Bear Creek is not open to fishing for these species [Jennings, pers. comm.]). The economic losses to commercial and sports fishermen due to the virtual elimination of salmonids spawned in Bear Creek in 1974 was calculated by the ODFW using their 1975 Economic Data Catalogue (Table 2-4). The ODFW's 1970 estimate of the number of adult spawners (escapement) within the Bear Creek system, and established catch-to-escapement ratios, were used to estimate the number of fish of each species lost from the sport and commercial fish catch for one year. These values were then used to estimate an economic loss of $67,468 in 1975 dollars.

Field and Laboratory Analysis of Stream Gravels

A stream gravel analysis was conducted in March 1979 to determine the gravel size composition in potential or actual spawning areas in Bear Creek. The information was used to assess the suitability of the stream gravels as salmonid spawning and rearing habitat at the time the sampling was done. Since these samples were taken three years following the most recent cleaning of Reeder Reservoir, they were not expected to relate to any impacts from that source.

Information available in the literature on salmonid biology indicates that the production of salmonids in freshwater streams is affected by the quality of the gravel substrate (Cordone and Kelley, 1961; Phillips, 1971; Iwamoto, et al., 1978). As is indicated in the Environmental Criteria Guidelines for steelhead, coho salmon and chinook salmon, gravel substrate composition directly affects spawning, egg incubation, emergence of the fry, and disposal and rearing of the young. Spawning gravel for salmonids should range between 0.5 and 6 inches in diameter, and contain fewer than 20 percent fine sediments less than 0.84 mm in diameter. Accumulated sediments smaller than 0.84 mm (0.03 in) in diameter in channel gravels have been shown to smother eggs and inhibit the development and emergence of
Table 2-4

ECONOMIC LOSSES OF THE ANADROMOUS SALMONID FISHERY IN THE BEAR CREEK BASIN
DUE TO THE 1974 DREDGING OF REEDER RESERVOIR
(based on information provided by the ODFW)

<table>
<thead>
<tr>
<th>Stream</th>
<th>Species</th>
<th>Number of adult fish estimated to be returning to spawn in 1974</th>
<th>Estimated number of fish lost from the sport catch due to 1974 sediment discharges</th>
<th>Economic value of sport catch losses due to 1974 sediment discharges</th>
<th>Estimated number of fish lost from the commercial catch due to 1974 sediment discharges</th>
<th>Economic value of commercial catch losses due to 1974 sediment discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bear Creek</td>
<td>Chinook Salmon (fall run)</td>
<td>50</td>
<td>72</td>
<td>$7,318</td>
<td>177</td>
<td>$2,994</td>
</tr>
<tr>
<td></td>
<td>Coho Salmon</td>
<td>60</td>
<td>87</td>
<td>785</td>
<td>213</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>Winter Steelhead</td>
<td>300</td>
<td>100</td>
<td>22,176</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>20</td>
<td>10</td>
<td>1,241</td>
<td>213</td>
<td>315</td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>30</td>
<td>15</td>
<td>1,861</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>40</td>
<td>20</td>
<td>2,483</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>20</td>
<td>10</td>
<td>1,241</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>15</td>
<td>7</td>
<td>869</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>75</td>
<td>37</td>
<td>4,592</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>30</td>
<td>15</td>
<td>1,861</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>50</td>
<td>25</td>
<td>3,102</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>75</td>
<td>37</td>
<td>4,592</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>75</td>
<td>37</td>
<td>4,592</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sumner Steelhead</td>
<td>100</td>
<td>50</td>
<td>6,204</td>
<td>390</td>
<td>$3,309</td>
</tr>
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<td></td>
<td>Sumner Steelhead</td>
<td>10</td>
<td>5</td>
<td>621</td>
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</tr>
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</table>

**TOTALES**  
960                                               612                                               $64,159                                               390                                               $3,309

1 Based on ODFW 1970 stream habitat inventory counts.
## Bear Creek: Summer Steelhead

### Activity/Life Stage

<table>
<thead>
<tr>
<th>Factors</th>
<th>Adult Passage</th>
<th>Spawning Eggs-Adults</th>
<th>Incubation Eggs-screen</th>
<th>Emergence Fry</th>
<th>Dispersal Fry-finger</th>
<th>Rearing Fingers-Juveniles</th>
<th>Smolting Juveniles</th>
<th>Smolt Passage</th>
<th>Adult Out-migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>Dec-Mar</td>
<td>Dec-Mar</td>
<td>Dec-Mar</td>
<td>Mar-May</td>
<td>Mar-Jun</td>
<td>All year</td>
<td>Mar-May</td>
<td>Jan-Apr</td>
<td></td>
</tr>
<tr>
<td>Depths (min.)</td>
<td>0.6 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.6 ft.</td>
<td></td>
</tr>
<tr>
<td>(25% of wetted surface)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Velocity</td>
<td>&lt;8 fps</td>
<td>1-3 fps</td>
<td>&gt;1.5 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>45-60°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-65°F</td>
<td>45-55°F</td>
<td>45-60°F</td>
<td>45-60°F</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td></td>
</tr>
<tr>
<td>Oxidation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substrate</td>
<td>gravel (.5-4 in.)</td>
<td>gravel (.5-4 in.)</td>
<td>gravel (.5-4 in.)</td>
<td>gravel &lt;20% fines</td>
<td>gravel &lt;20% fines</td>
<td>gravel &lt;20% fines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>&lt;1 ft (multiple)</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td>2-3 ft (single)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Environmental Criteria Guidelines Freshwater: Activity/Life Stage/Factors

