

COLUMBIA RIVER TECHNICAL MANAGEMENT TEAM

March 7, 2018

Facilitator's Summary

Facilitator: Donna Silverberg; Notes: Charles Wiggins, DS Consulting

The following Facilitator's Summary is intended to capture basic discussion, decisions and actions, as well as point out future actions or issues that may need further discussion at upcoming meetings. These notes are not intended to be the "record" of the meeting, only a reminder for TMT members. Official minutes can be found on the TMT website: <http://www.nwd-wc.usace.army.mil/tmt/agendas/2018/>

Meeting Minutes Reviews

TMT approved the posted minutes for the January 17 and 31, and February 7, 14, 21, and 22 meetings.

Official Water Supply Forecasts

The March Official Water Supply Forecasts were released March 5, and are available on the TMT web site. The March to July forecast for BOR's Hungry Horse project is 2674 kaf, at 136% of normal; April to August forecast at The Dalles is 98 maf, or 112%; Lower Granite April to July forecast is 22 kaf, or 108%; April to August at Libby is 7205 kaf, or 122%; Dworshak April to July is 3093 kaf, or 127%; April to August forecast at Grand Coulee is 66 maf, or 116%; and April to August forecast at Albeni Falls is 16 maf, or 133% of normal. Flow forecast information is also available for 45-120 days out, with inflow forecasts generally above average as measured at Lower Granite Dam and Bonneville Dam.

Dworshak Operations

Steve Hall, Corps, reported on current and proposed operations at Dworshak. The water supply forecast for Dworshak is 3.093 maf, which tracks the 2011 water year, which was a 4 maf (high water) year. The reservoir elevation is 1497 ft., with a target of 1461.6 ft. at the end March, and 1445 ft. on April 15. TDG levels are 121% in the river and 104.5% in the hatchery.

Depending on runoff, the project will transition around the third week in April from flood control to refill operations as those curves intersect the rule curve. The aim is to keep discharge up until that time, and then reduce to pass inflows, as per the rule. Given past years' experience, the Corps is planning to move a good deal of water out around the third week, then move to 5 kcfs until Unit 3 comes on line (predicted for June), and then could bump up to 7 kcfs if desired.

Planned operation: the Corps intends to hold at 16 kcfs as long as possible, until flood control operations are required. The Corps intends not to exceed the state TDG value of 110%, unless exceedances are required to meet the flood control mandate. Steve expects to be above the 110% until they hit the rule curve. At that time, the Corps will reduce spill in order to reduce gas to hit the state standard. If salmon managers, together with the State of Idaho and the Nez Perce tribe, believe that the biological needs of fish would benefit from additional higher spill levels that exceed the standard, they could present a unified request for a waiver to the State of Idaho and the Nez Perce tribe. (*Note: see below for agreed upon changes to this planned operation to aid hatchery releases*).

REQUEST/ACTION: To support planning for alternate water run-off possibilities, the Corps will model the following additional analog years: 2008, 2013, & 2014.

Gas Bubble Monitoring for Dworshak NFH

Jay Hesse, Nez Perce tribe, reported on gas bubble trauma observed at the hatchery on February 28. At the B Bay, looking at ten spring Chinook juveniles in degassed water, 6-10 fish had 1-6 bubbles in the gills, 8 showed 3-15 in the lateral line, and 1 with a bubble in the dorsal fin. For food content, 6 had full stomachs, with 3 showing reductions. For steelhead, 6 had at least a bubble in the gills, 4 had bubbles in the lateral line, and 1 had a bubble in the anal fin. All had normal full food levels. No cataracts were observed in any fish. This pattern is consistent with last year, but is 2 weeks earlier. Because of this, there are concerns that the longer duration may have an impact, and salmon managers will be looking for if/when the fish go off their food. At this point, it is unclear how long fish (hatchery and emerging wild fish in the North Fork of the Clearwater River) can sustain high TDG levels.

Hatchery Release Planning

Russ Keifer, IDF&G, and Jay reported on multi-agency discussions regarding early releases of hatchery fish as a result of the above observations. The hatchery plans to release juveniles March 26-28 so the fish hit Lower Granite around April 3rd, with the beginning of spill. Hatchery managers may ask for Lower Granite Dam RSW spill on March 26-28 to increase fish (especially steelhead) survival rates. Current plans/request: reduce to 12 kcfs at 12:01 on 3/26 for the hatchery release and bump back up on 3/28, if needed for flood control.

