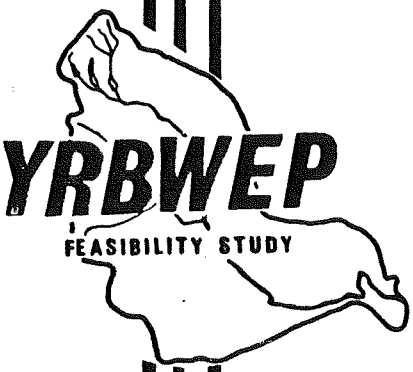

YAKIMA RIVER BASIN
WATER ENHANCEMENT PROJECT

EAST SELAH
REREGULATING RESERVOIR
STUDY TEAM REPORT

DECEMBER 1982

DEPARTMENT OF
ECOLOGY

U.S. BUREAU OF
RECLAMATION

YAKIMA RIVER BASIN WATER
ENHANCEMENT PROJECT

East Selah Reregulating Reservoir
Study Team Report

December 1982

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INTRODUCTION

The East Selah Reregulating Reservoir is a proposed facility to be located at the present site of the East Selah gravel pits, just east of the town of Selah, between the Yakima River and Interstate Highway 82.

Purpose of the reregulating reservoir is to provide downstream operational control of Yakima River flows released from upstream reservoirs during the irrigation season. River flows will be regulated by a storage and release cycle through the reregulating reservoir, thereby reducing river flow fluctuations. Thus, the reservoir would provide a means to decrease operational losses and increase efficiency of using available storage in the basin. The reregulating reservoir would become an operational tool of the Yakima project.

The East Selah reregulating reservoir has been included as a plan element of the Yakima River Basin Water Enhancement Project. The project study team has recommended that the reregulating facility be given consideration as an early action item as a means of enhancing utilization of the present water supply. The reregulating reservoir would also be designed with the capability to continue and even increase operational effectiveness if and when additional storage reservoirs are constructed for the Yakima system.

BACKGROUND

Study History

The concept of a reregulating reservoir on the lower Yakima River was identified in an inventory report "Drought Relief Measures; Idaho, Oregon, Washington," November 1977. This report was prepared by the Bureau of Reclamation in response to the drought in 1977 in the Pacific Northwest. During the drought of 1977, the Yakima River Basin Association of Irrigation Districts requested the Washington State Department of Ecology to assess the viability of a reregulating reservoir in the Yakima River Basin. The department contracted with the consulting firm of CH2M-Hill to study the potential and prepare a feasibility report. The report "Yakima River Reregulating Storage" was issued in May 1978. The CH2M-Hill plan was evaluated by the Bureau of Reclamation in the report "East Selah Gravel Pits Reregulation Storage," 1981.

The East Selah reregulating reservoir was included as a potential plan element in the Yakima River Basin Water Enhancement Project. This feasibility study was authorized by Congress in Public Law 91-162, December 28, 1979. Washington State supports the study and provided $500,000 to help fund the investigation (Substitute Senate Bill 2504, Chapter 263, Laws of 1979, 1st Extraordinary Session). In August of 1982 a Phase 1 study team report was prepared and presented to the regional director, Bureau of Reclamation, and the director of the Department of Ecology. The report identified the East Selah reregulating reservoir as a possible early implementation item and recommended that legislation for funding and early construction be pursued. The two directors, in an October 21, 1982 letter, instructed the study team to prepare this background report so that the Department of Ecology could present the proposal to the Washington Legislature for the purpose of obtaining project funds.

Yakima Basin Physiography and Hydrology

The Yakima River Basin, located in south-central Washington, covers an area of about 6,000 square miles or about four million acres. The basin centers around the city of Yakima and includes most of Yakima, Kittitas, and Benton counties. Topography is characterized by a series of long, rather hilly ridges extending eastward from the Cascades and encircling flat valley areas. Elevations in the basin range from over 12,000 feet in the Cascades to about 350 feet at the confluence of the Yakima and Columbia rivers.

