KARIN J. IMMERGUT, OSB #96314
United States Attorney
STEPHEN J. ODELL, OSB #90353
Assistant United States Attorney
District of Oregon
600 United States Courthouse
1000 S.W. Third Avenue
Portland, OR 97204-2902
(503) 727-1000

ROBERT L. GULLEY, Senior Trial Attorney
robert.gulley@usdoj.gov
RUTH ANN LOWERY, Trial Attorney
COBY HOWELL, Trial Attorney
Wildlife & Marine Resources Section
Benjamin Franklin Station, P.O. Box 7369
Washington, DC 20044-7369
(202) 305-0500 (ph)
(202) 305-0275 (fx)
Attorneys for Defendants

UNITED STATES DISTRICT COURT

DISTRICT OF OREGON

NATIONAL WILDLIFE FEDERATION, *et al.*

Plaintiffs,

v.

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

Civ. No. 01-00640-RE (Lead Case)
Civ. No. 05-0023-RE
(Consolidated Cases)

THIRD DECLARATION OF CYNTHIA A. HENRIKSEN
(Injunctive Relief)

COLUMBIA SNAKE RIVER IRRIGATORS ASSOCIATION, *et al.*,

Plaintiffs,

v.

CARLOS M. GUTIERREZ, *et al.*,

Defendants.

I, Cynthia A. Henriksen hereby state and declare as follows:

1. I have been employed by the U.S. Army Corps of Engineers (Corps) for approximately twenty-eight years. In November 1995, I became the Chief of the Reservoir Control Center (RCC), Water Management Division, Northwestern Division, U.S. Army Corps of Engineers.
2. I received a Bachelor of Science degree in Civil Engineering from Clemson University, Clemson, South Carolina in 1976, and I have been a registered Professional Engineer in the State of Oregon since 1985.
3. During my twenty-eight years with the Corps of Engineers, I have been involved in numerous water-related activities. During the early years of my career I performed floodplain studies using hydrologic models for the Mobile District of the Corps of Engineers. During the past twenty one years, I have worked in the Water Management Division (WMD) of the Northwestern Division. My responsibilities have included oversight of power planning studies and real-time operations related to power production at Corps multiple use projects in the Columbia, Snake, and Willamette rivers to assure these projects were operated within their design limitations. I have been a member of the Assured Operating Plan (AOP) Team with Canadian and Bonneville Power Administration (BPA) representatives.
4. Since late in 1995, I have been the Chief of the Reservoir Control Center (RCC) for the Corps in Portland. The RCC is responsible for water management throughout the Columbia River Basin. This responsibility includes meeting regional needs for flood control, power generation, fish passage, and water quality through river operation. The diverse staff within RCC includes fifteen multi-disciplined technical personnel with skills to respond to these many responsibilities. RCC relies upon expert input from other agencies to help formulate ultimate operational decisions. One activity I perform as Chief of RCC is to Chair the

Technical Management Team (TMT). The TMT role in regional operations decisions will be discussed below. Another function I perform as Chief of the RCC is being a member of the Columbia River Treaty Operating Committee. Although I have attended Operating Committee meetings for about fifteen years as a technical expert, I have been a member of the Operating Committee since late 1995.

5. I have recently accepted a temporary assignment as Chief of the Hydrologic Engineering Branch (HEB) in WMD. In this position I am responsible to assure the system flood control studies are complete, and that monthly flood control calculations are prepared for all project operators to use in actual operations during the winter and spring season. The HEB also maintains the Corps' Water Control Data System and assures that regional hydrologic data is available in the database and for use on the Corps' web pages. During my temporary assignment I am also a member of the Columbia River Treaty Hydrometeorologic Committee.

6. This declaration will review the measures proposed by Plaintiffs to determine if they are feasible and necessary in light of past performance of the FCRPS. The declaration will first provide an overview of the system and then discuss the Plaintiffs' spill and flow proposals. Specifically, I will address issues raised concerning the proposed spill operation, including Total Dissolved Gas (TDG) levels; the proposed alterations to flood control operations and procedures, including the calculation of Upper Rule Curves, and assertions that the Corps' has mismanaged flood control operations to the detriment of fish; how the Federal Columbia River Power System (FCRPS) has been operated in accordance with Biological Opinions for listed fish species and other authorized project uses; and, the operation of the lower Columbia and Snake river projects at minimum operating pool. I will also explore

weaknesses and failings of the Plaintiffs' modeling of their proposal as presented in the Declaration of Robert Heinith.

Overview of the Operation of the Federal Columbia River Power System

7. The Columbia River and its tributaries form the dominant water system in the Pacific Northwest and is a heavily utilized regional resource. The Pacific Northwest is dependent to a large extent upon the Columbia River to derive a multitude of benefits for the region as well as the nation. Since the 1930s, numerous dams - both Federal and private, have been built to provide for flood control throughout the basin, generate hydroelectric power, support fish and wildlife, navigation, recreation and irrigation, and municipal and industrial water supply and quality.

8. The mainstem of the Columbia rises in Columbia Lake on the west slope of the Rocky Mountain Range in Canada. After flowing a circuitous path for about 1200 miles, 415 miles of which are in Canada, it joins the Pacific Ocean near Astoria, Oregon. The river drains an area of approximately 219,000 square miles in the States of Washington, Oregon, Idaho, Montana, Wyoming, Nevada, and Utah. An additional 39,500 square mile portion of the basin, or about 15%, is within Canada.

9. The series of Columbia River Basin dams and reservoirs, which include congressionally authorized federal projects, were developed as part of a comprehensive regional plan[1]. For

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[1] The Corps was authorized to construct, operate and maintain 12 of the 14 federal projects in the FCRPS *see*, H.D. 531, which authorized Libby, Albeni Falls, John Day, The Dalles, and discusses what later became Dworshak as a potential project in the comprehensive system. Bonneville was authorized by, P.L. 74-409; McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite were authorized in 1938, H.D. 704; Chief Joseph was authorized in 1946, H.D. 693; and Dworshak was authorized in 1962, H.D. 403.

purposes of this litigation, the federal projects operated by the Corps and the U.S. Bureau of Reclamation (Reclamation) are referred to as the Federal Columbia River Power System (FCRPS), and are operated in a coordinated manner with certain Canadian projects pursuant to the Columbia River Treaty (Treaty) [2] between the U.S. and Canada, and several Public Utility District projects on the mid-Columbia for the following uses:

- Flood Control: Management of damaging floodwaters for the protection of Portland and Vancouver was one of the original incentives for the construction of the storage projects in the Columbia Basin. The Corps is authorized to direct flood control operations for all federal and non-federal storage projects, including Canadian projects, in the Columbia River Basin.
- Navigation: The four lower Columbia River projects and the lower Snake River projects were constructed with navigation locks through which boats and barges pass transporting products from the Pacific Ocean to inland ports as far upstream as Lewiston, Idaho.
- Hydro-electric Power Generation: The dams in the Pacific Northwest supply 60 percent of the region's power.
- Fish and Wildlife: The federal projects are operated to support the protection and conservation of fish and wildlife species both in the reservoirs as well as downstream.
- Recreation: The reservoirs and project lands provide recreational opportunities for boaters, anglers, swimmers, hunters, hikers and campers throughout the year.
- Irrigation: Farmers depend on water diverted from some of the federal projects to grow a variety of agricultural crops.

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[2] The Treaty Between the United States of America and Canada Relating to Cooperative Development of the Water Resources of the Columbia River Basin, 1964. The Canadian Entity

- Water Quality: The FCRPS projects are operated to maintain water quality by releasing water for downstream temperatures and by providing minimum flows to dilute pollutants.
- Municipal and Industrial Water Supply: Some of the FCRPS projects supply water to numerous municipalities and industries.