Steve Hall responded that, in order to reduce for the three days, the Corps would need to move more water now for flood control. He said the Corps should bump to 16.5 kcfs now to meet rule curve targets and the requested reduction. Jay asked if the bump up could happen after the release so as not to add additional TDG to the young fish, but Steve said they would need to move the water sooner than later. In addition, he did not believe the TDG levels would increase more than .5%. After discussion among the salmon managers, the group agreed:

ACTION: The Corps will start spilling 16.5 kcfs as soon as possible to set up for planned releases of 3/26 & 3/27, when they will reduce to 12 kcfs at 1201 am 12/26. TMT will check in on 3/21 to determine the feasibility of an additional day (3/28) at 12 kcfs.

Erick Van Dyke, Oregon, also noted that this operation was designed for flood control management at Dworshak, and there also should be some consideration for the greater impact on fish in the system as a whole.

Methodologies to Monitor Adult Passage in the Snake River

Russ noted that he got some very good comments and will be ready to discuss this again on March 14th.

ACTION: Any additional comments on the guidance document should be sent to Russ as soon as possible for inclusion and discussion at the March 14th TMT meeting.

Snake and Clearwater Rivers Confluence Surveys and Lower Granite Dam Variable MOP Operation

Steve Hall and Aaron Marshall, Corps, presented expanded results of a sediment accumulation survey at the confluence of the Clearwater and Snake Rivers. Charts related to the issue are available on the TMT web site. The red areas on the charts indicate encroachments on the safe navigation lane. On sheet 3, for example, several areas show sediment at 721 ft. or higher, including near the dock area. There is mounded sediment in the turning basin, and substantial accumulation under the railroad bridge. As a result, the COE will take two interim actions:

- 1) Operate a variable MOP operation, which matches those adopted by TMT in years 2011-14, beginning April 3rd.
 - The operation is based on an inflow forebay range at Lower Granite, and will accommodate 733 ft. at the Lewiston gauge. The Corps stated that 738 ft. is the highest level at the confluence that could maintain flood control at the Lewiston levees.
 - Variable MOP operations will not occur until the beginning of spill season, on April 3, and will continue until the end of August. The operation should have little impact on TDG levels.
- 2) Request for budgeting and other support to enable dredging of this area (already in progress), with a 1-3 year timeline.

A request was made to consider opening the RSW sooner than planned, if the Corps has to move to variable MOP operations sooner than April 3rd.

Operations Review

Reservoirs

Corps of Engineers

Libby -- elevation 2380.8 ft., 3.3 kcfs inflow; 19.0 outflow
 Albeni Falls – elevation 2052.1, 21 kcfs inflow, 27.7 outflow
 Dworshak -- elevation 1492.4 ft., 3.9 kcfs inflow, 16 kcfs outflow
 Lower Granite – average outflow 48.7 kcfs
 McNary – average outflow 185.5 kcfs
 Bonneville – average outflow 214.6 kcfs

Bureau of Reclamation

Hungry Horse – elevation 3521.5 ft., 1.2 kcfs inflow, 8.5 kcfs outflow
 Grand Coulee – elevation 2858.9 ft., 90 cfs inflow, 11.5 kcfs outflow
 Drum gate elevation will be reached the afternoon of Monday, March 12.

Fish

Paul Wagner, NOAA, reported that juvenile passage season has begun. Bonneville has started sampling, as have John Day and Little Goose. There is some activity, but there will be more. There is not too much to report for adults, though are some are passing. The fish ladder at Lower Granite has opened.

Water Quality

Forebay gauges are coming on line in the Lower Columbia. There is not much TDG because there is not much spill. The exceptions, above 110%, are at John Day and Dworshak.

Power Supply

Tony Norris, BPA, referred TMT members to the BPA web site for charts of balancing authority operations. He also noted that BPA will be updating these documents to conform to the FOP. A draft may be available next week, but probably on March 21.

**The next TMT meeting will be a conference call on March 14, 2018, at 9:00 AM.
Anticipated agenda items include: chum, DWR, Power, Hatchery updates, and Monitoring
Methodologies Guidance**

Columbia River Regional Forum
TECHNICAL MANAGEMENT TEAM OFFICIAL MINUTES

March 7, 2018
 Minutes: Pat Vivian

1. Introduction

Representatives of the COE, BPA, USFWS, NOAA, BPA, Nez Perce Tribe, Washington, CRITFC/Umatilla, Oregon, Idaho, and others participated in today's TMT meeting chaired by Doug Baus, COE, and facilitated by Donna Silverberg, DS Consulting.

