# Response to Draft Application For New License

## Hells Canyon Complex, FERC Project No. 1971
## Wallowa-Whitman and Payette National Forests

# Executive Summary

## Introduction

In September, 2002 Idaho Power Company (IPC) released their Draft License Application (DLA) for review and comment. A Forest Service interdisciplinary team comprised of resource professionals from the Payette and Wallowa Whitman National Forests has worked with Regional Office Staff from Forest Service Regions 4 and 6 to prepare the Response Document and supporting information contained in this document.

The Hells Canyon Hydroelectric Project Complex (HCC) is the largest non-federal hydroelectric facility that will be relicensed on National Forest System (NFS) lands in the Pacific Northwest. The project occupies or potentially effects significant NFS lands and resources including 71.5 miles of Congressionally designated Wild and Scenic river administered by the Forest Service below the Hells Canyon Dam. The 1166-megawatt project provides power over a 20,000 square mile region to over 814,000 potential customers in Southern Idaho and eastern Oregon.

The following table displays the NFS acres that could be affected by the project.

| **National Forest System Acres Potentially Affected by the Project** | | | |
|---|---|---|---|
| **County (Co.) that NFS acres are located in** | **Acres tied to IPC's associated Tier 2 Study Area** | **Acres within Project Boundary** | **Acres with Transmission lines** |
| Baker Co., OR | 236 | 0 | 0 |
| Wallowa Co., OR | 148,350 | 450 (approximate) | 408 |
| Washington Co., ID | 29,440 | 0 | <50 |
| Adams Co., ID | 64,780 | 910 | 126 |
| Idaho Co., ID | 110,318 | 0 | 0 |

Snake River project mileages are displayed below.

| **Snake River Project Mileage** | |
|---|---|
| Weiser to the northern boundary of the HCNRA | 175 miles |
| Mileage adjacent to NFS lands | 90 miles |
| Wild and Scenic Snake River miles | 71.5 miles |
| Wild section | 31.5 miles |
| Scenic section | 40 miles |

The Congress recognized the significance of the Canyon when it established the Hells Canyon National Recreation Area and designated the Snake River below Hells Canyon Dam as a Wild and Scenic River in 1975 (PL 94-199).

The primary focus of the Forest Service review of the DLA was to evaluate the adequacy of scientific studies conducted by IPC and conclusions relative to project impacts to NFS lands and resources. IPC has produced an extensive application package that addresses many project impacts and proposed Protection, Mitigation and Enhancement (PM&E) measures. In some instances, Forest Service objectives have been addressed. However, there are still many areas where Forest Service conclusions differ with IPC's conclusions which point to minimal or no project effects to NFS lands and resources, or where the Forest Service maintains that PM&E measures proposed by IPC will not fulfill the management requirements for the Payette and Wallowa-Whitman National Forests.

The objectives of the Forest Service in a hydropower project licensing or relicensing are:

- "to encourage hydroelectric production where it is compatible with National Forest purposes" and
- "[t]o ensure that planning, construction, and operation of hydroelectric projects are performed in such a manner to protect or effectively utilize National Forest System lands and resources."[1]

The Forest Service achieves these objectives by ensuring that Forest Service terms and conditions submitted to FERC under the Federal Power Act[2] are:

- reasonably related to the protection and utilization of National Forest System lands and resources;
- will make the project consistent with the Land and Resource Management Plans of the Wallowa-Whitman and Payette National Forests; and
- are supported by substantial evidence.

## Summary of Forest Service Review of the DLA

The damming of the Snake River by Brownlee, Oxbow and Hells Canyon dams, and the continued operation of the HCC is altering the flow regimes, nutrient cycling, and sediment delivery and transport processes within the main stem of the Snake River. The HCC with the three flat-water reservoirs and the project facilities including transmission lines has resulted in numerous effects and impacts to NFS lands and resources. These effects and impacts include but are not limited to:

[1] See Forest Service Manual 2770.
[2] P.L. 66-280; 16 U.S.C. 797. The relevant passage reads, "…the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation…"

- Clear water flows downstream of Hells Canyon Dam, devoid of sediment are altering the river morphology, nutrient cycling, recreation use, riparian communities, and terrestrial and aquatic biota through Hells Canyon. Current operations are not maintaining or enhancing the fluvial geomorphic processes that serve as a basis for aquatic and riparian habitat and the protection of heritage sites.

- Under the proposed operational regime, project generated flows and flow fluctuations will continue to play a role affecting water quality, erosion of alluvial and fluvial features, spawning and rearing substrate, riparian communities, and continue to affect other riparian, terrestrial, and aquatic habitat components within and downstream of the HCC.

- Several significant adverse impacts to water quality will continue under the proposed operating regime including: 1) internal nutrient recycling, 2) shift in warmer fall and warmer spring water temperatures below Hells Canyon Dam, 3) low dissolved oxygen (DO), 4) elevated levels of inorganochlorine compounds and trace elements, and 5) total dissolved gas (TDG) violations below all three HCC dams.

- HCC operations will continue to inundate and affect downstream aquatic, riparian and terrestrial habitats for Threatened, Endangered and Sensitive (TES), and Management Indicator Species (MIS).

- Proposed project operations will continue to affect the aesthetic quality, the Outstanding Remarkable Values (ORV) of the Wild and Scenic Snake River and the recreational experience in Hells Canyon, on and adjacent to the project reservoirs and downstream of Hells Canyon Dam.

- Ongoing and proposed operations will continue to cause downstream sandbar and terrace erosion causing adverse impacts or loss of cultural resource sites, and/or deterioration of organic-based archaeological material.

## Summary of Forest Service Objectives in the Relicensing of the HCC

**For Sediment Dependent Resources:**

1. Minimize or prevent adverse effects of project operations on sandbars, terraces, aquatic habitats, and riparian ecosystems.
2. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats in cooperation with the Forest Service.
3. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, and riparian ecosystems that continue to be adversely affected by project operations. The plan would be developed by IPC, the Forest Service, and other interested parties.

**For Hydrologic Resources:**

1. Provide reservoir operations and main stem flow regimes that ensure the physical processes necessary to sustain or enhance channel morphology, function and stability; aquatic habitat; riparian resources; and water quality.
2. Modify HCC operations to mitigate for the continuing affects of the project on alluvial and fluvial features within and below the HCC.
3. Modify HCC operations to mitigate for the continuing affects of the project on water quality, riparian resources, and aquatic habitat within and below the HCC.
4. Modify HCC operations to mitigate for the continuing affects of the project on recreation resources below the HCC.
5. Analyze a range of potential operational scenarios to meet flow related resource goals and objectives

**For Water Quality:**

Coordinate with the States of Oregon and Idaho to:

1. Provide for water quality in and downstream of the HCC that meets State standards.
2. Provide water quality conditions that will permit recovery and long-term persistence of listed threatened and endangered fish.
3. Develop and implement a monitoring plan to evaluate whether water quality objectives are being met in the reservoirs and downstream in the Snake River below Hells Canyon Dam.

**For Fisheries Resources and Habitats:**

**Anadromous Fish** (fall chinook, spring/summer chinook, steelhead, and Pacific lamprey)

According to the DLA, IPC will not provide anadromous fish passage. IPC concluded that passage would not be feasible due to low smolt to adult returns and loss of habitat.

1. The Forest Service recommends that a reintroduction workgroup be created and funded by IPC that would include resource agencies, tribes, and stakeholders. The workgroup would address study needs and develop potential passage scenarios with a goal of reintroducing anadromous fish above Hells Canyon Dam during the next license term.
2. Provide habitat to recover populations of anadromous fish below Hells Canyon Dam in the Hells Canyon Reach to meet ESA and LRMP requirements.

**Native Fish**

1. Provide habitat to recover populations of bull trout below Hells Canyon Dam in the Hells Canyon Reach to meet ESA and LRMP requirements.
2. Reconnect populations of bull trout and redband trout that have been fragmented by HCC.
3. Improve habitat in waters affected by the HCC for native fish species.
4. Manage non-native species for viable populations when not in conflict with goals for native species.

**For Terrestrial Resources:**

1. Manage T&E, Regional Forester Sensitive, Management Indicator Species, and their habitats for compliance with Federal laws, regulations and polices.
2. Maintain and restore quality steppe/shrub habitat (crucial winter range) for mule deer, bighorn sheep, rocky mountain elk, and other dependent species to reduce the effects from the on-going continued impacts of inundation on steppe shrub habitats.
3. Maintain and restore native riparian plant communities along the reservoir edge and river reach downstream of HC dam allowing riparian dependent species to re-colonize habitats to more fully obtain ecosystem function that can provide long-term integrity and productivity of biological communities.
4. Manage forest system roads, lands and resources to meet applicable LRMP resource goals and objectives, and standards and guidelines while permitting IPC right-of-way for transmission lines. Resources include but are not limited to: system roads; streams and associated riparian habitat; TES, MIS, big game and raptors species and habitat management, and noxious weed management.
5. Maintain and restore plant communities composed of the desired native and non-native species, structure and composition that minimize noxious weed spread and introductions. Existing noxious weed populations will be treated and eradicated where possible and prevented from further spread when eradication is not imminent.

**For Recreation Resources:**

**River Recreation**

1. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats while incorporating recreation user needs.
2. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, riparian ecosystems, and recreation resources that have been affected by IPC project operations.
3. Maintain or enhance the valued recreational opportunities below Hells Canyon Dam. Prepare and implement a monitoring and mitigation plan that addresses

campsite carrying capacity and effects related to beach erosion. This plan would be developed by IPC and the Forest Service.

4. Maintain or enhance a quality recreational experience at the Hells Canyon launch site and related facilities (including road access). Maintain this site as a gateway or welcome site to the HCNRA that meets and manages the destination and launch point expectations of the visitor.
5. Maintain or enhance the ORVs for which the Wild and Scenic Snake River was designated.

**Reservoir Recreation**

1. Maintain the area's roaded natural character by providing recreational opportunities that represent a blend of developed and dispersed recreation settings and facilities.
2. Maintain and improve developed recreation facilities and sites, and to plan and develop new facilities and sites to meet the projected demand while protecting resource values.
3. Manage and improve trail user's opportunities while maintaining the area's characteristic landscapes and protecting all resources. The trail use and design emphasis is for non-motorized access.
4. Provide safe and efficient access for movement of people and materials on Forest Service lands while meeting resource criteria.
5. Develop a reservoir recreation monitoring plan.

**For Aesthetic Resources:**

1. Develop management strategies to achieve the Desired Landscape Character and to meet scenic integrity goals as recommended by the Landscape Aesthetics Study (E.6.3).
2. Where practical make efforts to have all facilities, towers, substations, structures, etc., harmonize with or subordinate to the landscape.
3. Monitor resources and user preferences on a six-year cycle to ensure scenic integrity objectives are being met.

**For Heritage Resources:**

1. Facilitate the completion of a Cultural Resource Management Plan (CRMP) for that area of the Area of Potential Effect (APE) downstream from the Complex.
2. Supplement IPC proposed CRMP with additional educational and interpretive information opportunities, as well as improve IPC's proposed monitoring programs by articulating exact methodology and increase the frequency of site visitation. Also provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate effects to historic properties.
3. Provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate emerging effects to historic properties (36 CFR 800).

4. Identify and evaluate all historic properties within the APE. Protect and/or mitigate cultural resource sites that are affected by project erosion/ramping activity, recreation/vandalism and transmission line road impacts. Mitigate for impacts when sites cannot be protected (36 CFR 800).
5. Mitigate for adverse effects to organic-based archaeological material (36 CFR 800).
6. Mitigate for cultural resource sites impounded by the Hells Canyon Reservoir (36 CFR 800).
7. Extend the APE below the Salmon River confluence to at least the Oregon-Washington State line (36 CFR 800).
8. Conduct archaeological site protection measures (e.g. armoring) and/or testing, evaluation and data recovery, as needed, to rectify continuing or future adverse effects to heritage resource sites located at Big Bar and Eckles Creek on the Payette National Forest (36 CFR 800); and conduct a monitoring program at Red Fish Cave to insure archaeological properties associated with the cave remain protected (cf. Section 110 of the NHPA).

## Conclusion

The Forest Service will continue to seek to work in a collaborative manner with IPC and other interested parties to resolve differences with the company arising from Forest Service comments on the DLA. It is not unusual for differences in study interpretations to arise at this point in the licensing process. FERC regulations provide for “a dispute resolution” meeting. The Forest Service will fully participate in dispute resolution meetings being scheduled by IPC in early March

# Aquatics

The aquatics section consists of the Forest Service responses to sediment, project hydrology, water quality, and fisheries related issues.

# Sediment

## General Discussion

The Forest Service disagrees with Idaho Power Company's (IPC's) conclusions that the HCC has no effect on sediment resources downstream of Hells Canyon Dam. The Forest Service finds several components of IPC's analyses related to sediment to be misleading, invalid, and inconsistent with basic principles of river processes and sediment transport. Technical Report Appendix E.1-1 has significant flaws and contradictory conclusions (see comments specific to Technical Report Appendix E.1-1). Because the analysis leads to an erroneous conclusion, IPC has not proposed any PM&E's to manage the continuing degradation of downstream river beaches.

The Forest Service maintains that the HCC is largely responsible for degradation of sediment and sediment-dependent resources in Hells Canyon.

The construction and operation of the HCC has interrupted transport of silts, sands, and gravels from upstream sources, resulting in significant erosion of sandbars and terraces. This has reduced the availability of spawning gravels, juvenile fish rearing areas, camping sites for recreationists, and protection of terraces that contain important heritage resources.

The Forest Service maintains the studies and analyses are deficient in the following areas:

1. IPC did not present a comprehensive sediment budget by size class.
2. The supply of sand and gravel to HCC from upstream sources is underestimated.
3. Sediment yields from tributaries downstream of the HCC are grossly overestimated.
4. Sediment directly intercepted along the 94-mile length of the project is not addressed.
5. Incipient motion estimates of spawning gravels are most likely invalid.
6. The temporal scope of sandbar measurements does not adequately cover the post-dam period.
7. The effects of daily ramping (up to 15,000 cfs) on sandbar and terrace erosion are not addressed.
8. IPC failed to incorporate flow scenarios into the sediment analysis.

These conclusions are consistent with those made by Wilcock et al (2002), O'Connor (2002), and Andrews and Vincent (2002).

One key question in addressing the rate of sandbar degradation is how much sediment (by size class) is being trapped by the HCC that would otherwise enter Hells Canyon reach. IPC partly addressed sediment supply from the Snake River upstream of the HCC by estimating the volume of material trapped in Brownlee Reservoir. However, IPC failed to address sediment supply from tributaries that drain directly into the 94-mile length of the complex. In addition, IPC's estimates of sediment supply downstream of the complex are not realistic (Wilcock et al 2002, O'Connor 2002, and Andrews and Vincent 2002).

In addition, IPC failed to address the effect of daily operations (ramping) on sandbar and terrace erosion. Sandbar erosion can occur through three mechanisms: main channel erosion, seepage-induced erosion, and wave action (USDI 1995). Main channel erosion is likely a function of sediment supply, which is partly addressed in IPC's analysis. However, seepage-induced erosion that may be associated with daily ramping is not addressed. Seepage-induced erosion, caused by down-ramping and river fluctuations has been documented in Grand Canyon (Budhu 1992). The sandbar surfaces in Hells Canyon reach typically have gently slopes, which would suggest that seepage-induced erosion may not be occurring. However, the terraces are typically vertical, which may indicate seepage-induced erosion (caused by ramping).

IPC failed to incorporate flow scenarios into the sediment analysis. The studies should have focused on the relative effects of various operational scenarios on sediment resources. But, the flow scenarios described by IPC are inherently flawed (see comments on E.1-4, Chapter 3). It appears that IPC assumes sediment resources would be unaffected by any flow scenario.

## Comments Specific to the Draft License Application

Quotations or sections taken directly from the draft license application are shown in italics.

**Exhibit B. Statement of Project Operation and Resource Utilization.**

1. Page B-9. At the end of section B.1.2.2, Chapter 4 of Technical Report E.1-4 is referenced to describe proposed operations. Chapter 4 of Technical Report E.1-4 does not discuss proposed operations. This may be a typo. Chapter 3 of Technical Report E.1-4 is the document that describes proposed operations.

2. Page B-20. Figure B-3 is not consistent with Figure 3 in Technical Report E.1-4, Chapter 3 (Hells Canyon Complex Operations Modeling). Page B-9 says that Figures B-3, B-4, and B-5 represent low, median, and high inflow years based on proposed operations. Proposed operations are described in Chapter 3 of E.1-4. The Figures in both documents for low, median, and high inflow years should match.

3. Page B-21. Figure B-4 is not consistent with Figure 4 in Technical Report E.1-4, Chapter 3 (Hells Canyon Complex Operations Modeling). Page B-9 says that Figures

B-3, B-4, and B-5 represent low, median, and high inflow years based on proposed operations. Proposed operations are described in Chapter 3 of E.1-4. The Figures in both documents for low, median, and high inflow years should match.

4. Page B-22. Figure B-5 is not consistent with Figure 5 in Technical Report E.1-4, Chapter 3 (Hells Canyon Complex Operations Modeling). Page B-9 says that Figures B-3, B-4, and B-5 represent low, median, and high inflow years based on proposed operations. Proposed operations are described in Chapter 3 of E.1-4. The Figures in both documents for low, median, and high inflow years should match.

**Exhibit E.0. Conceptual Overview of Integration.**

1. Page E.0-2…*the Applicant conducted a series of integrated resource-specific studies to evaluate both positive and negative impacts of certain operational scenarios for managing water flows and reservoir levels in the Hells Canyon Complex. These studies are referred to as flow-related studies….specifically, the Applicant investigated influences of operational scenarios on aesthetic, wildlife, aquatic, botanical, cultural resources, as well as effects on recreation, sediment, and water quality.*

   Appendix Reports E.1-1 and E.1-2, do not describe the effects of IPC's two operational flow scenarios on sediment resources. In these documents, IPC concludes that construction and operation of the HCC has not affected sediment supply in Hells Canyon.

2. Page E.0-3. *Consistent with FERC regulations, the intent of these studies was to identify operational impacts to natural resources from the Applicant's proposed operations of the Hells Canyon Complex.*

   In Appendix Reports E.1-1 and E.1-2, IPC did analyze the effects of construction and operation of the HCC on sediment resources. However, there is no discussion about the two operational flow scenarios, and how the effects of these scenarios may differ in terms of effects on sediment.

**Exhibit E.1. General Description of Project Locale**

1. Page E.1-11. *The Hells Canyon Complex…is unable to significantly shape monthly, annual, or peak flows that control the channel form in Hells Canyon.*

   It is true that the HCC has had little effect on annual peak flows (Collier et al 1996, Grams and Schmidt 1999a). However, the complex has had significant effects on seasonal and daily discharge patterns. An analysis of flow frequencies greater than 30,000 cfs (pre and post dam construction) finds that flows of this magnitude occur from December through June with the only significant flow change between pre and post dam construction occurring in February (U.S. Department of Agriculture 1999, unpublished). In February, the occurrence of 30,000 cfs flows increased from 11%

prior dam to 21% post dam. Flows greater than 50,000 cfs occur from March through June with no significant difference noted prior to and post HCC (USDA 1999, unpublished). In addition, there has been a change in fall and winter flow levels since the completion of the HCC. Low fall flows and winter ice used to be common in the Snake River. Today, fall flows are slightly lower and warmer than those recorded prior to the HCC and are held steady for fall chinook salmon spawning. Prior to the HCC development, the Snake River experienced icing conditions with some frequency. With the current regulation and warmer water, winter ice is rare.

Evidence suggests that the greatest change to the Snake River flow regime from dam construction is in the daily and hourly flow fluctuations (Grams and Schmidt 1999, USDA 1999, unpublished). Prior to construction of the complex, the change in discharge over a six-hour time period ranged between 250 and 500 cfs. Current and proposed operations allow for as much as 15,000 cfs fluctuations on a daily basis and 2,000-3,000 cfs on an hourly basis. However, these flow changes may occur in time intervals as short as 15 minutes. Research from Glen Canyon Dam found downstream erosion to be more affected by down-ramping than up-ramping (USDI 1995). In the Snake River, daily and hourly flow fluctuations may be affecting heritage resources, riparian and aquatic plant and animal communities, and recreation resources by increasing the rate of erosion of sandbars and terraces. Thus the current and proposed ramping of the project may aggravate the adverse effects on sandbar maintenance due to the lack of sediment transport through HCC.

2. Page E.1-11. *For the past 1,000 years, local and regional climate conditions have remained essentially unchanged…Therefore, it is reasonable to assume that natural streamflows in the Snake River have also changed little during the same period.*

   It is not reasonable to assume that natural streamflows in the Snake River have remained unchanged during the past 1,000 years. Substantial water resource development has occurred throughout the Snake River basin during the past 150 years, which has changed hydrologic regimes dramatically. This fact is mentioned on page E.1-12.

3. Page E.1-12. *Anthropogenic disturbances over the past 150 years have affected physical processes throughout the Snake River watershed generally and in the Hells Canyon reach specifically.*

   The physical processes mentioned above refer to the sediment "slug" theory that is discussed throughout Technical Reports E.1-1 and E.1-2. IPC suggests that intensive land uses throughout the Snake River watershed first caused significant increases in sediment supply, and then subsequent decreases in supply after several dams and diversions were constructed. The combination of these factors produced a "slug" of sediment that worked its way through the system but may now have mostly disappeared. IPC contends that erosion of sandbars and terraces is the result of this "slug" of sediment making its way out of Hells Canyon. There is no scientific data to support this "slug" theory. If there truly is a "slug" of sediment in the Snake River

system, it is possible that it could be located upstream of the HCC or somewhere in the Columbia River. IPC presents no data that supports the slug theory in general, or that this "slug" happens to be downstream of the HCC.

4. Page E.1-13. *During the past 70 years, the bedload upstream of the Hells Canyon Complex has been restricted to sand and gravel sizes, with a median size of 30 mm (1.2 inches) or smaller…In contrast, the average median size of surface layer materials is 144 mm (5.7 inches) in the reach downstream of Hells Canyon Dam to the confluence with the Salmon River. The applicant calculated that flows in the Snake River must exceed 200 feet in depth to move material this large through the reach located between the confluence of the Snake and Weiser Rivers and Brownlee Reservoir. Given current hydrological conditions in the Snake River upstream of the Hells Canyon Complex, materials of the sizes that dominate the river downstream of the complex cannot be transported.*

   The fact that the Snake River would have to exceed 200 feet in depth to move the size of material found in Hells Canyon is not the issue. The Forest Service is concerned about resources that are dependent on smaller size classes such as sands and gravels, which are being transported to the HCC from the Weiser reach. River features, such as sandbars and terraces are made up of materials ranging in size between 0.062 and 2.0 mm. This is the size range of materials that has been transported to the HCC during the past 70 years (as stated above). Particles that are 144 mm in size are not useful in maintaining critical river features such as spawning beds, sandbars, and terraces in Hells Canyon.

   It is curious to note that IPC concludes that the Snake River upstream of the HCC is capable of moving gravels as large as 1.2 inches, but then concludes that spawning gravels as small as 1 inch in Hells Canyon do not move, even during flows exceeding 100,000 cfs. The Snake River in Hells Canyon is much steeper and more confined than upstream of the HCC, and therefore has a higher transport capacity. This contradiction indicates that IPC's analysis of incipient motion in both reaches is questionable.

5. Page E.1-13-14. *The stability of the Snake River is further illustrated by the lack of mobility for riverbed materials at the U.S. Geological Survey gauge at Weiser. At this location, the cross sections that were initially surveyed when the gauge was installed in 1910, as well as the rating curves to estimate flow, show that the river channel has experienced minor changes but no substantial degradation, aggradation, or lateral movement.*

   This conclusion is not relevant to Forest Service concerns about sediment supply. Channel stability over time does not mean the bed is not mobile. If erosion is balanced by deposition, bedload can be transported while the morphological channel characteristics remain unchanged.

In addition, riverbed material (bedload) does not typically make up the largest proportion of the total sediment load. The proportion of bedload to total sediment load can range from a few percent in low gradient rivers to 15% in steep mountain rivers (Collins and Dunne 1990).

6. Page E.1-14. *Approximately 96% of the sediment trapped in Brownlee Reservoir consists of fine sand, very fine sand, and silt/clay. Most of the fine-grained materials trapped in Brownlee Reservoir would flush through the Hells Canyon reach if the Hells Canyon Complex did not exist: the transport capacity of the Snake River is much higher in Hells Canyon because of the steeper gradient than in the unimpounded reach above Brownlee Reservoir.*

   Not all silts and clays would be flushed through the Hells Canyon reach. Some silts and clays would likely deposit in eddies and backwaters and be available to enhance establishment of riparian vegetation.

7. Page E.1-14. *The average sediment yield from the 17 tributaries is 28,100 tons per square mile per year. Applying this sediment yield to remaining 45% of area produces a total estimated sediment supply of 16.6 million tons per year.*

   Based on comparisons of sediment yields from the literature and Table 7 in Technical Report E.1-1, 28,100 tons per square mile per year appears to be a gross overestimate. The average of all the sediment yield values in Table 7 is 956 tons/mi$^2$/year. Sediment yield values from tributaries in Grand Canyon are all less than 500 tons/mi$^2$/year based on the values given in Table 7. Grand Canyon and lands located on the Colorado Plateau are well known for sparse vegetation and high erosion rates. Hells Canyon contains a mosaic of forests, grasslands, and bedrock outcrops. It seems unreasonable that Hells Canyon reach would produce 50 times more sediment per year than sparsely vegetated, erodible landscapes in Grand Canyon.

   Wilcock et al, 2002, Andrews and Vincent, 2002, and O'Connor, 2002 conclude that IPC's estimates of sediment yield from the Hells Canyon reach tributaries are unreasonable. The uncertainty associated with the bedload transport equation could be as high as an order of magnitude (Wilcock et al 2002). The IPC flow duration values (exceedance) were generated by fitting a logarithmic curve to only 3 points (20, 50, and 80 percent exceedance). The standard error associated with using only the 3 points is very high. Based on the uncertainty of flow estimates (exceedance values) and the bedload transport, the Forest Service has very little confidence in IPC's estimates of sediment yield in the Hells Canyon reach tributaries.

   The Lower Salmon River and the Snake River have similar morphological characteristics, especially near their confluence. In addition, the Lower Salmon River Canyon is very similar to the Hells Canyon reach in terms of geologic structure. If the Hells Canyon reach tributaries are truly contributing the volumes of material that IPC estimates, it would seem reasonable that the Salmon and Snake River would have similar particle size distributions. In reality, the particle size distribution of the Snake

River changes drastically, downstream of the Salmon River confluence (see Figure 2 page 36 of this document). This suggests radically different sediment supply characteristics between the two rivers.

8. Page E.1-15. *Analyses indicate that sediments from bed materials downstream of the Hells Canyon Complex have a distinctly different mineralogy than those collected upstream of the Hells Canyon Complex. The most distinctive differences is the lack of acidic-intrusive bed material, such as granite or granodiorite, in the coarse fraction and the lack of potash feldspar in the finer grained fraction in the downstream reach than in the reach above the complex. These differences suggest that most of the bed materials downstream of the Hells Canyon Dam are derived from local canyon sources, not from sources upstream of the Hells Canyon Complex.*

   It is not surprising that the bed materials currently found in the Snake River are derived from local sources. The Forest Service contends that upstream sources have been prevented from entering the Hells Canyon reach by the HCC.

9. Page E.1-16.…*over 96% of the sediments trapped in Brownlee Reservoir are composed of fine sand fractions (<0.25mm). Therefore, sediments deposited in Brownlee Reservoir do not provide the size range of sediments required to maintain sandbars downstream of Hells Canyon Dam.*

   IPC collected several core samples in Brownlee Reservoir. Several shallow samples were collected at 5-mile intervals along the thalweg to approximately 8 miles upstream of the reservoir (RM285 – RM340), and 3 deep core samples were collected near RM320 and RM324.

   The 4% value is a volume-weighted average of the fine sand and larger material in the reservoir, based on the shallow samples (Anderson, K. 2002). This conclusion is misleading because the amount of material larger than fine sand is expressed as a proportion, rather than a total volume or weight. The proportion of larger material (sands and gravels) is overshadowed by the large amounts of fine material produced by intensive agriculture upstream of the reservoir (see Figure 1, page 34 of this report).

   IPC estimates that Brownlee Reservoir has trapped approximately 62,000 acre-feet of sediment between 1958 and 1998. Using the 4% value and estimated submerged sediment density of 65 lbs/ft$^3$, approximately 2,500 acre feet (over 3.5 million tons) of fine sand and larger material would be in Brownlee Reservoir. Based on this value, an average of 88,000 tons of this material entered Brownlee Reservoir each year between 1958 and 1998. This is considered a very conservative estimate because IPC's sampling procedure is hardly adequate to fully characterize sediment size distributions in Brownlee Reservoir. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee

Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

The sampling strategy developed by IPC does not fully characterize the sediment deposition in Brownlee Reservoir. The distribution of size classes in any given cross-section and along 5 miles is likely to be quite variable. Therefore, the distribution of sediment size classes in the reservoir is considered to be a gross estimate. In addition, some sand size material may be deposited on the channel margins, and in backwater areas. These features were not sampled by IPC. Observations of sediment deposition at RM 239 suggest that sand and larger materials are forming bars in the reservoir/river, and allowing the colonization of riparian vegetation (Anderson, J. 2002).

Sandbars in Hells Canyon reach consist of material ranging between 0.062 mm (very fine sand) and 2mm (very fine gravel). The 4% value calculated by IPC does not account for material in the very fine sand size class. Therefore, the 4% value generated by IPC underestimates the volume of sandbar-building material.

In addition, the 94-mile HCC intercepts several tributaries and side canyons that supply sediment. IPC failed to account for this material in their analysis of sediment supply.

10. Page E.1-16. *Starting in 1997, after a 100-year flood event, the Applicant monitored sandbars at four locations between Hells Canyon Dam and the confluence with the Salmon River. Monitoring included measuring the size and shape of the sandbars, as well as using aerial photographs as part of a historical evaluation of these sandbars. Survey data, together with the aerial photography, indicate that sandbars have, and will continue to be, dynamic features of the river system, responding in size and shape to varying flows and sediment loads in the river. In general, the dramatic changes over the past 150 years in the Snake River basin suggest that sandbars described in historical accounts were not in dynamic equilibrium with the overall system. More likely, these features resulted from anthropogenic factors operating from the mid-1800s through the mid-1900s, coupled with the geomorphic and channel characteristics that allowed these sandbars to develop.*

    Credible conclusions about long term trends in sandbar characteristics cannot be drawn, based on IPC's data. IPC arrived at this conclusion through bar surveys, aerial photo analysis, and bar counts. Between 1997 and 2000, IPC conducted field surveys of Pine Bar, Salt Creek Bar, Fish Trap Bar, and China Bar. In general, the

survey data show both erosion and deposition during the survey periods, except for Salt Creek Bar, which shows only erosion between 1998 and 2000.

Using aerial photographs for the period 1946-1968, IPC calculated the surface areas of 10 sandbars (between RM192 and RM230). This investigation indicates no net decrease in sandbar surface area for the analysis period. The Forest Service finds several problems with the limited temporal scope of this analysis. Brownlee Dam was completed in 1958, and Oxbow and Hells Canyon Dams were completed in 1961 and 1967, respectively. As a result, IPC's analysis of aerial photos covering the period between 1946 and 1968 only evaluates a maximum of ten years of project effects. In contrast, Grams 1991, and Grams and Schmidt 1999a and 1999b, conducted much more comprehensive studies of sandbars in Hells Canyon using aerial photographs and field surveys. Their studies clearly document substantial erosion of sandbar features throughout the canyon, particularly along the upper reaches close to Hells Canyon Dam.

At the Tin Shed and Camp Creek sites, Grams and Schmidt 1999a, found that the 1996 sandbar surface areas for these two sites were only 23 and 32 percent of their size in 1964, respectively. In addition, Grams and Schmidt 1999b, documented that between 1955 and 1998, the number of sandbars in Hells Canyon reach decreased dramatically, and this decrease was more pronounced along the reaches closest to Hells Canyon Dam. This represents strong evidence that the HCC has reduced and eliminated important supplies of sediment from upstream sources.

In addition, IPC counted the number of sandbars using 1946 and 1955 aerial photographs, and found no net loss. Because the aerial photographs used in this analysis do not cover the post-dam period, it is impossible to draw conclusions about the effects the HCC has had on sandbar and terrace erosion from their analysis.

11. Page E.1-16. *At current flows, only one spawning site showed gravel movement for materials smaller than 1 inch. However, because 2-inch and larger sizes did not move, the movement of smaller material would tend to be limited. All gravel sizes at the remaining 16 sites were stable.*

To predict the entrainment and transport characteristics of spawning gravels, IPC used the relationship:

$$12.\ \theta = \tau_c / (\gamma_s - \gamma_f) d_i$$

Where $\theta$ equals the critical dimensionless shear stress, $\tau_c$ equals the bed shear stress, $\gamma_f$ equals the fluid density, $\gamma_s$ equals the sediment density, and $d_i$ equals the particle size in question. IPC chose a critical dimensionless shear stress value of 0.047. If the right side of the equation is larger than 0.047, the size of material in question is considered mobile. If the right side of the equation is less than 0.047, the size of material in question is considered stable.

IPC used a "cookbook" approach to assess the mobility of spawning gravel, which does not account for the extreme variability and complexity of sediment transport in

gravel bed rivers. The MIKE 11 1 dimensional hydrodynamic model generated shear stress values for flows ranging between 30,000 and 300,000 cfs. Bed shear stress can have relatively high spatial and temporal variability (Wohl 2000). Shear stress is very sensitive to water surface slope, and the MIKE 11 model may not provide an accurate representation of slopes over such a wide range of flows and channel characteristics. In addition, water depths generated by the model may not be fully accurate, especially if the bed is mobile and scour occurs. Andrews (1983) reported that a variety of bed material sizes maybe entrained within a small range of shear stress values (equal mobility). Therefore, small differences in shear stresses may create vastly different results in terms of bed mobility.

In Appendix E.1-1 (section 9.5.3), IPC provides detailed discussions about studies related to sediment transport and critical dimensionless shear stress. In particular, IPC referenced Andrews 1983, which describes a relationship between critical dimensionless shear stress and surface and sub-surface particle size distributions. Yet, in determining the critical dimensionless shear stress for spawning gravels, it appears that IPC arbitrarily used 1 and 2-inch particle sizes, without considering sub-surface particle size characteristics (Tables 9 and 10 of Appendix E.1-1). The critical dimensionless shear stress is more closely correlated with the ratio of the particle size in question to the median sub-surface particle size (Andrews 1983). Therefore, IPC's selection of 0.047 as the critical dimensionless shear stress value is likely invalid. If the surface particle sizes were significantly larger than the sub-surface particles (likely the case), then the critical dimensionless shear stress value would be lower.

12. Page E.1-17. *Except at a few locations, riverbanks in Hells Canyon are very stable. Results of a study of shoreline erosion (Technical Report E.3.2-42) indicate that the Hells Canyon reach is one of the most stable reaches studied. Erosion occurred at 60 sites, or in 3.9 of 125 miles (on both sides of the river). This area accounts for less than 3% of the reach.*

    This conclusion is misleading because the majority of the banks in Hells Canyon reach are well armored with large boulders and bedrock, and do not have the potential to erode. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach, which is why they are important recreation and heritage resources. The 3% of the reach where erosion is occurring are those areas the Forest Service is most concerned about (sandbars and terraces).

**Exhibit E.3.0 Report on Fish, Wildlife, and Botanical Resources**

Because various fish, wildlife, and botanical resources are dependent upon or related to sediment, IPC provided some general discussions about sediment and geomorphic processes in Exhibit E.3.0.

1. Page E.3-3. *In the last 150 years, human-caused, or anthropogenic, disturbances throughout the watershed first caused significant additional sediment supply to the system and then subsequent decreases in sediment supply, in part because of multiple*

*water resource projects such as the diversion and storage of water. The combination of these factors produced a "slug" of sediment that worked its way through the system but may now have mostly disappeared. Visitors to Hells Canyon in the early to middle twentieth century likely observed the effects of this slug of sediment working its way through the system.*

The "slug" theory is cited throughout in Appendix E.1-1 as a potential cause of "shrinking sandbars", yet IPC also concludes that the sandbars in Hells Canyon reach are stable. This is a significant contradiction.

On pages 72-79 of Appendix E.1-1, the authors suggest that sandbars in Hells Canyon reach are growing, shrinking, and changing shape in response to varying flows and sediment loads in the river. This is contrary to the above statement about "shrinking sandbars". In addition, IPC states that the Snake River at the Weiser Gage has been highly stable during the period of record. If a large "slug" of sediment passed the Weiser Gage at some point in the recent past, it would seem reasonable that it would have been detected by channel aggradation or other form of adjustment.

The Forest Service concurs with the idea that historic land uses accelerated erosion and sediment transport within the Snake River Basin. However, IPC presents no data that describes how and at what rate this pulse or "slug" of sediment is working its way through the Snake River system. IPC does not present any scientific evidence that supports the "slug" theory.

2. Page E.3-4. *Evidence indicates that anthropogenic factors in the last 150 years have changed sediment loads in the river by initially increasing and then decreasing them…therefore, evaluating only those changes that have occurred since the construction of HCC provides an incomplete picture for determining whether the construction and continued operation of the HCC affects the study area and if it does, how much and in what manner it affects it.*

   The above statement most likely refers to the "slug" theory. Grams and Schmidt 1999a and 1999b, determined that sandbar erosion decreases with distance downstream of Hells Canyon Dam. This finding alone is strong evidence that the construction of the HCC has indeed limited sediment supplies and contributed to sandbar and terrace erosion.

3. Page E.3-6. *…evidence strongly suggests that the Snake River has been a largely static river system for at least 1,000 years, if not longer (Hydrocomp 1990). Therefore, the HCC has had few effects on stream flows, sediment dynamics, and channel morphology in Hells Canyon.*

   This statement is inaccurate and misleading. The HCC has had little effect on annual peak flows and seasonal flows, but daily fluctuations have changed dramatically. Under current operations, flows change by as much as 15,000 cfs over a 24-hour period to meet daily power demands. These drastic fluctuations may be causing

downstream erosion of important recreation, botanical, and heritage resources (sandbars and terraces). In Grand Canyon, daily ramping has been shown to cause erosion of bank features (Budhu 1992). IPC neglected to address the effects of daily ramping on sandbar and terrace erosion in Hells Canyon reach.

Sediment dynamics have been changed dramatically by the construction of the HCC. More than 62,000 acre-feet of sediment has deposited in Brownlee Reservoir since 1958. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

4. Page E.3-6. *In terms of sediment dynamics, many of the potential channel responses to differing sediment inputs simply cannot compete with the larger geologic controls at work in the canyon. For example, decreased sediment loads generally cause riverbeds to armor, a response that decreases the zone of active sediment transport. In this case, the bed was already well armored long before the HCC was built, so only a minimal response would be detected.*

   This statement is completely unsupported. The Salmon River near its confluence with the Snake River is under the same set of "geological controls", but has a very different character. The lower Salmon River contains numerous, large sandbars that are popular camping sites for boaters. The particle size distributions in the Snake River are radically different upstream and downstream of the Salmon River confluence (see Figure 2, page 36 of this report), which indicates that the Salmon transports much finer material than the Snake. Figure 2 clearly indicates that the Snake River upstream of the Salmon River confluence is supply limited.

5. Page E.3-7. *The average $d_{50}$ of the surface layer in the reach from Hells Canyon Dam to the Salmon River is 144 mm. To move material of this size through the reach of the Snake River between the Weiser River and Brownlee Reservoir, the Snake River would have to flow at a depth of over 200 feet.*

   This statement is irrelevant. The Forest Service is not concerned about the mobility of 144 mm (8.8 inch) material. Sand and gravel size material is limited in the Hells Canyon reach because it is blocked by the HCC. Some of the key features in Hells Canyon reach, such as sandbars and terraces are made up of material small enough to be carried in suspension (sands and silts). It is estimated that as much as 214,000 tons

of sand size material is transported past the Weiser Gage each year (Wilcock et al. 2002). The HCC prevents this material from entering Hells Canyon, and is a direct project impact.

6. Page E.3-8. *Further evidence of the lack of bed-material mobility in this reach is the historical stability found at one of the U.S. Geological Survey (USGS) gauging stations. The stability of the river at the Snake River at Weiser (13269000) gauging station was evaluated, using both cross sections surveyed by the USGS over the time since the gauge was installed in 1910 and the rating curves developed by the USGS to estimate flow at this site. Both methods confirm that, in this location, the river has experienced some small changes but no substantial degradation, aggradation, or lateral movement.*

   Throughout Appendix E.1-1, bed mobility is often confused with stability. Rivers can obviously transport bedload and suspended sediment loads over time without significant channel adjustments. The fact that little change in channel morphology has been detected at the Weiser Gage merely indicates that this reach of the river is graded (Mackin 1948) and is most likely in an equilibrium state (Easterbrook 1993). In addition, most of the sediment load carried by rivers in suspension, which would have no effect on bed characteristics.

7. Page E.3-11. …*about 80% of the suspended sediment in the Snake River near Weiser is smaller than 0.062 mm, meaning that this sediment is predominantly silts and clays (smaller than very fine sand) (USGS 1997). This gauge is located downstream of all major tributaries to the Snake River before it enters Brownlee Reservoir.*

   Expressing the sand load as a percentage of the total load is misleading. In Appendix E.1-1 and Appendix E.1-2, IPC, the authors repeatedly discuss sediment load in terms of percentages instead of describing the real volumes and weights of material being blocked by the HCC. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

   In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

8. Page E.3-11. *Approximately 96% of the sediment trapped in Brownlee Reservoir consists of fine sand, very fine sand, and silt-clay (Appendix B to Technical Report E.1-1). This reservoir contains only about 8% of all sediment that was trapped*

*upstream of Hells Canyon between 1901 and 1999. Approximately 1,550 acre-feet of fine sediments from upstream of Brownlee Dam would have been transported downstream into Hells Canyon annually if the HCC had not been constructed.*

IPC collected several core samples in Brownlee Reservoir. Several shallow samples were collected at 5-mile intervals along the thalweg to approximately 8 miles upstream of the reservoir (RM 285 – RM 340), and 3 deep core samples were collected near River Mile (RM) 320 and RM324.

The 4% value is a volume-weighted average of the fine sand and larger material in the reservoir, based on the shallow samples (Anderson, K. 2002). This conclusion is misleading because the amount of material larger than fine sand is expressed as a proportion, rather than a total volume or weight. The proportion of larger material (sands and gravels) is overshadowed by the large amounts of fine material produced by intensive agriculture upstream of the reservoir (see Figure 1, page 34 of this report). IPC estimates that Brownlee Reservoir has trapped approximately 62,000 acre-feet of sediment between 1958 and 1998. Using the 4% value and an estimated submerged sediment density of 65 lbs/ft$^3$, approximately 2,500 acre feet (over 3.5 million tons) of fine sand and larger material would be in Brownlee Reservoir. Based on this value, an average of 88,000 tons of this material entered Brownlee Reservoir each year between 1958 and 1998. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

The sampling strategy developed by IPC does not fully characterize the sediment deposition in Brownlee Reservoir. The distribution of size classes in any given cross-section and along 5 miles is likely to be quite variable. Therefore, the distribution of sediment size classes in the reservoir is considered to be a gross estimate. In addition, some sand size material may be deposited on the channel margins, and in backwater areas. These features were not sampled by IPC. Observations of sediment deposition at RM 239 suggest that sand and larger materials are forming bars in the reservoir/river, and allowing the colonization of riparian vegetation (Anderson, J. 2002)

Sandbars in Hells Canyon consist of material ranging between 0.062 mm (very fine sand) and 2mm (very fine gravel). The 4% value calculated by IPC does not account

for material in the very fine sand size class. Therefore, the 4% value generated by IPC underestimates the volume of sandbar-building material.

In addition, recent storm events have resulted in considerable deposition of fine sediment in the Oxbow and Hells Canyon pools. This material is completely unaccounted for in IPC's analysis of project sediment storage.

9. Page E.3-12. *The Pine Creek drainage area is almost twice the drainage area of Wildhorse River (304 square miles and 177 square miles, respectively). However, transport calculations show that within the 1% exceedance flow, Pine Creek does not mobilize its bed, but Wildhorse River does. Although Pine Creek did not mobilize its bed during the 1997 flood event, the flows during this event far exceeded the 1% exceedance flow (calculated as the daily average by month, not as an annual peak) used in our analysis.*

   The determination that Pine Creek's bed does not mobilize during a 1% exceedance flow in no way indicates that sediment transport does not occur. Again, IPC confuses sediment load with bed mobility. Suspended load can certainly move through the system without the bed being mobilized (Dunne and Leopold 1978).

10. Page E.3-13. *The average sediment yield from these [Hells Canyon tributaries] was applied to the remaining 45% of that area, for an estimated total sediment supply of 16.6 million tons per year (Technical Report E.1-1). The same calculations for sand and spawning size gravels, respectively, are 2.52 million tons per year (15% of the total) and 7.06 million tons per year (42% of the total). To put these quantities in perspective, the annual quantity of sand that the tributaries supply is over six times the average annual load of sand-size material trapped in Brownlee Reservoir. Visual observations of the tributaries following high flow events support the findings that the tributaries do supply substantial quantities of sediments of all sizes to maintain the Snake River.*

    In Appendix E.1-1, the authors claim that the Snake River downstream of the HCC is highly stable, and that spawning gravels as small as 1 inch do not move, even at flows above 100,000 cfs. In addition, the authors estimate that the Hells Canyon reach tributaries contribute over 7 million tons of gravel annually. If this is truly the case, then the Snake River would be filled with approximately 2 feet of gravel material. This is a significant contradiction, and illustrates the fact that IPC's estimates of sediment yield and gravel mobility are not realistic.

    Wilcock et al 2002, conclude that IPC's estimates of sediment yield from the Hells Canyon reach tributaries are highly uncertain. This uncertainty arises from the transport equation itself and estimates of flow duration (Schoklitsch). The uncertainty associated with the bedload transport equation could be as high as an order of magnitude (Wilcock et al (2002).

The IPC flow duration values (exceedance) were generated by fitting a logarithmic curve to only 3 points (20, 50, and 80 percent exceedance). The standard error associated with using only the 3 points is very high. Based on the uncertainty of flow estimates (exceedance values) and the bedload transport, the Forest Service has very little confidence in IPC's estimates of sediment yield in the Hells Canyon tributaries.

11. Page E.3-13. *The concentration of the suspended sediments coming into Brownlee Reservoir is several orders of magnitude below what would be necessary to affect the sediment transport capacity downstream of Hells Canyon Dam (Technical Report E.1-1). Therefore, trapping sediments in Brownlee Reservoir does not make the river downstream any more "sediment hungry" than it would be if the sediments in Brownlee Reservoir were available downstream. Additionally, the vast majority of particles trapped in Brownlee Reservoir are too small to contribute significantly to channel features in the Hells Canyon reach.*

    The Forest Service does not concur with this conclusion. Water released from Hells Canyon Dam contains virtually no suspended sediment, and bedload transport is very limited due to the size of bed material downstream of the dam. Natural rivers dissipate energy in a variety of ways including turbulence, friction, and sediment transport (Kondolf 1997). The transport of sand and gravel materials is important in shaping the natural rivers. When sediment-free water is released from dams, it has excess energy. This energy is available to erode beds and banks. This can result in coarsening of the bed material until a size class is reached that cannot be moved (Kondolf 1997). This coarsening of the bed can decrease the availability of spawning gravels.

    On the Colorado River in Glen Canyon, Arizona, degradation and armoring of the riverbed has been documented since the construction of Glen Canyon Dam (Burkham 1987). This degradation was due to increased sediment transport capacity, which was due to the interruption of sediment delivery from upstream. As degradation progresses and velocity decreases, bed material increases in size. The bed material may increase in size until it cannot be transported. This process is referred to as armoring, and has been documented in the Colorado River downstream of Glen Canyon Dam (Pemberton 1976). In the Upper Sacramento River, construction of the Shasta Dam caused coarsening of the streambed downstream that led to the loss of important spawning habitat for chinook salmon (Parfitt and Buer 1980). It is likely that this same process has occurred in Hells Canyon.

    The Forest Service maintains that the Snake River immediately below Hells Canyon Dam is, in fact, "sediment hungry" because the supply of material from upstream sources has been interrupted by the HCC. Figure 2, on page 36 of this document, contains particle size data obtained from Appendix C of Technical Report E.1-1. It is clear that the Snake River is supply limited (sediment hungry) upstream of the Salmon River confluence. The Forest Service agrees that much of the sediment supplies upstream of the HCC have been cut off by dams. However, the Forest Service estimates that over 2,500 acre-feet of sand and larger materials have been

trapped in Brownlee Reservoir. If IPC's estimates of sediment yield from the Hells Canyon tributaries are valid, it is reasonable to assume that there would not be such a drastic difference in particle size distributions upstream and downstream of the Salmon River confluence.

In addition, Grams and Schmidt 1999b, found that the number of sandbars lost since construction of the HCC increases upstream towards Hells Canyon Dam. This is strong evidence that the Snake River is indeed sediment hungry.

12. Page E.3-15. *The analysis of sandbars in Hells Canyon yields or confirms several important points. The majority of the sediments found in the sandbars fall within the sand-size range (0.062 to 2 mm), with less than 7% of the material falling into the silt and clay-size range (<0.074 mm) (Technical Report E.1-1). Therefore, supplies over this full range of sizes are necessary to maintain the sandbars. Most of the sediments stored in Brownlee Reservoir are smaller than those found in sandbars throughout the Hells Canyon reach. Of the sand trapped in Brownlee Reservoir, over 72% is fine sand and smaller (<0.25 mm) (Appendix B to Technical Report E.1-1). Therefore, under current watershed development, sources upstream of Brownlee Reservoir do not provide the full range of sediment sizes required to maintain these sandbars.*

    IPC's estimates of sand-sized material in Brownlee Reservoir are inaccurate, based on analysis of suspended sediment data at the Weiser Gage. IPC estimates that 4% of the sediments in Brownlee Reservoir are made up of fine sand and smaller material. This value is a volume-weighted average of the fine sand and larger material in the reservoir, based on the shallow samples (Anderson, K. 2002). This conclusion is misleading because the amount of material larger than fine sand is expressed as a proportion, rather than a total volume or weight. The proportion of larger material (sands and gravels) is overshadowed by the large amounts of fine material produced by intensive agriculture upstream of the reservoir (see Figure 1, page 34 of this report). IPC estimates that Brownlee Reservoir has trapped approximately 62,000 acre-feet of sediment between 1958 and 1998. Using the 4% value, approximately 2,500 acre feet (over 3.5 million tons) of fine sand and larger material would be in Brownlee Reservoir. Using the 4% value and an estimated submerged sediment density of 65 lbs/ft$^3$, it is estimated that Brownlee Reservoir may contain over 3.5 million tons of fine sand and larger material. Based on this value, an average of 88,000 tons of this material entered Brownlee Reservoir each year between 1958 and 1998.

    Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

    In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average

annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

The sampling strategy developed by IPC does not fully characterize the sediment deposition in Brownlee Reservoir. The distribution of size classes in any given cross-section and along 5 miles is likely to be quite variable. Therefore, the Forest Service considers the distribution of sediment size classes in the reservoir to be a gross estimate. In addition, some sand size material may be deposited on the channel margins, and in backwater areas. These features were not sampled by IPC. Observations of sediment deposition at RM 239 suggest that sand and larger materials are forming bars in the reservoir/river, and allowing the colonization of riparian vegetation (Anderson, J. 2002)

In addition, IPC failed to address sediment contributions from the tributaries that drain directly into the HCC. The 94-mile complex intercepts several tributaries that contribute sediment.

13. Page E.3-15. *Analysis of survey data collected to date, together with aerial photography from various years before and during construction of the HCC, indicates that sandbars have been, and continue to be, dynamic features of the river system, features that grow, shrink, and change shape in response to varying flows and sediment loads in the river.*

    The Forest Service maintains that IPC's analysis of sandbars is inadequate. This conclusion was drawn through bar surveys, aerial photo analysis, and bar counts. Between 1997 and 2000, IPC conducted field surveys of Pine Bar, Salt Creek Bar, Fish Trap Bar, and China Bar. In general, the survey data show both erosion and deposition during the survey periods, except for Salt Creek Bar, which shows only erosion between 1998 and 2000.

    Using aerial photographs for the period 1946-1968, IPC calculated the surface areas of 10 sandbars (between RM192 and RM230). This investigation indicates no net decrease in sandbar surface area for the analysis period. The Forest Service finds several problems with the limited temporal scope of this analysis. Brownlee Dam was completed in 1958, and Oxbow and Hells Canyon Dams were completed in 1961 and 1967, respectively. As a result, IPC's analysis of aerial photos covering the period between 1946 and 1968 only evaluates a maximum of ten years of project effects. In contrast, Grams and Schmidt (1999a and 1999b) studied several sandbars in Hells Canyon using aerial photographs and field surveys. Their studies clearly document substantial erosion of sandbar features throughout the canyon, particularly along the upper reaches close to Hells Canyon Dam. At the Tin Shed and Camp Creek sites, Grams and Schmidt 1999a, found that the 1996 sandbar surface areas for these two sites were only 23 and 32 percent of their size in 1964, respectively.

In addition, IPC counted the number of sandbars using 1946 and 1955 aerial photographs, and found no net loss. Because the aerial photographs used in this analysis do not cover the post-dam period, it is impossible to draw conclusions about the effects the HCC has had on sandbar and terrace erosion from their analysis.

14. Page E.3-16. *Grams and Schmidt did not consider that 87% of the watershed upstream of the HCC was already behind dams (or sediment traps) by the time that Brownlee Dam was completed. Therefore, the majority of their assumed sediment supply was already unavailable. They also lacked information on sediments actually trapped in Brownlee Reservoir. Such information would have shown that only minor amounts of sand have been trapped. These sands are of the fine and very fine sizes and include almost no coarser sand sizes. In contrast, sandbars downstream have the full range of sand sizes, from very fine to very coarse sizes. Therefore, the Applicant's analysis and findings invalidate several of the key assumptions on which Grams and Schmidt relied when they concluded that the HCC was the sole cause of sandbar degradation in Hells Canyon. Another key assumption on which Grams and Schmidt's conclusions depend is that the Snake River and specifically the sandbars in Hells Canyon reach were in a state of dynamic equilibrium from 1955 to 1964. They did not consider anthropogenic disturbances in the watershed above the HCC. However, these disturbances initially increased the sediment supply to the Snake River, after which over 500 dams with over 10 million acre-feet of storage were built. Therefore, assuming that Hells Canyon reach was at a state of dynamic equilibrium following approximately 100 years of upstream activity and development is not appropriate, and making this assumption leads to the erroneous conclusion that the HCC is responsible for all changes to sandbars in the Hells Canyon reach.*

    Grams and Schmidt may have made an assumption about adequate sediment supply upstream of the HCC, based on the temporal characteristics of sandbar erosion and the construction of the HCC. However, this assumption has been validated by Wilcock et al. 2002. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

    In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

    The anthropogenic disturbances that IPC refers to are most likely related to their slug theory. In Appendix Reports E.1-1 and E.1-2, IPC suggests that a "slug" of sediment that is currently moving out of Hells Canyon reach may explain shrinking sandbars. But, then conclude that several key sandbars throughout Hells Canyon reach are

stable, based on analysis of aerial photos, bar surveys, and bar counts. These conclusions are contradictory.

15. Pages E.3-18-19. *Except at a few locations, riverbanks in Hells Canyon are also stable. A study of shoreline erosion (Technical Report E.3.2-42) indicates that the Hells Canyon reach is one of the most stable reaches studied (from the Salmon River upstream to Weiser). In the reach downstream of Hells Canyon Dam, erosion occurred at 60 sites, or in 3.9 or 125 miles (on both sides of the river), an area that accounts for only about 3% of the reach. Because most sites were above the range of typical flow fluctuations (Technical Report E.3.2-42), operations of the HCC do not appear to cause most of the erosion. Instead, this finding suggests that anthropogenic disturbances (such as recreational foot traffic) or other hillslope processes (such as groundwater seepage) probably cause the erosion. Grams and Schmidt (1999b) analyzed two locations-Tin Shed and Camp Creek-because they were specific riverbank terraces with cultural significance. Their analysis, based on historical aerial photographs from 1964 through 1996, was based on the assumption that any changes shown were driven by construction and operation of the HCC. They concluded that, in an unregulated system, the erosion of the bars and banks would be balanced by regular sediment deposition. However, their conclusion incorrectly assumed that the HCC severely limits the amount of material that would be available to replenish sandbars; it neglects all of the local sources of sediment that continue to contribute loads to the mainstem and its geomorphic features; and possibly most importantly, it ignores all anthropogenic influence upstream of the HCC. As with bed materials, local sources appear to have been primary contributors to sandbar features for a geologically long period of time, given the mineralogy of these materials. And, as discussed in section E.3.0.5.2, drawing any conclusions about the effects of HCC operations without also considering the contributions from local tributaries and the influences upstream of the HCC is inappropriate.*

    This conclusion is misleading because the majority of the banks in Hells Canyon reach are well armored with large boulders and bedrock. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach, which is why they are important recreation and heritage resources. The 3% of the reach where erosion is occurring are most likely those areas the Forest Service is most concerned about (sandbars and terraces). If IPC had divided the length of eroding banks by the length of banks that have a reasonable potential to erode, the percentage would be significantly higher.

    Based on comparisons of sediment yields from the literature and Table 7 in Technical Report E.1-1, 28,100 tons per square mile per year appears to be a gross overestimate of sediment yield. The average of all the sediment yield values in Table 7 is 956 tons/mi$^2$/year. Sediment yield values from tributaries in Grand Canyon are all less than 500 tons/mi$^2$/year based on the values given in Table 7. Grande Canyon and lands located on the Colorado Plateau are well known for sparse vegetation and high erosion rates. Hells Canyon reach contains a mosaic of forests, grasslands, and bedrock outcrops. It seems unreasonable that Hells Canyon reach would produce

over 50 times more sediment per year than sparsely vegetated, erodible landscapes in Grand Canyon.

Wilcock et al 2002, Andrews and Vincent 2002, and O'Connor 2002, conclude that IPC's estimates of sediment yield from the Hells Canyon reach tributaries are too high. The uncertainty associated with the bedload transport equation could be as high as an order of magnitude (Wilcock et al (2002). The flow duration values (exceedance) generated by fitting a logarithmic curve to only 3 points (20, 50, and 80 percent exceedance). In addition, the standard error associated with the 3 points is very high. Based on the uncertainty of flow estimates (exceedance values) and the bedload transport, the Forest Service has very little confidence in IPC's estimates of sediment yield in the Hells Canyon reach tributaries.

The Lower Salmon River and the Snake River have similar morphological characteristics, especially near their confluence. In addition, the Lower Salmon River Canyon is very similar to Hells Canyon reach in terms of geologic structure. If the Hells Canyon reach tributaries are truly contributing the volumes of material that IPC estimates, it would seem reasonable that the Salmon and Snake River would have similar particle size distributions. In reality, the particle size distribution of the Snake River changes drastically, downstream of the Salmon River confluence (see Figure 2, page 36 of this report). This suggests radically different sediment supply characteristics between the two rivers.

The Forest Service agrees that tributaries in Hells Canyon reach contribute material useful for maintaining sandbars and gravel beds. However, there is a concern that the tributaries do not contribute enough material to sustain sandbars and terraces over long time frames. The studies conducted by Grams and Schmidt 1999a and 1999b, clearly indicate a net erosion of sandbar and terrace features at several key sites throughout the canyon, which suggests that sediment from local sources is not sufficient to maintain these features.

In addition, Grams and Schmidt 1999b, found that the frequency of sandbars and the rates of erosion increase with distance downstream of Hells Canyon Dam. Based on aerial photography, the greatest erosion of sandbars occurred during the period of 1964-1973. In addition, the highest amounts of erosion occurred in the reaches closest to Hells Canyon Dam. Erosion rates have generally decreased since 1973 along the upper reaches, but have increased along the lower reaches. This suggests a cause and effect relationship between the HCC and sandbar erosion.

IPC estimates that the Hells Canyon reach tributaries contribute an average of 28,100 tons per square mile of sediment per year, and that spawning gravels as small as 1 inch are stable at 17 sites. In addition, IPC states that the Snake River in Hells Canyon reach is highly stable overall. These conclusions are in disagreement because if an average of 28,100 tons of material enters the river each year, and sediment transport is not occurring, then the river would aggrade. Assuming an average bulk

sediment density of 100 lbs per cubic foot, over 450 acre-feet of sediment would have been deposited in the Snake River since completion of the HCC.

16. Page 83. *Mineralogical composition of bed material sediments suggests that these sediments are of local Hells Canyon origin. The lack of minerals characteristic of the upper regions of the Snake River Basin suggests that riverbed materials in the Hells Canyon reach were not transported from upper parts of the basin (Miller et al. 2002).*

    Based on the size of bed material found downstream of Hells Canyon Dam, it is not surprising that it comes from local sources. This fact is not relevant in terms of the concerns raised by the Forest Service about sandbar and terrace erosion. The Forest Service is not concerned about the entrainment and transport of large bed material such as that found in the river below Hells Canyon Dam. The agency's main concern stems from the lack of fine material that builds sandbars and protects terraces.

17. Page E.3-19. *Grams and Schmidt (1999b) did acknowledge that the operations of the HCC could not be unequivocally linked to terrace erosion: they stated that the largest peak flows since 1964 could not have overtopped terrace surfaces. One example of where something other than river processes influenced a terrace area is found at Salt Creek. Archaeologists noted that the soil column had been recently disturbed. Apparently, soil that had been removed during historical placer mining operations had been redeposited. Given that placer mining was conducted before the HCC existed, these changes, as well as others, to beach and terrace areas did not result exclusively because of river processes, including river processes influenced by HCC.*

    Based on visual observations, the effects of placer mining on terrace erosion are relatively minor and isolated, based on visual observation. The Forest Service maintains that daily ramping and sediment-starved floods are primarily responsible for the accelerated erosion of terraces in Hells Canyon reach.

18. Pages E.3-19-20. *The Applicant's sediment study (Technical Report E.1-1) looked at both the supply to the mainstem and the stability of spawning gravel sizes (1 to 6 inches) in locations where the Applicant's biologists identified and described spawning areas for fall chinook salmon (Chapter 3 of Technical Report E.3.1-3). Results of the Applicant's studies indicate that these spawning beds are stable and that significant supplies of new material are available in a broad range of sizes (including sands and spawning gravels).*

    To predict the stability of spawning gravels, IPC used the relationship:

    $$\theta = \tau_c / (\gamma_s - \gamma_f) d_i$$

    Where $\theta$ equals the critical dimensionless shear stress, $\tau_c$ equals the bed shear stress, $\gamma_f$ equals the fluid density, $\gamma_s$ equals the sediment density, and $d_i$ equals the particle size in question.

    This conclusion is based on a "cookbook" analysis of entrainment, which does not account for the extreme variability and complexity of sediment transport in gravel bed

rivers. The MIKE 11 1dimensional hydrodynamic model generated shear stress values for flows ranging between 30,000 and 300,000 cfs. Bed shear stress can have relatively high spatial and temporal variability (Wohl 2000). Shear stress is very sensitive to water surface slope, and the MIKE 11 model may not provide an accurate representation of slopes over such a wide range of flows and channel characteristics. In addition, water depths generated by the model may not be fully accurate. Andrews 1983, reported that a variety of bed material sizes maybe entrained within a small range of shear stress values. Therefore, small differences in shear stresses may create vastly different results in terms of bed mobility.

In Appendix E.1-1 (section 9.5.3), IPC provides detailed discussions about studies related to sediment transport and critical dimensionless shear stress. In particular, IPC referenced Andrews 1983, which describes a relationship between critical dimensionless shear stress and surface and sub-surface particle size distributions. Yet, in determining the critical dimensionless shear stress for spawning gravels, it appears that IPC arbitrarily used 1 and 2-inch particle sizes (Tables 9 and 10 of Appendix E.1-1). The critical dimensionless shear stress is more closely correlated with the ratio of the particle size in question to the median sub-surface particle size (Andrews 1983). Therefore, IPC's selection of 0.047 as the critical dimensionless shear stress value is likely invalid.

In addition, IPC's conclusion about the stability of spawning gravels is questionable when viewed in light of sediment yield estimates from local tributaries. IPC estimates the average annual yield of gravel-size material from local tributaries is approximately 7 million tons. If this is truly the case, then the Snake River would be filled with approximately 2 feet of gravel material, based on IPC's sediment yield estimates from local sources. This is a significant contradiction, and illustrates the fact that IPC's estimates of sediment yield and gravel mobility are not realistic.

19. Page E.3-21. *Federal agency staff have suggested, based wholly or in part on studies by Grams and Schmidt (1999a, b) that "sediment starved floods" have caused the shoreline erosion that damaged several archaeological sites downstream of Hells Canyon Dam. Their suppositions were supported by the Grams and Schmidt studies (1991; 1999a, b). These beliefs imply that the Applicant is responsible for most or all of the bank stability problems at archaeological sites downstream of Hells Canyon Dam. However, the Applicant's study allows for a better determination of what, if any, effect the construction and operation of the HCC has had on erosion at these archaeological sites. Specifically, Applicant studies show that the HCC neither caused sediment-starved floods, nor has been the sole, or even the primary, cause of the loss of sand-sized materials in the Hells Canyon reach (Technical Report E.1-1). Furthermore, the river is largely stable, and much of the erosion identified at archaeological sites (Technical Report E.4-1) appears to occur at flows greater than the plant capacity of HCC (approximately 30,000 cfs). These flows are therefore outside the range of flows that can be controlled by the operation of the HCC.*

Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include

sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

IPC presents no data that distinguishes the relative effects of flows below and above 30,000 cfs on sandbar and terrace erosion. It is likely that daily ramping (below 30,000 cfs) and flooding (above 30,000 cfs) both affect sandbar and terrace erosion. However the relative proportion of these effects are unknown.

20. Page E.3-22. *The Applicant's studies show that the riverbanks downstream of the HCC are stable; in fact, bank erosion occurs in only about 3% of the Hells Canyon reach (Technical Report E.3.3-42). The geomorphology study (Technical Report E.1-2). Also indicates that the river is highly stable, with banks largely formed and "locked in" by the high flows of prehistorical floods. In recent history, the river has migrated from sided to side in very few places. The Applicant's studies further show that the HCC has not measurably increased the erosive potential of the Snake River in Hells Canyon.*

    The 3% value is misleading because the majority of the banks in Hells Canyon reach are well armored with large boulders and bedrock. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach, which is why they are important recreation and heritage resources. The 3% of the reach where erosion is occurring are most likely those areas the Forest Service is most concerned about (sandbars and terraces). If IPC had divided the length eroding banks by the length of banks that have a reasonable potential to erode, the percentage would be significantly higher.

**Exhibit E.6. Report on Land Management and Aesthetics.**

1. Page E.6-21. *Below Hells Canyon Dam, fluctuations in water levels caused by project operations reduce the amount of sediment and thereby contribute to the decline of coyote willow (salix exigua). Before the HCC was constructed, upstream dams trapped approximately 87% of the natural sediment load and the load from accelerated erosion caused by human activities (see section E.3.0.4.). The construction of Brownlee Dam in 1957 trapped the remaining 13% of the sediment load (Technical Report E.1-1). The reduction in sediment available for deposition in Hells Canyon is thought to have contributed to a decline in the distribution and abundance of coyote willow. There is no evidence, however, that Brownlee Reservoir has trapped significant quantities of sediment sizes that could affect any of the*

*downstream botanical resources. Ninety-nine percent of the material trapped in Brownlee Reservoir is smaller than the smallest size fraction that could replenish the sandbars in Hells Canyon (Technical Report E.1-1). Even if the current sediment in Brownlee had continued downstream, it would have been transported beyond the study area as was the actual sediment load.*

Expressing sediment as percentages is misleading. The HCC has, in fact, trapped significant quantities of sediments that would be useful in supporting riparian species such a coyote willow. The Forest Service estimates that Brownlee Reservoir may contain over 9 million tons of sand-sized material, based on data generated by Wilcock et al (2002). The trapping of silts and clays is also a direct project impact because this material is likely to be an important component in supporting riparian vegetation, particularly in eddy environments where small materials are likely to deposit.

## Comments Specific to the Technical Report Appendices

Quotations or sections taken directly from the technical report appendices are shown in italics.

**Technical Report Appendix E.1-1. Sediment Transport, Supply, and Stability in the Hells Canyon Reach of the Snake River.**

1. Page 2. *The transport competency of the Snake River upstream of the HCC is insufficient to mobilize and transport materials such as those found in the riverbed of the Hells Canyon reach. Therefore, no supply of bed materials would be available from sources upstream of the HCC under historical hydrologic conditions.*

   This conclusion is not relevant, and does not address the concerns raised by the Forest Service in Hells Canyon reach. The distribution of bed material sizes downstream of the HCC is much larger than that found upstream where IPC conducted their entrainment modeling. Downstream of Hells Canyon Dam, the Snake River is steeper, more confined, well armored, and consists of relatively large bed material. This armoring is most likely due to the lack of smaller sediments entering the system from upstream.

   The slope of the Snake River in Hells Canyon reach ranges between 0.002 and 0.0007 and IPC found the average $d_{50}$ particle size diameter to be 144 mm. The average slope of the Snake River between Weiser and the HCC is roughly 0.0014, which is only half of the minimum slope in Hells Canyon reach. Consequently, it is to be expected that larger bed material would be found below Hells Canyon Dam, and that the river between Weiser and Hells Canyon Dam would not be capable of transporting material that large under the current hydrologic regime.

   IPC states that the rating curves at the Hells Canyon Dam gage and the Weiser gage have remained essentially unchanged during the period of record. The Hells Canyon

Dam gage began operating in 1965 during the construction of Hells Canyon Dam. There is no pre-dam data on the channel cross-section where the gage is located. Therefore, this component of the conclusion is not valid.

2. Page 2. *Less than 4% of the sediment trapped in Brownlee Reservoir (the uppermost dam in the HCC and the first of the three constructed by IPC) is larger than fine sand. All of the features of interest downstream are largely made up of sediments larger than fine sand. Page 82. There is no evidence that Brownlee Reservoir (the uppermost reservoir in the HCC) has trapped significant quantities of sediment I sizes that could affect any of the important resources. More than 96% of the material trapped in Brownlee Reservoir is fine sand and therefore smaller than the majority of material found in the sandbars in Hells Canyon.*

   IPC collected several core samples in Brownlee Reservoir. Several shallow samples were collected at 5-mile intervals along the thalweg to approximately 8 miles upstream of the reservoir (RM285 – RM340), and 3 deep core samples were collected near RM320 and RM324.

   The 4% value is a volume-weighted average of the fine sand and larger material in the reservoir, based on the shallow samples (Anderson, K. 2002). This conclusion is misleading because the amount of material larger than fine sand is expressed as a proportion, rather than a total volume or weight. The proportion of larger material (sands and gravels) is overshadowed by the large amounts of fine material produced by intensive agriculture upstream of the reservoir (see Figure 1, page 34 of this report).

   IPC estimates that Brownlee Reservoir has trapped approximately 62,000 acre-feet of sediment between 1958 and 1998. Using the 4% value and an estimated submerged sediment density of 65 lbs/ft$^3$, approximately 2,500 acre feet (over 3.5 million tons) of fine sand and larger material would be in Brownlee Reservoir. Based on this value, an average of 88,000 tons of this material entered Brownlee Reservoir each year between 1958 and 1998. However, this value is an underestimate, based on analysis of suspended sediment data collected at the Weiser Gage. Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

   In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

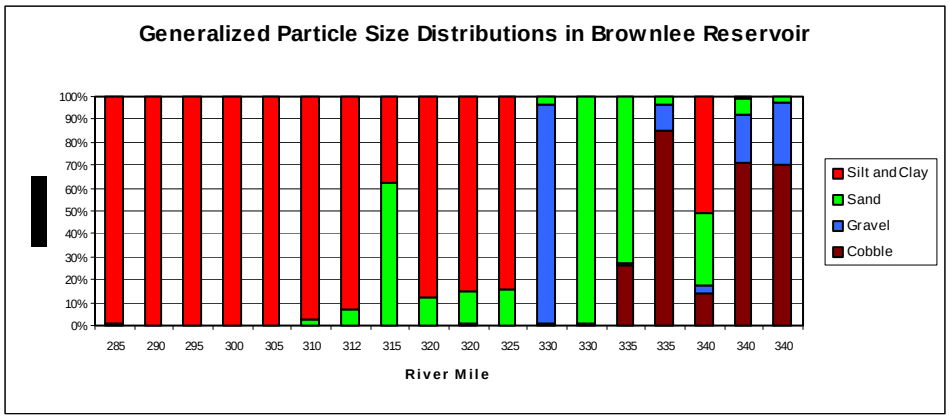


Figure 1. Generalized particle size distributions of shallow sediment samples.

The sampling strategy developed by IPC does not fully characterize the sediment deposition in Brownlee Reservoir. The distribution of size classes in any given cross-section and along 5 miles is likely to be quite variable. Therefore, the distribution of sediment size classes in the reservoir is considered to be a gross estimate. In addition, some sand size material may be deposited on the channel margins, and in backwater areas. These features were not sampled by IPC. Observations of sediment deposition at RM 239 suggest that sand and larger materials are forming bars in the reservoir/river, and allowing the colonization of riparian vegetation (Anderson, J. 2002)

Sandbars in Hells Canyon reach consist of material ranging between 0.062 mm (very fine sand) and 2mm (very fine gravel). The 4% value calculated by IPC does not account for material in the very fine sand size class. Therefore, the 4% value generated by IPC does not account for this size class.

In addition, recent storm events have resulted in considerable deposition of fine sediment in the Brownlee, Oxbow and Hells Canyon pools. The 94-mile HCC directly intercepts sediment from several small tributaries, and this is completely unaccounted for in IPC's analysis of sediment supply.

3. Page 2. *The trapping of fine sediments in Brownlee Reservoir has not caused the downstream river to become more "sediment hungry" because the size and concentration of these sediments has no effect on transport capacity in the Hells Canyon Reach of the Snake River.*

   The Forest Service disagrees with this conclusion. Water released from Hells Canyon Dam contains virtually no suspended sediment, and bedload transport is very limited due to the size of bed material downstream of the dam. Natural rivers dissipate energy in a variety of ways including turbulence, friction, and sediment transport (Kondolf 1997). The transport of sand and gravel materials is important in shaping the natural rivers. When sediment-free water is released from dams, it has excess energy. This energy is available to erode beds and banks. This can result in coarsening of the bed material until a size class is reached that cannot be moved

(Kondolf 1997). This coarsening of the bed can decrease the availability of spawning gravels. This is indicated by the particle size distributions shown in Figure 2, below.

On the Colorado River in Glen Canyon, Arizona, degradation and armoring of the riverbed has been documented since the construction of Glen Canyon Dam (Burkham 1987). This degradation was due to increased sediment transport capacity, which was due to the interruption of sediment delivery from upstream. As degradation progresses and velocity decreases, bed material increases in size. The bed material may increase in size until it cannot be transported. This process is referred to as armoring, and has been documented in the Colorado River downstream of Glen Canyon Dam (Pemberton 1976). In the Upper Sacramento River, construction of the Shasta Dam caused coarsening of the streambed downstream that led to the loss of important spawning habitat for chinook salmon (Parfitt and Buer 1980). It is likely that this same process has occurred in Hells Canyon.

