INTERIM COMPREHENSIVE BASIN OPERATING PLAN

for the

Yakima Project
Washington

U.S. DEPARTMENT of the INTERIOR
U.S. BUREAU OF RECLAMATION

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ABBREVIATIONS AND ACRONYMS

BIA	- Bureau of Indian Affairs
BP	- Before Present
BPA	- Bonneville Power Association
CFR	- Code of Federal Regulations
cfs	- Cubic Feet per Second
Corps	- U.S. Army Corps of Engineers
CWA	- Clean Water Act
DECREE	- 1945 Consent Decree
EIS	- Environmental Impact Statement
EPA	- Environmental Protection Agency
EQIP	- Environmental Quality Incentives Program
ESA	- Endangered Species Act
FCRPS	- Federal Columbia River Power System
FERC	- Federal Energy Regulatory Commission
FWCA	- Fish & Wildlife Coordination Act
FWS	- U.S. Fish & Wildlife Service
IOP	- Interim Comprehensive Basin Operating Plan
KID	- Kennewick Irrigation District
KRD	- Kittitas Reclamation District
LWD	- Large Woody Debris
MAF	- Million-acre Feet
NEPA	- National Environmental Policy Act
NMFS	- National Marine Fisheries Service
NPS	- Non-point Source
PEIS	- Programmatic Environmental Impact Statement
NWPPC	- Northwest Power Planning Council
PP&L	- Pacific Power and Light
RECLAMATION	- U.S. Bureau of Reclamation
RCW	- Revised Code of Washington
RID	- Roza Irrigation District
RM	- River Mile
SECRETARY	- Secretary of the Interior
SHPO	- State Historic Preservation Office
SOAC	- System Operations Advisory Committee
SVID	- Sunnyside Valley Irrigation District
TAG	- Enhancement Technical Activities Group
TITLE XII	- Title XII of the Act of October 31, 1994, Public Law 103-434, Section 1210
TMDL	- Total Maximum Daily Load
TWSA	- Total Water Supply Available
USGS	- U.S. Geological Survey
WAC	- Washington Administrative Code
WDFW	- Washington Department of Fish & Wildlife

WDOE	- Washington State Department of Ecology
WIP	- Wapato Irrigation Project
YBJB	- Yakima Basin Joint Board
YN	- Yakama Nation
YRBWEP	- Yakima River Basin Water Enhancement Project
YTID	- Yakima-Tieton Irrigation District

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EXECUTIVE SUMMARY

This Interim Comprehensive Basin Operating Plan (IOP) provides a framework within which the Field Office Manager for the Bureau of Reclamation (Reclamation) will operate the Yakima Project to meet the multiple use objectives of the project and the directives of Title XII of the October 31, 1994, Public Law 103-434, Section 1210 (Title XII). Title XII legislation is known as the Yakima River Basin Water Enhancement Project (YRBWEP). The stated goals of Title XII are to: 1) protect, mitigate, and enhance fish and wildlife through various means; and 2) to improve the reliability of water supply for irrigation. In addition to the IOP, Title XII includes directives to develop water conservation, water acquisition, habitat enhancement, improved fish passage and screening, and other means to enhance water supplies in the basin.

The IOP was developed by a group of representatives of the Yakama Nation, basin irrigation districts, Bonneville Power Administration, National Marine Fisheries Service, the State of Washington Department of Ecology (WDOE), Reclamation, and American Rivers on behalf of the environmental community. The group met monthly over a period of 2 years to develop a "comprehensive" report with sufficient background to allow for a thorough analysis.

The IOP presents a historical context of the project and its current operation, describes its legal and institutional aspects, articulates the impacts of project operations on the natural resources of the basin, analyzes various operational alternatives, and recommends strategies and operational changes that will address the goals of Title XII. The IOP is prepared for planning purposes only and is not intended by its drafters to be evidence nor admissions as to any party's rights including water rights in Ecology v. Acquavella or elsewhere. The savings clause in Section 1212 of Title XII applies fully to this document. The description of the project and some current operations does not address all applicable requirements of law nor does it describe the Yakama Nation's Treaty water right for fish.

As indicated, the IOP is an "interim" plan. It will be amended periodically to address new legal decisions; various study results and other new information; water supply and water needs; and the ongoing activities of the System Operations Advisory Committee (SOAC).

HISTORY & OVERVIEW

The Yakima River basin drains about 6,150 square miles, or 4 million acres. Elevations range from 8184 feet in the Cascades to 340 feet at the mouth of the River. The Yakima River flows for about 215 miles. Its major tributaries include the Naches, Kachess, Cle Elum, and Teanaway Rivers in the upper basin (above Yakima), and Toppenish and Satus Creeks in the lower basin. Timber, cattle, fish and wildlife habitat, and recreation are the major uses of the northern and western areas of the basin, while irrigated agriculture is the main economy of the lower basin. Climate ranges from alpine to arid, with precipitation varying from 140 inches annually in the Cascades to less than 10 inches in the Kennewick area.

The basin has been inhabited by the Yakama people since time immemorial. They lived sustainabley on fish, game, and native plants. The first non-Indian settlement of the basin began in about 1847. By the 1860s, cattle and sheep ranchers had settled in the area, followed by wheat and oat farming, irrigated by private ditches. By 1902, 121,000 acres were irrigated in the basin, but lacking storage facilities, water demand rapidly exceeded unregulated summer flow. In 1905, the Yakima Project was authorized. Between 1910 and 1933, 6 Federal reservoirs were constructed, with a total storage capacity of 1,070,000 acre-feet.

During years of low runoff, disputes began over water use in the basin. In 1945, the District Court of Eastern Washington issued the 1945 Consent Decree (Decree), which established the rules under which Reclamation should operate the project. The Decree determined the quantities of water to which all project users are entitled, and defines a prioritization for water-short years. Users were divided into two classes, non-proratable (those with the most senior rights) and proratable. Non-proratable users would be served first from the total water supply available (TWSA) and proratable users would share equally in the balance of available supply.

Since 1945, the Courts have issued numerous other decisions relative to the Yakima Basin Adjudication. These decisions are described in section 4 of this plan. They have involved issues such as protection of fish resources ("Quackenbush"), the rights of the Yakama Nation, return flows, groundwater involvement, abandonment of claims, and flood water use.

There are nine hydroelectric power plants and nine hydraulic pump plants in the basin. These are operated by Reclamation, irrigation districts, a private individual, and by PacificCorp (Wapatox). Only the Wapatox facilities have a right senior to the project. All others operate on flows subordinate to irrigation and storage.

The Yakima basin enjoys a diverse economic base, with over 50 percent of jobs being in the trade and service sectors. Agriculture represents 8.4 percent of the region's total sales revenue. Yakima County is among the leading agricultural counties in the nation, having ranked 1st in the production of many crops and 5th in total agricultural production.

Hydrology - The total estimated unregulated runoff at the mouth of the Yakima River for the period 1961 through 1990, is 3.97 million acre-feet per year. The runoff pattern was significantly altered by the project storage, moderating flood events, and sustaining higher flows during the irrigation season in some reaches. The groundwater regime has also been modified by project operations. Basin-wide activities including channel modifications and reduced flood frequency and magnitude have changed the timing and quality of flows to the lower basin.

Water Quality - Generally, water quality in the upper basin is high, but degrades downstream. Many reaches of the rivers and streams in the basin are included on the Federal Clean Water Act 303(d) list. The water quality problems are turbidity, pesticides, low dissolved oxygen, elevated temperatures, metals, fecal coliform, low flows, and pH. WDOE is developing Total Maximum Daily Loads (TMDL) for the reaches and water bodies on the 303(d) list.

Natural Resources - The basin contains a wide variety of wildlife and habitats. Table 2-6. outlines the wildlife by habitat type and species of special interest. Habitat areas include coniferous forest, scrub-shrub, shrub-steppe, riparian, wetlands, and agricultural zones. Table 2-7. shows fish species by species type and occurrence by reach throughout the basin.

CURRENT OPERATIONS

Section 5 of this plan describes the current project operational considerations, constraints, and thought processes. Reclamation operates the project to meet the specific purposes of irrigation water supply, flood control, and instream flows for fish. Anadromous fish management is part of operations during “flip-flop.” Recreation and hydroelectric power production are incidental to other project purposes.

The project consists of storage in six reservoirs (over 1 million-acre-feet) and six irrigation delivery “divisions.” The project serves approximately 465,000 acres. Reclamation physically operates the storage division of the project, but considers the entire basin outflow in the calculation of TWSA for all demands. All demands cannot be met in water-short years. Project operations makes use of a monthly forecasting process to provide advance notice of water availability and makes daily adjustments based upon weather conditions, water demand, travel time, unregulated inflows, and return flows to maximize management of the available supply. Junior districts share available short supplies in drought years.

The “operational year” consists of a 15 month period, beginning in August and ending in October of the following year. Tables 5.2. through 5.5. in section 5 demonstrate the complexity of considerations and constraints during each operational season.

Beginning in January, Reclamation develops monthly runoff forecasts for each of the five major reservoirs. The forecasts are used for flood control operations as well as in the calculations of TWSA, and are developed for anticipated precipitation levels of 50, 100, and 150 percent of normal. The forecast is determined using a multiple regression analysis formula which contains coefficients developed from basin data collected annually since 1940. Each user has an assigned “water bucket,” which is their proportion of the available TWSA.

Target instream flows were established through Title XII at the Sunnyside and Prosser Diversion Dams. These flows range between 300 and 600 cubic feet per second (cfs), depending upon the latest estimates of TWSA. Title XII states that, as conservation and other means reduce diversion demands, the target flows will be increased over time, at a rate of 50 cfs per each 27,000 acre-feet of reduced diversions, provided that such increases shall not further diminish the amount of water that otherwise would have been delivered by an entity to its water users in years of water proration Acquired consumptive use water increases target flows in direct proportion, i.e., 1 cfs acquired = 1 cs target flow.

Project operations seek to lessen impacts on fish resources. Water needs for spawning, incubation, rearing, and passage are all considerations in operations. The Yakama Nation's Treaty water rights for fish has the senior priority date in the basin and must be met before other water rights. The "Quackenbush" decision in 1980 directed Reclamation to safeguard salmon redds in the Yakima River below the mouth of the Cle Elum River to the confluence of the Teanaway and Yakima Rivers. The "flip-flop" operation is one example of operational considerations for fish, whereby flows are reduced during the September-October spawning period to encourage salmon to spawn in the reduced channel. This allows the resulting redds to be protected during the incubation stage with lower flows, and maximizes the storage opportunity.

In consultation with SOAC, operations also consider the needs for spawning, rearing, incubation, and rearing flows. Passage flows, ramping rates, flushing/pulse flows, and power subordination are also strong considerations with the mandate of maintaining fish life in the basin.

Fish passage and protection facilities have been constructed and maintained throughout the project. Through YRBWEP funding and funding provided under the Northwest Power Planning Act, old ladders have been upgraded, new ladders installed, and extensive fish screening devices have been installed or upgraded.

Section 5 of this plan includes detailed descriptions of project storage and delivery facilities, and annual maintenance and inspection criteria.

PROJECT EFFECTS

Basin-wide activities, including project operations, continue to impact the basin's natural resources. To the extent possible, the reader should attempt to distinguish between project effects, and those caused by other basin activities. Section 6 of the plan outlines existing impacts on the resources of water quantity and quality, fish, wildlife riparian zones, and floodplain function. Potentially negative impacts on irrigation, flood control, and hydropower production are also described.

Water Quality - Low water levels in some reaches due, in part, to agricultural diversions, and agricultural return flows contribute to water quality degradation in the basin. Water temperatures, turbidity, dissolved oxygen levels, and nutrient loading are all negative water quality impacts. The project has altered the timing, volumes, and magnitude of both the natural hydrograph and naturally occurring sediment and bedload movement. Drain maintenance has also contributed to increased sediment and pollution.

WDOE is conducting TMDL studies, and the Roza and Sunnyside Divisions have recently implemented highly successful pollution reduction programs.

Water Quantity - Operations' effects on water quantity vary by reach and timing throughout the basin. Section 6.1.2 examines the differences between regulated and unregulated (natural) flows at a number of key locations. Summary hydrographs are provided that graphically demonstrate these differences. The Yakima Project is typical of systems that are regulated for irrigation and flood control. Natural winter flows are captured for storage, reducing the magnitude and frequency of ecologically significant winter discharges.

Operational fluctuations, along with other human activities, have contributed to changes in the pattern of spatial and temporal habitat dynamics. These alterations can create new conditions to which the native species may or may not be able to adapt.

Fisheries - Numerous factors, including both in- and out-of-basin factors, have effected the fishery resources of the basin. Steelhead and bull trout are currently listed as threatened under the Endangered Species Act, and other native species such as chinook, coho, and sockeye salmon are either significantly reduced or have been extirpated from the basin. Lack of fish passage at all Yakima Project storage dams has prevented anadromous fish habitat and caused the extinction of sockeye salmon.

New information is continually being collected. A Biological Opinion on the project is anticipated soon, as are completions of the Ecosystem Diagnostic and Treatment (EDT) model, and the Subbasin Summary by the Northwest Power Planning Council. The synthesis study by Dr. Jack Stanford has been completed.

Section 6.2 assesses the effects of operations on the species of concern in eight separate reaches of the system. Within each reach, the factors of storage dams; diversion dams; flow regulation on habitat, survival and productivity; and water quality are examined. Each of these factors has had some degree of negative impact to fish resources.

Wildlife - Irrigated agriculture, including Yakima Project, as well as other types of human activities, have affected wildlife. The conversion of habitat has reduced native habitats by about a half-million acres, interrupted connectivity of habitats and created barriers to wildlife movement. The hydrologic alterations have resulted in a loss of wetlands, reduced channel-forming flows, and sediment delivery to the floodplain, and have altered the flow regime. Canals and dams have blocked migration corridors and fish passage, and blocked recruitment of large woody debris from the upper basin. The loss of large runs of fish have altered food chain and energy flows in the basin, contributing to the decline of the top level carnivores.

Riparian Vegetation - Naturally occurring riparian ecosystems normally extend one active channel width on each side of the free-flowing water body. In the Yakima basin, much of this area has been destroyed by railroads, highways, flood control levees, agricultural development, grazing, or human habitation. Essentially no true riparian areas exist around the project reservoirs due to the fluctuations of the water levels throughout the year. Along the main stem, flood control operations have allowed residential development in the floodplain. Pesticides and high nutrient levels from return flows in the lower river can be harmful to native riparian plants.

Floodplain Function - Properly functioning alluvial floodplains provide abundant and diverse habitats for cold water fish. They require a natural (normative) hydrograph that interacts with accessible floodplains.

In the Yakima basin, the reduction of flood peaks by capture in reservoirs reduces the frequency, duration, magnitude, and spatial extent of floodplain inundation. This decreases the size of the regulatory floodplain and allows development to encroach on the floodplain. Reductions in floodplain extent and overbank flows, while increasing irrigation induced recharge, has altered the quantity, quality, locations, and timing of groundwater discharge to the river.

Irrigation - The project is operated for many purposes, including irrigation, fish and wildlife, and flood control. Each of these other competing demands has compromised, to some extent, the ability of the project to provide a maximum irrigation benefit.

Hydropower and Flood Damage Reduction - There were no noted negative impacts to these functions caused by the project. The pertinent facts about them are described in sections 6.7 and 6.8, respectively.

RESOURCE OBJECTIVES

Section 7 of this plan identifies goals for the reduction of project impacts identified in section 6. In addition, interim measures of success toward the attainment of those goals are described.

OPERATIONAL ALTERNATIVES

The group summarized the "Project Effects" and the "Resource Objectives" developed in sections 6 and 7, respectively, into worksheets. The "Alternatives" shown in the tables in section 8 were then developed through a series of "brainstorming" sessions, designed to identify all available ideas from the individual group members without regard to legal, institutional or financial constraints, or any other issues affecting the practicality of the alternatives. No attempt was made to prioritize, edit, or censor this list.

RECOMMENDATIONS

The final recommendations for this plan were developed from the list of alternatives in section 8. The worksheets in section 9 show the project effect, the list of alternatives that were developed in the group's brainstorming sessions, and the 94 recommendations that the IOP committee chose to recommend for further action or follow-up.

Many of the resulting recommendations are repetitive in an effort to maintain the integrity and thorough nature of the group's efforts and to demonstrate that many of the recommendations address multiple project effects. For example, recommendations numbered 2 and 50 are essentially the same, but appear under the 2 project effect categories which the group felt would be improved by the recommendation.

Unlike the list of alternatives in section 8, the general view of the group was that each of the listed recommendations may have merit within the known legal and institutional constraints. The group did not, however, attempt to determine the financial implications of any particular recommendation or whether sufficient scientific data is currently available to allow the precise recommendation to be implemented without further study, modeling, or data collection.

The scope of the recommendations is recognized to be quite large. Due to financial constraints combined with legal and contractual issues, it is likely that the Yakima Field Office will be able, practically, to implement only some of the IOP recommendations. It is anticipated that the selected recommendations will be implemented over a period of many years, depending on funding. Some recommendations could require environmental impact statements prior to implementation. In addition, those recommendations that serve to directly improve Reclamation's ability to meet the Endangered Species Act responsibilities or Yakama Nation trust responsibilities would likely be given priority for implementation.

The list of recommendations reflects the general agreement of all members of the group who participated in its development, though not necessarily the complete consensus of every group member. As was previously stated, this plan is indeed "interim." It is anticipated that the Yakima Field Office staff or other basin interests will determine when and if the plan (recommendations) needs to be updated to reflect new knowledge gained from any number of sources. Experience in implementation of the recommendations or new scientific findings relative to the needs of the fish in the basin are two examples of developments which would prompt the need to update the IOP.

The recommendations involving large dollar modifications, such as the construction of large structures or fish ladders at major dams, will require congressional authorization and appropriations. Typically those modifications would require a full feasibility level study prior to congressional action. Constituents will need to initiate the needed congressional actions on a collaborative basis prior to any Reclamation implementation. As a Federal agency, Reclamation by law is not allowed to participate in any lobbying activity for such projects.

1.0 INTRODUCTION

1.1 AUTHORITY FOR INTERIM COMPREHENSIVE BASIN OPERATING PLAN

Title XII of the Act of October 31, 1994, Public Law 103-434, Section 1210 (Title XII), directed the Secretary of the Interior (Secretary), in consultation with the State of Washington, Yakama Nation, Yakima River basin irrigation districts, Bonneville Power Administration (BPA), and other entities as determined by the Secretary, to develop an Interim Comprehensive Basin Operating Plan (IOP).

As explained in the House Report accompanying Title XII, the Act of December 17, 1979 (Public Law 96-162), which authorized the Enhancement Project study, provided for the preparation of a comprehensive plan to assist the Field Office Manager in the operation of the Yakima Project. This comprehensive plan was to include a general operating framework for existing facilities as well as those that may be constructed as a result of Yakima River Basin Water Enhancement Project (YRBWEP) activities. Because a comprehensive plan was never written, Title XII directed the Secretary to develop an "Interim Comprehensive Plan."

The statute further directs the Secretary to prepare a draft IOP within 18 months after the completion of the Yakima River Basin Conservation Plan. Thereafter, the draft is to be published and distributed for a 90-day review period. The Secretary is to complete and publish the IOP within 90 days after the close of the public review period. The Secretary will update the IOP as needed to respond to decisions from water adjudications relating to the Yakima River basin.

1.2 PURPOSE FOR INTERIM COMPREHENSIVE BASIN OPERATING PLAN

The purpose of the IOP is to provide a framework within which the Field Office Manager operates the Yakima Project as well as a detailed explanation of current operations. It also attempts to analyze the impacts of current operations on various natural resources in the Yakima basin and to propose changes for future operations in light of those impacts. It also places current operations in a historical context.

1.3 OBJECTIVES FOR THE INTERIM COMPREHENSIVE BASIN OPERATING PLAN

The IOP is intended as a reference document to assist the Field Office Manager in operating the Yakima Project to meet the multiple use objectives of the project and the directives of Title XII and other Federal legislation, and to assist others in understanding the "how and why" of operations. The plan is a living document which will be updated periodically and include plans and recommendations for future operations. It is also anticipated the plan will be used by the Field Office Manager to obtain future funding to carry out the IOP recommendations.

Congress directed the Secretary to include measures implemented under the YRBWEP in the operating plan, including, but not limited to, the operating capability and constraints of the system; information on water supply calculations and water needs; system operations and stream flow objectives; and the activities of the System Operations Advisory Committee (SOAC).

Thus, it is clear that the plan must meet the needs of fish and wildlife, water quality, wetlands, and other habitat and natural resources of the Yakima basin as well as irrigation and other contractual obligations of the U.S. Bureau of Reclamation to deliver water, including the Treaty Rights of the Yakama Nation. The overarching goals of Title XII are: (1) to protect, mitigate, and enhance fish and wildlife through improved water management, instream flows, and water quality and the protection, creation and enhancement of wetlands, and by other appropriate means of habitat improvement; and (2) to improve the reliability of water supply for irrigation. These are also the overarching objectives of the IOP.

Within those overarching goals, the IOP has as its objectives:

- Making current operations of the Yakima Project as understandable as possible to the various stakeholders in the Yakima basin and beyond;

- consolidate the legal authorities, policies and practices that govern current operations of the Yakima Project;

- articulating the impacts of project operations on various resources in the Yakima basin;

- analyzing various alternative operation scenarios; and

- recommending strategies and operational changes that would serve the overarching goals better than current operations.

1.4 PLAN ADMINISTRATION

The plan will be administered and implemented by the Field Office Manager with the advice from the YRBWEP manager. As anticipated by Congress, the plan will be amended from time-to-time to incorporate water conserved under YRBWEP, decisions from the Yakima Basin Water Adjudication, and for other matters, such as new information and changes in the operating capability and constraints of the system; water supply and water needs; stream flow objectives and the ongoing activities of SOAC as well as the Endangered Species Act activities and other requirements of related Federal law. This document is not intended to represent any party’s views, now or in the future, as the interpretation of applicable law or Treaty.

2.0 HISTORICAL & CURRENT OVERVIEW OF THE YAKIMA BASIN

2.1 GEOGRAPHY

The Yakima River basin is located in south central Washington bounded on the west by the Cascade Range, on the north by the Wenatchee Mountains, on the east by the Rattlesnake Hills, and on the south by the Horse Heaven Hills. About half the basin lies in and occupies most of Yakima County. The upper part of the basin lies in and occupies most of Kittitas County, the southeastern portion occupies about half of Benton County, and the southern part of the basin extends slightly into Klickitat County. The entire basin lies within areas either ceded to the United States by the Yakama Nation (YN) or areas reserved for their use. The Yakama Indian Reservation occupies about 40 percent of Yakima County and about 15 percent of the entire basin. In total, the basin drains about 6,150 square miles, or 4 million acres.

The Yakima River flows southeasterly for about 215 miles from its headwaters in the Cascades east of Seattle, Washington to its confluence with the Columbia River near Richland, Washington. Altitudes in the basin range from 8184 feet above mean sea level in the Cascades to 340 feet at the confluence. The Naches River is the largest tributary of the Yakima, entering the river at the city of Yakima. Major tributaries of the upper Yakima River (above the Naches confluence) include the Kachess, Cle Elum, and Teanaway Rivers. Major tributaries of the Naches River are the Bumping River, Rattlesnake Creek, and the Tieton River. Toppenish and Satus Creeks, both originating on the Yakama Indian Reservation, are the major tributaries of the lower Yakima River (below the Naches confluence). Numerous smaller tributaries contribute seasonal flows to the rivers in the basin. A more detailed description of Yakima River basin hydrology will be provided in a subsequent section of this document.