10. To provide for these uses, the FCRPS was developed with both "storage" projects to capture water from rain and snowmelt for flood control, and "run-of-river" projects, which have minimal storage capacity[3] and were designed primarily for navigation and hydropower generation. Storage projects have large operating ranges and evacuate water (draft) from January through April creating space to capture spring snowmelt or rain.

11. It is important to understand that in the Columbia Basin, the total available storage in the system is relatively small compared to the total average annual runoff. This contrasts to other major systems in the western United States, such as the Missouri and Colorado River basins that have more storage capacity than the average annual runoff. (Exhibit 1). The Columbia River's annual runoff is nearly 200 million acre-feet (MAF), measured at the mouth of the Columbia. There is slightly more than a total of 46 MAF of storage space available in the entire Columbia River Basin including all federal, Canadian, and non-federal storage and run-of-river projects that have minimal storage capacity.[4] There is a total of 32.2 MAF in the projects relied on most often for storage – the federal and Canadian projects, and Brownlee reservoir, which is owned and operated by Idaho Power Company.

(B.C. Hydro) and the U.S. Entity (represented by the Corps of Engineers and Bonneville Power Administration) carry out the Columbia River Treaty.

[3] Generally, the daily inflow to a run-of-river project equals the daily outflow; however, with the minimal storage these projects do have, elevations may fluctuate numerous times a day.

[4] Columbia River Treaty Flood Control Operating Plan, May 2003, Table 1.

12. After it was determined that additional storage on the upper reaches of the river would be mutually beneficial to both Canada and the United States for flood control and power production, the Columbia River Treaty was signed in 1961 and put into effect in 1964 for the purpose of optimizing both power and flood control to the mutual advantage of both countries (*see*, Declaration of Richard Pendergrass). The Treaty required building three storage reservoirs in Canada – Mica, Keenleyside, and Duncan, and the option to build a fourth – Libby, in the U.S. These Canadian projects provide almost half the water storage on the Columbia River.

13. To obtain the multiple benefits of the Columbia River system, the strategy for operating the FCRPS is very complex and requires coordination on many levels. The project uses are interdependent and operating for one use can affect, sometimes negatively, one or more of the other uses. Often, judgments must be made as to the priority of a particular use at the detriment of another. For instance, meeting optimum flows conditions for chum salmon (adult spawning and juvenile rearing) can impact storage for other purposes including flows for other species of salmon and reservoir elevations desirable for recreation.

14. Traditionally the storage projects were operated in a manner that afforded some flexibility to provide for flood control, meet energy demands through hydropower generation, and support recreational uses in the summer. Over time, the strategy for the coordinated operation of the Columbia River projects changed. In the eighties the Northwest Power Planning Council, through its Fish and Wildlife Program, recommended a "water budget," which was to preserve some of the water stored in headwater reservoirs to be released to improve juvenile anadromous fish migration. Subsequently, in the early 1990's, Senator Mark Hatfield convened the "Salmon Summit," which was followed in the early 1990's with the first

Endangered Species Act (ESA) listings of Snake River anadromous fish species. As a consequence, the emphasis for operating the FCRPS projects has shifted to salmon recovery. As an example, under current operations the storage projects are managed to "shape" the heavy spring and summer run-off and to store as much water as possible for fish flow augmentation, while maintaining the Corps' ability to prevent or reduce flooding. In order to provide the maximum benefits for fish and to support the other uses, the operational flexibility that once existed has been significantly constrained.

15. With the initial listing of the Snake River sockeye in December 1991, followed by the Snake River spring-summer and fall Chinook in February 1992, the Corps and the other Action Agencies initiated the first ESA Section 7 consultation on the effects of the operation of the FCRPS on these species. This was followed by several subsequent consultations that have significantly changed how the system is operated. The strategy throughout these consultations has been directed at improving habitat conditions, providing safer dam passage through physical modifications and changed operations, increasing river velocities, and continuing research activities to obtain data on the effectiveness of these actions and how best to improve conditions for the listed species.

16. Through the consultations, actions have been adopted that significantly changed hydro-system operations including fish passage spill, juvenile transport, flow augmentation, and run-of-river minimum operating pool (MOP) operations. Examples of changes adopted to benefit fish are:

- Implementation of VARQ[5] flood control at Libby and Hungry Horse dams.

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[5] VARQ (variable "Q" or variable discharge) is currently being implemented on an interim basis. A Draft Environmental Impact Statement on implementing VARQ as a long-term operation, has

- Spill for juvenile fish passage has increased in volume and duration with a commensurate reduction in power generation.
- Storage projects are now drafted in the summer months for flow augmentation, whereas these reservoirs were previously operated for recreation through Labor Day.
- The lower Snake River projects are operated at their minimum pools, which can impede navigation.

<u>Plaintiffs' Proposed Spill and Flow Operations</u>

17. Following is a more detailed discussion of the how the FCRPS is operated and, limitations and constraints, in particular pertaining to the two primary areas addressed in Plaintiffs' Motion for Further Injunctive Relief – spill and improving flow conditions.

Fish Passage Operations - Spill

18. As noted above, an important function of the hydropower system is generating electricity to meet the Pacific Northwest energy demands, and as such, historically the Corps spilled, i.e. directing river flow through spill gates, only when necessary. This "involuntary spill" occurs when flow exceeds powerhouse capacity, there is insufficient demand for electric generation, or maintenance/repair activities limit powerhouse operations.

19. In the 1980's, spill for fish passage was initiated to provide better passage conditions for juvenile salmon. In the early 1990's, an objective of the Biological Opinions' was to provide spill to achieve a certain fish passage efficiency (FPE - or percentage of fish that pass the project through non-turbine routes, i.e. either spill or juvenile bypass facilities). Spill volumes, patterns, and spillway configurations, such as flow deflectors, spillway walls, and

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been published and is out for public review. A final EIS is scheduled to be completed in early 2006.

removable spillway weirs (RSWs), have been added over the last 10-15 years to improve juvenile fish survival and to decrease levels of total dissolved gas (TDG).

20. The Corps' practice is to evaluate and determine spill volumes and patterns based on research on spillway survival, impacts on juvenile egress and adult passage, such as fallback and passage delay, and impacts on other juvenile passage routes such as transport. Evaluations of operational or configuration changes are developed collaboratively with regional participants through the Studies Review Work Group, the Fish Facilities Design Review Work Group, and the System Configuration Team. The Corps funds travel to the Engineering Research Development Center (ERDC) in Vicksburg, Mississippi for regional parties. ERDC utilizes physical models in testing and evaluating modifications to improve spill operations.

21. One example of implementing spill without an adequate evaluation of potential effects on juvenile and adult fish passage occurred with the court ordered summer spill in 2005. Spill volumes as ordered at Little Goose Dam created an eddy condition in the tailrace that delayed and impeded adult passage until spill levels were reduced. (Third Declaration of Rock Peters, Dkt No. 1036 ¶¶ 23-29).

22. In addition to ensuring adequate research and evaluation is performed before modifying spill operations or making configuration changes, there are other factors to consider. One such consideration is the Corps' legal obligations under the Clean Water Act. The Corps has a rigorous monitoring program that assists in managing TDG when providing spill for fish passage. Currently, the States of Washington and Oregon provide exceptions to their respective TDG standards to enable fish passage spill. Generally, these TDG standards provide 120% in the tailrace or 115% in the forebay of the next dam downstream. Below in

¶¶ 27-33 is information concerning the TDG effects associated with Plaintiffs' proposed operation for 2006.

