TECHNICAL MANAGEMENT TEAM			
BOR:	*John Roache / Mary Mellema / Pat McGrane*	**BPA:**	*Tony Norris / Scott Bettin / Robyn MacKay*
NOAA-F:	*Paul Wagner / Richard Dominigue*	**USFWS:**	*David Wills / Steve Haeseker*
OR:	*Rick Kruger*	**ID:**	*Russ Kiefer / Pete Hassemer*
WA:	*Charles Morrill*	**MT:**	*Jim Litchfield / Brian Marotz*
Kootenai Tribes:	*Sue Ireland / Billy Barquin*	**Spokane Tribes:**	*Deanne Pavlik-Kunkel / Andy Miller*
Colville Tribes:	*Sheri Sears / Steve Smith*	**Nez Perce Tribe:**	*Dave Statler*
Confederated Tribes of the Umatilla Indian Reservation: *Tom Lorz (CRITFC)*			
COE: *Doug Baus / Karl Kanbergs*			

COLUMBIA RIVER REGIONAL FORUM

Technical Management Team
Annual Review of Lessons Learned: 2012

Wednesday, December 5, 2012
9:00 am - 3:30 pm PST
Ambridge Event Center
1333 N E MLK Blvd (cross-street is Clackamas)
Sellwood Room
Portland, Oregon
Map Quest [Directions]

AGENDA

Questions about the meeting may be referred to Robin Gumpert at (503) 248-4703.

Purpose: To provide an opportunity for TMT members and other interested parties to step out of the regular meeting format and review the management decisions and operations of the 2011 season in order to learn lessons that can enhance choices and decision making for 2012.

The timing of agenda items are offered as a guide for the day. Depending on information presented and group dynamics it may compress or expand. Presenters are reminded that their presentations are meant to provide visual cues that spark reflection and discussion, as opposed to a full blown analysis of the issue.

1. **9:00 Welcome, get settled and introductions** - *DS Consulting Facilitation Team*

2. **9:15 Conditions Review: What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?**

   - Weather, Water, System Flood Control & RIS GBT - *Kasi Rodgers, COE Division*
   - Summary of 2012-2013 Pre-Season Winter Weather Predictions - *Kyle Dittmer, CRITFC*
   - Winter 2012-2013 Climate Forecast - *Kyle Dittmer, CRITFC*

- Implementation of ESP Water Supply Forecast Methodology - *Ann McManamon, BPA*

- *This item will move to a later slot on the agenda but is kept here as a 'Conditions Review' item.

- Fish Passage
    1. Adult summary - *Charles Morrill, WA*
    2. Juvenile Summary - *Brandon Chockley, FPC*

- 10:00 to 10:15 Lessons Learned from the 2012 Conditions Review?

10:15 Break

3. **10:30 Reservoir Operations Review: How effective were the proposed actions (SORs) at achieving desired results? What changes might be necessary to enhance results in the future? How did this year compare to others?**

    - Libby Operations - *Joel Fenolio, COE Seattle District*
    - Summary of 2010-2012 Kootenai River Flow Tests with Spill from Libby Dam - *Dave Wills, USFWS*
    - Hungry Horse Operations - *John Roache, BOR*
    - Grand Coulee Operations - *John Roache, BOR*
    - Dworshak Spring/Summer Operations - *Steve Hall, COE Walla Walla District*
    - Upper Snake Flow Augmentation - *Ted Day, BOR*

    - Lessons Learned from the 2012 Reservoir Operations Review? Is there more flexibility that TMT could utilize to improve in-season operations?

Noon Break for Lunch

4. **12:45 Review of Specific Operations: What was learned about specific operations that were requested by TMT members or other regional entities? How effective were these operations in achieving the intended goal? Should they be continued or modified in future years? Why or why not?**

    - Juvenile Survival for 2012 - *Steve Smith, NMFS Science Center*
    - Juvenille Snake River Fall Chinook Survival 2012 - *Jerry McCann, FPC*
    - Bonneville PH2 Operations
        1. Operations Summary - *Doug Baus, COE*
        2. FPOM Task Force to Address PH2 issues - *Tom Lorz, CRITFC/CTUIR*

      -
    - Lake Pend Oreille Operations (SOR USFWS/IDFG-1) - *Andy Dux, Idaho*
    - Kootenai River Habitat Work -*Sue Ireland, Kootenai Tribe*
    - Performance Standard Testing Results - *Mike Langeslay, COE Portland District*

    - Lessons Learned from these specific operations?

5. **3:00 Other Lessons Learned?** Given the review of conditions, decisions and actions throughout the day, what are the overarching lessons that could impact future work of the TMT? Are there themes that might need further discussion at a future TMT meeting or other regional work group?

6. **3:30 Adjourn**

NOTE: Lunch will be brought in for all participating in or attending the meeting. A $10 contribution is required. **RSVP as soon as possible - and no later than Friday, November 30. Your RSVP is required to guarantee enough food for everyone! To RSVP & to make special food requests (e.g. vegetarian) please email Janhkelley@gmail.com or call 503-248-4703.**

Thank you in advance for your thoughtful participation.

COLUMBIA RIVER REGIONAL FORUM
TECHNICAL MANAGEMENT TEAM

Year End Review

December 5, 2012

FACILITATORS' SUMMARY NOTES
Facilitator: Robin Gumpert
Notes: Donna Silverberg

The following notes are a summary of the year-end review meeting and are intended to 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.

Welcome and Introductions - *DS Consulting Facilitation Team*

2012 Conditions Review: What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?

Weather, Water, System Flood Control & RIS GBT - *Kasi Rodgers, COE Division*

Kasi reviewed the water and temperature profile for the year, describing 2012 as an "indecisive year" with big fluctuations between warm/dry and wet/cold throughout the region. June was the wettest on record in the Basin. July started to warm and dry out and drought conditions started in some areas at that time. The amount of water impacted the water supply forecast—because it fluctuated so much, so did the reservoir operation plan. What seemed to be a dry year in March picked up speed in April for the rest of the season. Flood control space looked good, until there was too much water and drafts were necessary. Mica had the first spill since 1997; Birchbank in BC also had records of highest recorded discharges—and were able to manage the large amounts of water without any major floods.

Kasi also reported on the successful management of gas bubble trauma at Rock Island. The Corps managed with TMT to minimize the GBT given the forecast and awareness of what was coming and its possible impacts on fish.

Summary of 2012-2013 Pre-Season Winter Weather Predictions - *Kyle Dittmer, CRITFC*

Kyle reported on the annual winter weather forecast: near normal on the lightly warm, slightly dry side.
While El Nino has been suggested, ENSO signals are suggesting a neutral year is more likely. The Pacific is getting cooler, which is good news for salmon. Kyle said the forecast shows another year of high variability weather. He also forecasts 102 MAF or 95% of normal water supply, with four snow events in the Portland area.

Implementation of ESP Water Supply Forecast Methodology – *Erik Pytlak, BPA*

Erik explained the forecast methodology that is being relied upon now that the NWWS-RFC is no longer doing statistical forecasts for precipitation. The Columbia River Treaty Hydromet Committee developed a protocol for running statistics every three days and found that three days out has become pretty reliable, while looking nine days out is not as reliable. Meteorologists can give trends, but not reliable numbers to help with forecasting precipitation events. For this year, changes will be made with the coordinating agencies: The 'final' monthly forecast will be that which gets published on the 5th working day of the month and relies on a 3-day precipitation for forecast. For 2013, forecasts will be available on: 1/8; 2/7; 3/7; 4/7; 5/7; 6/6; & 7/8.

Fish Passage

Adult summary - *Charles Morrill, WA*

Charlie reported on adult fish counts for 2012-

- BON:
  - Adults were a little above average, a little below forecasted
  - Jacks: dropped off dramatically. 25,000 10-year average—this year saw 10,000
- LGR: Adults 72,500 10-year average, this year saw 80,000 returned
- Rock Island: 10-year: 14,700; this year just under 20,000
- BON Summer Chinook: 53,000
- Sockeye: It was a great year with more than 500,000 retuned
- Upriver bright Chinook: 296,000 (30,000 better than last year's10 year average)
- Tule jack Fall Chinook: 10-year average 47,000; this year 121,000
- LGR Fall Chinook: 10-year average 25,000; this year 35,000
- Summer steelhead numbers dropped: 10-year average 252,000; this year 68,000
- Steelhead at Lower Granite: 10-year average 117,300; this year 100,000
- Early coho run: 10-year average 267,000; this year 247,000
- Dave Statler, Nez Perce Tribe, reported on Pacific lamprey: This year's adult count at BON was 100,000. While this was good passage, we have seen poor passage to upstream areas. Conversion to LGR is about .2%. While this may be due in part to counting issues, passage issues remain a concern.
  - **ACTION**: Dave and Charlie discussed working on this and keeping the lamprey count issue on the agenda for future year-end sessions.

Juvenile Summary - *Brandon Chockley, FPC*

Brandon reviewed passage timing of juveniles compared to ten-year averages:

Rock Island:

Yearling Chinook —pretty much on average, with tail end coming a bit early

Steelhead arrived quite a bit earlier than the past ten years—the reason for this is uncertain

Sockeye were on schedule at the start, then spiked earlier than average

Coho came a bit early as well, again no explanation so far
Subyearling chinook came a bit late, but the middle end was on track with the average
Lamprey juveniles: this is the second year that data has been collected

Lower Granite:

Yearling Chinook began early and spiked early with high flows in the Snake
Steelhead started early, had a large release in March (early) and ended earlier than normal
Sockeye began late (maybe due to less early spill at Dworshak?), the middle of the run was on target, and the run ended a bit earlier than expected
Coho saw a little early start, but middle and end pretty much stayed on track
Subyearling Chinook were right on the 10-year schedule (as have been hatchery release schedules)
Larval lamprey—still collecting information

McNary:

Yearling Chinook were earlier than the 10-year average
Sockeye saw earlier timing
Coho were a little bit earlier, especially the tail end of the run
Subyearling Chinook were a little later at McNary, perhaps related to the later timing in the Upper Columbia
Lamprey saw an early pick up in April/mid-May and then again in June/July

Bonneville:

Yearling Chinook were a little early
Steelhead also were early at Bonneville
Sockeye also saw early tracking and early movement up river
Coho had a double peak this year that tracked timing wise, but counts did not track accordingly
Subyearling Chinook have begun releasing in April so while the average looks late, it correlates with the new release date at Spring Creek
Lamprey: a few were collected early

Brandon also looked at injury and descaling events this year. BON saw increased sample mortalities of Chinook and Sockeye compared to other projects. Lamprey had problems at BON and MCN. Descaling at LGR saw a 1.6% weighted average. This was the first time in more than ten years that it has been over 1%. The Fish Passage Center is trying to assess why this might have occurred.

Participant Question: How should the ten-year averages and passage this year be compared? Response: To see how the runs are moving, don't look at the total numbers as much as the timing.

Lessons Learned from the 2012 Conditions Review?

- Note that we don't really have a clue about runoff volume at this time of year, and we're not even too clear by April - we need to be conscious of this.
- While we had many fluctuations last year, no flooding occurred. It appears we have a management structure in place to manage a 130% year without big problems. Is there

one management decision that might have been changed? Are there additional tools that would be useful to have in our toolbox?

- Tools we've been using have been very useful for management.
- With regards to forecasting we have pretty good skill for snow on the ground. Skills break down for unusual rain events that drop large amounts of rainfall onto snow. Will need to be developing skills in this area given the climate change predictions at this point.
- Working to improve how forecasts are made —acknowledge that improvements are still needed.
- Got lucky the past two years with the shape of the flows.

- Bonners Ferry was flooding this year—and the Corps managed it very well on the ground.

<u>Reservoir Operations Review</u>: How *effective* were the proposed actions (SORs) at achieving desired results? What changes might be necessary to enhance results in the future? How did this year compare to others?

<u>Libby Operations</u> - *Joel Fenolio, Corps Seattle District & Dave Wills, USFWS*
June high levels of precipitation posed the most challenge for reservoir operations at Libby. Requested operations that had been goals early in the season had to be managed differently as a result of the high levels of inflows and accumulations. Snow pack developed similarly to other years, but the forecast underperformed when compared to observed levels creating management challenges. That said, regular coordination with the Tribes, TMT and Canada supported appropriate shifts needed to avoid major flood events while also meeting the fish needs as much as possible given the extremes at the dam. Joel mentioned that he would like to pursue additional conversations with TMT regarding future July and August management actions (and said hopefully it won't be as unusual a year).

Brian Marotz discussed the GBT issues for fish below Libby. TDG was above the state standard for more than 39 days—and biologists did see gas bubble trauma but no massive die-offs detected that might cause lasting effects. This may be because the river was so high they were able to find refuge from the gas. It is not clear yet, but Brian said good data was collected that can be reviewed and studied for the actual longer-term effects of the high water/gas year.

Dave Wills addressed the Kootenai River sturgeon operations (after a review of Kootenai River information). Sturgeon were listed in 1994, with the first BiOp in 2000 that was revised in 2006 and 2008. From that, there was agreement to try to raise flows in the river more like the historical, pre-dam peaks. The first attempt was in 2010. 2011 had enough in river water that the peak was very similar to historical flows. 2012 saw an even higher than historical peak average. With the three years of testing, there was no discernible change in sturgeon migration. As a result, calls for additional spill or sturgeon pulses will be unlikely. Dave said the sturgeon pulse in the spring that follows the BiOp tiered approach will likely continue without actual spill to support it.

<u>Hungry Horse Operations</u> - *John Roache, Reclamation*

John reported that HH had a similar situation as Libby with high June precipitation events and June runoff driving management actions. Record levels of precipitation in June and high inflows resulted in Reclamationsurcharging Hungry Horse in order to help control flows downstream. Forecasted inflow from the River Forecast Center changed dramatically through June which showed the influence that spring precipitation has on runoff volumes. TDG levels exceeded the state water quality standards for about 14 days with high spill levels. Brian Marotz, Montana, commended Reclamation for managing the gas levels this year. John also noted that Reclamation is thinking on the conservative end for managing this next year due to the abundant precipitation that fell in the basin this past falland the resultant high soil moisture levels. Brian Marotz noted that the Flathead River Commission is currently talking about suggesting some minor tweaks for future years to avoid flooded crop levels that were experienced this year (e.g. changing the flood levels to slightly below 14 feet).

Grand Coulee Operations - *John Roache, Reclamation*
Similar to HH and Libby, forecasts and flood control elevation shifts were impacted by the high precipitation levels in the region. Especially during March and April when there was a large increase from the March to April Forecast. This posed a challenge for operating but the change to more frequent forecast updates (NWRFC ESP) really helped to get ahead by enabling managers to pre-draft Grand Coulee during late March in anticipation of a larger runoff forecast in April. Adaptive management and drafting during March helped avoid excessive spill, high downstream TDG levels, and potential landslides around Lake Roosevelt. . Inflows and required discharges rose rapidly in May/Junebut fortunately Lake Roosevelt was high enough to allow spill over the drum gates when higher spill levels were required. Spilling water over the drum gates produces less TDG than spilling water through the outlet tubes. Downstream TDG levels were kept below 120% during most of the year with the exception of several days during late June. TDG levels in the Columbia River at the border were high this past year but may be reduced somewhat in the future with new turbines being installed at Juanita.

In addition, drum gate maintenance was done; the 45FE-1 bank stabilization project was completed (to protect cultural resources around the lake, Grand Coulee drafted to 1279.6' on August 31 and released 25,500 AF for the Lake Roosevelt Incremental Storage Release Project).

Dworshak Spring/Summer Operations - *Steve Hall, Corps Walla Walla District*
Steve noted that DWK didn't get the June rains that impacted others, but did get an earlier hit of precipitation. Flood control was shifted to Grand Coulee in April and brought spring augmentation into play which extended into early May. The Corps was able to fill the reservoir slightly early this year because of low observed snow levels in the region. They began summer temperature operations and augmentation on July 8th.

Temperature operations went smoothly this year. However, problems with a TDG gauge meant that the period that might have shown TDG exceedances was not able to be monitored. That said, all were on alert to manage to protect against any problems that might have been expected.

IDFG noted that the outcome was very good this year. Was it management or luck? Steve noted that they have gotten very good at managing tailwater and temperatures below DWK.

Upper Snake Flow Augmentation - *Ted Day, Reclamation*
Flow augmentation into the Upper Snake above Brownlee came from a number of sources, but primarily from the Upper Snake above Milner and the Payette Basin. Some water comes out of the Boise Basin and from natural flow water rights but not as much as the other two basins. Reclamation works with Idaho under the terms of the Nez Perce Agreement to provide up to 487 kaf during the April through August period, with an emphasis on providing as much as practicable by July. This year was slightly above average in the Payette and Boise, but slightly below average runoff above Milner. Near record peak inflows were experienced in the Boise and Payette in late April. A muted runoff pattern above Milner meant that the system did not refill completely. Reclamation was able to meet the 487 KAF target into the system for fish/flow augmentation, providing approximately an extra 5,000 cfs during the June migration period, and lesser amounts during the rest of the season. So far for Water Year 2013, Ted noted that the high snow levels this past fall are resulting in rain rather than snow in some parts of the Basin, but because the basin above Milner is so high in elevation, it is getting snow and precipitation to support refill this year and so far it looks hopeful for hitting the 487 kaf in 2013.

Lessons Learned from the 2012 Reservoir Operations Review?

- Management of DWK has been so well fine-tuned that we are able to hit the targets regularly now, even when we have different weather events/patterns. Maybe we take for granted how well we have done this as a group.
- Everything we have been hearing today relating to 2012 and operations is species specific which is an oddity of the BiOp process. So where we had high flows and more normative freshets in some of the tributaries, we may fail to see the natural benefits in the challenges that the weather has put on to the system. This is a call for managing the system in an ecosystem way.

Review of Specific Operations: What was learned about specific operations that were requested by TMT members or other regional entities? How effective were these operations in achieving the intended goal? Should they be continued or modified in future years? Why or why not?

Juvenile Survival for 2012 - *Steve Smith, NMFS Science Center*
Steve reported that this is the end of the 20th year of PIT tag survival studies. He reviewed where the studies have been occurring and what they are trying to understand: survival of migrating salmonids. For 2012, nothing stands out in terms of spill levels as compared to river size, and temperatures also followed usual patterns. In-river fish did well this year in comparison to other years. Chinook ran slightly above averages, while steelhead were lower than average in the upper river. The lower river saw some of the fastest travel times ever seen for both Chinook and Steelhead. Yearling Chinook had 92-95% survival which exceeds the average in every reach. This is similar for Steelhead (even though slightly lower than Chinook). ***Sockeye from the Snake Basin: those released as XX did poorly (2.1% survival) whereas the spring smolts had a higher than average survival.***

Transportation information: Steve reported that numbers and survival rates of the fish in river have increased, but this has not necessarily translated to smolt to adult survival rates (SAR). The SAR may be 10-35% lower than SAR for unmarked fish. Transported fish show a better SAR than in-river, but in-river has improved, likely due to improvements in the system and passage ways in the past few years.

Juvenile Snake River Fall Chinook Survival 2012 - *Jerry McCann, Fish Passage Center*
Jerry reported on juvenile Snake River Fall Chinook survival LGR to MCN looking at four cohorts that passed LGR on particular passage dates for a study. Survival in 2012 was slightly lower than 2011 but on a par with the other compared years. Transportation proportions were less than other years.

Bonneville PH2 Operations Review

- Operation – *Doug Baus, Corps*: Doug showed a recap of the actual operation and explained that the "best geometry" goal was to minimize juvenile descaling and mortality at PH2. 2012 coordination helped clarify an operation that had a number of steps. The region is still working to determine next year's operation. Next steps to inform future decisions include a trip to ERDC to look at ways to manage this; evaluating actual results on fish; making operational adjustments associated with BPA TBL transmission limitation; and improving gate well conditions through FFDRWG.

    - Question: Is there a way to exceed the TDG standard identified in the waiver if it will benefit fish? Response: No, the special short duration (2 hour) exceedance clause identified in the waiver is intended to address a potential short duration operational situations. The exceedance provision was not included to provide for a long duration operation that would exceed TDG waiver requirements.

- FPOM Task Force to Address PH2 Issues- *Tom Lorz, CRITFC/CTUIR*: Tom reported that this task force is working to create an actual plan for the best geometry issues rather than relying on TMT to answer the questions. A series of questions and data needs have been pulled together to review and evaluate the various options that may or may not exist. FPOM's subgroup is working to reach an agreement on language that NOAA will put forward by the end of the year.

Lake Pend Oreille Fishery Recovery Project/Operations (SOR USFWS/IDFG-1) - *Andy Dux, Idaho*
Andy reported that the goal of this project is to provide additional habitat for kokanee salmon in Lake Pend Oreille, with a focus on spawning habitat, predation issues, and altered food web/nutrient issues. There has been an 82% reduction in lake trout as a result of efforts to date. Less predation has led to a positive response in the Kokanee population. Abundance rates, and adult spawners, have gone up over the past couple of years, especially in 2012. Bull trout have also stabilized in recent years with the reduction in lake trout.

This year's SOR provided a couple of benefits: more habitat for a strong return of lakeshore spawners and researchers were able to place 60 embryo incubation sites which will provide a better understanding of the lake.

At this point, Andy said, we can't say whether the lake levels have had the intended benefit on Kokanee so we'll need to find a new metric to make these assessments. The team working on this project is looking for another way to make the analysis--which may require additional tests and lake level fluctuation requests to TMT.

- Comment: Consider that Kokanee are by nature cyclic in their population. Working for a steady level may be tough to do since it does not appear to occur when unmanaged. The studies at Pend Oreille have been going for a while and may have sufficiently answered water management questions. (Andy disagreed and suggested that, actually more questions have been raised…)

Kootenai River Habitat Work -*Sue Ireland, Kootenai Tribe*
The Tribe has been working on a habitat improvement project that has made a number of requests to TMT. Sue presented information on the project so that TMT has a better sense of the fruits of the requests. Restoration work impacts a number of species that are either threatened or endangered. Keeping an ecosystem view is serving the Tribe well for how it approaches these multiple projects located in three different reaches in a 55-mile stretch of the Kootenai River in Idaho.

SORs have been made for lower river flows in September when work can be done along the river (water is too high sooner than that). Sue walked the group through a series of pictures showing the work done in Phase 1 (2011). In 2012, the high water delayed start of construction, but they were able to get reduced flows in time to do initial work this Fall. As a result of the work thus far, a large portion of the river now has been restructured to be meandering habitat welcoming a variety of fish and other species. And landowners who provided the access have changed their own processes to have better grazing practices along the riparian areas. The Tribe has begun to study the recruitments into the newly improved areas.

Performance Standard Testing Results - *Mike Langeslay, Corps Portland District*
The Corps did a major telemetry study of more than 50,000 fish to test performance at dams in the Columbia. The NMFS BiOp requires a 96% minimum survival at the projects and that the Corps monitor for this. This year LOMO and LGS were added to the monitoring system which also included MCN, JDA, TDA and BON. The Corps conducted a variety of tests of different changes or proposed changes to passageways and routes. The results were robust with survival rates above the 96% target (96-99% range) at LGS, LOMO, JDA, TDA and BON (even though they weren't able to hit many of the planned for targets due to high flows). Next, the Corps will review the studies with its regional partners.

Programmatic Sediment Management Plan & Lower Granite Report & Update -*Steve Hall, Corps Walla Walla District*

Steve reported thatdredging is planned for Dec 2013-March 2014 in two areas: the downstream navigation channel at Ice Harbor and at the confluence of the Snake and Clearwater.

Re: Lower Granite MOP: Steve said the Corps received the survey data late last week and, in short, the situation has not improved at LGR.

Lessons Learned from these specific operations?

- More water is good and shape matters
- The Kootenai SOR has worked well, because it was requested so far in advance; everyone can work to meet the objectives; joint gains were experienced; and quick adaptive management was used to find best solutions.
- Seeing variability in weather that is impacting the system (e.g. rain on snow and rapid runoffs)—biologists have advocated for full pool during the migration season, but lately the action agencies have backed off for slower fill at the end, followed by spills and fills. If this variability is the 'new normal' maybe we should continue tweaking the targets to avoid the spill and fill that has become a regular part of management actions?

Other Lessons Learned? Given the review of conditions, decisions and actions throughout the day, what are the overarching lessons that could impact future work of the TMT? Are there themes that might need further discussion at a future TMT meeting or other regional work group?

[Facilitator's note: the final question will be asked again at a future TMT meeting, allowing the group time to think about what they saw, heard and thought about at today's meeting]

Present for all or part of the meeting:

Doug Baus (Corps), Richelle Beck (Grant County PUD), Scott Bettin (BPA), Jen Boyer (BPA), Brandon Chockley (Fish Passage Center), Erin Cooper ( ), Ted Day (Reclamation), Kyle Dittmer (CRITFC), Andy Dux (IDFG), Berry Espenson (Columbia Basin Bulletin), Joel Fenolio (Corps), Steve Hall (Corps), Laura Hamilton (Corps), Pete Hassamer (Idaho), Sue Ireland (Kootenai Tribes), Kim Johnson (Corps), Rick Kruger (Oregon), Jim Litchfield (MT), Tom Lorz, (CRITFC/CTUIR), Agnes Lut (BPA), Brian Marotz (MT), Jerry McCann (Fish Passage Center), Charles Morrill (Washington), Tony Norris (BPA), Christine Peterson (?), Erik Pytlak (BPA), John Roache (Reclamation), Kasi Rodgers (Corps), Sheri Sears (Colville Tribe), Tom Skiles (CRITFC), Steve Smith (NMFS Science Center), Dave Statler (Nez Perce Tribe), Glen Traeger (Avista Energy), Joel Turkheimer (?), Pat Vivian (Note taker),Paul Wagner (NOAA), Dave Wills (USFWS)

Robin Gumpert, Jan Kelley, and Donna Silverberg, DS Consulting Facilitation Team

Columbia River Regional Forum

TECHNICAL MANAGEMENT TEAM – OFFICIAL MINUTES

2012 Annual Review of Lessons Learned
December 5, 2011
Notes: Pat Vivian

1. Introduction

The 2012 TMT year-end review was chaired by Doug Baus (COE) and facilitated by Robin Gumpert (DS Consulting). Representatives of the COE, BPA, Kootenai Tribe, Montan, Colville and Nez Perce Tribes, USFWS, Oregon, NOAA, Washington, BOR, CRITFC, Idaho and others participated. This summary is an official record of the proceedings, not a verbatim transcript.

Today's annual review was a retrospective on specific conditions and operations that TMT coordinated in 2012. The purpose of the review is to look for lessons learned that can be applied to river management in 2013 and beyond. The presentations were accompanied by slide shows which are posted to the TMT web page.

2. Conditions Review *(What were the water, weather and fish conditions that existed throughout the year? How did this year compare to others? Is there something we can learn from this? Is there anything unique that bears sharing?)*

2a. Weather, Water, System Flood Control and RIS GBT. Kasi Rodgers, COE, reported. November and early December were warm and dry, followed by a few weeks of cold, wet weather and a cold snap in January. February was warm and dry, then turned cold and wet. March was completely wet and cold, with normal snowpack at the beginning of the month and 115% of normal by the end of the month. April began with spotty precipitation followed by extreme precipitation in some areas. The Snake River basin saw rain on snow. Runoff in April prompted the COE to start reservoir refill because of inflow spikes. May was dry and cool. Then came June 2012, the wettest June on record with the exception of the Snake basin, which stayed dry. Parts of the Snake basin experienced mild drought in July, a phenomenon that spread northward in August.

The April 1 water supply forecast is used to set the maximum draft for April 30 on federal reservoirs, Rodgers pointed out. Not all reservoirs were drafted completely in April 2012 because the forecast spiked up so much after that month.

Mica Dam had its first spill since 1997 and also was notably surcharged about 1.1 feet above full pool which also helps to mitigate flooding. Arrow Dam surcharged as well, with a maximum elevation of 1445.5' (full pool is 1444'). Libby Dam, to be covered in more detail by Joel Fenolio, was able to draft proactively in response to the water supply forecast. Grand Coulee Dam started refilling early on April 24. Actual peak discharge this year at Grand Coulee was 215 kcfs. Minor flooding occurs when Grand Coulee unregulated discharges reach 225 kcfs, and major regional flooding occurs at

280 kcfs. The year 2012 brought the fourth highest flows since 1929, with 119.1 MAF in April-August runoff volume.

Rodgers touched on GBT symptoms observed at Rock Island Dam in light of the high flows of spring 2012. The Action Agencies in 2012 coordinated with TMT to draft Grand Coulee proactively during the third week of March when the high water forecasts were released. This helped to minimize GBT symptoms as a result of the high flows. Other things that helped were the fact that 2012 was not as big a water year as 2011 at Grand Coulee, and the shape worked well. The incidence of GBT was significantly lower in 2012 than it was in 2011.

2b. Winter Weather Forecast. Kyle Dittmer, CRITFC, reported and distributed a handout on the winter 2012-13 predictions and climate forecast. The 20th annual Oregon forecast of the American Meteorological Society foresees near normal temperature and precipitation conditions this winter. The weather may be slightly dry, but not out of the ordinary. The past two years have brought la Nina conditions. This was a good year for snowfall, with 8 snow events and 10 inches total.

This year's forecast is favorable for el Nino, although it doesn't meet NMFS criteria for an el Nino year. The current trend is neutral. PDOs have been cold in the North Pacific, which is good news for salmon.

The CRITFC water supply forecast is for 102 maf, or 95% of normal. The NOAA RFC forecast came in very similar at 98 maf or 91% of normal. Dittmer predicted a 70-80% likelihood of around 4 snow events in January-March 2013. No extreme weather events are expected this winter.

Questions and comments:

- Q: What is the probability of having extreme heavy precipitation in the upper Columbia two years in a row (Charles Morrill, Washington)? A: It could happen because extreme weather events are occurring everywhere. This summer we had 12-13 weeks of no rain, which is highly unusual. That is indicative of el Nino years, not la Nina or ENSO-neutral years (Kyle Dittmer, CRITFC).

2c. BPA Implementation of ESP Water Supply Forecast Methodology. Erik Pitlak, BPA, gave a presentation on the new ESP forecasting methodology. The past few months have brought above average precipitation, but snow levels are unusually high. Snow levels above 7,000' elevation are especially high in the basin.

