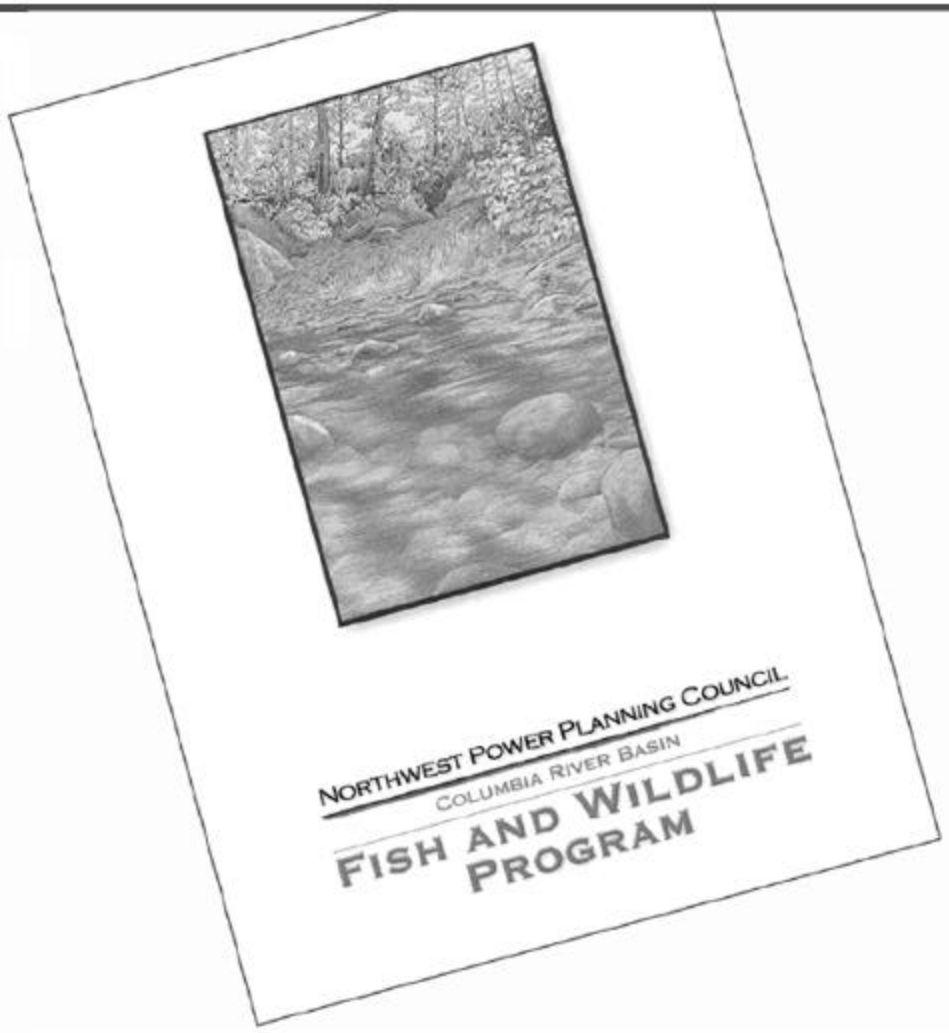
Draft
Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program

October 2002



Northwest Power Planning Council

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Introduction

The Columbia River Basin Fish and Wildlife Program

The states of the Columbia basin, Idaho, Montana, Oregon and Washington, formed the Northwest Power Planning Council, an interstate compact agency, under the authority of the Pacific Northwest Electric Power Planning and Conservation Act of 1980. The Power Act directs the Council to develop a program to protect, mitigate and enhance the fish and wildlife of the Columbia River Basin affected by the development and operation of the basin's hydroelectric facilities, while also assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply. The Act also directs the Council to inform the public about fish, wildlife and energy issues and to involve the public in its decisionmaking.

The Council's Columbia River Basin Fish and Wildlife Program, first adopted in 1982 and periodically revised, is the nation's largest regional effort to recover, rebuild, and mitigate impacts on fish and wildlife. As a planning, policy-making and reviewing body, the Council develops and then monitors implementation of the fish and wildlife program, which is implemented by the federal agencies that manage, operate and regulate the basin's hydroelectric facilities — the Bonneville Power Administration, the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the Federal Energy Regulatory Commission and its licensees.

The 2000 Fish and Wildlife Program and the draft mainstem plan

In 2000, the Council adopted a set of amendments to the fish and wildlife program to begin what will eventually be a complete revision of the program. In the first phase of the amendment process, the Council reorganized the program around a comprehensive framework of scientific and policy principles. The fundamental elements of the program as revised are the *vision*, which describes what the program is trying to accomplish with regard to fish and wildlife and other desired benefits from the river; basinwide *biological performance objectives*, which describe in general the fish and wildlife population characteristics needed to achieve the vision; implementation *strategies*, which will guide or describe the actions needed to achieve the desired ecological conditions; and a *scientific foundation*, which links these elements and explains why the Council believes certain kinds of actions should result in desired habitat conditions and why these conditions should improve fish and wildlife populations in the desired way.

The program amendments in 2000 set the stage for subsequent phases of the program revision process, in which the Council will adopt more specific objectives and action measures for the river's mainstem and the tributary subbasins, consistent with the basinwide vision, objectives and strategies in the program and its underlying scientific foundation. The Council intends to incorporate these specific objectives and measures

into the program in locally developed subbasin plans for the more than sixty subbasins of the Columbia River and in a coordinated plan for the mainstem Columbia and Snake rivers. This document is a draft of the *mainstem plan* that the Council is proposing to adopt into the program.

In preparing this draft mainstem plan, the Council solicited recommendations from the region's state and federal fish and wildlife agencies, Indian tribes, and others, as required by the Northwest Power Act. Various agencies and tribes responded, and the Council also received recommendations from other interested parties. The Council prepared this draft after reviewing the recommendations, supporting information submitted with the recommendations and comments received on the recommendations. The Council will conduct an extensive public comment period on the draft mainstem plan before finalizing the program amendments in early 2003.

Expectations for the elements of the mainstem plan

The role of the mainstem plan and the Council's expectations for the elements of that plan were described in the 2000 Fish and Wildlife Program, in the section on Basinwide Hydrosystem Strategies and in the section entitled Schedule for Further Rulemakings. The mainstem plan is to contain the specific objectives and action measures that the program calls on the federal operating agencies and others to implement in the mainstem Columbia and Snake rivers, including especially the operations of the hydrosystem, to protect, mitigate and enhance fish and wildlife affected by the development and operation of the hydroelectric facilities, while assuring the region an adequate, efficient, economical and reliable power supply. The draft mainstem plan includes objectives and measures relating to, among other matters:

- the protection and enhancement of mainstem habitat, including spawning, rearing, resting and migration areas for salmon and steelhead and resident salmonids and other fish;
- system water management;
- passage spill at mainstem dams;
- adult and juvenile passage modifications at mainstem dams;
- juvenile fish transportation;
- adult survival during upstream migration through the mainstem;
- reservoir elevations and operational requirements to protect resident fish and wildlife;
- water quality conditions; and
- research, monitoring and evaluation.

The Council evaluated the mainstem plan recommendations and these draft program amendments for consistency with the program framework elements adopted in 2000, including the vision, biological objectives, habitat and hydrosystem strategies and underlying scientific principles.

A different mainstem plan for a different context

Past versions of the Council's fish and wildlife program, including the most recent revision in 1994-95, specified in great detail the system operations for fish and wildlife that the Council and recommending entities called for from the federal operating agencies. In December 2000, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service issued Biological Opinions for the operation of the Federal Columbia River Power System to benefit populations of salmon, steelhead, bull trout and white sturgeon listed as threatened or endangered under the federal Endangered Species Act. The hydrosystem measures in these opinions run to hundreds of pages of detail and hundreds of measures on system configuration, river flows, reservoir management, passage improvements, spill, juvenile transportation, predator management and more. These measures are built on foundations developed in the Council's program over the past 20 years.

The Council asked for recommendations addressing, in part, how the Council's mainstem plan should relate to these biological opinions on hydrosystem operations. The relevant recommendations received can be loosely grouped into four categories:

- recommendations that the Council adopt a mainstem plan consistent with the objectives and measures in the biological opinions;
- recommendations that concluded that the biological opinions do not prescribe sufficient flow, spill and passage operations to benefit listed fish, and so the Council should adopt additional measures to that end;
- recommendations that concluded that the biological opinions exceeded what was necessary to benefit listed fish, to the detriment of the power supply and other uses of the river, and so the Council should adopt a mainstem plan with scaled back flow and spill operations that are, in their view, more biologically and economically efficient in how the limited resources of the region are applied; and
- recommendations that concluded that the operations specified in the biological opinions are not sufficient to protect, enhance or mitigate for the adverse effects of the hydrosystem on non-listed fish and wildlife, and may be especially adverse to resident fish (listed and non-listed), and so the Council should adopt objectives and measures for that purpose, which would be either supplemental to or in some cases in conflict with current implementation approaches to biological opinion operations.

The Council considered and drew from recommendations in all four categories in developing this draft mainstem plan. In some parts of the draft this has meant highlighting alternative operational strategies. The Council is seeking public comment on all parts of the draft mainstem plan, but is particularly interested in receiving comment on resolving the difficult issues represented by these alternatives.

In general, however, two overriding concerns have motivated the Council in deciding what objectives and measures to include in this draft mainstem plan:

- The draft mainstem plan includes a set of habitat considerations, objectives, principles and measures intended to protect, mitigate and enhance *all* the fish and wildlife of the Columbia River Basin that have been affected by the development, operation and management of the hydrosystem and that inhabit the mainstem of the Columbia and Snake rivers during part or all of their lives, whether listed or not, as required of the Council by the Power Act. Objectives, actions and operations intended to protect, enhance and mitigate for the effects of the hydrosystem on species other than those listed as threatened or endangered may require federal agency flexibility or changes in the implementation of the biological opinions, as described below.

- Scientific and policy uncertainty continue to plague a number of mainstem actions intended to benefit anadromous fish, leading to an inability to measure the extent of the benefits gained and to great differences of opinion as to the value of continuing these actions. Moreover, some of these actions have adverse impacts on resident fish and high costs to the power system. The draft mainstem plan includes provisions for how to improve the way the region engages in fish and wildlife research, power system research, monitoring and evaluation for the mainstem and how and what decisions are made on the basis of that information. This includes describing an approach and set of factors for prioritizing research; recommendations for specific priorities for mainstem research; and suggestions for how to better integrate research, monitoring and evaluation results into decisions made about mainstem actions and power system operations in the context of the Columbia basin as a whole. The Council's ultimate goal is to be able to provide recommendations to the federal operating agencies and fish and wildlife agencies for more biologically effective spill, flow and other mainstem operations and actions at the minimum economic cost. The Council understands the biological opinions to be sufficiently flexible in implementation to be able to accommodate recommendations of this type; that is, the biological opinions were adopted with the recognition that as new scientific information is developed, actions called for in the opinions could and, where found appropriate, would be changed.

The Council will review the comments on the proposed vision, objectives and strategies in this draft mainstem plan and then decide, consistent with the review procedures and standards in the Power Act, what are the most appropriate mainstem vision, objectives and strategies for both listed and non-listed species.

Another difference between this and past Council mainstem programs concerns the region's power supply requirements. The Power Act requires the Council to adopt a fish and wildlife program that not only protects, mitigates and enhances fish and wildlife but also assures that the region will continue to enjoy an adequate, efficient, economical and reliable power supply. The Council has evaluated current hydrosystem operations, the recommendations for mainstem amendments, and these draft amendments in an effort to ensure that the Council adopts objectives and measures for mainstem system operations that both meet the fish and wildlife requirements of the Power Act and are

consistent with its power supply obligations. The Council has also reviewed the latest scientific information and comments on the effectiveness of recommended fish and wildlife strategies in increasing the survival of specific populations.

Energy systems, markets and policy have changed radically since the last revision of the fish and wildlife program in the mid-1990s. Federal hydrosystem operations in 2001 brought a concrete example of a problem that the Council had seen developing over the last half-decade — the electricity load demands placed on the federal hydrosystem were increasingly greater than what the federal system could produce in a year of historically low runoff and river levels. Yet the dynamics of regional and west coast energy developments prevented the Bonneville Power Administration from acquiring new, long-term resources that could have closed the gap. Problems with west coast power markets in 2000-01 prevented Bonneville from being able to make up the energy deficit in those markets, leading to a situation in 2001 in which the federal agencies were forced to curtail regional load and reduce system operations intended to benefit fish and wildlife in order to maintain the reliability of the region's power system. Even with significant changes to the hydropower operations specified for fish, the system still produced inadequate energy to meet the demands of the region. This forced many of the region's utilities to curtail loads while also spending large sums to purchase power.

For these reasons, the draft analysis of the adequacy, efficiency, economics and reliability of the region's power supply that accompanies the draft mainstem plan includes consideration of the current status of the region's power system. The Council's draft conclusion is that the region's power system should be adequate and reliable for the next few years, due to power supply, demand and loss of load developments that have occurred since early 2001, and that the objectives and measures to protect, mitigate and enhance fish and wildlife included in this draft mainstem plan will not affect that conclusion. The analysis also concludes, however, that the region faces the possibility in later years of spiraling back into the power supply problems seen in 2001, unless measures are taken to ensure that new resources are added to the regional power supply in a more certain fashion than now seems likely. The analysis suggests possible actions by the federal agencies and by others in the region that will ensure that the federal system is better able to provide the specified operations for fish and wildlife and meet appropriate load demands in at least most if not all low-water years. The Council has begun the process of reviewing and revising its 20-year power plan as called for by the Northwest Power Act. The power plan will address in more detail the region's power supply and reliability issues.

Vision for the Mainstem Plan

The long-term vision of the Council's 2000 Fish and Wildlife Program is for a Columbia River Basin ecosystem that sustains abundant, productive and diverse communities of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal and treaty right harvest and for non-tribal harvest of fish and wildlife, and for the recovery of fish and wildlife affected by the operation of the hydrosystem. This program is to be "habitat-based." Wherever feasible, the program vision is to be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin.[1] Where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem. Actions taken under the program must also be cost-effective and not put at risk the region's adequate, efficient, economical and reliable power supply.

The vision for the mainstem plan is consistent with the broader program vision set out above. Hydrosystem operations, fish passage efforts, habitat improvement investments, and other actions in the mainstem should be directed toward protecting, enhancing, restoring, and connecting[2] natural river processes and habitats to allow for abundant, productive and diverse fish and wildlife populations, especially spawning,

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[1] Throughout the provisions of these draft amendments, the Council's position is not contrary to that of the National Marine Fisheries Service's 2000 Biological Opinion with reference to any and all considerations of breaching lower Snake River hydroprojects.

[2] "Restore" as used in the mainstem plan means to take an action in a particular area that currently has no habitat value for spawning or rearing or other desired population condition (because, for example, the area has been blocked, or inundated, or dewatered at an inopportune time), so that the area will have value for that purpose. It does not mean to re-establish the conditions that existed at any particular point in time, including the time before non-Indian settlement and development of the Columbia basin, and it does not mean or imply a Council position in support of the breaching of dams in the mainstem.

"Enhance," by contrast, when referring to habitat conditions, means to take an action in an area that presently has some value for spawning or rearing or other desired condition so as to increase that value.

"Connecting" habitat becomes important when a migrating population has areas of productive habitat that it cannot use to full advantage (or use at all) because they are unable to access that habitat or because the areas in between productive habitat that the population must make use of are not productive without habitat improvements. It also does not mean or imply a Council position in support of the breaching of dams in the mainstem.

rearing, resting and migration habitats for salmon, steelhead, sturgeon and important resident fish populations. This vision includes providing conditions within the hydrosystem for adult and juvenile fish that: (a) most closely approximate natural physical and biological conditions; (b) support the expression of life history diversity; (c) allow for adequate levels of mainstem survival to support fish population recovery in the subbasins; and (d) ensure that water management operations are optimized to produce the greatest biological benefits for targeted species with the least cost and the least adverse effects on other species while ensuring an adequate, efficient, economical, and reliable power supply. Any system changes needed to achieve these goals must be implemented in such a way and over a sufficient time period to allow the region to make whatever power system adaptations are needed, if any, to maintain an adequate, efficient, economical and reliable power supply.

Biological Objectives

Overarching objectives and priorities for the mainstem

The biological objectives stated here for the mainstem plan are intended to be based on and consistent with the biological objectives stated in the 2000 Fish and Wildlife Program.

These biological objectives and accompanying operational strategies are designed to improve the life-cycle survivals of important populations of listed and unlisted salmon, steelhead, resident fish and wildlife. The Council's goal is to apply the available resources in the most effective way possible to achieve protection, mitigation, recovery, and delisting in the shortest possible time frame. This demands that the Council set clear priorities for resource expenditures to protect, mitigate and enhance fish and wildlife populations so as to assure that the fish and wildlife benefits are achieved at the least cost to the region's financial and water resources.