23. Another consideration when determining optimum spill volumes and patterns is the effect on navigational safety. At some of the lower Snake and Columbia river projects, spill can cause strong currents across the navigation channel just downstream of the navigation lock and push barges out of the navigation channel. When this occurs there is danger that the leading or trailing edge of a barge will go outside the channel and become grounded or damaged.

24. Four of the Corps' projects, Lower Granite, Little Goose, Lower Monumental, and McNary are equipped with juvenile bypass facilities designed to collect migrating juvenile fish for transport in barges[6] downriver through the migration corridor. This is to reduce the number of dams and reservoirs juvenile fish have to negotiate in their migration to the ocean. The barges release the transported juveniles three to five miles downstream of Bonneville Dam, where fish continue their migration to the ocean.

25. Regional debate about the effectiveness of the juvenile transport program and spill for fish passage is long standing. Through the ESA Section 7 consultations, transport has been an integral part of ensuring salmon survival. However, because spill is an alternative means of passing fish, a more comprehensive evaluation of transport versus in-river migration is planned for the summer of 2006 (*see*, Second Declaration of John Williams and Fourth Declaration of Rock Peters).

26. Plaintiffs have requested modifications to the 2004 UPA/BiOp spring and summer spill program. Specific biological concerns raised by the Plaintiffs' requested spill operations,

[6] Once the numbers of juvenile fish diminish, the means of transport shifts from barges to trucks.

such as juvenile and adult passage concerns, are discussed in the Fourth Declaration of Rock Peters.

Total Dissolved Gas Effects of Spill Proposal

27. As to the TDG effects associated with Plaintiffs' proposal, the Corps conducted an evaluation of the proposed increased flows and spill volumes described in their motion. The SYSTDG model was used with flow input provided by the National Weather Service's Ensemble Streamflow Prediction model that presented average flow conditions for the April through August period, based on the 70 year streamflow record. The SYSTDG analysis evaluated two scenarios: the Plaintiffs proposed operation and the 2004 UPA/BiOp operations. (Exhibit 2).
28. SYSTDG is an hourly time step model developed by the Corps. It is regionally accepted for assessing TDG for different operations. Generally, the Plaintiffs' proposed spring operation calls for more flow and 24 hour spill at levels higher than previous operations. In the evaluation, SYSTDG first modeled the proposed spill volumes and durations absent other changes. The results of this first step indicate that the Plaintiffs' proposed increases in flows and higher volumes of spill 24 hours/day, will increase the TDG load in the river - more so than the 2004 UPA/BiOp spill operation. The Plaintiffs' operation generated twice as many exceedances of the states' TDG standards as the 2004 UPA/BiOp scenario in this first step.
29. To subsequently correct the TDG exceedances caused by the increased spill and flow levels, a reduction to levels lower than those called for in the 2004 UPA/BiOp is required. In general, in order to reduce the number of exceedances, the Plaintiffs' requested spill volumes had to be reduced at all projects except Lower Granite and Ice Harbor. At Bonneville Dam, for instance, spill volumes had to be reduced from 100 kcfs daytime to 60 kcfs for 69 days under the Plaintiffs' operation in contrast to no reduction in spill in the UPA. Lower Granite

and Ice Harbor spill volumes remained the same in each case because the RSWs at these projects generate less TDG.

30. The adjustments made to reduce TDG exceedances resulted in spill volumes that are lower than recommended for good juvenile and adult passage conditions and optimum survival. For instance, under the Plaintiffs' proposed operations, spill volumes at The Dalles dropped below 30 % for 3,456 hours compared to 151 hours with the UPA operation. Spill volumes of less than 30% at The Dalles result in more juvenile fish passing through the powerhouse - turbines and sluiceway, causing higher mortalities. Given the Plaintiffs' proposed operation significantly increases the incidences of exceeding the TDG standard at The Dalles - with consequent spill reduction to below 30%, this operation should be avoided.

31. While there are limitations in the application of the information provided by any model, outputs inform decision makers and assist in identifying potential problems. Based on the SYSTDG analysis of the Plaintiffs' proposed spill operations and increased spring flows, the following conclusions can be drawn:

    a. Higher volumes of spill and longer durations, i.e. 24 hours/day in the spring, will increase the TDG loading of the river over the 2004 UPA/BiOp.

    b. Under the Plaintiffs' operation, there is less opportunity for TDG levels to dissipate than with the UPA/BiOp scenario because of the longer durations - 24 hours/day spill at certain projects.

    c. With TDG at higher levels for longer durations with the Plaintiffs' proposed operation, spill volumes and/or duration will have to be reduced in an attempt to meet state TDG standards.

1. A consequence of adjusting spill volumes to manage TDG levels, is poor egress or other negative tailrace conditions for both juvenile and adult salmon passage.
2. At projects such as The Dalles, more juveniles will be diverted to the powerhouse for passage because of required spill adjustments. Without adjustments to spill volume, duration, or timing at other dams to correct this situation, there would be a negative impact on survival.

32. The modeled simulations discussed above inform what may happen in the real time implementation of the Plaintiffs' proposal. However, it is important to understand that the actual implementation and management of TDG and consequent effects on fish passage associated with Plaintiffs' proposed operation, without an adequate technical and biological evaluation to assess the systems response, will be extremely problematic.

33. Unlike the adjustments to spill volumes and patterns that occurred in the summer of 2005 at only one dam, to remedy the adult passage delays would be substantially more complex and challenging given the systemic effects of the TDG generated, the number of dams implicated, and the various responses that could occur. Adjustments would have to be made at multiple dams after consideration of adult and juvenile passage conditions in the spillway as well as other routes of passage at each dam.

Improved Flow Conditions and Natural Hydrograph

34. In their request for injunctive relief, Plaintiffs have also included actions they assert will improve flow conditions and provide a more natural hydrograph. A discussion about the significant changes in FCRPS storage project operations that have occurred to improve flow

conditions for fish, and issues raised by Plaintiffs requested change in these operations follows.

35. Prior to the shift in operations for ESA purposes, the FCRPS reservoirs drafted from October through March, the coldest months when the demand for power is highest. These projects would also fluctuate outflow on a daily and hourly basis to meet peak power demands throughout the year. Operating the FCRPS projects to meet ESA responsibilities has affected the ability to meet peak power demands.

36. From April through June, the output from the headwater storage projects, Libby, Hungry Horse, and Dworshak, was reduced to near minimum outflow to refill for the summer recreation season. The reservoirs then remained as full as possible during the summer recreation season only drafting five or ten feet at most. In the fall, the storage projects were again drafted to provide for flood control and power.

37. Since the 1995 BiOp, a goal for storage projects has been to operate to the upper rule curve (URC), so the reservoirs are as full as possible by April 10 to have water available for shaping flows for juvenile fish migration in the spring and assuring refill for flow augmentation in the summer. The URC is the highest reservoir elevation that provides adequate space to capture runoff to meet flood control objectives. The URCs for the Columbia Basin storage reservoirs were developed with the objective of providing flood protection for the Portland - Vancouver area, and local areas just downstream of individual dams. Operating above these elevations increases the risk of local and regional flooding.

<u>Headwater Storage Project Annual Operating Strategy</u>

38. The Corps' Columbia Basin headwater storage projects are Libby Dam in Montana and Dworshak Dam in Idaho. As previously discussed, the objective in operating these projects

to the URC is to ensure the reservoirs are as full as possible in April of each year, providing the optimum volume of water for spring flows while also ensuring there is space available to capture spring snowmelt. In the spring, the objective is to have water available to shape for salmonid and Kootenai River white sturgeon without compromising refill for summer releases. Once the summer drafts are completed, the fall operation objective is to provide for resident fish releases while still achieving the required December flood control elevation.