The Forest Service maintains that the Snake River immediately below Hells Canyon Dam is, in fact, "sediment hungry" because the supply of material from upstream sources has been interrupted, by the HCC, and erosion is not balanced with deposition. Figure 2, on the following page, contains particle size data obtained from Appendix C of Technical Report E.1-1. It is clear that the Snake River is supply limited (sediment hungry) upstream of the Salmon River confluence. The Forest Service agrees that much of the sediment supplies upstream of the HCC have been cut off by dams. However, the Forest Service estimates that over 2,500 acre-feet of sand and larger materials have been trapped in Brownlee Reservoir. If IPC's estimates of sediment yield from the Hells Canyon reach tributaries is valid, it is reasonable to assume that there would not be such a drastic difference in particle size distributions upstream and downstream of the Salmon River confluence.

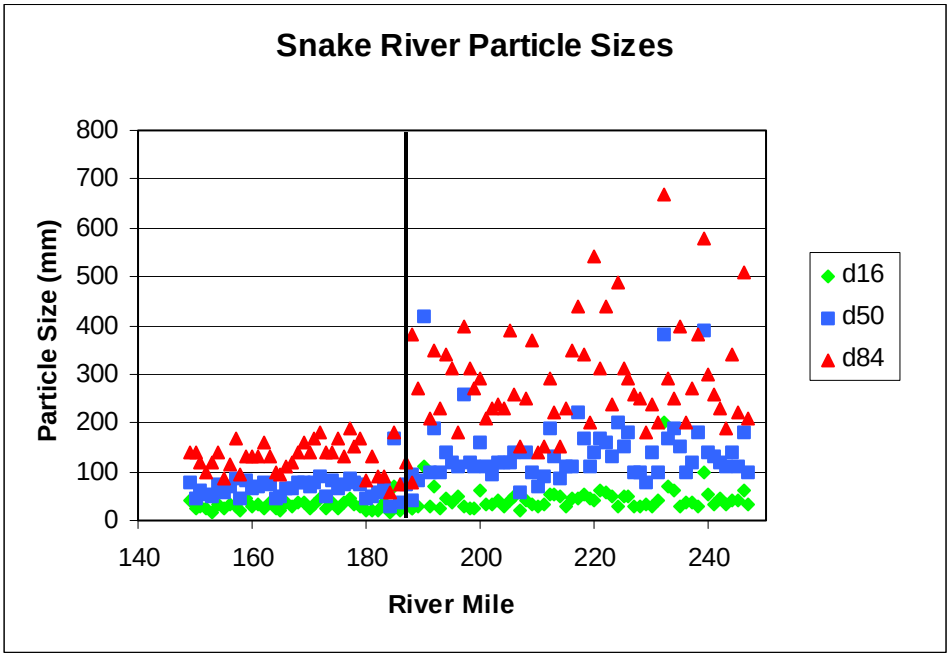


Figure 2. Bed material particle sizes in the Snake River. The vertical line represents the Salmon River confluence at RM188 (Appendix C to Technical Appendix E.1-1)

4. Page 72. *Sandbars have been and continue to be dynamic features of the river system, features that are growing, shrinking, and changing shape in response to varying flows and sediment loads in the river.*

   This conclusion is misleading and inaccurate. IPC arrived at this conclusion through bar surveys, aerial photo analysis, and bar counts. Between 1997 and 2000 (after the 1997 flood), IPC conducted field surveys of Pine Bar, Salt Creek Bar, Fish Trap Bar, and China Bar. In general, the survey data show both erosion and deposition during the survey periods, except for Salt Creek Bar, which shows only erosion between 1998 and 2000.

   Using aerial photographs for the period 1946-1968, IPC calculated the surface areas of 10 sandbars (between RM192 and RM230). This investigation indicates no net decrease in sandbar surface area for the analysis period. The Forest Service finds several problems with the limited temporal scope of this analysis. Brownlee Dam was completed in 1958, and Oxbow and Hells Canyon Dams were completed in 1961 and 1967, respectively. As a result, IPC's analysis of aerial photos covering the period between 1946 and 1968 only evaluates a maximum of ten years of project effects. In contrast, Grams and Schmidt (1999a and 1999b) studied several sandbars in Hells Canyon using aerial photographs and field surveys. Their studies clearly document substantial erosion of sandbar features throughout the canyon, particularly along the upper reaches close to Hells Canyon Dam. At the Tin Shed and Camp Creek sites, Grams and Schmidt 1999a, found that the 1996 sandbar surface areas for these two sites were only 23 and 32 percent of their size in 1964, respectively.

In addition, IPC counted the number of sandbars using 1946 and 1955 aerial photographs, and found no net loss. Because the aerial photographs used in this analysis do not cover the post-dam period, it is impossible to draw conclusions about the effects the HCC has had on sandbar and terrace erosion from their analysis.

The 1955 aerial photos of the Snake River now inundated by Hells Canyon and Oxbow Reservoirs show a considerable number of sandbars and islands. The presence of these sandbars indicate sediment was being supplied from either upstream to the HCC or from the HCC tributaries, or both. IPC does little to address these sandbars, where they came from, how much material was present.

5. Page 2. *Human activities in and above the Hells Canyon area, such as mining and grazing, modified hillslope processes from the mid-1800s to the mid1900s. These activities probably introduced an unusually large sediment supply to the river that decreased as the activities that introduced them also decreased. This "slug" of sediment may be working its way out of the Hells Canyon system. Changes in the river observed since the construction of the HCC (such as shrinking sand beaches) may be caused by human activity higher in the Snake River Basin since the mid-1800s and not by construction and operation of the HCC.*

   The authors suggest that intensive land uses (mining, grazing, timber harvest, etc.) throughout the Snake River Basin from the mid-1800s through the mid-1900s accelerated erosion and sediment delivery. Subsequently, sediment availability and transport in the basin began to decrease as a result of changing land uses and impoundments.

   On pages 72-79, the authors suggest that sandbars in Hells Canyon reach are growing, shrinking, and changing shape in response to varying flows and sediment loads in the river. This is contrary to the above statement about "shrinking sandbars". In addition, IPC states that the Snake River at the Weiser Gage has been highly stable during the period of record. If a large "slug" of sediment passed the Weiser Gage at some point in the recent past, it seems reasonable that it would have been detected by channel aggradation or other forms of adjustment.

   The Forest Service concurs with the idea that historic land uses accelerated erosion and sediment transport within the Snake River Basin. However, IPC presents no data that describes how and at what rate this pulse or "slug" of sediment is working its way through the Snake River system. IPC does not present any scientific evidence that supports the "slug" theory.

   In addition, IPC failed to address the effect of daily operations (ramping) on sandbar and terrace erosion. Sandbar erosion can occur through three mechanisms: main channel erosion, seepage-induced erosion, and wave action (USDI 1995). Main channel erosion is likely a function of sediment supply, which is partly addressed in IPC's analysis. However, seepage-induced erosion that may be associated with daily ramping is not addressed. Seepage-induced erosion, caused by down-ramping and

river fluctuations has been documented in Grand Canyon (Budhu 1992). The sandbar surfaces in Hells Canyon reach typically have gentle slopes, which would suggest that seepage-induced erosion may not occurring. However, the terraces are typically vertical, which may indicate seepage-induced erosion (caused by ramping).

6. Page 2. *Continuing supplies of sands, gravels, and cobbles from local sources below HCD have not been affected by the construction of and operation of the HCC.*

   This conclusion is true for sediment sources such as hillslopes and side canyons, but there is no doubt that construction of the HCC has interrupted the delivery of sediment from upstream sources.

7. Page 5. *We hypothesize that there would be little, if any, bed material transport within the main stem Snake River in the Hells Canyon reach, with or without the influence of the HCC. We based our hypothesis on three primary factors: 1) the considerable development of storage on the upstream reaches of the river and its tributaries, 2) the confined geomorphic character of the this reach of the river, and 3) early observations of the armored character of bed materials in the river.*

   It is reasonable to assume that upstream storage facilities have reduced the supply of sediment to the HCC, particularly sand-sized material. The Idaho Batholith in central Idaho consists of very erodible, sand sized material that most likely supplied an abundance of sand to the Snake River prior to extensive water development. The Boise and Payette river systems likely contributed large volumes of sand-sized material prior to being impounded. However, using IPC's data, it is estimated that over 3.5 million tons of fine sand and larger material has deposited in Brownlee Reservoir since its construction in 1958.

   Wilcock et al (2002) estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

   In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

   The conclusion related to sediment transport competency of the Hells Canyon reach should be better defined. This conclusion would likely be true if the streambed always consisted of the large cobbles and boulders, which currently make up the bed. However, this conclusion would almost certainly be false if the bed material historically was made up in part by sand, gravels, and small cobbles. In addition, the

sampling of bed material was conducted in the middle of the channel, where larger materials would be expected.

The confined geomorphic character of the Hells Canyon reach would be very efficient at transporting bed material if it were being supplied to the reach from upstream sources. The issue is not the ability of the Hells Canyon reach to transport fine material. The issue is the lack of fine material entering the system from upstream sources. Sandbars are rare but important alluvial features in Hells Canyon and typically form in protected areas such as backwaters and eddies outside of the main transport reaches. An early observation of the armored character of the river does not mean that sandbars and terraces were not present.

8. Page 82. *There are tributaries in Hells Canyon not affected by the HCC that supply sediment in the size range useful for maintaining the sandbars and gravel bed spawning sites in Hells Canyon.*

   The Forest Service agrees that tributaries in Hells Canyon reach contribute material useful for maintaining sandbars and gravel beds. However, there is a concern that the tributaries do not contribute enough material to sustain sandbars and terraces over long time frames. The studies conducted by Grams and Schmidt 1999a and 1999b, indicate a net erosion of sandbar and terrace features at several key sites throughout the canyon, which suggests that sediment from local sources is not sufficient to maintain these features.

   In addition, Grams and Schmidt 1999b, found that the frequency of sandbars and the rates of erosion vary with distance downstream of Hells Canyon Dam. Based on aerial photography, the greatest erosion of sandbars occurred during the period of 1964-1973. In addition, the highest amounts of erosion occurred in the reaches closest to Hells Canyon Dam. Erosion rates have generally decreased since 1973 along the upper reaches, but have increased along the lower reaches. This suggests a strong cause and effect relationship between the HCC and sandbar erosion.

   IPC estimates the average annual sediment yield from Hells Canyon reach tributaries to be 28,100 tons/mi$^2$ (a total of 16.6 million tons) and considers this a conservative estimate. In Table 7 of Appendix E.1-1, several sediment yield values are given from a variety of studies conducted throughout the United States. The average of all these values is 956 tons/mi$^2$/year. Sediment yield values from tributaries in Grand Canyon are all less than 500 tons/mi$^2$/year based on the values given in Table 7. Grand Canyon and lands located on the Colorado Plateau are well known for sparse vegetation and high erosion rates. Hells Canyon reach contains a mosaic of forests, grasslands, and bedrock outcrops. It seems highly unlikely that Hells Canyon reach would produce over 50 times more sediment per year than sparsely vegetated, erodible landscapes in Grand Canyon.

   Wilcock et al 2002, Andrews and Vincent 2002, and O'Connor 2002, conclude that IPC's estimates of sediment yield from the Hells Canyon reach tributaries are

unreasonable. The uncertainty associated with the bedload transport equation could be as high as an order of magnitude (Wilcock et al 2002). The IPC flow duration values (exceedance) were generated by fitting a logarithmic curve to only 3 points (20, 50, and 80 percent exceedance). The standard error associated with using only the 3 points is very high. Based on the uncertainty of flow estimates (exceedance values) and the bedload transport, the Forest Service questions IPC's estimates of sediment yield in the Hells Canyon reach tributaries.

In addition, IPC states that the Snake River in Hells Canyon is highly stable, and that spawning gravels as small as 1 inch are stable at 17 different sites, even at flows exceeding 100,000 cfs. These conclusions are in disagreement because if an average of 16.6 million tons of material enters the river each year, and sediments as small as 1 inch are not moving, then the river would aggrade. Assuming an average bulk sediment density of 100 lbs per cubic foot, over 450 acre-feet of sediment would have deposited in the Snake River since completion of the HCC. This would equate to a uniform depth of 2 feet on the riverbed between Hells Canyon Dam and the Salmon River confluence. This suggests that IPC's estimates of sediment yield and incipient motion of spawning gravels are not realistic.

9. Page 82. *Mineralogical composition of bed material sediments suggests that these sediments are of local Hells Canyon origin. The lack of minerals characteristic of the upper regions of the Snake River Basin suggests that riverbed materials in the Hells Canyon reach were not transported from upper parts of the basin (Miller et al. 2002).*

   Based on the size of bed material found downstream of Hells Canyon Dam, it is not surprising that it comes from local sources. This fact is not relevant in terms of the concerns raised by the Forest Service about sandbar and terrace erosion. The Forest Service is not concerned about the entrainment and transport of large bed material such as that found in the river below Hells Canyon Dam. The agency's main concern stems from the lack of fine material that builds sandbars and protects terraces.

   IPC collected 23 samples of bed material between RM 245.8 (downstream of Hells Canyon Dam) and RM 152 (downstream of the Salmon River confluence). This information was obtained from Appendix F of Technical Report Appendix E.1-2. It is not clear if the samples were collected in the middle of the channel or on the channel margins. Visual observations made by IPC suggest that the bed material is made up of basalt (41%), basalt with plagioclase (18%), quartzite/siltstone (20%), diorite (9%), altered metamorphics (6%), breccia (4%), and argillite (2%).

10. Page 82. *There are data from the early 1900s (well before the HCC was built) through the present time indicating that the Snake River upstream of the HCC is highly stable, with limited movement of bed material. More recent data from downstream of the HCC indicate similar findings.*

    The stability of the Snake River upstream of the HCC does not necessarily indicate that sediment is not being transported. Again, IPC confuses river stability with

sediment transport. Stream channels in dynamic equilibrium are capable of moving bedload and suspended material while maintaining their hydraulic and geomorphic characteristics (Leopold et al. 1964). The Forest Service concurs with the conclusion that the Snake River downstream of Hells Canyon Dam is currently stable. This is due primarily to the large bed material found there.

11. Page 83...*at the time the HCC could begin blocking sediment supply, approximately 84% of the area that could supply sediment to the study area was already cut off.*

    The key issue is the volume, weight, and size distribution of material that is intercepted by the HCC. These values would shed light on the true impact of the complex on sediment supply and transport. IPC's data indicates the Brownlee Reservoir has trapped approximately 62,000 acre-feet of sediment between 1958 and 1998, 4% of which is larger than fine sand. This equates to approximately 2,500 acre-feet (over 3.5 million tons) of fine sand and larger material that has deposited in Brownlee Reservoir.

    Wilcock et al 2002, estimate the annual sand supply to the HCC from the Snake River is likely between 250,000 and 750,000 tons per year. This estimate does not include sediment available from the 4,100 square mile area draining directly into the complex. Based on these estimates, Brownlee Reservoir may contain between 11 and 33 million tons of sand that would otherwise enter Hells Canyon.

    In addition, Wilcock et al 2002, estimate that the average annual sand load in the Snake River upstream of the HCC may be at least 7 times greater than the average annual rate of sand loss (from beaches) in Hells Canyon. Because the estimated annual sand load supplied to the HCC is much greater than the load exiting Hells Canyon, it is reasonable to assume that some of this material would be available for deposition in Hells Canyon if it had not been intercepted by the HCC.

    IPC failed to analyze effects of the project in terms of the volume or weight of various size classes being trapped in Brownlee Reservoir and failed to adequately recognize other studies that are inconsistent with their conclusions about sandbar and terrace erosion (Grams and Schmidt 1999a and 1999b).

12. Page 2. *Because the basic form and character of the river were established under vastly higher flow conditions, the bed and bank materials provide extremely limited opportunity for river movement.*

    The Forest Service is not concerned about entrainment and transport of the large bed materials found in the Snake River below Hells Canyon Dam. The availability of spawning gravels and sands is the primary concern. Figure 2, page 36 of this document, indicates that the basic form and character of the river changes suddenly at the Salmon River confluence (RM 188). The particle sizes found on the bed of the Snake River changes rapidly as finer sediments are introduced from the Salmon River. It is likely that the basic form and character of the Salmon River were

established under vastly higher flow conditions as well, and yet this river contains much smaller particle sizes on its bed. The most likely scenario is that smaller materials were transported out of Hells Canyon as dams were constructed upstream (including the HCC), and the riverbed became armored.

13. Page 2. *The storage capacity of the HCC is only about 11% of the average annual volume of the Snake River as given by calculated inflow to Brownlee Reservoir. Therefore the HCC has a relatively small effect on the hydrograph downstream of the complex.*

    The Forest Service concurs with this conclusion in terms of peak discharges. However, the HCC has significant effects on seasonal and daily discharge patterns.

    Because of limited flood storage, high flows are passed through the three dams with a flow regime similar to that which existed prior to construction. However, the shape of the flood hydrograph is subject to the storage and rule curves of Brownlee Reservoir.

    The concern about the effects of historic discharges compared to post dam flows is not related to the magnitude or frequency of the peak flows, but the amount of sediment the river transports and the hourly, daily and seasonal fluctuation rates (Collier et al 1996, Grams and Schmidt 1999). An analysis of flow frequencies greater than 30,000 cfs (pre and post dam construction) finds that flows of this magnitude occur from December through June with the only significant flow change between pre and post dam construction occurring in February (USDA 1999, unpublished). In February, the occurrence of 30,000 cfs flows increased from 11% prior dam to 21% post dam. Flows greater than 50,000 cfs occur from March through June with no significant difference noted prior to and post HCC (USDA 1999, unpublished).

    There has been a change in fall and winter flow levels since the completion of the HCC. Low fall flows and winter ice used to be common in the Snake River. Today, fall flows are slightly lower than those recorded prior to the HCC and are held steady to provide stable conditions for fall chinook salmon spawning. Prior to the HCC development, the Snake River experienced icing conditions with some frequency. Winter ice is now rare because water released from the complex is slightly warmer than it was prior to dam construction.

    Evidence suggests that the greatest change to the Snake River flow regime from dam construction is in the daily and hourly flow fluctuations (Grams and Schmidt 1999, USDA 1999, unpublished). Prior to construction of the complex, the change in discharge over a six-hour time period was between 250-500 cfs. Following closure of the dams, the average change in discharge over a six-hour period increased to 11,950-12,070 cfs. Hourly fluctuations below Hells Canyon Dam generally range between 2,000 to 3,000 cfs. However, these flow changes may occur in time intervals as short as 15 minutes. Research from Glen Canyon Dam found downstream erosion to be

more affected by down-ramping than up-ramping (USDI 1995). In the Snake River, daily and hourly flow fluctuations may be affecting heritage resources, riparian and aquatic plant and animal communities, and recreation resources by increasing the rate of erosion of sandbars and terraces. Thus the current and proposed ramping of the project may aggravate the adverse effects on sandbar maintenance due to the lack of sediment transport through HCC.

**Technical Report Appendix E.1-2. Draft Geomorphology of the Hells Canyon Reach of the Snake River.**

This report contains much of the supporting information for Technical Report Appendix E.1-1 (Sediment Transport, Supply, and Stability in the Hells Canyon Reach of the Snake River). The report provides comprehensive descriptions of historical processes that have shaped Hells Canyon. Much of the key information related to sediment supply and transport is the same as that described in E.1-1. The Forest Service responses to IPC's conclusions in E.1-1 also apply to the same conclusions that IPC has drawn in E.1-2.

## Discussion

The Forest Service disagrees with IPC's conclusions about the effects of the HCC on sediment resources. There are several components of IPC's analyses related to sediment that are misleading, invalid, and inconsistent with current thought about river processes.

IPC describes deposition and erosion in terms of percentages, rather than actual volumes or weights. For example, deposition of sand and larger material in Brownlee Reservoir is described as "only 4%", when the actual weight and volume of this material may be between 11 and 33 million tons (Wilcock et al. 2002).

In addition, IPC concludes that "only 3%" of the banks along the Snake River in Hells Canyon are eroding. This is misleading because the other 97% of the banks are armored with bedrock, boulders, or large cobbles, and do not have the potential to erode. The Forest Service believes that the majority of the banks that have the potential to erode, are in fact eroding.

**Inconsistencies --** There are three significant contradictions that are found in the IPC documents related to sediment. The first one relates to the sediment slug theory. IPC suggests that anthropogenic disturbances (during the past 150 years) first increased sediment loads in the Snake River, then wide spread water development upstream of the HCC captured some of this material, which then caused sediment loads to decrease. This theory is presented as an explanation for "shrinking sandbars". Yet IPC concludes that the sandbars in Hells Canyon are stable, based on analysis of aerial photos, bar counts, and bar surveys.

The second contradiction relates to the stability of spawning gravels and sediment supply downstream of the complex. IPC estimates the average annual sediment yield from tributaries to be 16.6 million tons, with about 7 million tons in the spawning gravel size

range. However, IPC states that gravels as small as 1 inch are stable, even at flows that far exceed 100,000 cfs. If the tributaries are contributing all this material, but none of it is moving, the river would aggrade with gravel size material. Obviously this is not the case because the average particle size in this reach of the Snake River is estimated to be about 9 inches.

The third contradiction relates to mobility of sediments upstream and downstream of the HCC. IPC concludes that gravels up to 1.2 inches are mobile upstream of the HCC, but not in Hells Canyon. This is highly unlikely, given the steeper slope and higher degree of confinement in Hells Canyon. In addition, Milligan 2000, concludes that spawning gravels smaller than 1 inch are mobile at two cross-sections near the Tin Shed site, which conflicts with IPC's position that spawning gravels in Hells Canyon are stable.

**Adequacy of Analysis** -- The Forest Service contracted with a cadre of experts to review and comment on IPC's Technical Report Appendix E.1-1 and supporting documents. The reports generated by these scientists Wilcock et al 2002, O'connor 2002, and Andrews and Vincent 2002, identify significant weaknesses in IPC's analysis of sediment supply, stability, and transport. The authors of these reports have extensive experience in hydrologic and geomorphic response of regulated rivers across the United States (including the Snake River and Hells Canyon).

The construction and operation of the HCC has interrupted transport of silts, sands, and gravels from upstream sources, resulting in significant erosion of sandbars and terraces. IPC's analyses of sediment supply and transport do not fully address the effects of current and proposed operations on sediment and sediment-dependent resources in Hells Canyon. Based on IPC's studies, it appears that operation of the HCC has no effect on downstream sediment resources. In general, the Forest Service concludes the following.

1. IPC did not present a comprehensive sediment budget by size class.
2. Supply of sand and gravel to HCC from upstream sources is underestimated.
3. Sediment yields from tributaries downstream of the HCC are grossly overestimated.
4. Sediment directly intercepted along the 94-mile length of the project is not addressed.
5. Incipient motion estimates of spawning gravels are most likely invalid.
6. The temporal scope of sandbar measurements does not adequately cover the post-dam period.
7. The effects of daily ramping (up to 15,000 cfs) on sandbar and terrace erosion are not addressed.
8. IPC failed to incorporate flow scenarios into the sediment analysis.

These conclusions are supported by Wilcock et al 2002, O'Connor 2002, and Andrews and Vincent 2002.

One key question in addressing the rate of sandbar degradation is how much sediment (by size class) is being trapped by the HCC that would otherwise enter Hells Canyon. IPC partly addressed sediment supply from the Snake River upstream of the HCC by

estimating the volume of material trapped in Brownlee Reservoir. However, IPC failed to address sediment supply from tributaries that drain directly into the 94-mile length of the complex. In addition, IPC's estimates of sediment supply downstream of the complex are not realistic.

In addition, IPC failed to address the effect of daily operations (ramping) on sandbar and terrace erosion. Sandbar erosion can occur through three mechanisms: main channel erosion, seepage-induced erosion, and wave action (USDI 1995). Main channel erosion is likely a function of sediment supply, which is partly addressed in IPC's analysis. However, seepage-induced erosion that may be associated with daily ramping is not addressed. Seepage-induced erosion, caused by down-ramping and river fluctuations has been documented in Grand Canyon (Budhu 1992). The sandbar surfaces in Hells Canyon reach typically have gently slopes, which would suggest that seepage-induced erosion may not be occurring. However, the terraces are typically vertical, which may indicate seepage-induced erosion (caused by ramping).

Through the Aquatic Resource Work Group (ARWG) and Geomorphology Sub-Group meetings and coordination, the Forest Service has provided IPC with study needs and information requests. These requests were designed to assist the Forest Service in analyzing the effects of past, present, and future project operations. Specifically, the Forest Service submitted a comprehensive Information Needs Assessment (INA) to IPC (letter dated 12/06/98). This INA includes several sediment-related issues and questions that needed to be addressed by IPC studies. Some of the key issues and questions in the INA that IPC failed to address and include in the DLA are highlighted below:

**Flow Fluctuations Related to Dam Operations**

- How do flow fluctuations, daily and annually affect beach erosion?
- At what flow does terrace erosion begin?

**Sediment Routing and Regime**

- Are flow fluctuations and changes in sediment transport eroding sandbars and terraces and what is the rate of erosion?
- Are there changes in dam operations that can be implemented to slow the rate of sandbar loss and terrace erosion?
- What is the sediment budget inflow and outflow to the HCC?
- How much beach has been lost since the construction of the HCC Dams?
- What is the predicted rate of beach and terrace erosion in the future?

In addition, the Forest Service provided comments to IPC on their aquatic study plans in a letter dated June 7, 1999. In these comments, the Forest Service requested that IPC document all assumptions and limitations of each study, and that the sediment studies should analyze the effects over a full range of operating flows. IPC has failed to address these components in Technical Report Appendices E.1-1 and E.1-2.

**Impacts and Effects on NFS Lands and Resources --** The Forest Service maintains that IPC is at least partly responsible for degradation of sediment and sediment-dependent

resources in Hells Canyon. The construction and operation of the HCC has resulted in significant sandbar and terrace erosion, and reduced the availability of spawning gravels. Sandbars are important camping sites for recreationists and provide protection to terraces, which contain important heritage resources.

## Preliminary Forest Service Objectives

The Payette and Wallowa-Whitman Land and Resource Management Plans (LRMPs) direct the Forests to recognize hydropower withdrawals to the extent required by law and to encourage hydropower production unless precluded or further limited by specific management direction. Goals and objectives in the PACFISH (Interim strategies for managing Pacific anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California), and INFISH (Inland native strategies for managing fish-producing watersheds in eastern Oregon and Washing, Idaho, western Montana, and portions of Nevada) aquatic conservation strategy limit activities that may adversely affect fish maintenance and recovery have been incorporated into the LRMP's. PACFISH amended the LRMP's to include the terms and conditions recommended to protect and recover anadromous fish. The Biological Opinion (BO) on the LRMP's rendered by the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) for salmon and steelhead and U.S. Fish and Wildlife Service (USFWS) for bull trout further imposes terms and conditions on the Forest that include the provision that the Forest must exercise all of its authority to protect and recover salmon and steelhead (Mechanism 4 of the BO), and bull trout (Bull Trout LRMP BO 1998 Conservation Recommendations).

The Payette and Wallowa-Whitman National Forest LRMP’s provide direction to protect heritage resources considered eligible for the National Register of Historic Places and protect eligible cultural resources from human degradation and natural destruction. Projects, permits, and licenses must comply with the National Historic Preservation Act. Physical processes and functions serve as a basis for maintenance of heritage resources.

The Land and Resource Management Plans for the Payette and the Wallowa-Whitman National Forests have standards and guidelines that require the Forests to protect and manage habitat for the recovery and maintenance of viable and diverse habitat and populations of aquatic, terrestrial, and riparian dependent species. These standards and guidelines include requirements for the perpetuation and recovery of plants and animals that are listed as threatened or endangered by the USFWS or NOAA Fisheries under the Endangered Species Act (ESA) and sensitive by Forest Service Regions 4 and 6. These diverse habitats and populations are to be well distributed across the Forest. It further directs that the Forest Service give management and enhancement of water quality, protection of watercourses and streamside management units, and fish habitat priority over uses described or implied in all other management standards and guidelines.

The Hells Canyon National Recreation Act and the Comprehensive Management Plan (CMP) for the Hells Canyon National Recreation Area (HCNRA) direct the Forest Service to maintain and protect fish habitat through careful resource management and recreation development. The CMP places strong emphasis on the protection and preservation of heritage resources in Hells Canyon.

The Snake River is a Wild and Scenic River with an approved plan amended to the Wallowa-Whitman National Forest LRMP. The Wild and Scenic Rivers Act requires evaluation of Federal Energy Relicensing Commission (FERC) licensed projects above or below a designated Wild and Scenic river. The determination to be made is whether the project will "invade the area or unreasonably diminish the scenic, recreational, cultural resource, and fish and wildlife values present in the area on the date of designation..."

The Wallowa-Whitman LRMP states that the Forest Service must comply with the Clean Water Act by meeting or exceeding State water quality standards.

Based on the Forest LRMPs, PACFISH, and the Hells Canyon National Recreation Area Act, the Forest Service has developed preliminary objectives for sediment resources. These objectives are listed below:

4. Minimize or prevent adverse effects of project operations on sandbars, terraces, aquatic habitats, and riparian ecosystems.
5. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats in cooperation with the Forest Service.
6. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, and riparian ecosystems that continue to be adversely affected by project operations. The plan would be developed by Idaho Power Company, the Forest Service, and other interested parties.

## Forest Service Response to Applicant's Proposed PM&E Measures

IPC has not proposed any protection, mitigation, or enhancement measures that would address erosion downstream of the complex. This is not surprising, since IPC concludes they are not responsible for sandbar and terrace erosion in Hells Canyon. The Forest Service disagrees with this conclusion and maintains that continued project effects to sediment dependent resources need to be mitigated.

## Additional Study Requests

The Forest Service requests that a more objective sediment study be conducted by an independent party. Wilcock et al 2002, provides some specific recommendations on future studies that could be conducted to address sediment issues in Hells Canyon.

The Forest Service requests the following four additional studies be conducted by IPC and an independently agreed upon contractor, and that agency specialists be involved in developing more specific components of associated study plans.

**1. Sediment Budget**

**Study ID:** Comprehensive sediment budget for all size classes.

**Basis for Study:** A comprehensive sediment budget will account for volumes and weights of sediment (by size class) in the study reach. The study reach would include the Snake River, from the head of Brownlee Reservoir to the Salmon River confluence and all adjacent tributaries. The sediment budget would include the following:

1. Average annual load (tons per year) of silt/clay, sand, and gravel that enters Brownlee Reservoir.
2. Average annual load (tons per year) of silt/clay, sand, and gravel that directly enters the 94-mile HCC from adjacent tributaries.
3. A more reasonable estimate of the average annual load of silt/clay, sand, and gravel that enters the Snake River downstream of the HCC from adjacent tributaries.
4. Average annual load (tons per year) of eroded material from sandbars and terraces.

The sediment budget should determine how much material is trapped in the HCC (by size class), how much enters the Snake River downstream of Hells Canyon Dam, and an estimate of sandbar and terrace erosion (tons per year). A comparison of average annual erosion of sandbars and terraces, and the average annual load of material intercepted by the HCC would determine the relative impact of the project.

**Study Methodology:** The specific methods would be determined in cooperation with agency specialists and scientists.

**Resource Goals and Objectives:** The goals and objectives for sediment and sediment-dependent resources are shown below.

1. Minimize or prevent adverse effects of project operations on sandbars, terraces, aquatic habitats, and riparian ecosystems.
2. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats in cooperation with the Forest Service.
3. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, and riparian ecosystems that continue to be adversely affected by project operations. The plan would be developed by IPC, the Forest Service, and other interested parties.

**Accepted Practices:** The accepted practices for conducting a sediment budget would be determined in cooperation with agency specialists and scientists.

**Usefulness of Information:** A sediment budget would determine the relative impact that the HCC has on sediment and sediment-dependent resources in Hells Canyon.

**2. Ramping and Peak Discharges**

**Study ID:** Effects of daily ramping and peak discharges on sandbar and terrace erosion.

**Basis of Study:** Daily ramping generally occurs at flows between 6,500 and 30,000 cfs. The effects of this ramping on sandbar and terrace erosion are unknown. In addition, peak discharges are believed to contribute to sandbar and terrace erosion. The relative contributions of these processes to erosion is currently unknown and needs to be determined to fully assess project impacts to Forest Service resources.

**Study Methodology:** Specific study methods would be determined in cooperation with agency specialists and scientists.

**Resource Goals and Objectives:** The goals and objectives for sediment and sediment-dependent resources are shown below.

1. Minimize or prevent adverse effects of project operations on sandbars, terraces, aquatic habitats, and riparian ecosystems.
2. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats in cooperation with the Forest Service.
3. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, and riparian ecosystems that continue to be adversely affected by project operations. The plan would be developed by IPC, the Forest Service, and other interested parties.

**Accepted Practices:** The accepted practices for this study would be determined by agency specialists and scientists.

**Usefulness of Information:** This information would be critically important in determining the relative contribution that IPC has had on sandbar and terrace erosion during past and current operations. In addition, this information would aid in developing terms, conditions, and mitigations that would be most effective in meeting applicable goals and objectives for sediment and sediment-dependent resources.

**3. Supply, Stability, And Transport Of Spawning Gravels**

**Study ID:** Supply, stability, and transport of spawning gravels at key sites in Hells Canyon.

**Basis for Study:** To determine the average annual supply, stability, and transport rates of spawning gravel at key sites in Hells Canyon. This study would determine how much spawning gravel is supplied to the Snake River, how much is transported out of the reach, and long-term predictions for the availability of spawning gravels. This study could be integrated with the sediment budget.

**Study Methodology:** Specific study methods would be determined in cooperation with agency specialists and scientists.

**Resource Goals and Objectives:** The goals and objectives for sediment and sediment-dependent resources are shown below.

1. Minimize or prevent adverse effects of project operations on aquatic habitats.
2. Develop and analyze project operation scenarios that minimize adverse effects on aquatic habitats in cooperation with the Forest Service.
3. Prepare and implement a monitoring and mitigation plan that addresses aquatic habitats that continue to be adversely affected by project operations. The plan would be developed by IPC, the Forest Service, and other interested parties.

**Accepted Practices:** Specific practices would be developed in cooperation with agency specialists and scientists.

**Usefulness of Information:** This information would be useful in determining the long-term availability of spawning gravels, and would aid in developing appropriate terms, conditions, and mitigation measures.

**4. Potential Alternatives for Mitigating Sediment-Related Effects**

**Study ID:** Potential alternatives for mitigating and preventing further impacts to sediment resources, specifically sandbars and terraces.

**Basis for Study:** To determine what types of treatment measures would be effective in stabilizing sandbars and terraces to prevent further degradation.

**Study Methodology:** Specific study methods would be determined in cooperation with agency specialists and scientists.

**Resource Goals and Objectives:** Minimize or prevent further degradation of sediment and sediment-dependent resources in accordance with applicable management direction.

**Accepted Practices:** Specific practices would be developed in cooperation with agency specialists and scientists.

**Usefulness of Information:** This information would be useful in designing effective stabilization measures that would protect sandbars and terraces, and prevent future degradation.

# Project Hydrology

## General Discussion

IPC has developed the models and tools that can be used to address flow dependant resource issues associated with the HCC. However, IPC has not properly utilized those tools to describe the effects of their proposed action on those flow dependent resources. Nor has IPC adequately utilized those tools to analyze a range of operational alternatives that could meet specific resource objectives.

The Forest Service disagrees with IPC selection of their proposed action as the base case scenario. The base case scenario should be defined by the current operations. The current operations should include how IPC was operating the HCC during the last 10 years specifically during the modeled years 1992, 1994, 1995, 1999, and 1997. The base case should include the actual drawdown for spring flood control as well as the actual summer drawdowns in Brownlee Reservoir. IPC should evaluate both the positive and negative impacts of their proposed operations to the actual impacts that occurred during the modeled years.

IPC has only modeled two operational scenarios: 1) proposed operations for the new license term, and 2) run-of-river full pool. Neither of these alternatives adequately addresses Forest Service resource concerns.

IPC contends that the full pool run-of-river scenario was developed because state agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of an “unaltered hydrograph” through the HCC. State agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of several operational scenarios. The run-of-river full pool alternative is only one of several alternatives to evaluate against current operations.

The consultation record indicates that the state and federal agencies and nongovernmental organizations believed it was critical for IPC to address several different operational scenarios as part of the DLA process. The Forest Service maintains it is necessary to evaluate those scenarios when it comes to discussion of project hydrology and how hydrology and operation affect the environment. The failure of not conducting this type of analyses has resulted in a lack of critical information needed to adequately evaluate the effects of the proposed operations on the identified environmental and natural resource issues and concerns.

IPC has severely limited their scope and range of analyses in regards to operational hydrology. IPC has avoided adequately describing the environmental effects of the existing operations and proposed operations. This has allowed IPC to avoid the discussion of several operational PM&E measures that would address critical resource issues.

On a technical note, the Forest Service recommends IPC conduct and display a better analysis of the continuing impacts of operations on daily flows.

## Comments Specific to the Draft License Application

Quotations or sections taken directly from IPC's draft license application are shown in italics.

**Exhibit E.0. Conceptual Overview of Integration.**

1. Page E.0-1. …*Therefore, water flows in the Snake River are a primary ecosystem process that influences the function and condition of the Hells Canyon ecosystem.*

   The Forest Service strongly agrees with the importance of this statement. As an active participant in the ARWG, the Forest Service had submitted to IPC several operational scenarios that we felt were necessary to adequately address water flows and their effect on the natural resources associated with the HCC. Because IPC chose to end collaborative discussion regarding these scenarios, the Forest Service maintains the hydrology and flow integration section of the DLA is inadequate.

2. Page E.0-1. *The Hells Canyon Complex, owned and operated by the Applicant, is situated on the Snake River in Hells Canyon. The Applicant operates the complex to comply with the Federal Energy Regulatory Commission (FERC) license, as well as to accommodate other concerns, such as recreational use, environmental conditions, and voluntary arrangements. Among these arrangements are the 1980 Hells Canyon Settlement Agreement; the fall chinook plan adopted in 1991; and between 1995 and 2001, the cooperative arrangement that the Applicant had with federal interests in implementing certain flow augmentation measures that are part of the Federal Columbia River Power System (FCRPS) biological opinion and intended to avoid jeopardy of the FCRPS operations below the Hells Canyon Complex.*

   The Forest Service maintains that operations associated with the 1995-2001 cooperative arrangement, a part of the FCRPS Biological Opinion, should be incorporated as part of the baseline operations (flow) conditions as part of the DLA.

3. Page E.0-1. *The Applicant modeled two operational scenarios: proposed operations and full pool run-of-river operations. For comparison purposes, operational analyses use the proposed operations scenario of the HCC as the base case scenario.*

   The Forest Service does not believe IPC Proposed Operations should be considered the baseline alternative in the DLA. The baseline alternative should reflect how IPC operated the majority of times in the recent years. This includes a reflection of operations for the primary model years of 1992, 1994, 1995, 1999, and 1997.

4. Page E.0-2. …*The other operational scenario analyzed is the full pool run-of- river operations scenario, for which inflows to the Hells Canyon Complex, as well as*

*tributary inflows, equal outflows from the complex, with water-surface elevations of the three reservoirs held constantly at full pool (that is, no load following would occur). The full pool run-of-river operations scenario does not necessarily reflect conditions that would be most beneficial to environmental resources. Rather, it allows the Applicant to analyze impacts with the project in place but without project operations influencing the outflow hydrograph.*

The Forest Service is disappointed that IPC has disregarded the input of the ARWG when unilaterally selecting operational scenarios.

The Forest Service maintains the hydrology and integration analysis conducted by IPC is rendered inadequate by IPC's decision to run the two alternatives they chose. The Forest Service maintains the analysis is lacking a true integrated approach.

The Forest Service recommends IPC develop and run alternatives to meet specific resource objectives. For example, IPC should run the low pool run-of-river alternative to address water quality (temperature and dissolved oxygen) issues and economic benefits.

The ARWG spent considerable time working with IPC identifying several critical operational scenarios to address resource and environmental concerns. This is well documented in the consultation record. IPC in their March 20, 2001 final executive summary to the HCC collaborative team stated, "*The company is analyzing two operation scenarios, based on continuing to operate the hydroelectric complex and project-related impacts. IPC understands that people would like them to look at additional scenarios, but they are unnecessary for the license application.*" This action by IPC eliminated all further discussion with the stakeholders for proper analysis of project impacts. The March 20, 2001 final executive summary is not included in IPC's consultation record. The Forest Service recommends a meaningful effort by IPC to collaboratively develop a range of operational flow scenarios that specifically address the critical resources issues.

5. Page E.0-2. *Proposed operations for the Hells Canyon Complex would provide for flood control in the spring, water releases for fall chinook salmon, and other constraints to operations, such as reservoir fluctuation limits. Proposed operations of the Hells Canyon Complex may also influence environmental conditions and natural resources. Although operations of the complex would affect many of these resources simultaneously, specific resources may be affected in different ways. Therefore, the Applicant conducted a series of integrated resource-specific studies to evaluate both positive and negative impacts of certain operational scenarios for managing water flows and reservoir levels in the Hells Canyon Complex. These studies are referred to as flow-related studies.*

   The Forest Service recommends that IPC evaluate "both the positive and negative impacts" of all the recommended ARWG operational scenarios, not just the two IPC selected (see the Additional Study Request section).

6. Page E.0-2. *The operational scenarios that the Applicant evaluated (see section E.0.1.), as well as information about the hydrologic characteristics of the Snake River, provided direct and indirect links for integrating results of the flow-related studies. Specifically, the Applicant investigated influences of operational scenarios on aesthetic, wildlife, aquatic, botanical, cultural resources, as wells as effects on recreation, sediment, and water quality (Figure E.0-1).*

   Again, The Forest Service recommends that IPC evaluate "direct and indirect links for integration" for all the recommended ARWG operational scenarios, not just the two IPC selected. Because this was not done the Forest Service does not believe IPC has adequately "investigated influences of operational scenarios on aesthetic, wildlife, aquatic, botanical, cultural resources, as wells as effects on recreation, sediment, and water quality".

7. Page E.0-2, 3. *Consistent with FERC regulations, the intent of these studies was to identify operational impacts to natural resources from the Applicant's proposed operations of the Hells Canyon Complex. Results of these studies were then used to develop protection, mitigation, and enhancement (PM&E) measures. The Applicant has included this conceptual overview to describe how studies across several resource disciplines were designed and integrated. This conceptual overview provides the following:*
   - *Description of two operational scenarios—proposed operations and full pool run-of-river operations—that were developed for identifying and comparing effects of operations to natural resources (section E.0.1.)*
   - *Discussion of the analytical process and simulation modeling used for evaluating the potential impacts of proposed operations to natural resources (section E.0.2. and section E.0.3.)*

   The Forest Service does not believe IPC is consistent with FERC regulations when basing IPC analysis on their Proposed Operations and Full Pool Run-of River scenarios. Again, Proposed Operations should not be considered the baseline. The Forest Service does not believe IPC has adequately evaluated the potential impacts of the proposed operations. Because IPC has not run a range of alternatives as suggested by the ARWG, IPC has not adequately analyzed or develop PM&E measures.

*E.012. Scenario Development*

1. Page E.0-3. *The Applicant proposes to operate (proposed operations) the Hells Canyon Complex according to a number of operating objectives or constraints over the period of the new license, assumed to be 30 years for the purpose of environmental analysis. These constraints, combined with inflow conditions, ultimately create the boundary conditions representing the components of the physical environment within and downstream of the Hells Canyon Complex. Operational and natural resource analyses use the proposed operations of the Hells*

*Canyon Complex as the base case scenario, which defines the operational parameters under which the complex would typically operate.*

Again, the Forest Service does not believe IPC's Proposed Operations should be used to define the base case scenario. The base case scenario for analysis purpose should be the scenario that reflects how IPC has been operating the HCC.

2. Page E.0-3. *Varying hydrologic conditions and numerous other factors influence the way hydropower projects operate. Daily operations are influenced by many factors, which may include project inflow, energy demand, market conditions, and emergency situations and are difficult to predict on a long-term basis with any certainty. In addition, constraints may be imposed on a hydroelectric project to provide for benefits other than hydroelectricity. Examples include operations for flood control, requirements for the operating reserve, navigation, and protection of natural resources. When defining operation rules for proposed operations the Applicant considered and attempted to balance these constraints. Operating rules for the Applicant's proposed operations are presented in Chapter 3 of Technical Report E.1-4.*

   The Forest Service maintains there are several potential operational constraints that IPC has not analyzed. These constraints should be considered PM&E measures. For example, IPC has not addressed modified ramping to benefit downstream erosion, recreation, or aquatic habitat.

3. Page E.0-3, 4. *Parameters of the proposed operations scenario for the Hells Canyon Complex are similar to those of the current operations, but they differ considerably from the operating parameters of the original license. The reason for these differences is that over time, energy and conditions have altered how the Hells Canyon Complex is operated. For example, after fall chinook salmon were designated as threatened under the Endangered Species Act, the Applicant modified its operations. In the fall of 1991, the Applicant started a program to protect the fall chinook salmon spawning and incubation period. The Applicant's proposed operations would continue this special program.*

   IPC is not including several operating constraints that reflect current operations in the proposed action. For example, the summer flow augmentation that IPC originally defined in their "Planned" Operations that was presented to the ARWG is not included in the "Proposed" Operations. It is important to note that the "Proposed" Operations do not reflect how IPC has recently operated the project.

4. Page E.0-4. *The Applicant's proposed operations scenario looks forward into the new license term and provides a general point of comparison for other potential operating scenarios. To determine the potential impacts of the project, the Applicant compared the full pool run-of-river operational scenario with the base case scenario (proposed operations). Differences in resource conditions, such as the extent of fish*

*and wildlife habitat availability, between these two operational scenarios constitute a measure of potential impacts and can assist in developing PM&E measures.*

The Forest Service disagrees with the statement that comparing the proposed operations to full pool run-of-river "determines the potential impacts of the project". All this does is compares these two alternatives. It does not even provide a comparison to the existing or no action alternative.

*E.0.2. Analytical Process*

1. Page E.0-4. *Because many natural resources, such as riparian habitat, have lengthy response periods to manipulations of river flows, empirical investigations were not feasible for understanding integrated impacts. Therefore, in cooperation with state and federal agencies and nongovernmental organizations, the Applicant developed an integrated, ecosystem-level process to evaluate how hydrology and project operations influence river flows and reservoir levels and, in turn, resources associated with the Hells Canyon Complex. This analytical process allows the applicant to identify potential effects occurring simultaneously to various natural resources under the two operational scenarios. In addition, the analytical process sequentially links several simulation models for projecting environmental conditions that could result if the proposed operations scenario were implemented.*

   The Forest Service maintains IPC is overstating their "cooperation with state and federal agencies and nongovernmental organizations". While IPC has developed the tools to provide an integrated, ecosystem-level process, IPC has not cooperated with state and federal agencies and nongovernmental organizations on the utilization of those tools to run the recommended operational scenarios. This lack of cooperation severely limits the evaluation and interpretation of the proposed action and potential PM&E measures.

2. Page E. 0-5. *The Applicant developed a process that hierarchically linked several simulation models for projecting river processes (such as hydrology, water quality, and sediment) as they related to individual hydrologic characteristics of the two operational scenarios. The analysis incorporated physical characteristics of Hells Canyon and the Snake River, such as topography, bathymetry, geology, geomorphology, land covers, and land uses (see Figure E.0-1). After defining the hydrologic conditions, two operational scenarios, and the projected conditions, such as water levels and flows, of the Hells Canyon Complex reservoirs and the Snake River in Hells Canyon, the Applicant incorporated resource-specific models into the analytical process so that resource conditions under the operational scenarios could be estimated. Finally, the Applicant identified general effects and developed PM&E measures. PM&E measures were also developed based on the results of other studies unrelated to hydrology and reservoir and river operations (Figure E.0-1).*

Because of the limitation of IPC's operational scenario evaluation, the Forest Service maintains that the DLA does not develop an adequate range of flow related PM&E measures.

3. Page E.0-5. *The Applicant's relicensing studies, and therefore the analytical process, spanned multiple levels of resolution, from the ecosystem level to individual species level. This approach enhanced the evaluation with the simultaneous integration of resource studies evaluated under the two operational scenarios (Figure E.0-1). Incorporating results of simulation models into the process further allowed the Applicant to evaluate effects of the Hells Canyon Complex to numerous natural resources under the operational scenarios.*

   Again, because of the limitation of IPC's operational scenario evaluation, the Forest Service maintains the DLA does not adequately evaluates the effects of the HCC to natural resource issues and concerns developed by the ARWG.

*E.0.3. Simulation Modeling*

1. Page E.0-6. *Toward the end of the process, the Applicant identified and quantified the effects of the Hells Canyon Complex as differences between resource conditions resulting from the proposed operations and full pool run-of-river operations scenarios. Given this common foundation for analysis, the Applicant could combine results of many resource evaluations for an overall evaluation of each resource discipline and then propose relevant PM&E measures (Figure E.0-1).*

   The Forest Service agrees with the statement, "*the Applicant identified and quantified the effects of the Hells Canyon Complex as differences between resource conditions resulting from the proposed operations and full pool run-of-river operations scenarios.*" The Forest Service maintains this is all the DLA does. It does not compare the current operations to the proposed action, nor does the DLA develop flow related PM&E measures to address critical resource issues and concerns submitted by the Forest Service and other ARWG members.

*E.0.3.1. Hydrology*

1. Page E.0-7. *Although not affected by the Hells Canyon Complex, several components of its inflows—reservoir and river processes such as water quantity, sediment loads, and water quality—directly affect many natural resources in Hells Canyon. Furthermore, the timing and magnitude of inflows directly affect operations of the Hells Canyon Complex. Therefore, inflow parameters, which are influenced by the entire Snake River basin, create constraints for the Hells Canyon Complex and, in turn, upstream boundary conditions for the modeling of the two operational scenarios. The inflow hydrology to the Hells Canyon Complex was developed based on historical flows into Brownlee Reservoir that were measured at the U.S. Geological Survey gauge at Weiser (Chapter 2 of Technical Report E.1-4). The development of this hydrograph was based on the Idaho Department of Water*

*Resources depleted-flow computations for the 1928–1991 period and historical data for the 1992–1999 period. For some resource analyses, such as the botanical resources, the 1928–1999 record was used. For other resource analyses more recent historical data were used. Historical data sets from the 1992–1999 period were chosen to represent a range of hydrologic conditions that corresponded to empirical data sets of water quality and meteorologic boundary conditions that were used to calibrate the water quality models. Five years were chosen from this period to represent an extreme-low (1992), low (1994), medium (1995), high (1999), and extreme-high (1997) set of hydrologic conditions. Because the assessment of aquatic resources is so closely integrated with water quality models, the Applicant used these five years as the basis for comparisons between the proposed operations and full pool run-of-river operations scenarios for water quality and aquatic resources.*

The Forest Service supports the use of the five years chosen to analyze and display model results: extreme-low (1992), low (1994), medium (1995), high (1999), and extreme-high (1997). However, the Forest Service also believes IPC should have used those five years of actual HCC operations to use as the base case scenario.

## Comments Specific to the Technical Report Appendices

Quotations or sections taken directly from the IPC technical report appendices are shown in italics.

**Technical Report Appendix E.1-4. Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River.**

1. Chapter 1, Page 2. *IPC, in cooperation with agencies and nongovernmental organizations, identified the need to develop an integrated, ecosystem-level approach. This approach would allow IPC to evaluate how hydrology and project operations influence river flows and reservoir levels and, in turn, how these flows and reservoir levels influence resources associated with the HCC. Two specific objectives were identified in developing this approach: 1) design a hierarchical, integrated analytical process that simulates project operations and subsequently project discharges within the study reach, as well as water quality processes within the reservoirs and below the projects in the Snake River; and 2) evaluate the influences—both positive and negative—of these simulated processes on individual components of the ecosystem and identify or quantify those effects attributable to the presence of the complex and its operations.*

   The Forest Service agrees that there is a need to develop and implement an integrated, ecosystem approach. The Forest Service maintains that IPC has developed the tools to meet this object, however, IPC failed to incorporate the recommendation made in the ARWG on implementing the approach. The Forest Service is concerned that IPC selected only two operational scenarios used to drive this process, and has not worked "in cooperation with agencies and nongovernmental organizations".

2. Chapter 1, Page 3. *Two operational scenarios were developed for resource evaluation: proposed operations and full pool run-of-river operations. The proposed operations scenario defines the operational parameters under which the HCC would operate, looking forward into the term of a new license, and serves as the base case. The full pool run-of-river scenario was developed because state agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of an "unaltered hydrograph" through the HCC, compared with IPC's proposed operations. Chapter 3 (Parkinson 2002) describes the operations modeling in more detail.*

   The Forest Service takes exception to IPC's statement that "the full pool run-of-river scenario was developed because state agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of an "unaltered hydrograph…" The state agencies, federal agencies, and other interested parties never intended the full pool run-of-river alternative be the alternative to address the unaltered hydrograph. Several interested parties expressed interest in a natural hydrograph scenario. NOAA Fisheries strongly recommended a low pool run-of-river scenario. As a matter of fact, the primary reason parties recommended full pool run-of-river was to address an operation that would meet objectives of a full stable reservoir for recreation. The Forest Service maintains that the evaluation of several operational scenarios is critical to address resource issues.

3. Chapter 2, Page 11. *Based on the assumption that the historic pattern adequately represents future conditions, an adjusted historic hydrology would use historic data on daily flows, as adjusted by the IDWR.*

   The Forest Service maintains that this may be an invalid assumption. The Bureau of Reclamation (BOR) provides a different assumption on future conditions that would alter the inflow hydrograph.

4. Chapter 2, Page 11. *Results of our applying the methodology for developing the inflow hydrology are provided in digital form in an attached file.*

   The Forest Service along with other agencies would like to obtain this file to assist in our further evaluation of the HCC project and previously requested this information in summer 2002. In a letter dated September 18, 2002 IPC declined to provide this data to the Forest Service and other parties involved in the relicensing of HCC.

5. Chapter 2, Page 25-26. *The chosen method for developing the inflow hydrology addressed elements outlined in the introduction of this document. It fulfilled the following considerations: Addressed the current level of water-resources development and the operation of existing projects in the Snake River Basin by using the IDWR-adjusted flows with fish augmentation (June 2000).*

The Forest Service maintains IPC should not base their assumption only on current operations but should consider and address future operations of upstream development.

6. Chapter 2, Page 26. *Once we had developed the approach, we discussed it with a hydrologist from the National Marine Fisheries Service by conference call in July 2000 and with the Aquatic Resources Work Group on July 19, 2000. No significant modifications to the approach were suggested during these discussions.*

   The Forest Service maintains that there are several viable inflow hydrograph alternatives that could be utilized to manage water flows and reservoir levels as well as addressing the impacts of operational alternatives on environmental resources. For example, in the June 21, 1999 letter from Oregon department of Fish and Wildlife (ODFW), ODFW requested IPC to evaluate several operational scenarios based on different alternative inflow hydrograph assumptions.

7. Chapter 3, Page 1. *IPC operates the complex to comply with the Federal Energy Regulatory Commission (FERC) license, as well as to accommodate other concerns, such as recreational use, environmental conditions, and voluntary arrangements. Among these arrangements are the 1980 Hells Canyon Settlement Agreement, the Fall Chinook Plan adopted in 1991, and, between 1995 and 2001, the cooperative arrangement that IPC had with federal interests in implementing portions of the Federal Columbia River Power System (FCRPS) biological opinion flow augmentation, which is intended to avoid jeopardy of the FCRPS operations below the HCC.*

   The Forest Service maintains that IPC has not fully integrated the State and federal agencies resource and environmental concerns in how they operate the HCC. IPC should incorporate in the baseline operational scenario the existing operations that reflect the 1995-2001 cooperative arrangement as part of the FCRPS BO.

8. Chapter 3, Page 2. *This general load shape used by the model to calculate water releases is presented in Figure 1.*

   Figure 1, The Relative System Load Demand scale should not only be relative for the yearly quarters provided but also relative to each other. In other words, the Forest Service maintains the figure should be presented so one could compare winter to spring demands, etc.

9. Chapter 3, Page 4. *The U.S. Army Corps of Engineers' (COE) North Pacific Division defines flood-control requirements and coordinates flood-control efforts with IPC. During the spring, IPC complies with Article 42 and responds to the COE request to lower the water level in Brownlee Reservoir. The lower water level provides space for excess spring runoff and helps prevent flooding, primarily on the lower Columbia and lower Snake rivers. Target elevations specified for Brownlee Reservoir in the spring are not calculated for the calibration exercise. However, the historical daily*

*elevations are included as boundary conditions in the model, which contain the historical flood-control requirements and operations for that specific year.*

The Forest Service maintains this is one example of the problems of not evaluating the actual baseline condition as defined by how IPC actually operated the HCC for the modeled years 1992, 1994, 1995, 1999, and 1997. Table 1, below, compares the modeled flood control elevations to the actual elevations for the average year 1995. Again, there is a large difference between actual and modeled storage of water in Brownlee Reservoir.

**Table 1. Actual vs. Modeled Flood Control**

| **Actual versus Modeled Flood Control at Brownlee Reservoir** | | | |
|---|---|---|---|
| **Date** | **Actual Elevation (1995)** | **Modeled Elevation (1995)** | **Difference in Acre feet** |
| February 28 | 2,059 | 2,044 | 117,000 |
| March 31 | 2,064 | 2,040 | 296,000 |
| April 15 | 2,062 | 2,035 | 299,000 |
| April 30 | 2,053 | 2,035 | 212,000 |

The Baseline Operational Scenarios should be defined as the way IPC had been operating the HCC. The Proposed Operations should not be the baseline.

10. Chapter 3, Page 7. *To further compare modeled and actual project outflows, IPC developed duration curves for discharge from Hells Canyon Dam (Figures 6 through 8). The duration curves are created from 15-minute historical data and 15-minute model output data for comparison purposes.*

    The Forest Service is concerned that IPC has not adequately displayed the current or proposed operation that characterizes the daily and hourly flows.

11. Chapter 3, Page 9. *Two operational scenarios are modeled for the license application. Operational analyses use the proposed operations scenario of the HCC as the base case scenario. This scenario defines the operational parameters under which the complex would typically operate as a point of comparison with other operational scenarios. The other operational scenario analyzed is the full pool run-of-river scenario.*

    The Forest Service does not believe IPC's Proposed Operations should be used to define the base case scenario.

12. Chapter 3, Page 9. *IPC's definition of proposed project operations looks forward into the new license term and provides a general point of comparison for other potential operating scenarios.*

    The base case scenario for analysis purpose should be the scenario that reflects how IPC has been operating the HCC. IPC should be comparing how they have operated under the existing license to how they plan to operate in the future.

13. Chapter 3, Page 9. *It is important to note that, if the output of IPC's operations model were compared with historical conditions, differences would be apparent. That is, parameters of the proposed operating scenario for the HCC differ considerably from the operating parameters of the original license. The reason for these differences is that over time, energy and environmental conditions have altered how the HCC is operated. For example, when fall chinook salmon were designated as threatened under the Endangered Species Act, IPC modified its operations. In the fall of 1991, IPC started a program to protect spawning adults and emerging fry. IPC's proposed operations continue this special program.*

    IPC is not including several operating constraints that reflect current operations in the proposed action. For example, the summer flow augmentation that IPC originally defined in their "Planned" Operations that was presented to the ARWG is not included in the "Proposed" Operations. It is very important to note that the "Proposed" Operations does not reflect the recent current operations, but a new alternative on how IPC wants to operate in the future.

14. Chapter 3, Page 10. *Full pool run-of-river is the operational scenario IPC will compare with the base case scenario (proposed operations) to determine project impacts. Full pool run-of-river establishes a scenario where inflows to the HCC, including tributary inflows, equal outflows from the HCC. This scenario does not necessarily reflect conditions that would be most beneficial to environmental resources. Rather, it reflects conditions under which IPC could analyze impacts with the project in place but without project operations influencing the outflow hydrograph.*

    The Forest Service and other ARWG members recommended the low pool run-of-river operational scenario to evaluate the impacts of an existing unaltered hydrograph with the project in place. Several other ARWG members recommended a natural hydrograph scenario where the inflow hydrograph would represent historic natural conditions. Others recommended a hydrograph based on BOR assumptions for how they plan to operate the upstream facilities in the future. The Forest Service does not believe IPC has done an adequate analysis of addressing other operational scenarios.

15. Chapter 3, Page 11. *As mentioned in Section 3.1.3., the COE's North Pacific Division defines flood-control requirements and coordinates flood-control efforts with IPC. During the spring, IPC complies with Article 42 and responds to the COE request to lower the water level in Brownlee Reservoir. The lower water level provides space for excess spring runoff and helps prevent flooding, primarily on the lower Columbia and lower Snake Rivers. The CHEOPS model uses the latest 1998 rule curve formulas to calculate the target elevations for Brownlee Reservoir based on observed flows at Brownlee and The Dalles projects.*

The Forest Service maintains that IPC should evaluate a baseline operation scenario that includes the actual flood control space that occurred for the modeled years of 1992, 1994, 1995, 1999, and 1997.

16. Chapter 3, Page 12. *After the Fourth of July holiday, the model again drafts the reservoir beginning July 5 each year to simulate IPC customers' power needs during the summer months. The amount of draft varies according to the type of water year and the target elevation specified for August 31 (Table 8).*

    IPC's Table 8 does not reflect how IPC has operated in recent years. The table below compares the August 31 Actual Brownlee Reservoir Elevations to the Proposed Operations Modeling for the model years 1992, 1994, 1995, 1999, and 1997. It clearly shows that IPC has been operating the HCC differently than their Proposed Action.

***Table 8. Comparison of August 31 Actual Brownlee Reservoir Elevation to Modeled Proposed Operations Elevations.***

| ***Year*** | ***Actual August 31 Brownlee Elevation*** | ***IPC August 31 Brownlee Elevation*** | ***Difference in acre feet*** |
|---|---|---|---|
| *1992* | *2,060* | *2,072* | *157,000* |
| *1994* | *2,060* | *2,072* | *154,000* |
| *1995* | *2,056* | *2,069* | *160,000* |
| *1997* | *2,052* | *2,059* | *73,000* |
| *1999* | *2,045* | *2,059* | *152,000* |

17. Chapter 3, Page 12. *After fry emergence, or June 1 in the model, the minimum instantaneous flow below Hells Canyon Dam is reduced to 6,500 cfs, or such inflows that Brownlee Reservoir is not drafted to meet the minimum flow requirement. Table 9 summarizes the minimum instantaneous flows below Hells Canyon Dam for three time periods.*

    The Forest Service maintains IPC should evaluate an operational scenario that would require a minimum flow of 6,500 cfs below Hells Canyon Dam, even if this includes drafting Brownlee Reservoir.

18. Chapter 3, Page 12. *A minimum flow of 6,500 cfs below Hells Canyon Dam is modeled by CHEOPS to represent the agreement between IPC and the COE initially dated September 1988. This agreement was entered into to maintain navigation flows below the project. However, IPC's license stipulates a minimum flow of 5,000 cfs below Hells Canyon Dam at Johnson Bar. Depending on water conditions, flows below 6,500 cfs may be released below Hells Canyon Dam if 13,000 cfs is maintained at Lime Point.*

    IPC's proposed action restricts their model to a minimum flow of 6,500 cfs but allows a true minimum flow of 5,000 cfs to continue. This is one more reason why IPC should use the actual operations as the base case scenario, not their proposed action.

The Forest Service maintains that minimum flow should be set by integrating all resource issues not just Army Corps of Engineers (ACOE) navigation requirements.

19. Chapter 3, Page 13. *Only the Hells Canyon Project has a license-restricted ramping rate. Its compliance is measured at Johnson Bar, located approximately 17.6 river miles downstream of the dam. Those restrictions are shown in Table 13.*

    IPC's Table 13 should provide the Ramping Rate Limits as an hourly and daily discharge and stage at both Hells Canyon Dam and Johnson Bar.

20. Chapter 3, Page 13. *During the recreation months, the daily fluctuation below Hells Canyon Dam is typically limited to 10,000 cfs and used in the model simulations. Again, this daily limit is used to represent typical operations between June 1 and September 30 because historically, 80% of the time, daily fluctuations below Hells Canyon were 10,000 cfs or less during this time period. Therefore, the remaining 20% of the time, the daily fluctuation exceeds 10,000 cfs and is not modeled by CHEOPS during this period.*

    IPC admits that summer daily fluctuations exceed 10,000 cfs per day at least 20 percent of the time but does not include that in their analysis. This is one more reason why IPC should use the actual operations as the base case scenario, not their proposed action. In reality, IPC has not constrained their proposed operations to less than 10,000 cfs per day.

21. Chapter 3, Page 13. *IPC uses the full pool run-of-river operational scenario to evaluate HCC project impacts.*

    The Forest Service disagrees that full pool run-of-river can be used to evaluate project impacts.

22. Chapter 3, Page 14. *To help analyze CHEOPS model output for the Snake River below the Hells Canyon Dam, we used the Indicators of Hydrologic Alteration (IHA) software, a statistical tool. The Nature Conservancy with Smythe Scientific Software developed the software. This tool helped us calculate hydrologic regime characteristics and analyze changes in those characteristics over time or between data sets. IHA statistically characterizes resulting flow regimes from project operations and presents the frequency, magnitude, and duration of flow events for scenario comparison. All data entered into IHA were daily average discharges (cfs) from Hells Canyon Dam, so we did not perform daily analyses.*

    The Forest Service maintains it is imperative that IPC evaluates and displays an analysis of daily flows.

23. Chapter 3, Page 14. *Appendix 1 contains additional CHEOPS model output for each of the five representative years. Data compare Hells Canyon Dam outflow for*

*proposed operations with the full pool run-of-river scenario. The data presented are 15-minute data for each month and each representative year.*

The Forest Service appreciates the graphical display of 15-minute data found in Appendix 1. However, the Forest Service recommends that the actual data files and IPC should develop and display a thorough analysis of the daily flows. See the previous discussion under item #4 Chapter 2, page 11.

24. Chapter 3, Page 14. *Chapter 4, Page 1. The calibrated model was then integrated with the operations model CHEOPS, as described in Chapter 3 (Parkinson 2002), to simulate relicensing scenarios. These results for water temperature, DO, and total dissolved gas were then used by other resource evaluation studies. In this chapter, we briefly discuss model calibration and show how the model was configured to simulate the relicensing operational scenarios and provide demonstrative results.*

    Because IPC has limited their evaluation to two operational scenarios, IPC has not adequately evaluated the effects of the HCC operations on temperature, DO and total dissolved gas (TDG).

## Discussion

**Inconsistencies and Adequacy of Analysis --** IPC has developed the models and tools that can be used to address flow dependant resource issues associated with the HCC. However, IPC has not properly utilized those tools to describe the effects of their proposed action on those flow dependant resources. Nor has IPC adequately utilized these tools to analyze a range of operational alternatives that could meet specific resource objectives.

The Forest Service disagrees with IPC selection of their proposed action as the base case scenario. The base case scenario should be defined by the current operations. The current operations should include how IPC has been operating the HCC during the last 10 years specifically during the modeled years 1992, 1994, 1995, 1999, and 1997. The base case should include the actual drawdown for spring flood control as well as the actual summer drawdowns in Brownlee Reservoir. Even in 1992 and 1994, before the 1995 through 2001 summer flow arrangement, IPC was drawing down Brownlee Reservoir during the months of July and August at a rate greater than in the proposed operations.

IPC contends that the full pool run-of-river scenario was developed because state agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of an “unaltered hydrograph” through the HCC. The Forest Service does not believe this is the one alternative to evaluate against the proposed action. State agencies, federal agencies, and other interested parties expressed interest in an evaluation of environmental conditions that would exist as a result of several operational scenarios. Full Pool Run-of-River alternative is only one of several alternatives.

The consultation record indicates that the state and federal agencies and nongovernmental organizations believed it was critical for IPC to address several different operational scenarios as part of the DLA process. The Forest Service maintains it is necessary to evaluate those scenarios when it comes to discussion of project hydrology and how hydrology and operation affect the environment. The failure to conduct this type of analyses has resulted in a lack of critical information needed to adequately evaluate the effects of the proposed operations on the identified environmental and natural resource issues and concerns.

IPC has severely limited their scope and range of analyses in regards to operational hydrology. IPC has avoided adequately describing the environmental effects of the existing operations and proposed operations. This has allowed IPC to avoid the discussion of several operational PM&E measures that would address critical resource issues.

**Impacts and Effects on NFS Lands and Resources --** Under IPC's proposed operational regime, project generated flows and flow fluctuations will continue to play a role affecting water quality, erosion of alluvial and fluvial features, spawning and rearing substrate, riparian communities, and affecting other riparian, terrestrial, and aquatic habitat components within and downstream of the HCC.

When historic flows are compared to post dam flows in Hells Canyon, differences in the magnitude or frequency of the peak flow is limited. Current peak flows are believed to taper off more rapidly than historic flows due to reservoir storage. Daily and hourly flow fluctuations are greater than was found under the prior dam hydrographs.

Habitat for riparian and aquatic plant and animal species is being lost because of changes in seasonal flow patterns and lack of sediment. Current operations appear to be exacerbating the situation because of rapid and frequent fluctuations in water level.

Recreation opportunities and archeology resources, both Outstanding Remarkable Values (ORVs) in the Snake River Wild and Scenic River Plan, are affected by the project. The HCC and upstream dams are effective sediment traps affecting the morphology of the river. Current HCC operations, including flow releases and ramping rates, appear to be intensifying sandbar and terrace erosion at sites used for recreation and those with cultural significance.

Daily and hourly ramping rates downstream of Hells Canyon Dam are adversely affecting the jet boating and floating recreational opportunities on NFS lands.

The HCC has altered the water quality of the Snake River both within the reservoirs and downstream from Hells Canyon Dam. The complex has changed the aquatic environment from a free flowing riverine system to a system that includes reservoirs in which water quality, fish habitat, and riparian habitat have been altered. The water quality does not fully support the State identified beneficial uses for cold water biota

and salmonid spawning and rearing, in Brownlee, Oxbow, and Hells Canyon reservoirs, and the Snake River below Hells Canyon Dam.

## Preliminary Forest Service Objectives

The Land and Resource Management Plans for the Payette and the Wallowa-Whitman National Forests have standards and guidelines that require the Forests to protect and manage habitat for the recovery and maintenance of viable and diverse habitat and populations of aquatic, terrestrial, and riparian dependent species. These standards and guidelines include requirements for the perpetuation and recovery of plants and animals that are listed as threatened or endangered by the USFWS or NOAA Fisheries under the Endangered Species Act (ESA) and sensitive by Forest Service Regions 4 and 6. These diverse habitats and populations are to be well distributed across the Forest. It further directs that the Forest give management and enhancement of water quality, protection of watercourses and streamside management units, and fish habitat priority over uses described or implied in all other management standards and guidelines.

The Payette and Wallowa-Whitman National Forest LRMP's provide direction to protect heritage resources considered eligible for the National Register of Historic Places and protect eligible cultural resources from human degradation and natural destruction. Projects, permits, and licenses must comply with the National Historic Preservation Act. Physical processes and functions serve as a basis for maintenance of heritage resources.

Based on the Forest LRMP's, the Hells Canyon National Recreation Area Act, the Forest Service has developed the following preliminary objectives:

1. Provide reservoir operations and main stem flow regimes that ensure the physical processes necessary to sustain or enhance channel morphology, function and stability; aquatic habitat; riparian resources; and water quality.
2. Modify HCC operations to mitigate for the continuing effects of the project on alluvial and fluvial features within and below the HCC.
3. Modify HCC operations to mitigate for the continuing effects of the project on water quality, riparian resources, and aquatic habitat within and below the HCC.
4. Modify HCC operations to mitigate for the continuing effects of the project on recreation resources below the HCC.
5. Analyze a range of potential operational scenarios to meet flow related resource goals and objectives

## Forest Service Response to Applicant's Proposed PM&E Measures

The only proposed PM&E measures related to hydrology are those stated in IPC Proposed Operational Scenario. The Forest Service strongly believes IPC should have developed flow scenarios recommended by ARWG members to address specific flow related issues and objectives.

The specifics of IPC Proposed Operational Scenarios listed are in Technical Report Appendix E.1-4, Chapter 3, Tables 8-13, and include the following:

***Table 8. Modeled Target Elevations For Power Needs (Proposed Operations)***

| ***Type of Water Year Brownlee Target Elevation for August 31*** |
|---|
| *Low 2,072* |
| *Medium 2,069* |
| *High 2,059* |

The Brownlee Target Elevation for August 31 should meet the following objective:

- Provide a sufficient flow in the Snake River below Hells Canyon to meet out migration objectives for spring/summer chinook and fall chinook.

IPC's original Planned Operations as presented to the ARWG included this with a 2,049 target elevation. In the DLA, IPC has failed to develop a flow scenario to address the issue associated with summer flow augmentation for listed spring/summer chinook and fall chinook.

***Table 9. Modeled Minimum Instantaneous Flows Below Hells Canyon Dam For Three Time Periods (Proposed Operations).***

| ***Time Period Type of Water Year Minimum Instantaneous Flow*** | | |
|---|---|---|
| ***Dec. 12 through June 1*** | ***June 2 through Oct. 20*** | ***Oct. 21 through Dec. 11*** |
| *Low 8,500 cfs* | *Low 6,500 cfs* | *Low 9,000 cfs* |
| *Medium 10,500 cfs* | *Medium 6,500 cfs* | *Medium 11,500 cfs* |
| *High 12,000 cfs* | *High 6,500 cfs* | *High 13,000 cfs* |

The Forest Service is concerned that the modeled minimum instantaneous flows shown in Table 9 are different from the required minimum in the existing license and in the proposed action. The current license actually allows a minimum flow of 5,000 cfs. IPC should evaluate a minimum flow of 6,500 even if that requires drafting of Brownlee Reservoir.

***Table 10. Modeled reservoir elevation limits (proposed operations).***

| ***Project Maximum Elevation Minimum Elevation*** |
|---|
| *Brownlee Reservoir 2,077 ft above msl 1,976 ft above msl* |
| *Oxbow Reservoir 1,805 ft above msl 1,800 ft above msl* |
| *Hells Canyon Reservoir 1,688 ft above msl 1,683 ft above msl* |

The Forest Service maintains that this table is not adequate for defining maximum and minimum reservoir elevations. IPC should include maximum and minimum reservoir elevations determined by resource issues and objectives at different times of the year. See the following example for maximum winter and spring reservoir defined by the following flood control objectives:

- Provide protection from flooding to Lewiston and Portland by following ACOE Flood Control Rule Curves (revised 1998).

- IPC and ACOE should negotiate the highest reservoir level possible based on projected yearly stream flow forecast.

The flood control rule curves for the five primary modeled years should be disclosed in the DLA. For example:

| **Flood Control Rule Curves (maximum elevation** | | | | | |
|---|---|---|---|---|---|
| Date | Low 1992 | Med-Low 1994 | Med 1995 | Med-High 1999 | High 1997 |
| Feb. 28 | 2,077 | 2,077 | 2,044 | 1,244 | 2,035 |
| Mar. 31 | 2,077 | 2,077 | 2,040 | 1,220 | 2,008 |
| Apr. 15 | 2,077 | 2,077 | 2,035 | 2,008 | 1,994 |
| Apr.30 | 2,077 | 2,077 | 2,035 | 1,995 | 1,976 |

Maximum summer reservoir should be defined by the spring/summer chinook and fall chinook flow augmentation objectives.

- Provide a sufficient flow in the Snake River below Hells Canyon to meet out migration objectives for spring/summer chinook and fall chinook.