One of the overarching biological objectives for the program as a whole is the recovery of the anadromous and resident fish and wildlife affected by the development and operation of the hydrosystem that are listed for protection under the Endangered Species Act. Federal hydrosystem operations to benefit fish are now focused on listed populations through the 2000 Biological Opinions on the Operation of the Federal Columbia River Power System from the National Marine Fisheries Service (anadromous fish) and the U.S. Fish and Wildlife Service (Kootenai white sturgeon and bull trout). The achievement of these biological performance objectives for listed species as stated in the biological opinions is a key biological objective of the Council's program and this draft mainstem plan, *except where these objectives are inconsistent with specific objectives and strategies included in this mainstem plan*.

Under the Northwest Power Act, however, the Council has an obligation to protect, mitigate and enhance *all* the fish and wildlife of the Columbia basin affected by the development, operation and management of the hydrosystem. Concern over populations listed under the Endangered Species Act is but one part of the Council's broader mandate. And so a broader goal of the program, as stated in the overarching objectives of the program framework, is to provide habitat conditions that sustain abundant, productive and diverse fish and wildlife populations, so as to allow for recovery of listed species *and* abundant opportunities for tribal trust and treaty right harvest and non-tribal harvest.

In addition, the science relating to the rebuilding of Pacific salmon, as incorporated into the objectives and habitat strategies in the 2000 Fish and Wildlife Program, indicates that success in protecting and enhancing abundant and diverse naturally spawning populations of salmon and steelhead and other native fish requires an emphasis on protecting, enhancing, connecting and restoring habitats and populations that are relatively productive. This is a priority for actions that should be equal to protecting migration and spawning conditions for listed populations. This priority includes, for example, protecting and improving mainstem migration conditions for important non-

listed tributary populations in the middle part of the river, such as spring chinook in the John Day and Deschutes rivers. And in a system in which historically the most productive populations were those that spawned in the mainstem or the lower part of the tributaries, as described in the habitat strategies in the 2000 Fish and Wildlife Program, and which have either been totally extirpated (e.g., the populations in the mainstem of the upper Columbia above Chief Joseph, or spawning in the area now inundated by the John Day Dam pool) or are relatively productive (Hanford Reach fall chinook), this plan provides an emphasis on protecting and restoring mainstem spawning and rearing habitats and populations. These general objectives for the mainstem are consistent with and incorporate the basinwide vision, biological objectives and habitat and hydrosystem strategies in the 2000 Fish and Wildlife Program framework.

More specific objectives and performance standards — for habitat characteristics and for population performance

Mainstem habitat conditions

- Identify and protect the habitat areas and ecological functions that are at present relatively productive for spawning, resting, rearing and migrating salmon and steelhead in the mainstem. This includes, among other things, protecting the Hanford Reach fall chinook habitat by determining and providing appropriate spawning and rearing flows. In addition, where feasible, restore and enhance habitats and ecological functions that connect to the protected productive areas to allow for the expansion of productive populations and to connect weaker populations to stronger populations and to each other, so as to restore more natural population structures.

- Protect, enhance, restore and connect freshwater habitat in the mainstem for the life history stages of naturally spawning anadromous and resident salmonids. Protect and enhance ecological connectivity between aquatic areas, riparian zones, floodplains and uplands in the mainstem.
  - Enhance the connections between the mainstem sections of the Columbia and Snake rivers and their floodplains, side channels and riparian zones.
  - Manage mainstem riparian areas to protect aquatic conditions and form a transition to floodplain terrestrial areas and side channels.
  - Identify, protect, enhance and restore the functions of alluvial river reaches in the mainstem.
  - Where feasible, reconnect protected and enhanced tributary habitats to protected and enhanced mainstem habitats, especially in the area of productive mainstem populations.

- Allow for biological diversity to increase among and within populations and species to increase ecological resilience to environmental variability.
  - Expand the complexity and range of mainstem habitats to allow for greater life history and between species diversity.
  - Manage human activities in the mainstem, such as passage at mainstem dams, transportation and harvest, to minimize artificial selection or limitation of life history traits.

- Increase the amount of spawning habitat for fall chinook core populations in the lower and mid Columbia area and in the lower Snake area. The Council acknowledges the recommendation from the four tribes of the Columbia River Inter-Tribal Fish Commission that the federal agencies act to provide 9,000 additional acres of spawning habitat for Snake River fall chinook and 40 additional miles of fluvial spawning habitat for mid-Columbia fall chinook core populations, derived at least in part from the Independent Scientific Group's *Return to the River*. However, the Council does not adopt at this time these or

any other numerical targets for increased fall chinook spawning habitat. Instead, the Council will consult with the state and federal fish and wildlife agencies, tribes, federal operating agencies, the Independent Scientific Advisory Board, and the Independent Economic Advisory Board to evaluate the scientific soundness, achievability and implications of the tribes' recommended targets as well as other reasonable alternatives, and then in a public review process consider adoption of a set of numerical objectives for additional mainstem spawning habitat.

- Where feasible, manage the hydrosystem so that patterns of flow more closely approximate the natural hydrographic patterns. Ensure that any changes in water management are premised upon, and proportionate to, scientifically demonstrated fish and wildlife benefits. Examples of management actions or limitations consistent with this objective include:
  - Attempt to provide natural spring freshets below the storage projects, within flood control constraints.
  - Increase the likelihood of storage reservoir refill, and then provide stable, even flows out of the storage reservoirs over an extended period of the summer and fall.
  - Apply rules of operation for all the storage projects, such as the Integrated Rule Curves developed by the Montana Department of Fish, Wildlife and Parks for Libby and Hungry Horse dams, so that drawdown and refill are based on local inflows, and so that the reservoirs, in concert, can shape the water to benefit fish in and immediately below the reservoirs and then, as the water travels downstream, benefit anadromous fish.
  - Operations based solely on efforts to achieve the flow targets in the lower Columbia river will adversely affect resident fish while failing to benefit anadromous fish if they do not take into account reasonable storage project operations.

- Operate the storage projects and manage water through the system consistent with the following objectives:
  - The amount of flow augmentation and the release schedule from storage reservoirs should be based on the best available science for each target species (resident or anadromous) and weighted for the greatest benefit to all species. Storage reservoir operation should first prioritize fish species in the immediate vicinity of, and directly affected by, the federal dams.
  - Shift hydrosystem management strategies away from spring flow augmentation to an operational strategy that results in a 95 percent probability of refilling the storage reservoirs to provide for more augmentation capability in the summer months of July through September.
  - Protect biological production in the rivers and in the storage reservoirs during the most productive period of the year, by drafting each storage reservoir according to elevation limitations that, when combined with projected inflows, results in stable or "flat" outflows in the summer months of July through September and in biologically appropriate reservoir levels throughout the same period.

- Identify, protect, enhance, restore and connect ecosystem functions in the Columbia River estuary and nearshore ocean discharge plume as affected by actions within the Columbia River mainstem. Evaluate flow regulation and changes to estuary-area habitat and biological diversity to better understand the relationship between estuary ecology and near-shore plume characteristics and the productivity, abundance and diversity of salmon and steelhead populations.

- Where feasible, pursue restoration of anadromous fish into mainstem areas blocked by dams. Where this is not feasible, other measures will be used to protect, mitigate and enhance the related habitat and species assemblages. Other measures will also be used where the Federal Energy Regulatory Commission, in deciding whether to issue a license for a non-federal project on the mainstem, has taken this objective into account to the fullest extent practicable at each relevant stage of decisionmaking — as required by the Northwest Power Act — but has decided not to require reintroduction of anadromous fish into an area blocked by that dam.

More specific objectives and performance standards — for habitat characteristics and for population performance (cont.)

Migration/passage conditions for anadromous fish

- The National Marine Fisheries Service's 2000 Biological Opinion includes project-by-project survival performance rates for in-river passage of affected life stages of listed salmon and steelhead through the eight federal dams in the lower Columbia and lower Snake rivers. Table 9.2-3. The program adopts these objectives. Achieve these objectives at the minimum economic cost.

- On an interim basis, the project-by-project survival performance rates also apply for inriver passage of affected life stages of non-listed salmon and steelhead that migrate through the system. The Council will consult with the state and federal fish and wildlife agencies and tribes, the Independent Scientific Advisory Board federal operating agencies (a) to evaluate whether these project-by-project performance rates should be adjusted for any affected, non-listed populations, (b) to evaluate whether to adopt project-by-project passage survival performance rates for the non-federal projects in the mid-Columbia area, and (c) to determine the possibility of adopting system survival performance rates for all relevant populations.

- Maximize spillway survival by selecting the most biologically effective level of spillway discharge at each specific project while not exceeding interim gas supersaturation standards.[3] Balance spillway survival probabilities against spillway passage efficiency and the efficiency and probabilities of other passage routes in order to determine the passage methods, including spill volumes, that maximize the survival of the fish passing the entire dam and minimize fall back and other effects on adult salmon.

- Improve adult migration survival through the system.

- Meet state and federal water quality standards under the Clean Water Act.

- As an interim objective, contribute to achieving smolt-to-adult survival rates (SARs) in the 2-6 percent range (minimum 2 percent; average 4 percent) for listed Snake River and upper Columbia salmon and steelhead. The Council will consult with the state and federal fish and wildlife agencies and tribes, the Independent

[3] Under current system operations for migrating anadromous fish, including under 2000 Biological Opinion operations, the federal operating agencies must secure waivers to the existing water quality standards to allow for spill operations that will result in total dissolved gas supersaturation levels of up to 120 percent. The Council considers current operations as well as any other specific spill operations included in these draft amendments to be "interim" while the Council works with the region to determine the most biologically effective level of spillway discharge at each project and for the system as a whole.

Scientific Advisory Board and the federal operating agencies to evaluate the scientific soundness and achievability of, and impact of ocean conditions on, these smolt-to-adult survival rate objectives. The Council will then, in a public review process, either confirm these smolt-to-adult survival rates as program objectives or revise to different objectives. The Council will investigate at the same time the possibility of developing smolt-to-adult survival rate objectives for other populations.

More specific objectives and performance standards — for habitat characteristics and for population performance (cont.)

Resident fish/wildlife

- Provide conditions that support the needs of resident fish species in upstream reservoirs and river reaches as well as the needs of anadromous and resident species in the lower parts of the mainstem.

- In accordance with Section 4(h)(11)(A) of the 1980 Power Act, and the Council's primary strategy for hydrosystem (fish) passage and operations under the 2000 Fish and Wildlife Program, the Administrator and other federal agencies responsible for managing, operating or regulating any federal or non-federal hydroelectric facility for purpose of flow or spill advantages to listed species shall assure, in consultation with the Secretary of the Interior and the Administrator of the National Marine Fisheries Service, together with state fish and wildlife agencies and appropriate Indian tribes, that flow and spill operations are optimized to produce the greatest biological benefits with the least adverse effects on resident fish.

- Enhance abundance and productivity of white sturgeon in the mainstem. Operate the hydropower system to maximize spawning and rearing success of white sturgeon in reservoirs, while operating consistent with the needs of other salmonids. The U.S. Fish and Wildlife Service's 2000 Biological Opinion concerning hydrosystem operations that affect listed Kootenai white sturgeon includes specific objectives for that species, which are incorporated here. The water management strategies in this draft mainstem plan (below) include a sturgeon operation strategy that is a minor refinement of the flow strategy in the Fish and Wildlife Service's Biological Opinion, and which is intended to be a more effective operation for achieving the objectives in the opinion and in this program.

- Provide mainstem conditions that help to protect and enhance bull trout habitat and thus help to enhance the abundance and productivity of bull trout populations. The U.S. Fish and Wildlife Service's 2000 Biological Opinion concerning hydrosystem operations that affect listed bull trout populations includes objectives for that species, which are adopted here.

- Contribute to providing the conditions necessary to restore populations of native fish and wildlife in the areas above and below Hungry Horse and Libby Dams to self-sustaining levels capable of supporting harvest. This includes protecting, restoring, and enhancing reservoir, riparian and wetland habitats above and below Hungry Horse and Libby Dams to meet the goals set forth in the management and mitigation plans and the recommendations of the Montana Department of Fish, Wildlife and Parks and the Confederated Salish-Kootenai Tribes.[4] As part of this objective, restore normative

[4] When the Council adopts subbasin plans into the program, which will supersede existing management and mitigation plans, the objective will be to implement the strategies and achieve the objectives in the relevant subbasin plans.

conditions in the seasonal pattern and stability of river discharges and reservoir conditions; restore in-channel habitat structure, function, and complexity; restore riparian and wetland habitats and floodplain function, and maintain temperatures within the tolerance range of native fish species.

- Contribute to providing the conditions necessary to protect spawning and rearing habitat for fish in and adjacent to Lake Roosevelt so as to build fish populations to levels capable of supporting harvest consistent with the goals set forth in the management and mitigation plans and the recommendations of the Spokane and Colville Tribes.[5]

- To improve survival and production of wildlife species in the mainstem affected by the development, operation and management of the hydrosystem, reduce limiting factors to wildlife in the mainstem and improve riverine and riparian mainstem habitat conditions for these species.

[5] When the Council adopts subbasin plans into the program, which will supersede existing management and mitigation plans, the objective will be to implement the strategies and achieve the objectives in the relevant subbasin plans.

Strategies

Overarching strategies

- The strategies stated here for the mainstem plan are intended to be based in and consistent with the general basinwide objectives and habitat and hydrosystem strategies stated in the 2000 Fish and Wildlife Program.

- All decisions on actions that affect or are intended to benefit fish and wildlife in the mainstem Columbia and Snake Rivers — whether embedded in long-range plans, annual plans or in-season management, and whether concerning water management or passage or reservoir operations — should reflect or be based on the following general strategies:
  - Protect the habitat areas and ecological functions that are at present relatively productive for all the life stages of the species important to the biological objectives of this Program, including for spawning, resting, rearing and migration of salmon and steelhead and resident fish. Enhance habitats and ecological functions that connect to the protected areas.
  - Protect biological diversity by benefiting the range of species, stocks and life-history types in the river.
  - Provide conditions that best fit those natural behavior patterns and river processes that most closely approximate the physical and biological conditions needed by the relevant species.
  - With regard to hatchery populations of salmon and steelhead, prioritize mainstem protection and support to those hatchery populations that provide the most significant contribution to the rebuilding of naturally spawning populations in areas of program habitat investments, or that provide the most significant contributions to harvest while ensuring the least detrimental impacts on the survival of native fish species.
  - Optimize actions to produce the greatest biological benefits for the targeted species with the least cost and the least adverse effects on other species while ensuring an adequate, efficient, economical, and reliable power supply.

- In December 2000, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service adopted Biological Opinions for the operation of the Federal Columbia River Power System for the benefit of populations of salmon, steelhead, bull trout and Kootenai white sturgeon listed as threatened or endangered under the Endangered Species Act. The measures in these opinions represent the recommendations of the federal fish and wildlife agencies with jurisdiction over the operational needs of these listed species. The Council accepts these measures as part of the Council's program for the near term, *except where these measures are inconsistent with specific objectives and measures included in this mainstem plan.* However, many of the Biological Opinion measures must be subject to systematic and rigorous monitoring and evaluation, as described in the more specific strategies below, to determine if the measures

have the biological benefits expected and represent the most cost-effective actions to achieve these benefits. These evaluations may result, after the adoption of this mainstem plan, in Council recommendations to the federal operating and fish and wildlife agencies for operations that differ from the current suite of operations called for in the Biological Opinion measures, based on the Council's conclusion that these different operations provide the same or greater benefits to listed fish and wildlife than current operations at less cost. The Council is confident that changes in operations of this nature can be made consistent with the flexibility built into the Biological Opinions.

- The 2000 NMFS and USFWS Biological Opinion operations may not be optimal when the needs of fish and wildlife other than listed species are taken into account. Based on the vision, the biological objectives and the overarching strategies stated above, the Council is adopting principles and measures that are also intended to benefit fish and wildlife affected by the hydrosystem other than listed species and meet the biological objectives and vision described above. These principles and measures may require changes in certain operations or priorities under Biological Opinion implementation. The Council is confident that these changes can also be made consistent with the flexibility built into the Biological Opinions and without adverse effects on the listed species, and will lead to a more broad-based, sustainable and cost-effective protection and recovery of fish and wildlife in the Columbia basin. The Council calls on the federal operating agencies and fish and wildlife agencies to consult with the Council, the states and the tribes on the implementation of these measures.

Strategies in specific areas

Mainstem habitat

- By means of system operations and investments in mainstem habitat improvements, increase the extent, diversity, complexity, and productivity of mainstem habitat by protecting, enhancing and connecting to mainstem spawning, rearing and resting areas to achieve the biological objectives stated above. Actions to consider include, but are not limited to:
  - providing appropriate spawning, rearing and resting flows in the mainstem
  - excavating backwater sloughs, alcoves and side channels
  - reconnecting alcoves, sloughs, and side channels to the main channel
  - dredging/excavation of lateral channels that have silted in
  - enhancement of wetlands
  - creating islands and shallow-water areas
  - adding large woody debris to these systems
  - stabilizing the water levels of the rivers and reservoirs to the extent practicable
  - planting riparian and aquatic plants at appropriate locations
  - acquiring and protecting lands adjacent to the mainstem

- Federal and state fish and wildlife agencies should analyze each proposed action to increase mainstem spawning and rearing habitat to ensure that the proposal may be implemented without adversely affecting the migration of listed populations through the mainstem.