The Yakima River and its tributaries drain the area. The Yakima River heads near the crest of the Cascade Range, above Keechelus Lake at elevation 2,517 feet and flows for 175 miles generally southeastward to its confluence with the Columbia River near Richland. Major tributaries include the Kachess, Cle Elum, and Teanaway rivers in the north and the Naches River, which has two major tributaries - Bumping and Tieton rivers. Ahtanum, Toppenish, and Satus Creeks join the river in the lower portion of the basin. Natural runoff for the basin above Parker averaged about 3.5 million acre-feet annually over the period 1940-76. Natural runoff usually peaks in May and June and drops to its lowest point in August.

The Yakima project is primarily an irrigation project, with hydroelectric power generation as an associated function. Project reservoirs provide incidental flood control and recreation benefits, and project operation provides some flows for fish.

The water supply for the Yakima project comes from natural flow, storage, and return flows. The six federal reservoirs in the basin which help regulate this supply have a total storage capacity of 1,070,000 acre-feet - Bumping Lake (33,700 acre-feet), Keechelus Lake (157,800 acre-feet), Kachess Lake (239,000 acre-feet), Cle Elum Lake (436,900 acre-feet), Rimrock Lake (198,000 acre-feet), and Clear Lake (5,300 acre-feet). Other principal features include several diversion dams, two hydroelectric generating plants, canals, laterals, and pumping plants. The Yakima River basin schematic shows the major tributaries and diversions.

About three-fourths of the present storage capacity of the Yakima basin is in the upper Yakima drainage (Keechelus, Kachess, and Cle Elum Lakes). One-fourth of the storage capacity occurs in the upper Naches drainage (Bumping, Clear, and Rimrock lakes). Upper Yakima reservoirs meet water supply needs in the valley above the Yakima-Naches River confluence and are the main suppliers of storage water to the large irrigation districts in the lower valley. The upper Naches reservoirs provide storage releases to irrigation development in the lower Naches Valley and make a small contribution to the irrigation developments in the lower Yakima Valley. Return flows from irrigation developments in the upper valley are major contributors to some lower valley irrigators.

The six project reservoirs are the key to present regulation and utilization of the Yakima basin water supply. Operation of these reservoirs provides the control necessary to meet the basin's irrigation needs in most years by the storage of winter and spring runoff for subsequent use

during July through September when natural runoff is low and irrigation demands are high. The carryover of water in storage from one irrigation season to the next is essential in assuming an adequate supply in water deficient years. Present carryover capability is limited.

Operational Problems

An objective of river operation is to maintain a flow of 200 cubic feet per second (ft^3/s) past Sunnyside Diversion Dam during the period April through September. This flow is based primarily on fishery considerations. In actual practice and during most years, a constant flow of 200 ft^3/s cannot be achieved and flows may vary from 1,000 ft^3/s to less than 100 ft^3/s. In poor water years, flows drop to zero and Sunnyside Canal does not receive adequate water. Meeting the target flow is difficult because the upstream storage dams are at a great distance from Sunnyside Diversion Dam which results in flow lag times of 12 to 40 hours depending upon the point of release and magnitude of flows. The maximum lag represents low flows from Keechelus Lake and the minimum represents high flows from Rimrock Lake.

Downstream from the storage reservoirs and upstream from Sunnyside Diversion Dam are a number of unregulated tributaries and many diversions. Major diverters provide a minimum 2-day advance notice to the Yakima Project Office when diversions are changed. But minor diverters, of which there are many, do not provide notice of diversion changes. Because of the long lag times from release points, short-term or rapid changes in unregulated inflows or diversions cannot be compensated by adjustment of flows at the storage reservoirs. As a result, flows at Sunnyside Diversion Dam fluctuate more than is desirable, causing operational problems. Present operational problems include (1) frequent gate changes to maintain a stable flow in Sunnyside Canal, (2) increase releases from storage reservoirs in an attempt to assure that the minimum flow of 200 ft^3/s is met and to buffer river fluctuations, (3) reduced carryover of irrigation supplies for following years because of releases to provide a buffer, and (4) occasional flows of less than 200 ft^3/s which adversely affect operation of Sunnyside Canal and can adversely affect fish immediately below Sunnyside Diversion Dam.