Timber harvest, cattle grazing, fish and wildlife habitat, and recreation are the major uses of about 2,200 square miles mainly in the forested northern and western areas of the basin. About one-forth of this area is designated as wilderness. Cattle grazing, wildlife, and military training are the main uses of about 2,900 square miles of rangeland. Irrigated agriculture, the main economy of the basin, occupies about 1,000 square miles. Agriculture is the single major use in the eastern and southern portions of the basin.

2.2 CLIMATE

The climate of the Yakima River basin ranges from alpine along the crest of the Cascade Range to arid in the lower valleys. The mountainous western and northern parts of the basin receive precipitation principally as snow during the period of November to March and as rain during the remainder of the year. Much of the snowfall in the mountains is retained through the winter; some is retained for longer periods in the perennial snow fields and glaciers at higher altitudes

(Pearson, 1985).[1] Chinook winds (warm air descending the eastern slopes of the Cascade Range) and “rain-on-snow” events occasionally cause rapid melting of the snowpack. At times, these events result in severe erosion of soils and flooding along lowland stream channels.

Precipitation varies considerably across the basin throughout the year. Mean-annual precipitation ranges from about 140 inches in the higher mountains of the northwestern part of the basin to less than 10 inches throughout the lower Yakima Valley. The amount of precipitation that occurs during the October to March period, in both the arid and alpine parts of the basin, ranges from 61 to 81 percent of the annual precipitation. The variation in annual precipitation can be large. The geographic variability in mean-annual precipitation for the Yakima River basin, 1951-1980, is shown in figure 2-1.

Air temperatures in the basin generally are inversely related to altitude. Minimum and maximum mean-monthly temperatures occur in January and in July, respectively. Mean-monthly temperatures ranged from 24 to 63 °F at Lake Kachess (about 2300 feet in altitude) and 31 to 77 at Kennewick (about 350 feet in altitude; McKenzie and Rinella, 1987). At Lake Kachess, the extreme daily minimum temperature was -33 °F on January 31, 1950, and the maximum was 104 °F on July 28, 1939, for the period of record, 1931-1977 (Western Regional Climate Center). At Kennewick, the extreme daily minimum temperature was -19 °F on January 29, 1950, and the maximum was 110 °F on August 17, 1977, for the period of record, 1948-1999 (Western Regional Climate Center).

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[1] For full documentation, see Rinella et al., 1991.

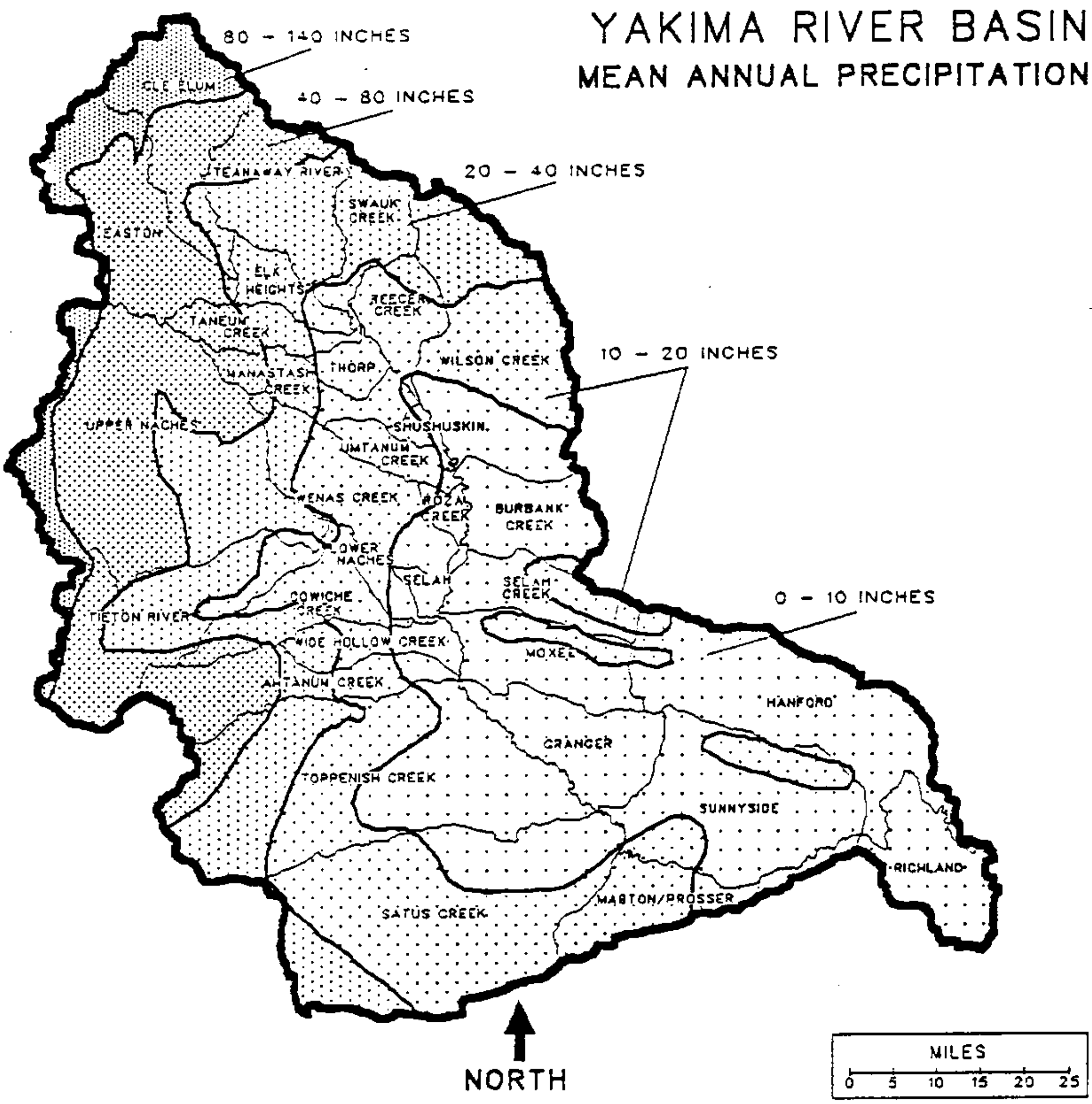

Figure 2-1.–Mean-Annual Precipitation in the Yakima River basin (from Rinella et al., 1991)

2.3 GEOLOGY

The geologic history of the Yakima basin produced features that regulate the hydrologic cycle and aquatic ecosystem. Contemporary river ecology emphasizes the importance of alluvial (river deposited) floodplain reaches. The basin contains many extensive floodplain reaches separated by relatively short canyon reaches which effectively subdivides it into several alluvial subbasins. Within each, surface water downwells and recharges the shallow groundwater zone at the upstream end; most of this water upwells to the surface again near the downstream end of the reach. In other western river basins alluvial floodplain reaches have been shown to be centers of biological productivity and ecological diversity (Stanford, 1996, 1997). Kinnison and Sceva, 1963, show the major gaining and losing stream reaches in the Yakima River basin.

Geologic structures such as folds and faults alter the groundwater flow pattern in the Yakima River basin. Folded ridges and troughs dominate the topography in the lower basin. The uplift of the ridges occurred slowly enough to allow the Yakima River to maintain its course across the structures, as seen at Union Gap where the river flows through Ahtanum Ridge. The bedrock folds determine flow patterns and form hydrologic boundaries.

Glacial outwash, reworked glacial deposits, and recently deposited river alluvium are important aquifers, primarily because of their storage capacities and high permeabilities. The aquifers are recharged during periods of high runoff and precipitation. They discharge to streams during late season dry periods and help maintain stream base flows.

The Yakima River basin consists of three principal aquifer systems: the unconfined alluvial aquifer system; the Ellensburg Formation/postbasalt aquifer system; and the Yakima Basalt aquifer system. Structural bedrock controls (anticlines and synclines) effectively isolate each groundwater basin and prevent most underflow (from one subbasin to another) through the alluvial and Ellensburg Formation/postbasalt aquifers and restrict underflow through the basalts.

2.4 BASIN HISTORY & DEVELOPMENT

Prior to Euro-American development, the economy of the basin was rooted in the abundant fish, wildlife, and vegetation resources. The complex water issues facing the Yakima River basin today are rooted in the history of basin development, which began in earnest in the late 1800s. The economic potential of the Yakima basin's rich and fertile land rapidly drew settlers to this promising valley. The Yakima River and its tributaries were, as they are today, the lifeblood of the region, fueling a rapidly expanding farming economy. Before long, the Yakima basin area had become one of the most agriculturally productive regions of the State. Coupled with this burgeoning agricultural economy, however, came the pressing issues surrounding water; who owned how much, and how was this resource to be effectively and fairly managed?

Within 20 years of full-scale irrigation development, farmers realized that they could not rely on natural runoff alone to meet year-round water demands. Certainly, no additional acreage could be developed unless water storage and supply management issues were resolved.

Throughout the history of the basin, fundamental questions of water rights, water supply management and storage have been addressed through State and Federal legislation and court decisions. Some court cases, such as the basin adjudication, have not yet been resolved.

Water quality issues were addressed to a limited degree in the early part of the 1900s, but did not gain prominence in the water discussion arena until the last 30 years. Since 1970, a number of State and Federal Acts have been passed to ensure water quality, enhance fish runs and preserve riparian vegetation.

A brief overview of the basin history is essential to understanding where we stand today, and the very urgent need to develop solutions which encompass all basin water users.

2.4.1 Human Development

The following outline of prehistoric land use patterns is largely synopsized from reports of YN archaeological surveys near Cle Elum Lake and in the Yakima River Canyon (Lothson and Hemphill, 1994). Historic period use and events are synopsized from Babcock et al., 1986.

Archaeological evidence indicates that human occupation of areas east of the Cascade Mountains extends back 9,000 to 12,000 years before present (BP). This evidence is clearly documented by Clovis materials found near East Wenatchee. An isolated Clovis-like point has also been collected at Cle Elum Lake, and Cascade or Vantage Phase artifacts (ca. 8,000 to 4,500 BP) have been found at Keechelus, Kachess, and Cle Elum Lakes. However, use of montane or upland areas appears to have been infrequent during early periods, and most sites found away from the lowland river corridors appear to date no earlier than 4,000 to 2,800 BP. Information available is insufficient to determine if this apparent settlement pattern reflects reality or is because most archaeological investigations have occurred along the main stem Columbia.

Despite data limits, archaeological and ethnographic information and Tribal history are sufficient to outline prehistoric land use patterns. At the earliest periods of human occupation, the focus was on large game hunting by highly mobile groups, primarily using areas near rivers and their tributary creeks. A shift appears to have taken place during the Cascade Phase to hunting smaller “big” game (deer, mountain sheep, etc.), with an increasing reliance upon roots and fish; this shift most probably occurred in response to general environmental changes affecting resource availability. By about 3,500 BP, regional populations had adopted what has been characterized as the “Plateau Pattern,” (Lothson and Hemphill, 1994).

The first non-Indian settlement in the Yakima River basin occurred from 1847 to 1852, with establishment of Catholic missions at seven locations in the Yakima, Kittitas, and Moxee Valleys.

In 1846, Great Britain had ceded land claims south of the 49th parallel and, soon afterward, the U.S. Army began explorations for transcontinental railroad routes through the Yakima River basin. In 1854, treaty negotiations began with area tribes in order to open lands for American settlement, and the Treaty of Walla Walla was signed in 1855 (Treaty of 1855). In the Treaty of June 9, 1855, the Tribes and bands later to become the YN ceded 10.3 million acres to the United States and reserved a 1.4 million-acre homeland. In the Treaty of 1855, the Tribes of the YN retained the rights to hunt, fish, and gather native foods and medicines off the Reservation. War with the Yakama and Kittitas Indians broke out within months of signature of the Treaty, when miners began illegally crossing the Yakama Indian Reservation on their way to gold fields in north-central Washington. The U.S. Army moved into the area to subdue the Tribes, but fighting continued sporadically until 1858.

Following the 1855 Treaty, settlement of the Yakima River basin occurred rapidly. By 1860, cattle ranchers had settled along the Columbia and in the Yakima area, and sheep grazing soon followed. In the 1860s, wheat and oat farming began along the rivers, irrigated by small private irrigation ditches. The Northern Pacific Railroad completed construction through the Yakima River basin in 1885, linking the area to wider markets. This link resulted in a population boom and also converted farming from largely subsistence to commercial enterprises. The Northern Pacific also fostered expansion of irrigated agriculture; they had received large "checkerboard" land tracts from the Federal Government and launched an aggressive program to sell these lands to settlers. The Northern Pacific was initially a substantial backer of Walter N. Granger's Sunnyside Irrigation Project and was involved in developing coal mining and timber industries in the Cle Elum vicinity.

2.4.2 Irrigation Development

By the turn of the century, numerous private irrigation systems served the Yakima River basin lands. However, over allocation of water and lack of reservoir storage resulted in insufficient water to meet demands during irrigation season.

By 1902, about 121,000 acres were irrigated in the Yakima River basin. This acreage was served by unregulated flows in the river and tributaries. Irrigation diversions exceeded the unregulated runoff during periods of low flow by the turn of the century. Before additional irrigation developments could take place, reservoirs were needed to store early season natural runoff, which peaks in May and June. This water could subsequently be released and used during the dry summer months when natural runoff drops to its lowest point and irrigation demands are high.

A petition dated January 28, 1903, from citizens of Yakima County to the Secretary of the Interior (Secretary), requested United States involvement in irrigation development. Investigations were initiated which led to the beginning of the construction of features of the Yakima Project by the U.S. Bureau of Reclamation (Reclamation). The Yakima Project was authorized in 1905, and the Sunnyside and Tieton Units were approved for construction in 1905. Early in 1906, investigation of storage sites was initiated, including Bumping Lake, McAllister Meadows (Tieton Reservoir), and Cle Elum, Kachess, and Keechelus Lakes.

Development of the Yakima Project progressed with the construction of Bumping Dam (1910), Kachess Dam (1912), Clear Creek Dam (1914), Keechelus Dam (1917), Tieton Dam (Rimrock Lake, 1925), and Cle Elum Dam (1933). These 6 Federal reservoirs have a total storage capacity of 1,070,000 acre-feet and provide the water supply necessary to help meet the irrigation and instream flow needs by storing and regulating a portion of the flow of the Yakima River and its tributaries. Other principal features of the Yakima Project include several diversion dams, two hydroelectric generating plants, and numerous canals, laterals, and pumping plants.

During years of low runoff, disputes began over the use of water from the Yakima River. In 1945, the District Court of Eastern Washington issued a decree under Civil Action No. 21 called the 1945 Consent Decree (Decree). The Decree is a legal document pertaining to water distribution and water rights in the basin. The Decree established the rules under which Reclamation should operate the Yakima Project system to meet the water needs of the irrigation districts that predated the Yakima Project, as well as the rights of divisions formed in association with the Yakima Project. The Decree determined water delivery entitlements for all major irrigation systems in the Yakima basin except for lower reaches of the Yakima River near the confluence with the Columbia River. The Decree states the quantities of water to which all project water users are entitled (maximum monthly and annual diversion limits) and defines a method of prioritization to be placed into effect during water-deficient years. The water entitlements are divided into two classes: non-proratable and proratable. Non-proratable entitlements are held by those water users with the earliest filed water rights, and these entitlements are to be served first from the total water supply available (TWSA). All other project water rights are proratable. They are of equal priority to each other, but second in line to the non-proratables. Any shortages that may occur are shared equally by the proratable water users. Section 5 contains a detailed description of current operations.

Development of the Wapato Irrigation Project (WIP), which is operated by Bureau of Indian Affairs (BIA), began just prior to the 1898 Spanish American War. The Yakama Indian Reservation encompasses an area of about 1,400,000 acres, about 800,000 acres of which are located within the Yakima River basin. About 142,000 acres of land on the Yakama Indian Reservation are irrigated through facilities of the WIP. The primary water supply is diverted from the Yakima River at the Wapato Diversion Dam. Water savings resulting from WIP irrigation system improvements developed through Section 4 of Title XII of YRBWEP would be available for use by the YN for irrigation and for other purposes on the Reservation, as well as for fish and wildlife in the Yakima River basin, at the discretion of the YN.

Today, the Yakima Project serves approximately 465,000 acres over an area extending from the Cle Elum vicinity to the Tri-Cities.

2.4.3 Hydropower

There are presently nine hydroelectric power plants and nine hydraulic pump plants within the Yakima basin. Of the nine power plants, the Chandler and Roza Plants are operated by Reclamation; the Drop 2 and Drop 3 plants are operated by the WIP; the Yakima-Tieton Irrigation District (YTID) operates two projects; the Pacific Power and Light Company (PP&L) (dba PacifiCorp, parent company is Scottish Power) operates the Naches, and Naches Drop Plants (Wapatox); and one small 32.5 kW plant (Leishman Irrigation System) operated by a private individual, J. Leishman. All of the power plants are served by water supplied through canal systems. These are described further under section 2.4.3.1, below. The nine federally-constructed, direct-connected hydraulic turbine-pump units are operated by Reclamation and/or the appropriate irrigation entity. These are described in section 2.4.3.2 below. Generally, there are no charges for power water usage of United State's claimed waters (RCW 90.16.050).

There are no hydroelectric power plants at any of the storage dams on the Yakima Project. A small hydroelectric station-service unit at Tieton Dam went out of service on December 23, 1969.

None of the above hydro plants have storage water rights, and all (except the PacifiCorp system) operate on flows subordinate to irrigation and storage rights. The PacifiCorp system has senior water rights that can require bypassing of inflow from Tieton or Bumping Lake Reservoirs to supply natural flow rights of the Company. All hydraulic pump plants are integral with downstream irrigation operations.

2.4.3.1 Hydroelectric Plants

Chandler Power Plant -

Constructed and operated by Reclamation, the plant is located on the left bank of the Yakima River, about 11 miles downstream from Prosser. Water diverted into the Chandler Canal (maximum 1,500 cubic feet per second [cfs] capacity for power and irrigation) at Prosser Diversion Dam (river mile 47.1 [RM]) is delivered to the pumping and power plant at canal mile 10.0, pumping a maximum of 334 cfs to Kennewick Irrigation District (KID) with the residual pumping and power water discharging to the Yakima River (RM 35.8) at the Chandler Power Plant. Two 6.0 MW generators (total rated capacity 12.0 MW at 1,325 cfs maximum flow) feed into the Bonneville Power Administration (BPA) transmission system. The first commercial power generation was in February 1956. The plant operates year around except for annual maintenance shutdown and ice conditions. The Chandler plant utilizes the entire canal capacity of 1,500 cfs when available, subject to the canal's variable hydraulic carrying capacity, irrigation and hydro pump requirements, and power subordination agreements for fish resource protection. The summer output of electric energy can be as low as zero, but usually ranges between 3.0 and 6.0 MW. The total power output from Chandler, less station power, is marketed and sold by BPA as part of the Federal Columbia River Power System (FCRPS). See section 6.7.1 for a discussion of the FCRPS.

The Interior Department Appropriation Act for 1931 (Act of May 14, 1930, ch. 273, 46 Stat. 279) provides that all net revenues received from the disposition of power not required for pumping water for irrigation of lands in the KID shall be applied to repayment costs incurred by the United States in connection with the Kennewick Highlands unit, including the power plant and appurtenances, until said construction costs are fully paid. In addition, Public Law 629 authorized the construction, operation, and maintenance of the Kennewick Division of the Yakima Project, Washington (Act of June 12, 1948, ch. 453, 62 Stat. 382, Sec. 1) for the purposes of irrigating lands, and of generating, transmitting, and marketing hydroelectric energy. Under Sec. 3. (Sale of Power - Rates), the Secretary is authorized to enter into contracts for the sale of electric power and energy not required for project uses.

The water right for power generation is based on State of Washington Surface Water Permit No. 1720, Application No. 3204 issued June 15, 1931, amended August 3, 1931. The permit was extended to proof stage,[2] December 31, 1981, by the Department of Ecology (WDOE). This permit is for 1,600 cfs diversion at Prosser Dam, with 600 cfs for irrigation, 1,000 cfs for power water for hydraulic turbine powered pumping units for delivery of KID water, and up to 1,600 cfs for power for pumping and commercial use. Currently, all water rights are subject to the final decree of the Yakima River Basin Adjudication. WDOE will not issue the final certificate of water rights for this permit until after the adjudication is completed.

The power water for electric generation at Chandler is subordinate to furnishing fishery flows, as defined by the Project Superintendent, over Prosser Dam and below in the Yakima River. The original operating agreement pertaining to minimum river flows in the Prosser Reach dates back to January 6, 1958, between the Reclamation and U.S. Bureau of Sport Fisheries and Wildlife. The agreement provides for minimum flows of 200 cfs from March 1st to July 10th; 50 cfs from July 10th to September 1st; 200 cfs from September 1st to November 30th; and 50 cfs from November 30th to March 1st. These flows are subject to maintaining prior existing water rights and water contracts, but have a priority over use of water for generation of electric power at Chandler Power Plant. Since the mid-1990s, other requests for power subordination have come to the forefront for increasing the Prosser Reach flows; including spawning, incubation, rearing, and upstream and downstream migration/passage flows. The most recent agreed upon power subordination was to target minimums of 450-1,400 cfs from November 1st to March 31st for the period of 1995 through 2000, and 450-1,000 cfs from April 1st to June 30th for the period of 1994 through 2000. The current minimum subordination target is for 450 cfs through the non-irrigation season, but for the past two years (1999 & 2000), all subordination target flows are annually inspected, reviewed, negotiated, and established between the System Operations Advisory Committee (SOAC), the Project Superintendent (Yakima Field Office Manager), and others.

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[2] The final stage in the State water right permitting process, prior to issuance of the final certificate of water right, is submitted as proof of appropriation by the permit holder. Upon the completion of a final “proof examination” the Department of Ecology then issues a certificate of water right for the amount of water actually put to beneficial use. RCW 90.03.320, RCW 90.03.330.

Reclamation has the authority to subordinate Chandler Power Plant as identified in Public Law 103-434, Title XII of the YRBWEP.

Roza Power Plant -

Constructed and operated by Reclamation, the plant is located in the Terrace Heights area, 2 miles northeast of Yakima. Water diverted into the Roza main canal (maximum 2,100 cfs capacity for power and irrigation) at Roza Diversion Dam (RM 127.9) is delivered to the power plant at canal mile 10.9 discharging into Roza Wasteway No. 2, and returning to the Yakima River (RM 113.2). One 12.0 MW generator provides power to 18 Roza Irrigation District (RID) electric pumps. Surplus power feeds into the BPA system. The first commercial power was generated here in August 1958. The plant can utilize up to 1,123 cfs of power water, and operates year-round except for annual maintenance shutdown and ice conditions.

The Roza Power Plant was built as an integral part of the Roza Division. Title to the plant rests with the U.S. Government, but Reclamation is under contractual obligation with the Roza District to supply all pumping power needs. Power generated in excess of that needed for project purposes is marketed and sold by BPA as part of the FCRPS. Any pumping power needed, in excess of plant production, is purchased from BPA. Lost generation to allow for the flip-flop[3] operation is covered by BPA through a power shaping agreement[4] with Reclamation.

