

TODD D. TRUE (WSB #12864)
ttrue@earthjustice.org
STEPHEN D. MASHUDA (MSB #4231)
smashuda@earthjustice.org
Earthjustice
705 Second Avenue, Suite 203
Seattle, WA 98104
(206) 343-7340
(206) 343-1526 [FAX]

THE HONORABLE JAMES A. REDDEN

DANIEL J. ROHLF (OSB #99006)
rohlf@lclark.edu
Pacific Environmental Advocacy Center
10015 S.W. Terwilliger Boulevard
Portland, OR 97219
(503) 768-6707
(503) 768-6642 [FAX]
Attorneys for Plaintiffs

UNITED STATES DISTRICT COURT
DISTRICT OF OREGON

NATIONAL WILDLIFE FEDERATION, et al.,
Plaintiffs,

Civ. No. 01-0640-RE (Lead Case)
CV 05-0023-RE
(Consolidated Cases)

and

STATE OF OREGON,

DECLARATION OF
STEPHEN W. PETTIT

Intervenor-Plaintiff,

v.

NATIONAL MARINE FISHERIES SERVICE, U.S.
ARMY CORPS OF ENGINEERS, and U.S. BUREAU
OF RECLAMATION,

Defendants,

and

NORTHWEST IRRIGATION UTILITIES, PUBLIC
POWER COUNCIL, WASHINGTON STATE FARM
BUREAU FEDERATION, FRANKLIN COUNTY

DECLARATION OF STEPHEN W. PETTIT

Earthjustice
705 Second Ave., Suite 203
Seattle, WA 98104
(206) 343-7340

FARM BUREAU FEDERATION, GRANT COUNTY
FARM BUREAU FEDERATION, and STATE OF
IDAHO,

Intervenor-Defendants.

COLUMBIA SNAKE RIVER IRRIGATORS
ASSOCIATION, and EASTERN OREGON
IRRIGATORS ASSOCIATION,

Plaintiffs,

v.

DONALD L. EVANS, in his official capacity as
Secretary of Commerce, NOAA FISHERIES, and D.
ROBERT LOHN, in his official capacity as Regional
Director of NOAA Fisheries,

Defendants.

I, STEPHEN W. PETTIT, state and declare as follows:

1. I hold a B.A. in Biology from Monmouth College (Illinois) and an M.S. in Zoology (emphasis in ichthyology and fisheries) from the University of Idaho. Between degrees, I was a helicopter pilot for the United States Army and served a combat tour of duty in the Republic of Vietnam. Upon receiving my Masters degree in 1973, I was employed by the Idaho Department of Fish and Game (IDFG) as a fisheries research biologist. From 1973 to 1981, my research responsibilities included investigation to assess hydroelectric project impacts on fisheries resources within the Clearwater River drainage. Between 1981 and 2003 (when I retired), my fisheries involvement switched to Columbia and Snake River mainstem passage concerns, during which time I represented IDFG interests at all levels of Columbia River Basin anadromous fish management.

2. One of my chief responsibilities at IDFG was serving as an original member of the Fish Transport Oversight Team (FTOT). FTOT provided program oversight and coordination between the U.S. Army Corps of Engineers' (COE) juvenile fish transport program and the Basin's fishery agencies and tribes. I served as FTOT chairman from its formation in 1981, the year the COE took over operation of the juvenile fish transport from National Marine Fisheries Service (NMFS) researchers, until the committee was terminated by the COE. As an FTOT member, and as IDFG's representative on the Fish Passage Advisory Committee (FPAC) of the Columbia Basin Fish and Wildlife Authority (CBFWA), I have been actively involved in establishing guidelines to provide safe fish passage and transport on the Snake and Columbia Rivers. A key aspect of these guidelines has been the development of specific, mainstem river flow volumes that provide decision points, in

combination with other river operations, for determining whether to transport juvenile salmon, known as smolts, or allow them to migrate in-river.

3. After three decades as an anadromous fish biologist based in Lewiston, Idaho, I have gained extensive field experience monitoring salmon migrations. My job responsibilities required me to be an active observer of upstream and downstream migrating salmon. I was frequently present at the mainstem dams during the annual migrations to evaluate conditions for both transported and in-river migrating salmon.

4. In addition to my FTOT duties and FPAC service noted above, I represented IDFG on the following multi-agency/tribal fisheries management and advisory groups:

- a. The Technical Coordinating Committee of the Corps of Engineers' Fish Passage Development and Evaluation Program and the following subcommittees:
 - i. Fish Research Needs and Priorities
 - ii. Fish Research Scientific Review
 - iv. Fish Facility Design Review
 - v. Fish Facility Operations and Maintenance;
- b. The Mainstem Passage Advisory Committee (MPAC) of the Northwest Power Planning Council (NPPC), now known as the Northwest Power and Conservation Council, on which I served for a two-year period beginning in 1986;
- c. The CBFWA's Ad Hoc Flow Group, which provides guidance to the Fish Passage Center (FPC) in matters of mainstem flow issues;
- d. The Snake River Drawdown Technical Advisory Group (TAG);

- e. The NPPC's Technical Work Group for Water Budget Effectiveness and Reservoir Mortality Evaluation (1987-1989); and
- f. Annual preparation of the CBFWA's Detailed Fisheries Operating Plan (DFOP), developed jointly by the agencies and tribes.

