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1997 Completion Report

Water Quantity Model Development

November 10, 1997

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
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Memorandum

To: Technical Work Group Members of the Klamath River Fishery Task Force and Water Quantity Model Partners

From: Dr. Marshall Flug, Hydrologist and Leader, Western Riverine Ecosystems Research Team

Subject: Task 11: Final Completion Report on Water Quantity Model Development

The attached subject report, Task 11, is provided in accordance with contract requirements of the FY '97 Interagency Agreement for the Development of a Water Quantity Model. This report is revised from the Draft Task 10 report, which was distributed on August 8, 1997, and comments on that Draft were due back to the USGS by September 12, 1997.

This Task 11 report contains an extensive Appendix of printed data files, as well as a computer disk that contains the data files for eight runs using the MODSIM Water Quantity Model. These runs include the Calibration and Validation runs, and six other alternative water management simulations which were provided by the Technical Work Group.

If you have any questions or feedback, please do not hesitate to contact Marshall Flug at (970)226-9391 Voice; (970)226-9230 FAX; or EMAIL: Marshall_Flug@usgs.gov.

Attachment

97 HP. 08

Project Title: Development of a Water Quantity Model

Task 11: Final Completion Report

Submitted by: Marshall Flug and John Scott

Date: November 2, 1997

Abstract

A Water Quantity Model (WQM) was developed for the Klamath River Basin for assessing water quantity related management alternatives in the recovery and maintenance of threatened and endangered fish species in the basin. The Biological Resources Division of the United States Geological Survey (USGS-BRD) developed under contract from with the United States Fish and Wildlife Service, with additional support from PacifiCorp and the Unites States Bureau of Reclamation. This WQM was primarily developed for the Technical Work Group of the Klamath River Basin Fisheries Task Force, who routinely interacted with and provided review and approval of each task in the modeling process. The WQM is a monthly water accounting computer model that simulates the operation of the river basin and reservoir system from Upper Klamath Lake to the Seiad Valley USGS stream gage.

I. Introduction

A. Project Background

The Klamath River Basin Fisheries Task Force (Task Force) represents Federal, state, county, Tribes, and anadromous fishery resource user groups. The Task Force has been directed by Congress to work with the Secretary of the Interior to restore Klamath River Basin anadromous fisheries to optimum levels by 2006. Since 1994, the National Biological Service (now the United States Geological Survey-Biological Resources Division {USGS-BRD}) has interacted with the Task Force primarily through its Technical Work Group (TWG). At its July 25-26, 1995 meeting, the TWG identified a high priority need to support the development of a water quantity model for the Klamath River Basin, including the major tributaries (Shasta, Scott, Salmon, and Trinity Rivers).

After the need to develop a water quantity model was identified, several exchanges of information and draft documents circulated among USGS-BRD, TWG, and Task Force. The current contract with the U. S. Fish and Wildlife Service (FWS) for development of a WQM became effective May 13, 1996. Additional support is also provided by PacifiCorp and the United States Bureau of Reclamation (BOR). The eight objectives described below are intended to meet the needs identified by the Task Force. Eleven

itemized Tasks, scheduled for delivery under the FWS contract agreement are consistent with the overall goals and objectives of the Klamath River Basin Conservation Area Restoration Program's Long Range Plan. The objectives draw upon the exchange of dialogue during 1995-1996 between USGS-BRD and the TWG, and the review and comments on the draft Task 1 document.

The BOR is concurrently upgrading their KPOP (Klamath Project Operations Plan) operations model; a water resources accounting model that will describe the features of the federal Klamath Project from Upper Klamath Lake to Iron Gate Dam. To avoid duplication of effort, this USGS-BRD project was initially limited to the Klamath River from Keno Dam to the Seiad Gage. However, after further consultation with the TWG, the BOR, and other basin interests, the scope of the study area was broadened to include Upper Klamath Lake and the major aspects of the Klamath Project operations. Inputs to this WQM will utilize measured (i.e., historic records) or simulated flows for the upstream portion of the basin consistent with the BOR operations. The major tributaries will not be modeled except as inflow points at their confluence with the Klamath River.

B. Enumeration of WQM Objectives

1. Create a WQM: Develop a tool capable of evaluating various historic and simulated river flow scenarios at selected points along the Klamath River. The Water Quantity Model is now the identified tool to accomplish this Objective.

2. Identify Important Flow Network Components: Provide an integrated flow network which identifies the physical interconnection of Klamath River system components. This identification will include specific river sections of interest; that is "nodes" and "links" that are of particular interest to various flow dependent resources. Defining such a network provides a good spatial description and shows the interdependency of flow dependent resources. All components of the water resources network must be identified to adequately account for water conveyance, water storage, deliveries in-stream and off-channel, power production, and to provide data for use by other tools in assessing impacts to water temperature, dissolved oxygen, and other water quality parameters, and other components of interest in defining fish habitat. In addition, the spatial locations that are important to these resource values should be identified within the flow network.

3. Compute Water Mass Balance: The flows at various river locations are needed to quantify impacts on flow dependent resources, fish habitats, water quality parameters, and other flow related needs important to restoration of anadromous fisheries in the Klamath River. Outputs from the WQM will include flows and storage of water on a spatial basis along the Klamath River and over time for different hydrologic alternatives. As such, the water storage and deliveries can be compared and differences between various natural hydrologic periods analyzed, as well as evaluating differences and impacts from simulating alternative hydrologic flow scenarios (i.e., newly proposed river management schemes). Additionally, the linkage of WQM outputs for use in

driving the other flow dependent resource models will provide a consistent and mass-balanced set of hydrologic values for comparing overall basin impacts. This overall comparison and evaluation falls under the responsibility of the Systems Analysis Model.

4. *Transfer a Usable Water Quantity Model:* Provide a documented, verified, and validated water quantity flow model that can be used in the future by concerned parties with a vested interest in Klamath River flows. The intent is to provide a working model that can be modified, if need arises, and can evaluate alternative hydrologic and water management schemes on a routine basis. This continued analysis is intended to support the planning and implementation of water management for the Restoration Program, under authority of the Klamath Act of 1982. The software selected and WQM developed will be capable of running on Personal Computers with specifications that can be found in the Bureau of Reclamation Klamath Area Office.

5. *Identify Physical, Legal, & Institutional Constraints:* In addition to the physical connections of the Klamath River System, the network model must identify operational policies, constraints, and limits, both legal and institutional, that influence the flow of river water between nodes and through linkages. This identification, enumeration, and quantification will provide a good compilation of possible points of restriction with respect to restoring the anadromous fisheries, or for other uses of water. Furthermore, this identification can provide an opportunity to quantify the influence of any constraint on deliveries of water to other points within the system.

6. *Support Linkages Between the WQM and Other Research Modeling Efforts:* Continue to interact with interested parties and other ongoing research efforts, with particular emphasis on specific data needed from the WQM. This effort will insure that there is a link between the WQM, and that its data outputs will serve as inputs and thereby help drive individual resource analyses (e.g., water quality parameters, fish habitat). Eventually the outputs of the flow routing and other linked resource models or analyses can be integrated into a complete Systems Analysis Model for the Klamath River Basin.

7. *Evaluate & Generate Flow Management Alternatives:* Interact with interested parties to identify specific flow alternatives (i.e., scenarios) that offer a potential for improving specific conditions or otherwise impacting resources in the Klamath Basin. Possible flow alternatives include Federal Energy Regulatory Commission (FERC) flow requirements; drought flow years; minimum or preferred flow alternatives for anadromous fish species; natural hydrograph patterned flows; and other new alternatives that will surface. After some initial analysis of select hydrologic flow scenarios using the WQM, other flow alternatives and water management modifications will be identified for possible further analysis.

8. *Promote Cooperation Between Lawful Users of the Klamath Basin's Water Resources & Those Concerned With Implementation of the Restoration Plan:* The WQM, which will provide one integrated model of water flow for the Klamath River

System, will allow individual users and interested parties to see the impact of a change in water use at one location upon other users elsewhere in the system. This link in hydrologic impacts should help sensitize cooperating parties to the importance of water flows on other vested interests. Throughout the development of the Water Quantity Model (WQM) there will be ample opportunity for comment and feedback from parties involved with the Task Force, Technical Work Group, and representatives of other water management agencies. This feedback and technical review, provided for in each of the eleven Tasks identified in the Project Contract, will foster some level of cooperation, dialogue, and hopefully provide some confidence in applying the model. In the end, all parties should be in agreement on the technical analysis and quantification of water volumes and flows that move through the Klamath River System.

II. Description of Study Area

The scope of the study area was initially limited to the mainstem Klamath River from Keno Dam to the Seiad Gage. The river points identified were the USGS gages shown in Figure 1, namely, the Klamath River (KR) at Keno, OR; KR below John C. Boyle Power Plant; KR below Iron Gate Dam; Confluence with the Shasta River; Confluence with the Scott River; and KR near Seiad Valley, CA. The system links are the river sections between each pair of adjacent river system nodes. After the receipt of written comments from the draft Task 2 report and from discussion during a presentation to the TWG at a meeting on August 1, 1996 in Redding, CA, the flow network was expanded in scope and detail. The scope of the study area was broadened to include Upper Klamath Lake and the major aspects of the Klamath Project operations. Modeling of the tributaries to the Klamath River remain as inflow points only. The network was expanded from 10 nodes to 30 nodes; and includes every node point identified from all of the written and verbal comments presented to date. This configuration is expected to accommodate the needs of other water quality modeling studies and provide data for river reaches in support of fish habitat studies. Inputs to the WQM utilize measured (i.e., historic records) or simulated flows for portions of the basin as needed. The WQM software has the flexibility to handle future expansion to capture the entire basin from Upper Klamath Lake to the mouth, including all major tributaries, if desired.

The additions to the model shown by the flow network diagram provide several water management alternatives that can be investigated to change the flow patterns and volumes in the river. The total operational storage of the original four reservoirs: Keno, J.C. Boyle, Copco and Iron Gate was only 13,555 acre-feet or about 1 percent of the average annual inflow to Upper Klamath Lake (Table 1 is a listing of the average annual hydrologic inputs to the system). By adding the active storage at Upper Klamath Lake, the available storage to manage river flow is increased to 500,383 acre-feet or 37 percent of the inflows (see Table 2 for a listing of storage values). Additionally, the only significant diversions from the system occur above Keno Dam in the BOR project area. (400,401 acre-feet in average annual diversions, while the annual returns or accretions to the system above Keno and below Upper Klamath Lake are about 235,079 acre-feet on

average). These agricultural and wildlife refuge diversions account for a net of 165,322 acre-feet annually in the 1961-1992 time period. Assuming that the development of the water quantity model was based on a perceived need to suggest and analyze potential management alternatives, the inclusion of these upper reaches is necessary to evaluate any system flexibility.

The WQM will combine water inflows, outflows, and storage of water to yield a mass balanced accounting of water at each node of the system. This accounting will include physical constraints on water delivery (i.e., passage) and legal restrictions on interstate deliveries, as well as other operational considerations. If the data are available to support definitions for out-of-basin transfers, fish instream flow needs, other environmental requirements, or for any other multi-purpose that can be defined, then a data-set could be created to support this simulation. Similarly, physical constraints on flow can be adjusted if it would be realistic for example to alter maximum or minimum flow through a power plant, or storage levels in a reservoir. This procedure combined with measured, gaged, or synthetic river flows is the heart of the WQM. These volumetric flows at various river locations are needed to quantify impacts on flow dependent resources, fish habitats, water quality parameters, and other flow related needs important to restoration of anadromous fisheries in the Klamath River.

The modeling environment selected allows the system to be described and analyses performed through the use of data-sets. Under this model architecture, analysis is not limited to any small subset of the water demands or priorities to meet these multi-purpose water demands. The capability exists for the model user to redefine a data-set and perform another model simulation of the Klamath River System for a different set of priorities, for different hydrologic sequences, and for adjustments to the data-set to alter other limitations on the flow network (e.g., increasing or decreasing turbine flows or by-pass flows).

III. Methods and Materials

A. Water Quantity Model Overview

The WQM for this study is a mathematical description of a river network which accounts for the inflows, storage, and released outflows of a river-reservoir system on a specific time step (e.g., monthly). The physical Klamath River system is represented by a network schematic consisting of discrete components representing a river control point, facility or a river section. A WQM simulates the distribution of water in a manner consistent with the hydrological, physical (e.g.., water conveyance, reservoir storage, or outlet controls), institutional (e.g., agricultural diversions and hydropower production), environmental (e.g., in-stream flow demands and lake levels), and legal allocations in a river basin. The WQM will provide users with the capability to simulate stream flow at selected points on the river or in a reservoir (i.e., nodes); thereby providing for the assessment of various historic and proposed future water management alternatives in a

river basin.

Task 4 required an identification of all appropriate water quantity models and a recommendation of one model for selection. Task 4 was completed, reviewed by the necessary entities, and the final task report was distributed on September 6, 1996. The model selected for use is MODSIM, developed at Colorado State University and previously applied by the USGS-BRD researchers to other river basins.

MODSIM is a general, multi-purpose, multi-reservoir simulation model, which will compute the amount of water at specified points (nodes) and water flows through specific river sections (links) of the Klamath system for each defined time step. The Klamath River Basin WQM has the potential to represent the natural Klamath River and tributary inflows. Operational features within the WQM can be defined by the user (or architect of the model) as varying in time, having seasonal or monthly values. Such Klamath River system operational features can include: reservoir storage volumes and controlled releases; physical limits on reservoir discharges (e.g., dependent upon outlet structures); limits on flows released to irrigation channels, diversion structures, or for delivery to consumptive use demands for agriculture, industrial, and municipal purposes; hydropower releases and power production levels; channel or river segment losses; and releases for instream purposes.

Simulation of water allocation within the WQM is performed by adhering to mass balance principles and by distributing water inputs according to a predefined set of operating criteria. These operating policies are defined by the user through a method of prioritizing the water demands of the Klamath River. Priorities can be assigned to water deliveries or use for hydropower, flood control, water quality, domestic and industrial water supply, irrigation deliveries, low-flow augmentation, instream or reservoir recreation uses, environmental requirements, fish and wildlife concerns, and inter-basin transfers. This prioritizing allows the user to evaluate alternative water basin management strategies by comparing water deliveries and impacts to resources from different operating policies under several alternative flow scenarios (e.g., high flow years, low flow periods).

The WQM is an important first step in an hierarchical process that provides resource management tools needed to determine the effects of changes in flow volume, time of flow releases and storage, and discharge on environmental and anadromous fishery variables; as well as to assess inputs to other water resource uses, including agriculture and hydropower generation in the Klamath Basin. Simulated water distributions analyzed with the WQM will provide realistic flow alternatives as input for driving data analysis in water quality and habitat models in the Klamath Basin.

The process for testing of the WQM was described initially in the Task 3 document, relating to the adoption of a QA/QC plan. The selected WQM was verified, calibrated and validated as reported in Task 8. Definitions of these terms and additional explanations are likewise provided in the Task 8 document.

B. Data Collection and Analysis

The process used to minimize potential errors in the application of flow data is described in the Task 3 document. Klamath River flow data are available from the USGS flow records in several formats; CD-Rom, hard copy, and on the Internet. (Additional criteria for data are discussed under the Task 3 report, concerning a QA/QC plan for the WQM data and model). The Phase I report (Compilation of Phase I Reports for the Klamath River Basin May 1995, and particularly the reports Klamath River basin Characterization of Hydrology Data from USGS Records) also included a thorough analysis of hydrologic flows for the Klamath River system and produced many of the needed data files. Data for the system was initially to rely upon gaged data records for the six USGS gaged sites identified earlier in this document. The expanded and revised Figure 1 flow network required other ungaged flow and accretion flow records to be generated. Measurements from topographic maps were made to determine the contributing areas for several subbasins and ungaged tributaries, which are now part of the network. This information was used to determine the accretion flows between these nodes on the network.

A considerable portion of the data needed for MODSIM in the upstream portion of the Klamath River (i.e., above Iron Gate) has been obtained from the BOR and their contractor, CH2MHill. The sharing of these data, which are used in the spreadsheet KPOP model will further insure that the results and comparisons between these two modeling efforts are meaningful. By use of the same input data set, many questions that may surface regarding model outputs and assumptions will be eliminated. Other flow data from operations performed at the reservoirs under the control of PacifiCorp will also be sought to help with identifying criteria and constraints.

As discussed in the Task 3 document, the use of reach net accretions in the WQM must be carefully evaluated. In MODSIM the net accretions to the major reservoirs (Upper Klamath Lake, Copco, and Iron Gate Reservoirs) have been adjusted for evaporation losses to estimate a natural inflow amount, since MODSIM calculates evaporation as a model output. The results of the Phase I report indicate that the remainder of the reach net accretions in the lower basin are not significantly impacted by recent system operations. Therefore, it should be possible to use the net accretions directly for the corresponding historical periods. If future operational scenarios are reasonably similar to what has occurred historically, then simple or multiple linear regression equations might be used to predict reach net accretions as a function of upstream conditions, such as reach inflow. These equations can be used to predict reach net accretions for different operational flow patterns. However, if future operational scenarios are very different in terms of seasonal water flows, the use of the computed net accretions will have to be reevaluated.

C. Relationship between Flow and Anadromous Fish Habitat

The overriding objective of the development and implementation of a WQM is to define

feasible river flow quantities and patterns under various management alternatives which enhance habitat for threatened and endangered species. Task 6 is entitled, "Coordinate and cooperate with BOR, PacifiCorp, and UC Davis in the integration of compatible water quality and habitat models at a time step appropriate to analyze the relationship between flow and anadromous fish habitat in the Klamath River".

Unfortunately, at this date the water quality and habitat studies are at an earlier stage in project development than this WQM. These other resource studies are still identifying river locations, collecting field data, and have not as yet established data outputs and results. However, several researchers, TWG members, the peer reviewer of this project, and other interested parties have provided feedback and comments. Most of these concerns were specific to Task 2 which addressed the Water Quantity Study Design and included a Flow Network specific to the Klamath River. A greatly expanded Flow Network included ten additional node points (river locations) in the river reach below Iron Gate Dam downstream to the USGS gage at Seiad Valley. A revised Flow Network for the Klamath River WQM was included with the previous Task 5 report. These ten node points were specifically requested by different individuals in support of the water quality studies and the fish habitat studies planned for 1997 and beyond. In addition, the USGS-BRD has been in close contact with water quality and habitat studies that involve other BRD staff and cooperators that have reported to the TWG.

The WQM was developed based on a monthly time step with the outputs provided in volumes of flow (acre-feet), rather than in flow rates (cubic feet per second) as in hydraulic models. There has been discussion of the potential need for output of results on a shorter time step, daily for example. The discussion has revolved around some method to pattern the monthly output results from MODSIM into daily flow volumes, but may not use the MODSIM model directly to calculate the results. Suggestions to divide the monthly flow volume by 30 or 31 for daily analysis are one method that can be used to generate average daily flow volumes. Alternatively, the historic daily flow records can be evaluated to help establish one or more weekly or daily flow patterns for specific time periods, such as for each month or season. For example, such a pattern could differentiate weekday from weekend flow releases corresponding to power demands. A similar method could also be employed to produce typical hourly flow volumes. All these methods produce average flow volumes in acre-feet per time period and not specifically instantaneous flow rates in cubic feet per second.