2. Review Meeting Minutes – January 17 and 31; February 7, 14, 21 and 22

All meeting minutes and facilitator's summaries were approved as final.

3. Official March Water Supply Forecasts

3a. Forecasts. Doug Baus, COE, and Joel Fenolio, BOR, provided the following official water supply forecasts for the month of March.:

- The Dalles (April-August) – 98 maf, 112% of average
- Lower Granite (April-July) – 22 maf, 108% of average
- Libby (April-August) – 7205 kaf, 122% of average
- Dworshak (April-July) – 3093 kaf, 127% of average
- Grand Coulee (April-August) – 66 maf, 116% of average
- Albeni Falls (April-August) – 16 maf, 133% of average
- Hungry Horse (May-September) – 2.3 maf, 136% of average

Baus presented extended STP forecasts from the NW River Forecast Center, which uses the official water supply forecasted volumes to forecast a 45 to 120 day inflow forecast. The current forecast shows near average inflows for April, with 200 kcfs inflows at Bonneville on April 10. However, the 10% and 90% climatology projections put Bonneville inflows at anywhere from 130 to 300 kcfs on April 10.

The latest STP forecast through the end of April has been scrutinized to reflect reservoir operations appropriately, Aaron Marshall, COE, pointed out. However, the current extended forecast is less focused, and there is greater uncertainty about operations after April 30.

3b. Lower Granite Dam Extended Inflow Forecast. March and April inflows at Lower Granite are expected to be above average, but

when spring spill starts April 3 on the Snake River, inflows are expected to be average. That means inflows of 65 kcfs at Lower Granite, according to the latest STP traces.

3c. Bonneville Dam Extended Inflow Forecast. The current NWRFC extended 45 to 120 day forecast indicates Bonneville Dam inflows will be slightly above average during the month of April. Forecasted inflows on April 1 are approximately 180 kcfs in increase up to 230 kcfs by April 30.

4. Dworshak Operations

4a. Water Supply Forecast. The official water supply forecast for Dworshak is 3.09 maf, which puts the end of March flood control elevation at 1461.6 ft and the April 15 flood control elevation at 1445 ft, Steve Hall, COE Walla Walla, reported.

This means emptying the reservoir; 1445 ft is the lowest it can go for flood risk management. April is a transition month from flood control to refill operations, based on when the flood control curve intersects the refill curve or 95% probability of refill according to the water supply forecast. Generally this occurs in the third week of April, but it's highly dependent on the shape of runoff. It will be necessary to move a lot of water to draft Dworshak reservoir to its FRM target of 1445 ft.

In response to a question from Tom Lorz, CRITFC/Umatilla, Hall said Dworshak releases will probably remain high through the third week of April, followed by an attempt to back off to approximately 5 kcfs when refill starts. This will reduce spill to nearly zero until unit 3 comes back on line. If the Salmon Managers request, the COE could target 7 kcfs discharges for the remainder of April, but in past years there have been concerns if the reservoir drafts too deeply below 95% confidence of refill.

The COE will do whatever it can, within operational constraints and without risking refill, to meet the Salmon Managers' desire for higher releases in late April and early May to aid smolt passage.

4b. NWRFC Water Supply Forecast North Fork Clearwater – Dworshak Dam. The NWRFC issues three different water supply forecasts for April-July on March 7 at Dworshak: 10 day (2.7 maf), 5 day (3.0 maf), and zero day (2.9 maf) ESP traces. The NWRFC and COE forecasts are 2.9 vs 3.09 maf, so they're in close agreement.

What's driving the COE forecast of a 3.09 maf year is accumulated snowfall at low elevation stations, two of which are over 120% of normal. Hall said. This forecast is based on good coverage of SNOTEL data

throughout the basin, plus the SOI which indicates the likelihood of La Nina conditions. The COE has a high level of confidence in its water supply forecast due to accumulation of significant low elevation snowpack, as well as above average snowpack throughout the basin.

Paul Wagner, NOAA, asked, if the April forecast drops to 2.9 maf, would that result in a lesser draft than to 1445 ft for flood control? Yes, Hall said.

4c. Dworshak Hourly TDG Data (tailrace and hatchery). Total dissolved gas levels have consistently been around 121% in the river and close to 104.5% in the Dworshak National Fish Hatchery.