## Bear Creek: Winter Steelhead

<table>
<thead>
<tr>
<th>Activity/Life Stage</th>
<th>Adult Passage</th>
<th>Spawning Eggs-Adults</th>
<th>Incubation eggs-sac-fry</th>
<th>Emergence Fry</th>
<th>Dispersal Fry-finger</th>
<th>Rearing fingers-juveniles</th>
<th>Smolting Juveniles</th>
<th>Smolt Passage</th>
<th>Adult out-migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (min.)</td>
<td></td>
<td>0.6 ft. (25% of wetted surface)</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.5 ft.</td>
<td>0.6 ft.</td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
<td>&lt;8 fps</td>
<td>1-3 fps</td>
<td>&gt;1.5 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>45-60°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-65°F</td>
<td>45-55°F</td>
<td>45-60°F</td>
<td>45-60°F</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
</tr>
<tr>
<td>Sediment</td>
<td>gravel (.5-4 in.)&lt;20% fines</td>
<td>gravel (.5-4 in.)&lt;20% fines</td>
<td>gravel (.5-4 in.)&lt;20% fines</td>
<td>gravel&lt;20% fines</td>
<td>gravel&lt;20% fines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>1 ft (multiple)</td>
<td>2-7 ft (single)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Environmental Criteria Guidelines: Freshwater
### Activity/Life Stage/Factors

#### Bear Creek: Coho Salmon

<table>
<thead>
<tr>
<th>Factors</th>
<th>Adult Passage</th>
<th>Spawning Eggs-Adults</th>
<th>Incubation Eggs-Sacry</th>
<th>Emergence Fry</th>
<th>Dispersal Fry-Finger</th>
<th>Rearing Fingers-Juv.</th>
<th>Smolting Smolt Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rates</td>
<td>Nov-Dec</td>
<td>Nov-Jan</td>
<td>Nov-Mar</td>
<td>Feb-Apr</td>
<td>Feb-May</td>
<td>All Year</td>
<td>Mar-May</td>
</tr>
<tr>
<td>Depths (min.)</td>
<td>0.6 feet (25% of wetted area)</td>
<td>0.5 feet</td>
<td>0.5 feet</td>
<td>0.5 feet</td>
<td>0.5 feet</td>
<td>0.5 feet</td>
<td>0.5 feet</td>
</tr>
<tr>
<td>Velocity</td>
<td>&lt;8 fps</td>
<td>1-3 fps</td>
<td>&gt;1.5 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
</tr>
<tr>
<td>Temperature</td>
<td>45-60°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-55°F</td>
<td>43-65°F</td>
<td>45-55°F</td>
<td>45-60°F</td>
</tr>
<tr>
<td>pH</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
</tr>
<tr>
<td>Substrate</td>
<td>gravel (.5-4 in.)</td>
<td>gravel (.5-4 in.)</td>
<td>gravel (.5-4 in.)</td>
<td>gravel &lt;20% fines</td>
<td>gravel &lt;20% fines</td>
<td>gravel &lt;20% fines</td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td>&lt;1 ft (multiple)</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
</tr>
</tbody>
</table>
### Bear Creek: Chinook Salmon (Fall Run)

#### Activity/Life Stage

<table>
<thead>
<tr>
<th>Factors</th>
<th>Adult Passage</th>
<th>Spawning Eggs-Adults</th>
<th>Incubation eggs-sacry</th>
<th>Emergence Fry</th>
<th>Dispersal fry-finger</th>
<th>Rearing fingers-juveniles</th>
<th>Smolting Juveniles</th>
<th>Smolt Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>depths (min.)</td>
<td>0.8 ft (25% of wetted surface)</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
<td>0.5 ft</td>
</tr>
<tr>
<td>Locality</td>
<td>&gt;8 fps</td>
<td>1-3 fps</td>
<td>&gt;1.5 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
<td>1-3 fps</td>
</tr>
<tr>
<td>Temperature</td>
<td>51-67°F</td>
<td>43-58°F</td>
<td>43-58°F</td>
<td>43-58°F</td>
<td>43-65°F</td>
<td>45-58°F</td>
<td>45-60°F</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen (ppm)</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td>&gt;7 ppm</td>
<td></td>
</tr>
<tr>
<td>Substrate</td>
<td>gravel (1-6 in.)</td>
<td>gravel (1-6 in.)</td>
<td>gravel (1-6 in.)</td>
<td>gravel (1-6 in.)</td>
<td>gravel (1-6 in.)</td>
<td>&lt;20% fines</td>
<td>&lt;20% fines</td>
<td></td>
</tr>
<tr>
<td>Corridors</td>
<td>&lt;1 ft (multiple)</td>
<td>2-3 ft (single)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PROBLEM ASSESSMENT: Bear Creek

Introduction

Bear Creek, located in southwestern Oregon near Medford, is a tributary to the Rogue River. The upper part of the drainage basin has narrow mountain canyons and is situated at the junction of the Cascade Range to the east and the Siskiyou Mountains to the southwest. Bear Creek originates at the confluence of Emigrant and Neil Creeks near Ashland. Bear Creek flows about 30 miles and enters the Rogue River 127 miles above the mouth of the Rogue. Much of the summer flow of Bear Creek comes from Emigrant Reservoir where water diverted from the Klamath Basin is stored. The Bear Creek Basin encompasses a drainage area of about 360 square miles and is contained in Jackson County.

