Summary of Brainstorming Meeting Regarding Expected Low Flows and High Temperature at MCN and LGR 3/16/01

❖ Definition of Potential Problems at MCN Dam

It is highly likely that water temperatures in the McNary Dam forebay and juvenile fish facility will reach near lethal if not lethal temperatures during the fish passage season. These high temperatures will likely cause significant stress, and possible mortality to juvenile salmonids passing MCN during the summer migration period. Based on historical temperature information it is likely that water temps will reach critical levels in late June through August. The most significant problems have been identified at the South end on the powerhouse and will transmit warm temperatures across the powerhouse as well as into the gatewells and fish facility.

❖ Suggested Solutions at MCN

- North powerhouse loading
  - Avoid turning units on and off
  - Lower turbine loads (priority on leaving units 1,2 and 3 off)
- Predictive temperature monitoring (forebay temp monitoring)
- Flow Inducers
- Daily Barge Loading (morning)
  - Allows fish to be held in tailrace rather than raceways
- Improve/Continue 3-D modeling
  - Currently on-going

❖ Definition of Potential Problems at LGR Dam/Pool

Expected low river flows and increased temperature throughout LGR pool may decrease fish passage, and at a minimal slow down fish travel time in LGR Pool. Low flows and increased temperature are expected to continue throughout the fish passage season.

❖ Suggested Solutions at LGR

- Consider “pulsing”/Flow control in LGR pool
- Use/Installation of BGS to potentially increase FGE in summer

5/8/01 DRAFT (mrs)

Columbia and Snake Rivers Water Temperature/Expected Low Flow
Brainstorming Meeting
3/16/01

Moderator:	Mark Smith	USACE-NWW	
Attendees:	Rebecca Kalamasz	USACE-NWW	(509) 527-7277
	Paul Ocker	USACE-NWW	(509) 527-7295
	Brad Eby	USACE-NWW	(541) 922-2242
	Lynn Reese	USACE-NWW	(509) 527-7531
	Tim Wik	USACE-NWW	(509) 527-7276
	Marvin Shutters	USACE-NWW	(509) 527-7249
	Chris Pinney	USACE-NWW	(509) 527-7284
	Dave Hurson	USACE-NWW	(509) 527-7125
	Brad Eppard	NMFS-Pasco	(509) 547-7518
	Lisa Hetherman	USACE-NWW	(509) 527-7239
	Lynn McComas	NMFS-Pasco	(509) 547-7518
	Rosanna Tudor	WDFW-McNary	(541) 922-3630
	Paul Wagner	Golder Associates	(509) 737-9666
	Dennis Rondorf	USGS-BRD-Cook	(509) 538-2299 x228
	Ken Tiffan	USGS-BRD-Cook	(509) 538-2299 x279
	Paul Hoffarth	WDFW-Kennewick	(509) 734-7434
	Russ Heaton	USACE-NWW	(509) 527-7282
	Eric Hockersmith	NMFS-Pasco	(509) 547-7518
	Fred Higginbotham	USACE-NWW	(509) 527-7236
	Gordon Axel	NMFS-Pasco	(509) 547-7518
	Rex Baxter	USACE-NWW	(509) 399-2233
	Les Cunningham	USACE-NWW	(509) 527-7291
Call Ins:	Rudd Turner	USACE-NWD	(503) 808-3935
	Jim Athearn	USACE-NWD	(503) 808-3723
	Bell Hevlin	NMFS-Portland	(503) 230-5415
	Chris Ross	NMFS-Portland	(503) 230-5416
	Jim Nielsen	WDFW	
	Steve Rainey	NMFS-Portland	(503) 230-5418
	John Ferguson	NMFS-Seattle	(206) 860-3276
	Charles Morrell		
	Larry Swenson	NMFS-Portland	(503) 230-5416
	Gary Fredricks	NMFS-Portland	(503) 230-5416
	Steve Pettit	IDFG	

The purpose of the meeting was to focus on the expected impacts of temperature and low flows, primarily at Lower Granite and McNary dams during the 2001 outmigration. The intention was to have no ideas suppressed, and all viable and potential solutions would be presented to the division office

Primary Goal: Identify what we can do to improve fish passage and survival this year during low flows and high temperatures.

Secondary Goal: Monitoring and evaluations

McNary Dam

Define the Problem

High forebay and gatewell temperatures (20°C) can occur as early as June 29th and have been known to reach 58-64°F in May and June. High temperatures can also expect to occur well into August. Temperature tends to be higher during the warmer times of the year on the South shore. Temperatures across the reservoir are stratified on both vertical and horizontal gradients, however the tailrace seems to be well mixed. Top to bottom, temperature can be as different as 8-10°F based on scroll case temperatures.

Reservoir control data will be out next week but discharge peaks are expected to be 160-170kcfs in early June.

