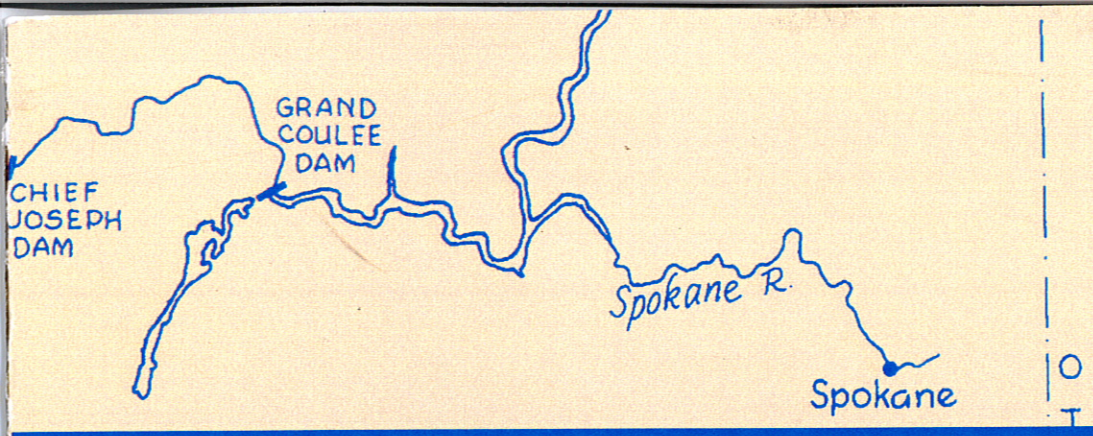
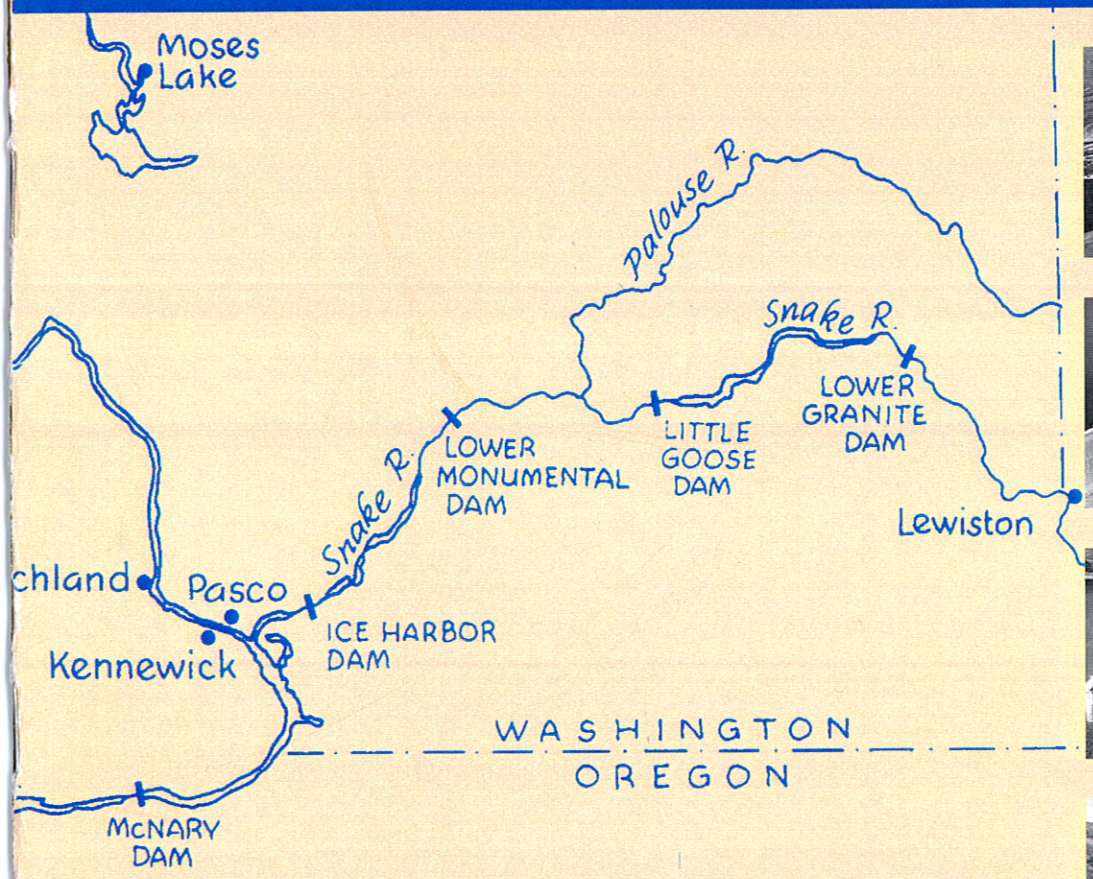
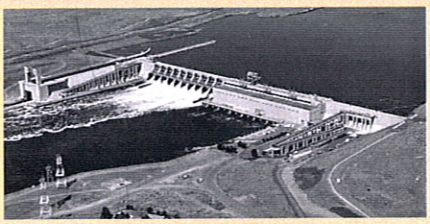
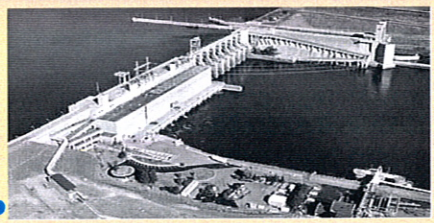


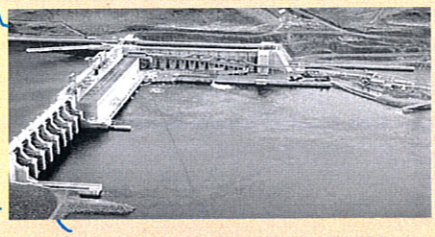
Lower Snake River Drawdown Study

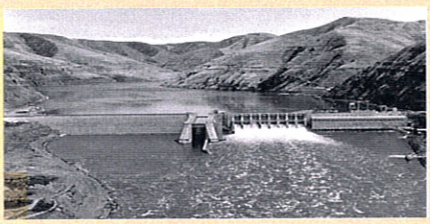
Summary of Transportation Impacts











prepared for
the Washington State Legislative Transportation Committee
by Lund Consulting, Inc.
with technical analysis by HDR Engineering, Inc.
February 1999

Washington State Legislature

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Lower Snake River Drawdown Study

Summary of Transportation Impacts

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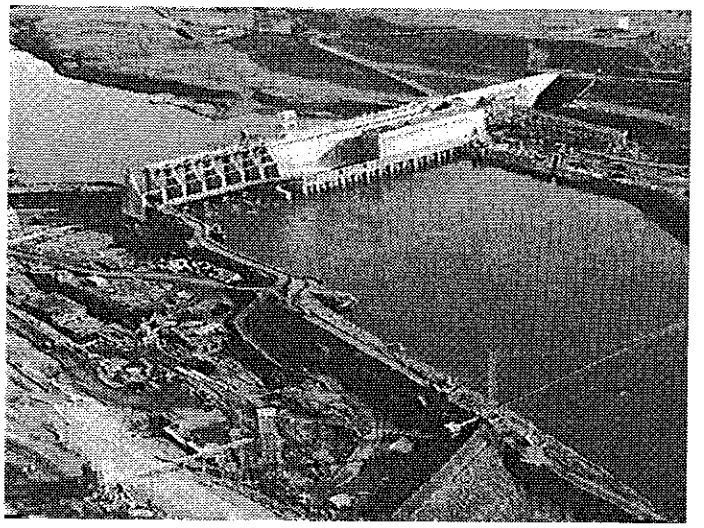
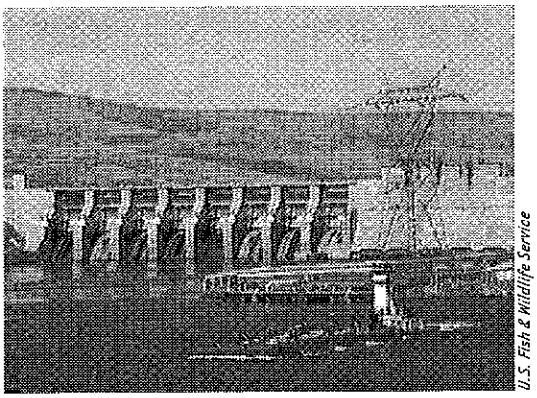


U.S. Fish & Wildlife Service

Ice Harbor Dam, dedicated in 1962, was the first of the lower Snake River dams in Washington State.

Lower Snake River Drawdown Study

SUMMARY OF TRANSPORTATION IMPACTS



U.S. Fish & Wildlife Service

Barge traffic on the lower Snake River.

Executive Summary

This report represents an analysis of transportation impacts to the state of Washington resulting from the proposed drawdown of four dams on the lower Snake River in eastern Washington — Lower Granite Dam, Little Goose Dam, Lower Monumental Dam, and Ice Harbor Dam. The 140-mile lower Snake River is now used to barge approximately 4.4 million tons of wheat, barley, wood, petroleum and other commodities annually, to and from oceangoing ports. Removal of the dams will necessitate shifts in the flow of commodities, resulting in possible long-term impacts to transportation service, systems, and related facilities.

In 1992, following a petition by the Shoshone-Bannock tribe, the Snake River sockeye salmon and the spring/summer and fall chinook salmon were listed as "endangered" by the U. S. Department of Commerce under the Endangered Species Act. Such action has triggered an analysis by the U. S. Army Corps of Engineers of the four dams on the lower Snake River in Washington for possible drawdown as one alternative to prevent further endangerment of the listed species or their habitat. By dam "drawdown" is meant the permanent breaching of the dams, returning the river to a more free-flowing state. The Federal government is considering a similar approach for the lower Columbia River.

The National Marine Fisheries Service of the U. S. Department of Commerce will decide by early 2000 if breaching these dams — Lower Granite, Little Goose, Lower Monumental, Ice Harbor — is the most "prudent and feasible" alternative to preventing further loss of the endangered species.