- In instances where proposed operations to protect or enhance mainstem spawning and rearing habitat may conflict with operations intended to benefit juvenile or adult salmon migration, the system operators and the fish and wildlife agencies and tribes should identify potential conflicts, priorities, trade-offs and opportunities, and consult with the Council, affected entities and the public on how best to resolve conflicting needs.

- The National Marine Fisheries Service's 2000 Biological Opinion calls on the federal operating agencies in conjunction with the Environmental Protection Agency and the U.S. Geological Survey to develop a program to (1) identify mainstem habitat sampling reaches, survey conditions, describe cause-and-effect relationships, and identify research needs; (2) develop improvement plans for all mainstem reaches; and (3) initiate improvements in three mainstem reaches. The Council adopts a similar measure as well, provided that this mainstem habitat initiative not focus wholly or even predominantly on the mainstem habitat needs of the populations currently listed. Salmon mitigation, enhancement and rebuilding opportunities in the mainstem may have greater relation to non-listed populations than for listed populations.

- Evaluate the feasibility of reintroducing anadromous fish into blocked areas, including above Chief Joseph and Grand Coulee dams.

- Identify the level of importance in protecting or improving mainstem habitat for recovering bull trout populations. The Council calls on the relevant state and federal fish and wildlife agencies to conduct the necessary research and report the analysis to the Council at the earliest possible date.

- Develop and implement actions that create littoral habitat and fish structures along the shores of Lake Roosevelt to diversify food available to fish and provide additional rearing habitat.

- Implement recovery actions to stabilize the upper Columbia and Kootenai River white sturgeon.

- Implement recovery actions to stabilize the burbot populations in the upper Columbia.[6]

[6] When the Council adopts subbasin plans into the program, which will supersede existing management and mitigation plans, the objective will be to implement the strategies and achieve the objectives relating to white sturgeon, burbot and Lake Roosevelt fisheries stated in the relevant subbasin plans.

Strategies in specific areas (cont.)

Juvenile and adult passage, in general

- Consistent with the biological objectives and overarching strategies above, all actions to provide or improve juvenile and adult fish passage through mainstem dams should emphasize adult survivals as a high priority. In addition, strategies should protect biological diversity by benefiting the broad range of species, stocks and life-history types in the river, not just listed species, and should favor solutions that best fit natural behavior patterns and river processes. To meet the diverse needs of multiple species and allow for uncertainty, multiple juvenile passage methods may be necessary at individual projects.

- The U.S. Army Corps of Engineers, working within the regional fish and wildlife project selection process, should report to the Council annually on how decisions on passage improvements take into account the strategies in the Council's program. In addition, the Council (1) expects that the Independent Scientific Review panel will apply these principles during the panel's review of the reimbursable portion of the Bonneville fish and wildlife budget, which includes the Corps' passage program; (2) will itself apply these standards in its review of any Independent Scientific Review Panel report and resulting recommendations to Congress on these passage budget items; and (3) will recommend to Congress, in its reimbursable budget recommendations, that budget requests from the Corps of Engineers be evaluated for consistency with these principles.

- The Corps of Engineers should apply Value Engineering to all projects that exceed $1 million.

- For the purpose of planning for this fish and wildlife program, and particularly the hydrosystem portion of the program, the Council assumes that, in the near term, the breaching of any dams in the mainstem will not occur. The Council revises its fish and wildlife program every five years, at a minimum. If, within that five-year period, the status of the lower Snake River dams or any other major component of the Columbia River hydrosystem has changed, the Council can take that into account as part of the review process.

Strategies in specific areas (cont.)

Juvenile fish transportation

- Because the existence of the dams and reservoirs creates conditions that are not natural, the Council, while seeking to improve inriver conditions, recognizes that there are survival benefits from transportation of migrating juvenile salmon. Therefore, the Council (1) continues to accept juvenile fish transportation as a transitional strategy; (2) will give priority to the funding of research that more accurately measures the effect of improved inriver migration compared to transportation; (3) will recommend increasing inriver migration when research demonstrates that salmon survival would be improved as a result of such migration, and vice versa; and (4) endorses the strategy of "spread the risk" until it is determined whether migration inriver or transportation will provide the best levels of survival.

- The National Marine Fisheries Service's 2000 Biological Opinion includes a series of measures concerning the transportation of listed juvenile salmon and steelhead. These are part of the Biological Opinion measures that the Council incorporates into its mainstem plan, as described above.

- In analyzing in any year the potential benefits of maximizing or minimizing transportation, the federal operating agencies must recognize that significant populations of salmon and steelhead important to the biological objectives of this program enter the mainstem hydrosystem either below the transport projects altogether or above McNary Dam but are not effectively transported at McNary. In-river passage of these fish is either the only passage alternative available or the most significant passage alternative.

- The three highest priorities for juvenile transportation studies should be to:
  - (1) evaluate whether the survival benefits of transport from McNary Dam are sufficiently greater, at least under certain circumstances, than in-river passage to justify continuing (or increasing) the transport effort from that dam;
  - (2) conduct a mass transportation study that targets Snake River fall chinook; and
  - (3) more clearly determine what delayed survival effects, if any, occur due to transport, such as adverse effects on homing behavior.

- The National Marine Fisheries Service should conduct annual evaluations of the effectiveness of transportation and report the results to the Council and the Independent Scientific Advisory Board.

Strategies in specific areas (cont.)

Spill

- During long-term, annual and in-season planning and decisionmaking, in deciding when and to what extent to spill water for passage, priority consideration should be given to (1) minimizing impacts on returning adults and (2) to optimizing the passage survival benefits for populations that are important to the biological objectives of this program and which cannot be transported or are ineffectively transported. This includes spring chinook from the John Day River; wild, naturally spawning and key hatchery populations of spring chinook from other tributaries above Bonneville Dam but below the transport projects (or that only a small proportion are collected at McNary), such as from the Deschutes, Hood, Umatilla, Wind, Klickitat, Umatilla and Yakima rivers; the listed Middle Columbia steelhead; and Hanford Reach fall chinook. These spill objectives will require a better understanding of the spill levels that optimize passage survival at each dam and how these change at various flow levels and for the range of fish populations that pass the project. The federal action agencies and NMFS, in consultation with the other federal and state fish and wildlife agencies and tribes, should determine an optimal passage strategy at each dam and for each passage route. The Council seeks to maximize improvements in life-cycle survival. This requires determining the cumulative effects on fish survival of passing multiple dams and taking that information into account.

- Spill should be managed according to the most biologically effective spill level at each project. Spillways continue to be an effective inriver passage route, more benign in general than juvenile bypass systems or turbine passage. On the other hand, (1) spilling to the maximum gas supersaturation levels of 120 percent may be increasing mortality at some dams when compared to what would occur at lesser volumes of spill; (2) spillway passage can also be the passage method most costly to the regional power system, especially in years of low water or high market prices for energy; (3) the difference in survival between spillway passage and other passage methods may in some but not all instances be minimal; (4) the maximum level of fish survival at each project may be different from and not necessarily correlated with the most spill; and (5) spill may have negative effects on returning adults. For these reasons, the Council will work with the federal operating and fish and wildlife agencies, in consultation with the state fish and wildlife agencies and tribes and the Independent Scientific Advisory Board, in a rigorous evaluation of the biological effectiveness and costs of spillway passage at each project and bring that information to bear in a systematic way in decisions on when and how much to spill. The goal of this evaluation should be to determine if it is possible to achieve the same or greater levels of survival and biological benefit to migrating fish as currently achieved while reducing the amount of water spilled, thus decreasing the adverse impact on the region's power supply. At the conclusion of this evaluation, the Council will conduct a public

review process with the goal of providing recommendations to the federal agencies for the most biologically effective spill actions at the least cost possible.

- The evaluation called for above should include or set in motion at least the following:
  - Dam-specific estimates of smolt passage survival by species through spillways. Spill efficiency information should be updated and applied in future spill decisions and passage modeling analyses. The Council recognizes the difficulty in obtaining reliable empirical survival estimates linked specifically to spill conditions, but the power system impacts of spill require an improvement in the quality of this information.
  - Additional research on the biological consequences of various spill strategies is needed to determine the long-term effects of extended exposure to high levels of gas super saturation on life-cycle survivals.
  - The interaction between high spill and dissolved gas levels and adult passage and survivals needs additional research to better determine if spill strategies are impacting adult migration and survival.

- The U.S. Army Corps of Engineers, in consultation with these other entities, should place a priority on designing, testing and evaluating methods and devices, that could produce the same or greater benefit to fish while spilling less water, especially what are known as removable spillway weirs. If these methods and devices produce positive results, implement as soon as is practical to do so.

- If efficient and effective use of spill results in increased volumes of water passing through active turbines for power generation, apply an equitable part of the additional financial resources that result to implement prioritized measures in the Council's Fish and Wildlife Program.

- The Council intends to recommend specific spill strategies at specific projects after comprehensive spill survival studies have concluded. The Council intends these studies to begin immediately.

- Until the cumulative effects of high levels of spill are better understood the Council recommends that the region continue to monitor and evaluate spill strategies. The Council recommends that more strenuous efforts be undertaken to avoid exceeding total dissolved gas saturation limits of 120 percent, over a time period of the twelve highest hourly measurements at all Federal Columbia River Power System projects which engage in spill operations. State authority to grant a variance deviation from the Federal Clean Water Act standard of 110 percent total dissolved gas supersaturation requires a determination by the state that the variance creates no long-term impact to the beneficial use for which the deviation was authorized. Juvenile fish mortalities for dissolved gas levels above 120 percent have been demonstrated and these mortalities put state variance rationale at risk. To avoid the possibility of exceeding the 120 percent total dissolved gas level, the U. S. Army Corps of Engineers is encouraged to operate individual

project spills at dissolved gas levels that will reduce “overshoot” of the 120 percent (not to exceed) limit. Further, where the spill level is a *manageable* option, the Bonneville Power Administration, in coordination with the Corps of Engineers and the National Marine Fisheries Service, shall provide estimates of mortality numbers associated with any period of twelve hours (highest consecutive twelve-hour total dissolved gas measurements) in which total dissolved gas saturation exceeds 120 percent at any Federal Columbia River Power System project.

Strategies in specific areas (cont.)

Juvenile bypass systems

- To provide passage for juvenile fish that most closely approximates natural physical and biological conditions, and to increase the energy produced by the hydrosystem, the U.S. Army Corps of Engineers should:
  - (1) continue testing and developing surface bypass systems, taking into account the widest range of biological diversity as described in the biological objectives and overarching strategies, utilizing an expedited approach to prototype development, and ensuring full evaluation for the developmental phase;
  - (2) relocate bypass outfalls in those circumstances where there are problems with predation and juvenile fish injury and mortality;
  - (3) modify turbines to improve juvenile survival; and
  - (4) conduct research on fish diseases at fish passage facilities.

Adult passage

- The U.S. Army Corps of Engineers should improve the overall effectiveness of the adult fish passage program. This includes expediting schedules to design and install improvements to fish passage facilities. The ultimate survival and successful spawning of adult fish are a high Council priority because returning adults determine the size and health of future fish populations. Cool water releases from reservoirs where temperature benefits can be attributed should continue to be used to facilitate adult migration. More emphasis should be placed on research, monitoring and evaluation, increased accuracy of fish counts, expansion of fish counting to all species of interest, installation of PIT-tag and radio-tag detectors, evaluation of escapement numbers to spawning grounds and hatcheries, research into water temperature and spill effects on fish passage, and the connection between fish passage design and fish behavior. In particular:
  - (1) as a priority for the Corps of Engineers' capital construction program, correct adult fish passage problems and report annually to the Council on progress;
  - (2) install adult PIT-tag detectors at projects that do not have them;
  - (3) improve fish counting accuracy; and
  - (4) conduct research on fish diseases at fish passage facilities.

Strategies in specific areas (cont.)

Water management

- Manage water through the hydrosystem so that patterns of flow more closely approximate the natural hydrographic patterns and are directed at re-establishing natural river processes where feasible, and produce the highest possible survival rates for a broad range of affected fish within the physical limitations of the multiple purposes of the region's storage reservoirs and hydrosystem. Assure that any changes in water management are premised upon, and proportionate to, fish and wildlife benefits, while assuring the region an adequate, efficient, economical, and reliable power supply. Elements of this general strategy for water management include:
  - Frame habitat restoration in the context of measured trends in water quantity and quality.
  - Allow for seasonal fluctuations in flow, including flood events. Stabilize daily fluctuations. Reduce or eliminate stranding and other problems associated with fluctuation of the hydroelectric system.
  - Increase the correspondence between water temperatures and the naturally-occurring regimes of temperatures throughout the basin. To the extent possible, use stored water to manage water temperatures below the storage reservoirs where temperature benefits from releases can be shown to provide for improved fish survivals.
  - Identify, protect and restore ecosystem functions in the Columbia River estuary and nearshore ocean discharge plume as affected by actions within the Columbia River hydrosystem. This includes evaluating flow effects, river operations and estuary-area habitat changes, as well as local effects from activities such as dredging and pollution from urban areas, to better understand and improve the relationship between estuary and near-shore plume characteristics and the productivity, abundance and diversity of salmon and steelhead populations.

- Systemwide water management, including flow augmentation from storage reservoirs, should balance the needs of anadromous species with those of resident fish species in the river and upstream storage reservoirs, and the needs of migrating fish with those of spawning and rearing fish, so that actions taken to advantage one species do not unnecessarily come at the expense of other species. Flow augmentation is defined as the intentional release or drafting of water from storage reservoirs for the purpose of increasing flows to enhance migratory conditions for juvenile and adult life-stages of salmon and steelhead through the reach of the lower river hydroprojects. The federal system operators, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service should identify

potential conflicts and seek recommendations from the Council, fish and wildlife agencies and tribes and other affected entities on how best to balance the different needs prior to the implementation of flow actions.

- The Council recognizes the continuing controversies over (a) the nature and extent of the flow-survival relationship for migrating salmon and steelhead, especially in the spring; (b) over the consistency between the flow targets and the flow measures; and (c) over flow augmentation in general, with these implications:
  - The Council does not support the National Marine Fisheries Service's 2000 Biological Opinion spring and summer flow targets due to lack of evidence that they are related to survival within the range of the operating agencies' control given reservoir and other system constraints.

  - The Council continues to call on Bonneville, in consultation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, to prepare an annual report based on scientific research for review by the Independent Scientific Advisory Board that documents the flow augmentation actions taken, the benefits of flow augmentation for fish survival, and the precise attributes of flow that may make it beneficial.

  - The Council will consult with these and other entities to determine whether and how to conduct a comprehensive evaluation of survival, flow targets and flow augmentation to determine the relationship between specific management actions and changes in life-cycle survival. This evaluation will, among other things:
    - evaluate the scientific validity of the flow targets and flow augmentation actions in the 2000 Biological Opinion;
    - evaluate how often and for what duration river flows, whether augmented or not from storage releases, meet the spring and summer flow targets in the 2000 Biological Opinion, and what additional amounts of water from what sources would be required to meet the targets on a sustained basis;
    - quantify the volume and shape of water that have been and are being provided as flow augmentation;
    - translate to the extent possible the incremental increase in flows from flow augmentation to changes in water velocity and temperature;
    - evaluate and predict to the extent possible the changes in adult survival attributable to those increases for populations important to the biological objectives of this program; and
    - evaluate the feasibility of Snake River flow augmentation requirements as a salmonid recovery mechanism in light of the U.S. Army Corps of Engineers' *Final Lower Snake River Juvenile Salmon Migration Feasibility Report/ Environmental Impact Statement* (2002).

At the conclusion of such an evaluation, the Council will conduct a public review process, with the goal of providing revised recommendations to the federal agencies for continuing or modifying the current system water management program for migrating salmon and steelhead. The Council may also decide at that time, if necessary, to initiate a process to further amend the mainstem portion of the Council's program to address system management matters.

– Research has not validated the predicted benefits of flow augmentation from upstream storage reservoirs . Focus research on hydrosystem operations on the relative costs and benefits to native fish throughout the Columbia watershed.

Strategies in specific areas (cont.)

Water management (cont.)

- **Modifications to operations of the Federal Columbia River Power System established in the 2000 Biological Opinions.** The National Marine Fisheries Service's 2000 Biological Opinion includes a series of measures concerning water management for the benefit of listed juvenile salmon and steelhead, while the U.S. Fish and Wildlife Service's 2000 Biological Opinion includes a set of measures concerning water management for the benefit of listed bull trout and Kootenai white sturgeon. The Council calls for the following modifications in operations of the Federal Columbia River Power System established in the biological opinions to protect, mitigate and enhance all the populations of fish adversely affected by the hydrosystem and important to the biological objectives of this program, not just the listed populations:

(1) Hanford Reach/mainstem and estuary spawning, rearing and resting habitat

- Manage flows, while maintaining consistency with this mainstem plan's flow and reservoir operations, to protect, improve and expand spawning, rearing and resting habitat in the mainstem and estuary, including especially flows to protect habitat conditions for spawning and rearing in the Hanford Reach area, on an equal basis as managing water to support the migration of listed species.

(2) Spring reservoir/flow operations

- As a highest priority at Hungry Horse, Libby, Grand Coulee and Dworshak dams, assure a 95 percent probability that these storage reservoirs refill by the end of June (Libby in late July), so that the reservoirs have the maximum amount of water available during the summer.

