

TMT In-Season Management Criteria – Objectives & Triggers

26 January 2000

Lower Columbia River

Overall

Goal

Increase survival of listed fish populations by providing suitable migration conditions for all life phases of anadromous fish.^A

Objectives

1	2
<p><i>Provide a non-turbine passage route for juvenile migrants by providing spill at the lower Columbia River dams during the spring period. Maintain spill at a level to achieve tailwater TDG levels of 120% at defined schedules during the juvenile migration period which is approximately mid-April through June 20. Maintain the same spill conditions during the summer period with the exception of McNary Dam, where transportation is maximized during the summer migration period (July 1 - August 31) and spill is not managed for.</i>^A</p>	<p><u>Spill to the maximum allowable state standard at all dams on the lower Snake and Columbia rivers when spring migrants are present (approximately early-April through mid-June) and minimize turbine and multiple bypass passage.</u>^C <u>Based on dissolved gas monitoring data, Idaho will not object to a gas level up to 120/125% in the lower Snake and Columbia rivers.</u>^C <u>Operate turbines within 1% of peak efficiency when smolts are present.</u>^C <u>Maintain Minimum Operating Pools at all reservoirs on the lower Snake and Columbia rivers (except John Day Reservoir at MIP) during the spring migration period.</u>^C <u>Utilize a “spread-the-risk” transportation strategy based on annual pre-season projections of in-river migration conditions. In 1999 Idaho recommended transportation of smolts collected at Lower Granite and Little Goose dams, and returning all bypassed fish to the river at Lower Monumental and McNary</u></p>

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

	<u>dams. (Spill to the maximum allowable by state water quality agencies at all collector projects throughout the spring migration period.) Trucking should be limited in the transport of smolts.</u> ^C
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Triggers

Initiation of spill

The date is near the historic migration time and juvenile fish numbers are in _ digits and show an increasing trend for _ consecutive days or are _ digits for _ days and do not decrease by more than _% on the _ day.^A

Bonneville

Objectives

Spill for Juvenile Fish April 20 – August 31

Provide adult and juvenile fish passage according to Fish Passage Plan (FPP)

Maintain Navigation

Operate Units within 1% guidelines

Provide flows to protect Chum and Fall Chinook Spawning below Project, late October to April

Triggers

Middle 90% of juvenile fish runs

Fall-winter flows: dates of initiation of spawning and incubation of listed chum and fall chinook; dependent on flow conditions

The Dalles

Objectives

Spill for Juvenile fish April 20 – August 31

Provide adult and juvenile fish passage according to FPP

Maintain Navigation

Operate Units within 1% guidelines

Triggers

Middle 90% of juvenile fish runs

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

John Day

Objectives

Spill for Juvenile Fish April 20 – August 31
Provide adult and juvenile fish passage according to FPP
Maintain Navigation
Operate within a one and half foot range of 262.5 from April 20 to September 30
Maintain Irrigation
Operate Units within 1% guidelines

Triggers

Middle 90% of juvenile fish runs

McNary

Objectives

Transport Juvenile Fish in the summer
Initiate transportation of fish at McNary Dam when spring migrants are passing in low numbers and in-river conditions are no longer “spring like” .^A
Spill for Juvenile Fish April 20 – June 30
Provide adult and juvenile fish passage according to FPP
220 – 260 kcfs Flow Objective from April 20 to June 30
200 kcfs Flow Objective from July 1 to August 31
Manage flows to achieve a level of at least 220 kcfs at McNary Dam during the spring period (April - June 20) and 200 kcfs during the summer period (June 21 - August 31) as frequently as possible.^A
Maintain Navigation
Operate Units within 1% guidelines

Triggers

Flow forecast
Middle 90% of juvenile fish runs
Begin transport when subyearling chinook predominate total chinook daily collections for 3 consecutive days.