The Roza Division was authorized on November 6, 1935, under the provisions of the Fact Finder's Act of December 5, 1924 (43 Stat. 672). The State water right for power generation is included in the Certificate of Surface Water Right issued by the State of Washington on May 22, 1961, based on Permit No. 1727. Diversion is limited to 2,200 cfs for irrigation, domestic supply, and power generation, with maximum power diversion of 1,123 cfs with preference to be given for irrigation.

Currently, power water for electric generation at Roza Power Plant is subordinated to improve fishery flows in the Yakima River below the Roza Diversion Dam. The original operations agreement with Reclamation pertaining to minimum river flows in the reach below Roza Dam dates back to a January 14, 1964 letter, between Reclamation and the Washington State Department of Game. Reclamation tentatively agreed to pass a minimum of 250 cfs in the Yakima River below the Roza Dam. An attempt to hold minimum flows in the 200 to 300 cfs range was made in the late 1960s through the early 1980s. In the late 1980s, power subordination became a larger issue. Reclamation does not have clear direction on the authority to subordinate Roza Power Plant, but maintains an informal agreement, in consultation with the SOAC and others to subordinate power generation to maintain a 400 cfs minimum in the river (at least

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[3] See Chapter 5, Consideration 15 & 16

[4] Power Shaping Agreement, BPA Contract No. DE-MS79-88BP92512 and Revision No. 1 of Exhibit H, Power Sales Contract No. DE-MS79-81BP90579.

300 cfs when no power is being generated). Since the late 1990s, other requests for power subordination have come to the forefront for increasing minimum flow below Roza Dam. During water year 2000, power was subordinated to provide a minimum flow of 600 cfs. BPA agreed to cover the cost for year 2000 of lost power generation, for this operational year only, so as not to impact the RID cost of power production in its water supply contract.

Wapato Drop 2 Plant -

This plant was constructed and is operated as part of Wapato Project, BIA. The plant is located north of West Wapato Road, in Section 11, Township 11N, Range 18E W.M., 5 miles west of Wapato. Water is delivered through the Wapato main canal, to the plant located about 6 miles below the headworks. There is one 2,500 kW generator with 33 foot of head. Power water is about 1,000 cfs. Tailwater continues down the lower main irrigation canal. The power generated is used for electric pumping within the project, but is inter-tied to BPA. The normal period of use is from April through September.

The water right for power generation is incidental to the irrigation deliveries through the canal system. There is no State certificate or permit. In the past, the Wapato Project engineer interpreted the Indian Appropriation Act of August 1, 1914, which provides 720 cfs for irrigation, to also permit use of 720 cfs during the non-irrigation season for power production, if water is available from natural river flow.[5] One interpretation holds that the Decree[6] was what justified the water use in the non-irrigation season for power production. (Note - Power generation continued after the end of the 1973 season, due to an electric energy shortage in the Northwest.)

Wapato Drop 3 Plant -

This plant was constructed and is operated as part of the Wapato Project, BIA. The plant is located north of Progressive Road in SW¼ of Section 22, Township 11N, Range 12E W.M., 7 miles southwest of Wapato. Water is delivered through the Wapato main canal, to the plant about 8 miles below the headworks. There are two 600 kW units (total 1,200 kW) with 33 foot of head. The total power water is about 600 cfs, and the tailwater continues down the irrigation canal system. The power is used for electric pumping within the project, but is also interconnected to BPA. The normal period of use is April through September.

The water right for power generation is incidental to irrigation. Comments for Wapato Drop 3 Plant regarding rights and usage are the same as for Drop 2 Plant, above.

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[5] N. A. Nybakken, Wapato Project

[6] Civil Action No. 21 (1945 Consent Decree) Article 4, 1st Para.

PacifiCorp Drop Plant -

This plant was constructed by Northwest Light and Water Company, and is now operated by PP&L (dba PacifiCorp - parent company, Scottish Power), the successor of Northwest Light and Water Company. This plant is located on the Wapatox Power Canal (Diversion point, Naches River @ RM 17.1 with 500+ cfs canal capacity) about 6 miles downstream from the Naches River Diversion, and 1 mile east of the town of Naches. Plant capacity of the single unit is approximately 1,100 kW, with tailwater continuing down the Wapatox Canal. The canal is operated year-round, except for maintenance shutdown, with generation becoming a part of PacifiCorp's commercial power service.

The State water right is based on an October 3, 1904 appropriation in Yakima County Water Rights Book B, page 178 for 1,000 cfs, which was modified by a limiting agreement of February 9, 1906, filed by Yakima County March 12, 1906, Volume 41 deeds, page 426. This agreement limits power flow to 300 cfs minimum and 450 cfs maximum, plus an irrigation schedule of approximately 51.6 cfs for April through September and 26.6 cfs for October.

This PacifiCorp water right was reviewed and confirmed by the State Superior Court of Yakima County in the ongoing Yakima Adjudication proceedings. The adjudication court's Conditional Final Order for Subbasin No. 19 (lower Naches), entered December 14, 1995, confirms a power generation water right to PacifiCorp with an October 4, 1904 priority date, for the year-round diversion of a minimum of 300 cfs and a maximum of 450 cfs (or more, under certain limited conditions) of the natural flow of the Naches River, when available. During the irrigation season PacifiCorp shares the use of the Wapatox Power Canal with the members of the Wapatox Ditch Company and several other named individual water users, whose water rights total 50.835 cfs from April 1st to September 30th each year, and 25.835 cfs for the month of October each year for irrigation of 2,548.67 acres. This PacifiCorp power generation water right's limitation of use states that the total authorized diversion into the Wapatox Power Canal is limited to 300 cfs as a minimum and 450 cfs as a maximum under the PacifiCorp power generation right and the rights confirmed for diversions into the canal by the Wapatox Ditch Company and several other named individual water users. It further states that all water diverted and not used for irrigation by the other users on the canal shall be returned to the Naches River not lower than the tailrace for the Wapatox Power Canal.

This PacifiCorp right precedes the 1905 Reclamation withdrawal, and because of this right's senior priority, it is sometimes necessary to bypass inflow from Tieton or Bumping Lake Reservoirs to satisfy this natural flow power right.

PacifiCorp Naches Plant -

This plant was constructed by Northwest Light and Water Company, and is operated by PP&L. It is located at the lower end of the Wapatox Power Canal, and has about 500 cfs capacity, of which 50.835 cfs are for irrigation diversion. It is located about 3 miles downstream from the

Drop Plant. Plant capacity is approximately 5,200 kW, being 2,200 kW from one unit, and 3,000 kW from the second unit. Tailwater returns to the Naches River at RM 9.7. Canal and power generation continues year-round, except for maintenance shutdown, with generation part of PP&L's commercial power service.

Water right data are the same as for the Drop Plant, above.

Yakima-Tieton Irrigation District Hydroelectric Plants -

The YTID operates the Cowiche and Orchard Avenue Hydroelectric Plants under Federal Energy Regulatory Commission (FERC) License Nos. 7337 and 7338 and State WDOE permit No. 256. The 2 plants have a combined capacity of 3 MW. The Cowiche plant is located on Summitview Road halfway between unincorporated Cowiche and the Town of Tieton. The Orchard Avenue plant is located on the intersection of Orchard Avenue and Mize Road. The hydroelectric plants serve as pressure-reducing stations for the pressurized pipeline distribution system completed in 1986. The in-line plants operate only during the irrigation season April through October. The operation of the plants is contingent upon the water demand within the district during the irrigation season.

2.4.3.2 Hydraulic Pump Plants

These installations are designed for hydraulic turbine powered pumping units (direct-drive from hydraulic turbine to pump without the use of electric motor power). Of the nine hydraulic pump plants described herein, eight are designed to reuse the power tailwater for in-district irrigation purposes (except for a portion of Wippel plant tailwater), and one, the Chandler Pump Plant, releases power tailwater into the Yakima River.

In all cases, except Chandler, the power water needed to activate the irrigation pumps is incidental to other irrigation requirements and no separate water right is involved (except part of Kittitas Reclamation District's [KRD] Wippel Plant); however, the right to use the water for power is expressed or implied along with the diversion right for irrigation.

Chandler Pump Plant -

This plant was constructed and is operated by Reclamation for the KID. It is located on the left bank of the Yakima River, 10 miles below Prosser and is contained in the same building as Chandler Power Plant, with a common forebay served by the Chandler Power Canal (capacity 1,500 cfs). The present installation includes 2 hydraulic turbine powered pumping units, each rated to deliver 167 cfs of water pumped to the KID Canal, and about 210 cfs each additional water required to generate the power required to pump the KID water, for a total demand of 754 cfs. Provision is made for installation of a third similar turbine-pump unit for Kennewick Extension, which would make a total of 500 cfs for irrigation and 625 cfs for power water, or a total diversion requirement of 1,125 cfs.

The water right for Chandler Power Plant water is included in State of Washington Surface Water Permit No. 1720, which was issued under an application filed with the State on June 15, 1931, and amended August 3, 1931. The permit was extended to proof stage,[7] December 31, 1981, by WDOE, which includes a provision for 1,000 cfs for power water for hydraulic pumping. Currently, all water rights are subject to the final decree of the Yakima River Basin Adjudication. WDOE will not issue the final certificate of water right for this permit until after the adjudication is completed.

Wapato Project Drop 1 Pump Plant -

This plant was constructed and is operated by BIA, Wapato Project. It is located on Wapato main canal, at canal mile 3.5 near the East ¼ corner of Section 35, Township 12N, Range 18E W.M., about 4 miles northwest of Wapato. The installation includes 3 hydraulic turbine powered pumping units, each with 90 foot of pump head and pump capacity of 60 cfs, or total of 180 cfs. The power water head is 26 foot and the pump power water ratio is 6:1. About 1,080 cfs total power water is needed to generate the power required to pump the 180 cfs of water. Tailwater is all used for irrigation in the lower main canal.

Wippel Pump Plant Kittitas Division -

This plant was constructed by Reclamation in 1932, and is operated by KRD. It is served by KRD North Branch Canal, and is located in Section 33, Township 17N, Range 20E W.M., about 10 miles southeast of Ellensburg. There are 2 hydraulic turbine pumping units operating under a net power head of 83 foot. Each unit is designed to pump 25 cfs with 130 cfs power water or a total power water requirement of 260 cfs. In 1954, 2 supplemental electric driven pumps of 5 cfs and 10 cfs capacity respectively, were installed.

Surface Water Certificate No. 4498 (Permit No. 1719), issued to the United States by the State of Washington on January 18, 1952, provides for 1,320 cfs diversion into the KRD main canal for purposes of irrigation, domestic supply, and power for use on lands within KRD. This quantity was reduced by 23.33 cfs (6,000 acre-feet annually) by way of a transfer to the City of Ellensburg on August 17, 1972. The power water is incidental to irrigation reuse within KRD, except that portion of excess power water returned to the Yakima River.

For many years the City of Ellensburg operated a hydroelectric generating plant on the Yakima River. Power generating water rights for the operation of the facility were secured by the City in 1902. The use of this generating facility was discontinued in 1957. The City of Ellensburg transferred up to 70 cfs of its power right to the KRD and then converted to M&I use the

[7] The final stage in the State water right permitting process, prior to issuance of the final certificate of water right, is submitted as proof of appropriation by the permit holder. Upon the completion of a final "proof examination" the Department of Ecology then issues a certificate of water rights for the amount of water actually put to beneficial use. RCW 90.03.320, RCW 90.03.330.

6,000 acre-feet of KRD irrigation water for the City's future municipal water supply needs. The City released to the State the balance of its non-consumptive power right pursuant to a December 21, 1971 contract between the City, KRD, and the United States.

Amon Pump Plant -

This plant was constructed by Reclamation in 1955-1956. It was placed in service in 1957, and is now operated by the KID. It is served by the KID main canal out of the Amon siphon and is located in Section 7, Township 8N, Range 29E W.M., 6 miles southwest of Kennewick. There is one hydraulic turbine powered pumping unit connected to a two-stage pump system. The turbine operates under 63 foot of head, pump discharge is 20 cfs, and power water required is 148 cfs. All water is reused for irrigation purposes in the Highlands Feeder Canal.

The power water right is included in Chandler Power Canal diversion under State Permit No. 1720, previously discussed under "Chandler Power Plant."

Sunnyside Division -

The five pumping plants on the Sunnyside Division that utilize hydraulic turbine powered pumping systems for all or part of their irrigation water requirements serve Outlook, Snipes Mountain, Grandview, and the former Prosser Irrigation[8] Districts, the latter being served by the Prosser and Spring Creek Plants. Irrigation water supply for all these pump-supplied districts is contained in Warren Act contracts between the respective districts and the United States. None of the contracts state a fixed quantity of water available for power for pumping, but each basic contract includes a statement to the effect that power water is not a surplus power water privilege, but shall be available for beneficial reuse for irrigation of lands in the Yakima Project, and that it is appurtenant to the land irrigated thereby.

Outlook Pump Plant -

This plant was constructed by Reclamation and first utilized in 1916. It is now operated by the Outlook Irrigation District, Sunnyside Division, and receives its water supply from Sunnyside main canal at canal mile 30.2. The location is in Section 8, Township 10N, Range 22E W.M., about 4 miles northwest of Sunnyside. The hydraulic turbine powered pumping units consist of 2 units with ratings of 240 horse power (hp) and 560 hp, respectively. Power head is 45 foot, pump lift 107 feet, discharging about 48 cfs maximum, with a ratio of approximately 4:1 of power to pumped water. The power water requirement is thus about 200 cfs. In 1969, an auxiliary 250 hp vertical shaft turbine type electric pump unit was installed at the Sunnyside Canal crossing connecting into the main pump discharge line with a rated capacity of 15 cfs at 120 foot total developed head.

[8] Merge with Sunnyside Valley Irrigation District.

Water right claims for power for pumping are included in the irrigation diversion rights for the Sunnyside Valley Irrigation District (SVID) Canal at its headworks. Tailwater from Outlook Pump Plant is reused for irrigation in Snipes Mountain Lateral, which in turn, also serves the hydro pump units for Snipes Mountain Irrigation District.

Snipes Mountain Pump Plant -

This plant was constructed by Reclamation and first utilized in 1915. It is operated by the Snipes Mountain Irrigation District, Sunnyside Division, and receives its water supply from Snipes Mountain Gravity Lateral, which begins at the tailrace of the Outlook Pump Plant as described above. The plant is located on the east line of Section 8, Township 9N, Range 22E W.M., about 2 miles southwest of Sunnyside. The original installation consisted of 2 hydraulic turbine powered pumping units operating under a 64 foot power head and 190 foot pump head, with the following individual characteristics:

a. 10.7 cfs 2-stage pump discharge with 65 cfs power water, and
b. 4.2 cfs single-stage pump discharge with 25 cfs power water.

Subsequently, the smaller pump was abandoned, and a third unit similar to "a." above was installed, providing the present total pump capacity of about 22 cfs, and 130 cfs power water for the entire plant.

A small hydraulic turbine powered pumping unit, Hillcrest Plant, is also operated out of the Snipes Mountain Lateral, in SW¼SW¼ of Section 25, Township 10N, Range 22E W.M., pump capacity is only about 1 cfs. This system was originally powered by the "Harrison Hill Ram," and is interconnected with the lateral system of the main Snipes Mountain Pump distribution system.

Water rights for power for pumping are included in the diversion rights for SVID Canal at its headworks. Tailwater from the Snipes plant is utilized for irrigating lands in the SVID.

Grandview Pump Plant -

This plant was constructed by Reclamation with first water delivered to it in 1917, and is operated by the Grandview Irrigation District, Sunnyside Division, receiving its water supply from SVID main canal at canal mile 50.35. The location is in the SW¼SE¼ of Section 30, Township 9N, Range 24E W.M., 2 miles southeast of Grandview. The plant presently consists of one 4-stage hydraulic turbine powered pumping unit (16 cfs) and 2 electric driven pumps of 150 hp (13 cfs) and 75 hp (6 cfs) capacity, respectively. Power head is 21 foot and the pump lift is 78 feet. Total output is about 35 cfs with an additional 5 cfs pumped into the lateral system from a drain. The original installation received its electric power supply from the Rocky Ford Power Plant, constructed as a part of the Grandview system to supply 187 kW of power to the Grandview plant via a 3-mile transmission line. The Rocky Ford plant was abandoned in 1953, and electrical energy is now supplied from commercial sources.

Water rights claims for power for pumping are included in the irrigation diversion rights for the SVID Canal at its headworks. Tailwater from the Grandview plant is utilized for irrigation of lands in the SVID in the vicinity of Mabton, south of the Yakima River, served by the Mabton Feeder Canal.

Prosser Pump Plant -

The plant was constructed by Reclamation with first water delivered to it in 1919, and is operated by SVID (former Prosser Irrigation District). This is the upstream-most of 2 hydroplants serving the former Prosser Irrigation District, Sunnyside Division, receiving its water supply from SVID Canal at canal mile 55.05. The location is in the SE¼NE¼ of Section 26, Township 9N, Range 24E W.M., 2 miles north of Prosser. The plant was rehabilitated in 1964, and now consists of a higher speed pump (in service in 1965) driven by original hydro-turbine of 174 hp, utilizing 45 cfs maximum of power water, with a power head of 52 foot, pump lift 106 feet, and discharging about 13 cfs.

Water right claims for power for pumping are included in irrigation diversion rights for SVID Canal at its headworks. Tailwater from the Prosser plant is utilized for irrigation of lands south of the Yakima River in the vicinity of Prosser, as part of SVID.

Spring Creek Plant -

The plant was constructed by Reclamation with the first water delivered to it in 1919, and is operated by the Prosser Irrigation District. This is the lower, or downstream, of the 2 hydroplants serving the Prosser Irrigation District, Sunnyside Division, receiving its water supply from SVID Canal at canal mile 59.32. The location is in the SW¼NE¼ of Section 20, Township 9N, Range 25E W.M., 4 miles northeast of Prosser. The plant was rehabilitated in 1963, and now consists of a higher speed pump (in service in 1964) driven by original hydro-turbine of 174 hp, utilizing 25 cfs maximum of power water, with a power head of 77 foot, and a pump lift of 95 feet, and discharging about 13 cfs.

Water right claims for power for pumping are included in the irrigation diversion rights for the SVID Canal at its headworks. Tailwater from the Spring Creek Plant is utilized for irrigation of adjacent lands within the SVID.

2.4.3.3 Federal Energy Regulatory Commission - Licenses
(Approved Use or Approved Future Use)

FERC issues licenses to successful applicants to construct and operate hydroelectric projects for a term of up to 50 years; projects must be relicensed when the license expires. Applicants are required to consult with local, State, and Federal agencies during preparation of a license application, and include evidence of these consultations in the application. FERC normally requires compliance with State and local requirements prior to issuance of a license. FERC will also issue a short term development permit to allow study of a potential hydroelectric power site.

Note: A FERC license does not provide a water right. Water rights for power water use must be obtained from WDOE. A list of current FERC licenses or permits in Yakima River basin is as follows:

Current FERC Status -- Active Power Projects in the Yakima River Basin

Project Name	FERC No.	Developer Name	Status
Exemptions			
Leishman Irrigation Sys. - Hydroelectric Plant	07684-00	J. & I. Leishman	On-Line
Licensed Projects			
Tieton Dam	03701-28	Yakima-Tieton Irrigation District	License Granted
Cowiche Hydroelectric Plant	07337-02	Yakima-Tieton Irrigation District	On-Line
Orchard Ave. Hydroelectric Plant	07338-02	Yakima-Tieton Irrigation District	On-Line
Non-Federal & Outside FERC's Jurisdiction			
Naches - Wapatox Power Plant	02672AOO	PacifiCorp (Scottish Power)	On-Line
Naches - Wapatox - Drop Power Plant	02672BOO	PacifiCorp (Scottish Power)	On-Line
Federally Owned			
Wapato I.P. Drop No. 3 Power Plant	00000S46	U.S. Bureau of Indian Affairs	On-Line
Wapato I.P. Drop No. 2 Power Plant	00000S45	U.S. Bureau of Indian Affairs	On-Line
Chandler Power Plant (Prosser)	00000S43	U.S. Bureau of Reclamation	On-Line
Roza Power Plant	00000S47	U.S. Bureau of Reclamation	On-Line

Note: There are currently 30 Non-Active FERC projects with proposed power in the Yakima River basin. Current FERC status of the 30 Non-Active FERC projects is as follows: 2 Rejected, 3 Cancelled, 3 Dismissed, 2 Withdrawn, 6 Expired, and 14 Surrendered.

2.4.4 Other Development

Logging, urban buildup, expanding transportation and recreational uses have influenced the history and development of the basin.

2.4.4.1 Forestry

Approximately 2,014,000 acres of the Yakima River basin are forested areas. Most of the forested areas are located in the higher elevations of Yakima, Kittitas, and Klickitat[9] Counties. The forested areas receive and provide the majority of water to the basin. Water from precipitation, primarily snowmelt, is routed through stream networks to the larger rivers and reservoirs or infiltrates into the ground to recharge groundwater aquifers.

Early settlement in the Yakima River basin was concentrated in alluvial bottom lands along lower-elevation tributary rivers and streams, where arable soils and water were plentiful and transportation was most feasible. Logging in the riparian areas accompanied the earliest settlement for the purposes of land clearance and construction materials.

The first sawmills in the basin were built in the 1870s. Initially the mills were small and were located in the Upper Wenas and Ahtanum Valleys, and in various canyons leading into the Kittitas Valley. The first water powered mill was built on the Yakima River near Ellensburg in 1876. Log drives were common in the mid-1880s when logs and lumber were needed to build the railroad. It took about 6 weeks to float logs downstream from Easton to Yakima. Horses were used for logging and, by the 1890s, horses and oxen were being used to pull logs to the mills on wagons and sleds. The last log drive on the Yakima River was in 1915.

Major logging operations were carried out in the early 1900s. The Cascade Lumber Company carried out extensive operations for about 15 years in the Teanaway region beginning in the World War I years. The company then logged in the Swauk watershed during the 1930s, and during World War II. Taneum Canyon was also logged in the 1930s. Railroads were built along these streams and their tributaries. Up to 40 miles of Cascade Lumber Company track was in use in the logging regions, connecting to the Northern Pacific near the Yakima River. By the mid-1900s, clear cutting was more common. The Cabin Creek watershed was logged using clear cuts between 1950 and 1980. Substantial timber harvest in the Naches Pass area did not begin until the mid-1970s, with partial cutting at lower elevations and clear cutting in the 1980s and early 1990s at higher elevations.

2.4.4.2 Urbanization

Yakima began as a trading post and was incorporated as Yakima City on December 1, 1883, at the original site in Union Gap. In 1884, Northern Pacific Railway Company established a station 4 miles west and moved over 100 buildings from Yakima to the new site, free. The new settlement was called “North Yakima.” The reason behind this was because the Northern Pacific could not obtain the concession to operation from the existing “Yakima.” North Yakima was incorporated and officially became the county seat in 1886.