Drawdown of the dams will result in the loss of barge shipping on the lower Snake River, and will shift the movement of commodities in eastern Washington from barge to truck or rail.

Total Transportation Costs of Lower Snake River Dam Drawdowns

In the event of a dam drawdown, transportation will be impacted in two ways: infrastructure — roadways, rails, and bridges — may be damaged by weakened soils; and highway and/or rail facilities must be built or upgraded to accommodate increases in traffic. State total transportation cost impacts of the Snake River dam drawdowns are estimated at $132 million to $406 million,[1] and are summarized below. This broad range of cost estimates is due largely to uncertainty over geo-technical conditions of nearby soils, and the estimated cost of soil stabilization.

TRANSPORTATION COST IMPACTS OF SNAKE RIVER DRAWDOWNS (IN MILLIONS)*

	low	high
Soils stabilization costs	$48	$192
Highway scenario costs	$84.1	$100.7
Rail scenario costs	$182.4	$214.0

** Cost estimates by HDR Engineering, Inc. See Technical Memoranda 4 and 6 in Appendix B of this report.*

Geo-technical Impacts

Weakened soils resulting from the dam drawdowns may also weaken transportation infrastructure adjacent to the dams and reservoirs. Total costs to remedy or mitigate damage could total anywhere from $48 million to $192 million.[2] Precise cost estimates would require a more detailed and extensive engineering analysis, which is outside the scope of this study.

Impacts to Corridors

Following dam drawdown, producers would need to find alternate methods of transporting commodities to market. According to HDR Engineering, the most likely alternative shipping modes would be truck or rail. Thus, the study examined two different scenarios resulting from a loss of navigation on the lower Snake — a scenario where most commodities would be shifted to truck for shipment, and one where commodities would be shipped by rail.

Under the truck scenario, there would be an increase of 169,000 one-way truck trips per year on eastern Washington's highways. Roads most seriously impacted will be US 395 from the Tri-Cities to Ritzville, SR 124/US 12 from the Tri-Cities to Clarkston, and SR 26/ Pasco-Kahlotus Highway between the Tri-Cities and Colfax. The total cost impacts of $84 million to $101 million include intersection and pavement improvements in the affected corridors.[3]

In the rail scenario, an increase of 2.2 million annual tons to be shipped by rail, and an additional 1.8 million tons in additional truck traffic, is envisioned. Short lines and their related facilities would bear much of the increase, and there would be a need for improved and upgraded facilities, including bridges, interchanges, tracks, railroad cars, and grain elevators. The total cost of infrastructure improvements under this scenario (including new rail cars and some highway improvements) is estimated to be $182 million to $214 million.[4]

The Tri-Cities Area will be Most Affected

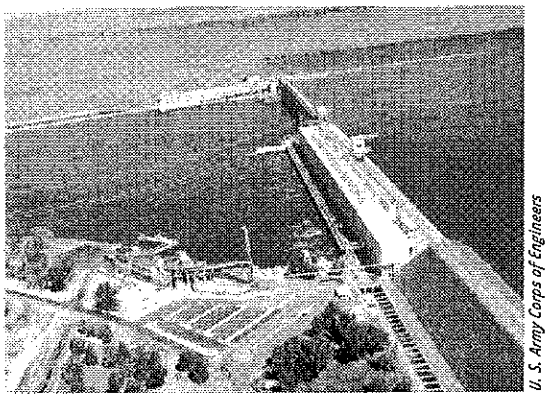
The cost impacts identified above are state transportation costs only. However, a brief analysis of regional economic impacts of the drawdowns was performed to describe the general economic landscape of eastern Washington following dam drawdowns.

According to estimates by HDR Engineering, it appears that most commodities originating upstream from the Tri-Cities area will be trucked to ports in the Tri-Cities area, and barged from there to Portland or southwest Washington ports. This convergence of commodities into the Tri-Cities area will have both economic and transportation implications. Intersection and capacity improvement costs alone in the Tri-Cities area are estimated to total $13 million to $16 million.[5]

While economic benefits will ensue to the Tri-Cities, producers and shippers in other eastern Washington communities are likely to see their shipping costs increase as their most economical mode of transport is no longer available to them. A reduction in profits as a result of increased shipping costs may ultimately take its toll on the viability of some marginally producing farms, and may also impact the value of agricultural land in some areas of eastern Washington. A decline in port-related employment is also anticipated for upriver communities, which will create an economic ripple effect in those areas.

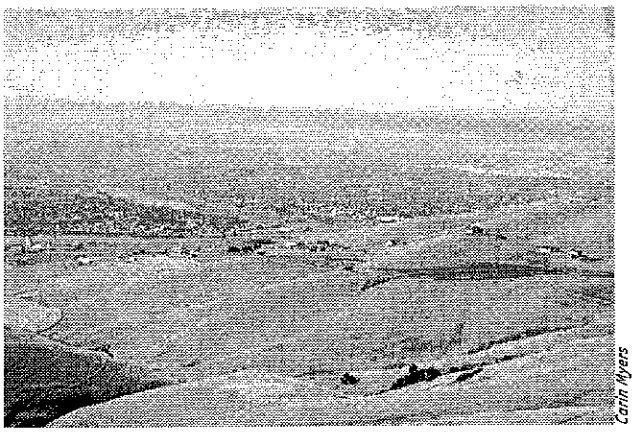
Future Studies

Results of planned studies on the potential breaching of two Columbia River dams, McNary and John Day, by the U. S. Army Corps of Engineers, may also impact future navigation and commodity shipment downstream on the Columbia River. However, this report covers only impacts related to Snake River dams, and cost impacts are limited to proposed changes to those dams' operations.



U. S. Army Corps of Engineers

Future studies may focus on Columbia River dams, including McNary Dam, shown here.



Wheat and the river—the economic backbone of eastern Washington.

Introduction

This report was prepared by Lund Consulting, Inc. in coordination with HDR Engineering Inc. The purpose of the report is to inform the Legislative Transportation Committee of possible transportation-related impacts of the potential drawdown of four dams on the Lower Snake River in Washington. This study addresses impacts to state highways and rail corridors. Except for a few county roadway geo-technical impacts, no other county, city, port district, or private property impacts have been analyzed. The report will also allow state legislators to make informed comment on the upcoming *Lower Snake River Juvenile Salmon Migration Feasibility Study* Draft Environmental Impact Statement to be issued by the U. S. Army Corps of Engineers in mid to late 1999.

Overview

The Snake River

The Snake River is 1,056 miles long, from its headwaters just inside the boundaries of Yellowstone National Park in Wyoming, through Grand Teton National Park, and into Idaho, Oregon, and Washington, where it meets the Columbia River four miles below Pasco.[6] From this confluence, as the Columbia River, it empties into the Pacific Ocean. The Snake is the tenth longest river in the United States, and in the West, only the Columbia carries more water. Lewis and Clark explored the Snake in 1805 in their search for a passage to the Pacific Ocean. In 1876 and 1898, the river was surveyed by the U. S. Army Corps of Engineers for its potential for future navigation. Thus, almost since the time of its discovery by early settlers, the Snake has been a "working river," and is today used largely for irrigation, flood control and hydroelectric power in Idaho and Wyoming, and for navigation in Washington State. The Snake is an intensively "managed" river, with over two dozen dams controlling its flow through four states.

History of Federal Actions

Dam building in the West—for power, irrigation, navigation , and flood control—began in earnest under President Franklin D. Roosevelt and the Works Progress Administration of the 1930s. From 1933 until 1977, considered by many to be the greatest period of dam

building in this country, over 1,000 dams were built in the Western United States.[7] Many of these multipurpose dams were built by the Bureau of Reclamation and by the U. S. Army Corps of Engineers. Western[8] dams helped to build a new, more efficient, and more productive agricultural economy, opening up vast new areas for farming and settlement, as well as opening up national and international markets for Western produce. Dams on the upper Columbia provided the Pacific Northwest with irrigation, flood control, and the most inexpensive hydroelectric power in the nation.

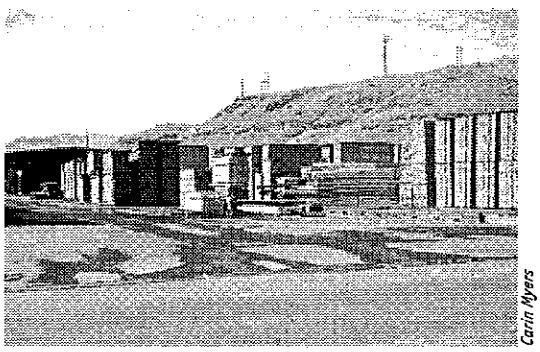
Although construction of the Snake River dams occurred only within the past generation, the project had its beginnings during Roosevelt's New Deal. In 1933, the Secretary of War submitted a report to the U. S. House of Representatives assessing the potential navigability of the Snake River as far as Lewiston, Idaho, based upon studies by the U. S. Army Corps of Engineers. The House Committee on Rivers and Harbors held hearings relating to the need for navigation on the Snake in 1944, and authorized the Lower Snake River Project in 1945.[9] Appropriations followed, and construction of the first of four new dams began in 1956.

Ice Harbor Dam, approximately eight miles east of Pasco, was the first dam on the Snake River in Washington, dedicated in 1962. Over the next thirteen years, three more dams were built on the Snake River in Washington. The dams were built from west to east — Lower Monumental (1969), approximately six miles south of Kahlotus, Little Goose (1970) on the Columbia – Whitman County border near Starbuck, and Lower Granite (1975), approximately sixty miles east of Clarkston.

Construction of the dams has created a series of slackwater reservoirs on the Snake's final 140 miles, where the water is both calm enough and deep enough to carry barge traffic. Although navigation occurred on the Snake River prior to dam construction, it did so in numbers much lower than today's traffic, and with smaller and lighter craft. As a result of the construction of these dams, some shifts in the economy of eastern Washington took place, perhaps best exemplified by the opening of inland ports to oceangoing navigation.