39. There are many considerations which may result in storage projects not achieving a URC elevation or a spring/summer refill objective besides releases for salmon and flood control. These include resident and other listed fish needs, power emergencies, project emergencies, and other unforeseen circumstances. In Appendix A to this declaration, we detail the year-round Libby and Dworshak, season-by-season.

40. Plaintiffs propose operating the FCRPS in a different manner to provide improved flow conditions. One assertion by the Plaintiffs is that storage projects need to be managed better to be on URCs so that, theoretically, more water will be available in April for salmon flows. Clearly, the Plaintiffs do not understand the complexity of developing and managing to the end-of-month URC flood control elevations for the storage projects and mistakenly believe bi-monthly URCs will provide more water with no flood control risks. These factors are explained next.

Water Supply Forecasts and Calculated Upper Rule Curves

41. Development of end-of-month URCs for each storage project requires a water supply forecast from which the URC is calculated.

42. Predicting water supply is inherently imprecise. The water supply forecast[7] is a function of anticipated precipitation and actual quantity of snow and its water content. Most of the snowpack is accumulated in the December to April period so it is impossible to know in November what the actual snowpack will be. If the snowpack is large, the expectation is that the runoff from snowmelt will be large and the water supply forecast will be above average. Conversely, if the snowpack is small, the water supply forecast is generally below average.

43. Contrary to Plaintiffs' implication, it is impossible at this time to know with any certainty what the water supply for 2006 will be. The water supply forecasts are calculated based on input such as expected precipitation and quantity of snow. Many of the snow data points are available only once a month because the snow depth at each site is measured and then the findings are sent to the appropriate agency such as the Natural Resource Conservation Service, National Weather Service, or Environment Canada. Some of the precipitation sites are manually sent by weather watchers at the end of each month.

44. The water supply forecast is an estimate of expected inflow to a reservoir over a multiple month period. Each monthly forecast has error bounds pertaining to the reliability of the forecasts. In January the 95% confidence error associated with the water supply is roughly 25% of the volume. Therefore, if the January water supply forecast is 100 MAF for the January through July period measured at The Dalles, with the 95% confidence error, there is an approximate range of 50 MAF that could materialize, i.e. there is 95% confidence the

[7] The Corps prepares the water supply forecast for Libby and Dworshak, and the Bureau of Reclamation prepares the water supply forecast for Hungry Horse. BC Hydro prepares the water supply forecasts for Canadian projects, and the National Weather Service's River Forecast Center prepares a water supply forecasts for all of the tributaries and the Columbia River measured at The Dalles.

observed volume at The Dalles from January through July will be somewhere between 125 MAF and 75 MAF. Hence, the reliability of the early water supply forecasts is low.

45. As the spring season progresses, the 95% confidence bounds become smaller. By April, the 95% confidence error is roughly 11%. Meaning that if the water supply forecast at The Dalles is still 100 MAF, the 95% confidence error bounds is about 11 MAF, so that here is 95% confidence the observed volume from January through July will fall between 111 MAF and 89 MAF - an approximate range of 22 MAF that may materialize.

46. There is an **equal chance that the water supply forecast will increase, decrease or stay the same from month to month** and the actual observed water supply may fall outside these bounds. In 1998, the May final forecast for the April to August period was 75.4 MAF at The Dalles, and the actual observed water supply was 90.1 MAF. This was a forecast error of about 20% which is well outside the 95% confidence boundary for a May forecast. Because of this variability, it is impracticable if not impossible to manage the storage projects in the context of changing monthly forecasts, actual runoff, project requirements, and unforeseen conditions, such that an expectation or even worse a requirement to meet an end-of-month URC elevation is reasonable.

47. As each water supply forecast is provided, the Corps calculates the URCs – the highest elevation that a storage project can be at and still provide adequate flood control space to capture the anticipated runoff. Each project has a series of graphs that defines flood control storage space by month based on estimated runoff. As the forecasts change and the URCs are revised, the actual elevation of any given reservoir may be higher or lower than the updated calculated URC elevation.

48. Specifically, the Corps completes the end-of-month URC for each project once the National Weather Service River Forecast Center (RFC) prepares the final water supply forecast as measured at The Dalles Dam.[8] This forecast is required to prepare the Grand Coulee URC which takes into account both the water supply forecast for The Dalles and the available storage space at upstream projects including the Canadian projects, Libby, Hungry Horse, Dworshak, and others (Kerr, Albeni Falls, and John Day dams). For example, if the actual elevation of Dworshak Dam is below its URC, the calculated URC for Grand Coulee will be at a higher elevation than it would if Dworshak was on or above the URC elevation. Or, if the actual elevation of the Canadian projects is below their respective URC elevations, the calculated Grand Coulee URC elevation will be higher.

49. The Plaintiffs and Mr. Heinith demonstrate their lack of understanding of the complexities involved with operating the FCRPS system operations, in particular, the technical intricacies required to ensure system-wide flood control. This leads them to erroneously conclude that keeping Canadian storage at URCs would result in an additional 4 million acre feet (MAF) of water being available for salmon flows. This is simply wrong in the context of real time operations. As I describe above, the Columbia River System has very limited storage space available relative to annual runoff. In order to provide adequate flood control protection, all available space is used to the extent it is available to capture runoff to reduce flooding.

50. Therefore, raising reservoir levels in Canada has off-setting effects in the FCRPS, and in particular at Grand Coulee as discussed below. If the Canadian reservoir water levels were raised to URCs as the Plaintiffs propose, there would have to be a corresponding increase in

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[8] In 2006, the National Weather Service will complete the final water supply forecasts calculations on January 9, February 7, March 7, and April 7.

empty flood control space, to ensure adequate space is available to catch run-off in the U. S. reservoirs offsetting the reduced space in Canadian reservoirs. This URC adjustment is taken at Grand Coulee.

51. The Biological Opinions recommend that storage reservoirs operate such that they are as full as possible on April 10 (i.e. operate to the BiOp April 10 flood control elevation). The Corps operates the storage projects to be as full as possible on April 10th, but does not prepare any April 10 flood control elevations.

52. Calculating an April 10th URC is difficult because of the monthly timeline for preparation of water supply forecasts and the resultant calculation of the end-of-month flood control target elevation. In the years from 1995 – 2005 the National Weather Service RFC prepared the final water supply forecast on or about the 10th of each month. It is impractical to compute an April 10th flood control elevation with a water supply forecast available on April 10, and then expect the storage projects to reach that flood control elevation on that same day.

53. Plaintiffs have proposed that the all FCRPS storage reservoirs (i.e. Dworshak, Grand Coulee, Hungry Horse, and Libby) operate at their URC elevation on a bi-weekly basis (i.e., each reservoir would be at its URC elevation on or about the 15th and 30th of each month) from February 1, 2006, through April 30, 2006. Our understanding of the Plaintiffs' theory is that this will maximize storage of water for flow augmentation in the spring and refill for summer flow augmentation. However, implementation of such a proposal may actually result in **less** water stored and potentially **additional** risk to flooding. In addition, there are fundamental technical problems of computing bi-weekly URC elevations at reservoirs and potential unintended consequences of operating to a mid-month URC.

54. As explained in ¶¶ 47 above, the Corps computes URC elevations starting in January and in each succeeding month, through April based on the monthly final water supply forecast.

55. If a mid-month URC elevation is implemented as suggested by the Plaintiffs, there are two approaches to identify a mid-month elevation, both with potentially undesirable consequences. It has been suggested that the Corps use a "straight line" measurement to compute the mid-month flood control elevation. (This would mean plotting reservoir elevation as a function of date and then drawing a line between one month's end-of-month level and the next month). Since there is only one monthly water supply forecast, the choice is to use the current month's forecast or the previous month's forecast. For instance, the February 15th flood control elevation could be calculated using the final February forecast using the February 8th data or the final January forecast using January 9th data. Neither of which assists in achieving the objective.