Middle Columbia River

Overall

Goals

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Improve survival of listed fish populations by providing suitable migration conditions for all life stages of anadromous fish.^A

Assure reservoirs are as full as possible at the start of the migration periods so natural runoff is used to increase river flows instead of filling empty reservoir space. Draft reservoirs as needed during the spring migration period to achieve flow objectives but place a higher priority on achieving reservoir refill by July 1 than meeting spring flow levels.^A

Provide suitable discharge from Grand Coulee and Chief Joseph projects to enable Priest Rapids Dam operations to minimize river fluctuations and stranding of juvenile chinook salmon.^B

Meet ESA obligations. Meet BiOP objectives and commitments per Record of Decision.

Meet tribal treaty and trust responsibilities.

Fulfill project operating requirements, authorizations and contractual commitments.

Meet multi-purpose objectives.

Achieve resident fish objectives to the fullest extent practicable.

Dam safety, public safety, operating efficiency and flexibility.

Objectives

Vernita Bar

Triggers

Establish and maintain fall chinook incubation flows according to 1988 VB Settlement Agreement.

Priest Rapids

Objectives

135 kcfs Flow Objective from April 10th - June 30

Manage flows to achieve a level of at least 135 kcfs at Priest Rapids beginning approximately April 10 and extending through June 30 as frequently as possible.^A

Implement Hanford Reach Stranding agreement

Maintain a steady or increasing hydrograph through the spring to the extent possible to protect emergent fry in the Hanford reach.^A

Coordinate federal and PUD project operations so that flow fluctuations are minimized during the sub-yearling chinook emergence and early rearing period.^B

Triggers

Index seining in the Hanford Reach captures 50 or more sub-yearling chinook from the 6 index seine sets.^A

Triggers for the Hanford Reach have been developed by the Hanford Reach Fish Protection Policy Group.^B

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Chief Joseph

Objectives

Operate at elevation 930 – 956 feet from October 21 to February 14
Operate at a lower limit of 950 feet from February 15 to May 15 for Goose nesting.
Operate at elevation 950 – 956 feet from May 16 to October 20

Triggers

Grand Coulee

Objectives

Assist in Meeting Flow Objectives
Meet Flood Control
Operate to meet 85% confidence level of meeting April 10 flood control elevation.
Meet BiOP in-season flow objectives (April 10 to August 31).
Meet chum flows October-April(?).
Protect during December-March the 85% confidence of refilling on April 10.
Serve irrigation diversion requirements.
Meet flood control.
Prevent spill through SNL, or by banking the water; Spill with minimum TDG impact.
Provide flows for Vernita Bar; alleviate Hanford stranding.
Draft/fill for power or non-power emergencies; Maintain power system integrity.
Meet multi-purpose needs: tribal needs (e.g., 1283 feet), power, NWPPC-resident fish.
minimum lake level for ferry operation, etc.
Refill on June 30. Provide for safe recreation through July 4 and Labor Day.
Secure optimum period-by-period storage levels to be responsive to needs and emergencies.

Triggers

BiOP flow targets, dates, elevation limits (1280 feet), fish curves.
Timing of flood control draft to minimize spill.
Volume forecast may trigger need for refill prior to April 10 for Hanford stranding.
Impending, perceived, or sudden emergencies – power or non-power.
Project operating requirements – daily draft or refill rate limits to prevent bank sloughing.
Maintenance and other actions for dam safety, public safety.
Sufficient water releases to protect such needs as navigation (e.g., reactor vessels, etc).
1225 feet FDR Lake level to maintain ferry operation.
1240 feet or other elevations for efficient pumping to keep up with irrigation demands.
Upstream (e.g., Canadian) operations.
August 31: transition from BiOP in-season operations to multi-purpose operations.

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Upper Columbia

Hungry Horse

Objectives

Assist in meeting flow objectives

Meet Flood Control

Operate to meet 75% confidence level of meeting April 20 flood control elevation

Attempt to meet IRC elevations if feasible after BiOp conditions have been met

Meet in-season (April 10 to August 31) BiOP flow objectives.