Pitlak described the recent change in NW Regional Forecast Center forecasting methodology. In 2004 the RFC began doing ensemble streamflow prediction (ESP) forecasts. Recently the RFC switched to daily forecasts based on 10 days of precipitation forecasting. One result of daily RFC forecasting is big swings in the water supply forecast from day to day, especially this time of year. Last year the ESP forecast responded well to dry trends, but the forecast failed to take precipitation into account.

As precipitation increased, so did the water supply forecast. In late March, a large rainstorm was predicted but didn't materialize. As a result, in 2012, BPA, B.C. Hydro, COE and BOR representatives met to review forecasting methodology. They settled on 3-day forecasting, based on the ESP forecast for the fifth working day of each month. This seems to be more reliable than 10-day forecasting.

BPA plans to make two changes in 2013 in its forecasting methodology. First, BPA will move from using the fourth to the fifth working day of the month as the official RFC forecast. Second, BPA will move from using the 9-day to the 3-day precipitation forecast, which seems to track water volumes better. Official BPA forecasts for 2013 will be issued on January 8, February 7, March 7, April 5, May 6, June 6 and July 8. Regional consensus would be needed to ask the RFC to produce a 5-day precipitation forecast.

Questions and comments:

- Q: When will the next group of ESP annual predictions be available? (Tony Norris, BPA) Probably in another 5 years because a scientific shift has occurred in short term forecasting. It will take a herculean effort between BPA, NWRFC and other entities to recalibrate the database with more years. At some point, decisions will need to be made regarding the effects of climate change.

2d(i). Fish Passage – Adult Summary. Charles Morrill, Washington, reported on this year's adult runs. At Bonneville, the 10-year average for adult spring chinook passage from January to June 15 is 182,300 fish as compared to the 2012 count of 186,000 fish, making this year a bit above average. Jack spring chinook runs, however, dropped off dramatically in 2012 compared to prior years. The 10-year average was 25,500 jacks compared to this year's count of 10,000 jacks.

Lower Granite passage counts of adult spring and summer chinook were almost 80,000 this year compared to a 10-year average of 72,200 fish. Rock Island adult spring chinook dam counts were just under 20,000 fish, an improvement over the 10-year average of 14,700 fish. Bonneville adult summer chinook counts were 53,000 fish, which is less than the 10-year average of 62,200 fish.

The year 2012 was a great one for sockeye, with over 500,000 fish compared to a 10-year average of 126,200 fish. Upriver bright adult fall chinook returns to Bonneville dam were almost 300,000 fish this year, an improvement over the 10-year average of 269,800 fish. The tule bright jack fall chinook count was very strong this year at almost 121,000 fish compared to the 10-year average of 47,000 fish.

Lower Granite fall chinook returns continued to rise this year thanks to the Snake River supplementation program, with almost 35,000 fish in 2012 compared to a 10-year average of 25,000 fish. The tule Spring Creek Hatchery jack fall chinook return this year was about 2,800 fish compared to a 10 year average of 3,400 fish.

Summer steelhead counts took a dive at Bonneville this year, at 232,000 fish which is well under the 10 year average. They also took a dive at Lower Granite, with counts of around 100,000 fish as compared to the 10 year average of 177,300 fish. Early coho salmon runs this year were only 247,000 fish compared to a 10 year average of 367,000 fish.

Questions and comments:

- The status of Pacific lamprey needs to be added to the annual run assessment. A total of around 100,000 lamprey passed Bonneville this year which makes 2012 a relatively good year. Poor conversion of adults from Bonneville to upstream areas is a consistent problem. In a year like 2012, when ther was relatively good passage of adult lamprey at Bonneville, the conversion rate to Lower Granite Dam was very poor at only about 0.02%. Extremely poor passage through the hydrosystem to upriver areas remains a consistent problem (Dave Statler, Nez Perce Tribe).

2d(ii). Fish Passage – Juvenile Summary. Brandon Chockley, FPC, gave a presentation on juvenile run counts in 2012.

At Rock Island Dam:

- Yearling chinook – Based on timing, this year is similar to the 10 year average, although the tail end of the run came early in 2012.

- Steelhead – They arrived earlier at Rock Island Dam this year than usual for the past 10 years. There were no changes in hatchery release strategies to explain the difference.

- Sockeye – They were on schedule at the beginning of the run. Then there was a giant spike, making the run early this year compared to the 10 year average.

- Coho – The run was early this year compared to the past 10 years.

- Subyearling chinook – They were late in the beginning of 2012 compared to the 10 year average, but by the middle of the run, counts were as expected.

- Pacific lamprey – This is the second year of the Pacific lamprey smolt monitoring program, which enables us to ask timing questions about this species. Collection numbers this year at Rock Island Dam were high in April.

At Lower Granite Dam:

- Yearling chinook – Timing this year was quite a bit earlier, especially for the beginning and middle of the run. Yearling chinook took advantage of high flows in

late April to leave the Snake River earlier than usual. Nevertheless, the 90% run date was similar to the 10 year average.

- Steelhead – The 10% passage date of April 16 was early compared to the 10 year average, and the 50% passage date of April 28 was also early. In 2012, steelhead rode the wave of high flows. There was a fairly large hatchery release in March 2012, although typically hatcheries have not been releasing steelhead that early. This is the second year of a March steelhead release.

- Sockeye – The run started late, but the middle of the run occurred when expected, and the end of the run was earlier than expected. This may be due to a lack of spill at Dworshak and reduced kokanee passage early in the season.

- Coho – The early peak compared well to the 10 year average for 10% passage, but the 50% and 90% passage dates were similar to recent years. Lower Granite saw a double peak in coho passage this year.

- Subyearling chinook – Scheduled hatchery releases have been consistent over the past 10 years, and this year's passage dates coincided with expectations.

- Larval lamprey – Collection numbers this year were relatively low.

- Lamprey – The majority were collected in March and in early May.

At McNary Dam:

- Yearling chinook – Timing this year was similar to the 10 year average.

- Steelhead – Timing was quite a bit earlier than the 10 year average at McNary, which reflects earlier timing on both the upper Columbia and Snake rivers.

- Sockeye – Run timing was earlier as well.

- Subyearling chinook – Passage was late this year; both the 10% and 50% passage dates occurred a few days after the 10 year average.

- Pacific lamprey – Passage peaked in late April/early May, and again in late June/early July.

At Bonneville Dam:

- Yearling chinook – The middle of the run was on time, but the latter portion of the run came earlier than the 10 year average.

- Steelhead – They arrived early at Bonneville, as they did elsewhere in the basin.

- Sockeye – Timing was significantly earlier in the upper Columbia. The 90% passage date in 2012 was about the same as the 50% passage date for the 10 year average.

- Coho – Timing at Bonneville was right on the 10 year average for the 10%, 50% and 90% passage dates. There was a double peak which is still being analyzed.

- Subyearling chinook – Because Spring Creek Hatchery stopped releasing juveniles in March as of 2009, the 10% passage date now occurs in April.

- Larval lamprey – Passage at Bonneville occurred early in the 2012 season.

- Juvenile lamprey – Peak passage occurred in mid April, with consistent passage numbers through June.

Chockley discussed an October 19, 2012, Fish Passage Center memo that documented fish condition this year compared to the past 10 years. The weighted average mortality for subyearling chinook at 2.5 was fairly high at Bonneville compared to other projects. Different estimating methods were used for lamprey because large enough samples for estimates were obtained only at the lower Columbia sites. The weighted average for descaling of subyearling chinook was 1.6, making 2012 the first year in the past 11 years that the weighted average was above 1. The cause of the descaling, which peaked in September and October, is not yet clear.

Questions and comments:

- Q: How do mortality and descaling rates for 2011 compare to 2012? (Tom Lorz, CRITFC). A: Chockley doubted that rates were higher in 2011, but will double-check the memo for comparison.

- Q: How does the population index compare for both seasons? How will the FPC come up with an estimate for passage abundance? (Paul Wagner, NOAA). A: The FPC population index is for passage at Lower Granite, Little Goose and Lower Monumental only. For post-season population estimates, the FPC uses the PIT tag detection seasonal average. The 2012 report should show the 2011 population index compared to the 2011 population estimate.

- Comment: Juvenile and larval lamprey at the four Snake River dams get caught in the strainers in January and sometimes February, even though that was not detected at juvenile fish facilities (Dave Statler, Nez Perce). A: The technical work group has been discussing lamprey winter migration. The winter run is not tracked because the smolt monitoring program operates from March through October only.

2e. Lessons Learned from the 2012 Conditions Review.

- We've learned that runoff forecasts in December are unreliable, and even those in April can be seriously off. We need to keep in mind that water supply forecasts have huge error bounds (Jim Litchfield, Montana).

- In 2012, the water supply forecast went from less than 100% in March and April to nearly 120% in June, then up to 129% in July. Could we have made a different management decision to achieve a different outcome? Or is there an additional management tool, such as a different type of forecast, that would provide greater flexibility? (Pete Hassemer, Idaho) A: The change to ESP forecasts has been extremely positive from a water management standpoint. It has definitely improved adaptive management decision making with regard to water supply forecasts (Tony Norris, BPA).

- Forecasting predictions have improved. Where forecasting breaks down is predicting abnormal rain events, especially if they occur past the typical period for snow and rain. This is something we will have to grapple with in future, because early information on climate change indicates an increased tendency for extreme rainfall and weather events (Steve Hall, COE).

- We got lucky this year because the shape of the runoff was good (Rick Kruger, Oregon).

- The COE managed the high flows of 2012 well, given the extreme nature of precipitation. Bonners Ferry was 3 feet above flood stage and the major damage was crop losses (Sue Ireland, Kootenai Tribe).

3. Reservoir Operations Review *(How effective were the proposed actions (SORs) at achieving desired results? What changes might be necessary to enhance results in the future? How did this year compare to others?)*

3a. Libby Operations. Joel Fenolio, COE Seattle, gave a retrospective of Libby operations this year. In June, Kootenai Basin was completely overwhelmed with precipitation at 200-400% of average. Many records were broken in the deluge, which led to a 9.2 MAF total April-August inflow volume – 156% of average, the highest inflow recorded since the dam began operating in 1974. Libby was surcharged almost a foot, up to 2459.9', which required extensive prior coordination with Canada. In 2012, Kootenai Lake at Queens Bay reached 1753.8' elevation, its highest since 1974.

Operational goals at Libby this year included fulfilling the third year of sturgeon spill and drafting to 2449' elevation at end August instead of end September to facilitate the Kootenai habitat restoration project. That planning was drastically altered by the heavy precipitation in June. Total June rainfall was 9 inches around Kootenai Lake compared to an average of 3.2 inches. Bonners Ferry received 5.3 inches of rain this year; the average is 1.7 inches and the previous high record is 3.8 inches.

Early in 2012 snowpack through Libby basin was similar to 2011, then it started to come off earlier. Precipitation in June probably added 1.5-2 MAF to the snowpack observed in May.

In December 2011, Libby drafted down to 2412', holding 4 kcfs out until late March 2012. In March the SNOTEL sites showed a significant increase in precipitation to 300% of average, and coordination of Libby operations with TMT began. On March 23, Libby began to increase releases since the April forecast was 1.2 MAF higher than the March forecast. The ICF was declared on April 24, meaning the start of refill was 10 days retroactive to April 14. Libby was drafted down to 2380.9' elevation at end April and operated to VARQ flows through May.

The sturgeon spill operation began on May 28, and the reservoir elevation hit 2459.9' on June 16. The reservoir remained surcharged from July 2 through July 26. The sturgeon operation from May 28 to June 18 this year expended 1.18 MAF.

On June 18, Libby began spilling for flood risk management of another 75 kcfs inflow predicted peak. Even though Libby Dam had spilled for the requisite 7 days per 2006 USFWS BiOp spill continued to try and control the elevation of the Dam. The actual peak release was 48 kcfs, with the project being operated to the special discharge regulation schedule. From June 18-July 25 Libby Dam was in flood risk management operations which included a deviation request and coordination with Canada to surcharge up to 2461' elevation to avoid further spill and flooding. By July 25, Libby was operating based on inflow triggers. August and September were extremely dry, with outflows of 8 kcfs. The reservoir hit the end of September target of 2449' elevation.

Bonners Ferry stage reached 1766.6' elevation on July 3, which is 2.5 feet above flood stage, and remained above 1764' from June 25 to July 11. The main damage from this was crop losses and there were no infrastructure losses. Without Libby Dam, the downstream elevation would have been 9' higher with significant damages.

In summary, record precipitation in June overrode all operations at Libby. Discussion turned to the Libby sturgeon operation of 2012. Brian Marotz, Montana, reported that Libby tailwater was above the state standard of 110% TDG saturation on 41 days in 2012. The highest reading was 129.4% TDG. Biologists have observed signs of GBT in fish when Libby tailwater has been above the state standard of 110% TDG saturation for 11 days or more. The symptoms of GBT are greatly increased when TDG is greater than 123% saturation. This year brought a high frequency of GBT symptoms, but no massive die-offs were detected as a result. Over the next few years, more PIT tag data and data points will become available to help determine the true impacts of TDG saturation.

David Wills, USFWS, presented a summary of 2010-12 Kootenai River flow tests with spill from Libby Dam. The Kootenai River had an active sturgeon sport fishery until 1983. In 1994 sturgeon were ESA-listed, and the first sturgeon BiOp came out in 2000.

There was regional agreement in 2006 to raise Kootenai River flows to historical peaks in an attempt to get the river stage above Bonners Ferry and entice sturgeon into the upstream spawning area. This was first tried in 2010, with 7 kcfs spill at Libby for a short time. There was no detectable change in sturgeon activity as a result. In 2011, due to higher than normal juvenile water supply, the river stage was achieved naturally without extra flows from Libby. In 2012, sturgeon spill began June 4, and the project went to flood control operations from June 25-July 11. Again, there was no noticeable increase in sturgeon spawning activity.

After 3 years of testing, there was no discernible change in sturgeon movement or spawning in the greater reach. USFWS concluded that river stages up to 1766.5' elevation at Bonners Ferry do not create conditions necessary to coax spawning upstream. Therefore, further calls for additional flows to augment the sturgeon pulse are unlikely.

The 2006 sturgeon BiOp and 2008 revised RPA are still in effect and will be followed. There will still be a sturgeon pulse in the spring based on the tiered approach presented in the BiOp. USFWS is working with members and co-members of the sturgeon recovery team on an updated sturgeon protocol to enhance recovery.

Questions and comments:

- What are the physical conditions necessary to use the spillway? (Pete Hassemer, Idaho) A: The stage has to be at a certain elevation in order to pass water through the spill gates.

- The COE appreciated the open-mindedness of TMT this year in coordinating summer operations with Canada (Joel Fenolio).

- Montana appreciated the way TMT devised a good Libby operation this year, despite having to deal with so much water (Jim Litchfield).

3b. Hungry Horse Operations. John Roache, BOR, reported that Hungry Horse, like Libby basin, was inundated with precipitation in June 2012. The season started off below average, but volume rose and precipitation for June was under-forecasted. The predicted June-July runoff volume was 880 KAF, which is 92% of average. Actual precipitation in June rose to 131% of average.

One of the major lessons learned this year was the dramatic impact precipitation can have on water supply. The highest precipitation on record occurred on June 12, 2012, when the dam surcharged 0.5'. Flathead Lake exceeded flood stage by about 2 inches for 13 hours.

Questions and comments:

- The main impact of this year's high elevations was crop damage. Flood stage is now considered 14' elevation at Columbia Falls; it used to be 13' (Brian Marotz, Montana).

3c. Grand Coulee Operations. John Roache reported. The dramatic shift from 1276.2' reservoir elevation in January to 1220.2' in April caused problems at Grand Coulee, including ferry problems at any elevation below 1228'. The frequency of ESP forecasts has proved to be an advantage in managing Grand Coulee flows. This year the Action Agencies were able to manage Coulee adaptively based on forecasts. Even with daily forecasts, it proved difficult. The ICF date at Grand Coulee was declared as of April 25, allowing refill to begin. Meanwhile inflows increased and peaked at 220 kcfs. The reservoir filled around July 4, then drafted down to 1279.6', including some incremental storage releases for the Columbia River water management plan.

Early in the season, spill had to pass through the outlet tubes because the reservoir elevation must be 1265.5' or higher to spill through the drumgates. Spill through the outlet tubes tends to increase TDG levels in the river. More spill occurred in June and July. Forebay TDG levels at Grand Coulee were high. Fortunately, the shape of the runoff allowed spill through the drumgates, as spill through the outlet tubes would have produced TDG levels of 135% or greater.

All of Grand Coulee's 24 units have undergone maintenance in 2012, with several units out of service at a time. There has been some degassing of the river, as evidenced in lower gas levels downstream of the Grand Coulee forebay. Tony Norris noted that over the long term, forebay gas levels at Coulee will decrease because turbine upgrades have dramatically increased turbine capability.

There were several accomplishments at Grand Coulee in 2012:

- Drumgate maintenance. The BOR tries to plan for this every year. The BOR worked with the Colville Tribe to complete the reservoir bank stabilization project.

- The reservoir was drafted to 1279.6' on August 31, 2012.

- The total volume release in 2012 from Lake Roosevelt for the incremental storage projects was 25.5 MAF.

<u>Questions and comments:</u>

- It appears there is degassing between Grand Coulee forebay and tailwater where TDG levels are concerned. However, during times of no spill, forebay TDG levels are typically 2% higher than spillway TDG levels. The forebay gage measures surface water 20' down, while the tailrace gage measures water about 200' down. This phenomenon indicates that no degassing actually occurs (Laura Hamilton, COE).

3d. Dworshak Spring/Summer Operations. Steve Hall, COE Walla Walla, reported. At the beginning of the year, the Dworshak water supply regression forecast was below normal. It ended up slightly above average for the year. Dworshak didn't receive the heavy June precipitation other parts of the Columbia basin experienced. With respect to BiOp targets, refill occurred on or around July 1 and the reservoir drafted to its BiOp target of 1535' by August 31.

The flood control shift to Grand Coulee this year became problematic with the rising forecast. Dworshak was not drafting down as it normally would for the purpose of the shift. When the April 1 forecast rose dramatically over the March 1 forecast, this drove the Dworshak flood control elevation considerably lower. In an effort to meet these more stringent flood control requirements, project discharges were ramped up to 19 kcfs for most of April. (The maximum discharge out of Dworshak without flooding is 25 kcfs.) This extended period of releases into May was initially part of the flood control operation. It also became part of the operation for spring flow augmentation.

In June, the final refill date for Dworshak is based on when inflows drop below powerhouse capacity. This year the reservoir filled early. A flight over Dworshak basin on June 10 found the snow covered area was only 8% instead of the assumed 20% of normal. As a result, the reservoir was able to refill sooner than otherwise. The COE held flat flows out of Dworshak for the 4th of July weekend. On July 8, Dworshak began releasing temperature augmentation flows.

Temperature management at Dworshak was successful this year, with no exceedances of the 68 degrees F standard at Lower Granite tailwater.

Management of TDG at Dworshak was complicated by the destruction of the TDG monitoring station in April by high flows. In September, the permanent station was reestablished. Generally, releases greater than 15 kcfs cause exceedances of the 100% TDG state standard. This occurred when releases out of Dworshak reached 19 kcfs. Unfortunately, there was little the COE could do about this situation. COE project operators have instructions to back discharges off when they see tailwater gage readings approaching the 110% state TDG standard. The summer of 2012 was warm, and the COE ran its CEQUAL-2 model to predict when releases would be needed. The COE has since fine-tuned the Dworshak summer temperature operation. Hall reminded everyone that Hells Canyon releases are an unpredictable aspect of Dworshak operations that is outside the COE's control.

<u>Questions and comments:</u>

- Does the gradual temperature increase at Dworshak starting about the first week of August indicate that cooler water was not needed at that time? A: The ability to switch units from undershot to overshot mode allows the COE to fine-tune flows. Undershot mode provides the coldest water. Generally, it's better to have slowly

rising temperatures through mid August, and the hatchery would prefer warmer water late in the summer.

3e. Upper Snake Flow Augmentation. Ted Day, BOR, gave a presentation on flow augmentation in the upper Snake River. The program includes drafting at Grand Coulee and Hungry Horse. The goal is to draft 487 KAF of extra water annually, to be released during April-August while operating within state law and the Nez Perce agreement. The BOR acquires augmentation water from several different sources. Two major sources are the upper Snake above Milner and the Payette basin, which provide about 75% of flow augmentation every year. For the third year in a row, in 2012 the BOR attempted to shift the flow augmentation water to an earlier timing to benefit fish.

This year was fairly normal on the Snake River, with slightly above average runoff volumes in the Payette (108%) and Boise (111%) basins. Winter got a slow start, and March and April were good snow-building months. However, upstream flows were below average – only 82% of average above Milner. The upper Snake got only 50% of average precipitation compared to 200-300% of average for the rest of the basin. Near record peak inflows in April were followed by rain. The system above Milner never did refill completely as a result of this year's high irrigation demands.

In general, 2012 could be considered a very successful year. The 487 KAF augmentation target was met, as it has been for the past several years. Augmentation flows started on June 8, 2012.

Questions and comments:

- Q: How much money did BOR have to spend to provide 487 KAF of flow augmentation? (Tony Norris). A: Any water BOR rents is $14 per acre foot.

- Q: How is refill working out for winter 2012-13? (Kyle Dittmer). A: The upper Snake River currently has high elevations, with Palisades around 5800'. The Boise and Payette systems are both filling. Peak record inflows for April occurred on the Boise and Payette systems.

3f. Lessons Learned from the 2011 Reservoir Conditions and Operations Review

- The fine tuning of Dworshak operations helps the Action Agencies meet operational targets (Pete Hassemer, Idaho).

- The extremely high flows of 2012 have potential positive aspects in terms of sustaining the natural functions of the river system. In addition to managing the system for a species-specific approach, we should manage in an ecosystem context (Dave Statler, Nez Perce Tribe).

4. Review of Specific Operations *(What was learned about specific operations that were requested by TMT members of other regional entities? How effective where these*

operations in achieving the intended goal? Should they be continued or modified in future years? Why or why not?)

4a. Juvenile Survival for 2012. Steve Smith, NMFS Science Center, reported on juvenile smolt migrant survival through the Snake and Columbia rivers. He presented newly available information on the return of PIT tagged fish as adults. Information from the PIT tag trawl below BON allows estimates to be made of survival and travel time to anywhere in the system. The survival estimates are oriented to spring migrants. This year was unusual in that peak flows at Lower Granite occurred before the end of April. The percent of flow being spilled is usually around 30% at each of the Snake dams during spring. Temperatures were average in 2012.

Around two-thirds (63.2%) of PIT tagged hatchery fish survived to Lower Granite. The 2012 survival estimate for yearling chinook was 57.6% of all fish coming out of the upper Columbia. Average steelhead survival from 3-4 hatcheries was about 44% to McNary Dam. With the high flows, this year had some of the fastest, shortest travel times seen for yearling chinook, with an average of 10-14 days for fish to migrate in river from Lower Granite to Bonneville. Steelhead passage was even quicker – 8-10 days on average from Lower Granite to Bonneville. This was the fastest steelhead passage ever seen.

Reach survival estimates for juveniles from 1995-2012 are as follows:

- Lower Granite to McNary: Yearling chinook: 79.5%. Steelhead: 69.8%.

- McNary to Bonneville: Yearling chinook: 80.7%. Steelhead: 69.8%

- Snake River trap to Bonneville: Yearling chinook survival was between 92-95% for each reservoir and dam, which exceeded the 11-year average in every reach. Steelhead survival was a bit lower for fish from the upper Columbia.

- Snake River fish from the Snake River trap to Bonneville fared well this year. Yearling chinook survival was 59.6%, the second highest seen. Steelhead survival was 59.8%, the third highest seen.

- Snake River sockeye from Redfish Lake to Lower Granite: released as parr in fall, 2.1% survival (these tend to have low rates); released as smolts in spring, 57% survival.

- Snake River sockeye released as smolts in spring: From Lower Granite to McNary: 76.2% survival. From McNary to Bonneville: 61.9% survival, which is lower than for other species. From Lower Granite to Bonneville: 47.2% survival.

- Steelhead survival estimates through the entire hydrosystem were the highest seen in the past 4 years. Apparently the presence of high spill rates, surface

collectors and passage routes, as well as increased migration rates in fall, have all led to better survival rates for juveniles.

Smith then discussed survival rates for adult returns in-river as compared to transported fish. In 2012 an estimated 24% of wild chinook and 28% of steelhead were barged, with an overall transport rate of around a quarter of all fish, the lowest transport rate ever seen. High flows pushed many fish through the system this year. Clearly, the number of fish remaining in-river has increased, especially for steelhead. This does not necessarily lead to increased smolt to adult survival rates for transported fish. Tagging effects must also be considered, as there are indications that PIT tagged fish may have 10-35% lower SARs than unmarked fish. In comparing SARs for transported and in-river fish, researchers assumed the PIT tag effect would be comparable for both groups.

A time stamp would be needed to estimate seasonal SARs. Evidence suggests that fish that never enter a bypass system have higher survival rates to adulthood. The estimate ranges from 6% higher for wild chinook to 69% or more for steelhead. Fish that are not detected could therefore be assumed to have higher return rates than those that were detected due to tagging effects. In general, bypassed fish do better earlier in the year.

The benefit of transport was found to be greater in 1998-2005 than in 2006-08 relative to earlier years, thanks to improved conditions for in-river migrants. Juveniles are surviving in-river at a higher rate, which decreases the benefit of transport. However, the adult return rate for transported fish still exceeded that of in-river migrants for most species during most of the season. Smith noted that juvenile steelhead survival in 2010 was twice as high as in 2007, despite the fact that both were low flow years.

4b. Juvenile Snake River Fall Chinook Survival 2012. Jerry McCann, Fish Passage Center, presented data on Snake River fall chinook survival of PIT tagged hatchery fish that passed Lower Granite from May 20-July 15, 2012. For the run at large in 2012, subyearling chinook timing to McNary was much later than for Snake River PIT tagged fish. Survival rates in 2012 are a bit lower than in 2011 but on par with the past several years. The exception was 2007, a low flow year. Water transit time in 2012 was lower than average, which is indicative of high flows. Spill proportions were also relatively high for 2012. Temperatures were slightly below average.

Overall, good conditions in 2012 resulted in higher than average survival estimates. Transport proportions for fish arriving at Lower Granite were lower than in other years: 42% for hatchery fish and 37% for wild fish. These are some of the lowest transport numbers seen since 2007, a low flow year with high spill proportions.

Questions and comments:

- Q: What about detection of surrogates? A: Those are available through spring, but few of these fish will hold over in the hydro system until next spring. Most of the holdover fish pass Lower Granite in August and September.

4c. Bonneville PH2 Operations

4ci. Operations Summary. Doug Baus, COE, provided a summary of best geometry operations at Bonneville during various periods between the dates of April 14-June 6, 2012, which was coordinated at TMT. The goal of using best geometry this year was to minimize juvenile descaling and mortality at PH2. The generation-neutral operation reallocated flows from PH2 to PH1 to minimize descaling and mortality at PH2. Best geometry was defined as operating the PH1 units just below the cavitation limit.

The operation was initiated for Spring Creek hatchery releases and continued for sockeye. PH1 discharge differentials between the PH1 best geometry operation and the PH1 1% operating range may be observed when comparing PH1 discharges prior to and during the best geometry operation. For example, on April 12, PH1 day average discharge under the 1% operating range was 94 kcfs. On April 14, PH1 hourly average discharge was 128 kcfs during the best geometry operation. These discharges are representative of real time conditions on these days only and change on an hourly basis due to real time conditions. The best geometry operation was a generation neutral operation that reallocated flow from PH2 to PH1.

Baus said he hopes it will be possible to streamline this operation in 2013, given the level of details that were coordinated in 2012. Next steps include modeling Bonneville operations at ERDC and examining PIT tag data from previous years for information that could help inform Bonneville PH1 operations. New transmission limits on the Bonneville 115-230 kV line will affect operations in 2013. This will result in an approximate 15 kcfs generation rate reduction most of the time, Scott Bettin, BPA, noted. In addition to the ERDC work, FFDRWG will continue its current efforts to improve gatewell conditions in PH2. Baus noted that several forums, including TMT, SCT, FPOM and FFDRWG, to improve this operation. There will be new information to come.

<u>Questions and comments:</u>

- The PH2 operation benefits subyearling chinook and steelhead. Can the Action Agencies work together to provide immediate relief for fish by operating above 120% TDG in the tailrace when needed? (Charles Morrill, Washington). A: The waiver allows exceedances up to 125% for 1 hour in Washington and 2 hours in Oregon (Kim Johnson, COE).

4cii. FPOM Task Force to Address PH2 Issues. Tom Lorz, CRITFC/Umatilla, reported on the task force's work to address the issues at Bonneville PH2. The group is analyzing adult fallback data and will present its findings to FFDRWG soon (a December 6 meeting had to be canceled). The basic question is, at the higher end of

turbine operations, are there impacts in the gatewell? Effects of operating outside 1% efficiency at PH1 are currently unknown. A December 17 trip to ERDC will include viewing turbine models of Bonneville operations.

4d. Lake Pend Oreille Operations. Andy Dux, Idaho, reported on bulltrout recovery efforts at the Lake Pend Oreille fishery. IDFG has been evaluating two different winter elevations for the lake, the traditional 2051' vs. the 2055' elevation TMT approved for 2012, per SOR USFWS/IDFG-1.

Since 2006 there has been an 82% decline in the lake trout population. Reduced predation in recent years has led to greater kokanee survival. The kokanee population has rebounded from near-collapse and a record low in 2008. The population now consists mainly of age-1 and age-2 adults. Given that kokanee are a key prey source for bull trout, the bull trout population has stabilized in recent years as a result of kokanee recovery. The SOR approved in 2012 provided two primary benefits:

- More habitat in recent years to support a stronger return of lakeshore kokanee spawners.

- An evaluation of spawning habitat at 60 potential kokanee sites, which would not have been possible without the 2055' lake elevation TMT approved in 2012.

  The work in 2012 led to two key findings:

- Kokanee survival estimates are strongly influenced by sampling variability. The egg-to-fry survival estimate lacks precision to estimate the influence of lake levels on survival. Therefore it is unknown whether lake levels have benefited kokanee. A key point in the decision tree for requesting lake elevation 2051' or 2055' is 70 female kokanee spawners. This finding indicates that number cannot be supported.