Turning units off and on can cause higher temperatures to occur within the collection channel. Thermal differences occur between: the gatewell and collection channel; forebay and tailwater (several degrees at times). The raceways do not seem to be heating up during the day, however, a temperature spike has been measured at the end of the day throughout the system and peak at 3-7pm. Speculation was that the higher turbine loading, the more surface draw occurred, causing more heated water to enter the gatewells and collection channel.

Tim Bardish found that the reservoir appeared to be well mixed in August and Dave Hurson reported that 3-5mph winds seem to mix the temperatures in the reservoir quite well. Hourly reports from Paul Hoffarth show that there can be hourly changes throughout the day. Dave Hurson said that daily fluctuations can be 8°F. Temperatures 15 feet deep to the surface at unit 1 track the temperatures at unit 1 gatewell.

There is a concern that the thermal shock to fish from experiencing multiple temperature changes may cause not only initial but cumulative mortality problems.

Operations used in the past

In the 80's, standard screens caused lower flows in the gatewells. Management around warmer water temperatures included North powerhouse loading to avoid taking the warmer water. The new collection system still has temperature problems. Turning off a turbine unity causes a gatewell to cool down. There has been a reduced capacity of the powerhouse coinciding with running the turbines at 1% efficiency. Recent testing has been inconclusive, however, temperature at the separator can be reduced by 1°F by turning 2 units off. The south powerhouse seemed to have the highest gradient. A possible solution could be to only use the units on the south shore from 4am to 10am then shut them off for the rest of the day.

Tools

An early warning system was discussed including the capability of the corps using chain thermistors in the reservoir at strategic points to determine what may be going on in the reservoirs for some adaptive management at the project. WDFW mentioned that 34 stowaway temperature monitors were in place around the dam during that period that collect temperature at 30 minute intervals. In addition, Battelle is currently working on a 3-D temperature model for the Snake and Columbia rivers to McNary Dam.

BRAINSTORMING SESSION

Flow Mixers

These devices were used at Cowlitz Falls Dam in an attempt to guide fish towards a surface collector. We have two 30" diameter mixers and four 16" diameter mixers at present and because these are off the shelf items from the sewage industry, they may be easily obtainable. See handout for specs.

Discussions were held regarding placement of the devices including suspension from barges, attachment to the dam at various locations et cetera.

Operation Changes
Suggestions and ideas for powerhouse running included:

When possible, lower the loading on the turbines to as low as possible (45 megawatts) and if needed run more turbines to make up the discharge requirements. This would decrease the draw from the warm surface waters.
Eliminate rapid load changes and try to keep the loading as stable as possible. This would reduce the incidence of high temperature water draws into the gatewell and CC.
Flat load at McNary during higher water temperatures and power peak at other FCRPS dams.
Shut down the three south units and spill the rest of the flow.

Other Suggestions included:

Using a Behavioral Guidance Structure (BGS) as a flow deflector in the forebay
Use a solid barrier wall at the turbine intakes, similar to the J shaped structures at The Dalles Dam
Use extensions similar to those used at Bonneville Dam for the turbine intakes.
Pump cooler water into the collection channel from a deep source
Use a hypolon curtain, similar to the BGS for flow mixing
Pull screens at non-operating units to minimize fish entrainment in the gatewells
Perform gatewell salvage operations as needed
Some amount of spill may reduce the water temperature
Bubbling structures are often used in reservoirs for de-stratification perhaps they can be used.
Perhaps water from gatewells of non-operating units can be pumped into gatewells of operating units to cool the water
Perhaps direct barge loading at McNary if debris problems can be reduced
Perhaps strategic barge operations including loading juveniles at coolest part of day and then transporting.
Perhaps have a barge that is dedicated to McNary Dam only
Crowding of gatewells or collection channels may decrease residence time
Have an instant access web page for temperature data so managers can immediately get important temperature information.
Perhaps put standard length screens in units 1, 2 and 3.
Get a 3-D temperature model together so we can evaluate the effectiveness of some of these measures. Model would need to encompass the warm water lenses near the dam.
Regulate the releases of hatcheries in an attempt to get an earlier run timing when temperatures are cooler

Questions and answers

Q: Using unit 1 was required in the past for adult passage, is it required now?
A: Adult Radiotelemetry studies have indicated is not required.

Lower Granite Dam

The priority at Lower Granite reservoir is the lack of flow encountered by fish in the first reservoir and the associated delay caused by lower velocities. The reservoir length and low velocities can cause fish to be stranded in the reservoir. Early data has shown that in low flow years, fish tend to mill about or be “lost.” Flows are expected to peak at 60-70kcfs at best and possibly peak 2 weeks earlier than the norm.

LGR reservoir acts as a lake in low flow conditions. The reservoir soon develops a nutrient loading problem and sees an increase in productivity including a blue-green algae problem. Mixing of water from Dworshak reservoir does not occur optimally because the colder water from the Clearwater tends to slide under the warmer Snake water.