- Eliminate the provision in the Biological Opinion calling for the operation of storage reservoirs to assure a high probability that reservoir levels are within 1/2 foot of the upper flood control rule curve by April 10.

- **Hungry Horse and Libby Dams:**
  - **Integrated Rule Curve operations.** At Hungry Horse and Libby dams, implement the Integrated Rule Curve operations as recommended by the Montana Department of Fish, Wildlife and Parks for the benefit of native resident fish in those reservoirs. Operations should reduce the frequency of refill failure (to within five feet of full pool) at Hungry Horse and Libby reservoirs as compared to historic operation; implement seasonal flow windows and flow ramping rates in the Flathead and Kootenai Rivers

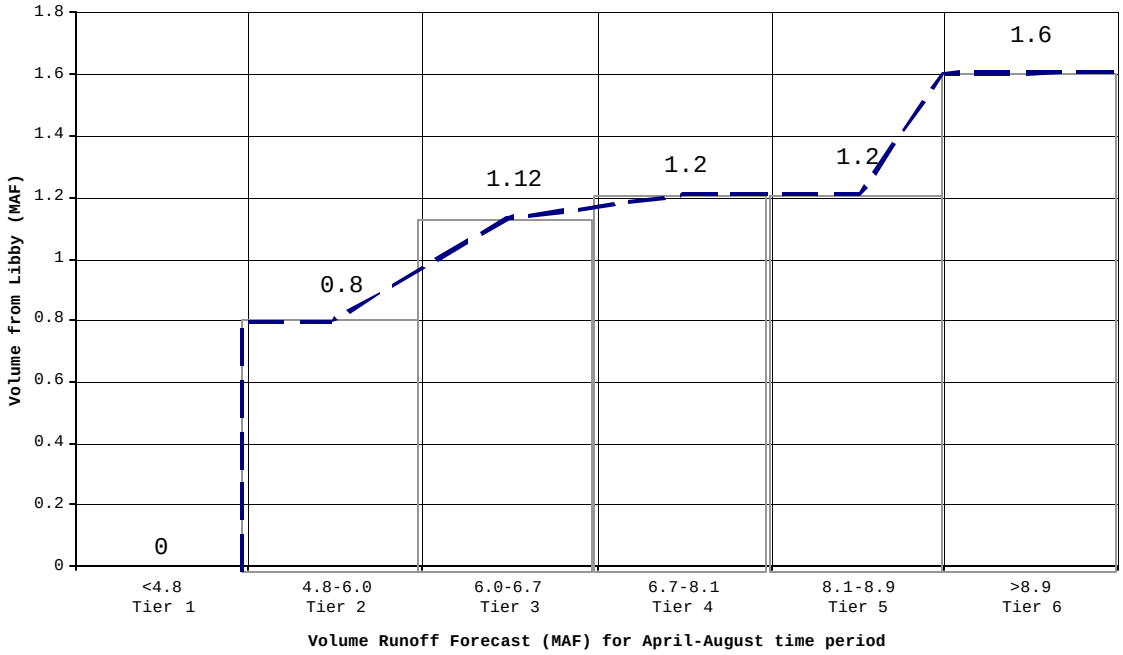
downstream of the storage reservoirs, and maintain minimum flows in the Flathead and Kootenai rivers as described by the Department.

- **VARQ flood control operations.** The Corps of Engineers and Bureau of Reclamation should implement the VARQ flood control operation at Libby and Hungry Horse dams called for in the Biological Opinions. The Corps of Engineers should place a high priority on immediately completing the environmental reviews required to implement the VARQ operations at Libby Dam, including evaluating the power impacts and downstream impacts, and mitigating for any adverse impacts. The Corps of Engineers should also place a priority on conducting the further comprehensive review of flood control operations called for in the National Marine Fisheries Service's Biological Opinion.

- **Operations at Libby Dam to benefit Kootenai River white sturgeon.** The U.S. Fish and Wildlife Service's 2000 Biological Opinion concerning hydrosystem operations that affect listed Kootenai River white sturgeon specifies a "tiered" strategy for flow augmentation from Libby Dam to simulate a natural spring freshet, controlled within flood constraints. Specified discharge volumes are determined by forecasted water availability, so that higher flows are released when water availability is ample and minimal flow augmentation occurs during drought. The Fish and Wildlife Service should modify the Biological Opinion to apply the following volumes from Libby for sturgeon purposes based on the corresponding run-off amounts. This strategy represents a minor revision to volumes specified in the 2000 Biological Opinion.[7]

[7] The sturgeon tiered flow strategy is a fish recovery action that is separate and distinct from the VARQ flood control operation. The tiered flow strategy in the US Fish and Wildlife Service's 2000 Biological Opinion differs from the original plan that was adopted by the international White Sturgeon Recovery Team. During a March 25-26, 2002, meeting with the U.S. Army Corps of Engineers, the Recovery Team determined that some problems could be corrected by establishing a new calculation for sturgeon flows. Release volumes are still based on water availability, but the volumes to be released are calculated over the entire range of possible inflows (dashed line) rather than grouped into the original six tiers.

Figure 1. BiOp Flow Augmentation Volumes for use with VARQ Flood Control at Libby Dam
(Volume would be taken off the dashed line connecting the midpoints of the tiers)



- **Grand Coulee Dam.** Operate Grand Coulee Dam in the winter and spring (from January through June) in the following manner:
  - Meet the following minimum monthly elevation targets in Lake Roosevelt while attempting to maintain the minimum monthly mean retention times as follows, until fisheries evaluation information indicates a change in these objectives:

Period	Minimum Elevation	Minimum Mean Retention Time
January	1270 feet above sea level	45 days
February	1260	40 days
March-April 15	1250	30 days
April 16	1255	30 days
May	1265	35 days
June	fill to 1290	40-60 days or maximum historically achievable for the month

  - March to May elevations are minimums, with the understanding that flood control operations will determine the actual upper elevation.
  - Manage the reservoir and dam discharges to produce steady flows across each season and each day to minimize reservoir fluctuations and ramping rates.

- **Flow Augmentation/Lower Granite Dam**
  - Because of scientific uncertainty, the National Marine Fisheries Service's 2000 Biological Opinion on the operation of the Federal Columbia River Power System established flow objectives at Lower Granite dam as a guide to manage available water resources during the juvenile and adult migration seasons and to provide a reference for comparing various operational scenarios that may affect inriver migration conditions. The flow objectives are not hard constraints because: 1) flow objectives are highly influenced by natural precipitation and runoff, and 2) hydraulic conditions and other constraints may preclude meeting these objectives at all times (NMFS 2000 Biological Opinion, Reasonable and Prudent Alternative 17). The Council concurs that the Biological Opinion flow objectives should not be hard constraints. The Council endorses a flow management approach that strives to provide the greatest possible biological benefit from the available storage volumes and system flexibility. Where flow augmentation is implemented, federal agency pre-season and in-season flow management actions are recommended to occur within the confines of the Technical Management Team/Implementation Team process and in coordination with the states and tribes.

  - The Council further notes, and agrees, that the issue of providing water from the Bureau of Reclamation's upper Snake River Basin projects and Idaho Power Company's Hells Canyon projects to assist in achieving Snake River flow objectives at Lower Granite Dam will largely be addressed in separate, ongoing Section 7 consultations, and that implementation of flow augmentation, with respect to the Snake River Basin, must be consistent with applicable state and federal law, including but not limited to Idaho Code §42-1763B.[8]

  - Cost-effective analysis for the "same biological objectives(s)" is an action commensurate with statutory provisions of the 1980 Power Act when reviewing issues surrounding flow objectives at Lower Granite Dam. Given the competing issues of flow augmentation and available water resources, the Council requests Bonneville, in coordination with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and state fish and wildlife managers and tribes to: 1) define Endangered Species Act harvest and recovery objectives for anadromous fish in specific mainstem sections and in tributaries of the mainstem, and 2) to develop alternative strategies to flow augmentation that will achieve "the same biological objectives." Factors

[8] No provision of this amendment may, by recommendation of the Council, propose to "(1) affect the rights or jurisdictions of the United States, the States, Indian tribes, or other entities over waters of any river or stream or over any groundwater resource, (2) alter, amend, repeal, interpret modify or be in conflict with any interstate compact made by the States, or (3) otherwise be construed to alter, or establish the respective rights of States, the United States, Indian tribes, or any person with respect to any water or water related right." Northwest Power Act, §10(i), 94 Stat. 2735.

related to this analysis are expected to include hatchery objectives, ocean effects, dissolved gas trauma losses from spill, and spill effects on migrating juveniles and returning adults.

NOTE: The Council considered an alternative for spring reservoir/flow operations that included a call for a comprehensive evaluation of specific spring operations, leading to Council recommendations to the federal agencies regarding the appropriate spring operations, as above. This alternative questions the validity of the spring flow objectives and flow augmentation, but does not call for interim changes in the biological opinion operations pending the completion of the evaluation.

(3) Summer reservoir/flow operations

- The Council does not support the summer flow targets in the National Marine Fisheries Service's 2000 Biological Opinion due to lack of evidence that they are related to survival within the range of the agencies' control given reservoir and other system constraints and due to the impact these flows have on resident fish in the Columbia watershed.

- At **Hungry Horse and Libby** dams:
  - Reduce the frequency of refill failure (to within five feet of full pool) as compared to historic operation; implement seasonal flow windows and flow ramping rates in the Flathead and Kootenai Rivers downstream of the storage reservoirs, and maintain minimum flows in the Flathead and Kootenai rivers as described by the Department.

  - Summer reservoir drafting limits at Hungry Horse and Libby should be 10 feet from full pool by the end of September (elevations 3550 and 2349, respectively) in all years except the lowest 20th percentile water supply (drought years) when the draft could be increased to 20 feet from full pool by the end of September. This would protect fisheries resources in the reservoirs and rivers downstream, while providing additional flow augmentation for fish immediately below the project and in the lower Columbia River.

  - Draft each storage reservoir according to elevation limitations that, when combined with projected inflows, results in stable or "flat" outflows in the summer months of July through September.

  - The Council understands that the effect of the IRC operations and summer reservoir drafting limits would be to reduce the drafting of these two reservoirs in summer compared to what they would be under ordinary Biological Opinion operations. The Council also understands that there is significant flexibility within the Biological Opinions to implement the IRC

operation through creative management techniques, such as what is known as the "Libby-Arrow swap." To the extent IRC operations at these two projects cannot be accommodated under the Biological Opinions, the Council calls on the federal operating agencies and federal fish and wildlife agencies to reinitiate consultation on the operation of these two projects in an effort to reach that accommodation. As the federal operating agencies consider these changes, they should ensure there is no adverse impact on Lake Roosevelt reservoir elevations or water retention times.

- Operate **Grand Coulee Dam** from June through December in the following manner:
  - Fill to elevation 1290 feet by the end of June.
  - Draft evenly from Lake Roosevelt to elevation 1283 feet by the end of August.
  - From September through December, maintain a minimum elevation of 1283 feet, to maximize water retention times and to protect kokanee access and spawning.
  - Maximize water retention times from June to December of 40 to 60 days or the maximum historically achievable for each month.
  - Manage the reservoir and dam discharges to produce steady flows across each season and each day to minimize reservoir fluctuations and ramping rates.

- Operate **Dworshak Dam** to meet the following minimum monthly summer/fall elevation targets for the Dworshak pool. Such operation is consistent with a coordinated Idaho, Nez Perce Tribe and Columbia River Inter-Tribal Fish Commission desire to meet water quality standards in the Clearwater River that afford balanced protection of sub-yearling salmonids and returning adults; maintain Dworshak elevation at or above 1520 feet; optimize the rearing of listed Clearwater River fall Chinook; minimize impacts at the Dworshak National Fish Hatchery; and establish consistency with the Nez Perce Tribe/Idaho Plan for Total Dissolved Gas Short-Term Activity Exemption.

Period	Outflow (kcfs)	SSARR Inflow (kcfs)	Storage Change (KaF)	Elevation (Forecast)
June 24 - 30				1600.0
Jul 1 - 7	9.1	9.1	0	1600.0
Jul 8 - 14	5.2	5.2	0	1600.0
Jul 15 - 21	6.0	3.3	-37	1598.0
Jul 22 - 28	9.0	2.3	-94	1593.0
Jul 29 - Aug 4	13.0	1.8	-156	1584.0

Aug 5 - 11	14.0	1.6	-172	1573.5
Aug 12 - 18	14.0	1.5	-174	1562.5
Aug 19 - 25	14.0	1.4	-175	1550.5
Aug 26 - Sept 1	14.0	1.3	-176	1538.0
Sept 2 - Sept 8	10.0	1.1	-124	1529.0
Sept 9 - Sept 15	7.0	0.7	-87	1522.5
Sept 16 - Sept 22	2.5	0.7	-25	1521.0
Sept 23 - Sept 29	1.4	0.6	-11	1520.0

- Do not draft Dworshak below elevation 1537 feet elevation before September 1st in order to reserve water for a 200 kaf draft in September to benefit sub-yearling and adult fall Chinook and steelhead migration.

- Sub-yearling fall chinook do not typically outmigrate from the Clearwater until an average size of 85 mm is reached. Sampling conducted on June 10th, 2002, on the Clearwater River by the Nez Perce Tribal staff indicates fish were 40+ mm. At an average growth rate of 1 mm per day, these fish are not expected to reach smolt size (actively migrating) until late July. Cold water conditions from protracted runoff may slow growth rates and delay out-migration. Passage data indicates that 40 percent of listed sub-yearling Clearwater River fall chinook migrate past Lower Granite Dam in September and October. Revised Dworshak operations by the schedule above is needed to accommodate these fish.

- Implementing this operational schedule will insure that the Federal operating agencies are meeting their Federal trust responsibilities to the Columbia Basin treaty tribes.

- Implementing this operational schedule comports with the State of Idaho Dworshak Operations Plan (December 21, 2000) as approved by the Idaho Legislature and adopted by the Idaho Water Resource Board.

- If river conditions degrade dramatically, the Technical Management Team/Implementation Team, in consultation with the Nez Perce Tribe and the State of Idaho, are encouraged to take appropriate actions to utilize Dworshak flow schedules other than the above to best possible advantage for migrating salmonids, resident fish populations and power production.

- The Independent Science Advisory Board and the Independent Economic Analysis Board shall review the operation of Dworshak Dam under the National Marine Fisheries Service's Biological Opinion to assess the adverse impacts of those operations on resident fish and wildlife and the adverse impacts on the Clearwater County regional economy because of impacts to resident fish and wildlife. The Council will review the ISAB and IEAB reports, consult with the relevant fish and wildlife managers and make recommendations to Bonneville on any additional fish and wildlife mitigation responsibilities deemed appropriate under the Power Act.

Strategies in specific areas (cont.)

Monitoring and evaluation

- The 2000 Fish and Wildlife Program describes a general strategy for monitoring and evaluation. The emphasis is on developing and implementing standards and procedures for monitoring and evaluating management activities that are aimed at improving habitat conditions for fish and wildlife. The ultimate goals are to determine whether the biological objectives of the program are being achieved at the basinwide level and at lower levels, and to make sure that the evaluation information is used to adapt or change management strategies that are not achieving the biological objectives. The monitoring and evaluation elements stated above in the various mainstem strategies, and the general provisions in this section, are intended to be consistent with this general strategy.

- The mainstem plan calls for the continued operation of the Fish Passage Center. The primary purpose of the Center is to provide technical assistance and information to the fish and wildlife agencies and tribes in particular and the public in general on matters related to juvenile and adult salmon and steelhead passage through the mainstem hydrosystem and to the implementation of the water management measures in the Council's Fish and Wildlife Program for the protection and enhancement of fish and wildlife habitat throughout the mainstem. In performing this function, the Fish Passage Center shall:
  - plan and implement the annual smolt monitoring program;
  - gather, organize, analyze, house and make widely available monitoring and research information related to juvenile and adult passage and to the implementation of the water management and passage measures that are part of the Council's program;
  - provide technical information necessary to assist the agencies and tribes in formulating in-season flow and spill requests that implement the water management measures in the Council's program, while also assisting the agencies and tribes in making sure that operating criteria for storage reservoirs are satisfied; and
  - in general, provide the technical assistance necessary to coordinate recommendations for storage reservoir and river operations that, to the extent possible, avoid potential conflicts between anadromous and resident fish.

  The Council may revise the functions of the Fish Passage Center as the region develops a comprehensive data management system.

  No analyses by the Fish Passage Center should be considered proprietary. All analyses, whether in draft or final form, are to be posted on the center's internet site within 24 hours of completion.

  The Council has established an oversight board for the Fish Passage Center, with representation from the National Marine Fisheries Service, the tribes, the Council,

and others, to provide policy guidance for the Fish Passage Center and to ensure that the Center carries out its functions in a way that assures regional accountability and compatibility with the regional data management system.

Operation of the Fish Passage Center includes funds for a manager and for technical and clerical support in order to perform the functions stated above. The fish passage manager is selected for knowledge of the multiple purposes of the regional hydropower system and of the water needs of fish and wildlife, as well as the ability to communicate and work with the fish and wildlife agencies, tribes, Council, project operators, regulators and other interested parties, including members of the public. The fish passage manager will be selected by the oversight board, in consultation with the fish and wildlife agencies and tribes. The fish passage center manager shall report to the oversight board. The oversight board will review and evaluate the manager's performance on a regular basis. The Council will consult with the oversight board and the fish managers to appoint a technical advisory committee to assist the oversight board in evaluating the technical performance of the Fish Passage Center.