IV. Results and Discussion

A. Overview

The Water Quantity Model (WQM) for the Klamath River Basin is a computer software tool developed to simulate the hydrologic operation of the river and reservoir system on a monthly time step. Simulation models maintain mass balance at nodes for water flowing

into and out of the system and account for the time step transition of storage in reservoirs, according to the system state equation, $S_{t+1} = S_t - O_t + I_t$.

where, S is the storage in a reservoir node; for non-reservoir nodes, $S_{t+1}=S_t=0$

O is the total outflow from a reservoir or node

I is the total inflow to a reservoir or node

t is the time period.

Reservoirs are a specific type of node which allow for storage between time periods. The objective of developing the simulation model is to predict the response of the Klamath River Basin system to different hydrologic conditions, which may be advantageous to fish species under study in the basin. The changed conditions will be developed as management alternatives to be studied by simulation of the model. For the Task Force, the Technical Work Group (TWG), and other basin water users to have confidence in the outcome of management alternatives, the model must go through a testing period to verify and validate the outputs.

As discussed in the revised Tasks 2 and 3 documents of August 19, 1996, the process of model development included the phases of verification, calibration, and validation. These terms were specifically defined in those documents, including an example of the types of time series data that would be used in the processes. The revised Tasks 2 and 3 reports state that the calibration and validation processes would utilize time series of input data which would include at least a dry, average and wet year sequence. Additionally, the need to develop potential management alternatives was introduced as the objective for future analysis. Task 8 concentrated on the processes of verification, calibration, and validation, hereafter collectively termed the model development processes.

An important aspect in performing a model study is to select a study period which reflects the conditions of the system being modeled and includes the range of hydrologic conditions experienced by the system and expected to occur in the future. The 1961 to 1992 period was selected to study the Klamath River Basin because it included the river flow conditions as a result of the construction and operation of the Klamath Project irrigation system and the hydroelectric operations of the majority of the PacifiCorp reservoirs. Iron Gate Reservoir was not constructed until 1962. The range of annual net inflow conditions into Upper Klamath Lake (UKL) in acre-feet (AF) for this period are:

	Maximum (Year)	Minimum (Year)	Average (1961-92)
Annual Inflow to UKL	2,119,000 (1965)	575,000 (1992)	1,350,000

These inflow estimates are based on work done by CH2MHill under contract to the Bureau of Reclamation (CH2MHill, 1997).

The time step used for this study is one month, which is appropriate for a model to analyze the decision making for planning for operations. The results of this study may not be adequate for analyzing flow conditions required or desired for fish habitat. For shorter time steps real-time operations for the system must be modeled, which would

include river routing. This is the major difference in *hydrologic accounting models* (e.g., MODSIM) and *hydraulic routing models* (e.g., HEC-2). As was noted in previous task reports, this WQM will account for flow volumes in monthly time steps, which may be converted to flow volumes at shorter time steps based on general rules for dividing the flow volumes.

B. Verification, Calibration and Validation Processes

Verification is the first step in the model development process. The members of the TWG accomplished this step, along with the model developers, when the objectives of the modeling process and the spatial scope of the model were defined. The TWG specified the extent of the river to be studied from Upper Klamath Lake to the Seiad Valley Gage, the reservoir system to be modeled, and the various nodes along the river that should be included. The OTA report (1982) states that a model is "verified when it is determined that the designer's conception of the model is accurately embodied in the program written and run on the computer".

The present configuration of the Klamath River Basin modeled by MODSIM is shown in Figure 1. The major hydrologic inflow points in the system are flows into Upper Klamath Lake, the Shasta River and the Scott River. Tributary accretions are also included in their appropriate river reaches. The net inflow to Upper Klamath Lake has been calculated by CH2MHill from BOR records as the difference between change in reservoir storage and reservoir releases. Since MODSIM calculates evaporation losses as a function of reservoir surface area, this amount has to be added to the net inflow values. Similarly, where change in storage is known – for Copco and Iron Gate Reservoirs from 1967 to present – the gross accretions or inflows are calculated as the addition of the evaporation losses and the net accretions, which are the calculated differences between USGS gage flows at measured points in the Klamath Basin.

The input node, Large Springs, was included to reflect a known point source of inflows, the magnitude of which is estimated at 100 cfs. This monthly flow volume is subtracted from the net accretions to the system, which is the difference between the gages below JC Boyle (and below the springs) and the gage at Keno. In several months a negative accretion or loss to the system occurs as a difference between the gages and additionally several more months occur with negative accretions due to the springs subtraction. Both of these cases with negative accretions are modeled as demands in the MODSIM model. These are shown in Figure 1 as losses in the river reach.

The major reservoirs in the system are: Upper Klamath Lake, Copco Lake and Iron Gate Reservoir, with storage values shown in Table 2. Data for these reservoirs have been verified with USBR and PacifiCorp and reviewed at the February 1997 TWG meeting. The maximum and minimum levels for all the reservoirs have been set at their historical levels for the calibration and validation runs, although these levels are potential variables in the simulations of management alternatives. The major diversions from the basin are those for the Klamath Project in the upper basin at: A Canal, Lost River diversions and

returns, North Canal, and ADY Canal. The input data for the Klamath Project operations have been coordinated with the BOR's contractor, CH2MHill, and have been set at the historical levels for the calibration and validation runs.

The input data have been discussed with the TWG in a meeting on March 14, 1997, and these data distributed to all members and interested parties. Additionally, a memorandum was distributed on March 21, 1997 with explanation of data discrepancies noted at the March 14, 1997 meeting.

The calibration process is the phase of model building where the outputs are compared to the historical operations of the river and reservoir system. The OTA report (1982) further defines this process as where the "model must be 'fitted' or 'fine-tuned' to the specific characteristics of the real-world system being studied. Each model contains a set of 'parameters,' i.e., values of coefficients, that establish the relationship between the model's predictions and the information supplied to the computer for analysis. A model is considered to be calibrated when model results match experimental observations taken from the particular system under investigation." There are very few parameters that must be estimated for this system during this process. The parameters may be more accurately characterized as additional data requirements that are time invariant for the system or for specific nodes in the system, i.e., reservoirs and demands. The parameters which are estimated for the Klamath Basin MODSIM model are: evaporation rates, reservoir area-capacity-elevation tables (to the extent these are not "known" quantities from BOR/PacifiCorp tables), power plant efficiency tables, and priorities on meeting demands and filling storage.

The calibration period was chosen to be 1970-1979, a period of low, average and high water years and for which excellent records on system hydrology were maintained. The early period of 1961-1967 lacked tabulated reservoir storage levels at both Copco and Iron Gate Reservoirs, which compromised the analysis of the results. Additionally, the construction of the reservoir system was not finished until after Keno Dam was built in 1967 and Iron Gate Reservoir filled after construction finished in 1962.

The principal method in performing the calibration process for water resources systems is to set two of the three sets of time series data in the system state equation at their historical values and then comparing the third or remaining variable. In this system that means setting either the reservoir storage levels or the reservoir releases at historical levels, i.e., pre-determined targets with high priorities. MODSIM will attempt to hit these targets before filling any other system demands. For the Klamath River Basin model, the storage targets were set at historical levels and the reservoir releases were calculated by the model. Additionally, the inputs and demands to the system are set at historical levels. The solution algorithm employed by MODSIM minimizes the sum of all flows in the network. The sum of flows is essentially the product of the flow volume multiplied by the priority of the flow link (priority in meeting a target). Therefore, the solution algorithm chooses to meet demands with the lowest priorities first.

Since MODSIM calculates the reservoir releases and all other node outflows, the modeled Klamath River flow at these nodes is available for comparison to the historical time series at USGS gage sites. The USGS maintains gages throughout the Klamath River Basin, recording discharge and reporting average daily flow in cubic feet per second. Three river points were chosen to perform this comparison: first, the river point below Keno Dam where the USGS has maintained a gage continuously since October 1929; second, the USGS gage below Iron Gate Reservoir with a record of October 1960 to present; and third, the USGS gage at Seiad Valley with a continuous period of record from July 1951 to present. All three of these gages reflect the current development on the Klamath River with the closure of Iron Gate Reservoir in 1962 and Keno Dam in 1967. The results of the calibration process are detailed in the Task 8 report.

The validation process is the last step in model building. Its purpose is to develop general criteria and guidelines that the computer simulation model will use to produce acceptable operational results during the simulation of management alternatives. The OTA report (1982) defines validation as "the process of determining how accurately the model can predict real-world events under conditions *different* from those on which the model is developed and calibrated. To validate a model, a different set of field data is used as input to the model and the output is compared to actual observations of the new field conditions."

Whereas calibration uses the historical values for storage targets at the reservoirs as known input time series, during the validation process, rule curves are used to guide the operation of reservoir storage. These rule curves are developed from the historical time series and are specified as targets. The development of storage rule curves is an involved process that should be done to guide the operation of the reservoir system irrespective of this model study. Storage rule curves are generally envelopes of storage levels that guide the reservoir operators in making release decisions based on the knowledge of present storage level and some expectation of future inflows. Obviously, this would produce an infinite number of curves if all combinations of future inflow and reservoir storage levels were considered, especially when considering the combinations of multiple reservoirs. Extensive work to develop the curves was not expended during this study, rather general curves were developed and effort was concentrated on analyzing the simulation results.

The time period from 1980-1989 was selected to test the model simulation during the validation process. This ten year period also has dry, wet and average hydrologic conditions. The specific points in the river basin chosen during the calibration process to compare the model results to historical time series data will also be used during this validation. The calibration parameters; i.e., evaporation rates; reservoir area-capacity-elevation tables, where needed; and power plant efficiency tables are maintained at the values determined during that model development process. The results of the validation process are also in Task 8.

C. Management Alternatives Analysis

The purpose for going through the model development processes is to have confidence in the model's simulation of different input conditions in the analysis of management alternatives. Objective 7 of the WQM was to evaluate and generate flow management alternatives. Possible management alternatives include analyzing the system with different FERC flow requirements below Iron Gate Reservoir or elsewhere in the system; investigating the effects of drought years; minimum or preferred flow alternatives for Tribal Trust species; natural hydrograph patterned flows; and other new alternatives that will surface. The input time series or desired operational criteria selected for a management alternative may differ drastically from the historical operations and inputs used in the calibration and validation runs, but the MODSIM configuration is valid for these alternatives. The results of these management runs should, however, be analyzed to insure that they make sense and that the model parameters and results are still valid for these flows.

Minimum storage levels will be set at the physical minimums for Copco Lake and Iron Gate Reservoir as shown in Table 3 for many of the runs and storage targets at the main reservoirs may be altered to effect various habitat objectives. The new storage-area-elevation tables for Upper Klamath Lake (as provided by BOR, July 1997) are used in the management alternatives. The priorities for agricultural and refuge diversions will change relative to storage and in-stream demands depending on the management run.

Four main management alternatives with two subsets were identified and transmitted to the USGS-BRD on July 1, 1997. The alternatives for MODSIM WQM and water quality model runs are:

1. October 1996 to September 1997 using current operations plan. Model used actual historical WY97 data.
2. No diversions
    A. Low water year (1992)
    B. Average year
3. Maximum diversions
    A. Low water year (1992)
    B. Average year
4. Current operations-Average water year, but start out with the lake level at 4143 and decrease lake level one inch per month October1-September 30 to lake level 4142.

The input data to simulate alternative 1 was the actual historical data – no forecast data were prepared nor simulations performed for operation of the system at a midway point in time for WY97. Data for the operation of the Klamath Project and USGS stream gage data were used in the simulation run.

The FERC mandated flows below Iron Gate Dam (totaling 831,422 acre-feet) were assumed to have a higher priority than meeting lake levels at Upper Klamath Lake as listed in the 1992 Biological Opinion for all the management runs. Both of these

environmental requirements have higher priorities than agricultural diversions in the two runs of alternative 3. The FERC flows and the storage targets of alternative 4 also have higher priorities, and in the same order as for alternatives 2 and 3, than any diversions.

The MODSIM configuration for alternative 2A uses 1992 inflow data throughout, however, no agricultural or refuge diversions were made and no return flows at LRDC or Klamath Straights Drain come back to the system. The average year for alternatives 2B and 3B was chosen as 1989 based on the hydrologic record of inflows into Upper Klamath Lake.

For both alternatives of 3A and 3B, the maximum diversions were the historical diversions and return flows for the 1992 water year. Although the gross diversions were greater in several years than in 1992 (i. e., 1987, 1988, and 1991), the minimal return flows in 1992 (18,500 acre-feet) made the net effect of 1992 the maximum on record at 450,430 acre-feet.

General results of the management alternatives are:

1: Minimum stream flows below Iron Gate were met, in addition to all agricultural demands for the Klamath Project. The lake level targets for Upper Klamath Lake set by the USBR were also met. WY97 was unusually wet during the early winter months which added to reservoir storage and alleviated any summer season shortages.
2A: Minimum instream flows below Iron Gate can be met, however, storage targets at Upper Klamath Lake (UKL) and Iron Gate fall below desired environmental levels at UKL and operational targets at Iron Gate as shown in Figure 2.
2B: All storage targets are met and the instream flows below Iron Gate reservoir are as shown in Figure 3.
3A: Storage levels at both Copco and Iron Gate fall immediately to minimum levels (17448 and 35533 acre-feet, respectively). Active storage levels at UKL are shown in Figure 4. Instream targets and actual simulated flows below Iron Gate are shown in Figure 5.
3B: Storage levels are met at all reservoirs, instream flows are exceeded at Iron Gate and no shortages to agricultural diversions occur. Flow below Iron Gate is shown in Figure 5 for Run 3B.
4: Storage targets at UKL can be met and instream flows below Iron Gate Reservoir are also met. However, agricultural diversions during June, July, August, and September are shorted by 23,916; 51,287; 61,295; and 23,399 acre-feet, respectively, or 31, 89, 96 and 76 percent of the total agricultural demands during these months. It has been pointed out by BOR and CH2MHill personnel that this alternative may need refinement as to the initial storage levels and the pattern for UKL. It should be noted also that these storage targets are not sustainable in this pattern.

These management alternatives were simulated with MODSIM and the results are considered to be an accurate representation of the system's operation given the individual alternative's assumptions. Some configurations of hydrologic conditions, and in

particular the effects of flow conditions on biological factors, may dictate that multiple year, either two or three consecutive years, should be analyzed. This is especially true for environmental criteria or limits that change depending on multi-year hydrologic conditions.

V. Summary and Conclusions

Objective 8 of the WQM was to: "Promote Cooperation Between Lawful Users of the Klamath Basin's Water Resources & Those Concerned With Implementation of the Restoration Plan". The network model developed by this contract will provide one integrated model of water flow for the Klamath River System and will allow individual users and interested parties to see the impact of a change in water use at one location upon other users elsewhere in the system. This link in hydrologic impacts should help sensitize cooperating parties to the importance of water flows on other vested interests. In the end, all parties should be in agreement on the technical analysis and quantification of water volumes and flows that move through the Klamath River System. The WQM has gone through the model development processes and several management alternatives have been analyzed.

The objective of developing this water quantity model was to assess recommended alternatives to the existing operation of the system to improve endangered species. The majority of alternatives will change one or more of the following time series quantities:

1. the historical water deliveries,
2. return flows from diversions,
3. tributary accretion flows,
4. reservoir physical characteristics, or
5. reservoir operational policies and resultant outputs.

The database developed for this project includes the historical data for all of the above time series or physical constants.

While the management alternatives were configured with existing data, future alternatives may require that additional analysis be performed to determine time series for the above quantities. If the historical deliveries to agricultural or refuge use are changed, then the return flows from these areas will need to be estimated by either statistical or physical modeling. Tributary accretion flows, especially from the Shasta and Scott Rivers, will need to be re-formulated for various management alternatives. These may be estimated from "typical" year flows or from statistical time series generation.

References

Compilation of Phase I Reports for the Klamath River Basin - May 1995, Report Prepared for the Technical Work Group of the Klamath River Fisheries Task Force, River Management Section, NBS-Midcontinent Ecological Science Center, Fort Collins, CO.

Use of Models for Water Resources Management, Planning, and Policy, Office of Technology Assessment, U. S. Government Printing Office, Washington, D. C., 1982.

Appendices

Data Summaries

The available historical flow records for the gaging locations in the study reach are described in the Klamath River Basin Phase I Report (1995). The shortest record at any of the identified gages is approximately 30 years. Some required flow data for the model was not directly available from the USGS and was gathered from USBR records. Streamflow gages are not available at all desired locations within the study reach and gages are not available on all tributaries to the Klamath river. The calculation for these accretion files were described in previous task reports. Many of the time series data inputs to MODSIM have been distributed to the TWG prior to this Task report, although a full set of the input files for the calibration study is attached. Please see Figure 1 for a listing of the data files at the various nodes. Additionally, diskettes with the MODSIM data files are included with this report.

Figure 1.