Protect during December-March the 75% confidence of refilling on April 10.

Meet local and system-wide flood control.

Meet IRC elevations to the fullest extent practicable.

Meet minimum flow requirement of 3,500 cfs at Columbia Falls.

Serve local and system-wide power or non-power emergency needs.

Avoid spill through such actions as deferring April 10 refill.

Assist in meeting Flathead Basin Management operating objectives.

Meet other multi-purpose needs.

Secure optimum period-by-period storage levels to be responsive to needs and emergencies.

Triggers

BiOP flow targets, dates, elevation limits (3540 feet), fish curves.

Kerr operating conditions that may prompt Horse assistance to meet FERC requirements.

Prognosis for spill; need for pre-emptive releases to avoid such spill.

Available turbine/generation capacity.

Impending, perceived, or sudden emergencies – power or non-power.

Expectations of flow arrival for BiOP objectives triggers timing of storage draft.

Discharge limits for downstream public safety.

River fluctuations must be minimized to protect resident fish.

Project operating requirements – ramp rates, minimum discharge, etc.

Maintenance and other actions for dam safety, public safety.

August 31: transition from BiOP in-season operations to multi-purpose operations.

Libby

Goals

Overall sturgeon goal for the Kootenai River is to restore natural recruitment to the Kootenai River white sturgeon population.^B

Provide suitable stream flows in the Kootenai River to recover Kootenai River white sturgeon.^B

Provide a suitable stream flow regime for bull trout in the Kootenai and Flathead rivers.^B

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Objectives

Operate to meet 75% confidence level of meeting April 20 flood control elevation.

On upper rule curves by April 10th (from ROD)

Balance the needs of providing a volume water for sturgeon spawning, riverine habitat for bull trout, and achieving refill of Libby reservoir by mid-July.^A

Meet flood control

Meet International Joint Commission (IJC) requirements at Kootenay Lake

Assist in Meeting Flow Objectives

Provide suitable river flow and water temperature for sturgeon spawning, incubation, hatching, and juvenile survival.^B

15 kcfs flow at Bonners Ferry from May 1 to Start of Sturgeon Spawning, then release full powerhouse capacity for up to 42 days. Goal = 35 kcfs at Bonners Ferry, then 11 kcfs at Bonners ferry for 21 days.

Maintain stable discharge from Libby Dam between the sturgeon spawning and salmon flow augmentation operations. This discharge may be between 4 kcfs and 10 kcfs.^B

Attempt to meet IRC elevations if feasible after BiOp conditions have been met

Ramp stream flows in the Kootenai River at a rate that does not strand or otherwise adversely impact bull trout. This ramp rate should not exceed a 10% change within a day or between days.^B

Triggers

Initiation of sturgeon spawning

Will be provided when 2000 Sturgeon Guidelines for Libby Dam operations are developed by the FWS.^B

The 1999 sturgeon guidelines can be used as a reference example. The 1999 guidelines specified maintaining 4kcfs outflow from Libby Dam starting April 1. Once local runoff downstream from Libby Dam increases flow at Bonners Ferry to 15kcfs, then maintain 15kcfs. If local inflow does not provide sufficient water to reach 15kcfs, regulate outflow from Libby Dam to reach 15kcfs at Bonners Ferry in June.^B

Triggers to start the flow pulsing operation for sturgeon include: 1) the combined water temperature at Bonners Ferry is expected to be maintainable at 10 degrees C.; 2) radio tagged sturgeon spawners have moved into the Kootenai River; and 3) local inflow to the Kootenai River between Libby Dam and Bonners Ferry is increasing or believed to be near the annual peak. When these trigger conditions are met, increase the Libby Dam discharge to the maximum extent possible.^B