- A new approach outside the existing metric is needed. Looking at incubation success in different habitats will provide new information.

The lake trout suppression approach appears to be working very well, Dux said, and predation is greatly reduced. IDFG plans to open a limited kokanee fishery in 2013. The increased kokanee population is expected to result in bull trout population growth.

<u>Questions and comments:</u>

- Q: Does the natural abundance of kokanee include hatchery abundance? (Tony Norris, BPA). A: Yes, it does.

- Were there any patterns in redd distribution observed during site sampling? (Charles Morrill, Washington). A: Yes. Part of the idea behind lake level

management is to provide additional habitat, as well as wave action to redistribute gravel.

- Will the current study reveal the impact of wave action on redds in the spawning zone? Why not fill above 2051' after fish have spawned? Could this investigation open the possibility that lake level won't be a limiting factor for additional kokanee spawning and population growth? (Tony Norris). A: IDFG is looking at the depth of disruption caused by wave actions at one of the incubation sites. Fish can spawn 6-8 inches below the water surface in the bay with no risk of wave action. The work underway does not address the quantity of kokanee habitat in the lake.

- Kokanee populations tend to fluctuate widely. There are significant kokanee losses at Dworshak Dam due to entrainment and various other factors. Trying to establish a steady population of kokanee might be unrealistic, as the kokanee population naturally fluctuates (Dave Statler, Nez Perce). A: While environmental factors play a big role in kokanee production, the objective is to maintain a stable enough kokanee population to support a fishery.

4e. Kootenai River Habitat Work. Sue Ireland, Kootenai Tribe, gave a presentation on the Tribe's habitat restoration work, supported by SORs that were presented to TMT over the past two years requesting lower flows for September (8 kcfs in 2012). Fish species populations in the Kootenai River are declining due to changes in the ecosystem caused by construction and operation of Libby Dam. White sturgeon and burbot populations have been adversely affected.

A Kootenai River Restoration Master Plan was produced in 2009 to guide restoration efforts in individual reaches over the next 7-10 years. The current focus is on the braided reach near Bonners Ferry, where eroded banks are being regraded, structures are being built and vegetation planted to address limiting factors for physical, riparian and aquatic habitat. The Tribe has been working closely with private landowners to ensure the restoration is successful.

<u>Questions and comments:</u>

- Q: How would you quantify the distance of habitat that has been improved? (Doug Baus, COE). A: In 2011, 2400' of side channel and 1800' of mainstem riverbanks were improved. There is approximately 2500' of restored riverbank in the Upper Meander Project Reach. Many partners have collaborated to make this happen.

- How did the large structures built in 2011 hold up? (Charles Morrill). A: Very well, despite being submerged for several months. The large woody structures have been well engineered to withstand high velocity and shear stress.

- What kind of survival rates have resulted from riparian planning? How successful have you been in working with landowners to avoid riparian grazing? Have you

sampled the area restored in 2011? (Charles Morrill). A: The tribe is quantifying survival now; suffice to say that it was high in 2012. At the beginning of the restoration, landowners understood they would have to change their land use practices and many have contracts with NRCS. A graduate student has been sampling fish populations in the restored areas.

4f. Performance Standard Testing Results. Mike Langeslay, COE Portland, reported on the results of performance standards testing at Little Goose and Lower Monumental Dam in 2012, the first year of BiOp performance testing on the Snake. Both Snake River dams have recently had spillway weirs installed, and the Lower Monumental outfall has been relocated.

The $10 million performance test of 2012 was a major, one-of-a-kind study of almost 50,000 PIT tagged fish on both the Columbia and Snake rivers. The BiOp standards to be met are 96% survival for spring chinook and steelhead and 93% survival for subyearling fall chinook.

The 2012 performance study tested spring and summer 30% spill at Little Goose, and gascap spill in spring and 17 kcfs spill in summer at Lower Monumental. At McNary Dam, the COE tested two different spill levels for spring and summer, with 40% for spring and 50% for summer. At John Day Dam, the COE tested 30% and 40% spill for both spring and summer. This was the third and final year of testing at The Dalles, with 40% summer spill tested for subyearling passage. At Bonneville, two summer spill levels were tested, 85 kcfs/121 kcfs and 95 kcfs 24 hours per day..

Unfortunately, high flows in 2012 meant that many of the target operations for performance testing couldn't be met. Results were as follows:

- Little Goose Dam – Actual spill was 31.9% in spring and 37.8% in summer, thus spill was above the target level for both spring and summer testing. Some of the data in the slide were wrong and would be corrected. Survival rates are nevertheless quite high, well above 96% for spring migrants and 93% for summer migrants, supported by high rates of precision.

- Lower Monumental Dam – Some of the numbers were wrong and would be corrected, as for Little Goose. Spill was probably above the gas cap range of 20-29 kcfs. Summer spill was 26 kcfs, well above the 17 kcfs target. Survival rates were high, as they were for Little Goose.

- McNary Dam – Spill levels were well above 40% in spring and 50% in summer, meaning that spill targets were missed. Survival rates were 99.1% for juvenile steelhead, well above the 93% criteria.

- John Day Dam – Although there was not good separation between spill treatments of 30% and 40% spill, all survival standards were met.

- The Dalles Dam – The operation was met with 40.5% spill on average, and a subyearling survival estimate of 94.7% which was above the standard.

- Bonneville Dam – The COE attempted to spill 85 kcfs/121 kcfs , and 95 kcfs all hours, without success. Survival rates were nevertheless very high: 97.4% for spring chinook and almost 95% for steelhead.

Langeslay noted that single release estimates were high at all dams, including Bonneville, The Dalles, John Day and the Snake projects. Of 14 tests at 7 dams, all 14 met the survival standards of 96% and 93%, and 13 of the 14 tests met the precision standard. However, John Day and The Dalles were the only dams at which spill targets were met, due to high flows in 2012.

Next steps in the performance testing process include releasing draft reports of test findings in December. SRWG will review the reports and share the results with the region. In 2013, the COE plans to do a summer test at Little Goose and Lower Monumental. In 2014, the COE plans to do a second year of testing at McNary and a final year of subyearling passage testing at John Day Dam.

4g. Programmatic Sediment Management Plan – Lower Granite Report and Update. Steve Hall, COE Walla Walla, reported on the PSMP for the confluence of the Snake and Clearwater rivers, as well as on the lower Snake to Ice Harbor Dam. The PSMP schedule calls for an in-water work window of December 2013-March 2014. Work will include dredging the most problematic points in the river. A public review comment period on the PSMP EIS runs from December 21, 2012-February 8, 2013. The final EIS will be released in July 2013, with a ROD to be signed in September. Then contract actions for the work can begin.

The proposed action addresses shoaling in the Ice Harbor navigation channel and at the confluence of the Snake and Clearwater rivers. Preliminary survey data late last week showed that the situation hasn't gotten any better. There is shoaling at the ports of Clarkston and Lewiston. More sediment has accumulated because 2012 was not a high flow year on the Snake or Clearwater rivers.

Hall addressed questions about the Lower Granite MOP operation in 2013. For a large part of summer 2012, Lower Granite operated in the MOP+1' or MOP+2' range. When flows were less than 50 kcfs, Lower Granite operated at MOP+2'. A temperature modeling study using CEQUAL-2 showed a negligible (0.1-0.2 degrees C) difference between this year's operation of MOP+1 or +2 and MOP.

<u>Questions and comments:</u>

- Q: What are the responsibilities of the ports of Clarkston and Lewiston with regard to dredging? (Charles Morrill). A: The settlement agreement from a previous dredging lawsuit allows the ports to piggyback on the COE's PSMP work at a substantial savings.

4h. Lessons Learned from the Review of Specific Operations

- More water is good – to a point (Tony Norris, BPA).

- From TMT's perspective, how did the Kootenai Tribe's SOR work out? (Sue Ireland). Montana appreciated the change from 6 kcfs to 8 kcfs flows in September (Jim Litchfield).

- Climate change could increase the probability of having a rain or snow event on the tail end of the season. We have also been seeing rapid runoffs on the refill trajectory. Therefore the region should consider taking on more risk in refilling the last few feet at Libby and provide a more stable, gradual refill, which is better for the reservoir biologically. Maybe we should consider changing flow targets and take on more risk to provide a greater margin of error so we can avoid filling and spilling (Brian Marotz, Montana).

Name	***Affiliation***
Eric Pitlak	BPA
Sue Ireland	Kootenai Tribe
Brian Marotz	Montana
Sheri Sears	Colville
Dave Statler	Nez Perce
David Wills	USFWS
Rick Kruger	Oregon
Paul Wagner	NOAA
Charles Morrill	Washington
Joel Fenolio	COE
Ted Day	BOR
John Roache	BOR
Glen Trager	Iberdrola
Doug Boyer	BPA
Agnes Lut	BPA
Brandon Chockley	FPC
Kyle Dittmer	CRITFC
Kasi Rodgers	COE
Pete Hassemer	Idaho
Laura Hamilton	COE
Steve Hall	COE
Jim Litchfield	Montana
Richelle Beck	Grant PUD
Tony Norris	BPA

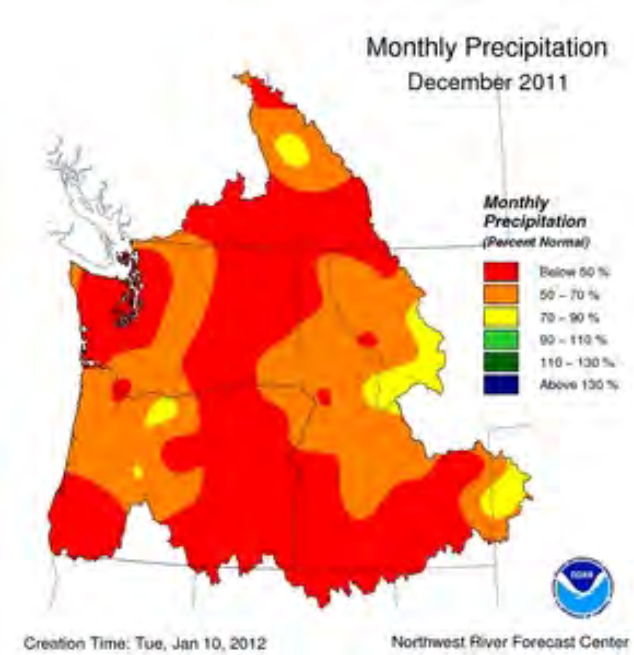
Doug Baus	COE
Donna Silverburg	DS Consulting
Kim Johnson	COE
Scott Bettin	BPA
Christine Peterson	BPA

TMT Annual Review

Weather, Water, System Flood Control, and Rock Island GBT

Presented by
Kasi Rodgers
USACE, Water Management Division

December 5, 2012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December 2011
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(Percent Normal)
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70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
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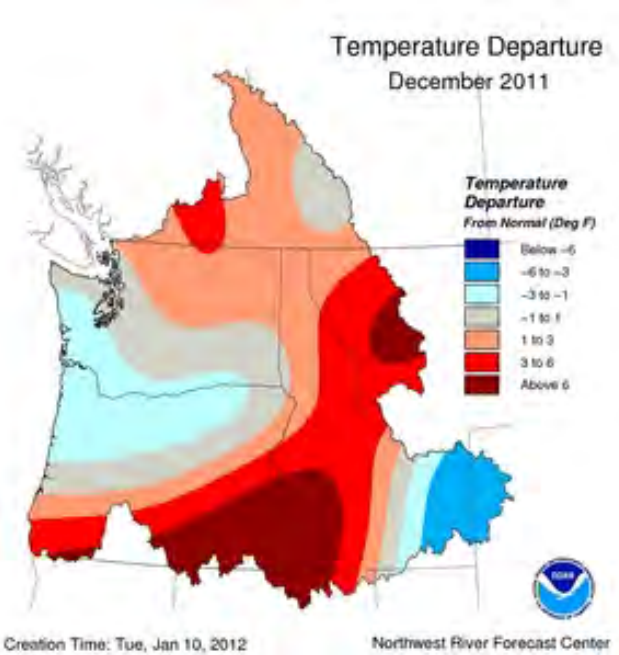
Northwest River Forecast Center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December 2011
Temperature Departure
From Normal (Deg F)
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-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
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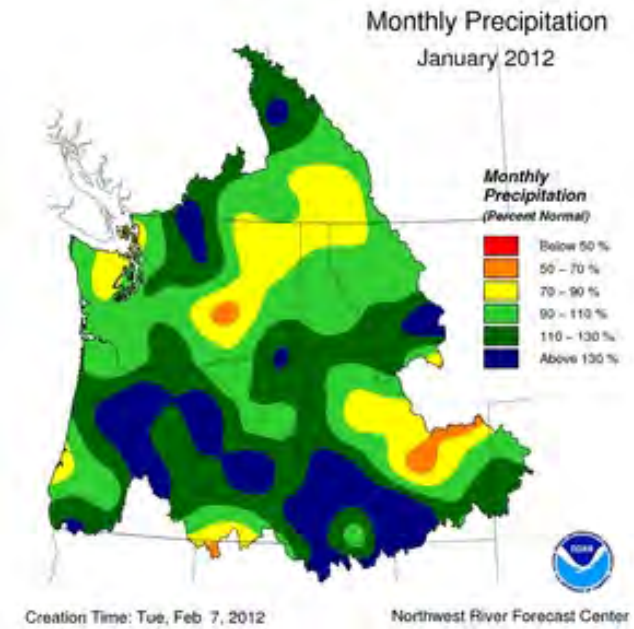
Northwest River Forecast Center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January 2012
Monthly Precipitation
(Percent Normal)
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70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
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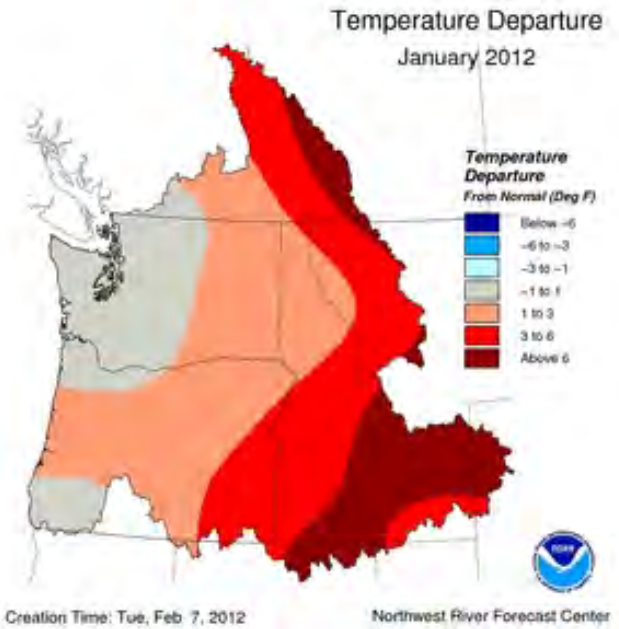
Temperature Departure
January 2012
Temperature Departure
From Normal (Deg F)
Below -6
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-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
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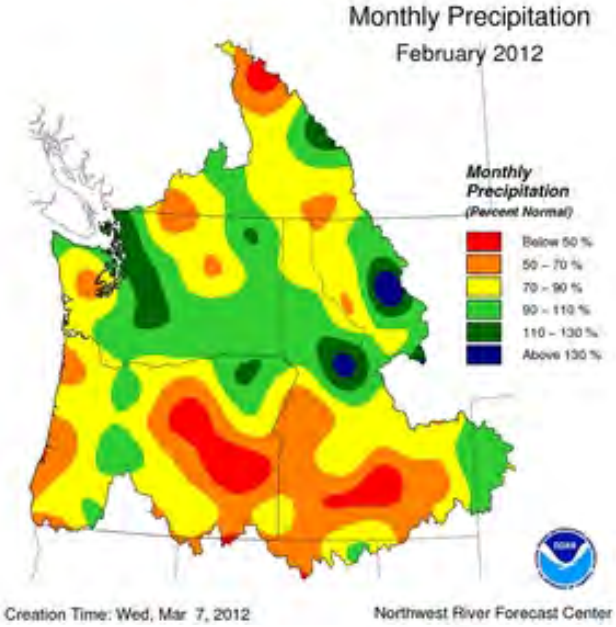
Northwest River Forecast Center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February 2012
Monthly Precipitation
(Percent Normal)
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90 – 110 %
110 – 130 %
Above 130 %
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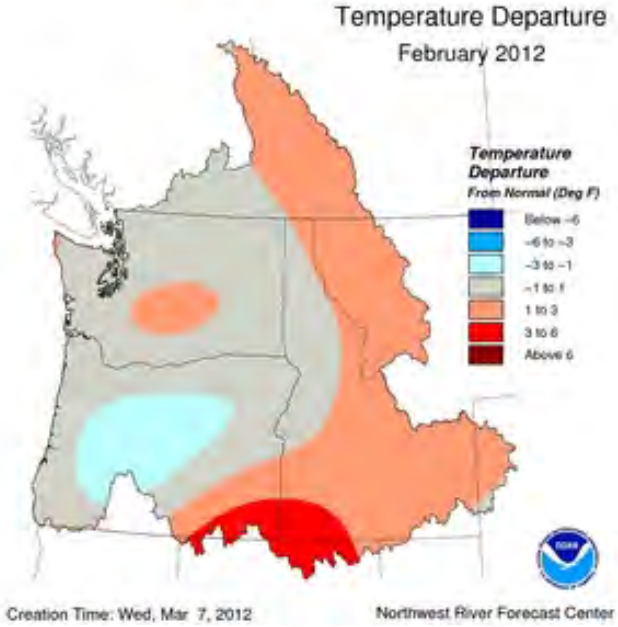
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February 2012
Temperature Departure
From Normal (Deg F)
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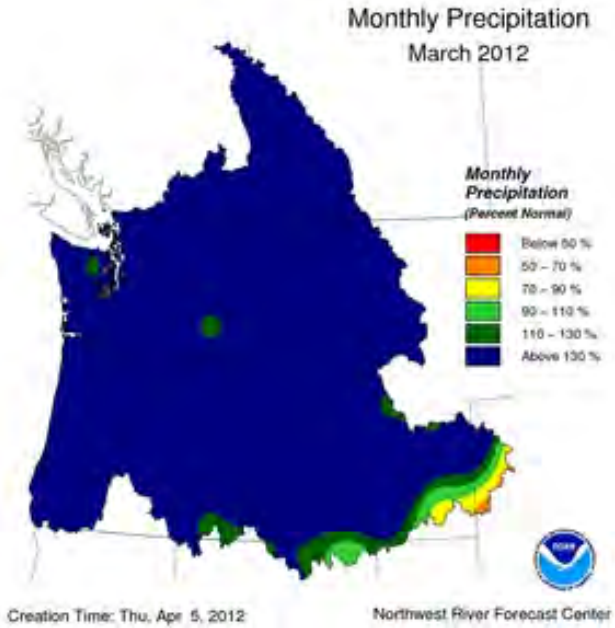
-1 to 1
1 to 3
3 to 6
Above 6
Creation Time: Wed, Mar 7, 2012
Northwest River Forecast Center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(Percent Normal)
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90 – 110 %
110 – 130 %
Above 130 %
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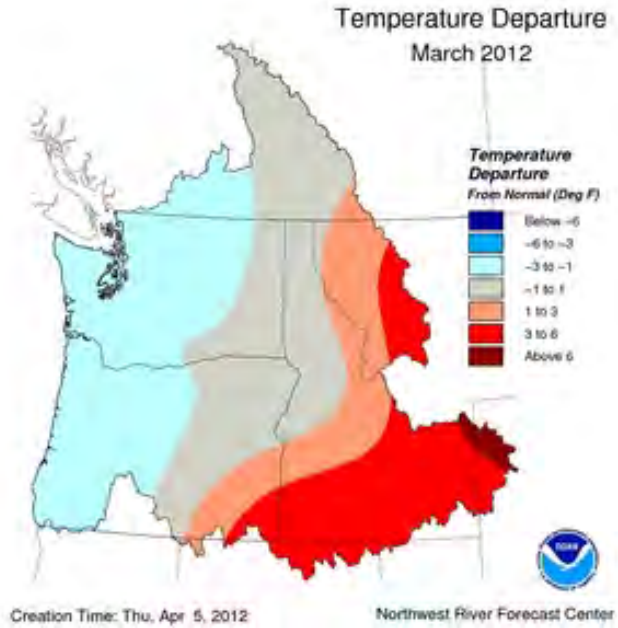
Northwest River Forecast Center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March 2012
Temperature Departure
From Normal (Deg F)
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-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
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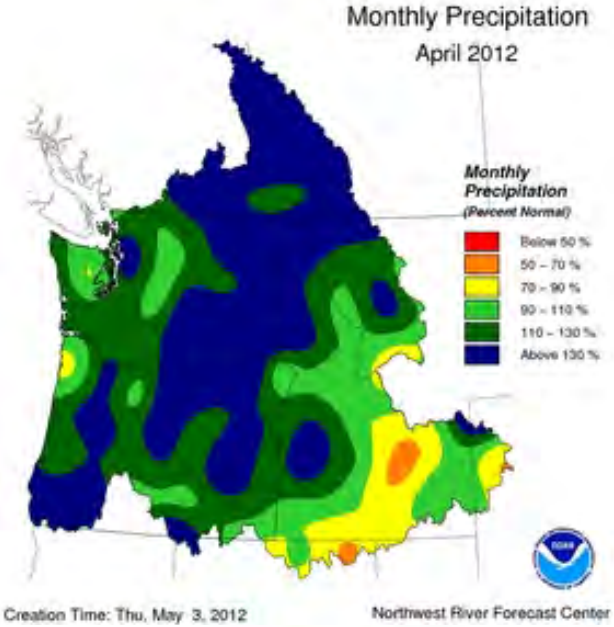
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Monthly Precipitation
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70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
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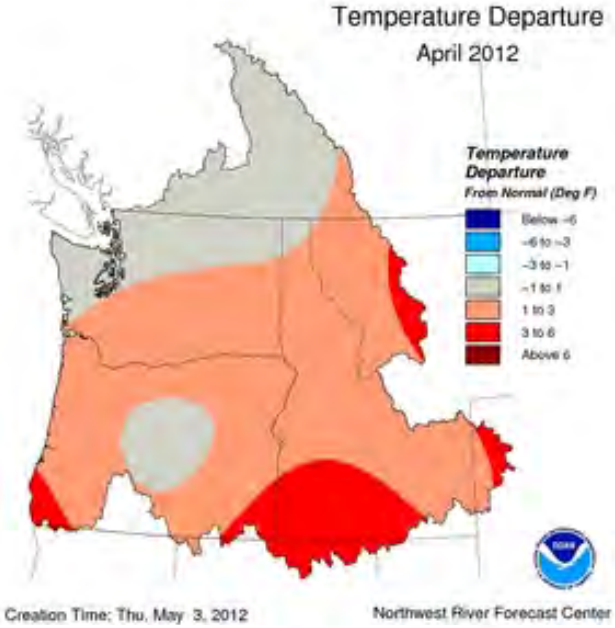
Northwest River Forecast Center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April 2012
Temperature Departure
From Normal (Deg F)
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-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
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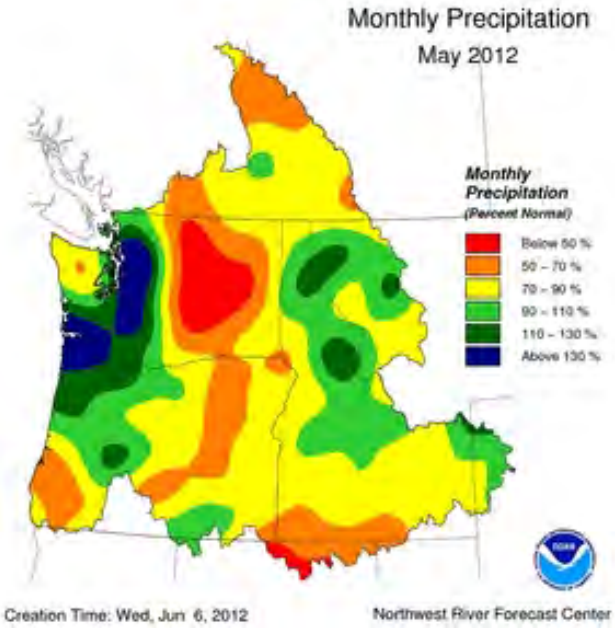
Northwest River Forecast Center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May 2012
Monthly Precipitation
(Percent Normal)
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70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
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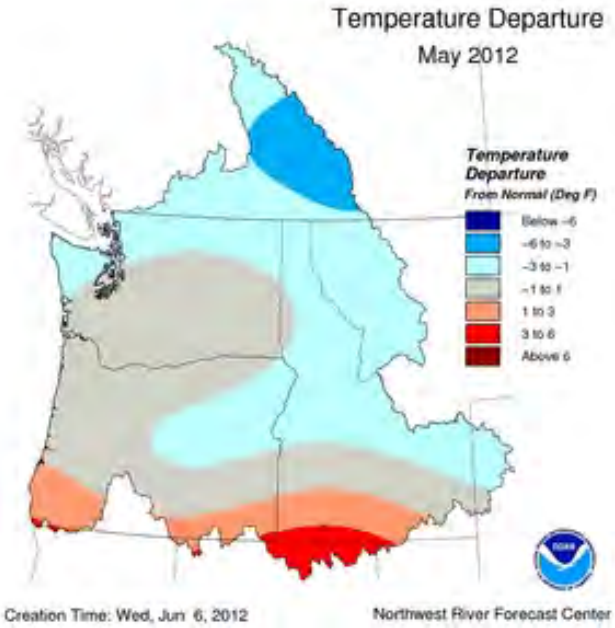
Northwest River Forecast Center