SCHEMATIC FOR THE WQM - October 8, 1997

(names in parenthesis are node names and data file names in MODSIM)

❍ ← Inflow into Upper Klamath Lake (UKL_INF.inf)
❍ → A Canal Diversions (A_CANAL.dem)
Δ Upper Klamath Lake/Link River Dam (LINK_DAM.trg & LINK_DAM.inf)
■ West and East Side Powerplants
● Link River at Klamath Falls
Δ Lake Ewauna (L_EWAUNA.inf - L_EWAUNA.trg is constant at 1000AF)
❍← Lost River Diversion Channel: Diversions and Return Flows (LRDC.dem & LRDC.inf)
❍ → North Canal Diversions (NO_CANAL.dem)
❍← Klamath Straights Drain (KLAM_DRN.inf)
❍ → ADY Canal Diversions (ADY_CAN.dem)
❍ → Losses to Upper Basin (L_EW_DEM.dem)
❍ Klamath River Above Keno
Δ Keno Lake and Dam (KENO_DAM.trg constant @ 1000 AF)
❍ → Acc/Losses to Gage Reach (USGS_KEN.inf & NACC_KEN.dem)
● Klamath River below Keno
❍← Trib Acc Keno to JC Boyle (ACC_JCB.inf)
❍ → Losses to JC Boyle Reach (NACC_JCB.dem)
Δ JC Boyle/Topsy Lake (JCBoyle constant @ 3377 AF)
❍← Large Springs (LG_SPRGS.inf constant @ 6000 AF/mo)
■ JC Boyle Power Plant
● Klamath River below JC Boyle Power Plant
❍← Trib Acc JC Boyle to Copco (ACC_COP.inf)
❍ → Losses to Copco Reach (NACC_COP.dem)
Δ Copco Lake (COPCO_L.trg)
■ Copco Power Plant 1
Δ Copco 2 Forebay (COPCO_@.trg constant @ 74 AF)
■ Copco Power Plant 2
❍← Trib Acc Copco to Iron Gate (ACC_IG.inf)
❍ → Losses to Iron Gate Reach (NACC_IG.dem)
Δ Iron Gate Reservoir (IRON_GAT.trg)
■ Iron Gate Power Plant
● Klamath River Below Iron Gate

Node Index

● Gaged Flow
❍ Input/Output Node
Δ Reservoir
■ Power Plant

CONTINUED - SCHEMATIC FOR THE WQM - October 8, 1997

- Klamath River Below Iron Gate

❍ ← Bogus Creek Reach Acc (Bogus_Cr.inf)
❍ ← Willow Creek Reach Acc (Willow _C.inf)
❍ ← Cottonwood Creek Reach Acc (Cottonwo.inf)
❍ → Losses to Shasta River reach (NACC_SHA.dem)

❍← Shasta River near Yreka (Shasta_R.inf)

❍ ← Humbug Creek Reach Acc (Humbug_C.inf)
❍ ← Beaver Creek Reach Acc (Beaver_C.inf)
❍ ← Dona Creek Reach Acc (Dona_Cre.inf)
❍ ← Horse Creek Reach Acc (Horse_Cr.inf)
❍ → Losses to Scott River Reach (NACC_SCO.dem)

❍← Scott River near Fort Jones and Acc to Confluence (SCOTT_R.inf & SCOTT_Ri.inf)

❍ → Losses to Seiad Valley Reach (NACC_SEI.dem)
❍← Acc Scott River Reach to Seiad Gage (ACC_SEI.inf)

- Klamath River near Seiad Valley

Figure 2

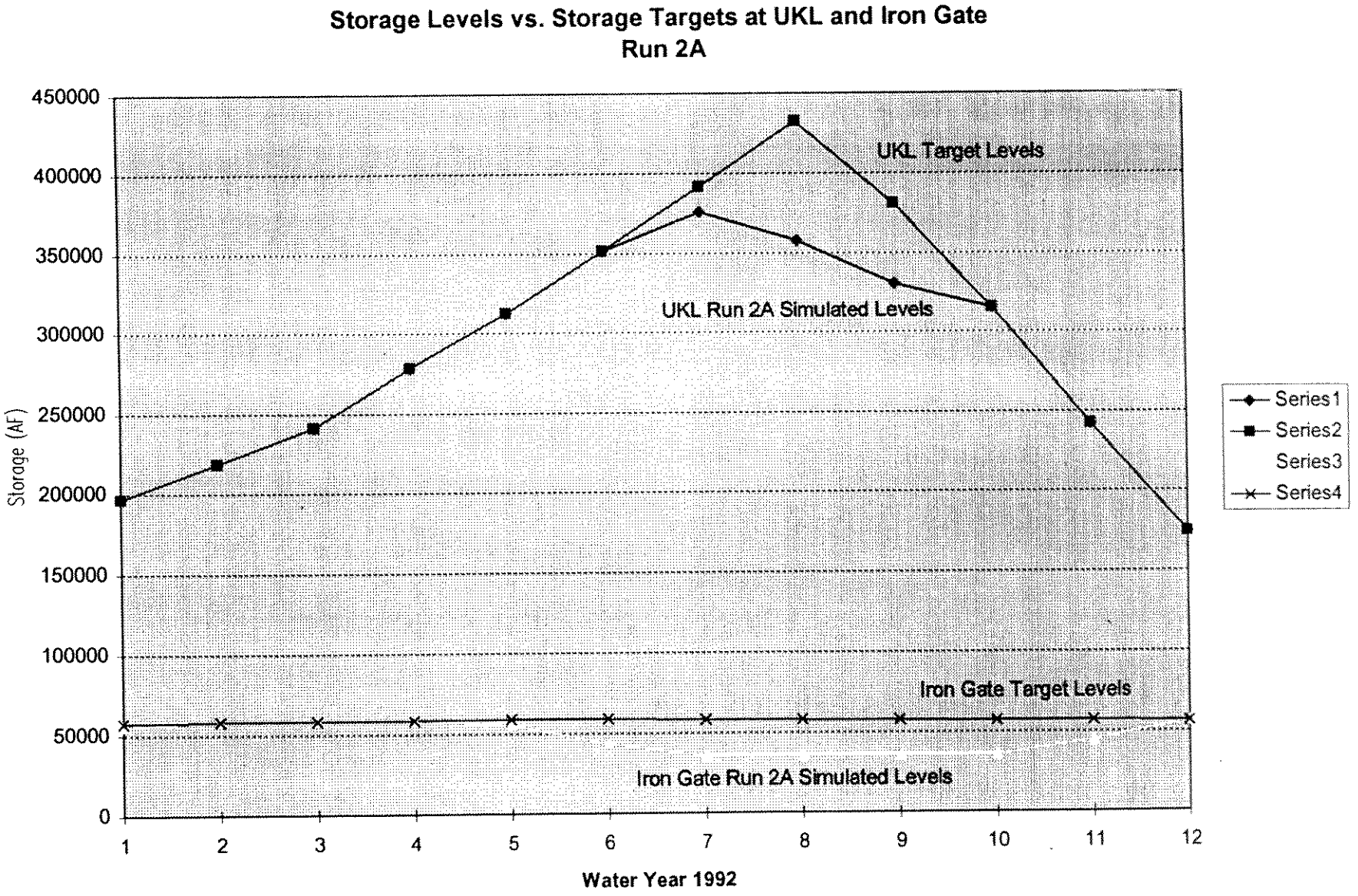
Storage Levels vs. Storage Targets at UKL and Iron Gate
Run 2A
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
Storage (AF)
UKL Target Levels
UKL Run 2A Simulated Levels
Iron Gate Target Levels
Iron Gate Run 2A Simulated Levels
1
2
3
4
5
6
7
8
9
10
11
12
Water Year 1992
Series1
Series2
Series3
Series4

Figure 3

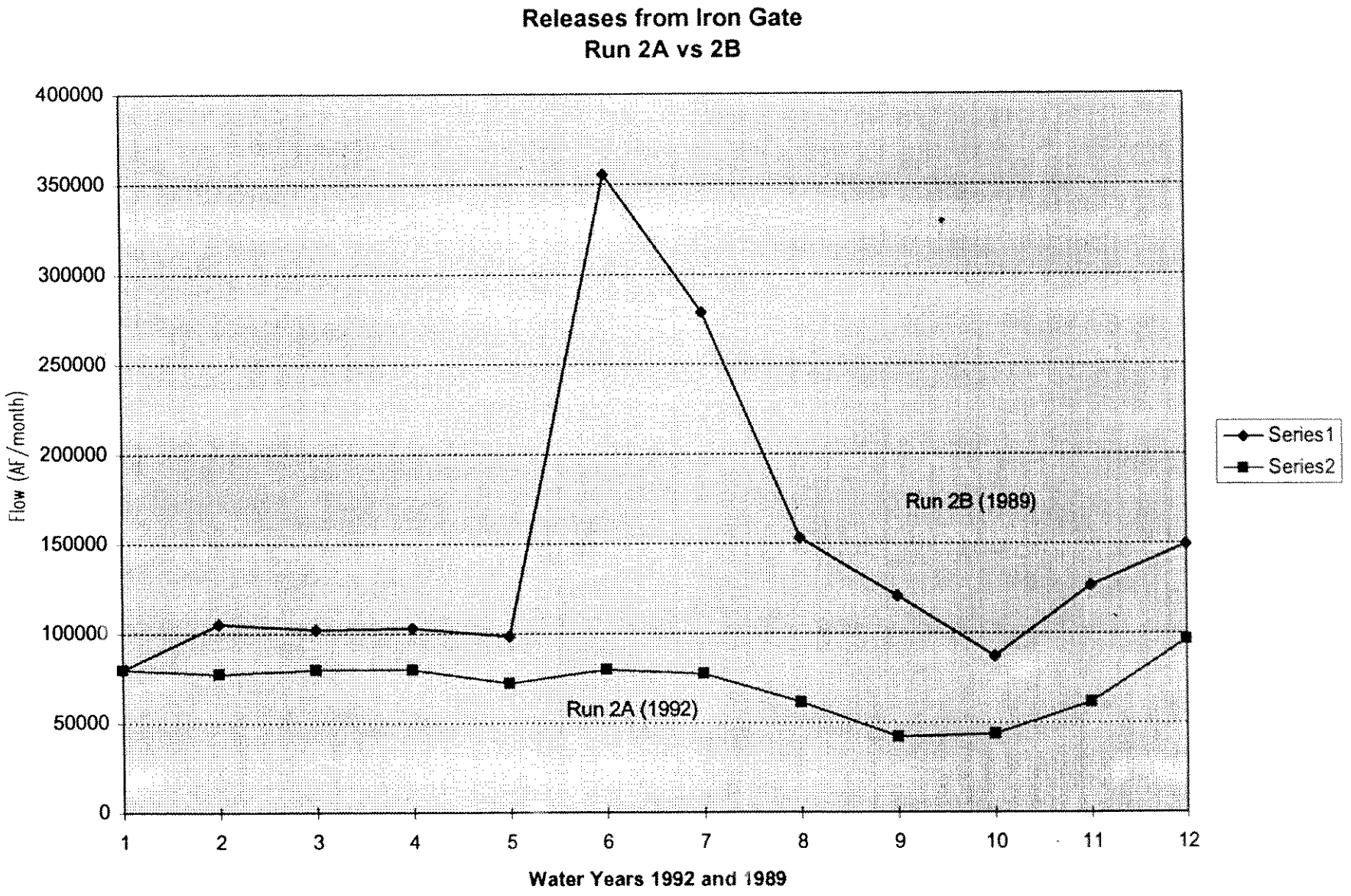
Releases from Iron Gate
Run 2A vs 2B
400000
350000
300000
250000
200000
150000
100000
50000
0
Flow (AF/month)
1
2
3
4
5
6
7
8
9
10
11
12
Water Years 1992 and 1989
Run 2B (1989)
Run 2A (1992)
Series1
Series2

Figure 4

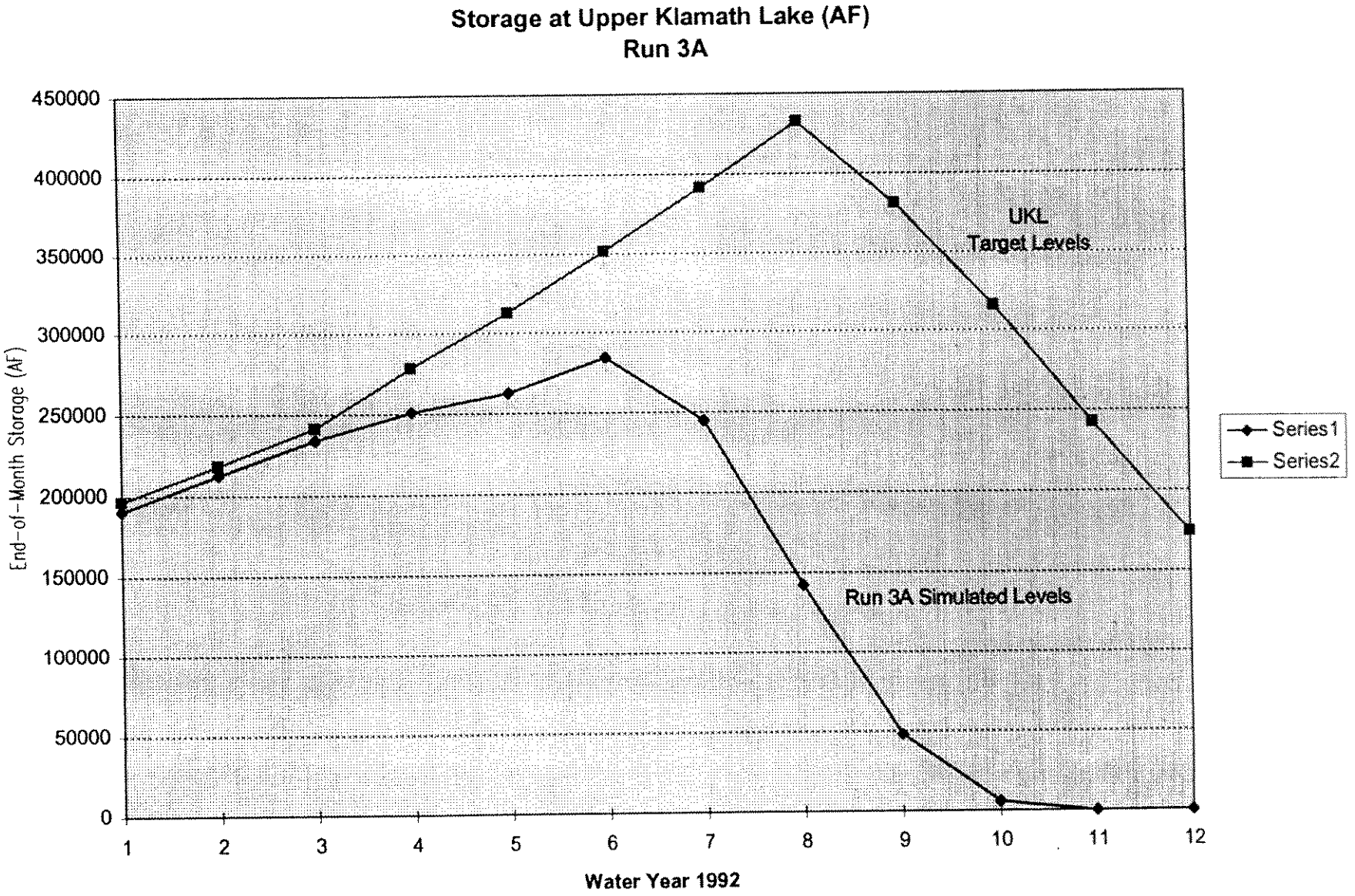
Storage at Upper Klamath Lake (AF)
Run 3A
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
End-of-Month Storage (AF)
1
2
3
4
5
6
7
8
9
10
11
12
Water Year 1992
UKL
Target Levels
Run 3A Simulated Levels
Series1
Series2

Figure 5

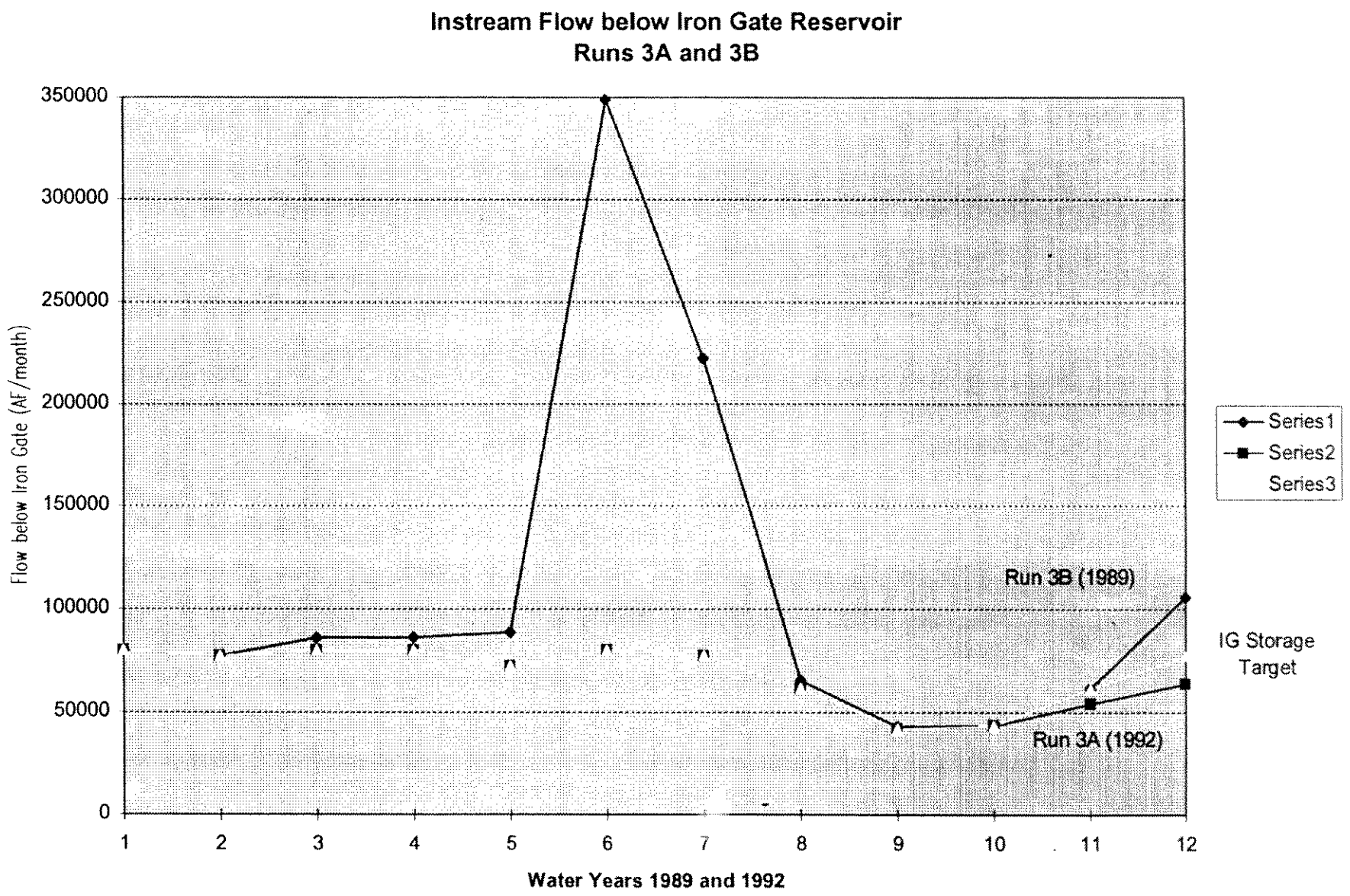
Instream Flow below Iron Gate Reservoir
Runs 3A and 3B
Flow below Iron Gate (AF/month)
350000
300000
250000
200000
150000
100000
50000
0
1
2
3
4
5
6
7
8
9
10
11
12
Water Years 1989 and 1992
Run 3B (1989)
Run 3A (1992)
IG Storage Target
Series1
Series2
Series3

Table 1

KLAMATH RIVER BASIN
WATER QUANTITY MODEL (MODSIM)
MASS BALANCE WATER ACCOUNTING

AVERAGE ANNUAL (1961-1992)
(Acre-feet) 8/897

INFLOWS:		
UPPER KLAMATH LAKE	1,345,656	
LOST RIVER DIVERSION CHANNEL	120,173	
KLAMATH STRAIGHTS DRAIN	114,906	
ACCRETIONS TO JC BOYLE REACH	161,321	
ACCRETIONS TO COPCO/IRON GATE REACH	220,596	
ACCRETIONS TO SHASTA RIVER REACH	175,577	
SHASTA RIVER FLOWS	137,096	
ACCRETIONS TO KR-SHASTA TO SCOTT REACH	210,468	
ACCRETIONS TO SCOTT RIVER-GAGE TO CONFL	277,762	
SCOTT RIVER FLOWS	448,827	
ACCRETIONS TO SEIAD VALLEY REACH	62,671	
TOTAL INFLOWS	3,275,053	
DEMANDS:		
A CANAL	268,128	
LOST RIVER DIVERSION CHANNEL	31,258	
NORTH CANAL	30,866	
ADY CANAL	70,149	
TOTAL DEMANDS	400,401	
OUTFLOWS:		
AT SEIAD VALLEY USGS GAGE	2,736,539	
TOTAL DEMANDS PLUS OUTFLOWS	3,136,940	
TOTAL INFLOWS-TOTAL OUTFLOWS		138,113

Table 2

KLAMATH RIVER BASIN
WATER QUANTITY MODEL (MODSIM)
RESERVOIR STORAGE DATA (Acre-feet)

8/8/97

RESERVOIR	MAX OPER	MIN OPER / MIN OUTLET	INITIAL	TARGET
UPPER KLAMATH LAKE	486,828	0	174,134/ variable	Biological Opinion Levels
LAKE EWAUNA	1,000	900	1,000	1,000
KENO RESERVOIR	18,500	15,000	17,000	18,500
J.C. BOYLE RESERVOIR (TOPSY LAKE)	3,377	1,870 / below 1,870 (penstock)	3,000	3,377
COPCO LAKE	45,390	40,632 (CAL) / 17,448 (MGMT) 17,448 (penstock)	42,746/ variable	Hist. Monthly Levels
-COPCO #2 FOREBAY	74	0	74	74
IRON GATE RESERVOIR	58,794	55,004 (CAL) / 35,553 (MGMT) 35,533 (penstock) 12,724 (lower fish intake)	56,339/ variable	Hist. Monthly Levels

APPENDICES

Task 11: Final Completion Report on Water Quantity Model Development

Hard copy printouts of "spreadsheet" data files for all "nodes" listed in the Klamath River Flow Network, Figure 1 of the main Task 11 report.