56. If the **current** month's water supply forecast is used to calculate a mid-month flood control elevation (February 8th forecast for a February 15th URC), then water may need to be released in 5 to 7 days to meet the mid-month elevations when it might otherwise be retained to meet an end-of-month elevation. For instance, if in the last 15 days of a month inflow drops and is very low, the reservoir may not be able to retain enough water to achieve an end-of-month flood control rule curve elevation because the project is meeting minimum outflow requirements. Therefore, in this case, the Plaintiffs' requested operation would have the opposite effect of releasing water rather than storing more water for future flow operations. By targeting an end-of-month elevation, there is greater opportunity to respond to the variations in runoff.

57. If the **previous** month's water supply forecast is used to calculate a mid-month flood control elevation (January 9th forecast for a February 15th URC), two issues arise depending on whether the previous forecast is less than or greater than the current month's forecast. If the previous month's water supply forecast (January) is *less than* the current month's forecast (February), the reservoir may be operated in anticipation of less runoff when actually more is expected. Under these conditions, the project could be too full at the mid-month and risk not being able to evacuate water to achieve the end-of-month flood control elevation without large outflows for the last two weeks of the month. This would increase the risk of damaging floods and spilling which could result in exceeding the TDG standard at site, or in the lower Columbia River depending on the flow conditions at the time.

58. If on the other hand, the previous month's (January) water supply forecast is *greater than* the current month's (February) water supply forecast, the reservoir would release more water for the first 15 days under the false assumption of a higher runoff. Then, with the new information that there is less runoff, there might not be enough inflow in the last 15 days of the month to reach a higher end-of-month flood control elevation.

59. Requiring the storage reservoirs to be exactly at specific elevations on specific dates is not only impractical, but beyond the control of project operators. Due to the variation of water supply forecasts, the inherent unpredictability of actual precipitation, and the real-time operation of storage projects for the multiple uses and unforeseen circumstances, actual reservoir elevations may be higher or lower than the calculated end-of-month flood control elevation. There are many technical impracticalities of calculating a mid-month URC and potential consequences to flood control and water availability.

60. A fundamental constraint is lack of mid-month water supply forecasts. The Corps can not develop mid-month water supply forecasts because inputs are not available such as precipitation and snowpack data on a more frequent basis than what we have described above (*i.e.*, once monthly). Some of the snowpack stations that are used in the calculation are visited once each month. Moreover, even if data were available, developing new techniques for calculating mid-month URCs would have to be jointly developed by all parties currently providing water supply forecasts. In turn, there would need to be a system-wide assessment of flood control risks. This can not be completed by January 2006.

61. Plaintiffs also refer to Mr. Heinith's Declaration indicating that additional water storage in Canada "can be implemented either directly or through supplemental operating arrangements." Mr. Heinith refers to one such arrangement suggesting that "on call" storage can be purchased by the United States to increase flow for salmon flow augmentation. (Heinith Declaration, ¶10, fn. 9). This is not correct. The Columbia River Treaty and Protocol are clear that on-call storage is not available for use other than to reduce spring flood flow. Mr. Heinith's further claim that on-call storage has never been used because it is too costly is also incorrect.

62. The United States has not requested on-call storage because the requisite criteria for requesting such storage have never been met. To be able to request such storage, the United States must experience extremely high flows as specified in the Protocol (Annex to Exchange of Notes), which I detail in the next paragraph. We have never experienced flow conditions that required consideration of utilizing on-call storage.

63. On-call storage can be used according to the Treaty for flood control purposes only. Paragraphs I and II of the Protocol (Annex to Exchange of Notes) in the Treaty clearly

defines the use of on-call storage. On-call storage is available to the extent necessary to meet the United States' forecast flood control needs that cannot adequately be met using the storage facilities in the United States. In the event a forecast would result in a flood flow in excess of 600,000 cfs at The Dalles, after all other U.S. storage has been exhausted; the United States may call upon Canada to draft the additional on-call space. On-call storage is a draft of additional storage in Canada during the winter months so that flow at The Dalles can be reduced below 600,000 cfs during the May – July freshet. It is not available to be released during May and June.

64. The Protocol specifies that the call for this storage "...shall be made only if the Canadian entity has been consulted whether the need for flood control is, or is likely to be, such that it cannot be met by the use of flood control facilities in the United States..."[9] In using on-call storage "...every effort will be made to minimize flood damage both in Canada and the United States of America."[10]

Review of Operations Show Storage Projects As Full As Possible in April

65. The Plaintiffs falsely report that the Corps' operation of storage projects failed to store as much water as possible for salmon flow augmentation by asserting the Corps is intentionally releasing water, not for flood control purposes, but rather, for power generation so that reservoirs are below the URC elevations at the end of the month. (Plaintiffs' Motion, pg 11).

66. At headwater projects such as Libby and Dworshak, the Corps intent is to achieve, as practicable, URC elevations from January through April to meet the April 10th objective

[9] Treaty between the United States of America and Canada relating to cooperative development of the water resources of the Columbia River Basin, and the documents associated therewith. Protocol (Annex to exchange of notes) Paragraph I.(3)
[10] Protocol Paragraph II.

identified in the 2004 UPA/BiOp. This operating strategy is to ensure the reservoirs are as full as possible to maintain flood control and to have the most water available for fish flows. To accomplish this, the Water Management Plan indicates these reservoirs should either operate, with a low water supply forecast, to minimum flows, i.e. releasing the project minimum outflow to maintain stream flows below the project that are protective of fishery and aquatic life and water quality, or, when the water supply is adequate, to release water to achieve the highest flood control elevation, i.e. the URC, at that project.

67. Since each Corps reservoir is operating to the end-of-month URC target elevation, there are occasions when the monthly outflow from an individual dam may be greater than the minimum flow requirement for purposes other than flood control. This includes downstream fish uses (i.e. chum flows), power emergencies (e.g. 2001 operations or cold snaps) or other unforeseen circumstances. In the case of a project releasing more than minimum outflow to target the end of month flood control elevation, flows may be shaped to meet energy load by releasing more water on weekdays and less on weekends within the month. Because of the nature of natural runoff, there will be years that the storage reservoirs will not refill to the URC flood control elevations due to low runoff conditions or deteriorating water supply forecasts.

68. The Corps evaluated the historical operation of Libby and Dworshak since 1995. For each project, the end-of-month elevation was compared to the calculated URC. Since 1995, with some limited exceptions (addressed below), Libby and Dworshak have either been operated on minimum flows or operated to release additional flows to meet the end-of-month URC elevation.

Libby Dam

69. The only year when stored water was released from Libby Dam for purposes other than minimum flow requirements or flood control is 2001, when 530 KAF was released for power production from January through March. This was a very low water year in which flow in the Columbia River Basin was insufficient to meet regional power needs. To meet the regional power load, water was released during the winter period from January 22 through March 7 the outflow was increased to as high as 15 kcfs to meet these power needs.

70. There were several years when Libby did not fill to the end-of-month URC elevations by April 30 because the water supply diminished during the winter period. When water supply forecasts predict low run-off, the calculated URC will be at a higher reservoir elevation because it is anticipated less space will be required to capture the run-off. So in years when the forecast runoff decreased each month, the end-of-month flood control URC target elevation went up, as occurred at Libby in 1998, 1999, 2003, 2004 and 2005. In these years the Libby reservoir could not refill to the end-of-month target elevation while only releasing project minimum outflow of 4 kcfs.