Pulsing

Flow pulsing through LGR reservoir was discussed. Coordinate releases from Dworshak combined with an evening increase in flows at the dam itself in a pulsing manner to get fish to move through the reservoir. Collection will increase with different sizes of spikes.

Releases from Dworshak typically take about 8 hours to reach LGR reservoir and effects to LGR Dam takes an additional 1.5 hrs. Releases may be increased from 1.3-1.5 kcfs to 10-14 kcfs, possibly doubling both discharge and velocities in the Lower Clearwater. (Velocities would increase in the free-flowing river from Dworshak downstream to the confluence as well). The discharge from Dworshak Dam would have a 4-hour ramp up time and would not increase velocities through Lower Granite Reservoir much. The greatest effect would be felt near the confluence (and in the Clearwater arm of the reservoir). On the other hand, ramping up releases through LGR Dam would increase velocities in the near dam area, but the effects would taper down to almost zero at the upstream end of the reservoir.

Suggestions and ideas for powerhouse running included:

At High pool, slant pool by operating the dams under MOP.

Perform a major drawdown at Lower Granite Dam and collect everything possible at Little Goose Dam.

Other Suggestions included:

Draw down Hells Canyon dam, essentially removing it from the power grid, for flushing flows.

Intentionally increase the silt load to drive fish downstream

Afternoon Session

Discussion were held regarding feasibility of the alternatives. The following were the generalized results.

Location	Action	Potential	Reasoning or Comment
McNary	North Powerhouse Loading with Flat Load	High	No adult issues, some has been done in the past, possibly peak in the morning
	Predictive Modeling	Moderate	The information would be good but is it really imperative that we have it?

	Flow Inducers	Moderate	Questions on placement, effectiveness, fish and debris entrainment, fish guidance changes, WES modeling and further investigation.
	BGS/Entraining Wall	Low	Time for construction, etc.. Makes this not feasible for '01
	Intake shaping	Low	Time for construction, etc.. Makes this not feasible for '01
	Cooler Water pumped into the CC or Gatewell	Possible	Concern for a high temperature gradient causing thermal stress and mortality
	Lower Turbine Loads	Possible	decrease surface draw and combine with a North Powerhouse loading
	Avoid On/Off turbine operation	Possible	Reducing large temperature spikes
	Hypolon Curtain or Flow Wing	Low	Time for construction, etc.. Makes this not feasible for '01
	Daily Barging	Possible	load a new barge every morning and hold fish in it, transport at night to John Day dam prior to high temperature changes
	Crowding the Collection Channel	Low	Increases stress, not necessary and equipment is not feasible for '01
	Instant Access Web Page	Low	Nice but not imperative
	Heat exchange with gatewells in non-operating units	Low	May Increase thermal shock to colder water
	STS and ESBS changeouts	Low	Probably not make a diffrence if ESBS intercepts more lower and cooler water
	3-D modeling of temps		Continuing
	pull screens at South Powerhouse	Low	Not worth the risk
	Spill to decrease temps	Low	Would keep fish in river in the longest (John Day) reservoir of the system
	Pump cool water from gatewells	Low	Experimental and possible for longer term
	Bubblers	Low	Pass on this year
	Coordinate Hatchery Releases	Unknown	Is it Feasible?
LGR	Draw Down - Collection at Goose	Low	Not Feasible
	Hells Canyon Modified Ops	Low	Is it feasible?
	Operate LGR below MOP	Low	Not feasible, collection channel would not be operable
	Pulsing Flows	Possible	Needs further investigation
	Additional flows at peak of the run	Low	Probably not feasible
	Flow inducers for fish guidance	Low	Probably would not work at LGR
	Use the BGS for Fall Chinook	High	Use at units 4, 5 & 6 for higher guidance of fall chinook
Other	Shut down the Ice Harbor Ladder during high temps to keep fish out during the highest temperatures of the year	Possible	?
	Perform Fish salvage in the reservoirs, gatewells, etcetera		

Drive Home Thoughts

5/8/01 DRAFT (mrs)

A request was made for people to send in any additional ideas regarding what should have been covered at the meeting or what the drive home may have inspired. The following are comments that were received.

Although the 16 March meeting had extensive discussions of how to prevent temperature problems at McNary Dam and flow problems at Lower Granite Dam fish salvage options once problems occur were not discussed.

Possible fish salvage options might include:

-Gatewell dipping
-Forebay purse seining
-Fish pump with leads like a merwin net in the forebay combined with some type of herding device like bubble wands
-Short duration (less than a half hour) pulsed spill

In addition to salvage options, the locations of salvage equipment, personnel, permit issues, and how to handle salvaged fish should be addressed prior to the 2001 out migration so that contingency plans are in place.

At the end of the meeting it was suggested to shut down the ICH ladder if or when temperatures create a migrational thermal block how about setting up an adults passive migration into a barge via a steep pass denil at ICH and then barge the adults to Lewiston?