The following table provides an example of the maximum summer reservoir as defined by the spring/summer chinook and fall chinook flow augmentation objectives and the minimum summer reservoir as defined by the reservoir recreation access objectives.

| **Date** | **Summer Maximum Elevation** | **Summer Minimum Elevation** |
|---|---|---|
| July 4 | 2,077 | 2,069 |
| August 10 | 2,051 | 2,051 |
| August 31 | 2,049 | 2,041 |
| September 30 | 2,045 | 2,041 |

IPC's Proposed Operations regarding reservoir-level fluctuation limits is displayed in Table 11, below:

***Table 11. Modeled Reservoir-Level Fluctuation Limits (Proposed Operations).***

| ***Project and Time Period Daily Fluctuation Limits*** |
|---|
| ***Brownlee Reservoir*** |
| *January 1 through May 20 3 ft per day* |
| *May 21 through June 21 1 ft per day for resident fish spawning* |
| *June 21 through December 31 3 ft per day* |
| ***Oxbow Reservoir*** |
| *January 1 through December 31 5 ft per day* |
| ***Hells Canyon Reservoir*** |
| *January 1 through December 31 5 ft per day* |

The Forest Service is concerned about IPC's DLA proposal to allow a maximum daily fluctuation on the Hells Canyon Reservoir of 10 feet rather than the currently imposed 5 feet. The Forest Service maintains that, in order to avoid problems with boat stranding, boat launching and bank access, the maximum daily fluctuation should not be allowed to exceed 5 feet. See the Forest Service comments to the DLA section E.5.2.2.3.2.5, Reservoir Level Comments, pages E-55 and 56.

***Table 12. Modeled Bypass Flows At The Oxbow Project (Proposed Operations).***

| ***Project Minimum Bypass Flow*** |
|---|
| *Oxbow Reservoir 100 cfs continuously* |

The Forest Service maintains that IPC should be evaluating options for improving the minimum flow in the Oxbow Bypass. See fisheries comments for more details.

IPC's modeled ramping rate restrictions are displayed in Table 13, below.

***Table 13. Modeled ramping rate restrictions (proposed operations).***

| ***Project and Conditions Ramping Rate Limits*** |
|---|
| ***Hells Canyon*** |
| *Ramp rate restrictions* |
| *Ramping rate up 1 ft per hour* |
| *Ramping rate down 1 ft per hour* |
| *Daily limit between minimum and maximum flows* |
| *June 1 through September 30 10,000 cfs per day* |
| *October 21 through December 11 No load-following during fall chinook program* |

The Forest Service finds the current description of daily and hourly ramping rates inadequate. Table 13, above, should provide the ramping rate limits as an hourly and daily discharge in cfs at Hells Canyon Dam.

IPC has not adequately described the current ramping rate constraints. It would be more informative if IPC described ramping rates in both discharge and stage at Hells Canyon and Johnson Bar. For example the "Proposed Operations" ramping rates should be described as follows:

| **Time** | **Discharge at Hells Canyon Plant (cfs)** | **Stage at Hells Canyon Gage (ft)** | **Discharge at Johnson Bar (cfs)** | **Stage at Johnson Bar (cfs)** |
|---|---|---|---|---|
| **Daily** | 15,000 cfs | 6.0 ft | 15,000 cfs | 4.4 ft |
| **Hourly** | 3,500 cfs | 1.5 ft. | 3,400 cfs | 1.0 ft. |

IPC should reduce daily and hourly ramping at the Hells Canyon Dam power plant to meet the following resource objective:

- Provide hourly ramping at the Hells Canyon Dam power plant to meet resource objectives for recreation boating and floating, beach stability, riparian habitat, aesthetics, aquatic food base, and aquatic habitat.

The Forest Service is concerned that IPC models a 10,000 cfs per day ramping rate from June 1 through September 30, when data show this is exceeded 20 percent of the time.

## Additional Study Requests

The following technical information is missing from the DLA and should be provided.

1. Table 13. Should provide the Ramping Rate Limits as an hourly and daily discharge and stage at both Hells Canyon Dam and Johnson Bar.
2. Figure 1. The Relative System Load Demand scale should not only be relative for the yearly quarters provided but also relative to each other. In other words, we would like to compare winter to spring demands.
3. Brownlee Reservoir elevations should be provided for the modeled and actual Flood Control Rules for 1992, 1994, 1995, 1999, and 1997.
4. The raw data files for the15 minute inflow and 15 minute outflow should be made available to those that request the information.
5. Additional statistical analysis of the inflow and outflow daily and quarter hourly hydrology. See Study Request Item 7.

The following is a summary of additional operational scenarios that should be evaluated through the DLA conceptual integration process. This includes fully developing these alternatives, displaying CHEOPS outputs, and evaluating the resource impacts. Specifics for each additional operational scenario are listed in the following Additional Study Request items 1-7.

1. Baseline Operations (IPC-1999)
2. Winter Flood Control (USFS3-1999)
3. Run of River Low Pool (NOAA Fisheries)
4. Modified Daily Ramping at the Hells Canyon Power Plant (Forest Service)
5. Minimum Flow
6. Integrated Resource Operations (Federal Agencies)
7. Daily Streamflow Data Study

**1. Baseline operational scenario**

**Study ID:** Baseline operational scenario

**Basis For Study:** This study is needed to evaluate the baseline operational scenario. This analysis should represent how IPC actually operated the HCC for the five primary model years.

**Study Methodology**: Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River." The inflow and outflow hydrographs should be represented by actual not

modeled data. Environmental effects should be exactly what did occur for the modeled year 1992, 1994, 1995, 1999, and 1997.

**Resource Goals and Objectives:** This alternative would establish the existing baseline operations for the HCC. From this baseline all other alternatives could be compared.

**Accepted Practices:** In any environmental analysis the Baseline Alternative or No Action Alternative describes the existing situation. It is important to describe the baseline for the HCC as how IPC actually operated the complex.

**Usefulness of Information:** The results of this study will establish the existing baseline operations for the HCC. IPC can then compare their proposed operations to the baseline. This way IPC will be required to disclose both positive and negative changes of their proposed action to a true baseline condition. In addition, a range of other operational scenarios meeting specific resource objectives can be developed. Again, IPC will be able to compare those alternatives to the baseline. From this type of integrated modeling recommended by all within the ARWG, potential operational PM&E measures can be developed and trade-offs can be disclosed.

**2. Winter flood control scenario**

**Study ID:** Winter flood control scenario.

**Basis for Study**: This study is needed to evaluate the effects of providing winter flood storage to reduce the magnitude and frequency of winter peak flows to sustain or enhance channel morphology, function and stability. This scenario meets the following objective:

- Provide adequate winter flood control storage in Brownlee Reservoir to reduce the extent of beach and terrace erosion by to reducing the magnitude and frequency of winter peak flow events.

**Study Methodology**: Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River." This alternative would be exactly the same as IPC's "Proposed Operations" but with the following changes that describe the following flood control objectives:

- Provide protection from flooding to Lewiston and Portland by meeting ACOE Flood Control Rule Curves (revised 1998). (IPC Proposed Operations)
- Reduce the magnitude and frequency of winter peak flows to protect beaches and terraces along the Snake River in the Hells Canyon NRA (Recommended)
- Provide for Flood Control in Hells Canyon by not filling above the lowest rule curve reservoir target elevation. (Recommended)

| Flood Control Rule Curves (elevation) | | | | | |
|---|---|---|---|---|---|
| **Date** | **Low 1992** | **Med Low 1994** | **Med 1995** | **Med High 1999** | **High 1997** |
| Jan 1 | 2,041 | 2,041 | 2,041 | 2,041 | 2,041 |
| Feb 28 | 2,041 | 2,041 | 2,041 | 1,241 | 2,035 |
| Mar31 | 2,077 | 2,077 | 2,040 | 1,220 | 2,008 |
| Apr 15 | 2,077 | 2,077 | 2,035 | 2,008 | 1,994 |
| Apr 30 | 2,077 | 2,077 | 2,035 | 1,995 | 1,976 |

Hydrology and environmental effects should be analyzed for the five model years (1992, 1994, 1995, 1999, 1997).

**Resource Issues:** The HCC and its operations are diminishing river geomorphic and habitat values in the Snake River below Hells Canyon Dam. Sediment deprived flows (including uncontrolled floods) are undercutting banks and terraces, washing sand bars and beaches, reducing stability of fluvial features and riparian community habitat.

**Accepted Practice:** Winter Flood Control was presented to IPC during the operational scenario development process within the Aquatic Work Group. In the April 27, 1999 joint Collaborative Team and ARWG meeting Craig Jones, IPC presented Winter Flood Control as one of the "Original 15" operational scenario to be considered. Jones further stated in his IPC power Point presentation that Winter Flood Control was one of the six operational scenarios narrowed down by IPC. Through the ARWG operational scenario process Winter Flood Control was identified as Scenario Number USFS3 in IPC's October 29, 1999 Operational Scenario document.

**Usefulness Of Information:** This information is needed to analyzing the opportunity of reducing the magnitude and frequency of uncontrolled peak flow events. The objective is to reduce the rates of terrace, bank and beach erosion by reducing the magnitude and frequency of unexpected flood flow events in the Snake River below Hells Canyon Dam.

**3. Low pool run of river**

**Study ID**: Low pool run of river.

**Basis For Study:** This study is needed to evaluate the potential of improving water quality within the reservoirs and downstream in the Snake River by changing how IPC operates the HCC.

**Study Methodology:** Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River."

This alternative would be exactly the same as IPC's "Full Pool Run-of-River" but with the following exceptions:

| Project | Maximum Elevation | Minimum Elevation |
|---|---|---|
| Brownlee Reservoir | 1,976 ft above msl | 1,976 ft above msl |
| Oxbow Reservoir | 1,800 ft above msl | 1,800 ft above msl |
| Hells Canyon Reservoir | 1,683 ft above msl | 1,683 ft above msl |

Hydrology and environmental effects should be analyzed for the five model years (1992, 1994, 1995, 1999, and 1997).

**Resource Goals and Objectives:** Operations have a significant impact on water quality within and downstream of the HCC. IPC has an obligation to evaluate the impacts of the current and proposed operations on water quality. In order to meet IPC conceptual concepts of integration it is essential to evaluate the operation that may have the most benefit to improving water quality and aquatic habitat. Members of the ARWG believe this alternative would show the best improvements for temperature and dissolved oxygen.

**Accepted Practices:** The Low-Pool Run-of-River operational scenario would provide a possible maximum water quality improvement bound to the range of operational scenarios. This alternative has been strongly recommended by all members of the ARWG.

**Usefulness of Information:** The results of this study will establish the limits of what improvements in water quality and aquatic habitat is possible with the project in place. This would provide critical information needed in order to develop potential PM&E measures to meet water quality and aquatic habitat goals and objectives.

**4. Modified ramping rate**

**Study ID:** Modified ramping rate

**Basis for Study:** This study is needed to evaluate the effects of providing modified daily and hourly streamflow conditions necessary to sustain or enhance channel morphology, function and stability; aquatic habitat; riparian and bank vegetation; and water quality. This scenario meets the following objective:

- Provide a moderate daily ramping and hourly below Hells Canyon Dam to meet resource objectives for recreation boating and floating, beach stability, riparian habitat, aesthetics, aquatic food base, and aquatic habitat.

**Study Methodology:** Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River." This alternative would be exactly the same as IPC's "Proposed Operations" but with the following ramping rate limits from December 12th through October 20$^{th}$:

**Ramping Rates, December to October**

| Time | Discharge at Hells Canyon Plant (cfs) | Stage at Hells Canyon Gage (ft) | Discharge at Johnson Bar (cfs) | Stage at Johnson Bar (cfs) |
|---|---|---|---|---|
| Daily | 5,000 cfs | 2.0 ft | 5,000 cfs | 1.5 ft |
| Hourly | 1,000 cfs | 0.4 ft. | 1,000 cfs | 0.3 ft. |

Hydrology and environmental effects should be analyzed for the five model years (1992, 1994, 1995, 1999, and 1997).

**Resource Goals and Objectives**: Operations have a significant impact on the daily flows downstream of the HCC. This operational scenario would provide a moderate daily and hourly ramping below Hells Canyon Dam to meet resource objectives for recreational boating and floating, beach stability, riparian habitat, aesthetics, aquatic food base, and aquatic habitat.

**Accepted Practices**: The Modified Ramping operational scenario would provide a middle point between the two extremes (Proposed Operations and Run-of-River) that IPC has presented in DLA. A modified ramping alternative had been strongly recommended by all members of the ARWG.

**Usefulness of Information**: This information is needed to analyzing the effects of daily and hourly ramping and is critical in the development of potential operational PM&E measures.

**5. Minimum flow**

**Study ID:** Minimum flow

**Basis for Study:** This study is needed to evaluate the effects of providing a minimum flow that does not go below 6,500 cfs. This scenario includes provisions that Brownlee Reservoir will be drafted to meet the 6,500 minimum flow requirement**.**

**Study Methodology:** Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River." This alternative would be exactly the same as IPC's "Proposed Operations" but with a strict limitation that does not allow minimum flows below Hells Canyon Dam to be less than 6,500 cfs.

**Resource Goals and Objectives:** Storage of water in Brownlee Reservoir may allow for maintaining a minimum flow of 6,500 cfs for years. Since the HCC and upstream storage projects have altered the natural system, this is an opportunity to provide a minimum base to resource protection downstream of the complex.

**Accepted Practices:** The Minimum Flow operational scenario would clarify the potential PM&E that IPC has presented in the DLA.

**Usefulness of Information:** This information is needed to analyze the effects of a strict minimum flow. This information is critical in the development of an important potential operational PM&E measure. By analyzing this alternative and using available statistical data, the resource agencies can determine the effects of a true minimum flow requirement of 6,500 cfs.

**6. Integrated Resource Operations**

**Study ID**: Integrated Resource Operations

**Basis for Study:** This study is needed to evaluate the environmental effects of an integrated resource operations alternative developed in a collaborative process by federal agencies. With all the discussion in the DLA about collaboration and balancing power and resource objectives the federal agencies believe it is imperative for IPC to evaluate an alternative that integrates those objectives. This alternative was developed after IPC chose to stop discussion with the ARWG on developing a collaborative operational scenario.

**Study Methodology:** Utilize the same concepts presented in DLA Exhibit E.0, "Conceptual Overview of Integration" and the Technical Report Appendix E.1-4. "Project Hydrology and Hydraulic Models Applied to the Hells Canyon reach of the Snake River." This alternative would be exactly the same as IPC's "Proposed Operations" but with the following exceptions:

**Objective 1: Summer Flow Augmentation for chinook migration**

| **Summer Flow Augmentation (target elevation)** | |
|---|---|
| **Date** | **Maximum Brownlee Elevation** |
| August 10 | 2,051 |
| August 31 | 2,049 |
| September 30 | 2,045 |

**Objective 2: Ramping Rates, December to October**

| **Time** | **Hells Canyon Plant (cfs)** | **Hells Canyon Gage (ft)** | **Johnson Bar (cfs)** | **Johnson Bar (cfs)** |
|---|---|---|---|---|
| Daily | 5,000 cfs | 2.0 ft | 5,000 cfs | 1.5 ft |
| Hourly | 1,000 cfs | 0.4 ft. | 1,000 cfs | 0.3 ft. |

**Objective 3: Brownlee Reservoir will be drafted to meet the 6,500 minimum flow requirement.**

Hydrology and environmental effects should be analyzed for the five model years (1992, 1994, 1995, 1999, and 1997).

**Resource Goals and Objectives**: This alternative incorporates the following critical aquatic flow related resource objectives:

**Fall chinook Routine:**

1. Provide a stable spawning flow for fall chinook from October 21 to December 10. (IPC Proposed Operations)

**Minimum Instantaneous Flow:**

2. The minimum instantaneous flow volume below Hells Canyon dam is reduced slightly (8,500 – 12,000 cfs) below the fall spawning flow from December 12 to June 1, so that water is maintained over the shallow-most redd through fry emergence in the spring. (IPC Proposed Operations)
3. After fry emergence, or June 1 in the model, the minimum instantaneous flow below Hells Canyon Dam is reduced to 6,500 cfs. (IPC Proposed Operations)
4. Provide and instantaneous minimum flow of 100 cfs for the Oxbow By-pass. (IPC Proposed Operations)
5. Brownlee Reservoir <u>will</u> be drafted to meet the 6,500 minimum flows. (Recommended)

**Winter Power Demand:**

6. Provide a full pool (2,077) in Brownlee Reservoir by January 1 to meet IPC winter power demand. This is accomplished by following the fall chinook Routine (Oct 21-Dec 10), where inflow to Brownlee Reservoir exceeds outflow at Hells Canyon Dam. (IPC Proposed Operations)

**Flood Control:**

7. Provide protection from flooding to Lewiston and Portland by following ACOE Flood Control Rule Curves (revised 1998). (IPC Proposed Operations)
8. Provide for Brownlee refill, spring and summer flow augmentation, and summer reservoir recreation by not drafting below the upper rule curve level. (Recommended)
9. IPC and ACOE should negotiate the highest reservoir level possible based on projected yearly stream flow forecast. (IPC Proposed Operations)

**Flow Augmentation:**

10. Provide a sufficient flow in the Snake River below Hells Canyon to meet out migration objectives for spring/summer chinook and fall chinook. (Recommended)

**Daily Ramping Rates:**

11. Daily ramping at Brownlee (35,000 cfs) and Oxbow (28,000 cfs) is not restricted in order to meet seasonal and daily power demands. (IPC Proposed Operations)
12. Daily ramping rate at Hells Canyon will be 0 cfs/day for the Fall Chinook Spawning Routine from Oct 21 through December 10. (IPC Proposed Operations)
13. Provide a moderate daily ramping at Hells Canyon Dam Gage not to exceed 5,000 cfs/day (2.0 ft/day) to mitigate resource objectives for recreation boating and

floating, beach stability, riparian habitat, aesthetics, aquatic food base, and aquatic habitat. (Recommended)

**Hourly Ramping Rates:**

14. Hourly ramping at Brownlee (35,000 cfs) and Oxbow (28,000 cfs) is not restricted in order to meet seasonal and daily power demands. (IPC Proposed Operations)
15. Hourly ramping rate at Hells Canyon will be 0 cfs/day for the Fall Chinook Spawning Routine from Oct 21 through December 10. (IPC Proposed Operations)
16. Provide moderate hourly ramping below Hells Canyon Dam Gage not to exceed 0.4 ft/hr (1000 cfs/hr) for increasing flows and decreasing flows; to mitigate resource objectives for recreation boating and floating, beach stability, riparian habitat, aesthetics, aquatic food base, and aquatic habitat. (Recommended)

**Reservoir Levels:**

17. Provide a full pool (2077) in Brownlee Reservoir by January 1 to meet IPC winter power demand. (IPC Proposed Operations)
18. Provide protection from flooding to Lewiston and Portland by following ACOE Flood Control Rule Curves (revised 1998). (IPC Proposed Operations)
19. Provide for Brownlee Reservoir to be refilled to 2069 (or above) by June 1 and to 2077 by July 1. (IPC Proposed Operations)
20. Reservoir daily fluctuation levels in Brownlee Reservoir will not exceed 3 feet/day from June 21 through May 20. (IPC Proposed Operations)
21. Reservoir daily fluctuation levels in Brownlee Reservoir will not exceed 1feet/day from May 21 through June 21 for resident fish spawning. (IPC Proposed Operations)
22. Reservoir daily fluctuation levels in Oxbow and Hells Canyon Reservoirs will not exceed 5 feet year round to enhance summer recreation and resident fish spawning. (IPC Proposed Operations)
23. Summer flow augmentation flow targets will be met by drafting Brownlee Reservoir to the level mentioned above. (Recommended)

**Accepted Practices:** State agencies, federal agencies, and other interested parties invested considerable time and resources working within the ARWG to develop operational scenarios and PM&E measures for the HCC relicensing. This study is intended to meet the original intent of the collaborative effect within the ARWG.

**Usefulness of Information:** This is a draft recommended integrated resource operational alternative developed through collaboration of Federal Agencies attempting to balance power needs and resource objectives. This operational alternative incorporates flow related operations that may best meet multiple resource objectives including power production, load following, summer flow migration for chinook salmon, recreation opportunities, riparian and aquatic habitat, and protection of fluvial and alluvial features. The results of the integrated model run for this alternative will indicate how a collaboratively developed operational alternative would affect power and environmental resources. The results of this operational scenario should display both the positive and negative effect as compared to the baseline (current) operational alternative.

## 7. Daily Streamflow Data Study

**Study ID: A**dditional analysis of daily streamflow data**.**

**Basis for Study**: The operations of the HCC have a significant impact on the daily flows of the Snake River downstream of the complex. A more detailed statistical analysis of existing and modeled hydrologic data is critical to address specific resource issues.

**Study Methodology:** IPC has not performed a daily analysis of historic and modeled flow data both above and below the HCC. A method for statistically analyzing and displaying flows related to ramping can be found in the "Indicators of Hydrologic Alteration" (IHA) software. It is important that IPC provide and display a thorough analysis of the Brownlee inflow and Hells Canyon outflow hydrology. This should be done for each of the operational scenarios recommended by members of the ARWG. Daily flow analyses should include the following:

**Quarter Hourly Flows (cfs)**
Annual Flow Duration Curves

**Minimum Quarter Hourly Flows For Each Day (cfs)**
Flow Duration Curves, (12) Each Individual Month

**Maximum Quarter Hourly Flows For Each Day (cfs)**
Flow Duration Curves, (12) Each Individual Month

**Frequency and Duration of High/Low Flow Pulses (daily)**
Number of high pulses for each year
Number of low pulses each year
Mean duration of high pulses within each year
Mean duration of low pulses within each year

**Frequency and Duration of High/Low Flow Pulses (quarter hourly)**
Number of high pulses for each year
Number of low pulses each year
Mean duration of high pulses within each year
Mean duration of low pulses within each year

**Rate/Frequency of Hydrograph Changes (daily)**
Means of all positive differences between consecutive daily values
Means of all negative differences between consecutive daily values
Number of flow reversals

**Rate/Frequency of Hydrograph Changes (quarter hourly)**
Means of all positive differences between consecutive values
Means of all negative differences between consecutive values
Number of flow reversals

**Resource Goals and Objectives*:*** Meet flow dependent resource objectives; including magnitude and timing of flows; sediment transport and routing; floodplain and riparian zone inundation frequencies and durations; timing and changes in water table elevations in riparian zones, and recreation flows in the Snake River downstream of Hells Canyon Dam.

**Accepted Practices:** Standard hydrological and statistical analysis, interpreted by appropriate graphics software. Utilize the *Indicators of Hydrologic Alteration* (IHA) program from the Nature Conservancy's Biohydrology Program and Smythe Scientific Software.

**Usefulness of Information**: Daily peak flow periods are particularly important for aquatic habitats, channel morphology, riparian zone condition, and recreational experience. This statistical information can be used for the following:

1. Evaluate impact from the HCC on changes in quarter hourly flows.
2. Assess how changes in daily and quarter hourly flows from operations affect aquatic and fisheries habitat.
3. Assess how changes in daily and quarter hourly flows from operations affect riparian vegetation and riparian-dependant resources.
4. Assess how changes in daily and quarter hourly flows from operations affect sediment transport and erosion of sandbars and terraces.
5. Assess how changes in daily and quarter hourly flows from operations affect recreational experiences and opportunities.
6. Evaluate compatibility with life cycles of aquatic organisms.
7. Evaluate predictability/avoidability of stress for organisms.
8. Evaluate evolution of life history strategies, behavioral mechanisms.
9. Evaluate frequency and magnitude of soil moisture stress for plants.
10. Evaluate frequency and duration of anaerobic stress for plants.
11. Evaluate nutrient and organic matter exchanges between river and floodplain.
12. Evaluate influences bedload transport, channel sediment textures, and duration of substrate disturbances.
13. Evaluate drought stress on plants (falling levels)
14. Evaluate entrapment of organisms on islands, floodplains (rising levels)
15. Evaluate desiccation stress on low-mobility stream edge (varial zone) organisms.

# Water Quality

## General Discussion

The HCC continues to alter the water quality of the Snake River both within the reservoirs and downstream from Hells Canyon Dam. The complex has changed the aquatic environment from a free flowing riverine system to a system that includes reservoirs, which affects water quality and fish habitat conditions. Currently, the water quality does not fully support the Oregon and Idaho State identified beneficial uses for cold water biota and salmonid spawning and rearing, in Brownlee, Oxbow, Hells Canyon Reservoirs, and the Snake River below Hells Canyon Dam.

The elevated water temperatures along with a shift of the thermal regimes affect aquatic biota both within the reservoirs and downstream in the Snake River below Hells Canyon Dam. The operation of Brownlee Reservoir is a substantial driver in water temperature changes. The water column structure in the reservoirs is largely dependent on the elevation of the penstock intakes. IPC should develop and evaluate different operational scenarios that could improve temperature conditions. In addition, IPC should develop potential engineering project modifications that would allow IPC to alter releases to meet downstream water quality and aquatic resource objectives.

Dissolved oxygen is higher as water enters the complex near Farewell Bend and lower when water leaves Hells Canyon Dam. Decreases in dissolved oxygen occur both longitudinally through the complex as well as vertically through the water column of each individual reservoir. In Brownlee Reservoir, during low flow years, there is extensive hypoxia. IPC has proposed several mitigation measures to improve low dissolved oxygen conditions. In addition, IPC should evaluate different operational scenarios and how project modification would provide opportunities for improving the low dissolved oxygen conditions.

The presence of organochlorine compounds in aquatic systems is a concern because of their toxicity and classification as probable human carcinogens. Data suggest that organochlorine compounds in the lower Snake River Basin may pose a health risk to humans and/or wildlife. Although levels in fish fillets did not exceed Food and Drug Administration (FDA) action levels or median international standards, concentrations of some organochlorine compounds exceeded criteria for cancer risk, fish eating wildlife, and protection of benthic life. IPC should conduct additional studies to monitor fish tissue data and water column data for both DDT and dieldrin.

The Snake River-Hells Canyon total daily maximum load (SR-HC TMDL) reach is listed as water quality limited due to human consumption advisories for mercury issued by both Oregon and Idaho. Elevated levels of mercury in fish tissues have been observed in Brownlee Reservoir. Methylation of mercury is a concern within Brownlee Reservoir. Low dissolved oxygen levels and the presence of a substantial amount of organic material near the sediment/water interface can result in higher rates of methyl-mercury production. Methyl-mercury represents a significantly greater threat for bioconcentration and

accumulation than inorganic mercury compounds. IPC should conduct additional studies of mercury in the water column and how low dissolved oxygen conditions associated with the reservoirs lead to increased methyl-mercury levels.

The HCC along with dam operations has resulted in elevated total dissolved gas (TDG) levels. Spills within the HCC in excess of 2,000 to 3,000 cfs result in TDG levels exceeding the state standard of 110% in Oxbow and Hells Canyon Reservoirs and in the Snake River below the Hells Canyon Dam (Myers and Stute, 1998). Supersaturation from the HCC may be a significant factor to TES fish along with other aquatic biota survival downstream in the Snake River (Idaho Power 1997). The Forest Service supports the construction of flow deflectors at Hells Canyon Dam. In addition, we believe IPC should evaluate the potential to reduce TDG levels by placing flow deflectors at Brownlee Dam.

IPC admits that there will be several adverse continuing impacts on water quality including: 1) shift in warmer fall and cooler spring water temperatures below Hells Canyon Dam, 2) low dissolved oxygen, 3) elevated levels inorganochlorine compounds and trace elements, and 4) TDG violations below all three HCC dams.

The Forest Service maintains IPC should be more proactive in evaluating ways to enhance water quality conditions in order to better meet State water quality standards and enhance aquatic and fisheries resources. IPC needs to fully investigate how various facilities designs and operational scenarios could affect and improve water quality conditions.

## Comments Specific to the Draft License Application

Quotations or sections taken directly from the draft license application are shown in italics.

### Exhibit E.2. Report on Water Use and Quality

The following comments and/or conclusions regarding the following components of water quality found in the DLA are important when it comes to the need for additional studies and proposed PM&E measures.

### Temperature

1. Page E.2-4. *Location of the thermal strata is based on temperatures of the water and elevation of the outlet (E.2.2.2.1.1).*

2. Page E.2-7. *As previously mentioned, the metalimnion forms near the centerline elevation of the powerhouse penstock intakes (at 1,948 feet mean sea level) and extends about 25 miles upstream of the dam (E.2.2.2.1).*

3. Page E.2-9. *The river downstream of the Hells Canyon Complex exhibits slightly delayed fall cooling and delayed spring warming, compared with seasonal changes in the river upstream of the complex (E.2.2.2.2.5).*

4. Page E.2-9. *Changes in seasonal water temperatures substantially change the saturation point for dissolved oxygen (DO) concentrations in the Hells Canyon Complex. The solubility of DO decreases as water temperature increases(E.2.2.2.3).*

5. Page E.2-22. *Instantaneous measurements were taken throughout the Hells Canyon Complex, and temperatures were found to exceed the 17.8 °C criterion in each of the reservoirs (E.2.2.2.9.1.1.).*

6. Page E.2-33. *Therefore, despite measurable improvements to downstream temperature conditions for coldwater biota caused by the presence of the Hells Canyon Complex, water temperature may continue to exceed the standard for coldwater biota throughout the Snake River system and exceed the standard for salmonid spawning where that use occurs.…Retention of the warm summer inflows in the reservoirs, especially Brownlee Reservoir, will continue to delay fall cooling of outflows relative to inflows. The Applicant's modeling showed that temperature conditions within and downstream of the Hells Canyon Complex are affected both in magnitude and timing by temperature conditions of inflowing water (Technical Report E.2.2-2). Despite the generally improved conditions for coldwater biota downstream of Brownlee Dam, Idaho and Oregon coldwater biota standards will continue to be exceeded annually because of the warm Snake River inflows to Brownlee Reservoir.*

The Forest Service maintains the following conclusions are critical when developing an operational and PM&E plan to address water temperature issues associated with the HCC:

- Water temperatures continue to exceed the standard for coldwater biota and salmonid spawning where that use occurs.
- The water column structure in the lacustrine zone is largely dependent on the location of the penstock intakes and reservoir operations.
- The river downstream of the HCC exhibits slightly delayed fall cooling and delayed spring warming, compared with seasonal changes in the river upstream of the complex.

The Forest Service maintains IPC has not adequately addressed reasonable alternatives that could protect, mitigate, and enhance water temperature conditions to benefit coldwater biota and salmonid spawning. Lacking in the DLA is a study relating to evaluation of potential project modifications at the dams. The Forest Service maintains that several feasible alternatives exit to improve water temperature conditions.

**Dissolved oxygen, nutrients, and organic matter**

1. Page E.2-9. *Generally, DO concentrations in the Hells Canyon Complex decrease throughout the summer and early fall, but levels are higher throughout the rest of the year. Although water temperatures can somewhat control DO concentrations, data clearly show that other mechanisms, such as organic matter processing, are controlling concentrations throughout the Hells Canyon Complex. There is also a relatively strong longitudinal trend through the Hells Canyon Complex: water entering the complex has higher DO concentrations than water leaving the complex. Most of these changes in DO concentrations occur in Brownlee Reservoir."(E.2.2.2.3.)*

2. Page E.2-15. *Bacterial respiration consumes DO through aerobic and anaerobic degradation of organic matter in both the water column and sediments (Maier et al. 2000). This decay of organic matter is the primary factor in low DO concentrations in Brownlee Reservoir's transition zone (Harrison et al. 1999)…. The following three mechanisms contribute to organic matter in Brownlee Reservoir's water column:*
    - *Externally produced organic matter delivered to Brownlee Reservoir by the Snake River*
    - *Externally delivered nutrients that stimulate the growth of algae within Brownlee Reservoir*
    - *Internally cycled nutrients from the sediments, which in turn stimulate the growth of algae within Brownlee Reservoir(E.2.2.2.6).*

3. Page E.2-16. *Soluble reactive phosphorus is the form of phosphorus most available for the production of algae. Given the assumption that all available inorganic phosphorus is converted to algal biomass, internally produced organic matter is less than 30% of the annual load."(E.2.2.2.6.2)*

4. Page E.2-16. *Nutrients delivered to Brownlee Reservoir from the Snake River and other tributaries contribute to depressed DO conditions…Based on this means for estimating, the potential organic matter load from externally delivered nutrients is less than 20% of the total load."(E.2.2.2.6.2.1.)*

5. Page E.2-16, 17. *Internal nutrient cycling from bottom sediment is a process that occurs in most lakes and reservoirs; likewise, it also occurs in Brownlee Reservoir. Although concentrations of soluble reactive phosphorus are highest in the anoxic hypolimnion of the reservoir, anoxic sediments in the riverine and transition zones can also release nutrients into the water column. Therefore, organic matter can be produced and deplete oxygen in the transition zone as a result of internal nutrient cycling. The estimated internal load is less than 10% of the total organic matter loads (E.2.2.2.6.2.2.).*

6. Page E.2-23. *Instantaneous DO measurements taken throughout the Hells Canyon Complex were compared with the coolwater instantaneous minimum criterion of 6.5*

*mg/L. About 55% of the measurements in Brownlee Reservoir were below the standard (E.2.2 2.9.2.1.).*

7. Page E.2-24. *Waters below Hells Canyon Dam are below the 6.5-mg/L standard an average of 92.5 days per year". (E.2.2.2.9.2.2)*

8. Page E.2-33. *Regarding nutrients and organic matter, improvements to the existing severely degraded condition of the inflowing water would substantially improve DO levels throughout the complex. In fact, modeling undertaken by the Applicant during the relicensing process indicates that improvement of inflowing water alone may allow oxygen targets to be met in Brownlee Reservoir. However, given the uncertainty associated with predicting the response to dramatic improvements in inflowing water, the Applicant has proposed to aerate Brownlee Reservoir at the level identified in the TMDL (see section E.2.4.2.4.). Both ODEQ and IDEQ have predicted that, through the TMDL process, reductions in inflowing nutrients and organic matter, along with the Applicant's proposed level of aeration, would lead to levels of DO that meet state standards. However, because of the uncertainty in predicting the effect aerating Brownlee Reservoir would have in the waters below Hells Canyon Dam, the Applicant has also proposed turbine venting at the Brownlee Project to further improve downstream oxygen levels. Given that demonstrable downstream impairments are absent with current low DO levels, continuing impacts related to future DO levels within and downstream of the Hells Canyon Complex should be minimal. The Applicant's proposed DO monitoring plan (proposed in sections E.2.4.2.1., E.2.4.2.2., and E.2.4.2.3.) would provide reasonable assurance that measures to supplement oxygen are implemented in the most efficient, effective, and practical way.*

The Forest Service maintains the following conclusions are critical when developing an operational and PM&E plan to address low dissolved oxygen issues associated with the HCC.

- Fish mortality has occurred in the transition zone because of low oxygen levels.
- The water column structure in the lacustrine zone is largely dependent on the location of the penstock intakes and reservoir operations related to large drawdowns.
- In summer, severe hypoxia occurs consistently in the hypolimnion of Brownlee Reservoir.
- The DO content in the metalimnion is often lower than in both the epilimnion and the hypolimnion.
- The epilimnion is characterized by a steep DO gradient that can contain oxygen levels ranging from as high as 12 mg/l at the surface to 0mg/L at the interface with the metalimnion.
- The primary symptoms of degraded water quality are DO concentrations that can be as low as 2 mg/L and 3.5 mg/L in Oxbow and Hells Canyon reservoirs, respectively.

- Significant improvements in water quality can be expected with the implementation of the SR–HC TMDL.
- In addition to inflow pollution reductions, various options have the potential for improving DO levels in Brownlee Reservoir and project discharges.

The Forest Service recommends that IPC be more proactive in developing additional PM&E measures to improve the low dissolved oxygen levels associated with the HCC. Specifically, IPC should evaluate the following: 1) opportunities to improve conditions in the Oxbow By-pass, 2) model the effects of low pool run-of river on improving DO, and 3) project modification to meet water quality and aquatic resource objectives.

**Metals and Pesticides**

1. *Pages E.2-19, 20. Trace elements in Sediments*
2. *Pages E.2-20, 21. Trace elements in Aquatic Life*

The Forest Service maintains the DLA and technical appendices does not adequately address the metals and pesticides issue. We do not understand why IPC has ignored the discussion of metals and pesticides as presented in the Snake River - Hells Canyon TMDL. Specifically, we found no reference to the following information regarding methyl mercury.

- The SR-HC TMDL reach is listed as water quality limited due to human consumption advisories for mercury issued by both Oregon and Idaho.
- Elevated levels of mercury in fish tissues have been observed in Brownlee Reservoir.
- Methylation of mercury is a concern within Brownlee Reservoir.
- Low dissolved oxygen levels and the presence of a substantial amount of organic material near the sediment/water interface can result in higher rates of methyl-mercury production.
- Methyl-mercury represents a significant greater threat for bioconcentration and accumulation than inorganic mercury compounds.

IPC should provide in the Final License Application (FLA) a more thorough discussion of metals and pesticides, including information presented in the SR-HC TMDL. IPC should discuss the issue of methyl-mercury production in a low DO environment.

IPC should conduct additional studies of mercury in the water column and how low dissolved oxygen conditions associated with the reservoirs lead to increased methyl-mercury levels.

It appears IPC has not developed any PM&E measures to address the pesticide concentration in Brownlee Reservoir. The Forest Service maintains IPC should conduct additional studies to monitor fish tissue data and water column data for both DDT and dieldrin.

IPC should develop operational scenarios that would address metal and pesticide water quality concerns.

**Total Dissolved Gas**

1. Page E.2-24. *Total dissolved gas is not to exceed 110% saturation (IDEQ and ODEQ 2001). Measurements indicated that Brownlee Reservoir complied with this standard (Technical Report E.2.2-4). However, elevated levels of total dissolved gas in the Brownlee Dam releases dissipate very little through the remainder of the Hells Canyon Complex, resulting in total dissolved gas saturation levels that exceed 110% in Oxbow and Hells Canyon reservoirs whenever water is spilled at Brownlee Dam.*

2. Page E.2-26. *The Applicant has found that spilling water from the upper spillgates at Brownlee Dam may help minimize elevated total dissolved gas levels during periods of spill (Technical Appendix E.2.2.4). The Applicant is proposing to continue to preferentially spill water through the upper spillgates whenever practical. Continuing this practice should help minimize total dissolved gas levels in both Oxbow and Hells Canyon reservoirs, and, therefore, the potential for negative effects associated with elevated total dissolved gas supersaturation during periods of spill.*

3. Page E.2-31. *Total dissolved gas conditions in the releases from Hells Canyon Dam meet neither the Idaho nor the Oregon standard for total dissolved gas during spills in excess of approximately 2,500 cfs (Technical Report E.2.2-4). Spill typically occurs between late winter and early summer in years of average to above-average runoff. Spill at Hells Canyon may also occur during a unit outage. When Hells Canyon Dam is spilling water and thereby elevating total dissolved gas levels, potentially harmful levels can persist in the river for up to 60 miles downstream.*

4. Page E.2-31. *The goal of this measure is to reduce total dissolved gas levels in the tailrace of Hells Canyon Dam and the Snake River downstream of the dam.*

5. Page E.2-34. *The Applicant has found that spilling water from the upper spillgates at Brownlee Dam may help minimize elevated total dissolved gas levels during periods of spill (Technical Appendix E.2.2.4). The Applicant is proposing to continue to preferentially spill water through the upper spillgates whenever practical. Continuing this practice should help minimize total dissolved gas levels in both Oxbow and Hells Canyon reservoirs, Installing flow deflectors on Hells Canyon Dam to alter the spillway flow characteristics during spill events of less than 30,000 cfs should substantially reduce the potential for continuing downstream effects from elevated total dissolved gas levels. The deflectors are expected to control gas levels during all but the highest 5% of flows. While the Applicant cannot quantify what the total dissolved gas levels would be after the flow deflectors were installed, similar measures at other projects (both federal and public utility districts) on the Snake and Columbia rivers have improved total dissolved gas conditions. The Applicant's effectiveness monitoring plan (proposed in section E.2.4.2.4.) would ensure that continuing effects of elevated total dissolved gas levels were being reduced. Levels of*

*total dissolved gas in both Oxbow and Hells Canyon reservoirs would continue to be elevated during periods of spill at Brownlee Dam, despite the Applicant's continued efforts to reduce these increases by spilling from the crest gates at Brownlee Dam. Despite the elevated levels of total dissolved gas, effects to biota in Oxbow and Hells Canyon reservoirs should continue to be minor because of the large amount of habitat available at depths greater than 2 meters.*

The Forest Service is concerned with several of the unanchored objectives used to describe environmental effects. For example on page E.2-26 the DLA states, "this practice should help minimize total dissolved gas levels in both Oxbow and Hells Canyon reservoirs". The term "minimize" is incorrect. "Reduce but not meet State standard" is a more accurate statement. Other examples include the adjectives "substantially reduced" and "minor" on page E.2-31. These statements should be quantified.

The Forest Service does not believe IPC goes far enough with their goal statement. IPC should modify facilities and /or operations to meet State water quality standards, not just improve continuing conditions. The Forest Service supports the construction of flow deflectors at Hells Canyon Dam, however, we believe IPC should evaluate the potential to further reduce TDG levels by placing flow deflectors at Brownlee Dam.

## Comments Specific to the Technical Report Appendices

The following technical studies have been reviewed and comments specific to those studies have been incorporated into the discussion section below.

E.1-3. Topographic Integration for Hells Canyon Studies
E.1-4, Chapter 1. Integration of Hydrologic Information and Models for the Hells Canyon Complex
E.1-4, Chapter 2. Development of Inflow Hydrology for Hells Canyon Complex Studies
E.1-4, Chapter 3. Hells Canyon Operations Modeling
E.1-4, Chapter 4. Hells Canyon Complex Reservoir Water Quality Modeling
E.1-4, Chapter 5. Hells Canyon MIKE 11 Hydrodynamic Model
E.1-4, Chapter 6. Hells Canyon MIKE 11 Temperature and Total Dissolved Gas
E.1-4, Chapter 7. Seven HD Models On the Snake River
E.2.2-1. Tributary Pollutant Sources to the Hells Canyon Complex
E.2.2-2. Pollutant Transport and Processing in the Hells Canyon Complex
E.2.2-3. Hydro Machine Oil Monitoring at Hells Canyon Complex Power Plants
E.2.2-4. Hells Canyon Complex Total Dissolved Gas Study

## Discussion

**Inconsistencies, Adequacy of Analysis and Impacts to NFS Lands** -- IPC has adequately described the current water quality conditions associated with the HCC. The continuation of the three current PM&E measures and the addition of four PM&E measures partially address several water quality concerns.

IPC acknowledges that there will be several adverse continuing impacts on water quality including 1) internal nutrient recycling, 2) shift in warmer fall and warmer spring water temperatures below Hells Canyon Dam, 3) low DO, and 4) TDG violations from Brownlee Dam.

IPC's primary conclusion is that water quality issues associated with the impoundments arise from the severely degraded inflows to the HCC. The Forest Service agrees that the water quality of the Snake River should be improved. However, the summary and conclusions in this document seems to avoid many of the major issues brought up in the ARWG. Specifically, IPC should be more proactive in evaluating ways to enhance water quality conditions in order to better meet State water quality standards and enhance aquatic and fisheries resources.

The HCC continues to alter the water quality of the Snake River both within the reservoirs and downstream from Hells Canyon Dam. The complex has changed the aquatic environment from a free flowing riverine system to a system that includes reservoirs, which affects water quality and fish habitat conditions. Currently, the water quality does not fully support the State identified beneficial uses for cold water biota and salmonid spawning and rearing, in Brownlee, Oxbow, and Hells Canyon reservoirs, and the Snake River below Hells Canyon Dam.

The elevated water temperatures along with a shift of the thermal regimes affect aquatic biota both within the reservoirs and downstream in the Snake River below Hells Canyon Dam. The operation of Brownlee Reservoir is a substantial driver in water temperature changes. The water column structure in the reservoirs is largely dependent on the elevation of the penstock intakes. IPC should develop and evaluate different operational scenarios that could improve temperature conditions. In addition, IPC should develop potential engineering project modifications that would allow IPC to alter releases to meet downstream water quality and aquatic resource objectives.

Dissolved oxygen is higher as water enters the complex near Farewell Bend and lower when water leaves Hells Canyon Dam. Decreases in dissolved oxygen occur both longitudinally through the complex as well as vertically through the water column of each individual reservoir. In Brownlee Reservoir, during low flow years, there is extensive hypoxia. IPC has proposed several mitigation measures to improve low dissolved oxygen conditions. In addition, IPC should evaluate different operational scenarios and how project modification would provide opportunities on improving the low dissolved oxygen conditions.

The presence of organochlorine compounds in aquatic systems is a concern because of their toxicity and classification as probable human carcinogens. Data suggest that organochlorine compounds in the lower Snake River Basin may pose a health risk to humans and/or wildlife. Although levels in fish fillets did not exceed Food and Drug Administration (FDA) action levels or median international standards, concentrations of some organochlorine compounds exceeded criteria for cancer risk, fish eating wildlife,

and protection of benthic life. IPC should conduct additional studies to monitor fish tissue data and water column data for both DDT and dieldrin.

The SR-HC TMDL reach is listed as water quality limited due to human consumption advisories for mercury issued by both Oregon and Idaho. Elevated levels of mercury in fish tissues have been observed in Brownlee Reservoir. Methylation of mercury is a concern within Brownlee Reservoir. Low dissolved oxygen levels and the presence of a substantial amount of organic material near the sediment/water interface can result in higher rates of methyl-mercury production. Methyl-mercury represents a significantly greater threat for bioconcentration and accumulation than inorganic mercury compounds. IPC should conduct additional studies of mercury in the water column and how low dissolved oxygen conditions associated with the reservoirs lead to increased methyl-mercury levels.

The HCC along with dam operations has resulted in elevated TDG levels. Spills within the HCC in excess of 2,000 to 3,000 cfs result in TDG levels exceeding the state standard of 110% in Oxbow and Hells Canyon Reservoirs and in the Snake River below the Hells Canyon Dam. Supersaturation from the HCC may be a significant factor to TES fish along with other aquatic biota survival downstream in the Snake River. The Forest Service supports the construction of flow deflectors at Hells Canyon Dam. In addition, we believe IPC should evaluate the potential to reduce TDG levels by placing flow deflectors at Brownlee Dam.

IPC admits that there will be several adverse continuing impacts on water quality including: 1) shift in warmer fall and cooler spring water temperatures below Hells Canyon Dam, 2) low dissolved oxygen, 3) elevated levels inorganochlorine compounds and trace elements, and 4) TDG violations below all three HCC dams.

The Forest Service believes IPC should be more proactive in evaluating ways to enhance water quality conditions in order to better meet State water quality standards and enhance aquatic and fisheries resources. IPC should fully investigate how various project modification alternatives and operational scenarios could affect and improve water quality conditions.

## Preliminary Forest Service Objectives

The Land and Resource Management Plans for the Payette and the Wallowa-Whitman National Forests provide direction to comply with the Clean Water Act by meeting or exceeding State water quality standards.

Oregon's 303(d) list of Water Quality Limited Streams identifies summer temperature and toxics as pollutants for all reaches of the Snake River between the Idaho and Washington borders (ODEQ, 1998).

Idaho's 303(d) list of Water Quality Limited Segments identifies dissolved oxygen, metals, nutrients, pH, and sediment as pollutants for Brownlee Reservoir, and nutrients,

pesticides and sediment as pollutants for the Snake River from Brownlee to Oxbow Dam (IDHW, 1998). The States of Idaho, Oregon, and Washington have adopted the National Academy of Science recommended standard for gas supersaturation at 110%.

Based on the Forests' LRMPs, the Forest Service has developed the following preliminary objectives:

1. Provide for water quality in and downstream of the HCC that meets State standards.
2. Provide water quality conditions that will permit recovery and long-term persistence of listed threatened and endangered fish.
3. Modify dam operations and/or dam facilities to improve dissolved oxygen conditions.
4. Modify dam operations and/or dam facilities in order to release cooler water in the fall and warmer water in the spring.
5. Develop and implement a monitoring plan to evaluate whether water quality objectives are being met in the reservoirs and downstream in the Snake River below Hells Canyon Dam.
6. Modify existing facilities with all known engineering measures to reduce TDG levels during spills from the HCC dams.
7. Evaluate operations that would reduce total dissolved gas supersaturation in the reservoirs and in the Snake River below Hells Canyon Dam by reducing the size, duration, and frequency of water spillage over the dams.
8. Develop collaborative scientific studies to assess the impacts of the project operation induced TDG levels on aquatic biota in the reservoir and downstream in the Snake River.

## Forest Service Response to Applicant's Proposed PM&E Measures

Page E.2-25. *The Applicant proposes to continue three existing measures: passing 100 cfs of minimum flow through the Oxbow Bypass, disposing of wastes associated with recreational use of the Hells Canyon Complex, and preferentially using the upper spillgates at Brownlee Dam during periods of spill.*

In regards to the 100 cfs minimum flow through the Oxbow Bypass, IPC admits that "standards are not always met". The Forest Service maintains IPC has not adequately addressed these issues or attempted to study and evaluate potential measures in order to meet water quality standards. Specifically, IPC should evaluate modified operations to improve water temperature. IPC should also investigate DO enhancement opportunities including aeration or injection to increase DO in the Oxbow Bypass. In addition IPC should evaluate what potential operational changes or structural modifications might be considered to meet water quality and fisheries objectives within that reach.

IPC should develop the recreational facilities recommended by the resource agencies on the Recreation and Aesthetics Resource Work Group (RARWG).

IPC has admitted that using the upper spill gates at Brownlee Reservoir alone does not meet State standards. IPC should design and evaluate flow deflectors at Brownlee Dam.

Page E.2-25. *The Applicant proposes four measures. Three of these measures—aerating Brownlee Reservoir, venting turbines for units 1 through 4 at the Brownlee Project, and venting for unit 5 at the Brownlee Project—are proposed to increase DO levels. The fourth measure—installing flow deflectors in the Hells Canyon Dam spillway—is proposed to decrease total dissolved gas levels.*

The Forest Service supports IPC proposals to implement actions to improve DO conditions within the HCC. This includes IPC proposals to: 1) supplement DO by 1,450 tons annually into Brownlee Reservoir by injecting it into the transition zone or the upstream end of the lacustrine zone, 2) install and operate turbine-venting systems in units 1 through 4 at the Brownlee Project, and 3) inject oxygen or atmospheric air into water passing through unit 5 at the Brownlee Project.

The Forest Service is concerned that the language written in the DLA only commits IPC to investigate, and install and operate if practical.

The Forest Service supports IPC proposals to install flow deflectors on the Hells Canyon Dam spillway.

The Forest Service maintains IPC should be evaluating, in coordination with the Idaho and Oregon Department of Environmental Quality (DEQ's), additional PM&E measures to improve DO and TDG levels within and downstream of the HCC.

## Additional Study Requests

The Forest Service maintains additional water quality studies are needed to adequately meet identified resource goals and objectives associated with the HCC hydropower project. Listed below are four additional study requests, needed to address water quality goals and objectives.

### 1. Project Modification Study

**Study ID**: Project Modification Study

**Basis for Study**: This study is needed to evaluate how project modification at Brownlee Dam would alter water quality, specifically temperature and dissolved oxygen.

**Study Methodology:** Conduct literature review of existing modification implemented on large dams. Determine types, cost, and feasibility of different types of structures. Develop potential engineering design of project modification at Brownlee, Oxbow, and Hells Canyon Dams. Model how those project modification alternatives would alter water quality, specifically temperature and dissolved oxygen. Determine if project

modification at Brownlee Reservoir could be used to cool fall and warm spring water temperatures in the Snake River below Hells Canyon Dam.

**Resource Goals and Objectives**: Water quality standards for temperature and dissolved oxygen are not met in the reservoirs and downstream in the Snake River. Location of the thermal strata in the Brownlee Reservoir is largely based on the centerline elevation of the powerhouse penstock intakes and extends about 25 miles upstream of the dam. Opportunities exist to manage and improve water quality conditions, specifically temperature and low dissolved oxygen, throughout the HCC by project modification at Brownlee Reservoir.

Water temperatures continue to exceed the standard for coldwater biota and salmonid spawning where that use occurs. The river downstream of the HCC exhibits slightly delayed fall cooling and delayed spring warming, compared with seasonal changes in the river upstream of the complex. This shift in thermal regime may affect the timing of fall chinook spawning and emergence.

**Accepted Practices:** Project modification on large reservoirs has been used to manage water quality parameters and to address specific water quality issues worldwide. Because the HCC continues to have an affect on water quality and aquatic species on NFS lands, IPC has an obligation to evaluate opportunity to improve water quality through project modification.

**Usefulness of Information:** Information is needed to understand the degree to which modification of the existing HCC facilities could improve water quality. Project modification could affect the hydrodynamics within Brownlee Reservoir. This change in hydrodynamics should alter both thermal stratification and dissolved oxygen response within the HCC. It is illogical to assume that the current inlet elevation is the optimum design location for improving water quality. Project modification could allow a managed control of hydrodynamics and thermal regimes that the current facility does not allow.

**2. Metals and Pesticides Study**

**Study ID:** Metals and pesticides study

**Basis for Study:** This study is needed to evaluate how the HCC affects the accumulation and production on methyl-mercury and DDT and dieldrin in the water column. In addition, it is important to determine how these metals and pesticides accumulate in fish tissue and are passed up the food change.

**Study Methodology**: Conduct studies of mercury in the water column within and downstream of the HCC as recommended in the SR-HC TMDL. Monitor fish tissue data and water column data for both DDT and dieldrin in Oxbow Reservoir.

Model the low pool run-of river operational scenario and evaluate how that alternative may reduce the re-suspension of sediments and low dissolved oxygen conditions, which in turn aggravate metal and pesticides in the water column.

**Resource Goals and Objectives:** The SR-HC TMDL reach is listed as water quality limited due to human consumption advisories for mercury issued by both Oregon and Idaho. Elevated levels of mercury in fish tissues have been observed in Brownlee Reservoir. Methylation of mercury is a concern within Brownlee Reservoir. Low dissolved oxygen levels and the presence of a substantial amount of organic material near the sediment/water interface can result in higher rates of methyl-mercury production. Methyl-mercury represents a significantly greater threat for bioconcentration and accumulation than inorganic mercury compounds.

The presence of organochlorine compounds in aquatic systems is a concern because of their toxicity and classification as probable human carcinogens. Data suggest that organochlorine compounds in the lower Snake River Basin may pose a health risk to humans and/or wildlife. Although levels in fish fillets did not exceed Food & Drug Administration (FDA) action levels or median international standards, concentrations of some organochlorine compounds exceeded criteria for cancer risk, fish eating wildlife, and protection of benthic life.

**Accepted Practices**: The SR-HC TMDL prepared jointly by the States of Idaho and Oregon identifies this need as a data gap.

**Usefulness of Information:** Information is needed to understand the continuing effects the HCC has on metals and pesticides in the water column and how that may pose health risks to humans, wildlife, and aquatic species. This information can be used to develop a load allocation for the SR-HC TMDL. It can also be used to assist in developing PM&E measures to improve those water quality conditions.

**3. Total Dissolved Gas (TDG) Flow Detflector Study**

**Study ID:** TDG flow deflector at Brownlee Dam

**Basis for Study:** This study is needed to evaluate all the feasible alternatives in order meet State TDG water quality standards

**Study Methodology**: Investigate the potential of TDG reduction at Brownlee Dam by designing and modeling a flow deflector at that dam. The same type of study that IPC and their contractors from the University of Iowa did on evaluating a reduction of TDG through the installation of a flow deflector at Hells Canyon Dam should be conducted for Brownlee Dam.

**Resource Goals and Objectives:** Measured levels in the tailwater of Brownlee Dam approach 125% saturation, with little dissipation downstream through Oxbow and Hells

Canyon reservoirs. Even when spilling exclusively from the upper spill gates, the TDG level still violates the State's standard of 110 percent.

**Accepted Practices:** Flow deflectors installed at other projects (both federal and public utility districts) on the Snake and Columbia rivers have improved total dissolved gas conditions. IPC and their contractors from the University of Iowa have done a good job of modeling a reduction of TDG through the installation of a flow deflector at Hells Canyon Dam. This same type of study should be conducted for Brownlee Reservoir.

**Usefulness of Information:** The detrimental effects of supersaturation on aquatic biota are well documented. Elevated TDG levels pose a potential threat to TES species of fish along with other aquatic biota within the Snake River. The Forest service maintains opportunities exist to fully meet TDG State water quality standards.

**4. Low pool run of river study**

**Study ID:** Low pool run of river

**Basis for study:** This study is needed to evaluate the potential of improving water quality within the reservoirs and downstream in the Snake River by changing how IPC operates the HCC.

**Study Methodology:** Model the Low-Pool Run-of-River operational scenario as proposed by the Aquatic Resource Work Group. Integrate the results of the CHEOPS model through the other water quality models.

**Resource Goals and Objectives:** Operations have a significant impact on water quality within and downstream of the HCC. IPC has an obligation to evaluate the impacts of the current and proposed operations on water quality. In order to meet IPC conceptual concepts of integration it is essential to evaluate the operation which may have the most benefit to improving water quality and aquatic habitat.

**Accepted Practices:** The low pool run of river operational scenario would provide a possible maximum water quality improvement bound to the range of operational scenarios. This alternative has been strongly recommended by all members of the Aquatic Resource Work Group.

**Usefulness of Information**: The results of this study will establish the limits of what improvements in water quality and aquatic habitat is possible with the project in place. This would provide critical information needed in order to develop potential PM&E measures to meet water quality and aquatic habitat goals and objectives.

# Fisheries

## General Discussion

**Anadromous Salmonid Reintroduction --** The anadromous fish study by IPC concluded that the habitat within and above the HCC has been drastically altered. Dams and irrigation diversions block most of the former habitat of summer steelhead and spring/summer chinook. The streams have been degraded to the point where those that are accessible would not produce the number of smolt that they did prior to European settlement. Fall chinook salmon habitat would be available in the mainstem river, but it is highly polluted by agricultural and urban waste. The water available in most tributaries and the mainstem river has been diverted to the point where flows that were once available for spawning fall chinook are greatly diminished.

The greatest impediment to reintroduction of anadromous fish may be the extremely low smolt-to-adult returns that would be expected. The loss of smolt at each of the dams in the Columbia and Snake rivers would be so great that few adults would return to spawn. It is believed that the runs could not be self-sustaining due to smolt and adult passage mortalities. Based on smolt-to-adult-survival data it is IPC's contention that the hatchery mitigation program is the only practical means of sustaining the Snake River anadromous genetic stocks.

The Forest Service maintains that IPC should fund an anadromous fish re-introduction working group that would continue to develop plans for reintroduction during the term of the license. The work group would gather and analyze information that could lead to reintroduction during the term of the license on habitat, passage, and marine-derived nutrients. The Forest Service would work with the other fisheries and land management agencies to develop a common agency position on anadromous fish reintroduction.

**Fall Chinook Salmon Of the Hells Canyon Reach --** IPC conducted extensive spawning ground counts and studies of fall chinook salmon using the Snake River between Hells Canyon Dam and Lower Granite Reservoir. IPC concluded that the reach is significantly under-seeded. IPC maintains that the reach could sustain more than 2000 redd sites. IPC also concluded that the water temperatures produced by the HCC are warmer in the fall and colder in the spring than were found under original conditions. Although juvenile chinook are late in emerging from the gravel, IPC believes that they are not harmed by the delay. IPC theorizes that the river is now similar to the Marsing Reach near Thousand Springs, Idaho that once produced the majority of the fall chinook run. The NOAA Fisheries, however, believes that the delay in hatching causes a delay in smolt migration from the Hells Canyon Reach. A delay in migration is known to cause low survival when the smolt reach Lower Granite Reservoir due to the warmer temperatures that are developed by summer river warming.

The Forest Service supports the NOAA Fisheries position that IPC should develop an inflow-equals-outflow at low pool flow scenario to determine whether water temperatures can be brought closer to the historic norm. IPC needs to develop an integrated

temperature, flow, and migration analysis to determine whether juvenile fall chinook salmon are being delayed by HCC operations.

The Forest Service is concerned that the trapping of sand and gravel by the HCC is continuing to deplete beaches and bars along the margin of the river. The beaches and bars are used by juvenile fall chinook for rearing.

The Forest Service is concerned that ramping in the Hells Canyon Reach may be adversely affecting juvenile rearing or their habitat. Description of the juvenile rearing habitat should be presented in terms of the minimum weighted useable area (WUA) available each day rather than the average daily WUA because of the wide fluctuations in daily flow. The Forest Service is concerned that IPC has not included flow augmentation to accelerate the smolt migration regime that is believed to increase survival rates.

The continuing effects on resident and anadromous fish of low dissolved oxygen (DO), elevated total dissolved gas (TDG), and asynchronous river temperatures are a concern. Although IPC proposes to improve these conditions, they do not believe they will meet state standards.

**Pacific Lamprey --** IPC conducted a literature review for Pacific lamprey. IPC proposes no PM&E measures to mitigate for the continued loss of Pacific lamprey that once accessed habitat above the HCC. Pacific lampreys have difficulties ascending the dams on the Columbia and Snake. Pacific lamprey are believed to have no fidelity to their natal streams. The Forest Service maintains that mitigation recommendations should be developed for the continued loss of Pacific lamprey.

**Hatchery Mitigation --** The hatchery mitigation program will be continued. IPC plans to upgrade their facilities to meet new objectives and standards for hatcheries in the Columbia Basin. The number of hatchery-produced fish will remain approximately the same. However, it is believed that the upgraded facilities will meet the smolt targets set in the Settlement Agreement more than in the past. Previously, IPC met their targets approximately 70% of the time. IPC will try to increase their fall chinook production to meet the original 1,000,000 smolt target. Meeting that target is dependent on eggs from the Washington Department of Fisheries Lyons Ferry Hatchery. The Forest Service maintains that the mitigation program should annually set up a budget for meeting the 1,000,000 fall chinook smolt target. When eggs are not available to meet production targets, the surplus funds should be used to improve other hatchery operations or enhance habitat.

**Warmwater Fish --** IPC's studies of warmwater fish focused on smallmouth bass, crappie spp., and catfish. Based on their finding, IPC has developed a warmwater fish plan that will provide stable water levels for warmwater species that spawn in the spring of the year. The findings indicate that reservoir fluctuations affect spawning survival but flow year determines the survival of fry. High flow years result in poor crappie survival. The higher velocities entrain the pelagic juveniles through the dams and on down the Snake River. The warmwater fish plan will provide an opportunity for good year class

survival, but the water year will ultimately determine whether a good year class will occur. The Forest Service supports the proposed warmwater fish plan if this plan is supported by all other fish management agencies.

**White Sturgeon --** IPC's research on white sturgeon extended from Swan Falls Dam to Lower Granite Reservoir. IPC determined that the population in the Hells Canyon Reach was healthy and has gradually increased in size and number. However, research found that the population within the HCC reservoirs has not increased in thirty years and is nearly extinct. One healthy but small population exists in the river approximately ninety miles upstream from Brownlee Reservoir. IPC explored the possibility of constructing white sturgeon fish passage structures at the HCC dams. IPC concluded that such facilities were too costly and there was a high level of uncertainty as to whether white sturgeon would use them.

IPC has developed a white sturgeon plan. As part of the white sturgeon plan, IPC has proposed a trap-and-haul operation for moving selected individual sturgeon. This would promote genetic interchange among populations that are isolated by the dams within the Snake River. The state fisheries agencies will need to agree to the plan before it can be implemented. The plan will only be practical if water quality conditions in the HCC reservoirs and the Snake River above the HCC can be improved. Low oxygen levels in the HCC reservoirs are a major problem. Lack of suitable spawning flows within the reservoirs is another limiting factor. The Forest Service will support IPC's white sturgeon plan if it addresses improving habitat for sturgeon spawning within the HCC including the Oxbow bypass reach and if this plan is supported by all other fish management agencies.

**Bull Trout --** IPC conducted extensive research on bull trout within the Hells Canyon reservoir and its tributaries. IPC conducted research below the Hells Canyon Dam to a lesser extent, and the Forest Service maintains that IPC needs to continue their studies to determine the effects of HCC operations on populations in the Hells Canyon Reach. IPC has proposed to develop a native salmonid plan to recover bull trout populations in the Hells Canyon Reservoir and its tributaries. The plan includes trapping and transporting bull trout over Hells Canyon and Oxbow dams to create a genetic infusion with resident populations in Indian Creek, Pine Creek, and Wild Horse River. IPC also proposes habitat improvements in Pine Creek. IPC proposes the eradication of brook trout in Indian Creek to prevent hybridization as well as the construction of a fish monitoring weir at the mouth of Pine Creek. IPC proposes working with landowners in the Pine Creek valley to improve habitat.

The Forest Service maintains that IPC should include inventories of the Eagle Creek Basin in the plan. Bull trout were present until the 1980s but have been thought to be extirpated although no thorough studies of the wilderness reaches of Eagle Creek have been conducted to determine whether remnant populations remain. The trap and haul method of reintroduction planned for Hells Canyon and Oxbow dams should be considered for Brownlee Dam if the technique is successful at the other two.

Although IPC has proposed measures to improve bull trout populations affected by the complex, a monitoring plan has not been provided. The Forest Service maintains that IPC needs to provide a complete monitoring plan as part of the native fish plan. Monitoring is essential for determining the success of the proposed actions.

**Redband Trout --** Research of IPC revealed that redband trout move into tributaries during the spring and summer months to spawn and rear, returning to the reservoirs in winter. IPC found this pattern to be the same in the Hells Canyon Reach. IPC found that redband trout in the reservoirs suffered from low body weight ($W_r$) (Page 3, Paragraph 4 Appendix 3.3.1-5*)*. This may be due to stress caused by inadequate food supply or poor water quality. IPC surveyed tributary access for redband trout both below and within the HCC and found that a number of culverts on tributaries to the reservoir do not meet fish passage standards. IPC has indicated that they are developing a proposal to remedy them. IPC found no tributaries below the HCC that had access problems. IPC found that some redband trout have hybridized with hatchery rainbow but the extent is limited to the lower reaches of a few tributaries of the reservoirs and is not considered a serious problem. IPC recommended planting sterile triploid rainbows to prevent hybridization with redband trout. IPC believes that the native resident fish plan will result in improved conditions for redband trout as well as bull trout. The Forest Service supports the plan to improve habitat through IPC's native fish plan.

**Benthic Macroinvertebrates --** The benthic macroinvertebrate studies found that the population was abundant and composed of those organisms that could tolerate the flow fluctuations caused by the HCC. The studies found that the 17.2 miles below the Hells Canyon Dam had a depressed population of macroinvertebrates that is probably caused by low oxygen levels during the summer months. The food supply of macroinvertebrates for most species of fish was considered to be abundant. It was noted in the fish community studies that some species in the reservoirs, i.e. rainbow and redband trout and yellow perch, have a below normal body weight ($W_r$). It is theorized that this may be due to water quality and not a lack of food availability.

The Forest Service agrees with these findings. IPC comports with the water quality information that is available in the draft license. The Forest Service maintains that this data supports its position that water quality must be improved both within and below the HCC.

IPC reported finding the Bliss Rapids snail in its sampling of the Hells Canyon Reach. IPC did not conclude that this ESA listed species was of importance and did not propose to conduct further surveys to define the extent of the population. The Forest Service maintains this conclusion is inconsistent with current theory on metapopulation and species viability and that further analysis of this listed species is necessary within waters affected by the project. .

## Comments Specific to the Draft License Application

Quotations or sections taken directly from IPC's draft license application are shown in italics.

### Exhibit E.2. Report on Water Use and Quality

1. Page E.2-28. *"The Applicant proposes to supplement DO by 1,450 tons annually into Brownlee Reservoir. The Applicant's proposed method of introducing the oxygen into Brownlee Reservoir is by injecting it into the transition zone or the upstream end of the lacustrine zone. Additional details regarding reservoir oxygen injection systems are present in section 5.15.1.7 of Technical Report E.2.2-2. The Applicant recognizes that there is significant uncertainty associated with identifying specific design features of, and understanding the reservoir response to this measure at this time. Because of this uncertainty, the Applicant proposes that the specific details regarding design, location, and operation, as well as a plan for monitoring effectives, be developed through consultation with ODEG and IDEQ as part of this measure. Consultation regarding these specific details would be conducted within the framework of the re-licensing process."*

   The Forest Service maintains that the oxygenation of Brownlee Reservoir, as proposed by IPC, will make the habitat within the reservoir more suitable for a wintering population of adfluvial bull trout.

2. Page E.2-29. *"The Applicant proposes to install and operate turbine-venting systems in units 1 through 4 at the Brownlee Project. Preliminary feasibility analyses conducted by the Applicant (Technical Report E.2.2-2) indicate that a passive aeration system using the existing turbine vacuum breaker system could aerate releases from units 1 through 4 of the Brownlee Powerhouse. Turbines at this project are Francis-type units with a vacuum breaker system that prevents damaging vacuum pressures from occurring during sudden closures of the wicket gates. Under certain operating conditions, the vacuum breaker system is designed to admit atmospheric air to each unit. This measure may include modifications to the units such as hub baffles or piping alterations to increase the amount of air admitted by the vacuum breaker system during operation and thereby increase DO levels downstream of Brownlee Dam."*

   The Forest Service agrees with IPC's proposal to inject oxygen at Brownlee Dam. This action may alleviate oxygen depletion below Hells Canyon Dam. A kill of approximately 100 adult steelhead occurred in October 2002 due to oxygen depletion below Hells Canyon Dam. The proposal to add oxygen at Brownlee Dam has inherent uncertainties and should have a fallback plan if it does not work. Whether the oxygenated water can carry through Oxbow and Hells Canyon reservoirs without becoming depleted provides a level of uncertainty. Thus a monitoring program should be instituted to evaluate the effectiveness of this mitigation measure and other options to address this issue may need to be explored.

**Exhibit E.3.0 Fish and Snail Resources**

1. Page E.3-66. *"Currently, the distribution of lamprey on the Snake River extends upstream to Hells Canyon Dam (Close et al. 1995), the upstream barrier to anadromous fishes."*

   Pacific lamprey life history and historic distribution is presented in Section E.3.1.1.2.1.4, Page 36 to 39 and 47 to 48. Pacific lamprey is also listed as a member of the fish communities in downstream areas affected by HCC.

   The Forest Service agrees with the fact that the HCC blocks Pacific lamprey migration. The Settlement Agreement of 1980 provided mitigation for the continued loss of anadromous salmonids that cannot pass the HCC. No mitigation for continued loss of Pacific lamprey was provided in the Settlement Agreement. No new measures are proposed in the draft application to mitigate for this loss. The Pacific lamprey is an important source of marine-derived nutrients in the ecosystem, and they provide a food source for many aquatic and terrestrial species. IPC has caused the continued loss of this species from NFS lands that would be accessible to them were it not for the HCC, and some form of mitigation for this continued loss should be developed.

   Based on what is known about Pacific lamprey passage at the dams, it is believed that they have difficulty migrating upstream but pass through the dams as juveniles with little harm. It is believed that lamprey do not specifically return to their natal streams as salmon do. IPC needs to mitigate for the continued loss of Pacific lamprey in waters affected by the HCC and include lamprey in future discussions on fish passage at the complex.

2. Page E.3-92 and Page E.3-93. *"The Applicant found little to no data concerning the species distribution and use of the mainstem Snake River. Historical accounts indicate that bull trout within the HCC occurred in the following basins: Powder River, Pine Creek, Indian Creek, Wildhorse River, and the mainstem Snake River (Buchanan et al. 1997). It is suspected that bull trout were widely distributed in the headwaters of the Powder River basin, but documentation of their distribution prior to the 1960s has not been established (Buchanan et al. 1997). Bull trout were documented in 1965 creel reports from Eagle Creek and West Fork Eagle Creek, but they are now believed to be extremely rare or extirpated from this basin. The most recent account of the species downstream of the Eagle Creek basin came from ODFW personnel who reported catching a 12-inch bull trout in a gill net set at Brownlee Reservoir in 1959."*

   The Forest Service agrees that bull trout are found in the headwaters of the Powder River and that they were known to exist until after the closure of Brownlee Reservoir in Eagle Creek, a tributary of the Powder River. IPC makes no provision for mitigating the continued loss of bull trout from Eagle Creek. The Eagle Creek system has excellent bull trout habitat potential in the headwater reaches that are snow-fed wilderness streams. The Forest Service maintains that the continued loss of Eagle

Creek fluvial bull trout that used the Snake River for winter habitat in the vicinity of what is now Brownlee Reservoir should be mitigated by IPC. The HCC prevents the fluvial bull trout component from moving freely between the Snake River below Hells Canyon Dam and the tributaries within the HCC. This includes Eagle Creek, a tributary of Brownlee Reservoir. A mitigation program as an extension of the one proposed for the Hells Canyon and Oxbow reservoir tributaries of Indian Creek, Pine Creek, and Wildhorse River should be considered. Introduction of fluvial bull trout to the Eagle Creek system, including necessary habitat restoration such as irrigation diversion screening, should be considered. This would be a second phase of the mitigation program proposed by IPC for the Hells Canyon and Oxbow reservoir tributaries and would be carried out when IPC's native salmonid plan measures prove successful (see E.3.1.3.2.1 Native Salmonid Plan).

3. Page E.3-98 and 99. *"Radio-tagged bull trout below Hells Canyon Dam exhibited classic fluvial behavior during both years that the Applicant biologists monitored movement. Fifty percent of the individuals that we remonitored made spring migratory movements downstream to the Imnaha River after wintering in the mainstem Snake River. Of the bull trout that were not tracked to the Imnaha River, most had radio tags that probably expired before fish would have begun migrating downstream to the Imnaha River. Thus, these fish may have made similar movements to tributaries but radio-tag life was inadequate to monitor their movements through spring. However, several bull trout that were tracked through summer did not migrate to the Imnaha River or any other tributary, possibly because they had spawned the previous year or had not reached sexual maturity. Tributary migrations for radio-tagged fish in the Snake River generally occurred in late April through May. Movement up the Imnaha River was gradual through May, June, and July, suggesting that increasing water temperatures may have been influencing upstream movement through the summer. Additional observations of bull trout tagged in the Imnaha River in summer 2001 and monitored through the winter by U.S. Forest Service, ODFW, and Applicant biologists (Forest Service, Wallowa–Whitman National Forest, unpublished data, 2002) provided further evidence for the existence of a fluvial population that spawns in the upper Imnaha River basin. These fish spawned between September and October 2001. After spawning, one of bull trout moved out of the Imnaha River sometime in November or December and remained in the Snake River from January to April 2002."*

   The Forest Service does not feel that the bull trout studies in the Hells Canyon Reach have adequately addressed agency concerns. IPC has shown that bull trout are dependent on the Hells Canyon Reach of the Snake River for a portion of their life history needs. However, the fact that only a few bull trout were tagged and tracked into tributaries leaves numerous questions about their behavior and the affect of the hydropower operations on the population. IPC found that some bull trout remained in the mainstem reach during the summer when temperatures are not suitable for bull trout. The relative portion of the population that remains in the mainstem Snake River during the summer was not determined. The Forest Service maintains that IPC should continue to study bull trout in the Hells Canyon Reach until the behavioral

patterns of the population throughout the year are known. The relative population abundance and the affect of hydropower operations on it throughout the year needs to be discovered.