Snake River Navigation and Eastern Washington

The Snake River dams in Washington, the last to be built in the Columbia Basin, have allowed wheat and other agricultural products to be shipped inexpensively via barge to Pacific ports and beyond. Prior to the availability of barge shipping, commodities were shipped by rail, a situation decried for many years by farmers because of the high cost of rail shipping and the chronic unavailability of rail cars in peak harvest periods.[10]



Carin Ayers

Wood products are among the commodities shipped on the lower Snake River.

Shipment by barge, while not as fast as other methods of shipping, is significantly less expensive than shipping either by rail or by truck. Goods shipped by barge on the lower Snake River include wheat, barley, wood chips and other wood products, petroleum, fertilizers, and oceangoing containers. Wheat and barley constitute eighty percent of the commodities shipped. Most commodities are shipped downstream, that is, westward, with the exception of petroleum and fertilizers, which are shipped from west to east. Total tonnage of commodities barged on the Snake is as follows:

SNAKE RIVER COMMODITIES

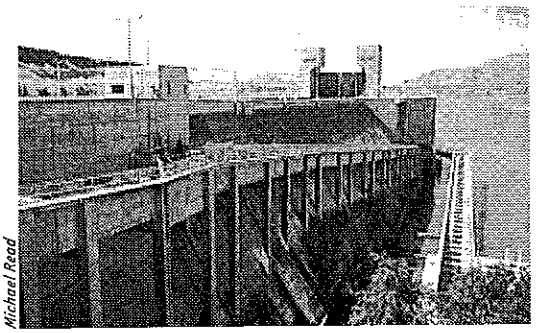
COMMODITY	VOLUME	DIRECTION
Wheat and barley	3,200,000 tons	downstream
Wood products	590,000 tons	downstream
Containers	458,000 tons	downstream
Petroleum	115,000 tons	upstream
Fertilizers	33,000 tons	upstream[11]

(Data are the most recent figures available: 1996 for wheat and barley, and 1997 for all other commodities.)

The Snake River and the Endangered Species Act

Following the completion of Lower Granite Dam in 1975, Congress passed the Lower Snake River Compensation Plan in an effort to restore chinook salmon and steelhead trout to the Snake and its tributaries. Over $200 million has been invested in this compensation plan since 1976, yet the numbers of returning chinook salmon have continued to dwindle.[12] Scientists believe that a 2-6 percent return rate of wild salmon stock is necessary to reverse the decline in numbers of the species. Most recent figures estimate that chinook salmon are returning to Columbia Basin rivers to spawn at a rate of 0.47 percent, far less than is needed to ensure the survival of the species.

In late 1991, the Shoshone-Bannock tribe petitioned the federal government under the Endangered Species Act of 1973 (ESA) to list the Snake River sockeye salmon as endangered. A year later, after considering local and state efforts to protect the species from extinction, the U. S. Department of Commerce invoked the ESA and listed the Snake River sockeye salmon as endangered. That was followed by a listing of the Snake River spring/summer and fall chinook salmon as endangered, later reduced to "threatened."[13] Invocation of the Endangered Species Act requires federal agencies with jurisdiction to determine "reasonable and prudent alternatives" to be taken in order to insure that the species are not further jeopardized by federal action. The final decision on alternatives falls within the jurisdiction of the National Marine Fisheries Service (NMFS) of the U. S. Department of Commerce. The NMFS is largely influenced by its own biological opinions, which report on the success of efforts to protect endangered species. However, the Environmental Impact Statement (EIS), which will recommend a "preferred alternative," is the responsibility of the U. S. Army Corps of Engineers, Walla Walla District, the federal agency which constructed and operates the four dams on the lower Snake River. The purpose of the Army Corps's study is to "evaluate and screen structural measures that may increase the survival of juvenile anadromous fish as they migrate" [14] through the four dams on the lower Snake River in Washington.



Michael Read

One alternative would maintain the existing systems of fish transport.

Alternatives proposed for study in the Draft EIS are as follows:

1. MAINTAIN THE EXISTING SYSTEM OF FISH TRANSPORT, AND IMPROVE EXISTING FISH BYPASS FACILITIES

Some juvenile salmon, or smolts, are currently trucked or barged from hatcheries or from slackwater to free-flowing water, speeding their journey downstream. Pursuant to the 1995 NMFS biological opinion, the Army Corps also implements flow augmentation

and increases spill measures to assist fish migration. This option, which appears to be the least favored alternative, includes improvements such as longer fish diverting screens to direct fish away from the turbines (already installed at Lower Granite and Little Goose dams in 1996[15]), additional barging, and flow deflectors on spillways.

2. MAJOR SYSTEM IMPROVEMENTS

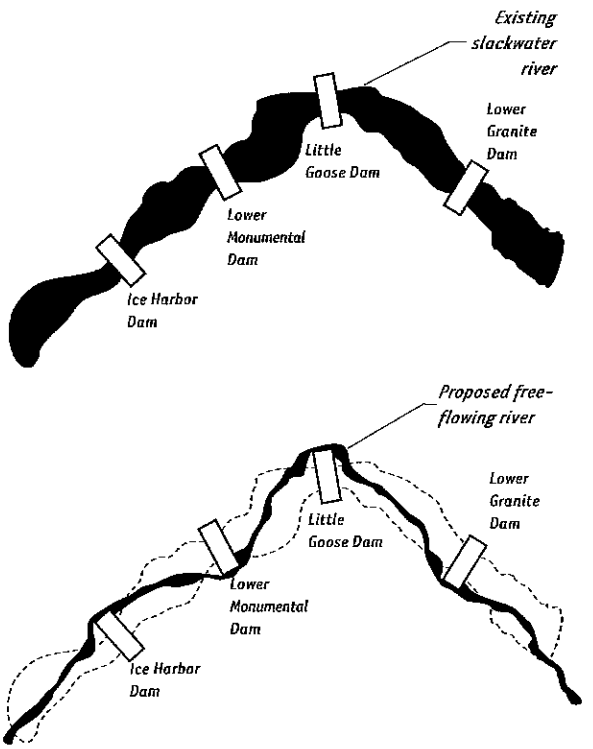
These improvements would take a more aggressive approach to increase the efficiency of transporting salmon smolts around the dams. Migrating fish that swim past the dams must either pass through turbines, through fish bypass systems, or over dam spillways. Many fish become disoriented in slow-moving slackwater pools, are killed by gas emissions from spillways, or die from the force of the dams' turbines while attempting to swim through them. Improvements proposed under this alternative include construction of surface bypass collection systems that divert fish nearer the water's surface than current systems; fish guidance improvements; turbine modifications, including costly screens; structural changes to reduce harmful dissolved gas levels from spillways; and operational changes such as modifying river flows and spills.

3. NATURAL DRAWDOWN OF THE RIVER

The four dams on the lower Snake River would be permanently breached; that is, the earthen embankments in the vicinity of the dams would be partially demolished or otherwise removed in order to allow the river to flow freely around and through the dams. Although the dams would be decommissioned, removal or demolition of the concrete dam structures themselves is not envisioned under this scenario. Natural river drawdown would lower the level of the reservoirs by approximately 100 feet below current operating elevations. Breaching of the dams would end commercial navigation and hydropower production on the lower Snake River, and significantly reduce irrigation.

These alternatives will be studied in full and results will be released in the Army's Draft EIS, expected to be issued in mid- to late 1999. The public and other interested parties will have time to comment on the Draft EIS following its release, and a Final EIS will be issued in 2000. The Final EIS will likely recommend a preferred alternative. The NMFS will issue its own decision on the most "prudent and feasible alternative" subsequent to the Final EIS. Although the NMFS has the decision-making authority, Congress must authorize as well as appropriate funds for any necessary implementation projects required, such as dam drawdowns.

In the meantime, numerous interested organizations and agencies have taken positions on the drawdown issue, and some new groups have been formed. Both the Army Corps and the NMFS have formed outreach groups as means of insuring broad public involvement in this politically and emotionally charged issue. The Army Corps has formed the Drawdown Regional Economic Workgroup (DREW) for involvement in the Corps's study. The DREW is ongoing and is being monitored by staff of the Washington State Legislature.[16]



Dam drawdown would result in a Snake River that flows faster, deeper, and narrower than at present.
(Note: drawings are not to scale, and are not intended to represent a specific drawdown proposal.)

More detailed lists of government jurisdictions and interested parties are included on pages 23 and 24 of this report, and in Technical Memorandum 8, "Snake River Drawdown Decision Process," Appendix C of this report.

River Drawdown & Transportation

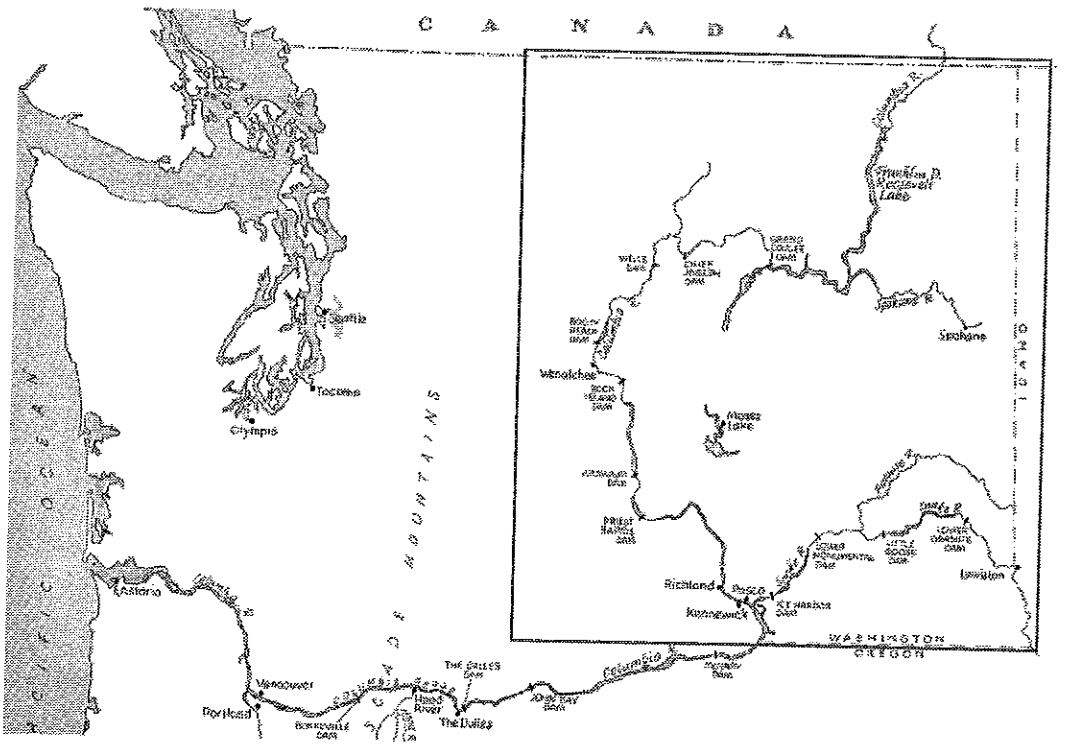
Carlin Myers

This study addresses transportation impacts only.