71. It is also important to recognize that in 2003, the Corps began implementation of interim VARQ flood control operations at Libby Dam. VARQ adjusts the URC in low to medium runoff years, so the reservoir elevation is higher than it would be under the standard flood control procedure. Illustrative of the low inflows that can occur in the January to March timeframe, was in 2003 when Libby went from elevation 2411 at the beginning of January to elevation 2404 (a drop of seven feet) by the end of March, despite releasing only minimum outflows.

72. Plaintiffs attempt to rely on an incomplete or inaccurate description of facts to support insinuations that Libby has not been operated to meet the April upper flood control elevation. In Mr. Heinith's Declaration, ¶¶ 7, he states that Libby was 42 feet below the April 10, 2004 flood control rule curve. Mr. Heinith did not report that Libby was operating to minimum flow during the winter period from January through March and thus every available tool was being used to achieve the URC. Libby started with an end-of-December flood control elevation of 2411. Based on the forecast and the calculated URC, the project released approximately 202 KAF outflow in excess of minimum flow from January 1 to January 17, 2004. However, the runoff forecast dropped in January and continued to drop each succeeding month resulting in a reduction in flood control storage space needed and the calculated URC at a higher reservoir elevation. Despite operating with minimum outflow of 4 kcfs from January 18 through May, it was not possible to refill Libby to the end of March flood control elevation in 2004.

73. Libby's actual elevation at the end of March was 2413 feet or approximately 30 feet below the calculated URC. Mr. Heinith is incorrect in his overly broad and unsupported assertion that "flexibility" in current operations under the 2004 UPA/BiOp allow for power production (Heinith Declaration ¶¶ 6-8) and for this reason Libby was 42 feet below its flood control rule curve in 2004. Rather, 202 KAF of additional outflow was released due to flood control concerns until the January water supply forecast was complete, and thereafter Libby was on minimum releases for the next two and a half months.

74. In the remaining four years since 1995, Libby was above the end of April URC elevation ranging from 0.9 to 52.3 feet. As explained in Appendix A, due to the International Joint Commission Order for Kootenay Lake, in some years Libby cannot draft its full flood control

storage amount, thus resulting in the inability to evacuate water, which is referred to as trapped storage. In the event that there is trapped storage in Libby during the winter months, this is taken into account when developing the Grand Coulee URC elevations, where there will be more flood control storage space to compensate for trapped storage.

Dworshak Dam

75. Dworshak was operated either on minimum releases or for flood control in an attempt to achieve an April 15th URC every year since 1995, except 2001 when some additional flow was released for unanticipated power needs. In this timeframe, there have been two years when the Dworshak reservoir did not meet the April 15th URC. In the fall of 1997, Dworshak reservoir was lowered to elevation 1500 feet in order to perform emergency grouting for dam safety. This resulted in Dworshak's elevation in the beginning of January 1998 at a very low elevation – 1505 feet, 50 feet below the URC. Despite only releasing minimum outflows, Dworshak did not achieve the April 15th URC.

76. In 2005, Dworshak met an end-of-month flood control elevation in January 2005; however, because the water supply forecast diminished the calculated URCs in the succeeding months were at higher elevations and the reservoir was not able to refill to the April 15th URC - 1.2 feet below, even though the dam released minimum outflow through February and March.

77. In the other seven years during this timeframe, Dworshak April 15th elevations ranged from 0.5 feet to 26.5 feet above the URC. As seen over this review of the last eleven years, the URCs clearly are objectives but actual reservoir elevations vary due to many factors and considerations.

GENESYS Modeling

78. Plaintiffs and Mr. Heinith rely on a hydrologic model called GENESYS to "realistically simulate the FCRPS." (Kyle Dittmer Memo to Bob Heinith dated November 15, 2005). The output for the 50 years modeled for each project was provided by the Plaintiffs on November 16, 2005. Corps and Reclamation staff conducted a preliminary review and identified the following major flaws in the model information provided by the Plaintiffs of their proposed operations:

- As described above in ¶66, the storage projects have monthly minimum outflow requirements to provide stream flows to protect aquatic resources and water quality. Inexplicably, the GENESYS model had zero outflows (0 kcfs) at all major storage projects for many months and years as follows: Hungry Horse outflows went to zero (0 cfs) in 30 years of the modeled 50 years; Libby had 34 years with 68 periods of zero outflows in the January through April periods; for Dworshak, there are 21 years with 81 months with zero outflow in the October through March period; at Grand Coulee there is one month with zero outflows; at Mica, there are 198 instances with zero outflows; at Arrow, there are 34 instances; and, at Duncan there were 34 periods
- Each storage project may also have flows necessary for other listed species like bull trout. GENESYS modeling did not provide the flows to protect these resources. For instance, at Hungry Horse, bull trout minimum flows at Columbia Falls of 3,500 cfs were not met.
- GENESYS modeling did not correctly model URCs and did not have projects operating on their URCs. Contrary to Plaintiffs' assertion that the federal agencies should be ordered to operate the FCRPS storage projects to the URCs, as well as make arrangements for the Canadian projects to do the same, in their GENESYS modeling they

did not operate all storage projects to the URC. For instance, it appears that the CRITFC modeler allowed Grand Coulee to operate below the URC in February, and March in many years. In addition, the model did not appear to use correct URCs at Grand Coulee when the Canadian projects were operated at their URC. Space requirements at Coulee are dependent on upstream space available, as noted above in ¶¶ 48-50. When calculating available storage, the space below the URC in Canadian reservoirs is calculated as available space. By filling the Canadian projects more, as Plaintiffs propose, Grand Coulee would have to draft deeper to maintain the same flood control protection for the Portland/Vancouver area. It is difficult to discern how the URCs were developed based on the GENESYS information provided.

- There are flows requirements at Vernita Bar to protect fall Chinook in the Hanford Reach. GENESYS modeling did not include these protective flows at Vernita Bar in 19 years.
- There are flows in the winter to provide for chum spawning and rearing. GENESYS modeling missed chum flows in 22 years.

79. Corps and Reclamation staff have not had sufficient time to review the model output; however, based on these preliminary observations, significant concerns have been raised about the outputs noted above, and therefore the assumptions used in the GENESYS are suspect. It is not clear based on the information supplied whether this was input error, a lack of understanding of the many requirements of the projects in Canada and the United States, or both. Based on my 18 years of experience working with the BPA and Corps models of the Columbia River Basin, the outputs of the GENESYS modeling used by the Plaintiffs should not be relied upon and do not "realistically simulate the FCRPS."

Seasonal Flow Objectives versus Peaking Hydrograph

80. Plaintiffs incorrectly characterize the current management of the FCRPS as meeting flat flow objectives on a seasonal basis and recommend managing flows to produce a peaking hydrograph. Apparently Plaintiffs lack the understanding in a water rich basin, such as the Columbia Basin, there is not enough storage capacity to significantly reshape natural runoff or shift the timing of the peak runoff to May, and that it is physically impossible to operate the Columbia River system "to a meet flat flow targets" as they assert. Storage capacity is approximately 32.2 MAF in a basin with total unregulated (natural) runoff ranging from about 50 MAF to 135 MAF during April through August period. As noted in ¶ 11 above, 32.2 MAF roughly represents the storage capacity available in the federal, Canadian, and Brownlee projects.