5. From 1985 to 2003, I also supervised two anadromous fish monitoring and marking projects for IDFG. The first, IDFG's Smolt Trapping Project, consisted of three juvenile migrant scoop traps located on the Salmon and Clearwater rivers as well as at the head of Lower Granite Reservoir at Lewiston, Idaho. Idaho's smolt trapping operations helped provide critical information for "real time" management of the Federal Columbia River Power System's (FCRPS's) fish passage plan. The fish traps also played a key role by marking thousands of migrating smolts annually, which were used to estimate travel time and reach survivals of Snake River juvenile migrants. The second, IDFG's Fish Marking Project, was charged with the task of marking between 20 million and 25 million hatchery salmon and steelhead annually at both state and federal anadromous hatcheries throughout Idaho.

6. After Snake River stocks were listed under the Endangered Species Act, coordination between regional entities for improvements to the FCRPS fell under the guidance of NOAA Fisheries' Regional Forum. In 1995, I was assigned to the Technical Management Team (TMT), one of the three technical teams under the Forum. The TMT provides "real time" technical input to the FCRPS operators to maximize salmon and steelhead survival through the hydrosystem. I served on the TMT until retiring in 2003.

7. Beginning in 1995, I was also assigned to represent IDFG on another technical group under NOAA's Regional Forum, the System Configuration Team (SCT). This group provides regional input to the Corps of Engineers' anadromous fish migration program with

the specific responsibility to prioritize and fund mainstem Columbia and Snake rivers fish passage improvements to the FCRPS. I also served on this team until my retirement in 2003.

8. In the preparation of this declaration, I have reviewed NOAA's 2004 BiOp and various other documents concerning the Action Agencies 2004/2004-2008 Implementation Plans. In addition I have reviewed and am familiar with the previous series of BiOps which NOAA produced as a requirement under the ESA following the listing of Snake River stocks of salmon and steelhead. I am also familiar with the series of Independent Scientific Advisory Board (ISAB) and the Independent Scientific Group (ISG) Reports and Reviews beginning with *Return to the River* (1996) and the more recent *A Review of Salmon Recovery Strategies for the Columbia River Basin* (2001) and *Review of Flow Augmentation* (2003). I have also reviewed numerous state, federal, and tribal fisheries manager joint technical memorandums, letters and comment responses to mainstem operation/implementation plans proposed by the Action Agencies and the NPPC. My reviews have also included the recent NOAA series of *White Papers* and *Technical Memoranda* which attempted to synthesize the existing salmonid passage information for anadromous fish moving through the FCRPS as related to dam passage, juvenile transport, flow/survival, and predation impacts.

I. ADEQUATE WATER VELOCITY IN THE SNAKE AND COLUMBIA RIVERS IS CRITICAL FOR SALMON & STEELHEAD SURVIVAL

9. Salmon and steelhead of the Columbia and Snake River Basin need sufficient amounts of clean water to survive. These species evolved in rivers without dams and depended on the annual runoff to aid their migration to the sea. Prior to the construction of dams on the Snake and Columbia rivers, spring/summer chinook, fall chinook, and steelhead migrations were timed with periods of high spring runoff, primarily using only the river current to bring them out to the ocean. As these salmon and steelhead travel to the river

estuary and ocean, biological changes occur that allow the young fish to transition to their saltwater life stage. The timing of arrival at the estuary within a “biological window” that is specific to each species is essential for the success of this transition.

10. When the dams were constructed on the Snake and Columbia rivers, the river ecosystems changed significantly. The river current slowed and consequently, the speed of migration also slowed; temperatures in the rivers increased; turbidity decreased; predators increased; and estuary conditions became less conducive for salmon and steelhead survival. (Poe *et al.* 1991, Poe *et al.* 1994) All of these changes had adverse impacts on salmon and steelhead survival. Following the ESA listings of up-river salmon and steelhead, biological opinions have attempted to address the continuing, on-going adverse impacts of hydroelectric project development and operation.

11. Mainstem flow targets in the Columbia and Snake rivers have been consistently recognized as a critical tool to mitigate for some of the hydrosystem’s adverse impacts on salmon and steelhead migration by ensuring adequate water velocities in the mainstem migration corridors to support successful juvenile and adult fish movements. (Chaney and Holubetz 1980) Increased flows have been found to aid in salmon and steelhead survival by decreasing juvenile migration times, increasing the survival of young salmon, decreasing water temperatures, increasing turbidity, and enhancing the estuary to make the transition to seawater more successful and subsequently, improving smolt to adult returns (SARs). (Joint Technical Staff 2003.)