3 ½ " computer disk contents - MODSIM Water Quantity Model *.xy files

Klam_c.xy	Calibration file
Klam_v.xy	Validation file
Klam_1.xy	TWG Alternative Management Simulation Runs
Klam_2a.xy	"
Klam_2b.xy	"
Klam_3a.xy	"
Klam_3b.xy	"
Klam_4.xy	"

Net Inflows Upper Klamath Lake (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	74140	116360	129720	106340	133710	148820	110240	95010	77490	31490	43360	57780	1124460
1962	95790	120590	139310	108490	126660	131580	179490	116230	37830	24760	40650	50650	1172030
1963	161570	126190	176770	112630	185680	143120	197480	174320	64490	41980	41350	58510	1484090
1964	85450	127990	128230	141540	114240	119880	190370	96620	90250	31960	30020	54310	1210860
1965	82230	105910	428120	406870	321700	215080	157400	150900	78770	47840	58850	65780	2119450
1966	106820	148120	131680	121970	106420	163420	178130	83490	54780	30480	31310	59240	1215860
1967	74730	121710	149590	145970	134570	152450	171910	222410	127920	19840	24550	47610	1393260
1968	84450	88050	104650	111020	171420	145790	79110	63800	29300	14560	46710	47640	986500
1969	68810	104830	113480	141640	113480	143630	300090	185460	94720	18140	17250	50760	1352290
1970	85180	90760	154630	302290	199540	179050	108110	102290	60470	18930	21130	47960	1370340
1971	84310	159070	157040	215790	168790	234430	267950	261970	150890	58990	28770	65270	1853270
1972	92860	138780	158050	121910	252130	419500	205060	169620	88960	28560	42100	68420	1785950
1973	100460	126800	174700	171940	137840	153700	111050	92200	33640	25010	21900	56700	1205940
1974	96720	191750	214360	275590	174700	271430	305190	197130	112330	61290	46620	55050	2002160
1975	85860	109250	153670	154440	155070	236780	212600	229470	134780	54470	43760	65660	1635810
1976	111450	140440	165730	155330	146420	165450	143750	108330	61510	42470	83390	57610	1381880
1977	79750	106460	99140	93770	92530	110940	66930	81180	45210	10690	25500	59010	871110
1978	73330	123430	202980	218700	170080	199430	191530	136540	59840	38580	32640	71420	1518500
1979	67330	81460	98810	121250	108910	149160	97350	109440	23240	13960	26050	48580	945540
1980	85120	111130	110070	197150	167690	147600	119620	106730	57240	16510	12170	49030	1180060
1981	57100	87590	118450	106500	121390	108560	95210	71300	26890	4810	14450	37720	849970
1982	75360	130470	249140	150230	310530	284600	249740	206170	115790	59370	36930	64420	1932750
1983	97980	132620	173140	157150	216660	322800	259020	232960	174490	77530	64530	65950	1974830
1984	93200	164570	254140	163950	157890	297720	244080	229760	147710	51590	52410	70320	1927340
1985	112720	193430	140210	120670	118040	163180	242390	113720	66710	26190	19170	90920	1407350
1986	95880	116190	112300	168110	296020	328530	175390	131880	66240	26750	28090	83210	1628590
1987	92460	111750	117800	126730	133380	166980	116040	72850	50320	43460	26440	45450	1103660
1988	66510	82270	138160	132380	128020	128200	91560	74020	61870	2590	17850	37150	960580
1989	63770	122650	101710	102420	95810	300950	249980	158730	53680	7330	40400	61950	1359380
1990	79030	82640	94490	130590	97630	137490	99670	74640	32820	12310	42380	43380	927070
1991	59240	70310	81260	102040	82200	108430	79760	72480	30210	20400	11790	31470	749590
1992	51960	77510	79960	81060	68820	73940	65880	23560	-760	21240	5890	25900	574960
average	85674	119096	151609	155202	156499	189144	167565	132663	72176	30753	33700	56088	1350170
min	51960	70310	79960	81060	68820	73940	65880	23560	-760	2590	5890	25900	574960
max	161570	193430	428120	406870	321700	419500	305190	261970	174490	77530	83390	90920	2119450

	Oct	Nov	Dec										
1961	0	0	0	430	0	0	1870	6090	[illegible]	2320	[illegible]	10080	158720
1962	3610	2290	0	0	310	7760	5710	5950	4100	10730	7750	8560	97190
1963	4980	6250	9390	9730	4730	0	0	7990	6040	10820	7580	4080	58470
1964	4520	7520	11410	11000	29530	0	11010	7310	7150	10300	10570	6240	99040
1965	9910	1960	24190	50540	2780	1690	940	6890	8790	8820	6590	7180	50500
1966	14960	4970	9900	10460	1090	0	5990	7570	6500	10180	12430	7880	63330
1967	1360	8580	1510	4360	660	40480	0	12160	5950	10200	12240	8100	55490
1968	2090	4670	6370	3060	0	0	4340	6140	7580	10160	11970	5310	74020
1969	2480	120	0	0	0	1840	0	2760	10090	13890	9040	8380	124750
1970	2350	6640	0	4120	3760	470	1750	12950	12590	18910	12020	8970	83780
1971	4400	1610	2170	0	1820	1160	10420	16390	17200	9660	11150	7020	72470
1972	3050	5810	5940	710	3250	7960	12630	13290	12940	10130	11240	8310	83730
1973	4370	5970	11200	8680	1520	330	90	13970	12530	14790	3600	6360	92670
1974	6570	2430	4290	0	0	0	5020	14580	12260	22350	14310	0	78880
1975	2240	5150	7150	2950	3410	0	4680	2770	23170	13150	6060	1290	40930
1976	4200	5450	5080	7030	1800	1140	16320	8770	7900	7470	2120	0	36050
1977	0	9420	4920	1750	9960	7670	0	9220	6920	6250	2600	3260	20390
1978	0	0	3190	5860	0	3280	0	3050	4280	5160	4310	0	31230
1979	4180	3590	1720	1140	0	0	0	2300	5360	4500	0	0	12430
1980	0	0	19870	0	0	0	0	16040	4850	990	0	0	3030
1981	0	0	0	0	0	0	0	0	460	1720	310	0	5940
1982	0	0	0	5840	0	0	0	1000	0	5830	110	0	7050
1983	0	10980	0	0	0	0	0	0	0	3230	1120	0	12880
1984	0	0	0	0	0	0	0	0	2700	970	0	2140	24210
1985	0	0	0	0	0	0	0	1580	3190	16320	0	0	15870
1986	0	0	0	0	0	0	7140	2330	3420	6310	750	0	3010
1987	0	0	0	0	0	0	0	1690	7120	3010	0	0	9960
1988	0	0	0	0	0	0	0	0	0	5730	1140	0	3110
1989	0	0	0	0	0	0	0	0	2810	680	2430		
1990	0	0	280	0	0	0	0	0	0				
1991	0	0	0	0	0	0	0						
1992	0												
average	2352	2919	4018	3989	2019	2306	3042	6507	6951	8797	5874	3968	52742

Evaporation Losses from Upper Klamath Lake (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	14903	8686	6705	6759	11566	13311	22491	29988	35517	35196	30372	22013	237507
1962	15232	8689	6601	6645	11312	13051	22420	30585	36343	35683	30757	22225	239543
1963	15636	9092	6883	6902	11966	13743	22873	30680	36457	36409	31544	22722	244907
1964	15752	9031	6771	6703	11246	12692	21685	29675	36395	37222	32199	23132	242503
1965	15911	9110	7332	7722	12584	13158	21615	30083	36958	37931	33524	24176	250104
1966	16348	9054	6685	6665	11257	12907	22109	29813	35684	35885	31047	22421	239875
1967	15531	8899	6776	6822	11449	12973	22404	30651	37169	37495	32052	22868	245089
1968	15833	9046	6756	6754	11721	13360	21848	28607	33661	33520	29397	21410	231913
1969	14841	8666	6744	6943	11815	13311	22698	30782	37266	37731	32380	23098	246275
1970	15993	9053	6830	7190	12402	13593	22698	30811	36958	36959	31652	22625	246764
1971	15745	9092	6862	6927	11901	13524	22606	30367	37125	38222	33451	24179	250001
1972	16649	9375	6987	6871	11814	13480	22508	30607	37107	37622	32756	23629	249405
1973	16367	9328	7004	7047	11935	13400	22420	29944	35073	34597	30040	21908	239063
1974	15447	9122	7094	7230	12262	13643	22677	30527	37028	37849	33213	23965	250057
1975	16565	9356	6951	6930	11701	13244	22437	30476	37169	38213	33524	24172	250738
1976	16646	9402	6983	6935	11681	13170	22338	30228	36140	36275	32296	23922	246016
1977	16553	9310	6919	6933	11758	13455	22589	30155	36149	35739	30651	22231	242442
1978	15512	8999	6929	7061	12000	13490	22704	30629	36571	36587	31572	22833	244887
1979	15923	9076	6856	6955	11946	13500	22644	30381	35437	34651	29799	21151	238319
1980	14564	8594	6753	7041	12192	13636	22824	30731	36659	36583	31214	22279	243070
1981	15432	8860	6788	6967	12121	13796	22928	30505	35667	34865	29390	20415	237734
1982	14232	8650	7002	7200	12345	13826	22535	30447	37270	38109	32985	23744	248345
1983	16536	9365	6939	6948	11969	13527	22595	30672	37116	37986	33712	24560	251925
1984	16790	9347	6942	6959	11857	13477	22737	30643	37072	37767	33017	24100	250708
1985	16690	9331	6887	6871	11765	13477	22835	30709	36597	36292	31294	22896	245644
1986	16103	9257	6937	7031	12308	13829	22748	30636	36747	36636	31449	22774	246455
1987	15949	9161	6928	7026	12021	13540	22644	29945	35193	35383	30920	22283	240993
1988	15371	8789	6759	6990	12052	13643	22862	30578	36483	36037	30589	21778	241931
1989	14947	8741	6802	6929	11742	13325	22720	30760	36580	35917	30759	22319	241541
1990	15612	9000	6842	6982	11950	13547	22802	30381	36018	35608	30559	21991	241292
1991	15116	8646	6511	6558	11261	12854	21875	29668	35258	34879	30057	21289	233972
1992	14506	8478	6610	6747	11489	12976	21647	28203	31947	32747	28097	19899	223346
average	15726	9019	6855	6945	11856	13389	22485	30277	36213	36331	31446	22656	243199

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Target Storage for Upper Klamath Lake - Actual Historical End-of-Month Levels (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1961	169600	229900	261200	266900	362300	447600	463600	447600	398100	289700	231900	195100
1962	188400	193100	228500	221600	317500	421800	478700	501600	422600	319700	261200	209300
1963	286100	294800	319000	307900	443400	473700	496600	494900	440100	373300	307900	264800
1964	264800	284700	252100	238200	273200	362300	426800	448500	480400	407000	349200	301300
1965	274700	316000	540700	499900	429300	343000	435900	486400	496600	456000	433400	370100
1966	317500	244400	233300	230600	285400	407000	445900	445100	416000	349900	267600	243000
1967	221600	260500	279700	291900	302800	411900	486400	501600	501600	411100	327900	275400
1968	277500	279700	246500	278200	396400	425100	388400	366200	290400	200500	184300	163600
1969	164900	229900	288300	356100	363900	445900	497400	505900	506700	427600	346900	297700
1970	302800	258400	319000	447600	430900	448500	494900	511800	471100	392400	294800	257700
1971	269700	311600	287600	349200	394000	468600	460200	494900	504200	475400	407000	396400
1972	355300	353000	323500	282500	418500	432600	481300	501600	495700	428500	383600	346100
1973	351500	341500	346900	360700	391600	440100	460200	445900	358400	268300	203200	202500
1974	237500	351500	377200	412800	427600	464400	475400	498300	491500	453500	404600	370100
1975	365400	337000	324200	322700	362300	430900	472000	495700	507600	471100	418500	384400
1976	367000	350700	324200	326400	354500	420200	467800	471100	433400	367800	398100	370900
1977	362300	318300	320500	328700	374100	472000	454300	476200	429300	317500	247200	224400
1978	234700	298400	343000	370900	398900	455200	488900	496600	449300	380400	301300	294100
1979	285400	287600	307200	349200	406200	450100	484700	472000	367000	262600	183600	138900
1980	150900	222300	302100	390800	430900	459400	503300	494000	460200	369300	263300	218200
1981	217500	244400	303500	356900	445900	484700	494000	477100	383600	266900	152200	97300
1982	144900	263300	398900	377200	487200	451000	466900	497400	519500	453500	382000	363100
1983	367000	338500	313100	342300	419300	443400	483800	506700	491500	466100	442600	412800
1984	366200	331700	323500	340700	390800	460200	488900	498300	495700	441800	396400	396400
1985	363100	327900	289000	316800	383600	467800	496600	498300	450100	353000	300600	307900
1986	325700	340000	309400	382000	472000	466900	483800	502500	460200	374100	291900	291200
1987	296200	321200	324200	370100	405400	461000	473700	432600	382800	338500	266200	216100
1988	201900	223700	305000	366200	417700	474500	494000	485500	451800	324900	230600	172200
1989	170900	255600	302100	340700	360000	453500	493200	507600	439300	327200	254200	235400
1990	252800	281100	304300	363100	393200	475400	483800	472800	420200	313100	237500	189700
1991	176900	194400	180300	225700	291900	390000	427600	446800	374900	281800	193100	142900
1992	138900	191000	238900	281100	330900	398100	388400	313100	224400	178300	108500	89400
average	264675	283628	306778	334238	386300	440838	469919	474831	437944	360650	295978	263700
MAX	367000	353000	540700	499900	487200	484700	503300	511800	519500	475400	442600	412800
MIN	138900	191000	180300	221600	273200	343000	388400	313100	224400	178300	108500	89400

Positive Inflows to Lake Ewauna (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	70	2740	5830	0	5750	2860	0	0	0	0	0	0	17250
1962	0	0	490	580	6380	8190	0	0	0	0	0	0	15640
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	1500	0	0	0	0	0	0	1500
1965	0	0	0	0	0	16770	4540	0	0	0	0	0	21310
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	470	0	0	0	0	0	0	470
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	180	330	260	3580	4380	0	0	0	0	0	8730
1970	0	0	350	0	3080	0	0	0	0	0	0	0	3430
1971	0	0	0	890	0	0	4890	0	0	0	0	0	5780
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	3860	0	0	0	0	0	0	0	0	3860
1975	0	0	0	0	890	12630	0	0	0	0	0	0	13520
1976	0	0	0	0	0	1220	0	0	0	0	0	0	1220
1977	470	0	0	0	0	0	0	0	0	0	0	0	470
1978	2950	1100	0	0	0	0	0	0	0	0	0	5480	9530
1979	0	0	0	0	3520	0	2390	0	0	0	0	0	5910
1980	3930	5390	0	3760	10020	3660	2060	0	0	0	0	2780	31600
1981	5040	5520	8810	8610	10160	5220	2430	0	0	0	0	0	45790
1982	4990	9120	16950	0	6770	16850	18480	0	0	0	330	210	73700
1983	710	0	6610	4050	10590	25010	20690	290	0	0	1780	5350	75080
1984	640	12180	48510	24310	24190	30070	18660	0	770	0	0	7070	166400
1985	22230	33160	20020	10620	10560	13330	11830	1820	820	0	0	5450	129840
1986	6260	7590	8110	6170	24230	32190	8000	2700	0	0	0	6890	102140
1987	15770	9230	7930	10560	7500	10310	0	0	0	0	4840	6370	72510
1988	5450	6050	13350	9480	11600	8640	5410	0	0	0	50	0	60030
1989	2920	8230	8770	13110	10740	44810	28720	0	0	0	0	3230	120530
1990	4470	2450	3690	3210	4630	7250	810	20	3310	0	750	3380	33970
1991	5180	7840	0	1760	3600	9230	3790	4680	0	0	0	3590	39670
1992	10530	11540	16640	15430	5620	12540	9000	1090	100	0	0	1130	83620
average	2863	3817	5195	3648	5003	8323	4565	331	156	0	242	1592	35734