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[9] Approximately 1,000 acres

Sunnyside was recognized as the commercial center of the Yakima Valley in the early 1800s, with its history closely linked to the development of the early irrigation canals. Prosser was a recognized center due to its railroad access and surrounding irrigation developments. The Ellensburg townsite was established in 1875. Cle Elum and Roslyn developed as mining towns in the 1880s, supplying coal to the railroads. The Ellensburg State Normal School (predecessor to Central Washington University) was established in 1890.

There has been the rapid growth of diverse populations and the simultaneous development of urban and suburban areas in the three major counties of the watershed. For example, from 1990 to July 1, 1997, the populations of Kittitas, Benton, and Yakima Counties increased by more than 15 percent, or about 60,000 people. A detailed analysis of floodplain development in the area from Lake Easton to the Cle Elum River confluence found that five major subdivisions with 230 individual housing structures were built in the designated river floodplain between 1961-1970.

In 1998, about one-half of the population lived within incorporated cities. The larger cities (over 5,000 population) include Yakima, West Richland, Richland (part), Kennewick (part), Ellensburg, Sunnyside, Toppenish, Grandview, and Selah. The Yakima River basin includes 24 incorporated municipalities, of which 5 are in Kittitas County, 14 are in Yakima County, and 5 are in Benton County.

2.4.4.3 Transportation

Railroads played a major role in the early development years of the Yakima basin. An important point in agricultural history occurred when the Northern Pacific Railroad's transcontinental line reached Yakima in 1886, and opened populous market areas to the farmers. In 1883, the Northern Pacific Railroad started construction of its mainline up the Yakima Valley, following the south bank of the Yakima River from Kiona through Prosser and on to the west.

Most of the roads were developed from widening trails that followed along the rivers and streams. Snoqualmie Pass has long been a favorite route across the Cascade Range; this route was used for hundreds of years by the Yakama and Snoqualmie Indian Tribes who traded frequently using the trail across this well known gap in the mountains. The original Snoqualmie wagon road used by the 19th century settlers was hacked out along the old Indian trail in about 1868. Freeway construction that created Interstate 90 was carried out in the 1970s and 1980s. Gravel was excavated for the new roadway at various locations along the route creating ponds and lakes visible from the roadway. Similar construction created ponds along State Highway 10 in the 1930s, and along I-82 in more recent times.

Railway and road locations altered the riparian ecosystem throughout the basin. They reduced backwater areas, sloughs, oxbows, and meandering features of the river systems by channelizing the streams.

2.4.4.4 Recreation

The recreation setting of the Yakima River basin varies from designated wilderness areas to urban greenways. Features are mainly situated in roaded natural settings. Recreationists are attracted to the basin by quality of the scenery, water, and recreation opportunities. Primary recreation activities include fishing the reservoirs and rivers for cold water sport species; whitewater boating and kayaking; motorized boating; and other related activities such as camping, hiking, picnicking, and wildlife viewing.

Interagency Committee for Outdoor Recreation surveys indicate the number one preferred recreation setting is water oriented. Public demand for access to rivers, streams, and reservoirs continues to increase yearly. Recreation concerns and actions taken by project operations are addressed in section 5 of this plan.

2.5 SOCIAL

The Yakama and Kittitas people were the primary inhabitants of the Yakima basin in the 1700s to the mid-1800s. Before 1870, poor transportation kept immigration to a minimum. Population increased rapidly from 1880 to 1910, because of the new railroads, settlement of irrigated lands developed by Federal irrigation projects, and increased lumbering activity. Between 1910 and 1940, population grew slowly, but steadily. County population trends over the 1940 to 1990 period have generally been up. Between 1940 and 1950, Benton County experienced a tremendous jump, from just over 12,000 to over 51,000 residents, because of the establishment of the Hanford Atomic Works. The City of Richland experienced an 88-fold population increase as a result of the development.

In 1990, about 29.6 percent of the area population was classified as rural. Many small towns in the region are supported primarily by agriculture and agricultural processing plants. Many of the rural residents are employed in the major cities of Yakima, a trade and food-processing center; Richland, with nuclear research; Kennewick, with a mixed industrial base; and Ellensburg, an educational, food-processing, and farm trade center.

The 1990 census data on population by race for the Yakima River basin indicated that whites are the largest group (over 80 percent). Race and ethnicity are overlapping categories. In 1990, 16 percent of the population identified themselves as Hispanic, regardless of race. The percentage of Hispanics in the region has increased from about 10 percent in 1980. (This is partly due to changes in census taking methods.)

Among the persons living on the Yakama Indian Reservation, Tribal members are in the minority. The 1990 census counted 27,522 total persons within the Reservation boundaries, and of that total, about 6,300 were Tribal members. Some of the non-Indian residents live on or have developed business enterprises on allotted lands that were purchased from Indian owners in the earlier part of the century. The YN and its members own the majority of irrigated and irrigable land on the

Reservation and own the single biggest block of irrigated land in the Yakima basin. The YN manages its land through a Tribal Enterprise which grows and markets apples and other fruit and vegetables.

Prior to the 1990 census, the Bureau of the Census did not display information to facilitate comparisons of demographic information specific to the Reservation. Therefore, historical information and population trends are only briefly discussed below. The estimated enrollment of the Yakama Tribe in March 1975 was 6,650 members. About 70 percent (5,150) of the Tribal members resided on the Reservation. The enrollment register for July 1996 listed 8,586 Tribal members, and 5,685 Tribal members resided on the Reservation (Yakama Nation, Economic Development Division, Business and Management Office, personal communication, 1995).

2.6 ECONOMIC

The Yakima basin has developed a diverse economy, providing many opportunities for employment and income, with a strong agricultural base. The employment and personal income in the basin depends more on agriculture than the State or the United States. Agriculture represents 8.4 percent of the total regional sales revenue, compared to about 2 percent for the State and for the United States (Reclamation's Programmatic Environmental Impact Statement [PEIS] pg. 96, 1999). Yakima County is among the leading agricultural counties in the United States. It is, or has ranked first in the Nation in the production of hops, apples, mint, peas for processing, honey, and several tree fruits. It ranked fifth in the Nation in total agricultural production.

Total employment in the region for 1993 was about 191,000 (including full and part time) as shown in table 2-1. (Reclamation's PEIS pg. 95, 1999.) Of this number, 51.1 percent were in the service (32.0%) and trade (19.1%) sectors. The service sector includes businesses that provide services to the public such as dry cleaners, barbers, automobile repair shops, bowling alleys, hospitals, lawyers, and accountants. The trade sector is an aggregation of trade industries including wholesale trade, general merchandising, food stores, apparel stores, and home furnishing stores.

The agricultural sector employed close to 18,000 workers. About 10,000 of the jobs were involved in production of fruits and vegetables, and over 80 percent of fruit and vegetable production stemmed from acres receiving project water. In addition to those directly employed in agriculture, over 5,100 are employed in processing of fruits and vegetables, an indirect contribution of agricultural production to the regional employment. Table 2-1. presents a summary of employment by sector for the region; the State and national levels are shown for comparison.

Table 2-1.–Summary of Employment Levels by Sectors for 1993

Sectors	Yakima basin	Percent	Washington	Percent	United States	Percent
Agriculture	17,874	9.3	99,343	3.3	4,311,664	3.0
Natural resources	6,040	3.2	16,115	0.5	563,071	0.4
Construction	11,141	5.8	217,084	7.2	9,235,307	6.5
Manufacturing	16,629	8.7	360,541	12.0	18,684,040	13.2
Transportation, communications, and utilities	4,954	2.6	121,217	4.0	6,135,673	4.3
Trade	36,535	19.1	650,949	21.6	30,161,940	21.2
Financial, insurance, real estate	7,549	3.9	203,970	6.8	9,640,669	6.8
Services	61,188	32.0	819,033	27.2	41,037,520	28.9
Government	29,404	15.4	518,769	17.3	22,211,622	15.7
Total	191,314	100.0	3,007,021	100.0	141,981,504	100.0

Lands in irrigated croplands have decreased from 371,096 acres in 1982, to 360,675 acres in 1992. The lands irrigated vary from year to year depending on the water supply; 1992 through 1994 were some of the drier years on record. Table 2-2. shows the irrigated acreage of crops grown in the Yakima Project from 1982 to 1992 (Reclamation's YRBWEP PEIS pg. 71, 1999).

Table 2-2.–Irrigated Acreage of Crops Grown in the Yakima Project From 1982 to 1992

Yakima Project - Irrigated Crop Production in Acres											
Crop	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Corn	14,937	13,941	21,095	18,444	13,995	10,958	8,859	14,124	12,244	13,134	13,489
Grain	52,176	48,846	43,839	35,996	32,726	27,095	26,740	27,951	31,370	19,449	27,417
Forage	136,797	139,242	135,851	146,014	134,833	135,010	134,617	136,769	140,931	139,268	139,390
Beans	7,731	1,225	2,436	2,975	2,413	2,308	2,385	3,226	3,046	2,949	3,834
Hops	28,928	27,024	23,150	21,000	20,324	23,539	23,791	23,237	26,924	28,472	29,500
Mint	15,874	14,106	16,854	18,959	15,258	13,880	15,342	16,492	19,144	19,474	18,664
Vegetables	28,267	27,521	28,587	27,655	27,296	33,045	30,041	27,185	29,818	30,108	24,158
Nursery	895	1,356	1,078	633	698	625	780	964	561	596	629
Seed crops	457	390	262	726	91	471	773	797	485	447	358
Fruits	82,071	91,566	94,080	90,570	95,000	102,231	103,281	100,017	101,146	99,580	102,226
Nuts	0	0	0	5	5	5	5	29	38	38	38
All crops	371,096	367,669	369,113	363,870	363,870	350,752	349,931	354,111	365,809	354,470	360,675

Over 45 percent of the irrigated area is used for perennial crops, including orchards, vineyards, hops, mint, and asparagus. Perennial crops require an adequate annual water supply. Plant stress in these crops attributable to water shortages can result in severe economic hardship to the grower because of lower production and reduced crop quality that may render them unmarketable, which occurred in 1994 (worst year on record), and to a lesser degree in the mid-1970s. Water shortages can also damage plants enough to require rootstock replacement, which involves high replanting costs and continuing economic losses for several years. The prevailing trend in the area is to convert from stress-tolerant crops to the higher value crops; therefore, an adequate water supply to ensure against crop stress will become more critical.

Reclamation's 1992 Summary Statistics (table 2-3.) indicates that of the 1,789,068 acre-feet of water diverted throughout the project in 1992, 1,314,713 acre-feet (73%) reached the farms (Reclamation, 1992), as shown in the table below. The other 27 percent were lost to evaporation, leakage losses, or other reasons. Deliveries averaged 73 percent, but divisions varied on the efficiency of water deliveries. Also, divisions had varied levels of on-farm water efficiency, using from 2.42 to 4.62 acre-feet per acre as shown in the table below. The average for the Yakima Project was about 3.5 acre-feet per acre.

Table 2-3.–Agricultural Irrigation by Division

Division	Total acres	Acres irrigated	(acre-feet) Water diverted from river	Water delivered to farms	Delivered water per acre
Kennewick	25,471	7,698	99,971	32,918	4.28
Kittitas	59,104	55,516	246,012	134,514	2.42
Roza	72,511	65,546	245,898	162,693	2.48
Sunnyside	103,562	80,764	423,999	373,215	4.62
Contract	47,531	38,214	156,713	133,138	3.48
Tieton	27,271	25,048	83,280	82,009	3.27
Wapato	136,000	103,337	533,195	396,225	3.83
Total	471,450	376,124	1,789,068	1,314,713	Average 3.48

Reclamation's 1992 Summary Statistics.

2.7 HYDROLOGY

2.7.1 Surface Water

The major river draining the Yakima River basin is the Yakima River, which is a tributary of the Columbia. Main tributaries include the Kachess, Cle Elum, Teanaway, Bumping, Tieton, and Naches Rivers, and Toppenish and Satus Creeks.

The surface water supply for the Yakima Project is obtained from the unregulated flows of the Yakima River and its tributaries, return flows, and stored waters. Average yearly runoff at key locations along the Yakima River and its tributaries for the period 1961 through 1990 are displayed in table 2-4.

Table 2-4.–Average Yearly Runoff at Key Locations

Site	(Acre-feet per year)	
	1961 - 1990[3] estimated unregulated flow	1961 - 1990[4] measured flow
Yakima River at Martin [1]	245,000	245,145
Kachess River near Easton [1]	211,000	211,406
Yakima River near Easton	651,000	342,215
Cle Elum River near Roslyn [1]	665,000	665,946
Yakima River at Cle Elum [2]	1,478,000	1,183,648
Yakima River at Umtanum	2,007,000	1,750,128
Yakima River at Pomona	2,009,000	953,861+/-
Bumping River near Nile [1]	205,000	205,872
Tieton River below Tieton Dam [1]	369,000	368,242
Naches River near Naches [2]	1,234,000	838,606*
Yakima River at Parker [2]	3,410,000	1,563,216
Yakima River at Kiona	3,970,000	2,475,950

[1] Measures reservoir outflow
[2] TWSA control points
[3] Reclamation Surface Water Hydrology Model
[4] Reclamation records
* Wapatox Power Plant diverts 257,350 acre-feet per year up-stream of gage

Water is released from the Yakima Project reservoirs during the irrigation season to meet diversion demands and target flows. In the fall, winter, and spring, releases are made in conjunction with system flood control guidelines. A flip-flop procedure of reservoir releases is used to minimize spring chinook spawning and subsequent incubation flows, and also to minimize the potential impact on irrigation water supplies. See section 5 for further details.

Basin streamflow was historically moderated by natural storage processing (Parker and Story, 1916), particularly groundwater storage and storage in natural lakes, including the large natural lakes that existed at the current sites of major storage reservoirs, Cle Elum, Kachess, Keechelus, and Bumping Lakes. These processes captured peak flows and released water gradually, sustaining river flows through extended periods of little precipitation. Pre-irrigation system maps show that, historically, the channel system in the basin was much more complex with myriad side channels and dense riparian vegetation. Without the current reservoirs capturing and regulating most of the winter and spring runoff, overbank flows were much more frequent. Flood waters infiltrated into the floodplain alluvium and were naturally released later sustaining summer flows (Parker and Story, 1916; Kinnison and Sceva, 1963) and moderating water temperatures.

Published information on the natural hydrograph of the Yakima River is found in Parker and Story (1916) and in historical streamflow records of the U.S. Geological Survey (USGS). Parker and Story estimated that natural flow at Union Gap followed a basic pattern of peak runoff during April through June in the range of 7,000-12,000 cfs. Flows receded throughout the summer with annual lows occurring in September and October. The lowest estimated mean-monthly flow was approximately 800 cfs. Flows were higher at Parker in the late summer and fluctuated less than with the current development and reservoir operations.

Major floods, historically (and presently), occur during the winter (mid-November through February), usually resulting from a rain-on-snow precipitation event coupled with a rapid thaw. Storage has reduced the frequency and limited the distribution of significant "channel forming" flood events. Major floods provide sufficient hydraulic energy to periodically reshape the river channel and associated riparian vegetation. A 25,000 cfs peak instantaneous flow at the Yakima River gaging station at Parker currently has a recurrence interval of 10 years. A 58,000 cfs event in February 1996, had a 110-year recurrence interval. Table 2-5. illustrates the effect of Yakima storage development on natural flood events. The difference between the "estimated unregulated" peak discharge (Qu) and the observed discharge reflects the "flood moderating" influence of the project reservoirs.

Table 2-5.–Yakima River Flood Flows Above 25,000 cfs @ Parker

#	Date of Crest	Water year	Gage Height Stage - feet	Reg. Inst. Peak discharge (CFS)	Event [1] Frequency in years	Inst. Unregulated (CFS)	Event[2] Mean daily unregulated (CFS)
1	Dec. 23, 1933	1934	(17.7)	65,000	150		81,662
2	Feb. 09, 1996	1996	16.21	58,150*	110	92,700	85,298
3	Dec. 30, 1917	1918	16.8	52,900	85		
4	May 29, 1948	1948	15.0	37,700	30		60,683
5	Nov. 30, 1995	1996	14.61	36,500*	25	76,300	80,777
6	Dec. 13, 1921	1922	14.7	35,800	25		
7	Nov. 26, 1990	1991	14.5	35,620*	25	56,400 [3]	
8	Nov. 25, 1909	1910	14.6	35,000	25		
9	Dec. 02, 1977	1978	13.97	34,320	25		64,460
10	Dec. 27, 1980	1981	13.44	31,675	20		65,955
11	Jan. 16, 1974	1974	13.3	27,700	10		42,351
12	Dec. 04, 1975	1976	13.3	27,600	10	61,800	56,713
13	Nov. 24, 1959	1960	13.2	27,400	10		48,440
14	June 19, 1916	1916	12.7	24,800	10		

Note: All gage height stage-feet based upon present site datum data is from Reclamation records

* Based upon Provisional Data (Calculated)

[1] Based upon cumulative frequency curve, April 1986, Brown/Merkle

[2] May not be same day as peak regulated discharge = peak PARW QD + SYS QU day before

[3] Event primarily driven by upper Yakima basin runoff

2.7.2 Groundwater

Introduction -

The groundwater regime in the Yakima River basin has been profoundly modified by operation of the Yakima Project, and irrigated agriculture in general. This section describes the geologic and hydrologic factors that influence the groundwater regime, and how the regime has been altered by large-scale agricultural development and other changes in the watershed. The section also briefly describes relationships between streamflow and groundwater, and the role of surface water-groundwater interactions in river ecology.

Previous Work -

A body of peer-reviewed literature describes the groundwater regime of the Yakima River basin. Kinnison and Sceva (1963) studied well logs and stream gaging data to describe geologic and hydraulic controls on streamflow. They subdivided the basin into 7 relatively independent groundwater basins and 25 groundwater subbasins, and identified stream reaches where appreciable groundwater discharge to streams occurs (gaining reaches) and where appreciable aquifer recharge from streamflow occurs (losing reaches).

The portion of the basin underlain by the Columbia River Basalts (approximately the eastern ⅔ of the basin) was included in the USGS Columbia Plateau Regional Aquifer System Analysis (RASA). The RASA produced many publications on subjects including groundwater levels, recharge modeling, pumpage estimates, geochemistry, geology, and numerical groundwater modeling. See Vaccaro (1999) for a summary and listing of other literature.

Groundwater studies of several portions of the basin have been published including:

> The Lower Yakima River basin - Molenaar (1985);
> Toppenish Creek basin - USGS (1975); Skrivan (1987); and Bolke and Skrivan (1981);
> Satus Creek basin - Mundorff et al., (1977); Prych (1983); and
> Ahtanum Creek basin - Foxworthy (1962).

Other studies have appeared in agency literature and proceedings articles. Pacific Northwest River Basins Commission (1970) describe the hydrogeologic framework of the basin. U.S. Army Corps Of Engineers (Corps) (1978) describe the hydrogeology of the basin by subbasin and display plots of water level contours. Hendry et al., (1992) used environmental isotopes to interpret sources and estimate ages of groundwater in Toppenish Creek basin. Ring and Watson (1999) describe changes in the spatial and temporal distribution of groundwater recharge and discharge in the basin and implications for aquatic habitat.

Hydrogeologic Setting -

The distribution and flow of groundwater and the interactions between surface and groundwater in the Yakima River basin are strongly influenced by the topography and geology of the basin (Ring and Watson, 1999).

Topography and Climate -

The Yakima River drains the eastern slope of the Cascade Range in central Washington and flows through 150 miles of semi-arid lowland valleys and canyons before joining the Columbia River. Orographic uplift and cooling of moist air from the Pacific Ocean cause high precipitation along the Cascade crest (Pacific Northwest River Basins Commission, 1970). Warming and drying of the descending air mass east of the crest causes a strong rain shadow effect (120 in/yr precipitation on the crest, <10 in/yr in most of the lower basin). Runoff and precipitation-induced groundwater recharge are low in the lower basin; 75 percent of precipitation comes from October through March, much of it as snowfall along the crest. Snowpack builds from October through April. A dry season runs from late spring through summer, with less than 5 percent of precipitation occurring in July and August. High elevation snowpack remains until June or later, causing runoff to persist well into summer. Estimates of the unregulated hydrograph in the lower basin show annual peaks in April through June in the range of 7,000 to 12,000 cfs, with annual lows in September or October of about 1,000 cfs (Parker and Storey, 1916). Record peaks, however, are rain-on-snow events occurring between November and February.

Geologic Evolution -

A sequence of geologic processes including accretion, vulcanism and plutonism, uplift and erosion, folding and faulting, glaciation, and gravel deposition created a basin characterized by numerous alluvial valleys separated by relatively short bedrock canyon reaches. In the semi-arid lowlands, these geologic controls, along with the temporal and spatial distribution of surface water delivered from the upper watershed, determine the timing and location of most groundwater recharge and discharge, and provide mechanisms that moderate streamflow and water temperature.

Yakima River basin geology and hydrogeology fall in two main regions: a Cascade Mountains province in the northwestern Yakima basin with a varied suite of older rocks; and the Columbia Plateau province, where a thick sequence of basaltic lava flows and overlying sediments cover the older rocks (Kinnison and Sceva, 1963).

The oldest rocks in the Yakima basin are Cascade province igneous and metamorphic rocks that were added to the North American continent by accretion (plate tectonic processes). These rocks occur at the surface in the Cascade and Wenatchee Mountains in the western and northern portions of the Yakima basin. Younger Cascade province rocks formed by vulcanism and by deposition of sedimentary rocks, chiefly sandstones and shales in non-marine basins.

Numerous lava flows of the Columbia River Basalt Group emanating from fissures located southeast of the Yakima basin covered the older rocks across southeastern Washington, including all of the Yakima basin except the Cascade province rocks in the northern and western part of the basin. Sediments shed from now extinct volcanoes in the vicinity of the Cascades (Ellensburg Formation) were interbedded between the uppermost basalt flows and formed thick deposits on top of the basalts. The basalt plateau was then folded and faulted into northwest-southeast trending anticlinal ridges and synclinal valleys called the Yakima Fold Belt. The Cascade Range was uplifted at about the same time. The antecedent Yakima River incised canyons and water gaps through the rising ridges. Ellensburg Formation sediments and gravels eroded from uplifting mountains and ridges were deposited in the valleys. Later, alpine glaciers draining the Cascade crest eroded broad valleys in the Cascades and delivered large volumes of gravel to the alluvial basins. Glaciation left many lakes, four of which were expanded to serve as storage reservoirs. Backwaters from the ice age Lake Missoula flood left thick silt deposits in the lower valley.

Hydrogeologic Units -

The Columbia River Basalts, interbeds, and overlying sediments form a regionally important aquifer system. The alluvial aquifers are generally quite permeable, but heterogeneous and anisotropic due to deposition in dynamic fluvial environments. Cascade Mountains province rocks generally store and transmit little water. A description of individual units follows:

> Cascade Province Rocks - The bedrock units of the Cascade province have generally low permeability, except moderate where fractured. They store and transmit relatively little groundwater. Alluvial deposits in montane valleys form local flow systems. Kinnison and Sceva (1963), and Pacific Northwest River Basins Commission (1970) describe the individual rock units and their hydraulic properties.
>
> Columbia Plateau Province Rocks - Columbia River Basalts. Total thickness of the Columbia River Basalts reaches several thousand feet and thins to the west. Individual flows range from about 20 to 100 feet in thickness. Sedimentary interbeds of the Ellensburg Formation (see below) are interbedded between some flows, particularly toward the top of the basalts.
>
> Basalt flows develop a characteristic structure as they cool. Lateral hydraulic conductivity is greatest in the rubbly interflow zones (top of one flow, interbed if present, bottom of next overlying flow), where permeability is moderate to high. Vertical hydraulic conductivity is through joints and fractures and is generally much less than lateral hydraulic conductivity. Water table conditions generally exist in the uppermost basalt flows. Wide differences between the horizontal and vertical hydraulic conductivities cause the deeper aquifers in the Columbia River Basalts to be semi-confined. Fine-grained interbeds and flow center units compose the semi-confining beds for the underlying flows. The hydraulic connection between flows is sufficient to allow some continuous vertical movement of water between them (Bauer et al., 1985).