4. Page 3-117. *The Applicant did not sample this reach for resident nonsalmonids, but did survey the members of the Aquatic Resources Work Group and the literature to obtain information. Native resident nonsalmonids found below HCC consist of the largescale sucker, bridgelip sucker, mottled sculpin, shorthead sculpin (Cottus conusus), northern pikeminnow, longnose dace (Rhinichthys cataractae), chiselmouth, and Pacific lamprey (S. A. Grunder, IDFG, personal communication, April 17, 2000). Other nonsalmonid species that might possibly occur in the reach below HCC are the peamouth, speckled dace (Rhinichthys balteatus), and redside shiner (Richardsonius balteatus) (S. A. Grunder, IDFG, personal communication, April 17, 2000). Incidental nonsalmonid fish caught by electrofishing in the free-flowing section of the Snake River (RM 145–RM 215) are dace species and the common carp, chiselmouth, largemouth bass, largescale sucker, northern pikeminnow, peamouth, redside shiner, sculpin species, smallmouth bass (Nelle and Bennett 1998)." . (E.3.1.1.5.4. Fish Communities in Downstream Areas Affected by the HCC)*

   The Forest Service is responsible for insuring that all native species are adequately protected when it approves project activities on National Forest lands. The Forest Service maintains that IPC should have conducted field sampling to document species presence, relative abundance, and to identify any effects of the project on all species in the fish community of the Hells Canyon Reach. For IPC to state that some species "might occur" in the reach is not adequate science. It is a concern of the Forest Service that some species such as the Pacific lamprey are declining and could become ESA listed due to adverse impacts on the habitat caused by the HCC.

5. Page E.3-119. *Since 1991, the Applicant has operated the reservoirs of the HCC during fall, winter, and early spring (October through May) in a manner to protect fall chinook spawning and incubating. This flow program provides stable flows during the fall spawning period. After the spawning period, the Applicant maintains the stable discharge level as a minimum discharge until emergence is estimated to be complete during the following spring. This program provides a stable, benign environment for spawning adults, thereby reducing the potential for redd abandonment that might occur if flows fluctuated widely. Another benefit of the stable spawning and incubation discharge is that shallow redds are protected from potential desiccation, which could result in a mortality loss of 100% for any dewatered redd." (E.3.1.3.1.1.1. Fall Chinook Salmon Spawning and Incubation Protection)*

   The Forest Service agrees with the proposal to maintain spawning and incubation flows as part of IPC's existing measures to protect fall chinook salmon. However, IPC should evaluate other possible mitigation that may also be necessary for

protection of fall chinook. This would include operational or structural changes needed to create temperatures that are closer to pre-dam conditions as stated above.

Fall chinook salmon spawn in the Hells Canyon Reach of the Snake River. The Settlement Agreement of 1980 has mitigated the loss of spawning areas above the HCC. Wild chinook salmon still spawn in the Hells Canyon Reach below the HCC. Delayed out-migration of wild smolt from the Snake River and the Hells Canyon Reach has been determined by NOAA Fisheries to cause poor survival. NOAA Fisheries acknowledges that a large portion of the delay is due to the federal hydropower system. This delay is believed to be related to river temperatures that are warmer in the fall and cooler in the spring than those experienced prior to dam closure. The Forest Service supports the NOAA Fisheries request that a flow scenario be developed that would model the HCC affect on temperatures when inflow equals out-flow at minimum pool. The purpose of this modeling effort would be to determine whether temperatures could be closer to the pre-dam conditions.

6. Page E.3-121. *"The Applicant will continue to support and participate in spawning surveys to the extent that they provide data useful for managing the HCC in a manner that protects listed fall chinook salmon within the mainstem Snake River downstream of Hells Canyon Dam."*

   The Forest Service agrees with IPC's proposal to continue participating in fall chinook spawning ground surveys. IPC has an obligation to continue this effort due to the impacts of the project on this species. The potential for impacts to spawning redds by hydropower operations makes it essential that this work continue. The extent of the surveys is within the discretion and authority of the NOAA Fisheries and state agencies.

7. Page E.3-121. *"The Applicant will continue to monitor water temperature during the early fall through late spring within the upper Hells Canyon reach to determine when emergence in that river reach is complete and protective minimum flows can be relaxed each spring."*

   The Forest Service agrees with IPC's proposal to monitor water temperature related to spawning and emergence of fall chinook salmon. Fisheries management agencies should make the determination when emergence is complete and flow regime changes are appropriate.

8. Page E.3-127, and E.3-128. *"As part of the warmwater fish plan, the Applicant implements actions to protect resident centrarchids during spawning periods and to monitor populations."*

   *"For the proposed operations scenario, the Applicant would use a series of target elevations on specific dates as operational guidelines. A target elevation (minimum) of 2,069 feet mean sea level in Brownlee Reservoir would be set for May 20. Once the elevation of Brownlee Reservoir reached 2,069 feet on or after May 20, a 30-day*

*period would be protected during which the reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period. <u>The exception would be for system or economic emergencies.</u> From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet mean sea level would have to be maintained through July 4. The 30-day period beginning on or after May 20 would allow the Applicant to protect peak spawning periods identified for smallmouth bass (May 19 to June 1) and crappie (May 10 to 21 and again from June 8 to 24) in Brownlee Reservoir (Chapter 1 of Technical Report E.3.1-5)."*

The Forest Service tentatively agrees with the concepts in the warmwater fish plan. However, the exception for *"system or economic emergencies"* needs to be defined before the Forest Service can fully support this measure.

9. Page E.3-131. *"A native salmonid plan is intended to mitigate and enhance native populations of resident salmonids. This measure primarily includes the development of a plan to recover and restore bull trout populations associated with the Pine–Indian–Wildhorse core area. This plan would be developed with state management agencies and the USFWS. The Applicant assumes that actions undertaken to recover and restore bull trout would equally benefit other native salmonids such as redband trout. The plan would in turn provide upstream access to areas above Hells Canyon and Oxbow dams; increase the forage base in the lower portions of tributaries, Hells Canyon Reservoir, and the upper portions of tributaries to enhance rearing areas; and reduce effects of degraded habitats and land uses within tributary habitats. Other elements included in the plan would address facilities for long-term monitoring of fluvial fish, experimentation to reduce the impacts of introduced brook trout into Indian Creek, and population monitoring.*

   *Specifically, measures in the native salmonid plan include pathogen surveys in Pine and Indian creeks, modifications to Hells Canyon fish trap, design and construction of Oxbow fish trap, enhancements of tributary habitat, outplants of anadromous carcasses, enhancement of the forage and prey base, installation of a permanent monitoring weir at Pine Creek, introduction of fluvial bull trout, and long-term monitoring and removal of brook trout in Indian Creek. These measures are detailed in the following sections."*

   The Forest Service agrees with the concepts in the native salmonid plan. It recognizes that this is a long-term effort that will require adaptive management concepts. The Forest Service would like IPC to include reintroduction of bull trout to Eagle Creek in this plan. However, reintroduction of bull trout to Eagle Creek would only be attempted if the proposed plan proves effective. The bull trout that inhabited Eagle Creek have been extirpated, and it is believed that the HCC blocked fluvial bull trout. The presence of brook trout and irrigation diversions eliminated the remnant population. The wilderness headwaters of Eagle Creek are believed to provide excellent habitat conditions for bull trout.

10. Page E.3-143. *"The Applicant proposes to plant approximately 1 million triploid (reproductively sterile) rainbow trout fry in the Oxbow Bypass and the lower portions of Pine Creek (possibly including North Fork Pine Creek). Eggs certified as free of pathogens would be purchased, hatched, and reared for approximately one month at the Oxbow Fish Hatchery. Upon release, fry would be approximately 2 inches long. The Applicant would use triploid fish to reduce the likelihood that survivors could reproduce with native redband trout. The releases would be at times to reduce immediate predation by warmwater species, although all piscivorous (fish-eating) species would benefit."*

    *"Fry could be released in several pulses. The location of releases is based primarily on information collected during the Applicant's studies (Chapter 4 of Technical Report E.3.1-7). The relatively quiet backwater provided in the Oxbow Bypass may help keep outplants from being flushed into the reservoir where they would be less available. In addition, if fry were planted near or within North Fork Pine Creek, they should be well distributed between the outplant site and the mouth of Pine Creek. Oxbow Fish Hatchery would need additional rearing space under this measure. The additional rearing space could be incorporated into planned expansions of the facility to rear juvenile fall chinook salmon (see section E.3.1.3.2.2.2.)."*

    The Forest Service agrees with the concept of releasing a forage species that would aid bull trout recovery. However, many of the Pine Creek tributaries do not have good road access for stocking fry where bull trout are now found.

11. Page E.3-149. *The proposal to upgrade and enhance facilities at the anadromous mitigation hatcheries includes measures for each of the four hatcheries. These measures, organized by hatchery, are detailed in the following sections." (E.3.1.3.2.2. Anadromous Mitigation Hatchery Facility Upgrades and Enhancements)*

    The Forest Service supports the plan for IPC's hatchery improvements. The Snake River fall chinook, spring/summer chinook, and summer steelhead propagated by these hatcheries are the gene pool for future reintroduction above the HCC should technology for successfully passing adults and juveniles become available. The Forest Service maintains that the hatchery program that was set in place to mitigate for the continued loss of these important runs of anadromous fish should be "state of the art". The Forest Service maintains that the hatchery program should continue to provide the Hells Canyon Reach with runs of salmonids that will support both tribal and sport fisheries.

12. Page 40, Paragraph 3, Appendix E.3.1-7. *"Culvert surveys at 18 Hells Canyon Complex tributaries suggested that most were upstream barriers for adult rainbow and bull trout. The primary factors responsible for creating barriers were water depth and water velocity inside the culverts. Culvert size and lack of downstream control points appeared to be responsible for inadequate depths, while culvert gradient was responsible for the extreme velocities."*.

The Forest Service did not find any reference to correction of culvert passage problems in the draft license application. The HCC has fragmented bull trout habitat and IPC needs to contribute to efforts reconnecting bull trout populations in this reach of the Snake River. The report cited above clearly notes that a problem exists. The ownership of the culverts was not stated in the report. The Forest Service maintains that IPC should address this issue. The report cited below indicates redband trout in the reservoirs are being negatively affected by the project.

13. Page 3, Paragraph 4 Appendix 3.3.1-5 *"The data collected in the HCC indicates that several species have $W_r$ below 85, but not for all HCC reservoirs. In Brownlee Reservoir, bridgelip sucker was the only sampled species having a $W_r$ less than 85. In Hells Canyon Reservoir, common carp, largescale sucker, mountain whitefish, rainbow trout, and yellow perch had low $W_r$. Of species sampled in Oxbow Reservoir, only rainbow trout had a $W_r$ less than 85."*

    The Forest Service agrees with the findings and believes *a $W_r$ less than 85* is symptomatic of the low oxygen and high water temperatures that adversely affect native redband trout. The Forest Service maintains that IPC should develop a plan to provide access to all coldwater tributaries blocked by culverts or other obstacles within the project area to provide redband trout with refugia from inhospitable conditions in the reservoirs during the summer. The addition of oxygen may improve the conditions for trout, but the extreme temperatures within the HCC affected waters also need to be addressed through mitigation otherwise they will continue to adversely affect trout growth and condition factor ($W_r$).

14. Page E.3-172. *"The Applicant proposes to conduct stock assessments of white sturgeon populations in Snake River reaches between Swan Falls and Brownlee dams and downstream of Hells Canyon Dam every 10 years during the new license period established for the HCC. For example, based on a 30-year license, a total of three stock assessments (at 10-year intervals) would be conducted for sturgeon populations in these reaches. Stock assessments in Oxbow and Hells Canyon reservoirs would probably be conducted less often since the remnant status of sturgeon in these pools has changed little over the past 30 years (Chapter 1 of Technical Report E.3.1-6)."*

    The Forest Service agrees that the 10-year monitoring plan should be implemented on the free flowing reaches of the Snake River. However, monitoring of populations in Hells Canyon Reservoir should be included in this schedule.

15. Page E.3-177. *"Therefore, the Applicant proposes translocation as a means to improve white sturgeon productivity in the Snake River between Swan Falls and Brownlee dams. Similar actions (trawl and haul supplementation) have been implemented to improve white sturgeon productivity in the impounded reaches of the lower Columbia River (Kern et al. 2001). The Applicant acknowledges that the feasibility of this measure depends on significant improvements to water quality in the reach (see Technical Report E.2.2-2 for a description of water quality issues). A population viability analysis indicated that recruitment would not be reestablished*

*unless water quality was improved in the Swan Falls to Brownlee reach (Chapter 3 of Technical Report E.3.1-6). The feasibility of this measure may also depend on study findings from the water quality assessment (see section E.3.1.3.2.3.2.).”*

The Forest Service agrees with this translocation strategy if it is approved by the Oregon and Idaho fisheries agencies. However, this does not address the habitat lost due to inundation by the HCC.

16. E.3-182. *“The river segments between Brownlee and Hells Canyon dams are relatively short and consist primarily of impounded reservoir habitat. Reservoir habitat may provide some benefits to white sturgeon. For example, the relative weight of individuals caught in reservoirs with good water quality tended to be higher than that of individuals caught in free-flowing sections of the Snake River (Chapter 1 of Technical Report E.3.1-6). However, two commonly cited drawbacks of reservoir habitat for sturgeon are poor water quality and lack of turbulent flow conditions for spawning (Jager et al. 2001). The Applicant’s stock assessment between Brownlee and Hells Canyon dams (Chapter 1 of Technical Report E.3.1-6) indicated that the status of white sturgeon within these two reservoirs has remained unchanged over the last 30 years. Welsh and Reid (1971) concluded that, although anglers have captured a few sturgeon in the tailrace of Brownlee Dam, the species is probably not abundant in Oxbow Reservoir and not present in Hells Canyon Reservoir.”*

    IPC has not addressed the issue of white sturgeon habitat inundated by Hells Canyon and Oxbow reservoirs. The Forest Service maintains that the white sturgeon population should be recovered or mitigation measures for the lost production should be developed. It may be possible to improve white sturgeon productivity in the HCC reservoirs through oxygenation of reservoir waters as proposed by IPC. However, the lack of reproduction in Oxbow and Hells Canyon reservoirs currently precludes the development of a viable population. The Forest Service maintains that the population in the three reservoirs would have been comparable or greater than the one presently found in the Hells Canyon Reach. The pre-dam habitat now inundated by the reservoirs would have been similar in size and quality to the Hells Canyon Reach. The Forest Service maintains that IPC should propose PM&E measures that address these issues.

17. Page E.3-231. *“Conversely, the Bliss Rapids snail appears to be a very minor component within the aquatic ecosystem downstream of Hells Canyon Dam. Despite relatively extensive sampling downstream of Hells Canyon Dam, only two Bliss Rapids snails were collected (Technical Report E.3.1-8). Because these two individuals were collected approximately 300 river miles downstream of the species’ historical range or of any other documented colonies, their importance to continued species survival or as indicators of ecosystem integrity is questionable. Continued operation of the HCC, as proposed by the Applicant, would most likely not affect the survival and persistence of the Bliss Rapids snail. It may even benefit the species by being a factor in providing additional suitable habitat beyond its historical range.”*

The Forest Service does not agree with this statement. IPC does not propose to conduct additional sampling and the existing sampling appears to be inconclusive. The extensive area of the Hells Canyon Reach could provide habitat for populations of the Bliss Rapids snail that have not yet been identified. The effects of IPC's operations on the snail are unknown due to the small sample size. The Forest Service will rely on the USFWS to provide direction to IPC on measures to protect the ESA listed Bliss Rapids snail in the Hells Canyon Reach.

**Exhibit 6.0. Land Management and Aesthetics**

The following quotes represent the major fisheries sections in the land management and aesthetics report. This presentation is an overview that does not address specific fisheries and aquatic resource issues. The information necessary to acquire a full understanding of the draft license application aquatic resource issues is located in sections 1.0, 2.0, and 3.0.

The following are IPC's statements in section 6.0 that are relevant to fisheries resources of concern to the Forest Service:

**E.6.4.4.1. Aquatic Resources**

1. *"1. Sufficient water levels will be provided during the spawning and incubation period to protect fall chinook redds.*
2. *Adequate reservoir levels should be maintained to protect spawning of bass and crappie.*
3. *Excavation, dredging, and filling in perennial streambeds should be timed to protect fish, wildlife, and other resources.*
4. *Best Management Practices (BMPs) for resource protection should be defined and followed for any development, improvement, or maintenance activity.*
5. *Any chemical herbicides used near a waterway will consist only of products approved by the U.S. Environmental Protection Agency for aquatic application. These products will be used in compliance with labeling instructions and will be applied by a state-certified applicator.*
6. *No significant ground-disturbing activities should occur within 75 feet of a perennial tributary stream except for activities that are important for resource protection or essential for utility operations, or for public access to which streamside location is necessary.*
7. *All new and replaced culverts for drainage purposes will comply with Oregon and Idaho fish passage requirements." (Page E.6-47)*

**E.6.5.3.1. Plans Relevant To Both States**

*"All the measures proposed in section E.2.4. to protect, mitigate, or enhance water quality, as well as measures in sections E.3.1.3., E.3.2.3., and E.3.3.3. for fish, wildlife, and botanical resources are consistent with this plan's policies. Specific examples include following measures:*

1. *Warmwater fish plan (see section E.3.1.3.1.3.)*

2. *Native salmonid plan, which includes modifying the Hells Canyon Dam fish trap and redesigning the Oxbow Fish Trap (section E.3.1.3.2.1.) Conducting pathogen surveys in Pine and Indian creeks (section E.3.1.3.2.1.1.)*
3. *Modifying culverts on Brownlee and Hells Canyon reservoirs (section E.3.1.x.x.x.)*
4. *Habitat enhancement and riparian protection (section E.3.1.3.2.1.4.)*
5. *Screening of irrigation diversions (section E.3.1.3.2.1.4.)*
6. *Monitoring and brook trout removal in Indian Creek (section E.3.1.3.2.1.9.)*
7. *Continuation of the fall chinook program (section E.3.1.3.1.1.)*
8. *Development and implementation of the white sturgeon protection and enhancement plan (section E.3.1.3.2.3.)*
9. *Continuation and improvement of the Pahsimeroi, Oxbow, Niagara Springs and Rapid River hatchery programs (section E.3.1.3.2.3.)*
10. *Provision for public recreation on the Applicant's lands." (Page E.6-63)*

**Comprehensive Plan For Production and Management Of Oregon's Anadromous Salmon and Trout: Part I. General Considerations (Page E.6-71)**
*[Applicant response]: "The Applicant's various studies on anadromous and trout populations investigated many aspects of these four management concepts. For example, a number of studies were directed at water quality conditions in the reservoirs in relation to standards for fisheries and the general condition of habitat, both upstream and downstream of the project area (habitat concept). The HCRMP and the Applicant's responsibilities in implementing measures of the TMDL (IDEQ and ODEQ 2001) address land-use practices intended to improve habitat in the future. The proposed PM&E measures for anadromous fish, native trout, and other fish species include habitat enhancements, such as providing fish passage, that would expand available habitat for these populations (see section E.3.1.3.). Improvement of tributary streams, including improved flows, screening of diversions, and improved riparian habitat, would improve habitat for bull trout and redband trout. The Applicant's reintroduction plan proposes further study so that key uncertainties regarding adequacy of habitat for reintroduction above the HCC can be better addressed. Downstream of Hells Canyon Dam, the fall chinook plan would maintain habitat (see section E.3.1.3.1.1.)." (Page E.6-73, Paragraph 2)*

*"To achieve optimum numbers of artificially produced anadromous fish and trout, the Applicant proposes to continue operating its Pahsimeroi, Oxbow, Niagara Springs, and Rapid River fish hatcheries and improve the facilities at each of them (see section E.3.1.3.2.2.)." (Page E.6-72, Paragraph 2)*

**Warmwater Game Fish Management Plan (ODFW 1987a)—**This plan's goals are to provide optimum recreational benefits to the people of Oregon by managing warmwater game fish and their habitats. *(Page 72, Paragraph 6)*
*[Applicant response]: "The HCC provides substantial angling opportunity by enabling public access to the warmwater fishery through its lands and roads along the reservoirs. The current proposal would increase angling opportunities in Oregon by providing an additional boat ramp at Swedes Landing to provide access at lower reservoir elevations*

*when other boat ramps in Oregon are unusable. The "Applicant proposes water quality improvements through the TMDL (IDEQ and ODEQ 2001) and land management practices that should in turn improve fishery habitat. Finally, the Applicant would continue stabilizing Brownlee Reservoir during bass and crappie spawning periods to help protect spawning habitat (see section E.3.1.3.1.3.). Ongoing monitoring of warmwater species would be continued to determine the effects that these and other actions have on these species." (Page E.6-73, Paragraph 2)*

**[The Statewide Trout Management Plan (ODFW 1987b)]** *[Applicant response]:* **"***These goals and policies are similar to those of the 1982 Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout (above) by the ODFW. The Applicant's proposals, which are notably consistent with these goals and policies, are also similar to those listed for the anadromous salmon and trout plan. The Applicant's proposed HCRMP and responsibilities in TMDL (IDEQ and ODEQ 2001) implementation address land-use practices intended to improve trout habitat. Proposed PM&E measures for native trout include enhancements, such as providing fish passage, that would expand the amount of available habitat for these populations (see section E.3.1.3.2.1.). Proposed improvements to tributary streams— including improved flows, screening of diversions, and improved riparian habitat (see section E.3.1.3.2.1.4.)— would also benefit habitat for bull trout and redband trout. The Applicant's reintroduction plan proposes further study so that key uncertainties regarding adequacy of habitat for reintroduction of trout and other species above the HCC can be addressed." (Page E.6-74, Paragraph 3)*

**Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part III. Steelhead Plan (ODFW 1995) (Page E.6-77, Paragraph 4)**

*[Applicant response]: "The Applicant's studies have provided information about the status of wild steelhead, updating information that ODFW has assembled in the past. The Applicant is committed to implementation of the TMDLs (see section E.2.2.1.) and the proposed native salmonid plan and reintroduction plan (see section E.3.1.3.2.). These PM&E measures would be consistent with this plan for steelhead because they improve habitat and passage. The Applicant's continued operation of the Oxbow and Niagara Springs fish hatcheries for steelhead would provide opportunities for harvest while protecting wild fish. Additionally, the Oxbow Fish Hatchery and other services provided by the Applicant promote opportunities for nonconsumptive public recreation that involves steelhead. Tours of the hatchery and viewing of the steelhead are services provided at the hatchery. The Applicant also makes presentations regarding fish conservation to schools and other groups. In addition, the Applicant's proposed interpretive and education programs (see section E.5.4.4.1.3.) could promote other types of public recreational activities. The Applicant's studies, proposed mitigation measures, and HCRMP were developed in coordination with ODFW personnel." (Page E.6-78, Paragraph 1)*

**Oregon Water Use Programs (Oregon Water Resources Commission 1987)**
*[Applicant response]: "Although the 1987 document was unavailable, the 1992 Oregon Water Management Program similarly establishes statewide policies and principles regarding major water management issues. The issues relevant to this relicensing include development of hydroelectric power, protection of instream flows, and protection of water resources on public riparian lands. The relevant policy on hydroelectric production is that "[r]elicensing of existing facilities which have adversely impacted, or may preclude the recovery of, anadromous fish resources shall include measures to restore, enhance or improve the anadromous fish resource. The relicensing of any facility shall include measures to prevent the net loss of other natural resources resulting from future operation of the facility." Related principles are that mitigation is required for harm to natural resources such as anadromous fish; wildlife; water quality; scenic and aesthetic values; and historical, cultural, and archaeological sites. Measures for restoring, enhancing, or improving resources because of past harms to Oregon's anadromous and steelhead resource are to be considered and implemented." (Page E.6-83, Paragraph 5)*

*"Consistent with this plan, the Applicant has proposed a number of measures restoring, enhancing, or improving anadromous and steelhead resources (see section E.3.1.3.2.1.), as addressed in the discussion of consistency with the Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout (ODFW 1982 above)." (Page E.6-84, Paragraph 2)*

*"Also in accordance with the policy, the Applicant has proposed a number of PM&E measures directed at protecting and enhancing wildlife, water quality, scenic and aesthetic values, and cultural resources (see section E.3.2.3.2., section E.2.4.2., and section E.6.4.3., respectively). Regarding the protection of instream flow, the Applicant proposes to continue an instream flow of 100 cfs in the Oxbow Bypass to protect fish and other aquatic resources (see section E.2.4.1.)." (Page E.6-84, Paragraph 3)*

*"The Applicant also proposes a new measure to stabilize reservoir levels to help protect warmwater fish spawning (see section E.3.1.3.1.3.) and an existing measure to continue its fall chinook program (see section E.3.1.3.1.1.). To protect riparian areas, the program advocates developing land management plans and practices; establishing databases of riparian areas by which to make management decisions; monitoring effectiveness of management directed by management plans; and avoiding and minimizing impacts from human activities, among others. The Applicant proposes to acquire and manage riparian habitat (see section E.3.2.3.2.1.1.) and includes a number of land management policies in its HCRMP to protect riparian habitat from human activities. Specific measures include requiring resource surveys before any significant human disturbance to assess and protect resources, prohibiting most human activities in riparian areas, and developing a GIS atlas to serve as a database for existing and new resource information, including riparian resources." (Page E.6-84, Paragraph 4)*

**Fish and Wildlife Resources—18 Basins: Powder River Basin (Oregon State Game Commission 1963–1975)…. (Page E.6-84, Paragraph 5)**
*[Applicants response]: "The Applicant's studies add a great deal of information about the current conditions of fisheries resources and habitat in this basin, which is consistent with the intent of this report. In addition, because all of the PM&E measures proposed in section E.3.1.3. are directed at sustaining and enhancing fisheries resources in this and other basins, they are consistent with this report. Specifically, the proposal in the reintroduction plan to enhance Pine Creek with diversion screening and habitat improvement (see section E.3.1.3.2.1.) is based on the finding documented in this report that Pine Creek is an important stream for fishery resources." (Page E.6-85, Paragraph 2)*

The information provided in Exhibit 6.0 makes it appear that IPC has adequately addressed all aquatic issues. However, the Forest Service response to the Fisheries and Snail Resources E.3.1 presents a list of issues that are not satisfactorily addressed.

It is noted in this section that IPC has recommended modification of culverts on Brownlee and Hells Canyon reservoirs to provide fish passage (section E.3.1.x.x.x). No section E.3.1.x.x.x currently exists in the DLA. It is assumed that this section will be provided in the FLA.

## Comments Specific to the Technical Report Appendices

The following technical studies have been reviewed and comments specific to those studies have been incorporated into the discussion section below.

1. (E.3.1-2, Chapters 1-11) Feasibility Of Reintroduction Of Anadromous Fish Above Or Within the HCC
2. (E.3.1-3, Chapter 1) The Timing and Distribution Of Fall Chinook Salmon Spawning Downstream Of the HCC
3. (E.3.1-3, Chapter 2) Physical Habitat and Water Quality Criteria For Fall Chinook Salmon Associated With the HCC
4. (E.3.1-3, Chapter 3) The Quality and Availability Of Fall Chinook Salmon Spawning and Incubation Habitat Downstream Of the HCC
5. (E.3.1-3, Chapter 4) A Description Of Pacific Lamprey Life history, Physical Habitat and Water Quality Criteria, and Their Current Status Downstream Of the HCC
6. (E.3.1-4) Evaluation Of Idaho Power Hatchery Mitigation Program
7. (E.3.1-5, Chapter 1) Water-Level Impacts To Spawning Smallmouth Bass, Crappie Spp. and Channel Catfish
8. (E.3.1-5, Chapter 2) Early Rearing Success (Crappie spp. and Channel Catfish)
9. (E.3.1-5, Chapter 3) Status Of the Fish Community 1991-2000 HCC
10. (E.3.1-5, Chapter 4) Relative Potential Consequences Of Alternative Operational Scenarios For Centrarchid Populations In Brownlee Reservoir (Smallmouth Bass and Crappie spp.)

11. (E.3.1-5, Chapter 5) A Literature Review and Discussion Of the Trophic Structure In Reservoirs Similar To HCC
12. (E.3.1-6, Chapter 1) Status Of Snake River White Sturgeon Associated With the HCC
13. (E.3.1-6, Chapter 2) Physical Habitat Use and Water Quality Criteria For Snake River White Sturgeon
14. (E.3.1-6, Chapter 3) Population Viability Model For Snake River White Sturgeon
15. (E.3.1-6, Chapters 4) Conceptual Design For White Sturgeon Passage Facilities At the Hells Canyon Complex
16. (E.3.1-7, Chapter 2) A Population Viability Of Bull Trout Living Within the Hells Canyon Reach Of the Snake River Basin—Using a BayVAM Assessment
17. (E.3.1-7, Chapter 3) Differentiation Of Oncorhynchus mykiss Associated With the HCC Using Allozyme Electrophoresis
18. (E.3.1-7, Chapter 4) Distribution, Status, Life History, and Limiting Factors Of Redband Trout and Bull Trout Associated With the HCC
19. (E.3.1-8) Benthic Macroinvertebrates Of Hells Canyon

## Discussion

**Inconsistencies --** It is an established fact that the Snake River inflow temperature to Brownlee Reservoir is different than the outflow temperature from the Hells Canyon Dam in both the spring and fall. IPC maintains that the water temperatures that are warmer in the fall and cooler in the spring below Hells Canyon Dam do not affect the fall chinook salmon survival. However, fall chinook are believed to hatch two weeks late, due to the cooler temperatures delaying incubation. The smolts leaving the Hells Canyon Reach are also late and have low survival rates (Ritchie Graves, personal communications 2002). They arrive late at Lower Granite Reservoir when water temperatures are elevated, and this is believed to cause high mortality. The Forest Service supports a request to IPC by NOAA Fisheries to model an inflow-equals-outflow at low pool flow scenario to determine if river temperatures below HCC can be brought in line with those above the HCC.

IPC concluded that the Bliss Rapids snail found during benthic sampling is a "*….minor component within the aquatic ecosystem downstream of Hells Canyon Dam." "…their importance to continued species survival or as indicators of ecosystem integrity is questionable.*" (Page E.3-231, Paragraph 1) The Forest Service maintains these conclusions are inconsistent with current theory on metapopulation and species viability. Additional populations of an ESA listed species are important and should be specifically located and protected.

**Adequacy of Analysis --** The analysis of the fish and snail resources affected by the HCC is generally adequate for most of the prominent species such as salmonids, sturgeon, and warmwater sport-fish.

However, there are a number of omissions by IPC that need to be addressed before the Forest Service concludes that the fish and snail section of the draft application is adequate. The Forest Service recommends that IPC address the following list of inadequacies:

1. IPC did not subject its potential anadromous fish reintroduction analysis to peer-review. A collaborative team comprised of agency, Tribal, and stakeholder personnel should be established to continue evaluation of habitat and fish passage issues raised in the analysis.
2. IPC did not model an inflow-equals-outflow at minimum pool flow scenario to determine the effects of the temperature regime on fall chinook survival below the HCC.
3. IPC did not provide an integrated temperature, flow, and migration model to access the effects of the HCC on smolt migration.
4. IPC did not adequately address the effects of current and proposed ramping rates on rearing juvenile fall chinook salmon.
5. IPC uses a mean daily weighted useable area as a measure of rearing habitat effectiveness for juvenile fall chinook salmon. The Forest Service questions whether this is valid.
6. IPC did not address the effects of continued beach and bar erosion on juvenile fall chinook that use these habitats extensively for rearing.
7. IPC inadequately addresses the effects of sediment trapping by the HCC on fall chinook spawning bars in the Hells Canyon Reach.
8. IPC does not address the need for flow augmentation to accelerate fall chinook smolt migration in its proposed operations flow scenario.
9. IPC did not develop PM&E measures to compensate for the blockage of Pacific lamprey by the HCC.
10. IPC did not propose alternative measures for increasing oxygen in the reservoirs that can be used if the proposed injection method proves to be inadequate.
11. IPC did not adequately address D.O., TDG, and water temperature effects on native fish caused by the HCC in the Hells Canyon Reach that currently do not meet state standards.
12. IPC did not consider other alternatives to triploid rainbow as a means of seeding bull trout reaches above Hells Canyon and Oxbow dams with “forage” fry.
13. IPC did not include surveys for isolated bull trout populations and reintroduction of fluvial bull trout in Eagle Creek in the native fish plan.
14. IPC did not propose to continue study of the bull trout population in the Hells Canyon Reach to determine the effects of the project on the population. The study to date is incomplete. Additional information should be collected that documents abundance, movements, and the effect of hydropower operations on those fish that summer in the reach.
15. IPC inadequately addresses the issue of reconnecting native fish populations blocked from genetic interchange by the HCC.
16. IPC did not provide a plan for correcting culverts that were found to block redband trout migration.

17. IPC did not develop PM&E measures for the continued loss of habitat for native fish species inundated by the Hells Canyon Reservoir and the rest of the HCC.
18. IPC did not propose to consider increasing flows through the Oxbow Bypass to improve water quality and fish habitat for bull trout, redband trout, and white sturgeon.
19. IPC did not adequately address the effects of Hells Canyon operations on the Bliss Rapids snail.
20. IPC did not provide detailed monitoring plans for fish, water quality, and sediment below, within, and above the HCC that are needed to determine the effects of implementing the license and the associated proposed PM&E measures.

**Impacts and Effects On NFS Lands and Resources --** The HCC affects aquatic species on NFS lands. The following effects are known:

1. White sturgeon have been nearly extirpated from NFS lands between Hells Canyon Dam and Oxbow Dam. The valuable sport fishery that could be provided has been lost. The poor water quality and lack of spawning habitat caused by the HCC has led to this decline.
2. Pacific lamprey that once used nearly all tributaries below, within, and above the HCC are blocked from returning to NFS lands in the Pine Creek, Indian Creek, Wildhorse River, and Powder River. They are an important source of marine-derived nutrients and a food source for many aquatic and terrestrial species.
3. Redband trout that migrate from the reservoirs to NFS lands exhibit physical condition below the norm (i.e. greater than $W_r$ 85). Below normal physical condition can lead to lower reproduction rates on NFS lands where they spawn.
4. Bull trout are blocked by the HCC from their historic fluvial migration routes that included summer residence and fall spawning on NFS lands in Pine Creek, Indian Creek, Wildhorse River, and Eagle Creek. The remnant populations on NFS lands are declining and nearing extinction. The continued loss of genetic interchange between the resident bull trout and the fluvial bull trout is caused by HCC blockage.
5. The mainstem Snake River and its tributaries that are inundated by the HCC no longer provide a riverine habitat for native aquatic species.
6. Spring/summer and fall chinook salmon and summer steelhead no longer access NFS lands where they provided recreation opportunity, food for wildlife, and aesthetic benefits.
7. NFS lands are no longer provided with marine-derived nutrients from anadromous fish. These nutrients provide essential elements to riparian plants, terrestrial species, and aquatic species.
8. NFS lands in the Hells Canyon Reach are being eroded by clear-water flows and continuing loss of sediment trapped by the HCC. The continuing loss of sediment to maintain gravel and sand bars is affecting spawning and rearing habitat used by fall chinook salmon.
9. Native fish in the Hells Canyon Reach on NFS lands are being adversely affected by low D.O., elevated TDG, and asynchronous water temperatures caused by the HCC.

## Preliminary Forest Service Objectives

The Land and Resource Management Plans for the Payette and the Wallowa-Whitman National Forests have standards and guidelines that require the Forest Service to protect and manage habitat for the recovery and maintenance of viable and diverse habitat and populations of aquatic, terrestrial, and riparian dependent species. These standards and guidelines include requirements for the perpetuation and recovery of plants and animals that are listed as threatened or endangered by the USFWS or NOAA Fisheries under the Endangered Species Act (ESA) and sensitive by Forest Service Regions 4 and 6. These diverse habitats and populations are to be well distributed across the Forest. It further directs that the Forest give management and enhancement of water quality, protection of watercourses and streamside management units, and fish habitat priority over uses described or implied in all other management standards and guidelines.

The Payette and Wallowa-Whitman Land and Resource Management Plans (LRMPs) direct the Forests to recognize hydropower withdrawals to the extent required by law and to encourage hydropower production unless precluded or further limited by specific management direction. Goals and objectives in the Interim strategies for managing Pacific anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California (PACFISH), and Inland native strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana, and portions of Nevada (INFISH) aquatic conservation strategy that limit activities that may adversely affect fish maintenance and recovery have been incorporated into the LRMP's. PACFISH amended the LRMP's to include the terms and conditions recommended to protect and recover anadromous fish. The Biological Opinion (BO) on the LRMP's rendered by the National Marine Fisheries Service (NOAA fisheries) for salmon and steelhead and U.S. Fish and Wildlife Service (USFWS) for bull trout further imposes terms and condition on the Forest that include the provision that the Forest must exercise all of its authority to protect and recover salmon and steelhead (Mechanism 4 of the B.O.) and bull trout (Bull Trout LRMP BO 1998 Conservation Recommendations).

Hells Canyon National Recreation Act and the Comprehensive Management Plan (CMP) for the Hells Canyon National Recreation Area (HCNRA) direct the Forest to maintain and protect fish habitat through careful resource management and recreation development. The CMP places strong emphasis on the protection and preservation of heritage resources in Hells Canyon.

The Snake River is a Wild and Scenic River with an approved plan amended to the Wallowa-Whitman National Forest LRMP. The Wild and Scenic Rivers Act requires evaluation of FERC licensed projects above or below a designated Wild and Scenic river. The determination to be made is whether the project will "invade the area or unreasonably diminish the scenic, recreational, cultural resource, and fish and wildlife values present in the area on the date of designation...”

Forest Service objectives are as follows:

**Anadromous Fish** (fall chinook, spring/summer chinook, steelhead, and Pacific lamprey)

According to the DLA, IPC will not provide anadromous fish passage. IPC concluded that passage would not be feasible due to low smolt to adult returns and loss of habitat.

1. The Forest Service recommends that a reintroduction workgroup be created and funded by IPC that would include resource agencies, tribes, and stakeholders. The workgroup would address study needs and develop potential passage scenarios with a goal of reintroducing anadromous fish above Hells Canyon Dam during the next license term.
2. Provide habitat to recover populations of anadromous fish below Hells Canyon Dam in the Hells Canyon Reach to meet ESA and LRMP requirements.

**Native Fish**

1. Provide habitat to recover populations of bull trout below Hells Canyon Dam in the Hells Canyon Reach to meet ESA and LRMP requirements.
2. Reconnect populations of bull trout and redband trout that have been fragmented by HCC.
3. Improve habitat in waters affected by the HCC for native fish species.
4. Manage non-native species for viable populations when not in conflict with goals for native species.

## Forest Service Response to Applicant's Proposed PM&E Measures

IPC's proposed protection, mitigation, and enhancement measures have elements that may improve fish communities associated with the HCC. However, the Forest Service finds the draft application deficient in the following areas:

**Reintroduction of anadromous fish** -- IPC does not plan to pursue efforts to introduce anadromous salmonids within or above the HCC. No PM&E measures for Pacific lamprey are proposed by IPC.

The Forest Service recommends that a reintroduction work group be created and funded by IPC that would include resource agencies, tribes, and stakeholders. The work group would address habitat limiting factors, barrier passage, and continued loss of marine-derived nutrients with the goal of reintroducing anadromous fish during the term of the license. The reintroduction of Pacific lamprey to streams within and above the HCC needs to be addressed.

**Anadromous fish downstream** -- With regards to anadromous fish downstream of the HCC, IPC concluded the following:

1. The proposed operational flow scenario benefits fall Chinook.
2. The project does not delay juvenile fall chinook migration that can lead to low smolt survival.
3. The spawning gravels in the Hells Canyon Reach are adequately supplied by local tributaries.
4. The juvenile rearing habitat provided by the proposed operations flow scenario is the same as run-of-the-river.

The Forest Service maintains that IPC fails to adequately analyze fish habitat requirements downstream of the HCC and that the following deficiencies must be addressed by IPC:

1. Water temperatures altered by the HCC may delay fall chinook salmon juvenile hatching and outmigration that causes low smolt survival.
2. The use of mean daily weighted useable area as a measure of rearing habitat effectiveness for juvenile fall chinook salmon is questioned.
3. The effects of ramping on juvenile fall chinook salmon rearing are underestimated.
4. The continued trapping of sediment/gravel by the HCC reduces rearing habitat for fall chinook juveniles. Juveniles use finer substrate for rearing located along shoreline beaches and bars. The beaches and bars are being eroded by the clear-water flows and lack of sediment replenishment.
5. The effect of flow augmentation on fall chinook smolt migration needs to be analyzed.
6. Poor water quality in the Hells Canyon Reach caused by the HCC that does not meet state standards will continue to adversely affect fish (low D.O., elevated TDG, and asynchronous water temperatures).

**Resident fish --** IPC partially addresses resident fish mitigation through its native fish plan and white sturgeon plan. The Forest Service maintains that the viability of isolated native fish populations be maintained. The following deficiencies in the draft application need to be addressed by IPC:

1. The Eagle Creek bull trout population needs to be addressed in the native fish plan.
2. Monitoring needs to be included in the native fish plan that would address bull trout population size, habitat condition, and genetic integrity throughout the HCC.
3. The bull trout, redband trout, and white sturgeon populations need to be reconnected throughout the HCC and tributaries.
4. The decline of the white sturgeon population in Hells Canyon Reservoir needs to be addressed.

**Habitat PM&E's for Aquatic Resources --** IPC proposes acquiring habitat for bull trout in the Pine Creek drainage as part of the proposed native fish plan. IPC also proposes to plant carcasses in Pine Creek to restore marine-derived nutrients and to develop riparian habitat protection agreements with willing landowners. The Forest Service maintains that the HCC has had, and continues to have, a much more significant effect on native fish and habitats than IPC proposes to mitigate. The Forest Service maintains that all PM&E measures should be carried out with the cooperation of the tribes, resource agencies, and stakeholders. The following are impacts that are not fully addressed in the draft application:

1. Habitat fragmentation and its effect of isolating populations of native fish.
2. The continued inundation of Forest Service Snake River and tributary habitat by the Hells Canyon Reservoir.
3. The loss of sediment transport affecting downstream habitat in the Hells Canyon Reach.
4. The hydropower ramping of the Snake River below Hells Canyon Dam as it affects fish habitat.
5. The loss of marine-derived nutrients within and above the HCC as a continuing impact.

**Bliss Rapids Snail --** IPC concluded that the Bliss Rapids snail is not important to the species survival, and the project may be helping it survive. The Forest Service maintains that IPC's position is not consistent with current theory on metapopulation, species viability, or the ESA.

## Additional Study Requests

The Forest Service requests that the following four studies be conducted by IPC, and that agency specialists be involved in developing more specific components of associated study plans.

**1. Bliss Rapid Snails**

**Study ID**: Bliss Rapids Snail Study

**Basis for Study:** The Bliss Rapids snail is an ESA listed species. Two Bliss Rapids snails were found in IPC's sampling of the Hells Canyon Reach on Forest Service managed lands. IPC's hydropower operations affect the Hells Canyon Reach.

**Study Methodology:**

1. The Forest Service recommends that IPC conduct a complete literature search to determine the habitat and life history needs of the Bliss Rapids snail.
2. The Forest Service recommends that IPC contact the USFWS and consult on the species to obtain current species information.

3. IPC should conduct a field survey to determine the relative size and location of the population, if the USFWS believes there may be an affect on the Bliss Rapids snail by IPC's current or proposed operations.

**Resource Goals and Objectives:** The Bliss Rapids snail is an ESA listed species that may be affected by current and proposed HCC hydropower operations. Current theory on metapopulation and species viability suggests that having more than one population of a species in an area is essential to the long-term survival of the species. It is currently believed that the only other known population is found 300 miles up-river from where the two snails were found by IPC. IPC does not propose to conduct further sampling to determine the relative abundance, location, and effects on the species of current or proposed operations.

**Accepted Practices:** When an ESA listed species may be affected by a project on NFS lands, it is standard practice to consult the USFWS. A literature search to find all available information is part of consultation. A field study to ensure that the project is not impacting the species is also part of the biological assessment performed to determine whether the species is being adversely affected. Methods of collection must be approved by the USFWS under ESA regulations.

**Usefulness of Information:** The proposed study will provide the appropriate agencies with the knowledge needed to make recommendations for the protection of any populations of the ESA listed Bliss Rapids snail found in the Hells Canyon Reach.

**2. Bull trout Study**

**Study ID:** Bull trout study in the Hells Canyon reach.

**Basis for Study:** IPC's hydropower operations affect the Hells Canyon Reach of the Snake River inhabited by ESA listed bull trout.

**Study Methodology:** IPC needs to continue field studies using radio-telemetry to determine the life history patterns of bull trout using the Hells Canyon Reach. The study needs to be designed to determine the relative abundance and habitat preference of bull trout using the Hells Canyon Reach throughout the year. The study needs to correlate instream flow to habitat utilization by bull trout. The effect of ramping should be correlated with habitat utilization. The IFIM model procedure should be used.

**Resource Goals and Objectives:** IPC has radio-tagged a limited number of bull trout in the Hells Canyon Reach. The results of the study provided valuable information but were inconclusive due to the small sample-size. The continuance of the existing work is needed to provide valid conclusions related to habitat utilization and the effects of the HCC operations on bull trout using the reach throughout the year. IPC needs to explain why the minimum available habitat identified in the "Instream Flow Study" is not a bottleneck to bull trout survival. IPC needs to show that low D.O., elevated TDG, and

high late-summer water temperatures are not limiting bull trout habitat utilization in the Hells Canyon Reach.

**Accepted Practices:** The use of radio-telemetry to track tagged fish is standard practice and has been used by IPC to follow a limited number of bull trout in the Hells Canyon Reach. The IFIM modeling of habitat is a standard procedure that requires valid biological and hydrological data.

**Usefulness of Information:** The proposed study will provide the appropriate agencies with the knowledge needed to make recommendations for the protection of any populations of the ESA listed bull trout found in the Hells Canyon Reach.

**3. Anadromous Fish in the Hells Canyon reach.**

**Study ID:** Anadromous Fish In The Hells Canyon Reach

**Basis For Study:** IPC's hydropower operations affect the habitat of ESA listed fall chinook salmon in the Hells Canyon Reach of the Snake River.

**Study Methodology:**

1. IPC needs to integrate temperature and flow data with migration data to substantiate their conclusion that delayed migration of fall chinook salmon smolt is not a function of HCC operations.
2. IPC needs to better evaluate the effects of ramping on fall chinook salmon juveniles rearing along the river margins in the Hells Canyon Reach.

**Resource Goals and Objectives:** It is believed that the asynchronous temperatures created by the HCC are causing fall chinook smolt to leave the Hells Canyon Reach of the Snake River later than the historic norm. The delay in migration results in low smolt survival when they encounter elevated water temperatures in Lower Granite Reservoir.

The current ramping of the Snake River in the Hells Canyon Reach by 1 foot per hour at Johnson Bar may affect fall chinook juvenile survival. Ramping may cause stranding or alter survival strategies. IPC did not conduct studies to determine the effects of ramping on juvenile fall chinook.

**Accepted Practices:** Field investigations of juvenile chinook along river margins would include visual observation by snorkeling. IPC should identify bars and beaches where potential stranding may occur in cut-off channels and puddles during the down-ramping phase of the hydropower operation. These areas should be inventoried for stranded or dead fall chinook juveniles.

**Usefulness Of Information:** The proposed study will provide the appropriate agencies with the knowledge needed to make recommendations for the protection of any populations of the ESA fall chinook salmon found in the Hells Canyon Reach.

## 4. Reintroduction of Anadromous Fish within and above the Hells Canyon Complex

**Study ID:** Reintroduction of Anadromous Fish Within and Above the Hells Canyon Complex

**Basis For Study:** The HCC blocks fall and spring/summer chinook salmon, summer steelhead, and Pacific lamprey from migrating beyond the Hells Canyon Dam to their historic spawning areas.

**Study Methodology:** IPC needs to provide a more detailed analysis of passage for adults and smolt as related to all aspects of the HCC caused blockage. A detailed analysis of possible fish passage for all native species needs to be presented. The draft application studies of fish passage lacked the detail necessary for independent evaluation.

IPC needs to provide a better analysis of upstream habitat potential that would include the following:

1. Analysis of irrigation diversions and de-watered habitat.
2. Test releases of smolt in HCC reservoirs and the mainstem Snake River to determine travel time and possible concentration areas where they could be trapped and transported.
3. Better modeling of upstream habitat productivity including the continued loss of habitat due to inundation by the HCC.
4. Analysis of fall chinook egg-to-fry survival in the Snake River above Brownlee Reservoir.
5. Peer-review of habitat assessment assumptions.

**Resource Issues:** IPC concluded that reintroduction of anadromous fish to the area within and above the HCC was not feasible at this time. The study was not peer-reviewed and many assumptions concerning habitat were presented as fact. Cost estimates and techniques for fish passage were not detailed. Many fish passage assumptions are based on information gathered over 40 years ago when fisheries personnel were trying to develop adequate fish passage for adults and smolt. IPC's study needs greater detail before it can be accepted as valid by the stakeholders. IPC proposes to continue to operate a hatchery mitigation program with no further effort to study possibilities of reintroducing native anadromous fish within or above the HCC.

**Accepted Practices:** IPC needs to provide detailed designs and costs for construction and operation of fish passage facilities at each of the three dams in the HCC.

IPC needs to conduct a number of field studies to determine how smolt will move through the HCC using modern radio-telemetry techniques to track fish. IPC needs to test spawning gravel assumptions concerning fall chinook egg-to-fry survival. IPC needs to field-verify habitat estimates in collaboration with agency and Tribal field biologists familiar with current conditions in each subbasin within and above the HCC.

**Usefulness Of Information:** The appropriate agencies will use this information to determine how to best to mitigate for the continued loss of anadromous fish. IPC's study results will influence long-term planning strategy for anadromous fish.

# Terrestrial

IPC's display of terrestrial resources issues only identifies issues IPC enumerated in their Formal Consultation Package (FCP). IPC does not include any additional issues or further refinement of issues developed through the efforts of the Terrestrial Resources Working Group (TRWG) over the last four years. The Forest Service in their response to IPC's FCP (May 15, 1997, 8.2 Wildlife, pages VIII-139 through VIII-462) identified 10 primary issues of concern with the continued HCC operation. The DLA only exhibits ICP's issues therefore the discussion on continued project impacts are limited to those issues. IPC's DLA wildlife and botanical sections do not provide a comprehensive discussion nor disclosure of HCC operational impacts on wildlife and botanical species, and their habitats.

As part of the consultation record for the TRWG meetings, the January 18, 2000 TRWG executive summary/meeting record reported IPC's (Frank Edelmann) developing a process for tracking all terrestrial and botanical issues through PM&E development. The matrix was to be arranged by issues, with every issue ever brought up or on the record represented. This was the last reported discussion regarding this process.

The Forest Service recommends that IPC complete the tracking matrix and fully disclose all identified issues to evaluate on-going and continued project impacts, and how IPC will mitigate these impacts. IPC by limiting the issue identification and impact analyzes in the DLA also limits its proposed PM&E measures to mitigate those issues/impacts.

The Forest Service disagrees with IPC's scope of analysis by selection of just two operational scenarios. 18 CFR 4.51 (f) (3) (iv) requires an analysis of "any anticipated continuing impact on fish, wildlife, and botanical resources of the continued operation of the project". IPC did not fully disclose all continued impacts to NFS lands and resources by limiting the scope of their analysis. IPC's analysis only provided descriptions and discussion of proposed project impacts to the reservoir and downstream river **shoreline zones**, and the reservoir **fluctuation zone**. IPC did not analyze the continued project impacts to terrestrial resources within the reservoirs **inundation zone**. The Forest Service maintains that IPC is responsible to disclose all project related impacts to NFS lands and resources due to project operations and reservoir inundation.

The Forest Service disagrees with IPC's analysis that the HCC operations have no effect to soil erosion thus riparian habitat on the river reach downstream of Hells Canyon Dam and minimized effects to riparian and terrestrial habitats within the HCC. The Forest Service maintains that IPC is at least partly responsible for degradation of sediment and sediment-dependent resources in Hells Canyon.

The Forest Service does not agree with the "irrigation effect" scenario proposed by Blair (2002) and reiterated by IPC. We find it to be without adequate rationale or citation and not supported by recent literature on the subject. Elmore, (pers. comm., 2002) indicated that the "irrigation effect" scenario is not based on any known ecological theory and is wholly unsubstantiated. Irrigation of riparian vegetation would not occur in a system

where the substrate is of coarse material. Without fine substrates (silt and clay) the coarse material doesn't provide any water retention ability. In a sediment hungry system, daily and hourly water fluctuations with high ramping rates continue to armor the substrate and prevent the establishment of diverse riparian communities.

The Forest Service concludes that IPC did not provide a comprehensive analysis of on-going continued project impacts to:

- Inundated upland and riparian habitats for TES species in HC reservoir
- Shoreline erosion of riparian habitats and TES species in the river reach downstream of Hells Canyon Dam
- TES species
- Noxious weed infestation, and
- Upland and riparian habitats, and TES species in IPC's ROW for project transmission lines

IPC's T&E, candidate, and sensitive species, and habitat analysis and conclusions are inadequate and misleading, claiming no or minimal impacts due to HCC continued operations. The Forest Service suggests that IPC revisit their analysis and conclusions regarding species and their habitats in Hells Canyon.

## Comments Specific to the Draft License Application

Quotations of sections taken directly from IPC's draft license application are shown in italics.

### Exhibit 0. Conceptual Overview Of Integration

1. Page E.0-1. *The Applicant modeled two operational scenarios: proposed operations and full pool run-of-river operations. For comparison purposes, operational analyses use the proposed operations scenario of the HCC as the base case scenario. It defines the operational parameters under which the complex would typically operate. The other operational scenario analyzed is the full pool run-of- river operations scenario, for which inflows to the Hells Canyon Complex, as well as tributary inflows, equal outflows from the complex, with water-surface elevations of the three reservoirs held constantly at full pool (that is, no load following would occur).*

   IPC's evaluation of only two operational scenarios does not fully address nor disclose all on-going continued impacts to NFS lands and resources. IPC did not evaluate and analyze pre-impoundment conditions to existing conditions (current project operations) or even current operations to the proposed operating scenarios.

### E.1.6.1. Wetland and Riparian Communities

1. *Page E.1-18… Most weedy exotic species grow at and above the headwaters of Brownlee Reservoir (Technical Report E.3.3-1).*

IPC needs to integrate this discussion with the findings in Technical Report E.3.3-2 - *Inventory of Rare Plants and Noxious Weeds Along the Snake River Corridor in Hells Canyon* and TR E.3.2-45. The conclusion above is currently not entirely synchronous with that report. Being a general statement, it is not inaccurate, though it does little to illuminate the situation in this discussion.

In their vegetation discussions, IPC consistently mismatches species group comments and their scope of occurrence, with the concept of a given section. Thus making the paragraph concept and conclusion irrelevant. IPC needs to construct their discussions such that the context of each statement relates to the thesis of the heading and paragraph. For example, when discussing wetland communities, maintain the discussion of weed influences relative to that habitat (e.g. weedy riparian species) and not insert general weed statements that have little bearing on the thesis or conclusion of the paragraph.

**E.3.2. Wildlife Resources**

1. Page E.3-281. *E.3.2.1.2. Habitats in Hells Canyon.*

   This section only provides a brief generic overview of habitats based only on federal land ownership. IPC should also include habitats and conditions on IPC owned lands as well as a description of habitats and their importance on other private lands. IPC needs to better integrate the habitat discussions in *E.1.6. Vegetative Cover* as this section and *E.3.3. Botanical Resources* as habitats are the key component for the species discussions. These discussions then need to be better linked to the quantification of potential project impacts to wildlife and botanical resources, at *E.3.2.4 and E.3.3.4.*

*E.3.2.1.3. Wildlife Resources of the Hells Canyon Complex and Vicinity*
*E.3.2.1.3.11.2. Rocky Mountain Bighorn Sheep*

1. Page E.3-310. *Current hydroelectric operations and fluctuating river flows mostly affect riparian habitats, and should, therefore, have minimal impact on bighorns (Technical Report E.3.2-34).*

   Forest Service notes IPC's acknowledgement of fluctuating river flows affecting downstream riparian habitat.

*E.3.2.1.3.11.3 Black Bear*

1. Page E.3.312. *On the Oregon side, black bears are hunted only during the fall season (ODFW 1997). E.3.2.1.3.11.3. Black Bear*

ODFW allows spring bear hunting on a limited permit basis. Refer to ODFW Big Game Regulations, 2002, page 34. There are several spring hunts allowed in Hells Canyon.

*E.3.2.3.11.5 Rocky Mountain Mule Deer*

1. Page E.3.316. *Population Status and Abundance (E.3.2.1.3.11.5. Rocky Mountain Mule Deer)*

   Discussion of population and abundance does not relate current population densities to either Oregon or Idaho management objectives for wintering deer herds, let alone identify what those objectives are. These objectives and the current population status should be discussed in the final license application.

2. Page E.3-320. *Having unique vegetation, elevation, and climate, Hells Canyon provides much of the crucial 2 winter range (Hells Canyon Complex winter range) within the region. In Hells Canyon, 250,911 ha of mule deer winter range were delineated (Table 5 in Technical Report E.3.2-31). Crucial winter range accounted for 135,282 ha (54%), and regular winter range for 115,629 ha (46%). The USFS (99,224 ha), private landowners (78,908 ha), and the BLM (49,996 ha) manage winter range habitat. In addition to the Hells Canyon Complex, numerous issues potentially impact mule deer habitat on the Hells Canyon Complex winter range: noxious weeds, human disturbance, and forage competition from domestic livestock (Technical Report E.3.2-31).*

   Federal, state and private, including IPC's ownership of crucial and regular winter range needs to be displayed in a figure or table.

*E.3.2.1.3.11.6. Rocky Mountain Elk*

1. Page E.3-326. *Estimates of the total population of elk in Hells Canyon (on the Oregon and Idaho sides) are not available. Data from Oregon and Idaho are not directly comparable due to different configurations and establishment of management units.*

   Management objectives for each state were not identified nor discussed in relation to current wintering population densities. IPC needs to address the current population status compared to state management objectives and what are the potential project impacts to the elk herds.

2. Page E.3-326. *Hells Canyon has been identified as having the most important big game winter habitat in the region (Technical Report E.3.2-31).*

   Because of the importance of this big game winter range, IPC needs to do a better job of quantifying current winter population densities, limiting factors affecting

population densities, impacts attributable to HCC and compare these figures to the state's management objectives.

*E.3.2.1.4. Wildlife Resources Downstream of the Hells Canyon Complex*

1. Page E.3-375. *Influences of the Hells Canyon Complex on wildlife resources are most associated with the three reservoirs of the complex (see section E.3.2.4., Anticipated Impacts on Wildlife Resources). Conversely, the Hells Canyon Complex has relatively less influence on wildlife associated with the un-impounded section of the Snake River downstream of Hells Canyon Dam. Therefore, the Applicant conducted a less comprehensive review and investigation of wildlife resources downstream of Hells Canyon Dam*

   While this statement notes the difference between the impounded and un-impounded areas of HCC, the Forest Service asserts that IPC's operation of the HCC has a large influence on riparian habitat downstream of Hells Canyon dam. As noted in "E.3.2.1.3.11.2. Rocky Mountain Bighorn Sheep - Current hydroelectric operations and fluctuating river flows mostly affect riparian habitats…" IPC should provide an in-depth comprehensive review of continued project effects downstream of Hells Canyon Dam.

*E.3.2.1.3. Wildlife Resource of the Hells Canyon Complex and Vicinity*
*E.3.2.1.4. Wildlife Resources Downstream of the Hells Canyon Complex*

Both sections provide an overview of current population and distribution status in the HCC. IPC needs to include a discussion integrating botanical and wildlife habitat information from these two sections. Provide a discussion relating species to habitats to potential impacts from the HCC.

IPC needs to put more effort into assessment of wildlife impacts in riparian habitats downstream of the project. IPC should revisit its conclusions regarding the effects of project operations and sediment transport on plant communities downstream of the project, and integrate these conclusions to the types of wildlife species expected in different riparian habitat types. IPC needs to recognize that plant communities have different values and functions for wildlife species and populations, and that hackberry associations are not as important for birds and other wildlife species as willow/cottonwood communities.

*E.3.2.1.5. FERC-Permitted Transmission Lines and Associated Service Roads*
*E.3.2.1.5.1. Current Habitat Conditions*
*E.3.3.1.2. Botanical Resources along Transmission Lines and Associated Service Roads*
*E.3.3.1.2.1. General Vegetation Resources*

The above sections are duplicative although each section cites a different Technical Reports E.3.2-37 and E.3.3-4.

### E.3.3. Botanical Resources

In general, E.3.3 falls short of adequately painting a picture of the impacts to the botanical resources from the construction and management of the HCC. It is void of any pre-HCC condition discussion for comparison. There is much repetition of general figures and only selective information integration. Most paragraphs contain underdeveloped discussions and several simply contradict each other. This section does repeat assertions found in TR E.3.2-43, but does not sufficiently integrate all the Technical appendices being referenced. It does not adequately integrate the effects to vegetation with the vegetation's effects on wildlife species. The referenced effects determinations from Technical Appendices are often inadequate or simply lacking.

Although the heading system gives the appearance of organization, the sections are poorly differentiated and the headings are fairly different between sections supposedly discussing the same group of organisms. For example, the discussion in *E.3.3.4 Anticipated Impacts on Botanical Resources* uses few of the same headings or discussion items as the preceding *E.3.3.1 Description of Botanical Resources*. Thus E.3.3 does not properly track issues or ideas. E.3.3.simply lacks a consistent sequence of logic. The discussions are often a collage of contentions rather than a train of thought leading the reader to the conclusions offered by IPC. Paragraphs consistently contain mismatched sentences, shifting between specific effects items and vague or irrelevant generalizations. The effects of the historic flow regime, existing flow regime, proposed flow regime, and full pool flow regime are not consistently addressed in any of the sections.

The trend in E.3.3's discussion appears to propose mechanisms for the influence of the HCC on the spread of perennial riparian weed species, but suggest that these same mechanisms do not influence the spread and establishment of native perennial riparian species.

The largest single problem with this section is that the majority of botanical impact conclusions suggested by IPC are based on seriously flawed flow and sediment transport modeling and analyses. With this weak of a scientific foundation, the vegetation response conclusions are correspondingly unsubstantiated.

*E.3.3.1.1.1.*

1. Page E.3-547. *Most of these weedy riparian assemblages occur in the upstream Weiser reach and along the headwaters of the Brownlee Reservoir reach. The reach below Hells Canyon Dam had relatively few weedy riparian assemblages. Based on the distribution, abundance, and life history characteristics of many riparian weedy species in the study area, it appears that the large fluctuations in water levels on Brownlee Reservoir from current operations may help restrict downstream infestation of several weedy riparian species through riverine processes (Technical Reports E.3.3-1 and E.3.3-3).*

This section needs better integration with TR E.3.3-1, TR E.3.3-2 and TR 3.2-45. The Forest Service notes the effects of reservoir fluctuation on the establishment of riparian vegetation, in this case noxious weeds. The Forest Service agrees that the Weiser reach is more weedy but questions the degree of downriver weed establishment inhibition from Brownlee reservoir itself, as weed distribution in the Oxbow and Hells Canyon reach suggest otherwise (TR E.3.3-2). A later discussion of noxious weeds (E.3.3.1.1.2.) reports the central reservoir reaches contained moderate to high levels of both upland and riparian weeds. However, the use of the phrase *several weedy riparian species* provides enough vagaries for the statement to be partially accurate. This discussion needs to describe each species, their life history attributes, and how these species could be restricted, and by what mechanisms. Any conclusion based on distribution correlation is specific to a given species and looses utility when lumped.

The discussion of Brownlee's influence relates to perennial riparian weeds only, not annuals. The discussion lacks integration with the influence on weed spread by the amount, condition, and fragmentation of available habitat below Brownlee. The patterns of infestation below Brownlee may just as likely the result of available habitat. Brownlee's drawdowns may inhibit weed establishment around its edge, but there is no discussion of the fate of weed seed or other reproductive tissues, in the watercourse itself or via recreational activities.

Given the relative newness of both the HCC ("reservoir shorelines are young") and the weed species known from upriver, it maybe too early to claim such a degree of weed spread inhibition form the HCC. It may be just a matter of time. Indeed, IPC found 7 weed species to be positively associated with dam regulated water fluctuations (TR E.3.2-45). IPC also concluded that operational processes contribute to the spread of weeds in riverine environments, even though some structural aspects (Brownlee draw-down zone) of the operation may be inhibiting the extent of weed establishment. The Forest Service contends that a better description of the effect of the dams is to retard establishment rather than restrict dispersal.

*E.3.3.1.1.3. Threatened, Endangered, and Sensitive Species*

1. Page E.3-557. *Only two federally listed species are known to occur in the study area vicinity: Mirabilis macfarlanei (Macfarlane's four-o'clock) and Spiranthes diluvialis (ladies' tresses), which are both listed as threatened.*

   The Forest Service asks if this is a miss-print as we are not aware of any ladies tresses being known from the project area nor did we find the discussion of its occurrence?

   Section E.3.3.1, and particularly E.3.3.1.1.3 reference TR E.3.3-2 and TR E.3.3-1, but do an inadequate job of integrating them into the Description of Resources text or Anticipated Impacts text. E.3.3.1 lacks integration with TR E.3.2-45. The reader is left puzzled as to how all these sections relate. It is particularly unclear as to how the lists of "rare" plant species to be analyzed were developed for the rare plant studies,

the vegetation studies and the transmission line studies? Report E.3.3-2 developed a potential rare plant list (23 species?)"in consultation with appropriate state and federal agencies." However Table 8 in Report E.3.3-2 only lists the 8 rare species IPC ultimately decided to survey for, and with only a vague discussion on why these were selected. How did Report E.3.3-1 develop a more "comprehensive list" with "agency personnel"? Why would E.3.3-2 not explicitly include the rare plants: *Carex backii, Rubus bartonianus* and *Cyperus rivularis (E.3-558)?*

Both upland and riparian associated rare plant species were inundated with the creation of the reservoirs within the HCC. Thus, IPC needs to consistently analyze and discuss the effects of dam construction/reservoir creation, and the operational scenarios, to all the rare plants that are: known from the study area, had the potential to be on ground under the reservoirs, and currently have the potential to be impacted by the HCC.

This discussion of rare species should consistently include: *Mirabilis macfarlanei, Silene spaldingii, Leptodactylon pungens* ssp *hazeliae, Mimulus clivicola, Pentagramma triangularis,* and the riparian related (including moist cliffs) *Bolandra oregana, Carex backii, Carex hystericina, Carex interior, Cyperus rivularis, Cyperus schweinitzii Epipactus gigantea, Mimulus hymenophylus, Mimulus patulus, Rubus bartonianus,* and *Teucrium canadense* var. *occidentale.*

IPC should likewise extent their discussion and analysis of rare habitats that are, or could be found within the study area, or affected by the operations of the HCC. These generally would be, at a minimum: Sand Dropseed communities, Giant Wildrye plant communities, wet cliff communities, river beach communities, spring and seep communities, Coyote willow communities, White Alder/mixed shrub communities, and Black Cottonwood- White Alder/mixed shrub communities.

*E.3.3.1.1.4.3. Oxbow Reservoir and Hells Canyon Reservoir Reaches*

1. Page E.3-561 and 562. *Ninety percent of the time, Oxbow Reservoir fluctuates on a daily basis within 5.6 ft of the normal maximum elevation and Hells Canyon Reservoir is operated within 3.8 ft of the normal maximum elevation (Technical Report E.1-4). Although shorelines are steep in the canyon, relatively stable pool levels at both Oxbow and Hells Canyon reservoirs enhance establishment of riparian habitats.*

*E.3.2.2. Hells Canyon Reservoir Operation Curves*

1. Page B-16. *Currently, and for proposed operations, the elevation of Hells Canyon Reservoir is cycled daily within a 5 vertical-foot operating range to manage load-following flows through he Brownlee, Oxbow, and Hells Canyon power plants. However, under certain load conditions, and maintenance and construction activities, the Applicant proposed to use up to an additional 5 vertical feet to meet power demands.*

This section needs better integration with TR E.3.3-3 and TR E.3.3-1. Describe how the riparian habitat is enhanced, and enhanced by what measure? Three to five feet may be "relatively" stable in terms of measuring average water levels in terms of height, but the Forest Service maintains that this amount of daily fluctuation has a large effect on the ability of vegetation to establish and persist. The discussion of 90% of the time… is misleading in this paragraph as "the time" is left undefined, and the timing and degree of fluctuation of the remaining 10% is not discussed. The effects on riparian vegetation needs to be discussed from the operations for the remaining "10 %" of the time, as depending on what these are, these effects could erase any benefits of the majority of the time.

IPC did not disclose the additional 5 vertical feet drawn down in Hells Canyon and Oxbow reservoirs for analysis of effects when addressing the shoreline and fluctuation zone impacts to wildlife and botanical species and habitats. IPC did not fully disclose all effects to wildlife and botanical species and their habitats by omitting the additional 5 vertical feet drawn down and analysis of that drawn down.

Additionally, *enhance riparian habitats* is too vague to illuminate actual effects to the vegetation. There are several kinds of riparian communities, and they are not all equal in terms of their quality or ability to function or persist within an operating scenario of the Project. Community type and species richness are not discussed here. One would not expect the vegetation that occurs in the ecotone between water and upland habitats to be the same in areas subject to daily/hourly fluctuations (ongoing or propose operations) as that found under the fluctuations of a natural seasonal climatic cycle. Annual species with less root development tend to be more opportunistic in the ecotone experiencing daily peaks and ebbs, and these species are less able to provide substrate stability.

*E.3.3.1.1.4.4. Reach Below Hells Canyon Dam*

1. Page E.3-563 and 564.

   In this section there is a brief discussion of upland species, native species, special status plants, and riparian weed species. However it entirely lacks a discussion of riparian species/habitats below Hells Canyon Dam. Riparian species were explicitly discussed in the previous sections of E.3.3 Botanical Resources. IPC needs to integrate Botanical technical appendices E.3.3-3 and E.3.3-1 with this section and describe the lack of riparian vegetation below Hells Canyon Dam.

*E.3.2.3. Applicant's Existing And Proposed Measures Or Facilities*
*E.3.3.3. Applicant's Existing And Proposed Measures Or Facilities*

To logically frame the discussion of project impacts and the proposed PM&E measures to mitigate those impacts, the Forest Service suggests that in the FLA the above two sections follow *E.3.2.4 and E.3.3.4* discussions on anticipated impacts to

wildlife and botanical resources. See page 154 for Forest Service discussion on the proposed PM&E measures.

The Forest Service suggests that IPC combine the two PM&E sections as both discuss and recommend many of the same PM&E's.

*E.3.2.4. Anticipated Impacts On Wildlife Resources, And*
*E.3.3.4.Anticipated Impacts On Botanical Resources*

These sections are consistent in being inconsistent relative to discussions of impacts to wildlife and botanical resources. IPC periodically addresses some impacts directly in this text, but frequently references impact discussions in one or another technical report, rather than systematically integrating report findings into this part of the DLA. These sections need to be constructed better, and more consistently integrate the potential impacts to wildlife and botanical resources from past operations, proposed operations, full pool run-of-river, and other suggested operational scenarios.

IPC has avoided the issue raised by the Forest Service regarding the continued project effects to riparian habitat caused by the change from a free-flowing river to a large slack water reservoir.

*E.3.3.4. Anticipated Impacts on Botanical Resources*

Throughout this section there is a distinct implication that reservoir-bank morphology (slope, topography etc.) is somehow equivalent to the riverbank morphology above the Brownlee reservoir. IPC appears to suggest that reservoir vegetation responses to full pool or other consistent flows would be similar to that found in the free flowing sections of the river toward Weiser ID, or the shallower (headwater) sections of the Brownlee reservoir. An explanation of how the steep banks of the reservoir edges would respond in the same manor as a flowing river with sand bars and low-slope, wider flood plains was not clearly developed (bottom E.3-592). The vagaries of this text often stem from the poorly differentiated effects discussions of the reach locations, the shoreline zone, fluctuation zone, and riparian zone. Often, proposed species responses are too lumped for the conclusions being presented, or are proposed for a reach or a zone that is out of context with the effects being discussed. In this section as well as in TR E.3.2-45 & TR E.3.3-2, there is no discussion on the effects of HCC construction. Needs to be better integrated with TR E.3.3-1.

There are suggestions that differences in effects between proposed and run of river operations are minimal but there is insufficient discussion (with the exception of only two riparian vegetation types) about what those effects would be, especially down river from HCC.

*E.3.2.4.1. Hells Canyon Complex and Vicinity*
*E.3.2.4.1.1. Reservoir Operations*

1. Page E.3-439. *Identifying impacts to wildlife is an important concern for relicensing the Hells Canyon Complex (FERC 1990, IPC 1997). During the Applicant's relicensing consultation, state and federal resource agencies identified several issues and expressed concerns about potential impacts to wildlife habitat (IPC 1997). Primary issues were that operations of the reservoirs 1) accumulate contaminates that are potentially toxic to wildlife in the portion of Brownlee Reservoir that is permanently inundated (also known as reservoir inundation zone); 2) prevent perennial low-elevation wildlife habitat from becoming established between reservoir maximum operational drafting depths and full-pool shorelines (known as operational fluctuation zones); 3) prevent the establishment of perennial riparian habitat along full-pool reservoir shorelines (reservoir shoreline zones); 4) fragment patches of riparian habitat in the reservoir shoreline zones; 5) limit waterfowl brooding habitat in the shoreline zones; 6) decrease habitat for threatened, endangered, candidate, and special status species in the shoreline zones; and 7) reduce the capability of winter range (winter range zone) to support mule deer (IPC 1997). Reservoir zones are defined in Technical Report E.3.2-45.*

   IPC's display of issues only lists issues IPC enumerated in their Formal Consultation Package (FCP) and does not include any additional issues or further refinement of issues developed through the efforts of the Terrestrial Resources Working Group (TRWG) over the last four plus years.

   The Forest Service in their response to IPC's FCP (May 15, 1997, 8.2 Wildlife, pages VIII-139 through VIII-462) identified 10 primary issues of concern with the continued HCC operation. These primary issues are discussed below.

   Many of the issues that have been identified are of interest to the Forest Service, some more than others. In general, the effects of the HCC construction and maintenance on the varied species of the area may have predetermined some of our options and opportunities. Below are the issues that are most significant to NFS lands and the species of which the Forest Service is in part responsible.

   1. Determining the effects of original impoundments on the wildlife and botanical resources. How much habitat was lost and what were the effects on these resources? This would provide the historic condition with which existing condition could be compared to determine losses or gains in specific habitat and species of concern today. Examples include: loss of low elevation winter range; loss of low elevation cliff habitat; loss of large stable, low elevation, complex riparian habitats, etc.
   2. Impacts of water levels on reservoir and riverine habitats. What is the effect of the constant change on the existing habitats? e.g. water fluctuations on riparian species and habitats?

3. The effect of changing from a free-flowing riverine habitat to large, slack water impoundments.
4. Lack or loss of quality riparian habitats. Riparian habitats are very important to many species and are a major concern for all land managers. Construction of dams and flooding riparian and bottomlands reduces or eliminates high quality river riparian habitat. Flow fluctuations associated with impoundment drawdowns and dam operations have further reduced the potential for the area to replace some of the lost riparian habitat.
5. Effects of transmission-lines on wildlife, e.g., electrocutions and collisions by raptors and other bird species. Many of these birds are PETS (proposed endangered, threatened, and sensitive plant species) and land managers are going to great lengths to preserve and protect these species. Little is known about the effects to wildlife created by the transmission lines associated with this project.
6. Management of the project may be spreading the invasion of noxious weeds throughout the area. Roads and equipment associated with the project may be increasing this risk. Water fluctuations may be maintaining sites for noxious weed establishment.
7. Continued loss of anadromous fish link in the wildlife food chain. What are the effects of the reduction or elimination of this large nutrient base?
8. Habitat fragmentation caused by construction and operation of the project. There is the potential to cause habitat fragmentation for some species, some of which are of specific concern to land managers.
9. The continued loss of, or reduction in, some microhabitats from dewatering and flooding.
10. The potential effects of recreation on PETS species and other wildlife resources, e.g., increased recreation use tied to the impoundments, later season water flows below dams, and roads associated with the project.