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Diversions to Lost River Diversion Channel from Klamath River (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	0	0	0	0	4000	0	9310	7090	0	0	20400
1962	0	0	0	0	0	0	0	0	13270	6990	0	0	20260
1963	0	0	0	0	0	0	0	0	15780	7790	1310	0	24880
1964	0	0	0	0	0	0	0	0	0	10660	0	0	10660
1965	0	0	0	0	0	0	0	0	0	2240	0	0	2240
1966	0	0	0	0	0	0	10060	0	6860	3470	0	0	20390
1967	0	0	0	0	0	0	0	0	9660	13400	0	0	23060
1968	0	0	0	0	0	12770	13230	0	11900	5040	0	0	42940
1969	0	0	0	0	0	0	0	0	0	4280	0	0	4280
1970	0	0	0	0	0	0	0	0	10420	10350	0	0	20770
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	5110	0	0	0	5110
1973	0	0	0	0	0	0	5050	0	11880	10040	0	0	26970
1974	0	0	0	0	0	0	0	0	18440	4470	0	0	22910
1975	0	0	0	0	0	0	0	0	12000	0	0	0	12000
1976	0	0	0	0	0	0	9970	0	4490	6920	0	0	21380
1977	0	0	0	0	0	2720	19990	0	930	6700	0	0	30340
1978	0	0	0	0	0	0	0	0	12870	7280	0	0	20150
1979	0	0	0	0	0	0	3850	8680	26580	19520	6690	600	65920
1980	0	0	0	0	0	0	0	280	10700	15390	5190	0	31560
1981	0	0	0	0	0	0	4370	2360	24100	21340	14090	6370	72630
1982	0	0	0	0	0	0	0	820	7950	5730	4340	0	18840
1983	0	0	0	0	0	0	0	0	8710	10930	0	0	19640
1984	0	0	0	0	0	0	0	0	5370	14770	0	0	20140
1985	0	0	0	0	0	0	0	2620	14570	19590	310	0	37090
1986	0	0	0	0	0	0	1400	0	15860	12840	1930	0	32030
1987	0	0	0	0	0	0	12590	3970	10190	4750	8420	0	39920
1988	0	0	0	0	0	0	6360	940	16200	16310	7290	0	47100
1989	0	0	0	0	0	0	0	0	20340	17750	3880	0	41970
1990	0	0	0	0	0	0	6560	0	16910	22260	4080	0	49810
1991	0	0	0	0	0	0	13660	1270	21760	23220	17700	8150	85760
1992	200	0	0	0	0	0	22400	22470	23950	17060	18910	4110	109100
													31258
average	6	0	0	0	0	484	4172	1357	11441	10256	2942	601	31258

Inflows to Klamath River from Lost River Spills (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	3750	6420	11880	8300	12720	6140	0	8490	0	0	5310	10540	73550
1962	8940	8170	12320	8450	22110	16290	1200	11170	0	0	5120	6970	100740
1963	40030	10350	15970	8130	20940	6620	10630	9590	0	0	0	11760	134020
1964	10420	8940	8040	10050	8080	20670	6110	6740	6050	0	8060	10100	103260
1965	7320	8420	50940	69970	45170	11850	7410	10590	4030	0	10340	13970	240010
1966	9350	7280	8520	12430	8430	11110	0	3100	0	0	3550	13130	76900
1967	10070	6250	17000	14800	14020	20290	8160	11540	0	0	950	9590	112670
1968	12080	6010	7190	9680	13560	0	0	8580	0	0	13580	11230	81910
1969	12700	7920	10360	22850	20450	34830	17540	9840	1570	0	6780	13920	158760
1970	14430	8510	21170	59600	30630	23450	2710	12370	0	0	3380	12930	189180
1971	13590	12500	18500	25940	12170	46940	49020	20890	2510	5980	22250	43970	274260
1972	20280	9800	11200	31030	28620	81650	9720	11560	0	4840	14910	22640	246250
1973	14670	9410	12400	12400	13050	7390	0	810	0	0	4440	14800	89370
1974	12670	14240	19640	19250	10870	28780	35540	9870	0	0	8220	15420	174500
1975	14070	7640	8770	8830	16850	27780	7780	8150	0	2040	11610	17540	131060
1976	15470	10220	10150	9920	9900	10460	0	1800	0	0	18610	15200	101730
1977	14140	6000	7330	7020	6120	0	0	8690	0	0	3490	9550	62340
1978	10200	7520	21470	23230	12110	18490	21460	7090	0	0	3060	14420	139050
1979	11650	5950	8350	10830	6790	7570	0	0	0	0	0	0	51140
1980	9550	10080	10700	24890	20380	10370	160	0	0	0	0	7160	93290
1981	8850	4890	6580	5720	9240	6940	0	0	0	0	0	0	42220
1982	8900	16090	33190	10150	53430	19050	52090	0	0	0	0	10850	203750
1983	9660	8150	13680	19910	53800	66680	31330	14190	0	0	4550	8680	230630
1984	14570	10250	53770	37880	17730	27080	25490	8190	0	0	4690	27360	227010
1985	32650	17090	11660	7880	12650	11120	6430	0	0	0	0	10260	109740
1986	8810	5640	6680	10660	37410	39310	0	2300	0	0	0	12190	123000
1987	7270	5180	5650	6690	9470	6770	0	0	0	0	0	7760	48790
1988	4240	3610	5550	8410	13080	2970	0	0	0	0	0	3590	41450
1989	4170	6200	6150	5240	13530	33790	7330	2860	0	0	0	11770	91040
1990	8680	4900	5110	11910	7220	12440	0	350	0	0	0	3670	54280
1991	7460	3720	2630	5330	4340	3740	0	0	0	0	0	0	27220
1992	0	2880	2890	2990	2740	900	0	0	0	0	0	0	12400
													120173
average	11895	8132	13920	16574	17738	19421	9378	5899	443	402	4778	11593	120173

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Diversions to North Canal from Klamath River (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	2300	1200	2900	6300	2300	1000	700	1000	2300	3400	2100	800	26300
1962	800	1500	1700	6400	3400	1400	500	1400	2300	3300	2200	900	25800
1963	600	1600	1400	8000	2700	200	100	400	2300	3300	2000	700	23300
1964	400	900	3000	7200	3600	700	300	1300	1300	2900	1900	1000	24500
1965	500	500	1000	5500	800	1000	200	1100	2200	2400	1200	1100	17500
1966	1200	1000	1500	3300	2300	900	1600	1700	2100	3400	6800	1900	27700
1967	1700	400	3400	3100	2200	200	100	500	2400	3000	3600	1700	22300
1968	1100	800	1500	5900	4900	800	1600	1800	3200	3800	2700	1500	29600
1969	1000	400	400	6700	2800	1300	800	1800	2300	3900	4600	2300	28300
1970	1900	1900	2600	4700	1400	300	900	1600	3400	3700	3900	2300	28600
1971	4200	1100	1700	1200	1800	300	400	1300	1700	4600	5000	3400	26700
1972	1100	1800	1600	1400	2100	200	400	1800	3200	4400	3300	2500	23800
1973	1100	2600	3400	2700	1300	500	1100	4100	3800	4000	3900	1800	30300
1974	2700	2500	3000	1100	500	400	600	1900	4200	3700	3200	1500	25300
1975	5000	3500	1900	1600	2900	700	500	2000	4800	2800	3000	2500	31200
1976	700	4700	4200	3700	2300	0	1200	2600	4200	4000	400	1400	29400
1977	1400	2100	4700	4000	4000	1300	1900	800	3100	4400	4300	3000	35000
1978	1500	5100	2800	1600	800	800	200	1800	2600	4200	3800	2900	28100
1979	2600	3200	4900	3200	3600	800	1200	2000	4800	5000	3000	3300	37600
1980	4300	1800	3600	5100	2000	400	600	2100	3000	4300	2600	2100	31900
1981	1900	5900	5900	5800	600	300	1100	1100	4200	4900	3600	2100	37400
1982	800	3800	6900	4300	0	0	400	1800	5300	2100	2800	2100	30300
1983	1300	3500	8700	2500	0	0	700	1500	4200	3300	2700	2000	30400
1984	3100	2700	6400	2500	0	200	900	1700	4700	3500	3100	3200	32000
1985	3100	2100	3100	1700	3800	700	1600	4200	4200	5200	2100	1600	33400
1986	1600	8400	3200	2100	1400	800	1300	3000	6200	5900	3300	2300	39500
1987	7800	5000	6200	3400	1400	600	2900	3500	5400	3600	4000	3700	47500
1988	2900	3800	7100	5100	1400	2300	2400	3700	3600	6000	3800	2900	45000
1989	2800	1300	300	2900	6100	2900	1600	1300	4900	2900	1300	1700	30000
1990	900	900	700	3800	6100	2800	2000	2100	3100	7100	2700	2900	35100
1991	1400	1700	6500	2000	1300	6100	3900	1100	4100	5600	4100	3000	40800
1992	1900	500	4300	5400	5800	1200	800	3400	4400	2900	1700	800	33100
average	2050	2444	3453	3881	2363	972	1078	1919	3547	3984	3084	2091	30866

Inflows to Klamath River from Klamath Straights Drain (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	7800	12600	13800	8200	16500	14700	7700	17800	6700	2600	2500	1500	112400
1962	3800	14000	15000	1700	8000	18300	12500	4100	2800	3500	4400	1900	90000
1963	11000	18400	19000	12400	14200	18800	9300	7000	1600	1500	2300	1400	116900
1964	7000	17600	7200	8100	14000	18400	6400	4600	10600	4200	3900	3300	105300
1965	900	12600	8400	17300	16200	18800	18800	17300	10100	13600	15300	8100	157400
1966	6100	14700	13800	2000	11700	16900	5500	3200	4200	6800	5600	5400	95900
1967	1500	8100	15700	15200	12000	17400	7300	18000	4300	2900	4500	6600	113500
1968	7200	8800	6100	9100	13100	45400	3300	2700	4400	4900	7700	9500	122200
1969	3800	15100	11100	9100	16700	18600	12300	13100	7400	13000	10400	10200	140800
1970	15200	11000	11700	18800	17100	18600	10300	17200	10600	13900	4700	9000	158100
1971	10800	17800	18200	8900	13900	13600	4100	15700	8200	6100	5700	8200	131200
1972	11900	17700	15400	10400	17200	18700	9000	11300	4200	5500	7600	11000	139900
1973	1500	14800	17000	14700	12600	10400	2600	9000	5200	5800	10600	10800	115000
1974	4600	2900	18900	18300	15100	17700	7600	9000	5200	7400	10700	7900	125300
1975	6300	12100	7600	11800	16600	18600	17000	13600	6300	5600	8200	12700	136400
1976	7800	8500	13900	17200	11300	12300	3000	3900	6700	6300	14600	14800	120300
1977	12900	15900	6300	5700	8100	17300	8500	13500	17700	5300	8800	3300	123300
1978	4200	3000	8100	12100	13300	12700	12100	4900	3500	6100	7300	0	87300
1979	5900	3400	12200	15100	10100	17100	3400	5700	3600	5800	7900	9500	99700
1980	4400	11200	16300	13800	16800	22700	6300	6200	6900	7500	4800	10000	126900
1981	4900	8900	5900	10000	10800	10200	4300	6600	4600	5000	3600	3700	78500
1982	4100	9800	15800	20100	23600	27800	7400	3900	6700	11900	7100	7700	145900
1983	4900	10300	6300	7500	24700	26000	9300	7600	7200	8900	9900	10000	132600
1984	6300	11500	20500	23500	30000	23400	6900	5900	8900	5700	4700	13000	160300
1985	6700	15800	12800	3700	4600	20700	7000	6200	8400	4500	11000	8500	109900
1986	5000	6000	6900	10900	18400	28000	9600	11800	7100	5900	9000	7400	126000
1987	3100	9300	4500	8900	11900	15700	6800	5500	7500	8200	11800	7400	100600
1988	2700	2900	8500	6200	11800	18700	12000	9600	9400	4900	8000	5400	100100
1989	2500	4100	6400	4800	6500	26900	16600	15000	7100	4900	7700	9800	112300
1990	4500	7800	3700	7300	6100	19400	10700	8900	11800	6400	7900	8200	102700
1991	3500	7100	4600	4400	6200	17600	8600	10200	7600	5400	3100	5900	84200
1992	300	400	700	0	300	2400	700	1200	100	0	0	0	6100
													114906.3
average	5722	10441	11009	10538	13419	18869	8341	9069	6769	6250	7228	7253	114906.3

ADY_CAN.dem

Diversions to ADY Canal from Klamath River (Acre-feet)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	2800	600	3500	17200	4300	1300	1600	1700	7300	13100	4500	5400	63300
1962	2100	800	5900	14600	4300	600	2100	6600	5900	16500	9500	7200	76100
1963	1000	3300	800	20000	3400	200	1100	800	11200	8200	5900	6200	62100
1964	1200	200	1900	14800	10300	1600	500	4800	5300	8800	5000	3700	58100
1965	1500	100	300	5400	3300	1200	3000	3600	4700	7200	4800	2000	37100
1966	1500	600	100	13400	6100	1100	3100	5900	1500	5200	4300	2500	45300
1967	1400	2900	6800	7600	6600	1700	0	2700	4100	10500	10800	4000	59100
1968	1700	5800	8600	8700	3400	1600	4300	5000	7500	9500	3900	3500	63500
1969	5100	1100	5700	14000	1100	500	4800	5900	7000	9200	8500	6400	69300
1970	2400	6200	3500	8600	1500	400	4000	5600	6300	7200	8400	5700	59800
1971	4500	2400	7600	8100	1200	1100	600	1900	7500	7600	9800	5400	57700
1972	1500	4500	6500	12900	1600	300	600	3300	5900	9900	6300	4900	58200
1973	6200	5900	9400	3600	5600	2400	4400	6600	9400	9300	9200	5300	77300
1974	7100	2700	13100	5100	4200	2300	2800	4300	10900	11600	6500	6100	76700
1975	1700	5600	13300	9500	1700	0	1200	5000	10800	7300	6600	7000	69700
1976	3500	800	4700	10000	5800	1900	2000	8500	12100	11100	4700	3100	68200
1977	3000	4600	5600	8800	7100	1900	2400	2600	4000	8000	13000	13300	74300
1978	5400	0	0	5600	7000	100	200	3100	5500	9100	10900	5300	52200
1979	8800	4200	3900	5800	7400	3100	1700	3400	7300	7000	6000	8200	66800
1980	6400	6500	3500	4000	8200	800	200	4300	6400	7500	7300	8700	63800
1981	5400	10700	5900	5400	1700	300	5900	4300	6400	9000	8300	10100	73400
1982	1500	2900	8600	7300	3000	300	0	4700	6600	4400	7000	3100	49400
1983	3300	4900	8600	6500	3100	2000	800	1200	7800	5600	8400	5800	58000
1984	5700	5500	4600	13200	2300	100	1600	3000	8500	8600	6400	5000	64500
1985	4800	5700	3900	8500	6900	6000	4500	5900	7000	11400	7500	2100	74200
1986	3600	7100	10900	9700	6600	6800	3000	5800	11100	11200	11700	9600	97100
1987	7800	9200	10200	13000	5900	8100	4500	8500	11400	6900	7200	10300	103000
1988	8700	7400	7400	9600	6800	8300	4900	4500	7500	11600	7500	8900	93100
1989	7900	7600	8500	8600	6500	9000	7600	5300	9300	10500	8800	6200	95800
1990	2200	5200	8900	5300	5000	5500	10200	6400	8200	11000	8900	8100	84900
1991	7300	7600	9500	7300	8600	9700	5000	4000	10800	10200	7800	11100	98900
1992	13400	9000	11000	14300	6800	8400	5600	10400	5200	4300	3200	2200	93800
average	4388	4425	6334	9575	4916	2769	2944	4675	7513	9016	7456	6138	70147

Negative Accretions/Demands to Lake Ewauna (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	0	430	0	0	3490	20890	7380	13410	9030	4480	59110
1962	3610	2290	0	0	0	0	5930	4550	9090	12070	9180	4980	51700
1963	4980	6250	9390	9730	310	7760	1870	6090	10060	11430	8930	6520	83320
1964	4520	7520	11410	11000	4730	0	5710	5950	4100	2320	9400	7820	74480
1965	9910	1960	24190	50540	29530	0	0	7990	6040	10730	7750	10080	158720
1966	14960	4970	9900	10460	2780	1690	11010	7310	7150	10820	7580	8560	97190
1967	1360	8580	1510	4360	1090	0	940	6890	8790	10300	10570	4080	58470
1968	2090	4670	6370	3060	660	40480	5990	7570	6500	8820	6590	6240	99040
1969	2480	120	0	0	0	0	0	12160	5950	10180	12430	7180	50500
1970	2350	6640	0	4120	0	1840	4340	6140	7580	10200	12240	7880	63330
1971	4400	1610	2170	0	3760	470	0	2760	10090	10160	11970	8100	55490
1972	3050	5810	5940	710	1820	1160	1750	12950	12590	13890	9040	5310	74020
1973	4370	5970	11200	8680	3250	7960	10420	16390	17200	18910	12020	8380	124750
1974	6570	2430	4290	0	1520	330	12630	13290	12940	9660	11150	8970	83780
1975	2240	5150	7150	2950	0	0	90	13970	12530	10130	11240	7020	72470
1976	4200	5450	5080	7030	3410	0	5020	14580	12260	14790	3600	8310	83730
1977	0	9420	4920	1750	1800	1140	4680	2770	23170	22350	14310	6360	92670
1978	0	0	3190	5860	9960	7670	16320	8770	7900	13150	6060	0	78880
1979	4180	3590	1720	1140	0	3280	0	9220	6920	7470	2120	1290	40930
1980	0	0	19870	0	0	0	0	3050	4280	6250	2600	0	36050
1981	0	0	0	0	0	0	0	2300	5360	5160	4310	3260	20390
1982	0	0	0	5840	0	0	0	16040	4850	4500	0	0	31230
1983	0	10980	0	0	0	0	0	0	460	990	0	0	12430
1984	0	0	0	0	0	0	0	1000	0	1720	310	0	3030
1985	0	0	0	0	0	0	0	0	0	5830	110	0	5940
1986	0	0	0	0	0	0	0	0	2700	3230	1120	0	7050
1987	0	0	0	0	0	0	7140	1580	3190	970	0	0	12880
1988	0	0	0	0	0	0	0	2330	3420	16320	0	2140	24210
1989	0	0	0	0	0	0	0	1690	7120	6310	750	0	15870
1990	0	0	0	0	0	0	0	0	0	3010	0	0	3010
1991	0	0	280	0	0	0	0	0	2810	5730	1140	0	9960
1992	0	0	0	0	0	0	0	0	0	680	2430	0	3110
average	2352	2919	4018	3989	2019	2306	3042	6507	6951	8797	5874	3968	52742

USGS_KENO.inf

Accretions/Inflows to USGS Keno Gage (AF)
(positive difference between PP&L Keno gage and USGS Keno gage)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	10	3	1	2	0	0	4	0	4	2	26
1962	0	0	0	24	0	0	0	4	0	0	3	0	31
1963	0	13	0	0	2	16	0	0	0	0	0	2	33
1964	0	48	28	0	0	4	0	0	2	0	1	3	86
1965	1	0	0	0	0	0	3	3	1	0	0	0	8
1966	11	0	39	26	5	0	5	2	0	0	1	0	89
1967	0	3	0	0	0	0	0	38	0	0	1	0	42
1968	4	2	17	0	0	0	0	2	0	0	0	5	30
1969	5	0	0	0	0	30	0	0	2	0	4	0	41
1970	0	0	0	0	0	5	0	0	0	0	0	3	8
1971	3	0	21	0	45	19	0	3	0	0	2	1	94
1972	0	16	0	2	36	0	0	0	0	0	0	3	57
1973	0	0	4	0	20	5	4	0	4	0	3	0	40
1974	2	0	0	0	0	0	14	0	1	5	0	0	22
1975	2	0	0	0	10	32	38	46	3	0	0	0	131
1976	0	0	0	0	310	0	0	9	0	0	6	15	340
1977	0	0	0	27	0	0	0	0	0	0	0	0	27
1978	0	0	6848	8412	6642	6727	8341	2452	0	0	0	0	39422
1979	0	0	1434	2695	0	6444	0	1423	0	0	0	0	11996
1980	0	0	25269	2196	0	0	0	0	0	0	0	0	27465
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	6943	0	0	0	0	0	0	0	0	6943
1983	0	0	0	0	1864	0	0	0	0	0	0	0	1864
1984	2113	0	0	0	0	0	0	0	0	578	0	0	2691
1985	0	0	0	165	0	41	1183	0	0	489	0	0	1878
1986	0	98	0	348	0	0	0	0	191	234	2871	0	3742
1987	0	0	0	0	0	0	0	0	131	0	0	0	131
1988	0	0	0	0	0	0	0	0	0	668	0	0	668
1989	0	0	0	0	4572	0	0	0	812	1691	0	0	7075
1990	0	0	0	3081	119	4108	0	0	0	664	0	0	7972
1991	0	0	0	351	978	451	1078	43	357	1097	397	0	4752
1992	0	0	0	0	0	166	0	299	202	0	0	0	667
average	67	6	1052	759	456	564	333	135	53	170	103	1	3699