Temperature Departure
May 2012
Temperature Departure
From Normal (Deg F)
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-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
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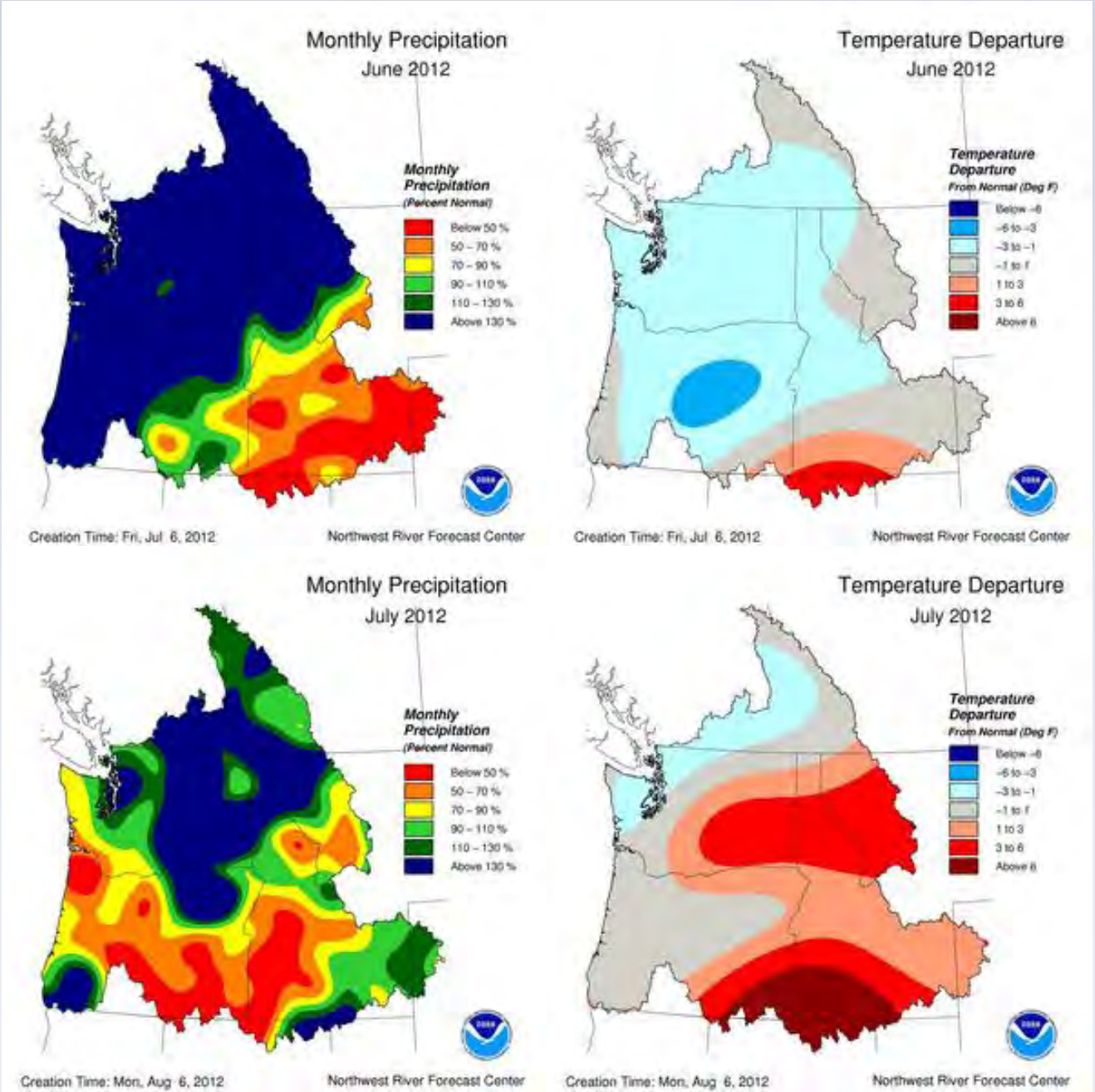
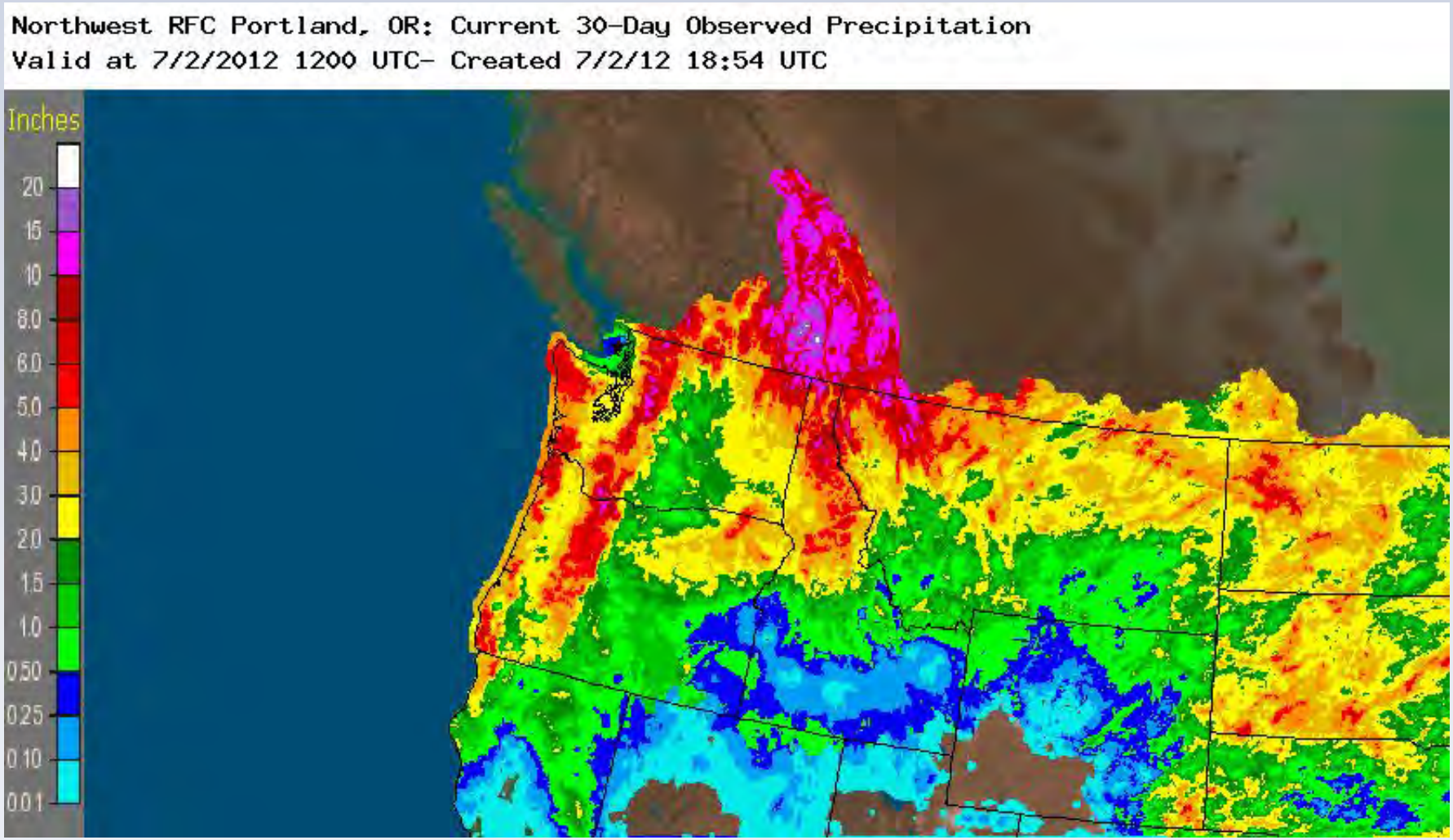
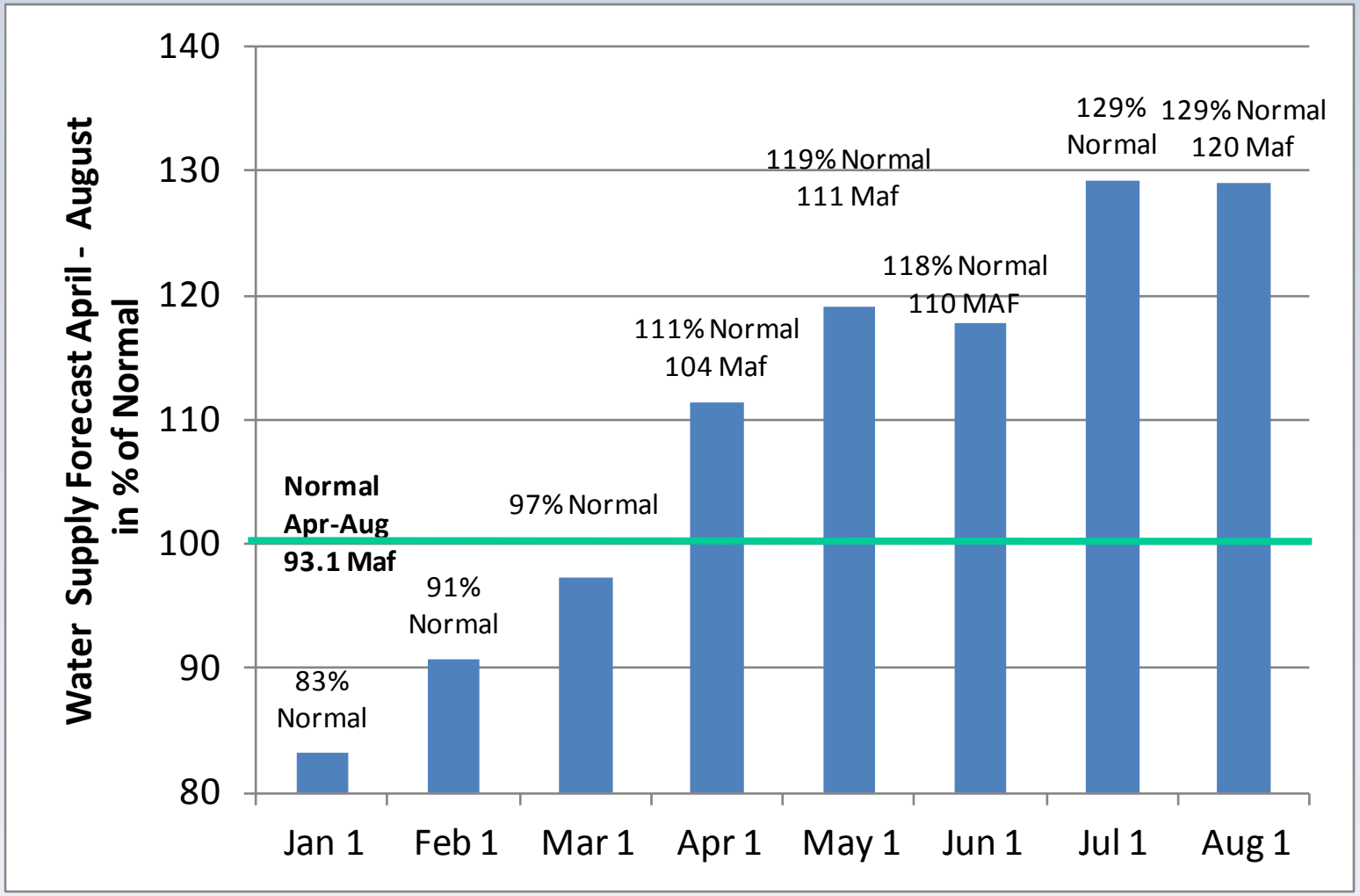
Northwest River Forecast Center


Monthly Precipitation
June 2012
Monthly Precipitation
(Percent Normal)
Below 50 %
50 – 70 %
70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
Creation Time: Fri, Jul 6, 2012
Northwest River Forecast Center
Temperature Departure
June 2012
Temperature Departure
From Normal (Deg F)
Below -6
-6 to -3
-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
Creation Time: Fri, Jul 6, 2012
Northwest River Forecast Center
Monthly Precipitation
July 2012
Monthly Precipitation
(Percent Normal)
Below 50 %
50 – 70 %
70 – 90 %
90 – 110 %
110 – 130 %
Above 130 %
Creation Time: Mon, Aug 6, 2012
Northwest River Forecast Center
Temperature Departure
July 2012
Temperature Departure
From Normal (Deg F)
Below -6
-6 to -3
-3 to -1
-1 to 1
1 to 3
3 to 6
Above 6
Creation Time: Mon, Aug 6, 2012
Northwest River Forecast Center

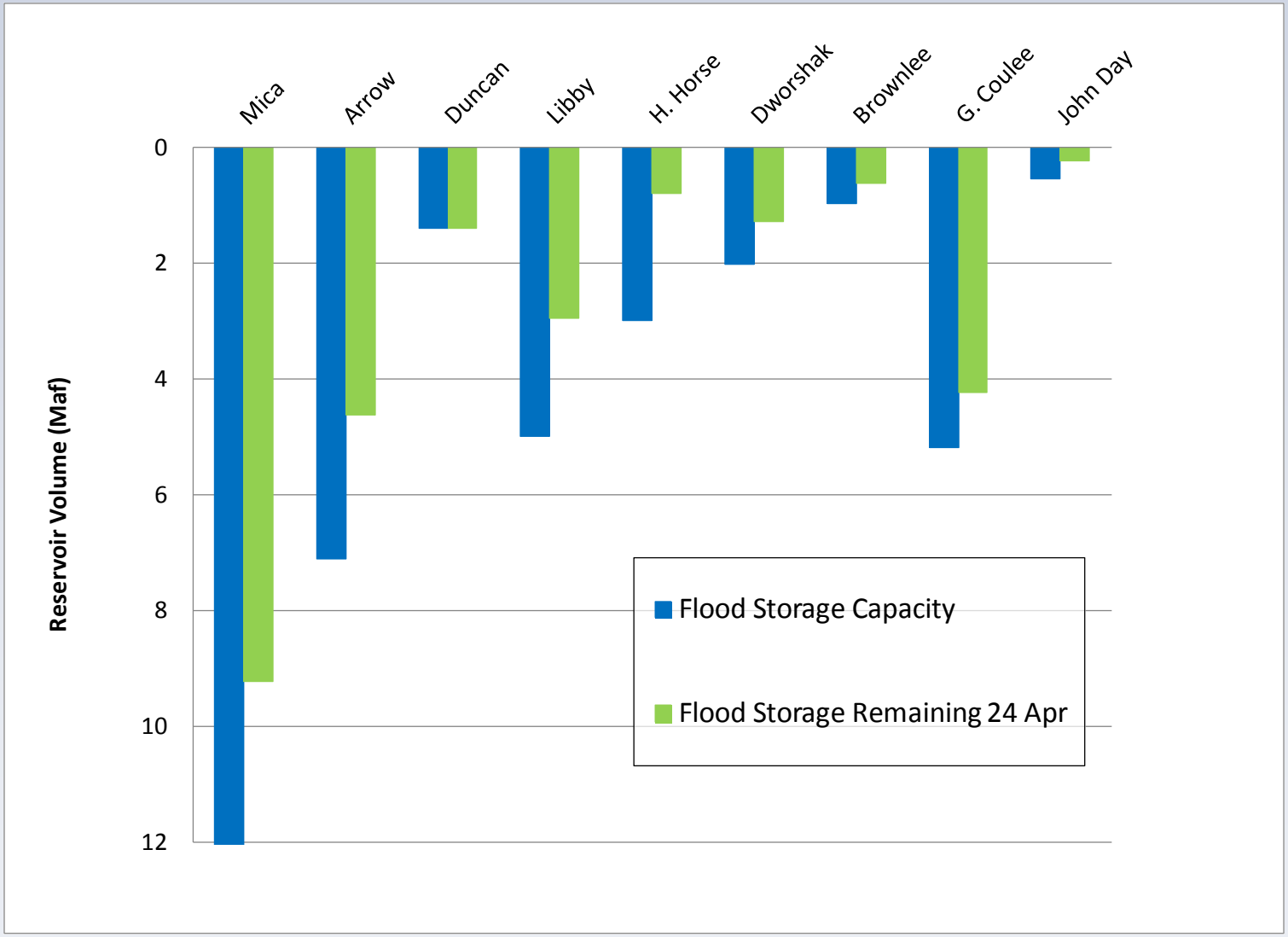
Basin precipitation for 02 June to 02 July

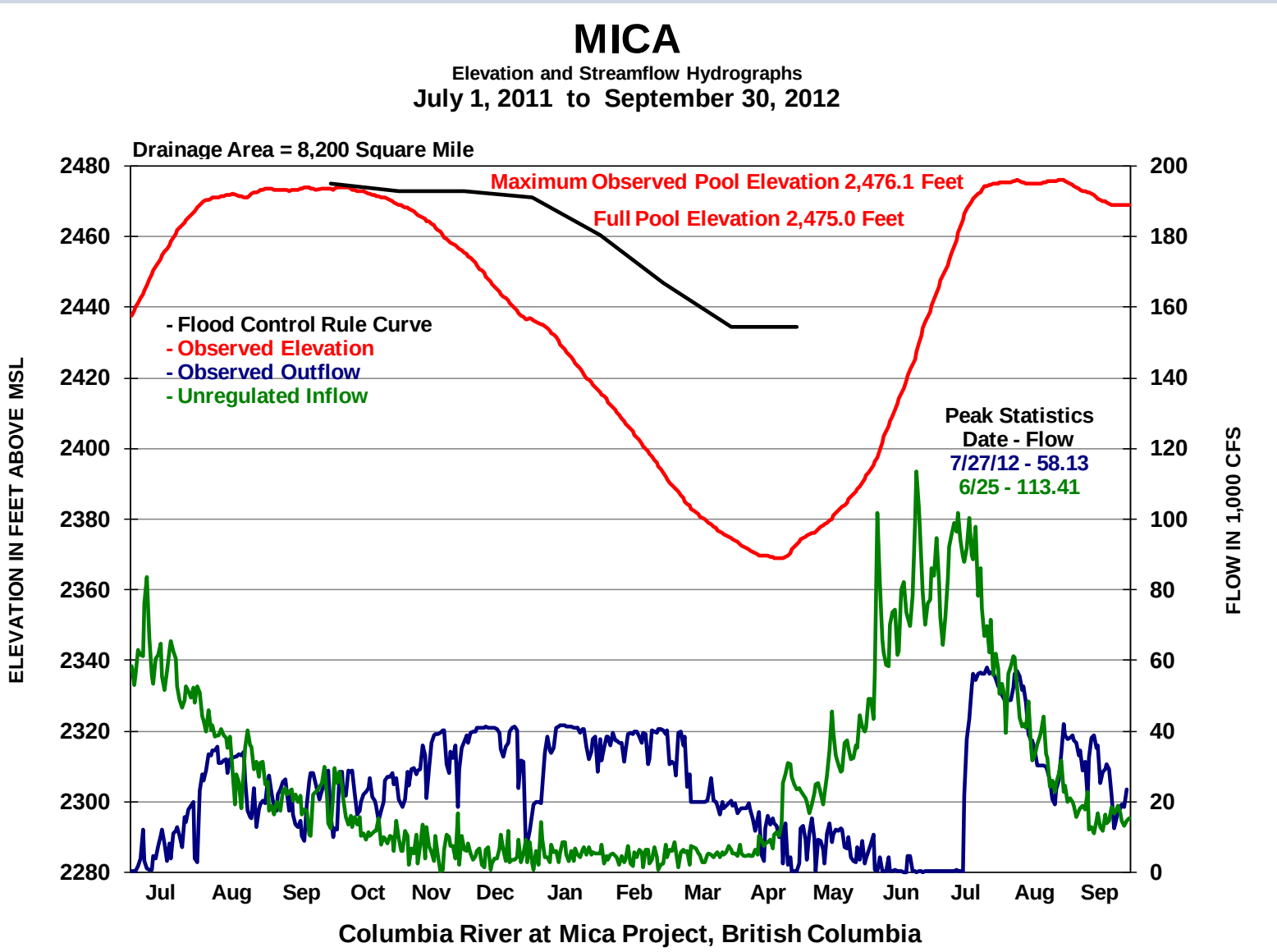


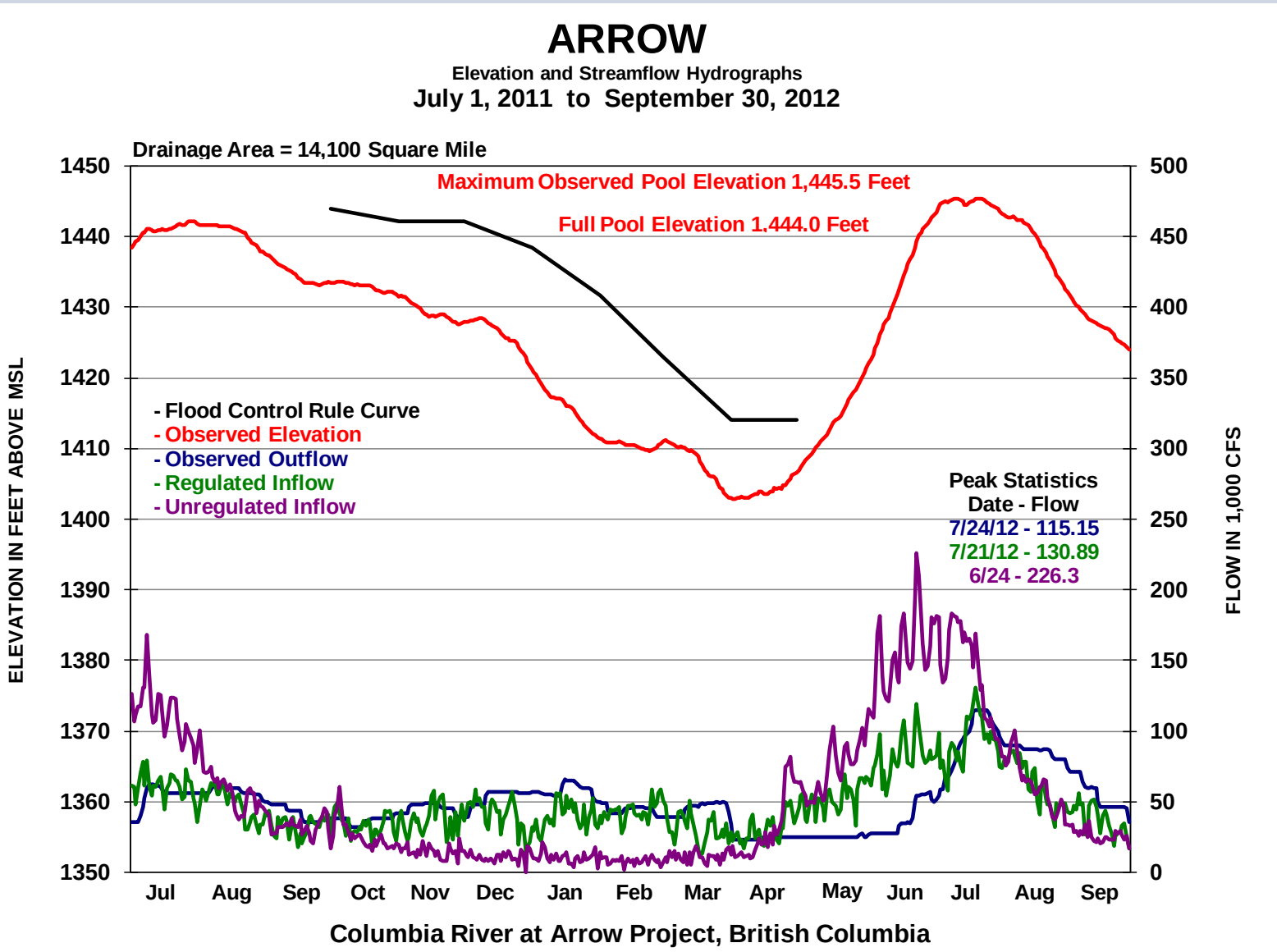
2012 Water Supply Forecast at The Dalles (Apr – Aug)



2012 Reservoir Space Available for Flood Risk Mgmt




MICA
Elevation and Streamflow Hydrographs
July 1, 2011 to September 30, 2012
Drainage Area = 8,200 Square Mile
Maximum Observed Pool Elevation 2,476.1 Feet
Full Pool Elevation 2,475.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Unregulated Inflow
Peak Statistics
Date - Flow
7/27/12 - 58.13
6/25 - 113.41
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
200
180
160
140
120
100
80
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Columbia River at Mica Project, British Columbia


ARROW
Elevation and Streamflow Hydrographs
July 1, 2011 to September 30, 2012
Drainage Area = 14,100 Square Mile
Maximum Observed Pool Elevation 1,445.5 Feet
Full Pool Elevation 1,444.0 Feet
- Flood Control Rule Curve
- Observed Elevation
- Observed Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
7/24/12 - 115.15
7/21/12 - 130.89
6/24 - 226.3
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
1450
1440
1430
1420
1410
1400
1390
1380
1370
1360
1350
500
450
400
350
300
250
200
150
100
50
0
Jul
Aug
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Nov
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Jan
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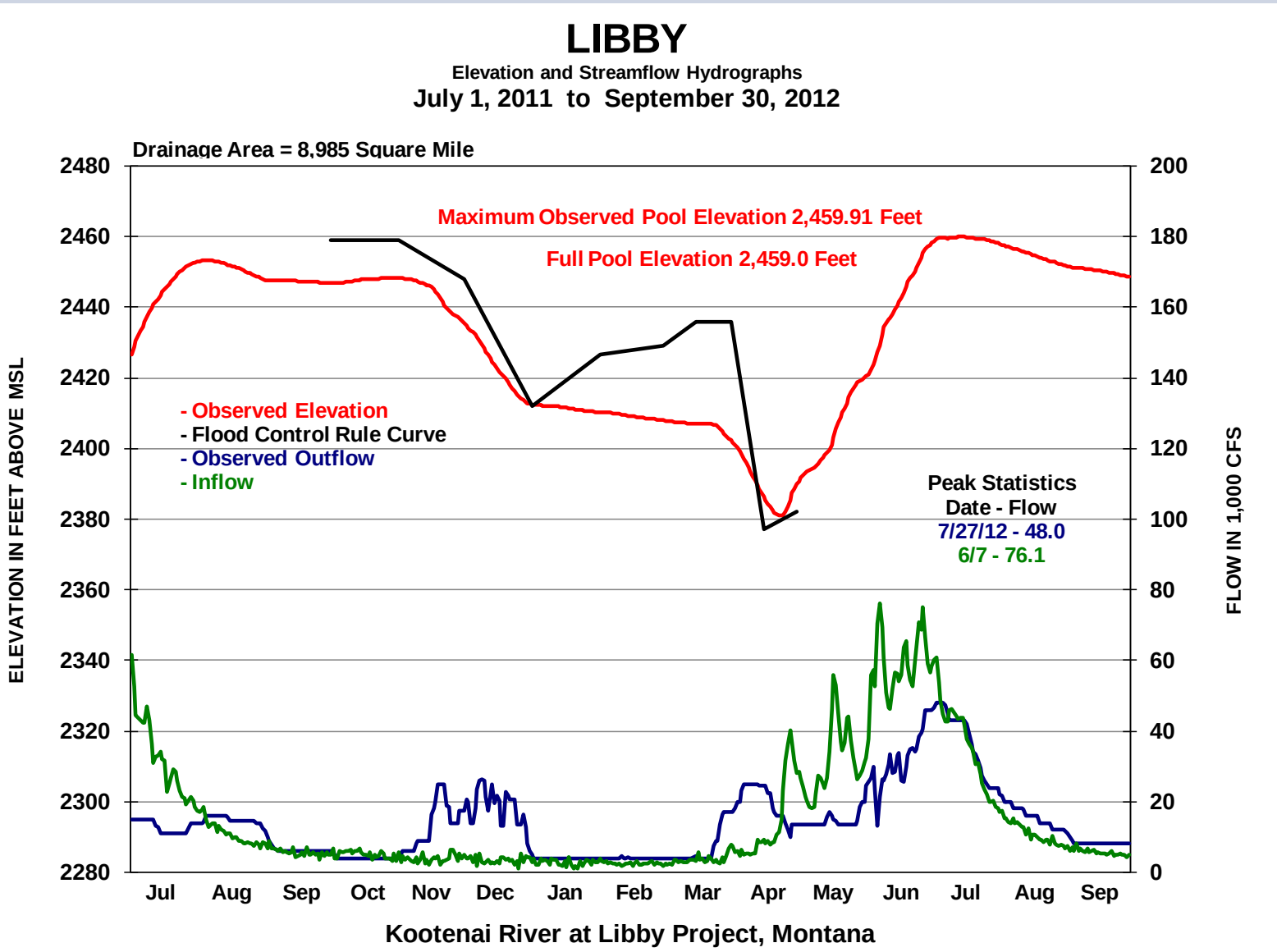
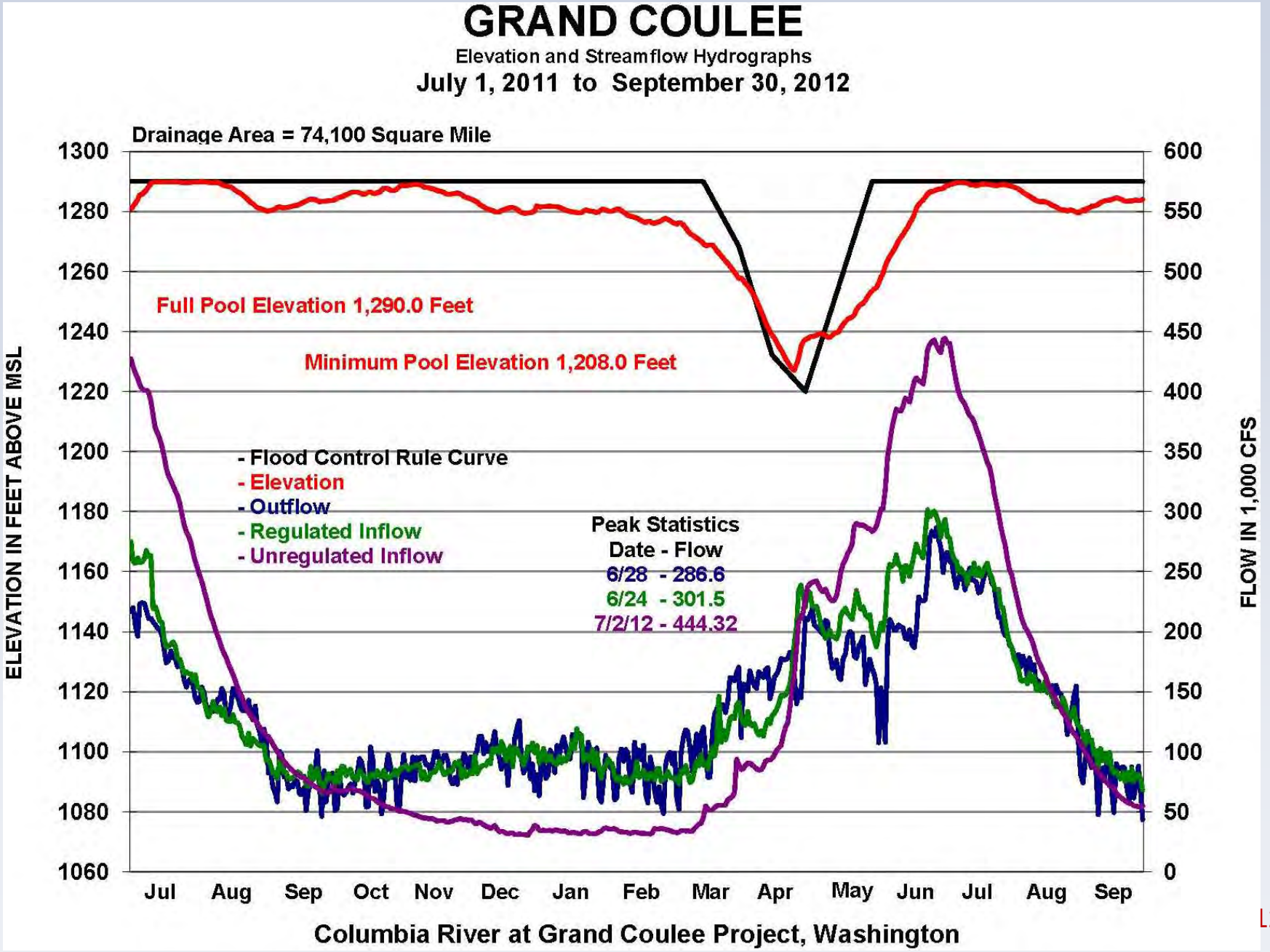
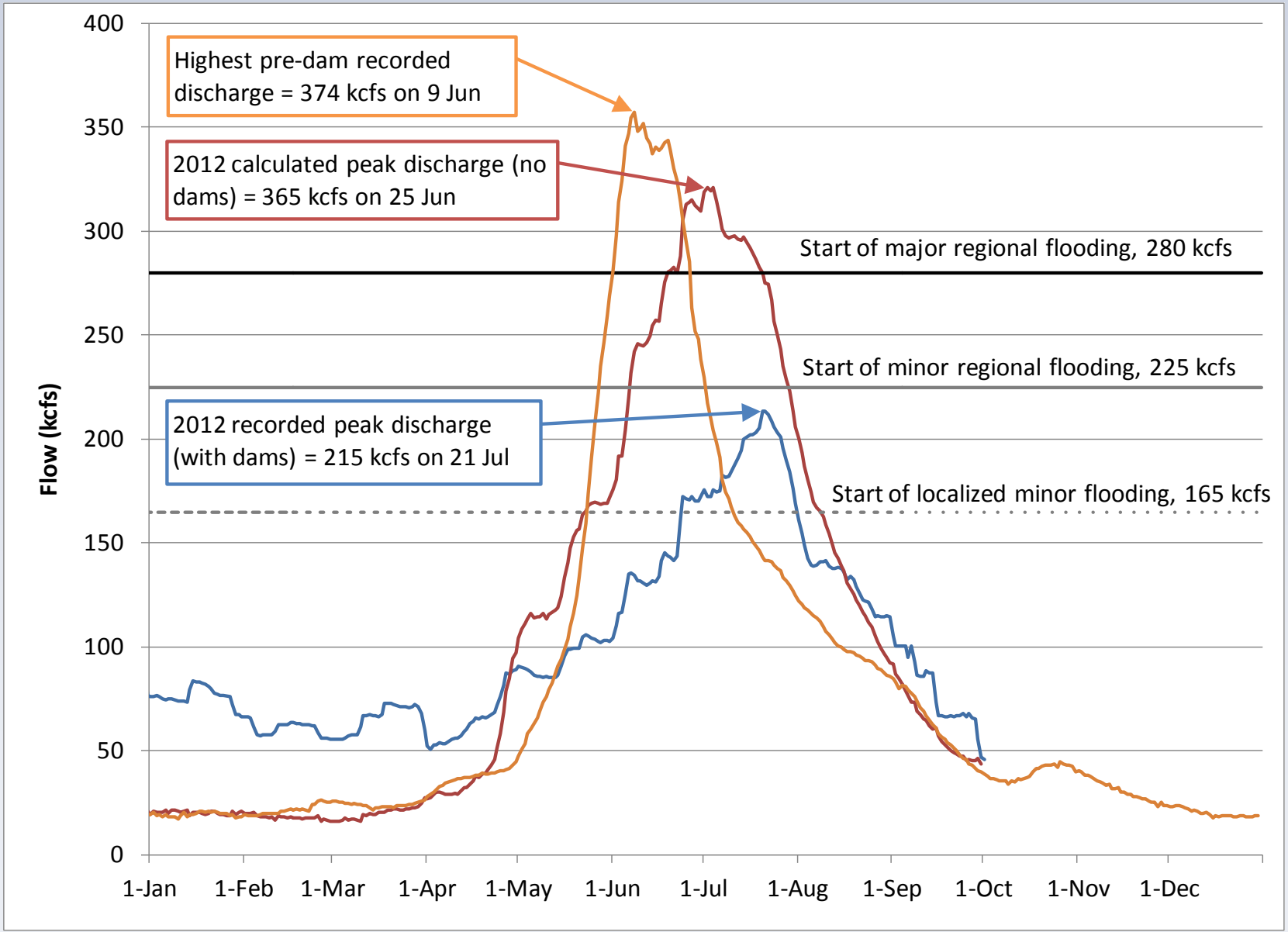
Mar
Apr
May
Jun
Jul
Aug
Sep
Columbia River at Arrow Project, British Columbia