12. Studies of juvenile fish migration through the development of the Snake and Columbia River hydrosystem repeatedly identified the importance of flow and water velocity to successful downstream migration of salmon and steelhead. Early studies conducted in the

1970s (Sims and Ossiander 1981) formed the fundamental basis for the state, federal, and tribal fisheries agencies' consistent recommendations for the establishment of adequate flows for downstream salmon migration. In 1981, using that consistent data, the fish managers crafted a set of recommendations for the first Northwest Power Planning Council Fish and Wildlife Program that requested adequate flows for salmon and steelhead. (Joint Fishery Agencies 1981.) Data collected in subsequent years consistently confirmed the importance of water particle travel time to fish for decreasing travel time and increasing survival. (Petrosky and Schaller 1998; Connor *et al.* 2003b.)

13. Because of the overwhelming scientific support for adequate mainstem flows, NOAA's biological opinions since 1995 have adopted minimum river flow targets for spring and summer migration seasons to aid migrating salmon in making their way to the sea. Current established mainstem flow objectives for downstream salmon and steelhead migrants in the Snake and Columbia rivers in the spring and summer migration periods are based on monitoring and research data that have consistently shown that water particle travel time is an important component of reducing fish travel time, and increasing their survival. (NMFS 2000b; FPC 2004b.)

14. In the 2000 BiOp, NOAA expressly identified the importance of proper river flows to protect and restore listed salmon in the Columbia and Snake rivers. In fact, managing the hydrosystem to meet flow objectives was a cornerstone of the 2000 BiOp's hydro measures, providing "direct and indirect survival benefits to salmon." (2000 BiOp at 9-53.) As part of the underlying scientific foundation for that recommendation, for example, NOAA concluded "consistent and highly significant relationships have been observed between flow and survival for juvenile fall chinook (summer migrants) from release points in

the free-flowing portion of the Snake River to Lower Granite Dam.” (NMFS 2000b at 56.)

The 2000 BiOp also strongly recommended cold water releases from Dworshak Dam to help reduce elevated water temperatures and augment flow during the summer when juvenile Snake River fall chinook migrate. NOAA’s conclusion that there exists a strong relationship between the seaward migration rate of juvenile fall chinook and water particle travel time is confirmed by the science. (Williams *et al.* 2004; Connor *et al.* 2003b.)

15. In addition to the documented benefits of flow for summer migrating chinook, the rationale for flow objectives in the 2000 BiOp also included a recognition on the part of NOAA that there is a “strong flow/travel time relationship for yearling chinook [spring migrants] and steelhead” (NMFS 2000b). Further, NOAA noted that flow augmentation may improve survival of these ESUs outside the hydrosystem “as a result of earlier arrival to the estuary, improved estuary conditions, and reduced delayed mortality.” (NMFS 2000b.) Since then, state, federal, and tribal fishery experts have documented a positive relationship between water travel time and survival for spring migrating chinook of Snake River and Mid-Columbia River origin (Joint Technical Staff 2003). This relationship was also confirmed in a review by the Independent Scientific Advisory Board (“ISAB”) which noted that “there is a strong effect of flow on survival of yearling chinook and steelhead” when flows are below the BiOp’s spring flow target in the Snake River. (ISAB 2003 at 13.)

16. Strong support for augmenting flows in the Snake and Columbia rivers also has come from the state, tribal, and federal fish managers due to the positive impact increased flows have on moving juvenile salmon and steelhead through the hydrosystem and on decreasing river temperatures, increasing turbidity, enhancing the estuary conditions and improving smolt to adult returns (SARs).

17. As noted above, this support for flow augmentation to move juvenile salmon through the system faster reflects a broad regional agreement among the state, federal, and tribal anadromous fish managers that decreased water travel time (higher water velocity) is related to increased survival for spring/summer and fall chinook migrants. (Joint Technical Staff 2003.)

18. Water particle travel time, or water travel time, is the estimated time it takes for a water particle to travel a fixed distance. Water travel time is directly related to the rate of flow of water over the same fixed distance. That is, the higher the average flow of water (increased velocity), the shorter the water travel time and conversely the lower the flow of water, the longer the water travel time. Water travel time or velocity also is directly related to the cross sectional area of a water body: the larger the cross section of the water body, the longer the water travel time, and the smaller the cross section, the shorter the water travel time given the same volume of water. Consequently, water velocity or water particle travel time over a fixed distance can be increased by either increasing flow or decreasing the cross-sectional area of the river at the same flow level, or a combination of the two. Increasing flow in the Snake and Columbia rivers is generally accomplished by putting more water into the river system. Decreasing the cross-sectional area of the reservoirs in the system is accomplished by drawing down reservoir levels and is currently used as a management tool during the juvenile salmonid migration by, for example, drafting reservoirs to Minimum Operating Pool (MOP). The relationship between flow and water travel time is illustrated in the two graphs attached to this declaration, taken from the JTS Comments to the NPPC. What the graphs show is that increasing flows in the Snake River (figure 1) and between Ice Harbor

Dam in the Snake River and McNary Dam in the Columbia River (figure 2), decreases water travel time.