In contrast with the relatively flat and undeformed terrain east of the Columbia River, the western part of the plateau was folded late in Columbia River Basalts time into east-west trending anticlinal ridges and broad synclinal valleys (called the Yakima Fold Belt). Many faults (both thrust and normal) occur on the ridges. This structure strongly influences groundwater flow patterns in the Yakima basin by reorienting and truncating permeable zones and creating substantial topographic relief.

Ellensburg Formation - The Ellensburg Formation consists of volcanically produced sedimentary deposits from extinct volcanoes in vicinity of Bumping Lake. Total thickness reaches up to about 2,000 feet thick in valleys, but is largely absent on the ridges except as interbeds between basalt flows. Composition is sand, clay, and conglomerate. Layers of well sorted sand due to reworking by streams form important aquifers with intervening clay aquitards. Upper and lower sand zones supply all or part of the drinking water supply for most major cities in the basin. Where occurring as interbeds between basalt flows, the Ellensburg Formation forms either aquifers or semi-confining layers depending on local properties.

Tieton Andesite - The Tieton andesite consists of young volcanic rock erupted in Goat Rocks area (upper Tieton drainage). A large lava flow descended the Tieton River canyon and covers the Naches Heights area (upland south of Naches River, west of Yakima). Structure and hydraulic properties are thought to be similar to those of the Columbia River Basalts (Kinnison and Sceva, 1963).

Alluvium - Gravel, sand, and silt deposited by the Yakima River and its tributaries during uplift and glaciation form an extensive alluvial aquifer system in both the Cascade and Columbia Plateau provinces. Gravels form moderate to high permeability aquifers. The alluvial aquifers provide water to domestic and irrigation wells.

Distribution of Recharge Sources -

Groundwater recharge sources include precipitation and the application of irrigation water.

Precipitation and Runoff - The strong rainshadow effect causes an uneven distribution of precipitation induced recharge. Steep, low permeability rocks in the Cascades favor runoff over infiltration. Under pre-development conditions, streamflow provided recharge to alluvial aquifers; infiltration from precipitation provided some recharge to uplands. Most precipitation falling in the unirrigated drier parts of the basin leaves as evapotranspiration.

Application of Irrigation Water - Application of irrigation water caused increases in recharge over pre-development conditions by a factor estimated to range from of about 10 in the Kittitas Valley to about 50 in the hotter, dryer lower valley (Whiteman et al., 1994, see figure 2.2.).

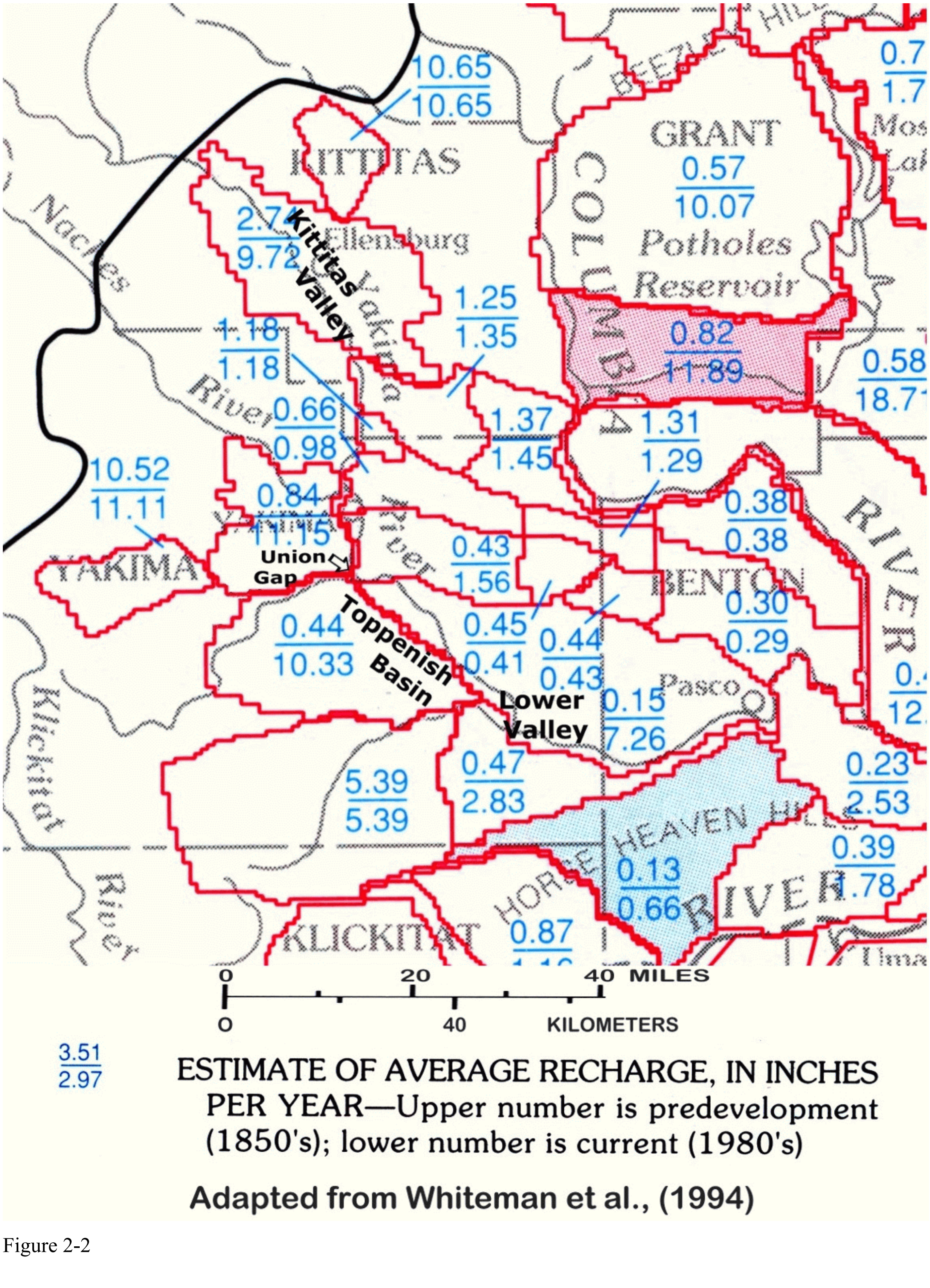
10.65
10.65
KITTITAS
GRANT
0.57
10.07
Potholes
Reservoir
COLUMBIA
Kittitas
Valley
2.74
9.72
Ellensburg
Yakima
Naches
1.25
1.35
1.18
1.18
0.82
11.89
0.58
18.71
River
0.66
0.98
1.37
1.45
1.31
1.29
10.52
11.11
0.84
11.15
0.38
0.38
RIVER
Union
Gap
YAKIMA
River
0.43
1.56
BENTON
0.30
0.29
0.44
10.33
Toppenish
Basin
0.45
0.41
0.44
0.43
Pasco
Klickitat
Lower
Valley
0.15
7.26
5.39
5.39
0.47
2.83
0.23
2.53
HEAVEN HILLS
0.39
1.78
River
HORSE
0.13
0.66
RIVER
KLICKITAT
0.87
0 20 40 MILES
0 40 KILOMETERS
3.51
2.97
ESTIMATE OF AVERAGE RECHARGE, IN INCHES PER YEAR—Upper number is predevelopment (1850's); lower number is current (1980's)
Adapted from Whiteman et al., (1994)

Figure 2-2

Structural Control of Groundwater Flow -

Folding and faulting divided the Yakima River basin into a number of relatively independent groundwater basins and subbasins (Kinnison and Sceva, 1963). Most flow from one basin to another is by surface flow (including canals), little is groundwater underflow. Local flow systems develop within each subbasin, meaning that recharge and discharge occur locally within each subbasin. Within basins, streams are generally losing (contributing surface water to groundwater) at the upstream ends, and gaining (groundwater contributing to streamflow) at the downstream end of the basin. Seepage from streams to the alluvial aquifer system occurs at the upstream ends of the alluvial floodplain reaches within each basin. Recharge from precipitation and irrigation is distributed through the basin. At the downstream end of the basin, sedimentary aquifers pinch out, causing groundwater discharge to river and tributaries. Permeability of basalt aquifers decreases on the anticlinal ridges, so basalt aquifers discharge by upward vertical leakage through overlying strata and to the river.

The sedimentary aquifers in the basins store water during times of high precipitation, streamflow, or irrigation application, and release water to streamflow during drier, low flow times. These aquifers act "as the flywheel on an engine" sustaining streamflow during times of low precipitation and runoff (Kinnison and Sceva, 1963).

Patterns of Groundwater Flow -

Groundwater flow directions and quantities are influenced by topography, geology, distribution of recharge, and the surface water network.

Water table contours in the shallow aquifers closely mimic surface topography indicating that groundwater flow directions generally parallel the surface water drainage network. Water level contours in the deeper aquifers are more muted versions of surface topography, but show local discharge to surface water. Some interbasin underflow is inferred in deeper layers in some places.

Flow paths converge toward streams at the downgradient ends of basins. In the basalt aquifers, upward vertical hydraulic gradients (increasing water pressure with depth) drive flow from deeper to shallower layers and then to streams at the downstream end of the subbasins (Kinnison and Sceva, 1963; Foxworthy, 1962).

Local, intermediate, and regional flow systems occur simultaneously in the Columbia Plateau as a result of the structure and stratigraphy of the region.

Change Over Time -

Substantial rises in water table elevations were recorded during the early history of irrigation in the basin (Kinnison and Sceva, 1963). Agricultural drains were cut to control high water tables and prevent alkaline soils. Some drains used existing surface water channels.

Irrigation brought about a change in the seasonal patterns of groundwater recharge. Under pre-development conditions, most recharge during the winter and spring occurs when precipitation is highest and evapotranspiration is low. Current recharge follows the seasonal patterns of irrigation diversion and application. As a result, water levels in wells show two distinct seasonal patterns, depending on whether the well is influenced by surface water irrigation. Groundwater pumping for agricultural purposes also affects seasonal and long term water level change.

The frequency, duration, and a real extent of floodplain inundation has been reduced by storage, among other causes. Recharge of the alluvial aquifer system with cold freshet flows is reduced. Irrigation has increased aquifer recharge, but has also delayed it, increasing the mean temperature of infiltrating water.

Groundwater and River Ecology -

Contemporary river ecology emphasizes the influence of alluvial floodplain reaches interacting with a normative hydrograph on the production and survival of anadromous fishes and associated aquatic food webs in gravel bed river systems (Independent Scientific Group, 1996; Stanford and Ward, 1988). Under conditions of unregulated streamflow and connectivity between river and floodplain, alluvial aquifer systems in the floodplain reaches capture cold snowmelt-generated runoff from winter through early summer, and subsequent groundwater discharge during baseflow conditions moderates streamflow and temperature, creating favorable conditions for cold water fishes and associated food web components in semi-arid basins. The natural hydrograph creating and interacting with complex surface and subsurface (hyporheic) habitats formed the template that determined the distribution and abundance of aquatic species.

In the Yakima basin, bedrock constrictions between alluvial subbasins control the exchange of water between streams and the aquifer system. Under pre-development conditions, vast alluvial floodplains were connected to complex webs of braids and tributary channels. These large hydrological buffers spread and diminished peak flows, promoting infiltration of cold water into the underlying gravels. Side channels and sloughs provided a large area of edge habitat and a variety of thermal and velocity regimes. For salmon and steelhead, these side channel complexes increased productivity, carrying capacity, and life history diversity by providing suitable habitat for all freshwater life stages in close physical proximity. The hyporheic zone (zone of shallow groundwater made up of downwelling surface water) extended the functional width of the alluvial floodplain and hosted a microbe- and invertebrate-based food web that augmented the food base of the ecosystem. As snowmelt-generated runoff receded through the summer, cool groundwater discharge made up an increasing proportion of streamflow. Much of this groundwater upwelled from the gravel into complex channel networks upstream of bedrock constrictions.

Temperature is a key environmental variable for salmonids and other stenotherms. River/floodplain interactions provided cool, clear base flows during times of low flow and high air temperatures, creating thermal refugia for out-migrating smolts and returning adults moving through the hot lower basin. In winter, upwelling groundwater prevented freezing and drove the flow of oxygenated water through the gravel substrate, providing excellent conditions for incubating eggs and alevin (Ring and Watson, 1999).

2.7.3 Surface Water Quality

The Washington Administrative Code (WAC) separates waters of the State into five classes: AA, A, B, C, and Lake. "Characteristic uses" are given for each of these classifications and criteria to support the uses are specified within the WAC. The characteristic uses for Class AA and Class A waters are domestic, industrial, and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning and harvesting; wildlife habitat; recreation; and commerce and navigation. These characteristic uses are to be maintained and protected and no further degradation is to be allowed. When there is a need to protect or improve water quality in a specific waterbody the most sensitive of the identified uses are targeted. While Class AA and Class A waters have substantially the same uses, some of the specific water quality criteria are less stringent for Class A waters. For instance, in Class AA waterbodies the criteria for dissolved oxygen is "shall exceed 9.5 mg/L," while in Class A waterbodies the criteria is "shall exceed 8.0 mg/L." For Classes B and C waters some of the characteristic uses and the standards are further reduced, as are the characteristic uses that these poorer quality waterbodies are expected to support. Criteria for Lake Class are similar to those of Class A waters. Waters within national forest and national park boundaries are designated as Class AA. All other non-lake waters are generally Class A unless specifically identified (see appendix A-1, WAC 173-201A-030).

The Yakima River from its junction with the Cle Elum River (RM 186) to its headwaters is designated as Class AA, as is the Naches River from RM 35.7 to its headwaters. Tributaries to the main stem Yakima and Naches Rivers in these upper reaches are also designated as AA. Below these points to their mouths, the Yakima and Naches Rivers and tributaries are Class A except for Sulphur Creek, an agricultural return drain (originally an ephemeral creek) that is a tributary to the lower Yakima River, which is designated as Class B. There are no Class C waterbodies within the Yakima basin.

Typically, water quality in the upper portions of the basin is high, but degrades downstream. In several reaches of the main stem Yakima River and its tributaries, water quality does not comply with one or more State water quality criteria, either seasonally or on a year-round basis. When a waterbody fails to meet State water standards it is placed on the State 303(d) list and targeted for a Total Maximum Daily Load (TMDL). The 303(d) list is prepared every 4 years by the State of

Washington and submitted to U.S. Environmental Protection Agency (EPA) in compliance with the Federal Clean Water Act. The list identifies waterbodies that are known to exceed State water quality standards. A TMDL must be completed for all water bodies on the 303(d) list unless it can be determined that the original decision was incorrect, the problem no longer exists, or "natural conditions" are being met. TMDLs (or Water Cleanup Plans) are designed to address a variety of pollution problems and provide remedies to bring the water back into compliance with standards and meet its highest targeted use.

Many river and stream reaches within the Yakima basin are included on the 303(d) list. Pollutants include turbidity, pesticides, low dissolved oxygen, elevated temperatures, metals, fecal coliform bacteria (FC), and pH (see appendix A-2, 1998 303(d) list for WRIAs 37, 38, & 39).

Sediment -

Significant suspended sediment loads have been associated with the discharge of agricultural return flows to the river during the irrigation season. The prevalence of suspended sediment from eroded farm soils has long been recognized as a problem in the tributaries and main stem of the Yakima River where furrow and flood irrigation are employed. In the lower basin, high sediment levels have been correlated with high levels of turbidity and high levels of FC, which exceed water quality standards during the irrigation season (WDOE, 1997). This is particularly apparent in the reaches below the City of Yakima. It has been observed to a lesser extent in the upper Yakima River main stem and some of the tributaries that drain the Kittitas Valley.

Suspended sediment has been directly correlated with the presence of the banned pesticide DDT in some of the drains and in the main stem Yakima. DDT and its breakdown products have been found in fish tissue well in excess of recommended human health criteria. It is suspected that the agricultural drain systems also may be associated with the transport of other pesticides, FC, and nutrients such as phosphorus and nitrites to the Yakima River.

The ongoing lower Yakima River Suspended Sediment and DDT TMDL is designed to reduce suspended sediments, improve water clarity, and reduce pesticides (most notably DDT) in the river. Turbidity standards, which are being used as a surrogate for sediment loads, have been set for the irrigation returns and tributaries discharging to the lower Yakima River. These enforceable limits, set in 5-year increments over the next 15 years, will improve water clarity and reduce the amount of sediment and pesticides entering the river. The primary implementation activities of this TMDL will be to improve irrigation water management practices and reduce tailwater runoff.

To accomplish these goals, growers are being encouraged to convert furrow and flood irrigated fields to sprinkler and drip irrigation or to install facilities to remove sediment from return water. Conversion to sprinkler and drip systems will essentially eliminate surface water runoff, its associated erosion, and suspended sediment. Water delivered to crops in this manner can be much more precisely and efficiently applied. The Roza-Sunnyside Board of Joint Control developed and is implementing policy that will require grower observance of the TMDL targets. The policies are enforced by the potential reduction or denial of service by the districts to growers who refuse to come into water quality compliance.

Temperature -

Exceeding temperature criteria is the most prevalent pollutant parameter on the1998 State 303(d) list for the Yakima basin. Of the 180 listings in the Yakima basin on the 1998 list, 73 are for failure to meet temperature criteria. The criterion for maximum allowable temperature is 18 °C for Class A waters and 16 °C for Class AA waters or "natural conditions." The main stem Yakima River below the confluence of the Cle Elum River has a special temperature criteria of 21 °C. Because many factors affect stream temperature, determining natural conditions is difficult. Modeling is generally used to estimate natural conditions and to determine the influence of proposed mitigation or restoration activities.

The highest temperatures have occurred in the lower portion of the basin, although there are numerous 303(d) listings in the upper basin tributaries. Water is usually cooler in the upper basin, but warms as it flows to the lower basin. Human activities have dramatically altered the Yakima River system in ways that may influence water temperature, such as changes to channel morphology; removal of riparian cover; and disruption of floodplain function, hyporheic flow, and flow regimes.

A prototype temperature TMDL is under way in the Teanaway basin. Implementation is focused on restoring riparian shade and reducing the width/depth ratio through improvements in sediment control. Modeling has shown that increases in flow would also help reduce temperatures. The Reclamation, under Title XII, has an ongoing project to increase flow in certain portions of the lower Teanaway through removal and relocation of irrigation diversions and the purchase or lease of irrigation water rights.

Fecal Coliform Bacteria -

There are 18 303(d) listings for FC in the Yakima basin. FC contamination is found periodically in several reaches of the Yakima River and regularly in several tributaries. These pollution problems are often noted downstream of areas where livestock operations are prevalent or failing septic systems are suspected. Activities that will reduce FC include a sediment TMDL that targets the reduction of surface water runoff from agricultural lands; recent dairy legislation including periodic compliance inspections; local irrigation district policies requiring the exclusion of livestock from drain and watercourses; and increased monitoring to identify failing septic systems. A Granger Drain FC TMDL was developed and is being implemented to specifically reduce bacterial loadings to the Granger Drain, a tributary of the lower Yakima River through best management practices directed at seducing the runoff of suspended sediment from irrigated agricultural lands.

Pesticides and Other Organic Compounds -

There are 46 listings for pesticides and organic compounds on the 1998 State 303(d) list in the Yakima basin (WDOE, 1998). Pesticides and other organic compounds continue to have a significant presence in the Yakima River system. During a 1987-91 study, USGS scientists detected more than 110 different organic compounds in Yakima River basin streams. These findings included pesticides applied to agricultural fields during that period, persistent pesticides used historically (such as DDT), and organic compounds associated with industrial and urban activities (Morace et al., 1999). Sampling and analysis by USGS in 1999 and 2000, for a large suite of pesticides and chemicals will yield more information on the prevalence of these pollutants.

Metals -

There are 16 listings for metals in the Yakima basin on the 1998 303(d) list, including arsenic, silver, mercury, cadmium, and copper. The findings of 1999 sampling and analysis by WDOE personnel will likely result in the removal of several of these listings in the upper Yakima basin.

Nutrients -

Nutrients include nitrate/nitrite nitrogen, ammonia nitrogen, and phosphorus. Giffin Lake, which receives return flows from agriculture, is 303(d) listed for phosphorus. Two waterbody segments, Selah Ditch and Granger Drain, are listed for ammonia nitrogen (WDOE, 1998).

Dissolved Oxygen and pH -

There are nine dissolved oxygen (DO) listings in the Yakima basin; all occur in areas heavily influenced by agricultural return flows. There are also four listings for pH. Both DO and pH have a tendency to react to other changes in the water quality. DO may fall out of compliance with standards as water temperature increases, and as decomposing compounds that require oxygen (biological oxygen demand) are added to the waterbody. pH may rise above criteria levels as water levels drop and aquatic plants thrive, changing the chemistry of the waterbody.

Instream Flow -

Eight stream segments are listed for insufficient instream flow in the Yakima basin. Of these, two are in the main stem of the Yakima River itself. While there are no State water quality standards for low instream flows at this time, insufficient flow can interfere with many of the characteristic uses and influence other pollutant criteria in a waterbody. The EPA and the U.S. Supreme Court have indicated that low instream flow can be considered pollution and will be addressed by increasing instream flows using such methods as buying water rights and implementing water conservation measures on agricultural lands.

2.8 NATURAL RESOURCES

2.8.1 Wildlife

The Yakima River basin contains a broad spectrum of wildlife and the habitats in which they exist. For the purposes of this document, wildlife that generally exist in similar habitat types were grouped together. Seven habitat types are described and the species that are often found in each habitat type are mentioned. No attempt was made to list all the species present, and some species are found in more than one habitat type. The species of plants and wildlife mentioned for each habitat type were ones that are usually present or ones of special interest to the Yakima River basin which may include those listed as threatened or endangered under the Endangered Species Act (ESA). The specific vegetative community typically defines the habitat types and are included in table 2-6. They are: 1) coniferous forest; 2) scrub-shrub; 3) shrub-steppe; 4) riparian; 5) wetland; 6) agricultural; and 7) vegetated urban/developed habitat.

2.8.1.1 Coniferous Forest

Coniferous forests on the east slopes of the Cascade Mountains are usually dominated by Douglas fir, grand fir, or ponderosa pine. As rainfall decreases toward the east, ponderosa pine tends to be the lone dominant species. Coniferous forests are typically used by elk, deer, furbearers, raptors, owls, herons, grouse, and many other species, including Ute ladies'-tresses. Common understory shrubs include huckleberry, Oregon grape, and snowberry. The dominant ponderosa pine forest may include bitterbrush and big sagebrush as understory species. Young regenerating coniferous forests include recently planted clearcuts dominated by Douglas fir and western hemlock.