The Forest Service's primary concern is that IPC is only displaying and discussing issues enumerated in their FCP and not the issues that were identified in response to IPC's FCP and during TRWG meetings (1997 to 2000). As the DLA now exhibits, only a limited number of issues are enumerated and the discussion on continued project impacts is limited to those issues. It is not a comprehensive discussion of identified terrestrial and botanical issues and their associated impacts.

As an example, IPC has avoided the issue regarding the continued project effects to rare plants and riparian habitat when changing from a free-flowing river to a large slack water reservoir. While IPC did not address this issue in the DLA, Blair 2001 (Technical Report E.3.2-44) described the large-scale conversion from a flowing river to three reservoirs. Effects of changing a free flowing river to large-scale impoundments include: converting terrestrial and riparian vegetation types to permanently flooded aquatic habitats; converting a flowing river several hundred feet wide to three reservoirs up to several thousand feet across; improvement of wintering waterfowl habitat; and the change in riparian vegetation composition in the river

reach downstream of Hells Canyon Dam by the adverse effects from the reduction in downstream movement of fine sediments and IPC's resulting water-level fluctuations.

As part of the consultation record for TRWG meetings, the January 18, 2000 TRWG executive summary/meeting record reported IPC's (Frank Edelmann) developing a process for tracking terrestrial and botanical issues through PM&E development. The matrix was to be arranged by issues, with every issue ever brought up or on the record represented. This was the last reported discussion regarding this process.

The Forest Service recommends that IPC complete the tracking matrix and fully disclose all identified issues to evaluate on-going and continued project impacts, and how IPC will mitigate these impacts. IPC by limiting the issue identification and impact analyzes in the DLA also limits its suggested PM&E measures to mitigate those issues/impacts.

*E.3.2.4.1.1. Reservoir Operations*

1. Page E.3-439. *The Applicant evaluated and compared operational impacts to wildlife for two potential operational scenarios: 1) proposed operational scenario for the complex and 2) full pool run-of- river scenario in which hydroelectric operations would not influence reservoir water-surface elevations (see Technical Report E.1-4 for a description of operational scenarios.*

   IPC in their March 20, 2001 final executive summary to the HCC collaborative team meeting stated, "*The Company is analyzing two operational scenarios, based on continuing to operate the hydroelectric complex and project-related impacts. IPC understands that people would like them to look at additional scenarios, but they are unnecessary for the license application.*" This action by IPC eliminated all further discussion with the stakeholders for proper analysis of projects impacts. Additionally, the March 20, 2001 final executive summary is not included in IPC's consultation record.

   The proposed operational scenario is only an alternative to be considered and should not be used as the primary base scenario, rather current project operations should be used as the baseline to describe project impacts on NFS lands and resources.

   The Forest Service, as a member of the TRWG identified, developed and proposed a study for identification pre-project habitat conditions of the HCC (06.12.98). The intent of the study was not to hold IPC liable for past project impacts rather to develop a baseline to identify resource trends and to develop appropriate mitigation for the on-going/continued impacts during the new license period.

   The study was designed to address Project impacts that are occurring in the present and have been on-going since the original license period. These on-going impacts include inundation of the river environments, loss of riverine habitat, loss of habitat complexity, loss of habitat accessed through migration, loss of nutrients deposited by

migrating and spawning anadromous fish, impacts to water temperature and quality, loss of deer wintering range, changes in species composition, and increased proportion of fine sediments to the lower river. These and other on-going impacts are some of the most significant Project impacts to NFS lands and resources.

To help assess these impacts, and the mitigation needed to address them, IPC must address and disclose the on-going and continued impacts to NFS lands and resources.

In legal opinions discussing the Commission's baseline policy, both the Commission and the Ninth Circuit Court of Appeals recognized the practicality of utilizing information and data regarding on-going impacts to conduct an NEPA analysis that displays a project's impacts in light of the mitigation needed to address those impacts. In the relicensing of the Leaburg-Walterville hydroelectric project, while recognizing that the existing environment was the appropriate "context" for its NEPA analysis, the Commission also determined that its NEPA analysis would be informed by information and data that allow for an assessment of the proposed mitigation in light of past environmental impacts. *Eugene Water & Elec. Bd.*, 81 F.E.R.C. 61,270 at pp. 62,326-27 (1997). The Commission stated, "Of course, the past environmental impacts are relevant in determining what measures are appropriate to protect, mitigate, and enhance natural resources." *Id.* at p. 62, 327.

Moreover, in an appeal of this proceeding, the Ninth Circuit Court of Appeals approved of the Commission's use of past conditions to inform its environmental analysis. *American Rivers v. FERC*, 201 F.3d 1186, 1195-99 (9th Cir. 2000). Recognizing the Commission's need to evaluate the proposed mitigation in light of past impacts, the court stated that, "[t]o the extent a hypothetical pre-project or no-project environment can be recreated, evaluation of such an environment against current conditions . . . serves to describe the current cumulative effect on natural resources of these historical changes." *Id.* at 1197 (citations omitted). In addition, the Court agreed that, "the adoption of an existing project baseline does not preclude consideration and inclusion of conditions in a license that enhance fish and wildlife resources and reduce negative impacts attributable to a project since its construction." *Id.* at 1198 (citations omitted).

*E.3.2.4.1.1.5. Threatened, Endangered, Candidate and Special Status Species in Shoreline Zones*

1. *Bald Eagles*

The Forest Service disagrees with IPC's conclusions that "The Hells Canyon Study Area appears to provide adequate resources for nesting bald eagles, with the possible exception of suitable nesting trees" and "no impacts to wintering bald eagles are identified for either scenario". Perching, roosting, and nesting trees are all limited in Hells Canyon (George Keister, Vic Coggins, and Mark Henjum, ODFW, Frank Isaacs, OSU, and Jim Clark, BLM, personal communication). Inundation of lands by project reservoirs eliminated numerous trees and bald eagle habitat. Continued

inundation of this habitat and project operations prevent tree species from regenerating and continue to limit bald eagle habitat. IPC needs to revisit their conclusions regarding bald eagle habitat in Hells Canyon.

2. *Yellow-Billed-Cuckoo*

   The Forest Service disagrees with IPC's conclusion that the yellow-billed cuckoo is unlikely to be impacted by proposed or full pool run-of-river operations. DLA @ E.3-447. Construction and ongoing operations of the HCC eliminated extensive habitat of the yellow-billed cuckoo. Existence of the HCC prevents establishment of habitat in the Powder River Arm that would provide suitable nesting habitat if the project were not in place.

*Species That Use Riparian Shoreline Habitat*

3. Page E.3-448. "…*Therefore, all species that potentially occur along Brownlee Reservoir and that need riparian habitat for their life requirements are impacted by proposed operations*".

   The Forest Service agrees that all riparian dependent species are impacted by current and proposed operations of the HCC.

*E.3.3.4.1.6.1. Rare Plants*

1. Page E.3-598. *The Applicant evaluated occurrences of 23 species of rare plants in Hells Canyon. No federally listed plant species were found in the study area (Technical Report E.3.3-2). Sixty-seven occurrences of 12 rare plant species were near sites of human activities (Technical Report E.3.3-4). Of these occurrences, 3 at locations where the Applicant has management responsibility or authority were considered to be at risk of disturbance. These three occurrences are located in riparian areas along reservoir margins near dispersed recreation sites. Two occurrences of Carex hystricina) are located along Oxbow Reservoir, and one occurrence of Cyperus rivularis) is along Brownlee Reservoir. The Applicant recommends continued monitoring of occurrences at risk from its facilities or maintenance activities and also recommends developing protection measures in coordination with appropriate state or federal agencies, if warranted.*

   This paragraph of text is location information, but does not discuss impacts or effects. It needs to discuss effects of past operations, proposed operations, and full pool operations. What kind of monitoring is proposed for what risk? The risk needs to be identified. The Forest Service notes and supports the proposal to coordinate with the appropriate land management agency but suggests that this coordination and consultation should be occurring during the preparation of the final application, not just relegated to a time after license issuance.

There are suggestions (TR E.3.3-2 & TR E.3.2-45) that differences in effects between proposed operations and run of river operations are minimal but there are no discussions about what those effects would be. And there are no discussions of the operational scenario effects to rare plants down stream of HCC. IDP needs to address all of these shortcomings.

*E.3.3.4.1.6.2. Riparian Habitat*

1. Page E.3-599. *Riparian habitat is limited in Hells Canyon (Technical Report E.3.3-1). Human activities associated with recreation or project operations can be especially detrimental to habitat when they occur within riparian habitats. Therefore, the Applicant evaluated potential impacts to riparian habitats having human activities present or nearby (Technical Reports E.3.2-45 and E.3.2-46).*

   IPC should describe how and why "riparian vegetation is limited…" and identify these limitations as compared to what. The Forest Service notes the contribution to riparian impacts from recreational activities. However, it would make sense to also discuss the impacts to riparian vegetation from reservoir/dam operations. Why was this discussion truncated here, when it has been discussed to various degrees in other parts of this section?

*E.3.3.4.2 and E.3.2.4.2. Downstream of the HCC*
*E.3.3.4.2.1. Downstream Operations and General Vegetation*
*E.3.3.4.2.1.1. General Riparian and Upland Habitats Below Hells Canyon Dam*

1. Page E.2-599. *Generally, HCC operations contribute slightly to the continued decline of native Salix exigua communities due to the widespread decline in available sand-sized sediments in the watershed: the dams trap a small percentage of the incoming sediment of the sizes useful for building rooting substrate (Technical Report E.1-1) (see section E.3.3.4.2.1.2.). Overall, however, HCC operations benefit riparian habitats in the river shoreline zone, especially native Celtis reticulata communities (see following section E.3.3.4.2.1.3.), and have negligible influence on upland plant communities below Hells Canyon Dam (Technical Report E.3.2-45).*

   The Forest Service notes the detrimental effects the HCC has had on downstream sediment transport. However, in this discussion, wording such as "slightly", "small", and "overall" suggest a value judgment statement, rather than a quantification of the amount and kind of effect to these communities. Stating that there is a "widespread decline in available sand sized sediments", inappropriately ignores the amount of sediment still available. IPC does not address this. How HCC operations benefit riparian communities is not defined. It is simply an opinion offered as a conclusion. Which riparian habitats benefit? The Forest Service strongly disagrees with this general conclusion. The second part of the above paragraph reaches a conclusion without providing the logic to support that conclusion. IPC also implies that all "riparian habitats" are somehow equivalent in terms of their function and species richness. *Celtis reticulata* and *Salix exigua* communities neither function similarly,

nor do they have the same structure or species composition refer to TR E.3.3-1. If IPC feels that *Celtis* communities are benefited by project operations, further explanation and disclosure is required to substantiate that claim. This section and following discussions also omit specific discussions relative to the impacts to the four classes of riparian vegetation defined in E.3.3 Botanical Resources. This paragraph also relates only to the "shoreline zone" and omits reference to any of the other zones (as defined by IPC else where) within the potential riparian area.

2. Page E.3-600. *Because the storage capacity of the HCC is only about 11% of the average annual volume of the Snake River, as calculated by inflow to Brownlee Reservoir, the HCC has a relatively small effect on the overall hydrograph downstream of the complex with respect to peak flows (Technical Reports E.1-1 and E.1-4). Below the dam, HCC operations have little effect on flows greater than 30,000 cubic feet per second (cfs) (Technical Report E.1-4), and operations fluctuate water levels in a zone that would otherwise be scoured by spring flows (Technical Report E.3.3-3). Under past operations and the proposed operational scenario, the largest influences of HCC operations have been and would be 1) the capacity to maintain higher base flows during summer months (this capacity varies depending on annual inflow) and 2) the characteristics of load-following flows in late spring to early summer (following spring runoff) that can repeatedly irrigate portions of the riverbed (Technical Report E.1-4). The higher base flows and load-following fluctuations have allowed riparian vegetation (for example, Celtis reticulata and associated understory riparian species) to creep down into a zone that was previously scoured annually and then left "high and dry" (Technical Report E.3.3-3). Full pool run-of-river operations would not promote as extensive development of riparian habitat below the dam as would proposed operations.*

   The Forest Service concurs with IPC that the project has a relatively small effect on the overall hydrograph downstream of the complex with respect to peak flows. However, the relevance of the conclusion is questionable. The issue is the impact to riparian vegetation downstream of the HCC and the significant effects the Complex exerts on seasonal and daily discharge patterns. Because of limited flood storage, high flows are passed through the three dams with a flow regime similar to that which existed prior to construction. However, the shape of the flood hydrograph is subject to the storage and rule curves of Brownlee Reservoir. The concern about the effects of historic discharges compared to post dam flows is not related to the magnitude or frequency of the peak flows, but the amount of sediment the river transports and the hourly, daily and seasonal fluctuation rates. Evidence suggests that the greatest change to the Snake River flow regime from dam construction is in the daily and hourly flow fluctuations. Research from Glen Canyon Dam found downstream erosion to be more affected by down ramping than up ramping. In the Snake River, daily and hourly flow fluctuations may be affecting riparian and aquatic plant and animal communities by increasing the rate of erosion of sandbars and terraces. Thus the current and proposed ramping of the project may aggravate the adverse effects on sandbar maintenance due to the lack of sediment transport through HCC (Kendall 2002).

IPC's use of "scouring and high and dry" is portrayed inaccurately. The Forest Service maintains that there would be several zones of riparian vegetation inhabiting sandbar and terrace zones. Under stable flow conditions, these areas would support a diverse set of habitats and species.

*E.3.2.4.2.1.1. Riparian Habitat in the River Shoreline Zone*

1. Page E.3-461. *The daily and seasonal storage capabilities of the Hells Canyon Complex have permitted short-term deviations between flows entering and exiting the Hells Canyon Complex (flow/stage fluctuations for load following). Although water levels fluctuated only where shorelines were scoured by spring runoff flows (Technical Reports E.1-4 and E.3.3-3), historical load-following operations during summer have been described as an irrigation effect (Technical Reports E.3.2-44 and E.3.3-3). The irrigation effect (in addition to changes in land-use practices) probably contributed to the increased upslope extent and robustness of the riparian vegetation (especially hackberry) that currently fringes the river downstream of Hells Canyon Dam (Technical Reports E.3.2-44 and E.3.3-3). Periodically, large scouring flows probably limit the lower extent of permanent vegetation on the shoreline slope (Technical Reports E.1-4, E.3.3-1, and E.3.3-3).*

*E.3.3.4.2.1.3. Increase of Celtis reticulata Communities*

1. *Page E.3-602. In general, the Applicant concludes that the enhancement of native riparian communities downstream of Hells Canyon Dam by HCC operations is a benefit of the project; the project has had no negative impact. This enhancement would continue with the Applicant's proposed scenario, while a decline in riparian habitat would occur under full pool run-of-river operations.*

   Throughout this section (and others), IPC misrepresents the action of "scouring" and "irrigation" effects. In functioning systems, scouring and deposition happen in concert. Spring flows acted to scour the river course after construction of the HCC because of it's sediment trapping. When sediment-free water is released from dams, it has excess energy. This energy is available to erode beds and banks. This can result in coarsening of the bed material until a size class is reached that cannot be moved (Kondolf 1997). This coarsening of the bed decreases the availability of smaller material such as sand, silt and clay used for riparian vegetation establishment. Without the dams, annual spring flows would have also deposited sediments needed for the establishment and maintenance of riparian specific riparian communities post peak flows, such as *Salix exigua*, that are now almost missing from the canyon.

   The Forest Service does not agree with the "irrigation effect" scenario proposed by Blair 2002, and reiterated by IPC. The Forest Service finds it to be without adequate rationale or citation and not supported by recent literature on the subject. Elmore, indicated that the "irrigation effect" scenario is not based on any known ecological theory and is wholly unsubstantiated (pers. comm., 2002). Irrigation of riparian

vegetation would not occur in a system where the substrate is of coarse material. Without fine substrates (silt and clay) the coarse material doesn't provide any water retention ability. In a sediment hungry system, daily and hourly water fluctuations with high ramping rates continue to armor the substrate and prevent the establishment of diverse riparian communities.

IPC is inconsistent in its conclusions regarding project impacts to riparian vegetation. In *E.3.2-45, page 16.* IPC states, "*At the full-pool shoreline of Brownlee Reservoir, run-of-river operations would maintain greater soil moisture throughout the growing season that proposed operations.*" IPC concludes that stable water levels would maintain greater soil moisture than daily and seasonal water fluctuations. Then IPC states in *E.3.2.4.2.1.1 "The Applicant concludes that proposed operations for the Hells Canyon Complex would provide slightly more riparian wildlife habitat in the river shoreline zone downstream of Hells Canyon Dam than would full pool run-of-river operations (Technical Report E.3.2-45). Full pool run-of-river operations would probably increase riparian fragmentation more than proposed operations would (Technical Report E.3.2-45)."* IPC argues that flow fluctuations (proposed operations) have a beneficial effect to riparian habitat and that stable flows (full pool run-of-river) would probably increase riparian fragmentation.

IPC has not provided a depiction of community structure within this ecotone to support the contention that this riparian zone has been enhanced. *Celtis reticulata* may have the growth form (deep rooted, long lived perennial, occupying seepage lines and river terraces with subterranean moisture availability to accommodate drops in the water level and maintain itself in this zone, but the associated vegetation in this ecotone is not as species rich as that found in other riparian associations (Johnson personal communication, 2002).

It is also unclear where riparian habitat would find room for "extensive development" (under proposed operations) in a reach sometimes characterized by IPC as being "comprised almost entirely of large basalt outcrops (bedrock walls) or large boulders and cobbles, with few sands or gravels" (IDP E.3.3.1.1.4.4). Thus, going on to say that there are very few riparian weed species below Hells Canyon Dam is misleading without putting it in context with the limited amount of available riparian habitat below the HCC. The statement, as presented, also implies a high degree of certainty about the occurrence and distribution of noxious weeds along the river corridor.

The limits of their studies should be presented along with such statements. TR E.3.3-2 is very clear about the intent of the study and its design. The contractor designed a sample scheme that would allow them to characterize the level of weed infestation, but was not intended to be a 100% survey of the river corridor. In general the Forest Service agrees with the work described in TR E.3.3-2, but wonders if characterization (only 25 % of the study area was inventoried) is enough to enable this kind of predictive statement? For example, the DLA does not mention the existence of a one acre purple loosetrife (*Lythrum salicaria*) population growing next to the launch ramp

at Pittsburg Landing. The existence of this occurrence has been known for many years and was shared during consultation with agency personnel and the TRWG.

*E.3.3.4.2.1.2. Decline of Salix exigua Communities*

1. Page E.3-600. *Operations of the HCC play a minor role in the continuing decline of native Salix exigua communities below Hells Canyon Dam. For reproduction and growth, Salix species need suitable substrate (sand and fines), scouring flows in the spring to create places for establishment, and a gradual recession of flows that does not exceed about 5 centimeters [cm] per day (Mahoney and Rood 1998, Technical Report E.3.3-3). Before construction of the HCC, dams constructed upriver trapped approximately 84% of the natural sediment load and the accelerated erosion caused by human activities (Technical Report E.1-4). The construction of Brownlee Dam in 1958 trapped the remaining 16% of the sediment load (Technical Report E.1-1). This reduction in sediment available for deposition in Hells Canyon may contribute to a decline in the distribution and abundance of Salix exigua in the study area.*

   The discussion figures used in this section are inconsistent with section E.6-21 relative to percents of sediment trapped that identifies the following; page E.6-21. *Below Hells Canyon Dam, fluctuations in water levels caused by project operations reduce the amount of sediment and thereby contribute to the decline of coyote willow (salix exigua). Before the HCC was constructed, upstream dams trapped approximately 87% of the natural sediment load and the load from accelerated erosion caused by human activities (see section E.3.0.4.). The construction of Brownlee Dam in 1957 trapped the remaining 13% of the sediment load (Technical Report E.1-1).*

   The Forest Service notes the role HCC plays in the decline of *Salix exigua* communities below Hells Canyon Dam, and agrees with IPC that current conditions are less suitable for the establishment and growth of this species than historical conditions. The Forest Service agrees with IPC that sediment trapping behind the dams may have contributed to the decline in the distribution of *Salix exigua*. Thus, the Forest Service considers it a dubious suggestion that the HCC plays a minor role in this decline. The Forest Service contends that the HCC has limited the movement and deposition of sediment along the main channel of the Snake River corridor. In a comparison of 5 eddy sandbars before and after the installation of the HCC, Grams and Schmidt 1991, found that the surface area and number of studied beaches had declined by 75%.

   The Forest Service notes that there are numerous willow sand bars and other riparian communities upriver from the headwaters of Brownlee reservoir in spite of the contention that dams constructed upriver may have trapped 84% of the natural sediment load. Also, there are willow communities along the Salmon River and the Snake River below its confluence with the Salmon that could be used for comparison. “Eighty-four percent” is an irrelevant measure intended to obfuscate the impacts of the HCC to down river resources. The text should discuss the volume of material (the

supposed 16%) per area available for deposition, above Brownlee dam (as well as below for that matter). In addition IPC fails to account for sediment intercepted by the reservoirs between Hells Canyon Dam and Brownlee reservoir, further illuminating flaws in their analysis of sediment supply and transport and their resulting effects.

2. Page E.3-601. *However, there is no evidence that Brownlee Reservoir (the most upstream reservoir in the HCC) has trapped significant quantities of sediment of sizes that could affect any of the downstream botanical resources. Most of the material trapped in Brownlee is smaller than the smallest size fraction that could replenish the sand bars in Hells Canyon (Technical Report E.1-1). Even if the current sediment in Brownlee Reservoir had continued downstream, it would have been transported as wash load (Technical Report E.1-1).*

   The assertion above contradicts the previous paragraph and is simply conjecture without supporting rationale. The Forest Service disagrees with this conclusion. A detailed discussion of the inadequacy of this discussion can be found in the "Comments On IPC's Draft License Application Related to Sediment Supply, Stability, and Transport" (Kendall 2002)

   The Forest Service estimates that Brownlee Reservoir may contain over 9 million tons of sand-sized material, based on data generated by Wilcock et al 2002. The trapping of silts and clays is also a direct project impact because this material is likely to be an important component in supporting riparian vegetation, particularly in eddy environments where small materials are likely to deposit.

3. Page E.3-601. *The nature of sediment loads entering Hells Canyon has also changed. Prior to construction of upriver dams on the Snake River, the sediment load was primarily sand-based and from the Idaho Batholith. Human activities in and above the Hells Canyon area—such as mining, grazing, cultivation, and forestry—modified hill slope processes from the mid-1800s to the mid-1900s. These activities probably introduced an unusually large sediment supply to the river, a supply that decreased as the activities that introduced them also decreased. A "slug" of sediment is thought to be working its way out of the Hells Canyon system (Technical Report E.1-2). Since construction of the upriver dams, the majority of the sediment now entering the study area consisted of silts and clays, and most is probably from erosion of agricultural land. Continuing supplies of sands, gravels, and cobbles from local sources have not been affected by the construction and operation of the HCC (Technical Report E.1-1).*

   The idiosyncrasies in IPC's analysis of impacts to riparian communities below HCC, and specifically to *Salix exigua* communities, are directly linked to the inadequate analysis of the system's sediment budget (Kendall 2002). Therefore the conclusions put forth regarding impacts to *Salix exigua* communities are also questionable. IPC has developed a "slug" theory of sediment movement without any peer review from the scientific community, nor any data to support that theory. The Forest Service disagrees that "*continuing supplies of sands, gravels, and cobbles from local sources*

*have not been affected by the construction and operation of the HCC (Technical Report E.1-1)"*. The Forest Service maintains that the Snake River immediately below Hells Canyon Dam is, in fact, "sediment hungry" because the supply of material from upstream sources has been interrupted, by the HCC.

4. Page E.3-601. *Because the gradient of the reach of the Snake River downstream of Hells Canyon Dam is much steeper than that of the Weiser reach, the river has a much higher capacity to transport sediment; approximately 16 times greater capacity than in the Weiser reach (Technical Report E.1-2).*

   The issue is not the ability of the Hells Canyon reach to transport fine material. The issue is the lack of fine material entering the system from upstream sources. Sandbars are rare, but important alluvial features in Hells Canyon and typically form in protected areas such as backwaters and eddies outside of the main transport reaches. A visit to this rugged and rocky part of the canyon allows one to see that there is still plenty of roughness, to create areas of eddies and sand bar development, were sediment being delivered. These areas would measure out to be a small percentage of the overall reach but that actually increases the value of the plant assemblages and habitat that establishes on these sites. A review of historical aerial photos, confirms this observation.

5. Page E.3-601. *The steep gradient of the Snake River below Hells Canyon Dam, combined with scouring spring flows, historically limited the distribution of Salix species in this reach, as evidenced by photographs and General Land Office records from 1900 to the late 1950s (Technical Report E.3.2-44). Current conditions are even less suitable for establishment and growth of Salix species in the Hells Canyon reach.*

   Salix species limitations and the potential mechanisms thereof, are not adequately described here. The use of "limited" in this context is misleading and says nothing about the actual area occupied. Prior to the construction of the HCC and even with extensive grazing willow likely exploited the extent of available habitat, even if that was a small proportion of that reach of river. Historically, scouring spring flows would have been followed by depositions promoting the development of Salix species. Spring flows following construction of the HCC are sediment deprived due to the trapping of sediment behind the dams, so now there is no deposition period following peak spring run-off (as influenced by dam operations). It is this lack of deposition, in conjunction with daily and hourly stage ramping that limits the distribution of Salix species. In addition, IPC counted the number of sandbars using 1946 and 1955 aerial photographs, and found no net loss. Because the aerial photographs used in this analysis do not cover the post-dam period, it is impossible to draw conclusions about the effects the HCC has had on sandbar and terrace erosion from their analysis.

6. Page E.3-602. *Analyses of past and current hydrologic conditions on the establishment and persistence of Salix species suggest that many areas of the Hells Canyon reach are not, and were not, conducive to Salix species survival due to*

*excessive stage (water level) recession rates (greater than 5 cm/day) of spring runoff (Technical Report E.3.3-3). Since flow fluctuations occurring in the scour zone is not conducive to Salix species persistence, ongoing operations apparently have little negative influence on Salix establishment and survival. And because of the continued decline of sediments in the watershed, neither the proposed operational scenario nor the full pool run-of-river scenario would significantly influence Salix species establishment.*

The Forest Service disagrees with IPC's conclusion. Salix establishment depends on sediment structure as well as water level. Pre-1957, the rate of unidirectional recession of seasonal flow levels following peak spring run off were not excessive to the needs of Salix species, especially given the sediment supplied and deposited, and its retention of moisture. At that time there were no daily or hourly excessive stage recessions. Post construction of the HCC, the dam operations altered the seasonal flow regime as well as the daily and hourly flow regime. The dam's effects on the daily/hourly fluctuations (up and down) likely do result in stage recession rates often being excessive to the needs of Salix species. It is the daily/hourly fluctuation that has the greatest effect on these species as well as sediment transport and deposition. Yet, now that the dam influenced flows have scoured away many of the sediment bars in that section of the Snake River, the current daily and hourly stage recession rates will not support the establishment of Salix species nor the deposition of sediment.

As there is still some potential willow habitat left, saying that ongoing and proposed actions apparently have little significant effect is misleading. The significance of the influence should be judged on the differences in sediment transport and flow regime between ongoing, proposed, and full pool scenarios, (and compared to historical). This was not displayed in this discussion, and so a conclusion about effects to those Salix resources that remain cannot be made. Nor does IPC offer any information as to how modified operations might stem the Salix decline or rebuild willow bars in areas where alluvial terraces and the river course intersect. It is likely that full pool flows would at least minimize the negative hourly and daily down-ramping effects to sediment deposition, inter-canyon sediment transport, and willow establishment. This analysis was missing in IPC's discussion.

Similarly, to say, *"many areas of the Hells Canyon reach are not, and were not, conducive to Salix species survival"*…distorts the issue. It is known that the majority ("many areas") of the banks in Hells Canyon are well armored with basalt cliffs, large boulders, or bedrock, and do not have the potential to support Salix or be affected by recession rates. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach but this small fraction provides valuable habitats for numerous species. These areas are where the discussion should focus and provide the real context for significance. It is likely that it is the lack of sediment following spring run-off flows in combination with fluctuating excessive recession rate (down-ramping) that impacts Salix species (directly and via sediment placement disruption).

IPC has failed to make a comparison with pre-dam conditions, nor have they sufficiently explained the difference in this section of the Snake River with that section down river from the confluence with the Salmon River. IPC needs to study similar sections of the Salmon River in the same elevational zone and compare the vegetation communities. IPC also needs to compare the reach from Hells Canyon Dam to the Salmon with that reach down river of the Snake / Salmon confluence. This comparison would clearly show a difference in vegetation distribution based on sediment and hydrological conditions.

*E.3.3.4.2.1.3. Increase of Celtis reticulata Communities*

1. Page E.3-602 and 603. *Historical photographs taken during the early part of the 1900s and retaken recently clearly show an increase in size and extent of Celtis reticulata stands both above and below the high-water mark in the reach below Hells Canyon Dam (Technical Reports E.3.2-44 and E.3.3-3). In some instances today, the margin of the river is entirely bordered by riparian Celtis reticulata communities, while scattered individuals were found there 60 to 80 years ago.*

   *There are three main reasons for the observed increase in the zone below the high-water mark. First, base flows from the HCC are higher during summer, and more stable, than they were before the HCC was constructed (Technical Report E.1-4). Second, the load-following flows in late spring and summer (following spring runoff), below 30,000 cubic feet per second stage levels, repeatedly irrigate portions of the riverbed. Daily water levels often fluctuate several feet in the riverbed zone that was previously annually scoured and then left high and dry. Analyses of past HCC operations indicate that between June 1 and September 30, daily fluctuations below Hells Canyon were 10,000 cubic feet per second or below, 80% of the time (Technical Report E.1-4). Third, scouring of the roots of Celtis reticulata growing near the high-water mark stimulates the growth and suckering of the root systems, which benefit from higher base flows and repeated irrigation events (Technical Reports E.3.2-44 and E.3.3-3). All combined, these conditions enable Celtis reticulata communities to occupy a zone that was previously not available. Under full pool run-of-river operations, riparian habitats would not be enhanced by these factors.*

   Given the abundance of electronic publishing and reproduction technologies IPC should simply display, side by side in this section of text, the photo comparison they are referencing. IPC must also discuss the ecological effects for livestock removal from the river reach downstream of Hells Canyon Dam.

   The three reasons given for Celtis increase are misleading and depend only on project operations as opposed to looking at the biology of the species. IPC fails to relate, “higher base flows” to Celtis ecology. IPC again overstates their irrigation theory, in conjunction with annual flows. Peak annual flows did not leave a riverbed high and dry, though certainly there were some zones of the riverbed and sand bars not colonized in any given year. Rather, deposition occurred post peak flows (or in eddies out of the main channel during peak flows), and different riparian species

established in different zones relative to the annual average stage level and substrate composition. IPC misrepresents beaches or cobble bars as being "high and dry". IPC again portrays inundation as irrigation.

That Celtis can accommodate this also says little about other associated species in this habitat. Rather, the Forest Service contends that the daily/hourly and annual fluctuation resulting from dam operations impedes the deposition and retention of sediment and establishment of associated riparian species. Scouring flows without sediment deposition or retention has eroded the beaches away from the uplands they protected. It is likely that some of the increase in Celtis in the river zone is the result of the river margin eroding toward the Celtis (TR E.3.3-1). This sets up the 3rd reason for Celtis community changes offered by IPC. The Forest Service agrees with IPC, that when riverbank sediments erode away from where Celtis exist, their roots sprout into new stems, (at least until the whole clone falls into the river as at Camp Creek). Although suckering via hydration without erosion is possible too, IPC overstates this effect. IPC fails to establish the aspects of this river zone composition shift that would be considered enhancement. Celtis roots do not have the same ability to maintain substrates as other perennial riparian vegetation. There is no fully developed full pool run discussion in association with this section, so the suggestion that that operation scenario would not enhance riparian habitats as well as current/proposed operations cannot be supported. Again, IPC shifts from talking about Celtis communities to suggesting effects to all riparian habitats.

This section is most notable for what it does not say. IPC fails to discuss effects to more than two community types. What are the impacts to the other community types (shore and bottomland wetland, emergent herbaceous wetland, forested wetland or other communities within the scrub-shrub wetland)? It is probable that *Celtis reticulata* has increased in the area it occupies. The amount of available habitat is finite. The river corridor was not barren prior to the 1900s. For Celtis to increase, some other habitat must be decreasing. What this section lacks is an integrated discussion of the changes in riverine vegetation as a whole and the role the HCC plays in those impacts. There is no mention of the other riparian vegetation types identified in TR E.3.3-1 or E.1.6. Nor are effects displayed to sandbar or cobble and terrace communities. There is no integration with the previous discussion on the decline in Salix species. Nor is this discussion integrated with effects to wildlife species (via the shift in plant species).

There is no discussion of the role of fire suppression or livestock grazing changes. Celtis communities may have been on a natural increase prior to the construction of the HCC. This discussion implies that all riparian habitats are the same, and are of the same value and function. *Celtis reticulata* may have the growth form (deep rooted, long lived perennial, occupying seepage lines and river terraces with subterranean moisture availability) to accommodate drops in the water level and maintain itself in this zone, but the associated vegetation in this ecotone is not as species rich as that found in other riparian associations (Johnson, 2002 Pers. Comm.). IPC fails to discuss the effects to all of the various zones (as defined by IPC) within

the potential riparian area. IPC does not display data that shows new Celtis plants regenerating or establishing in this zone, just that existing plants occupy more margin. Age data suggests that most of the Celtis established prior to the construction of HCC.

*E.3.3.4.2.2. Downstream Operations and Noxious Weeds*

1. Page E.3-603 and 604. *Few occurrences of riparian noxious weeds occur downstream of the project. Little negative influence on the spread of these occurrences would be expected, both under the Applicant proposed scenario or with full pool run-of-river operations. However, as stated in section E.3.3.4.2.1.2., if the project were operated under full pool run-of-river operations, new sources of noxious weeds would be expected to quickly invade this reach from upstream sources and become detrimental to existing riparian communities, which consist almost entirely of native species (Technical Reports E.3.3-1, E.3.3-2, E.3.3-3).*

   It should be described what and how much habitat below the HCC is actually available for colonization. Why would active integrated weed management practices not be sufficient to control noxious weeds on such a limited number of acres, especially for Tamarix?

   The Forest Service agrees that occurrences of *Phalaris arundinace*a, *Equisetum arvense* (Common horsetail), and *Cyperus esculentus* (yellow nut sedge) possibly could be spread by water level fluctuations in the downstream reach. The Forest Service also agrees with IPC that leafy spurge, purple loosestrife and salt cedar are also positively associated with water-level fluctuations (TR E.3.3-2). All but salt cedar have been identified below Hells Canyon Dam, so invasion from above is already underway. IPC needs to describe the effects of the operational scenarios, not just say both might have little influence.

2. Page E.3-604. *Both natural runoff events and project operations probably influence the distribution of some riparian noxious weeds below Hells Canyon Dam. Quantifying those influences would be difficult, if not impossible.*

   This statement contradicts the first paragraph of this section. The Forest Service questions the "impossibility" of quantifying the impacts these plants would have under IPC operational scenarios, given the extensive discussions IPC has produced for native riparian plants growing in roughly the same environment. IPC should integrate their reports into an analysis of impacts from all operational scenarios and compare that to the historic regime prior to construction of the HCC.

   Other contradictions arise. It is suggested there is enough data and analysis to propose possible impacts (or a lack of) from operational scenarios, yet it is stated that it is impossible to quantify those influences. Both the inventories of noxious weeds and rare plants surveyed only 25% of the study area. The Forest Service agrees that this could be enough to "characterize" the reaches relative to the existence of noxious

weeds and rare plants. However, without further modeling, based on their inventory results and disturbance correlations, it would seem difficult to make conclusions based on any of the operational scenarios. IPC should take the inventory results and model the effects of all operational scenarios then compare them to pre-dam conditions.

*E.3.3.4.2.3. Downstream Operations and Threatened and Endangered Plant Species*

1. Page E.3-605. *Potential impacts to these four special status plants are summarized in Technical Report E.3.2-45.Just one of several factors that potentially affect occurrences of these four plant species is water level fluctuation. Differences between the Applicant's proposed and full pool run-of-river scenarios are expected to be minimal. In general, the Applicant recommends working cooperatively with federal land management agencies to protect rare plant sites that are threatened by disturbance activities.*

   The impact discussions in E.3.2-43 and E.3.3-2 are entirely of a hypothetical nature. These reports did not discuss any operational scenario effects to Threatened and Endangered (T&E) plants. E.3.2-45 only states that IPC believes that neither operational scenario will negatively affect rare plant populations, but does not offer any analysis of potential effects. Neither discussion addresses impacts below Hells Canyon Dam. Neither discussion addresses the impacts of the construction of the HCC. A discussion of impacts needs to be developed in this document integrating E.3.3-2 and E.3.3-1. It is not enough that IPC "expects" minimal differences in proposed and full pool run of river scenarios, IPC needs to address these differences as they affect rare plants. IPC has not yet addressed the issue raised by the Forest Service regarding the continued project effects to rare species when changing from a free-flowing river to a large slack water reservoir.

*E.3.3.4.2.4. Downstream Operations and Shoreline Erosion of Terrestrial Habitat*

1. Page E.3-605 and 606. *Riverbanks in the reach below Hells Canyon Dam are very stable except at a few locations. This downstream river reach was the most stable of the reaches studied (from Weiser above the HCC to the Salmon River). Erosion occurred at 60 sites along about 3.1% of the available shoreline (3.92 mi out of 125 total mi) (Technical Report E.3.2-42). Factors that probably influence shoreline erosion include boat-generated waves, disturbance from recreation (for example, camping and hiking), channel flow, and flooding of tributary drainages (Technical Report E.3.2-42). Most bank erosion occurred upslope of the typical zones of water fluctuation and summer base flows (above 30,000 cfs)—areas that could only be impacted by high flows (Technical Report E.3.2-42). Because HCC operations have little effect on flows greater than 30,000 cfs (Technical Report E.1-4), HCC operations have little or no effect on shoreline bank erosion. The Applicant believes that, likewise, proposed operations and the full pool run-of-river operations would have little or no effect on shoreline bank erosion.*

The 3.1% characterization is misleading, as this equals 3.92 miles at 60 sites where erosion is occurring. The majority of the banks in Hells Canyon are well armored with large boulder and bedrock, and do not have the potential to erode. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach. Many of these sites include important recreation, botanical and heritage resources. If IPC had divided the length of eroding banks by the length of banks that have a potential to erode, the percentage would be significantly higher. The 3% of the reach where erosion is occurring are most likely those areas the Forest Service is most concerned about (sandbars and terraces).

In addition, Grams and Schmidt 1999b, found that the frequency of sandbars and the rates of erosion increase with distance downstream of Hells Canyon Dam. Based on aerial photography, the greatest erosion of sandbars occurred during the period of 1964-1973. In addition, the highest amounts of erosion occurred in the reaches closest to Hells Canyon Dam. Erosion rates have generally decreased since 1973 along the upper reaches, but have increased along the lower reaches. This suggests a cause and effect relationship between the HCC and sandbar erosion (Kendall 2002).

An analysis of flow frequencies greater than 30,000 cfs (pre and post dam construction) finds that flows of this magnitude occur from December through June with the only significant flow change between pre and post dam construction occurring in February (USDA 1999, unpublished). In February, the occurrence of 30,000 cfs flows increased from 11% prior dam to 21% post dam. Evidence suggests that the greatest change to the Snake River flow regime from dam construction is in the daily and hourly flow fluctuations (Grams and Schmidt 1999, USDA 1999, unpublished). Prior to construction of the complex, the change in discharge over a six-hour time period was between 250-500 cfs. Following closure of the dams, the average change in discharge over a six-hour period increased to 11,950-12,070 cfs. Hourly fluctuations below Hells Canyon Dam generally range between 2,000 to 3,000 cfs. However, these flow changes may occur in time intervals as short as 15 minutes. Research from Glen Canyon Dam found downstream erosion to be more affected by down ramping than up ramping (USDI 1995). In the Snake River, daily and hourly flow fluctuations may be affecting heritage resources, riparian and aquatic plant and animal communities, and recreation resources by increasing the rate of erosion of sandbars and terraces. Thus the current and proposed ramping of the project may aggravate the adverse effects on sandbar maintenance due to the lack of sediment transport through HCC (Kendall 2002).

The Forest Service maintains that the HCC is largely responsible for degradation of sediment and sediment-dependent resources in Hells Canyon. The construction and operation of the HCC has resulted in significant sandbar and terrace erosion.

2. Page E.3-606. *Riverbank erosion is a natural geomorphic process that cannot and should not be completely eliminated (Olson 1983, Dorava and Moore 1997). The amount of shoreline erosion in this reach is not considered to be above natural rates (Technical Report E.3.2-42).*

River bank erosion acts as a natural geomorphic process only when accompanied with deposition from upper reaches. IPC's erosion value is misleading because the majority of the banks in Hells Canyon are well armored with large boulders and bedrock. Sandbars and terraces make up a very small fraction of the total length of the Hells Canyon reach, which is why they are important recreation and heritage resources. The river reach where most erosion is occurring are most likely those areas the Forest Service is most concerned about (sandbars and terraces). If IPC had divided the length of eroding banks by the length of banks that have a potential to erode, the percentage would be significantly higher. The Forest Service maintains that sandbar and terrace erosion has accelerated (Kendall 2002).

*E.3.3.4.3. Transmission Lines and Service Roads*

1. Page E.3-607**.** *The Applicant conducts numerous O&M activities (such as line patrolling, vegetation clearing, structure repair, and road maintenance) that potentially impact botanical resources. Therefore, state and federal agencies and nongovernmental organizations expressed concern that O&M activities might impact highly valued botanical resources and facilitate the spread of undesirable weeds. In response to concerns, the Applicant assessed impacts to botanical resources from HCC transmission lines, service roads, and O&M activities (Technical Report E.3.3-4).*

   The Forest Service applauds IPC's recognition that Operations and Maintenance (O&M) activities impact terrestrial resources including T&E and Regional Forester Sensitive botanical species. The Forest Service, in January 2002 met with IPC staff to review and comment on the draft O&M plan for project transmission lines, Dumas 2002. In our initial comments we stated we would be addressing all resources impacts associated with O&M activities associated with the transmission lines. In that context we will be requiring IPC to provide an integrated comprehensive O&M plan. See comments to section and E.3.2.3.2.2. and E.3.3.3.2.2, below.

*E.3.3.4.3.2. Operation and Maintenance Activities and Noxious Weeds*

1. Page E.3-610. *Noxious weeds are common throughout the transmission-line corridors and throughout the surrounding regions. O&M activities play a role in the spread of noxious weeds along transmission-line service roads and at tower locations. However, because most disturbance factors are interrelated, attributing the potential cause of noxious weed occurrence and spread to any single influence is difficult, if not impossible.*

   IPC overstates the difficulty of ascertaining causes of noxious weed spread. There are numerous locations where operations and maintenance activities for the transmission lines are directly and indirectly responsible for the establishment and spread of noxious weeds. Maintenance of early seral stages and travel corridors

(roads/trails) are known to be the most common factors in the spread of noxious weeds.

*E.3.2.3. Applicant's Existing And Proposed Measures And Facilities*
*E.3.3.3. Applicant's Existing And Proposed Measures And Facilities*
*E.3.2.3.2. New Measures Or Facilities Proposed By The Applicant*
*E.3.3.3.2. New Measures Or Facilities Proposed By The Applicant*

The Forest Service comments are divided into two sections: First, below are response and comment to specific DLA proposed PM&E sections; and second, (See sections Forest Service Terrestrial Objectives and Forest Service Response to IPC's Wildlife and Botanical Proposed PM&E Measures) are Forest Service comments to the IPC's proposed PM&E measures and how those measures address the Forest Service identified issues.

*E.3.3.3.2.1. HCC Reservoirs and the Reach Downstream of Hells Canyon Dam*

1. Page E.3-570. *Three PM&E measures for botanical resources focus on the HCC reservoirs and the reach downstream of Hells Canyon Dam*:

2. Page E.3-570. *Acquisition—Acquisition of upland and riparian habitat (same PM&E measure as in section E.3.2.3.2.1.1.)*
   *Cooperative Projects—*
   - *Noxious weed control and site monitoring and reseeding*
   - *Protection and monitoring of sensitive plant sites*

   The Forest Service by law, requires that any weed control, monitoring, and reseeding on NFS lands will be coordinated with, and conducted according to Forest Service standards and guidelines.

   IPC should develop cooperative programs to produce employee and public education programs regarding to the threat of noxious weeds, their identification, mechanisms of spread, and methods of controlling.

   IPC should develop cooperative programs to re-vegetate degraded habitats with local native plant materials.

   IPC should develop cooperative programs to develop species management guides for rare plants impacted by IPC operations.

   IPC should develop cooperative programs to restore rare plant habitat and reintroduce or introduce rare plants to appropriate habitats in accordance with species management guides.

IPC should develop cooperative programs to construct exclosures around rare plant populations threatened by livestock use associated with trailing avenues provided by construction and maintenance of transmission line ROWs.

IPC should develop cooperative programs to construct exclosures around select small noxious weed populations during treatment actions to reduce their chance of spreading via livestock and recreational actions associated with transmission line ROWs.

*Management programs*

IPC should develop a management program for noxious weeds on lands they own, as state law requires landowners treat noxious weeds. Weed sites on private land provide a seed source for neighboring public lands, and IPC should treat occurrences on land they own, as well as establish BMPs for equipment working in known weeds sites on IPC lands.

*E.3.2.3.2.1.1. Acquisition of Upland and Riparian Habitat*

1. Page E.3-412. *Continued operation of the Hells Canyon Complex would affect wildlife habitat and wildlife species, including threatened, endangered, and special status species, associated with the three reservoirs (Technical Report E.3.2-45). Impacts occur in the fluctuation, shoreline, and mule deer winter range (or crucial winter range) zones.*

*E.3.2.3.2.1.1. Acquisition of Upland and Riparian Habitat*

1. Page E.3-413. *The Applicant also concluded that it is not possible to eliminate the influence on shoreline erosion from water-level fluctuations of the Hells Canyon Complex that are necessary for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation (Technical Report E.3.2-42). Therefore, the Applicant proposes to mitigate for 90 acres of reservoir and river shoreline that has eroded, possibly because of Hells Canyon Complex operations.*

   The Forest Service will recommend mitigation for all of the on-going continued impacts of the HCC over the new license term including the inundation zone as well as the shoreline and fluctuation zones. IPC did not fully disclose the impacts to upland and riparian habitats by narrowing their impact analysis to the shoreline and fluctuation zones. The PM&E measures proposed do not adequately mitigate project effects to NFS lands and resources.

   Upland habitats inundated by the Hells Canyon Reservoir will not be available for the next license term for those species that depend on them. IPC identified upland habitats immediately adjacent to Hells Canyon Reservoir as crucial winter range for mule deer. Therefore, the upland habitats inundated by Hells Canyon Reservoir were

crucial winter range for mule deer and most likely other big game species. To determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where upland habitats are of equal (crucial winter range) value and a 2:1 replacement ratio where the upland habitat is of lesser quality (winter range zone).

Likewise, riverine riparian habitats that have been inundated by the Hells Canyon Reservoir will not be available as habitat for the next license term. Those riparian zones had the ability to provide high quality habitat for riparian dependent and associated species, including flora and fauna T&E species. With the continued operations of the HCC, acquisition of high quality riverine riparian habitats is questionable. Therefore, to determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where riparian habitats are of equal high quality value and a 2:1 replacement ratio where the riparian habitat is of lesser quality.

Both upland and riparian rare plant species lost potential habitat (likely, unknown occurrences were also lost) with the creation of the HCC, its reservoirs, and the decline in down river conditions for these species. Proposed acquisition and management of land should include potential habitat for the following rare plant species: *Mirabilis macfarlanei, Silene spaldingii, Leptodactylon pungens* ssp *hazeliae, Mimulus clivicola, Pentagramma triangularis*, and the riparian related (including moist cliffs) *Bolandra oregana, Carex backii, Carex hystericina, Carex interior, Cyperus rivularis, Cyperus schweinitzii Epipactus gigantea, Mimulus hymenophylus, Mimulus patulus, Rubus bartonianus,* and *Teucrium canadense* var. *occidentale,*.

Likewise, the following rare habitats should also be addressed: Sand Dropseed communities, Giant Wildrye plant communities, wet cliff communities, river beach communities, spring and seep communities, Coyote willow communities, White Alder/mixed shrub communities, and Black Cottonwood- White Alder/mixed shrub communities.

*E.3.3.3.2.1.1. Acquisition of Upland and Riparian Habitat*

1. Page E.3-570. *This PM&E measure is the same as that explained in section E.3.3.3.2.1.1. The justification for this measure is presented in this section as it reflects botanical resources in Hells Canyon.*

2. Page E.3-570. *Continued operation of the HCC would affect botanical resources associated with the three reservoirs (Technical Report E.3.2-45).*

   Neither section, TR E.3.3-2, TR E.3.3-1, or TR E.3.2-45 have adequate analyses or discussions of the impacts of HCC construction and operation to rare plants, noxious weeds or native habitats. Likewise the discussion and analysis of impacts to rare plants found in sections E.3.3.4 (E.3.3.4.1.3, E.3.3.4.1.6.1, or E.3.3.4.2.3) are also

inadequate, or in the case of E.3.3.4.1.6.1, entirely lacking. Thus IPC's PM&E proposals inadequately address the acquisition of upland and riparian habitats. IPC does not fully disclose the impacts to upland and riparian habitats or species by limiting their impact analysis to the shoreline and fluctuation zones. The PM&E measure proposed is not wholly adequate to mitigate project effects to NFS lands and resources.

In order to develop appropriate PM&Es, IPC needs to consistently analyze and discuss the effects of dam construction/reservoir creation and all operational scenarios, to all rare plants known from the study area, that had the potential to be under the reservoirs, or currently have the potential to be impacted by the HCC.

Both upland and riparian rare plant species lost potential habitat (likely, unknown occurrences were also lost) with the creation of the HCC, its reservoirs, and the decline in down river conditions for these species. Proposed acquisition and management of land should include potential habitat for the following rare plant species: *Mirabilis macfarlanei, Silene spaldingii, Leptodactylon pungens* ssp *hazeliae, Mimulus clivicola, Pentagramma triangularis*, and the riparian related (including moist cliffs) *Bolandra oregana, Carex backii, Carex hystericina, Carex interior, Cyperus rivularis, Cyperus schweinitzii Epipactus gigantea, Mimulus hymenophylus, Mimulus patulus, Rubus bartonianus,* and *Teucrium canadense* var. *occidentale.*

Likewise, the following rare habitats should also be addressed: Sand Dropseed communities, Giant Wildrye plant communities, wet cliff communities, river beach communities, spring and seep communities, Coyote willow communities, White Alder/mixed shrub communities, and Black Cottonwood- White Alder/mixed shrub communities.

3. Page E.3-572. *With water fluctuations necessary for flood control, anadromous fish spawning and protection, downstream navigation, and hydroelectric generation, the Applicant concluded that eliminating negative impacts to shoreline erosion from human activity is impossible at the HCC (Technical Report E.3.2-42). Because many of the factors that influence shoreline erosion are interrelated, it is impossible to attribute the cause of erosion at any specific site to any single influence. With regard to HCC operations, erosion cannot be attributed only to one operational influence.*

   IPC's conclusions may be misleading. Interrelationship does not preclude an understanding of the individual factors. Holmstead concluded that management actions would be best directed at controlling human-caused factors that negatively affect shoreline banks. He specifically noted that IPC should consider minimizing water-level fluctuations, controlling recreation influences (such as boat-driven waves, camping, trails and dispersed recreation activities) minimizing effects of road and other construction or maintenance activities and reducing negative livestock grazing effects *(TR E.3.2-45).*

In their PM&Es, IPC needs to address actions that relate to their contribution to shoreline erosion.

*E.3.3.3.2.1.1. Acquisition of Upland and Riparian Habitat*

1. Page E.3-572. *Taking a liberal approach, the Applicant concluded that HCC operations have potentially contributed to the total shoreline erosion occurring throughout the canyon; about 84 acres of terrestrial habitat along reservoir reaches and an additional 6 acres of such habitat downstream of Hells Canyon Dam. Habitat management actions designed to protect (for example, through acquisition) and enhance 90 acres of terrestrial habitat would mitigate for potential HCC operational influences on shoreline erosion along reservoirs and downstream reaches (Table 2 in Technical Report E.3.2-45).*

   Blair, et.al., 2001, Technical Report Appendix E.3.2-44, conclude the lack of fine substrates due to the large-scale trend of sediment trapping in upstream reservoirs and the greater sediment transport capacity through the Hells Canyon reach (IPC's dramatic flow fluctuations) limit the recruitment of sandbar willow. This conclusion conflicts directly with IPC's claim that HCC operations have minimally contributed to the total shoreline erosion occurring throughout the canyon.

   Grams, 1991, compared five sets of aerial photos of the canyon taken at intervals between 1955 and 1982. He found that the surface area of beaches in Hells Canyon had shrunk by 75 percent. Beaches between Hells Canyon dam and the confluence of the Salmon were most heavily degraded. Grams' suggests that the beaches of Hells Canyon continue to shrink each year. It is these beaches or the fine sediment of the beaches that provide the substrate for riparian vegetation. It is the disappearance of the fine sediment caused by HCC and HCC flow fluctuations that is limiting current riparian habitat.

   Blair, et al., 2002, Technical Report Appendix E.3.2-40, estimates current downstream riparian habitat at 7.6% of the total shoreline acres (3,435 ac) or 262 acres. Blair, et al. 2002, does not define vegetative species composition for riparian habitat however, Edelmann et al., 2002, defines the riparian cover as predominately native netleaf hackberry communities. Hackberry is not a typical riparian zone dependent species rather it is expanding its occupancy of the riparian zone.

   The Forest Service asserts that IPC has not adequately described the HCC downstream effects on riparian habitat in the DLA. For example, IPC has not disclosed the relationship between sediment transport, river flow fluctuations, and vegetative riparian establishment.

2. E.3.2-45, page 16 *"At the full-pool shoreline of Brownlee Reservoir, run-of-river operations would maintain greater soil moisture throughout the growing season that proposed operations."*

This statement is a contradiction of IPC's argument elsewhere in the DLA saying downstream riparian habitat on the Snake River would be greater for the proposed operational scenario due to the "irrigation effect."

*E.3.3.3.2.1.2. Cooperative Noxious Weed Control, Site Monitoring, and Reseeding*

1. Page E.3-573. *Although large fluctuations on Brownlee Reservoir have helped reduce downstream spread of noxious weeds from upstream reaches under riverine processes (Technical Reports E.3.2-40, E.3.3-1, and E.3.3-3), ongoing operations can still contribute to the spread of riparian noxious weeds along the reservoir and downriver reaches (Technical Reports E.3.3-1 and E.3.3-2).*

   IPC has not established cause and effect between reservoir creation and weed distribution; they have merely characterized apparent distribution patterns. "May have helped reduce downstream spread", is a more accurate statement.

   The Forest Service concurs with the conclusion that ongoing operations can still contribute to the spread of riparian noxious weeds along the reservoir and downriver reaches.

2. Page E.3-573. *Applicant has actively participated with several newly formed organizations called Cooperative Weed Management Areas (CWMAs) in the Hells Canyon vicinity. Participation has been with CWMAs in Washington, Payette, and Adams counties in Idaho and principally with Baker County in Oregon. The Applicant proposes to continue and expand such efforts. Goal: The primary goal of this measure is to formalize cooperative relationships between the Applicant, agencies, landowners, land managers, and other interested individuals and organizations needed to effectively manage nonnative invasive plants and noxious weeds along the Snake River corridor from Weiser downstream to the confluence of the Salmon River.*

   The Forest Service intends that IPC work cooperatively with weed management entities and implements weed control measures in accordance with the Standards and Guidelines of the governing landowner. However, in their following discussion of goals, objectives, and management prioritization, IPC neglects to emphasize the treatment and eradication of existing noxious weed species or select weed populations. Treating existing weed occurrences needs to be priority. IPC needs to focus on more than just addressing "new invaders". Simply proposing to "*Treat centers of established invaders*" is not adequate. Likewise, managing to "*reduce the extent and density of established noxious weeds to a point that natural resource damage is within some acceptable limits*" is too vague. In the HCNRA, that limit will be "zero tolerance" for many weed species.

3. Page E.3-574. *Under duties of the proposed Noxious Weed Advisory Board. Identify common inventory and mapping protocols*

The Forest Service notes that there are already national standards for noxious weed inventory and mapping protocols that would need to be employed on NFS lands.

4. Page E.3-575… *suggested management objectives –Early Detection/Prevention—Identify potential invaders and prevent their establishment through regular monitoring and control treatments.*

   The Forest Service suggests that noxious weed spread prevention would include BMPs for all equipment operating in the permit area, such as cleaning them prior to entering NFS lands, if they have been operating in an area of known noxious weeds.

5. Page E.3-576. *Tolerate—Accept the presence of the weed when 1) the species is not inherently invasive, 2) environmental or biological elements keep the populations within acceptable limits, or 3) control is not economically feasible under current technologies.*

   "Economically feasible" is not defined, nor is a method of establishing a threshold of economic infeasibility suggested. That is, economically feasible also needs to be related to the significance and values of resources impacted by the weed species.

   The Forest Service suggests a 5th management priority: Re-vegetate treated noxious weed sites with native species approved by the appropriate land management agency.

6. Page E.3-579. *on rare plant management goals*

   The Forest Service suggests that IPC add a fifth goal of working cooperatively to introduce or reintroduce rare plant species were habitat is appropriate, in order to address conservation plans or recovery plans.

*E.3.3.3.2.2.1. Development and Implementation of Transmission-Line O&M Plan*

1. Page E.3-583. *The Applicant recognized that O&M activities contribute to the spread of noxious weeds along transmission-line service roads and at tower locations. However, because most disturbance factors are interrelated, attributing the cause of noxious weed occurrence and spread to any single factor is difficult, if not impossible. Other factors potentially contributing to the spread of noxious weeds along transmission lines include livestock grazing, wildlife use, use of roadways by recreationists, ranchers, landowners, and land resource agency personnel.*

   The Forest Service agrees that weed spread has many causes and applauds IPC's recognition that O&M activities are one of the contributors. However, IPC's conclusion above is erroneous. Interrelationship does not preclude an understanding of the individual factors.

   Dumas 2002, concluded that O&M activities can propagate the spread of noxious weeds which may negatively impact 38 rare plant occurrences in addition to native

habitats that lie within the service road ROWs. He specifically noted that IPC should adopt protection activities to minimize these impacts *(TR E.3.2-45).*

In their PM&Es, IPC needs to address actions that relate to their contribution to noxious weed spread and reduce the spread of noxious weeds by IPC vehicles traveling across infested terrain, and by transmission line maintenance activities.

2. Page E.3-586. *Implement best management practices for road maintenance*

   The Forest Service is assuming the BMPs are Forest Service BMPs.

3. Page E.3-585. *Noxious Weeds. The Applicant proposes to work cooperatively with state and federal agencies, counties, and other private landowners to control the establishment and spread of noxious weeds. Specifically, the Applicant recommends participating with local WMAs where transmission-line ROW exist. These groups build cooperative relationships between agencies, landowners, land managers, and other interested individuals and organizations needed for effective management of noxious weeds. Specific actions to minimize impacts from Applicant-related O&M activities would include the following:*

   - *Clean vehicles that travel off-road or disturb soil and that are likely to spread noxious weed seeds*
   - *Promptly reseed areas following disturbance to reduce the potential for weed invasion*
   - *Educate and communicate with the Applicant's personnel and contractors regarding noxious weed control*
   - *Implement best management practices for road maintenance*

   The vehicle cleaning statement needs to be expanded to include all vehicles and equipment that work in known noxious weed sites, not just those that are designed to go off road. If equipment is traveling along a road that has known noxious weeds on it, it should be cleaned (washed or by other means), as soon as possible before traveling to un-infested lands whether it goes off road or not. A public education element should be added to the statement regarding education of IPC employees and contractors.

   IPC should enter into a cooperative agreement to develop an access and travel management plant for roads within their permit area.

## Discussion

IPC's display of terrestrial resources issues only identifies issues IPC enumerated in their Formal Consultation Package (FCP). IPC does not include any additional issues or further refinement of issues developed through the efforts of the Terrestrial Resources Working Group (TRWG) over the last four years. The Forest Service in their response to IPC's FCP (May 15, 1997, 8.2 Wildlife, pages VIII-139 through VIII-462) identified 10

primary issues of concern with the continued HCC operation. The DLA only exhibits ICP's issues therefore the discussion on continued project impacts are limited to those issues. The DLA wildlife and botanical sections do not provide a comprehensive discussion nor disclosure of HCC operational impacts on wildlife and botanical species, and their habitats.

As part of the consultation record for the TRWG meetings, the January 18, 2000 TRWG executive summary/meeting record reported IPC's (Frank Edelmann) developing a process for tracking all terrestrial and botanical issues through PM&E development. The matrix was to be arranged by issues, with every issue ever brought up or on the record represented. This was the last reported discussion regarding this process.

The Forest Service recommends that IPC complete the tracking matrix and fully disclose all identified issues to evaluate on-going and continued project impacts, and how IPC will mitigate these impacts. IPC by limiting the issue identification and impact analyzes in the DLA also limits its proposed PM&E measures to mitigate those issues/impacts.

The Forest Service disagrees with IPC's scope of analysis by selection of just two operational scenarios. 18 CFR 4.51 (f) (3) (iv) requires an analysis of "any anticipated continuing impact on fish, wildlife, and botanical resources of the continued operation of the project". IPC did not fully disclose all continued impacts to NFS lands and resources by limiting the scope of their analysis. IPC's analysis only provided descriptions and discussion of proposed project impacts to the reservoir and downstream river **shoreline zones**, and the reservoir **fluctuation zone**. IPC did not analyze the continued project impacts to terrestrial resources within the reservoirs **inundation zone**. Additionally, IPC did not disclose nor analyze the effects of the additional 5 vertical feet drawn down in the reservoir fluctuation zone. The Forest Service maintains that IPC is responsible to disclose all project related impacts to NFS lands and resources due to project operations and reservoir inundation.

IPC in their March 20, 2001 final executive summary to the HCC collaborative team meeting stated, "*The Company is analyzing two operational scenarios, based on continuing to operate the hydroelectric complex and project-related impacts. IPC understands that people would like them to look at additional scenarios, but they are unnecessary for the license application.*" This action by IPC eliminated all further discussion with the stakeholders for proper analysis of projects impacts. Additionally, the March 20, 2001 final executive summary is not in IPC's consultation record.

The Forest Service disagrees with IPC's analysis that the HCC operations have no effect to soil erosion thus riparian habitat on the river reach downstream of Hells Canyon Dam and minimized effects to riparian and terrestrial habitats within the HCC. The Forest Service maintains that IPC is at least partly responsible for degradation of sediment and sediment-dependent resources in Hells Canyon.

**Inconsistencies --** IPC is inconsistent in their analysis of effects by confusing and mixing the "on-going, proposed and full pool run-of-river operational scenarios.

IPC's conclusions regarding proposed project effects to riparian habitat in the reservoirs and the river reach downstream of Hells Canyon Dam are inconsistent. IPC when analyzing the two operational scenarios for project reservoirs concludes that stable water levels would maintain greater soil moisture than daily and seasonal water fluctuations. *(E.3.2-45, page 16 "At the full-pool shoreline of Brownlee Reservoir, run-of-river operations would maintain greater soil moisture throughout the growing season that proposed operations").* Then for the river reach downstream of Hells Canyon Dam IPC argues that daily flow fluctuations (proposed operations) have a beneficial effect to riparian habitat and that stable flows (full pool run-of-river) may increase riparian fragmentation (*E.3.2.4.2.1.1. The Applicant concludes that proposed operations for the Hells Canyon Complex would provide slightly more riparian wildlife habitat in the river shoreline zone downstream of Hells Canyon Dam than would full pool run-of-river operations (Technical Report E.3.2-45). Full pool run-of-river operations would probably increase riparian fragmentation more than proposed operations would (Technical Report E.3.2-45).* IPC states the riparian habitat would increase with the proposed operational scenario (daily flow fluctuations) due to the "irrigation effect." However, IPC then states that water level fluctuation in the river reach downstream of Hells Canyon Dam would impact four riparian dependent T&E plant species.

IPC is inconsistent in disclosing effects to the river reach downstream of Hells Canyon Dam. On one hand, IPC states that the proposed operation would provide slightly more riparian habitat and on the other hand, IPC states that the on-going operations (close to the proposed operations) would impact four riparian dependent T&E plant species because of the water level fluctuations.

IPC is inconsistent in their discussions of impacts to wildlife and botanical resources. IPC conclusions are inconsistent between species and their habitats, and the operational scenarios. IPC periodically addresses some impacts directly but frequently references impact discussions in one or another technical report, rather than systematically integrating report findings into the wildlife and botanical sections of the DLA. These sections need to be constructed better, and more consistently integrate the potential impacts to wildlife and botanical resources from a comprehensive analysis than just the two operational scenarios.

**Adequacy of Analysis --** The construction of the HCC has contributed to the large-scale trend of sediment trapping in upstream reservoirs. IPC's analyses of sediment supply and transport do not fully address the effects of current and proposed operations on sediment and sediment-dependent resources in Hells Canyon (Kendall, 2002). Additionally, IPC failed to address the Forest Service requests to analyze the on-going continued project impacts from reservoir inundation on terrestrial resources for the new license term.

Based on IPC's analysis, it appears that the HCC operations have no effect to soil erosion thus riparian habitat on the river reach downstream of Hells Canyon Dam and minimized effects to terrestrial habitats within the HCC.

The Forest Service concludes that IPC did not provide a comprehensive analysis of on-going continued project impacts to:

- Inundated upland and riparian habitats for TES species in HC reservoir
- Shoreline erosion of riparian habitats and TES species in the river reach downstream of Hells Canyon Dam
- TES species
- Noxious weed infestation, and
- Upland and riparian habitats, and TES species in IPC's ROW for project transmission lines

IPC's T&E, candidate, and sensitive species, and habitat analysis and conclusions are inadequate and misleading, claiming no or minimal impacts due to HCC continued operations. The Forest Service suggests that IPC revisit their analysis and conclusions regarding species and their habitats in Hells Canyon.

The Forest Service does not agree with the "irrigation effect" scenario proposed by Blair 2002, and reiterated by IPC. The Forest Service finds it to be without adequate rationale or citation and not supported by recent literature on the subject. Elmore, personal communication 2002, indicated that the "irrigation effect" scenario is not based on any known ecological theory and is wholly unsubstantiated. Irrigation of riparian vegetation would not occur in a system where the substrate is of coarse material. Without fine substrates (silt and clay) the coarse material doesn't provide any water retention ability. In a sediment hungry system, daily and hourly water fluctuations with high ramping rates continue to armor the substrate and prevent the establishment of diverse riparian communities.

IPC misrepresents the use of "scouring and high and dry". The Forest Service maintains that there would be several zones of riparian vegetation inhabiting sandbar and terrace zones. Under stable flow conditions, these areas would support a diverse set of habitats and species.

**Impacts and effects on NFS Lands and Resources --** The Forest Service maintains that HCC is largely responsible for degradation of sediment and sediment-dependent resources in Hells Canyon. The Forest Service also maintains that IPC is responsible to disclose all continuing project impacts to NFS lands and resources due to project reservoir inundation.

Under IPC's proposed operational regime, project generated flows and flow fluctuations will continue to affect water quality, erosion of alluvial and fluvial features, spawning and rearing substrate, riparian communities, and affect other riparian, terrestrial, botanical, and aquatic habitat components within and downstream of the HCC.

When historic flows are compared to post dam flows in Hells Canyon, differences in the magnitude or frequency of the peak flow is limited. Current peak flows are believed to taper off more rapidly than historic flows due to reservoir storage. Daily

and hourly flow fluctuations are greater than was found under the prior dam hydrographs.

Habitat for riparian and aquatic plant and animal species is being lost because of changes in seasonal flow patterns and lack of sediment. Current operations appear to be exacerbating the situation because of rapid and frequent fluctuations in water level.

## Preliminary Forest Service Objectives

The Land and Resource Management Plans for the Payette and the Wallowa-Whitman National Forests have standards and guidelines that require the Forests to protect and manage habitat for the recovery and maintenance of viable and diverse habitat and populations of aquatic, terrestrial, and riparian dependent species. These standards and guidelines include requirements for the perpetuation and recovery of plants and animals that are listed as threatened or endangered by the USFWS or NFMS under the ESA and sensitive by Forest Service Regions 4 and 6. These diverse habitats and populations are to be well distributed across the Forest.

The Forest Service, based on applicable management direction, developed objectives for terrestrial (wildlife and botanical) resources.

- Manage T&E, Regional Forester Sensitive, Management Indicator Species, and their habitats for compliance with Federal laws, regulations and polices.
- Maintain and restore quality steppe/shrub habitat (crucial winter range) for mule deer, bighorn sheep, rocky mountain elk, and other dependent species to reduce the effects from the on-going continued impacts of inundation on steppe shrub habitats.
- Maintain and restore native riparian plant communities along the reservoir edge and river reach downstream of Hells Canyon Dam allowing riparian dependent species to re-colonize habitats to more fully obtain ecosystem function that can provide long-term integrity and productivity of biological communities.
- Manage forest system roads, lands and resources to meet applicable LRMP resource goals & objectives, and standards & guidelines while permitting IPC right-of-way for transmission lines. Resources include but are not limited to system roads; streams and associated riparian habitat; TES, MIS, big game and raptors species and habitat management, and noxious weed management.
- Maintain and restore plant communities composed of the desired native and non-native species, structure and composition that minimize noxious weed spread and introductions. Existing noxious weed populations will be treated and eradicated where possible and prevented from further spread when eradication is not imminent.

## Forest Service Response to Applicant' Proposed PM&E Measures

This section provides the Forest Service response to IPC's proposed PM&E measures for both wildlife and botanical resources based on Forest Service identified issues.

**Forest Service Issue #1:** What are the continued project effects (reservoir and habitat loss) on Forest Service wildlife and botanical resources? Ex: loss of low elevation winter range.

**Forest Service Issue #2:** What are the continued project effects of water level fluctuations on riparian habitats adjacent to project reservoirs and to the river downstream?

**Forest Service Issue #4:** What are the continued project effects on the lack or loss of quality riparian habitats? Inundation from project reservoirs and ramping rates associated with the river downstream.

**Forest Service Issue #5:** What are the continued project effects on habitat fragmentation?

*E.3.2.3.2.1.1.*

Pages E.3-412-414. *"…the Applicant concludes that proposed operations of the HCC would impact 6,148 acres (388 acres riparian and 5,761 acres upland habitat) of wildlife habitat in the reservoir fluctuation zone…"*

*"…the Applicant concludes that the proposed operations would preclude 343 acre of riparian habitat in the shoreline zones of Brownlee Reservoir currently occupied by upland habitat."*

*"…the Applicant proposes to mitigate for 90 acres of reservoir and river shoreline that has eroded, possibly because of HCC operations." "ID for shoreline zones downstream of HC dam: provides 6 acres of riparian habitat and 84 acres along all reservoir reaches." (E.3-413 and E.3-572).*

*"An estimated 582 acres of habitat…prevented from establishing in the fluctuation zone of Brownlee Reservoir…"*

*"…16,418 acres of habitat would be required to mitigate for impacts to winter range of mule deer."*

*"The goal of this measure is to acquire, enhance, and manage 23,581 acres…"*

*"The wildlife management plan would be developed cooperatively with natural resource agencies…"*

*E.3.2.3.2.1.4.*

Page E.3-424. *Mgmt of wildlife resource on applicant owned lands (3,450 acres of fee title lands) (1,850 acres would not be part of pkg., known as non-project lands). $145K annually, totaling $4.37MM for 30 yrs.*

*"…enhance riparian and upland habitat on the 4 islands purchased per Article 37-current license, for waterfowl and T&E, candidate, and special status species."*

The Forest Service, as previously detailed, maintains that IPC did not fully disclose all of the on-going continued impacts to NFS lands and terrestrial resources from project operations. Because IPC's analysis did not fully disclose all of the project impacts IPC's presentation of mitigation measures are insufficient to mitigate all on-going continuing projects impacts. However, the Forest Service applauds IPC's efforts to provide mitigation for the area of analysis they conducted.

The Forest Service maintains that it is IPC's responsibility to mitigate all on-going continued impacts to NFS lands and terrestrial resources adjacent to HC Reservoir for the inundation zone as well as the shoreline and fluctuation zones, the river reach downstream of Hells Canyon Dam, and to NFS land adjacent to and within IPC's right-of-way for project transmission lines.

Upland habitats inundated by the HC Reservoir will not be available for the next license term for those species that depend on them. IPC identified upland habitats immediately adjacent to HC Reservoir as crucial winter range for mule deer. Therefore, the upland habitats inundated by HC Reservoir was crucial winter range for mule deer and most likely other big game species. To determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where upland habitats are of equal (crucial winter range) value and a 2:1 replacement ratio where the upland habitat is of lesser quality (winter range zone).

Likewise, riverine riparian habitats that have been inundated by the HC Reservoir will not be available as habitat for the next license term. Those riparian zones had the ability to provide high quality habitat for riparian dependent and associated species, including flora and fauna T&E species. With the continued operations of the HCC, acquisition of high quality riverine riparian habitats is questionable. Therefore, to determine mitigation needs, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where riparian habitats are of equal high quality value and a 2:1 replacement ratio where the riparian habitat is of lesser quality.

Both upland and riparian rare plant species lost potential habitat (likely, unknown occurrences were also lost) with the creation of the HCC, its reservoirs, and the decline in down river conditions for these species. Proposed acquisition and management of land should include potential habitat for the following rare plant species: *Mirabilis macfarlanei, Silene spaldingii, Leptodactylon pungens* ssp *hazeliae, Mimulus clivicola, Pentagramma triangularis*, and the riparian related (including moist cliffs) *Bolandra*

*oregana, Carex backii, Carex hystericina, Carex interior, Cyperus rivularis, Cyperus schweinitzii Epipactus gigantea, Mimulus hymenophylus, Mimulus patulus, Rubus bartonianus,* and *Teucrium canadense* var. *occidentale.*

Likewise, the following rare habitats should also be addressed: Sand Dropseed communities, Giant Wildrye plant communities, wet cliff communities, river beach communities, spring and seep communities, Coyote willow communities, White Alder/mixed shrub communities, and Black Cottonwood- White Alder/mixed shrub communities.

To meet NFS land and resource management direction, acquisition of upland and riparian habitats will be on-site or immediately adjacent to the HC Reservoir. Acquisition acreage will be commensurate with the level of impact to NFS lands.