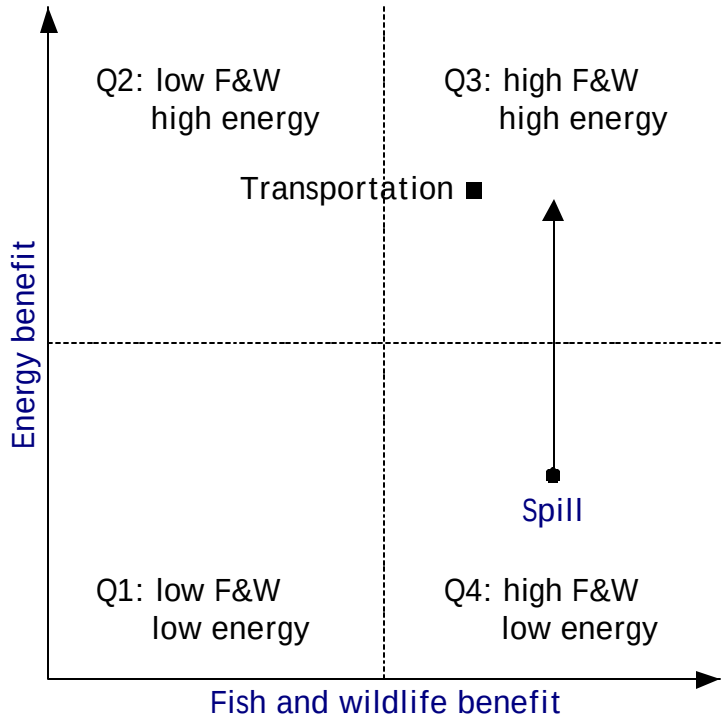
The Fish Passage Center shall prepare an annual report to the oversight board and the Council, summarizing its activities and accomplishments.

Strategies in specific areas (cont.)

Research

- **2000 Fish and Wildlife Program.** The 2000 Fish and Wildlife Program describes a general approach or strategy regarding research related to the Program, including the development by the Council of an overall or basinwide research plan that identifies key uncertainties for the Program and its biological objectives and the steps needed to resolve these uncertainties, coordination of this overall plan with particular research elements, including ocean research, and a call to make research results and other information important to the Program more readily available. The research elements stated above in the various mainstem strategies, and the general provisions in this section, are intended to be based in and consistent with this general strategy.

- **Research aimed at optimizing fish and wildlife benefits and energy production**. Actions taken to benefit fish and wildlife should also consider and minimize impacts to the Columbia Basin hydropower system if at all possible — the central goal should be to try to optimize both values to the greatest degree possible. Thus a high priority for mainstem research in general should be to try to determine what actions can be taken to provide both high fish and wildlife and energy benefits, or at least to increase one set of benefits without degrading the other. This diagram expresses the concept:



Research activities should be prioritized to focus on activities that would fall in quadrant 3 or activities that could potentially push current activities into quadrant 3. As an example, spill is an operation for fish with a serious energy impact for the power system. As described above in the Strategy on spill, this operation should be examined to determine whether spill can be more effectively utilized to help fish and lessen its impacts to the energy production.

- **Approach to prioritization of research ideas and proposals.** In any process for deciding on what mainstem research to fund or implement, the assigning of priorities should take into account a wide array of factors, such as:
  - potential biological benefits to fish and wildlife
  - widespread scientific value — can what is learned be applied to other situations?
  - management application
  - degree of uncertainty of the question asked
  - cost of the research
  - cost to power system of activity proposed for study
  - potential cost to implement the results of research
  - level of completion/duplication
  - legal relevance — does the research activity respond to the Biological Opinion and/or to the Fish and Wildlife Program or to other legal requirements?
  - "doability" in the technical sense — is the proposal a reasonable way to complete this activity?
  - "doability" in the legal/institutional sense

  Research proposals should be evaluated against each of the important elements, with the results combined in a variety of ways to expose the weight of different variables. These prioritization efforts should involve a broad set of people and interests in the prioritization efforts to match broad set of factors, including the use of independent scientific panels. People at the policymaking level should be more involved in the final decisions on long-term and annual research plans.

Strategies in specific areas (cont.)

Annual and in-season decisionmaking

- Through the Biological Opinions, the federal agencies have established an implementation structure for deciding on annual operation plans for fish and wildlife, in-season management of hydrosystem operations for fish and wildlife, and recommendations to Congress for funding for passage improvements. The Council continues to recommend to the federal agencies that this implementation structure, which includes the Technical Management Team and the Implementation Team, be jointly sponsored by the Council and the federal agencies, and allow for effective participation in these considerations by the relevant federal agencies, the Council and states, the tribes of the Columbia River Basin, and other affected entities, in a highly public forum. Discussions to this end began in 2001, but then became overcome by events. The Council will re-initiate the discussions to jointly sponsor these coordination teams.

Strategies in specific areas (cont.)

Mid-Columbia Hydroelectric Projects

- The Council will review and include as appropriate in the program settlement agreements for the Mid-Columbia hydroelectric projects.

Revised Transition Provisions

In the 2000 Fish and Wildlife Program amendments, the Council provided that all measures in the program that were "not directly superseded" by the adoption of the basinwide provisions in the 2000 Fish and Wildlife Program amendments would "continue to have force and effect until":

1. a subbasin plan has been adopted by the Council for the subbasin in which the project [or measure] is located (or, for research and mainstem measures, a research or mainstem plan);
2. the measure has been specifically repealed in a subsequent rulemaking; or
3. three years have elapsed following the final approval of this program, whichever occurs first.

The Council is both applying and revising these transition provisions at this time, in this way:

- Final adoption of the mainstem plan amendments to the Fish and Wildlife Program will supersede all provisions, objectives and measures in the Council's 1994-95 Columbia River Basin Fish and Wildlife Program that relate to systemwide hydrosystem operations, systemwide water management, mainstem flows, mainstem and storage reservoir operations, spill, bypass systems, smolt monitoring, mainstem operations research and evaluation and other matters related to juvenile and adult salmon migration through the mainstem, including all of Sections 5 and 6 of the 1994-95 program.

- *All* other specific measures in the 1994-95 program that have not been directly superseded by the adoption of the 2000 Fish and Wildlife Program amendments or by the adoption of the mainstem plan amendments remain in effect until 1) a subbasin plan has been adopted by the Council for the area in which the measures is located; or 2) the measure has been specifically repealed in a subsequent program amendment process. This includes any resident fish substitution or mitigation measures, such as the Lake Roosevelt monitoring or production programs, that occur in the mainstem but which are not directly related to systemwide operations or salmon migration.

- Upon final adoption of the mainstem plan amendments, the Council is also deleting the three-year sunset clause from the Transition Provisions in the 2000 Fish and Wildlife Program amendments. *No* specific measure in the Fish and Wildlife Program prior to the adoption of the 2000 program amendments will expire simply because three years have elapsed from the final approval of the 2000 Fish and Wildlife Program amendments.

Draft Analysis of the Adequacy, Efficiency, Economics and Reliability of the Regional Power System

Analysis of Adequacy, Efficiency, Economy and Reliability of the Power System

Introduction

The U.S. Ninth Circuit Court of Appeals' 1994 decision in *NRIC v. Northwest Power Planning Council* characterizes the fish and wildlife provisions of the Northwest Power Act as "[a]ttempting to balance environmental and energy considerations."[9] The Northwest Power Planning Council's Columbia River Basin Fish And Wildlife program must consist of measures to "protect, mitigate, and enhance fish and wildlife affected by the development, operation, and management of [hydropower] facilities while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply."[10] "Assuring" the region of such a power supply implies a reasonable degree of certainty that the objectives of adequacy, efficiency, economy and reliability will be achieved.

The Council must also determine whether the fish and wildlife program is consistent with the purposes of the Northwest Power Act.[11] These purposes include encouraging conservation of electricity and timely repayment of the Bonneville Power Administration's debt to the federal treasury.[12] An adequate, efficient, economical and reliable power supply that includes a healthy and financially viable Bonneville Power Administration is essential to carrying out those purposes.

In terms of their effect on the power system, the alternative Mainstem Amendments to the Fish and Wildlife program that are under consideration have greater or lesser power system impacts relative to the National Marine Fisheries Service (NMFS) 2000 Biological Opinion. In some cases, the differences are significant. The 2000 Biological Opinion itself has had a sizeable impact on the power system relative to a "power plus non-fish constraints"[13] operation. Council analysis has found that the current Biological Opinion reduces net regional power system output by approximately 1200 average megawatts on average[14] and has an average annual power system cost of approximately $260 million in reduced value of the output when evaluated using wholesale electricity market prices based on average water conditions and an efficiently functioning market.[15] As the experience of 2000 – 2001 demonstrated, the impacts can be much greater when conditions deviate significantly from those assumptions. Bonneville estimates that for 2001, the additional power purchases and foregone revenues attributable to the flow

[9] *NRIC v. Northwest Power Planning Council* slip opinion at p. 10879 (9th Cir. 1994)/
[10] 16 U.S.C. § 839b(h)(5).
[11] 16 U.S.C. § 839 b(h)(7)
[12] 16 U.S.C. § 839(1), (4).
[13] There has never been a true power only operation in that operation of the system has always taken into account multiple purposes such as flood control, recreation, navigation and irrigation, all of which impact the power producing capability of the system.
[14] Average regional hydroelectric generation is about 16,000 average megawatts based on a fifty-year historical water record.
[15] This estimate is based on an annual average wholesale electricity price of about $28/megawatt-hour.

requirements of the BiOp was $1.5 billion.[16] Had spill not largely been curtailed, the cost would have been considerably larger. The large increase in costs is attributable to the fact that market prices across the period were approximately a factor of 10 greater than those seen under "normal" market conditions.

The alternative mainstem amendments under consideration are summarized in Table X-1.

Table X-1
Description of Alternatives

Alternative	Summary
Council Draft Alternative	Remove April fill requirement, fill by June 30th Summer flow augmentation through Sept 30th 10' draft limit @HHR, LIB (20' in 20% driest years) LIB & HHR release to achieve flat outflows Jul-Sep GCL specified min elevation Jan-Jun, 1283' July-Dec DWR specified target summer elevations Biop spill levels
Alternative A Flat HHR, LIB, GCL, DWR 115% gas	Passive spring flow augmentation, fill by June 30th Summer flow augmentation through Sept 30th 10' draft limit @HHR, LIB (20' in 20% driest years) LIB & HHR release to achieve flat outflows Jul-Sep GCL & DWR even release Jul-Sep Spill levels not to exceed 115% gas supersaturation
Alternative B Flat HHR, LIB, GCL, DWR Biop spill	Same as A but use the 2000 Biological Opinion spill levels
Alternative C Flat HHR, LIB, GCL, DWR 110% gas	Same as A but limit spill levels not to exceed 110% gas supersaturation
Alternative D Flat HHR, LIB, GCL, DWR No spring fill 115% gas	Same as A but remove the April fill requirement
Alternative E Flat HHR, LIB, GCL, DWR 115% gas 20' draft HHR, LIB	Same as A but use 20' draft limits at LIB & HHR in all years
Alternative F Flat DWR	Same as 2000 Biop except provide specific elevation targets at DWR for summer
Alternative G Deeper summer drafts Add US & BC water	Fill by April, active spring flow augmentation Fill by June, 10' deeper drafts by end of August 24-hour bypass spill at 4 lower Snake and Columbia dams 1 maf of additional Upper Snake water 1 maf of non-treaty water for summer flow augmentation Increase max flow at DWR to 22 kcfs spring and summer
Alternative H Deeper summer drafts	Same as G but Remove the additional 1 maf of Upper Snake water

[16] It should also be noted that the cost of all other non-power hydro operations in 2001 were equally affected by the high electricity prices.

Add BC water	
Alternative I Flat GCL @1288'	Same as BiOp except provide specific elevation targets at GCL, 1288 feet from June through December
Alternative J Flat GCL @1283'	Same as I but January to June elevation targets become minimums, fill by June 30th Draft GCL evenly to 1283' by end of July Keep GCL @1283' from September through December

The power system energy and cost effects of the alternative Mainstem Amendments currently under consideration are summarized in Table X-2. Data are presented relative to the 2000 Biological Opinion for the average annual energy impact in average megawatts, the average annual cost or cost reduction, and the average energy impact in megawatt-months over the winter season, December through March. The latter is of interest from the standpoint of winter (peak season) reliability. Most of the alternatives under consideration result in somewhat greater power system production and lower cost. Some alternatives, however, head in the opposite direction. The most significant deviation from current operations is the reduction in winter season energy associated with alternatives G and H.

Generally speaking, impacts to winter reliability stem from reservoir operations that are rigid and offer little or no flexibility in terms of drafting water below the rule curves during short emergency periods. Having more hydro energy available during the winter months clearly helps in this area but the ability to shape that energy into the peak demand hours is the key component to reliability. Alternatives G & H reduce the amount of winter energy on average, but do not necessarily constrain the reservoirs in a way to inhibit their use during a cold snap. A more detailed reliability analysis of this operation is warranted.

Currently, the Northwest is not facing a reliability concern. Under this condition, it is unlikely that implementing Alternatives G and H will increase the winter loss of load probability (LOLP) beyond acceptable standards. However, when the region gets closer to a demand and resource balance, the effects of Alternatives G and H will have a more significant impact. Analysis done last year by Council staff indicated that having an additional 1,500 megawatt-months of stored energy heading into the winter season reduced the forecasted LOLP from 17 percent to about 12 percent. This is considerably less winter period energy than the reduction associated with Alternatives G & H. This indicates that should Alternatives G or H be adopted, resource acquisitions would be required to maintain an adequate power supply and would have to be made sooner than would otherwise be the case.

Table X-2

Average Power System Impacts of 2002 Fish and Wildlife Mainstem Amendment Alternatives

Difference from 2000 BiOp Operation			
Alternative:	**Average Annual Energy (aMW)**	**Regional Cost/Year (millions)**	**Dec-Mar Energy (MW-Months)**
Council Draft Alternative	41	-$8	1747
Alternative A Flat HHR, LIB, GCL, DWR 115% gas	345	-$61	52
Alternative B Flat HHR, LIB, GCL, DWR Biop spill	70	-$9	52
Alternative C Flat HHR, LIB, GCL, DWR 110% gas	530	-$102	52
Alternative D Flat HHR, LIB, GCL, DWR No spring fill 115% gas	345	-$68	950
Alternative E Flat HHR, LIB, GCL, DWR 115% gas 20' Draft HHR, LIB	345	-$65	-160
Alternative F Flat DWR	40	-$10	-180
Alternative G Deeper summer drafts Add US & BC water	-235	$42	-2130
Alternative H Deeper summer drafts Add BC water	-260	$47	-2130
Alternative I Flat GCL @ 1288'	57	-$4	1130
Alternative J Flat GCL @ 1283'	42	-$6	775

There is a very wide spectrum of views in the region regarding the meaning of an adequate, efficient, economical and reliable power supply. Some hold that it must be considered entirely in the context of the power system that existed in 1980. In this view, an acceptable power supply is one whose characteristics are different than those of the 1980 system in only minor respects. For others, it may mean doing whatever is necessary to accommodate the needs of fish and wildlife, so long as some kind of power system can be maintained that is roughly as adequate, efficient, economical and reliable as those in other parts of the nation.

It would be difficult to argue that the power system impacts of the 2000 Biological Opinion have made the power system inadequate, inefficient, uneconomical and unreliable in an absolute sense. For several years the system has been operated under similar fish and wildlife constraints without

disastrous consequences for the system or the regional economy. However, the cost to the power system was nonetheless considerable. Consequently, the Council is very interested in the power system impacts of mainstem actions. The question of how the impacts of fish operations on the power system can be lessened while still fulfilling the objective of protecting, mitigating and enhancing the fish and wildlife of the Columbia Basin is in the forefront of the Council's thinking. The Council recently considered analysis of the power system impacts of specific mainstem actions, e.g. spill at specific projects.[17] This information, considered in light of the uncertainty regarding the effectiveness of flow and spill should help frame a research agenda that would improve the cost-effectiveness of mainstem actions[18]

In 2000-2001, the system was inadequate to meet loads, satisfy the requirements of the Biological Opinion and maintain moderate prices in what turned out to be a very poor water year. However, while the effects of fish operations on the power system contributed in some measure to the problem, they were by no means the cause. As will be discussed in greater detail later, the problem was the consequence of a systemic failure to develop sufficient resources, exacerbated by characteristics of an immature and, particularly in the case of California, poorly designed power market. One of the mechanisms by which the power system coped with the crisis was to dramatically reduce spill in order to be able to increase current power production and reduce purchased power costs and to store energy for future use. Some argue that reliability of the power system was protected at the expense of fish and wildlife.[19] However, as was noted earlier, very large costs were incurred by the power system in meeting the flow requirements of the Biological Opinion.