Negative Accretions/Demands at USGS Keno Gage (AF)
(difference between PP&L Keno gage and USGS Keno gage)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	3	3	0	0	0	0	3	3	0	4	0	0	16
1962	4	36	38	0	4	1	0	0	3	3	0	0	89
1963	30	0	45	8	0	0	37	30	1	3	0	0	154
1964	1	0	0	12	5	0	14	3	0	7000	0	0	7035
1965	0	2	37	26	1	48	0	0	0	4	0	47	165
1966	0	31	0	0	0	1	0	0	2	0	0	3	37
1967	4	0	1	0	25	3	39	0	2	5	0	1	80
1968	0	0	0	0	1	14	4	0	5	0	4	0	28
1969	0	0	2	2	40	0	7	8	0	2	0	3	64
1970	5	46	28	16	1	0	1	2	5	1	2	0	107
1971	0	46	0	5	0	0	11	0	4	5	0	0	71
1972	12	0	8	0	0	0	28	23	3	0	2	0	76
1973	2	41	0	39	0	0	0	5	0	3	0	3	93
1974	0	3	4	13	37	37	0	10	0	0	3	3	110
1975	0	12	37	35	0	0	0	0	0	2	0	0	86
1976	4	1	6	0	0	5	3	0	10	8	0	0	37
1977	1456	81	44	0	44	372	774	3811	1750	1096	485	1989	11902
1978	9204	4082	0	0	0	0	0	0	1586	588	4313	3901	23674
1979	4067	533	0	0	417	0	2655	0	1868	627	3940	4517	18624
1980	4115	1967	0	0	1474	7	2839	2179	2398	1384	5571	5790	27724
1981	6635	6496	5940	6148	5061	1673	3031	4342	2597	1469	5203	3958	52553
1982	2695	1617	2610	0	3872	20748	18097	1480	1349	1024	5265	4428	63185
1983	3421	4160	6438	1322	0	16396	18456	5469	3273	2310	2025	1672	64942
1984	0	469	21717	6344	5622	16434	5649	451	9	0	898	856	58449
1985	1191	8737	2107	0	2131	0	0	457	453	0	2207	1629	18912
1986	1535	0	113	0	6027	20931	6665	2718	0	0	0	3667	41656
1987	1868	2838	3204	3149	3289	4670	3295	2715	0	301	1928	4418	31675
1988	4528	4361	3082	2590	727	701	1874	1198	560	0	2960	2176	24757
1989	3219	3658	3372	2726	0	11392	9697	229	0	0	2465	3115	39873
1990	3410	3981	2869	0	0	0	622	592	83	0	2140	984	14681
1991	3850	3983	588	0	0	0	0	0	0	0	0	96	8517
1992	3416	1586	2145	2272	512	0	1396	0	0	352	269	530	12478
average	1709	1524	1701	772	915	2920	2350	804	499	506	1240	1368	16308

ACC_JCB.inf

Calculated Positive Inflow to JC Boyle Reservoir (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	8315	8836	8519	8500	8814	10160	11296	11712	11218	7557	10624	8084	115055
1962	6516	5567	6917	5345	7065	7618	10911	11368	7512	7657	9290	7359	94545
1963	10568	10384	10482	7884	9846	8182	0	3531	5787	7866	6624	4489	86418
1964	6686	4017	1498	5782	5853	8942	8559	9652	7167	7688	6879	7186	81329
1965	1220	664	0	6495	5961	0	12080	11304	10099	9489	9386	3977	64419
1966	2906	0	6734	843	1576	10465	10572	9757	8318	7842	8503	8383	72132
1967	8122	8997	6357	11038	8023	11736	7909	6020	11845	8948	8711	8949	108075
1968	5671	2365	0	8162	8591	7492	8172	8507	5766	7755	6533	6067	74448
1969	8572	6232	5333	6248	2827	5038	1399	17217	11254	10957	9859	6514	92870
1970	3358	0	2160	2529	0	0	9112	7922	7089	8268	6456	5943	37963
1971	5372	0	0	11950	0	30	0	8380	11758	12653	11111	10060	60020
1972	4010	4512	644	12744	307	28354	8122	13736	13825	11572	10215	9893	119354
1973	8499	6714	12407	4969	3203	5504	9094	10302	8198	8206	8854	8160	95530
1974	9049	11379	5861	5187	6436	1696	17207	20312	16147	14911	15430	13072	138107
1975	11693	6515	5068	0	0	0	2152	12603	14215	12546	10632	7831	72824
1976	2985	2053	6714	6179	4830	4453	9767	14642	9635	9007	10102	9080	90867
1977	1880	3878	5603	5122	6201	10163	9940	8124	7495	7335	7463	6990	81614
1978	11268	8820	0	0	2077	6432	2801	7453	9355	9453	8553	7959	71714
1979	7599	4652	3779	3283	5121	4949	9449	9657	7549	8348	7740	6710	80256
1980	7391	7155	6805	3698	0	5265	8095	8546	8779	7991	7657	5117	77527
1981	6660	6041	6571	6069	6863	5816	7886	8741	8237	8713	7440	8151	88608
1982	7672	8640	1950	5107	10205	981	0	15283	10723	8706	9691	8560	76790
1983	8360	9947	3877	10998	0	0	9729	15163	12361	11899	10711	7721	100520
1984	9947	0	0	110	4493	0	3640	12010	12596	11373	10719	9243	65722
1985	2013	0	743	11296	6614	7488	8519	12190	9548	9725	10036	8646	72320
1986	7395	7032	21173	10661	11633	8757	11811	10368	8731	9700	6563	8509	123753
1987	6159	6833	8618	9630	8459	11395	11681	10622	9659	9600	9007	8959	112042
1988	9392	9237	9051	8559	9054	11224	9132	9364	8069	8505	8090	8317	109414
1989	7651	8227	8118	8392	8659	1614	12010	14356	8636	7027	8168	7922	102200
1990	6948	7557	6303	9158	8454	11752	11129	8781	6236	6340	7541	8414	100033
1991	9802	8340	8652	12056	6390	8628	7218	8248	7192	7481	7204	6268	98899
1992	8359	8634	8089	8291	7516	8487	8265	7099	6486	6605	6478	6560	92289
average	7037	5001	5034	6596	4973	6270	7622	10886	9624	9326	9010	7924	89302

Calculated Negative Inflow (Losses) at JC Boyle Reservoir (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	0	0	0	0	0	0	0	0	0	0	115055
1962	0	0	0	0	0	0	0	0	0	0	0	0	94545
1963	0	0	0	0	0	0	645	0	0	0	0	0	86418
1964	0	0	0	0	0	0	0	0	0	0	0	0	81329
1965	0	0	3739	0	0	3937	0	0	0	0	0	0	64419
1966	0	5187	0	0	0	0	0	0	0	0	0	0	72132
1967	0	0	0	0	0	0	0	0	0	0	0	0	108075
1968	0	0	2053	0	0	0	0	0	0	0	0	0	74448
1969	0	0	0	0	0	0	0	0	0	0	0	0	92870
1970	0	347	0	0	11633	4314	0	0	0	0	0	0	37963
1971	0	1220	4969	0	1517	0	5008	0	0	0	0	0	60020
1972	0	0	0	0	0	0	0	0	0	0	0	0	119354
1973	0	0	0	0	0	0	0	0	0	0	0	0	95530
1974	0	0	0	0	0	0	0	0	0	0	0	0	138107
1975	0	0	0	4254	4096	3501	0	0	0	0	0	0	72824
1976	0	0	0	0	0	0	0	0	0	0	0	0	90867
1977	0	0	0	0	0	0	0	0	0	0	0	0	81614
1978	0	0	1559	2318	0	0	0	0	0	0	0	0	71714
1979	0	0	0	0	0	0	0	0	0	0	0	0	80256
1980	0	0	0	0	392	0	0	0	0	0	0	0	77527
1981	0	0	0	0	0	0	0	0	0	0	0	0	88608
1982	0	0	0	0	0	0	12148	0	0	0	0	0	76790
1983	0	0	0	0	545	1121	0	0	0	0	0	0	100520
1984	0	2311	5961	0	0	1557	0	0	0	0	0	0	65722
1985	0	15918	0	0	0	0	0	0	0	0	0	0	72320
1986	0	0	0	0	0	0	0	0	0	0	0	0	123753
1987	0	0	0	0	0	0	0	0	0	0	0	0	112042
1988	0	0	0	0	0	0	0	0	0	0	0	0	109414
1989	0	0	0	0	0	0	0	0	0	0	0	0	102200
1990	0	0	0	0	0	0	0	0	0	0	0	0	100033
1991	0	0	0	0	0	0	0	0	0	0	0	0	98899
1992	0	0	0	0	0	0	0	0	0	0	0	0	92289
average	7037	5001	5034	6596	4973	6270	7622	10886	9624	9326	9010	7924	89302

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Positive Inflows to JC Boyle to Copco Reach (AF)

													Total
1961	4820	7075	11380	908	16055	14576	8962	9830	6953	2714	5644	4305	93222
1962	4221	0	0	530	16853	14067	18155	9638	8913	1562	4457	2142	80538
1963	8558	11496	21591	5764	17580	8218	24534	13860	7811	2349	4892	6326	132979
1964	8641	5141	7744	18322	9208	10722	19269	15136	9822	9465	14672	1044	129186
1965	5090	13946	110485	63317	49629	25585	23945	19146	8008	5716	6667	6764	338298
1966	10569	7409	13571	24845	11622	17513	28652	18636	6271	4519	1215	6274	151096
1967	0	4008	16562	16104	16135	18679	16691	30969	13761	6627	8677	0	148213
1968	5088	9464	20153	8648	19703	18758	4548	5732	5504	394	7834	4557	110382
1969	3311	12915	6293	25961	19825	25892	32194	20309	8630	1864	0	9363	166557
1970	3906	10125	22173	51647	40029	40049	10988	12555	9105	2528	5893	3926	212923
1971	8167	16366	30629	30141	27883	47749	54872	42159	19532	3838	4313	1500	287148
1972	9811	12721	18439	28810	30588	78390	30523	14302	9723	3501	2776	5092	244675
1973	4659	5668	9539	14850	12648	14765	10975	8568	6758	3361	1942	6830	100562
1974	6307	13716	22833	58345	24725	40256	49436	27042	8907	3943	2809	2359	260677
1975	7049	462	9520	16571	25963	36043	38000	43169	18552	6181	5301	5035	211845
1976	9952	8594	11787	13687	15193	17910	19526	12958	6828	3464	8376	4163	132437
1977	5568	6300	8184	5909	6433	4082	4374	6363	3746	3822	2750	4470	62000
1978	2554	8281	25554	29762	16930	23051	18133	12032	5337	4045	5307	6095	157080
1979	5242	6299	7790	12275	9744	12558	13387	14172	3880	2067	4497	4171	96081
1980	5383	11131	10912	36324	23852	25411	14427	12801	5150	5556	3487	6959	161392
1981	6549	6844	8696	8187	11288	6864	9089	6220	3034	2882	3484	4434	77570
1982	3349	13626	43891	21720	52241	36449	47706	15249	7213	4997	2254	3871	252565
1983	4079	5762	24638	15919	31945	45583	33743	26603	12340	6333	3370	3542	213856
1984	3832	11713	40874	19997	27215	37044	36259	17947	8356	5983	4231	3986	217436
1985	5163	27672	16291	7638	13794	16821	26568	10992	4176	3461	1444	5730	139749
1986	5163	1847	0	10500	38484	28784	12584	9668	3371	2509	1346	3657	117912
1987	5291	2234	5874	3827	7577	9480	9115	3535	1952	4656	2367	1938	57845
1988	3138	3126	4552	10032	4694	7814	4931	4212	3837	2560	1399	1402	51696
1989	1469	6938	3511	8756	2846	32017	20847	11657	4443	4758	995	3561	101797
1990	6066	6987	5315	8119	5914	11657	9438	7357	7488	5359	4283	3201	81183
1991	3252	3561	1509	1470	5450	12057	8745	11632	5303	3146	2185	3021	61330
1992	616	2333	3176	3327	3908	4639	3554	3769	3714	2950	3508	1450	36943
average	5215	8243	16983	18194	19249	23234	20755	14944	7450	3972	4136	4099	146474

Negative Inflows (Losses) to JC Boyle to Copco Reach (AF)

													Total
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	7396	9432	0	0	0	0	0	0	0	0	0	16828
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	2219	0	0	0	0	0	0	0	0	0	0	6244	8463
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	1773	0	1773
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	318	0	0	0	0	0	0	0	0	0	318
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
average	69	231	305	0	0	0	0	0	0	0	55	195	856

COPCO_L

HISTORICAL LAKE LEVELS FOR COPCO LAKE (AF)
Record Keeping Started WY68

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1961	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1962	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1963	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1964	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1965	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1966	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746
1967	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	40600
1968	41700	44800	46100	41400	44400	42900	44400	41400	41900	34500	39400	37100
1969	34800	42900	42500	40500	40700	44100	43600	45700	46700	44300	33700	44200
1970	45753	43144	44769	41490	45186	43833	42391	43814	45734	41220	45675	42460
1971	46087	43737	44323	42925	42300	41117	41622	41951	46205	41725	42745	39957
1972	42158	41397	43239	43334	43506	40772	44506	42027	43794	39800	35466	43429
1973	43602	43344	42849	43823	45871	45186	43296	42707	46058	40772	37884	46362
1974	45264	40959	42992	40493	43182	42319	43938	44963	45616	44083	43315	39561
1975	44083	40810	41753	41715	41800	40669	41024	44671	45021	45380	42887	40595
1976	43573	42102	41509	41565	42935	44015	45594	43192	42470	37453	44613	44285
1977	43420	42027	43916	45245	42659	42973	45584	45920	45685	45793	44227	40949
1978	41192	45635	40772	42992	42669	43154	43458	43382	44265	42205	44005	42498
1979	43382	43832	43948	44720	41772	41472	43049	43631	44729	42319	43154	40336
1980	40317	44681	42602	43020	41136	45283	43938	42319	44064	42802	43316	43173
1981	43804	43458	42545	43039	42811	42954	42441	42488	43976	42574	41857	42564
1982	43078	40772	41257	42422	40744	41089	42074	44662	45157	46077	44112	42716
1983	41174	41744	41276	42158	40438	40660	42328	41257	42925	44419	45674	44506
1984	42111	40716	41425	41706	41999	40838	42830	42451	44516	45390	45734	44933
1985	42064	40679	41753	43173	44342	41820	42630	45177	44826	45468	45293	45089
1986	45547	42177	42925	42347	40410	41961	42840	45410	44381	44189	44141	42583
1987	41905	41706	44972	42697	42008	41905	40420	44035	43880	45245	45803	44179
1988	44700	43525	40512	43411	42507	43135	44700	45167	43736	44739	44818	43746
1989	42555	42093	43602	44729	44710	42338	43268	42735	43240	44150	44972	42792
1990	43612	43746	41819	44584	42963	43154	41905	43746	43650	42650	45002	44217
1991	42792	42168	44035	42271	42413	43516	43287	46097	45148	45685	45410	44419
1992	43030	39874	39259	39222	41622	43640	45186	44797	43602	42925	44024	41999
average	42868	42481	42666	42599	42603	42592	43212	43748	44451	43035	43089	42746

Positive Inflows to Copco to Iron Gate Reach (AF)

													Total
1961	3427	4996	6312	795	8898	7882	4150	4770	3263	1867	3095	2161	51617
1962	3104	0	0	591	9327	7608	9100	4666	4318	1246	2455	997	43413
1963	5439	7376	11810	3409	9719	4459	12535	6940	3724	1671	2689	3250	73022
1964	5484	3955	4354	10171	5210	5807	9700	7627	4807	5502	7956	405	70979
1965	3572	8695	59676	34399	26976	13810	12218	9786	3831	3483	3645	3486	183578
1966	6522	5175	7492	13684	6511	9464	14752	9511	2896	2839	709	3222	82778
1967	0	3344	9103	8977	8941	10091	8312	16152	6929	3974	4727	0	80551
1968	3843	5183	7095	8631	8767	6488	6071	6173	493	5404	0	1830	59979
1969	3717	450	10247	16499	10640	12591	17434	9876	407	3402	5737	0	91000
1970	6353	6834	11256	31104	18222	20551	5638	7427	2554	3857	1118	3295	118210
1971	2430	14292	16073	17135	15363	27843	28464	22847	5470	5106	0	4665	159689
1972	6445	7335	9020	15664	17445	43571	13534	8615	1732	3696	2632	0	129689
1973	3442	6176	5476	7475	5632	4587	7705	5196	3299	3851	2559	793	56192
1974	2578	13073	11599	32936	11471	23384	24803	11979	3866	3286	2795	596	142367
1975	0	9643	4702	9006	14087	20896	19798	20640	8521	3476	3865	4418	119052
1976	5883	5675	6541	7383	7556	8963	8101	8912	3499	5136	122	2188	69960
1977	6130	4447	1134	2510	3847	2136	2307	1265	4407	2054	2690	2899	35827
1978	2126	1665	20125	14587	9075	12439	9740	5010	2741	1853	2260	3987	85609
1979	3155	4132	3441	5025	7357	9581	3874	7216	3000	2780	2337	2649	54548
1980	3560	4245	6866	21470	14366	9231	9950	5846	4182	930	3622	2726	86995
1981	3413	3703	5783	4167	5717	6554	3010	3023	2172	1817	1495	1320	42175
1982	3341	8258	27078	10211	30634	18339	25079	5810	3661	2100	2245	2438	139195
1983	5296	3100	13453	8358	18924	24898	16653	14554	5411	1243	2074	2247	116212
1984	5099	7612	22265	9479	14678	21572	17769	9584	3785	1292	2884	1754	117774
1985	7053	15734	7691	2362	6821	10920	14683	3338	2929	360	2079	1435	75406
1986	2724	6138	0	7175	23231	13627	4649	3297	3441	1476	1157	2522	69438
1987	2756	3459	100	4549	4534	5487	3655	1301	1987	819	0	3031	31679
1988	1401	2114	4719	3808	4752	2255	2335	2422	3308	279	618	1317	29329
1989	508	4795	819	4095	3985	20328	10674	4948	2894	0	1959	1536	56542
1990	3589	2788	3389	5707	2766	7895	2575	5002	5037	2312	1330	2408	44799
1991	2940	2810	839	182	2055	6586	4789	4233	3706	2714	848	1959	33662
1992	1658	1604	1493	1727	2238	1566	1957	2793	691	1800	1325	3651	22504
average	3601	5501	9166	10102	10617	12544	10501	7524	3535	2549	2262	1971	79873