The Forest Service does not agree with IPC regarding mitigation for downstream riparian habitats. The Forest Service contends that more riparian habitat would have been present given the higher amounts of sediment beaches. The Forest Service maintains that the Snake River downstream from Hells Canyon Dam is "sediment hungry" because the supply of material from upstream sources has been interrupted and trapped by the HCC reservoirs. As stated previously, that sediment provides the necessary substrate for riparian vegetation to establish and propagate. The Forest Service concludes that riparian vegetation has been limited in the river reach downstream of Hells Canyon Dam by the lack of sediment recruitment and IPC's daily flow fluctuation. Therefore, as mitigation, the Forest Service recommends that IPC use a 1:1 habitat replacement ratio where riparian habitats are of equal high quality value and a 2:1 replacement ratio where the riparian habitat is of lesser quality. Acquisition of lands for riparian habitat mitigation in the river reach downstream of Hells Canyon Dam will be as close to on-site as possible.

The Forest Service notes IPC's acquisition of four Snake River islands and their proposed PM&E measure to enhance associated habitats on these islands. However, IPC does not address the combined loss of all riverine islands in their discussion of project impacts. These islands were important refugia for both flora and fauna species and their habitats. Blair 2001, indicates through aerial photo analysis that numerous islands were inundated by Hells Canyon Reservoir. The Forest Service recommends that IPC analyze what the effect of the on-going continued loss of the unique habitats represents to NFS lands and resources.

The Forest Service will also expect IPC to manage, enhance, and provide O&M for all acquired habitats for the term of the new license.

**Forest Service Issue #3:** What are the continued project effects to riparian habitat when changing from a free-flowing river to large slack-water reservoir?

IPC did not evaluate this issue in the DLA even though Blair 2002 provided a discussion on the effects of converting a free-flowing river to large slack-water reservoirs. IPC did not specifically provide a PM&E measure to address this issue. However, if IPC

provides mitigation for all affected zones (shoreline, fluctuation and inundation zones for the HCC reservoir, and the shoreline and fluctuation zones on the Snake River downstream of Hells Canyon Dam), Forest Service objectives for riparian habitat will be met.

**Forest Service Issue #6:** What are the effects of transmission-lines on wildlife, e.g., electrocutions and collisions by raptors and other bird species?

*E.3.2.3.2.2. Transmission Lines and Associated Service Roads*

Page E.3-430. *One new measure is associated with transmission lines of the Hells Canyon Complex: development and implementation of a transmission-line O&M plan. This measure is primarily a management program action with cooperative project components; it requires no acquisition of land.*

*E.3.3.3.2.2. Transmission Lines and Associated Service Roads*

Page E.3-581. *One new measure for botanical resources …"*

The Forest Service, in meetings with IPC, reviewed and commented on IPC's draft O&M plan for project transmission lines (Dumas 2002). The Forest Service recommends the plan to address communication and coordination between IPC and the Forest Service to implement, monitor and adapt all aquatic and terrestrial resource specific restoration, protection, and management strategies associated with the transmission lines. IPC, at a minimum should include the following sections in the O&M plan for the transmission lines:

1. Communications between interested parties,
2. Project Notification, Review and Approval procedures,
3. Environmental Protection Measures including but not limited to:
    a) Imnaha Wild and Scenic River;
    b) Riparian Habitat Restoration and Management;
    c) Culturally Significant Plant Habitat Restoration and Management;
    d) Vegetation Management;
    e) Erosion Control;
    f) Travel and Access Management;
    g) Exotic and Invasive Vegetation Management, including re-vegetation with native species;
    h) Protection of Threatened, Endangered, Proposed for Listing and Sensitive Plant and Animal Species Restoration and Management;
    i) Fire Protection;
    j) Cultural Resource Protection;
    k) Aesthetic Resource Protection;
    l) Avian Collision and Electrocution Hazards; and
    m) Aquatic and Terrestrial Resource-Specific Monitoring Plans and Schedules (including implementation and effectiveness monitoring).

Additional sections or components for inclusion in the O&M plan may be identified in consultation and coordination with the Forest Service.

IPC needs to consolidate all resource (wildlife, botanical, cultural, recreation) PM&E measures associated with the transmission line into one PM&E and display that PM&E in one location in the FLA.

**Forest Service Issue #7:** What are the continued project effects on the spread of noxious weeds?

*E.3.3.3.2.1.2. Cooperative Noxious Weed Control, Site Monitoring, and Reseeding*

*Page E.3-573.*

The Forest Service concurs with the conclusion that ongoing continued operations can still contribute to the spread of noxious weeds along the reservoir and downriver reaches. As such, the Forest Service recommends IPC participate in the prevention, suppression and containment of noxious weed plants. IPC should at a minimum identify and implement the following activities on NFS lands associated with river margin, project-related roads, campgrounds and trails:

- Inventory and map noxious weed presence, distribution, and density. The initial inventory will be completed within one year of issuance of the new license, and annually through out the length of the license or as defined by the agencies.
- Inventory and map noxious weed response to major landscape events, such as wild fire and large scale floods.
- Develop and implement a monitoring program for noxious weeds that includes evaluating the effectiveness of prevention, control, and eradication measures.
- Annually inventory, map changes and eradicate small existing populations and new introductions of noxious weeds.
- Control, suppress, and contain large-scale infestations of noxious weeds, especially those that overlap different ownerships or responsibilities.
- Maintain native plant composition and re-vegetate weed infested and disturbed sites with native species.
- Prevent invasion of new invaders by limiting weed dispersal, minimizing soil disturbances, and properly managing desirable vegetation.
- Complete all necessary NEPA environmental analyses and comply with existing NEPA and the Record of Decision for Managing Competing and Unwanted Vegetation (USDA Forest Service 1988, as amended in 1992a). Prior to any noxious weed control activities on NFS lands, the licensee should obtain approval from the Forest Service.
- Collaborate with the Forest Service to ensure that exotic and invasive vegetation objectives are met across administrative boundaries.

**Forest Service Issue #8:** What are the effects of the reduction or elimination of the loss of anadromous fish link in the wildlife food chain as large nutrient base?

*E.3.1.3.2.1.5. Anadromous Carcass Outplants*

*The Applicant proposes to distribute carcasses within known bull trout rearing areas in the Pine–Indian–Wildhorse core area to enhance the forage base available to rearing salmonids.*

The Forest Service notes that IPC provides a limited PM&E measure to distribute carcasses in several streams to enhance the forage base for rearing salmonids. This measure will most likely provide limited benefits to the wildlife food chain. The Forest Service maintains that IPC did not directly address the issue regarding project effects on the reduction or elimination of the anadromous fish link to the wildlife food chain. Therefore the Forest Service contends that IPC needs to analyze this issue.

**Forest Service Issue #9:** How is the continued project operation contributing to the loss of, or reduction in, some microhabitats from dewatering and flooding?

IPC did not address nor did they propose any mitigation in response to this Forest Service issue. However, IPC did study benthic macroinvertebrate and found that the 17.2 miles below the Hells Canyon Dam had a depressed population of macroinvertebrates that is probably caused by low oxygen levels during the summer months. Therefore the Forest Service maintains that this data supports its position that water quality must be improved both within and below the HCC.

**Forest Service Issue #10**: How will the continued project operations and potential increase in recreational activities affect PETS species and other wildlife resources?

*E.3.2.3.2.1.1.*

Page E.3-413. *"…the 343 acres of riparian habitat would constitute mitigation for habitats of T&E, candidate, and special status species that would be affected by proposed operations of HCC (Tech Report E.3.2-45).*

IPC's analysis of proposed project impacts to T&E, candidate and special status species are limited to IPC's two operational scenarios. These scenarios only address the reservoir and downstream river shoreline zone, and the reservoir fluctuation zone. The analysis does not address the continued loss of these species habitats by project reservoirs inundated nor does it adequately address the cause and effect of the on-going continued project operations on these species. Therefore, the Forest Service contends that IPC's proposed acquisition of 343 acres of riparian habitat for T&E, candidate, and special status species is inadequate. Until an adequate analysis is supplied for actual cause and effect to these species, the Forest Service will base its mitigation on estimates of needed habitat.

IPC claims no impact to nesting or roosting habitat for Bald Eagles based on their two operational scenarios. Yet, with the inundation of 56 miles the Snake River, numerous suitable nesting and roosting trees were lost (Blair 2001). Importantly, current literature describes suitable nesting and roosting trees necessary for the species life history, therefore the remaining individual and stands of trees must be protected and managed for the eagle. IPC must at a minimum, adhere to the Bald Eagle Recovery Strategy (USDI, 1986) habitat requirements.

Both upland and riparian rare plant species lost potential habitat (likely, unknown occurrences were also lost) with the creation of the HCC (including transmission line ROWs), its reservoirs, and the resultant decline in down river conditions for these species. Proposed acquisition and management of land should include potential habitat for the following rare plant species: *Mirabilis macfarlanei, Silene spaldingii, Leptodactylon pungens* ssp *hazeliae, Mimulus clivicola, Pentagramma triangularis,* and the riparian related (including moist cliffs) *Bolandra oregana, Carex backii, Carex hystericina, Carex interior, Cyperus rivularis, Cyperus schweinitzii Epipactus gigantea, Mimulus hymenophylus, Mimulus patulus, Rubus bartonianus,* and *Teucrium canadense* var. *occidentale,*.

Likewise, the following rare habitats should also be addressed: Sand Dropseed communities, Giant Wildrye plant communities, wet cliff communities, river beach communities, spring and seep communities, Coyote willow communities, White Alder/mixed shrub communities, and Black Cottonwood- White Alder/mixed shrub communities.

## **Additional Study Requests --** None

# Recreation

## General Discussion

Hells Canyon is a very unique and incredible place to experience. The environment experienced in the canyon is a result of the culmination of systems in a very dramatic geological environment. The remnants of the history of mankind and the ongoing human experience add to the sense of place in Hells Canyon. The aesthetics and the recreation experience are created by all of these biological and physical systems. The effects to these systems are or will eventually be reflected by the aesthetic quality. Scenic and ecological integrity is rated to determine how negative attributes are affecting the aesthetic quality. Recreation and aesthetics cannot be separated from one another, and this report considers the aspects of both resources.

Congress designated this area as the Hells Canyon National Recreation Area (Public Law 94-199 (1975) to assure that the natural beauty, and historical and archeological values of the Hells Canyon Area and the 71 mile segment of the Snake River between the Hells Canyon Dam and the Oregon-Washington border, together with portions of certain of its tributaries and adjacent lands are preserved for this and future generations, and that the recreational and ecological values and public enjoyment of the area are thereby enhanced.

In addition, this act that established the Hells Canyon National Recreation Area (HCNRA), amended the Wild and Scenic Rivers Act (PL 90-542) to include the National Forest portions of the Snake River in the National Wild and Scenic Rivers System. The Act designated 71.5 miles of the Snake River as wild and scenic.

IPC operations affect the aesthetic quality and recreation experience of Hells Canyon and other NFS lands within the HCC. The river system and the elements of hydrology, geomorphology, and sediment transport are critical to the essence of the canyon. IPC operations manipulate this system and its elements for the purpose of generating hydroelectric power. There are other manipulations of the system mandated by the Army Corp of Engineers.

IPC has not fully recognized nor addressed the effects of the HCC as it operates currently, nor has IPC fully explored the alternatives that could lessen or even reverse some of the effects caused by HCC operations. The value of the canyon and the HCNRA was recognized by the Congress, and its attributes are of extreme importance to the Forest Service and to people who value and enjoy NFS lands.

It is clear from the Draft License Application (DLA) and technical reports that IPC has done many studies to determine effects of operations on and the preferences of recreating publics. However, many findings from those studies have not been addressed by IPC. From sediment impacts to complaints from boaters and floaters about daily river level fluctuations, the study results have not altered the proposed operations scenario in any significant manner, nor have these results motivated IPC to analyze other flow scenarios that would address recreation-related resource issues.

Therefore, the Forest Service maintains that the proposed operations and the proposed PM&Es will not effectively address the effects of the HCC to the canyon and that the DLA does not propose PM&E measures below Hells canyon Dam to protect or enhance the resources that make Hells Canyon so unique. Based on what IPC has proposed, the Outstandingly Remarkable Values (ORVs) of this Wild and Scenic River will not be protected or enhanced, the landscape character would not be maintained, scenic and ecological integrity would not be maintained and the recreational experience would continue to be degraded.

The recreation technical reports are generally well formulated and included much pertinent information. IPC used the years 1994-1998 on site surveys and 2000 on site and mail surveys as the major pool of information for technical reports. Many of the study findings cite the overall and distinct downward trend in recreation during the survey time period. The major reasons for the trend are well documented and include the dramatic drop in angling success and the major change in reservoir level drawdowns that started in the early 1990's.

The Forest Service maintains that the downward trend that occurred during the study years needs to be considered in proper perspective. Although a general downward trend is apparent within the limited survey time period, the overall longer term and continuing trend in the Hells Canyon area is increased recreation use (See study E.5-1). Since use was very high in the early survey years due to the good fishing, it effectively established an elevated baseline standard to compare other years to. Even though the overall recreation use trend during the survey years was downward, the increasing use trend in non-angling miscellaneous categories on the Hells Canyon Reservoir and at the Hells Canyon tailwater area is an important consideration that needs to be monitored and addressed in the PM&E's.

A common Forest Service concern in the review of the recreation technical reports and the DLA was the lack of discussion and explanation on how the study conclusions and findings shaped IPC's version of PM&E's. The PM&E descriptions in the DLA similarly lacked detailed discussion. The justification, description, implementation schedules and cost estimate sections lacked specificity which made it difficult for us to determine the adequacy of the measure. The justification section of many PM&E's includes a very brief explanation statement and then a note to see the pertinent technical reports. But when we review the cited technical reports there is not an adequate connection made between the report summaries and conclusions and the PM&E justification. A notable exception was Technical Report E.5-9. The authors put an "HCC Findings" section near the front of the report, and also included some specific management recommendations in the summary, conclusions and major findings sections.

The cost estimate sections of the PM&E's do not address IPC's financial obligations in a way that accommodates current and future need nor changes in actual experienced costs. IPC's financial obligations for future PM&E work and for future undetermined costs (e.g., a new facility development needs identified in the Adaptive Management Plan for

license year 20) are not adequately addressed. IPC needs to address how inflation will be indexed over the term of the new license to account for increases in costs.

IPC does not propose any PM&Es for any portions of the HCC below Hells Canyon Dam. The ORVs of the Wild section of the Snake River are the scenic, recreational, geological, wildlife, fisheries, cultural, botanical, and ecological resources. The Forest Service maintains that the proposed operations and the continuing effects of sediment impoundment and daily river level fluctuations may have impacted six of the seven resources to a degree that negatively affects the scenic and ecological integrity of Hells Canyon. (See Sediment discussion section, page 8). The Forest Service is concerned that impacts have occurred and will continue to occur, thus endangering those ORVs recognized by the wild river designation. It is clear that IPC has a responsibility to participate in the preservation of the ORVs' of the Wild and Scenic Snake River.

The Forest Service recommends more discussion on the rationale and background for the PM&E measures. The Recreation and Aesthetics Resource Workgroup (RARWG) developed a long list of potential PM&E's. There is no discussion in the DLA of this potential PM&E process and no explanation for why IPC chose to carry forward the ones that were presented.

The Forest Service recommends an additional section in the DLA that discusses and explains the role and accomplishments of the RARWG. If the work done in the workgroup was a major driver in IPC's formulation of the DLA, then it should merit more detailed discussion. The discussion should include the workgroup's detailed potential PM&E list, how IPC made it's PM&E choices from that list, and how IPC proposes to address the potential PM&E's that were not selected. .

## Comments Specific to the Draft License Application

Quotations or sections taken directly from IPC's draft license application are shown in italics.

### Exhibit B. Statement of Project Operation and Resource Utilization

*B.3.1 Hells Canyon Plant Operations*

1. Page B-13, B.3.1. *The Applicant proposes a minimum flow of 5,000 cfs and a ramp rate limit of one foot an hour measured at Johnson Bar, located about 18 river miles downstream of Hells Canyon Dam.*

   A proposed minimum flow of 5,000 cfs is inadequate for minimal navigation needs. Study E.5-7, River Level Issues in the Hells Canyon National Recreation Area, concluded that floaters and boaters defined minimum navigable flows similarly: "*Most floaters and powerboaters define the lowest navigable flows at similar levels (about 5,000 to 7,000 cfs)*" and "*however, many boats in Hells Canyon are much larger than 24 feet and likely to have difficulty in any of the segments upstream of the*

*Salmon River at levels below 6,000 cfs*", (E.5-7, 4.4.2, paragraph 4, page 34). Based on the outcome of the additional studies IPC needs to analyze the effects of the proposed minimum flow levels on resources on NFS lands.

2. Pg. 134, B.3.1.2.*Under normal hydrologic conditions, flows through Hells Canyon Powerhouse are ramped up in the morning, concurrent with the ramping up of flows at the Brownlee and Oxbow powerhouses, to follow the regional electrical load and ramped down late in the evening to retain as much inflow as possible to use for generating electricity during heavy load periods. Existing and proposed operating restrictions limit the extent and speed of flow changes through the Hells Canyon Powerhouse.*

   Study E.5-7, River Level Issues in the Hells Canyon National Recreation Area, concluded that daily ramping or daily fluctuation is of high concern for boaters and floaters. "When asked about fluctuation effects on overall experience quality, about 93% of floaters and 84% of power boaters report fluctuation problems (43% of floaters and 54% of power boaters reported they are major problems)" E.5-7, 4.5.2, Page 41. The current limitation of daily fluctuation is 1 foot per hour measured at the Johnson Bar gauge. Under current limitations daily fluctuations are negatively impacting the recreation experience for over 80% of the users. Study E. 5-7 also concluded that: *"Majorities of floaters (59%) and power boaters (69% agree that some level of fluctuation is acceptable, as long as it is less that 5,000 cfs per day." (E.5-7, 4.5.2, Page 43).* A daily maximum fluctuation that is representative of the user preferences should be maintained, at least during the primary boating season. PM&E measures should be developed to address this need.

*B.3.2.2. Hells Canyon Reservoir Operation Curves:*

1. Page B-16, B.3.2.2. *Currently, and for proposed operations, the elevation of Hells Canyon Reservoir is cycled daily within a 5 vertical-foot operating range to manage load-following flows through the Brownlee, Oxbow, and Hells Canyon power plants. However, under certain load conditions, and maintenance and construction activities, the Applicant proposes to use up to an additional 5 vertical feet to meet power demands.*

   The current elevation cycle of 5 ft. maximum vertical change daily should not be exceeded. An additional 5 ft. of vertical change would negatively impact recreation uses, particularly access to the shoreline and on water recreation. Study E.5-6, Reservoir Level Issues in the Hells Canyon Complex, concluded that daily level changes can significantly impact recreation: "Daily changes at Hells Canyon and Oxbow can leave boats stranded" (E.5-6, 4.1.2, 4$^{th}$ paragraph on pg. 27) and "Specific level issues appear related to a variety of other issues, including effects on fishing, use of boat ramps, access to parts of the reservoirs, problems with boats being stranded (Hells Canyon and Oxbow only) (E.5-6, 5. Summary and Conclusions, 6$^{th}$ paragraph on pg. 51). IPC proposes this operational change in order to meet power demands, but no analysis of this proposal on any of the resources is presented in the DLA.

**Exhibit E.5. Report on Recreational Resources**

*E.5.1.1.7. Idaho Trails:*

1. Page E.5-6, E.5.1.1.7. *Designated Campsites—The USFS has identified more than 100 distinct camping areas within the HCNRA. These sites are scattered throughout the Snake River corridor. For details about these campsites and other sites, see Technical Report E.5-9.*

   This paragraph does not appear to belong in this section, but should be in 5.1.1.4, Forest Service Sites and Trails in the HCNRA.

*E.5.1.2.1 U.S. Forest Service Facilities and Opportunities:*

1. Page E.5-9, E.5.1.2.1 *The USFS (Payette Ranger District) is currently evaluating potential recreational enhancements for Big Bar.*

   "Payette Ranger District" should read "Payette National Forest" (Refer to E.5.4.4.2.2.3, Development of Site Plan for Big Bar Recreation Site, page 189 of this document.)

*E.5.2.1.2.2.1 Zone 1, Subzone HC:*

1. Page E.5-31. *Bank angling was the activity most often observed in the cold season during three of the four years measured (the exception being 1995). Cold-season anglers usually targeted steelhead. Many of these anglers used stairs on the Idaho side, which lead from the top of Hells Canyon Dam down to the confluence of Deep Creek with the Snake River. Miscellaneous activities, mainly related to sightseeing and boat loading and unloading, varied from 3,939 hours during 1994 to 8,761 hours during 1995 (Figure E.5-21). During the warm season, bank angling remained an important part of overall use, but hours of bank angling were consistently lower than total hours for cold-season angling and much lower than the hours for the miscellaneous category (Figure E.5-22). Without steelhead as a target, bank anglers usually target trout and smallmouth bass. Warm-season use in the miscellaneous category varied from a high of 34,416 hours in 2000 to a low of 18,891 hours in 1995 (55% of the 2000 total). This category during the warm season consisted mainly of sightseers and boaters. The contribution of sightseers to the overall number of hours was relatively constant, whereas hours for boaters loading and unloading at the ramp varied considerably each year, depending on the flows in the Snake River and the availability of flows at other similar areas (Technical Report E.5-7).*

   This entire text appears to be located in the wrong section. The discussion and Figures cited are applicable to subzone HT, not HC.

*E.5.2.1.2.2.1 Zone 1, Subzone HT:*

1. Page E.5-31. *Warm-season use in the miscellaneous category varied from a high of 34,416 hours in 2000 to a low of 18,891 hours in 1995 (55% of the 2000 total). This category during the warm season consisted mainly of sightseers and boaters.*

   Note the above quote appears to be incorrectly located under section "subzone HC". It is actually the description for subzone HT.

   The Forest Service points out the finding that warm season recreation use in the miscellaneous category in subzone HT increased by 45% between 1995 and 2000. The Forest Service maintains that a definite connection between use in subzone HT and subzone HC needs to be highlighted and considered. Although sightseeing was recorded as a major component of the miscellaneous category of use in subzone HT, it is actually the sightseeing qualities as seen from the Hells Canyon Road, along the entirety of subzones HC and HT, that contributes to visitor enjoyment. Because of this linkage, the Forest Service maintains the increase in the miscellaneous category of use recorded in subzone HT is also occurring in subzone HC.

   Sightseeing, wildlife viewing and driving for pleasure is a motorized recreational use that is not adequately surveyed by the methods used by IPC. The drive along the Hells Canyon Reservoir is popular, particularly in the warm season. The destination for many is the Hells Canyon Creek Launch Site. Users do not necessarily stop at any of the sites along the reservoir, so they, more than likely, were not interviewed by surveyors. If survey methods used did not adequately sample this use category, then the Forest Service requests that this be measured, monitored and incorporated into the recreational use summaries and conclusions. Traffic counters recently installed by Idaho Power at major HCC entry points will provide data to establish total use trends. Perhaps the counter information, coupled with on-site survey information related to sightseeing and wildlife viewing, could be used to estimate use levels and trends in this recreation activity.

   Study E.5-4 found that "Among the three reservoirs, higher percentages of users at Brownlee and Oxbow reservoirs fish, while higher percentages of Hells Canyon Reservoir users engage in other activities, particularly camping, sightseeing, wildlife viewing, and swimming." (*E.5-4, 5.2.5.2, 2nd paragraph on page 33*). This finding is important in terms of management direction in the HCC, and on Hells Canyon Reservoir in particular. Although fishing is still a favorite activity, recreation users on Hells Canyon Reservoir are there for more reasons than just to fish. Planning for future site development needs to consider and accommodate these preferences for non-fishing activities.

*E.5.2.1.2.2.1 Zone 1, Subzone HC:*

1. Page E.5-32. *Warm-season recreational use in subzone HC increased from 37,104 hours during 1994 to 76,939 hours in 1996 (an increase of 207%), but use then*

*decreased to 37,480 hours in 2000, an amount almost identical to the 1994 level. Possibly, some of the people who were frustrated with the changes in access and with angling success in Brownlee Reservoir came to this area hoping for better angling results.*

Most of the recorded decrease in use in 2000 (back to the levels of use recorded in 1994) was due to less fishing activity. Study E.5-2 found that "Use in this area peaked in 1996 and then returned to about the same level of use in 1998 and 2000 as in 1994. Increased angling, especially boat angling, was responsible for a majority of the increase." (E.5-2, section 6, page 61, paragraph 6 and Figure 35, page 199). Although the trend in overall recreational use and in boat angling use is as stated, the use in the "lounging" category, recorded in study E.5-2, needs to be highlighted. This category increased (between 1994 and 1997) by a higher proportional amount than angling, and unlike angling, the lounging category did not drop significantly in the years following the 1997 peak. In 2000 it remained as a large component of the overall recreational use in subzone HC. This result demonstrates that most recreational use in subzone HC is not directly angling related, but is based on other reservoir related recreational opportunities such as camping, lounging, pleasure boating, and sightseeing. Also, the downward trend in recreational use is not nearly as prevalent in this subzone as it is in the overall HCC. This finding, along with the related findings that subzone HT is experiencing a 45% increase in use in the miscellaneous category, and that higher percentages of Hells Canyon Reservoir users engage in activities other than fishing (Study E.5-4), is very significant. The DLA needs to include PM&E measures that adequately address these findings and accommodate short and long-term needs during the new license period.

*E.5.2.2.3.2.5. Reservoir Level Comments:*

1. Page E.5-55 and 56. *Among all reservoir users, about 14% of all comments pertained to water operations and reservoir level issues. The only categories with more comments were general comments (26%) (Table E.5-18) and facility development comments (28%) (Table E.5-20). These data suggest that reservoir levels are among users' most important recreation issues.*

   *The most often mentioned subcategories for Hells Canyon and Oxbow reservoirs were "stop fluctuations" (33% and 42%, respectively),*

   The current Hells Canyon and Oxbow reservoir elevation cycle of 5 feet maximum vertical change daily should not be exceeded. The proposed additional 5 feet of vertical change would negatively impact recreation uses, particularly access to the shoreline and on water recreation. Study E.5-6, Reservoir Level Issues in the Hells Canyon Complex, concluded that daily level changes can significantly impact recreation: *"Daily changes at Hells Canyon and Oxbow can leave boats stranded" (E.5-6, 4.1.2, 4th paragraph on pg. 27)* and *"Specific level issues appear related to a variety of other issues, including effects on fishing, use of boat ramps, access to parts of the reservoirs, problems with boats being stranded (Hells Canyon and Oxbow*

*only) (E.5-6, 5. Summary and Conclusions, 6th paragraph on pg. 51).* Study findings also indicate that since 1982 the fluctuations have rarely been over 5 feet (especially on Hells Canyon Reservoir), with a majority of the daily fluctuation being under 3 feet. Throughout the DLA, IPC has mentioned an additional 5 feet drawdown in Hells Canyon and Oxbow reservoirs, however, IPC has not analyzed the effects of the additional drawdown on NFS lands and resources. This needs to be addressed in the FLA.

*E.5.2.2.3.2.6. Access Comments:*

1. Page E.5-58. *Hells Canyon and Oxbow reservoir users showed interest in improved or additional docks or moorings (29% and 19%, respectively).*

   This finding along with the findings concerning impacts of a fluctuating reservoir level, suggest that moderate improvements and additions to the boat mooring and dock facilities could greatly benefit recreation. Additional facilities could help alleviate the boat stranding problem noted in Study E.5-6. PM&E measures should adequately address this need.

*E.5.2.2.3.2.7. Visitor Impacts Comments:*

1. Page E.5-59. *Litter was the most important issue for users who commented on visitor impacts. About 24% of these comments were general litter criticisms, 9% were about improving litter pick-up or maintenance, and 11% were calls for improved litter enforcement*"

   *The second most common visitor impact comments were associated with crowding (24% of all comments), particularly at Hells Canyon Dam tailwater area (56%), Hells Canyon Reservoir (36%), and Oxbow Reservoir (30%). In contrast, only 13% of visitor impact comments at Brownlee Reservoir were about crowding.*

   A related finding in study E.5-9 states: *"A second general tendency concerns litter and human waste. Both of these impacts appear to be major problems, at least in the HCC. All but 2 sites had some trash present, and more than 50% had evidence of human waste. These elements are known to have a particularly great impact on visitor experiences and should be addressed." (E.5-9, 6.1, 3rd paragraph on page 79).*

   PM&E measures need to address both short term and potential long-term impacts and needs. A PM&E that provides for bi-annual litter patrols and additional vault toilets and portable toilets will be beneficial in the short term, but does not adequately address long term or potential future problems. A PM&E commitment is needed that provides for additional measures in the future years of the license, as specific problem areas surface. Provisions for additional vault toilets, replacement of older deficient toilets, and increased levels of garbage pickup/management should be included.

The finding concerning crowding, particularly in the Hells Canyon Dam tailwater and Hells Canyon Reservoir areas, suggests additional PM&E's are needed to fully address the concerns. The PM&E's should include an adequate level of facility development in the near term (within the first 5 years of the license) to alleviate the crowding, and also include measures that address additional future development needs (adaptive management planning) as impacts and visitor preferences change.

*E.5.2.2.3.2.9. Enforcement/Regulations Comments:*

1. Page E.5-60. *Comments about enforcement and general regulations made up less than 1% of all comments and were largely negative (94%). Because fewer than 1% of visitors remarked on enforcement and regulations, conclusions cannot be drawn about user attitudes toward these topics.*

   However, the related finding, below, suggests that active law enforcement in the HCC is very important, and additional enforcement presence may be warranted as a PM&E.

   Study E.5-4, section 6.6, Use Conflicts, pages 70 and 71 includes the following findings: *"While majorities of visitors reported several different types of encounters, in general about one-third or fewer of all visitors considered encounters to be a problem (with fewer than 10% reporting any to be a major problem)." "However, satisfaction ratings at recreation settings are typically quite high, so 10% reporting major problems and 30% reporting minor ones are not trivial proportions of visitors registering conflicts as problems." "The data are better at helping rank potential conflicts, with encounters with jet skiers (35%, 9% major), loud and rowdy people (32%, 7% major), and people camping too close (28%, 4% major) leading the list."*

   The three specific conflict types recorded (jet skiers, loud and rowdy people, and people camping too close) suggest additional law enforcement measures are needed in the HCC. A PM&E that adequately and directly funds additional officers and associated support such as signing, communications equipment and patrol boats, is warranted. Regulations need to be clearly understood, well posted and as uniform and consistent as possible among agencies. Also, the resources and means must be available to effectively share the information with the public. A forum of agencies and entities involved in law enforcement in the Hells Canyon area should be empowered to determine current and future law enforcement related needs. Ongoing and future needs should also be part of IPC's proposed Recreation Adaptive Management Plan (RAMP) process, and since most of the needs are HCC project related, IPC should be responsible for a significant portion of the current and future costs.

*E.5.2.3.1 Population Growth*

1. Page E.5-63. *The document discusses population growth between 1980-2000, that shows growth in excess of 20% per decade and states that the continued growth in the*

*PNW is expected to continue to outpace national growth in the foreseeable future. (paraphrased from the DLA).*

With this anticipated growth, the proposed RAMP needs to address how it will monitor and respond to these changes over time.

*E.5.2.3.3. Changes in On-Site Conditions:*

1. Page E.5-67. *The present users are those who will visit to the HCC given the present operational regime and angling success. If either or both of these factors change, the Applicant and other managing entities in the HCC should monitor recreational use in the area and, if use dramatically increases in a short time, be ready to respond with appropriate managerial input*.

   Litter and crowding, particularly in the Hells Canyon Dam tail water area and along the Hells Canyon Reservoir, were the most common visitor impact comments made in surveys of recreational users (See study E.5-4, pg. 42). The litter and crowding concern in the Hells Canyon Reservoir vicinity, along with the increased recreational use in the non angling miscellaneous categories, indicates that management action is needed now, even if "the present operational regime and angling success" does not change. The PM&E's need to adequately address these specific concerns, for both the short (years 1-5 of license) and long (years 6-30) term of the new license.

2. Page E.5-67. *E.5.3 Measures and Facilities Recommended by the Agencies. Measures recommended by the agencies will be included in the final New License Application: Hells Canyon Hydroelectric Project after the agencies have reviewed this draft application and submitted their comment letters.*

   The Forest Service and other members of the RARWG provided IPC with potential PM&E measures that they felt should be considered in order to meet the vision statements established by the RARWG. These potential PM&Es were discussed during the meeting on October 3, and 4, 2001.

3. Page E.5-67. *E.5.4 Applicant's Existing and Proposed Measures or Facilities. The Applicant proposes a recreational plan for the HCC that considers land-and water based recreational opportunities. The recreational plan was developed through consultation with the following agencies, nongovernmental organizations and counties:…and Washington County (Idaho).*

   The Recreation Plan discussed in E.5 should be included in the DLA, if in fact this plan has been developed. The Forest Service cannot adequately respond to a plan as critical as this one without thoroughly reading the actual plan. This plan was not developed by the RARWG. IPC communicated that the plan would be developed by a working group of stakeholders including the affected agencies, after the License was received. (*E.5.4. Recreation Plan)*

4. *E.5.4.1. Existing Measures To Be Continued for Recreation and Safety Downstream of Hells Canyon Dam*

   There is no mention of additional PM&Es downstream of Hells Canyon Dam. There is no mention here, of shared efforts to restore areas of bank erosion as was mentioned in section E.3.3.4.2.1.2.

5. Page E.5-68. *E.5.4.1.1 Flow Information Monitors Downstream of Hells Canyon Dam. The Applicant proposes to continue to operate and maintain monitors to provide information about river flows below Hells Canyon Dam.*

   The Forest Service supports this measure.

6. *Pages E.5-69 to 70. E.5.4.1.2 Memorandum of Understanding between the USFS and the Applicant. The goal of this measure is to continue the memorandum of understanding abbreviated as MOU on tables in the exhibit 0 between the USFS and the Applicant at Hells Canyon Visitor's Center. The Applicant would incur the cost of employing one full-time staff member at the Hells Canyon Visitors Center*

   The Forest Service supports this measure. This full time staff member does not currently work full time for the Hells Canyon Creek Launch Site, nor does this staff member work full time for HCNRA related issues. This proposal would provide additional services based on the year round staffing. The MOU that is currently in place serves as an interim measure until the new license is issued. The Forest Service maintains that this PM&E measure should be included as a requirement of the new license.

*E.5.4.2.1-6. Zone Vision Statements (pages E.5-72 to 73)*

The included vision statements for the six recreation/social zones are not the same vision statements developed by the RARWG. The statements in the DLA are not nearly as specific and are insufficient to provide management direction that will maintain and protect the desired landscape character of each zone. See RARWG Notes of July 18 and 19, 2001, for Zone Vision Statements, Attachment A. Attachment A was not included in the CD or the paper copy of the consultation package.

Pages E.5-74 to 79. *E.5.4.3.2 Existing Measures For All Recreation Zones*

- *Continuation of Litter and Sanitation Plan*
- *Continuation of Public Safety Program*
- *Continuation of Aid to Local Law enforcement*
- *Continuation of Road Maintenance*
- *Continuation of Existing Measures for Recreation Zone 2*

The Forest Service agrees with these existing measures for continued recreation and safety in the HCC, but maintains that there are additional measures that IPC should

consider over the term of the new license. The mechanisms for monitoring and implementation, needs to be addressed in the RAMP.

*E.5.4.4.1.1 Provisions of Boat Moorage on HCC Reservoirs:*

1. Page E.5-80. *The Applicant would fund this measure with counties and agencies. The Applicant's portion of the estimated total capital costs for years 3 through 5 of a new license: $180,000. The Applicant's portion of the estimated O&M costs for year 15 of a new license: $120,000.*

   In order to adequately assess the effects of this PM&E on National forest lands, specific information is needed as to where the projects would occur. What project costs are being proposed as "Applicant's portion"? Since the $180,000 and $120,000 are preliminary cost estimates, then additional explanation is needed to address how IPC proposes to cover the actual costs in the year of work.

   The Forest Service is concerned about IPC's DLA proposal to allow a maximum daily fluctuation on the Hells Canyon Reservoir of 10 feet rather than the currently imposed 5 feet. The Forest Service maintains that, in order to avoid problems with boat stranding, boat launching and bank access, the maximum daily fluctuation should not exceed 5 feet. See the Forest Service's previous response to the DLA under E.5.2.2.3.2.5, Reservoir Level Comments, pages E. 5-55 and 56.

*E.5.4.4.1.2. Litter and Sanitation Plan:*

1. Page E.5-81. *In consultation with appropriate agencies, the Applicant would plan and implement proposed enhancements within year 1 after a new license is issued and would operate and maintain the enhancements over the life of the new license.*

   *The Applicant would fund this measure. The estimated initial capital costs for year 1 of a new license: $60,000. The estimated average annual O&M costs for years 1 through 30 of a new license: $55,000.*

   The Forest Service goal for this PM&E provision is to adequately provide for the health and safety of Hells Canyon area users, during the entire life of the license. Another goal is to minimize the impacts of litter and waste on the natural resources.

   The wording of the provision suggests that the portable and vault toilets would be installed in year 1, then, only operation and maintenance would occur in subsequent years. The provision needs to be worded to make it clear that new vault toilets can be installed in future years, in locations that may not need it now but may need it in later years of the license period. Also, replacement of older, deficient toilets will be needed during the license period.

   How monitoring results and consultation with appropriate agencies will be used to decide how the Litter and Sanitation Plan would be implemented should be described.

A RAMP is needed to address this and other concerns related to implementation of the PM&E's. The mechanism of how the consultation with appropriate agencies would work needs to be spelled out in more detail. See page 216 for discussion on Development of Plans Proposed by the DLA.

The estimated costs of $60,000 and $55,000 appear quite low for all the work described. A new concrete single vault toilet costs approximately $10,000 and a double vault is approximately $23,000. These costs will rise with inflation during the life of the license. More explanation is needed as to what specific work will be covered by the estimated costs, and how costs over and above these estimates will be handled.

*E.5.4.4.1.3. Information and Education (I&E) Plan:*

1. Page E.5-82. *The Applicant proposes to develop and implement an I&E plan by 1) providing interpretive and directional information within the HCC and related recreation facilities in the area about cultural, natural, and historical resources and about public safety and 2) further enhancing visitor information provided within the Oxbow vicinity. The Applicant would operate and maintain the I&E amenities and associated facilities resulting from this plan.*

   The I&E plan needs to be a fully integrated effort with all resources and developed upon the foundation of the zone/node concept developed by the RARWG. The design standards and guides should be considered when developing the I&E plan. The I&E plan should be developed and implemented by a professional contractor.

   This effort needs to be coordinated by a workgroup that includes all the interested agencies and tribes that would consult with IPC. This plan needs to be developed collaboratively with the Forest Service, BLM, State, Counties and other landowners that are responsible for HCC lands. IPC informed the RARWG that these plans would be developed and approved by a stakeholder workgroup that would include the above stated agencies. This plan should be linked to the RAMP. This planning effort needs to be thoroughly defined before the Forest Service can be assured that these plans will meet Forest Service objectives.

   The statement *"further enhancing visitor information provided within the Oxbow vicinity"* could be more specific. The RARWG was unanimous as to the need for the construction of a major visitor center (that would provide information and interpretation of the Hells Canyon area) at or near Oxbow. The statement should be modified to state outright it is anticipated that a new major I&E Visitor Center will be constructed at or near Oxbow.

*E.5.4.4.1.4. Law Enforcement Program:*

1. Page E.5-83 and 84. *The Applicant proposes to provide a forum and limited funds to coordinate resources among law enforcement agencies.*

*The Applicant would contribute cooperatively with law enforcement agencies to the O&M costs associated with this measure. The Applicant's portion of the estimated average annual O&M cost for years 1 through 30 of a new license: $15,000.*

The Forest Service goal for this PM&E is to adequately provide for public safety in the HCC area.

When the forum of agencies involved in law enforcement in the Hells Canyon area determines specific needs, IPC should fund a significant portion of the total cost. Included is start up and annual funding needs of additional law enforcement officers, costs of acquiring and implementing centralized communications, signing needs, and needed equipment including patrol boats. In addition to the law enforcement agency forum, the Recreation Adaptive Management Plan (RAMP) needs to address how future law enforcement needs are to be dealt with. The RAMP committee will be considering overall adaptive needs in the HCC and needs to work in coordination with the law enforcement forum group to establish the timing and levels of development needed. This provision for future needs should be described in detail.

IPC's estimated average annual O&M share of $15,000 appears quite low for all probable cost needs that will arise as law enforcement issues escalate in the future.

*E.5.4.4.1.5. Recreation Adaptive Management Plan [RAMP]:*

1. Page E.5-84 and 85. *Whenever monitoring results indicate that change may be needed, the plan would provide a way to evaluate the appropriate level of recreation development or management in relation to use of recreation sites, while protecting other resource values. Changes or additions to PM&E measures would be based on trends, visitor preferences, facility conditions, monitoring, and other requirements as established.*

   The Forest Service goal is to have a RAMP that is effective, specific as to Applicant responsibilities, and responsive to changing recreational development needs during the entire license period.

   IPC has not provided nearly enough detailed explanation of how the RAMP will be developed and how it will actually operate. It is understood that some of the details of the RAMP process would need to be worked out in another forum, in consultation with appropriate agencies and entities. But in order to be able to effectively comment on the suitability of this draft PM&E provision, we need to see more explanation of the basic framework and operation of the RAMP. Some of the questions that IPC needs to address include: How and by whom will specific triggers for necessary changes and additions to PM&E's be established? What specific role will agencies and entities have in the RAMP development and implementation? How will triggers be adaptive over time, as conditions change that may justify changing a prior established trigger or PM&E? What are the roles and authorities of the RAMP stakeholder group?

2. Page E.5-84, 85. *Monitoring efforts—such as on-site observations and traffic counters—would occur annually, while surveys for social indicators and general recreational use would occur every 6 years. Reporting would occur annually and every 6 years (comprehensive report).*

   The Forest Service recommends that seasonal occupancy levels be reported annually for the individual parks and campgrounds in the HCC, to develop trend information. During the license period, we anticipate that campground occupancy levels and crowding concerns will be a key trigger point in determining the future needs for additional development at Big Bar.

3. Page E.5-85. *The Applicant would fund the construction, and O&M associated with this measure. The estimated capital cost every sixth year (beginning year 9 through year 27) of the new license period: $300,000. Applicant's estimated O&M cost every sixth year (beginning year 6 through year 24) over the life of the license: $450,000.*

   The PM&E needs to specify IPC responsibility for future development needs that exceed the estimated cost amounts, and also specify how the RAMP decision making process will occur.

   This section needs more detail and explanation provided. How did IPC arrive at these estimated cost figures? The Forest Service maintains that probable future PM&E needs, as they are identified in the ongoing RAMP process, will greatly exceed the $300,000 and $450,000 estimates. How will actual costs over and above these estimates be handled? Will the RA MP process be constrained by how much IPC is willing to spend at any given time? The Forest Service agrees that IPC should fund "the construction, and O&M associated with this measure. The amounts listed, (capital costs of $300,000 every 6$^{th}$ year, and O&M of $450,000 every 6$^{th}$ year) are very low considering the large list of potential PM&E measures developed by the RARWG.

   The Forest Service again emphasizes that IPC needs to provide a greater level of detail on how the RAMP would work (especially the agency consultation process), how decisions would be made, and also how specific triggers (such as occupancy levels of nearby campgrounds and increasing resource impacts) would be developed and used as a decision tool.

*E.5.4.4.1.6. Enhancement of Road Maintenance:*

1. Page E.5-86. *Enhance road maintenance on roads maintained by the Applicant in Recreation Zones 1 and 2. The Applicant proposes to enhance ongoing road maintenance by establishing a road maintenance program identifying best management practices. Best management practices for road maintenance would address ongoing maintenance concerns regarding cultural resources, noxious weeds, sensitive plants, threatened and endangered species, soil erosion, and side casting.*

*The Applicant would implement best management practices during regularly scheduled road maintenance*.

Road maintenance is an important issue. Road design and construction standards are also an important issue. An integrated plan for road management needs to be developed. This plan, which could be part of a larger Access and Travel Management Plan for the Hells Canyon Complex, needs to address safety, construction and maintenance standards, protection of or mitigation for impacts to natural or cultural resources, etc. The main access road was built in an era of less concern for public safety and for the protection of resources. As the mix and number of users increase, safety becomes even more important.

The level of road maintenance should meet established guidelines for high standard roads and provide for the safety of road users. The Forest Service needs assurance that safe and reasonable, year round access to NFS lands and facilities will be maintained.

IPC, in conjunction with other resource agencies and interested parties, would develop the best management practices to be implemented throughout the life of the license to insure protection of the resources listed above. The $10,000 O&M annual estimate seems low given the description of BMP'as on page E-86.

*E.5.4.4.2 Proposed Measures for Zone 1*

**Proposed Measures for Zone 1:**

1. A Preliminary Design Report should be developed for each site that requires development in this zone. This report would be developed in consultation with and approved by the appropriate agencies. This report would develop objectives that would carry out the Zone 1 vision statement developed by the RARWG. This report would include a vision statement for the site, goals and objectives, landscape design goals and objectives, a list of needed facilities with quantities, and a justification statement. Once this report is developed and approved, the conceptual design should be developed and approved. Then construction drawings and contract would be prepared. Concurrently, the processes required by NEPA would be ongoing if the site is managed by a public agency. Construction drawings and contracts for sites must be approved by the appropriate line officer, forest engineer, and forest landscape architect. The preliminary design report should be required for development in all zones (E.5.4.4.2. Proposed Measures for Zone 1).

2. Forms of the term *enhancement* should not be used by IPC to describe improvements that need to be made as part of the protection and mitigation of project effects on resources as enhancement has a very specific meaning to FERC.

3. IPC should assume the financial responsibility for site planning, NEPA analysis, capital improvement, and O&M costs for the Forest Service sites located on the Hells

Canyon Reservoir. The rationale for IPC having full responsibility is because nearly all of the recreation use occurring at these sites is directly linked to HCC project operations. Technical Reports E.5-2 and E.5-4 provide study findings that strongly support this linkage of recreation use with the HCC project.

*E.5.4.4.2.1. Enhancement of Eagle Bar Dispersed Recreation Site:*

1. Page E.5-87 and 88. *O&M of the enhanced Eagle Bar site would be the responsibility of the USFS. The Applicant and the USFS would share construction costs associated with this measure. The Applicant's portion of the estimated total capital cost for years 1 through 3 of a new license: $150,000.*

   The Forest Service maintains that work related to Eagle Bar is a mitigation measure rather than an enhancement.

   The site plan (Figure E.5-74) shows an outdoor gazebo. There may be a need for a picnic shelter, however a gazebo is not a structure that would fit in with the architectural style that was discussed as appropriate for the area. This design seems quite extensive. A review of the design by the Forest Service should be conducted before any further planning is done. See related comments regarding Eagle Bar E.6-45 and Preliminary Design Report above E.5.4.4.2).

   The Forest Service would work in cooperation with IPC to finish the site plan development. Subsequent NEPA analysis, capital improvement, and O&M costs should be Applicant responsibility due to the direct linkage of the use of this site with project operations. The "estimated" amount of $150,000 does not appear to include all of these associated costs. An explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

*E.5.4.4.2.2. Restriction of Public Access to Redfish Cave*

1. Page E.5-88. *The Applicant proposes to work cooperatively with the USFS to restrict public access to Redfish Cave by obliterating the cave trail and reclaiming native vegetation.*

   The Forest Service commends IPC's recognition of the resources at Redfish Cave. Currently the cave trail is a low standard path that is well camouflaged and not in need of obliteration. The Forest Service proposes that a portion of these funds be used for effectiveness monitoring (condition of the trail and gate).

*E.5.4.4.2.3. Development of Site Plan for Big Bar Recreation Site:*

1. Page E.5-89 and 90. *The Applicant proposes to develop a site plan for Big Bar in cooperation with the USFS to define the extent of future development. If demand becomes consistently high, and is so indicated by the recreation adaptive management plan, consultation with the appropriate agencies would be used to*

*determine the appropriate level and extent of recreation development that would best accommodate recreational use and demand at this site, while also protecting other resource values. Site, scope, and location of improvements would be based on trends, visitor preferences, facility conditions, and other requirements as established by the Forest Service.*

*The Applicant and the USFS would share costs associated with developing the Big Bar site plan. The Applicant's portion of the estimated total capital cost for years 1 and 2 of a new license: $50,000.*

The Payette Forest Plan goal for the Hells Canyon area and for Big Bar is to provide recreational opportunities that represent a blend of developed and dispersed recreation settings and facilities, and to plan and develop new facilities and sites to meet the projected demand while protecting resource values.

IPC should work in cooperation with the Forest Service to develop a site plan. The site plan would be detailed and specific in addressing the immediate PM&E needs at Big Bar. Total needs are only partially identified in section E.5.4.4.2.4 – only needs at Big Bar D are discussed. The Forest Service maintains that the identified needs at Big Bar C should be included in the detailed site plan work identified in section E.5.4.4.2.3 as well as in the actual work identified in E.5.4.4.2.4. The Forest Service presented the specific Big Bar C needs in the RARWG meetings, as part of the group's potential PM&E list exercise. Along with the detailed site plan for immediate needs at Big Bar C and D, the site planning effort will include a more general schematic plan for the anticipated longer term needs at Big Bar sections A, B, C and D

The site plan elements being proposed as PM&E's within the first 5 years of the license will be accomplished outside of the RAMP process. These immediate need elements are required PM&E's that are not subject to the RAMP. The long-term needs identified in the site plan schematic would be subject to the RAMP process and "*consultation with appropriate agencies*". The consultation process would be helpful to determine priority needs, but the Forest Service would retain the final decision authority on the level and extent of recreation development (see Preliminary Design Report in E. 5.4.4.2, #1).

The cost of developing the site plan should be IPC's responsibility due to direct linkage of the use of this site with project operations. Identifying an "estimated" amount now is acceptable, but there needs to be additional explanation of how inflation will be accounted for and how actual site plan costs at the time the plan is developed will be covered.

IPC proposes no PM&E for the development of the site with the exception of those noted in E.5.4.4.2.4, below, nor is there any discussion of the reoccurring O&M costs. The Forest Service maintains that work proposed above related to Big Bar is a

mitigation measure rather than an enhancement (see forms of the term enhancement in E.5.4.4.2, #2.).

*E.5.4.4.2.4. Enhancement of Boat Ramp and Associated Facilities at Big Bar D Recreation Site:*

1. Page E.5-91. *The Applicant proposes to work cooperatively with the USFS to enhance the Big Bar D Recreation Site's boat ramp and associated facilities. Enhancements may include but are not limited to relocating and enhancing the boat ramp, designating boat ramp parking, and upgrading toilet facilities. O&M of Big Bar D Recreation Site would remain the responsibility of the USFS.*

   *The Applicant and the USFS would share construction costs associated with this measure. The Applicant's portion of the estimated total capital cost for years 3 through 4 of a new license: $250,000.*

   The Forest Service agrees with the proposed PM&E measures to provide these amenities at Big Bar D. The Forest Service maintains that work proposed above related to Big Bar is a mitigation measure rather than an enhancement. (See forms of the term enhancement, E.5.4.4.2 #2)

   The Forest Service submitted a potential PM&E measure in RARWG meetings for Big Bar C that needs to be implemented concurrently with the Big Bar D developments. Primary development items at Big Bar C include improving access roads, providing toilet facilities, constructing 15 to 20 universal campsites, landscaping, providing a well with hand pump, and protecting a cultural resource site. The Big Bar site plan, to be developed cooperatively by IPC and the Forest Service, will specify detailed design elements for Big Bar D and C areas (see Preliminary Design Report in E.5.4.4.2, #1).

   Implementation of the site plan, via the PM&E that proposed "E*nhancement of Boat Ramp and Associated Facilities at Big Bar D*" will be IPCs responsibility. As stated above, improvements at Big Bar C are needed and should be included in IPC's PM&E description, implementation schedule and cost estimate sections.
   Since nearly all of the recreational use at Big Bar is directly HCC project related, IPC should be responsible for the site planning, NEPA analysis, capital improvement, and O&M costs. The "estimated" amount of $250,000 does not appear to include all of these associated costs. Explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

*E.5.4.4.2.5. Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site:*

1. Page E.5-92. *The Applicant proposes to develop a site plan and enhance Eckels Creek dispersed site in cooperation with the Forest Service. Enhancements could include improving boat moorage, providing a portable toilet, and defining campsites.*

*O&M of Eckels Creek dispersed recreation site would remain the responsibility of the Forest Service.*

*The Applicant and the Forest Service would share construction costs associated with this measure. The Applicant's portion of the estimated total capital cost for years 1 through 3 of a new license: $30,000.*

The Forest Service goal is to plan and develop the site to meet projected demand while protecting resource values.

The Forest Service agrees with the proposed PM&E measures to provide these amenities at Eckels Creek. The Forest Service maintains that work proposed above related to Eckels Creek is a mitigation measure rather than an enhancement (see Preliminary Design Report in E.5.4.4.2, #1 and forms of the term enhancement, E.5.4.4.2 #2).

Improvements at the site should include protecting the cultural resource site. The Forest Service maintains that since nearly all of the recreational use at Eckels Creek is directly project related, IPC should be responsible for the costs of site planning, capital improvement, and O&M. The "estimated" amount of $30,000 does not appear to include all of these associated costs. Explanation is needed concerning how inflation will be accounted for and how actual costs at the time of implementation will be covered.

The goal of the Zone 1 vision statement (page E.5-72), to "reflect and respect the character and essence of the natural landscape", is particularly applicable here. A development plan that emphasizes retention of the existing shade trees and maintaining the secluded nature of the site is needed.

*E.5.4.4.3 Proposed Measures for Zone2*
*E.5.4.4.4 Proposed Measures for Zone 4*
*E.5.4.4.5 Proposed Measures for zone 5*

The Forest Service offers no specific comment on these measures. The Forest Service is supportive of proposed PM&E measures that promote appropriate recreation opportunities in the HCC. The proposed PM&E measures should be consistent with the Zone concept and vision statements developed by the RARWG. These PM&E measures need to be supported by the jurisdictional authorities or stakeholders where they are proposed.

*E.5.6 Areas Associated with the National Wild and Scenic River System or Wilderness Area.*

**Wild and Scenic Snake River**

In 1975, PL 94-199, the act that established the Hells Canyon National Recreation Area, amended the Wild and Scenic Rivers Act (pl 90-542) to include the National Forest portions of the Snake River in the National Wild and Scenic Rivers System. The Act designated 71.5 miles of the Snake River as wild and scenic. This river is classified into the following segments: "Wild River" – the 31.5 miles from the Hells Canyon Dam to Pittsburg Landing; "Scenic River" – the 40.0 miles from Pittsburg Landing to the northern boundary of the Wallowa-Whitman National Forest. The river corridor is approximately a quarter-mile each side of the high water mark.

**Based on the Draft License Application, These Values of Designated Wild and Scenic Rivers Could Be Affected:**

- Scenic – The Wild and Scenic Snake River is recognized nationally for its scenic qualities. The designated river corridor provides great contrasts of landform, vegetation, color, climate and sound. Scenic qualities are recognized as an outstandingly remarkable value of the river.
- Recreation – The Snake River's designation into the National Wild and Scenic Rivers System as well as the river's inclusion within the Hells Canyon National Recreation Area, signifies the national importance of recreation values in the river corridor. The wide range of available recreation activities, the unique backcountry river setting, and the diversity of users combine to make recreation an ORV.
- Fish - In the Wild and Scenic Snake River there are several stocks of anadromous fish, including spring, summer, and fall chinook salmon, sockeye salmon, summer steelhead, trout, and Pacific Lamprey, as well as several other resident species of native fish. Nationally and regionally, the Snake River is known for its unique and diverse sport fishery.
- Wildlife – Diverse wildlife species inhabit the Snake River corridor and affirm its importance as wildlife habitat. The area incorporates significant migration, wintering, and year round habitat for numerous wildlife species.

The DLA does not fully address or identify impacts to these Outstanding Remarkable Values.

Section 7(a) of the Wild and Scenic Rivers Act provides a specific standard for review of developments outside the designated river corridor, below or above or on a stream tributary to a designated river. Such developments may occur as long as the project "will not invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date of designation"… This standard applies to projects outside the river corridor but on the same river or a tributary. In conjunction with consideration of the new license proposal for the HCC, the Forest Service will prepare a Wild and Scenic River Section 7(a) determination for the Wild and Scenic Snake River. See Appendix E for Wild and Scenic River Section 7(a) Determination standards.

In addition to the Wild and Scenic River Section 7 (a) determination prepared by the Forest Service, project analysis for the new proposal must consider effects of the proposal to the Wild and Scenic Snake River and evaluation of the proposal's consistency with management direction for the river. The Wallowa-Whitman Final Environmental Impact Statement (FEIS) for the LRMP (1990), established management direction specific to the HCNRA Snake River Corridor (Management Area 8), which includes the Wild and Scenic Snake River. The primary emphasis is on maintaining the recreational experiences available at the time of designation. Maintenance of visual qualities, and the management of use are also emphasized.

Management direction is also provided in the decision for the 1994 Wild and Scenic Snake River FEIS and in the decision for the 1996 Outfitter and Guide Environmental Assessment.

The decision for the Wild and Scenic Snake River Recreation Management Plan (revised, January 1999) also provides specific management direction for the river corridor. This most recent plan consolidated all previous management direction and amended the Wallowa-Whitman National Forest LRMP.

Management Objectives for the Wild and Scenic Snake River include:

- Maintain or enhance the values for which the river was designated under the National Wild and Scenic Rivers Act.
- Maintain or enhance the values for which the HCNRA was established including the protection of cultural resources, fish and wildlife, unique biological communities, scientific values and scenery.
- Provide a wide range of recreation uses compatible with the provisions of the Wild and Scenic Rivers Act.
- Resources will be managed in accordance with management direction as established in the Forest Plan as well as applicable Forest-wide standards and guidelines.

**Imnaha Wild and Scenic River**

With enactment of PL 100-557, the Omnibus Oregon Wild and Scenic Act of 1988, an amendment to the Wild and Scenic Rivers Act of 1968, designated the Imnaha River as wild and scenic.

A portion of the Oxbow to Lolo transmission line is located within the Imnaha Wild and Scenic River corridor. This line (#908) runs from Pallette Junction to the town of Imnaha, a distance of approximately 6.3 mile on NFS lands within the designated river corridor. The line is a 230 KV line located on wooden H frames with no portion below the ordinary high water mark of the Imnaha River. The line existed at the date of the rivers designation (October 28, 1988). The Forest Service will consider direction in the Wallowa-Whitman National Forest LRMP as amended by the Imnaha Wild and Scenic River Management Plan as the basis for its evaluation under Section 4(e) of the Federal Power Act.

The Wallow-Whitman (FEIS) for the Land and Resource Management Plan (1990) established management direction specific to Wild and Scenic Rivers (Management Area 7). The primary emphasis is to preserve the wild, scenic, and recreational values of those rivers or river segments added to the system by the Omnibus Oregon /wild and Scenic Rivers Act of 1988.

Specific direction for the Imnaha River Wild and Scenic corridor is defined in the Imnaha River Wild and Scenic River Management Plan (January 1993) and its accompanying Environmental Assessment (EA). The plan defines standards and guidelines for federal lands, standards and guides for private lands and implementation in relation to the following ORV's:

Scenery
Recreation
Fisheries
Wildlife
Heritage Resources
Vegetation and Botanical Resources
Traditional Value/Lifestyle Adaptation

The Imnaha Wild and Scenic Management Plan addresses the specified values as identified by Section 7(a) as:

- Scenic - Is dominated by a diverse landscape creating high quality natural scenery. Manmade developments have a primitive, historic, or rustic western setting.
- Recreation – Is a combination of recreational activities including hunting, fishing, sightseeing, horseback riding, hiking, snowmobiling, and camping.
- Fish – Includes the population and habitat of the threatened spring and fall Snake River chinook salmon, and sensitive steelhead and bull trout.
- Wildlife – Includes the wildlife population and habitat in the Imnaha River corridor, which includes Rocky Mountain Bighorn Sheep, mule deer, elk, and black bear. Proposed, Endangered, Threatened, and Sensitive (PETS) species of animals within the corridor are an important part of the OR value. These include, but not limited to, the Townsend's Big-Eared Bat, Peregrine Falcon and Bald Eagle.

## Comments Specific to the Technical Report Appendices

Quotations or sections taken directly from IPC's technical report appendices are shown in italics.

### Technical Report Appendix E.5-1. A Review of Past Recreation Issues and Use in the Hells Canyon Complex and the Hells Canyon National Recreation Area

1. Page 1. *Recreational use within the corridor appears to have increased dramatically during the last two decades.* (Abstract, paragraph 1)

Page 2. *Recreational use in the Hells Canyon area has reportedly increased dramatically during the last two decades."* (Introduction, paragraph 4)

The Forest Service agrees with this conclusion. Although other IPC recreation studies show inconclusive and downward trends in several recreation use categories between 1994 and 2000, the longer-term demographically based trend is increasing recreation use.

IPC cites a 1991 report by Grams and Schmidt identifying the role of the HCC in the erosion of sand bars in the Hells Canyon National Recreation Area (HCNRA). *(Page 55, 5.2.5.3 Sediment Transport and Sand Bar Degradation Issues, paragraph 2)*

IPC's summary of this report makes it clear that they are fully aware of the scientific conclusions made by Grams and Schmidt, i.e., that 1) the dams prevent sediment transport, 2) only clear water flows are released from the HCC and 3) sandbars increased in the canyon during the pre-impoundment era and decreased in the post-impoundment era.

**Technical Report Appendix E.5-2. Reservoir-Related Recreational Use at the Hells Canyon Complex**

1. Page E.5-2, 42. *Camping-related object counts during the warm season at Big Bar showed that almost all of the people camping were using tents.* (*5.2.3.1 Recreational Use in Zone 1, page 42, and Table 12, page 81)*

   The Forest Service maintains that IPC's survey count underestimates the number of motor homes and camper units being utilized at the Big Bar site. The Forest Service surveyed users at Big Bar in 1997 and 1998 and found that 65 to 70% of the camping was by motor home and camper, and 30-35% was by tent. In 1997 a Forest Service Technician checked the site 25 days during the late June through August period, and in 1998 the site was checked 51 days between the latter part of June through September. The number and types of camping units were recorded and the location of each use delineated on a Big Bar site map.

   The Forest Service found that motor home and camper use occurred in all four sections of the Big Bar site with most use in BGBD followed by BGBC and BGBB. The area receiving the least motor home and camper use was BGBA. Another IPC study reports 25-33% of all reservoir users are retired (E.5-4, 5.1.1.2, pg.21). The Forest Service maintains that this finding supports the probable under reporting by IPC of motor home and camper use at Big Bar, since it is likely that most retirees prefer using motor homes and campers rather than tents.

2. Page 61, paragraph 2; and Figure 30, page 194; and page 40. *The lower two-thirds of Hells Canyon Reservoir is the least-used roaded area within the HCC.* (6. Discussion and Summary, Recreational Use in Zone 1, page 61, paragraph 2; and Figure 30, page 194; and page 40, paragraph 4, Miscellaneous category discussion)

The Forest Service agrees with the finding that Zone 1, subzone HC is the least used roaded area within the HCC, but recommends that the connection between use in subzones HT and HC should be highlighted. The Miscellaneous category of use in subzone HT includes mainly sightseers and boaters (ref. page 40, paragraph 4). It is actually the sightseeing qualities as seen from the Hells Canyon Road, along the entirety of subzones HC and HT, that contributes to visitor enjoyment. Because of this linkage, the Forest Service maintains the Miscellaneous use credited to the use totals in subzone HT could also be credited to subzone HC.

3. Page 61, paragraph 6; and Figure 35, page 1999. *Use in this area peaked in 1996 and then returned to about the same level of use in 1998 and 2000 as in 1994. Increased angling, especially boat angling, was responsible for a majority of the increase. (6. Discussion and Summary, Recreational Use in Zone 1, page 61, paragraph 6; and Figure 35, page 199)*

   Although the trend in overall recreational use and in boat angling use is as stated in the report, a key non-angling category (lounging) should be highlighted. This category increased (between 1994 and 1997) by a higher proportional amount than angling, and, unlike angling, the lounging category did not drop significantly in the years following the 1997 peak. In 2000 it remained as a large component of the overall recreational use in subzone HC. This result demonstrates that most recreational use in subzone HC is not directly angling related, but is based on other reservoir related recreational opportunities such as camping, lounging, pleasure boating, and sightseeing. Also, the downward trend in recreational use is not nearly as prevalent in this subzone as it is in the overall HCC.

**Technical Report Appendix E.5-3. Recreational Use Associated with the Snake River in the Hells Canyon National Recreation Area**

1. Page 40, paragraph 2. *The total number of powerboaters varied relatively little while the number of float boaters varied by as much as 100%. Study results identify several significant use patterns within the study area: Use numbers in several categories varied considerably but were not part of any apparent trend over time. These changes appeared to be associated with extremes in river flows or changes in USFS boating regulations.* (6. Discussion and Summary, page 40, paragraph 2)

   Since the total number of powerboaters varied "relatively little" as compared to float boaters whose numbers varied "by as much as 100%", it follows that a major factor causing this is river flows. The changes made in Forest Service boating regulations evidently were not a major factor, since overall powerboating use did not vary much.

1. Page 36, paragraph 6. *E.5.2.1. Recreational Activities (and elsewhere)…When asked to list the recreational activities they participated in…was reported much more frequently…*

It would be helpful to understand how "sightseeing" is defined given that only 71-72% of the private floaters and boaters participated in this on the river. Although many people define sightseeing quite broadly, others may require a "site" to see.

**Technical Report Appendix E.5-4. General Recreation Findings from Hells Canyon Complex Reservoirs: 1994-2000 Onsite Interviews and 2000 Mail Survey**

1. Page 25, paragraph 2 and 7. *Relatively few reservoir visitors reported trail use (usually less than 10%). Hells Canyon Reservoir visitors were slightly more likely to report trail use than Oxbow or Brownlee reservoir visitors. (E.5-4, 5.2.1.1., 2nd paragraph on page 25)*

   *Relatively few reservoir visitors reported trails as their primary destinations (fewer than 2% overall). (E.5-4, 5.2.1.2, 7th paragraph on page 25)*

   Information at seven trailhead registers along Hells Canyon Reservoir provides a different finding. The trail registers have been in operation since 1998 with IPC maintaining and collecting the information cards. The Forest Service has requested that a summary of the information be made available (see Forest Service comments on "Study Adequacy" and "Forest Service Recommendations" in the technical review of Study E.5-2). A copy of the registration cards has been supplied to the Forest Service. Informal review of the card information indicates that about 50% of the respondents came to the HCC primarily to use the trails. That would indicate that the other 50% of trail users came to the HCC for other reservoir recreation related reasons, such as fishing or camping.

2. Page 29, paragraph 8. *There are fewer primitive site campers who used to be campground users (5%) than campground users who used to use primitive areas (16%). In general, this finding suggests that in the future there may be a moderate increase in demand for more developed facilities in comparison to dispersed camping. (E.5-4, 5.2.2.2, 8th paragraph on page 29)*

   The Forest Service agrees with this conclusion of a projected moderate increase in demand for developed recreation facilities, especially for the near future (next 5 years). Continued monitoring is needed to determine any future increases in demand. As the HCC becomes more popular over time, and draws more visitors, the need for more facility development and other management strategies will likely rise.

3. Page 33 paragraph 2. *Among the three reservoirs, higher percentages of users at Brownlee and Oxbow reservoirs fish, while higher percentages of Hells Canyon Reservoir users engage in other activities, particularly camping, sightseeing, wildlife viewing, and swimming. (E.5-4, 5.2.5.2,2nd para. on page 33).*

   This finding is important in terms of management direction in the HCC, and on Hells Canyon Reservoir in particular. Recreation users on Hells Canyon Reservoir are

there for more reasons that just to fish. Planning for future site development needs to consider and accommodate these preferences for non-fishing activities.

4. Page 42 paragraph 4. *Litter was the most important issue for those users who commented on visitor impacts. (E.5-4, 5.3.2.7, 4th para. on pg. 42)*

5. Page 42 paragraph 5. *The second most common visitor impact comments were associated with crowding (24% of all comments), particularly at Hells Canyon tailwater (56%), Hells Canyon Reservoir (36%), and Oxbow Reservoir (30%). In contrast, only 13% of Brownlee Reservoir visitor impact comments were about crowding. (E.5-4, 5.3.2.7, 5th para. on pg. 42)*

6. Page 68 paragraph 6. *First, maintenance/clean-up patrols are probably the single greatest way that managers could improve dispersed camping in the area. Second, campers at dispersed sites may not be opposed to some smaller-scale facility improvements in dispersed areas, although it seems unlikely they support full development into small campgrounds. (E.5-4, 6.4, 6th para. on pg. 68)*

   PM&E measures along Hells Canyon Reservoir need to adequately address these findings and conclusions. Limited facility development in the near term (next 5 years) may be appropriate, but the new license needs to address possible future development needs (adaptive management planning) if impacts and visitor preferences change.

**Technical Report Appendix E.5-5. General Recreation Findings from Hells Canyon National Recreation Area: 1999 Visitor Survey**

1. Page 27. *E.5-5.4.2.3. Group Size and Number of Boats and elsewhere. The number of boats per party and per person is increasing…trend in people being more interested in operating their own craft instead of being a passenger on a larger craft.*

   As the new license would span at least 30 years, it would be helpful to draw conclusions throughout these studies and devote a section in each to trends. In this particular case, the trend may have ramifications for flows, campsite selection, perceived crowding, etc. It would also be helpful to highlight any needs identified by significant numbers.

2. Page 39 paragraph 2. *Floaters were more concerned than powerboaters about river level problems, while powerboaters were more concerned about having a good boat landing area. Both attributes, however, reflect the different ways in which daily fluctuation in river levels can impact the way boats are landed and tied up. (E.5-5, 4.4.2.1, 2nd para. on pg. 39)*

3. Page 41. *The most common problem reported about campsites concerned fluctuating water levels (50 comments, or 18% of all comments). Of those comments, just under one-half specifically mentioned boats being left grounded by dropping water levels.*

*One comment mentioned being forced to move camp because of rising water levels, and the remaining comments were more general complaints about daily flow changes. (E.5-5, 4.4.5, last paragraph on page 41)*

4. Page 41 and 42. *E.5-5.4.4.5 Problems with Campsites*

   This section notes several issues that are recurrent symptoms of the limited availability of sandy beaches and other preferred campsites and the lack of replenishment of those beaches and sites. The comments here include concerns about fluctuating water levels, signs-of-use impacts, competition for campsites (or lack of good camps) and steep banks and other features that made camps less desirable.

5. Page 46 and 47. *Perceived Crowding Ratings in Hells Canyon (E.5-5.4.5.2 and E.5-5.5)*

   This information provides a good baseline for monitoring during this license period.

6. Page 61 paragraph 6; pages 84, 85. *…, floaters were more concerned than powerboaters about river level problems, while powerboaters were more concerned about having a good boat landing area. Both attributes, however, reflect the different ways in which daily fluctuation in river levels can impact trips. (E.5-5, 5.4, 6th paragraph on pg. 61, also Table 24 on pg. 84 and Table 25 on pg. 85)*

   Study E.5-5 demonstrates that both floaters and powerboaters are impacted by changing levels water levels. Fluctuating water levels were identified by many users as a common campsite problem, and potential problems from water levels was identified as an important campsite attribute concern by floaters and boaters. Since IPC project operations clearly affect water levels, there is a definite linkage (IPC responsibility) to impacts on recreational use in the HCNRA. IPC failed to address these concerns or develop any PM&E measures.

**Technical Report Appendix E.5-6. Reservoir Level Issues in the Hells Canyon Complex**

1. Page 27 paragraph 4. *Daily changes at Hells Canyon and Oxbow can leave boats stranded, but seasonal changes on Brownlee are unlikely to cause those problems (per day changes are rarely over 2 feet).* (E.5-6, 4.1.2, 4th paragraph on pg. 27)

2. Page 51 paragraph 6. *Specific level issues appear related to a variety of other issues, including effects on fishing, use of boat ramps, access to parts of the reservoirs, problems with boats being stranded (Hells Canyon and Oxbow only), and the aesthetics of a drawn-down reservoir (Brownlee only). (E.5-6, 5. summary and Conclusions, 6th para. on pg. 51)*

   Daily level fluctuations on Hells Canyon and Oxbow reservoirs have been identified as a problem that can cause stranding of boats. Study findings indicate that since

1982 the fluctuations have rarely been over 5 feet (especially on Hells Canyon reservoir), with a majority of the daily fluctuation being less than 3 feet. These findings suggest that moderate improvements and additions to the boat mooring and dock facilities could greatly benefit the stranding problem. PM&E measures should adequately address this need. Average daily fluctuations specified in the next license should not be allowed to exceed what has occurred historically since 1982. The historical maximum drawdown rarely has exceeded 5 feet. Throughout the DLA, IPC has mentioned an additional 5 feet drawdown in Hells Canyon and Oxbow reservoirs, however, IPC has not analyzed the effects of the additional drawdown on NFS lands and resources. This needs to be addressed in the FLA.

3. Page 33 paragraph 2. *In any case, the on-site data are more valid because they can be associated with a definitive reservoir level. (E.5-6, 4.3.3, 2nd para. on pg. 33)*

4. Page 36 paragraph 4. *On the other hand, the sample does not provide information from users who did not visit the reservoir in 2000, including those who might have been displaced by unacceptable levels. (E.5-6, 4.3.4, 4th para. on pg. 36)*

5. Page 37 paragraph 5. *However, these findings should be placed in context; most 2000 users did not encounter unacceptable levels (although many saw less than ideal levels). (E.5-6, 4.3.5, 5th para. on pg. 37)*

6. Page 37 paragraph 6. *In years where drawdowns are lower, managers can expect more displacement, vocal complaints, and higher dissatisfaction levels than those shown in 2000. (E.5-6, 4.3.5, 6th para. on pg. 37)*

   The study findings make it clear that the on-site interview and mail survey sample (year 2000 only) was too narrow of a sample to be most useful. Reservoir recreationists were mostly happy campers in 2000 because of the low to moderate amount of drawdown experienced. Due to the limited extent of this survey, we believe IPC's monitoring plan should include conducting additional on-site interviews (especially in large drawdown years) pertaining to level acceptability.

7. Page 52 paragraph 6. *Based on an analysis of use and reservoir levels, reservoir levels do not "drive" use levels at the HCC reservoirs" (E.5-6, 5. 6th para. on pg. 52)*

8. Page 52 paragraph 6. *This does not mean that reservoir levels (low or high) do not affect trip quality, but use levels are too coarse an indicator variable to assess these effects. Survey and other information provide better detail about effects of levels on trip quality. (E.5-6, 5. pg. 52)*

   Since the on-site and mail survey information was done in a small drawdown year, we suspect this finding understates the importance of reservoir levels to many reservoir visitors. Future monitoring should continue, and should include on-site surveys that ask specific questions about reservoir level acceptability. Survey results

during large drawdown years may show that the above finding underestimates reservoir level importance to recreationists.

**Technical Report Appendix E.5-7. River Level Issues in the Hells Canyon National Recreation Area**

IPC conducted a study that focused on river flow levels and recreation to determine the preferences of the users in Hells Canyon. Surveys were conducted to collect user preference data regarding general flow levels and daily changes in flow. The study also provides information about historical and current flow regimes. This allows for general comparisons of project-induced flow effects.