4d. NWRFC Dworshak Dam Short Term Inflow Forecast. The weather is supposed to warm up in the near term with increased precipitation, Hall reported. Inflows are expected to increase to 10-12 kcfs. The longer term forecast is consistently wet. By mid-month, the reservoir is on track to be at 1480 ft elevation if these kinds of inflows continue, and another 20 ft will be drafted out by the end of March. In order to attain 1460 ft elevation by the end of March, it will be necessary to increase the draft if inflows rise as expected.

4e. NWRFC Climate Forecast. The 6-10 day forecast is showing warmer than normal conditions in the North Fork Clearwater with higher than normal probability of precipitation. The 8-14 day forecast follows a recent trend toward cooler than normal temperatures and higher probability of precipitation.

The same holds true for the 1 month and 3 month forecasts as well. The long term forecast of cooler and wetter conditions is another reason the COE has a high level of confidence in its inflow forecast of 3.09 maf at Dworshak.

4f. Planned Dworshak Operations. Hall showed TMT a model of the current Dworshak Dam operation using Crater Meadows data from the analog year 2011. The Crater Meadows SNOTEL station data are very similar to 2011 in terms of snowpack. Several other stations throughout the basin – Hemlock Butte, Hoodoo, Lolo Pass – are also tracking close to 2011, and Lost Lake has more snowpack than in 2011.

The COE will track this situation carefully. Discharge from Dworshak is currently 16 kcfs. The last graph in the series shows a longer range proposed operation to meet the April 15 flood control requirement of 1445 ft elevation. This scenario shows DWR reservoir attaining 1461 ft elevation on March 31. Based on this forecast, continuing 16 kcfs discharges would allow the reservoir to meet its end of

March FRM target. The April 15 FRM target would be met by increasing discharges to 18 kcfs in the first two weeks of April. Hall reminded everyone this is just one trace using the current 10 day RFC forecast combined with 2011 historical inflows.

Dworshak inflows peaked in late March 2017 at 44 kcfs, with substantial low elevation snowpack. This raises the likelihood of similarly high inflows this spring due to snowmelt.

Hall pointed out the modeled STP scenario is an ideal forecast, with a steady rate of 10-14 kcfs inflows in March and most of April, but there could be a lot more fluctuation. A spike in inflows would mean having to increase Dworshak discharges to meet the flood control elevations. The scenario shows outflows dropping to 6 kcfs on March 16, presuming that the flood control curve intersects the refill curve on March 15. The actual FCRC date is unknown.

Under these conditions, the COE proposes to hold 16 kcfs discharges from Dworshak until there's a need for an increase, which is likely.

Tom Lorz, CRITFC/Umatilla, asked why local flood control parameters aren't included in the modeling. Because it is highly unlikely to return the reservoir to system flood control without violating the rules of the Dworshak-Grand Coulee shift, which includes adhering to the 110% TDG standard, Hall replied. For Dworshak reservoir to be above its system flood control elevation, the space must be shifted to Grand Coulee and be reversed in April. This shift is designed to pass more water from Dworshak in order to aid juvenile outmigration – assuming it can be reversed without exceeding 110% TDG. With unit 3 out of service, it is likely not be possible to release enough volume to reverse the shift without violating the 110% TDG limit. Obviously TDG levels are higher than that now, but the COE cannot intentionally violate water quality standards. Once refill starts, the COE expects to manage DWR discharges so as not to exceed 110% TDG downstream.

An April-July inflow forecast of 3 maf or higher at Dworshak means a flood control shift is prohibited under the Water Control Plan. In a 3 maf year, high inflows can make it difficult to reach the April flood control elevation. Full powerhouse capacity discharge with 110% spill in high years would only exceed inflows by 2 kcfs limiting the capacity when drafting to the required elevation. That is why a shift is banned when the Dworshak inflow forecast is above average.

Given that the rest of the Snake River basin is not so flush with water, Lorz asked for flexible DWR options to aid juvenile migration. Hall

replied that the COE never violates state water quality standards unless water must be released for flood control.

The only way the COE can deviate from this would be a request from the Salmon Managers that has been approved by the states and tribes, such as the water quality waiver the Nez Perce and Idaho granted last summer. Unless the Salmon Managers request a special operation to release more water, the COE will reduce Dworshak discharges to 7 kcfs or 110% TDG downstream once the refill curve is met. The BiOp clearly states that all fish targets and operations are predicated on meeting state water quality standards. If a waiver is issued allowing 120% TDG saturation, discharges may be increased to 11 kcfs.