PROPOSED FACILITIES AND OPERATIONS

The site and facilities description in this section were taken from the May 1978 feasibility report prepared by CH2M-Hill.

Site Description

The East Selah gravel pits are located between the Yakima River and Interstate Highway 82 on the floodplain just north of the city of Yakima and east of Selah. Although the area is generally flat, levees constructed around the gravel pits and excavation of sand and gravel have resulted in elevations of about 10 feet above to about 40 feet below normal river elevations. The existing riverbed and valley floor are alluvium and flood deposits, consisting of poorly to well-graded gravel with a small percentage of fines. Material size and compaction increase slightly to a depth of about 15 feet. Gravel size and the amount of compaction below

that depth is fairly constant being slightly cemented, capable of standing on near-vertical cut slopes in the gravel pits. A hardpan layer about 2-feet thick occurs at a depth of about 45 feet which is the maximum depth of present quarry activity.

Inactive gravel pits have filled with water and emergent vegetation has produced a marsh habitat around some of the pits. Scattered willow and cottonwood trees line many of the older ponds and the existing river dike.

A total of seven land parcels would be acquired to locate the reregulating reservoir at this site. Total acreage to be utilized would be 238.86 acres of which 215 acres are associated with the existing gravel mining operation.

Facilities

The facilities described here are from preliminary designs which would be refined and could be modified. A basic aspect of the design is that gravel mining in the reservoir area would continue, and provisions are included to allow for such activity. While final designs could result in some modifications and changes, the basic functions and aspects of the reregulating reservoir are not expected to change.

The reregulating facility would consist of three cells formed by constructing dikes and control structures to regulate water inflow, outflow, and transfer among cells (see East Selah Reregulating Reservoir Facilities schematic). All dikes would have slopes of three horizontal to one vertical and all, except for one, would have a top width of 15 feet. The interior northsouth dike is expected to be a main haul road for gravel mining and would have a top width of 24 feet. All dikes would have an elevation of 1,112 feet to provide 2.5 feet of freeboard above spillway crest elevation of 1,109.5 feet. The three cells would have a total capacity of about 3,000 acre-feet.

A variety of control structures would be constructed to regulate flows. The inlet canal, to be excavated to river bottom elevation, would be controlled by a manual gate. Inlet structures would be constructed from the inlet channel to cell A and from the inlet channel to cell B. The structures would consist of radial gates in concrete channels. A total of three transfer structures, to allow flow of water among cells and to allow storage in two cells while one cell is dewatered for mining, would be constructed. The transfer structures would consist of 10-foot-wide concrete chutes with heavy-duty slide gates.

Outlet structures consisting of 10-foot by 10-foot box culverts equipped with heavy-duty slide gates would be constructed in cell A to the river and in cell C to an outlet channel leading to the river. Each cell would have a 100-foot wide overflow spillway lined with four inches of asphalt concrete. Cells A and C would spill to the river, and cell B would spill to cell A.

Fish screens would be installed at the inlet and outlets of the reservoir. The inlet would be fitted with a self-cleaning screen to prevent entrance of anadromous smolts migrating downstream, and the outlets would be fitted with bar screens to prevent entrance of adult anadromous fish migrating upstream.

All of the gates, except the manual control gate in the inlet canal, would be fitted with remote control equipment. Remote monitoring equipment would be installed in the inlet canal to measure river elevations and in each cell to measure water-surface elevations of the cells.

Operation

The reregulating reservoir will be operated in most years with two active cells and one cell dewatered for mining gravel. During critical water years, it is possible that all three cells would be available for storage. Agreement with the gravel pit operator would be necessary for simultaneous use of the three cells. The single dewatered cell and two active cells will be rotated so that all parts of the reservoir will, over time, be available to the gravel mining activity. The two active cells will be filled or emptied as required to smooth river fluctuations and maintain target flows past Sunnyside Diversion Dam. Project personnel at the Bureau of Reclamation's Yakima Project Office will use remote control and monitoring equipment to operate the facility.