Bull Trout Triggers will be developed by the FWS for 2000. Flow requirements for 1999 can be used as an example for 2000. In 1999, the FWS requested that all flow changes be limited to a maximum of 10% within and between days when the river flow was less than 14 kcfs. The FWS also requested that Libby Dam discharge be maintained at about 8 kcfs during the summer between the sturgeon spawning flow pulse and the start of salmon flow augmentation. .^B

Albeni Falls

Objectives

90% confidence level of being at the (April 15th (ROD or April 20 Water Management plan) flood control elevation

Meet Flood Control

Meet Minimum Flow Requirements

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Triggers

Lower Snake River

Overall

Goals

1	2
<p><i>Improve survival of listed fish populations by providing suitable migration conditions for all life stages of anadromous fish.</i> ^A</p> <p>The overall goal is to recover listed stocks of anadromous salmonids in the Snake River Basin. ^B</p> <p>To provide safe downstream passage for juvenile salmonids in a timely manner. ^B</p> <p>To provide timely upstream passage for adult salmonids. ^B</p> <p>To meet water quality standards in the Snake River. ^B</p> <p>To optimize passage conditions for juvenile salmonids. ^B</p>	<p><u>Provide the best utilization of Idaho resources to benefit ESA stocks, resident species, and improve conditions associated with the Clean Water Act.</u> ^C</p> <p><u>Provide the best possible in-river migration conditions, given existing dam configurations and water availability limitations, and ensure a sensible balance, based on river conditions, between the number of fish transported and those allowed to migrate in the river.</u> ^C</p>

Objectives

1	2
<p><i>Assure reservoirs are as full as possible at the start of the migration periods so natural runoff is used to increase river flows instead of filling empty reservoir space. Draft reservoirs as needed during the spring migration period to shape flows on fish movement and achieve flow objectives but place a higher priority on achieving reservoir refill by July 1 than meeting spring flow levels.</i> ^A</p> <p><i>Shape flood control water to the extent</i></p>	<p><u>Determine the amount of water available to aid fish migration based on state water law and projected runoff volumes. Prioritize available water supplies for springtime migrants.</u> ^C</p> <p><u>Prioritize available storage at Brownlee and Dworshak reservoirs to fill in the holes from spring snowmelt and flood control operations to help keep average flows at Lower Granite Dam from dropping below the 85-100 kcfs sliding</u></p>

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

<p><i>possible from winter and early spring to the late April period.</i> ^A</p> <p>Manage flood control to ensure the highest possible reservoir levels by early April and shift as much of the flood control drafting as possible to coincide with smolt migration (beginning early to mid April).^C</p> <p><i>Assure contracts are in place to provide 427 kaf of water from upper Snake River reservoir storage to maintain flows in the lower Snake River during the juvenile migration season.</i> ^A</p> <p><i>Provide a non-turbine passage route for juvenile migrants by providing spill at all the lower Snake River dams. Maintain spill at a level to achieve tailwater TDG levels of 120% at defined schedules during the juvenile migration period which is approximately April through June 20.</i> ^A</p> <p><i>Control temperatures for juvenile summer migrants to the extent possible while using Dworshak and Brownlee reservoirs as sources of flow augmentation water.</i> ^A</p> <p>To maintain suitable water temperatures in the Snake River for subyearling chinook salmon survival. ^B</p> <p><i>Determine whether use of Dworshak reservoir storage to date during the juvenile migration period provides adequate adult salmon benefits and whether alternative operations are justified or feasible.</i> ^A</p>	<p><u>scale seasonal flow target from mid-April through May when spring migrants are present. Idaho supported 100 kcfs for the 1999 spring migration.</u>^C</p> <p><u>Spill to the maximum allowable state standard at all dams on the lower Snake and Columbia rivers when spring migrants are present (approximately early-April through mid-June) and minimize turbine and multiple bypass passage.</u>^C</p> <p><u>Based on dissolved gas monitoring data, Idaho will not object to a gas level up to 120/125% in the lower Snake and Columbia rivers.</u>^C</p> <p><u>Operate turbines within 1% of peak efficiency when smolts are present.</u>^C</p> <p><u>Maintain Minimum Operating Pools at all reservoirs on the lower Snake and Columbia rivers (except John Day Reservoir at MIP) during the spring migration period.</u>^C</p> <p><u>Utilize a “spread-the-risk” transportation strategy based on annual pre-season projections of in-river migration conditions. In 1999 Idaho recommended transportation of smolts collected at Lower Granite and Little Goose dams, and returning all bypassed fish to the river at Lower Monumental and McNary dams. (Spill to the maximum allowable by state water quality agencies at all collector projects throughout the spring migration period.) Trucking should be limited in the transport of smolts.</u>^C</p>
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Triggers