Although the proposed drawdown of the four dams on the lower Snake River in eastern Washington will have numerous and far-reaching effects, this study will examine only transportation and related impacts. Except for a few county roadway geo-technical impacts, no other county, city, port district, or private property impacts have been analyzed. Other agencies are or will be studying economic, social, and recreational impacts to eastern Washington and local communities, biological impacts on the endangered species and habitat, and impacts on delivery of hydroelectric power and irrigation to the affected area.

Under this study, several scenarios were analyzed to determine impacts to transportation services, systems, and facilities should the four dams be drawn down. The study and scenarios attempt to answer the following questions:

- With the loss of barge traffic on the Snake River, how would commodities be shipped to their final destination?
- What impacts would river drawdowns have on the soils of nearby embankments or transportation infrastructure?
- What would be the effects on state and local roadways or railroads?
- Would any commodities be caused to be shipped outside of Washington State?
- How would the change in shipment methods affect the cost of shipping? routes and modes chosen?



The project study area, showing the four dams on the lower Snake River.

Assumptions and Model

HDR performed its analysis using a study model for the flow of commodities based upon one previously developed for eastern Washington. The model is the Eastern Washington Intermodal Transportation Study, commonly known as the EWITS model. Under EWITS, the transportation networks and commodity flows in eastern Washington have been studied for the past seven years. Using this study model as a basis for analysis of Snake River dam drawdown impacts, HDR has generated a series of computer procedures that attempts to model accurately and predict rational economic behavior of growers and shippers in eastern Washington. The model:

- Maps the extensive farm-to-market roadway network in eastern Washington.
- Identifies lowest-cost routes and modes (including truck, barge, and rail) for shipping grain and other commodities.
- Maps likely routes and shipment frequencies.

This study model, which is used to predict likely shipping methods and routes following dam drawdown, was evaluated and approved by a panel of economic, agricultural, and transportation experts in October 1998. A more detailed and technical description of the EWITS model, its assumptions, and the peer panel review process, are included in HDR's Technical Memorandum 3, *Description of EWITS Model and Features*, in Appendix B of this report.

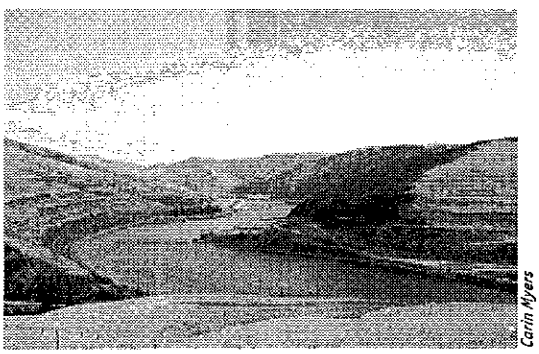
Transportation Impacts

The transportation effects of a dam drawdown include impacts to nearby soils, thus impacting transportation infrastructure in the adjacent areas, and impacts to the highway or rail corridors that will replace the river as primary shipping paths. The total cost of transportation effects, both geo-technical and corridor (highway or rail) impacts, could total as much as $406 million (1998 dollars).[17]

Geo-technical Implications of a Drawdown

Dam drawdowns will return the existing system of slackwater reservoirs to a more free-flowing state, resulting in a river that flows faster, yet deeper and narrower, than it does currently. Such a free-flowing waterway, a condition that was in place prior to 1962, is not suitable for barge traffic, which cannot negotiate swiftly flowing water that may also be subject to seasonal changes in level.

As the dams are drawn down and the level of the river is lowered, saturated soil in nearby embankments will be drained of water. Geo-technical effects to nearby soils are described below.



Carin Myers

Alluvial deposits, basalt bedrock, and talus slopes are characteristic of the Snake Riverbed and valley.

GENERAL SOIL CONDITIONS AND GEOLOGIC HISTORY OF SNAKE RIVER BASIN

The history of the Snake River valley is one of repetitive erosion and deposition. Large terraces of sand, gravel, lake deposits, and debris deposited by outwash from Ice Age glaciers are present along the entire length of the river in eastern Washington. In the terrace reaches, embankment foundations are generally sandy gravel or alluvial sands

covered with flood plain silt (up to fifteen feet). Besides these alluvial deposits, wind-deposited sand and silt, basalt bedrock, and talus slopes are the most distinct soil types and configurations to be found in the riverbed and valley. While alluvial deposits and basalt bedrock are generally deemed to be competent foundation materials, wind-deposited material is loose and low strength, and talus slopes are unstable in many areas.[18] Weaker soils benefited by dam construction in that these soils were strengthened by an increase in their water content.

EMBANKMENTS AND SLOPE PROTECTION

Railroad and roadway embankments adjacent to the river predate the dams by as much as seventy years. Many of these early embankments were built of random fill material, without efforts to compact the soil. At the time of dam construction, existing railroad embankments were not reconstructed but were rather provided with slope protection in the form of a twenty-seven inch thick layer of riprap, up to five feet in height.

1992 TEST DRAWDOWN

A test drawdown of Little Goose and Lower Granite dams was performed during the entire month of March 1992. During the drawdown, the levels of the reservoirs behind the dams were lowered to their 'minimum operating pool' levels, the lowest levels at which the dams were designed to operate. This experiment, performed by the Army Corps of Engineers during the peak migration month for juvenile salmon, did not study impacts on fish biology. It was intended to study structural impacts of a drawdown. A proposed 1993 test drawdown, intended to study impacts on fish biology, was never performed.

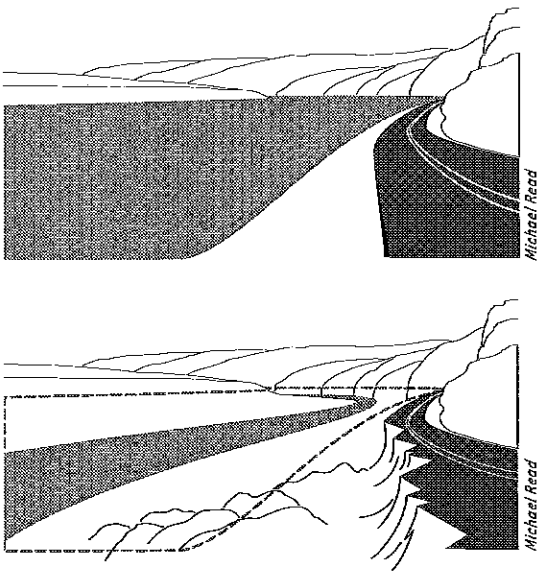
During the test drawdown, Whitman County Road 9000 and the Camas Prairie Railroad embankment were studied for soil impacts. Along Whitman County Road 9000, thirty-three areas of cracking, depressed and raised areas of the roadway were observed between Steptoe Canyon and Wawawai Canyon. Settlements of up to eighteen inches were noted, and cracks varied from 1/8" to 15". Sloughing of the slope occurred in two areas. The railroad embankment experienced lateral and vertical movement during the drawdown that required realignment and raising of the ballast at several locations, as well as orders to reduce train speeds in affected areas.[19]

Analysis of Geo-technical Impacts

Soils in the immediate vicinity of the river are in many cases already compromised, as they are man-made embankments that were constructed of random and uncompressed material in the earlier part of this century. Construction of the dams served to saturate the soils with water, providing additional strength in compression. Drawdown of the dams means that water will be drained from soils that have been saturated for twenty-five to forty years. Water will flow back into the river through rock joints and cracks, the talus slopes, and through the man-made embankments. Depending on the rate of drawdown, this movement of water could result in large seepage forces and reduced soil strengths that could contribute to slope instability, or worse, slope failure conditions. The slope failures could impact the operation of the roadways and railroads, and may cause damage ranging from soil settlement to catastrophic landslides.

Additionally, bridge foundations may also be impacted by a drawdown. Increased river

velocity may result in damage to bridge foundations. Likewise, bridges supported by deep foundations may be affected by lateral movement caused by a drawdown, which would impose large horizontal forces on the foundations. Vertical settlement may impose a large downdrag on deep foundations. Highway bridges most susceptible to impacts of a drawdown include SR 261 at Lyons Ferry, SR 127 at Central Ferry, and SR 127 at Deadman's Creek. Two railroad bridges at Lyons Ferry could also be impacted.[20]



Roads and rail lines near embankments will be threatened by slope instability.

Solutions and Costs

Solutions to geo-technical impacts differ between those intended to mitigate the impacts, that is, those solutions undertaken in advance of a drawdown, and solutions intended to remedy impacts to adjacent facilities. Remedial solutions would be undertaken following a drawdown, and following an assessment of damage to roads, bridges, and railroads. Mitigation efforts include:

- More detailed analysis of the precise rate at which the river could be drawn down to minimize unbalanced pore water pressures. This would require extensive point analysis of soil conditions at embankments, roadbeds, railroad grades, and canyon walls throughout the Snake River valley. The cost of such an investigation would exceed $1 million.
- Increasing soil strength through installation of stone columns, compaction grouting, or riprap replacement. Stone columns, installed along the face of the embankment, would provide improved drainage in the embankment and increase stability. Compaction grouting, which essentially replaces loose soil with denser and more stable soil, would improve the density and strength of some embankments and talus materials. Compaction grouting would work best in localized areas, such as at bridge abutments or structure footings.[21]

Mitigation costs, which include stabilization of 78 miles of railroad track, 30 miles of state and county roads, and strengthening of highway and railroad bridges, could total $82 million to $162 million.[22] While the focus of analysis is state transportation impacts, some county roadways are included in road costs because of their proximity to the river.