Water from Bear Creek is needed for irrigation to maintain the high agricultural productivity of Jackson County. Bear Creek is also a natural stream corridor which supports 15 species of fish. The Bear Creek Greenway provides recreational opportunities for residents of Jackson County. In addition, the City of Talent uses treated water from Bear Creek for domestic purposes.

Problem Description

Oregon Administrative Rules (OAR) Chapter 340, Division 41, Rule 362, lists the beneficial uses for which water quality will be protected in Bear Creek. They are:

- Public Domestic Water Supply
- Industrial Water Supply
- Irrigation
- Livestock Watering
- Water Contact Recreation
- Aesthetic Quality
- Boating
- Anadromous Fish Passage
- Salmonid Fish Spawning
- Salmonid Fish Rearing
- Resident Fish & Aquatic Life
- Wildlife and Hunting
- Fishing

This list of beneficial uses was established by the Oregon Water Resources Commission pursuant to direction given in ORS 536.300. As charged by ORS 468.020, the Oregon Environmental Quality Commission adopted rules and standards that were necessary to protect those recognized beneficial uses. In practice, water quality rules and standards have been set at levels to protect the most sensitive of the uses: fish and human water supplies.

A number of water quality parameters have criteria values which have been adopted as regulatory standards for Bear Creek. Included are temperature, turbidity, pH, dissolved oxygen, fecal coliform bacteria, and dissolved chemical substances. To evaluate ambient water quality against the standards, monitoring data have been collected by DEQ at six stations in Bear Creek. These station
locations are as follows:

- Bear Creek at Mountain Avenue near Ashland (RM 22.4)
- Bear Creek at South Valley View Road (RM 19.9)
- Bear Creek at Fern Valley Rd. near Phoenix (RM 14.4)
- Bear Creek at Barnett Road (RM 11.0)
- Bear Creek at Highway 62 (RM 7.6)
- Bear Creek at Kirtland Road (RM 0.9)

Monitoring results are summarized in Table 1 for several parameters of interest. Table 1 identifies the season of concern, median values monitored during that season, and the 90th percentile of all observations in the season of concern.

Table 1. Bear Creek Water Quality Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Season</th>
<th>Above Valley (RM 22.4)</th>
<th>Valley View (RM 19.9)</th>
<th>Fern Valley (RM 14.4)</th>
<th>Barnett Road (RM 11.0)</th>
<th>Hwy. 62 (RM 7.6)</th>
<th>Kirtland Road (RM 0.9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Oxygen (%)</td>
<td>Summer</td>
<td>95</td>
<td>89</td>
<td>104</td>
<td>94</td>
<td>104</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>86</td>
<td>82</td>
<td>75</td>
<td>79</td>
<td>75</td>
<td>70</td>
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<tr>
<td>pH</td>
<td>Summer</td>
<td>7.8</td>
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<td>90%</td>
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<td>8.8</td>
<td>8.6</td>
<td>8.8</td>
<td>8.6</td>
</tr>
<tr>
<td>Fecal Coliform (#/100ml)</td>
<td>Summer</td>
<td>...</td>
<td>240</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>930</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>...</td>
<td>2400</td>
<td>...</td>
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<td>...</td>
<td>2400</td>
</tr>
<tr>
<td>BOD (mg/L)</td>
<td>Summer</td>
<td>1.0</td>
<td>3.2</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>2.3</td>
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<tr>
<td></td>
<td>Median</td>
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<td>8.7</td>
<td>8.7</td>
<td>8.7</td>
<td>8.7</td>
<td>8.7</td>
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<tr>
<td>Turbidity (JTUs)</td>
<td>Annual</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Phosphate (ug/L)</td>
<td>Summer</td>
<td>79</td>
<td>400</td>
<td>270</td>
<td>260</td>
<td>260</td>
<td>275</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>160</td>
<td>600</td>
<td>690</td>
<td>320</td>
<td>296</td>
<td>495</td>
</tr>
<tr>
<td>Nitrate (ug/L)</td>
<td>Summer</td>
<td>40</td>
<td>250</td>
<td>490</td>
<td>530</td>
<td>490</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>120</td>
<td>310</td>
<td>1200</td>
<td>770</td>
<td>550</td>
<td>960</td>
</tr>
<tr>
<td>Chlorophyll (ug/L)</td>
<td>Summer</td>
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<td>2.1</td>
<td>1.2</td>
<td>3.2</td>
<td>3.7</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>2.1</td>
<td>2.8</td>
<td>9.2</td>
<td>3.6</td>
<td>11.9</td>
<td>11.2</td>
</tr>
<tr>
<td>Un-ionized Ammonia (ug/L)</td>
<td>Summer</td>
<td>1.0</td>
<td>18.0</td>
<td>1.9</td>
<td>3.2</td>
<td>5.8</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>2.0</td>
<td>50.1</td>
<td>4.1</td>
<td>6.2</td>
<td>7.5</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Note: Upper value is the median; lower value is the 90th percentile.
Dissolved oxygen (D.O.) is essential for maintaining aquatic life. Its effect on aquatic organisms, especially at low concentrations, has been studied extensively. The water quality standard for dissolved oxygen in Bear Creek states that: "D.O. concentrations shall not be less than 90 percent saturation at the seasonal low, or less than 95 percent of saturation in spawning areas during spawning, incubation, hatching, and fry stages of salmonid fishes."