Initiation of spill:

The date is near the historic migration time frame and juvenile fish index numbers show a steady and or increasing trend. Examples: (1) Index numbers are in the _ digits and show an increasing trend for _ consecutive days or _ digits for _ days and do not decrease by more than _% on the _ day. (2) _% of the projected run has passed lower Granite Dam to date. These would serve as initiation points to further evaluate the run. ^A

Termination of spill:

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

June 20 or spring migrants are consistently in double digits. ^A

Use of Brownlee and Dworshak for flow augmentation:

This needs some analysis given Billy Conner's presentation and an understanding of the Nez Perce's position. ^A

Ice Harbor

Objectives

Spill for Juvenile Fish April 3 – August 31

Provide adult and juvenile fish passage according to FPP

Maintain Navigation

Operate within 1 foot of MOP from April 3 until adult fall chinook enter lower Snake.

Operate Units within 1% guidelines

Triggers

End MOP when daily adult fall chinook passage at IHR exceeds ___ fish for ___ consecutive days.

Middle 90% of juvenile fish runs

Lower Monumental

Objectives

Juvenile Fish Transport

Spill for Juvenile Fish April 3 – June 20

Provide adult and juvenile fish passage according to FPP

Maintain Navigation

Operate within 1 foot of MOP from April 3 until adult fall chinook enter lower Snake.

Operate Units with 1% guidelines

Triggers

85 kcfs seasonal average flow forecast

End MOP when adult fall chinook enter lower Snake (see IHR trigger)

Middle 90% of juvenile fish runs

Little Goose

Objectives

Juvenile Fish Transport

Spill for Juvenile Fish April 3 – June 20

Provide adult and juvenile fish passage according to FPP

Maintain Navigation

Operate within 1 foot of MOP from April 3 until adult fall chinook enter lower Snake.

Operate Units within 1% guidelines

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

Triggers

85 kcfs seasonal average flow forecast
Middle 90% of juvenile fish runs
End MOP when adult fall chinook enter lower Snake (see IHR trigger)

Lower Granite

Objectives

Juvenile Fish Transport
Spill for Juvenile Fish April 3 – June 20
Provide adult and juvenile fish passage according to FPP
85 – 100 kcfs Flow Objective April 3 to June 20
Manage flows at a level of at least 85 kcfs during the spring period (April - June 20) and at least 50 kcfs during the summer period (June 21 - August 31) as frequently as possible.^A

To provide flow augmentation in the Snake River until 90% of the subyearling chinook salmon has passed Lower Granite Dam to increase their survival.^B

50 – 55 kcfs Flow Objective June 21 to August 31
Maintain Navigation
Operate within 1 foot of MOP from April 3 to November 15
Operate Units within 1% guidelines

Triggers

85 kcfs seasonal average flow forecast
Middle 90% of juvenile fish runs
End MOP when adult fall chinook enter lower Snake
augment flow when significant fish are present and forecasted runoff is less than that year's flow objective

Dworshak

Objectives

1	2
Assist in Meeting Snake and Columbia Salmon Flow Objectives Meet Flood Control Be no higher than 1558 elevation on December 15 Be on the flood control curve by April	<u>Pass inflow and release storage (in complement with Brownlee) as necessary to fill in the holes from natural spring runoff to help keep average flows at Lower Granite Dam from dropping below 100 kcfs from mid-April through May.</u> ^C <u>Strive for a full pool by June 1, and maintain as full a pool as possible through Labor Day by delaying large-</u>