Other conifer species may be present depending upon species planted or naturally regenerating. Understory vegetation in these forests includes young red alder, blackberry, salmonberry, sword fern, and bracken fern. Stands of old-growth forest occur in the area with patches of old growth being dominated by western hemlock or silver fir. Patches of quaking aspen are scattered in moist sites; small aspen groves and Oregon white oak occur in the area at Swauk Creek in Kittitas County.

Table 2-6.–General Habitat Type, Common Species Present and Species of Special Interest

Habitat Type	Examples of Typical Common Wildlife Species	Species of Special Interest
Coniferous forest, east of the Cascade Crest	Common raven, hairy woodpecker, Clark's nutcracker, Swainson's thrush, white-breasted nuthatch, chipping sparrow, Cassin's finch, yellow-pine chipmunk snowshoe hare, porcupine, elk, bear, long-toed salamander.	Gray wolf, Grizzly bear, fisher, Canada lynx, Marbled murrelet, Northern Spotted owl, osprey, Bald eagle, Northern goshauk, Ute ladies'-tresses.
Scrub-shrub (shrubby plant communities, usually within maintained rights-of-way or recently harvested forest)	Western fence lizard, northwestern garter snake, dark-eyed junco, song sparrow, Mac Gillivray's warbler, Townsend's mole, Townsend's vole, vagrant shrew, Nuttall's cottontail.	Peregrine falcon, Swainson's hawk, ferruginous hawk, prairie falcon, turkey vulture.
Shrub-steppe (is the predominant native habitat type dominated by native grasses and sagebrush)	Western skink, loggerhead shrike, Western meadowlark, Brewer's sparrow, Say's phoebe, red-tailed hawk, northern harrier, common raven, chukar, turkey vulture, great basin pocket mouse, bushy-tailed woodrat, Nuttall's cottontail, northern pocket gopher, yellow-bellied marmot, badger, coyote, bats, mule deer.	Swainson's hawk, ferruginous hawk, prairie falcon, turkey vulture, long-billed curlew, Sage grouse.
Riparian areas (consists of vegetation along streams and rivers)	Canada goose, mallard duck, wood duck, pintail duck, rough grouse, black-capped chickadee, yellow warbler, downey woodpecker, beaver, raccoon, Pacific tree frog.	Same as above.
Wetland areas (include wet meadows, seeps, small shallow ponds and lakes, marshes, and riparian wetlands along streams)	Great blue heron, small shorebirds, muskrat, Canada goose, mallard duck, wood duck, pintail duck, common snipe, racoon, Cascade frog, Pacific tree frog.	Same as above and Columbia spotted frog.
Agricultural areas (cropland, hay/pasture, grass/forb)	Gopher snake, European starling, Brewer's black-bird, brown-headed cowbird, ring-necked pheasant, mourning dove, horned lark, Western meadowlark, killdeer, northern flicker, red-tailed hawk, northern harrier, American kestrel, black-billed magpie, quail, long-billed curlew, Canada goose, coyote, bats, striped skunk, deer mouse.	Same as above.
Vegetated urban/developed areas (parks, golf courses)	White-crowned sparrow, northern flicker, American robin, European starling, striped skunk, bats, deer mouse.	

2.8.1.2 Scrub-shrub

Scrub-shrub vegetation primarily occurs in intensively managed areas, but also includes riparian areas adjacent to rivers and streams. Commonly occurring shrubs include vine maple, young cottonwood, salal, blackberries, salmonberry, hazelnut, rose, snowberry, young alder, and willows. Wildlife species that utilize this habitat are deer, coyote, rabbits, small rodents, raccoon, waterfowl, raptors, sparrows, warblers, and a variety of small reptiles.

2.8.1.3 Shrub-steppe

Shrub-steppe is the predominant native habitat type from approximately Ellensburg to Pasco; however, large-scale conversion to cropland and rangeland has left only about 5 percent of the historic extent of shrub-steppe in relatively undisturbed condition based on estimates by the Washington Natural Heritage Program. Examples of some species that utilize shrub-steppe habitats include loggerhead shrike, Western meadowlark, sage grouse, mule deer, coyote, rabbits, and a variety of small reptiles.

While undisturbed shrub-steppe habitat is very rare, moderately disturbed shrub-steppe communities are fairly common, being impacted to various degrees from grazing, weed infestations, and other disturbances. About 26 percent of the relatively undisturbed shrub-steppe habitat is dominated by native grasses and sagebrush, with an intact cryptogam crust (a thin layer of moss and lichen that indicates an undisturbed community), and contains mostly native shrubs (e.g., big sagebrush and bitterbrush) with a predominantly native grass understory. This habitat type, while previously disturbed by grazing, off-road vehicle use, and other disturbances, still provides cover, food, and nesting habitat for many species of wildlife. The importance of these areas is enhanced by the overall lack of vegetative cover during winter within the cultivated fields that are common in the area.

2.8.1.4 Riparian

Riparian habitat generally occurs adjacent to flowing water (e.g., streams and canals) and contains elements of both aquatic and terrestrial ecosystems that mutually benefit each other (WDFW, 1995). Riparian communities are not controlled by the surrounding vegetation community, but by available water, soil, stream channel substrate and morphology; elevation and latitude; climate; and land-use history (Brinson et al., 1981). A dynamic interaction exists between water and plants in the riparian zone such that the availability of water supports plants that could not otherwise survive in semi-arid regions, and the type of vegetation that survives reflects the water regime that supports it.

Benefits of properly functioning riparian communities include improved water quality; filtration of sediments; streambank stability; moderated streamflow (reduced flood damage); retention of water that extends late season flow; restoration of perennial streamflow; groundwater recharge; erosion protection; aggradation or maintenance of high water table; increased recreational opportunities; critical habitat for fish and wildlife; increased biological diversity; increased forage; and enhanced esthetics (Ohmart and Anderson, 1986; Bureau of Land Management [BLM], 1991a). Plants in riparian zones, and the many animals supported by it, are important to Native Americans and others.

Undisturbed riparian communities provide abundant food, cover, and water for wildlife. Riparian vegetation supplies food and cover for insects emerging from the river as well as its own resident invertebrate populations. These invertebrates, in turn, support numerous mammals, birds, reptiles and amphibians, and other invertebrates. For these reasons and others, riparian areas generally provide high-value wildlife habitat.

About 90 percent of Washington's land-based vertebrate species use riparian habitat for essential life activities. Existing riparian conditions in the Yakima River basin vary, ranging from severely degraded to nearly pristine. Good riparian habitat generally is found along some forested headwater reaches, whereas degraded riparian habitat is concentrated in the valleys and is frequently associated with agriculture, grazing, and fluctuating regulated streamflow.

The Yakima River basin still contains remnants of contiguous aquatic and riparian vegetative cover types suitable for wildlife habitat. Riparian habitats are associated with the backwaters, sloughs, and oxbows, as well as the main river channel. Higher elevation riparian forests (which typically contain cottonwood, alder, willow, and other species) are used by elk, deer, furbearers, raptors, grouse, many neotropical bird species, Pacific tree frog, and many other species. At lower elevations, the riparian forests (which typically contain cottonwood, willow, silver maple, mulberry, hackberry, and other species) are used by mule deer, furbearers, rodents, bats, raptors, owls, herons, water fowl, pheasant, quail, neotropical bird species, and many other species.

Riparian herbaceous habitat is common along many of the irrigation canals and drains, mainly because of regular disturbance (mowing, burning, pesticides) to destroy weeds. Irrigation districts have noxious weed control programs on ditchbanks and rights-of-way. Woody vegetation makes up a very small percentage of the total plant cover along canals. Oakerman (1979) found that unlined canal/drain systems had more value as wildlife habitat than lined canal/drain systems. For example, within the WIP, unlined canals and drains provide habitat (nesting, brood rearing, feeding, and thermal and escape cover) for upland game, waterfowl, furbearers, and many non-game birds (Yakama Nation, 1992).

Since no historical reference has been done on the past versus current status of riparian areas in the basin, the following discussion is based on national and State trends. Riparian areas are currently estimated to encompass less than 1 percent of the land base in the Pacific Northwest, yet they support the greatest diversity and abundance of wildlife in the arid portions of the region (FWS, 1990). For the United States as a whole, about 70 to 90 percent of the natural riparian areas have been lost because of human activities (Ohmart and Anderson, 1986). Because of the importance of riparian areas combined with the large losses that have already occurred, remaining riparian areas must be protected.

Efforts are currently being made to preserve, restore, and enhance riparian areas in the basin. BPA has funded or intends to fund projects benefitting riparian areas at Sunnyside, Wenas, and on the Yakama Indian Reservation (BPA et al., 1994; 1996). The YN has also contributed to protecting and enhancing riparian areas along the Yakima River and plans to protect and manage additional areas as well (Yakama Nation, Waterfowl Biologist, personal communication, 1996). On several wildlife areas in the basin, the Washington Department of Fish and Wildlife (WDFW) is also protecting and managing riparian areas along the Yakima, Tieton, and Naches Rivers, and Taneum, Manastash, Umtanum, Wenas, Oak, and South Fork of Cowiche Creeks. The BLM manages land along the Yakima River northwest of Yakima and is attempting to improve wildlife habitats, including riparian areas (BLM, 1991b). The Yakima Greenway Foundation protects and manages riparian forest along the Yakima River in and near Yakima.

The U.S. Department of Agriculture Wildlife Habitat Incentives Program offers an opportunity for landowners to obtain financial and technical assistance to enhance riparian habitats. The U.S. Forest Service has a variety of policies and regulations which provide protection to riparian areas.

Riparian habitats are degraded along Toppenish and Satus Creeks because of draining and excessive livestock grazing. Although current land use practices limit this type of habitat, residual vegetation remaining through the winter is necessary to provide critical early spring nesting cover for many species. Spring burning of canal banks is generally followed by herbicide applications through the summer. Late spring burning has decreased active waterfowl and pheasant nesting (Oakerman, 1979; Oliver, 1983). Ducks use the canals and drains of irrigation facilities and areas of undisturbed wetland habitat. Vegetation overhanging water channels provides valuable escape and feeding cover for waterfowl broods. Much of this type of vegetation has been removed to improve flows, eliminating many miles of channels and creeks for use by waterfowl broods.

2.8.1.5 Wetlands

Wetlands in the basin are located along the major streams and rivers, especially along the Kittitas Valley, the lower Yakima River floodplain, and Toppenish and Satus Creeks. Additional wetlands were found along smaller tributaries, at seeps and springs, higher elevation wet meadows, and along the shorelines of natural lakes. Many of these wetlands have been lost or degraded.

As a trend, the State of Washington has seen a decline of wetlands of about 30 percent (about 940,000 acres remain from about 1,350,000 acres originally). The loss of inland wetlands in Washington has been estimated at 25 percent (FWS, 1990). Losses have been attributed to agriculture conversion (drainage and leveling for crop production), floodplain gravel mining, filling for solid waste disposal, road construction; and commercial, residential, and urban development; construction of dikes, levees, and dams for flood control, water supply, and irrigation; discharges of materials (for example, pesticides, herbicides, nutrient loading from domestic sewage and agricultural runoff; and sediments from agriculture and other land development); hydrologic alteration by canals, drains, spoil banks, roads, and other structures; and groundwater withdrawal.

Aside from the direct loss of wetlands, many wetlands have been reduced in quality from some of the above factors.

Stream restoration efforts are premised on the idea that wetland and riparian area functioning is tightly linked to overall ecosystem functioning and productivity (Kauffman et al., 1997). It has been suggested by others that if activities that cause the most ecosystem damage could be altered, the system will likely restore itself to some extent.

Continuing threats to wetland functions include overgrazing, intensive adverse agricultural practices (including increased chemical uses, buffer removal, feedlots, and dairy operations in and near wetlands), erosion, high water temperature, poor water quality of irrigation return flow, exotic species (for example, carp and purple loosestrife), dessication, and fairly recently, the changes in older irrigation systems which reduced associated wetlands (for example, lining canals and changing from open waterways to piped and pressurized systems).

Efforts have been made to protect some remaining wetlands (Sunnyside Wildlife Area, Toppenish National Wildlife Refuge, Yakima Greenway, and several units managed by YN). Over 300 acres of wetland/riparian areas along the Yakima and Naches Rivers were recently acquired by the Corps and are being managed by WDFW to help fulfill mitigation for construction of Lower Snake River dams and reservoirs. Several other Federal, State, Tribal, and local agencies are involved in restoring and enhancing wetlands in the basin.

Opportunities to protect and enhance wetlands include YRBWEP's water and land acquisition program, mitigation under the Basin Conservation Program, Federal Aid in Wildlife Restoration, Migratory Bird Conservation Fund, Land and Water Conservation Fund, and the Wetland Reserve Program.

Wetlands are critical ecological systems of enormous importance to a wide range of wildlife species because they provide specialized habitat values not found in upland areas. These habitat values include providing cover, water, shade, forage habitat, rearing habitat, breeding habitat, brood-rearing habitat, loafing areas, winter habitat, relief from extreme summer or winter temperatures, and biodiversity (Weller, 1986). Wetlands are among the most productive ecosystems in nature because of the ready availability of water, nutrients, and energy in such close proximity (Weller, 1986). Wetlands also provide flood conveyance, shoreline protection, flood storage, water quality enhancement, sediment control, recreation, groundwater recharge, and esthetics.

The riverine-wetland complex would have been integral to the ecosystem that evolved in the Yakima River basin. Wetlands would have served several purposes important to wildlife such as they provide nutrients that contribute to the ecosystem and wildlife productivity; provide backwater areas for feeding; loafing and security; and provide for a productive wildlife food source.

Of the approximately 43,695 acres of wetlands in the basin, about 19,000 are palustrine herbaceous (emergent marsh, aquatic bed), and 19,000 acres are palustrine woody (shrubs and trees). These wetlands include wet meadows; seeps; small shallow ponds and lakes; marshes; and riparian wetlands along streams. Aside from natural wetlands, many wetlands have formed and been maintained from artificial water sources such as reservoirs, sewage lagoons, stock ponds, irrigation canals, and irrigated cropland runoff. Other wetland areas include lakes and streams (about 29,000 acres) and marshy unvegetated areas (about 4,000 acres). Total wetland areas equal about 2 percent of basin area.

In the semi-arid lowlands, wetlands are critical to many species of wildlife because they provide good vegetative growth for food and cover, invertebrate production, and water. Recognition of the value of wetlands has historically focused on waterfowl populations, and tens of thousands of waterfowl can be found in the lower Yakima River basin in winter and during migration. Oliver (1983) estimated that up to 300,000 ducks wintered on the Yakama Indian Reservation in the 1960s. Many wood ducks in eastern Washington are bred and raised along the Yakima and Naches Rivers. Waterfowl within just the WIP account for about 20 percent of the population in eastern Washington (Yakama Nation, Waterfowl Biologist, personal communication, 1996). Also, as many as 40,000 Canada geese use areas flooded by Toppenish and Simcoe Creeks in the spring (BPA et al., 1994). Historically, sandhill cranes and swans nested in the basin and could conceivably return if wetland restoration and enhancement efforts were to continue (Parker, 1989 as cited in FWS, 1996). Many other birds, mammals, amphibians, and reptiles depend upon riparian areas.

As in other Yakima River basin areas, most emergent wetland habitat in the Satus and Toppenish Creek areas has been removed through draining and land leveling much the same fate as befell wetlands in the Kittitas Valley, Gap to Gap reach, Wenas, Ahtanum, and other once lush riverine wetland areas. Along most of these stream reaches, remaining areas are heavily grazed during spring and summer months, further decreasing their potential as wildlife habitat. Basic protection and enhancement activities have excellent potential to increase the quality of furbearer, songbird nesting, and waterfowl brood-rearing habitat (BPA et al., 1994). Toppenish and Satus Creeks, with their low gradient, braided channels, and abundant sloughs and wetlands, provide excellent wintering habitats for wildlife. Spring floods immerse large acreages of pasture land next to the creeks. These flooded areas are heavily used by migratory waterfowl, annually attracting 20,000 to 40,000 of the Taverner's subspecies of Canada geese en route to nesting grounds on the North Slope of Alaska. Streambanks and nearby wetlands provide wintering habitats for upland game bird and waterfowl use. Refuges along Toppenish Creek provide important sanctuaries, especially for migratory and wintering waterfowl.

2.8.1.6 Agricultural

Agricultural land in the southern two-thirds of the basin contains large tracts of orchards, vineyards, and hop fields, as well as a wide variety of other crops. Pasture, hay, corn, and wheat are the primary uses of agricultural land in the northern portion of the basin. Historically, croplands provided much higher quality habitat than exists in most places today. However, more efficient irrigation practices, larger fields, changes in crops, removal of fence rows, increased herbicide use, and other changes removed much of the wildlife habitat. Cropland and pasture in the lower Yakima River basin can still be very important to large numbers of wintering waterfowl (especially mallard duck and Canada goose); however, their numbers do not approach the 300,000 recorded in the 1960s (Oliver, 1983). Irrigated agricultural valleys provide habitat for a variety of wildlife, including pheasant, quail, long-billed curlew, raptors, and small rodents. Canals and drains provide habitat for species such as muskrat, raccoon, bats, waterfowl, great blue heron, neotropical bird species, and small shorebirds. Orchards, vineyards, and hop fields provide only marginal habitat for some wildlife, including American robin, mourning dove, California quail, western meadowlark, and gopher snake.

2.8.1.7 Vegetated Urban/Developed

Vegetative urban areas have essentially the same vegetive species as described in the shrub-steppe habitat, with the addition of mostly non-native weed species. Developed areas include land which is essentially cleared of all native vegetation such as residential property, parks, and golf courses. These areas are typically dominated by lawns, shrubs, and trees that are relatively intensively managed through mowing, pruning, cultivating, and fertilizing. Vegetative urban/developed areas are important to large numbers of wintering waterfowl (especially mallard duck and Canada goose). Many State, county and city parks, and golf courses provide marginal habitat for some wildlife, including American robin, mourning dove, California quail, western meadowlark, gopher snake, and provide important sanctuaries for a myriad of other wildlife which have adapted to human presence. Non-native weed species are those species that easily invade farmland, decrease forest productivity, and alter ecosystems by out-competing native vegetation. Non-native weeds are commonly annual and perennial forbs. In eastern Washington and the Yakima River area, non-native weed species are ox-eye daisy, purple loosestrife, orange hawkweed, diffuse and spotted knapweed, yellow star-thistle, yellow toadflax, rush skeleton weed, and Canada thistle.

2.8.2 Fisheries

A diverse array of fish species inhabit the Yakima River basin including a number of exotic species (table 2-7.). For the purpose of this document, fish that exhibit similar life history and habitat characteristics were grouped together. All species were placed into one of five groups, some fish were placed into more than one (i.e., bull trout and rainbow trout). The groups include: anadromous (e.g., chinook and coho salmon); resident migratory (e.g., pikeminnow, sucker); resident local (e.g., sculpin, dace); lentic (e.g., kokanee, pigmy whitefish); and exotic (e.g., bass, catfish). Described below are the unifying characteristics of each group including a list of species present today. Current distribution and abundance patterns are presented in table 2-7.

2.8.2.1 Anadromous

Anadromous fish spend most of their adult life in the marine environment and return to freshwater streams to spawn. Egg incubation, and juvenile growth and development occur in the freshwater streams for various amounts of time depending on species and race. The Yakima River basin once supported healthy anadromous salmonid populations of spring, summer and fall chinook salmon, coho salmon, sockeye salmon, and steelhead. Species present today include: spring and fall chinook salmon, summer steelhead, and coho salmon (table 2-7.). Three species are considered functionally extinct and include sockeye and summer chinook. Coho salmon have been reintroduced via artificial propagation from efforts of the Yakima-Klickitat Fisheries Project (YKFP).[10] All anadromous salmonid populations have experienced substantial declines. Once numbering in the hundreds of thousands, the composite anadromous totals are now less than 10,000 returning to the basin (Northwest Power Planning Council [NWPPC, 1990]). In early 1999, steelhead were listed as threatened under the ESA.

Except for streams rendered inaccessible or unusable by unladdered dams or by excessive irrigation diversions or releases (e.g., Taneum, Manastash and Wenas Creeks; the lower Tieton River) the current distribution of spring chinook spawning areas is the same as it was historically (Tuck, 1995). In the Yakima River, spawning spring chinook are found upstream of Ellensburg and upstream of the Tieton River confluence in the Naches River basin. Rearing juveniles are present in and downstream of spawning areas as far as Union Gap. Historic distribution of fall chinook salmon is largely unknown, but is believed to be similar as todays where most spawning is below Sunnyside Dam (Tuck, 1995). Previously, coho spawned in the upper reaches of the Yakima (above Ellensburg) and Naches (above the confluence of the Tieton River) Rivers and numerous tributaries (Tuck, 1995). Currently, the main spawning distribution for coho extends from Marion Drain to Easton in the Yakima and the upper Naches Rivers. The majority of spawning occurs below Ahtanum Creek to Marion Drain based on the Yakama Nation’s radio telemetry study (1999-2001). Steelhead once spawned broadly throughout the Yakima basin. Most adult steelhead return to and spawn in Satus (47%) and Toppenish (11%) Creeks and the Naches River basin (32%). The remaining fish spawn in Marion Drain (2%), the Yakima River below Roza Dam (4%) and the upper Yakima River basin (4%) (Hockersmith et al., 1995). For information on timing of successive freshwater life stages of Yakima basin chinook (spring and fall), coho, and steelhead as well as recent productivity estimates for those species, see appendix B.

The Pacific lamprey is another anadromous species present in the Yakima basin. Little is known about current and historic distribution and abundance of this species. In other tributaries of the mid-Columbia River, Pacific lamprey population are considered depressed (Jackson et al., 1996).

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[10] The YKFP is a joint project of the YN and the WDFW, the goal of which is to rebuild stocks of spring and fall chinook salmon and coho through hatchery supplementation.

2.8.2.2 Resident Migratory

Resident migratory fish are native species that reside in the Yakima basin nearly year-round. These fish exhibit migration at certain times of the year, primarily as adults moving to spawning grounds. Species included in this group are: mountain whitefish, northern pikeminnow, largescale sucker, mountain sucker, bridgelip sucker, rainbow trout, and bull trout. Although undocumented, distribution of resident migratory species in the main stem of the Yakima River today is believed to be unchanged except for bull trout. This notion is based on the fact that resident migratory fish currently occur throughout the basin (table 2-7.) and there is reason to believe they were there previously. However, the abundance has been reduced particularly in the lower basin (Patten, 1970). Resident migratory (fluvial) bull trout grow and mature in the main stem Yakima or Naches Rivers and then migrate during the late summer into the upper tributaries to spawn. (Bull trout that display resident local and adfluvial life histories will be discussed in other sections.) The status of fluvial bull trout is considered critical in the main stem Yakima River and unknown for the Naches River (WDFW, 1997). Bull trout were considered extirpated in the lower Yakima River by the 1950s.