19. Decreasing water travel time has consistently been shown to decrease juvenile spring and summer salmon migration time downstream and increase salmonid survival. In general, the shorter the water travel time, the faster the juvenile salmon migration. Many factors may account for the increased survival of juvenile salmon with decreased water travel time, including for example, reduced exposure to predators and reduced water temperatures. (Poe *et al.* 1991, Poe *et al.* 1994.)

20. Additionally, the faster juvenile salmon move through the hydrosystem, the more energy reserves salmon are able to retain, the better salmon are able to cope with stresses and the transition to the saltwater environment and survival to adulthood. As discussed above, salmon did not evolve with dams in their migration habitat. Instead, these species demonstrated a mostly passive migration and moved downstream by high natural river flows. Thus, decreased water travel time helps move salmon through the hydrosystem faster without using up their energy reserves and results in higher overall survival. (Congleton *et al.* 2000, 2001, and 2002.)

21. Decreased water travel time also provides at least three additional benefits that promote juvenile migration survival. First, as noted above, increased flows generally help to decrease water temperatures. Increased water temperatures increase energy demands for migrating salmon, increase their susceptibility to disease, disrupt smoltification (i.e., the biological process salmon and steelhead undergo in the transition to the saltwater environment, and often increase predation on juvenile salmon. Decreasing water temperatures help to ameliorate these adverse impacts. Second, decreased water travel time

also increases turbidity. (Joint Technical Staff 2003.) Increases in turbidity help hide juvenile salmon and steelhead from predators, thus decreasing the rate of predation and increasing salmon and steelhead survival. (Joint Technical Staff 2003.) Third, water travel time has a positive relationship to post-dam passage survival. Studies have shown that shortening water travel time through increased flows can have a positive benefit on estuary habitat that helps young salmon in their transition to saltwater and consequently decreases delayed mortality. (Schreck and Stahl 1998.)

22. Finally, shorter water travel time has been shown to increase the overall ratio of adult salmon and steelhead that return to spawn. Studies indicate that smolt-to-adult ratios (SARs) increase as water travel time decreases. That is, as water moves through the system faster, we achieve higher adult salmon and steelhead returns in relationship to the number of juvenile salmon and steelhead that make it past the dams. (Joint Technical Staff 2003.)

23. The relationship that has been found between water travel time and smolt survival is a key component for the justification for specific flow targets in the NOAA BiOps over recent years. However, general scientific consensus indicates that those flow targets represent minimum flows necessary to maintain healthy salmon and steelhead populations under average or good ocean conditions. Under poor ocean conditions, even these flow levels are inadequate to protect salmon and steelhead. (Joint Technical Staff 2003.)

II. SPILLING WATER PAST DAMS INCREASES SALMONID SURVIVAL

24. There are three in-river passage routes for migrating juvenile salmonids to pass hydroelectric projects: (1) spilling water and fish over the dams spillways; (2) allowing salmonids to pass the dams through the turbines; and (3) “bypassing” salmon and steelhead through a series of turbine screens, pipes, and flumes. An alternative to in-stream migration is

the collecting and transporting of salmon and steelhead on trucks and barges around the dams. Of the three options for in-river passage routes, spill for fish passage has consistently been shown to be the safest means of passage for downstream migrating juvenile salmon and steelhead.

25. Over the past two decades, state, federal, and tribal anadromous fish managers have consistently recommended spill as the safest passage route for downstream migrants. As a result, specific spill operations for fish passage have been in place in the Columbia and Snake rivers since 1988. In the 2000 BiOp, for example, NOAA identified passage through the spillways as the safest route, explaining that salmon experienced the “lowest direct mortality through the spillways.” (2000 BiOp at 6-17.) In fact, because spill has proven to be so effective, NOAA prescribed in 2000 that “measures that increase juvenile fish passage over FCRPS spillways are the highest priority” for passage improvements. (2000 BiOp at 9-82.)

26. Studies show that spill provides a safer route of passage than turbine passage, bypass options, or even transportation. Whitney *et al.* (1997) reviewed estimates of spillway mortality for salmonid and steelhead studies conducted through 1995. They concluded that 0 to 2% is the most likely mortality range for spillway passage survival for standard spillways. In comparison, turbine passage has a passage mortality range of 5 to 14%. (2000 BiOp at 6-18.) Spill also results in lower mortality than the practice of diverting fish from the turbine intakes and “bypassing” them through a series of pipes, channels, and flumes to be released in the tailwater below the dam. (FPC and CSSOC 2004; 2000 BiOp at 9-82.)

27. The impacts of transportation on juvenile fish are less clear than other passage options and have been shown to be different for different salmonid stocks. However, the most recent studies indicate that transportation of wild juvenile salmonids has at best no

comparative advantage to leaving the fish to migrate in-river with good in-river migration conditions that include spill and flow. Analysis for summer migrants indicates fish passed by spill experience less delayed mortality than fish passing the dams through other passage routes, including the transportation alternative. (Bowes 2004.) Increasing spill, thus, increases overall salmon and steelhead survival benefits.