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Negative Inflows (Losses) to Copco to Iron Gate Reach (AF)

													Total
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	2797	4894	0	0	0	0	0	0	0	0	0	7691
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	364	0	0	0	0	0	0	0	0	0	0	2902	3266
1968	0	0	0	0	0	0	0	0	0	0	136	0	136
1969	0	0	0	0	0	0	0	0	0	0	0	3375	3375
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	635	0	635
1972	0	0	0	0	0	0	0	0	0	0	0	47	47
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	1370	0	0	0	0	0	0	0	0	0	0	0	1370
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	1756	0	0	0	0	0	0	0	0	0	1756
1987	0	0	0	0	0	0	0	0	0	0	162	0	162
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	203	0	0	203
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
average	54	87	208	0	0	0	0	0	0	6	29	198	582

Historical Lake Levels for Iron Gate Reservoir (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1961	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1962	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1963	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1964	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1965	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1966	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339
1967	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	55800
1968	57400	59100	56000	57400	57100	52600	56900	58200	55800	56800	54900	52900
1969	53500	51300	57900	59300	59300	59700	59400	59300	55400	56300	57100	54200
1970	59190	59111	59259	60744	59329	57507	56322	57583	56069	55928	56088	55401
1971	55290	59447	59299	59408	59348	60764	59824	59976	57020	57440	54849	57068
1972	59319	59338	59378	59536	60531	60340	59319	58726	55975	55429	54049	55411
1973	56341	59269	59299	59259	59111	55300	55947	56041	57306	56294	56069	57612
1974	56106	59418	59774	59905	59438	60602	59527	57325	56548	56679	57364	54531
1975	51704	59279	59319	59338	59418	60218	59616	58804	57325	57459	56943	57278
1976	59309	59507	59338	59338	59378	59200	57507	57977	57211	57574	56858	56491
1977	59061	59309	57010	57010	55928	55956	57183	55032	57096	56943	57125	55715
1978	56500	56041	59744	59457	59170	59378	59388	57707	57851	56210	56398	56154
1979	56867	57793	57058	55845	56295	58873	56257	55984	57287	57450	57631	56379
1980	56934	57478	57306	59398	59834	57536	58863	56773	58923	55975	57812	56576
1981	56707	56482	57048	57029	56473	59328	57038	56566	57707	57010	56060	55235
1982	56953	56576	60238	59338	60866	59685	59477	58298	58143	57841	57631	57096
1983	59269	59517	59408	59626	60350	60744	59996	59477	58942	57373	58124	57698
1984	59348	59845	60440	59259	59368	60289	59477	59022	59220	57555	58163	57202
1985	59834	59865	59319	58289	58240	58665	59348	57968	58260	56896	57919	56022
1986	56116	59388	58163	59329	60723	59606	57822	57125	57997	57812	58035	57612
1987	57058	59150	57802	59022	59032	59279	57096	58269	58923	57764	56445	57420
1988	57316	57058	57660	57584	59249	57555	57948	58182	58454	57688	57411	57259
1989	56238	56991	56688	56632	59002	60733	60552	58765	59339	56858	58541	56848
1990	57516	56557	56003	58784	57420	59061	55752	57612	58366	57048	57154	57278
1991	57603	58103	59091	57488	56613	57221	57048	56360	56500	57603	56943	56604
1992	57087	55678	55087	54959	56313	56389	57134	57516	55364	55004	54849	56491
average	57143	58064	58305	58531	58713	58661	58190	57784	57481	56917	56818	56339

Bogus_Cr.inf

Inflows to Klamath River from Bogus Creek Reach (AF)
(Calculated as 41 % of Iron Gate to Shasta Acc (24.2 % of Total IG to Seiad Acc)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	119	4599	5489	1525	9186	9112	7905	7086	5368	1404	484	341	52620
1962	648	1730	3633	1488	5659	5395	7610	5653	3173	1208	772	557	37526
1963	4195	4138	11041	3834	14232	4986	9182	9979	3996	1523	555	0	67661
1964	748	3883	3032	7120	6001	5460	6946	6299	4660	1171	73	192	45586
1965	0	686	45156	54925	10708	5514	9735	8395	4936	2001	915	805	143776
1966	956	1124	1079	6420	4584	9439	11184	8971	3913	1500	372	301	49842
1967	365	2178	6276	8381	6636	7146	4304	9439	7117	2151	1097	816	55905
1968	1165	1233	1767	5200	10040	6221	4919	4472	2448	1006	704	300	39476
1969	484	1729	3987	8971	7109	8111	13563	15160	6710	2070	936	766	69595
1970	943	871	7013	27147	8899	7209	5061	6014	4028	1591	667	469	69913
1971	797	7827	10191	23768	10384	16461	13088	14719	9937	3922	1666	1203	113962
1972	1432	2972	4446	13699	10091	30124	10107	7835	5039	1798	1157	653	89351
1973	1010	1034	2826	5162	2967	3320	4091	4490	1915	797	522	621	28754
1974	774	10881	16643	42379	11232	21012	24416	15090	10606	3418	1291	989	158732
1975	1081	1617	2679	3371	7236	17162	13042	17023	12132	4581	1712	1133	82769
1976	1647	3369	5027	3790	4722	5810	4499	5634	2834	1341	1301	744	40717
1977	660	931	1220	930	984	1459	1428	1824	1305	557	413	609	12321
1978	1021	4166	10818	10148	8705	8951	7251	6559	3878	1872	708	1026	65103
1979	583	749	1141	2411	2788	5445	3873	10237	2781	1225	528	396	32157
1980	1625	3462	5150	16606	8607	9949	7306	7740	4147	2000	677	477	67748
1981	530	1001	4130	2789	4428	3013	3156	2566	1425	544	160	260	24001
1982	771	8754	27955	9477	23416	12570	11735	9670	6579	5130	1077	681	117815
1983	1162	2364	11400	9514	20534	24812	19263	19251	14953	5065	2093	1313	131722
1984	687	5178	17034	9591	7605	10971	10016	10565	6021	2083	771	667	81189
1985	1061	6835	5208	3184	5506	4869	10313	6502	3834	1405	817	477	50012
1986	842	903	2182	5384	20055	12474	5361	4630	3028	1417	879	853	58008
1987	1168	1646	1944	3234	5252	5101	5362	4582	1819	1057	706	394	32267
1988	554	816	3695	4620	3298	3290	3150	3100	3276	1058	533	338	27727
1989	599	3065	1987	3132	2713	12696	9932	6758	3045	1298	1291	1589	48106
1990	664	381	879	3719	2160	4712	3448	2934	2671	779	251	36	22635
1991	227	728	1008	2141	2081	3684	3128	3946	2456	1231	262	340	21233
1992	344	912	1641	1444	2284	2112	3168	2286	1230	581	103	36	16140
average	902	2868	7115	9547	7816	9018	8048	7794	4727	1837	797	606	61074

Willow_C.inf

Inflows to Klamath River from Willow Creek Reach (AF)
(Calculated as 22 % of Iron Gate to Shasta Acc (24.2 % of Total IG to Seiad Acc)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	64	2468	2946	818	4929	4890	4242	3802	2881	753	260	183	28235
1962	348	928	1949	798	3037	2895	4083	3033	1703	648	414	299	20136
1963	2251	2221	5924	2057	7637	2676	4927	5354	2144	817	298	0	36306
1964	401	2083	1627	3821	3220	2930	3727	3380	2500	628	39	103	24461
1965	0	368	24230	29472	5746	2959	5224	4504	2649	1074	491	432	77148
1966	513	603	579	3445	2460	5065	6001	4814	2099	805	200	161	26745
1967	196	1169	3367	4497	3561	3834	2309	5065	3819	1154	589	438	29998
1968	625	662	948	2790	5387	3338	2640	2399	1314	540	378	161	21182
1969	260	928	2139	4814	3814	4352	7278	8134	3600	1111	502	411	37344
1970	506	468	3763	14567	4775	3868	2715	3227	2161	854	358	252	37514
1971	428	4200	5468	12753	5572	8833	7023	7898	5332	2105	894	645	61151
1972	768	1595	2386	7350	5415	16164	5423	4204	2704	965	621	350	47944
1973	542	555	1516	2770	1592	1781	2195	2410	1027	427	280	333	15429
1974	415	5839	8930	22740	6027	11275	13101	8097	5691	1834	693	531	85173
1975	580	867	1437	1809	3883	9209	6998	9134	6510	2458	919	608	44413
1976	884	1808	2697	2034	2534	3118	2414	3023	1520	719	698	399	21848
1977	354	500	655	499	528	783	766	979	700	299	222	327	6611
1978	548	2235	5805	5445	4671	4803	3891	3519	2081	1005	380	550	34933
1979	313	402	612	1294	1496	2922	2078	5493	1492	658	283	213	17255
1980	872	1858	2764	8910	4619	5339	3921	4153	2225	1073	363	256	36352
1981	284	537	2216	1497	2376	1617	1693	1377	765	292	86	139	12879
1982	414	4697	15000	5085	12564	6745	6297	5189	3530	2753	578	365	63218
1983	624	1268	6117	5105	11018	13314	10336	10330	8023	2718	1123	704	70680
1984	368	2778	9140	5146	4081	5887	5374	5669	3231	1118	414	358	43565
1985	569	3667	2795	1709	2954	2612	5534	3489	2057	754	438	256	26836
1986	452	485	1171	2889	10761	6693	2877	2484	1625	760	472	458	31126
1987	627	883	1043	1735	2818	2737	2877	2459	976	567	379	212	17314
1988	297	438	1983	2479	1770	1765	1690	1663	1758	567	286	181	14878
1989	321	1644	1066	1680	1456	6813	5329	3626	1634	697	693	853	25813
1990	356	204	471	1995	1159	2529	1850	1574	1433	418	135	20	12146
1991	122	391	541	1149	1117	1977	1678	2118	1318	661	140	182	11393
1992	184	489	881	775	1226	1133	1700	1227	660	312	55	19	8661
average	484	1539	3818	5123	4194	4839	4319	4182	2536	986	428	325	32771

Cottonwo.inf

Inflows to Klamath River from Cottonwood Creek Reach (Acre-feet)
(Calculated as 37 % of Iron Gate to Shasta Acc (24.2 % of Total IG to Seiad Acc)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	108	4150	4954	1376	8289	8223	7134	6395	4845	1267	437	308	47486
1962	585	1561	3278	1343	5107	4869	6867	5101	2863	1090	697	503	33865
1963	3785	3735	9964	3460	12843	4500	8286	9005	3606	1374	501	0	61060
1964	675	3504	2736	6426	5416	4928	6269	5685	4205	1056	66	174	41139
1965	0	619	40751	49567	9663	4976	8786	7576	4454	1806	826	727	129749
1966	863	1014	974	5794	4137	8518	10093	8096	3531	1353	336	271	44980
1967	329	1965	5663	7563	5989	6449	3884	8518	6423	1941	990	736	50451
1968	1051	1113	1594	4693	9060	5615	4439	4035	2209	908	635	271	35625
1969	437	1561	3598	8096	6415	7319	12240	13681	6055	1868	845	691	62805
1970	851	786	6329	24499	8031	6505	4567	5427	3635	1436	602	424	63092
1971	719	7064	9197	21449	9371	14855	11811	13283	8968	3540	1504	1085	102844
1972	1292	2682	4012	12362	9106	27185	9121	7070	4547	1623	1044	589	80634
1973	912	933	2550	4658	2677	2996	3692	4052	1728	719	471	560	25948
1974	699	9819	15019	38245	10136	18962	22034	13618	9571	3085	1165	892	143246
1975	976	1459	2417	3043	6530	15488	11769	15363	10949	4135	1545	1022	74694
1976	1486	3040	4536	3420	4261	5243	4060	5084	2557	1210	1174	671	36744
1977	596	840	1101	840	888	1317	1289	1646	1178	503	373	550	11119
1978	921	3759	9763	9158	7856	8077	6544	5919	3500	1690	639	925	58751
1979	526	676	1029	2176	2516	4914	3495	9238	2509	1106	476	358	29019
1980	1466	3124	4648	14986	7768	8979	6594	6985	3743	1805	611	431	61138
1981	478	903	3727	2517	3996	2719	2848	2315	1286	491	144	234	21659
1982	696	7900	25228	8553	21131	11344	10590	8726	5937	4629	972	615	106320
1983	1049	2133	10288	8585	18530	22391	17384	17373	13494	4571	1889	1185	118871
1984	620	4673	15372	8655	6863	9901	9039	9534	5434	1880	696	602	73268
1985	957	6168	4700	2874	4969	4394	9307	5868	3460	1268	737	431	45133
1986	759	815	1969	4859	18098	11257	4838	4178	2733	1279	793	770	52349
1987	1054	1486	1755	2918	4740	4604	4839	4135	1641	954	637	356	29119
1988	500	736	3335	4170	2977	2969	2843	2797	2956	954	481	305	25022
1989	540	2766	1793	2826	2448	11458	8963	6099	2748	1172	1165	1434	43412
1990	599	344	793	3356	1949	4253	3112	2648	2410	703	227	33	20427
1991	205	657	910	1932	1878	3324	2823	3561	2216	1111	236	307	19161
1992	310	823	1481	1303	2061	1906	2859	2063	1110	524	93	32	14566
average	814	2588	6421	8616	7053	8139	7263	7034	4266	1658	719	547	55116

Negative Accretions (Losses) to Klamath River from Iron Gate to Confluence with Shasta River (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	285	285
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	292	0	0	0	0	0	0	0	0	0	0	0	292
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
average	9	0	0	0	0	0	0	0	0	0	0	9	18

1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	460	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
average	14	0	0	0	0	0	0	0	0	0	0	14	28

Inflows to Klamath River from Humbug Creek Reach (Acre-feet)
(Calculated as 28 % of Shasta to Scott Acc (38.2 % of Total IG to Seiad Acc))

	Oct	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	129	4958	5918	1644	9902	9823	8522	7639	5787	1514	522	368	56725
1962	699	1865	3916	1604	6101	5816	8203	6094	3420	1302	833	600	40453
1963	4522	4461	11902	4133	15342	5375	9898	10757	4307	1642	598	0	72939
1964	807	4185	3269	7676	6470	5886	7488	6791	5023	1262	79	208	49142
1965	0	739	48679	59210	11543	5944	10495	9049	5321	2157	986	868	154992
1966	1031	1212	1164	6921	4941	10175	12056	9671	4218	1617	401	324	53731
1967	393	2348	6765	9035	7154	7703	4640	10175	7672	2318	1183	879	60266
1968	1256	1329	1905	5606	10823	6707	5303	4821	2639	1085	759	324	42555
1969	522	1864	4298	9671	7663	8743	14621	16342	7233	2231	1009	826	75024
1970	1016	939	7561	29265	9593	7771	5455	6483	4342	1715	719	506	75367
1971	859	8438	10986	25622	11194	17745	14109	15867	10712	4228	1796	1296	122852
1972	1544	3204	4793	14767	10878	32474	10896	8446	5432	1938	1247	703	96321
1973	1089	1114	3046	5564	3198	3579	4410	4841	2064	859	563	669	30997
1974	834	11730	17941	45685	12108	22651	26321	16268	11433	3685	1392	1066	171114
1975	1166	1743	2887	3635	7800	18501	14059	18351	13079	4939	1846	1221	89226
1976	1775	3632	5419	4086	5090	6263	4850	6074	3055	1445	1403	802	43893
1977	712	1004	1316	1003	1060	1573	1539	1966	1407	600	445	657	13282
1978	1100	4491	11662	10940	9384	9649	7817	7070	4181	2018	764	1106	70182
1979	629	807	1230	2599	3006	5870	4175	11035	2998	1321	569	427	34665
1980	1751	3732	5552	17901	9279	10726	7876	8344	4471	2156	730	514	73032
1981	571	1079	4452	3007	4774	3248	3402	2766	1537	586	172	280	25873
1982	832	9437	30136	10217	25242	13551	12650	10424	7092	5530	1161	734	127005
1983	1253	2548	12289	10256	22135	26747	20766	20753	16119	5460	2257	1415	141998
1984	740	5582	18363	10339	8198	11827	10797	11389	6491	2246	831	719	87522
1985	1143	7368	5614	3433	5936	5248	11118	7010	4133	1515	881	514	53913
1986	907	974	2352	5805	21619	13447	5779	4991	3265	1528	948	920	62534
1987	1259	1775	2096	3486	5662	5499	5780	4939	1961	1140	761	425	34784
1988	597	880	3983	4981	3556	3546	3396	3342	3532	1140	574	364	29890
1989	646	3304	2142	3376	2925	13687	10707	7285	3282	1400	1392	1713	51858
1990	716	411	947	4009	2329	5080	3717	3163	2879	840	271	39	24401
1991	245	785	1087	2308	2244	3971	3372	4254	2647	1327	282	366	22889
1992	371	983	1769	1557	2462	2277	3415	2465	1326	626	111	38	17399
average	972	3091	7670	10292	8425	9722	8676	8402	5096	1980	859	653	65838

Beaver_C.inf

Inflows to Klamath River from Beaver Creek Reach (Acre-feet)
(Calculated as 29 % of Shasta to Scott Acc (38.2 % of Total IG to Seiad Acc))