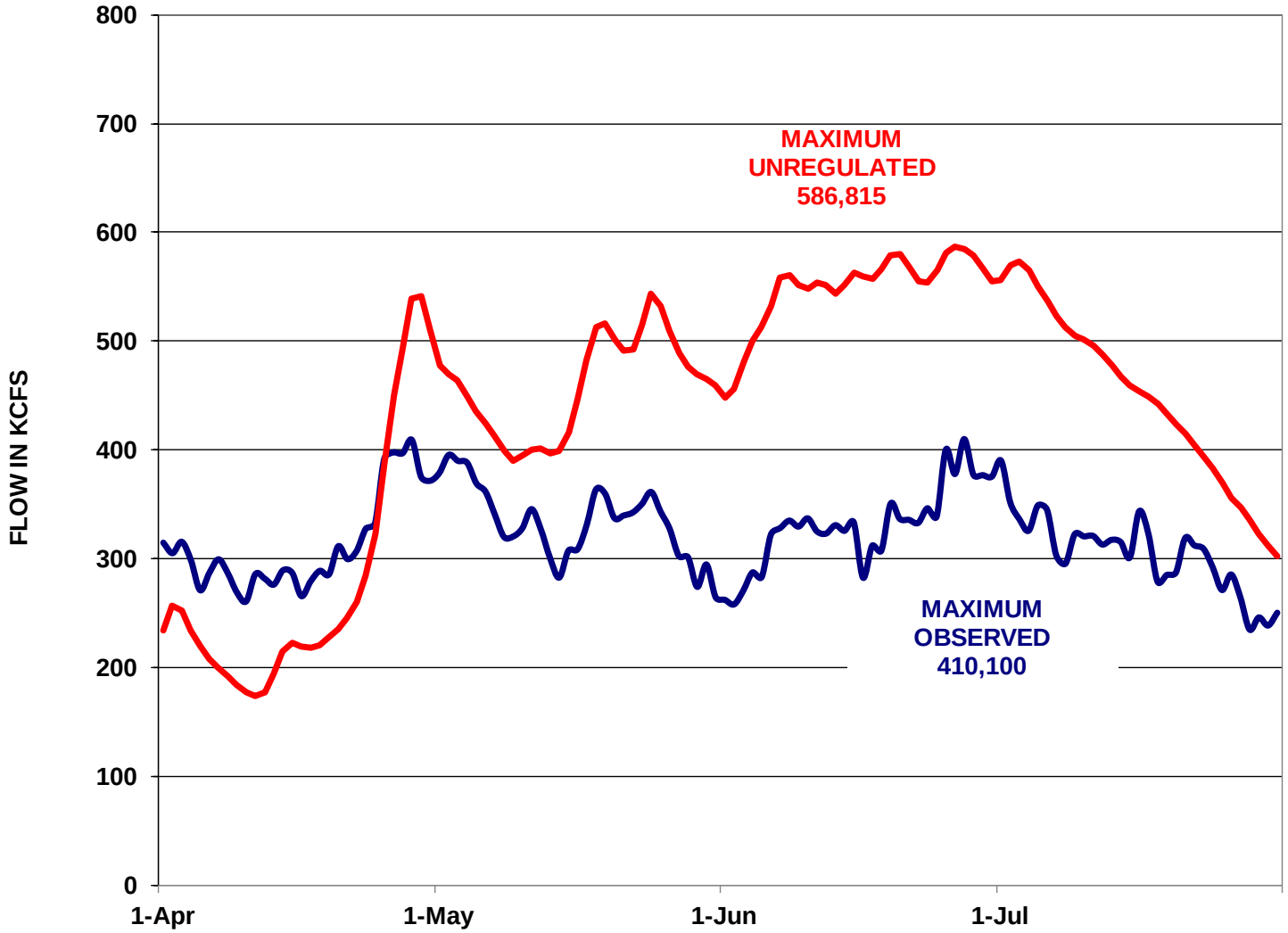

LIBBY
Elevation and Streamflow Hydrographs
July 1, 2011 to September 30, 2012
Drainage Area = 8,985 Square Mile
Maximum Observed Pool Elevation 2,459.91 Feet
Full Pool Elevation 2,459.0 Feet
- Observed Elevation
- Flood Control Rule Curve
- Observed Outflow
- Inflow
Peak Statistics
Date - Flow
7/27/12 - 48.0
6/7 - 76.1
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
2480
2460
2440
2420
2400
2380
2360
2340
2320
2300
2280
200
180
160
140
120
100
80
60
40
20
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Kootenai River at Libby Project, Montana


GRAND COULEE
Elevation and Streamflow Hydrographs
July 1, 2011 to September 30, 2012
Drainage Area = 74,100 Square Mile
Full Pool Elevation 1,290.0 Feet
Minimum Pool Elevation 1,208.0 Feet
- Flood Control Rule Curve
- Elevation
- Outflow
- Regulated Inflow
- Unregulated Inflow
Peak Statistics
Date - Flow
6/28 - 286.6
6/24 - 301.5
7/2/12 - 444.32
ELEVATION IN FEET ABOVE MSL
FLOW IN 1,000 CFS
1300
1280
1260
1240
1220
1200
1180
1160
1140
1120
1100
1080
1060
600
550
500
450
400
350
300
250
200
150
100
50
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Columbia River at Grand Coulee Project, Washington

Historic and 2012 Flow at Col. River at Birchbank



The Dalles Average Daily Flow 2012 April-July

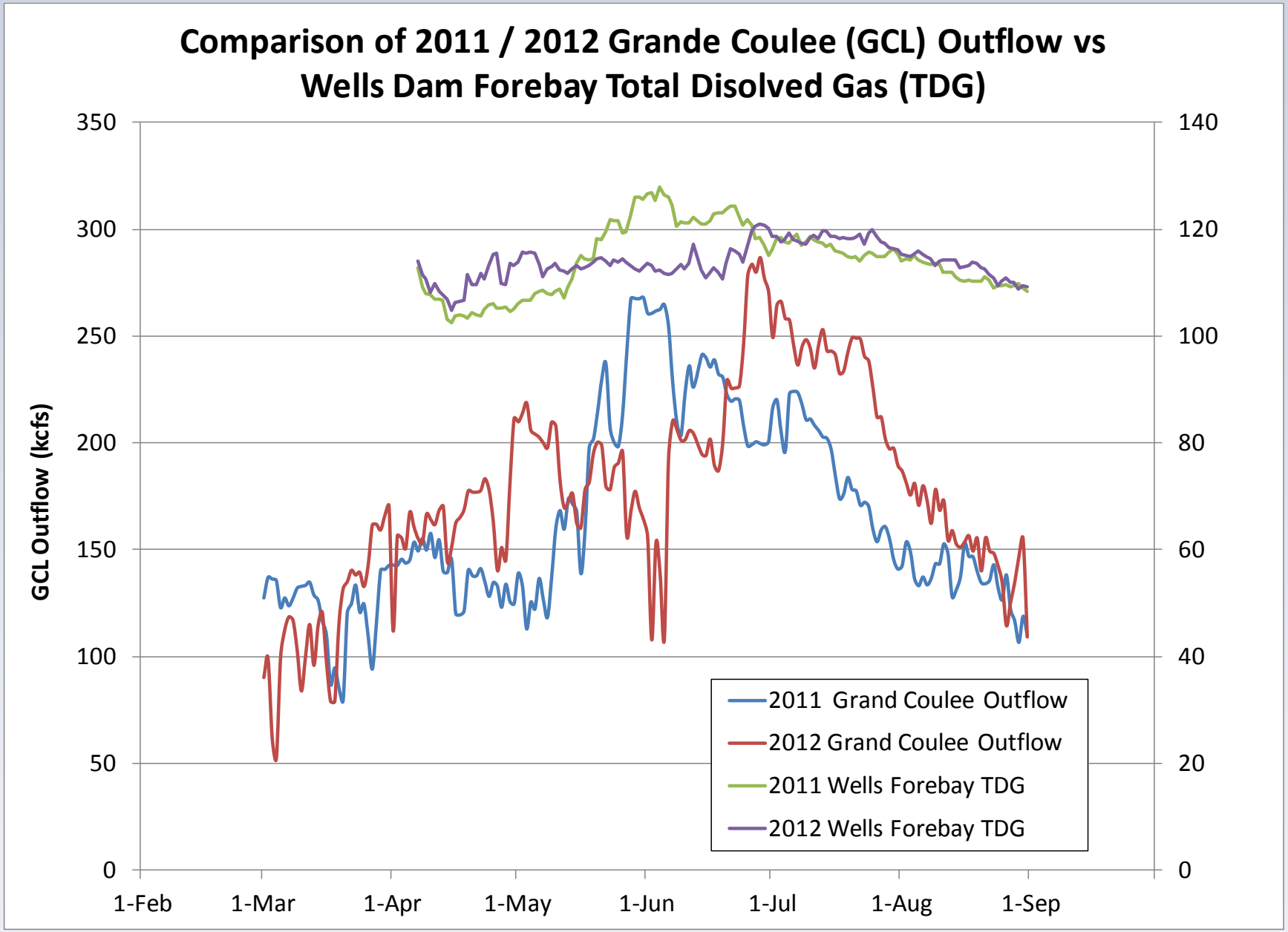


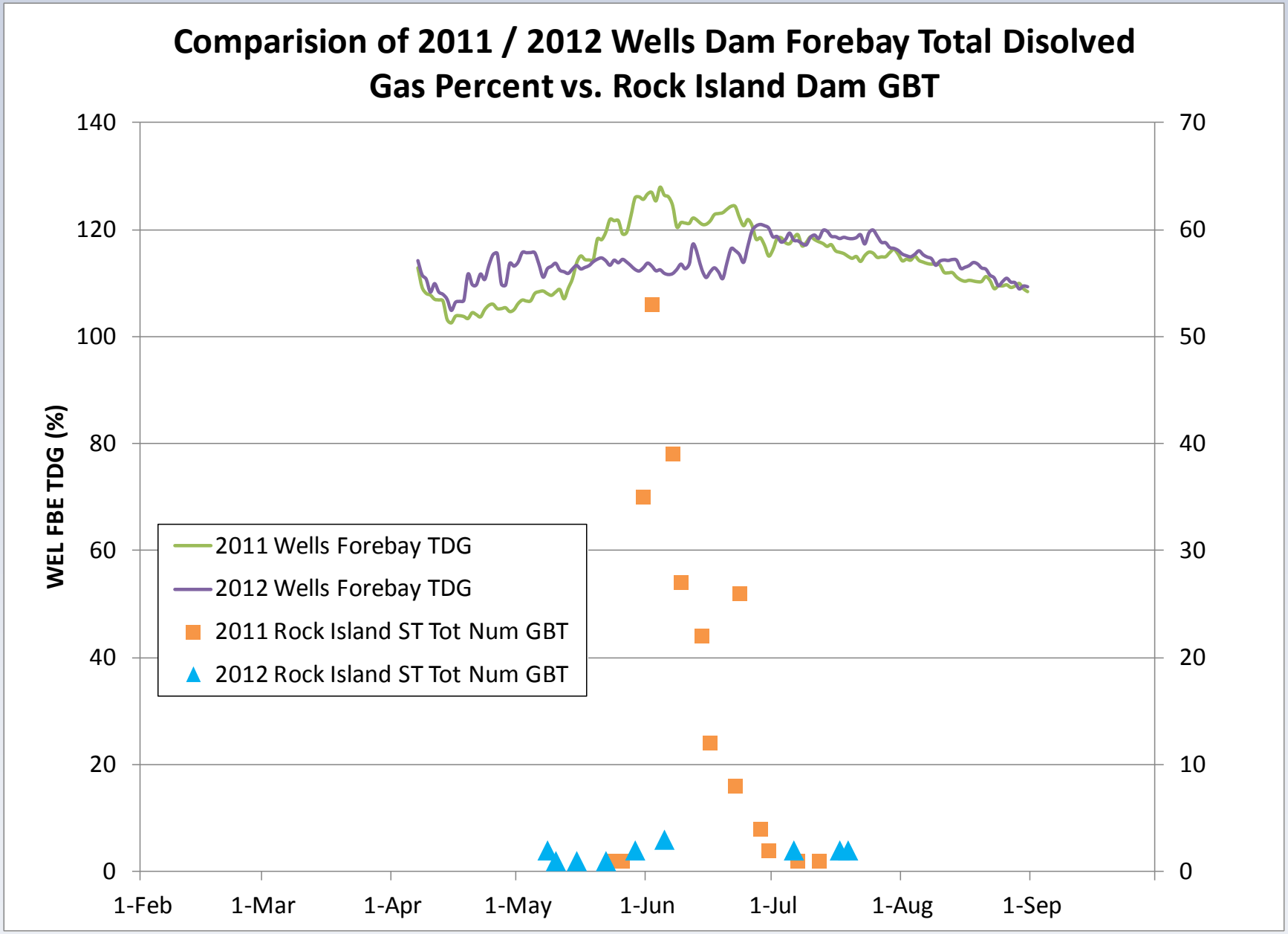
The year in comparison to highest years

Rank	Year (1929 to 2012)	Apr-Aug TDA Runoff Volume (Maf)
1	1974	134
2	1997	133
3	1972	129
4	2011	127
5	1956	126
6	1948	124
7	1971	121
8	2012	119.1
9	1982	116
10	1976	115

2011 vs. 2012 Gas Bubble Trauma (GBT) at Rock Island Dam

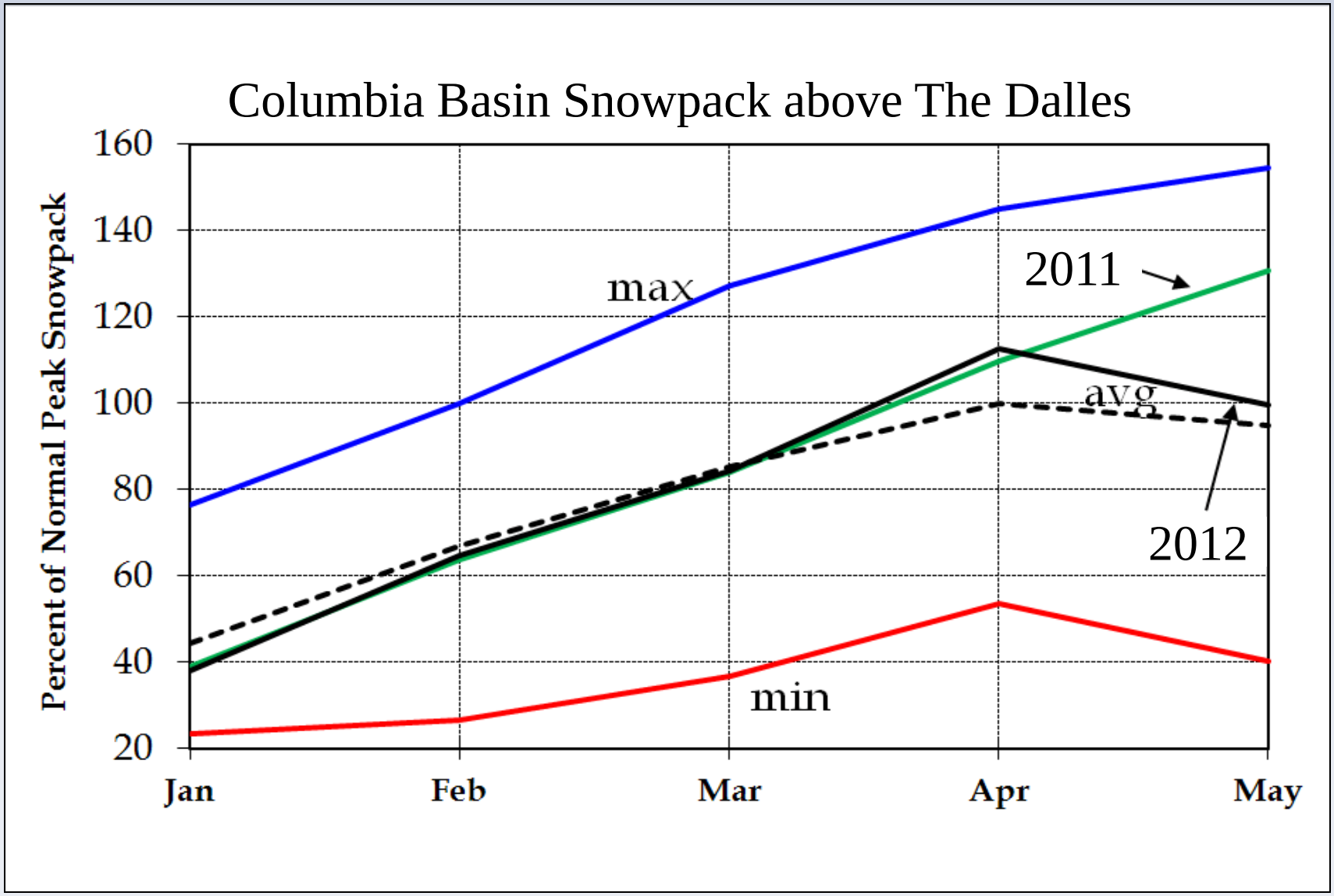
- GBT associated with elevated Total Dissolved Gas (TDG) at Rock Island Dam was significantly lower in 2012 compared to 2011
- Based on the gradually increasing March 2012 forecast the AAs coordinated with the TMT an early draft (3rd wk of March) of Grand Coulee
- The early GCL draft helped to minimize GBT at Rock Island in 2012 when compared to the higher levels observed in 2011


Comparison of 2011 / 2012 Grande Coulee (GCL) Outflow vs Wells Dam Forebay Total Disolved Gas (TDG)
GCL Outflow (kcfs)
350
300
250
200
150
100
50
0
140
120
100
80
60
40
20
0
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
2011 Grand Coulee Outflow
2012 Grand Coulee Outflow
2011 Wells Forebay TDG
2012 Wells Forebay TDG


Comparision of 2011 / 2012 Wells Dam Forebay Total Disolved Gas Percent vs. Rock Island Dam GBT
WEL FBE TDG (%)
140
120
100
80
60
40
20
0
70
60
50
40
30
20
10
0
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
2011 Wells Forebay TDG
2012 Wells Forebay TDG
2011 Rock Island ST Tot Num GBT
2012 Rock Island ST Tot Num GBT

Questions?

Kasi.a.rodgers@usace.army.mil
503-808-3950


Columbia Basin Snowpack above The Dalles
Percent of Normal Peak Snowpack
160
140
120
100
80
60
40
20
Jan
Feb
Mar
Apr
May
max
2011
avg
2012
min

Winter 2012-2013 Climate Forecast

Kyle Dittmer

Hydrologist-Meteorologist

December 5th, 2012

TMT End-of-Year Review Meeting, Portland

Columbia River Inter-Tribal Fish Commission
Portland, Oregon

2011-2012 Climate Forecast Performance

Month:	Temperature (mean monthly):	Avg. (20-yr)	**Observed**	Precipitation (% normal):	Avg. (20-yr)	**Observed**
November	Near Normal (-1.8 to + 1.8 degF)	0.6	-0.9	Above Normal (110 - 130%)	113%	117%
December	Near Normal (-1.8 to + 1.8 degF)	0.5	-1.1	Above Normal (110 - 130%)	124%	44%
January	Near Normal (-1.8 to + 1.8 degF)	-0.3	-0.3	Near Normal (90 - 110%)	106%	146%
February	Near Normal (-1.8 to + 1.8 degF)	-1	-0.7	Near Normal (90 - 110%)	105%	71%
March	Near Normal (-1.8 to + 1.8 degF)	-1.3	-3.2	Above Normal (110 - 130%)	111%	214%
	average:	-0.3	**-1.2**	average:	112%	**118%**

…but what about Portland snow events?!

Forecast three events…1 to 5 inches each, December to early March.

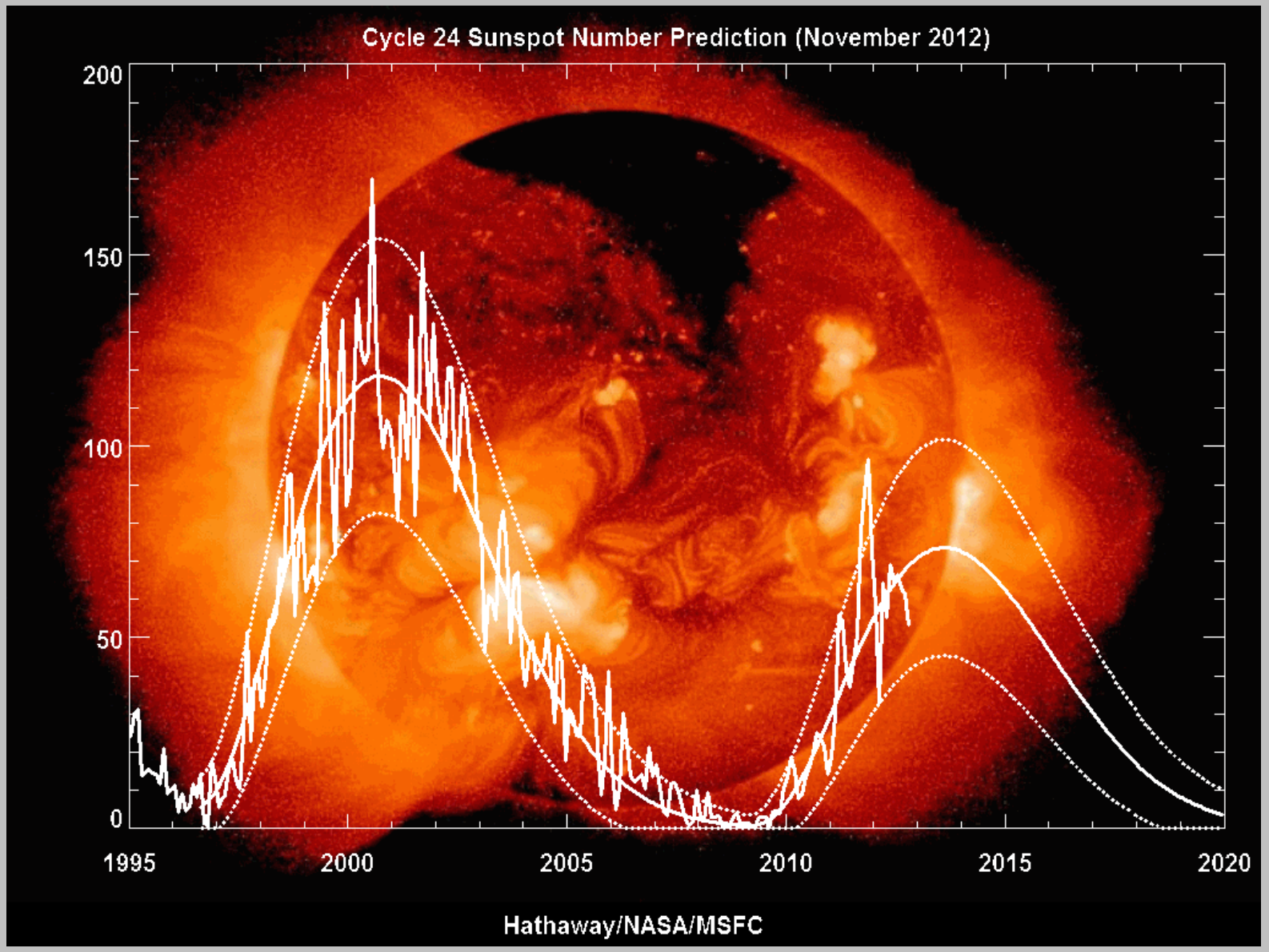
Observed EIGHT snow events…9.5 inch seasonal total.

Water Supply Forecast (MEI method): Columbia R. at The Dalles, Jan.-July:
117 MAF (issued Oct 2011), 109%. Observed: 129 MAF. Error ±9%.
132 MAF (issued April 2012), 130%. Observed: 129 MAF. Error ±2%.

Introduction – Methods

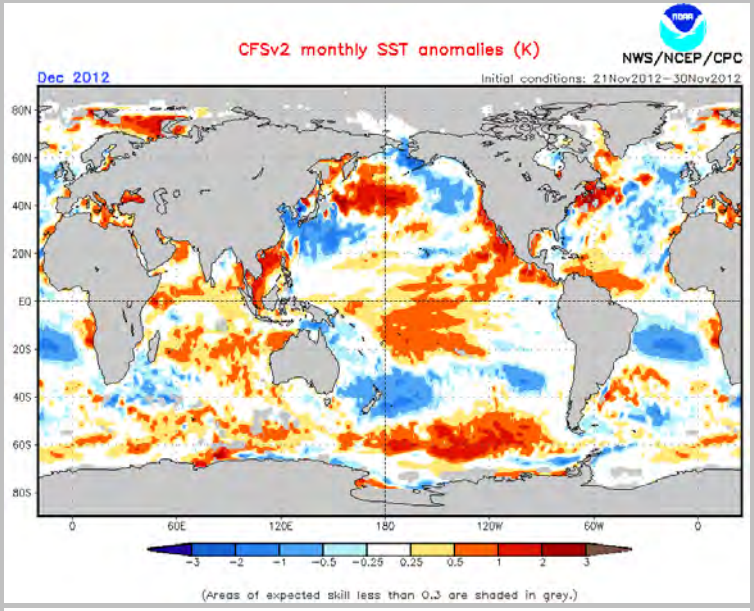
- Forecast uses a holistic, integrated big picture view.
- Big-picture: **Solar Forcing** (e.g., sunspot cycles) does influence our global weather patterns. *In memoriam:* Dr. Landscheidt, 1922 – 2004, of Germany.
- Track ENSO with the Multi-variable ENSO Index.
- Sea-Surface Temperature Departure Forecasts.
- "Hydro-Climate" approach: Water year 2013 volume forecast uses regressed Multi-variable ENSO Index vs. historic runoff for the Columbia R. at The Dalles. Average of 20 water years = the volume forecast.
- Pattern recognition is key: ***El Niño & ENSO-neutral***.

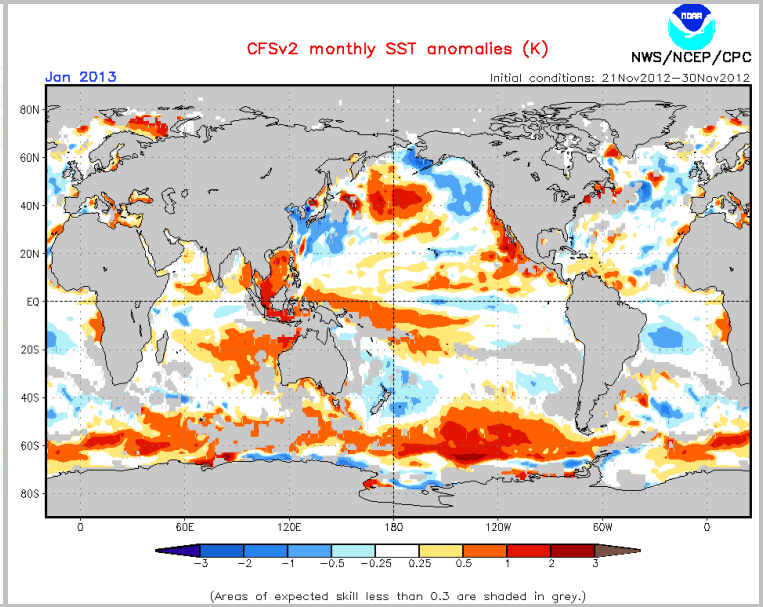
SUNSPOT COUNTS – SUGGEST "EL NIÑO"

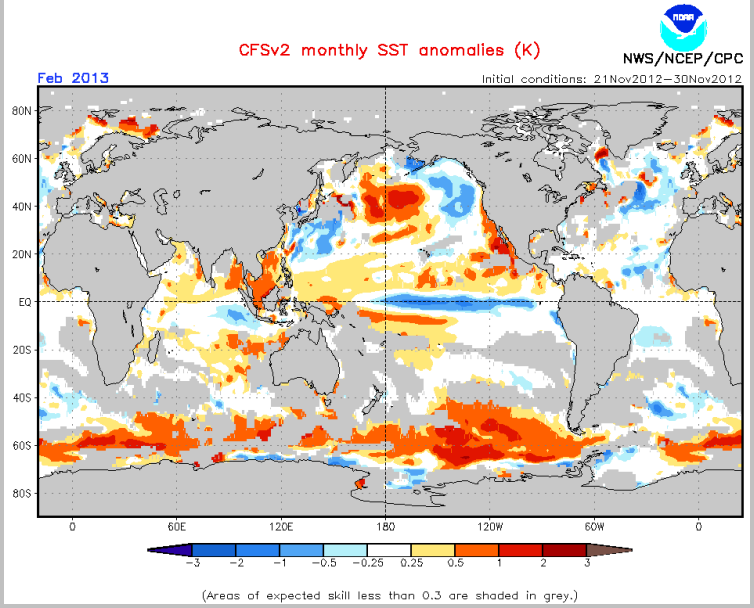


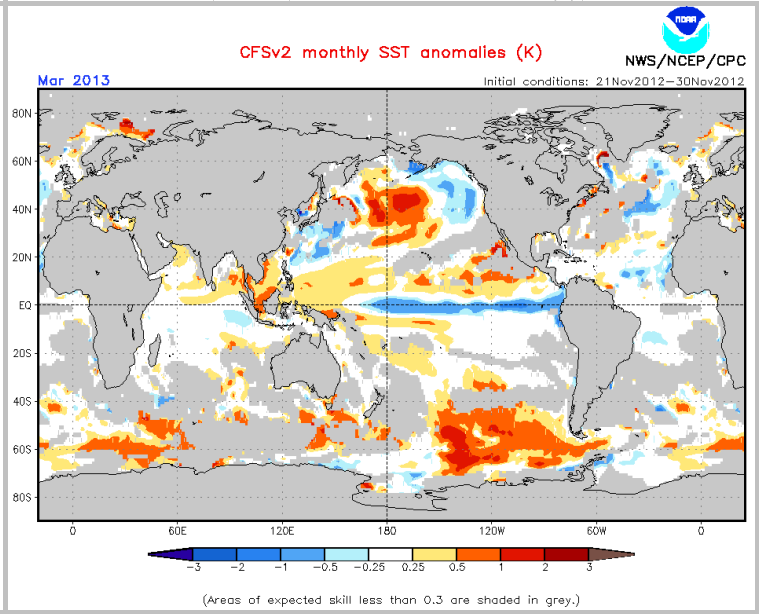
http://solarscience.msfc.nasa.gov/images/ssn_predict_l.gif

SEA SURFACE TEMPERATURES SUGGEST "????"