As can be seen in Table 1, Bear Creek from Ashland to the mouth, violates the Oregon Water Quality Standard for dissolved oxygen. These low dissolved oxygen measurements usually occurred in the early morning hours.

Dissolved oxygen in a stream is influenced by a variety of factors. Reaeration and photosynthesis add dissolved oxygen to a river. Carbonaceous oxidation, benthic demands, algal respiration, and nitrogenous oxidation diminish D.O. levels. The increase in BOD, ammonia, and nitrate just below Ashland contribute to the oxygen depletion observed in Bear Creek through carbonaceous and nitrogenous oxidation. Wide diurnal fluctuations in dissolved oxygen levels are indicative of high algal productivity. Algal respiration is generally responsible for low D.O. readings in the early morning hours. Other parameters which confirm excessive algal growth as a problem include pH and chlorophyll a.

According to the standards, the pH (hydrogen ion concentration) shall not fall outside the range of 6.5 to 8.5. The pH for Bear Creek below Ashland has exceeded 8.5 during critical conditions in the summer months. The pH problems in Bear Creek appear to be the result of excessive algal growth. A major reason for elevated pH readings is the use of carbon dioxide by algae and other aquatic plants. Photosynthesis tends to use up carbon dioxide which then increases the pH.

Many factors contribute to algal growth. Some, like sunlight, are natural phenomena. Other factors, such as nutrient levels, are influenced by the activities of man. Many studies suggest that phosphorus is a major factor leading to excessive algal growth. Phosphate concentrations monitored in Bear Creek below Ashland (Table 1) are significantly higher than phosphate measured at the upstream station. This data indicates a major phosphorus source in Bear Creek below Ashland.

Excessive levels of un-ionized ammonia have been shown to be toxic to fish and other aquatic organisms. Guideline criteria values have been adopted which are dependent on pH and temperature. For typical summer conditions observed in Bear Creek, the average un-ionized ammonia concentration should be no greater than 35 ug/L and the maximum should not exceed 260 ug/L. There is a significant jump in un-ionized ammonia concentrations below Ashland. Although it is still below the average criteria value, ammonia levels in Bear Creek must be closely monitored in the future.
Another water quality parameter is of concern in Bear Creek. Elevated levels of fecal coliform bacteria have been observed. Standards violations appear related to the effects of non-point sources. Occasional sewage bypasses and land runoff contribute to high bacteria measurements.

**Pollutant Sources**

Stream quality is affected in a variety of ways. Typically, land use exerts a major effect on water quality. Land use in the drainage is predominantly agriculture. During periods of low flow, point source discharges can also have a major influence on the quality of a receiving water. In terms of water quality standards violations, the summer months are the period of greatest concern in Bear Creek.

Significant improvements have been monitored in Bear Creek over the past ten years (RVCOG, 1986). Most historical water quality problems in Bear Creek resulted from non-point source activities such as agricultural runoff and failing septic systems. By reducing pollutant loads from these non-point sources, the relative significance of point source contributions have increased.

The City of Ashland operates a conventional, activated sludge sewage treatment plant. Treated effluent is discharged to Ashland Creek about one-half mile above its confluence with Bear Creek. The influence of the Ashland STP on water quality in Bear Creek is particularly evident during low flow conditions. For example, the U.S. Geological Survey concluded that treated sewage from Ashland is the primary source of nitrogen and orthophosphate in Bear Creek. This pattern is also evident from DEQ’s monitoring data (Table 1). The significant increases in BOD, ammonia, phosphate, and nitrate in Bear Creek between Ashland and Valley View is due to the Ashland treatment facility.

Normal secondary domestic wastewater treatment facilities have effluent phosphate concentrations between 6 and 8 mg/L. The Ashland STP has a current summer discharge of almost 2 mgd (3.1 cfs). This produces a phosphate load of between 100 and 125 pounds per day, nearly 10 times the background load. If Ashland operates at their full permit limits, the increase in phosphate at the mixing zone boundary could go to 20 times the background load, without additional treatment.

The cumulative effect of the other sources and attenuation must also be considered. This includes irrigation return flows. The dramatic increase in key water quality parameters highlights the need to review the assimilative capacity of Bear Creek. A logical starting point is to evaluate available dilution. Low flows in Bear Creek typically fall below 30 cfs. The 7-day average low flow which
occurs every other year (7Q2) in Bear Creek is 25 cfs. Using a permitted discharge flow of 3 mgd for the Ashland STP and the 7Q2 of 25 cfs gives a dilution ratio of 5.4.