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation

	<p>scale drafts until mid-August.^C <u>Limit late summer drafting to elevation 1535 ft msl. This will reserve approximately 200 kaf storage to be shaped in the fall to aid adult steelhead and fall chinook migration.</u>^C</p> <p><u>Strive for as full pool as possible, within flood control constraints, by early April. Shift timing to release as much of the flood control volume as possible after smolt migration begins early to mid-April.</u>^C Provide Temperature Control for Lower Snake Projects <u>Water used from Dworshak should not jeopardize the ability of federal and state hatcheries at Ahsahka, Idaho, from fulfilling their federal mitigation debt.</u>^C</p>
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Triggers

1	2
<p>Conditions at Hatchery Condition of juvenile and adult migrating fish on lower Snake</p>	<p style="text-align: center;">Begin flow augmentation from Dworshak Dam when water temperature in the Lower Granite Dam tailrace reaches 17 to 19 degrees C.^B</p>

Brownlee/Upper Snake

Objectives

1	2
<p>Secure annual volume on a willing buyer/seller basis, in compliance with Idaho State law. Deliver available volumes into</p>	<p><u>Strive for as full pool as possible, within flood control constraints, by early April. Shift timing to release as much of the flood control volume as</u></p>

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers
From Bureau of Reclamation

<p>Brownlee in coordination with Idaho Power Company. Achieve water quality objectives from volume deliveries.</p>	<p><u>possible after smolt migration begins early to mid-April.</u>^C <u>Contribute up to 110 kaf storage (approximately eight feet) as needed prior to mid-May to help ensure flows at Lower Granite Dam do not drop below 100 kcfs. If Lower Granite flow are adequate, inflow can be used to help refill Brownlee Reservoir by June 7.</u>^C <u>Maintain stable or rising reservoir levels (at no lower than 2,069 ft msl) from mid-May through June.</u>^C <u>Pass through or shape up to 427 kaf BOR contribution from uncontracted storage and will seller/lessor agreements for anadromous fish. Provide this water as best possible to meet the real-time needs of migrating fish, taking into consideration management factors such as resident fish and water quality.</u>^C <u>Any late summer drafts should be timed and shaped as best possible for the benefit of adult fall chinook and steelhead migration, taking into consideration resident fish needs and provided that reservoir elevation is 2,059 ft msl by September 30.</u>^C <u>Any flow augmentation operations by Idaho Power Company to assist survival of anadromous fish at downstream federal facilities must meet Idaho's requirement that BPA reimburse energy, capacity and head losses incurred by IPC at its facilities.</u>^C</p>
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Triggers

1	2
<p>BiOP flow targets, dates River flow limit (eg., 1500 cfs at Milner). Delivery is after flood control releases, typically late spring or in summer. Consistent with Water Master scheduling.</p>	<p>Begin flow augmentation from Brownlee Dam (Hells Canyon Complex) before water temperature reaches 17 to 19 degrees C.^B Maximize the release of outflow from Brownlee Dam (Hells Canyon Complex) within total dissolved gas standards and ramp</p>

Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers
From Bureau of Reclamation

<p>Volumes delivered into Brownlee are summer/winter split per arrangements.</p> <p>Shaping services from Brownlee delivers the full 427 KAF into Lower Granite in-season.</p> <p>Operating plans expressed by letter to the State of Idaho</p>	<p>down outflows in the shape of the natural hydrograph when water temperature in the Lower Granite Dam tailrace reaches 17 to 19 degrees C.^B</p>
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Source:

^A From Paul Wagner-NMFS

^B From Marv Yoshinaka-FWS

^C From Ed Bowles-Idaho

From Corps of Engineers

From Bureau of Reclamation