1. Page 26. *Based on other findings in this survey, it appears that flows do not drive overall use. The major factor affecting use is the season, while day of the week has a lesser effect. In general, people go when time is available and when weather or fishing is generally better. This propensity doesn't mean that flow (low or high) doesn't affect trip quality, but use level is too coarse an indicator by which to assess these effects. Survey information provides better detail about effects of flow on trip quality.*

   The Forest Service agrees that use level is too coarse an indicator by which to assess these effects. The season, the availability of time and the lottery permit system probably have more effect to use levels than river flow levels. It is important to the Forest Service to understand the preferences of users regarding flow levels, and how those levels affect specific aspects of their trip and how those levels affect the overall quality of their experience.

2. Page 32. *About three-quarters of both groups agreed that beaches provide better camp and picnic sites on the river than upland sites. (E.5-7, 4.3.2, last paragraph on pg. 32)*

   *…this result is provided to simply suggest that recreation users in Hells Canyon are likely to be interested in flow regimes that create or maintain beach sites.* (*E.5-7, 4.3.2, last paragraph on pg. 32)*

   This finding supports the need to apply PM&E measures that would improve beach conditions and usability. Modifications to project operations (reduction of daily fluctuations and of very high flows) may benefit beach physical stability and benefit recreational uses of the beaches.

3. Page 33. *Among those who had taken each type of trip, few boaters consider any opportunity to be unimportant, according to responses shown in Figure 14. Results are consistent with the general flow question, indicating the majority interest in a diversity of flows.*

The Forest Service agrees that a diversity of flows is important to users. Regarding other resources, the Forest Service maintains that providing the low and high flows that provide technical and challenge type experiences should be provided much like a natural hydrograph would seasonally provide these flows.

4. Page 34. *Most floaters and powerboaters define the lowest navigable flows at similar levels (about 5,000 to 7,000 cfs). (E.5-7, 4.4.2, 4th para. on pg. 34)…however, many boats in Hells Canyon are much larger than 24 feet and likely to have difficulty in any of the segments upstream of the Salmon River at levels below 6,000 cfs.* (*E.5-7, 4.4.2, 4th para. on pg. 34)*

   The study findings show the need to set a minimum allowable flow between 5,000 and 7,000 cfs, with 6,000 cfs needed for boats larger than 24 feet. When the findings on the minimum safe flow for navigation and on preferred daily fluctuation are compared with IPC's "Proposed Operation" (PO) Model, it is apparent there is a conflict. The PO model, as described in section 4.6.2, pages 48 and 49, calls for a 6,500 cfs minimum flow release below Hells Canyon Dam (except it is allowed to drop to 5,000 cfs on dry years), with a daily fluctuation of up to 10,000 cfs. A daily maximum fluctuation that is representative of the user preferences should be maintained, at least during the primary boating season. PM&E measures should be developed to address this need.

5. Page 41 paragraph 5. *These results suggest that daily fluctuations are probably the single biggest management issue on the river. (E.5-7, 4.5.2)*

6. Page 43 paragraph 5. *Majorities of floaters (59%) and powerboaters (69%) agree that some level of fluctuation is acceptable, as long as it is less than 5,000 cfs per day." (E.5-7, 4.5.2)*

7. Page 55 paragraph 3. *Floaters and powerboaters are similar in their majority (71 to 72%) agreement that smaller daily fluctuations are important, even if it decreases hydroelectric generation for the region. (E.5-7, 4.6.4, 3rd)*

8. Page 57. *It is likely that most boaters would strongly support lower fluctuation levels during the prime recreation season (May through October). (E.5-7, 5. Summary and Conclusions)*

9. Page 57. *Daily flow fluctuations are among the most significant recreation issues in the HCNRA, comparable to those involving visitor impact and float/jet boat conflicts. Fluctuation issues also appear to be more important than general flow level issues (flow changes through the year).*

   The study findings and conclusions clearly show a need to reduce daily fluctuations. It is clear that those who come to Hells Canyon are being directly affected in a negative way by the operations of IPC.

10. Page 41. *The following list comprises the most important fluctuation problems for floaters:*
    1. *The way they have to tie up boats (97% report problems, and 68% report a major problem)*
    2. *Where they set up camps (98% report problems, 53% major)*
    3. *Access to camps (94% report problems, 54% major)*
    4. *Access to beaches (93% report problems, 51% major)*
    5. *Overall fishing quality (89% report problems, 45% major)*
    6. *Having to abandon camps (81% report problems, 46% major)*

    *The following list comprises the most important fluctuation problems for powerboaters:*
    1. *Having to wake up at night to move/check boats (100% report problems, 70% major)*
    2. *Effects on steelhead fishing (93% report problems, 73% major)*
    3. *The way they have to tie up boats (93% report problems, 61% major) Where they set up camps (86% report problems, 40% major)*
    4. *Effects on overall fishing quality (92% report problems, 55% major)*
    5. *Having to stay with boats at stops (81% report problems, 43% major) pg. 41*

    This list shows how daily flow fluctuations adversely affect the user's experience. These are the direct effects to the user. Indirect effects to other resources can be inferred. Daily flow fluctuations create problems for users, and as a result, users modify their patterns to deal with these problems. In doing so, many times the modified pattern results in greater impact to the site. For example, as users set up camps further from the waters edge, they move up onto terraces. In doing so, the size of the site increases and impact more area. In so doing, the used area may increase and there may be displacement/erosion associated with user trails getting on to the terraces.

11. Page 44. *When asked to evaluate specific fluctuation levels or choose between a stable flow and a corresponding fluctuating range, boaters generally prefer no fluctuation or the stable flow. However, they also tolerate some level of fluctuation; only fluctuations over about 6,000 to 9,000 cfs (depending upon the starting flow and the group) are considered unacceptable for most boaters. Under current operations, fluctuation levels are often greater (see section 4.6. below) during July, August, and the first half of September (until stable flows are provided to minimize impacts on spawning salmon). These data suggest many boaters feel current fluctuations are too high.*

    This conclusion leads the Forest Service to believe that a daily fluctuation range of 0 cfs to 3,000 cfs is preferable to users, and that fluctuation ranges become unacceptable at 6,000 to 9,000 cfs depending on the general river level flows. This information verifies that daily flow fluctuations above 6,000 cfs have an impact on the recreation experience.

12. Page 53. *These results indicate that the PO regime clearly detracts from powerboater opportunities in comparison to an ROR regime.*

    The Forest Service maintains that the PO regime does not provide the minimum requirements necessary to provide a quality recreation experience for river users.

13. Page 53. *Floater evaluations suggest that greater than 6,000 to 7,000 cfs daily fluctuation is considered unacceptable, and most floaters prefer even lower fluctuations. In average years under the PO regime, fluctuations above 6,000 cfs are likely to occur about 47% of the days in the May to September season, and only 23% of days would have fluctuations less than 4,000 cfs. Based on these results, the PO regime clearly detracts from floating opportunities in comparison to an ROR regime.*

    This conclusion verifies Forest Service concerns about the PO regime. It is clear that the PO regime does not consider user preferences in regard to daily fluctuations. During an average year 47% of the days in May through September the fluctuations are above recognized acceptable levels, and during 23% of those days, fluctuations would be below 4,000 cfs, which is still not within the preferred range of stable to 3,000 cfs. It would be more useful for IPC to portray how many days during this time period had flow fluctuations less than 5,000 cfs, which appears to be the acceptable variance.

14. Page 53. *Powerboater evaluations suggest more than 8,000 to 9,000 cfs daily change is considered unacceptable, and most powerboaters also prefer lower fluctuations. In an average year under the PO regime, fluctuations above 8,000 are likely to occur 51% of the days in the April to October season, and only 24% of the days would fluctuate less than 4,000 cfs. These results indicate that the PO regime clearly detracts from powerboater opportunities in comparison to an ROR regime.*

    This conclusion verifies Forest Service concerns about the PO regime. It is clear that the PO regime does not consider user preferences in regard to daily fluctuations. During an average year 51% of the days in May through September the fluctuations are above recognized acceptable levels, and during 24% of those days, fluctuations would be below 4,000 cfs, which is still not within the preferred range of stable to 3,000 cfs.

15. Page 56. *A plurality of both groups (45 to 48% agree and 21 to 25% disagree) prefer a diversity of recreation opportunities through the flow range, even if this diversity means that some opportunities are not provided as often. Results suggest that many boaters are not focused exclusively on certain parts of the hydrograph and may recognize that diverse flows provide a range of ecological and recreation benefits through the year.*

    This conclusion shows that users are aware of and understand the ecological benefits that may be provided for by a scenario that is not developed solely for optimum

recreational benefits. It appears that the Forest Service goals are compatible with the attitudes of the river recreation users.

16. Page 77. *This study notes the problem of slippery rocks being related to daily fluctuations. Of the private floaters surveyed in 1999, three commented on the slippery rocks. (Table 26, pg. 77)*

    Although in this survey, the number of comments is low, this effect is related to daily flow fluctuations and identified as a negative attribute. The Forest Service maintains that slippery rocks may be a more widespread concern but that many people mistakenly believe the algae is natural to the river.

17. Page 109. *IPC concludes that floaters and boaters prefer sites that have beaches by 77% and 73% respectively. (See Figure 13, pg 109)*

    This conclusion identifies beaches as a positive attribute, contributing to the quality of their recreation/aesthetic experience. The importance of beaches to floaters and boaters is clearly identified here. About three quarters of both groups agreed that beaches make better camp and picnic sites on the river than upland sites.

**Technical Report Appendix E.5-8. Description of Existing Developed Recreation Sites in the Hells Canyon Complex and Associated Recreational Use**

1. Page 34 paragraph 2, page 40. *"Throughout the years sampled, RV and tent counts revealed that usually none of the HCC developed recreation sites in the HCC were filled to capacity. The maximum RV counts at Hells Canyon, Copperfield, and McCormick parks suggest that these developed sites are the first to exceed their capacities. It is difficult, however, to determine facility capacities because of variables that exist between recreation sites." (E.5-8, 6. Discussion, 2nd paragraph on page 34 and E.5-8, Table 2, pg. 40).*

   Table 2, "Capacities and counts for sites developed for RV and tent use in the HCC", is useful information for assessing occupancy levels in the campgrounds. The information in Table 2 displays averages from recreational survey data taken during the 1997, '98 and '00 warm seasons. The Forest Service recommends that the Table 2 information be reported for the warm season of each year, to show possible year to year trends. Likewise, future monitoring should report actual percent occupancy levels for each warm season and overall operating year. The most readily available source of information for determining occupancy levels is the actual campground fee envelopes and receipts. The total number of campsites in the campground divided by the number of sites occupied each night would yield the necessary percent occupancy number. The trend and magnitude of average occupancy levels for each warm season would be helpful in determining trigger points for decisions about future development needs.

The data used in the study was from actual recreational surveys, and the Forest Service realized it is probably not practical to have this type of sample survey every year. But if campground fee envelopes and receipts are continually collected and summarized by park personnel, it should be relatively easy to track, summarize, and report occupancy levels. This level of monitoring should be completed and reported each year.

2. Page 34 paragraph 3. *Crowding scores reported from the mail survey suggest that respondents feel more crowded at IPC developed sites than at non-IPC developed sites. The percentage of recreationists who reported feeling crowded was 50% or higher at IPC sites and 40% or lower at non-IPC sites. …. Hells Canyon and McCormick parks had the highest percentage of visitors experiencing crowding (E.5-8, 6. Discussion, 3rd paragraph on page 34).*

   The Forest Service recommends that information displaying the "percentage of recreationists feeling crowded" should be provided for each individual campground. Crowding information, considered along with occupancy level reports, would help determine trigger points for decisions on future facility development needs, including the level and timing of new development at existing developed and dispersed sites. The crowding measure also needs to be monitored throughout the license period.

**Technical Report Appendix E.5-9. Description of Existing Recreation Areas in the Hells Canyon Complex and Hells Canyon National Recreation Area**

1. Page 2. *However, the majority of dispersed sites had some signs of human waste (58%) or livestock waste (54%) in at least 1 used or useable area. (E.5-9, HCC Findings, Waste and Litter, page 2)*

2. Page 59 paragraph 1. *There are very few trash receptacles or toilets, which may help explain the prevalence of litter and waste at dispersed sites. (E.5-9, 5.1.4.5, 1st paragraph on pg. 59)*

3. Page 79 paragraph 3. *A second general tendency concerns litter and human waste. Both of these impacts appear to be major problems, at least in the HCC. All but 2 sites had some trash present, and more than 50% had evidence of human waste. These elements are known to have a particularly great impact on visitor experiences and should be addressed.* (*E.5-9, 6.1, 3rd paragraph on pg. 79)*

   PM&E measures need to address both short term and potential long-term impacts and needs. Bi-annual litter patrols and additional portable toilets are short-term helps that do not adequately address long term or potential future problems. A PM&E commitment is needed that provides for additional vault toilets and garbage pickup/management in the future as specific problem areas surface.

4. Page 53 paragraph 2. *However, access roads probably should be brought up to standard. These determinations were based on the perspective of a typical passenger*

*vehicle. In many cases, the access roads and spurs are quite passable, even though grading or graveling would improve passage. (E.5-9, 5.1.3.6, 2nd para. on pg. 53) and (Table 8, pg. 54)*

The study findings indicate about 43% of access roads to dispersed sites and 50% of associated spur roads are in need of grading, and about 35% of spurs would need gravel to be brought up to passenger vehicle standard. A PM&E to address grading needs of main access roads appears to be warranted. However, road improvements could enable enough additional use to exacerbate other site problems such as litter and waste. Road improvements at dispersed sites should be coordinated with litter and waste management and with planned future facility developments.

5. Page 69 paragraph 1. *We counted 7 used areas (at 6 disperse sites) that had noxious weeds present within their perimeters and 10 used areas (at 6 dispersed sites) that had noxious weeds nearby. (E.5-9, 5.2.3.2, pg. 69)*

   A PM&E of continued monitoring for presence and abundance of noxious weeds at HCNRA dispersed recreation sites will be a key need through the license period.

6. Page 223-295. *E.5-9 HCNRA Findings and Site Descriptions, (Appendix G)*

   While the descriptions, including GPS, photos and observations provides important information, it would be helpful to have comparable insight into the past conditions at these sites. About a fourth of these sites have stranded beaches. Above the Salmon, only about a fifth of these sites have sandy beaches. Many of these sites have names that suggest the past presence of more sand than is currently there. As many of these sites have been used for some time, it would be meaningful to track the conditions of these sites into the past as well as into the future.

**Technical Report Appendix E.5-13. Recreation in the Hells Canyon Recreation Area: Selected Photos and Major Study Findings**

1. Page 50. *Litter is a common concern among recreation users; out of a list of 21 dispersed site attributes, an un-littered environment was the only one rated "necessary" by a majority of visitors. (E.5-13, Figure 47, page 50)*

   A related finding was made in study E.5-9, section 5.1.4.5, which discussed the "major problem" of litter and waste, particularly in the HCC area. IPC's DLA partially addresses the problem in the Litter and Sanitation Plan section of the DLA (E.5.4.4.1.2). Twice per year litter patrols and additional portable toilet are short-term helps that do not adequately address long term or potential future problems. A PM&E) commitment is needed that provides for additional vault toilets and garbage pickup/management in the future as specific problem areas surface.

2. Page 53. *While there are some facility types that majorities or substantial minorities want increased on specific reservoirs, most visitors appear satisfied with current levels of development.*

*However, dispersed area campers would not support a high level of development that would turn dispersed areas into small park-like campgrounds (with more substantial facilities, landscaping, hosts, and more regulations). (E.5-13, Figure 50, page 53)*

A related finding was made in study E.5-8, section 6. Discussion, page 34, which discussed the crowding concern that visitors expressed at HCC developed sites, particularly at IPC's Hells Canyon and McCormick parks.

It is quite understandable that dispersed campsite users would indicate a preference for no substantial developments, since they are the primary user group looking for the more primitive camping that involves less crowding and no user fees. However, the crowding concern, especially in the IPC parks, suggests that some additional campground development in currently dispersed use areas is necessary. Primitive dispersed camping opportunities could still be provided in many areas, even if a few select dispersed areas are chosen for development.

There's a wide range of possible development levels, from no facilities at all to full service campgrounds with Recreational Vehicle (RV) hookups. The choice doesn't have to be limited to either full RV campsite development with all amenities, or primitive sites with only minimal site developments (such as use of "passive barriers" to define camp site areas). The Forest Service maintains that a few smaller campground developments (specifically at Big Bar and Eagle Bar on Hells Canyon Reservoir) with basic amenities such as potable water, some individual campsites (with picnic tables, fire rings and shade shelters), toilet facilities and some landscaping are needed within the first five years of the new license. The developments should be an IPC responsibility and described in a PM&E measure in the FLA. A related PM&E measure is needed that addresses possible long-term development needs and how monitoring and an Adaptive Management Plan will be used to determine the extent and timing of future developments. Specific IPC funding responsibilities needs to be addressed in the short term and long term PM&E's.

3. Page 56. *Data suggest that jet ski conflicts, loud and rowdy people, and people camping too close are three issues that deserve increased management attention. (E.5-13, Figure 53, page 56)*

   The need for additional Law Enforcement presence within the Hells Canyon Recreation Area (HCRA) is evident from this finding. There is an increasing need to resolve conflicts and respond to emergencies. IPC should continue to work with the Hells Canyon Public Safety Committee to explore potential PM&E measures that might be required. For more information on PM&E needs related to law enforcement see comments on the DLA, E.5.2.2.3.2.9, Enforcement/Regulations on page 181 of this document

4. Page 79. *Many of the dispersed camps have substantial beaches that extend to the water, with higher proportions available below the Salmon (which has no upstream dams and carries greater sediment loads*). *(E.5-13, Figure 76, page 79)*

   This study finding is in agreement with the Forest Service assertion that the HCC dams have caused substantial beach degradation within the HCNRA, by blocking sediment movement as well as by creating high flows. The DLA (and IPC's PM&E's) does not adequately address this finding.

## Discussion

**Inconsistencies --** The finding reported in E.5-13, page 79, is that "there are more substantial beaches below the Salmon (which has no upstream dams and carries a greater sediment load)." This finding implies the reason for the more substantial beaches is the lack of dams on the Salmon along with the greater sediment loads. This is in agreement with the Forest Service assertion that the HCC dams have contributed to beach and terrace erosion by blocking sediment movement as well as by creating high fluctuating flows. The DLA and IPC's PM&E proposals do not address this finding. The sediment study E.1-1, page 2, has conclusions that essentially deny the role of the HCC in sandbar and terrace erosion.

Study E.5-2, page 42 and Table 12, page 81 indicates that almost all of the people camping at Big Bar were using tents. This finding is inconsistent with Forest Service surveys, which indicate that a majority of campers at Big Bar use motor homes and campers (See Forest Service response to technical report E.5-2). This inconsistency is important to the Forest Service because the site planning work for Big Bar will need to consider the actual types of recreation use occurring now. We maintain that motor home and camper use at Big Bar is a common activity that needs to be appropriately accommodated for in the immediate and long-term development plans.

There is an inconsistency between the DLA and Technical Report E.5-7 concerning the comparative desirability of beaches versus terraces for river camping. The DLA section E.3.0.6.2, page 276 states that terraces above sand beaches are generally more desirable for camping than the beaches themselves. Technical Report E.5-7, page 32 has the opposite finding: that three-quarters of floater and powerboating groups agreed that beaches provide better camp and picnic sites on the river than upland sites. The Forest Service maintains that the beaches are a very desirable component to recreation and are a valued positive attribute of the Hells Canyon landscape character. This attribute is being directly impacted by the operations of IPC operations.

**Adequacy of Analysis –** Generally, the recreation studies were very thorough and in depth. However, a Forest Service concern is the lack of complete and specific discussion on how the study conclusions and findings shaped IPC's version of PM&E's. The DLA lacks background discussion and explanation of why certain PM&E's were proposed, why other potential PM&E's were dropped, and how IPC determined their share of estimated costs. For example, why did IPC decide to not address PM&E needs for

HCNRA recreation below Hells Canyon Dam, or for trailheads and trails along the Hells Canyon Reservoir? There is no explanation provided for the omissions. Detail is also lacking on responsibilities for PM&E development needs in the future. The information presented on the proposed Recreation Adaptive Management Plan (RAMP) prompts more questions than it provides answers. Left open ended is discussion of how the RAMP would be developed and implemented, specific levels of IPC responsibility in future years as RAMP needs are identified, and an explanation of roles and decision making authority of cooperating agencies.

The studies did not address reservoir-related use of Forest Service trails adjacent to the Hells Canyon Reservoir. Seven trailhead registers have been in operation since 1998. These registers were installed cooperatively between IPC and the Forest Service in order to collect information on how much trail use was HCC related. IPC did not provide any information on trail register summaries and findings, nor was the omission of a trail PM&E explained.

Study E.5-6 analyzed reservoir level issues in the HCC. An on site and mail survey in 2000 was utilized to gauge recreationist's level of concern about fluctuating water levels. In 2000 the reservoir levels did not fluctuate greatly, and we suspect that many of those surveyed understated their true level of concern for the impact of level fluctuations, since they were essentially happy campers in 2000. Future monitoring work should continue to include on site surveys and should be conducted during large drawdown years, to better estimate the public's concern for level changes.

Study E.5-7 is limited by the scope of flow scenarios that were compared. However, the comparison of the two scenarios is valuable. The adequacy of the surveys conducted to determine river user preferences related to flows is sufficient. The information provided in this study gives a good indication of what the river users would like to see in terms of river level flows.

Study E.5-7 concludes that users prefer a diversity of flows, but the majority prefer the standard opportunity provided by flows from 10,000 cfs to 30,000 cfs. The Forest Service recommends that IPC provide a diversity of flows that is closely related to the benefits provided by a natural hydrograph, or a modified run of river scenario that would maintain minimum navigable flows during dry years. The Forest Service objectives are to provide optimal recreation in a natural setting, while maintaining navigability of the river throughout the prime recreation season. It is not a Forest Service goal to provide optimal recreation at the cost of other resource impacts.

Study E.5-7 concludes that the quality of river user experience is being impacted by IPC flow regimes. Flows that have large daily fluctuations impact the user in many ways and are considered a major issue by users. Reducing large daily fluctuations would directly reduce negative impacts to the users experience as well as indirectly reduce impacts to campsites and terraces caused by modified user patterns. The Forest Service concludes that the negative impacts to campsites and terraces caused indirectly by daily flow

fluctuations must be addressed by IPC. The Forest Service would support a flow scenario that maintains a flow fluctuation that is within the range of user acceptance.

Study E.5-7 shows that the Proposed Operations scenario allows for a maximum of 10,000 cfs daily fluctuation. This amount of daily fluctuation is unacceptable to most river users. The study found that users found daily flow fluctuations up to 5,000 cfs to be acceptable, but flow fluctuations of 3,000 cfs or less were preferred. It is clear that the Proposed Operations flow scenario would not be the preferred choice for a majority of the river users, nor would it provide the minimum requirements for quality recreation experience for river users.

The studies reviewed appear to be accurately portraying user preferences and valued scenic attributes. The Forest Service is concerned that these studies have had very little if any affect on the decisions IPC made in drafting the DLA. The proposed operations scenario does not the impacts that have occurred to beaches or other shoreline attributes. The scenario does not address the issue of daily river level fluctuations that are affecting the recreational experience of the users. No PM&Es are proposed for recreation issues below Hells Canyon Dam.

Given that the new license would last at least 30 years, its important for IPC to identify and incorporate conclusions and trends that may have been or could be identified from all of these studies.

**Impacts and Effects on NFS Lands and Resources --** IPC's proposed operation hydrology model allows a minimum flow of 5,000 cfs at Hells Canyon Dam, and a 10,000 cfs maximum daily fluctuation. The 5,000 cfs allowances would not provide an adequate minimum flow necessary for navigation. The high daily flow fluctuation allowance would negatively impact floaters and boaters and cause campsite problems. To accommodate recreation uses and other resources, IPC should consider an integrated flow scenario that incorporates minimum flow allowances and daily fluctuation rates within the identified user preference range.

IPC's proposed operation hydrology model allows a maximum 10 feet daily elevation change in Hells Canyon Reservoir. This would significantly impact recreation uses on the reservoir, particularly bank access, boat launching, moorage and chances of boat stranding. Throughout the DLA, IPC has mentioned an additional 5 feet drawdown in Hells Canyon Reservoir however IPC has not analyzed the effects of the additional drawdown on NFS lands and resources. This needs to be addressed in the FLA.

The increases in non-angling "miscellaneous" type recreation use along Hells Canyon Reservoir and at the Hells Canyon tailwater need to be appropriately considered in current and future PM&E proposals.

The IPC proposed operations pose no significant changes that will improve the trends that currently affect many of the valued resources of Hells Canyon. The effects of the proposed manipulation of outflows alone cause negative impacts to aquatic resources,

sandbars and terraces. The sediment impoundment compounds the impacts by eliminating any sediment replacement that would come from above the HCC. This loss of sediment affects the potential for sustaining riparian vegetation and shoreline terrestrial habitat that adds positive attributes to the landscape character. Daily and hourly river level fluctuations impact recreational users, forcing them to modify their use patterns regarding the way they use the recreation site, which in turn causes impacts to terraces and the cultural features located on these terraces.

The ORVs in the Wild and Scenic Snake River may be impacted by IPC operations. The landscape character is being changed due the loss of positive attributes such as sand beaches and the threat of loss of cultural features. The majority of erosion has already occurred, what remains is a precious remnant of the sandbars and gravels. It is critical that IPC recognize the role they play in the protection of this remarkable landscape and begin to make decisions that will improve the resources that recreationists value. The Forest Service can manage recreationists, but if the campsite carrying capacity continues to be reduced due to beach erosion, there is little the Forest Service can do to maintain the recreational experience. Since enactment of the HCNRA and Wild and Scenic Rivers designation, the Hells Canyon reach is known for providing quality recreational experiences.

## Preliminary Forest Service Objectives

The HCNRA should provide a unique blend of whitewater boating opportunities, a year-round diverse sport fishery, horse packing/backpacking in a remote river setting, a diversity of interpretive, sightseeing, and wildlife viewing opportunities, and protection and enhancement of the ORVs for which the river was designated Wild and Scenic.

### River Recreation

1. Develop and analyze project operation scenarios that minimize adverse effects on sandbars, terraces, riparian habitats, and aquatic habitats while incorporating recreation user needs.
2. Prepare and implement a monitoring and mitigation plan that addresses sandbars, terraces, aquatic habitat, riparian ecosystems, and recreation resources that have been affected by IPC project operations.
3. Maintain or enhance the valued recreational opportunities below Hells Canyon Dam. Prepare and implement a monitoring and mitigation plan that addresses campsite carrying capacity and effects related to beach erosion. This plan would be developed by IPC and the Forest Service.
4. Maintain or enhance a quality recreational experience at the Hells Canyon launch site and related facilities (including road access). Maintain this site as a gateway or welcome site to the HCNRA that meets and manages the destination and launch point expectations of the visitor. Provide those amenities that may be necessary in the future to meet managerial and informational services, including annual O&M, and facility modification.

**Reservoir Recreation**

The Hells Canyon Reservoir area should provide recreational opportunities that represent a blend of developed and dispersed recreation settings and facilities, and the planning and development of new facilities and sites should meet the projected demand while protecting resource values.

1. Maintain the area's roaded natural character by providing recreational opportunities that represent a blend of developed and dispersed recreation settings and facilities.
2. Maintain and improve developed recreation facilities and sites, and to plan and develop new facilities and sites to meet the projected demand while protecting resource values.
3. Manage and improve trail user's opportunities while maintaining the area's characteristic landscapes and protecting all resources. The trail use and design emphasis is for non-motorized access.
4. Provide safe and efficient access for movement of people and materials on NFS lands while meeting resource criteria.
5. Develop a reservoir recreation monitoring plan. This monitoring plan should address types and amounts of use, seasonal occupancy levels for parks and campgrounds, user perceptions, traffic count information, and user surveys. User surveys include the number of people sightseeing, wildlife viewing, and driving for pleasure on the Hells Canyon Reservoir.

In addition to being included in the monitoring plan for the new license, the Forest Service requests that as much of this information as possible be addressed in the DLA study findings and conclusions and also in the Final License Application (FLA).

The new license proposal will need to include provisions for IPC to share in the costs associated with river and reservoir related recreation and opportunities. IPC should contribute an appropriate share to the operations and maintenance, replacement, and development of recreational sites and facilities on NFS lands that are impacted by the hydroelectric project. This share should be commensurate with the effects of the project on those recreation opportunities. Site management and development will meet Forest Service quality standards and meet all applicable regulations such as accessibility guidelines of the Americans with Disabilities Act.

There are several other recreation improvement opportunities that were identified by the RARWG that the Forest Service recommend be considered as PM&E measures. Several may best be accomplished through cooperative efforts between the Forest Service and IPC, and possibly other groups such as State Departments of Parks and Recreation, BLM, Idaho Fish and Game, Oregon Fish and Wildlife, county governments, and the State Departments of Transportation.

**Roads**

Recreation use is popular at other sites along the Hells Canyon Road and Reservoir as well. To accommodate this use and be consistent with proper operation of the project, Idaho Power should continue to allow the public free access to the Hells Canyon Road (Idaho Power Road 454). IPC should continue to maintain the road for unrestricted and free use by the traveling public.

## Forest Service Response to Applicant's Proposed PM&E Measures

Forest Service comments on the portion of the DLA dealing with PM&E's are included in this section. Also see DLA Specific Comments, Exhibit E.5 Report on Recreation Resources for specific Forest Service comments on IPC's proposed PM&E measures.

In addition to the above referenced comments on IPC's proposed PM&E's, there are several omissions that the Forest Service maintains should have been addressed in the DLA package:

- IPC proposes no PM&E's for the HCNRA area below Hells Canyon Dam.
- IPC proposes no PM&E's for impacts to trails or trailheads located along the Hells Canyon Reservoir.
- In most of the PM&E's that IPC has proposed, IPC's portion of financial responsibility is listed as a certain "estimated" dollar amount. The Forest Service maintains that for Forest Service sites located on Hells Canyon Reservoir, all costs (site planning, NEPA analysis, capital improvement, and O&M) should be IPC's responsibility. For PM&Es at other locations on NFS lands the Forest Service maintains that IPC's portion should be expressed as a percentage of the total actual costs that will be experienced in the year that the work is done. Identifying an "estimated" amount now is acceptable, but there needs to be additional explanation of what percentage share of the costs of specific work elements will be IPC's responsibility and how inflation and actual costs in the year of work will be covered.

**IPC Proposed Operations**: The proposed operations flow scenario does not provide minimum flow levels for navigation and other summer recreation uses, summer flow augmentation for anadromous fisheries, sediment replacement for sand beaches and gravels for redds, and limits on daily and hourly river level fluctuations to protect, mitigate or enhance positive attributes of the shoreline of Hells Canyon. IPC needs to propose operations flow scenarios that address a variety of resource needs.

**E.6-1 Hells Canyon Resource Management Plan:** The Hells Canyon Resource Management Plan designates land and water use classifications that are to be managed by specific policies. The Forest Service is concerned that this plan does not adequately address the recreation/aesthetic issues. The RARWG developed six zones that had specific vision statements that would provide guidance and direction of future management and development of the zones. This plan does not reflect the specificity of

the six zones identified by the RARWG. The six zones, the vision statements and the zoning concept of major nodes, minor nodes and points should be recognized and utilized to collaboratively develop and implement policies that will protect, mitigate and enhance the desired landscape character of the HCC.

**E.5.4 Recreation Plan**: The Recreation Plan discussed in E.5 should be included, if in fact this plan has been developed. The Forest Service cannot adequately respond to a plan as critical as this one without thoroughly reading the actual plan. This plan was not developed by the RARWG. IPC communicated that the plan would be developed by a working group of stakeholders including the affected agencies, after the License was received.

**Development of Plans Proposed by the DLA**: There are numerous plans that are proposed or have been developed by IPC. These plans include the Recreation Adaptive Management Plan, the Information and Education Plan, the Aesthetic Design Standards and Guides, the Landscape Standards and Guides, Litter and Sanitation Plan and the Transmission Line Operations and Maintenance Plan. These plans need to be developed collaboratively with the Forest Service, BLM, State, Counties and other landowners that are responsible for HCC lands. IPC informed the RARWG that these plans would be developed and approved by a stakeholder workgroup that would include the above stated agencies. Many if not all of these plans should be linked to the Recreation Adaptive Management Plan. This agreement needs to be thoroughly defined before the Forest Service can be assured that these plans will meet Forest Service needs.

**E.5.4.1.2 Memorandum of Understanding between the USFS and the Applicant**: This full time staff member does not currently work full time for the Hells Canyon Creek Visitor Station, nor does this staff member work full time for Hells Canyon NRA related issues. This proposal would provide additional services based on year round staffing. The MOU that is currently in place serves as an interim measure until the new license is issued. The Forest Service maintains that this PM&E measure should be included as a requirement of the new license.

**E.5.4.2.1-6. Zone Vision Statements (pages E.5-72 to 73):** The included vision statements for the six recreation/social zones are not the same vision statements developed by the RARWG. The statements in the DLA are not nearly as specific and are insufficient to provide management direction that will maintain and protect the desired landscape character of each zone. See RARWG Notes of July 18 and 19, 2001, for Zone Vision Statements, Attachment A. Attachment A was not included in the CD or the paper copy of the consultation package.

**E.5.4.3.1.4/E.5.4.4.1.6. Continuation of Road Maintenance**: The Hells Canyon Road receives substantial traffic including public usage. Although this is a private road, the safety of the public is of great importance to the Forest Service. This road should be maintained at a level equal to a Forest Service Traffic Service Level B, Maintenance Level 4, FSH 7709.56. Road Pre-construction Handbook, and meet all MUTCD (Manual

Uniform Traffic Control Devices) standards that are required for roads of similar vehicular use and speed. (E.5.4.3.1.4/E.5.4.4.1.6. Continuation of Road Maintenance).

**E.5.4.4.1.5. Recreation Adaptive Management Plan**: Additional detail is needed on how the RAMP would work (especially the agency consultation process), how decisions would be made and also how specific triggers for needed action would be developed, what those triggers may be, and how they would be used as a decision tool. For further discussion, see the Forest Service comments on the DLA, page 186 of this document.

**E.5.4.4.2. Proposed Measures for Zone 1:** A Preliminary Design Report should be developed for each site that requires development in this zone. This report would be developed in consultation with and approved by the appropriate agencies. This report would develop objectives that would carry out the Zone 1 vision statement developed by the RARWG. This report would include a vision statement for the site, goals and objectives, landscape design goals and objectives, a list of needed facilities with quantities, and a justification statement. Once this report is developed and approved, the conceptual design should be developed and approved. Then construction drawings and contract would be prepared. Concurrently, the processes required by NEPA would be ongoing if the site is managed by a public agency. Construction drawings and contracts for sites must be approved by the appropriate line officer, forest engineer, and forest landscape architect. The preliminary design report should be required for development in all zones. (E.5.4.4.2. Proposed Measures for Zone 1)

Forms of the term *enhancement* should not be used by IPC to describe improvements that need to be made as part of the protection and mitigation of project effects on resources as enhancement has a very specific meaning to FERC.

IPC should have the financial responsibility for site planning, NEPA analysis, capital improvement, and O&M costs for the Forest Service sites located on the Hells Canyon Reservoir. The rationale for IPC having full responsibility is because nearly all of the recreation use occurring at these sites is directly linked to the HCC project operations. Technical Reports E.5-2 and E.5-4 provide study findings that strongly support this linkage of recreation use with the HCC project.

**E.5.6.1 National Wild and Scenic Rivers System:** IPC does not propose any PM&Es for any portions of the HCC below Hells Canyon Dam. The ORVs of the wild section of the Snake River are the scenic, recreational, geological, wildlife, fisheries, cultural, botanical, and ecological resources. The Forest Service maintains that the proposed operations and the continuing effects of sediment impoundment and daily river level fluctuations may have impacted six of the seven resources to a degree that affects the scenic and ecological integrity of Hells Canyon. The Forest Service is concerned that impacts have occurred and will continue to occur, thus endangering those ORV's recognized by the wild river designation. It is clear that IPC has a responsibility to participate in the preservation of the outstandingly remarkable values of the Wild and Scenic Snake River.

## Additional Study Requests

The following technical information is missing from the DLA and should be provided.

1. Seasonal occupancy levels need to be reported annually for the parks and campgrounds in the HCC, to develop trend information. During the license period, we anticipate that campground occupancy levels and crowding concerns will be a key trigger point in determining the future needs for additional development at Big Bar. See the Forest Service review of Technical Report E.5-8 for further explanation and for a description of a possible method to gather the data annually using campground fee information.

2. The "percentage of recreationists feeling crowded" needs to be reported for each individual campground. There is a need to establish a baseline now as well as monitoring these perceptions on a six-year cycle. Crowding information, considered along with occupancy level reports, would help determine trigger points for decisions on future facility development needs, including the level and timing of new development at existing developed and dispersed sites.

3. A summary report of IPC traffic count information needs to be reported that shows total traffic entering and leaving the HCC (in particular for the Hells Canyon Reservoir), on a daily and seasonal basis. This information may be helpful in determining the number of people sightseeing, wildlife viewing, and driving for pleasure along the Hells Canyon Reservoir.

The following is a study request to evaluate measures to stabilize and enhance fluvial and alluvial features.

**1. Feasibility Study for Stabilization and Enhancement of Fluvial and Alluvial Features**

**Study ID:** A study that proposes measures to stabilize and enhance fluvial and alluvial features in relation to dispersed recreation sites and cultural resource sites on the Snake River below Hells Canyon Dam.

**Basis for Study:** A feasibility study will determine the requirements, effects, and costs stabilization and enhancement of fluvial and alluvial features that support recreational and cultural resources.

1. Bioengineering techniques that would stabilize sand and sediment features.
2. Identify techniques that would be compatible with the constraints of the Wild and Scenic Rivers Act and withstand Snake River flows during average flow years.

**Study Methodology:** The specific methods would be determined in cooperation with agency specialists and scientists.

**Resource Goals and Objectives:** The goals and objectives for stabilization and enhancement of fluvial and alluvial features are shown below:

- Protect and enhance Outstanding Remarkable Values of the Wild and Scenic Snake River including recreation, scenery and cultural.
- Re-establish a campsite carry capacity that resembles the capacity that was available at the time of designation.
- Meet scenic integrity goals.
- Provide for the protection, preservation, enhancement, and interpretation of heritage resources so as to preserve their historical, cultural and scientific values for the benefit of the public.

**Accepted Practices:** The accepted practices for conducting a bioengineering study would be determined in cooperation with agency specialists and scientists.

**Usefulness of Information:** Appropriate techniques that would be compatible with the constraints of the Wild and Scenic Rivers Act would assist in the development of PM&E measures that could be successfully implemented to meet the resource goals.

The Forest Service requests that IPC develop and analyze an operational scenario that better accommodates recreational and other resource uses below Hells Canyon Dam. See study request #6, Integrated Resource Scenario, on page 76 of this document.

# Land Management and Aesthetics

## General Discussion

Hells Canyon is a very unique and incredible place to experience. The environment experienced in the canyon is a result of the culmination of systems in a very dramatic geological environment. The remnants of the history of mankind and the ongoing human experience add to the sense of place in Hells Canyon. The aesthetics and the recreation experience are created by all of these biological and physical systems. The effects to these systems are or will eventually be reflected by the aesthetic quality. Scenic and ecological integrity is rated to determine how negative attributes are affecting the aesthetic quality. Recreation and aesthetics cannot be separated from one another, and this report considers the aspects of both resources.

IPC operations affect the aesthetic quality and recreation experience of Hells Canyon and other NFS lands within the HCC. The river system and the elements of hydrology, geomorphology, and sediment transport are critical to the essence of the canyon. IPC operations manipulate this system and its elements for the purpose of generating hydroelectric power. There are other manipulations of the system mandated by the Army Corp of Engineers.

The Wallowa-Whitman and Payette National Forest Plans, including the Wild and Scenic Snake River Management Plan, provides direction for scenery management, including visual quality objective for sensitivity levels and variety class. The wild section of the river is managed for very high scenic integrity and the scenic section for high scenic integrity. Wilderness lands are managed for very high scenic integrity and non-wilderness lands surrounding the reservoir for moderate scenic integrity. Additionally, the Forest Plans provide direction for the management of power transmission lines.

IPC has not fully recognized nor addressed the effects of the HCC as it operates currently, nor has IPC fully explored the alternatives that could lessen or even reverse some of the effects caused by HCC operations. The value of the canyon and the HCNRA was recognized by the Congress, and its attributes are of extreme importance to the Forest Service and to people who value and enjoy NFS lands.

It is clear from the DLA and technical reports that IPC has done many studies to determine effects of operations on and the preferences of recreating publics. However, many findings from those studies have not been addressed by IPC. From sediment impacts to complaints from boaters and floaters about daily river level fluctuations, the study results have not altered the proposed operations scenario in any significant manner, nor have these results motivated IPC to analyze other flow scenarios that would address recreation-related resource issues.

Therefore, the Forest Service maintains that the proposed operations and the proposed PM&Es will not effectively address the effects of the HCC to the canyon and that the DLA does not propose PM&E measures below Hells canyon Dam to protect or enhance

the resources that make Hells Canyon so unique. Based on what IPC has proposed, the Outstandingly Remarkable Values (ORVs) of this Wild and Scenic River will not be protected or enhanced, the landscape character would not be maintained, scenic and ecological integrity would not be maintained and the recreational experience would continue to be degraded.

## Comments Specific to the Draft License Application

Quotations or sections taken directly from IPC's draft license application are shown in italics.

### Exhibit E.6. Report on Land Management and Aesthetics

See comments on E.6, Report on Land Management and Aesthetics for Sediment on page 31 of this document.

See comments on E.6, Report on Land Management and Aesthetics for Fisheries on page 109 of this document.

1. Page E.6-21. *Salt cedars, or tamarisk (Tamarix) species, are invasive riparian species, the downstream migration of which is evidently impeded by ongoing operations of Brownlee Reservoir. Salt cedars often form dense stands that out compete other riparian species (Cleverly et al. 1997). Though not listed as noxious weeds in Oregon or Idaho, salt cedar species are listed in many other western states. Prolific in the Weiser reach and reservoir headwaters, salt cedars were found nowhere else in the study area (E.6.1.5. Short and Long Term Impacts on Wetlands and Floodplains)*

   This species should be eradicated from the HCC. This non-native species is not yet widespread and should be dealt with before it becomes a problem.

2. Page E.6-21, 22. *The reduction in sediment available for deposition in Hells Canyon is thought to have contributed to a decline in the distribution and abundance of coyote willow. There is no evidence, however, that Brownlee Reservoir has trapped significant quantities of sediment of sizes that could affect any of the downstream botanical resources. Ninety-nine percent of the material trapped in Brownlee is smaller than the smallest size fraction that could replenish the sandbars in Hells Canyon (Technical Report E.1-1). Even if the current sediment in Brownlee had continued downstream, it would have been transported beyond the study area as was the actual sediment load. (E.6.1.5. Short and Long Term Impacts on Wetlands and Floodplains)*

   This comment, although made numerous times in this DLA is not supportable. See comments regarding riparian vegetation and impacts to ecological integrity previously noted in this section.

3. Page. E.6-38. *Ultimately, the goal is to blend facilities and operations with the surrounding landscape. (E.6.4.3 Aesthetic Values*)

   The goal of the Scenery Management System (SMS) and the FS Built Environment Image Guide FS-710 2001 is to develop needed and appropriate facilities that have an architectural style that is derived from the culture, heritage, and geography of the area, and that compliment the surrounding landscape.

   The RARWG was assured that IPC would consult with interested agencies in the process of developing design standards and guidelines for landscaping and physical structures. This process needs to be more specifically defined to include the scope of participation the Forest Service, other agencies and stakeholders will have in the development of these standards and guides.

   The whole concept of zones with portal facilities, major nodes, and minor nodes was developed by the RARWG to guide the effort of ensuring appropriate levels of development and design standards. This concept was developed to be the foundation for the interpretive and educational plan as well as signage, sanitation, and access management. It is imperative that the management of all of these human related elements be integrated into a framework that will coordinate the efforts to carry out the vision statements for each zone.

4. Page E.6-43. *Metal guardrails and jersey barriers would be replaced throughout the project area with barriers made of corten steel or other visually acceptable material. However, jersey barriers would not be replaced where they function as barriers to slides and falling rocks along roads and developed areas. (E.6.4.3.4.Replacement of Guardrails and Jersey Barriers)*

   Jersey barriers that function as barriers to slides and falling rocks should be stained with a concrete stain that would help the barriers blend in with the natural occurring rock in the area. Safety is an issue as well. The placement of jersey barriers should be done in accordance with Manual of Uniform Traffic Control Devices (MUTCD) standards.

5. Page E.6-44. *Developing and implementing an improvement plan for Hells Canyon Dam, including enhancement of the road entrance to the dam and HCNRA; painting contrasting or reflective fixtures (such as railings and light standards); relocating or interpreting stop logs; revegetating the shoreline below the dam; and providing interpretation of the complex. (E.6.4.3.5. Mitigation of Contrast from Project Facilities)*

   An architectural/engineering firm should be contracted to develop alternatives for visual improvements to the Hells Canyon Dam area. This site is the first introduction to the Hells Canyon National Recreation Area and the Wild and Scenic Snake River. The intent is not to make the dam be not evident but to provide an entrance to the

heart of Hells Canyon that is suitable to its international importance. This site should be modified to appear and serve as a gateway.

6. Page E.6-45. *Eagle Bar on Hells Canyon Reservoir (USFS)—This measure would include eliminating the visual contrast resulting from concrete pads at this site and from impromptu camping. The concrete pads would either be removed or covered with native gravel, and the site would be screened from the road with vegetation. (E.6.4.3.6. Enhancement of Other's Facilities)*

   The concrete pads need to be removed from the site. Covering them with native gravel is not a sufficient solution. The site plan shown in figure E.5-74 shows much more development than this paragraph discusses. It is unclear what IPC's intent is at this site. Please see discussion on Eagle Bar, E.5.4.4.2.1, on page 189 of this document.

7. Page E.6-49. *Grazing of domestic sheep and goats will not be allowed within the Planning Area because of the potential for spreading lethal disease to bighorn sheep. (E.6.4.4.3 Wildlife Resources)*

   The statement above is in error as it applies to NFS lands. The Forest Service has a current sheep grazing permit on the slopes above Hells Canyon Reservoir, on the Idaho side. Current Forest Plan direction allows for continuance of this type of use. The sheep are unloaded near Big Bar every other year. The Forest Service has implemented biological control of thistle and knapweed, by allowing sheep to graze in the Big Bar site for 1-2 days. Then they are sent up the slope onto the allotment. Also, the use of pack goats by trail users is becoming increasingly popular. The grazing permit and use of pack goats would continue on National Forest lands.

8. Page E.6-50. *Improvement of roads into and within the canyon would facilitate access of more and larger vehicles and of more people and would therefore increase potential conflicts with wildlife and other natural and cultural resources. Because lands suitable for recreation are limited and because many wildlife populations rely on the canyon for habitat, new and improved access to and within the canyon should be minimized. (E.6.4.4.5. Access)*

   The Forest Service maintains that road improvements are an appropriate action in the canyon for recreational benefits and to provide for safety of road travelers and should be considered in areas where the access is compatible with management direction and protection objectives, and zone vision statements.

Although the following comments (indented and alpha-indicated) do not relate to NFS lands the Forest Service has provided the following general comments in response to the developed zone vision statements:

a) Page. E.6-28. *And, although unnatural colors of hardscape and buildings detract from the natural landscape, they help recreationists locate these facilities*

*and therefore reduce the potential for sign clutter. (E.6.1.7 Existing Aesthetic Values)*

This statement about unnatural colors helping recreationists locate facilities is unfounded. Buildings are easily found in this landscape and have no need of obtrusive colors to set them apart from the landscape. It is not the intent of any aesthetics resource management system to make all buildings disappear into the landscape, but help them blend as to not be obtrusive. Using colors that compliment the natural color palette would be compatible with Forest Service goals.

b) Page E.6-40. *All new and modified Applicant structures (at the time of construction or modification) must comply, as must all new and existing leases, permits, and other agreements that may involve construction or modification of a structure*. (*E.6.4.3.1 Design Standards and Guidelines for Physical Structures)*

How IPC will monitor and enforce the design standards on new and existing leases, permits, and other agreements that may involve construction or modification of a structure should be described. It is unclear how permittees will be made aware that new standards are required.

c) Page E.6-41. *All new and modified landscaping by the Applicant (at the time of development or modification) must comply, as must all new and existing leases, permits, and other agreements between the Applicant and other parties for projects that may involve development or modification of landscaping. (E.6.4.3.2. Design Standards and Guidelines for Landscaping)*

How IPC will monitor and enforce the design standards on new and existing leases, permits, and other agreements that may involve construction or modification of a structure should be described. How permittees will be made aware that the new standards are required is unclear.

d) Page E. 6-43. *Developing and implementing a plan to modify the "cage" over Idaho 71 near the Brownlee Yard that would minimize the contrast while continuing to protect the powerhouse from rock . (E.6.4.3.5. Mitigation of Contrast from Project Facilities)*

The cage over Idaho Highway 71 is a concern for visual and safety issues. The structure or measures to protect the Brownlee Yard should also protect the traffic on the highway. This structure should be designed to improve the driving experience as well as provide protection. An architectural/engineering firm should be consulted.

e) Page E.6-43. *Modifying the color and reflectance of facilities at Woodhead Park during the normal maintenance process so that they comply with design guidelines and standards; modifying the landscaping during the normal*

*maintenance process to improve the transition from park to natural landscaping. (E.6.4.3.5. Mitigation of Contrast from Project Facilities)*

Modifying landscaping during the normal maintenance process is a nebulous time frame. Landscape maintenance is an ongoing occurrence. Modifying the landscaping should be scheduled at a specific time or within a maximum amount of time following the issuance of the license.

f) Page E.6-43. *Defining and emphasizing the entrance to McCormick Park; paving the access road; screening the flood berm and spoils pile; replacing the jersey barriers in the parking lot with wheel stops; and modifying signs to comply with design standards.*

*Developing and implementing an overall improvement plan for the Oxbow Power Plant area, including painting of the shop building, to lessen contrast.*

*Enhancing and identifying the entrance to Oxbow Village, including refurbishment of the visitors' area; removing or modifying the chain-link fence on the north side of the road and landscaping this area; landscaping around the facilities on the north side of the road; improving signage; painting buildings and structures during normal maintenance to contrast less with the surrounding landscape; and landscaping or filling the "island" in the road on the Idaho side of the bridge. (E.6.4.3.5. Mitigation of Contrast from Project Facilities)*

This area needs a conceptual plan to ensure coherence that will provide the visitor with a welcoming experience to the area. This is a major portal and should provide the visitor with welcome, information, education and potentially necessary supplies. The design and presentation of the facilities provided could set the tone for the entire visitor experience and help address a number of human/resource issues in a positive, proactive manner.

## Comments Specific to the Technical Report Appendices

Quotations or section taken directly from IPC's technical report appendices are shown in italics.

### Technical Report Appendix E. 6-1 Hells Canyon Resource Management Plan (HCRMP)

The purpose of the HCRMP is to provide guidance for resource management decisions and to synthesize land management and relicensing requirements. The plan consists of goals and objectives for each resource, land use classifications, policies for those classifications and implementation "tools".

This review is primarily of the land and water use classifications and policies that are related to human uses. This review does not address the goals and objectives of the

HCRMP. The goals and objectives are subject to considerable doubt due to the lack of a range of studied flow scenarios that would have been necessary to determine the best scenario to meet the goals and objectives.

1. Page 22. *Land and Water Use Classifications*

   As described on pages 22 of E.6-1, land and water use classifications were developed by incorporating 6 zones identified by the RARWG related to recreation and human uses, and 5 classes identified by the TRWG related to terrestrial habitat and use into a suitability analysis. IPC used the ESRI Spatial Model Builder to create suitability maps that classified uses that were found to be moderate to moderately suitable for those particular activities.

   This process was successful in developing broad classifications and identifying areas of concern that were classified as Special Management Areas. However, the intent of the zoning process that the RARWG developed is nearly lost in these classifications. The Forest Service maintains that the zoning process that identified 6 zones created a framework for making management decisions that would help maintain, and enhance the landscape character of each of these areas. The vision statements developed for each zone provided a landscape character goal that would guide recreation development, interpretation and education, architectural styles and law enforcement.

   The land and water use classifications described here have not captured any of the specifics of those 6 zones. These zones need to be incorporated into this plan. The PM&Es developed by the RARWG were based on these zones and the vision statements. Without these zones the framework that established the landscaper character to be maintained and enhanced is lost. This framework identified major and minor nodes that were identified as key recreation areas. Specific nodes were identified as key portals into the area, and PM&Es were developed to establish these portals and develop them appropriately. Each zone had specific characteristics identified that would give guidance to the type and level of recreation, the interpretive themes, educational needs, architectural elements, road surface type and even levels and types of needed public safety measures.

*E.6.3.2. New Development and Other Human Actions*

1. E.6.3.2. IPC states that *"Any development should be clustered within an appropriately designated area, rather than dispersed."*

   This statement needs further definition to describe what is an appropriately designated area. The RARWG zones defined specific areas for development and what level of development was appropriate.

2. *All new development and landscaping will be conducted to comply with the aesthetic design and landscape standards. Existing development and landscaping will be*

*brought into compliance with these standards as normal maintenance and reconstruction occur.*

This statement makes all the compliance measures seem minimal such as changing the paint color when the building needs to be repainted. Many compliance measures are more substantial and will not be done if the IPC waits until the building is in need of structural repair. Modifications of siding and roofing materials are compliance measures that are not normal maintenance projects. Normal maintenance and reconstruction is a very indefinite time frame. The Forest Service recommends that an implementation schedule be developed for bringing facilities into compliance.

Although the following comments (indented and alpha-indicated) do not relate to NFS lands the Forest Service has provided the following general comments:

a) E.6.3.210. *Erosion control structures along water bodies should be permitted only where essential to protect existing development or cultural resources and where technically feasible. (E.6.3.210)*

*Erosion control structures should be designed to blend or compliment the aesthetic qualities of the site.*

b) E.6.3.2.20. *Except for gravel extraction, mining will not be permitted on IPC lands. Areas in which gravel extraction may be permitted will be extremely limited, and criteria must be met for both excavation and restoration.*

The Forest Service recommends that commercial gravel extraction undertaken be consistent with aesthetic goals established for the project area.

c) E.6.3.3.31. *Gravel extraction should be allowed only to provide for local use.*

Local use should be defined. The scale of gravel extraction for whatever use is an aesthetic concern. Therefore the Forest Service recommends that no commercial gravel extraction be allowed in the project area.

d) E.6.3.2.22. *Commercial retail concessions are allowed in proper land use designations (developed recreation, community, recreation reserve, and resource conservation) within the Planning area through IPC's authorization process. The focus of these uses is expected to be recreation and recreation support. (E.6.3.2.22)*

The Forest Service recommends that there be specific limitations to the type and character of concessions related to the sense of place and the vision statement for the particular zone and location where the concession is proposed.

*E.6.3.9. Recreation/Aesthetics*

e) E.6.3.9.2. *Existing developed recreation facilities should be improved and redeveloped.*

Improvements and redevelopment should be done to meet aesthetic design standards. The use of should here implies that this is not a requirement, yet, it was understood by the RARWG that this intent was to make all facilities comply with the aesthetic design standards. The Forest Service recommends that an implementation schedule be developed for meeting aesthetic design standards at existing developed recreation facilities.

*E.6.4.1.1. Community*

1. E.6.4.1.1.6. *Retail commercial use may be permitted in community areas through the authorization process.*

   The Forest Service recommends that there be specific limitations to the type and character of retail commercial use related to the sense of place and the vision statement for the particular zone and location where the concession is proposed.

*E.6.4.1.3.2. Developed Recreation*

1. E.6.4.1.3.2. *Facilities developed in developed recreation areas should be consistent with the recreation vision statement for the area that is described in Exhibit E.5 of the New License Application: Hells Canyon Hydroelectric Project (IPC forthcoming).*

   There is not sufficient information regarding the vision statements to comment on this element of the HCRMP. The vision statements for each recreation zone were written in the RARWG. It is unclear why those vision statements are not in the draft license application.

2. E.6.4.1.4.4. *Dispersed recreation sites adjoining special management areas and resource protection areas may require buffering. The interdisciplinary Team will determine when buffering is required.*

   It is not clear what is meant by buffering in this statement.

*E.6.4.1.6. Utility Corridors*

1. E.6.4.1.6. *The existing utility corridors also provide alignment opportunities for new and expanded utility transport that would minimize further resource impacts. These alignments would hopefully be designated by federal land management agencies as recognized utility corridors.*

The designation of utility corridors by the Forest Service would need to be accomplished during the revisions of Forest Land and Resource Management Plans.

2. E.6.4.2.1.2. *A resource-specific management plan will be developed for the specific resource(s) and site design as SMA.*

   The Forest Service recommends that this management plan be developed by an interagency group, or at least be subject to interagency consultation, and approval. A specific timeframe should be set for when these management plans should be finished and implemented. Before these plans are implemented, what surety is there that dispersed recreation or any other human activity will not negatively affect the resource? Is there any monitoring plan in place or proposed to make this determination?

**E.7. Implementation**

**Program Development**

1. Page 51. *1. Information and Education Program.*

   In this section IPC discusses the development of an information and education program. The Forest Service agrees with this proposal and recommends that the I&E Program be developed in consultation with stakeholders/agencies.

2. Page 53. *USFS review of aesthetic considerations in permitting below Hells Canyon Dam.*

   The Forest Service agrees that in order to maintain the scenic integrity of the HCC and lands in and near the project area, all landowners need to cooperate. It is not clear what IPC means by this statement regarding permitting below Hells Canyon Dam.

**Technical Report Appendix E. 6.3. HCC Aesthetic Resource Inventory and Evaluation**

IPC conducted a comprehensive study of the aesthetic resource of the Hells Canyon Complex. This study utilized two systems for purposes of inventory and evaluation. The Visual Resource Management system (VRM) was used for lands managed by the Bureau of Land Management (BLM), and the Scenery Management System (SMS) was used for lands managed by Forest Service. The report summarizes the inventory and evaluation of the aesthetic resources and makes recommendations for appropriate class and scenic integrity levels, as well as PM&Es. This is an overall review of the study, however most of the comments are related to the areas managed by the Forest Service and that portion of the study that utilized the SMS.

1. Page 10. *Determine compatibility of Project effects with VRM Classes and Visual Resource Objectives for Current/Proposed Operations scenario. (2.1 Goals and Objectives)*

   The study appears to be done with the understanding that the proposed operations are the same as the current operations, which is not the case. This makes the study unable to identify changes to the study area that would be caused by the proposed operations and compare those changes to existing and historic conditions.

2. Page 64. *Table 13 shows that only 10 out of the 27 Special Places in the Snake River Corridor rate at high or very high. DEA identified detractors from scenic integrity that occurred commonly throughout the study area including transmission structures, power-generating facilities, access roads, reservoir drawdown effect, river water-level fluctuatuion effect, modifications to vegetation, hardscape elements, (e.g., river gauging stations, campground shelters, sidewalks, picnic tables), and possibly loss of sandy beaches. Pg. 64*

   This study is a sound evaluation of the aesthetic conditions. Recommendations were made regarding VRM class designations and scenic integrity levels as requested by the BLM and the Forest Service. The recommendations were based on appropriate conclusions of the importance and value of the aesthetic resources in the area. The evaluations were made regarding the complete landscape condition while effects caused by IPC operations were separated out to make PM&E recommendations. The ratings given do not place responsibility directly on IPC. It is the responsibility of the Forest Service to manage in a way that moves landscapes toward the scenic integrity objectives. However, the impacts to scenic or ecological integrity caused by IPC operations are an issue that IPC must address in the DLA.

3. Page 68. *This study made clarification that some of the effects were inconclusively related to IPC operation. For instance, the loss of sandy beaches were considered a* ***direct hypothetical****, meaning "if it exists, may be a direct result of Project facilities and operations, but existing data is inconclusive or insufficient to determine whether the Project has actually caused it." (3.5.9.2 Objective 9)*

   It is clear that some impacts that reduce the scenic integrity and ecological integrity are unrelated to IPC operations. This study does not clarify whether some impacts are directly caused by IPC operations. Therefore this study is inconclusive regarding issues such as the continuing loss of sand bars. It is clear that there are improvements that can be made by the Forest Service and IPC.

   This study does not clarify whether some impacts are directly caused by IPC operations. Designations of direct hypothetical, direct fact, and indirect fact were appropriate due to the timing of the study. Because the aesthetics study was done before other studies were complete, the necessary data was not available. It does show a need for revisiting the issues such as the aesthetics of sandy beaches now that the other hydrological studies have been completed. However, at the time of this

review, the necessary studies have now been completed. The Forest Service does not agree that the continuing loss of sandbars is a direct hypothetical and does not agree with conclusions stated in the IPC sediment study (E.1-1). The Forest Service maintains that there are known operations such as daily fluctuations or ramping and impoundment that affect the perpetuation of sandy beaches which are a key element of the scenic integrity of the Snake River Corridor. It is clear that the HCC is hindering the perpetuation of sandbars. See the Sediment discussion section of this document, page 8.

Having concluded that sandbars and terraces are dependent on a replenishing sand source that is being hindered by the HCC, the Forest Service maintains that the continuing loss of sandbars and impacts to terraces are a "direct fact". As a result scenic and ecological integrity are impacted by IPC operations.

4. Page 55. *Some commented on the negative attributes of power facilities and power lines but also said they realized that power facilities, dams and power lines are necessary and provide economical power for homes and industry.*

   This constituent information affirms that people weigh the need for aesthetic quality with other needs such as convenience and commerce provided by power and its related facilities. It shows there is a balance that needs to be made between the two interests. The Forest Service maintains that there is sufficient concern shown by the constituents to merit PM&Es that would minimize impacts of the IPC facilities to improve the aesthetics. The Forest Service also believes that there is not sufficient concern shown by the constituents to merit consideration of the removal of facilities in the area, but there is indication that opportunities to modify and manage facilities in a manner that is aesthetically pleasing is appropriate.

5. Page 67. *It must be noted that although high scenic integrity levels may be desirable, they may not be realistically attainable in some cases. For example, recommended levels at Eagle Bar and Red Ledge Mine are high, but it would not be reasonable to modify Hells Canyon Dam, which is visible from these viewpoints, so that it is not evident. (3.5.8.2.Results)*

   The decision of what is unreasonable may have been made too hastily and possibly inappropriately. Although common sense is expected to be used when making recommendations for PM&Es, the determination of what is unreasonable can be debated. The process for making this determination is not made clear. The assumption that Hells Canyon Dam must be modified to be not evident from these viewpoints to obtain high scenic integrity is not an accurate assumption. The landscape character of this area should include the existence of hydropower structures. The appropriate modifications required would not hide Hells Canyon Dam, but make the experience of viewing and driving over the dam more appealing.

Although the following comment (indented below and lettered) does not relate to NFS lands the Forest Service has provided the following general comment in response:

a) Page 32. *PM &E are needed to reduce the visual contrast of IPC facilities and operations at 35 KOPS (out of 47) where the Visual Contrast Rating exceeds the acceptable range. (2.4.5.2 Results)*

Much of the visual contrast is caused by the draw down "dead zone" that occurs around Brownlee Reservoir. This is not only a visual contrast but also a huge departure from the recreational expectations of what a reservoir complex would provide. The aesthetic experience is immensely impacted by the drawn down and the exposed denuded bank. Some fluctuation is expected but a minimum level that would support the normal recreation activities during the primary recreation season is desired. Required facilities to match the given water level would need to be provided, as well as restoration of vegetation if the chosen water level is below current high water level. It is understood that there are necessary reasons for draw down under current operations, such as flow augmentation for migrating anadromous fish. This is why the Forest Service maintains that other flow scenarios should be considered and modeled to determine what operations could best serve all resources.

## Discussion

The Land and Water Use Classifications developed in this plan are meant to provide a framework for what uses will be allowed and what policies will be implemented to manage those areas. The framework is necessary and useful, however the Forest Service maintains the classifications are not specific enough to the character and sense of place to ensure the preservation of the desired landscape character of the area. Very specific vision statements were developed for each of the six zones and those vision statements (July 18,19 2001 RARWG meeting notes) spoke to the character of the area and its unique qualities that were to be protected and enhanced. It appears that much of that work has been lost, or has not been fully incorporated. This classification system is insufficient for the protection and enhancement of the recreation/aesthetic experience.

**Inconsistencies --** There is an inconsistency concerning the desirability of beaches versus upland campsites. Study E.5-7, on pg. 32 states that three-quarters of floater and powerboating groups agreed that beaches provide better camp and picnic sites on the river than upland sites. The DLA states in E.3.0.6.2 page E. 3-276 that terraces above sand beaches are generally more desirable for camping than the beaches themselves. The Forest Service maintains that the E.5-7 study is a more accurate statement regarding the users preference toward beaches. The Forest Service maintains that beaches are a valued, positive attribute of the Hells Canyon landscape character and that HCC is largely responsible for the degradation of sediment and sediment dependent resources of the Snake River below Hells Canyon dam.

The two analyzed flow scenarios have not adequately addressed issues related to valued scenic attributes such as riparian vegetation and necessary silt and sand replacement, nor have any PM&Es been proposed to minimize impacts to these resources.

Fisheries issues were not fully addressed nor were there adequate mitigation to protect the anadromous fish, and sturgeon population. Fisheries are a valued attribute to aesthetics and recreation.

Daily and hourly river level fluctuations have not been adequately addressed in studies, and no PM&Es are proposed to mitigate for the effects these fluctuations have on sandbars, beaches, terraces and related vegetation, which make up the majority of the river related campsites in Hells Canyon.

The riparian vegetation in Hells Canyon is critical to the microclimates of the recreation campsites. The continued loss of this vegetation eliminates the minimal amounts of shade available to the user in a very hot canyon.

Study E.6.3 did not appropriately attribute impacts related to sediment transport to IPC. The study was done without adequate information regarding the IPC operations effects on sandbars, beaches, and terraces. The results of this study should be modified to reflect these impacts and recommend PM&Es that would address these issues related to aesthetics and recreation. IPC has not adequately address many issues that affect aesthetics and recreation.

**Adequacy of Analysis --** The studies reviewed generally appear to be accurately portraying user preferences and valued scenic attributes. It is unclear how the results of these studies were used in drafting the DLA. The proposed operations scenario does not address the impacts that have occurred to beaches or other shoreline attributes. The scenario does not address the issue of daily river level fluctuations that are affecting the recreational experience of the users. No PM&Es are proposed for recreation issues below Hells Canyon Dam.

Study E.6.3 compares two flow scenarios that were defined by IPC: the current/proposed operations scenario and the Full Pool Run-of-River scenario. This is a very limited range of flow scenario alternatives and does not represent options that could be beneficial to ecological functions and landscape character. Several other scenarios were recommended by the ARWG to be modeled and analyzed, however only these two were considered in this study. It appears that the study was limited by the number of flow scenarios that were compared.

Study E.6.3 addresses and rates scenic integrity as it is defined in the Scenery Management System. This study also addresses ecological integrity as the intent of SMS is defined. However, the designation of direct hypothesis related to impacts that may or may not be caused by IPC operations points to the need for related data to sufficiently determine whether IPC operations are in fact impacting aesthetic resources. It was understood by the RARWG that it was outside of the scope of this study to determine the impacts that were under the designation of direct hypothesis, i.e. continuing loss of sandbars.

It is of crucial importance to consider ecological function and whether the system is functioning in a manner that will retain or attain, or rather negatively impact the desired landscape character. The ecological integrity rating is meant to rate the key elements of an ecological function that relate to scenic attributes that make up the desired landscape character. This study does not address a key system function that can and has impacted the landscape character of Hells Canyon.

The perpetuation of sandy beaches is a key attribute of this portion of the Snake River. Sandy beaches provide a welcome invitation to a shoreline that is greatly comprised of rock cliffs and large boulders. The preference for campsites associated with sand beaches among river users is verified in Technical Report E.5-7 River Level Issues in the Hells Canyon National Recreation Area. The scenic and ecological integrity rating is affected in many special places by the reduction and continuing loss of sandy beaches.

Determining the condition of, and the cause of sandbars and beaches is outside of the scope of this Technical Report, however further recommendations related to this issue would have invariably been included in the recommended PM&Es had the condition and cause of the sandbars been known at the time of this study.

The conclusions reached in Technical Report E.1-1 Sediment Transport, Supply and Stability in Hells Canyon Reach of the Snake River has been thoroughly refuted by Wilcock, Schmidt, and Grams, Review of Idaho Power Company Documents Concerning Sediment-Related Impacts of the Hells Canyon Complex Dams on the Snake River in Hells Canyon.

It is clear that evidence necessary to prove that shrinking sandbars are not caused by IPC operations is insufficient and contrarily that the evidence points to conclusions that IPC operations do negatively affect sandbars.

The scenic integrity and ecological integrity were rated at special places. Many of these sites were rated below the recommended integrity and recommendations were made for improvement. Many places in the study were not rated for scenic and ecological integrity because those sites were not determined to be special places. It may be inferred that those places are not considered special places because of the existing low integrity. The integrity of broader more encompassing areas may be necessary to address places that could be or would be special places if aesthetics were appropriately addressed.

Study E.6.3 is adequate for the most part, however, the following questions are left unanswered:

- Direct hypotheticals need to be determined, fact or not fact, before this study can adequately evaluate the need for PM&Es.
- The judgments and how they are made in this study of whether mitigation measures are reasonable or unreasonable are not sufficiently determined.
- A limitation of this study regarding the two chosen flow scenarios is a serious omission of a no action alternative. A current operations flow scenario and the

related impacts needs to be compared to the proposed operations, a full pool/run of river scenario and other scenarios that would address other resource issues.

- The issue of daily flow fluctuations of river levels, or ramping is not addressed sufficiently in this study related to the aesthetic experience of viewing and using sand beaches, the hazards of slick, algae covered rocks on the shoreline, and the related impacts to terraces and cultural features within the terraces.
- The issue of ecological integrity of the aquatic resources is not sufficiently addressed in this study related to the aesthetic experience of viewing unique species such as sturgeon and chinook salmon.

In brief, Study E.6.3 is for the most part accurate in the evaluation of the scenic integrity levels of special places. The evaluation of ecological integrity is limited to vegetation primarily and is not sufficient. Many of the outstandingly remarkable values of this Wild and Scenic River are dependent on the ecological integrity of the aquatic resources. The constituent information gathered is helpful yet limited due to the format of the questions, and the lack of statistical relevance. The recommended PM&Es are limited by some inaccurate assumptions that the current and proposed flow scenarios are the same. It is clear that some impacts that reduce the scenic integrity and ecological integrity are unrelated to IPC operations. This study does not clarify whether some impacts are directly caused by IPC operations. Therefore this study is inconclusive regarding issues such as continuing loss of sand bars. It is clear that there are improvements that can be made by the Forest Service and IPC.

Study E.6.3 does not clarify whether some impacts are directly caused by IPC operations. Designations of direct hypothetical, direct fact, and indirect fact were appropriate due to the timing of the study. Because the aesthetics study was done before other studies were complete, the necessary data was not available. It does show a need for revisiting the issues such as the aesthetics of sandy beaches now that the other hydrological studies have been completed. However, at the time of this review, the necessary studies have now been completed. The Forest Service does not agree that the continuing loss of sandbars is a direct hypothetical and does not agree with conclusions stated in the IPC sediment study (E.1-1). The Forest Service maintains that there are known operations such as daily fluctuations or ramping and impoundment that may affect the perpetuation of sandy beaches which are a key element of the scenic and ecological integrity of the Snake River Corridor. It is clear that the operation of HCC is hindering the perpetuation of sandbars.

**Impacts and Effects on NFS Lands and Resources --** The IPC proposed operations pose no significant changes that will improve the trends that currently endanger many of the valued resources of Hells Canyon. The effects of the proposed manipulation of outflows alone may cause negative impacts to aquatic resources, sandbars, terraces, and riparian vegetation. The sediment impoundment compounds the impacts by eliminating any sediment replacement that would come from above the HCC. This continuing loss of sediment affects the potential for sustaining riparian vegetation and shoreline terrestrial habitat that adds positive attributes to the landscape character. Daily and hourly river level fluctuations impact recreational users, forcing them to modify their use patterns

regarding the way they use the recreation site, which in turn causes impacts to terraces and the cultural features located on these terraces. The Outstandingly Remarkable Values in the Wild and Scenic Snake River are being impacted by IPC operations. The landscape character is being changed due the loss of positive attributes such as sand beaches and the threat of loss of cultural features. The situation, as it is now calls for significant action to turn this downward trend around. The majority of erosion has already occurred, what remains is a precious remnant of the sandbars and gravels. It is critical that IPC recognize the role that HCC plays in the degradation of this remarkable landscape and begin to make decisions that will improve the resources that the people of this nation value. The Forest Service can manage recreationists, but if the recreational habitat continues to be eliminated by the effects of IPC operations, there is little the Forest Service can do to replace that habitat.

## Preliminary Forest Service Objectives

The Wallowa-Whitman and Payette National Forest Plans, including the Wild and Scenic Snake River Management Plan, provides direction for scenery management, including visual quality objectives for sensitivity levels and variety class. The wild section of the river is managed for very high scenic integrity and the scenic section for high scenic integrity. Wilderness lands are managed for very high scenic integrity and non-wilderness lands surrounding the reservoir for moderate scenic integrity. Additionally, the Forest Plans provide direction for the management of power transmission lines.

1. The licensee should develop management strategies to achieve the Desired Landscape Character and to meet scenic integrity goals as recommended by the Landscape Aesthetics Study (E.6.3).
2. The licensee should make efforts to make all facilities, towers, substations, structures, etc., harmonize with or subordinate to the landscape where practical.
3. The licensee should monitor resources and user preferences on a six-year cycle to ensure scenic integrity objectives are being met.

## Forest Service Response to Applicant's Proposed PM&E Measures

This section provides the Forest Service response to IPC's proposed PM&E measures for land use management and aesthetics resources.

1. **E.6-1 Hells Canyon Resource Management Plan:** The Hells Canyon Resource Management Plan designates land and water use classifications that are to be managed by specific policies. The Forest Service is concerned that this plan does not adequately address the recreation/aesthetic issues. The RARWG developed 6 zones that had specific vision statements that would provide guidance and direction of future management and development of the zones. This plan does not reflect the specificity of the 6 zones identified by the RARWG. The 6 zones, the vision statements and the zoning concept of major nodes, minor nodes and points should be recognized and utilized to collaboratively develop and implement policies that will protect, mitigate and enhance the desired landscape character of the HCC.

2. **E.6.4.2 and E.5.4. Recreation Plan:** The Recreation Plan discussed in E.5 should be included, if in fact this plan has been developed. The Forest Service cannot adequately respond to a plan as critical as this one without thoroughly reading the actual plan. This plan was not developed by the RARWG. IPC communicated that the plan would be developed by a working group of stakeholders including the affected agencies, after the License was received.

3. **Development of Plans Proposed by the DLA:** There are numerous plans that are proposed or have been developed by IPC. These plans include the Recreation Adaptive Management Plan, the Information and Education Plan, the Aesthetic Design Standards and Guides, the Landscape Standards and Guides, Litter and Sanitation Plan and the Transmission Line Operations and Maintenance Plan. These plans need to be developed collaboratively with the Forest Service, BLM, State, Counties and other landowners that are responsible for HCC lands. IPC informed the RARWG that these plans would be developed and approved by a stakeholder workgroup that would include the above stated agencies. Many if not all of these plans should be linked to the Recreation Adaptive Management Plan. All plans to be applied to NFS lands and resources will need to be done in consultation with and be subject to approval by the Forest Service.