The Oregon Water Quality Standards provides a frame of reference for evaluating dilution. OAR 340-41-375(1)(c) states that "Effluent BOD concentrations in mg/L, divided by the dilution factor shall not exceed one". In other words, the dilution ratio represents the maximum allowable BOD effluent concentration. BOD, in turn, reflects the level of treatment provided to municipal wastewater. Table 2 summarizes annual low flow data for Bear Creek to further illustrate the concern over available dilution. The current summer BOD effluent limit for the Ashland STP is 20 mg/L, or 5 to 10 times the available dilution in Bear Creek during critical summer flow conditions. Ashland actually discharges to Ashland Creek, a tributary to Bear Creek with even less flow. Based on the treatment criteria defined in the standards, there is inadequate dilution in the Bear Creek to assimilate the Ashland STP discharged flow.

Table 2. Low Flow Summary for Bear Creek

<table>
<thead>
<tr>
<th>Year</th>
<th>Low 1-Day Flow (cfs)</th>
<th>Maximum Allowable BOD Effluent Concentration for Ashland STP to Meet Dilution Ratio (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>27</td>
<td>5.8</td>
</tr>
<tr>
<td>1977</td>
<td>22</td>
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<td>1979</td>
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<tr>
<td>1985</td>
<td>23</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Actions to Date

Areas where water quality standards are not or would not be met after the implementation of technology-based effluent limitations are said to be "water quality limited". In January 1987, the Department identified Bear Creek as being "water quality limited". The parameters violating water quality standards include dissolved oxygen, pH, and fecal coliform bacteria.
On March 13, 1987, the Environmental Quality Commission (EQC) approved a process for establishing total maximum daily loads (TMDLs) on "water quality limited" stream segments. Phase I is scheduled for completion by November 1987 on Bear Creek for phosphorus and ammonia to address the dissolved oxygen and pH violations.

Historically, several activities have been undertaken which deal with the water quality problems of Bear Creek. Between 1960-70, the population of Jackson County increased by more than 20,000 people or nearly 30 percent. The vast majority of this growth occurred in the Bear Creek Valley. Several towns south of Medford, such as Ashland and Talent, provided sewer service and individual treatment with discharge to Bear Creek or its tributaries. However, approximately half of the growth in the Bear Creek Valley was on septic tanks. As rural growth continued, so did the number of septic tank failures. The incidents of water born communicable diseases, such as hepatitis, reached alarming proportions (RVCOG, 1980).

On behalf of the residents of Jackson County, the 1955 State Legislature enacted ORS 450.705 through 450.980, the enabling legislation for the creation of Sanitary Authorities. In 1966, Jackson County residents created the Bear Creek Valley Sanitary Authority (BCVSA). A regional Sewer Plan was developed in 1964, prior to the formation of BVCSA. Since that time, at least an additional major sewer plans or engineering studies have been conducted.

BCVSA currently provides collection facilities for the unincorporated area of Jackson County from south Medford to north of Ashland. The BCVSA Bear Creek interceptor transports sanitary wastes to the regional Medford treatment facility. BVCSA contracts with the City of Medford for treatment of wastewater. Effluent is discharged to the Rogue River where dilution is much greater than Bear Creek.

The Ashland sewer system was first constructed in 1906. A treatment plant expansion was completed in 1975 with a design flow of 3.1 mgd. The BVCSA interceptor extends up to the north Ashland area and transports wastes to the Medford facility located on the Rogue River. However, Ashland opted not to connect into the regional system.

Water quality samples have been collected since 1960 from Bear Creek and many of its tributaries. In 1960 and 1962, the Oregon State Sanitary Authority measured Bear Creek water quality. Results indicated that the quality was unsuitable for most of the desired uses in Bear Creek. In a report by the U.S. Public Health Service (1965), it was concluded that, because of increases in population and industrialization, Bear Creek would need more flow to prevent further degradation.
A study of the biological, chemical, and physical characteristics of Bear Creek in 1968-69 by Linn (Southern Oregon State College) showed that high background levels of turbidity in Bear Creek originated from Emigrant Reservoir. This turbidity was increased by stormwater runoff from Medford. The report also showed that sewage treatment plant effluent was a source of high nitrate and orthophosphate concentrations in Bear Creek below Ashland Creek.

Pursuant to the terms of Section 208, P.L. 92-500, the Bear Creek Basin was designated for special areawide waste treatment planning. It was under the planning guidance of the Rogue Valley Council of Governments (RVCOG). In July of 1977, RVCOG adopted the Greater Bear Creek Basin Waste Treatment Master Plan. The most significant aspect of this plan was the fact that it was the first such plan to be mutually adopted by all the locally affected agencies. The plan essentially evaluated the needs for further domestic sewage collection and treatment, industrial waste treatment and/or control, and non-point source waste control.

Pollution Control Strategy

The development and adoption of TMDL’s is a phased process. The first phase is to propose through a public notice a site specific TMDL for Bear Creek to eliminate dissolved oxygen and pH violations caused by algal growth. The second phase establishes a local advisory group to help develop a water quality management plan for Bear Creek. The Bear Creek management plan would be incorporated into the water quality management plan for the Rouge Basin. The revised management plan will include the final TMDL, implementation strategies, and compliance schedules for reducing discharges to Bear Creek to meet the final TMDL.