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	133	5135	6129	1702	10256	10174	8826	7912	5994	1568	541	381	58751
1962	724	1932	4056	1661	6319	6024	8496	6311	3543	1349	862	622	41898
1963	4683	4621	12327	4281	15890	5567	10252	11141	4461	1700	619	0	75544
1964	835	4335	3385	7950	6701	6097	7755	7033	5203	1307	81	215	50897
1965	0	766	50417	61325	11955	6156	10870	9373	5511	2234	1022	899	160527
1966	1068	1255	1205	7168	5118	10538	12487	10017	4368	1674	415	336	55650
1967	407	2432	7007	9357	7410	7978	4805	10538	7946	2401	1225	911	62418
1968	1301	1376	1973	5806	11209	6946	5492	4993	2733	1124	786	335	44075
1969	541	1931	4451	10016	7937	9055	15143	16926	7492	2311	1045	855	77703
1970	1053	973	7831	30310	9936	8049	5650	6714	4497	1776	745	524	78058
1971	890	8739	11378	26537	11594	18379	14613	16434	11095	4379	1860	1343	127240
1972	1599	3319	4964	15295	11266	33633	11285	8747	5626	2008	1292	729	99761
1973	1128	1154	3155	5763	3313	3707	4568	5014	2138	889	583	693	32104
1974	864	12149	18582	47317	12541	23460	27261	16849	11842	3816	1442	1104	177226
1975	1208	1805	2991	3764	8079	19161	14561	19007	13546	5115	1912	1265	92413
1976	1839	3762	5612	4231	5272	6487	5023	6291	3164	1497	1453	830	45460
1977	737	1040	1363	1039	1098	1629	1594	2037	1457	622	461	680	13757
1978	1139	4651	12079	11331	9719	9993	8096	7323	4330	2091	791	1145	72688
1979	651	836	1274	2692	3113	6080	4324	11430	3105	1368	589	442	35903
1980	1814	3865	5750	18540	9610	11109	8158	8642	4630	2233	756	533	75641
1981	591	1118	4611	3114	4944	3364	3523	2865	1592	607	178	290	26797
1982	861	9774	31212	10582	26144	14034	13102	10796	7345	5728	1203	761	131541
1983	1297	2639	12728	10622	22926	27702	21507	21494	16695	5655	2337	1466	147069
1984	766	5781	19019	10708	8491	12249	11183	11796	6723	2326	861	744	90648
1985	1184	7631	5815	3555	6148	5436	11515	7260	4281	1569	912	533	55839
1986	940	1008	2436	6012	22391	13927	5985	5169	3381	1582	982	953	64767
1987	1304	1838	2171	3611	5864	5696	5987	5116	2031	1180	789	440	36026
1988	618	911	4126	5159	3683	3673	3517	3461	3658	1181	595	377	30957
1989	669	3422	2219	3497	3029	14176	11089	7546	3400	1450	1442	1774	53710
1990	742	425	981	4152	2412	5261	3850	3276	2982	870	281	41	25272
1991	253	813	1126	2390	2324	4113	3492	4406	2742	1375	292	380	23706
1992	384	1018	1832	1612	2550	2359	3537	2553	1373	648	115	40	18021
average	1007	3202	7944	10659	8726	10069	8986	8702	5278	2051	890	676	68190

Inflows to Klamath River from Dona Creek Reach (Acre-feet)
(Calculated as 3 % of Shasta to Scott Acc (38.2 % of Total IG to Seiad Acc))

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	14	531	634	176	1061	1052	913	818	620	162	56	39	6078
1962	75	200	420	172	654	623	879	653	366	140	89	64	4334
1963	484	478	1275	443	1644	576	1061	1153	461	176	64	0	7815
1964	86	448	350	822	693	631	802	728	538	135	8	22	5265
1965	0	79	5216	6344	1237	637	1124	970	570	231	106	93	16606
1966	110	130	125	742	529	1090	1292	1036	452	173	43	35	5757
1967	42	252	725	968	767	825	497	1090	822	248	127	94	6457
1968	135	142	204	601	1160	719	568	516	283	116	81	35	4559
1969	56	200	460	1036	821	937	1567	1751	775	239	108	88	8038
1970	109	101	810	3136	1028	833	585	695	465	184	77	54	8075
1971	92	904	1177	2745	1199	1901	1512	1700	1148	453	192	139	13163
1972	165	343	513	1582	1165	3479	1167	905	582	208	134	75	10320
1973	117	119	326	596	343	383	473	519	221	92	60	72	3321
1974	89	1257	1922	4895	1297	2427	2820	1743	1225	395	149	114	18334
1975	125	187	309	389	836	1982	1506	1966	1401	529	198	131	9560
1976	190	389	581	438	545	671	520	651	327	155	150	86	4703
1977	76	108	141	107	114	169	165	211	151	64	48	70	1423
1978	118	481	1250	1172	1005	1034	838	758	448	216	82	118	7519
1979	67	86	132	278	322	629	447	1182	321	142	61	46	3714
1980	188	400	595	1918	994	1149	844	894	479	231	78	55	7825
1981	61	116	477	322	511	348	364	296	165	63	18	30	2772
1982	89	1011	3229	1095	2705	1452	1355	1117	760	593	124	79	13608
1983	134	273	1317	1099	2372	2866	2225	2224	1727	585	242	152	15214
1984	79	598	1967	1108	878	1267	1157	1220	695	241	89	77	9377
1985	122	789	602	368	636	562	1191	751	443	162	94	55	5776
1986	97	104	252	622	2316	1441	619	535	350	164	102	99	6700
1987	135	190	225	374	607	589	619	529	210	122	82	46	3727
1988	64	94	427	534	381	380	364	358	378	122	62	39	3202
1989	69	354	230	362	313	1466	1147	781	352	150	149	184	5556
1990	77	44	101	429	249	544	398	339	309	90	29	4	2614
1991	26	84	116	247	240	425	361	456	284	142	30	39	2452
1992	40	105	190	167	264	244	366	264	142	67	12	4	1864
average	104	331	822	1103	903	1042	930	900	546	212	92	70	7054

Horse_Cr.inf

Inflows to Klamath River from Horse Creek Reach (Acre-feet)
(Calculated as 40 % of Shasta to Scott Acc (38.2 % of Total IG to Seiad Acc))

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	184	7082	8454	2348	14146	14033	12174	10913	8268	2162	746	525	81036
1962	998	2664	5594	2291	8716	8309	11719	8705	4886	1860	1189	858	57791
1963	6460	6373	17003	5905	21917	7679	14140	15367	6153	2345	854	0	104198
1964	1152	5979	4669	10965	9242	8409	10697	9701	7176	1803	112	296	70203
1965	0	1056	69541	84586	16490	8492	14993	12928	7601	3082	1409	1240	221417
1966	1473	1731	1662	9887	7059	14536	17223	13816	6025	2309	573	463	76758
1967	562	3354	9665	12907	10220	11005	6628	14536	10961	3312	1690	1256	86094
1968	1794	1899	2721	8009	15461	9581	7576	6887	3770	1550	1084	462	60793
1969	746	2663	6139	13815	10948	12490	20887	23346	10333	3187	1442	1179	107177
1970	1452	1342	10801	41807	13705	11102	7793	9261	6203	2450	1028	723	107667
1971	1228	12054	15694	36602	15991	25350	20156	22667	15303	6040	2566	1852	175503
1972	2205	4577	6847	21096	15540	46391	15565	12065	7759	2769	1781	1005	137601
1973	1556	1592	4352	7949	4569	5113	6300	6915	2948	1227	804	956	44281
1974	1192	16757	25630	65264	17298	32359	37601	23240	16333	5264	1989	1523	244449
1975	1666	2490	4125	5192	11143	26430	20084	26216	18684	7056	2637	1745	127466
1976	2536	5188	7741	5837	7272	8948	6928	8677	4364	2065	2004	1145	62704
1977	1017	1434	1879	1433	1515	2247	2199	2809	2010	858	636	938	18975
1978	1572	6415	16661	15628	13406	13784	11167	10100	5972	2883	1091	1579	100259
1979	898	1153	1757	3713	4294	8386	5964	15765	4282	1887	813	610	49522
1980	2502	5331	7932	25573	13256	15322	11252	11920	6387	3080	1042	735	104332
1981	816	1541	6360	4296	6820	4640	4860	3951	2195	837	246	400	36962
1982	1188	13481	43051	14595	36060	19358	18071	14891	10131	7900	1659	1049	181436
1983	1790	3640	17556	14651	31622	38210	29665	29647	23027	7800	3224	2022	202854
1984	1057	7974	26233	14770	11712	16896	15425	16270	9273	3208	1188	1027	125032
1985	1633	10526	8020	4904	8479	7498	15883	10014	5905	2164	1258	735	77019
1986	1296	1391	3361	8292	30884	19210	8256	7130	4664	2182	1354	1314	89334
1987	1799	2536	2994	4980	8088	7856	8258	7056	2801	1628	1088	607	49692
1988	853	1257	5690	7115	5080	5066	4851	4774	5045	1629	820	520	42700
1989	922	4720	3060	4823	4178	19552	15295	10408	4689	2000	1989	2447	74083
1990	1023	587	1353	5727	3327	7257	5310	4518	4113	1200	387	56	34858
1991	349	1122	1553	3297	3205	5673	4817	6077	3782	1896	403	523	32699
1992	529	1404	2527	2224	3518	3253	4878	3521	1894	894	159	55	24856
average	1389	4416	10957	14703	12036	13889	12394	12003	7279	2829	1227	933	94055

Negative Accretions (Losses) to Klamath River in Shasta to Scott Reach (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	450	450
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	460	0	0	0	0	0	0	0	0	0	0	0	0	460
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
average	14	0	0	0	0	0	0	0	0	0	0	0	14	28

SCOTT_R.inf

Inflows to Klamath River Basin System from Scott River at USGS Gage near Fort Jones (Acre-feet)
(USGS Gage #11519500)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	3630	13313	29891	18133	85011	54201	53065	57157	52934	8025	3546	3721	382627
1962	4314	8043	25986	17173	39509	33249	67594	48731	28931	7845	3921	3338	288634
1963	57833	45000	107432	28078	141009	38256	89630	102230	31940	9539	4203	3675	658825
1964	6071	43718	26204	49831	36178	30302	33763	39991	34162	7547	3608	2894	314269
1965	3318	7678	307635	137000	75589	49040	83486	63712	35247	8896	4812	4209	780622
1966	4393	13789	13424	46612	21263	48961	86877	70831	27235	6189	2936	2789	345299
1967	3741	22279	49403	53818	52591	50916	35804	106030	72045	17627	4146	3148	471548
1968	5822	6339	9412	30538	114167	58690	34126	34207	17544	3955	2682	2553	320035
1969	3122	12486	28449	78886	60001	59755	92867	141919	71912	11758	3687	3606	568448
1970	6101	7059	68580	257395	81058	65241	34731	56546	35477	6639	3122	2858	624807
1971	3937	60461	79602	166878	70880	102005	80161	114805	73497	22291	5582	5185	785284
1972	6911	15586	23151	86375	56846	173723	56234	59695	43336	8392	3856	4098	538203
1973	5161	7498	35104	50448	29955	27089	33543	60388	16987	4028	1745	1702	273648
1974	9053	96860	131506	271613	70200	130832	129364	113990	94903	23455	6974	4175	1082925
1975	4528	7208	12076	24550	55153	135362	76682	130792	107174	22737	6165	4737	587164
1976	10257	31206	37688	23378	23893	37222	36141	58119	19133	5504	4477	3673	290691
1977	4881	5173	5169	4977	5498	5123	3277	7442	9275	2118	632	637	54202
1978	1081	20323	101341	111532	72308	78215	60517	57537	43258	16239	3975	8251	574577
1979	5752	6113	9088	24925	19835	44609	34303	67883	12250	3223	1414	1307	230702
1980	7533	27767	41207	133515	82997	59578	58019	49492	29808	7260	2331	1900	501407
1981	2753	4417	31270	27079	54745	33144	29038	24502	8003	1442	454	475	217322
1982	1307	64105	199586	69615	171714	92019	80110	93363	58981	18443	4185	3384	856812
1983	10044	18506	84196	83587	123651	168935	101357	146263	102349	47289	16544	13585	916306
1984	11986	57149	128235	77301	52524	66350	58295	83839	41106	11229	3152	3090	594256
1985	6107	52440	33418	20353	30463	26982	67693	40267	22225	4126	1914	2319	308307
1986	4046	5949	11552	45232	175700	130395	57389	48362	31962	5349	2099	2610	520645
1987	5625	7666	8963	15818	31020	52914	50167	41903	9055	2454	826	803	227214
1988	1200	2265	46124	31865	28736	28433	24829	26819	27811	3771	922	707	223482
1989	1678	21870	18014	18940	17919	104197	87911	56363	21828	4526	1269	1912	356427
1990	8614	8144	9755	37694	15455	34830	31897	27015	24088	3755	851	727	202825
1991	1904	3299	4060	7363	12938	23417	17592	29074	15229	2517	794	683	118870
1992	1085	2585	8598	7551	21541	23901	48213	22975	4643	2963	483	1533	146071
average	6681	22072	53941	64314	60323	64621	57334	65070	38260	9723	3353	3134	448827

Accretions to Basin from Reach of Scott River from USGS Gage to Confluence with Klamath River (Acre-feet)
(Calculated as 29.0 % of Total Iron Gate to Seiad Acc)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	349	13442	16045	4456	26848	26634	23106	20712	15691	4104	1416	997	153798
1962	1895	5057	10617	4349	16541	15769	22242	16522	9274	3530	2257	1628	109681
1963	12260	12096	32271	11207	41596	14575	26837	29166	11678	4452	1621	0	197759
1964	2187	11348	8862	20811	17541	15960	20302	18412	13619	3421	213	563	133239
1965	0	2004	131982	160536	31297	16116	28455	24535	14427	5849	2675	2354	420229
1966	2795	3286	3155	18765	13398	27587	32688	26222	11436	4383	1087	879	145679
1967	1067	6365	18343	24495	19397	20886	12580	27587	20802	6286	3207	2384	163398
1968	3405	3603	5164	15200	29344	18184	14378	13070	7156	2942	2057	877	115380
1969	1415	5055	11652	26220	20777	23705	39642	44308	19612	6049	2737	2239	203412
1970	2756	2547	20499	79346	26010	21070	14791	17577	11773	4650	1951	1372	204341
1971	2330	22878	29786	69468	30350	48111	38253	43020	29044	11464	4870	3515	333089
1972	4185	8687	12994	40038	29493	88046	29541	22899	14727	5256	3381	1907	261155
1973	2952	3022	8259	15086	8672	9703	11957	13125	5596	2328	1527	1815	84041
1974	2262	31803	48643	123865	32829	61415	71363	44106	30999	9991	3774	2890	463941
1975	3161	4725	7829	9854	21148	50161	38118	49756	35460	13391	5004	3311	241918
1976	4814	9847	14692	11077	13801	16982	13149	16467	8282	3918	3803	2173	119006
1977	1929	2722	3567	2719	2875	4265	4174	5332	3814	1628	1207	1780	36012
1978	2983	12176	31620	29661	25443	26161	21194	19169	11335	5473	2071	2997	190283
1979	1705	2188	3334	7046	8149	15915	11320	29920	8127	3582	1542	1158	93987
1980	4748	10118	15054	48535	25158	29080	21355	22624	12122	5846	1978	1394	198012
1981	1548	2926	12071	8152	12943	8807	9223	7499	4166	1589	467	759	70150
1982	2255	25586	81707	27701	68439	36740	34298	28263	19228	14994	3148	1991	344348
1983	3396	6909	33320	27806	60016	72519	56301	56268	43703	14804	6118	3837	384998
1984	2007	15134	49787	28033	22229	32066	29274	30880	17598	6089	2254	1948	237298
1985	3100	19977	15222	9307	16093	14230	30144	19005	11207	4107	2388	1394	146175
1986	2460	2640	6378	15738	58616	36459	15669	13532	8851	4142	2570	2494	169547
1987	3414	4812	5683	9452	15351	14910	15672	13392	5316	3090	2064	1152	94310
1988	1618	2385	10800	13504	9641	9615	9206	9060	9575	3091	1557	987	81041
1989	1750	8958	5808	9153	7930	37109	29029	19753	8900	3795	3775	4644	140603
1990	1941	1114	2568	10869	6314	13773	10079	8576	7807	2278	735	106	66158
1991	663	2129	2948	6257	6084	10767	9143	11534	7178	3599	765	994	62059
1992	1005	2665	4796	4221	6676	6174	9259	6682	3595	1697	301	104	47175
average	2636	8381	20795	27904	22844	26359	23523	22780	13816	5369	2329	1770	178507

ACC_SEI.inf

Accretions to Klamath River in Reach from Scott River Confluence to Seiad Valley USGS Gage (Acre-feet)
(Calculated as 8.6 % of Total Iron Gate to Seiad Acc)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	103	3986	4758	1321	7962	7898	6852	6142	4653	1217	420	296	45609
1962	562	1500	3149	1290	4905	4676	6596	4900	2750	1047	669	483	32526
1963	3636	3587	9570	3323	12335	4322	7959	8649	3463	1320	481	0	58646
1964	649	3365	2628	6172	5202	4733	6021	5460	4039	1015	63	167	39512
1965	0	594	39140	47607	9281	4779	8438	7276	4278	1734	793	698	124620
1966	829	974	936	5565	3973	8181	9694	7776	3391	1300	322	261	43201
1967	316	1888	5440	7264	5752	6194	3731	8181	6169	1864	951	707	48456
1968	1010	1069	1531	4508	8702	5393	4264	3876	2122	872	610	260	34216
1969	420	1499	3455	7776	6162	7030	11756	13140	5816	1794	812	664	60322
1970	817	755	6079	23530	7713	6248	4386	5212	3491	1379	578	407	60598
1971	691	6784	8833	20601	9000	14267	11344	12758	8613	3400	1444	1042	98778
1972	1241	2576	3853	11873	8746	26110	8760	6791	4367	1559	1003	566	77446
1973	875	896	2449	4474	2572	2877	3546	3892	1659	690	453	538	24923
1974	671	9431	14425	36732	9736	18213	21163	13080	9193	2963	1119	857	137583
1975	937	1401	2322	2922	6272	14875	11304	14755	10516	3971	1484	982	71741
1976	1428	2920	4357	3285	4093	5036	3899	4883	2456	1162	1128	644	35291
1977	572	807	1058	806	853	1265	1238	1581	1131	483	358	528	10679
1978	885	3611	9377	8796	7545	7758	6285	5685	3361	1623	614	889	56429
1979	506	649	989	2090	2417	4720	3357	8873	2410	1062	457	343	27872
1980	1408	3001	4464	14393	7461	8624	6333	6709	3595	1734	587	413	58721
1981	459	868	3580	2418	3838	2612	2735	2224	1236	471	139	225	20803
1982	669	7588	24230	8215	20296	10895	10171	8381	5702	4446	934	590	102117
1983	1007	2049	9881	8246	17798	21506	16696	16686	12960	4390	1814	1138	114172
1984	595	4488	14764	8313	6592	9509	8681	9157	5219	1806	668	578	70371
1985	919	5924	4514	2760	4772	4220	8939	5636	3323	1218	708	413	43348
1986	729	783	1891	4667	17383	10812	4647	4013	2625	1228	762	740	50279
1987	1013	1427	1685	2803	4552	4422	4648	3971	1576	916	612	342	27968
1988	480	707	3203	4005	2859	2851	2730	2687	2840	917	462	293	24033
1989	519	2656	1722	2714	2352	11005	8609	5858	2639	1125	1119	1377	41696
1990	576	330	762	3223	1872	4084	2989	2543	2315	675	218	32	19619
1991	197	631	874	1856	1804	3193	2711	3421	2129	1067	227	295	18404
1992	298	790	1422	1252	1980	1831	2746	1982	1066	503	89	31	13990
average	782	2485	6167	8275	6774	7817	6976	6756	4097	1592	691	525	52937

Accretions to Klamath River from Scott River to Seiad Valley gage (AF)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	443	443
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	453	0	0	0	0	0	0	0	0	0	0	0	453
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0