4. **E.5.4.2.1-6. Zone Vision Statements:** The included vision statements for the six recreation/social zones are not the same vision statements developed by the RARWG. The statements in the DLA are not nearly as specific and are insufficient to provide management direction that will maintain and protect the desired landscape character of each zone. See RARWG Notes July 2001, Attachment A. Attachment A was not included in the CD or the paper copy of the consultation package.

5. **E.6.4.3.1 Design Standards and Guidelines for Physical Structures:** This PM&E should be linked to the Zones, the development hierarchy and the Vision Statements related to each zone, as well as the I&E plan. There are some minor changes in wording that would more appropriately meet Forest Service objectives for these standards and guidelines:

   a) Page E.6-38. *2. Carry out the recreational visions for different areas of the HCC.*

   This objective should directly link the standards to the 6 zones of HCC.

   b) Page E.6-38. *3. Blend the appearance of structures with the natural environment.*

   This objective should speak of harmonizing and complimenting rather than blending with the natural environment.

c) Page E.6-38. *4. Facilitate direction and guidance for visitors without creating excessive visual contrast.*

This objective should also address the issue of signage drawing too much attention to signage due to the style that may not be visually contrasting but excessively urban in character.

d) Page E.6-38. *Minimize maintenance needed to address vandalism and natural aging.*

This statement should include durability and having an appearance of permanence.

e) Page E.6-38 and 39. *E.6.4.3.1. Therefore, standards and guidelines would address the visual factors of form, line, color, and texture, in addition to facility placement. The Aesthetic Subgroup has defined a "homestead" style of architecture as the concept for the architectural standards and guidelines. This style is generally defined as a rectangular or square shape with a moderate pitch of roof. Some exceptions to this may be included. Rough-sawn lumber and native rock, or materials that resemble them, are the materials to be used in construction. Construction is to vary by region. More lumber- and less rock-like materials would be used at the upstream reaches, while more rock- and less lumber-like materials would be used in the downstream reaches to reflect the rocky canyon cliffs. The following types of facilities would be addressed by the standards and guidelines.*

This statement should address the need for the architectural style to be derived from the area and it's cultural history rather than contrived by contemporary styles of today.

The list of facilities that these design standards and guidelines is not all inclusive and it should be noted that many other types of facilities would be addressed as well, such as: visitor information buildings, new residential buildings on IPC properties, utility/facility type buildings, etc.

The procedure for developing these objectives should be clearly identified. The Forest Service recommends that the process be done with full Forest Service and other agency/stakeholder participation.

6. **E.6.4.3.3. General Aesthetic Clean-Up Plan and Implementation:** These general clean up items are those specifically listed by the Aesthetic Subgroup. It should be IPC's ongoing responsibility to maintain all of their facilities and grounds in a manner that is welcoming, inviting and aesthetically pleasing to all visitors.

7. **E.6.4.3.4. Replacement of Guardrails and Jersey Barriers:** The jersey barriers used as barriers to slides and falling rocks should be addressed in light of a road

safety issue. It may be necessary to use a barrier that is less dangerous to oncoming traffic, or turn the ends of the barriers into the hill slope, in the event of accidentally driving into the barrier. The safety of our ever increasing population of elderly drivers is very important. Aesthetically, the barriers would blend or harmonize with the landscape if they were stained with a concrete stain of the appropriate color to blend with the surrounding rock.

The following comments do not relate to NFS lands. The Forest Service has provided the following general comments:

*E.6.4.3.5. Mitigation of Contrast from Project Facilities:*

a) Page E.6-43. *Developing and implementing a plan to modify the "cage" over Idaho 71 near the Brownlee Yard that would minimize the contrast while continuing to protect the powerhouse from rocks.*

   This cage needs to address the safety of the traffic on Idaho 71 as well as protecting the powerhouse. Use materials that are complimentary to those in the Design Standards and Guidelines for Physical Structures.

b) Page E.6-43. *Modifying the color and reflectance of facilities at Woodhead Park during the normal maintenance process so that they comply with design guidelines and standards; modifying the landscaping during the normal maintenance process to improve the transition from park to natural landscaping.*

   The material that needs to be replaced is the blue roofing. Metal roofing will not require normal maintenance for many years, possibly not until after the length of the new license. If this is a PM&E, it should be address within the first 10 years of the new license.

c) Page E.6-43. *Defining and emphasizing the entrance to McCormick Park; paving the access road; screening the flood berm and spoils pile; replacing the jersey barriers in the parking lot with wheel stops; and modifying signs to comply with design standards.*

d) Page E.6-43. *Developing and implementing an overall improvement plan for the Oxbow Power Plant area, including painting of the shop building, to lessen contrast.*

e) Page E.6-43. *Enhancing and identifying the entrance to Oxbow Village, including refurbishment of the visitors' area; removing or modifying the chain-link fence on the north side of the road and landscaping this area; landscaping around the facilities on the north side of the road; improving signage; painting buildings and structures during normal maintenance to*

*contrastless with the surrounding landscape; and landscaping or filling the "island" in the road on the Idaho side of the bridge.*

f) Page E.6-44. *Making improvements at Bob Creek and the landing strip, including contouring and revegetating bare earth at the end of the airstrip and minimizing contrasts of the old substation, including the color of the building and chain-link fence. The substation building could be removed as an alternative.*

g) Page E.6-44. *Redesigning Hells Canyon Park to comply with design standards and guidelines (see section E.5.4.4.3.3.); enhancing the entrance to the park, including removal or modification of the chain-link fence; screening and landscaping the RV dump station and caretaker's house, and tying the entrance into the park visually with landscaping.*

h) Page E.6-44. *Developing and implementing a conceptual plan for enhancing the Brownlee Bridge area (just below Brownlee dam), particularly the dispersed recreation area at the Oregon end of the bridge, and planning to tie the various elements together visually.*

The Forest Service recommends that these projects should be defined by a Preliminary Design Report approved by the Design Standards and Guidelines group, in consultation with interested agencies and other parties.

i) *Developing and implementing an improvement plan for Hells Canyon Dam, including enhancement of the road entrance to the dam and HCNRA; painting contrasting or reflective fixtures (such as railings and light standards); relocating or interpreting stop logs; revegetating the shoreline below the dam; and providing interpretation of the complex. Pg E.6-44*

The Forest Service recommends that these projects should be defined by a Preliminary Design Report that is approved by the Design Standards and Guidelines group in consultation with interested agencies and other parties. This is a complex problem that should be addressed by an architect/mechanical engineering group to determine what can be done to make this site an appropriate entrance to the HCNRA.

8. *E.6.4.3.6. Enhancement of Others' Facilities:*

The Forest Service is supportive of those proposed PM&E measures that enhance other's facilities. The proposed PM&E measures should be consistent with the Zone concept vision statements developed by the RARWG. These measures need to be supported by the jurisdictional authorities or stakeholders where they are proposed.

See prior discussion on PM&E's for Forest Service facilities in the Recreation section.

## Additional Study Requests

Two additional study requests have been developed in other sections of this document. They are Study Request # 6, Integrated Resource Operations described on page 76 of the Project Hydrology section, and Study Request #1, Feasibility Study for Stabilization and Enhancement of Fluvial and Alluvial Features, on page 218 of the Recreation section.

# Heritage Resources

## General Discussion

The Forest Service maintains that HCC is largely responsible for downstream sandbar and terrace erosion resulting from sediment-free flows exiting the HCC and perhaps ramping activity. The Forest Service maintains that HCC is also partly responsible for recreation impacts downstream from the Complex as well, given the access provided by the presence of Hells Canyon Dam to areas previously remote on the Snake River. Vandalism is considered a surrogate issue to recreation access. Deterioration of organic-based archaeological material is also linked to HCC as are impacts to cultural resource sites along transmission line corridors. Finally the Hells Canyon Reservoir has adversely affected hundreds of historic properties through impoundment.

Of these concerns, IPC addressed only impacts to cultural resources along transmission lines with any degree of adequacy. The other impact concerns were either not addressed at all, or presented in a manner that reflects a lack of responsibility on the part of IPC to address the impact.

## Comments Specific to the Draft License Application

Quotations or sections taken directly from IPC's draft license application are shown in italics.

### E.4. Report on Historical and Archaeological Resources

1. Page E.4-1. Reservoir Area of Potential Effect (APE) - *Along the reservoirs, the APE consists of the area between the reservoir drawdown zone to a line 100 meters upslope from the reservoir high-pool level.*

   This information conflicts with IPC's own information provided in E.4-15 (page 16; 1.5.2). There the APE is described as being 161 meters "*inland from the high water mark on reservoirs and the from the water's edge along the free-flowing river sections*." The same comment is offered for page E.4-2 under River APE where the APE is described as 100 meters, but similarly conflicts with that information presented in E.4-15 where the APE is said to be 161 meters from the water's edge.

2. Page E.4-2. [River APE] *Of this distance, the APE for the free-flowing river segment extends downstream of Hells Canyon Dam to the confluence of the Snake and Salmon Rivers. Downstream of the confluence, Salmon River flows mask the effects of flows from Hells Canyon Dam*.

   Information collected by the Forest Service during July of 2002 indicates that extensive streamside erosion is occurring on the Snake River below its confluence with the Salmon River. For instance there are approximately 2.9 miles of streamside erosion within the 24.6 shoreline miles between the Salmon River confluence and the

north end of the Hells Canyon National Recreation Area (HCNRA) at river mile 176, while there are only approximately 1.7 miles of streamside erosion within the 101.8 shoreline miles between the Salmon River confluence and Granite Rapids at river mile 239.2 (Lucas 2002). Thus 12% of the Snake River corridor is eroding downstream of the Salmon River confluence, while only 2% of the corridor is eroding upstream.

When one factors in that many reaches of the river are vertical canyon walls void of terrace structures, the above erosion figures gain in significance when considering just how few terraces there are, or remain to be eroded within the above 63 river miles. That erosion on the Snake River is more extensive downstream from the Salmon confluence is, in an ironic sense, most likely related to the larger sediment supply that the un-impounded sediment-rich Salmon River contributes. This increased sediment supply has served to retard the effects of large scale erosion known for the Snake River above the Salmon confluence immediately following completion of the HCC.

In this sense, the Salmon's infusion of sediment has prolonged the fate of downstream beaches and terraces experienced by similar Snake River beaches and terraces above the Salmon confluence shortly after completion of the Complex. This sediment –life support process provides a fading glimpse of what beaches and terraces on the upstream portions of the Snake probably looked like prior to IPC's three dams effectively sealing off downstream stretches from upstream sediment resources. Thus, IPC's statement that "*downstream of the confluence, Salmon River flows mask the effects of flows from Hells Canyon Dam"* is probably true, but not in the sense in which it is portrayed by IPC. Additionally, the above erosional process is generally believed to begin directly below the dam and gradually work its way downstream at a rate in keeping with its appetite for entrainment (Grams and Schmidt, 1999b, Williams and Wolman, 1984). Evidence for Snake River terrace erosion downstream from the Salmon River confluence seems consistent with this explanation.

In the Sediment section of this document, page 23, it is stated that "The Forest Service maintains that the Snake River immediately below Hells Canyon Dam is, in fact, "sediment hungry" because the supply of material from upstream sources has been interrupted by the HCC, and erosion is not balanced with deposition. Figure 2 contains particle size data obtained from Appendix C of Technical Report E.1-1. It is clear that the Snake River is supply limited (sediment hungry) upstream of the Salmon River confluence. The Forest Service agrees that much of the sediment supplies upstream of the HCC have been cut off by dams. However, the Forest Service estimates that over 2,500 acre-feet of sand and larger materials have been trapped in Brownlee Reservoir. If IPC's estimates of sediment yield from the Hells Canyon tributaries is valid, it is reasonable to assume that there would not be such a drastic difference in particle size distributions upstream and downstream of the Salmon River confluence."

Due to the above information collected in 2002 which suggests that project-induced erosional processes well known on the Snake River upstream of the Salmon River confluence are indeed occurring downstream from the confluence, the APE should be extended at least to the Washington-Oregon State line (if not further) in order to assess the impact that this newly-collected erosional data, and related processes, are having on historic properties within this downstream corridor. The legal authority to ask for an increase in the APE may be found in the definition of the APE itself which states: The geographical area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist (36 CFR 800.16[d]).

**E.4.1. Identification of Historical and Architectural Sites**

1. Page E.4-6. *E.4.1.2.1.3 Hells Canyon Reservoir. Archaeologist from SAIC recommended that, of the seven archaeological sites recorded on Hells Canyon Reservoir, two are eligible for nomination to the National Register and five are potentially eligible. (E.4.1.2.1.3 Hells Canyon Reservoir).*

   This information conflicts with IPC's own data. In 3.1.1.3.2 of the Cultural Resource Management Plan (CRMP page 39), IPC states that there are nine National Register quality sites within the Reservoir, not seven.

2. Page E.4-7. *E.4.1.2.2. Historic Buildings in the HCC and Vicinity. The Applicant agrees with SAIC's evaluations of National Register eligibility except for their evaluation of the Vista House at the Hells Canyon Visitor's Center.*

   The Forest Service agrees with IPC that the Vista House should not be considered eligible for the National Register.

3. Page E.4-10. *E.4.1.3.2. Operational Impacts to Sites in Downstream Areas. Of the many impact categories recorded by the Applicant's consulting archaeologists, only riverene erosion of archaeological sites is potentially related to the operation of the project (specifically Hells Canyon Dam)...The Applicant does not control the amount and types of recreational activities in downstream areas. Recreational activities, including use of the Hells Canyon boat launch, are controlled and managed by the Hells Canyon National Recreation Area. Therefore the Applicant does not have an operational effect on archaeological sites located in downstream areas.*

   The Forest Service does not agree with this statement. There are four specific types of impacts that IPC has a responsibility for, in part or wholly, downstream of Hells Canyon Dam. River erosion, recreation impacts, vandalism and wetting/drying related decay of organic archaeological material are all known to be impacting, or suspected of impacting, historic properties below Hells Canyon Dam.

   **Erosion caused by clear-water flows**. The lack of sediment in the Snake River within the HCNRA is well documented (Carlson 1999a). Brownlee, Oxbow and

Hells Canyon dams have been extraordinarily successful in trapping and retaining sediment upstream from the HCNRA. Williams and Wolman (1984) have noted that large dams may retain 99% of river-born sediment. Indeed Schmidt and Graf (1990) reported a 98% decrease in sediment load on the Colorado River following dam construction near Lee's Ferry. By the time the Snake River impounds behind the three dams comprising the HCC, water exiting Hells Canyon Dam is "*crystal clear*" (Collier et al. 1996:24) relative to its upstream sediment load.

Because no other large streams enter the Snake River before the Salmon/Imnaha locality, the sediment-poor river flushes its way through the HCNRA for nearly 70 miles. The tendency of the Snake and other sediment-poor rivers is to entrain sediment through erosion of the river bed, sand bars, gravel bars and alluvial terraces until such time an equilibrium between sediment transport and transport capacity is reached (cf. Grams and Schmidt 1991). This erosional process is generally believed to begin directly below the dam and gradually work its way downstream at a rate in keeping with its appetite for entrainment (Grams and Schmidt 1999b, Williams and Wolman 1984). Notable evidence suggests this process is at work within the HCNRA.

Erosion of sand bars and terrace features within the HCNRA has occurred at an alarming rate since the establishment of the HCC (1958-1967). Based on aerial photo studies, Grams and Schmidt 1991, reported a 75-80% reduction in the frequency, aerial extent, and volume of the sand bars below Hells Canyon Dam during the period 1964-1982. The largest period of erosion occurred between 1964-1973 with many sand bars having been completely eroded. During this same time period high terraces also actively eroded, the rate of which was most pronounced between 1970-1973. That the highest rate of terrace erosion followed shortly on the heels of the highest rate of sand bar erosion can be seen in the function sand bars serve in stabilizing adjacent terrace features. Sand bars often serve as the toehold for high terraces (Grams and Schmidt 1999a). Once these footholds have been eliminated, near vertical terrace features are more susceptible to erosion by sediment-limited flows.

An additional challenge posed by the presence of the HCC is the lack of its flood control capability. While the small reservoirs and related ramping ability of the complex work well to supply power to the electrical grid of western North America, their small capacity serve little benefit in retaining flood water (Grams and Schmidt 1991, Grams and Schmidt 1999a). Floodwater releases from the complex are nearly identical to pre-dam flood events. Pulses of high water are essentially transmitted down stream in near real time. Slack water behind each of the three dams still serves to drop considerable sediment out of transport, but the sediment-poor Snake River simply surges forward with flood level volume and velocity. The results of these torrential clear-water events are catastrophic to fragile terraces and bars.

While it is the function of normal floodwater to also replenish sediment to stream courses, the Snake River below Hells Canyon Dam is mechanically deprived of this natural restorative opportunity. Indeed Grams and Schmidt's 1991 study showed no

aggradation of sand bars occurred within the HCNRA between 1964 and 1982. That the highest rate of sand bar erosion occurred between 1964-1973, may not be surprising given this time period is also marked by the first series of large, post-dam, clear-water floods for the HCNRA (Grams and Schmidt 1991). The apparent decline in erosion of bars and terraces within the HCNRA over the last 25 years should not be taken as a sign that erosional processes have ceased to exist. Rather, this reduction simply reflects the magnitude of erosion that occurred in the canyon immediately following the completion of the HCC.

The stripping of finer sediment from bars and terraces have left a gravelly armor substrate in many places, which has proved more resistant to erosion than sand (Grams and Schmidt 1999b). Indeed terrace erosion continues at a number of sites within the HCNRA today. For example according to Grams and Schmidt 1999b, Salt Creek Bar has receded over 50 meters between 1955 and 1990, with active erosion occurring at Fish Trap Bar as late as 1998 (Grams and Schmidt 1999a). Reid, 1999, has also documented active terrace erosion just below Tryon Creek. Lucas, 2002, has documented approximately 7,400 meters of eroding streambank on the Snake River between river mile 176 and 239.2 (4,710 of which was from the stretch between the Salmon River confluence and the Oregon-Washington State line, or 12.3 miles). Of notable concern is the terrace erosion that continues at the Tin Shed and Camp Creek archaeological sites. Grams and Schmidt 1999a, report that between 1964 and 1996 these two sites' alluvial terrace deposits, debris fan-terrace deposits, and sand bars were actively eroded. Carlson 1999b, has shown that erosion at the sites continue today.

The Tin Shed and Camp Creek archaeological sites are located within the HCNRA in the Pittsburgh Landing vicinity. Archaeological testing at both sites has shown intense occupation spanning at least the last few millennia. Grams and Schmidt 1999a, noted that in 1964 the Camp Creek site contained many large sand deposits, but by 1977 much of the sand had been eroded. Extensive terrace erosion was also reported as late as 1999, with a considerable amount of erosion occurring adjacent to eroding sand bars. Today, 50% of eroded terraces show evidence of active erosion, with nearly all the terraces having been eroded to some degree since 1964 (Grams and Schmidt 1999a).

Notable erosion at the Tin Shed site has also been reported (Grams and Schmidt 1999a). Sand deposits, alluvial terraces and fan-terraces have experienced extensive erosion since 1964, but significant terrace deposit erosion did not occur until after 1982. Interestingly, Grams and Schmidt note once again that sand bar erosion preceded terrace erosion at this site as well. Indeed terrace erosion continues at the site today. Visits to the site by a Forest Service team in 1999 revealed a variety of artifactual remains including bone, shell and projectile points eroding out of remaining terrace features and/or existing as lag deposits resulting from newly eroded terrace faces.

Clearly, sand bars and terrace features within the HCNRA have been drastically

altered since the establishment of dams comprising the HCC. Concerning the mechanism responsible for the extensive reduction of sand bars, Grams and Schmidt 1999a, have stated that "the rapid erosion of sand deposits in Hells Canyon is most likely caused by the lowered sediment concentration coupled with an unaltered flood regime." They further summarize that this process is generally linked to the subsequent erosion of terrace features by stating; "most of the terraces are adjacent to sand bars or locations where sand has been eroded. Loss of sand deposits may remove buttress-type support from the terrace and exposes a greater height of the bank. Removal of the sand bar support would increase the likelihood of bank failure and would expose the base of the terrace to streamflow at a lower discharge, increasing the time of exposure to potentially erosive flows" (Grams and Schmidt 1999a):18).

In the Sediment section of this document, page 23, it is stated that "The Forest service maintains that the Snake River immediately below Hells Canyon Dam is, in fact, "sediment hungry" because the supply of material from upstream sources has been interrupted by the HCC, and erosion is not balanced with deposition. Figure 2 contains particle size data obtained from Appendix C of Technical Report E.1-1. It is clear that the Snake River is supply limited (sediment hungry) upstream of the Salmon River confluence. The Forest Service agrees that much of the sediment supplies upstream of the HCC have been cut off by dams. However, the Forest Service estimates that over 2,500 acre-feet of sand and larger materials have been trapped in Brownlee Reservoir. If IPC's estimates of sediment yield from the Hells Canyon tributaries is valid, it is reasonable to assume that there would not be such a drastic difference in particle size distributions upstream and downstream of the Salmon River confluence."

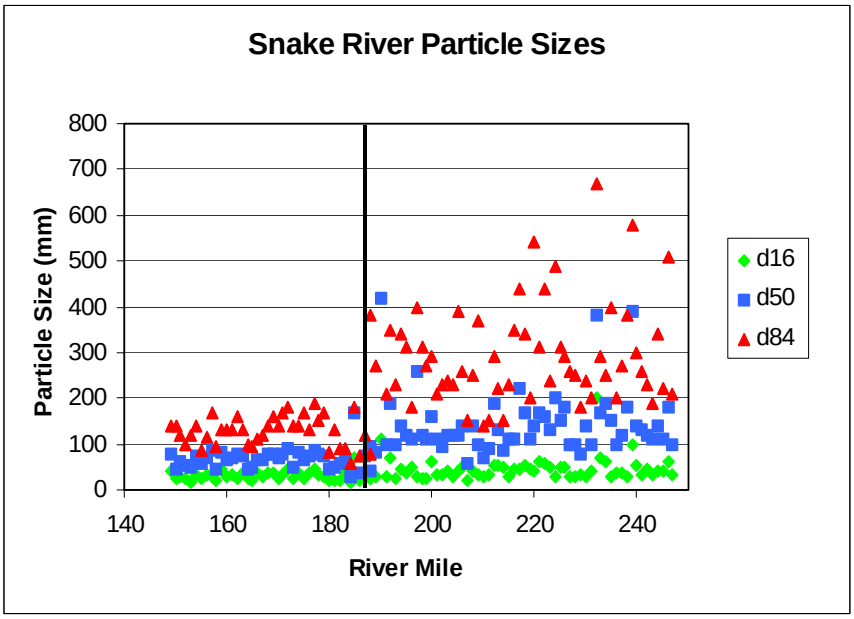


Figure 2. Bed material particle sizes in the Snake River. The vertical line represents the Salmon River confluence at RM188 (From Kendall, 2002:4).

In the Sediment section of this document, it discusses that the Forest Service maintains that construction of the HCC is indeed responsible for sediment starved floods because Brownlee Reservoir contains an estimated 9 million tons of sand-sized material. The HCC prevents this material from entering Hells Canyon, and is a direct project impact. In addition, the three reservoirs that make up the HCC cover 94 river miles and intercept all sediment from local tributaries.

Concerning this idea, Wilcock et al. state "We find that the rate of sand loss in Hells Canyon is no more than one tenth of the rate at which sand had been supplied from upstream, but is now eliminated by the HCC. This ratio indicates that the sand bars in Hells Canyon represent a small proportion of the previous sand transport through Hells Canyon, an observation that is consistent with, and supports, the conclusion that the HCC is largely responsible for sediment losses in Hells Canyon. This conclusion rests not only on the available empirical evidence linking a reduction in upstream supply (in time, space and magnitude) with the observed sediment loss in Hells Canyon, but is also consistent with our understanding of sediment dynamics in canyon rivers." (Wilcock et al. 2002:21)

Wilcock et al. further state "We believe that IPC's argument that HCC flows are unrelated to terrace erosion is unsupported. No data are provided to support this contention, and the other processes that might cause erosion are entirely speculative" (e.g. recreational foot traffic and wind). (Wilcock et al. 2002:18)

Lastly, Wilcock et al. conclude "We found the overall approach taken by IPC to be most discouraging. The available evidence on sand bar loss in Hells Canyon has been entirely omitted from the Parkinson et al. report. Air photo analysis clearly shows the coincidence in space and time of sand bar loss with closure of the HCC complex. Although IPC purports to investigate this impact, they simply omitted from their analysis all air photographs taken after closure of the HCC. This is a curious approach if the goal is to honestly investigate the possible impacts of the HCC on the Hells Canyon sediment resources. The photographic analysis clearly demonstrates the sand bar loss following closure of the HCC. IPC does not directly challenge these results, but instead raises diversionary challenges to vaguely stated "assumptions" behind it. Rather than present an objective and open review based on the best available science, IPC uses arguments that divert attention away from the real issues, or that undermine compelling conclusions regarding the HCC without directly addressing the scientific evidence" (Wilcock et al. 2002:22-23).

IPC has also shown that between 7% and 37% of archaeological sites recorded during the relicensing survey suffered from erosional impact (page E.4-14). This broad range is unfortunately the result of two different crews utilizing two different methods of evaluating impacts. The Forest Service finds it troubling that IPC had two different crews working in the field with two different sets of criteria concerning what constitutes which kind of effect, especially for impact categories such as erosion. This arrangement is inconsistent with a relicensing process having notable interest in both the legal and political arenas, and serves to distract from the ultimate merit of

data assembled for that area below Hells Canyon Dam.

**Project-induced recreation impacts** (portions gleaned from McFaddan 2000). Historically, pre-dam recreational opportunities in Hells Canyon were limited in the spring by high water, in the winter by frozen water and in the late summer and fall by low water.

Use figures for 1963 show only three commercial boat permittees working in the Snake River Canyon at that time. These operators took approximately 750 people into the canyon where they each averaged four-day stays. Two permittees operated out of Lewiston, Idaho while the third operated from Homestead, Oregon. Conversely, approximately 400 people averaging a five-day stay entered the canyon in privately owned craft from the Lewiston Basin area in 1963. It should be noted that navigation between Johnson Bar and Battle Creek was considered so hazardous that this stretch was seldom attempted. Additionally, motorized navigation became difficult in certain stretches due to low water in the late summer and fall (High Mountain Sheep Impact Report 1965).

Prior to 1967 recreation opportunities in the upper canyon were thus limited due to poor access. Recreation use was light, resulting in infrequent horse-pack trips and a few river raft tours provided by the three commercial outfitters permitted at that time (Multiple Use Survey Report 1970). River use increased dramatically with the construction of the Hells Canyon Dam and paved access road extending to the launch facility at Hells Canyon Creek. Visitor use data indicates from 1971-1997 visitor use at the Hells Canyon Creek launch site increased from several thousand to over 30,000 during the primary season (Memorial Day through the middle of September).

Not only did the construction of the HCC effectively shut down 95 miles of whitewater recreation opportunity including five large rapids, it consequently opened up direct access to the only remaining Class IV rapids on the river (between Hells Canyon Dam and Rush Creek). The effect was to concentrate free flowing river recreation into a small portion of the canyon directly below Hells Canyon Dam, and extend the season of use to virtually year-round. This increased use has occurred at the same time carrying capacity has been greatly reduced.

It has been noted that sand bars below Hells Canyon Dam were reduced by 75-80% between 1962-1982 (Grams and Schmidt 1991). Grams and Schmidt 1999a, have also noted that this process is probably related to a lower sediment concentration and an unaltered flood regime resulting from the presence of the HCC. The resulting effect of this process has been to alter the pattern of recreation within the HCNRA. While the limited pre-dam river users chose to camp and otherwise recreate on the multitude of sand bars within the canyon, the historic reduction of these bars have served to focus increased post-dam recreation activity into an even smaller area on the river in addition to forcing river-users higher upon the terraces in search of suitable camp locations.

The impacts to archaeological sites have been notable. Recreationists build and continue to improve established camp locations atop sensitive archaeological sites resulting in the trampling and compaction of soil, in addition to artifact breakage. Further, in an attempt to acquire flat camp locations on an otherwise inclined slope, campers often excavate tent platforms into streamside terraces and slopes. To insure proper foul-weather drainage, the same campers often excavate drainage channels around tent locations to insure dry sleeping conditions. Not to be overlooked is the tendency for campers to continually till the same secluded areas adjacent to camps, in an effort to dispose of waste. In addition to altering soil chemistry, the above activities generally serve to churn, mix and otherwise destroy sensitive information. That this activity takes place, in part, on or near actively eroding terraces only serves to aggravate further erosion problems stemming from project-induced clear-water flows.

Moreover, the above statement by IPC conflicts with their own statements. On page E.4-12 (E.4.1.3.2.1.) IPC states, "*Although many impacts were observed, the kinds of effects potentially relevant to the licensing process are those related to river flows/erosion and recreational use*." Thus in one statement IPC disavows any linkage with recreation impacts and then later states that there may indeed be a project recreation linkage.

**Vandalism** (portions gleaned from Womack 1999). In 1978, the first systematic heritage resource inventory to occur within the HCNRA was undertaken by the Forest Service. Involving both the Idaho and Oregon sides of the Snake River, from Hells Canyon Launch to the northern boundary of the National Recreation Area, this survey resulted in the identification of over 700 historic properties. Additionally, the survey also revealed that 20% of these resources (n=140 sites) had already been degraded by site theft/vandalism activities. Of the 140 damaged sites, 60 sites or 43% occur within the first ten miles below Hells Canyon Dam. As noted above, pre-dam access to that area of the river just downstream from where Hells Canyon Dam stands today was very limited. Prior to the construction of the dam, there was no road access beyond Eagle Bar on the Idaho side, and no road access on the Oregon side past Nelson Creek (1948 Wallowa-Whitman N.F. map).

In 1989, a heritage resource monitoring survey was conducted along the Snake River within the HCNRA. Eighty-seven sites were visited and site theft activities were documented at 69 (79%) of the sites.

Forest Service experience with site theft and vandalism in Hells Canyon has repeatedly shown that looting impacts to archaeological sites generally heal within several years following an incident. The evidence of looting apparent in both 1978 and 1989 indicate a trend for this kind of activity, and minimally places the time of looting between the mid-1970s through 1989.

Looting, vandalism and direct recreation impacts continue to occur in the HCNRA today. Recent survey work in the canyon (1998-2000) has shown intentionally

excavated holes in a cemetery near the Rush Creek vicinity believed to have been made within the last few years. Also, rock art along the river corridor continues to experience an apparent exponential increase in fading starting just after the time Hells Canyon Dam was constructed. This increased fading has been attributed to over-exuberant touching by visitors (Ken Reid; personal communication). Loubser 1997, also notes intentional vandalism at rock art sites located near Lower Granite Creek, Higher Granite Creek, Saddle Creek, Bernard Creek and Lower Cotton Wood. He also notes that a new visitor trail to a rock art site has developed within the past few years near Saddle Creek.

**Accelerated deterioration of organic properties due to fluctuating water levels.** Little is known about the effects this process is having on organic properties within the drawdown zone associated with HCC reservoirs, or subsequently downstream within the terraces encasing archaeological deposits. However, Murphy 1981, in Reid 1999:4, has stated that "*fluctuating water levels behind dams rapidly disintegrates vertebrae bone tissue, low fired ceramics, and pollen grains*." Intuitively, given the hundreds of complex archaeological sites within both the river and reservoir corridor, there is reason to suspect this same process is probably at work within the HCC.

4. Page E.4-11. *E.4.1.3.2. The hydraulic capacity of Hells Canyon Dam is 30,500 cfs. Therefore, flow-related effects to archaeological sites located outside of the reach that lies within the 30,500-cfs level cannot reasonably be assigned to project operations.*

   This is incorrect. The well documented beach erosion that has occurred downstream of Hells Canyon Dam has removed the buttress-type support from adjacent terraces. Without this basal-support the adjacent and artificially steep terraces fail, bringing with them deposits located higher on the terrace (not unlike removing the door at the bottom of a grain silo). Further the blockage of sediment by the Hells Canyon Dam has prevented the river from re-depositing and replenishing sediment higher upon the terraces (above the 30,500 cfs level) through hydraulics normally associated with larger flood events on un-impounded rivers.

5. Page E.4-11..*(E.4.1.3.2. Observations must be made while the erosion is occurring. Then, in combination with data from other disciplines, one may be able to distinguish project-related from nonproject-related flows.*

   IPC believes that direct observation is the only way to infer what phenomenon is responsible for impacts to sites. However, IPC's field archaeologists experienced little problem in characterizing impacts to archaeological sites from a variety of different agents they did not observe. For instance, IPC notes numerous sites impacted from past vandalism activity. Yet IPC's archaeologists did not witness any vandalism in the field. How can a site be characterized as vandalized when it was not observed being vandalized? The Forest Service maintains IPC's field archaeologists can indeed make valid determinations of effect. For instance when a placer mining-

row situated perpendicular to the river's shoreline has sand related sediment within the feature above the 30,500 cfs line, and no sand within the same feature below the 30,500 cfs line, it would be reasonable to conclude that river erosion has stripped the finer sediments below the 30,500 cfs mark. However, IPC archaeologists were restricted from being able to state this fact as they did not personally observe the river stripping the sediment (Mark Druss, CRWG Meeting 2001).

A similar comment applies to the second paragraph of E.4.1.3.2.4 (page E.4-23). IPC has used intuitive knowledge to further their assumptions as fact. However, since IPC did not witness historic flood events the Forest Service cautions that their own logic suggests IPC cannot then use hypothesized effects from these floods to explain away contemporary impacts noted by their own field archaeologists.

6. Page E.4-12. *E.4.1.3.2.1. Although the* [erosional] *categories vary somewhat between the two survey teams, they can be reconciled.*

   The Forest Service finds it troubling that IPC had two different crews working in the field with two different sets of criteria concerning what constitutes which kind of effect, especially for an impact category such as erosion. This arrangement is inconsistent with a re-licensing process having notable interest in both the legal and political arenas, and serves to distract from the ultimate merit of data assembled for that area below Hells Canyon Dam.

7. Page E.4-14. *E.4.1.3.2.1.1 and E.4.1.3.2.1.2.* IPC acknowledges that 196 sites were found to be suffering from river related erosion. However, 15 of these sites were described between pages E.4-15 and E.4-17. No rationale was provided as to why IPC chose to only discuss these 15 sites, and not the other 181sites. Further, the Forest Service finds it troubling that such a large discrepancy exists between the numbers of sites found eroding by one survey team vs. the other survey team (7% vs. 37%). They each recorded a like amount of sites and virtually identical stretches of the river, but yet their erosion results were separated by an enormous statistical margin. Based on this data it appears as though one survey team recorded erosion as they found it, while the other survey team chose, for reasons not explained, not to record erosion as it was encountered. The Forest Service would like an explanation as to how this could have occurred, and also evidence as to why the field results associated with the "7% survey team" should be accepted.

8. Page E.4-14. *E.4.1.3.2.1.2. Of the several recorded impacts mentioned above, only river erosion impacts are potentially related to project operations. The Applicant has no control over recreational activity occurring below Hells Canyon Dam. Therefore, recreation impacts are unrelated to project operations. The following sections discuss the extent to which these two classes of impacts are related to project operations.*

Again, in another internal inconsistency, IPC has provided statements indicating they are not responsible for recreation impacts below Hells Canyon Dam, and then in the next sentence state that perhaps they are.

9. Page E.4-15. *E.4.1.3.2.1.2. Sites located higher above the river* [than 30,500 cfs] *(that is, subject to 50,000-; 75,000-; and 100,000-cfs flows) are not within the range of Applicant-controlled flows*.

   The Forest Service disagrees, but does acknowledge the 30,500 cfs operational limit of Hells Canyon Dam. Obviously the HCC is not known for its flood control capability. While the small reservoirs and related ramping ability of the complex work well to supply power to the electrical grid of western North America, their small capacity serve little benefit in retaining flood water (Grams and Schmidt 1991, Grams and Schmidt 1999a). Floodwater releases from the complex are nearly identical to pre-dam flood events. Pulses of high water are essentially transmitted down stream in near real time. Slack water behind each of the three dams still serves to drop considerable sediment out of transport, but the sediment-poor Snake River simply surges forward with flood level volume and velocity. The results of these torrential clear-water events are catastrophic to fragile terraces and bars, including those above the 30,500 cfs line. While it is the function of normal floodwater to replenish sediment to stream courses, the Snake River below Hells Canyon Dam is mechanically deprived of this natural restorative opportunity. The tendency of the Snake and other sediment-poor rivers is to entrain sediment through erosion of the river bed, sand bars, gravel bars and alluvial terraces until such time an equilibrium between sediment transport and transport capacity is reached (cf. Grams and Schmidt 1991). Thus "clear-water" flood events caused by the presence of the HCC will entrain sediment from above the 30,500 cfs line. This entrainment is otherwise known as erosion.

10. Page E.4-17. *E.4.1.3.2.2.2. The foregoing indicates that not all sites needing immediate attention fall within the limits of project operations. There fore, these sites are not adversely affected by project operations.*

    The Forest Service does not agree with this statement. The information provided above (under comments to page E.4-15) suggests that project operations can and do affect historic properties above 30,500 cfs.

11. Page E.4-17. *E.4.1.3.2.3. Therefore, in order to provide a more precise description of erosion impacts, we now discuss erosion at the feature level.*

    The Forest Service acknowledges this line of discussion as having merit, but offers that the discussion that follows it concerns only those features that were recorded on the surface of each site. Given that most sites have considerable depth, it can be assumed that if erosion continues to occur, considerably more, and currently unknown, features will be adversely impacted in the near future.

12. Page E.4-21. *A more recent study commissioned by the U.S. Forest Service reaffirmed the sediment-starved flood hypothesis (Grams and Schmidt 1999a,b). However, evidence compiled by the Applicant demonstrates that the sediment-starvation paradigm proposed by Grams and Schmidt is incorrect (Technical Report E.1-1). For example, the HCC does not block sediments of the size needed to build beaches; instead, silt is trapped behind Brownlee Reservoir, and materials for building beaches comes from local tributaries. Grams and Schmidt also failed to realize that other dams have already enclosed 87% of the watershed upstream of the HCC and impoundments by the time the HCC was constructed.*

    See comments offered under E.4-10.

13. Page E.4-23. *(E.4.1.3.2.4. The monitoring efforts described as PM&E measures in section E.4.2.5 of this application will include data collection techniques designed to distinguish project-generated erosion from natural erosion.*

    The PM&E's referenced above do not include information as to how this data collection program may work. Also, the Forest Service questions why these data collection techniques have not already been implemented. River erosion was identified many years ago (1997 Formal Consultation Package) as a dominant issue in the relicensing process, but yet IPC did not address this monitoring issue in their Study Plans to date, and instead allows the reader to infer they just discovered erosion is affecting historic properties along the Snake River. A similar statement is offered for E.4.2.4.1 (page E.4-29).

14. Page E.4-23. *E.4.1.3.2.4. Therefore, with the possible expectation of effects from daily flow fluctuations related to project operations and occurring below 30,000 cfs, the HCC is not the cause of adverse effects to cultural resources in downstream areas because of riverine erosion.*

    The Forest Service acknowledges that daily flow fluctuations may be affecting historic properties, but does not understand how that subject suddenly appears in the DLA. Until this statement, daily flow fluctuations have not been addressed at all within the cultural resource section of the DLA. How daily flow fluctuations affect historic properties needs to be addressed. The Forest Service is open to discussions concerning this effect.

**E.4.2. Measures Recommended by the Agencies and Tribes**

1. Page E.4-28. *Three oral history studies have been completed, one study is underway, and two more may be developed pending cooperation from the Tribes.*

    The Forest Service questions why IPC has not instigated an Oral History program with the Joseph Band of Confederated Tribes of the Colville Indian Reservation. Clearly this group's ancestors, as much if not more than other groups, occupied the

area of the HCC. Moreover IPC has identified them on page 10 of the CRMP (1.3 Consultation) as having an interest in the HCC.

2. Page E.4-31. *E.4.2.5.1.1. Description. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to recreational or private use of the areas underneath the transmission lines.*

   IPC has made no attempt to state what a distinguishing characteristic of project erosion is, only that they will try and determine it.

3. Page E.4-41. *E.4.2.5.1.5. Justification. Project operations are not causing any demonstrable impacts to archaeological sites downstream.*

   See comments for page E.4-10.

4. Page E.4-42. *E.4.2.5.1.5. Description. Each site would be visited at least five times over the 30-year license period.*

   IPC has provided the rate of erosion for one site below Hells Canyon Dam (page E.4-16, E.4.1.3.2.2.2.). This rate was approximately one meter per year. Assuming a similar rate of erosion at other sites, many historic properties may cease to exist at the end of the first six-year monitoring cycle. Thus, the apparent purpose of the monitoring program is to document once that a given site no longer exists. This is not acceptable. The monitoring frequency should be in keeping with the known impacts (and rate of impacts) affecting sites. IPC's own data reflects that a more aggressive monitoring schedule is required to accurately capture site condition information and impact identification.

5. Page E.4-42. *E.4.2.5.1.5. Description. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to boat wakes or wind action.*

   No information is provided by IPC as to how this distinction would be made.

6. Page E.4-42. *E.4.2.5.1.5. Description. As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the reservoir APE.*

   This is a cut-and-paste error. This statement is wholly confined within discussions related to a monitoring program downstream of Hells Canyon Dam, not a reservoir.

7. Page E.4-44. *E.4.2.5.1.6. Justification.*

   The six goals stated here for the CRMP are different than the five goals noted on Page 50 within 4.2 of the CRMP. While all eleven tasks may in fact be goals, having two stated sets of goals is confusing.

8. Page E.4-47. *(E.4.2.5.1.7. Justification. Project operations are not causing any demonstrable impacts to archaeological sites downstream.*

   The Forest Service does not agree with this statement. Available evidence suggests the opposite is true (see comments above for page E.4-10). Also, IPC has led the reader to infer they would fund this PM&E, as it is listed along with the other "funded" PM&Es. However, close examination reveals that IPC has chosen not to state they would fund this $3.2 million project. The Forest Service has asked IPC for clarification of this issue via E-mail on October 31, 2002. IPC has, to date, chosen not to respond. IPC has also chosen not to pay for PM&E E.4.2.5.2.1 (Stabilization of Sites on Brownlee Reservoir).

9. Pages E.4-61 through E.4-70. *E.4.2.5.3.6*. IPC has proposed to fund six Tribes $1,000,000 each. However this is internally inconsistent with 4.4.2.3 found within the CRMP. There, IPC has proposed to give $1,005,000 to four Tribes (Burns Paiute, Warm Springs, Nez Perce and Umatilla Tribes) and $502,000 to the Shoshone-Paiute and Shoshone-Bannock Tribes. Further, on page 10 of the CRMP (1.3 Consultation) IPC has shown that the Confederated Tribes of the Colville Indian Reservation have an interest in the HCC. However, no funding has been allotted to them, as there was for the other six Tribes within 4.2.5.3.6, for PM&E participation, scholarships or cultural resource enhancement projects.

## Comments Specific to the Technical Report Appendices

Quotations or sections taken directly from IPC's technical report appendices are shown in italics.

**Technical Report Appendix E.4-1 (Volume 1). From Hells Canyon to the Salmon River: Archaeological Survey of Hells Canyon.**

1. Page 3. *Because the potential impact of fluctuating river flows and the recreational opportunities were provided by river management, the project corridor was set at the area between the water's edge at the time of the inventory and an imaginary line 100 meters (328 ft) from normal high water, as indicated by vegetation growth.*

   This survey area description conflicts with the survey area description provided on page 16 (1.5.2) of the CRMP where it was said to extend 0.1 mile (528 feet or 161 meters) inland from the high water marks on reservoirs and from the water's edge along the free-flowing river sections. See also E.4-1 (Volume 2) page 5, 2nd paragraph; as well as E.4-1 (Volume 3) page 3.

2. Page 5. Inventory Techniques. *The following records were made for each site….An Intermountain Antiquities Computer System (IMACS) record form.*

The IMACS form is not accepted by the Forest Service or the Oregon State Historic Preservation Office (SHPO) for sites located in Oregon. The Forest Service will only accept site forms for Oregon sites on the approved State of Oregon site forms.

**Technical Report Appendix E.4-2 (Volume1). Archaeological Inventory in Oxbow and Hells Canyon Reservoirs, Hells Canyon Complex.**

1. Page 4. Under Land Jurisdiction in Table 1-1, IPC lists there being a Wallowa and Whitman National Forests. There have not been these two separate National Forests since 1954. The correct designation should be Wallowa-Whitman National Forest. The same comment applies for Table 5-1 on page 43, Table 5-2 on page 45, Table 5-9 on page 59, Table 6-1 on page 65, Table 6-3 on page 69. The Forest Service has previously supplied this comment to IPC, but to date the appropriate changes have not been made.

**Technical Report Appendix E.4-3 (Volume 1). Cultural Resource Survey of the Brownlee Reservoir Drawdown Zone and Reservoir Margin, Washington and Adams Counties, Idaho; Baker and Malheur Counties, Oregon.**

No specific comments are offered at this time.

**Technical Report Appendix E.4-5. Cultural Resources Survey of IPC Transmission Line 945: Pine Creek-Hells Canyon Adams County, Idaho.**

1. Page 6. *Site 10AM77…The site is an appealing campsite and is regularly used.*

   The Forest Service agrees. The reservoir-edge site has intact deposits and experiences considerable project-induced recreation. The Forest Service recommends this site be hardened.

**Technical Report Appendix E.4-7. Results of an Archaeological Survey of Hells Canyon Transmission Lines 907, 908, 909, 910, and 913, Baker and Wallowa Counties, Oregon, and Adams County, Idaho.**

1. Page 16. *A total of 18 previously undocumented sites were identified and recorded.*

   To date, the Forest Service has not been supplied with copies of these site forms. The Forest Service also reminds IPC that these forms must be completed on the approved State of Oregon site form.

**Technical Report Appendix E.4-11. Non-Native Exploration, Settlement, and Land Use of the Greater Hells Canyon Area, 1800s to 1950s.**

**Technical Report Appendix E.4-12. An Archival Review and Ethnographic Study for the Relicensing of the Hells Canyon Complex Hydroelectric Plants.**

**Technical Report Appendix E.4-13. Native American Oral History Studies of the Hells Canyon Complex and Vicinity.**

**Technical Report Appendix E.4-14. Hells Canyon Complex Historic Buildings Reconnaissance Survey.**

No specific comments are offered at this time.

**Technical Report Appendix E.4-15. Cultural Resources Management Plan, Hells Canyon Complex.**

1. Page 2. *Executive Summary*. *The following Cultural Resources Management Plan (CRMP) was written in order to manage archaeological, historical and cultural resources in Hells Canyon.*

   This is incorrect. As is stated on page 1 of the CRMP "*document is* [only] *designed to guide the management of cultural resources on Idaho Power Company (Company) lands in Hells Canyon…*" and as stated further on Page 2 the CRMP "*applies only to resources within the Company's control in the Hells Canyon License area*." The important point here is that the CRMP does not cover the entire APE identified and surveyed by IPC.

2. Page 2. *Executive Summary*. *The CRMP also provides for access by Native Americans to traditional cultural places and scared areas.*

   The Forest Service does not understand how the CRMP provides for access to these site types. Neither of these site types was identified within the HCC project area.

3. Page 3.1.1. *The CRMP would be implemented by a programmatic agreement (PA) among the Company, FERC, Advisory Council on Historic Preservation (Advisory Council) and State Historic Preservation Officers (SHPO).*

   At this time, the Forest Service reserves the right to be a full signatory to the PA and CRMP.

4. Page 3.1.2.1.1 *A number of federal laws and regulations pertain to this CRMP*

   Nowhere are Treaty Rights addressed, nor is it explained who has Trust Responsibility for these. Further, how does the Programmatic Agreement between the Forest Service, ACHP, and Oregon SHPO (*Cultural Resources Management on National Forests in the State of Oregon),* factor into the future management of Forest Service resources affected by a potential CRMP, or undertakings associated with the Complex?

   Moreover, an additional law that is not included in this section is the Act that established the Hells Canyon National Recreation Area (HCNRA). The Forest

Service maintains this piece of legislation is critical in understanding the significance of cultural resources within Hells Canyon. The Act specifically mandates protection and preservation of archaeological and historic sites within the HCNRA. The Forest Service finds it curious that despite its relevant cultural resource protection language, IPC chose not to mention the Hells Canyon Act anywhere in its discussions concerning cultural resource laws pertaining to the HCC. What better legal context exists for addressing cultural resource protection than a cultural resource related Act with the same name as IPC's Complex?

5. Page 8. 1.2.2.1. *A similar* [Protection of Graves] *protocol will be developed in consultation with the Oregon SHPO and consulting tribes.*

   The Forest Service recommends consultation in this process as the License Area includes NFS lands.

6. Page 9. 1.2.2.3. *Similar* [reporting] *standards apply in Oregon, although the standard site forms differ*.

   The Forest Service agrees that standard site forms differ for Oregon. However, to date IPC has not supplied the agency with approved State of Oregon site forms. Instead, IPC has supplied forms for Oregon sites utilizing forms only accepted in Idaho. This is an unacceptable format.

7. Page 15.1.4. *The purpose of this CRMP is to formalize a strategy to protect, mitigate adverse impacts to, and enhance cultural resources.*

   The Forest Service contends this goal statement has merit, however, the CRMP should not be unilaterally developed IPC. Rather, it should be developed in conjunction with all members of the Cultural Resource Workgroup (CRWG). This includes the Forest Service.

8. Page 15. 1.5. Scope of Work. *The CRMP applies to National Register-quality cultural resources and traditional cultural resources that might not be National Register-eligible*.

   The Forest Service does not agree to language included within the CRMP that infers an arbitrary and separate protection/management umbrella for traditional cultural resources outside of that already established for Treaty resources, or historic properties such as a Traditional Cultural Property. This concern applies to 4.3.3 (page 54), 4.3.3.2 (page 55) and 4.4.2.1.6 (page 68) as well.

9. Page 16. 1.5.1. *Nevertheless, for management purposes the CRMP treats the hydropower projects and traditional Native American plant resources as if they were National Register-eligible.*

The Forest Service assumes that the words "structures and buildings" were meant to be placed after the word projects in the above sentence.

The Forest Service does not agree to language included within the CRMP that infers an arbitrary and separate protection/management umbrella for traditional cultural resources outside of that already established for Treaty resources, or historic properties such as a Traditional Cultural Property.

10. Page 16. 1.5.2. *For archaeological and architectural resources, the APE extends 0.1 mile (528 feet or 161 meters) inland from the high water marks on reservoirs and from the water's edge along the free-flowing river sections.*

    This statement conflicts with information provided in the CRWG meetings. In those meetings the APE was repeatedly said to be 100 meters (not 161 meters) from the rivers edge on the free-flowing section of the river.

11. Page 22. 1.5.2.4. *Below Hells Canyon Dam, the river is free-flowing until the mouth of the Salmon River.*

    This statement is misleading. While the 59 mile stretch of river between the dam and the confluence of the Salmon River is free-flowing, so is that stretch from the Salmon River downstream to near Asotin, Washington (approximately 41 miles). Thus there is approximately 100 miles of free flowing river downstream from Hells Canyon Dam. IPC's own information supports this in E.4 River APE (page E.4-2)

12. Page 38. 3.1.1. *Hundreds of archaeological resources have received preliminary evaluations by recording archaeologists, and many of the sites are considered to have the potential to be determined significant…"*

    The Forest Service maintains that an adequate determination of National Register eligibility must be made. Simply stating that sites within the APE may be of National Register quality does nothing to convey significance or the need for further management.

13. Page 39. 3.1.1.3. *There are, however, four possibly eligible and five eligible National Register-quality prehistoric and historic archaeological sites along Oxbow Reservoir.*

    The Forest service maintains that this sentence (3.1.1.3) should refer to Hells Canyon Reservoir and not Oxbow Reservoir.

14. Page 40. 3.1.1.5. *There are, however, 50 eligible National Register-quality prehistoric and historic archaeological sites along the lines.*

    The total of 50 sites does not reflect that amount indicated lower on page 40 within 3.1.1.5.2, where only a total of 36 sites are indicated.

15. Page 42. 3.1.2.4. *The two organizations that surveyed the project area downstream from Hells Canyon Dam used somewhat different categories to rank impacts to the sites.*

    The Forest Service finds it troubling that IPC had two different crews working in the field with two different sets of criteria concerning what constitutes which kind of effect. This arraignment is inconsistent with a relicensing process having notable interest in both the legal and political arenas, and serves to distract from the ultimate merit of data assembled for that area below Hells Canyon Dam. Page 43 further notes the statistical errors that may have derived from this practice.

16. Page 43. 3.1.2.5. *Forty sites are eligible or possibly eligible for the National Register; another 11 are considered unevaluated.*

    This site density conflicts with the site density characterized for the transmission line corridor on page 40 in 3.1.1.5 where it is stated that there are 50 National Register quality sites.

17. Page 47. 3.4. *As listed for each project element, effects to archaeological resources can include those related to: roads, recreation and access, construction, slopewash erosion, agriculture, vandalism, pool fluctuations, and wave action.*

    The Forest Service notes here that IPC failed to include river erosion as an impact category despite its common identification as an impact category within IPC sponsored CRWG meetings (see, for example, Appendix 4.3-b, page 351of the CRMP). Moreover, in an internal inconsistency IPC concludes within the CRMP (pages 50 –51 of 4.2) that the CRWG did indeed identify river erosion as an impact category, but yet they decline to list it on page 47 as such. Further, within 4.4.2.1.5 (page 67 of the CRMP) they note that river erosion is indeed a viable impact category.

18. Page 50. 4.1.1.2. *In other words, the presence of an affect does not automatically translate into an adverse effect. Only if an effect reduces the integrity of a resource, or diminishes those characteristics that qualify the resource for the National Register, does the effect become adverse.*

    The Forest Service agrees, in part, with a basic philosophical aspect of this statement. However, with it IPC has created an umbrella under which they apparently intend to provide management-shelter to certain historic properties that are affected by project operations. While this paradigm may have limited merit concerning some resources within the HCC, the Forest Service does not see this concept as having pan-applicability, and is aware that IPC may attempt to “lump” many aspects of project effects into this legally benign category (see 4.4.2.1.3, page 63). The Forest Service offers that this approach has not been particularly successful for other federal agencies.

19. Page 55. 4.3.5. *The Company will protect the shorelines of historically significant cultural resource sites when it is determined that the Company's operations may cause degradation of the shorelines.*

    The Forest Service agrees, in principle, with the actions proposed to protect shoreline sites. However, the statement does nothing to convey how such a determination should be made.

20. Page 57. 4.3.7. *Therefore, if there is no legitimate research interest in the archaeological data, then data recovery excavations are not appropriate.*

    Again, the Forest Service agrees, in part, with a basic philosophical aspect of this statement. However, with it IPC is proposing a redundant-data theory that has not yet been established, nor is close to being established, within the greater HCC. A tremendous wealth of archaeological data would be required to achieve this end. While this concept may have merit at some point well into the future, the Forest Service does not see this as a viable construct for the next license period, and is aware IPC intends to utilize this concept as a means to minimize its legal obligations, despite the wealth of archaeological data that would be needed in lending legitimacy to this concept.

21. Page 58. 4.3.8. *The precise protection/stabilization plan will vary depending on the cause(s) of the disturbance (which may be the proposed action) and the resource characteristics.*

    The Forest Service agrees in part. However, additional aspects that may alter protection/stabilization opportunities are found within the Wild and Scenic Rivers Act.

22. Page 59. 4.3.9. *The Company prefers to re-inter Native American human remains as near as possible to their discovery location…"*

    IPC has not proposed how this process would be funded.

23. Page 61. *4.4.2.1.1. Description. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to recreational or private use of the areas underneath the transmission lines.*

    IPC has made no attempt to state what a distinguishing characteristic of project erosion is, only that that will try and determine it.

24. Page 67. *4.4.2.1.5. Justification. Project operations are not causing any demonstrable impacts to archaeological sites downstream.*

This has not been determined and therefore is misleading. Moreover, in an internal inconsistency, IPC states in the very next paragraph (GOALS, 4.4.2.1.5) that the cause of site impacts, and the distinction between project-related impacts and other impacts has not been determined. Thus in one statement IPC is not responsible for downstream effects, and in the next statement show there is not enough data to know.

25. Page 67. *4.4.2.1.5. Description. Each site would be visited at least five times over the 30-year license period.*

    IPC has provided the rate of erosion for one site below Hells Canyon Dam (page E.4-16, E.4.1.3.2.2.2.). This rate was approximately one meter per year. Assuming a similar rate of erosion at other sites, many historic properties may cease to exist at the end of the first six-year monitoring cycle. Thus, the apparent purpose of the monitoring program is to document once that a given site no longer exists. This is not acceptable. The monitoring frequency should be in keeping with the known impacts (and rate of impacts) affecting sites. IPC's own data reflects that a more aggressive monitoring schedule is required to accurately capture site condition information and impact identification.

26. Page 67. *4.4.2.1.5. Description. For example, the Applicant would try to distinguish between erosion that is related to project operations and erosion that is related to boat wakes or wind action.*

    No information is provided by IPC as to how this distinction would be made.

27. Page 68. *4.4.2.1.5. Description. As currently envisioned, the monitoring plan would consist of on-site monitoring of impacts to specific cultural resources within the reservoir APE.*

    This is a cut-and-paste error. This statement is wholly confined within discussions related to a monitoring program downstream of Hells Canyon Dam, not a reservoir.

28. Page 69. *4.4.2.1.6. Justification.*

    The six goals stated here for the CRMP are different than the five goals noted on Page 50 within 4.2. While all eleven tasks may in fact be goals, having two sections with two different and separate goal-sets is confusing.

29. Page 70. *4.4.2.1.7. Justification. Project operations are not causing any demonstrable impacts to archaeological sites downstream.*

    This has not been determined and therefore is misleading. Also, in yet another internal inconsistency, IPC states three paragraphs later that the "associated benefit" of this particular PM&E is to "…*mitigate for adverse effects shown to be related to project operations*." In one paragraph, IPC states they are not responsible for river erosion, and then conversely state the purpose of the PM&E is to indeed mitigate for

river erosion associated with project operations. Moreover, IPC has led the reader to infer they would fund this PM&E, as it is listed along with the other "funded" PM&Es. However, close examination reveals that IPC has chosen not to state they would fund this $3.2 million project. The Forest Service has asked IPC for clarification on this issue via E-mail on October 31, 2002. IPC has, to date, chosen not to respond. IPC has also chosen not to pay for PM&E 4.4.2.2.1 (Stabilization of Sites on Brownlee Reservoir).

30. Page 71. *Develop and implement site stabilization program for a maximum of 20 sites*.

    The Forest Service disagrees to any "ceiling" or limit in this regard. The number of sites in question should be related to the needs of the resource and related laws, not an arbitrary and unexplained "maximum" limit.

31. Page 79-85. As a part of 4.4.2.3 within the CRMP, IPC has proposed to give $1,005,000 to four Tribes (Burns Paiute, Warm Springs, Nez Perce and Umatilla Tribes) and $502,000 to the Shoshone-Paiute and Shoshone-Bannock Tribes. This is internally inconsistent with information provided within Exhibit E.0 (Conceptual Overview of Integration). In pages 61-70 of that document IPC has proposed to fund all six Tribes $1,000,000 each. Further, on page 10 of the CRMP (1.3 Consultation) IPC has shown that the Confederated Tribes of the Colville Indian Reservation have an interest in the HCC. However, no funding has been allotted to them, as there was for the other six Tribes within 4.4.2.3; for PM&E participation, scholarships or cultural resource enhancement projects.

## Discussion

**Inconsistencies --** IPC has repeatedly oscillated between the idea they are not responsible for any downstream effects to cultural resources; or perhaps they are but there is not enough information to know; or indeed they are but the effects are not adverse; and finally that indeed they are probably affecting cultural resources adversely.

There also seems to be notable internal confusion as to what the APE is between reservoir margins and the downstream corridor, as well as conflicting field definitions used to characterize effects by the two downriver survey teams.

Finally, there is conflicting and/or confusing information as to what the goals of the Cultural Resource Management Plan are, in addition to just how many sites may have been recorded, or are present, within the Hells Canyon Reservoir and Transmission line corridors, and the funding amount meant to assist the various Tribes in PM&E participation, etc.

**Adequacy of Analysis --** IPC did not address what their contribution is to completing a Cultural Resource Management Plan (CRMP) for that portion of the APE below Hells Canyon Dam. Their CRMP for other areas of the APE was also not adequate in terms of

outlining a long-term education and interpretive strategy for the HCC. IPC also did not present any information as to what effect their operations are having on downstream or reservoir organic-based archaeological material subjected to changing aerobic/anaerobic or wetting/drying conditions from daily ramping activities. Nor did IPC address the role that ramping activity may play in the erosion of downstream terraces. Further IPC did not adequately address the affect that sediment-free flows are having on the erosion of those same terraces. Moreover, beyond saying they are not responsible, IPC also provided no information to support their position that they are not responsible for recreation impacts downstream of the HCC, or how project access has (or has not) facilitated vandalism to cultural resource sites. Finally IPC did not address the impacts that the Hells Canyon Reservoir (or other reservoirs) has had on the hundreds of archaeological sites that lie at the bottom of these impoundments.

**Impacts and Effects to NFS Lands and Resources --** The Forest service maintains that HCC is largely responsible for downstream sandbar and terrace erosion resulting from sediment-free flows exiting the HCC and/or ramping activity. The Forest Service maintains that IPC is also partly responsible for recreation impacts downstream from the Complex as well, given the access provided by the Complex to areas previously remote on the Snake River. Vandalism is considered a surrogate issue to recreation access. Deterioration of organic-based archaeological material is also linked to the HCC as are impacts to cultural resource sites along transmission line corridors. Finally the Hells Canyon Reservoir has adversely affected hundreds of historic properties through impoundment.

## Preliminary Forest Service Objectives

Cultural resource related objectives include:

1. Facilitate the completion of a Cultural Resource Management Plan (CRMP) for that area of the APE downstream from the Complex.
2. Supplement IPC proposed CRMP with additional educational and interpretive information opportunities, as well as improve IPC's proposed monitoring programs by articulating exact methodology and increase the frequency of site visitation. Also provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate effects to historic properties.
3. Provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate emerging effects to historic properties (36 CFR 800).
4. Identify and evaluate all historic properties within the APE. Protect and/or mitigate cultural resource sites that are affected by project erosion/ramping activity, recreation/vandalism and transmission line road impacts. Mitigate for impacts when sites cannot be protected (36 CFR 800).
5. Mitigate for adverse effects to organic-based archaeological material (36 CFR 800).
6. Mitigate for cultural resource sites impounded by the Hells Canyon Reservoir (36 CFR 800).
7. Extend the APE below the Salmon River confluence to at least the Oregon-Washington State line (36 CFR 800).

8. Conduct archaeological site protection measures (e.g. armoring) and/or testing, evaluation and data recovery, as needed, to rectify continuing or future adverse effects to heritage resource sites located at Big Bar and Eckles Creek on the Payette National Forest (36 CFR 800); and conduct a monitoring program at Red Fish Cave to insure archaeological properties associated with the cave remain protected (cf. Section 110 of the NHPA).

## Forest Service Response To Applicant's Proposed PM&E Measures

Specific comments on IPC proposed PM&Es are provided above under the review of Technical Report Appendix E.4-15, Cultural Resources Management Plan, HCC. Several comments from that section are reiterated here, in addition to outlining the adequacy of IPC proposed PM&Es in addressing Forest Service preliminary objectives.

Some previous PM&E comments offered above included:

**Monitoring of Known Eligible Sites Below Hells Canyon Dam** (4.4.2.1.5 of the CRMP; page 67). The Forest Service finds this PM&E inadequate. The monitoring frequency should be in keeping with the known impacts (and rate of impacts) affecting sites. IPC's own data reflects that a more aggressive monitoring schedule is required to accurately capture site condition information and impact identification.

**Stabilization of Sites Below Hells Canyon Dam** (4.4.2.1.7 of the CRMP, page 70). IPC has led the reader to infer they would fund this PM&E, as it is listed along with the other "funded" PM&Es. However, close examination reveals that IPC has chosen not to state they would fund this $3.2 million project. The Forest Service has asked IPC for clarification on this issue via E-mail on October 31, 2002. IPC has, to date, chosen not to respond. IPC has also chosen not to pay for PM&E 4.4.2.2.1 (Stabilization of Sites on Brownlee Reservoir).

**Native American Programs** (page 79 – 85 of the CRMP). As a part of 4.4.2.3 within the CRMP, IPC has proposed to give $1,005,000 to four Tribes (Burns Paiute, Warm Springs, Nez Perce and Umatilla Tribes) and $502,000 to the Shoshone-Paiute and Shoshone-Bannock Tribes. This is internally inconsistent with information provided within Exhibit E.0 (Conceptual Overview of Integration). In pages 61-70 of that document IPC has proposed to fund all six Tribes $1,000,000 each. Further, on page 10 of the CRMP (1.3 Consultation) IPC has shown that the Confederated Tribes of the Colville Indian Reservation have an interest in the HCC. However, no funding has been allotted to them, as there was for the other six Tribes within 4.4.2.3 for PM&E participation, scholarships or cultural resource enhancement projects.

The adequacy of IPC's proposed PM&Es in addressing Forest Service Preliminary Objectives are outlined below.

**Preliminary Objectives Included**:

1. Facilitate the completion of a Cultural Resource Management Plan (CRMP) for that area of the APE downstream from the Complex.

   **Adequacy**: This was not addressed by IPC's PM&E package.

2. Supplement IPC proposed CRMP with additional educational and interpretive information opportunities, as well as improve IPC proposed monitoring programs by articulating exact methodology and increase the frequency of site visitation. Also provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate effects to historic properties (cf. Section 110 of the NHPA).

   **Adequacy:** This was not addressed by IPC's PM&E package.

3. Provide for periodic surveys of the Complex's APE throughout the next license period to identify and evaluate emerging effects to historic properties (36 CFR 800).

   **Adequacy**: This was not addressed by IPC's PM&E package.

4. Identify and evaluate all historic properties within the APE. Protect and/or mitigate cultural resource sites that are affected by project erosion/ramping activity, recreation/vandalism and transmission line road impacts. Mitigate for impacts when sites cannot be protected (36 CFR 800).

   **Adequacy:** Only transmission line road impacts were addressed in IPC's PM&E package. Mitigating other site impacts was vaguely addressed by IPC within their PM&E package, but not in relation to river erosion, ramping, recreation or vandalism impacts.

5. Mitigate for adverse effects to organic-based archaeological material (36 CFR 800).

   **Adequacy:** This was not addressed by IPC's PM&E package.

6. Mitigate for cultural resource sites impounded by the Hells Canyon Reservoir (36 CFR 800).

   **Adequacy:** This was not addressed by IPC's PM&E package.

7. Extend the APE below the Salmon River confluence to at least the Oregon-Washington State line (36 CFR 800).

   **Adequacy**: This was not addressed by IPC's PM&E package

8. Conduct archaeological site protection measures (e.g. armoring) and/or testing, evaluation and data recovery, as needed, to rectify continuing or future adverse effects to heritage resource sites located at Big Bar and Eckles Creek on the Payette National Forest (36 CFR 800); and conduct a monitoring program at Red Fish Cave to insure archaeological properties associated with the cave remain protected (cf. Section 110 of the NHPA).

   **Adequacy:** This was not addressed by IPC's PM&E package

## Additional Study Requests

Listed below are five additional study requests needed to address heritage resource goals and objectives.

### 1. Understanding Accelerated Organic-Decay of Archaeological Resources Associated with Fluctuating Water Levels

**Necessity of Study**. Little is known about the effect fluctuating water levels are having on archaeologically sensitive organic properties within the draw-down zone associated with the HCC reservoirs, or subsequently downstream within the terraces encasing archaeological deposits. However, Murphy (1981) in Reid (1999:4) has stated that "*fluctuating water levels behind dams rapidly disintegrates vertebrae bone tissue, low fired ceramics, and pollen grains*." Intuitively, given the hundreds of complex archaeological sites within the river/pool corridor, there is reason to suspect this same process is probably at work within the greater HCC area (cf. Reid 1999). Thus a detailed review of all appropriate literature concerning this phenomenon is needed to better understand the nature and extent of effect occurring to archaeologically sensitive organic properties within the downstream terrace features and reservoir-lake shore environments of the HCC. Further, the study should characterize which site types stand at risk and identify how, if possible, this adverse affect may be mitigated.

**Relationship of Study to Agency Goals and Objectives**. Mitigate for adverse effects to historic properties per 36 CFR 800.

**Suitability Over Other Studies**. IPC has not conducted any studies related to this request.

**Acceptability of Study Plan Methodology**. Little is known about this phenomenon, therefore relating it to other studies and associated methodology is difficult at this time.

**Utility of Study Request to the Agency**. Facilitate compliance with the National Historic Preservation Act (36 CFR 800).

**2. Streambank Stabilization Opportunities Within a Wild and Scenic River Corridor**

**Necessity of Study**. Erosion of streamside sand bars and terraces within the HCNRA are well documented (Grams and Schmidt 1991, Collier et al. 1996, Carlson 1999a, Grams and Schmidt 1999a, Grams and Schmidt 1999b, Chatters and Reid 1999, Lucas 2002, Wilcock et al. 2002). Grams and Schmidt 1999a, have also noted that this process is probably related to a lower sediment concentration and an unaltered flood regime resulting from the presence of HCC. Thus a study plan that addresses the feasibility of stream bank stabilization alternatives specific to the Wild and Scenic Snake River corridor, and relative to heritage resource preservation, needs developed.

**Relationship of Study to Agency Goals and Objectives**. Protect or mitigate for adverse effects to historic properties per 36 CFR 800.

**Suitability Over Other Studies**. IPC has not conducted any studies related to this request

**Acceptability of Study Plan Methodology**. The methodology proposed herein is not complex. Its purpose is to simply identify streambank stabilization technologies such that an evaluation can be made concerning what alternatives exist for potential stabilization opportunities within the HCNRA.

**Utility of Study Request to the Agency**. Facilitate compliance with the National Historic Preservation Act (36 CFR 800).

**3. Reducing and/or Eliminating Recreation Impacts on Cultural Resources**

**Necessity of Study**. As noted above under *Project Induced Recreation Impacts* (response to E.4.1.3.2.), IPC is partly responsible for recreation impacts to historic properties within the greater APE associated with the HCC. Therefore, a study or plan is needed that identifies how these impacts can be abated.

**Relationship of Study to Agency Goals and Objectives**. Protect or mitigate for adverse effects to historic properties per 36 CFR 800.

**Suitability Over Other Studies**. IPC has not conducted any studies related to this request

**Acceptability of Study Plan Methodology**. The methodology proposed herein is not complex. Its purpose is to simply identify programs or technologies that can aid in reducing or eliminating recreation impacts to historic properties with the APE.

**Utility of Study Request to the Agency**. Facilitate compliance with the National Historic Preservation Act (36 CFR 800).

**4**. **Cultural Resource Survey on the Snake River Downstream From the Salmon River Confluence**

**Necessity of Study**. Information collected by the Forest Service during July of 2002 indicates that extensive streamside erosion is occurring on the Snake River below its confluence with the Salmon River. For instance there are approximately 2.9 miles of streamside erosion within the 24.6 shoreline miles between the Salmon River confluence and the north end of the Hells Canyon National Recreation Area at river mile 176 (Lucas 2002). Thus, 12% of the Snake River corridor is eroding downstream of the Salmon River confluence. That erosion on the Snake River is more extensive downstream from the Salmon confluence is, in an ironic sense, most likely related to the larger sediment supply that the un-impounded sediment-rich Salmon River contributes. This increased sediment supply has served to retard the effects of large scale erosion known for the Snake River above the Salmon confluence immediately following completion of the HCC. In this sense, the Salmon's infusion of sediment has prolonged the fate of downstream beaches and terraces experienced by similar Snake River beaches and terraces above the Salmon confluence shortly after completion of the Complex.

This sediment-life support process provides a fading glimpse of what beaches and terraces on the upstream portions of the Snake probably looked like prior to IPC's three dams effectively sealing off downstream stretches from upstream sediment resources. Additionally, this erosional process is generally believed to begin directly below the dam and gradually work its way downstream at a rate in keeping with its appetite for entrainment (Grams and Schmidt 1999b, Williams and Wolman 1984). Evidence for Snake River terrace erosion downstream from the Salmon River confluence seems consistent with this explanation.

**Relationship of Study to Agency Goals and Objectives**. Identification, evaluation, protection and/or mitigation of historic properties within the APE. Information collected by the Forest Service in 2002 indicates the APE requires extension downstream on the Snake from its confluence with the Salmon River.

**Suitability Over Other Studies**. IPC has not conducted any studies related to this request.

**Acceptability of Study Plan Methodology**. The same survey methodology employed by IPC for areas between the Hells Canyon Dam and Salmon River confluence, are proposed for that area downstream on the Snake from its confluence with the Salmon River.

**Utility of Study Request to the Agency**. Facilitate compliance with the National Historic Preservation Act (36 CFR 800).

**5. Facilitate Completion of a Cultural Resource Management Plan for Areas Downstream of the Hells Canyon Dam.**

**Necessity of Study**. IPC has identified over 800 historic properties within its APE downstream from Hells Canyon Dam, but has not proposed how they will contribute to the programmatic management of these resources over the term of a new license.

**Relationship of Study to Agency Goals and Objectives**. Facilitating the completion of a CRMP for areas downstream of the Hells Canyon Dam has been identified as a specific agency objective.

**Suitability Over Other Studies**. IPC has not completed any CRMP for that area downstream of the Hells Canyon Dam.

**Acceptability of Study Plan Methodology**. A CRMP similar to that completed for other areas of the Complex is herein proposed.

**Utility of Study Request to the Agency**. Facilitates the long-term management and perpetuation of historic properties that encompass a federally recognized and protected archaeological *District* listed on the National Register of Historic Places.

# Socio-Economics

The DLA is deficient in describing the economic impacts of the HCC on the local economy, and specifically recreation and tourism related expenditures. Section E9 on Socio-economics is not included in the DLA. This section is relevant even though no major construction is proposed, to provide information about the project's ongoing effects on the local economy and specifically related to communities surrounding the project. Estimates of ongoing effects and changes in employment and income associated with any anticipated changes in recreation use in the project area particularly with respect to changes in fishing, or changes in boating on the Wild and Scenic Snake River and the reservoirs is needed.

To analyze the local economic impacts attributable to the project, an input-output model should be constructed. IMPLAN (IMpact analysis for PLANning) is an input-output model with a database and modeling system to carry out regional economic studies of the consequences of agency decisions and proposed actions. This program of similar analysis would provide a regional economic analysis of the affected area and related impacts from the project.

There are several sources of information describing regional economic impact analyses, methods and procedures. Some of these include an economics analysis conducted by the State of Idaho and Oregon, Boise State University and Oregon State University departments, state employment offices, or economic consulting firms. "Economic Analysis For Hydropower Project Relicensing Guidance and Alternative Methods" a handbook prepared by the U.S. Fish and Wildlife Service also contains a brief description of regional economic modeling and its applications.

The DLA provides no basis for determining the ongoing impacts of the project on the economy in terms of recreation-related spending and associated jobs and income. Without such an analysis, the basis for determining the impact to visitors to the project area and impacts to communities from any changes proposed for the water use and quality, fish, wildlife, botanical, historical, archeological, recreation, land management and aesthetics resource is inadequate.