In general, it is likely that the adequacy, reliability, efficiency and economy of the region's power supply can only be fully gauged in the context of a full revision of the Council's Power Plan, which is currently underway. Congress appears to have had this in mind. Congress anticipated that the Council would develop the fish and wildlife program immediately after passage of the Act.[20] In contrast, the Council was given up to two years to develop the power plan. Among its several purposes, the power plan is intended to lay out a resource strategy that will:

> reduce or meet the Administrator's [of the Bonneville Power Administration] obligations with due consideration by the Council for (A) environmental quality, (B) compatibility with the existing regional power system, (C) protection, mitigation and enhancement of fish and wildlife and related spawning grounds and habitat, including sufficient quantities and qualities of flows for successful migration, survival, and propagation of anadromous fish, and (D) other criteria which may be set forth in the plan.[21]

In a sense, the Act establishes a reciprocal arrangement between the fish and wildlife program and the power plan. The fish and wildlife program must still assure the region that it will not cause the power system to be inadequate, inefficient, uneconomical and unreliable. In return, the requirements of fish and wildlife program is a factor to be taken into account in the power plan,

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[17] Cost and Energy Impacts of Fish and Wildlife Operations, http://www.nwcouncil.org/library/2002/costenergyimpacts/slide1.HTM

[18] "Mainstem Passage Strategies in the Columbia River System: Transportation, Spill, and Flow Augmentation" by A. Giorgi, M. Miller, and J. Stevenson of BioAnalysts, Inc. (Giorgi et al. 2002).

[19] In reality, changes in fish operations were only one aspect of the response to tight supplies and high prices. Other responses included very large long-term curtailments of electricity loads and substantial new "emergency" generation.

[20] Remarks of Rep. Dingell, Cong. Rec. p. H10683, November 17, 1980.

[21] 16 U.S.C. § 839b(e)(2).

and the mutual impacts of fish and power measures are intended to be examined together.[22] It may be that the potential impacts of a particular fish and wildlife measure look different in the context of a full revision of the power plan than they do during the fish and wildlife amendment process. Conversely, it is likely that we will be better able to assure an adequate, efficient, economical and reliable power supply that adequately supports the protection, mitigation and enhancement of fish and wildlife in the context of a full revision of the Power Plan and implementation of its key recommendations.

This is almost certainly the case with this revision of the Power Plan. This has very little to do with the current amendments to the Fish and Wildlife Program and much more to do with the power system itself. The experience of 2001-2002 revealed serious problems with the planning, development and operation of the power system in the current market environment and the ability to assure an adequate, efficient, economic and reliable power system. The revision of the power plan that is underway is analyzing these problems and possible solutions. Among the specific issues is the interaction of the fish operations and the power system during periods of power system stress and how to assure equitable treatment of fish in that context.

This does not mean that, in adopting the fish and wildlife measures, the Council need not make a determination that the fish and wildlife program does not jeopardize the ability of the region to have an "adequate, efficient, economical and reliable power supply." It must do so. But its determination must recognize that a fuller analysis of the issue will follow in the revision of the power plan.

This appendix describes the Council's analysis of the balance between fish and wildlife measures and the power system.

Summary

The adequacy, efficiency, economy and reliability of the power system is best thought of in two time frames: the short-term (the next 2-3 years) during which period in would not be possible to complete large changes to the system to respond to fish and wildlife program requirements; and the long-term during which there is time to respond, provided the market and/or regulatory incentives are there to do so. In the near term (the next 2-3 years), the region is expected to have an adequate, reliable and efficient power supply under any of the alternatives under consideration, even those that somewhat reduce the power system output. This is largely the result of still-depressed demand for electricity and the number of new power plants that have recently entered service or are under construction here in the Northwest and elsewhere in the West. While the pace of development has dropped off recently, the lowered demand combined with the plants that have been or soon will be completed, provide sufficient adequacy and reliability in the near term.

The "economical" objective is somewhat more questionable. Bonneville and other utilities in the Northwest are facing financial problems as a consequence of both the costs of power purchased at elevated prices during the electricity crisis and reduced revenues as a result of the depression in prices in the wholesale electricity market over the past year. The Northwest economy is in recession and, while increased retail electricity prices are not the cause, they do not help. Bonneville is facing the need to cut costs and either increase rates or risk higher probabilities of being unable to meet its treasury repayment. This is, for the most part, attributable to problems with the structure and operation of the power system that significantly affected Bonneville's costs and revenues. It does, however, mean that incremental costs are more difficult to accommodate.

[22] 16 U.S.C. § 839b(e)(3)(F).

The annual cost impact of the alternatives relative to Bonneville's annual revenue requirement is shown on Table X-3. The Fiscal Year 2000 was chosen as a relatively "normal" year for Bonneville in terms of its revenue requirements and because the cost impacts of the alternatives are based on average conditions and normal market conditions. Most of the alternatives have positive impact Bonneville's financial condition. The exceptions are alternatives G and H, which increase costs somewhat. The amount of the increase is on the order of 1.5 percent of Bonneville's revenue requirement.

Table X-3
Annual Power System Cost of Mainstem Amendment Alternatives in relation to Bonneville Annual Expenses

Alternative	Average Annual Cost Impact - Millions	As percent of Bonneville FISCAL YEAR 2000 Expenses
Council Draft Alternative	-$8	-0.29%
Alternative A	-$61	-2.18%
Alternative B	-$9	-0.32%
Alternative C	-$102	-3.64%
Alternative D	-$68	-2.43%
Alternative E	-$65	-2.32%
Alternative F	-$10	-0.36%
Alternative G	$42	1.50%
Alternative H	$47	1.68%
Alternative I	-$4	-0.14%
Alternative J	-$6	-0.21%

In the longer term, assuring the region an adequate, efficient, economic and reliable power supply will depend on the successful resolution of a number of issues: These include:

- The adequacy of financial or regulatory incentives for the development of new resources, both generation and demand-side;
- Mechanisms to increase the responsiveness of retail demand to increases in wholesale prices;
- The adequacy of mechanisms to ensure investment in cost-effective levels of new efficiency resources;
- Barriers to ensuring adequate resource diversity to mitigate risk;

- Development of mechanisms to ensure equitable treatment of fish and power during extreme low hydro years.

These issues are being addressed in the Fifth Power Plan. With successful resolution of these issues, an adequate, efficient, economical and reliable power system can be assured with the fish operations embodied in the Mainstem amendments. A related issue is the efficiency or cost-effectiveness of some fish operations. A focus on reducing the cost to the power system of meeting biological objectives is needed.

Adequate, Efficient, Economical and Reliable

Adequate and Reliable — Definitions

Adequate and reliable have specific meanings in the power industry. Adequacy is a component of reliability. A Power system is ***reliable*** if it is:
–***Adequate*** - the electric system can supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.
–***Secure*** - the electric system can withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.[23]

Adequacy refers to having sufficient resources – generation, efficiency and transmission – the serve loads. Simplistically, in determining adequacy, resources are "derated" to take into account expected performance including scheduled and typical forced outages. Hydro resources are evaluated under worst case or "critical" hydro conditions. Similarly, loads are evaluated under extreme temperature conditions. Here in the Northwest, that typically means during a prolonged cold snap.

Security is achieved largely by having reserves that can be brought on line quickly in the event of a system disruption and through controls on the transmission system. These reserves can be in the form of generation or demand side curtailment that can take load off the system quickly. The National Electric Reliability Council (NERC) and the Western Electricity Coordinating Council (WECC) establish reserve requirements. The reserve requirement is frequently expressed in terms of a percentage of load or largest single contingency, e.g., the loss of Energy Northwest's Columbia Generating Station. The reserves required for security are an additional resource requirement necessary for a reliable power system.

Here in the Northwest, determination of power supply adequacy and reliability is complicated by the fact that the output of the hydroelectric system can vary widely from year to year. This is because the hydro system has limited storage capacity. Consequently, the output of the system can vary widely depending on the amount, timing and form (rain or snow) of precipitation in a given year. In addition, during cold snaps side flows into the system can be reduced, restricting the ability of the system to sustain a high level of output for an extended period.

For purposes of this analysis, adequacy and reliability need to be evaluated in two time frames: the short-term – the two to three years it takes to bring significant new resources into the system; and the long-term – three years a beyond. In the short-term, the question is whether there exist sufficient resources to assure adequacy and reliability. In the long-term, the question is whether

[23] "Glossary of Terms," North American Electric Reliability Council, Glossary of Terms Task Force, August 1996

the incentives, market or otherwise, or regulatory policies and mechanisms exist to ensure that sufficient resources, including demand side resources, will be added to the system.

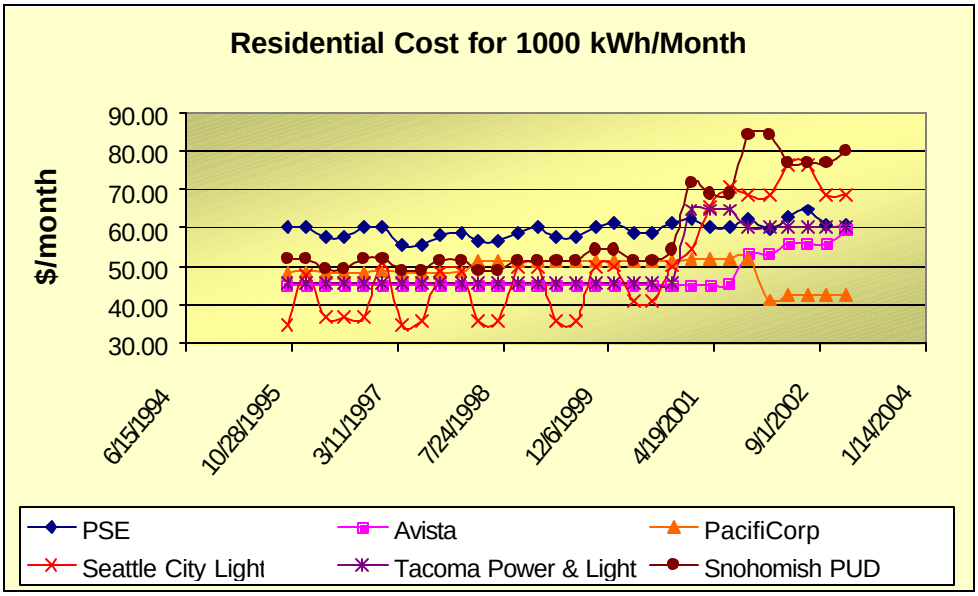
Adequate and Reliable – Short-Term Analysis

In the short-term, we believe the Northwest has an adequate and reliable power system. The reasons are three: 1) In the worst case, the Mainstem Amendments alternatives do not sufficiently adversely affect the power output of the hydro electric system beyond current operations to cause immediate adequacy/reliability problems. 2) Slowly recovering demand means the stress on the system is less significant than when the Council did its 2000 reliability analysis; and 3) There has been the substantial addition of new resources here in the Northwest and elsewhere in the West, even taking into account recent construction deferrals.

As noted earlier, the 2000 Biological Opinion has had a substantial effect on the power production of the hydro system compared to a "power and non-fish constraints" operation. However the system has been operating successfully under these constraints for some time. In the most severe case, one of the proposed mainstem amendments further degrades the system, particularly in the winter months. In the near-term, however, there is sufficient cushion to avoid adequacy/reliability problems. Other alternatives are expected to improve the system somewhat from a power standpoint.

Regional loads are down substantially from "normal" levels. This is a function of depressed aluminum market (that precludes many aluminum plants from returning to operation), the effects of the economic slowdown, and "hangover" effects of the 2000-2001 power crisis, (e.g., conservation stimulated by the increases in retail rates that have taken place over the last 6 to 12 months). For example, Figure X-1 shows data compiled by the Washington Utilities and Transportation Commission comparing the cost for a 1000 kWh of electricity for 6 Washington utilities.

Figure X-1

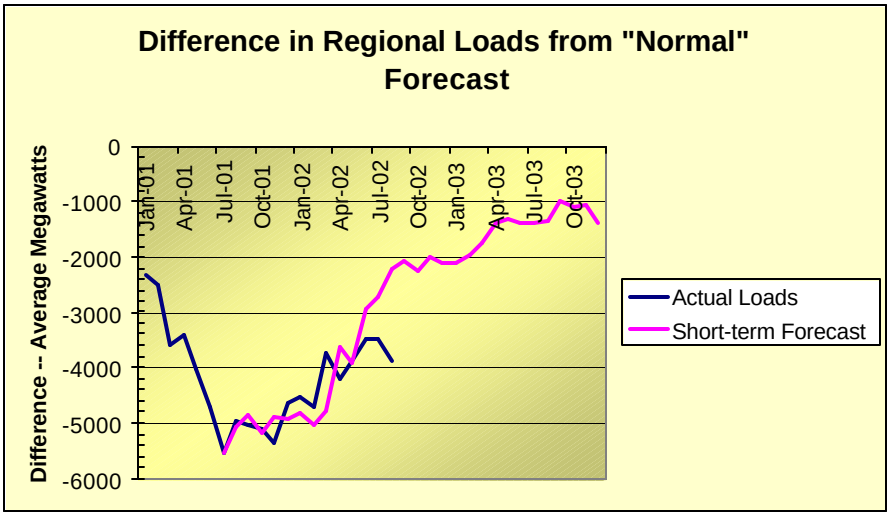


As this chart shows, many of these utilities have experienced substantial increases over the last several months. This is typical of other utilities both within Washington and elsewhere in the

region. The increase in retail rates has stimulated demand for efficiency services that is reflected in lower loads.

A comparison of actual and forecast loads over the next year is shown on figure X-2

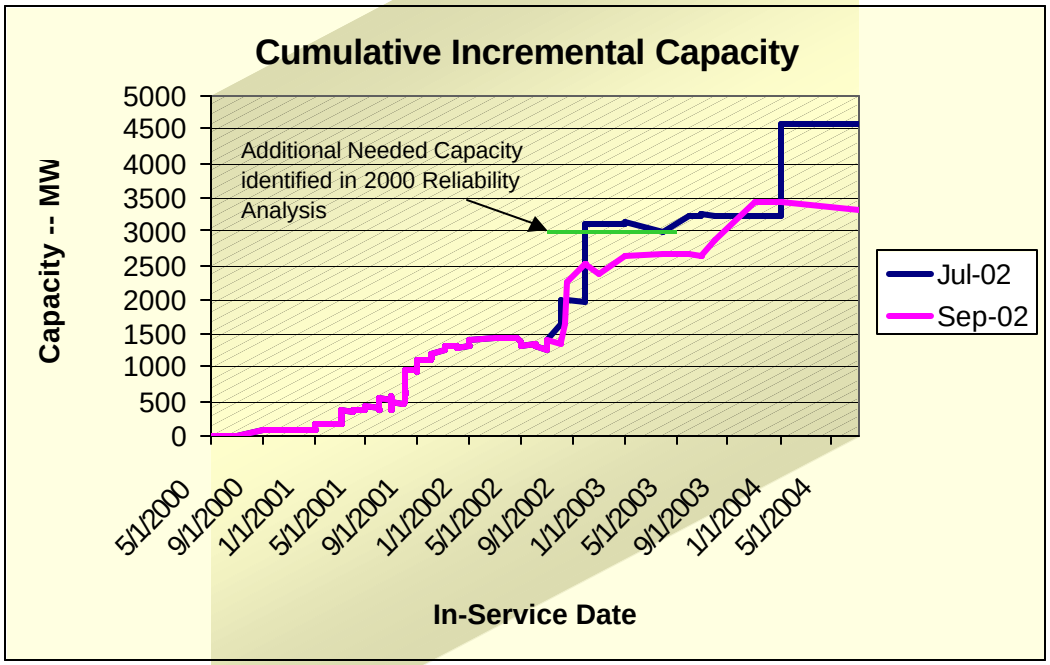
Figure X-2



This figure shows the difference between the Council's long-term demand forecast (used in the 2000 Reliability Analysis) and actual regional loads. Also shown is the difference between the current short-term forecast and the long-term demand forecast. The long-term forecast had been tracking aggregate loads quite well up until the Western Electricity Crisis. The short-term forecast reflects known load reductions, estimates of the effects of the recession, the effects of retail rate increases and estimates regarding the recovery of the aluminum industry loads. The short-term forecast anticipates loads, which remain at least 1000 – 2000 average megawatts below the Fourth Plan forecast for the next year. Actual loads appear to have been diverging from the short-term forecast in recent months. If that trend continues, suggesting a slower than anticipated economic recovery and slower recovery of aluminum industry loads, the difference from normal loads will be even greater.

The high prices during the Western Electricity Crisis also stimulated the development of substantial new generation. Figure X-3 shows the cumulative amount of new generation in the Northwest that has been recently completed or that is under construction judged to be likely to be completed. As the figure indicates, however, our view of what is likely to be completed is imperfect at best. Our estimates as of July of 2002 proved to be optimistic as the suspension of construction was announced at three major plants.