28. Given the unknown or potentially detrimental impacts of transportation, state, tribal, and federal anadromous fish managers long have called for a spread-the-risk approach to salmon passage that would improve in-river migration conditions, including increased spill and flow and only transporting a portion of migrating salmon. This is in opposition to current federal policy that maximizes salmon and steelhead transportation in the summer, and often in the spring as well. Indeed, conventional wisdom says that federal hydro managers should allow “more fish to migrate in the river whenever possible.” (Williams *et al.* 2004 at 96.) As the Idaho Department of Fish and Game (“IDFG”) aptly noted, “[i]f indeed transportation is not helping fall chinook survival compared to inriver survival, then the NOAA[] strategy of continuing to rely only on transportation just delays attention to other strategies that may improve survival.... (State of Idaho 2004 at 8.)

29. In addition to providing safe passage, spill is an effective tool to help fish move through the hydrosystem more quickly and thereby decrease the amount of time they are exposed to predators in the tailraces and forebays around the dams. Snelling and Schreck (1994) also found that spill was an important factor in reducing forebay delays. Beamesderfer and Rieman (1991) found that populations of northern pike minnow and small mouth bass were present in the forebay of John Day Dam. These and other predator studies (Poe *et al.*

1991) indicate that decreased forebay residence time by providing spill increases survival of listed salmonids.

30. There are additional benefits of spill for fish. Spill creates a flow net (i.e., an attraction current on the water surface where the bulk of salmon and steelhead migrate at dam forebays) and thus reduces delays associated with passing dams. Spill creates tailrace conditions that make it more difficult for predators to attack juvenile salmonids exiting the dam tailwaters. (Fahler *et al.* 1988.) Shively *et al.* (1996) found that even small river flows of just one meter per second helped disperse predators (i.e., northern pikeminnow) and thereby increase salmon survival through the hydrosystem. Finally, without spill, there is no spread-the-risk alternative. In order to balance the risks and uncertainties of the benefits of the transportation alternative, spill must be maximized as part of the improvement of in-river migration conditions.

31. In December 2003, the Fish Passage Center (FPC 2003) in response to a request by the Columbia River Inter-Tribal Fish Commission, summarized the benefits of spill for fish passage. In that memorandum, the FPC stated, “the benefits of spill for fish passage are well established and accepted throughout the scientific community. There is substantial data and literature documenting the direct and indirect benefits of spill for fish passage.” (FPC 2003 at 1.) Evidence of survival benefits from spill for fish passage has been documented through recent years. The FPC also analyzed 2001 smolt survival in the lower Columbia River index reach and found that survival through this reach increased when spill was provided at The Dalles, Bonneville, and John Day dams. (FPC 2003.)

32. As mentioned above, spill is *the* key element to implement an effective spread-the-risk program for the juvenile salmon and steelhead transportation program. Studies of

transportation and transportation smolt-to-adult return data have shown that the benefits of transporting juvenile fish are highly uncertain and particularly uncertain for juvenile fall chinook. (FPC 2004a.) Because spill for fish passage provides the best route of passage, avoiding higher turbine and bypass mortalities, as well as reducing passage delay and dispersing predators, it is the best option with good in-river migration conditions for an alternative passage to transportation of juveniles and can ameliorate the uncertainties related to the benefits of transportation.

III. PROPOSED 2005 DAM OPERATIONS UNDER THE 2004 BIOP WILL BE HARMFUL TO MIGRATING JUVENILE SALMON AND STEELHEAD

33. The 2004 Biological Opinion sets forth an overly flexible plan for hydrosystem operations that could have drastic impacts on the listed salmon and steelhead in the Columbia and Snake rivers by not providing these fish with the adequate migration conditions through the hydrosystem that are necessary for their protection. In fact, the 2004 BiOp as currently written could produce a result this year that would be as lethal if not more lethal than the 2001 migration.

34. Nothing in the 2004 BiOp compels the federal agencies to aggressively try to meet the river flow levels set forth in the plan. The established flow levels are nothing more than targets that the agencies may meet, but can miss without consequence, although salmon will be harmed. As the BiOp/UPA states, these targets are merely objectives and the agencies do not believe that it is “possible to achieve the flow objectives in many water years.” (2004 UPA at 47.)

35. In addition, the federal hydro managers have already made decisions and are currently undertaking specific actions that could make the situation worse for salmon during the summer migration this year. For example, in January, the Army Corps of Engineers

notified salmon managers that it would draft Dworshak reservoir for power purposes by up to roughly 100,000 acre feet, despite the knowledge that water supply forecasts were low and getting worse. This action was carried out over the objection of federal, state, and tribal salmon managers (including NOAA). (State, Federal, and Tribal Salmon Managers 2005.) Access to this water from Dworshak is particularly important to Snake River salmon and steelhead that migrate in the summer when water temperatures in the lower Snake are at their highest. The Corps' decision to disregard the salmon managers' request to retain this water for summer use has reduced water supplies that could be critical for better salmon migration conditions. Additionally, the Grand Coulee Dam reservoir (Lake Roosevelt) is currently being drafted to roughly 30 feet below its end-of-spring flood control target for six weeks in order to perform maintenance work at the dam this spring. The Bureau of Reclamation has never adequately explored whether options exist to complete this maintenance at a different time, but this drawdown now means that it will be very difficult to meet spring and summer flows on the Columbia River for salmon and steelhead during the height of the migration.