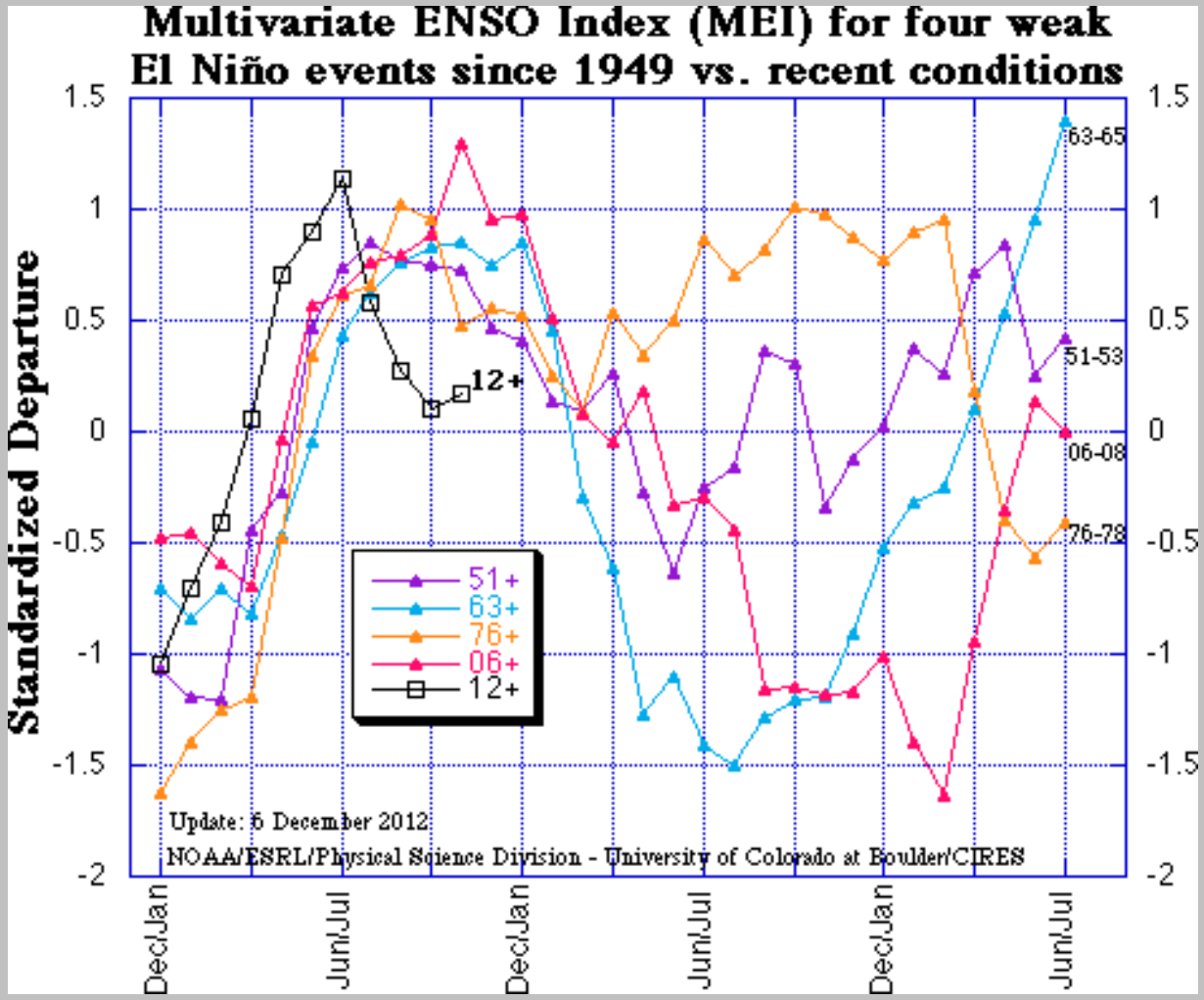






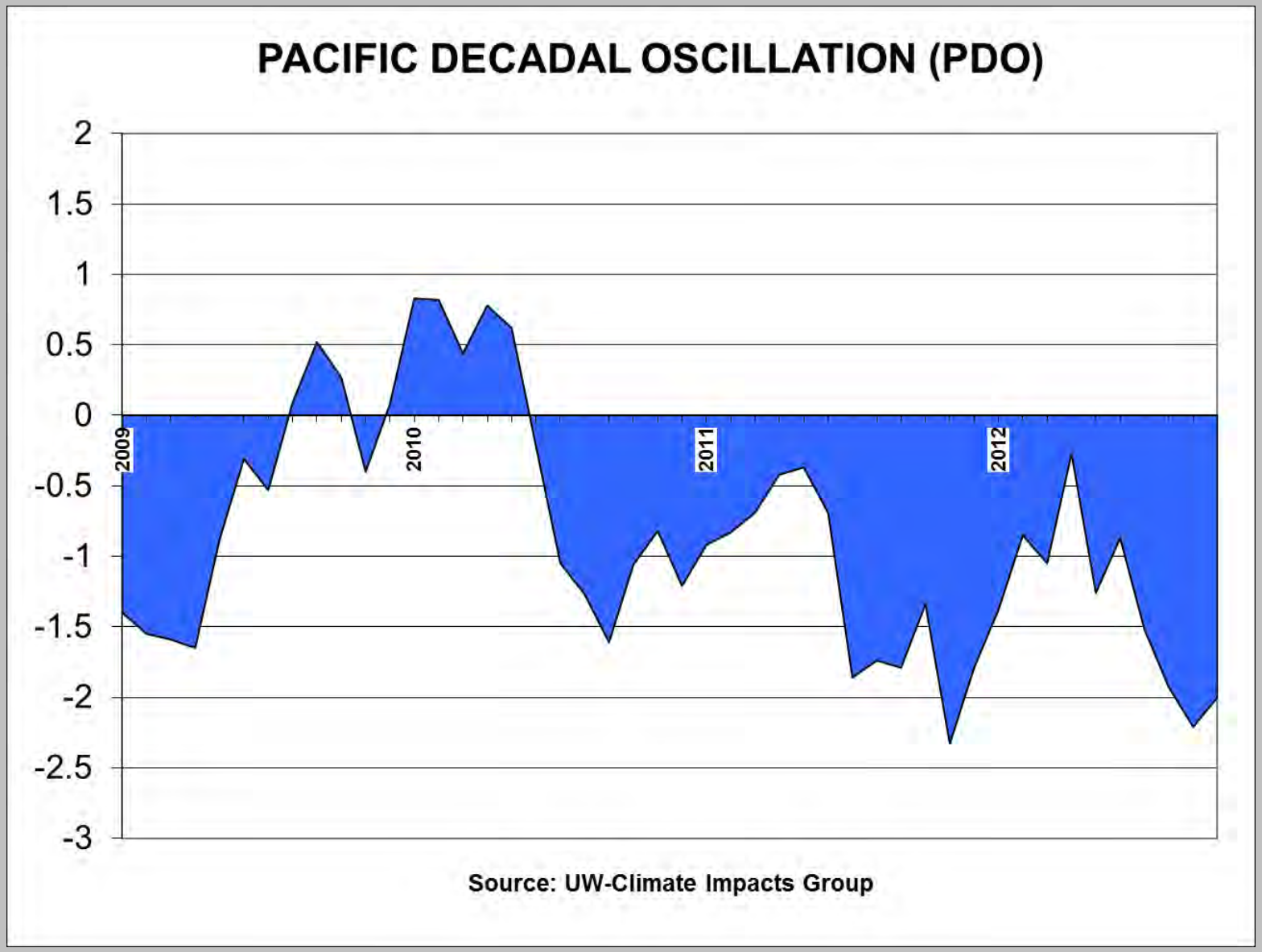
http://www.cpc.ncep.noaa.gov/products/people/wwang/cfs_fcst/images3/glbSSTMonMask.gif

ENSO SIGNAL SUGGESTS "ENSO-NEUTRAL" WINTER WEATHER

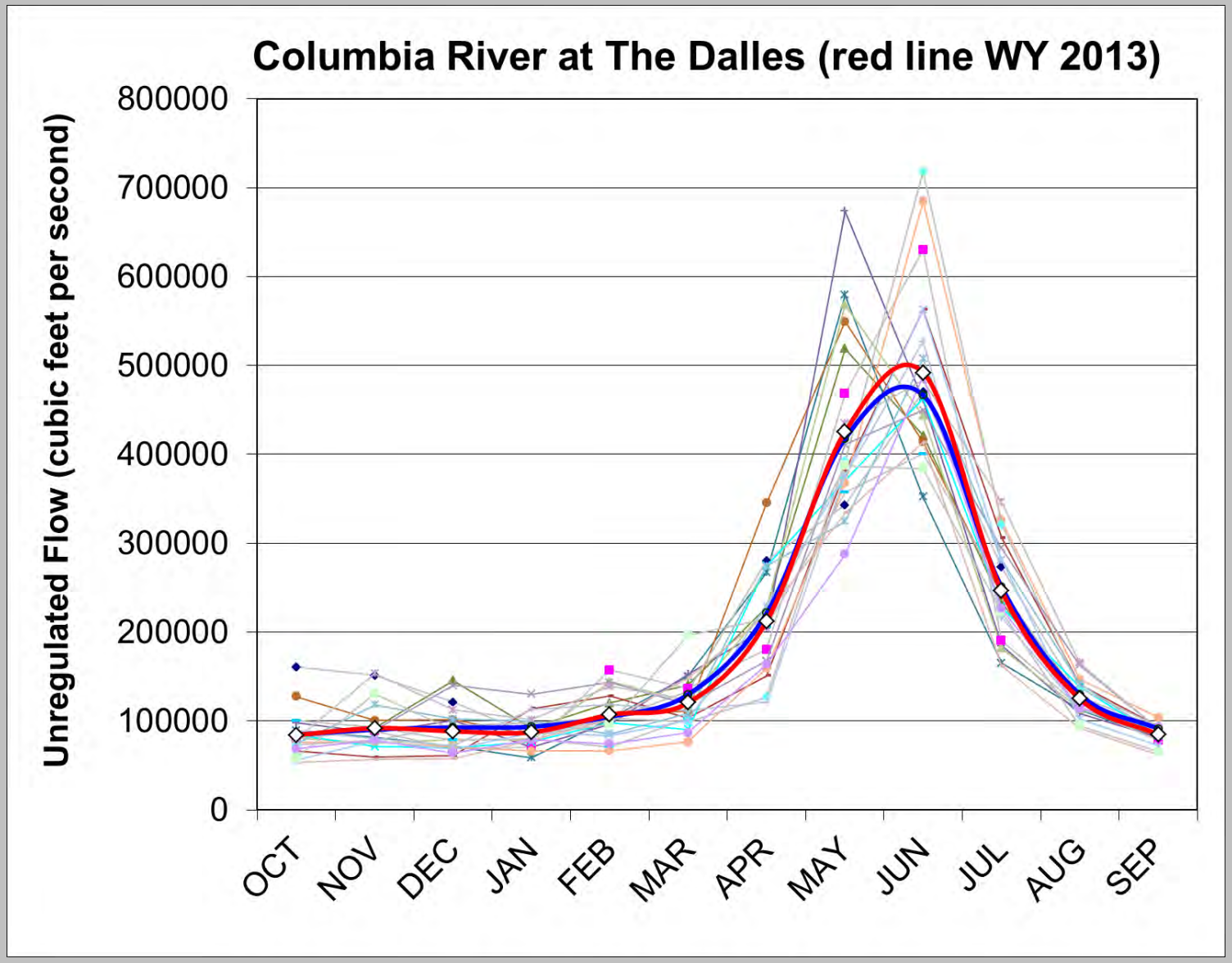


MEI tracks the Sea-Level Pressure, surface winds (2D), Sea-surface Temperature, Air Temperature, and fraction of Cloud cover.

PDO SIGNAL...THE COLD PHASE GETS COLDER!



ENSEMBLE STREAMFLOW FORECAST



Blue line = long-term average (WY 1929-2012)

Summary: The Forecast

Month:	Temperature (mean monthly):	Avg. (20-yr)	Precipitation (% normal):	Avg. (20-yr)
November	Near Normal (-1.8 to + 1.8 degF)	1	Near Normal (90 - 110%)	92%
December	Near Normal (-1.8 to + 1.8 degF)	1	Below Normal (70 - 90%)	86%
January	Near Normal (-1.8 to + 1.8 degF)	1	Near Normal (90 - 110%)	99%
February	Near Normal (-1.8 to + 1.8 degF)	1	Below Normal (70 - 90%)	88%
March	Near Normal (-1.8 to + 1.8 degF)	1	Near Normal (90 - 110%)	101%

EXPECT HIGH VARIABILITY IN THE WEATHER…BUT NOT EXTREME – HEAVY RAIN EVENTS, FLOODS, etc.

WATER SUPPLY FORECAST: 102 MAF or 95%, COLUMBIA RIVER AT THE DALLES, JANUARY - JULY.

…but what about snow events?!

Expect FOUR events…1 moderate (2-5 inch), 3 minor (1 inch)

(70-80% likely), January through mid-March.

TO: Columbia River Forecast Group

FROM: Kyle Dittmer, 2012 CRFG Chairman

DATE: November 27, 2012

SUBJECT: Summary of 2012-2013 pre-season winter weather predictions

The following is a summary of the 20th annual Oregon AMS Winter Weather meeting. Link: http://www.ametsoc.org/chapters/oregon/Minutes/2012/2012_11_17_Meeting/2012_11_17_Minutes.html

Methods:

Clinton Rockey (NOAA-NWS): Probabilistic (ensemble)

Kyle Dittmer (CRITFC): Hydro-Climatological (hybrid of Analogue-Probabilistic methods)

George Taylor (ACS), Jim Little (ODF), Pete Parsons (ODA): Analogue years

Indices used:

Kyle Dittmer: NASA solar cycle, Nino 3.4 Anomaly, MEI, and PDO.

Jim Little: CPC SOI, MEI, ONI, AUS-BOM SOI, Nino 3.4 Anomaly, Nino 3 Temps, Nino 4 Temps, PNA, PDO, NAO, AO, WP, and QBO.

Pete Parsons: ONI, Nino 3.4 Anomaly.

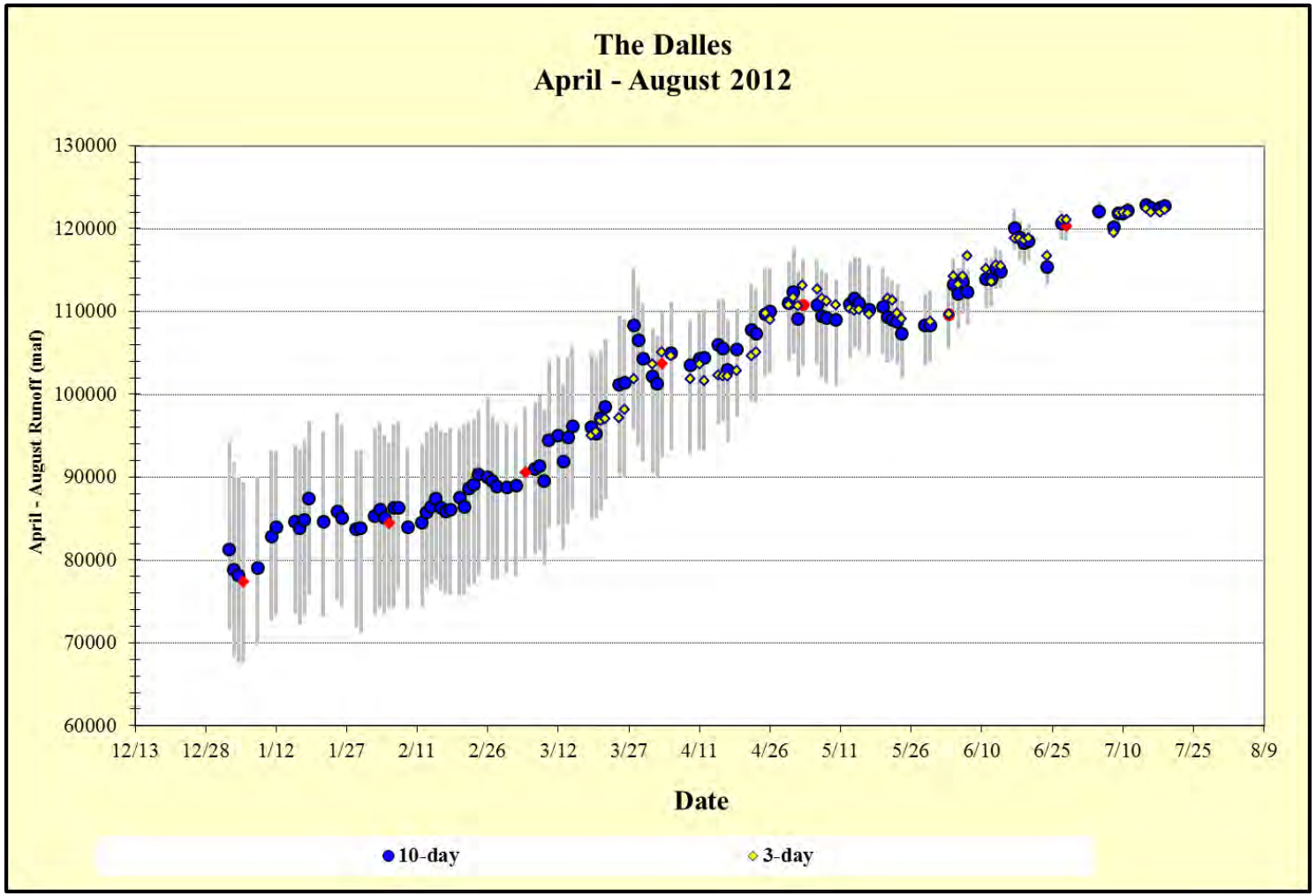
FORECAST:	Temperature	Precipitation	Willamette-Valley Snow
Clinton R.	Near Normal	Slightly drier than Normal	Low-to-mod. chance (Jan-Feb)
Kyle D.	Near Normal (warm)	Near Normal (dry side)	70-80% chance (Jan-March)
George T.	Mild	Oct, Nov, Feb, March	50% chance (Feb.)
Jim L.	Near Normal	Near-to-Below Normal	Near-to-Below normal (N-Casc.)
Pete P.	Near Normal	Slightly drier than Normal	Mid-Dec. through January

It was noted amongst the forecasters that since ENSO-neutral will play a role this winter, that expect high variability in weather patterns throughout the season (i.e, stormy then dry periods).

2013 Implementation of ESP Water Supply Forecast Methodology

Ann McManamon
Co-chair Columbia River
Treaty Hydromet Committee

2012 Results



Recommendation

- Use forecast which is available on or prior to the 5th working day of each month
  - Allows as much time as possible for inclusion of real-time snow measurements to be incorporated into forecast
- Use forecast which contains 3 days of short-term meteorological forcings
  - Allows for inclusion of short-term forecast but recognizes the diminishing skill with longer time horizons

2013 Dates

8 January 2013
7 February 2013
7 March 2013
5 April 2013
7 May 2013
6 June 2013*
8 July 2013

* This date is actually the 4th working day in the month of June. Shortening the forecast preparation period by one day makes the TSR available about 5 days earlier (due to the way the calendar falls) By June, none of the agencies preparing water supply forecasts should be adjusting snowpack conditions based on ground observations.

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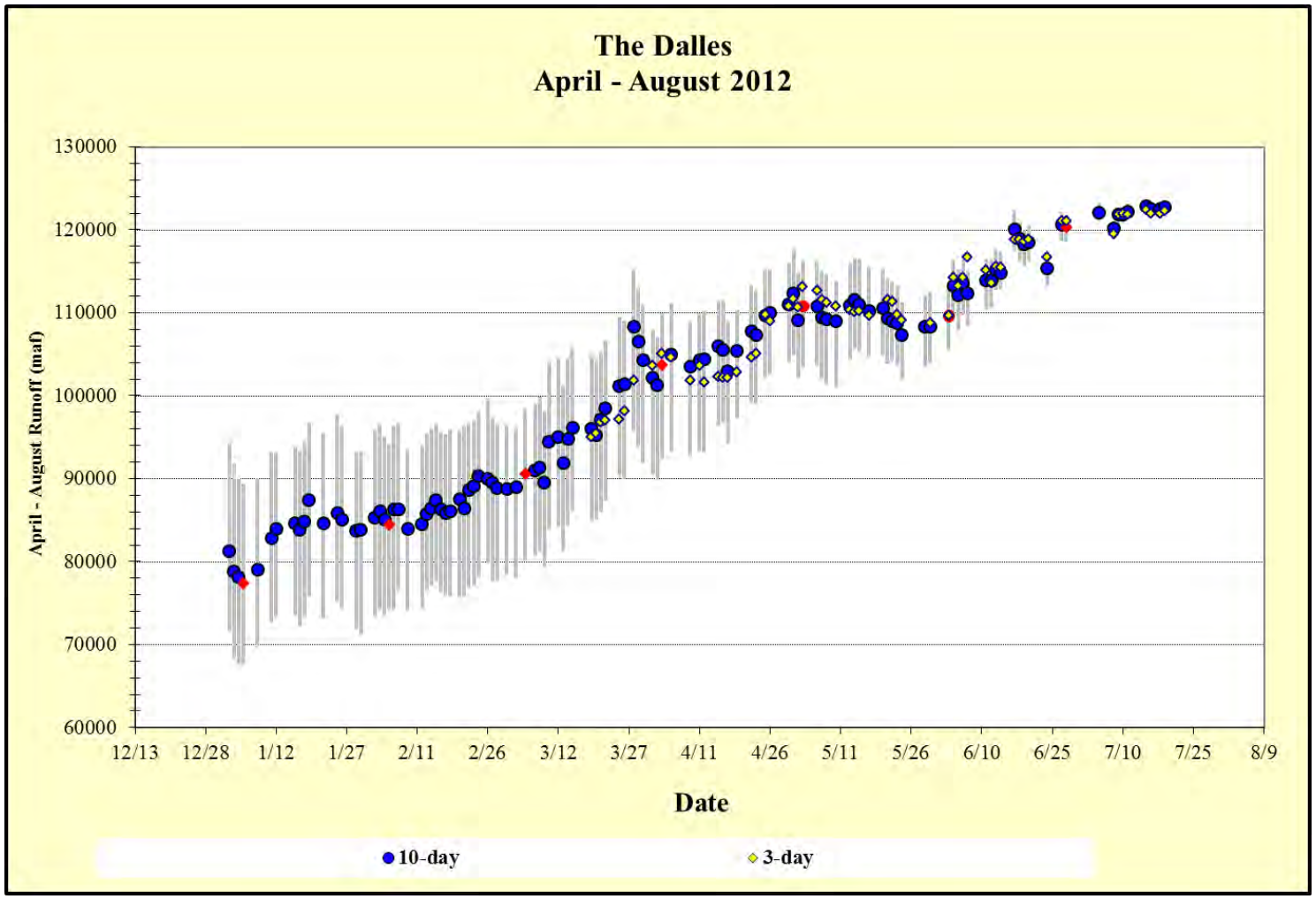

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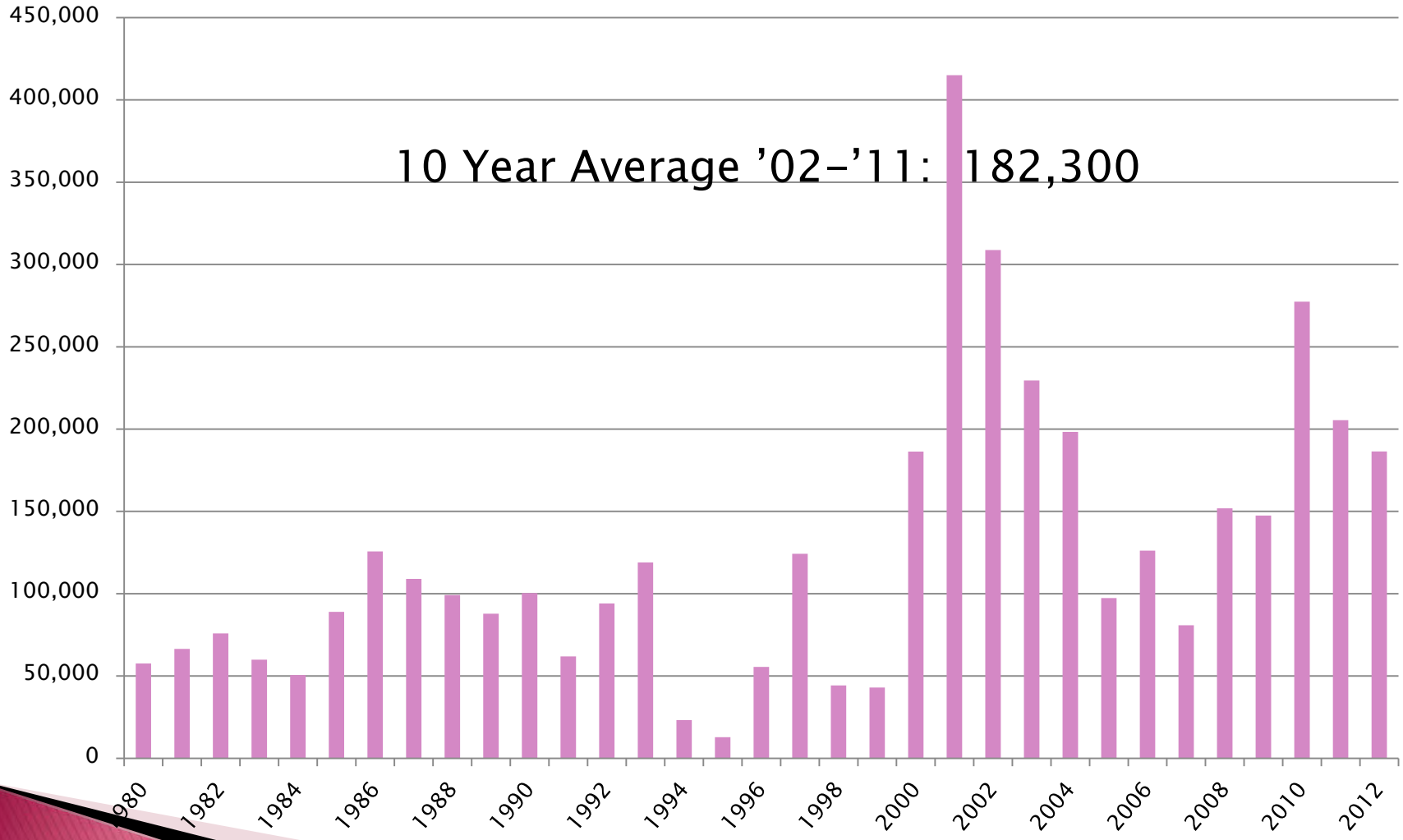
Columbia River Salmon and Steelhead Returns