Remedial costs assume that no repairs or strengthening of soils would take place until after drawdown, and following observation of damage to adjacent embankments, bridges, or roadways. Costs would not include delay or detour costs from roadways or bridges closed due to embankment failure. Remedial measures include repair and replacement. Approximately 78 miles of railroad grade along the north and south embankments may be affected by substantially weakened soils. An additional thirty miles of state and county roads would be impacted.

Remedial repair costs, including railroad track repair, state and county road repair, and highway and railroad bridge repair, could total $48 million to $192 million.[23]

Total costs of geo-technical impacts are summarized in the table below:

SOILS STABILIZATION COSTS (IN MILLIONS)*

Unit	Location	Mitigation costs (STABILIZE BEFORE DRAWDOWN)		Repair costs (REPAIR AFTER DRAWDOWN)	
		Low	High	Low	High
Union Pacific RR	S. side of river, Ice Harbor to Lyons Ferry	$25	$45	$12	$53
Camas Prairie RR	N. side of river, Lyons Ferry to Clarkston	$40	$80	$24	$93
Northern Pacific RR	N. side of river, Ice Harbor to L. Monumental	$ 5	$10	$ 1	$ 6
State & County Rds.	various short segments	$ 2	$ 4	$ 2	$10
Whitman Cty. Rd. 9000	Wawawai to Clarkston	$ 4	$ 8	$ 3	$15
Highway Bridges	various	$ 4	$10	$ 4	$10
Railroad Bridges	near Lyons Ferry	$ 2	$ 5	$ 2	$ 5
TOTAL		$82	$162	$48	$192

** Cost estimates by HDR Engineering, Inc. See Technical Memorandum 4 in Appendix B of this report.*

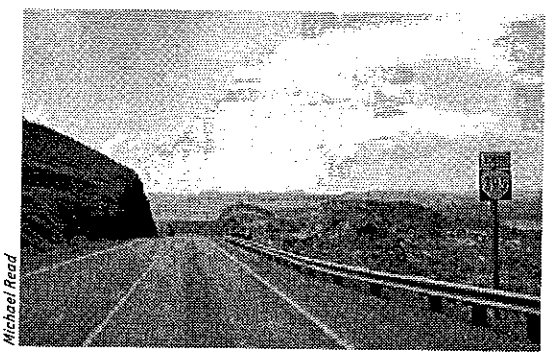
Corridor Impacts of a Drawdown

Following a drawdown of the four dams on the lower Snake, the river would become non-navigable upstream of the Tri-Cities. Farmers must then choose between shipping via truck or rail. Uncertainty regarding the relative costs of trucking and rail following a drawdown led HDR to the consideration of several possible shipping outcomes to be evaluated using the modified EWITS model.

Two scenarios were evaluated, a highway and railroad scenario. Under the highway scenario, a truck and barge combination would continue to carry the majority of commodities. Under the rail scenario, a significant (but not total) shift in commodities to rail would maximize the need for upgraded railroad facilities.

Highway Scenario Impact

Under this scenario, it is assumed that shipping rates for rail and truck/barge systems would not change relative to one another. Thus, downstream of the Tri-Cities, commodities would continue to be shipped by barge down the Columbia River to Portland or southwest Washington ports. Upstream of the Tri-Cities, commodities would be moved by truck to the nearest slackwater port, possibly one in the Tri-Cities area. From there, commodities would be off-loaded at transshipment stations onto barges and then sent to ocean ports.



Michael Read

Route 395 will be one of the state highways most impacted under this scenario.

TRANSPORTATION CORRIDORS AFFECTED

Three primary highway corridors and their tributary roadway systems would be affected — US 395 between the Tri-Cities and Ritzville; SR 124/US 12 from the Tri-Cities to Clarkston, and SR 26/Pasco-Kahlotus Highway between Pasco and Colfax. These highways would receive an annual increase in 4,512,000 tons of freight, or 169,000 additional one-way truck trips per year (1,608 additional trucks per day during the peak month).[24]

Infrastructure improvements would be necessary to maintain levels of traffic service,

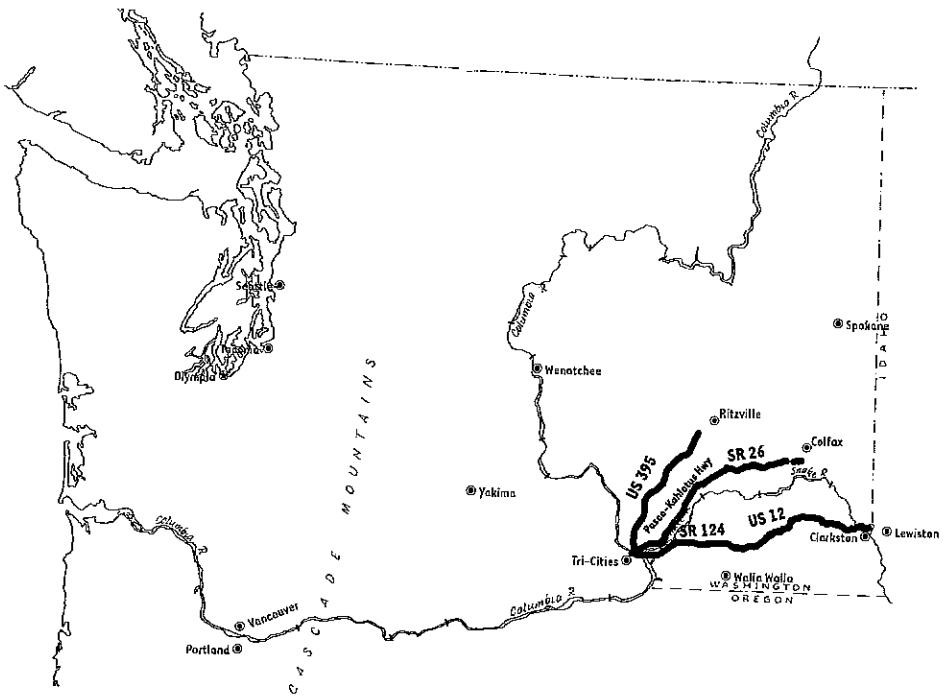
as well as minimize congestion, on state and local highways. Improvement projects include intersection and interchange improvements to minimize congestion, as well as some localized capacity increases. Additionally, roadway surfaces would require increased maintenance, and resurfacing would likely be necessary sooner than would have been without increases in traffic. A further factor for consideration is the cost of an increase in the number of traffic accidents that would occur as a result of increased traffic volumes on local and state highways.

The total cost impacts of the highway scenario are estimated at $84.1 million to $100.7 million, and are given in detail in the table and map below:

COST IMPACTS, HIGHWAY SCENARIO (IN MILLIONS)*

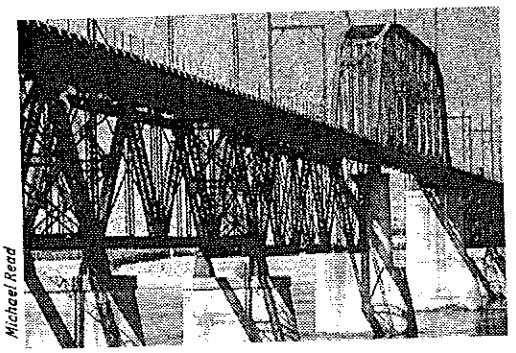
Highway Corridor	Intersection Low	Intersection High	Pavement Low	Pavement High	Total Transp. Cost Low	Total Transp. Cost High	Annual Increase in accident costs
US 395 (Tri-Cities to Ritzville)	$0	$0	$20.4	$24.4	$20.4	$24.4	$0.5
SR 26/Pasco-Kahlotus Highway (Tri-Cities to Colfax)	$0	$0	$18.9	$22.7	$18.9	$22.7	$0.5
SR 124/US 12 (Tri-Cities to Clarkston)	$0.2	$0.2	$31.3	$37.6	$31.5	$37.8	$1.3
Tri-Cities Area	$8.7	$10.4	$4.6	$5.4	$13.3	$15.8	$0.1
TOTAL	$8.9	$10.6	$75.2	$90.1	$84.1	$100.7	$2.4

** Cost estimates by HDR Engineering, Inc. See Technical Memorandum 6 in Appendix B of this report.*

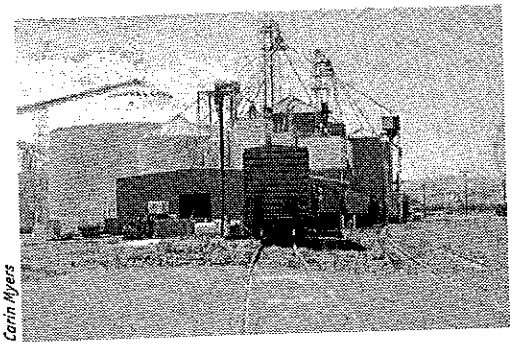


US 395, SR 26/Pasco-Kahlotus Highway, and SR 124/US 12 will be most impacted under a highway scenario.

Railroad Scenario Impacts



Michael Reed



Corin Myers

Railroad bridges and silos will require improvements under a rail scenario.

This scenario assumes that railroad costs would be reduced relative to truck/barge transportation rates by 10%. Such a scenario could take place if, following a drawdown, railroads attempt to become more competitive with trucking. Rates could be reduced by negotiating contract rates with guaranteed shipment volumes. This method of low-cost shipping is currently used by freight railroads in the Midwest and Northern Plains states.[25] This scenario also assumes the availability of sufficient rail cars to meet additional demand for shipping. The cost of an additional 1,000 rail cars is included in the total cost impact of this scenario.