2.8.2.3 Resident Local

Resident local fish are native species that generally do not exhibit large scale annual migration. These fish include: western brook lamprey, rainbow trout, westslope cutthroat trout, bull trout, chiselmouth, peamouth, redside shiner, longnose dace, leopard dace, speckled dace (Umatilla Dace), three-spine stickleback, piute sculpin, torrent sculpin, and mottled sculpin. All native species are present today. Bull trout are listed as threatened under the ESA. Little is known about the population of western brook lamprey, thus warranting the concern. The only significant populations of bull trout that exhibit the resident life form exist in the Ahtanum Creek and Teanaway River where populations are considered critical (WDFW, 1997). Other populations of resident bull trout probably exist in other tributary streams, but are likely small in size and would be difficult to detect without a significant amount of effort. Little historic documentation is available on the abundance and distribution of other resident local fish. In the mid-1950s, Patten et al. (1970) suggested that abundance of native fish in the lower Yakima River have experienced declines. Information available today (table 2-7.) generally supports Pattern et al. (1970) work. Rainbow trout and westslope cutthroat trout are major game fish and considered priority species in Washington (WDFW, 1991). Special regulations are in effect to preserve the quality of the angling in the main stem Yakima River for trophy rainbow trout.

2.8.2.4 Lentic

The unifying characteristic of these fish is that they reside primarily in reservoirs. All reservoirs except Rimrock were natural lakes that have since been impounded. Primary lentic species include: pygmy whitefish, kokanee, burbot, bull trout, rainbow trout, westslope cutthroat trout, redside shiner, suckers (largescale, mountain, and longnose), pikeminnow, sculpin, and dace. Sockeye salmon historically inhabited the basin's natural lakes, but have since been extirpated when impassable dams were built in the early 1900s to create the reservoirs. Kokanee, a resident sockeye which resides solely in fresh water, were introduced as sport fish in the mid-1900s. Most of these species utilize reservoir tributaries for spawning, incubation, and early rearing, and include pygmy whitefish, kokanee, burbot, bull trout, rainbow trout, westslope cutthroat trout, redside shiner, suckers (largescale, mountain, and longnose), pikeminnow, sculpin, and dace. Historic and current abundance estimates of reservoir fish are unavailable with the exception of bull trout. Within the last 10 years, redd counts for bull trout have been conducted by WDFW on index reaches to reservoir tributaries. Data suggests that bull trout in the reservoirs are healthy in Rimrock, depressed in Bumping, critical in Kachess and Keechelus, and unknown in Cle Elum (WDFW, 1997). Bull trout are federally listed as threatened. Concern for the pygmy whitefish and burbot stem from the lack of information on life history and population status as well as their limited range (Hallock and Mongillo, 1998; and Bonar et al., 1997).

2.8.2.5 Exotic

Exotic fish species were introduced by man from another area. Exotic species are of concern because of negative interactions with native species. Introduction of exotics began in the late 1800s with the completion of the railways. By the 1920s, the exotic species present today were pretty much established and State agencies became involved with transplants of established stocks into suitable habitats. Intense management for warm water species began with the coming of tournament bass fishing in the 1970s. Today the management objective for introduced game fish species is on maximizing long-term recreational benefits, while minimizing adverse impacts to native fish and wildlife and their habitats. Exotic species present today include: brook trout, lake trout, brown trout, largemouth bass, smallmouth bass, black crappie, white crappie, bluegill, pumpkinseed, green sunfish, walleye, yellow perch, channel catfish, brown bullhead, black bullhead, mosquitofish, goldfish, and carp. Several hatchery strains of two native fish (rainbow and cutthroat trout) have been introduced to the basin from other states. Most warm water exotic species are located in the lower river, downstream of the city of Yakima and provide for viable recreation opportunities including bass tournaments. Introduced salmonids are generally found in the cooler parts of the upper watershed including reservoirs and also provide for recreational fishing opportunities.

Table 2-7.–Current Species Distribution in the Yakima River Main stem and Reservoirs. Shaded Cells Indicate the Species is Rare (relatively few captures reported) in That Stream Section (Washington Department of Fish and Wildlife, Yakima River Species Interaction Study, Ellensburg, Personal Communication, Updated 8/21/98)

Distance from River Mouth (km)[a]

Group	Species	0-44	45-68	69-161	162-180	181-305	Reservoir
Anadromous	Pacific lamprey	X	X	X	X		
Anadromous	coho salmon	X	X	X	X	X	
Anadromous	spring chinook salmon	X	X	X	X	X	
Anadromous	fall chinook salmon	X	X	X	X		
Anadromous	summer steelhead	X	X	X	X	X	
Lentic	kokanee						X
Lentic	burbot		X			X	X
Lentic	bull trout		X		X	X	X
Lentic	cutthroat trout				X	X	X
Lentic	pygmy whitefish					X	X
Lentic/ Resident Migratory	northern pikeminnow	X	X	X	X	X	X
Lentic/ Resident Migratory	rainbow trout	X	X	X	X	X	X
Lentic/ Resident Local	mountain whitefish	X	X	X	X	X	X
Resident Local	three-spine stickleback	X	X	X	X	X	
Resident Local	chiselmouth	X	X	X	X	X	X
Resident Local	peamouth	X	X	X			X
Resident Local	sandroller	X		X			
Resident Local	longnose dace	X	X	X	X	X	
Resident Local	speckled dace	X	X	X	X	X	X
Resident Local	leopard dace	X	X	X			

Group	Species	0-44	45-68	69-161	162-180	181-305	Reservoir
Resident Local	Umatilla dace (subspecies)	X	X	X			
Resident Local	redside shiner	X	X	X	X	X	X
Resident Local	mottled sculpin			X	X	X	
Resident Local	torrent sculpin			X	X	X	
Resident Local	piute sculpin			X	X	X	
Resident Local	shorthead sculpin			X		X	
Resident Local	prickly sculpin	X					
Resident Local	western brook lamprey						
Resident Migratory?	white sturgeon	X	X				
Resident Migratory	bridgelip sucker	X	X	X	X	X	
Resident Migratory	largescale sucker	X	X	X	X	X	X
Resident Migratory	mountain sucker			X	X	X	
Resident Migratory	W. brook lamprey			X	X	X	
Exotic	brown bullhead	X	X	X	X		
Exotic	channel catfish	X	X	X			
Exotic	pumpkinseed	X	X	X	X	X	
Exotic	bluegill	X	X			X	
Exotic	smallmouth bass	X	X	X	X	X	
Exotic	largemouth bass	X	X	X	X	X	
Exotic	black crappie	X	X				
Exotic	white crappie	X					
Exotic	common carp	X	X	X	X	X	
Exotic	goldfish	X	X				
Exotic	yellow perch	X	X	X	X	X	

Group	Species	0-44	45-68	69-161	162-180	181-305	Reservoir
Exotic	walleye	X	X	X			
Exotic	lake trout			X	X	X	X
Exotic	brown trout	X	X	X	X	X	
Exotic	brook trout				X	X	X
Exotic	mosquitofish	X					

[a] Mouth (Tri-cities) = River km 0; Kiona (Benton City) = rkm 44; Prosser = rkm 68; Yakima = rkm 161; Roza Dam = rkm 180; Keechelus Dam = rkm 305.

3.0 RECLAMATION AUTHORITIES AND OBLIGATIONS

The Federal Acts providing the authorities and obligations in the Yakima Basin Project are cited below. For persons who wish to obtain additional information about these citations, they are further described in the Federal Reclamation and Related Laws Annotated, United States Department of the Interior, located in the Reclamation Upper Columbia Area Office library. A brief explanation is included for those acts that are most commonly used by Reclamation for contracting purposes.

3.1 AUTHORIZATIONS and PURPOSES - Irrigation, Fish & Wildlife, Hydropower, Flood Control, and Municipal and Industrial uses.

3.1.1 Water Rights

1. Act of July 26, 1866 - Recognition of Vested Water Rights

3.1.2 Project & Irrigation

1. Act of June 17, 1902 - The Reclamation Act of June 17, 1902 (32 Stat. 388) authorized the issuance of water-right applications by which individual water users contracted to repay their portion of the construction cost of a project in a period of 10 years.

2. Act of June 25, 1910 - Advances to the Reclamation Fund

3. Act of February 21, 1911 - The Warren Act (36 Stat. 925) provided for the disposition of surplus water to individuals or irrigation enterprises outside Government Reclamation projects on terms determined to be just and equitable. The terms of payment now usually run from 10 to 40 years. The Act also allows for the use of Federal facilities for conveying private waters.

4. Act of August 13, 1914 - The 20-year repayment plan, authorized by the Reclamation Extension Act of August 13, 1914 (38 Stat. 686) was designed to permit a longer term for payment than the Reclamation Act of 1902.

5. Act of February 25, 1920 - Sale of Water for Miscellaneous Purposes

6. Act of December 5, 1924 - The Fact Finders' Act of December 5, 1924 (43 Stat. 672) provided for a plan of payment based on 5 percent of the average gross crop value in a district for a 10-year period. These payments, as a general rule, will run long terms of years. Authority for additional contracts of this type was repealed in 1926.

7. Act of August 4, 1939 - The Reclamation Project Act of 1939 (53 Stat. 1187) provides for flexibility in determining the annual rate of repayment for new contracts, again on a crop-income basis, but total repayment must be made in 40 years for distribution systems. A development period not to exceed 10 years may be established, from the time water is delivered to a block of land, before payment of construction charges commences. Storage repayment contracts are authorized for storage and carriage works. It also authorizes the negotiation of amendatory contracts for old projects, under the same rules, or for submission of the most practical amendatory plan to Congress for its approval.

The Reclamation Project Act of 1939 authorizes the United States to allocate portions of the total cost of a project to be repaid from power revenues or from municipal water revenues, and to flood control and navigation on a non-reimbursable basis. This made feasible for construction many projects where the water users could not reasonably be expected to repay the entire costs.

8. Act of August 11, 1939 - Water Conservation and Utilization Act

9. Act of October 7, 1949 - A number of contracts have been entered into pursuant to the Rehabilitation and Betterment Act (63 Stat. 724). This Act provides that repayment of rehabilitation and betterment expenditures on Federal Reclamation projects is to be in installments fixed in accordance with the ability of the water users to pay, and, to the fullest practicable extent, is to be scheduled for return concurrently with the water users' existing construction repayment obligations.

10. Act of July 3, 1958 - The Water Supply Act of 1958 (72 Stat. 297) recognizes the primary responsibilities of the States and local interests in developing water supplies for domestic, municipal, industrial, and other purposes and that the Federal Government should participate and cooperate with States and local interests in developing such water supplies in connection with the construction, maintenance, and operation of Federal navigation, flood control, irrigation, or multiple-purpose projects. The Act permits storage capacity to be included in any Bureau of Reclamation or Corps of Engineers reservoir for present and/or anticipated future demand or need by States or local interests for municipal or industrial water. The maximum permissible allocation of construction costs to anticipated future demands for municipal and industrial water supply is 30 percent of the cost of the dam and reservoir project. Costs allocated to municipal and industrial water supply for any given user must be repaid within 50 years after reservoir storage capacity is first used for municipal and industrial water supply purposes or within the life of the project, whichever period is shorter. Dam and reservoir costs allocated to deferred municipal and industrial water supply are interest free for a maximum period of 10 years. This Act is an alternative to and not a substitute for the Reclamation Project Act of 1939.

11. Act of July 9, 1965 - Public Law 89-72 (79 Stat. 213), known as the Federal Water Project Recreation Act, establishes uniform policies for the inclusion of recreation and fish and wildlife enhancement developments at planned and existing Federal water resources development projects and encourages non-Federal participation in those project purposes.

In planning Reclamation projects, the Act requires that a non-Federal public body agree to administer the land and water areas and bear not less than one-half of the separable costs and all costs of operation, maintenance, and replacement. Execution of such an agreement is a prerequisite to the construction of the facilities.

Costs allocated to recreation and fish and wildlife enhancement cannot exceed one-half of the total project cost. The non-Federal share of separable costs may be provided in cash, by the provision of land, interests therein, or facilities. The non-Federal share also may be repaid, with interest, within 50 years from the first use of project facilities for recreation or fish and wildlife. In the latter case, repayment may be financed entirely from entrance and user fees collected at the project by non-Federal interests.

At existing Reclamation projects, the Act authorizes the Secretary to provide public outdoor recreation or fish and wildlife developments, but precludes reallocation of project costs. Execution of an agreement with a non-Federal public body also is required. The Federal expenditure on any one existing reservoir is limited to $100,000.

12. Water Resources Planning Act of 1966

13. Act of October 3, 1975 - Amend Rehabilitation and Betterment Act

14. Safety of Dams Act of 1978

15. Reclamation Reform Act of 1982

16. Yakama Treaty of June 9, 1855

3.1.3 Flood Control

1. Act of June 22, 1936 - Flood Control Act of 1936

2. Act of June 28, 1938 - Flood Control Act of 1938

3. Act of December 22, 1944 - Flood Control Act of 1944

4. Act of August 4, 1954 - Watershed Protection and Flood Prevention Act

5. Act of July 14, 1960 - Flood Control Act of 1960

6. Act of December 31, 1970 - River and Harbor and Flood Control Acts of 1970 (see also Acts of August 4, 1939 [Section 8b], August 11, 1939, and July 3, 1958 above)

3.1.4 Hydropower

1. Act of June 10, 1920 - Federal Water Power Act

2. Act of August 31, 1964 - Pacific Northwest Power Marketing

3. Act of December 5, 1980 - Pacific Northwest Electric Power Planning and Conservation Act (see also Act of June 12, 1948, Kennewick Division)

3.1.5 Recreation

1. Act of July 9, 1965 - Federal Water Project Recreation Act

3.1.6 Yakima Specific Authorities

1. Reclamation Act of 1902 - Tieton and Sunnyside Divisions

2. Act of June 25, 1910 - Benton, Kittitas, and Wapato Divisions

3. Act of June 25, 1910, Section 4 and December 5, 1924, Subsection B of Section 4 - Roza Division

4. Act of June 12, 1948 - Kennewick Highlands/Division

5. Act of June 12, 1948 - Kennewick Division, Yakima Project

6. Act of June 30, 1954 - Amended Contract with Roza Irrigation District

7. Act of August 25, 1969 - Kennewick Division Extension

8. Hoover Power Plant Act of 1984 - Yakima River Basin Fish Passage

9. Act of 1994 - Yakima River Basin Water Enhancement Project

3.1.7 Yakama Nation

1. Yakama Treaty of June 9, 1855

2. Act of August 1, 1914 - Partial Provision of Irrigation Water Rights of Yakama Nation

3. Act of July 1, 1940 - Ratification of Delivery of Additional Treaty Water for Wapato Indian Irrigation Project

4. Act of December 28, 1979 - Feasibility Study, Yakima River Basin Water Enhancement Project

3.1.8 Fish & Wildlife

1. Act of March 10, 1934 - Fish & Wildlife Coordination Act

2. Act of August 14, 1946 - Fish & Wildlife Coordination Act. This amendment (60 Stat. 1080) to the Fish, Wildlife and Game Act of 1934 provides for non-reimbursable allocations to the preservation and propagation of fish and wildlife for new projects.

3. Act of August 12, 1958 - Name and Amend Fish and Wildlife Coordination Act

4. Act of September 29, 1980 - Fish and Wildlife Conservation Act

5. Act of December 28, 1973 - Endangered Species Act

6. Yakama Treaty of June 9, 1855.

4.0 LEGAL & INSTITUTIONAL ASPECTS OF THE YAKIMA BASIN PROJECT

4.1 PROJECT & LEGISLATIVE BACKGROUND - Development of the Yakima River Basin Water Enhancement Project and Title XII

Initial Authorization and Objectives of the Yakima River Basin Water Enhancement Project -

The Yakima River Basin Water Enhancement Project (YRBWEP) was initially authorized by Congress by the Act of December 28, 1979, (Public Law 96-162). The Act authorized the Secretary of the Interior (Secretary) to undertake a feasibility level study of the proposed YRBWEP. Drought conditions that were prevalent throughout the Western United States at that time focused attention on the need for additional efforts to expand and assure adequate water supplies in the Yakima River basin.

Preliminary work on the feasibility study began in 1980. The YRBWEP study initially had 2 planning phases: Phase 1, preliminary identification of water needs, available resources, and potential plan elements which could meet the needs; and Phase 2, detailed studies of more promising plan elements, the formulation and evaluation of alternative plans, and the identification of a preferred plan for consideration.

Early Implementation Program -

Interest in seeking expedited congressional action for authorization of elements that would be part of an overall YRBWEP became the focus of the study in late 1985. Consequently, additional work on the detailed analysis and evaluation of the four alternative plans was placed on hold.

In 1987, a “Policy Group” was formed to oversee the YRBWEP with respect to plan proposals, guidance on policy matters, and public involvement activities. Through this activity, the decision was made to pursue several legislative proposals, including early implementation legislation and comprehensive legislation.

Comprehensive Legislation -

Comprehensive legislation dated September 2, 1988, stipulated the quantity of water to be available to the Yakama Indian Reservation, to off-reservation irrigation entities, and to instream flows. However, extensive efforts to reach an amenable solution failed, and comprehensive legislation was abandoned.

Enhancement Roundtable Group -

During December 1988, and January 1989, legislators and basin interest groups met to develop a core group representing the various parties and discuss proceeding with a Phase 2 program emphasizing water conservation. The Enhancement Roundtable Group was formed as a result of this effort. An Enhancement Technical Activities Group (TAG) consisting of representatives from the irrigators, the Yakama Nation (YN), the State, Bonneville Power Administration (BPA), and the Bureau of Reclamation (Reclamation) was formed to guide and oversee work activities. Subsequent meetings of the Enhancement Roundtable Group considered draft Federal legislation to authorize a "pilot" water conservation program to assist in determining the amount of the basin's water needs that could be met through water conservation and the amount and location of additional storage capacity that might subsequently be required as part of a comprehensive enhancement program.

On May 2, 1990, the TAG transmitted draft legislation for Phase 2 to legislators with the recommendation that they proceed with its review by legislative counsel and then submit it to the Enhancement Roundtable Group with a request that a decision be made regarding future action in seeking authorization. The TAG further recommended that the major focus of the YRBWEP at that time should be water conservation, providing a mechanism for developing, evaluating, and implementing entity specific water conservation measures and their integration into a basin-wide conservation program. Consequently, TAG recommended deferral of further activities related to additional storage, except those possibilities that could augment existing stored waters such as identified with the conveyance of Cabin Creek and Silver Creek flows for storage in the existing Kachess Lake.

Renewed interest was generated in proceeding with the Phase 2 legislative concept following the Acquavella Adjudication summary judgment ruling on the YN rights in 1990. Draft legislation was introduced in late July 1991. By resolution dated April 8, 1992, the Tribal Council indicated its support for the bill as modified by Tribal comments. The bill was passed by Congress as Title XII of the Act of October 31, 1994, Public Law 103-434.

4.2 TREATY of 1855

The Treaty of June 9, 1855, between the 14 confederated Tribes and bands later to become the YN and the United States, ceded 10.3 million acres to the United States and reserved a 1.4 million-acre homeland. In the Treaty of June 9, 1855, the Tribes of the YN retained the rights to fish, hunt, and gather native foods and medicines off the Reservation.

4.3 LIMITING AGREEMENTS

As a condition for involvement of Reclamation in the irrigation development of the Yakima River basin, the Secretary in 1905, required limitations on diversions by water claimants. This was accomplished through "Limiting Agreements" with some 50 claimants on the Yakima and Naches

Rivers agreeing to limit their diversions to the following: for August and preceding months, the amount actually diverted in August 1905; for September, two-thirds of this amount; and for October, one-half of the amount. The actual August diversion totaled about 2,000 cubic feet per second (cfs). Of this amount, nearly 1,900 cfs or 95 percent of the claimed diversion quantities were covered by limiting agreements or adjusted claims.[1]

4.4 WATER RIGHTS & CONTRACTS

The most comprehensive listing of claims and contract quantities for the Yakima basin was compiled by Mr. C.R. Lentz, Reclamation Project Superintendent, in 1974. A copy of this listing is available in the Bureau of Reclamation's Upper Columbia Area Office.

4.5 COURT DECISIONS

4.5.1 1945 Consent Decree

The 1945 Consent Decree (Decree) was the outgrowth of water supply deficiencies in 1941, 1942, and 1943, and disputes over rights to the available supply. Rather than proceed with extensive litigation, a stipulated settlement was reached by the parties and a judgement entered. In January 1945, the District Court of Eastern Washington issued a decree under Civil Action No. 21 called the 1945 Consent Decree. The Decree is a legal document pertaining to water distribution and water rights in the basin. This judgement set forth the obligations of the United States to deliver water "to the plaintiffs, to the defendants, and to the lands of the Wapato Irrigation Project." The Decree established procedures under which Reclamation should operate the Yakima Project system to meet the water needs of the irrigation districts that predated the Yakima Project, as well as the rights of divisions formed in association with the Yakima Project. The Decree provided water delivery allocations for all major irrigation system diversions down to Sunnyside in the Yakima basin. The Decree states the quantities of water to which most main stem water users were allowed (maximum monthly and annual diversion limits) and defined a method of prioritization to be placed into effect during water-deficient years. The water allocations were divided into two classes, non-proratable and proratable.[2] Non-proratable entitlements are held by those water users with the earliest filed water rights, and these entitlements are to be served first from the total water supply available (TWSA). All other water rights are proratable, which means they are of equal priority. Any shortages that may occur are shared equally by the proratable water users.

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[1] The adjusted claims included 147 cfs for the Yakima Nation and 650 cfs for the Sunnyside Canal.

[2] This included claims by others for natural flows from the Yakima River and its tributaries which were heretofore recognized by the United States whether or not they signed "Limiting Agreements" or were parties to the 1945 Consent Decree.

4.5.2 Quackenbush Decision

In 1980, spring chinook spawned in the upper portions of the Yakima River between the mouth of the Cle Elum River to the mouth of the Teanaway River during the period that reservoir releases were being made to meet downstream irrigation demands. When the irrigation season drew to a close and reservoir releases were being curtailed, about 60 redds (fish nests), a portion of which were dewatered by the reduced releases, were identified in the Yakima River reach between the mouth of the Cle Elum River and the mouth of the Teanaway River. In October 1980, Judge Justin Quackenbush of the Federal District Court directed Reclamation, acting through the Yakima Field Office Manager, to release water from Yakima Project reservoirs to keep the redds covered with water. In November 1980, the Court directed the Yakima Field Office Manager to work with fishery biologists and report back prior to the 1981 irrigation season:

> ". . . on means by which the needs of the Yakima Project water users can be met through more efficient or less extensive use of Project waters or by modification of Project operations or facilities so as to have less impact on the fisheries resource, including the possibility of management of the various Project reservoirs and releases of water so as to provide for appropriate water flows during the spawning and hatching periods that may be practicable while at the same time providing water for irrigation purposes for users within the Project."

As a result, the "flip-flop" operation was conceived and initiated in 1981, and has since been a part of the Yakima Project operation. The flip-flop term derives from the fact that the Yakima and Naches Rivers form a "Y." In this operation, water from the three reservoirs in the upper Yakima River system (right side of the "Y") is used to meet irrigation demands downstream of the confluence of the Naches and Yakima Rivers through the first week of September, and water is retained in reservoirs of the Naches River arm (left side of the "Y") to the maximum extent possible. After the first week of September, reservoir operations are flip-flopped with demands downstream of the confluence of the Naches and Yakima Rivers being met from the Naches River system reservoirs and flows from the upper Yakima River system reservoirs are reduced. This operation reduces flows in the upper Yakima River at the time that fish spawn, forcing the fish to build redds at a lower elevation in the stream channel. As a result, less water is needed to be released during the winter to keep the redds under water and maintain the fish eggs.[3]

4.5.3 Acquavella Adjudication

Water supplies in the Pacific Northwest in 1977 were inadequate to meet the needs in many areas, including the Yakima River basin. The State of Washington, October 12, 1977, filed an adjudication of the Yakima River system in the Superior Court of Yakima County (Case No. 77-

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[3] A mini flip-flop operation is also conducted upstream from Easton Diversion Dam by reducing outflow of Keechelus Lake at the headwaters of the Yakima River in early September and drawing on Kachess Lake to meet downstream irrigation needs of the Kittitas Valley diverters and the Roza Irrigation District.