During the irrigation season, the manual gate in the inlet canal will normally be left wide open. Between irrigation seasons, the gate would normally be closed to permit the cells to be dewatered for mining operations, to prevent ice damage to control structures, and to prevent uncontrolled flows through the cells during floods.

ACCOMPLISHMENTS AND EFFECTS

Operational Modeling

Operational modeling of flows by computer was used to determine the effects of a reregulating reservoir at East Selah. Historical flows for four water years, 1966, 1968, 1973, and 1977, were selected for the study because they are recent and reflect present operations and diversions. A range of target flows passing Sunnyside Diversion Dam, as measured at the Parker gage, was used to simulate operation of the reregulating reservoir and to determine possible water savings and benefits under varying conditions. The operational technique consisted of computing the three-day running average (present day plus previous two days) for flows at Parker and adjusting releases if the average differed by more than 50 ft^3/s from the target flow.

The modeling assumed that the reregulating reservoir would be operated with two cells, about 2,000 acre-feet of active storage, in good water years and operated with three cells, about 3,000 acre-feet of active storage, in critical water years (1973 and 1977). The model also assumes that between irrigation seasons the reregulating reservoir would not be in operation when storage reservoirs are filling or when spilling to

maintain flood control space. Just before irrigation releases begin, the reregulating reservoir would be filled.

In actual operation, river flow would be monitored continuously at Terrace Heights gage just below the confluence of the Yakima and Naches rivers. This gage would be used instead of the Parker gage just below Sunnyside Diversion Dam to measure target flows because diversion between Terrace Heights gage and Sunnyside Diversion Dam are essentially constant and adjusted with a 2-day notification to the project office. Using the Terrace Heights gage provides a large advantage because the lag time from the reregulating reservoir is only 2 hours to the gage compared with a 7½-hour lag to Sunnyside Diversion Dam.

Operational Effects

With operation of the reregulating reservoir, the present lag time of 12 to 40 hours to adjust flows at Sunnyside Diversion Dam would be reduced to two hours (lag time from the reregulating reservoir to Terrace Heights gage). The decrease in lag time for adjustment would reduce fluctuations at Sunnyside Diversion Dam.

While the reregulating reservoir would not actually increase the storage space within the basin, it would provide a means to decrease operational losses and increase the efficiency of using the available storage. This can be calculated as an increase in storage or water saved.

On the average, system storage releases to meet a specific target flow past Sunnyside Diversion Dam would be decreased by a daily average of about 100 ft^3/s during the storage control period (that period when releases are made for downstream requirements, usually June through October) with operation of the East Selah reregulating reservoir. During 75 percent of the years, the annual savings would amount to a total of 22,000 acre-feet and during 25 percent of the years the savings would amount to a total of 36,000 acre-feet. The volume of water that would be saved is a function of the average daily savings and the number of days in the storage control period which is increased when supplies are low and a possibility of shortage to irrigators exists. In addition, the magnitude and frequency of fluctuations above and below the target flow would be significantly decreased with operation of the reregulating reservoir.

While filling of the reservoir would be dependent entirely on flows released from the upper Yakima River, the water savings would occur in reservoirs located on both the upper Yakima River and the Naches River.

Major accomplishments of the East Selah reregulating reservoir would be to (1) increase the usable water supply, (2) stabilize lower Yakima River flows at Sunnyside Diversion Dam, (3) reduce the risk of water shortage to irrigation interests, and (4) potentially improve instream flows during the fall and winter.

Environmental Effects

Three areas of environmental concern have been identified by state and federal agencies: 1) fisheries, 2) water fowl, and 3) recreational use of the gravel pit area.