Under a rail scenario, there would be a significant shift of commodity shipment to rail, an increase of 2.2 million tons per year. Because trucks serve areas not served by rail and would retain a competitive advantage in some areas of the state, truck traffic would also increase under this scenario, by approximately 1.8 million tons per year.

Short line railroads would be most affected, as well as their related facilities, such as bridges, grain elevators, interchanges, storage tracks (necessary to assemble cars into unit trains), and possibly rail cars. Affected railroads include the Blue Mountain Railroad, Palouse River Railroad, Camas Prairie Railroad, Burlington Northern-Santa Fe and Union Pacific mainlines, Coulee City-Palouse River corridor, and Columbia Basin corridor.[26]

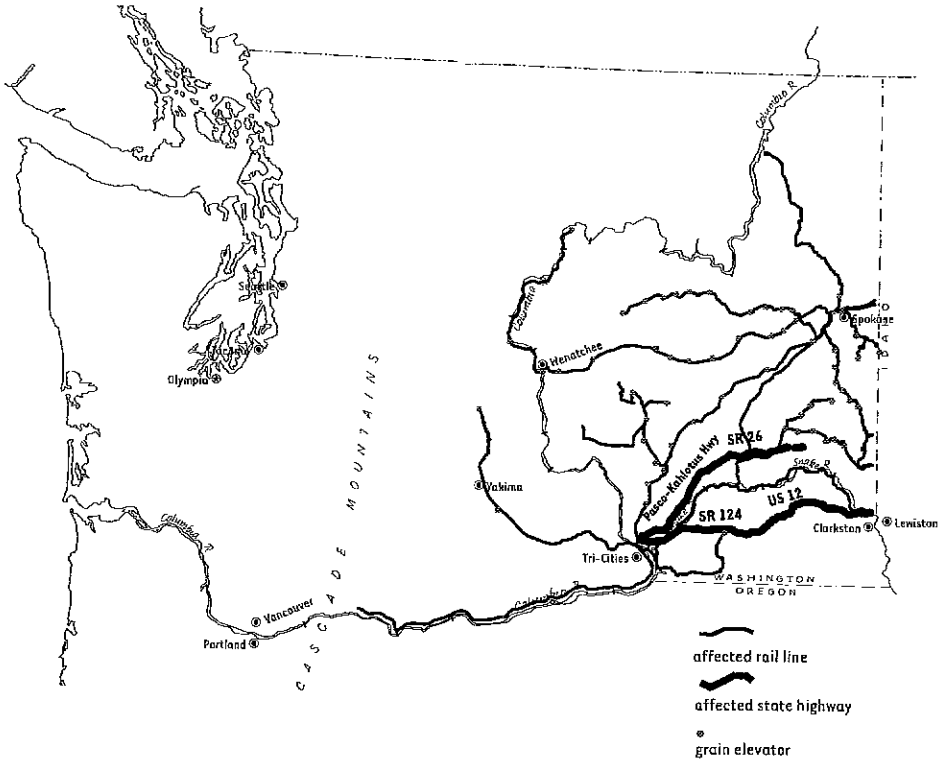
The total cost impacts of a rail scenario include: $17 million to $21 million in track and

COST IMPACTS, RAIL SCENARIO (IN MILLIONS)*

Railroad Corridor	Interchange Low	Interchange High	Track Upgrade Low	Track Upgrade High	Bridges, etc. Low	Bridges, etc. High	Elevators & loading Low	Elevators & loading High	Total Low	Total High
Blue Mountain RR	—	—	—	—	—	—	$0.4	$0.5	$0.4	$0.5
Palouse River RR	$2.8	$3.4	$4.6	$5.5	$1.0	$1.2	$8.8	$10.6	$17.2	$20.7
Camas Prairie RR	$2.0	$2.4	—	—	—	—	$0.8	$1.0	$2.8	$3.4
BNSF/UP Mainline	—	—	—	—	—	—	$8.4	$10.1	$8.4	$10.1
Coulee City Palouse R.	$2.0	$2.4	$4.0	$4.8	$1.0	$1.2	$4.0	$4.8	$11.0	$13.2
Columbia Basin	—	—	—	—	—	—	$1.6	$1.9	$1.6	$1.9
Columbia R. ports	—	—	—	—	—	—	$35.0	$42.0	$35.0	$42.0
SUBTOTAL	$6.8	$8.2	$8.6	$10.3	$2.0	$2.4	$59.0	$70.9	$76.4	$91.8
New Rail Cars	—	—	—	—	—	—	—	—	$50	$55
Related highway improvements	—	—	—	—	—	—	—	—	$56	$67.2
							TOTAL		$182.4	$214.0

** Cost estimates by HDR Engineering, Inc. See Technical Memorandum 6 in Appendix B of this report.*

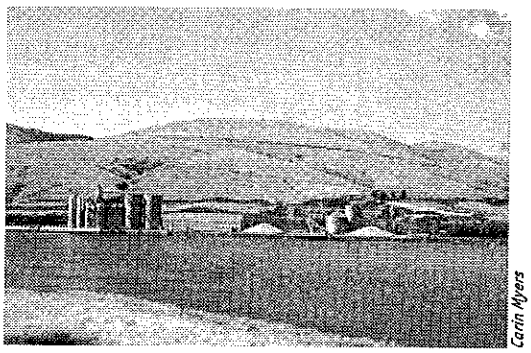
bridge improvements and interchanges; $59 million to $71 million for improvements at grain elevators; $50 million to $55 million in new rail cars; and $56 million to $67 million in related highway improvements.



An entire network of railroad and highway facilities would be impacted in eastern Washington under a scenario where a large percentage of commodities would be diverted to rail. Total transportation cost impacts under this scenario are estimated at $182 to $214 million.

Regional Economic Impacts

Out-of-state shifts are not envisioned to result from the lower Snake River dam drawdowns. (See HDR Technical Memorandum 7, *Summary of Commodity Shifts out of Eastern Washington as a Result of a Drawdown of the Lower Snake River Reservoirs,* for more detailed analysis.) Research by HDR, Inc. shows that commodities will not likely be diverted from Washington as a result of dam drawdowns. However, there will be a shift of commodity flows within the state, with some port communities experiencing a significant reduction in traffic and handling, and other ports, particularly those in the Tri-Cities area, experiencing an increase in shipping and port-related activity. Other impacts relate to the presumed increase in shipping rates as a result of the loss of an economical mode of transport, increases in operational costs at certain grain elevators, and other indirect costs such as a possible loss in value of some cropland, and employment changes resulting from port closures.

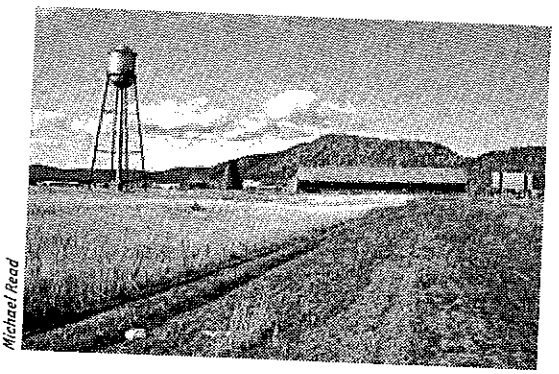


Carin Myers

Upriver ports would see the end of barge traffic on the lower Snake River.

HDR's analysis of commodity movement shifts focused specifically on grain, which com-

prises 75% of all commodities shipped on the Snake River. According to HDR, eliminating river navigation at the Snake River ports above the Tri-Cities would force most commodities that were formerly trucked to an upriver port to be shipped elsewhere. Based upon the EWITS, the study model used by HDR, these commodities would generally flow through one of several ports in the Tri-Cities area. From that port, the commodities would be shipped via barge down the Columbia River to Portland or southwest Washington ports, as at present. It is assumed that ports in the Tri-Cities area would thus be required to handle an additional 100 million bushels of grain en route to ocean ports. This is three to four times the amount of grain now handled at Tri-Cities ports, and translates into almost 700 more trucks per day on local roads, as well as increased traffic and activity at ports and transshipment areas in the Tri-Cities region.[27]



Michael Read

There may be a drop in the value of agricultural land, and some farms may go out of business.

This increased activity at Tri-Cities ports comes largely at the expense of upriver ports that will see an end to barge traffic. Commodities from these areas will likely be trucked to the Tri-Cities for loading onto barges. Under the study model used by HDR, it is assumed that shipping costs in affected corridors would immediately increase by $1.50 to $14 per ton, depending on the commodity. (See HDR Technical Memorandum 7, page 7-6, for a discussion of shipping price changes for specific commodities). The lowest increases in cost are for grain, the highest for petroleum.[28] Thus, the primary direct economic impact of a drawdown would be an increase in the commodity shipping costs borne by the producers, and a decrease in profits. Shipping cost increases may cause some marginal producers to go out of business.[29]

One indirect cost impact of dam drawdowns is a shift in regional earnings and employment. It is expected that some of the port facilities upriver from the Tri-Cities will close due to the termination of barge shipping at those ports. This would mean a loss of jobs for those employed at the ports, as well as an economic ripple effect throughout the local area. Although the loss to specific areas would likely be offset by an increase in activity in other communities in eastern Washington, notably the Tri-Cities, such news may be of small consolation to those in the affected communities.[30]

A second indirect cost impact of dam drawdowns is the potential loss in value of agricultural land in portions of eastern Washington. As lower profits are realized by some producers due to increases in shipping costs, that loss can lead to a proportionate reduction in land value. HDR estimates that the reduction in profitability of grain production could decrease land values by as much as $125 per acre in some areas of eastern Washington.[31]

Focus: Tri-Cities Area

The Tri-Cities of Richland, Pasco, and Kennewick will become the focal point of much of the new traffic that would be generated under either the truck/barge or the railroad scenarios, as described above. Increases in traffic would be a benefit to the local economy as more goods pass through local ports and transshipment points. It is estimated that for the Tri-Cities to handle the additional 100 million bushels of grain de-

scribed above, new investments in port-related facilities to handle additional traffic would be needed, as well as additional labor.