Tony Norris, BPA, said maintaining a higher flood control elevation to enable greater discharges during refill runs the risk of extremely high discharges in order to avoid refilling too soon. This could adversely affect the hatchery and put wild juveniles at risk to as well, Dave Swank USFWS, added. When DWR drafts to 1445 ft elevation, 2 maf of space remains in the reservoir, so a 3 maf forecast means releasing 1 maf during refill, Hall said. If the forecast rises to 4 maf like it did in 2011, that would mean having to release 2 maf during refill. There will be opportunities to shape outflows, but all indications are it could become necessary to pass large volumes in May and June.

Russ Kiefer said Idaho plans to request a further reduction in Dworshak discharges for a few days in late March to accommodate hatchery releases. He asked, would it be acceptable to target the April 15 elevation at Dworshak? Hall said the COE would not plan for Dworshak reservoir elevation to be above the end of March elevation. If the Salmon Managers schedule a reduction in flows at the end of March to facilitate hatchery releases, the COE would accommodate the request without missing flood control targets. Implementing Idaho's request might mean bumping up discharges for a few days to facilitate the corresponding reduction. Kiefer said he will clarify the release dates with the IDFG hatchery manager.

For the next TMT meeting, Erick Van Dyke, Oregon, requested modeling of analog years 2008, 2012 and 2014 because these years were similar to 2018 in terms of regional water supplies. He asked for clarification of the Umatilla Tribe's request for flexibility regarding higher flows when juveniles are in the river, as opposed to releasing water now for flood control.

As for unit 3, Hall reported the work is proceeding well and is on schedule. The contractor is connecting the stator bars and will test them soon, working around the clock to keep the project on schedule. It

appears that none of the bars were damaged in the process of realignment, and none of the 14 spares were used. The unit 3 return to service date is still June 2018.

Charles Morrill asked whether a snow flight was able to maintain confidence in outflow projections, and how that affects confidence in the DWR inflow forecast. Given the desire for lower flows during hatchery releases, would it be appropriate for the Salmon Managers to discuss flow increases that exceed 110% TDG?

Hall said the COE will attempt the snow flight again today, one of the first days offering clear conditions. An earlier effort to reach Elk Butte and Hemlock Butte stations was fogged out, but the Shanghai station has been repaired and is reporting data again. A second attempt is being made to access Elk Butte and Cool Creek to perform repairs, which is a high COE priority. As for verification flights, the COE is planning to visit other sites via ground, but that's difficult because the snow accumulation presents an avalanche danger.

If the high inflow forecast doesn't materialize, Wagner asked, would an in-season forecast be applied to the decision regarding flows, or would ongoing forecasts or snow accumulation change the April 15 target of 1445 ft? Hall said the COE would look at intermediate forecasts and adjust as necessary, while not explicitly operating to a mid-month forecast. If the forecasting change is significant, Julie Ammann said, a COE deviation process could be used to justify a change in operations based on new information. The deviation process takes a few days and begins with a flood risk assessment.

Tony Norris asked what threshold of flows the Salmon Managers would seek at Lower Granite. Lorz said keeping flows in the 65-70 kcfs range is generally best for adults and juveniles at Granite, and around 85 kcfs at Goose. These flows are desirable when juveniles and adults are in the river.

5. Gas Bubble Monitoring for Dworshak National Fish Hatchery

Jay Hesse, Nez Perce Tribe, gave a fish health report based on the most recent sampling February 28 at Dworshak Hatchery, with sampling to be done again tomorrow.

Of spring chinook being reared in B-Bank, 6 of 10 fish had 1-6 bubbles in gills; most of those bubbles were larger than on previous exams. Eight of the fish had 3-15 bubbles on lateral lines; 6 of those were rank 1, and the other 2 were rank 2. One fish had 2 bubbles in the dorsal fin that were rank 1. As for food consumption, 6 fish had normal

stomach content, 1 fish was 50% full, and 3 were 30% full. The hatchery is starting to see reductions in food consumption in response to high TDG exposure.