Figure X-3

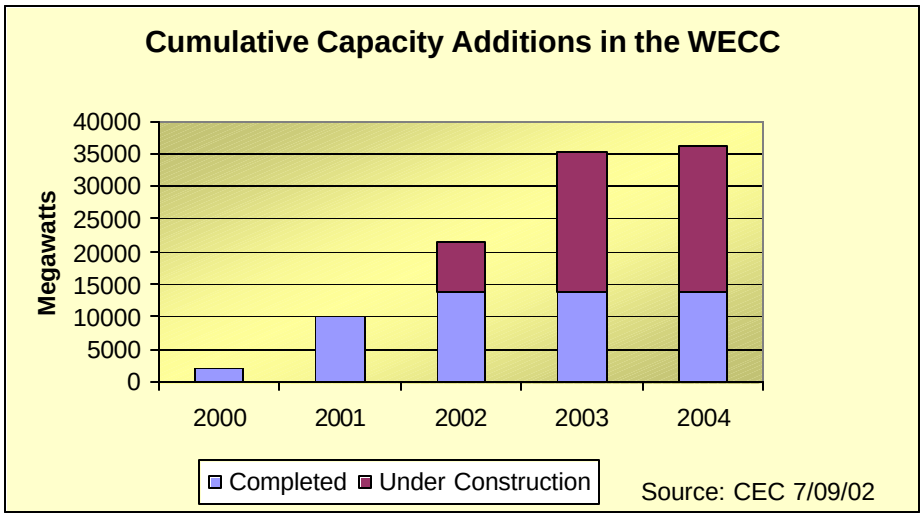


As this figure shows there has been a drop-off in the amount of new generation scheduled to be added to the system. Nonetheless, we believe there will be sufficient generation capacity in relation to the reduced loads to assure adequacy and reliability over the next couple of winters. In addition, those plants that have been deferred should have a relatively short construction period to complete, provided prices recover to the point that the developers can restart or load serving entities contract for a sufficient amount to justify restart.

There have also been significant resource additions in the rest of the WECC. Figure X-4 shows the cumulative resource additions for the entire WECC since 2000. This is in relation to a peak demand in the WECC of about 130,000 Megawatts. As is the case in the Northwest, there have been some deferments of some of the "Under Construction" capacity since this data was compiled. However, at least in the near term, the WECC expects a margin of resources over peak demand in excess of minimums even without further resource additions.[24]

[24] WECC 10 year Coordinated Plan Summary 2002-2011, Western Electricity Coordinating Council, 2002, P 26.

Figure X-4



Most of the generation in this figure is located in California, Arizona and Nevada. These data suggest that for the next two or three years there will be sufficient generation in the rest of the WECC for the Northwest to draw on in the event of winter emergencies and a substantially reduced likelihood that summer loads in these areas would place unusual demands on Northwest resources.

A complete reliability analysis using the GENESYS model is underway. It is looking at the current year (spanning the winter of 2002-2003) and the year spanning the winter of 2004-2005. The latter period was chosen because if additional permanent generation resources were needed for this period, construction would have to begin now. This will be a stochastic analysis, running several hundred simulations in which water conditions, temperatures (which affect loads) and forced outages are sampled according to their probabilities. This simulation will also estimate the potential supply from outside the region and use imported power where necessary. The data from these simulations can be used to estimate the probability, magnitudes and duration of supply shortfalls.

Adequate and Reliable – Long Term Analysis

The experience of the past few years has put a somewhat different light on the meaning of an adequate, efficient, economical and reliable power supply. It is this experience that frames the fundamental questions being addressed in the Council's Fifth Power Plan. Are the institutional, regulatory and market structures of the power system such that we can be assured of an adequate, efficient, economical and reliable power system, with or without fish constraints, and if not, what changes are required? While fish operation requirements added to some degree to the magnitude of the supply shortfall during 2000-2001, they did not cause it. It was the fundamental failure of the power system to provide adequate resources that was the root problem. Because of this failure, there is some justification in saying that power system failed in its obligation to protect, mitigate and enhance the fish and wildlife resources of the Columbia Basin. And in fact, one of the tools used to help the power system through this period was to largely eliminate spill at federal projects until resource/load balance had been restored, as permitted by the Biological Opinion in emergency conditions. There is some disagreement about what damage this may have caused to listed and unlisted species. However, that the system failed to provide the operations called for in the 2000 Biological Opinion is very clear. However, the power system and the other

users of the power system also bore major consequences in the form of curtailed load, high purchased power costs and high costs for emergency resources.

If we are to avoid or at least to lessen the likelihood and severity of such events in the future, it is probably useful to briefly review the experience of the last few years and the lessons we might derive from that experience.

The period leading up to summer 2000-01

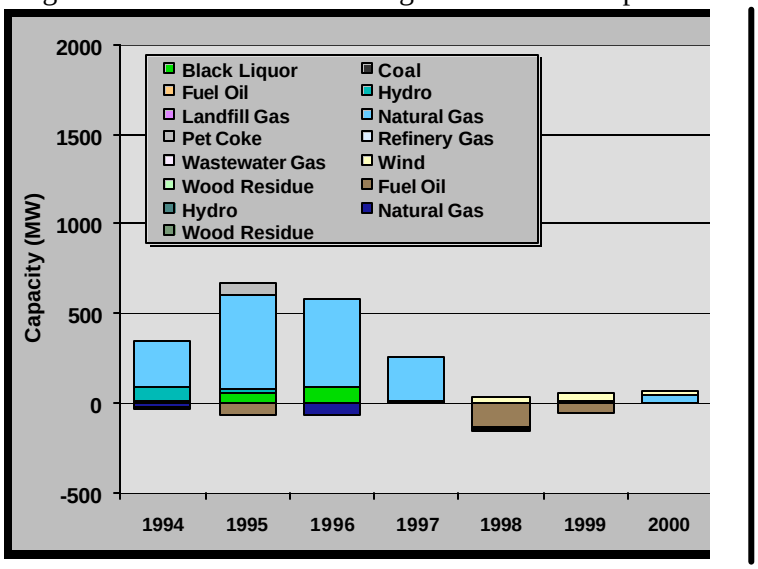
The period of the late 1990's was a period of significant change and uncertainty in the power industry. Years earlier, national policy had set in motion a move to a competitive wholesale power market in which most development of new generation is undertaken by independent power producers (IPP).[25] The vast majority of power plants currently under construction or in the permitting and planning process are IPP projects. Unlike traditional vertically integrated utilities, IPPs do not have a native load customer base from whom to recover the fixed costs of new power plants. To build, they require adequate market prices and/or sufficient long-term sales contracts to justify financing.

The primary source of uncertainty affecting the industry was the movement toward retail competition in various states and nationally. This raised the concern that a utility's customers today might not be their customers in the future. The potential for investments in new resources becoming stranded investments weighed on heavily on the industry's thinking. This situation coincided with a period of very low market prices in the West brought about by several successive years of average or above average hydro conditions combined with what was initially excess capacity on the system, primarily in California. The availability of low cost market power made it uneconomical for developers to build power plants as merchant plants selling into the spot market. It also further discouraged utilities with load serving responsibility from placing long-term contracts for power supply with IPPs. The prudence of such contracts could be and and in some cases were called into question in the face of the then-current low market prices.

The net effect was little development of resources. Figure, X-5 shows Northwest generating resource development from through the 90s. .

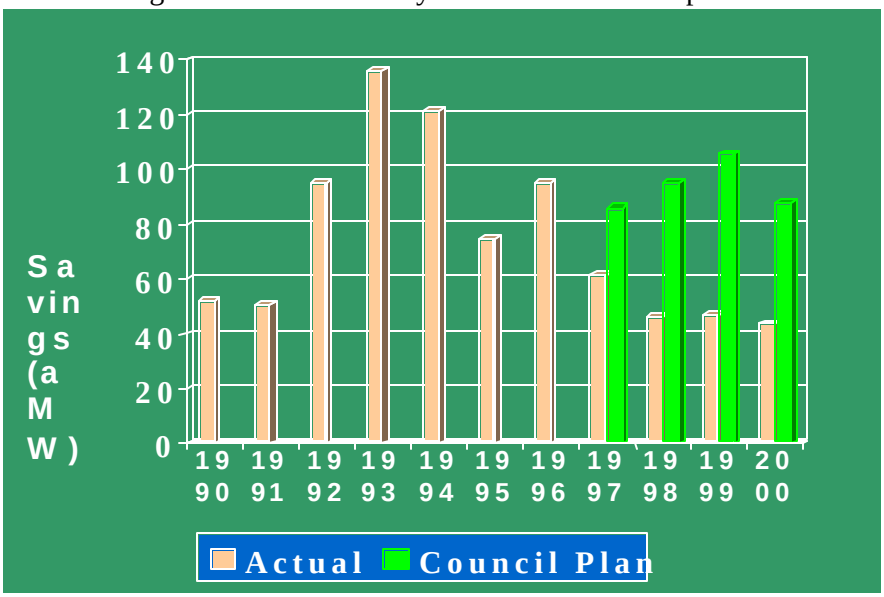
[25] Relevant policies were established as early as 1978 in the Public Utilities Regulatory Policy Act (PURPA) and more recently in the National Energy Policy Act of 1992.

Figure X-5 Northwest Generating Resource Development



The same behavior is evident in the development of efficiency resources as shown on Figure X-6. Conservation development dropped off dramatically from the early 1990s to levels that were less than half the recommended cost-effective level in the Council's Fourth Power Plan.

Figure X-6 Annual Utility Conservation Development

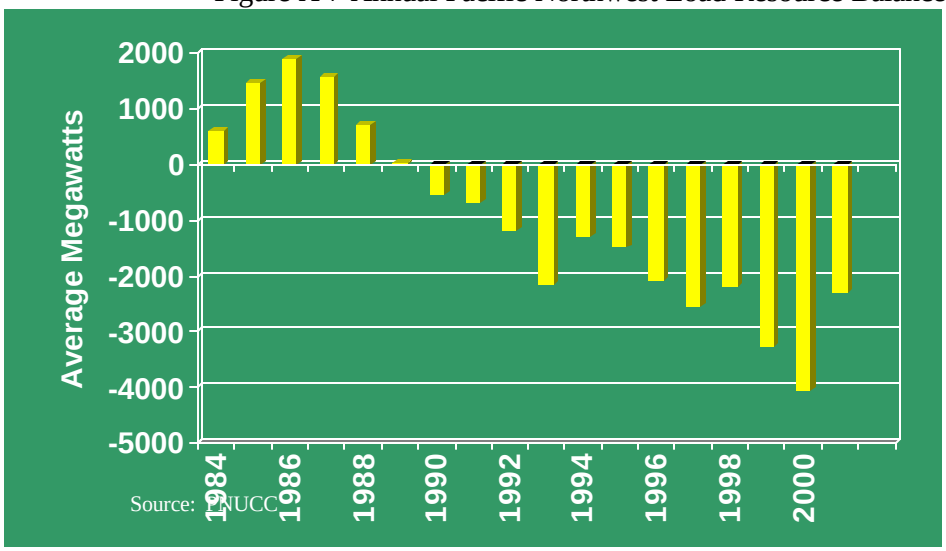


The net effect of this of this low level of development combined with reasonably robust regional growth was plainly evident in the annual estimates of load-resource balance compiled by the Pacific Northwest Utilities Conference Committee (PNUCC).[26] This report compiles from regional utilities the statements of loads (annual energy and January Peak), including export commitments; and resources, including conservation and contracted imports. The analysis assumes critical water hydro. While each year's report includes a forecast going forward 10

[26] Pacific Northwest Regional Forecast, Pacific Northwest Utilities Conference Committee, Portland, OR. http://www.pnucc.org/2002%20NRF/nrf_toc.htm

years, we have compiled the data for each forecast going back to 1984 using only the data for the first year in each forecast. This is shown on Figure X-7.

Figure X-7 Annual Pacific Northwest Load-Resource Balance



These data show that the region has not been in critical water load-resource balance for more than a decade. At some level, this is good. The Northwest has strong electrical interconnections with California and the Southwest. The load diversity between these regions (the NW peaking in the winter, California and the Southwest peaking in the summer) means that there is usually excess power for the Northwest to purchase in the winter when our supplies are tightest as well as a market for excess power in the summer. For several years, regional utilities leaned heavily on the market to fill out their resource needs.

In addition, most years' water supply exceeds the amount observed in the driest (critical) year. Averaged over the 50-year historical record, the hydroelectric system produces nearly 4,000 average megawatts more energy than it does in the driest year. In the highest runoff year, the system produces nearly 8,000 average megawatts more. The combination of having out-of-region supplies and greater than critical water runoff has masked the inadequacy in the power system over the last decade.

However, there is a limit. The increasing deficits observed in Figure X-7 and in Bonneville's "White Book"[27] prompted the Council to undertake an analysis of the region's power supply adequacy. This report, released in early 2000, focused on the ability to meet regional loads in the winter, which is usually the most difficult period for the Northwest. Stochastic analysis techniques were used to estimate the probability of being unable to fully meet loads during one or more periods across the winter season.[28] Hydro conditions, temperatures (and, therefore, loads) and forced outages on generating facilities were sampled according to their statistical probability of occurrence. Several hundred winter seasons were simulated. The analysis found that by the winter of 2002-03, the region faced a 24 percent probability of some level of shortfall (loss of

[27] Pacific Northwest Loads and Resources Study, http://www.bpa.gov/power/pgp/whitebook/whitebook.shtml, Bonneville Power Administration

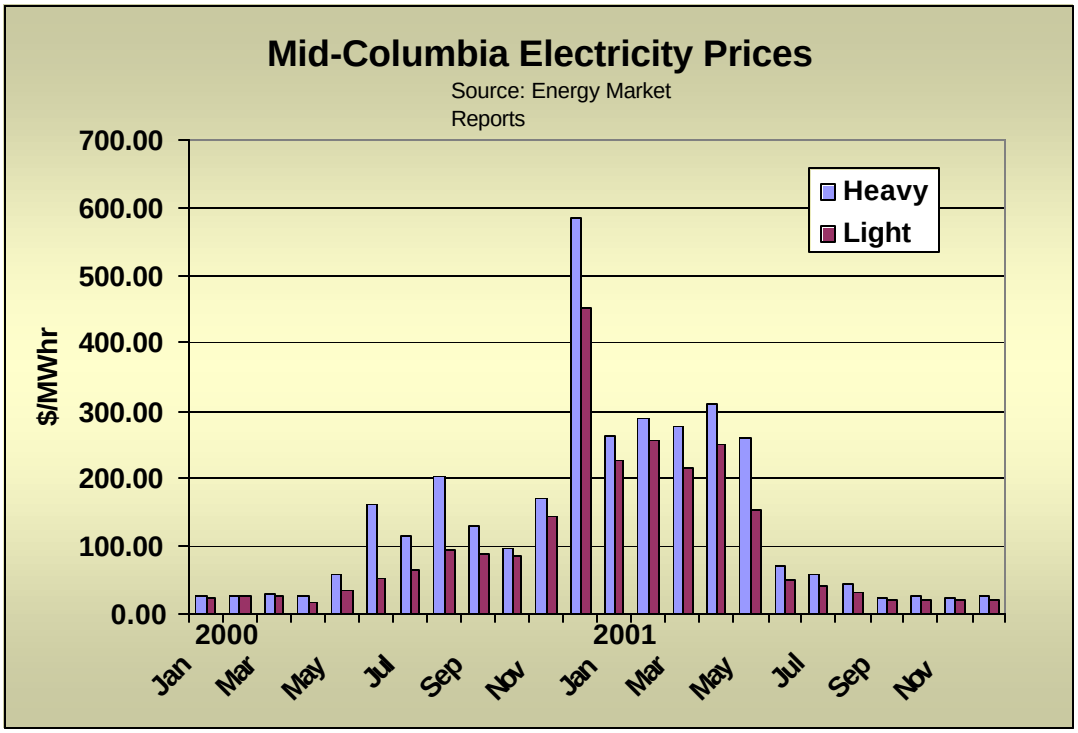
[28] Northwest Power Supply: Adequacy/Reliability Study Phase I Report, Northwest Power Planning Council, March 2000.

load probability – LOLP) despite heavy use of imports and hydro system flexibility[29]. Ordinarily a 5 percent probability would be considered acceptable. It was estimated that the equivalent of 3000 MW of new generating capacity would be required to achieve the desired 5 percent LOLP.

Summer – Fall 2000

The limit to which we could push our reliance on good water and a healthy marketwas reached in the summer of 2000. A history of market prices at the Mid-Columbia trading hub from January 1, 2000 up to this writing is shown on Figure X-8. Note that this chart is plotted on a logarithmic scale to permit covering the extreme range of prices with some resolution. In a sense, this chart provides a history of the Western Electricity Crisis.

Figure X-8



The year 2000 began with "normal" prices and, in the spring, good runoff. However, in late June and throughout the summer and fall, the West experienced much higher than normal power prices, punctuated by some extreme price spikes. During the same period, California was frequently on the verge curtailing loads and did so several times. There were a number of factors that lead to this situation. There were physical and economic factors including:

- Declining generation margins resulting from lack of investment in new resources:
- Higher than normal weather-driven demands throughout the West;
- An unusual pattern of hydropower generation – an early run-off followed by reduced hydro generation;
- A high level of planned and forced outages of thermal generating units; and

[29] Hydro system flexibility implies drafting reservoirs deeper than would ordinarily be the case in order to meet extreme loads and then attempting to replace the water to meet April flood control levels through imports and greater use of thermal resources.

- High gas prices in reaction to the high demand for gas-fired generation.