However, the increases to traffic on state and local roads also mean a possible decrease in the level of traffic service, potential increase in the number of accidents, and traffic congestion. An additional 696 trucks would be expected in the Tri-Cities area every day, most of them bound toward local ports or grain handling facilities. Necessary improvements to state roads and intersections to accommodate the additional traffic in the area are expected to cost from $13 million to $16 million.[32]

Next Steps

Decision Making Process

The Army Corps of Engineers Walla Walla District, together with the NMFS Seattle office, will recommend a preferred alternative in the Final EIS due to be released in early 2000. William Stelle, the northwest regional administrator of NMFS in Seattle, will make the final decision on the preferred alternative.

The Final EIS will then be sent to Congress. If the NMFS's preferred alternative is to breach the dams, Congress must do two things in order to implement that decision: it must authorize the Army Corps of Engineers to breach the federal dams on the lower Snake, and it must appropriate necessary funds to accomplish that task.[34]

PUBLIC COMMENT PERIOD

After the Draft EIS is published, there will be a two to three month comment period. That is the time for the State and other interested parties to comment by writing a comprehensive letter outlining their concerns to NMFS. The Draft EIS will likely NOT recommend a preferred alternative for the dams, but will merely lay out the options with arguments for and against each one. The preferred alternative — if one is laid out — will be included in the Final EIS expected in early 2000.

However, once the final EIS is published and a draft alternative is recommended, there is not an administrative agency appeal, according to the legal counsel for NMFS in Seattle (NMFS is an administrative agency of the federal government). Therefore, the State of Washington would have no ability to appeal the decision to NMFS or the Army Corps.

Once the preferred alternative has been delivered to Congress, interested parties, including the State, can vigorously participate in the legislative process. That is, in effect, an appeal process if the State opposes the preferred alternative.[35]

Other Issues

LEGAL QUESTIONS

Can there be a lawsuit filed by a party either after the NMFS/Corps decision or after Congress's decision? To file suit, there must be a cause of action to the administrative agency decision; for example, a failure to follow proper procedures. A suit filed after congressional action would almost certainly have to be on constitutional grounds. If a suit were filed, and the State wanted to join, the Attorney General could advise the

State on options. Likewise, if the State wanted to initiate a lawsuit, they should direct that question to the Attorney General for a list of options.[36]

TRANSPORTATION MITIGATION

If drawdown is selected as the preferred option and is authorized by Congress, how will appropriate mitigation measures be determined and by whom?

There is an ongoing process to conduct a variety of economic studies necessary to assist decision-makers in determining the best course of action to facilitate recovery of listed salmon. DREW, as mentioned on page 9 in this report, is led by the Army Corps of Engineers, and consists of numerous subcommittees reviewing everything from direct mitigation to social and economic impacts. DREW findings should be included in the Draft EIS. State legislative staff have been monitoring the DREW at monthly meetings in Portland. DREW participants include federal agencies, the Northwest Power Planning Council, tribes, state and local governments, and private interests.

Secondly, the State should participate in the comment period following the release of the Draft EIS. A detailed summation of necessary mitigation measures should the dams be breached would be appropriate at that point. Even if such measures are not recommended to Congress, they will be part of the record and included in a report to Congress.

Congress will ultimately make the decision on mitigation. Their decision, if any transportation mitigation is needed, will be influenced in some measure by DREW's work and whatever comments are made on the Draft EIS. Congress will craft whatever mitigation, if any, is needed, and Congress alone can provide federal funds for such mitigation.

As mentioned above, a detailed letter outlining desired mitigation measures from the State of Washington's viewpoint should be drafted during the Draft EIS comment period in late 1999.

A timeline of relevant dates is given below:

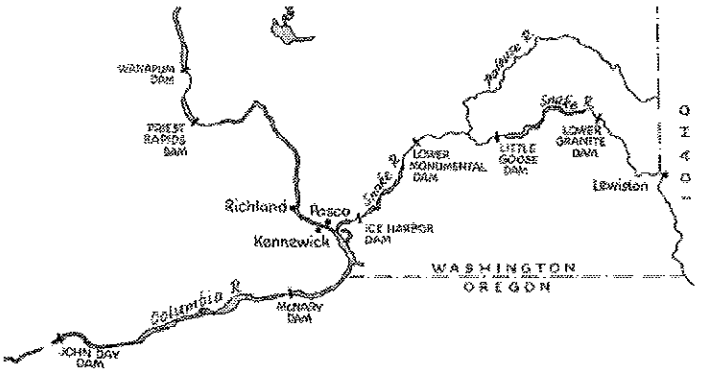
TIMELINE

Date	Action	By
mid to late 1999	Draft EIS, lower Snake River drawdown study	US Army Corps of Engineers, Walla Walla
late 1999	public comment on Draft EIS	general public, interested parties
early 2000	Final EIS, lower Snake River drawdown study	US Army Corps of Engineers, Walla Walla
2000	Preferred alternative selected, recommended	National Marine Fisheries Service, Seattle
	authorization and appropriation to implement	U. S. Congress

Emerging Issues

The Snake empties into the Columbia four miles below Pasco. The Columbia River is also being studied for possible impacts to endangered species and habitat. Results of studies of the McNary and John Day dams, the two easternmost of the four dams on the lower Columbia River, and those nearest to the Snake River confluence, are likely to impact future navigation on the Columbia, as well as future movements of commodities in eastern Washington.

The first phase of a drawdown study was begun for the John Day Dam in October 1998. It is part of the continuing Columbia River Fish Mitigation Study (CRFM). This yearlong, Congressionally-mandated study by the Army Corps of Engineers, Portland District, will determine if natural river drawdown of the John Day Dam (constructed 1968) could improve survival rates for migrating juvenile salmon.[33] A second phase, not yet authorized, would include an EIS to analyze impacts resulting from a natural river drawdown of the Columbia, as well as other alternatives.



Studies will soon be underway on two Columbia River dams, John Day and McNary.

Similarly, a drawdown study of McNary Dam (constructed 1954), though not yet mandated, is also within the scope of the CRFM Study. The NMFS's 1998 biological opinion requested that the Corps perform a drawdown study of McNary Dam, so it is likely that the Corps will request Congressional authorization for such a study in the near future. Drawdowns of these dams would likely affect commodity flows to the Tri-Cities as well as other ports, and would require additional analysis to determine impacts to state transportation facilities. The findings of this report will be altered if additional drawdowns occur, limiting access to the Tri-Cities.

Endnotes

[1] HDR, Inc. Technical Memorandum 4, "Summary of Geotechnical Implications of Drawdown on Parallel Transportation Facilities," page 4-15; and Technical Memorandum 6, "Summary of Corridor Impacts and Costs," pp. 6-4 — 6-8.
[2] HDR, Inc. Technical Memorandum 4, "Summary of Geotechnical Implications of Drawdown on Parallel Transportation Facilities," pp. 4-15.
[3] HDR, Inc. Technical Memorandum 6, "Summary of Corridor Impacts and Costs," pp. 6-4
[4] Ibid., pp. 6-6 — 6-8.
[5] Ibid., pp. 6-3 — 6-4.
[6] Palmer, Tim. *The Snake River: Window to the West*, Washington, DC: Island Press, 1991, p. 274.
U. S. Secretary of War. "Survey of the Snake River, Washington, from its Mouth to Riparia," (letter to the U. S. House of Representatives) Washington, DC: U. S. Government Printing Office, 1898, p. 2.
[7] International Commission on Large Dams. *World Register of Dams*, Paris, 1973. (updated 1976, 1977).
[8] Western states consist of Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.
[9] U. S. House of Representatives. "Snake River, Oreg., Wash., and Idaho" (Hearings before the Committee on Rivers and Harbors), Washington, DC, February 10, 1944
U. S. Secretary of the Army. "Middle Snake River, Snake River and Tributaries, Wyoming, Idaho, Oregon, and Washington" (letter to Congress), June 14, 1955.
[10] U. S. House of Representatives. "Snake River Hearings" 1944.
[11] HDR, Inc. Technical Memorandum 6, "Summary of Corridor Impacts and Costs," p. 6-3.
[12] U. S. Department of the Interior Fish and Wildlife Service. "To Restore a Legacy: The Struggle for the Snake River's Salmon and Steelhead (video)," n.d.
[13] Doubleday, Mike. Technical Memorandum 8, "Snake River Drawdown Decision Process," p. 8-8.
[14] U. S. Army Corps of Engineers, Walla Walla District. *Lower Snake River Juvenile Salmon Migration Feasibility Study*, System Configuration Study — Phase II, Interim Status Report, January, 1999.
[15] "Columbia Basin Bulletin, Weekly Fish and Wildlife News," October 26-30, 1998.
[16] Doubleday, Mike. Technical Memorandum 8, "Snake River Drawdown Decision Process," p.8-15.
[17] Total cost impacts are derived as follows: the low estimate is the sum of a) the lowest cost estimate of geotechnical impacts and b) the lowest cost estimate of the highway or the rail scenario, whichever is lower (in this case it is highway); the high estimate is the sum of c) the highest cost estimate of geo-technical impacts and d) the highest cost estimate of the highway or rail scenario, whichever is higher (in this case it is rail).
[18] HDR, Inc. Technical Memorandum 4, "Summary of Geotechnical Implications of Drawdown on Parallel Transportation Facilities," pp. 4-8 — 4-10.
[19] Ibid., p. 4-12.
[20] Ibid., p. 4-14.
[21] ibid., p. 4-13.
[22] Ibid., p. 4-15.
[23] Ibid., p. 4-15.
[24] HDR, Inc. Technical Memorandum 6, "Summary of Corridor Impacts and Costs," p. 6-3.
[25] Ibid., p. 6-2.
[26] Ibid., pp 6-5, 6-6.
[27] HDR, Inc. Technical Memorandum 7, "Summary of Commodity Shifts out of Eastern Washington as a Result of a Drawdown of the Lower Snake River Reservoirs," p. 7-3.
[28] Ibid., p. 7-6.
[29] Ibid., pp. 7-4 — 7-5.
[30] Ibid., p. 7-6.
[31] Ibid., p. 7-6.
[32] HDR, Inc. Technical Memorandum 6, "Summary of Corridor Impacts and Costs," p. 6-4.
[33] U. S. Army Corps of Engineers, Portland District. "John Day Drawdown Study," Information Paper, November 1998. Also, "The Columbia Basin Bulletin: Weekly Fish and Wildlife News," October 26-30, 1998. Also, telephone conversation with Adele Merchant and John Kranda of U. S. Army Corps of Engineers Portland District, December 23, 1998.
[34] Doubleday, Technical Memorandum 8, "Snake River Drawdown Decision Process," pp. 8-23 — 8-24.
[35] Ibid., p. 8-24.
[36] Ibid., 8-24.