Steelhead being reared in B-Bank are in degassed river water to which liquid oxygen has been added. Steelhead in system 2 were exposed to 104.5-105% TDG when the samples were taken. Six fish had bubbles in the gills and 4 of those had 1-3 bubbles along the lateral lines. One fish had a rank 1 bubble in the anal fin. All had full stomachs. No cataracts were found.

Consistent with hatchery observations in mid-February 2017, staff are starting to see a progression of GBT effects on fish, Dave Swank noted. Although the fish don't look bad now, they are showing some impacts in terms of feeding. The long-term concern is how they will fare if released on their normal schedule. At this point, it's unknown for how long fish can tolerate TDG levels of 104-104.5%, with evidence that they will eventually go off feed, possibly in the next week. This means scheduling an early release and contracting for trucks which takes 2 weeks.

Hesse reminded everyone that fish in the natural environment are at risk too. Fall chinook redds in the North Fork Clearwater are probably experiencing lethal conditions with TDG levels of 114% saturation at the Peck gage. He will provide emergence timing estimates for these fish at the next TMT meeting. Fall chinook juveniles being acclimated in the Peck area have been behaving abnormally, hovering at the bottom of their rearing tank. At the Nez Perce hatchery, where in-river TDG levels are just over 110%, the degassers are bringing levels down to 104% for kelt reconditioning.

6. Clearwater Basin Hatchery Release Planning Update

The Nez Perce Tribe, USFWS, and Idaho gave a joint presentation. Yesterday, all hatchery production staff in the Clearwater and multiple agencies had a conference call to discuss fish health and river conditions, Jay Hesse reported. The original release dates, previously shared with TMT, were planned so hatchery smolts would arrive at Lower Granite during spill, which starts April 3. However, these dates have been changed to accommodate early releases for a portion of the hatchery fish. Chinook are now scheduled to be released directly into the mainstem Clearwater on March 26-27, the same days when the Clearwater anadromous fish hatchery plans to do an early release. The travel time for these fish to Lower Granite is an estimated 1-3 days, which is about 5-7 days earlier than originally intended.

Release dates for the steelhead in systems 2 and 3 on direct river water are being accelerated, and trucking will begin March 28. Fish that remain on station will be released March 30. Hatchery staff are trying to hold these fish for as long as possible in hopes they will not arrive at Lower Granite Dam until spill starts. The fish in system 1, which uses blended water, will be held until April 15 as originally planned. The decision to release fish early must be made at least 2 weeks in advance to allow time for contractual arrangements.

This plan may be adjusted depending on whether the Lower Granite juvenile bypass system is in operation. The JBS is currently scheduled to begin operating March 25 but that is questionable.

Hatchery staff believe all fish will be up to size by these accelerated release dates, Dave Swank said. They would prefer the fish not pass through unscreened turbines at Lower Granite. Ideally PIT detection would be in place, but fish screens are a critical component.

If for some reason the JBS will not be operational on March 25, Hesse said hatchery managers would request that the removable spillway weir at Lower Granite be turned on to give fish an alternative passage route to the turbines. While this is not a request at present, it's a heads-up in case the JBS doesn't open on schedule. Hesse will report on this at the next TMT meeting.

Dave Swank said hatchery staff are waiting for an update on the status of the Lower Granite juvenile bypass and spill, with a conference call planned for March 12. Hatchery managers are considering a request for a day or two of RSW spill at Granite, even with the fish screens installed, to help more fish pass via surface spill. Hatchery managers are doing everything they can to improve chances of survival for these early releases. Charles Morrill said over the next week, the Salmon Managers should consider requesting that the Action Agencies start operating the RSW at Lower Granite on March 25 to provide spill for hatchery and in-river fish.

IDFG, USFWS and tribal hatcheries work together as a team to coordinate smolt releases, Russ Kiefer reported. They jointly decided to schedule the early Chinook release over a 2 day period so there would be more opportunity to keep Dworshak outflows and TDG levels lower for the release.

Therefore, Idaho proposes a minimum of 2 days and hopefully 3 days of 12 kcfs releases on March 26-28. If discharges need to go up to 20 kcfs for a few days to meet the April 15 flood control requirement, Kiefer asked that it be done the second week of April, when it would have

less impact on fish than in March, and it would help the early out-migrating runs.