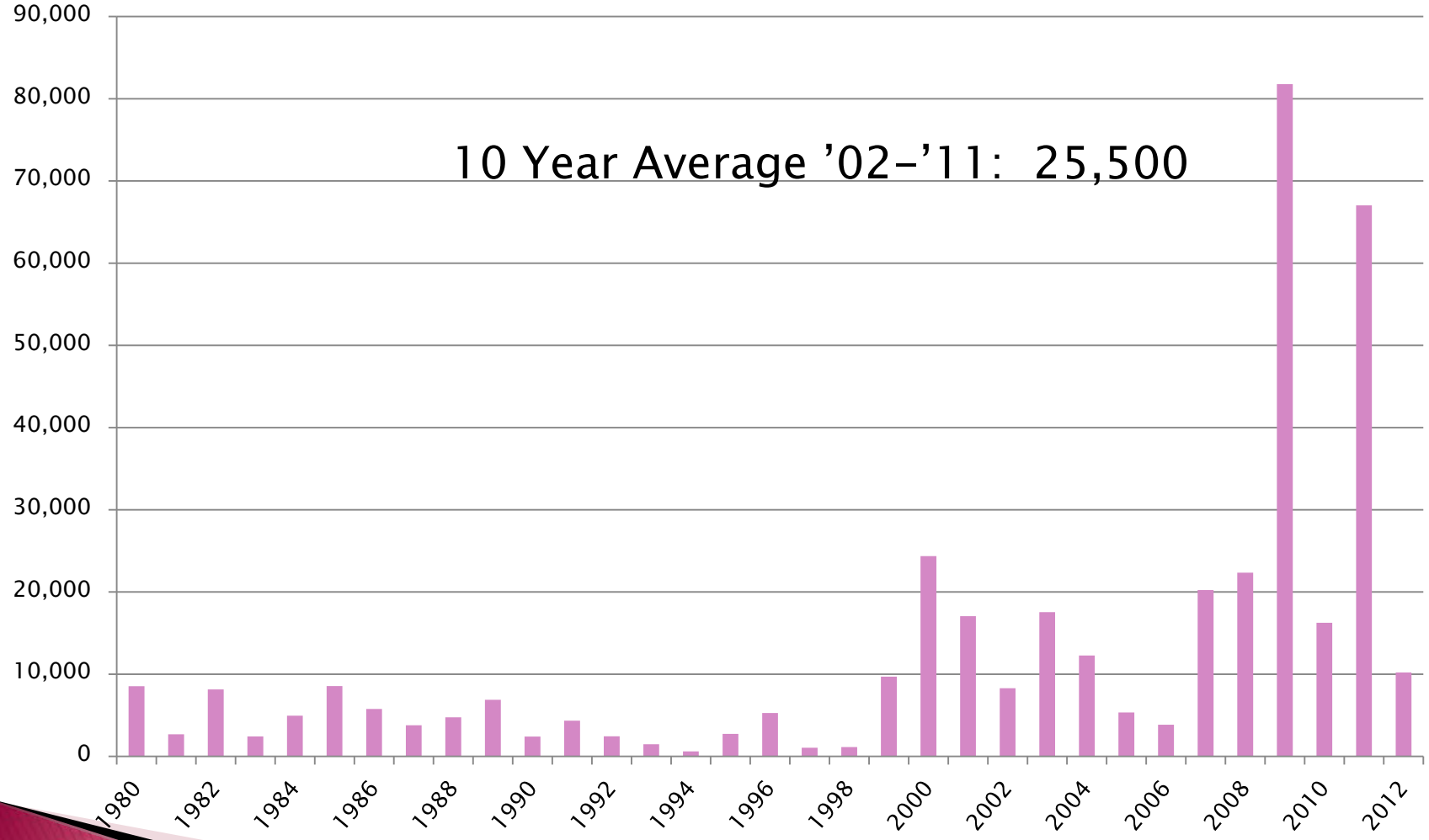
TMT – December 5, 2012

Charles Morrill and Cindy LeFleur
Washington Department of Fish and Wildlife

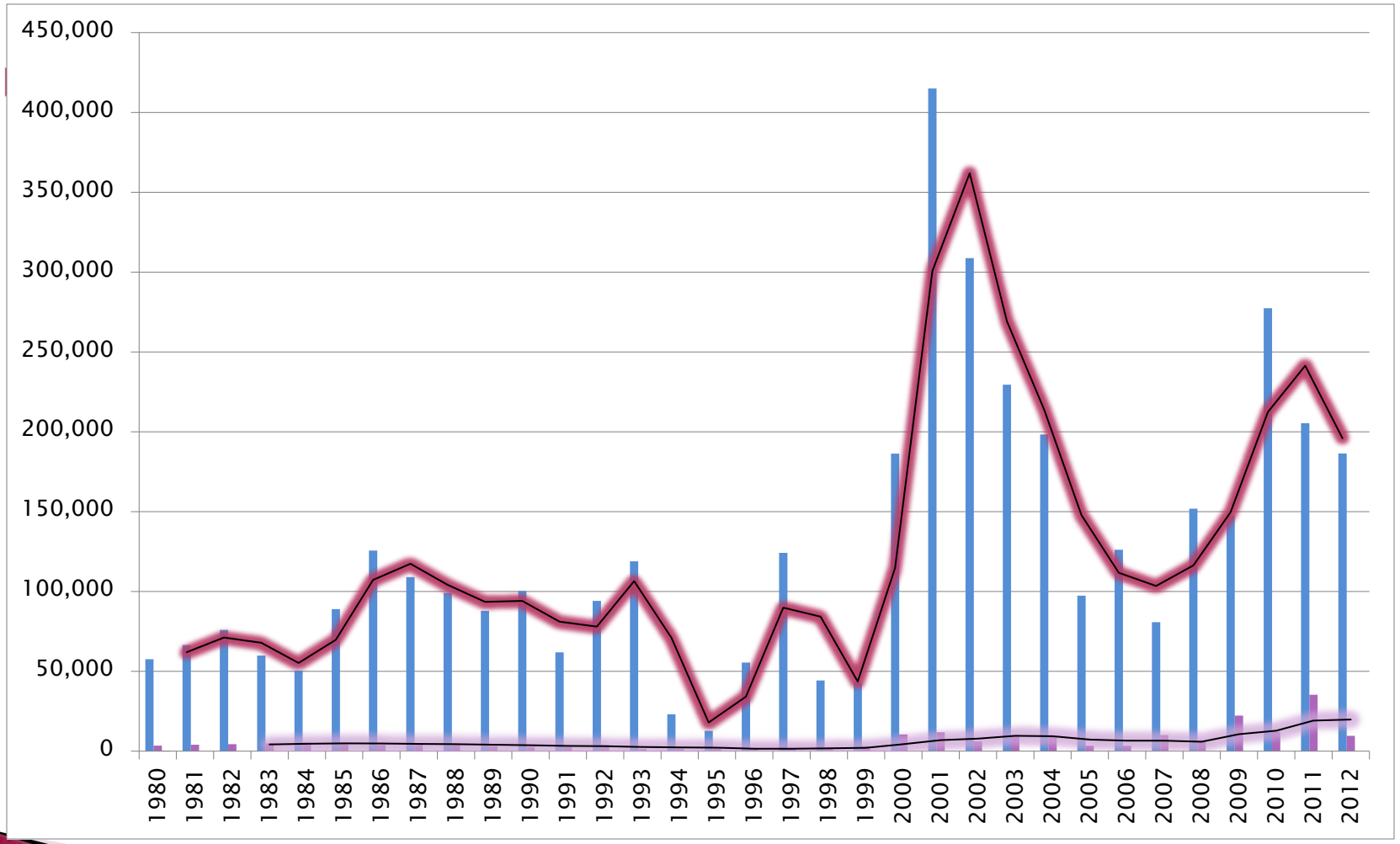
Bonneville Dam Counts of Adult Spring Chinook January – June 15



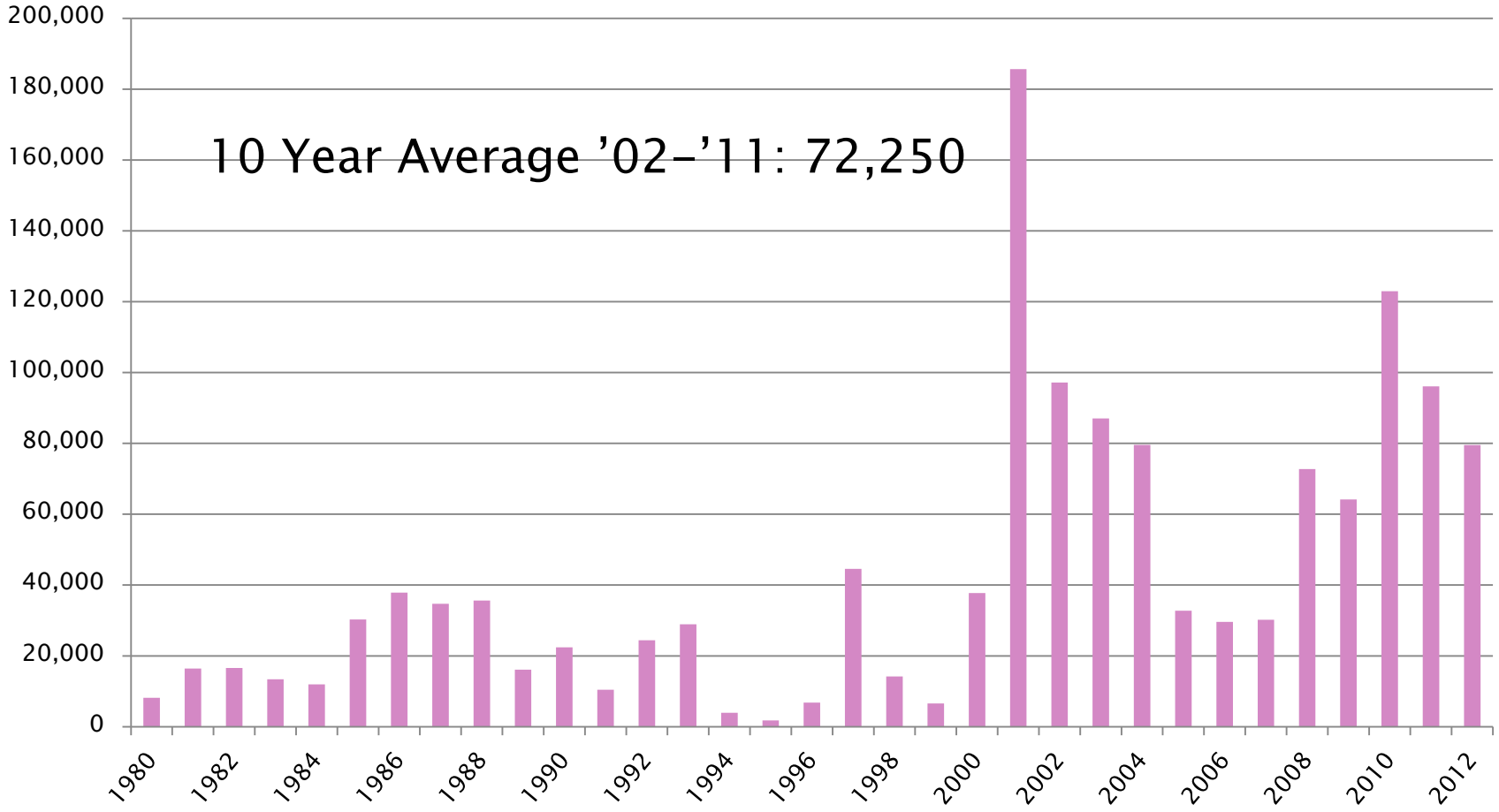
Bonneville Dam Counts of Jack Spring Chinook January – June 15



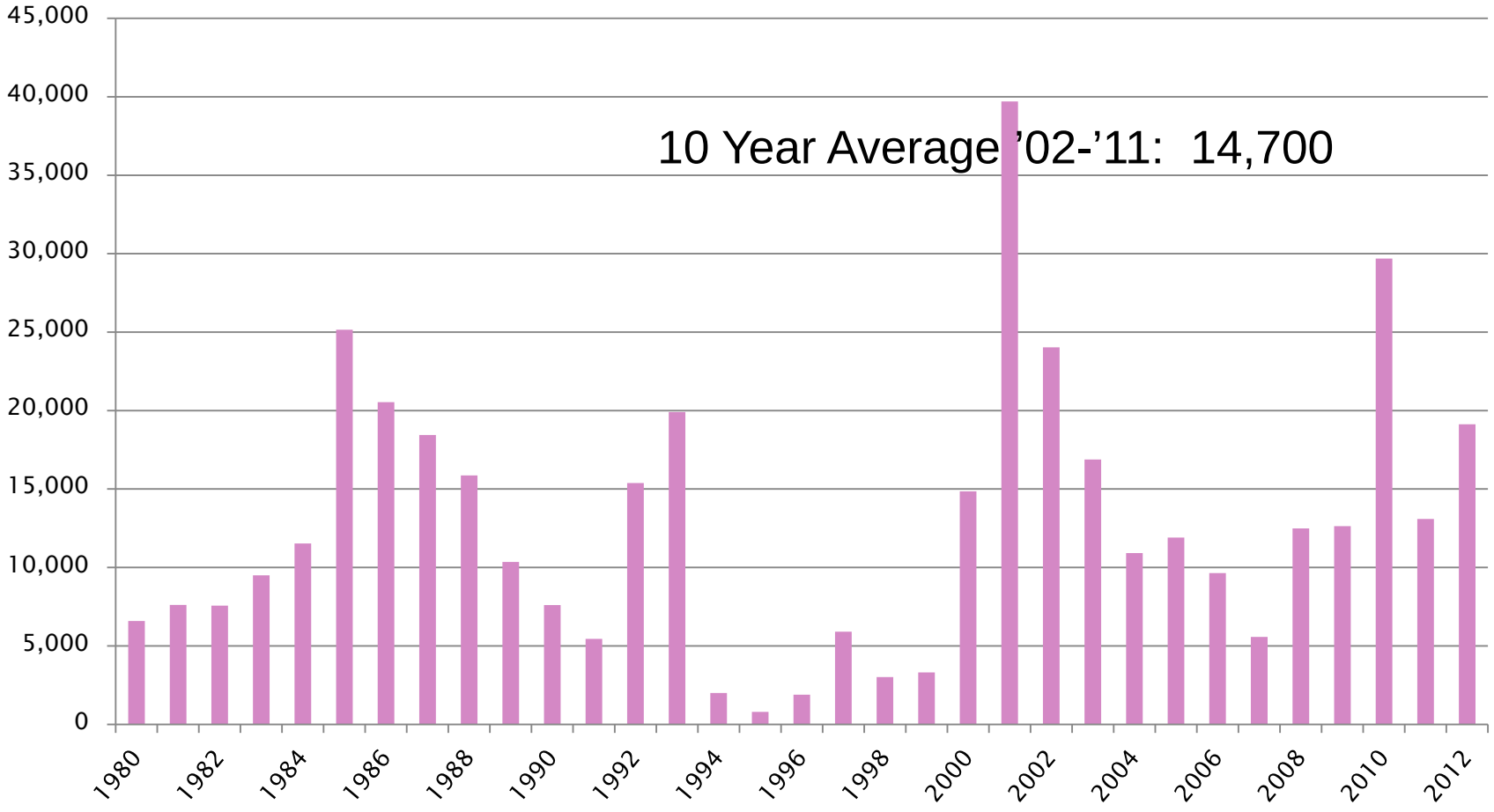
Bonneville Dam Counts of Adult & Jack Spring Chinook: January – June 15



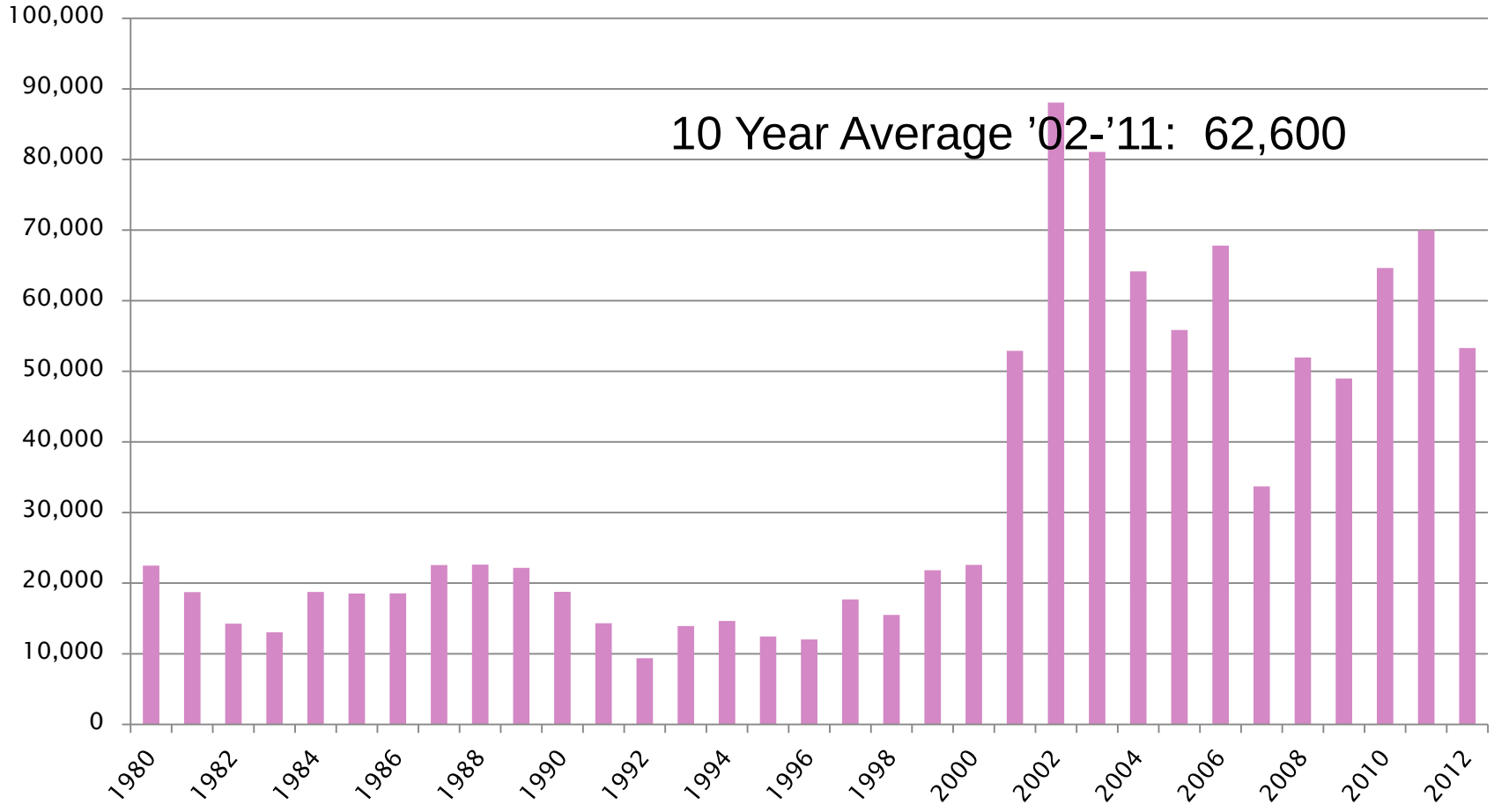
Lower Granite Dam Counts of Adult Spring/Summer Chinook



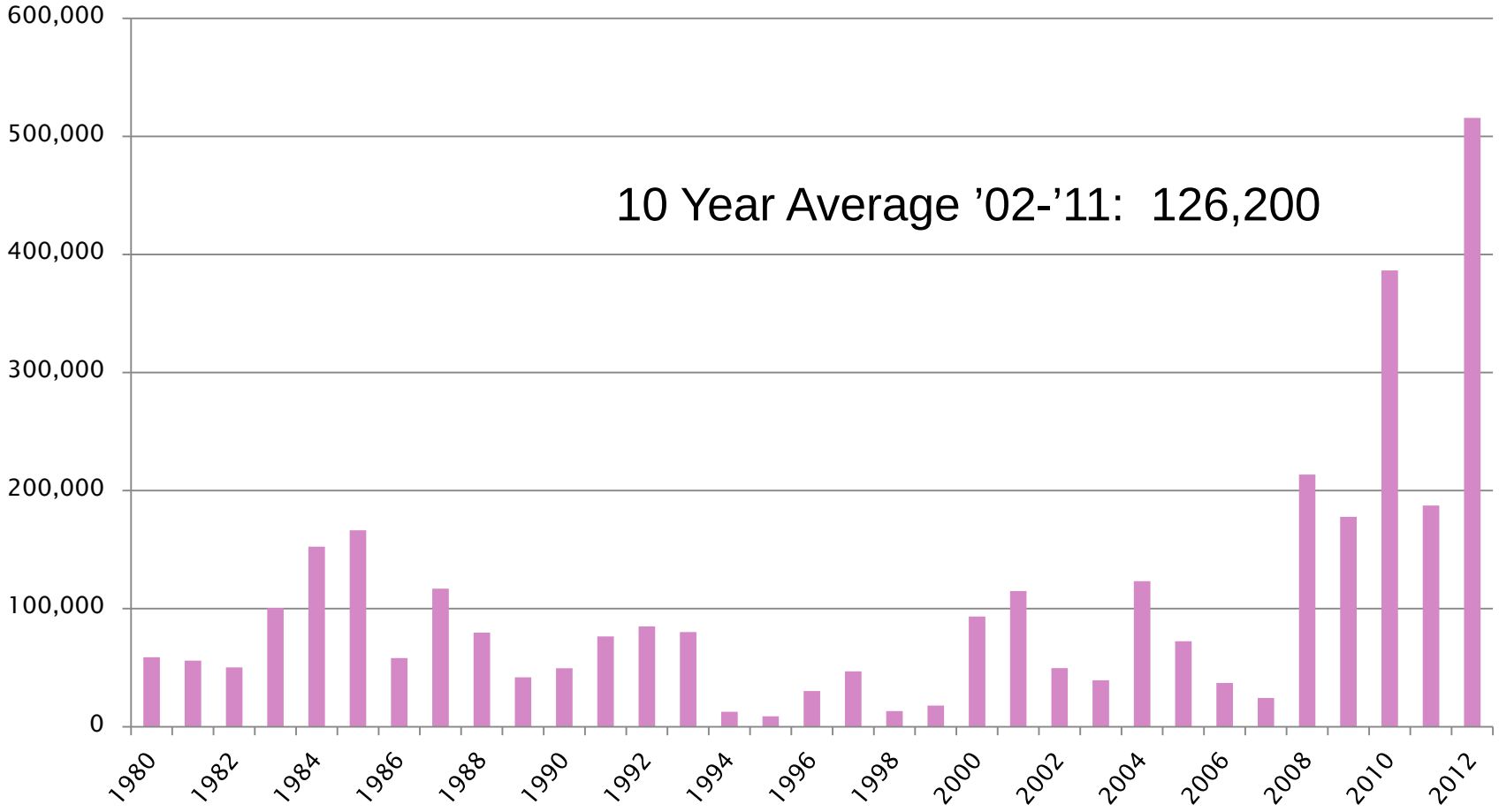
Rock Island Dam Counts of Adult Spring Chinook



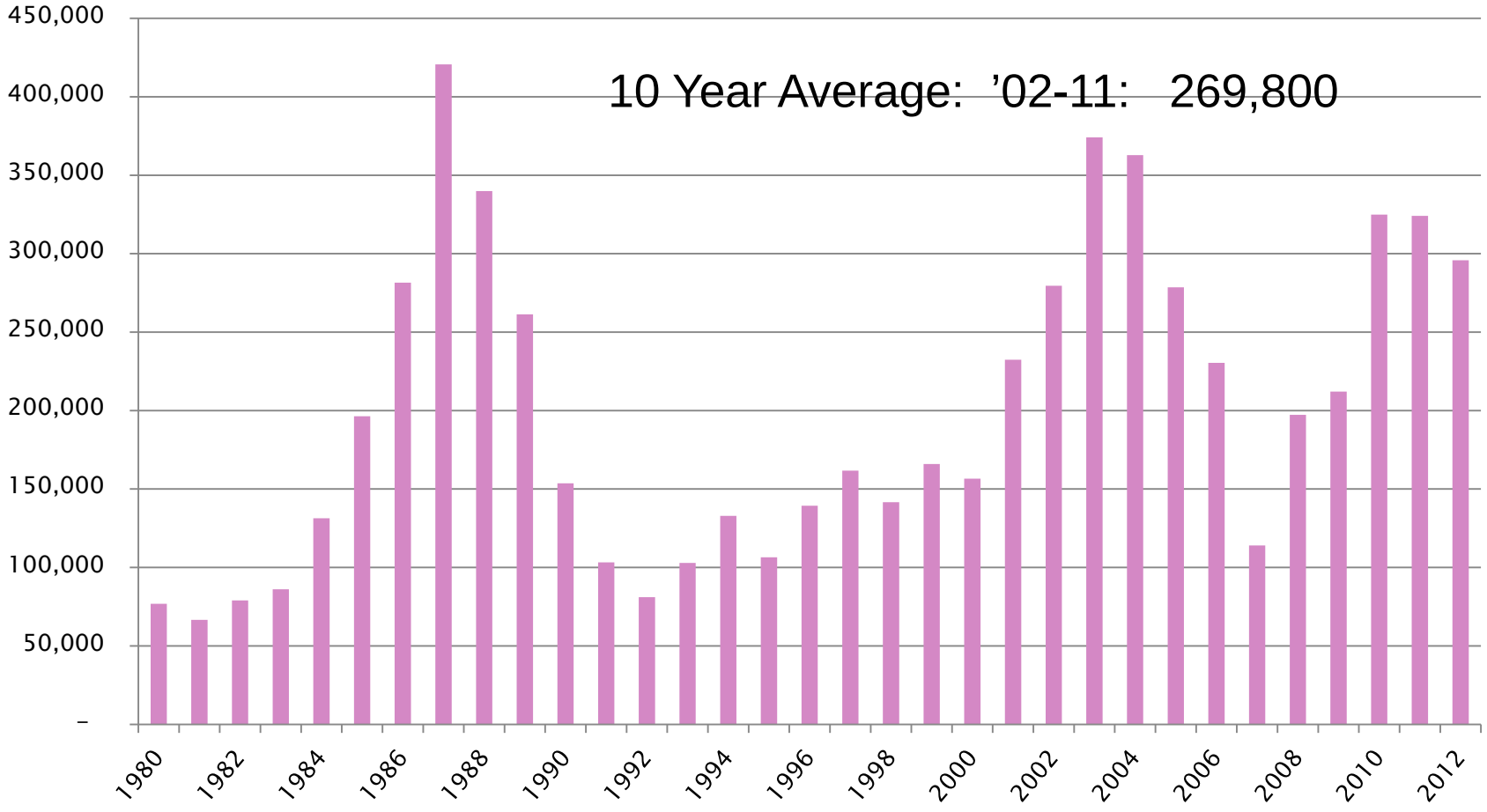
Bonneville Dam Counts of Adult Summer Chinook
June 16 – July 31



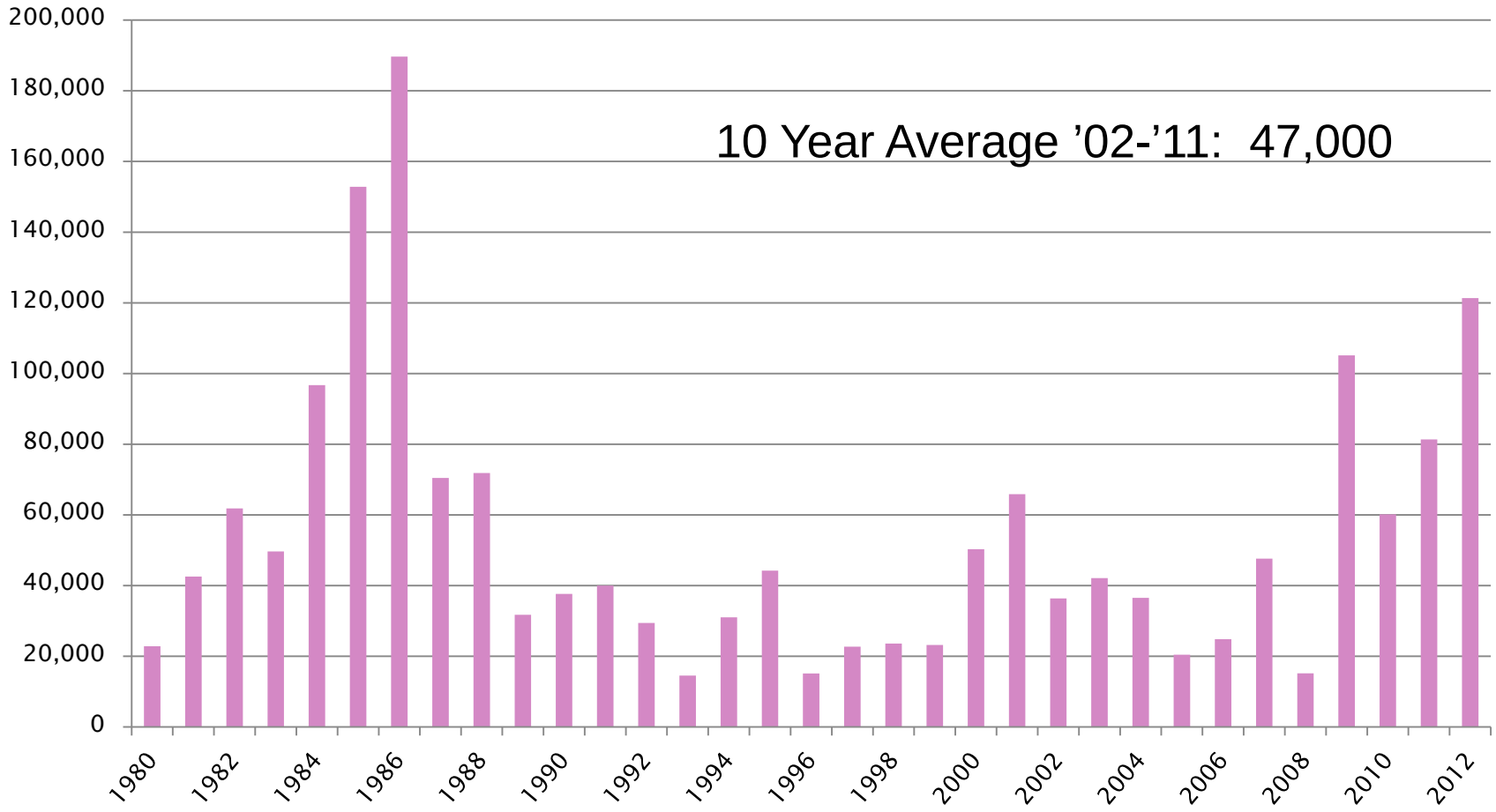
Bonneville Dam Counts of Sockeye



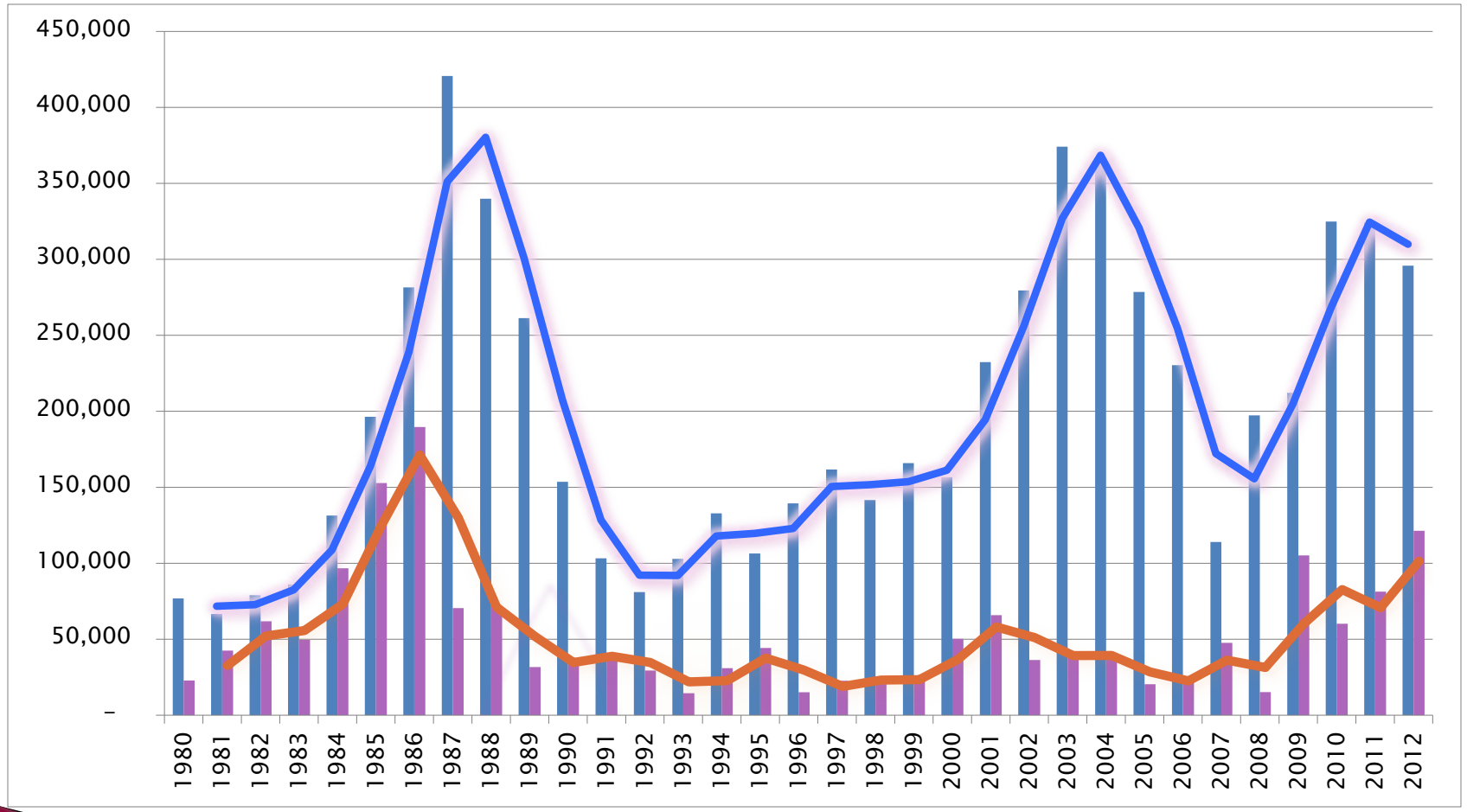
Upriver Bright Adult Fall Chinook Returns To Bonneville Dam