The design included in this report contains fish screens at the inlet and outlets of the reservoir to prevent the facility from impeding anadromous fish migration. This is a preliminary design and the exact nature of needed fish facilities would be determined in cooperation with state and federal fishery agencies during final design stage.

A resident fishery exists in the ponds formed by the gravel mining operation. The Washington State Department of Game does stocking of fish in those ponds not being actively mined, and the public is allowed access for fishing. The Department of Ecology is now consulting with the Department of Game to ascertain what resident fishery impacts would occur when the reregulating reservoir is constructed. The Department of Game is also being consulted to determine impacts on other forms of wildlife, such as waterfowl use of the area for nesting, rearing, and wintering. Potential mitigation measures will also be discussed.

Because the design and operation of the East Selah reregulating reservoir have not been finalized, it is not yet possible to provide details on possible impacts and mitigation measures for fish and wildlife resources and recreational use at the construction site. As detailed planning and design progresses, impacts would be accurately determined. Appropriate environmental compliance procedures will be taken and included in plans to ensure protection of environmental factors.

Additionally, protective measures will be required during the construction phase to reduce air and water pollution and to preserve visual value.

BENEFITS

The East Selah reregulating reservoir will reduce operational losses for the Yakima project, either as it now exists or if additional storage facilities are constructed through implementation of the Yakima River Basin Water Enhancement Project. If more storage is added, the benefits derived with the existing project could almost be doubled.

Major beneficiaries of the reregulating reservoir include irrigation interests who would receive a supplemental water supply during water-short years, and the anadromous fishery which would be provided with improved stream flows. Other benefits, which have not been quantified in this report, would also accrue to (1) irrigation interests from reduction of risk due to water shortage, (2) irrigation interests from reduced operation and maintenance costs, (3) resident fishery due to improved stream flow, (4) hydropower generation due to increased water supply, and (5) recreational interests from a better flow regime.

The reregulating facility enriches many aspects of the Yakima water regime and helps the operational system of the entire Yakima project. As mentioned previously, it's potential water savings can be increased appreciably by adding storage facilities in the future. For purposes

of this report, benefits have been quantified only for water savings applied to the existing Yakima project, and then assigned to supplemental irrigation and anadromous fisheries.

Benefits that would accrue to irrigation are based on a supplemental (insurance-water) need that occurs during water-short periods on an average of one in every 10 years. Thus, the annual water savings due to operation of the reregulating reservoir during shortage periods have been assigned to supplemental irrigation use (10 percent of the time).

The Study Team estimated fishery benefits based on the water saved annually being released from Cle Elum Lake for anadromous fish passage and maintenance of eggs and embryos in "redds." The releases for anadromous fish would be made each year except when a water shortage occurs and irrigation needs cannot be adequately met.

Benefits that have been quantified on an annual basis are as follows:

Anadromous fish	$ 487,000
Supplemental irrigation	720,000
Total	$1,207,000

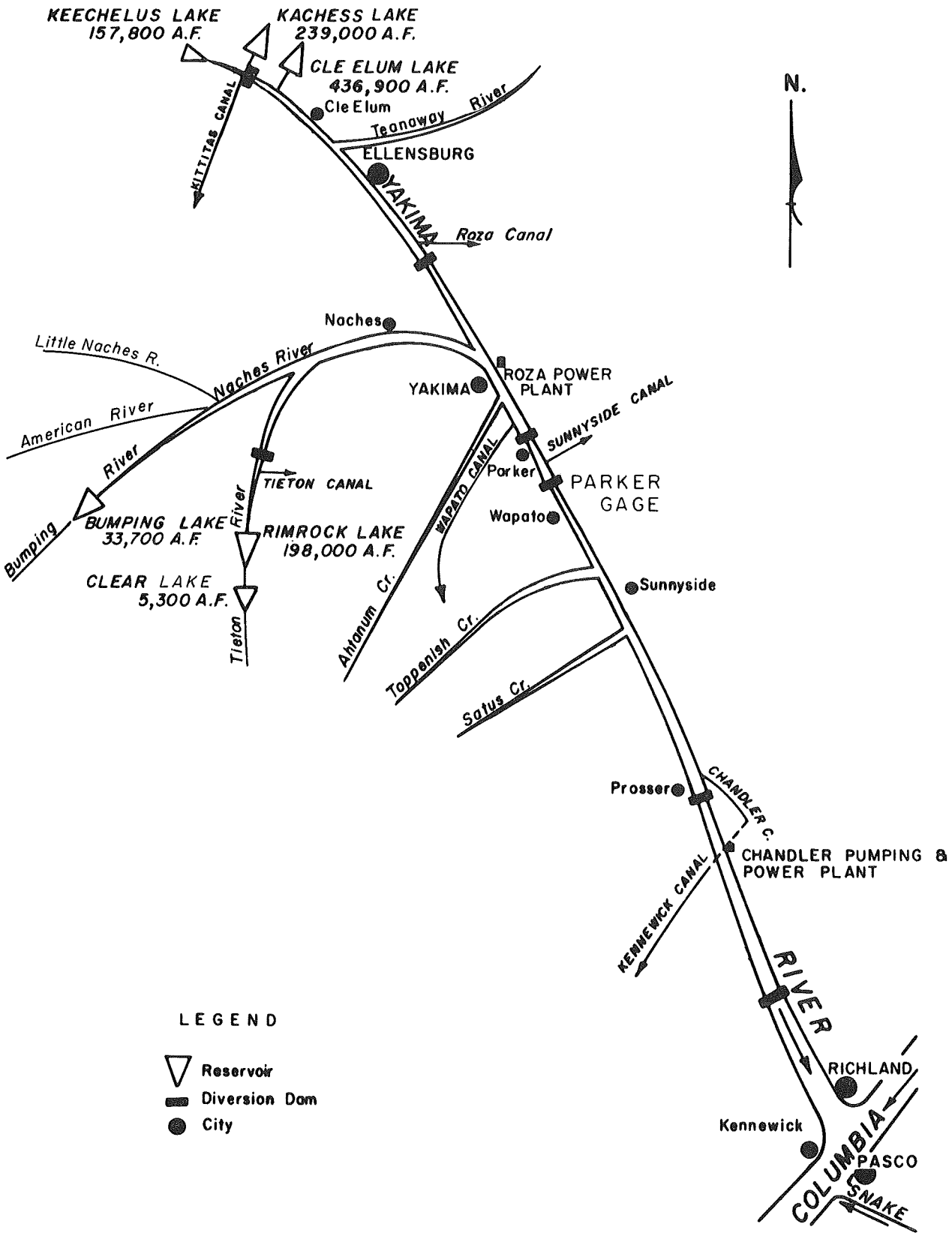
COSTS

A land acquisition study was conducted at the proposed East Selah reregulating reservoir site in 1978. The total just compensation for the land to be acquired, as estimated in the 1978 study, has been updated to 1982 values for this report. A final land acquisition determination will be made during the design phase. Approximately 238.86 acres will be acquired for the reregulating facility. The major land parcel is 215 acres of an industrial tract that is currently used as an operating gravel pit. The land acquisition costs for the gravel mining site are based on plans that the gravel pit operation will continue with approximately one-third of the reservoir area available for mining during the storage control season of each year.

Following are the estimated construction costs that have been updated from previous reports to a December 1982 price level:

Construction costs including design, administration, and facilities	$11,600,000
Lands and rights	1,000,000
Interest during construction	1,900,000
Total Investment Cost	$14,500,000