Idaho's request for reduced outflows to accommodate early releases reinforced Steve Hall's sense that discharges should be increased now. The difference between current outflows of 16 kcfs and the desired 12 kcfs is 4 kcfs for 3 days, equivalent to an additional 24 kaf. Hall proposed that Dworshak releases go to 16.5 kcfs in the near future to spread the extra 24 kaf over the next 12 days in compensation for reduced flows on March 26-28. Scott Bettin, BPA, asked how the 500 cfs increase would affect TDG levels downstream. The change would be insignificant, probably less than 1%, Hall replied.

Hesse encouraged the COE to explore the possibility of catching up on the 24 kaf releases later, given all the accommodations being made in hatchery practices to minimize the effects of high TDG levels on fish. Would it be possible to miss the end of March flood control target by 24 kaf? While the COE RCC acknowledges the Salmon Managers' desire for releases to aid smolt migration, it grants deviations on the basis of minimal risk to flood control, not necessarily for biological purposes, Julie Ammann said.

Charles Morrill commented that the unit 3 outage plays a big role in the need for a flood control deviation. Erick Van Dyke commented that TMT tends to focus on Dworshak, but lower Snake fish should be part of the plan for the long term. Van Dyke requested for operational flexibility to meet the needs of a broader population of fish.

At this point Kiefer clarified his request:

1. Reduce DWR discharges to 12 kcfs starting at 12:01 am March 26 so there is time for gas levels to dissipate before the hatchery releases fish that morning.
2. Three days of reduced flows are desired, but the third day is not as crucial as the actual release on March 26-27. An extra day on March 28 would give the fish time to clear the North Fork, but that could be exchanged for lower TDG levels a few days later for the next release.

Paul Wagner proposed the Salmon Managers caucus to discuss Idaho's request for a reduction in Dworshak outflows to 12 kcfs. After the caucus, Wagner reported that the Salmon Managers endorsed, with varying opinions, the COE proposal to increase DWR discharges by 500 cfs as soon as possible in preparation for the smolt releases March 26-

27. The Salmon Managers will decide then whether a third day of 12 kcfs outflows is a priority.

Hearing the consensus recommendation, the COE and BPA will coordinate to increase Dworshak discharges to 16.5 kcfs as soon as possible.

7. Methodologies to Monitor Adult Passage in the Snake River

Russ Kiefer followed up on his earlier plan to provide a draft document for TMT to review and hopefully approve today. The purpose of the document is to advise technical research groups who are working on ways to improve tracking of adult passage for in-season management. Kiefer said he received several good comments and will send the document to TMT members later today if possible. One question remains: should there be one data set or two for mid-Columbia spring and summer chinook? TMT will revisit this next week.

8. Snake and Clearwater River Confluence Surveys and Lower Granite Dam Variable MOP Operation

Following up on a survey of navigation channel depth requirements the COE presented to TMT in January, Steve Hall and Aaron Marshall showed TMT updated survey results and a PowerPoint presentation depicting the need for variable MOP operations at Lower Granite Dam. A 14 ft minimum depth requirement for navigation at the confluence of the Snake and Clearwater rivers means that any riverbed elevation above 719 ft encroaches on safe navigation when Lower Granite is at MOP. While several data points on the survey indicate elevations of 721 ft or greater near the south bank, the main concern is the navigation channel and the area near the docks, particularly the turning zone near the port of Lewiston. When Lower Granite is at MOP, the zone is too shallow for tugs and barges to turn around without hitting mounds of sediment. Another area where sediment has accumulated is the confluence area where the river bends near the Port of Clarkston.

In light of these impacts to the navigation channel in Lower Granite pool, the COE is planning to implement a variable MOP operation for 2018 fish passage season, Aaron Marshall said. Variable MOP operations were implemented in 2011-2014 due to sedimentation in the channel. These were coordinated with TMT and documented in the Water Management Plan. Dredging during the winter of 2014-15 prior to passage season allowed Granite to return to normal MOP operations beginning in 2015. High flows during 2017 deposited large amounts of sediment near the Snake-Clearwater confluence so now the area needs dredging again.

A variable MOP operation is based on inflows, with a lower forebay range at higher levels of inflow, Marshall explained. When inflows are lower, the forebay range is higher to provide the necessary depth in the confluence for safe navigation. This approach strikes a balance between providing safe navigation and enhancing juvenile fish migration, as well as meeting the flood control requirement in the Water Control Manual not to exceed 738 ft at the Lewiston gage.