Guide to Appendices

HDR Engineering Inc., and Mike Doubleday Government Relations prepared technical studies which support the information given in this report. These technical memoranda are included as appendices to this report, and are available through the staff of the Legislative Transportation Committee. Telephone LTC staff at (360) 786-7311.

Appendix B Technical Studies (HDR Engineering Inc.)

Technical Memorandum 1: *Annotated Bibliography of Existing EWITS and Eastern Washington Freight Mobility Study Data Sources*

Technical Memorandum 2: *Annotated Bibliography of Newly Acquired Data Sources*

Technical Memorandum 3: *Description of EWITS Model and Features*

Technical Memorandum 4: *Summary of Geotechnical Implications of Drawdown on Parallel Transportation Facilities*

Technical Memorandum 5: *Summary of Model Assumptions*

Technical Memorandum 6: *Summary of Corridor Impacts and Costs*

Technical Memorandum 7: *Summary of Commodity Shifts out of Eastern Washington as a Result of a Drawdown of the Lower Snake River Reservoirs*

Appendix C Technical Study (Mike Doubleday Government Relations)

Technical Memorandum 8: *Snake River Drawdown Decision Process*

Appendix A

Summary of assumptions for study model and analysis of drawdown impacts

(See HDR, Inc. Technical Memorandum 5 "Summary of Assumptions and Affected Corridors," in Appendix B of this report, for a complete description of assumptions and study methodology.)

Time Frame — This report assumes a drawdown under 1998 conditions, as opposed to the U. S. Army Corps of Engineers Draft EIS, which will examine a drawdown in the year 2008. A 1998 impact year allows for a clearer understanding of the effects of a drawdown, without needing to include unknown potentially mitigating factors that would be required under a future scenario.

Commodities — six commodity groups — wheat, barley, forest products (wood chips and logs), containers, petroleum, and fertilizers — make up 90% of all goods shipped on the Snake River. Of grain products, only grain which is grown in Washington, or is trucked into Washington for shipment by barge, is included in this study.

Volumes —calculated based upon 1997 (1996 for wheat and barley) data.

Shipping patterns — assumes that farmers will use the most direct routes and the most cost efficient methods of shipping.

Market demand — no significant changes in the markets that import and export goods traveling through eastern Washington are assumed.

Availability of systems and services — no significant changes in the availability and types of transportation modes, systems, or services are assumed.

Shipping rates — barge rates are estimated based upon the 1998 tariff sheet provided by each of the four common carriers; truck rates are provided directly by the motor carriers; rail rates are estimated based upon 1998 published tariff sheets.

Jurisdictions

(A more complete list appears in Technical Memorandum 8, "Snake River Drawdown Decision Process," Appendix C of this report.)

A host of parties have jurisdiction over the river and the salmon, or have an interest in the river or the salmon:

- **U. S. Congress.** Congress originally authorized the construction of the lower Snake River dams as federal multipurpose projects, and any change in purpose (whether navigation, hydropower production, flood control, irrigation, or recreation) must also be authorized by both houses of Congress. Congressional authority includes authorization as well as funding appropriation for any dam-related project.
- **National Marine Fisheries Service (NMFS).** Also known as NOAA Fisheries, this agency is a division of the U. S. Department of Commerce, and is responsible for the final administrative agency decision on lower Snake River dam drawdowns. Its 1995 biological opinion directed the Army Corps of Engineers to prepare the feasibility study currently underway.
- **U. S. Army Corps of Engineers,** Walla Walla District, built and maintains the four dams on the lower Snake River. *The Lower Snake River Juvenile Salmon Migration Feasibility Study*, the Environmental Impact Statement which is due in mid to late 1999, is being prepared by the Army Corps, a division of the federal Department of Defense. The study focuses on how the lower Snake River dams can be changed to improve survival and recovery prospects for Snake River salmon stocks listed as "endangered" under the Endangered Species Act of 1973. The Army Corps' Portland District is overseeing the study on the John Day Dam.
- **Bonneville Power Administration** is under the U. S. Department of Energy, and supplies power from dams in the Columbia River basin to energy customers.
- **Bureau of Reclamation.** This U. S. Department of the Interior agency operates other dams in the Columbia River basin. Its largest project was the construction of Grand Coulee Dam.
- **Indian tribes** (thirteen) — historically depend upon salmon fishing for sustenance and livelihood; the Shoshone–Bannock tribe filed the initial petition to list sockeye and chinook salmon on endangered species list.

Other agencies, listed below, are described in more detail in Technical Memorandum 8, "Snake River Drawdown Decision Process," Appendix C of this report.

AGENCIES AND JURISDICTIONS

- U. S. Energy Regulatory Commission
- State of Idaho
- State of Montana
- State of Oregon
- State of Washington
- "Three Sovereigns"
- Northwest Power Planning Council

INTERESTED PARTIES

- Environmental organizations
- Sportfishing groups
- Wheatgrowers Association
- Columbia River Alliance
- Northwest Waterways Association
- Public Power Council
- Irrigators Association

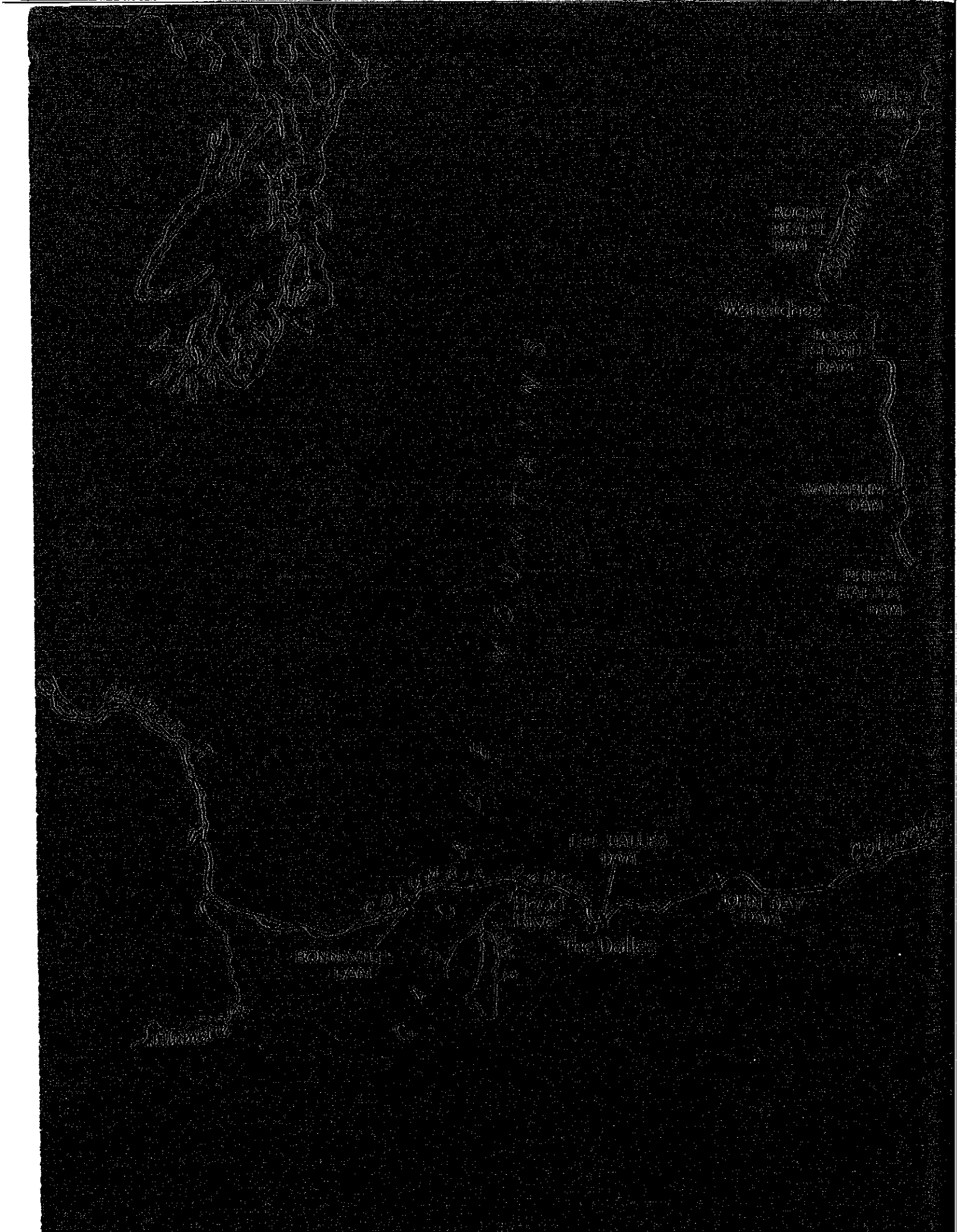
Consultant Team

Lund Consulting, Inc.

Kjris Lund, project manager
Mike Doubleday, government relations
Carin Myers, research and photography
Michael Read, graphics and presentations
Melinda Schneider, PowerPoint presentation
Dennis Sellin, writer

HDR Engineering, Inc.

Roger Johnson, Senior Vice President
Lawrence A. Kyle, project manager
Chris Fowler
Sorin Garber
George Oamek


ROCKY REACH DAM
Wenatchee
ROCK ISLAND DAM
WANAPUM DAM
PRIEST RAPIDS DAM
The Dalles
DAM
Columbia
Bonneville
DAM