As the TMDL and associated plan are being developed, current waste discharge requirements for point source permits will be reviewed. Until the TMDL process is completed, for permit renewals where no increase in discharge is requested, the Department intends to reissue without modification of permit limits.

After the TMDL has been adopted, it will be the Department’s responsibility to address point source permits consistent with the implementation strategy. Current administrative rules (OAR 340-45-055) allow the Department to modify existing permits and to include new limits for complying with established waste loads if the implementation strategy would so dictate. Should reduced limits be placed in permits, compliance schedules for reaching those limits would be specified and would be consistent with the adopted implementation strategy.

The development of TMDLs for parameters related to non-point sources will be conducted sometime after completion of the Department’s non-point source assessment (August 1988). The Department will coordinate with the appropriate local agencies to develop a plan for addressing NPS problems related to bacteria.
Proposed Total Maximum Daily Load

In April 1987, the Department proposed a TMDL for phosphate in the Tualatin River. This TMDL was based on a target value for phosphate of 0.15 mg/L. Algal assay studies have been conducted in Oregon since this TMDL was proposed. The results of these tests indicate that a target level of 0.10 mg/L is required to significantly reduce algal growth. This is consistent with studies conducted in other areas. A TMDL based on a guidance value of 0.10 mg/L total phosphorus will reduce algal growth which leads to the current dissolved oxygen and pH violations in Bear Creek.

The approach being used in Oregon is to identify a set of loads for varying flow conditions. This technique better addresses the dynamic nature of rivers. This approach also allows a variety of options to be pursued to comply with water quality standards. Alternatives include specifying permit conditions in terms of receiving water flows or using upstream reservoir storage capacity to increase stream flows. By using varying flow conditions and the target concentrations, maximum allowable pollutant loads have been calculated. These loads are presented in Table 4.

Table 3. Maximum Allowable Pollutant Loads to Bear Creek from June through October

<table>
<thead>
<tr>
<th>Discharge (cfs)</th>
<th>Maximum BOD (lbs/day)</th>
<th>Maximum Total Phosphate (lbs/day)</th>
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</thead>
<tbody>
<tr>
<td>10 - 20</td>
<td>50</td>
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</tr>
<tr>
<td>20 - 40</td>
<td>100</td>
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<tr>
<td>40 - 60</td>
<td>200</td>
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<td>60 - 100</td>
<td>300</td>
<td>30</td>
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<tr>
<td>100 - 150</td>
<td>500</td>
<td>50</td>
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<tr>
<td>150 - 200</td>
<td>800</td>
<td>80</td>
</tr>
</tbody>
</table>
Rogue Basin

Beneficial Water Uses to be Protected

340-41-362 Water quality in the Rogue River Basin (see Figures 1 and 6) shall be managed to protect the recognized beneficial uses as indicated in Table 5.

Stat. Auth.: ORS Ch. 468
Hist.: DEQ 128, f. & ef. 1-21-77; DEQ 9-1986, f. & ef. 8-6-86

Water Quality Standards Not to be Exceeded (To be Adopted Pursuant to ORS 468.735 and Enforceable Pursuant to ORS 468.720, 468.990, and 468.992)

340-41-365 (1) Notwithstanding the water quality standards contained below, the highest and best practicable treatment and/or control of wastes, activities, and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and
water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels.

(2) No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause violation of the following standards in the waters of the Rogue River Basin:

(a) Dissolved oxygen (DO):

(A) Fresh waters: DO concentrations shall not be less than 90 percent of saturation at the seasonal low, or less than 95 percent of saturation in spawning areas during spawning, incubation, hatching, and fry stages of salmonid fishes; (B) Marine and estuarine waters (outside of zones of upwelled marine waters naturally deficient in DO): DO concentrations shall not be less than 6 mg/l for estuarine waters, or less than saturation concentrations for marine waters.

(b) Temperature:

(A) Fresh waters: No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 58° F. or greater; or more than 0.5° F. increase due to a single-source and when receiving water temperatures are 57.5° F. or less; or more than 2° F. increase due to all sources combined when stream temperatures are 56° F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventive techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses;

(B) Marine and estuarine waters: No significant increase above natural background temperatures shall be allowed, and water temperatures shall not be altered to a degree which creates or can reasonably be expected to create an adverse effect on fish or other aquatic life.

(c) Turbidity (Nephelometric Turbidity Units, NTU): No more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:

1. Emergency activities: Approval coordinated by DEQ with the Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare;

(B) Dredging. Construction or other Legitimate Activities: Permit or certification authorized under terms of Section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 141-85-100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate.

(d) pH (hydrogen ion concentration): pH values shall not fall outside the following ranges: (A) Marine waters: 7.0 - 8.5;

(B) Estuarine and fresh waters: 6.5 - 8.5.