36. The 2004 BiOp's spill plan calls for the elimination of spill and the maximization of transportation of listed fish in the spring when river levels are as low as they are likely to be during the 2005 migration. This means that under the current plan, we would see no spill in the lower Snake River at collector projects and no spill at the McNary Dam on the lower Columbia in the spring. In the summer, the best case under the 2004 BiOp is the same "no-spill at collector projects" situation as in the spring.

37. Data to date indicates that transportation of fall chinook does not provide a significant survival benefit to the stock. (FPC 2004a; Anderson *et al.* 2004.) These data also indicate that transportation could have harmful impacts to the stock. The poor SARs for

transported fall chinook suggest that fall chinook may benefit from a spread-the-risk policy with provision of flow and spill for in-river migration. (FPC 2004c.) Despite these data, the 2004 BiOp/UPA calls for the maximum transportation of these fish. (2004 BiOp at 5-15; 2004 UPA at 40.) As noted above, state, federal, and tribal fishery managers have called for a “spread-the-risk” policy that would allow fall chinook to migrate in the river while a roughly equal number are transported down stream. (Joint Technical Staff 2004.) The fish managers’ approach, unlike the 2004 BiOp, represents a precautionary approach to addressing the uncertainties regarding the efficacy of transportation. Given the data available, implementation of the 2004 BiOp is likely to harm fall chinook as compared to an alternative that provides additional flow and spill within a spread-the-risk transportation program.

38. The underlying fish survival and migration problems associated with the 2004 BiOp will likely be accentuated this year. Hydrologists are predicting that the 2005 water year will be one of the worst on record, perhaps similar to 2001 (the second lowest water year on record). (NRFC 2005.) This means that significantly less water will be available for salmon, irrigation, and power purposes. Given the weak fish protection requirements of the 2004 BiOp, it is likely that salmon will suffer high mortality as they did in 2001.

39. The low flow year in 2001, combined with hydropower management decisions, resulted in very low river flows and little or no spill. As a result, river flows averaged roughly 50 percent below the 2000 BiOp’s flow targets in the spring and summer and young salmon travel times were some of the slowest observed in the historic record. (FPC 2002.) Not surprisingly, survival of downstream migrants was the worst ever documented since monitoring has taken place (FPC 2002). For example, juvenile chinook and steelhead survival from the tailraces of Lower Granite Dam to Bonneville Dam were a very low 30

percent and 4 percent, respectively. (FPC 2002.) In a similar review, NMFS found that in 2001 in-river and system survival for Snake River fall chinook were 1.5% and 4.2%, respectively – well below the 2000 BiOp’s hydro performance standards. (Ruff 2004.)

40. This year, salmon biologists predict that 2005 adult returns for some listed ESUs will be lower than seen in the last several years. For example, Snake River spring/summer chinook are predicted to come back at levels close to those reached when the stock was listed for ESA protections in the 1990’s. According to a preseason forecast by the Oregon and Washington Departments and Fish and Wildlife, roughly 16,000-17,000 wild Snake River spring/summer chinook adults will pass Lower Granite Dam to spawn in 2005. Joint Columbia River Management Staff 2005 (applies roughly 70% escapement to river mouth estimate). Roughly 12,500 wild adult spring/summer chinook returned past Lower Granite Dam in 1992/1993. (TAC 2004.) Given the poor potential returns for this year, what we choose to do in this coming year on federal hydrosystem operations will have significant impacts on future salmon generations.

41. The 2004 BiOp does not provide measures that will avoid a result in 2005 that is similar to or worse than what occurred in 2001. Instead, as discussed above, the implementation of the 2004 BiOp this year is likely to result in extremely low in-river survivals, extended fish travel time, reduced project passage survivals, and maximization of transportation and increased risk to stocks.

IV. PLAINTIFFS’ REQUEST FOR AN INJUNCTION WILL REDUCE HARM TO SALMON AND STEELHEAD

42. In the preceding sections of this declaration, I have explained some of the basic tools we have to help juvenile salmon navigate the dams and reservoirs on the Snake and Columbia rivers with better rates of survival and why the plans for operation of these projects

this summer are likely to cause real harm to these fish, especially as compared to operations that fisheries scientists consistently have identified as those that would better protect these fish. In this section, I summarize the features of the injunction the plaintiffs are requesting and explain why this relief, if ordered, will at least reduce the harm to juvenile salmon and steelhead from operation of the hydrosystem during the summer migration season (June 20, 2005 through August 31, 2005). The Court may be familiar with some of these issues based on the litigation in the summer of 2004 regarding plans by the Corps to curtail spill.