81. As discussed above, an objective in operating the Columbia Basin projects is to be as full as possible in April for salmon flows while retaining sufficient storage space for flood control. From April to June, the objective is to capture the peak flood runoff and refill the storage projects. Therefore, there is no flow augmentation from storage projects occurring in the spring to produce a "peaking hydrograph" as suggested by the Plaintiffs. Rather the management of flows in the spring is to reduce the peak of the hydrograph to minimize flooding by storing water and shape the resulting hydrograph for salmon

82. For example, the most recent average water year was 2002. In that year, the April through August runoff at The Dalles was about 94 MAF. During the refill period of April though June, 2002, the unregulated runoff at The Dalles was about 70 MAF or 102% of average. The required flood control storage space on April 15 was about 16.5 MAF in both Canada and United States. Only about 23% of the natural spring hydrograph from April though June

was required for flood control storage. The Canadian storage projects were drafted below their combined 8.9 MAF flood control requirement (Canadian portion) in 2002 and filled through July, therefore the refill of the Canadian storage projects contributed significantly to the reduction of the peak flow at The Dalles during the refill period. The regulated flow at The Dalles from April through June 2002 was about 46 MAF, where the outflow through the system mimicked the natural shape of the hydrograph. This is shown in Exhibit 3. The shape of the blue, regulated flow at The Dalles mimics the shape of the red, unregulated flow at The Dalles.

83. As discussed in the 2004 UPA/BiOp, the BiOps since 1995, and the annual Water Management Plans, there are seasonal flow objectives for the Snake and Columbia rivers, which are used as a way to assess the hydrosystem's performance in providing optimum instream flows for juvenile salmon and steelhead.

84. To calculate the seasonal average flows for the spring and summer period at Lower Granite and McNary dams, daily average flows are totaled and then an average flow is calculated for the spring and summer period. Contrary to the Plaintiffs' characterization of the operation of the FCRPS, seasonal flow objectives are not used in the real-time management of the system.

Increasing Water Velocity By Operating Run-of-River Projects at MOP

85. Water velocities in the run-of-river projects can be increased by operating these projects at the lower end of their operating range. Lowering the level of the reservoir reduces the cross-sectional area of the river increasing water velocities and improving juvenile salmonid migration. The powerhouse, fish facilities, navigational locks, recreational access and other

facilities were designed to operate at or above the minimum operating pool (MOP), and would not function properly if these projects were operated below MOP.

Lower Snake River Dams

86. The four lower Snake River run-of-river dams, Lower Granite, Little Goose, Lower Monumental, and Ice Harbor, historically operated throughout the limited operating range of three to five feet to meet daily power demands, and to respond to changing flow conditions.

87. In 1992, the Corps decided to operate the four lower Snake River dams at MOP[11] in order to increase water velocities and improve juvenile salmon migration. The NMFS BiOps have consistently recommended the MOP operations in lower Snake River projects since 1992.

88. The typical reservoir elevation fluctuation is up to one foot at the four lower Snake River Dams when operating at MOP; in other words, there is a one-foot operating range. When operating to MOP, or any other defined reservoir elevation, some fluctuation occurs as a result of upstream flow changes, wind and wave action, and power generation at the dam.

89. From 2003 through 2005 Lower Granite, Little Goose and Ice Harbor dams have operated above the recommended MOP operation because shoaling in the 14 foot navigation channel caused unsafe navigation in some areas and maintenance dredging was precluded. This navigation concern was addressed by the TMT and these projects were operated at higher ranges during fish passage season.

90. Plaintiffs have requested that the four Snake River projects be operated within one foot of MOP. The Corps is planning to conduct navigation channel maintenance this winter and operate the four lower Snake River projects within one foot of MOP, consistent with the

[11] At Lower Granite the operating range for MOP is between elevation 733 and 734 feet, at Little Goose it is 633 to 634 feet, at Lower Monumental 537 to 538 feet, and at Ice Harbor it is 437 to 438 feet.

Plaintiffs' request. However, in the event the scheduled dredging is not completed as planned or unforeseen navigation safety issues arise, adjustments to operating ranges and the timing of MOP operations will be coordinated with the TMT.

Lower Columbia River Dams

91. The four lower Columbia River mainstem dams are also run-of-river projects, and like the lower Snake projects, these projects have limited operating ranges. Unlike the lower Snake projects, however, the lower Columbia projects typically operate throughout their operating range. The one exception is John Day Dam, where the NMFS BiOps and the 2004/UPA provide that it operate at its lowest elevation that continues to allow irrigation from April 10 to September 30.

McNary Dam Operation at MOP

92. In their Motion, Plaintiffs have requested that McNary operate at MOP. At McNary Dam, the operating range is from elevation 335 to 340 feet. The normal operating range, however, is the top three feet of this five foot operating range (from elevation 337 to 340 feet) to accommodate upstream fluctuations (from both the Columbia and Snake rivers), and power generation.

93. Operating McNary Dam at MOP as requested by the Plaintiffs presents problems with navigation as well as other concerns described below. The navigation channel, and in particular the approach to the Ice Harbor navigation lock (upstream of McNary Dam) is impeded by rock pinnacles that may interfere with safe navigation if this project were operated at MOP. Dredging this area to remove the rock pinnacles is not routinely conducted and is not included in the planned maintenance dredging of the lower Snake projects

(discussed in ¶90 above) because operating lower than its normal operating range had not been contemplated previously.

94. In addition to the navigation concerns, a significant area of new shoreline would be exposed with Plaintiffs proposal, subjecting it to erosion due to wind and wave action. This area has a history of significant use by Native American Tribes and is rich in cultural artifacts and sites. Operating the McNary pool at MOP may result in exposing cultural artifacts and increased vandalism.

95. There would also be some impact to recreational users of the McNary reservoir. For instance, utility connections to mooring slips at some marinas would need to be modified in order to avoid damage, boats would need to be moved because their drafts at the mooring slip locations exceed the water depth at the lower pool elevations, and some boat ramps and beaches would be unusable.

96. I have reviewed the information contained in the Columbia River Salmon Flow Measures Options Analysis/EIS concerning changes in water particle travel time associated with operating McNary Dam at MOP. As noted in Exhibit 4, Appendix M, Table M-2, the estimated reduction in travel time between elevation 337 and 335 feet, would be 0.2 days with flows of 100 kcfs; 0.1 day with flows of 200 kcfs; and, with flows of 300 kcfs there was no measurable change.

97. Given the relationship between increased flow and survival as asserted by Mr. Heinith has not been adequately demonstrated, (*see*, Second Declaration of Williams and Fourth Declaration of Peters ¶ ¶ 64-66), and the nature and degree of problems associated with Plaintiffs' proposed McNary MOP operation, the Corps plans to continue to operate McNary

Dam in its normal operating range, from 337 feet to 340 feet (*see*, Second Declaration of Col. Martin ¶13).

John Day Operation at "MIP"

98. The typical operating range for John Day is elevation 262.5 to 265 feet. Since 1992, John Day Dam has operated at elevation 262.5 feet to 264.0 feet during the salmon migration season unless higher pool levels were necessary for irrigation. As river flow decreases over the summer, there is less of a backwater effect at John Day Dam, impacting some irrigation facilities.

99. Plaintiffs have requested John Day Dam be operated at what they refer to as minimum irrigation pool "MIP." The Corps interprets this request to be consistent with the 2004 UPA/BiOp operation and plans to continue operating John Day from elevation 262.5 to 264.0 feet unless and until irrigation facilities are impacted. Changing from operating in the 262.5 to 264.0 feet to a higher elevation would be coordinated through the TMT.

Conclusion

100. Plaintiffs and their proffered expert Mr. Heinith simply are not experts in water management and have presented a proposal that cannot fully be implemented, would be unlikely to achieve their stated objectives, and could have adverse impacts on other listed species. Plaintiffs have attempted to rely on measures that either cannot be delivered, such as water subject to the provisions of the Columbia River Treaty; have recommended procedures that are not practicable and unnecessary, principally bi-weekly URCs; and, have inaccurately modeled a complex international river system.