There were also factors related to market immaturity and transitional uncertainties including:

- The lack of a demand-side response to increases in wholesale prices;
- Inadequate utilization of risk mitigation strategies; and
- Factors related to the design and operation of the California market including some level of market manipulation by some market participants.[30]

High power prices and power supply concerns persisted through the fall. The fall was extremely dry and the forecast of a moderately cold weather event in mid-December of 2000 prompted real concern of potential supply problems in the Northwest. In California, large amounts of generation that would normally be available to the Northwest were offline. The reasons were several:

- Older plants that had been run hard through the summer and fall and legitimately were shut down for necessary maintenance;
- So-called QF plants that had contracts for sale of power to California utilities were not run because of the fear that they would not be paid as a result of the increasing financial problems of the California investor-owned utilities;
- Some older plants had used up their emissions allowances and could no longer run;[31] and
- There was some level of withholding plants from production to manipulate prices.

The Northwest responded in many ways:

- The region's governors made appeals for conservation and curtailment of unnecessary use;
- Utilities faced with rapidly declining reservoirs began seeking additional sources of supply – sometimes expensive contracts, sometimes relatively expensive emergency generation, typically diesel generators or small turbines; environmental controls were relaxed to allow older, more polluting regional gas turbines to run for extended periods; and
- Efforts were made to contract for load reduction, particularly in the aluminum industry.

December also marked the first order by the Federal Energy Regulatory Commission to address problems with the California market. The remedies instituted, like eliminating the requirement that utilities purchase their requirements in the day-ahead market and establishing penalties for underscheduling of load, were steps in the right direction. However, they were too little too late.

This period also began to reveal another problem related to the competitive wholesale power market – the inability and/or unwillingness of regional load serving entities (LSEs) to provide information regarding the sources and amounts of purchase power. Similarly, merchant generators located within the region could not or would not provide information regarding the disposition of power from their plants. This information is important to the ability to assess the adequacy of resources available to the region. However, even though the data were only to be used in the aggregate without individual entities identified, most LSEs and merchants were unwilling to provide this information. Some of this may have been concerns about their own competitive position becoming known or that they would be charged much more if it became

[30] Study of Western Power market Prices: Summer 2000, Summary of Final Report Northwest Power Planning Council October, 2000.

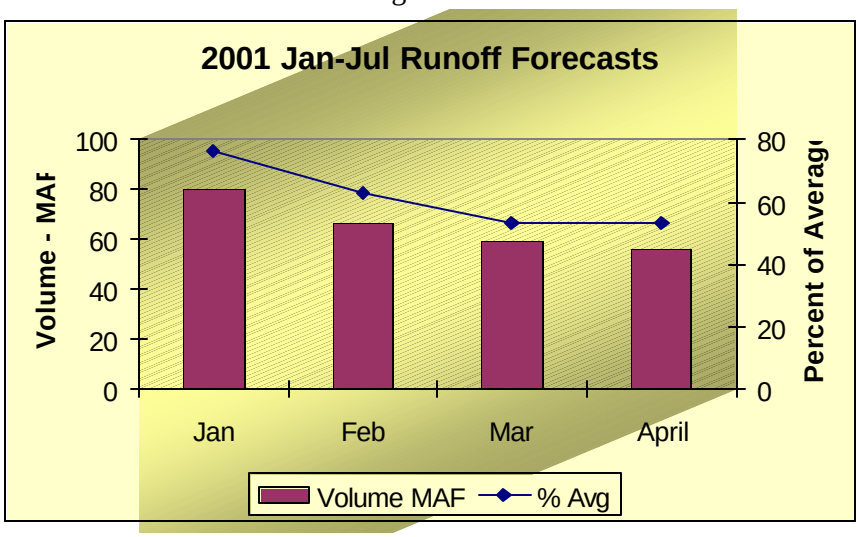
[31] This issue was addressed fairly quickly and most of these plants were returned to service.

known that they were short. In other instances it may be that the source of power behind contracts with power marketers may not be known until after the fact. Whatever the reason, this information gap seriously handicaps the ability to assess power supply adequacy.

Winter-Spring 2001

High prices persisted through the winter and early spring of 2001 with heavy load hour prices averaging over $200 per megawatt-hour. There were times during which prices were much higher than that. January also marks the first snow pack measurements and estimates of runoff – essentially an estimate of the amount of water that will be entering the hydro system over the spring and early summer. The runoff forecasts for the first several months of 2001 are summarized on Figure X-9. The anticipation of poor runoff conditions was reflected in high forward prices. By the first of February, publicly quoted forward prices for the second and third quarters of the year were in the $350 – $400 per mw-hr range.

Figure X-9



At this time, the Council, Bonneville and others were attempting to look forward and assess power supply adequacy across the summer and into the following winter. These assessments were made difficult by several factors:

- The high degree of uncertainty surrounding runoff early in the season;
- Uncertainty with respect to how successful efforts to reduce loads would be;
- Uncertainty with respect to how much emergency generation might ultimately be brought on line; and
- Uncertainty with regard to the availability of power from California and the Desert Southwest in the fall and winter as well as uncertainty with regard to NW obligations to supply power to California in the summer.

A further and generally unrecognized uncertainty was the economic slowdown that was just beginning.

Across the winter and spring of 2001, the Council did several assessments of power supply adequacy. By the time the Council did its first assessment in early February, the runoff forecast had fallen to 67 MAF, about 63 percent of normal. This analysis focused on the winter season. Under extreme weather conditions, this analysis indicated a significant potential for shortages.

This analysis also looked toward the summer and noted the large amount of energy associated with spill.

A second analysis was done in March. It incorporated updated estimates of load reduction and emergency generation as well as a deteriorating runoff forecast. This analysis looked at summer conditions for two water years that bracketed the current runoff forecast. It then assessed the winter situation. Because the region would be coming off a dry year, it was assumed that fall-winter 2001-02 runoffs would be limited to those of the driest two thirds of water years in the historic record, treating each with equal probability. The findings of this analysis were that it was not possible to avoid summer curtailments AND return reservoirs to Biological Opinion levels by the end of August without significant reductions in spring and summer spill. Failure to return the reservoirs to Biological Opinion levels resulted in very high probabilities of winter power supply problems. Even with reductions in spill, the winter season loss of load probability was 20 percent. Council fish and wildlife staff estimated the effects of downstream migrants and found them to be relatively small. The staff conclusions at that point were:

- Decisions on spill need to be made soon but can be revisited
  - If spring spill is maintained, energy is lost, more stringent and expensive steps may be required later
  - Spill can be restored if conditions improve or other resources become available
- Winter 2001-2002 outlook calls for continued and increased attention to load reduction, conservation and generation.

Spring-Summer 2001

In May, the Council reassessed the power supply situation. This analysis incorporated increased estimates of new generation expected to be available during the period of analysis. It also incorporated increased estimates of load reduction and conservation. It also attempted to refine its look at summer conditions by analyzing a range of 7 "synthetic" run off volumes and patterns that were intended to better represent the range of uncertainty in runoff. The analysis also assumed that no imports were available in the summer while firm export obligations were met. Intertie loadings at the time tended to support this assumption, showing the Northwest as a net exporter during this period, albeit at levels well below levels typical of a normal water year. This analysis found that without reductions in spill, there was still the potential for power supply problems early in the summer for several of the water years analyzed, although the magnitudes of the problems were significantly reduced from the March analysis.

The analysis again looked at the winter 2001-2002 situation, limiting the analysis to the driest 2/3 of the historic water years. While the winter reliability situation looked better than in the earlier analysis, the loss of load probability was still uncomfortably high (17 percent). The analysis went on to assess the value of increased storage in Canadian reservoirs. It found that storing 1500 megawatt-months of energy in Canadian reservoirs could reduce the winter loss of load probability to 12 percent. This was still high but significantly better than 17 percent. The analysis went on to look at the ability to store that amount of energy. It was found that if spill were maintained, we could be confident of storing 1500 megawatt-months of energy only if a January-July Runoff volume greater than 59 MAF were achieved. If there was virtually no spill at federal projects, the storage could be achieved with 56 MAF. Since a runoff of 56 MAF appeared considerably more likely, eliminating spill appeared the prudent choice (2001 runoff

turned out to be 58 MAF). This information was influential in the decision by the federal agencies to largely eliminate spill at the Federal projects.[32]

Later in May and late June the Federal Energy Regulatory Commission issued price mitigation orders, first for California and later for the entire WSCC. The WSCC order established a price cap slightly under $100/megawatt-hour for sales in the West. As figure X-8 shows, prices had already begun heading down. This may be because the market had already internalized the price caps. Or, it may be that the market was finding that it could not sustain the very high prices in the face of reduced loads and increased generation. It is likely that both had an effect. However, the fact that prices barely paused as they moved below the price cap suggests that the fundamental change in the supply-demand situation played a major role in reducing prices.

Fall 2001 – Winter 2001-2002

Wholesale power prices continued downward through the fall and early winter. In one sense, this marked the end of the Western Electricity Crisis, although the effects of the crisis on retail rates and perhaps on future fish runs will extend for some time. In September and October of 2001, the Council reassessed the adequacy and reliability of the power system for the winter of 2001-2002. By this time it had become clear that in addition to utility and government-initiated conservation and curtailment efforts, the slowdown in the economy was having an effect on loads. The analysis found a winter season loss of load probability well under 5 percent. The major factor behind this was a much lower estimate of winter loads. In total, the estimated loads for the period October 2001 through March 2002 were approximately 11000 megawatt-months less than the May estimates for the same period. In addition, approximately 3700 megawatt-months of energy had been stored in Canadian reservoirs (as opposed to the 1500 analyzed in May) and constraints on the use of that water had been reinterpreted in such a way as to make the water much more useful for addressing periods of high demand. In moving the LOLP from about 12 percent in the May analysis to under 1 percent in the October analysis, the greater than expected drop in demand contributed about 7 percent of the drop, the additional water stored in Canadian reservoirs and the greater flexibility in the use of that water contributed another 3 percent and a better forecast of expected winter water conditions contributed 1 percent. The winter remained moderate, precipitation and resulting runoff were close to normal, wholesale prices are again below the full cost of new generation (and much conservation) and everyone is asking what happened to the Western Electricity Crisis.

What issues are raised by the experience of 2000-2001?

The experience of 2000-2001 was the consequence of actions and inactions in the preceding years that resulted in a power system that was not adequate to maintain a reliable and economical power supply in the event a very dry year. Fish operations had reduced the power capability of the system but those effects were certainly internalized into the thinking and planning of the industry by 2000-2001. The primary causes of the supply and price problems of 2000 – 2001 had much more to do with the changes going on in the industry, the industry structure, particularly in California, the relative immaturity of competitive wholesale markets, and so on.

The experience of 2000-2001 raises two basic sets of issues. First, what changes in power planning, policy, regulation and implementation need to take place to avoid a similar situation in the future? Second, if such situations do arise again in the future, how might they be better managed. The first raises such issues as:

[32] Approximately 1000 MW-Months of energy was spilled at federal projects compared to the several thousand that would ordinarily be spilled.

- Are there adequate "incentives" for the development of new resource, both generation and efficiency. If load-serving entities have learned to limit their exposure to the market by making more long-term resource investments even when they are facing very low short-term market prices, the answer may be yes. If not, other mechanisms will have to be explored.
- Are there acceptable and effective ways to better link retail consumption decisions with wholesale prices to achieve quicker and more predictable load reductions in the face rising wholesale prices? To do so would both mitigate prices increases and reduce the likelihood of involuntary curtailments.
- Is the region carrying adequate physical hedges against volatility in electricity prices and the underlying fuel prices? How well do different resource strategies limit risk and at what cost? What barriers exist to implementing such strategies? How might those barriers be overcome?

The experience of 2000-2001 also suggests that to better manage such situations should they occur in the future, will require better information regarding loads, resources, imports and export obligations, conservation and curtailment efforts and so on. It will also require better coordination among the responsible parties. The information requirements and flows need to be worked out in advance and everyone needs to provide such information with confidence that their own competitive position will not be compromised.

It is also clear that attention also needs to be paid to assuring the fish and wildlife needs and reliability needs are balanced appropriately is crisis situations. Staff believes that over this period, there was a balancing that took place. Yes, spill was dramatically reduced but so were power system loads while expenditures for power and new generation were greatly increased. Still, there needs to be a way to ensure that one value is not being sacrificed unnecessarily for the sake of the other – that there is equitable treatment of the two goals. We don't expect a 0 percent loss of load probability. It would be too expensive to achieve such reliability under all possible circumstances. Similarly, we should not expect a 0 percent "loss of fish operations" probability.

These issues cannot be resolved in the context of the Mainstem Rulemaking. They are issues that are most appropriately left to the Power Plan.

Efficient

The objective of the planners and operators of the power system is a power system that is as efficient as possible given the multiple objectives for the use of system. From the single objective perspective of power operations, the power system is less efficient than it was at the time of the passage of the Act. This is the result of many factors, some of which are just related to characteristics of new resources available to meet growth and some related to the effects of fish recovery measures. It is still, however, a very efficient system relative to systems elsewhere. The Council does not believe that the framers of the Power Act meant the term "efficient" to establish an absolute standard. The system is currently operated efficiently given the constraints under which it must operate. The consequences of not doing so are economic — additional costs to supply a given amount of power. In the past, the expansion of the power system has also been efficient. Regulation and least-cost planning requirements encouraged the development of efficient resources. The question of whether or not the power system is structured to assure the most efficient operation and expansion going forward is one that is being addressed in the Fifth Power Plan.

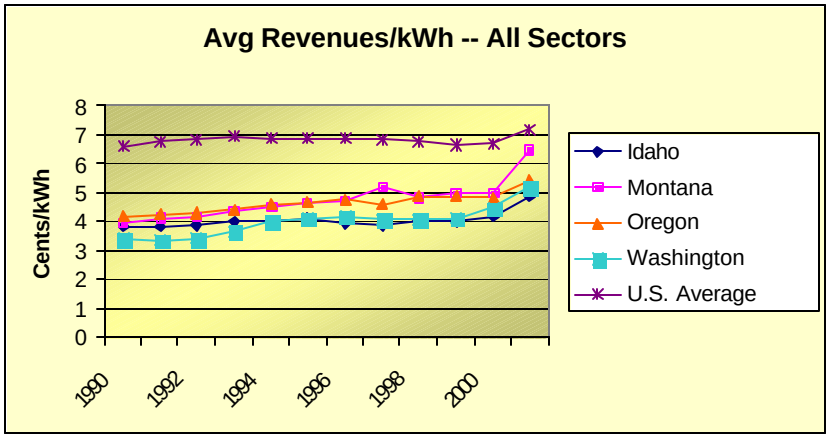
The Northwest Power Act clearly expected a balancing of fish and power objectives, i.e., operating the system with multiple objectives. Fish objectives should also be met as efficiently or cost-effectively as possible. Given the high cost of some fish measures and the relative lack of information regarding their effectiveness in meeting biological objectives, it is imperative that efforts be made to assess and improve the cost-effectiveness of these measures.

Economical

Much of the concerns with respect to adequacy, reliability and efficiency boil down to the question of economics. We can certainly assure ourselves of an adequate and reliable power system if we are willing to spend the money. But will the system still be economical? We can degrade the efficiency of the system, but that will affect its economics.

There are perhaps three ways of thinking about the economical criterion. One is whether the per kilowatt-hour costs of the system have been caused to increase significantly in comparison to other regions. On this basis, the power system is clearly less economical than it was. Figure X-10 shows average revenues from the sale of power for the Northwest states compared to the US average through the 1990s up to 2001 in nominal (not adjusted for inflation) dollars.

Figure X-10



As this figure shows, there was some erosion of the Northwest's competitive advantage in electricity prices through 1990s, some of which is attributable to the effects of fish operations. However, the largest impact on the economics of the region's power supply came about over the last two years as a consequence of factors related to the structure, operation and immaturity of the wholesale electricity market as has been described elsewhere in this appendix. Most of the alternatives would somewhat lessen power system costs although two somewhat increase power system costs.

Unfortunately, this kind of aggregate look at the question does not capture the potential impacts on particular elements of the economy. In particular, electricity-intensive industries, such as aluminum smelting, are proportionately harder hit by increases in electricity costs. Many aluminum plants in the region have increasingly become "swing" plants that are only economic to operate when aluminum prices are relatively high. Fish recovery costs have contributed to this, although in the current context, they are only one contributor.

Finally, economical relates to the question of whether the fish and wildlife program is consistent with other purposes of the Act, in particular, timely repayment of Bonneville's debt to the United

States Treasury. Bonneville is currently in difficult financial circumstances arising primarily from the market circumstances of the last two years, although fish and wildlife costs are a contributor to Bonneville's overall cost structure. An estimate of the effect of the proposed mainstem amendments on Bonneville's annual revenue requirement was previously shown in Table X-3. Most of the alternatives under consideration would reduce costs somewhat. The Oregon alternatives increase costs some. In the context of Bonneville's current financial situation this could be problematic.

The longer-term question of assuring an economical power supply in the future is being addressed in the Fifth Power Plan. The fundamental issues are the same as those related to the adequacy and reliability of the system: Are there adequate incentives for the development of new resources; can retail loads be made more responsive to wholesale prices; and is the region developing a resource portfolio that adequately hedges risks while still achieving low cost.

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