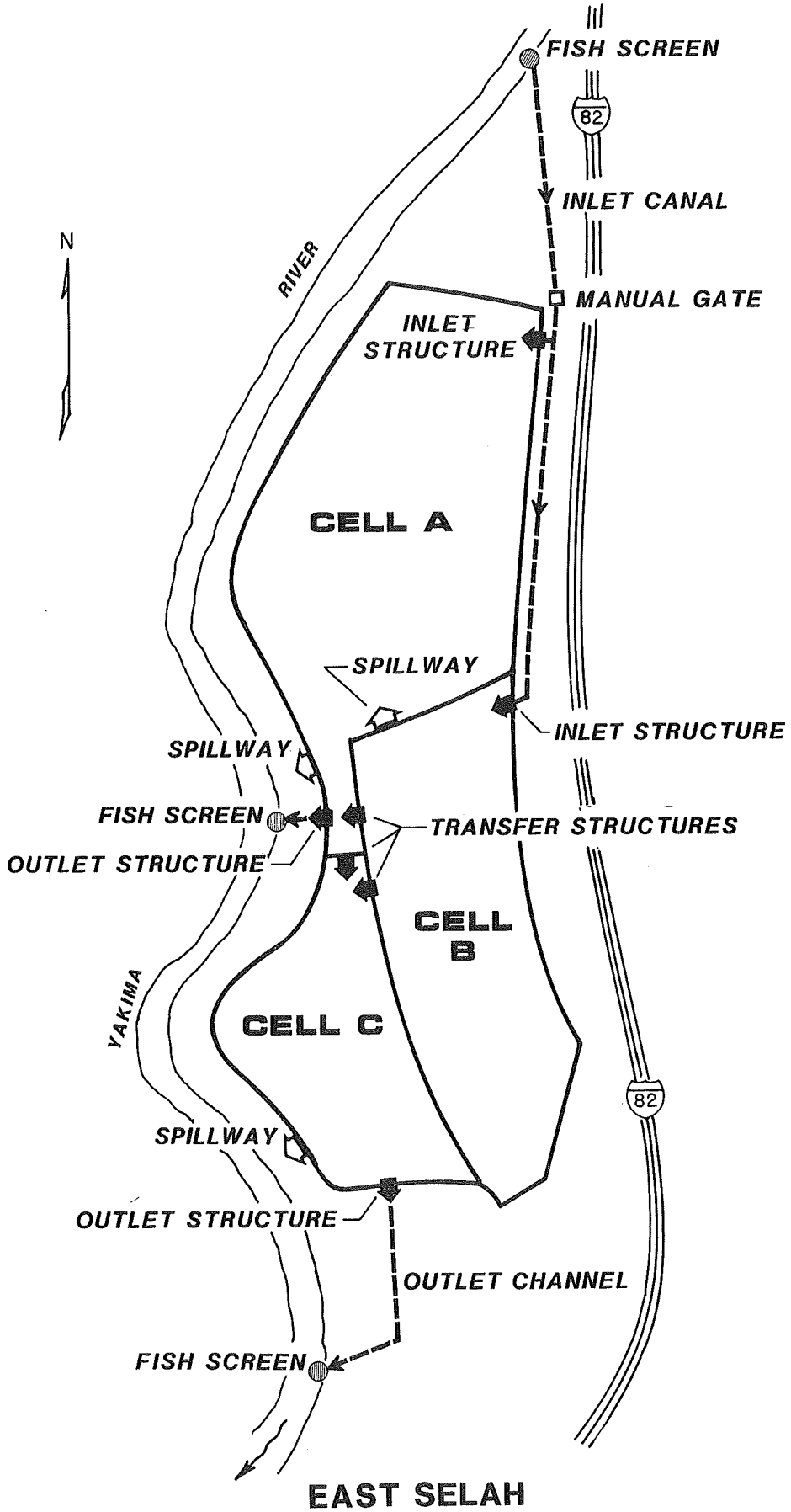
Annual operation, maintenance, and replacement cost is estimated at $56,000.