2-0148-5) naming the United States and all persons claiming the right to use the surface water of the Yakima River basin as defendants. Motions were filed to reopen the judgment on the 1945 Consent Decree. However, the District Court held that the Decree was being correctly interpreted by Reclamation. At the same time, the YN filed an action in Federal District Court to determine the priority and quantity of the water rights of the YN under the Treaty of 1855. Later in the same year, the State of Washington filed in State Court for a general adjudication of the Yakima River drainage basin. In March 1985, the Court ruled that this action could be limited to surface waters of the Yakima River basin and that groundwater users need not be included for a general adjudication. The Federal case was deferred to the State's case, and the prior filing by the YN did not proceed. The general adjudication remains open and in progress with orders continuing to be issued on water right claims in the Yakima River and its tributaries.

4.5.3.1 Partial Summary Judgment

Some irrigators opposed the Phase 2 legislation in view of the motion for partial summary judgment filed by several irrigation districts. An order of the Superior Court was entered on July 17, 1990, regarding the rights of the YN. In that decision, the treaty-reserved water rights of the YN were defined and those rights to flow in the mainstream Yakima were unanimously affirmed by the Washington Supreme Court on appeal. The treaty rights were divided into separate rights for fish and agriculture.

1. First, the Court determined that various acts of Congress, agencies and decisions of various tribunals had defined and limited the treaty irrigation right of the YN. This translated into existing non-proratable irrigation rights with 1855 priority, and proratable irrigation rights with a priority date of 1905.

2. The treaty right for fish had likewise been limited by various acts of Congress and agency actions and had been compensated in the proceeding before the Indian Claims Commission, (ICC) Docket No. 147. The substantially diminished instream flow right was held to be the “specific minimum instream flow necessary to maintain anadromous fish life in the river, according to the annual prevailing conditions as they occur and determined by the Yakima Field Office Manager in consultation with the Yakima River Basin System Operations Advisory Committee, Irrigation Districts and Company managers and others.” This decision was extended later to specifically include all tributaries that support fish availability at the YN’s usual and accustomed fishing locations as set forth in ICC Docket No. 147. The priority date for the treaty fishing right is “time immemorial.”

3. The Court also quantified the on-reservation tributary rights of the YN, but did not apply the Practicably Irrigable Acreage standard in doing so. The Court also found that, as to the on-reservation streams, the treaty fishing right was not diminished.

4.5.3.2 Other Rulings

In addition to determinations on thousands of adjudication claims, numerous decisions by Superior Court Judge Walter Stauffacher, have been made (and some appealed) that affect water allocation and management in the Yakima basin and thus, must be considered and included in planning documents. Some of the decisions critical to the planning process are:

1. The Court also upheld the basic TWSA concept of the Decree (discussed above) which places all water into one "bucket" and then divides that bucket between "non-proratable" and "proratable" rightholders. The Superior Court found that, although some disagreement may have existed in the early stages of the Federal project formation as to whether "natural flow" rights would be satisfied from storage during times of shortage, the judgment in the Decree settled that issue in the affirmative. Discretionary review of that decision was sought in the Washington Supreme Court. The Commissioner thought the appeal was premature and, at this time, stated: "the care and thoroughness with which (the lower court's) opinion addresses the various contentions of the parties forecloses any characterization of the decision as probable error." The Superior Court decision may be subject to another appeal at the conclusion of the adjudication.

2. During the adjudication, the Court synthesized an approach to return flows that accommodated the defined legal precedents and a vast array of factual patterns. Return flow from foreign or imported water cannot be established. The United States believes that rights to return flow that derive from Federal project water cannot be established, except by the United States or by the permission of the United States. However, as to other types of return flow water that is diverted from a stream that is returning to that same stream, a right could be established, depending on compliance with State law.

3. The Court also determined that a general adjudication could bind the United States, even though it did not include an adjudication of groundwater rights. Therefore, groundwater rights were not considered and remain unadjudicated.

As of January 1997, approximately two-thirds of the total water rights claimants had been adjudicated.

Since the partial summary judgment ruling, the following have also been ruled:

1. An irrigation district or water company which has not used its full entitlement of water shall not have its water right diminished unless it is established that the entity abandoned or voluntarily failed to use the water without just cause and there can be no relinquishment by a claimant who supplies water for municipal purposes. The

regulation of water use by the United States to enhance carry over in the storage reservoirs shall constitute just cause.

2. Flood waters are part of the natural flow of the Yakima River which were withdrawn by the United States for the Yakima Project in 1905, and the major claimants, including the United States, may upon proper proof establish a water right in such flood water.

3. No distinction exists between natural flow and storage for the purposes of providing water for the YN's treaty-reserved water right for fish.

4. No YN surface water right in the Yakima River basin is subject to State law or oversight.

5. The YN enjoys a federally reserved, treaty-based right to an undiminished instream flow for Satus, Simcoe, and Toppenish Creeks to support fish and other aquatic life.

6. The YN's minimum instream flow right for fish in those tributaries that presently and actually support anadromous fish availability at the "usual and accustomed" fishing stations shall be determined in accordance with the annual prevailing conditions as they occur. The rights have been extended to cover flows for resident fish.

7. The YN's treaty-based water right allows the Yakima Field Office Manager to release stored water for flushing flows when they are absolutely necessary to maintain fish life in the Yakima River basin.

8. The water rights of the YN are affirmed and described by the Conditional Final Order, filed with the Adjudication Court on September 12, 1996. The Conditional Final Order incorporates the water right set forth in the Partial Summary Judgment, dated November 29, 1990; the water rights established in the Final Order re: Treaty Reserved Water Rights At Usual and Accustomed Fishing Places, dated March 1, 1995; and sets forth all of the remaining water rights of the YN.

4.6 SYSTEM OPERATIONS ADVISORY COMMITTEE

The System Operations Advisory Group (SOAC) was formed in 1981, as directed by the Quackenbush decision. SOAC is an advisory board to Reclamation consisting of fishery biologists representing the U.S. Fish and Wildlife Service (FWS), the YN, the Washington Department of Fish and Wildlife (WDFW), and irrigation entities represented by the Yakima Basin Joint Board (YBJB). The group's first product was the development of the flip-flop concept, in conjunction with Reclamation.

Reclamation provides a fishery biologist as a liaison to SOAC. Since 1981, SOAC has provided information, advice, and assistance to Reclamation on fish-related issues associated with the operations of the Yakima Project. Flows for maintaining fish life in the Yakima basin are determined by the Field Office Manager, according to the annual prevailing conditions, and in consultation with SOAC, irrigation district managers, and others. Phase 2 of the Yakima enhancement legislation (see section 4.7 below) in 1994 directed SOAC to develop a report on biologically based flow needs for fish in the basin. The report is complete.

4.7 LEGISLATION AFFECTING YAKIMA BASIN PROJECT

4.7.1 Yakima River Basin Water Enhancement Project

The YRBWEP was authorized by Congress by the Act of December 28, 1979, Public Law 96-162. The Act authorized the Secretary to undertake a feasibility level study of the proposed YRBWEP. Drought conditions that were prevalent throughout the Western United States at that time focused attention on the need for additional efforts to expand and assure adequate water supplies in the Yakima River basin.

The feasibility study was initiated in 1980. The YRBWEP study was divided into two phases. Phase 1 was comprised of the preliminary identification of water needs, available resources, and potential plan elements which could meet the needs. Phase 2 was composed of detailed studies of the more promising plan elements, the formulation and evaluation of alternative plans, and the identification of a preferred plan for consideration. Phase 1 was completed in August 1982, with the release of the Phase 1 Study Team report. Phase 2 was initiated in September 1982, and by early 1987, identification and analysis of potential elements had been completed at a preliminary level.

The Congress of the United States enacted Title XII of Public Law 103-434 on October 31, 1994 (appendix C). Title XII authorized Phase 2 of YRBWEP to protect, mitigate, and enhance fish and wildlife; and to improve the reliability of the water supply for irrigation through improved water conservation and management; and other appropriate means.

The major purpose of implementing water conservation measures is to reduce out-of-stream irrigation water diversions from the Yakima River and its tributaries. Savings achieved through improvements to water delivery systems and changes in operation and management will result in more water remaining in the stream and storage system. This saved water will be used to improve streamflows for fish and wildlife, and to improve the reliability of the irrigation water supply.

As of December 2000, 6 irrigation districts applied and received YRBWEP funding to develop water conservation plans on their districts. Four of the irrigation districts have completed their water conservation plans and 3 are in the process of investigating the feasibility of the conservation measures proposed to be implemented in the next 5 years. Funding of the feasibility investigation on one of the irrigation district's plan was deferred until it could be determined if improving instream flows in that particular reach of the river would be beneficial to fish. In 5 of the irrigation district plans, an estimated 131,000 acre-feet of water would be available for the beneficial use of improving instream flow and the reliability of irrigation water.

Another significant element of Title XII is the acquisition of habitat and water from willing sellers. This program is guided and directed through research being conducted by the University of Montana and Central Washington University.

Other elements of Title XII include increasing the storage capacity of Cle Elum Reservoir, constructing fish passage at Cle Elum reservoir, Kachess Reservoir augmentation, and Kachess Reservoir discharge modification; will further improve streamflows in the Yakima River basin. Title XII also includes some specific elements for implementation by the YN on the Yakama Indian Reservation.

Title XII also provided for the completion of two reports, with recommendations which shall provide a basis for the third phase of the YRBWEP. These reports are: 1) A report addressing the adequacy of the water supply available for sustaining the agricultural economy of the Yakima River basin, and 2) The Biologically Based Target Flow Report which has been completed by SOAC.

Title XII was modified in November 2000, to include the feasibility study for a pump exchange involving Kennewick and Columbia Irrigation Districts.

4.7.2 Endangered Species Act

Endangered Species Act (ESA) of 1973, as amended, Public Law 93-205. A species of plant or wildlife shall be presumed to be rare or endangered if it is listed in Title 50 CFR Sections 17.11 or 17.12, pursuant to the ESA as rare, threatened, or endangered. The ESA establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants, and the preservation of the ecosystems upon which they depend. Section 7(a) of the ESA requires Federal agencies to consult with the FWS, to ensure that the actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any endangered or threatened species or adversely modify or destroy their critical habitats. If such species are anadromous fish, consultation is required with the National Marine Fisheries Service (NMFS). Actions that might jeopardize listed species include direct and indirect effects, and the cumulative effects of other actions.

4.7.3 Clean Water Act

The Clean Water Act (CWA) of 1972, Public Law 92-500, as amended 1987, Public Law 100-4 had the objective “to restore and maintain the chemical, physical, and biological integrity of the Nations water.” The CWA sets national goals and policies to eliminate discharge of water pollutants into navigable waters and to achieve water quality levels to protect fish, shellfish, and wildlife while providing for other uses, such as recreation, where possible.

The Act contains the following important principles:

1. Discharge of pollutants to navigable waters is not a right. A permit is required to use a public resource for wastewater disposal. Agricultural returns are exempt from permitting, but not from polluting.

2. The discharge permit limits the amount of pollutants to be discharged.

3. Wastewater must be treated with the best treatment technology, which is economically achievable, regardless of the condition of the receiving water.

4. Effluent limits are based on treatment technology, but more stringent limits may be imposed if the technology-based limits do not prevent violations of applicable water quality standards.

5. Control of non-point source (NPS) pollution is addressed by states that have approved NPS Management Plans.

6. Lists of waterbodies not meeting water quality standards must be prepared, and updated every 4 years (the "303(d) list").

7. A Total Maximum Daily Load (TMDL) to address all listed waterbodies must be prepared (see below).

The State of Washington became one of the first states to be delegated authority by the Federal government to administer the requirements of the CWA. The Washington State Department of Ecology (WDOE) is the authorized State agency. WDOE is responsible for preparing wastewater discharge permits and for addressing NPS pollution.

WDOE is also given the statutory authority and the responsibility to set and enforce State of Washington water quality standards within the State's jurisdictional boundaries (Section 90.48.080 of the Revised Code of Washington [RCW]). These statutes support the water quality regulations found in the Washington Administrative Code, Chapter 173-201A, which specifically identifies the water quality criteria enforced by WDOE.

Total Maximum Daily Loads -

The 303(d) list is a list of the impaired waterbody segments and associated pollutants. TMDLs are water clean-up plans prepared to address each of the listed waterbodies and each of the individual pollutant parameters. These plans include estimates of the amount of a specific pollutant that a specific waterbody could receive without impairing water quality. TMDLs also include a technical evaluation to determine pollutant loading during critical periods, pollutant sources, the capacity of a waterbody to receive pollutants without exceeding standards, and allocations of that carrying capacity to the different sources. Seasonal variation must be addressed and a margin of safety included in the final allocation. TMDLs are used to set an enforceable limit on the amount of a specific pollutant that can be discharged.

In Washington State, there are over 1,500 waterbody segments and associated pollutants on the 1998 303(d) list. For the Yakima River and many of its tributaries, pollutants include high turbidity, low dissolved oxygen, high temperature, PCBs, pesticides, metals, pH, ammonia, and fecal coliform bacteria (FC). Several reaches within the basin also are listed for low instream flow. WDOE is in the process of developing and implementing TMDLs to restore water quality throughout the State and is using the TMDL process as one mechanism to attain State water quality standards in the Yakima basin.

State Water Quality Standards -

Washington State water quality standards have two primary components - characteristic uses (e.g., salmonid migration), and criteria (e.g., pH of 6.5 to 8.5). There is also an anti-degradation provision, to prevent backsliding. Both parts of the standards are important and separately enforceable. Of these, the standard for characteristic uses may be less understood. One example is the characteristic use of “salmonid migration, rearing, spawning, and harvesting.” The Environmental Protection Agency describes “full support” for cold water biota, including salmon, as that which supports “thriving, sustainable populations of species which would normally occur in cold water absent water column/habitat degradation. Full confirmation would include attainment of applicable numeric criteria and the presence of a biological community representative of what one might expect for that given ecosystem.”

Current Washington State water quality standards for characteristic uses and criteria are provided in table 4-1.

Table 4-1.–Water Quality Criteria and Characteristic Uses (WAC 173-201-A) for Class AA (extraordinary), Class A (excellent) and Class B (good), Freshwater Only

	Class AA	Class A	Class B
General Characteristic:	Shall markedly and uniformly exceed the requirements for all, or substantially all uses.	Shall meet or exceed the requirements for all, or substantially all uses.	Shall markedly and uniformly exceed the requirements for all, or substantially all uses.
Characteristic Uses:	Shall include, but not be limited to, the following: domestic industrial and agricultural water supply; stock watering; salmonid and other fish migration, rearing, spawning, and harvesting; wildlife habitat; primary contact recreation, sport fishing, boating, and aesthetic enjoyment; and commerce and navigation.	Same as AA.	Same as A, with these exceptions: 1) water quality must meet or exceed requirements for most (but not all) uses, 2) water supply includes only industrial and agricultural (not domestic) uses, 3) spawning for salmonids and harvesting of shellfish are not included, and 4) recreational use includes secondary contact (e.g. fishing or wading), but not primary.
Fecal Coliform:	Shall not exceed a geometric mean value of 50 organisms/100 ml, with not more than 10% of samples exceeding 100 organisms/100 ml.	Shall not exceed a geometric mean value of 100 organisms/100 ml, with not more than 10% of samples exceeding 200 organisms/100 ml.	Shall both not exceed a geometric mean value of 200 colonies/100 ml, and not have more than 10% of all samples obtained for calculating the geometric mean value exceeding 400 colonies/100 ml.
Dissolved Oxygen:	Shall exceed 9.5 mg/L.	Shall exceed 8.0 mg/L.	Shall exceed 6.5 mg/L.
Total Dissolved Gas:	Shall not exceed 110% saturation.	Same as AA.	Shall not exceed 110% of saturation at any point of sample collection.

Water Quality Criteria:

	Class AA	Class A	Class B
Temperature:	Shall not exceed 16.0 °C due to human activities. When conditions exceed 16.0 °C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3 °C. Increases from non-point sources shall not exceed 2.8 °C.	Shall not exceed 18.0 °C due to human activities. When conditions exceed 18.0 °C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3 °C. Increases from non-point sources shall not exceed 2.8 °C.	Shall not exceed 21.0 °C due to human activities. When natural conditions exceed 21.0 °C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3 °C. Increases resulting from non-point sources shall not exceed 2.8 °C.
pH:	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.2 units.	Shall be within the range of 6.5 to 8.5 with a man-caused variation with a range of less than 0.5 units.	Same as A.
Turbidity:	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10% increase in turbidity when the background turbidity is more than 50 NTU.	Same as AA.	Shall not exceed 10 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 20% increase in turbidity when the background turbidity is more than 50 NTU.
Toxic, Radioactive, or Deleterious Material:	Shall be below concentrations which have the potential singularly or cumulatively to adversely affect characteristic uses, cause acute or chronic conditions to the most sensitive aquatic biota, or adversely affect public health as determined by the department (see WAC 173–201A–040 and 173–201A–050).	Same as AA.	Same as AA.
Aesthetic Value:	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	Same as AA.	Shall not be reduced by dissolved, suspended, floating, or submerged matter not attributed to natural causes, so as to affect water use or taint the flesh of edible species.

4.7.4 Northwest Power Act

The Northwest Power Planning Council (NWPPC) was directed by the Northwest Power Act of 1980, to develop a program to protect, mitigate, and enhance fish and wildlife on the Columbia River and its tributaries. The NWPPC's programs have included the Yakima River Basin Fish Passage and Protective Facilities Program, the Yakima-Klickitat Fisheries Project (YKFP), subbasin plans of the Columbia River Fish Management Plan, and several activities within the Yakima River basin. Additional information on these programs is listed below.

Yakima River Basin Fish Passage/Protective Facilities -

Beginning in the early 1980s, the Reclamation, the BPA, the YN, the State of Washington, and local irrigation entities constructed fish ladders and screens pursuant to the Columbia Basin Fish and Wildlife Program adopted by the NWPPC in 1982. Under Phase 1 of this program, improvements to existing fish passage facilities and installation of new fish ladders and screens at 16 of the largest existing diversion dams and canals were completed by the fall of 1989.

Under Phase 2 of the program, improvements are being made to existing fish screens, and new screens are being installed at approximately 66 sites. These sites include a few Federal facilities (Reclamation and Bureau of Indian Affairs), but are primarily private canal companies or individually owned diversion structures.

Yakima-Klickitat Fisheries Project -

The BPA is funding the YKFP to undertake fishery research and restoration activities in the Yakima River basin. These facilities are operated by the YN and managed jointly by the YN and the State of Washington. This effort will construct, operate, and maintain anadromous fish production facilities to facilitate research activities designed to increase knowledge of supplementation techniques. These techniques would be applied to rebuild naturally spawning anadromous fish stocks historically present in the Yakima River basin.

The YKFP is one part of a comprehensive effort to restore fisheries resources by the BPA, the YN, the State of Washington, and Reclamation.

Columbia River Fish Management Plan -

Salmon harvest management in the river remains rooted in processes developed by the ongoing litigation *United States* v. *Oregon*. In the late 1980s, the Federal District Court of Oregon approved the Columbia River Fish Management Plan, which addresses harvest allocation and production strategies.

The Columbia River Fish Management Plan currently directs fishery protection and enhancement efforts by rebuilding upper Columbia River chinook, sockeye, coho, and steelhead runs, while assuring an equitable sharing of harvestable fish between treaty and non-treaty fisheries.

Current activities sponsored by the Columbia River Fish Management Plan in the Yakima River basin include programs for both fall chinook and coho salmon. The fall chinook program includes the production and release into the Yakima River of 1.7 million smolts from the Little White Salmon National Hatchery. Between 1983 and 1994, the smolts were transported and released directly into the Yakima River. The YN has developed acclimation facilities in the vicinity of Prosser Dam for final rearing and release of these fall chinook smolts. The coho program released 700,000 early-run coho into the Yakima River. This program is part of a larger effort to redistribute coho for release in upper Columbia tributaries rather than in the lower Columbia. Federal agencies, the State, and private entities have engaged in habitat improvement work throughout the Yakima River basin.

National Water Quality Assessment Program -

The U.S. Geological Survey has selected the Yakima River basin as part of its National Water Quality Assessment Program. The objectives of the program are to: 1) describe current water quality conditions for a large part of the United States' freshwater streams, rivers, and aquifers; 2) describe how water quality is changing over time; and 3) improve understanding of the primary natural and human factors that affect water quality conditions. The first round was developed during the 1988 to 1994 period. The second round will occur from 1999 to 2004.

4.7.5 Fish & Wildlife Coordination Act

Fish & Wildlife Coordination Act (FWCA) of 1958, Public Law 85-624. The FWCA requires consultation with the FWS or NMFS when any waterbody is impounded, diverted, controlled, or modified for any purpose. These two agencies incorporate the concerns and findings of the State agencies and other Federal agencies into a report that addresses fish and wildlife affected by a Federal project. Sections 1 and 2 of the FWCA mandate that fish and wildlife receive equal consideration with other project benefits throughout planning, development, operation, and maintenance of water resources development programs. Whenever Reclamation proposes to impound, divert, channelize, or otherwise alter or modify any stream, river, or other body of water for any purpose; Reclamation must first consult and coordinate its actions and projects with these two agencies and the affected State fish and game agency wherein the diversion or other control facility is to be constructed.

4.7.6 National Environmental Policy Act

National Environmental Policy Act (NEPA) of 1969, Public Law 91-190, as amended 1975, Public Law 94-83. NEPA provides a commitment that Federal agencies will consider the environmental effects of their actions. An Environmental Impact Statement (EIS) must be prepared for any major Federal action significantly affecting the quality of the human environment. The EIS must provide detailed information regarding the proposed action and alternatives, the environmental impacts of the alternatives, potential mitigation measures, and any adverse environmental impacts that cannot be avoided if the proposal is implemented. Federal agencies are required to demonstrate that these factors have been considered by decision makers prior to undertaking any action.

4.7.7 Federal Agricultural Conservation Program

The Environmental Quality Incentives Program (EQIP) was established in the 1996 Farm Bill to provide a single, voluntary conservation program for farmers and ranchers to address significant natural resource needs and objectives. The USDA Natural Resources Conservation Service administers EQIP.

The EQIP has provided $2,406,444 in cost share to farmers in Yakima and Benton Counties in the last 4 years (1997-2000). Over 90 percent of these cost share funds improved on-farm irrigation systems with irrigation water management on 10,075 acres. On field irrigation efficiencies have been improved by an average of 35 percent. In addition, soil erosion has been reduced from 100 tons/acre/year to less than 1 ton/acre/year on about 6,000 of the 10,075 acres.