(e) Bacteria Standards:

(A) Effective upon filing and through June 30, 1995. Organisms of the coliform group where associated with fecal sources (MPN or equivalent MF using a representative number of samples):

(i) Freshwaters: A geometric mean of 33 enterococci per 100 milliliters based on a minimum of five samples in a 30-day period with no more than ten percent of the samples in the 30-day period exceeding 61 enterococci per 100 ml;

(ii) Marine waters: A geometric mean of 33 enterococci per 100 milliliters based on a minimum of five samples in a 30-day period with no more than ten percent of the samples in the 30-day period exceeding 104 enterococci per 100 ml;

(B) Effective July 1, 1995. Bacteria of the coliform group associated with fecal sources and bacteria of the enterococci group (MPN or equivalent membrane filtration using a representative number of samples) shall not exceed the criteria values described in subparagraphs (2)(e)(B)(i) through (iii) of this rule. However, the Department may designate site-specific bacteria criteria on a case-by-case basis to protect beneficial uses. Site specific values shall be described in an included as part of a water quality management plan:

(i) Freshwaters: A geometric mean of 33 enterococci per 100 milliliters based on no fewer than five samples, representative of seasonal conditions, collected over a period of at least 30 days. No single sample should exceed 61 enterococci per 100 ml;

(ii) Marine waters: A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than ten percent of the samples exceeding 43 organisms per 100 ml;

(iii) Estuarine waters: A geometric mean of 33 enterococci per 100 milliliters based on no fewer than five samples, representative of seasonal conditions, collected over a period of at least 30 days. No single sample should exceed 61 enterococci per 100 ml;

(f) Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health shall not be allowed;

(g) The liberation of dissolved gases, such as carbon dioxide, hydrogen sulfide, or other gases in sufficient quantity to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such waters shall not be allowed;

(h) The development of fungi or other growths having a deleterious effect on stream bottoms, fish
or other aquatic life, or which are injurious to health, recreation, or industry shall not be allowed;

(i) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish shall not be allowed;

(j) The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life hazardous to the health, recreation, or industry shall not be allowed;

(k) Objectionable discoloration, scum, oily slick, or floating solids, or coating of aquatic life with oil films shall not be allowed;

(l) Aesthetic conditions offensive to the human senses of sight, taste, smell, or touch shall not be allowed;

(m) Radioisotope concentrations shall not exceed maximum permissible concentrations (MPC's) in drinking water, edible fishes or shellfishes, wildlife, irrigated crops, livestock and dairy products, or pose an external radiation hazard;

(n) The concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection shall not exceed 110 percent of saturation, except when stream flow exceeds the ten-year, seven-day average flood. However, for Hatchery receiving waters and waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection shall not exceed 105 percent of saturation;

(o) Total Dissolved Solids: Guide concentrations listed below shall not be exceeded unless otherwise specifically authorized by DEQ upon such conditions as it may deem necessary to carry out the general intent of this plan and to protect the beneficial uses set forth in OAR 340-41-362; 500.0 mg/l;

(p) Toxic Substances:

(A) Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations which may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life; wildlife; or other designated beneficial uses;

(B) Levels of toxic substances shall not exceed the criteria listed in Table 20 which were based on criteria established by EPA and published in Quality Criteria for Water (1986), unless otherwise noted;

(C) The criteria in paragraph (B) of this subsection shall apply unless data from scientifically valid studies demonstrate that the most sensitive designated beneficial uses will not be adversely affected by exceeding a criterion or that a more restrictive criterion is warranted to protect the beneficial uses, as accepted by the Department on a site specific basis. Where no published EPA criteria exist for a toxic substance, public health advisories and other published scientific literature may be considered and used, if appropriate, to set guidance values;

(D) Bio-assessment studies such as laboratory bioassays or in stream measurements of indigenous biological communities, shall be conducted to determine the toxicity of complex effluents, other suspected substances or chemical substances without numeric criteria, to aquatic life. These studies, properly conducted in accordance with standard testing procedures, may be considered as scientifically valid data for the purposes of paragraph (C) of this rule subsection. If toxicity occurs, the Department shall evaluate and implement measures necessary to reduce toxicity on a case-by-case basis.

(3) Where the numerical quality parameters of waters of the Rogue Basin are outside the numerical limits of the above assigned water quality standards, the natural water quality shall be the standard.

(4) Mixing zones:

(a) The Department may allow a designated portion of a receiving water to serve as a zone of dilution for wastewaters and receiving waters to mix thoroughly and this zone will be defined as a mixing zone;

(b) The Department may suspend all or part of the water quality standards, or set less restrictive standards, in the defined mixing zone, provided that the following conditions are met:

(A) The water within the mixing zone shall be free of;

(i) Materials in concentrations that will cause acute toxicity to aquatic life as measured by a Department approved bioassay method. Acute toxicity is lethality to aquatic life as measured by a significant difference in lethal concentration between the control and 100 percent effluent in an acute bioassay test. Lethality in 100 percent effluent may be allowed due to ammonia and chlorine only when it is demonstrated on a case-by-case basis that immediate dilution of the effluent within the mixing zone reduces toxicity below lethal concentrations. The Department may on a case-by-case basis establish a zone of immediate dilution if appropriate for other parameters;

(ii) Materials that will settle to form objectionable deposits;

(iii) Floating debris, oil, scum, or other materials that cause nuisance conditions;

(iv) Substances in concentrations that produce deleterious amounts of fungal or bacterial growth.