SCHEMATIC
YAKIMA RIVER BASIN

Bureau of Reclamation

August 1982



EAST SELAH
REREGULATING RESERVOIR FACILITIES

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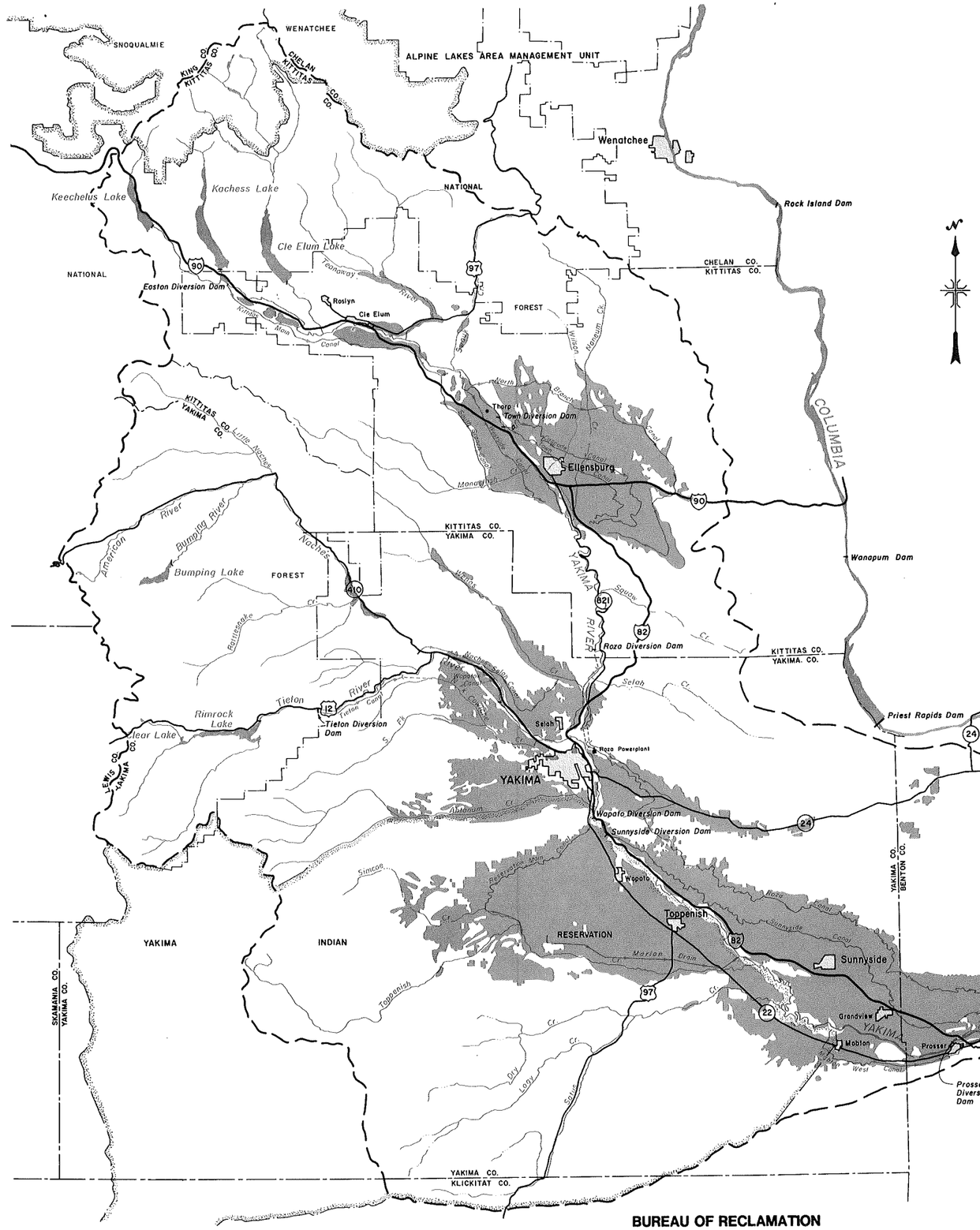
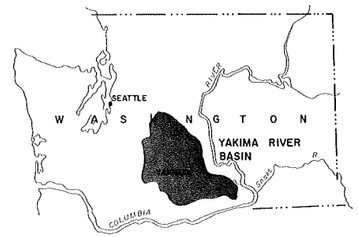
YAKIMA RIVER BASIN

PRESENTLY IRRIGATED LANDS





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