When inflows are greater than 120 kcfs, Lower Granite is able to operate in the MOP range of 733-734 ft, due to the backwater effect from Lower Granite Dam to the confluence that provides the necessary depths for safe navigation. But when inflows drop off, especially below 50 kcfs, Lower Granite needs to operate at MOP+2 or 735-736 ft elevation in order to provide sufficient depth in areas where sedimentation has elevated the river bottom to 721 ft or higher.

The COE RCC will use day-ahead forecasting in real time to determine the transition between forebay operating ranges and will keep TMT updated on transitions. The variable MOP operation is designed to pull the backwater effect closer to the dam and past the confluence, which creates more natural river conditions during high flows and protects levees in the area.

Erick Van Dyke asked why dredging was not initiated during the in-water work period of December through February this year. Julie Ammann said it can take 3 years or more to budget and award a dredging contract and perform environmental compliance. A variable MOP operation is needed in the interim. Jay Hesse asked whether dredging would be performed soon, and Ammann said it would be challenging to get it done this winter, but the COE is exploring options.

Hesse asked how the variable MOP operation will be aligned with TDG management. Does holding flows balance between spill and power generation, or will TDG levels be maintained at the gas cap? Ammann said the MOP+2 range has some overlap with MOP +1.5 so there would be no impact on gas cap spill. The transition from MOP to MOP+1 could take a little time, but these operations will only occur during high flow when spill is above the gas cap (involuntary). Marshall said day-ahead forecasting should allow for a seamless transition from one day's operation to the next. Filling Lower Granite forebay by half a foot only means a 2 kcfs reduction in inflows, Tony Norris added.

Charles Morrill advocated opening the RSW earlier this season to offset having to operate Granite above MOP during spill season. Per the BiOp MOP operations on the Snake don't go into effect until April 3; the

forebay operating range is 733-738 ft prior to that, Baus replied. Operating the RSW on March 25-26 would aid downstream migration for smolts that are being released early, Morrill pointed out. The COE will keep TMT informed of progress on dredging.

9. Operations Review

9a. Reservoirs. Lisa Wright, COE, and Joel Fenolio, BOR, reported. Libby is at elevation 2380.8 ft with inflows of 3.3 kcfs and outflows of 19.0 kcfs. Albeni Falls is at elevation 2052.1 ft with inflows of 21.0 kcfs and outflows of 27.7 kcfs. Dworshak is at elevation 1492.4 ft with inflows of 3.9 kcfs and outflows of 16 kcfs. Lower Granite outflows are 48.7 kcfs, McNary outflows are 185.5 kcfs, and Bonneville outflows are 214.6 kcfs.

Hungry Horse is at elevation 3521.5 ft, releasing 8.5 kcfs. Inflows are 1.2 kcfs. Discharges will ramp up Friday to 11 or 12 kcfs. Grand Coulee reservoir should be down to its drum gate elevation of 2058.9 ft by early next week. Inflows are 90 cfs and releases are 115 cfs.

9b. Fish. Paul Wagner reported. Juveniles: Passage season is in its early stages. The Imnaha trap has captured 3 yearling migrants, but subyearling chinook and coho passage has not started yet. Little Goose has started sampling and caught 6 fish the first day, 9 the second. John Day and Bonneville start sampling March 1. Little Goose and John Day sampling this time of year is new. Some steelhead have been captured at the John Day and Little Goose sampling facilities. Lamprey are also showing up at John Day.

Adults: There was not much to report. Some 720 winter steelhead have passed Bonneville to date, at a rate of about 10-25 per day. Wild fish are fewer but passing as well. The Lower Granite fish ladder opened this week, and on Friday a few steelhead passed.

9c. Water Quality. Dan Turner, COE, reported. Forebay gages are coming on line this week. The Chief Joseph tailrace gage was turned on in February to capture the effects of spill at Chief Joseph. TDG levels have been low except downstream of John Day, where there have been some exceedances of the 110% threshold. Dworshak and John Day are spilling for adult attraction at Bonneville

9d. Power. Tony Norris reported that language has been added to this year's Fish Operations Plan re: transmission reliability. BPA will update the power system emergency action plan and the TMT emergency protocol to be consistent with the FOP. A draft will be available for TMT review at the March 14 or March 21 TMT meeting.

10. Next TMT Meetings

TMT will meet next in a conference call on March 14 and in person on March 21. The March 14 meeting agenda will include Dworshak operations (including 3 more analog years), adult passage monitoring recommendations to researchers, the power system emergency action plan and TMT emergency protocol, and the effect of high Bonneville tailwater elevations on chum.

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