43. First, as I understand the plaintiffs' injunction request, it consists of three broad parts: (a) improved water movement through the lower Snake and Columbia Rivers consistent with the limitations imposed by the kind of water-year we are actually experiencing in 2005; (b) increased spill at the four lower Snake projects and McNary Dam on the Columbia to improve safe passage of juveniles at these dams as compared to what would be provided under the 2004 BiOp; and (3) continued implementation of all other measures required by the 2000 BiOp RPA to the extent they are not inconsistent with either (a) or (b). I will address only the first two of these components.

44. The plaintiffs have asked the Court to order the federal agencies to speed up water particle travel time in the lower Snake River during the summer salmon migration season by at least 10%, and in the lower Columbia River by a similar amount over the particle travel time that would otherwise occur under the 2004 BiOp and the agencies' current forecast of river flows and flow augmentation. This is a modest improvement in water particle travel time. By contrast, if the flow targets that NMFS has identified since 1995 as necessary to avoid high juvenile salmon mortality were met on a weekly average basis during this period,

water particle travel time would speed up by more than 37% in the lower Snake River and by some 34% in the Columbia over what is likely to occur under the 2004 BiOp.

45. In my opinion, even the modest improvement in water particle travel time that the plaintiffs seek will significantly reduce harm to migrating juveniles this summer. I reach this conclusion because, as explained above, there is considerable scientific evidence that the faster water travels through these systems – up to a point not relevant to the plaintiffs’ injunction request – the lower the mortality of juvenile salmon and steelhead. The biological factors that produce these survival improvements include, among other things, less exposure to predators, cooler water temperatures, and stronger, healthier juveniles upon reaching the estuary and ocean (as well as improved estuary conditions).

46. The plaintiffs have also asked the Court to increase the amount of spill at the four lower Snake River projects and at McNary on the Columbia. Specifically, the plaintiffs seek an order requiring spill of water at the four lower Snake projects on a 24-hour basis except for the amount of water necessary for what is called “station service.” Generally, this means operating one of the units at each project to generate at least enough electricity to operate that project. For three of the lower Snake projects, station service requires approximately 11.5 kcfs of flow and at Ice Harbor, station service requires between 7.5 and 9.5 kcfs. Because flows in the lower Snake River this summer are expected to be quite low, the spill plaintiffs are seeking at the lower Snake projects would amount to a little over half of the summer flow volume.

47. For purposes of comparison, without this change in operations, some spill on the lower Snake would occur only at Ice Harbor this summer. At the other projects, there would be no spill so that all fish could be collected for transportation to the maximum extent

possible. It is important to bear in mind that even with the additional spill plaintiffs seek, juvenile fish still can be collected and transported at the lower Snake collector projects, effectively spreading the risk among the routes of dam passage on the lower Snake, a strategy that has strong support among state, tribal, and federal fish managers.

48. On the Columbia, plaintiffs seek only a change in spill at McNary Dam. Spill at the remaining projects would be as called for in the 2000 BiOp RPA (which is also what is suggested in the 2004 BiOp). At McNary, plaintiffs ask the Court to order all water above 50 kcfs to be spilled during the summer migration season. This likely would amount to a spill volume of more than 75 kcfs at this project. In the absence of this change, there would be no spill at McNary this summer because, like all of the upper Snake projects except Ice Harbor, spill at McNary would be eliminated under the 2004 BiOp so that all fish could be collected for transportation.

49. The biological benefits of spill have been widely documented and I have summarized them above. See supra ¶¶ 24-32. Increasing spill this summer as plaintiffs request will reduce the harm to migrating juvenile salmon and steelhead as compared to what they would otherwise experience under the 2004 BiOp. First, spill is quite simply the safest way to get juvenile salmon past these projects and more spill will get more salmon past the projects without harm. Because of the flows this summer, there is little or no risk that the increased spill in the lower Snake and at McNary will increase dissolved gas in the water to levels of concern but if for any reason it did, spill could certainly be limited to stay within the gas caps that have been set for past operations. Second, additional spill will enhance the benefits of increased water velocity by also helping juvenile salmon spend less time in dam forebays and other areas where adverse effects are more likely. Third, increased spill this

summer will necessarily lead to a more balanced distribution of juvenile passage between transportation and in-river migration (simply because with increased spill all of the migrating juveniles cannot be captured and transported although a significant fraction of them still will be). This spread-the-risk approach, especially for summer migrants, has long been advocated by state, tribal and other federal fish managers. The available scientific evidence and the need to balance the risk and uncertainty of the benefits of the transportation program with a precautionary approach also tend to support it.

50. In addition, it is my opinion that the *combination* of faster water travel time and additional spill that plaintiffs seek will have combined and synergistic effects that will reduce the harm to migrating salmon this summer by considerably more than either action would accomplish on its own. It is not unusual for biological mitigation measures to have such synergistic effects. For example, recent studies by Connor *et al.* (2003) have documented a similar synergy between measures that decrease water temperature and measures that increase water velocity.