(B) The water outside the boundary of the mixing zone shall:

(i) Be free of materials in concentrations that will cause chronic (sublethal) toxicity. Chronic toxicity is measured as the concentration that causes long-term sublethal effects, such as significantly impaired growth or reproduction in aquatic organisms, during a testing period based on test species life cycle. Procedures and end points will be specified by the Department in wastewater discharge permits;

(ii) Meet all other water quality standards under normal annual low flow conditions;

(c) The limits of the mixing zone shall be described in the wastewater discharge permit. In determining the location, surface area, and volume of a mixing zone area, the Department may use appropriate mixing zone guidelines to assess the biological, physical, and chemical character of receiving waters, and effluent, and the most appropriate placement of the outfall, to protect instream water quality, public health, and other beneficial uses. Based on receiving water and
(c) Where industrial, commercial, or agricultural effluents contain significant quantities of potentially toxic elements, treatment requirements shall be determined utilizing appropriate bioassays; 
(d) Industrial cooling waters containing significant heat loads shall be subjected to offstream cooling or heat recovery prior to discharge to public waters; 
(e) Positive protection shall be provided to prevent bypassing of raw or inadequately treated industrial wastes to any public waters; 
(f) Facilities shall be provided to prevent and contain spills of potentially toxic or hazardous materials and a positive program for containment and cleanup of such spills should they occur shall be developed and maintained.

Stat. Auth.: ORS Ch. 468
Hist.: DEQ 128, f. & ef. 1-21-77

Special Policies and Guidelines
340-41-385 In order to improve water quality within the Bear Creek subbasin to meet existing water quality standards for dissolved oxygen and pH, the following special rules for total maximum load allocations, the biochemical oxygen demand, and water quality standards for dissolved oxygen and overall water quality shall be adopted and administered. 

(1) After the completion of wastewater control facilities and program plans approved by the Commission under this rule and no later than December 31, 1994, unless otherwise modified by program plans no activities shall be allowed and no wastewater shall be discharged to Bear Creek or its tributaries without the authorization of the Commission that cause the following parameters to be exceeded in Bear Creek:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Low-Flow Season</th>
<th>High-Flow Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia Nitrogen</td>
<td>0.25 mg/l</td>
<td>1.0 mg/l</td>
</tr>
<tr>
<td>Biochemical Oxygen</td>
<td>3.0 mg/l</td>
<td>2.5 mg/l</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>0.08 mg/l</td>
<td></td>
</tr>
</tbody>
</table>

(2) No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause violation of the following standards in the waters of the Willamette River Basin:

(a) Dissolved oxygen (DO):

Water Quality Standards Not to be Exceeded
340-41-445 (1) Notwithstanding the water quality standards contained below, the highest and best practicable treatment and/or control of wastes, activities, and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidity, odor, and other deleterious factors at the lowest possible levels.

(2) No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause violation of the following standards in the waters of the Willamette River Basin:

(a) Dissolved oxygen (DO):
## ATTACHMENT 8

**UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - OREGON DISTRICT**

**STATION NUMBER**: 1435700

**NAME**: BEAR CREEK AT MIDDOLD, OR

**SOURCE AGENCY**: USGS

**LATITUDE**: 421440

**LONGITUDE**: 1275210

**DRAINAGE AREA**: 290.00

**DATE**: 07/22/94

**STATE**: 41

**COUNTY**: 029

**DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993**

### DAILY MEAN VALUES

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### STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1915 - 1993, BY WATER YEAR (WT)

| MEAN | 31.2 | 35.5 | 444 | 196 | 205 | 194 | 190 | 129 | 70.3 | 30.7 | 31.1 | 33.4 |
| MAX  | 216 | 290 | 1537 | 1080 | 873 | 787 | 686 | 391 | 232 | 95.4 | 114 | 91.6 |
| MIN  | 4.74 | 8.23 | 17.3 | 13.2 | 11.5 | 13.7 | 4.88 | 1.46 | 2.12 | 53.5 | 20. | 20. |

### SUMMARY STATISTICS FOR 1992 CALENDAR YEAR

- **ANNUAL TOTAL**: 8617.9
- **ANNUAL MEAN**: 23.5
- **HIGHEST ANNUAL MEAN**: 304.8
- **LOWEST ANNUAL MEAN**: 8.42
- **HIGHEST DAILY MEAN**: 216
- **LOWEST DAILY MEAN**: 9.0
- **ANNUAL SEVEN-DAY MINIMUM**: 9.6
- **ANNUAL RUNOFF (AC-Ft)**: 17050
- **10 PERCENT EXCEEDS**: 36
- **50 PERCENT EXCEEDS**: 20
- **90 PERCENT EXCEEDS**: 13

**STATISTICS COMPUTED BY**: JMCENTER

**Date**: 05/10/1994 **AT**: 07:27:00
## Attachment 9

### Summary of Natural Flow Estimates

#### Watershed in the Bear Creek and Little Butte Basin

#### 50% Exceedance (Natural Stream Flow)

<table>
<thead>
<tr>
<th>Stream:</th>
<th>Watershed ID #</th>
<th>CFS:</th>
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<tbody>
<tr>
<td></td>
<td>(ISWR Application #)</td>
<td>JAN.</td>
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<tr>
<td>Bear Creek</td>
<td>70993</td>
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#### Watershed in the Bear Creek and Little Butte Basin

#### 80% Exceedance (Natural Stream Flow)

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