101. Pursuant to 28 U.S.C. § 1746, I declare under the penalty of perjury that the foregoing is true and correct to the best of my knowledge, based on my education, experience and professional judgment. Executed November 21, 2005, at Portland, Oregon.

Cynthia A. Henriksen
Northwestern Division,
U.S. Army Corp of Engineers

Appendix A

An Overview of U.S. Army Corps of Engineers FCRPS Storage Project Seasonal Operations

Libby Operating Strategy

1. Prior to the Biological Opinions, the Corps targeted elevation 2411 feet on December 31 for flood control. In 2003, based on recommendations by NMFS and USFWS, the Corps developed a forecast procedure enabling the end of December flood control elevation to be higher than elevation 2411 feet if the water supply forecast was expected to be below average. This is to increase the probability of reaching an April 10 upper rule curve in low water years, when there is less risk that the reservoir would fill above the URC and increase the risk of flooding. In above average water years, the operation may result in Libby being higher than the monthly flood control storage amounts, because releasing the water in January through April would cause Kootenay Lake to fill and exceed its maximum storage elevation defined in the1938 International Joint Commission Order for Kootenay Lake. Hence, in these higher runoff years, the end of December elevation is 2411.

2. During the winter period, January through March, the reservoir is operated to the VARQ end of month flood control elevations. In years when inflows are low, Libby releases minimum outflow, i.e. 4 kcfs. Releases of less than 10 kcfs from Libby during the winter are considered to be advantageous to the upstream migration, spawning, and larval development of burbot in the Kootenai River. Operating Libby to a higher end of December flood control elevation and a higher VARQ flood control elevation increases the likelihood of lesser outflow in the winter period, to the benefit of burbot. Some years, even with these minimum releases, when water supply or inflow is low, the reservoir may not refill to the end of March (or April 10) URC.

3. During the spring period from April through June, the objective is to refill the reservoir by June 30, and meet the spring flow objectives for listed salmonids in the lower Columbia River (as set forth in the 2004 UPA/BiOp) and the listed Kootenai River white sturgeon (sturgeon) and bull trout [1] in the Kootenai River downstream of Libby Dam. Every year the USFWS requests specific flow regimes for the listed white sturgeon. The flow released for sturgeon may be greater than inflow to the reservoir therefore Libby reservoir may not refill by June 30. For example, in 2004

[1] The Kootenai River white sturgeon are listed as endangered by the U.S. Fish and Wildlife Service. This species resides in the Kootenai River downstream of Libby Dam. The bull trout, listed as threatened, that are affected by Libby dam operations reside in the tributaries feeding into the reservoir (Lake Koocanusa), within the reservoir, and below Libby Dam. The operations of this project require significant coordination between NMFS and the USFWS concerning the noted listed species, and burbot, which also reside below the project, in addition to the other coordination activities identified previously concerning the Columbia River Treaty.

the Corps operated Libby consistent with a System Operation Request[2] (SOR) that requested flows of 18 kcfs at a location downstream of Libby Dam for four consecutive weeks. As a result of releasing the requested outflow for sturgeon, Libby was 9 feet from full by the end of June. An added management issue concerns the provision of releases for spring flow augmentation without causing downstream flooding.

4. During the summer months from July through the end of August, Libby operates to augment flow in the lower Columbia River by drafting to elevation 2439 feet. Since operations began for listed fish species in the mid-1990's, Libby has been near full by the end of June except in very dry water years, or years when the sturgeon outflow in spring compromised refill of the reservoir. In those very dry years, the outflow during the summer months was 6 kcfs to support listed bull trout downstream in the Kootenai River.

5. In the fall period from September through December, Libby usually is about 20 feet from full at the beginning of September. The reservoir generally drafts through the fall period when the operating strategy is to target the variable end of December flood control elevation.

6. The Libby – Arrow "swap" is described in Paragraph 11 of the Libby Coordination Agreement (LCA) (February 16, 2000). The LCA allows either Entity to request storage releases from Canadian Storage in exchange for Libby releases during the July 1 through August 31 of any given year. This is not an agreement to carry out such operation; it provides for negotiation of such an operation if either Entity wishes to consider the operation in any year. A "swap" operation means that Libby outflow is reduced during July and August, while the outflow from Canadian Treaty storage is increased an equal amount during the same time. Therefore there is no additional flow crossing the U.S. Canadian border, although the origin of the water may be from Canadian storage rather than Libby. Mr. Heinith is incorrect in his characterization of the Libby – Arrow "swap" of storage. He says in paragraph 11 of his declaration that, "[t]he entities have also consummated an agreement to provide a water "swap" between Libby and Arrow Lakes Treaty Storage to benefit white sturgeon spawning in the Kootenai River and to allow for summer flow augmentation." He goes on to say that, "[b]enefits to Canada may include financial remuneration." This agreement does not guarantee any operation, nor does it define any monetary payment, so Mr. Heinith has mischaracterized the agreements and operations with Canada.

<u>Dworshak Operating Strategy</u>

7. With the Biological Opinion provision for an 80 foot summer draft to elevation 1520 feet, Dworshak is usually below its end-of-December flood control upper limit of

[2] SOR 2004-FWS1, submitted by Susan Martin, USFWS, requesting flow at Leonia of 18 kcfs, received May 20, 2004

1558. In the winter period from January through March, Dworshak operates to the end of month URC, or, in low water years, to minimum outflow.

8. In years when the April through July water supply forecast at Dworshak is generally less than 3 MAF, system flood control space requirements may be shifted from Dworshak to Grand Coulee. These shifts do not occur in larger water years because system flood protection would be compromised. This shift in system flood control space allows Dworshak reservoir to be higher than it might otherwise have been in April in order to have additional water to enhance flow augmentation for early migrants in the lower Snake River in April and May. In order to preserve system flood protection, a shift of an equal amount of space to Grand Coulee is allowable because it is approximately equidistance to Portland. This operation poses some flood risk as was seen in both 2000 and 2002 when Dworshak reservoir was well above its end of April URC. High outflows of near 16 kcfs continued into May to ensure there was adequate space in the reservoir to capture the remaining snowmelt. These shifts do not occur in higher water years because system flood protection would be compromised.

9. In the spring, Dworshak is operated to shape outflow for the benefit of salmon while retaining a high probability of achieving refill by the end of June in order to provide flow augmentation for summer migrants.

10. Once Dworshak reaches full at the end of June, the reservoir operates for flow augmentation in July and August. Although NMFS BiOps have recommended drafting Dworshak 80 feet from elevation 1600 to elevation 1520 feet between July 1 and the end of August, through adaptive management Dworshak has operated to the operation recommended by the Nez Perce Tribe and the State of Idaho to reach 1535 feet by the end of August in 1996, and 2002, 2003, 2004, and 2005. In these years, the remaining 200 KAF between elevation 1535 feet and 1520 feet was released in September for flow augmentation.

11. The water released from Dworshak from late June into September is also used to cool the water downstream in the lower Snake River. The temperature of the water released from Dworshak is often 43 to 45 degrees Fahrenheit during the late June through September period. The cold water is used to moderate water temperatures at the tailrace of Lower Granite with the objective of keeping the temperature below the state standard of 68 degrees.

12. In the fall period from September through December, Dworshak is at elevation 1520 feet and releases minimum flow through December. If there are rain events in November and December, Dworshak may store that water no higher than the winter URC of 1558 feet. In dry fall periods such as 2000, 2002, and 2003, Dworshak may draft several feet below 1520 feet from September through December as it releases minimum outflow near 1.3 kcfs.