51. In this case, while it is not possible to predict precisely the magnitude of the cumulative effects of improved water movement and increased spill, several lines of reasoning suggest they could be quite substantial. First, by improving water movement and spill at each of the lower Snake projects and McNary together, the benefits to fish would have multiplicative, rather than merely additive, effects. Thus reduced mortality at, for example, Lower Granite means there are more fish that will experience reduced mortality in passage at the next project and so on downstream. Second, I have already discussed many of the reasons that flow improvements and spill work well together. For example, each of them contributes to reductions in downstream migration delays, each reduces exposure to predation, each

reduces delayed mortality from transportation by allowing more fish to migrate and survive better in the river, and each increases the overall health of juvenile migrants that reach the ocean.

52. I have reviewed information about the likely water conditions in the Columbia Basin this summer and based on that information and my general experience with operation and management of the hydrosystem over many years, it is my opinion that there are a variety of combinations of operational measures that could achieve the modest improvements in water particle travel time in the Snake and Columbia rivers that plaintiffs seek for the summer migration season.

53. For example, based on the federal agencies' current estimate that they will only provide 300,000 acre feet of flow augmentation this summer, if all of the reservoirs on the lower Snake River were held at minimum operating pool elevations (MOP) during the summer migration season, and additional water for flow augmentation were provided from reservoirs in the upper Snake Basin so that flow augmentation from this source exceeded, perhaps by as little as 100,000 to 150,000 acre feet, the 427,000 acre feet of flow augmentation that is actually supposed to be delivered each year, see 2000 BiOp at 9-55 to 9-71; 2004 BiOp at 1-4, and assuming that about 70% of this flow augmentation water could be delivered in July and August, with additional late summer flows available from a full 80-foot draft of Dworshak Reservoir as has been proposed in past biological opinions, the federal agencies would likely be able to meet or even exceed the water travel time improvement standard that the plaintiffs seek for the lower Snake River.

54. Additional water travel time improvements, if necessary, could be achieved by drafting the largest Snake River reservoir above Lower Granite dam below MOP by as much

as 10 additional feet or, alternatively, the shorter water travel time could be achieved with this deeper drawdown at Lower Granite and less flow augmentation water. This deeper draft of Lower Granite is a practical mitigation measure because the adult passage facilities at that project already have an emergency exit chute in place that would allow these facilities to operate effectively at elevations well below MOP (Reservoir Drawdown Test, COE December 1993). A deeper drawdown of Lower Granite reservoir would also be very effective at improving water travel time because it is the largest and longest of the lower Snake reservoirs and reducing its cross-section significantly will provide water travel time improvements. An added benefit of a deeper drawdown of Lower Granite as compared to other Snake River reservoirs is that it would reduce the residence time of migrants in Lower Granite pool which appears to be where most of mortality of subyearling fall chinook migrants occurs.

55. I am not aware of any physical or structural barriers that would preclude some combination of operations like those outlined above to achieve the water travel time improvements the plaintiffs seek in the lower Snake River this summer. One objection that may be raised, at least to the deeper drawdown of Lower Granite pool, is that it would eliminate the ability to collect and transport fish at this project. Consequently, any juveniles that do not pass that project through spill would be routed through the turbines of the unit that provides station service. Even if this occurs, it is my opinion that the moderate increase in mortality for this fraction of juvenile migrants would be more than offset by the survival benefits of improved water movement and increased spill. And even this increase in mortality could be reduced by measures like pulling the screens on the unit that provides station service

and using Lower Granite unit 2 to provide this service (thereby moving the risk of turbine passage away from the spillway and away from the emergency adult exit chute).

56. Similarly, with operations like those described above in place on the lower Snake River, the water travel time improvements plaintiffs seek for the Columbia River also could be achieved with modest operational changes. As in the Snake River, these could include operating the John Day and The Dalles reservoirs at MOP together with purchasing, on a one-time basis, additional flow augmentation water needed to achieve the water travel time improvements in the Columbia River from Canadian storage. Alternatively, some of the additional water for Columbia River improved flows may be available from Libby and Hungry Horse reservoirs in the upper Columbia River Basin. But the availability of water from these reservoirs could be limited by the needs of other listed species in the upper Basin.

57. I provide the above examples of operations that could achieve the water flow improvements that plaintiffs seek not because these are the precise operations that the agencies should adopt to comply with an injunction but merely to illustrate that there are available and implementable measures to meet the terms of such an injunction.

58. With respect to the plaintiffs' request for increased spill in the lower Snake River and at McNary Dam, there are no physical constraints I am aware of to implementing these operations and, in fact, at different times and in different forms state, tribal, and other federal fishery managers have called for increased spill and a spread-the-risk strategy for juvenile summer migrants.

59. Based on the foregoing discussion, it is my opinion that the measures for improved water flow and increased spill the plaintiffs have requested, if implemented for the summer salmon migration season in 2005, will reduce significantly, even substantially, the harmful effects ESA-listed salmon and steelhead would otherwise experience under the 2004 BiOp.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge. Executed this 10 day of March at Cherrydome, Idaho.



STEPHEN W. PETTIT