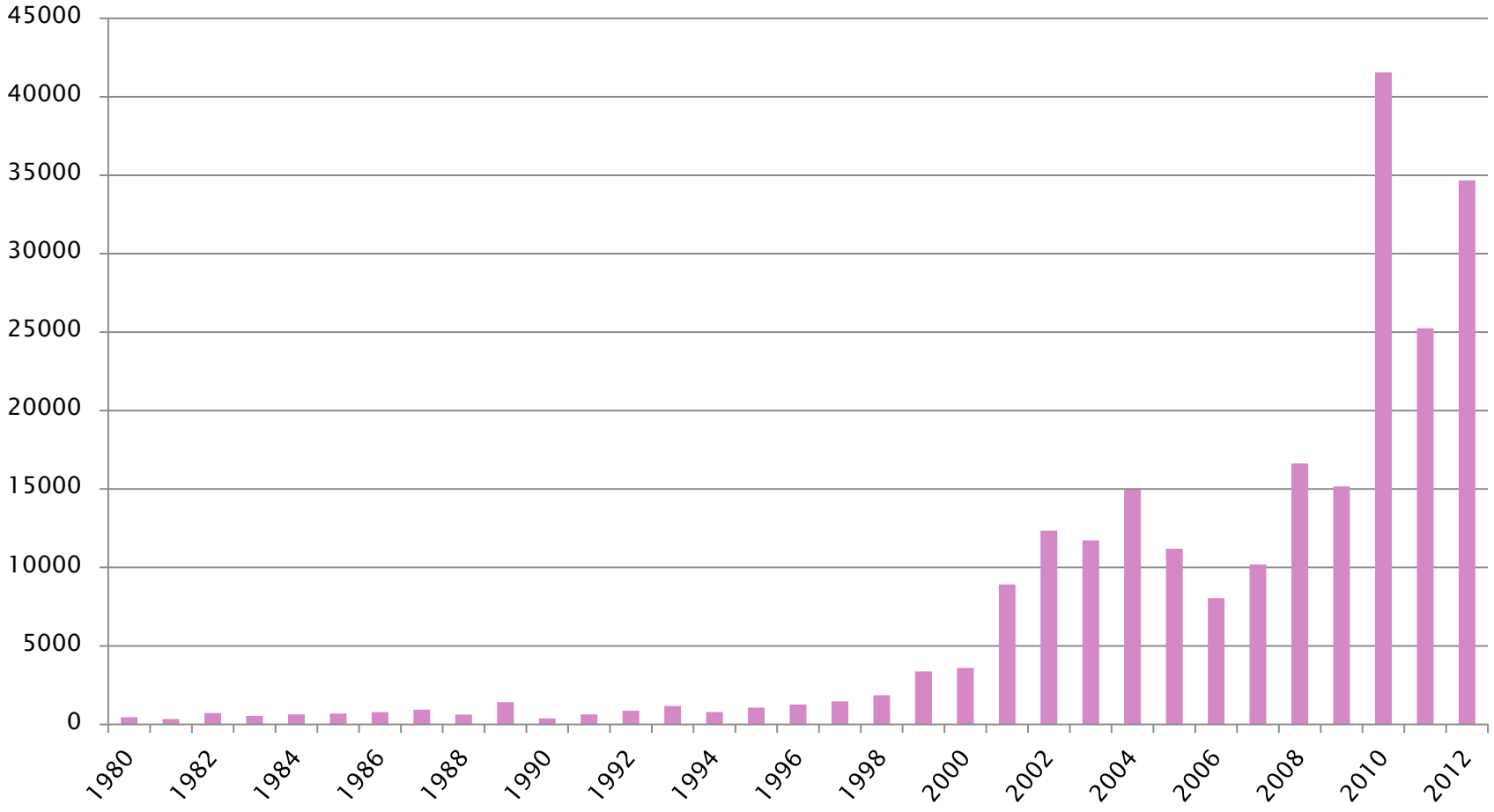
Bonneville Dam Counts of Bright Jack Fall Chinook



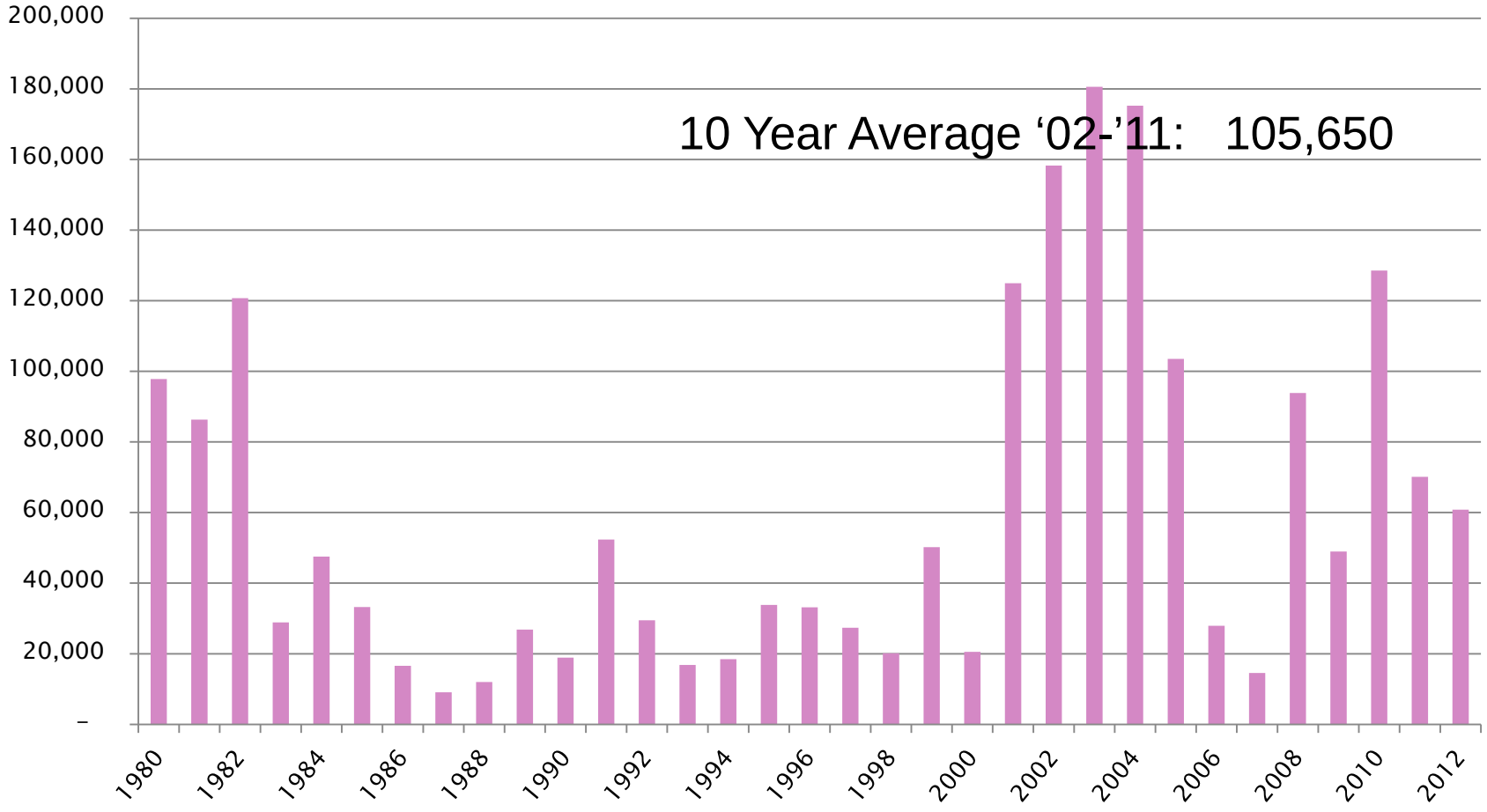
Upriver Bright Adult & Jack Fall Chinook Stock Returns To Bonneville Dam



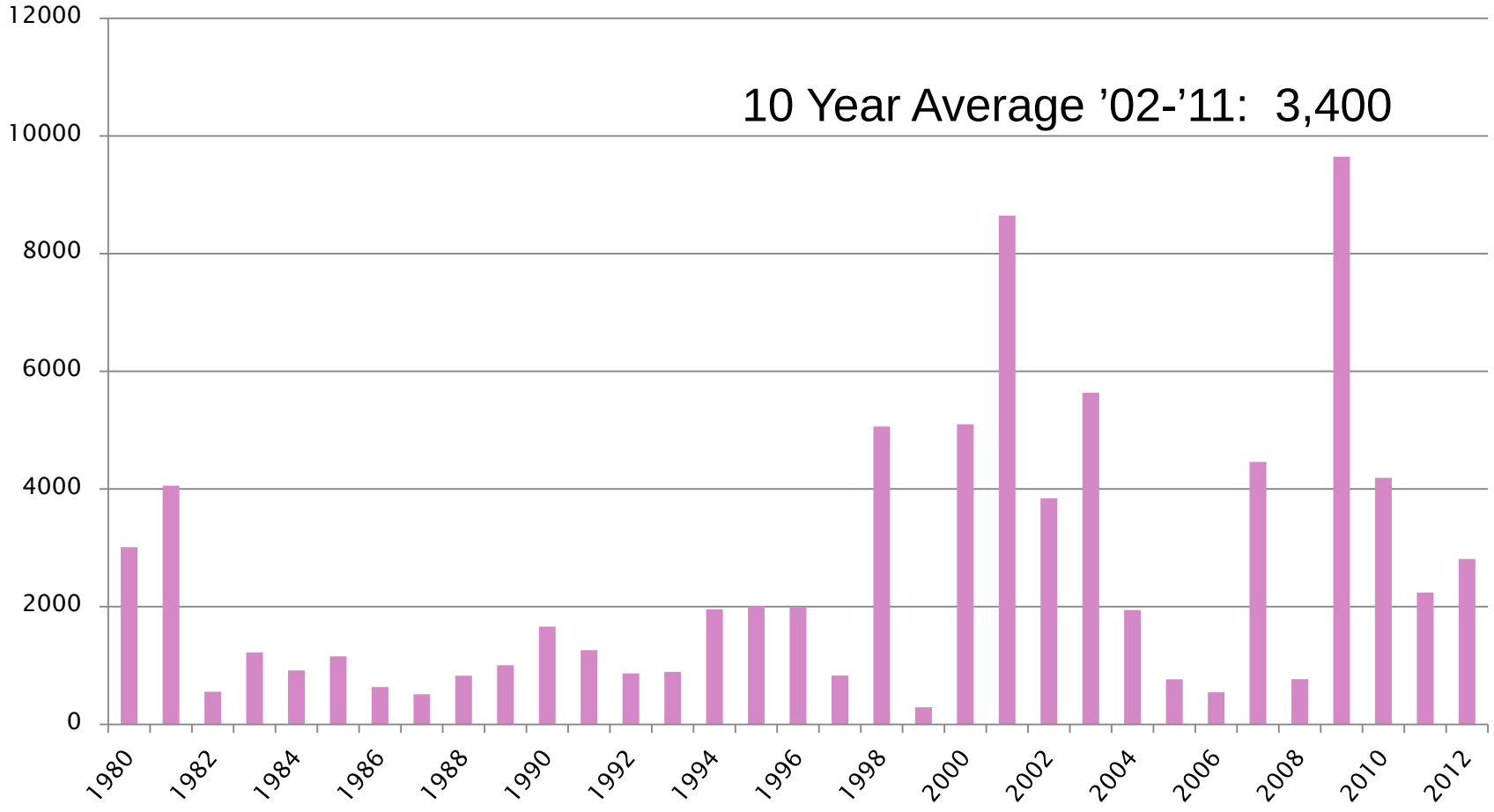
Lower Granite Dam Counts of Adult Fall Chinook



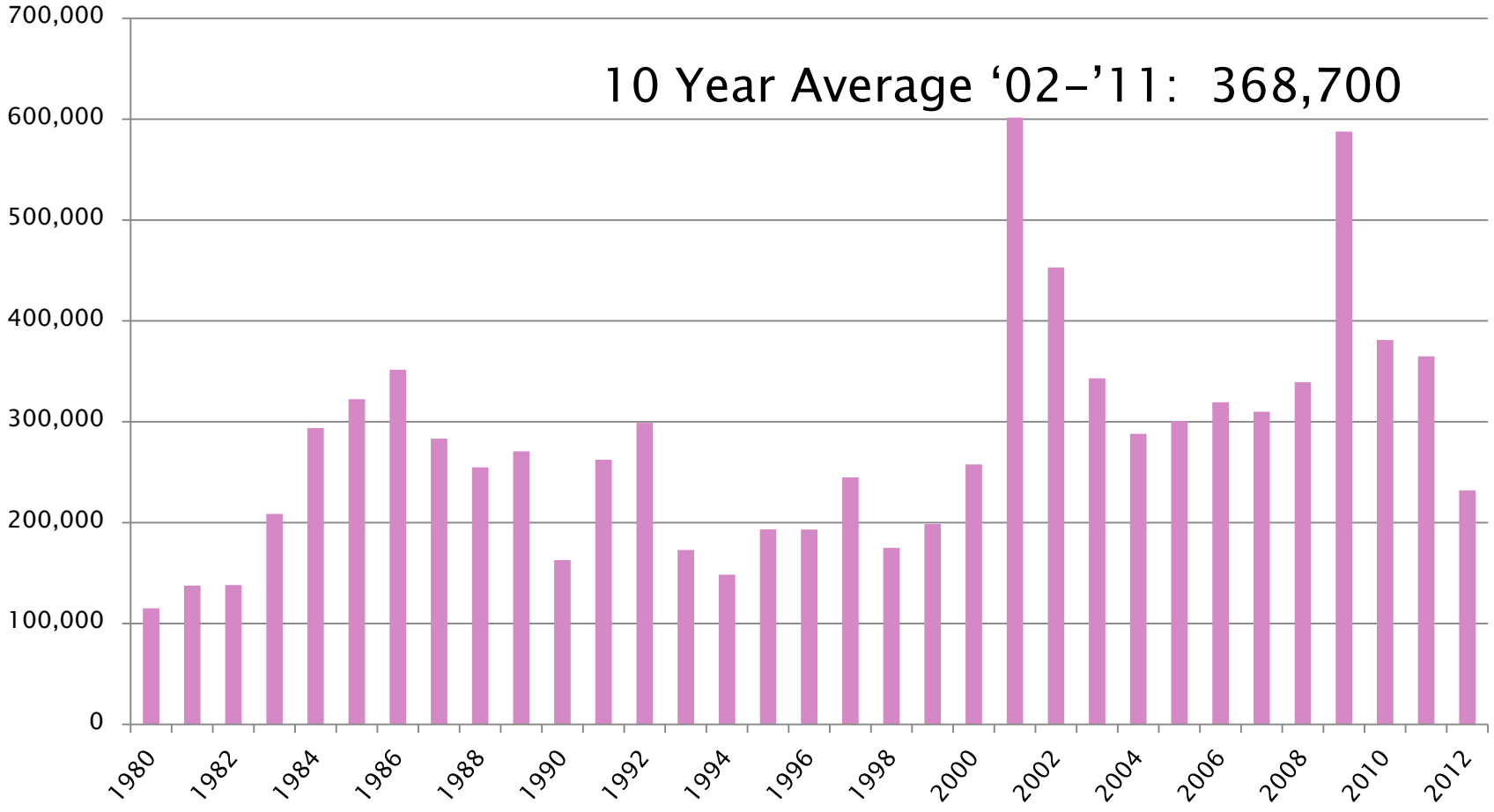
Bonneville Pool Hatchery Adult Fall Chinook Returns to Bonneville Dam



Bonneville Dam Counts of Tule Jack Fall Chinook (Spring Creek Hatchery)

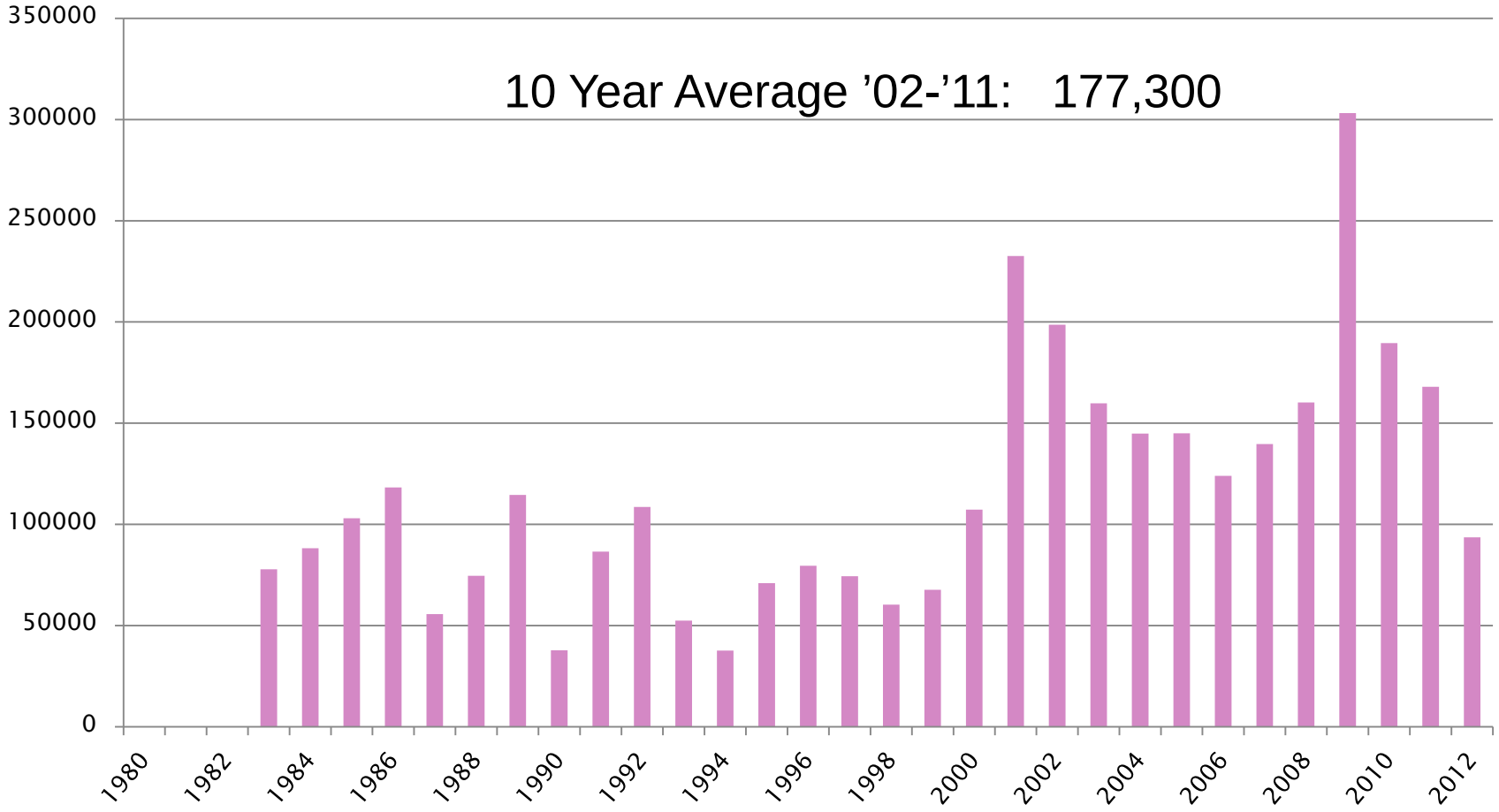


Bonneville Dam Counts of Summer Steelhead

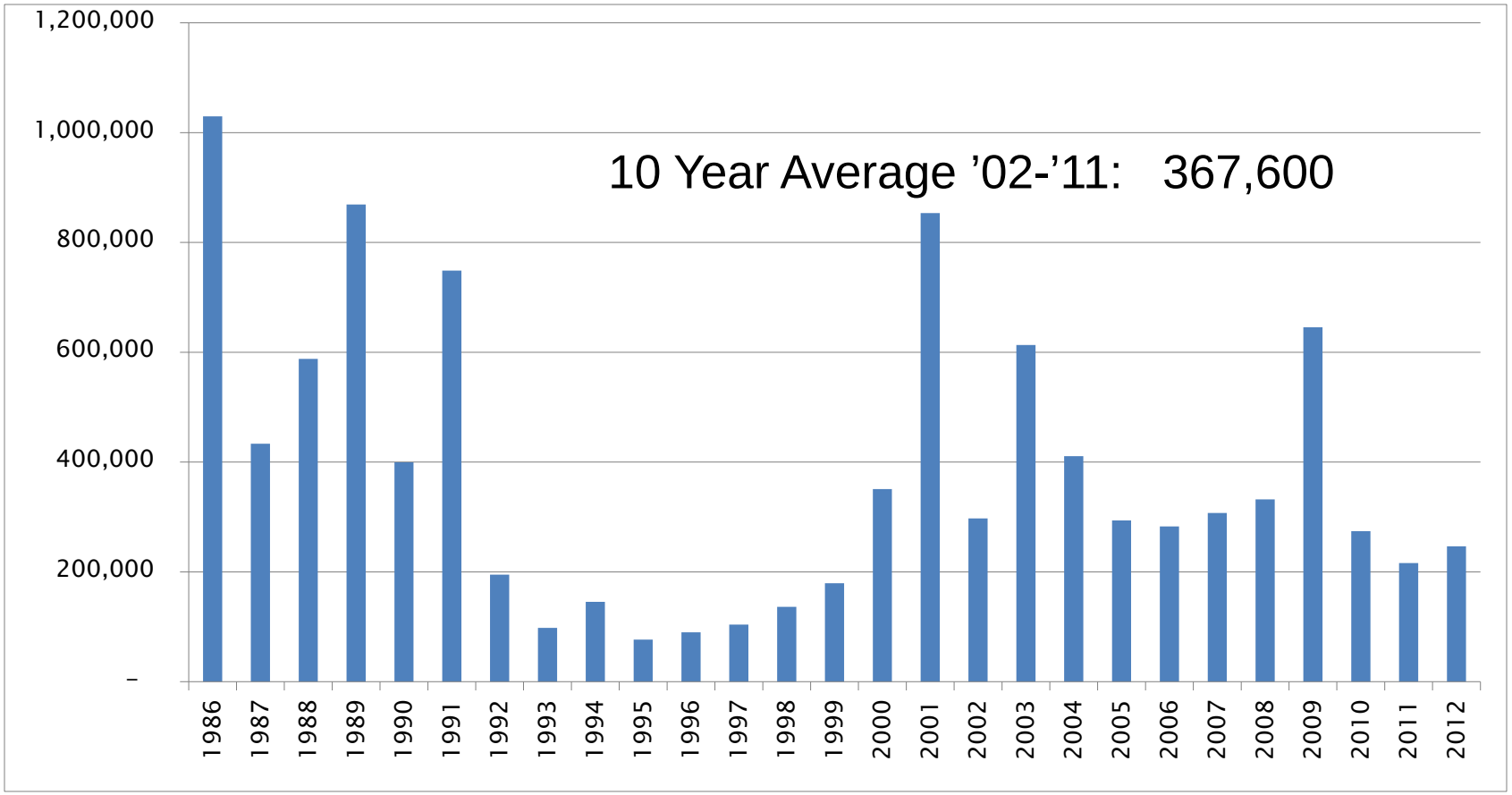


Lower Granite Dam Counts of Summer Steelhead

June 1 – November 5



Early Coho Run Returns
Mid-Aug to Early October



Questions?


Cascade Locks 9-8-1929
image courtesy of Portland District
US Army Corps Of Engineers

2012 Smolt Monitoring Program

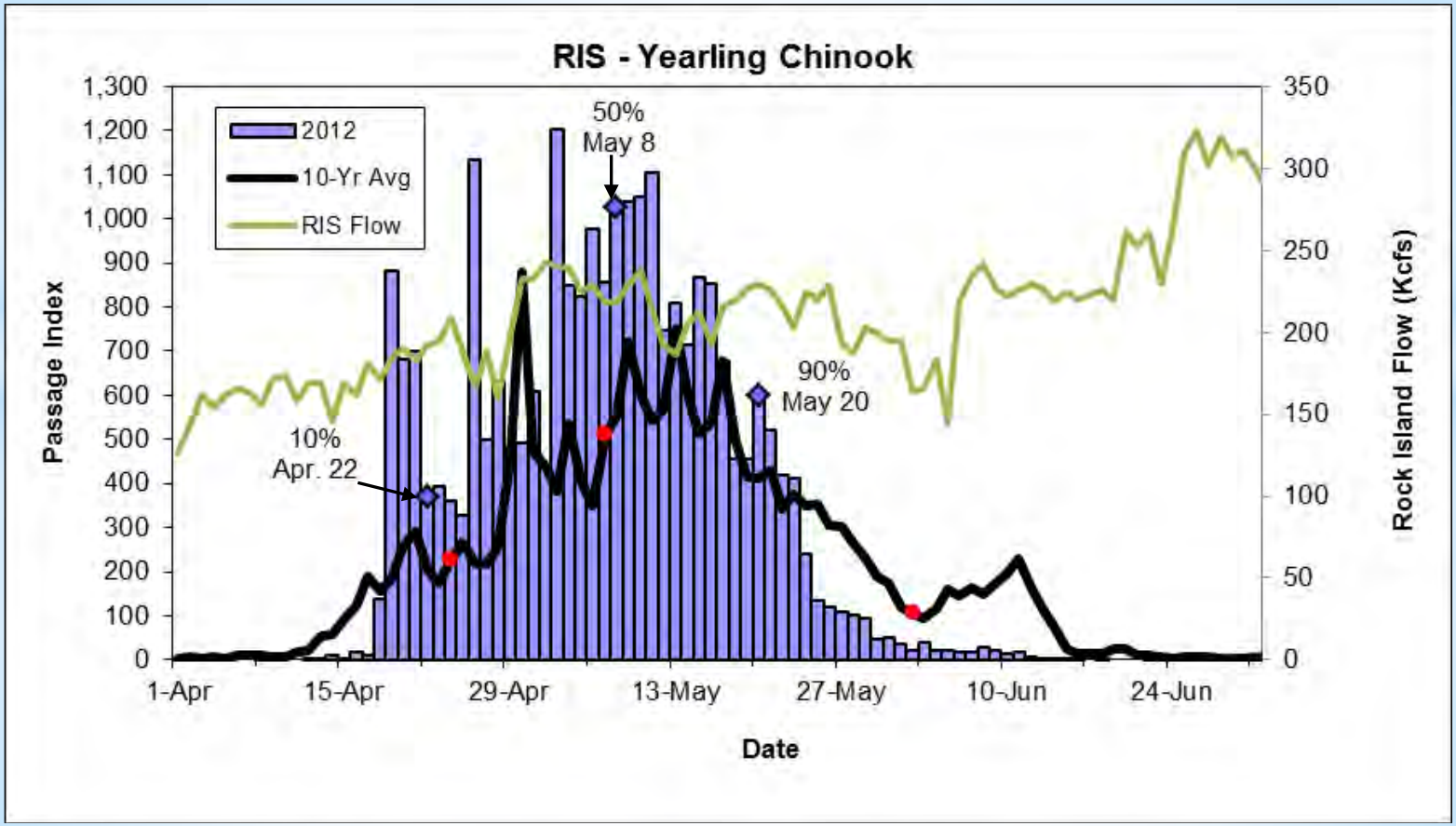
Juvenile Passage Data and Noteworthy Events

2012 TMT Year-end Review

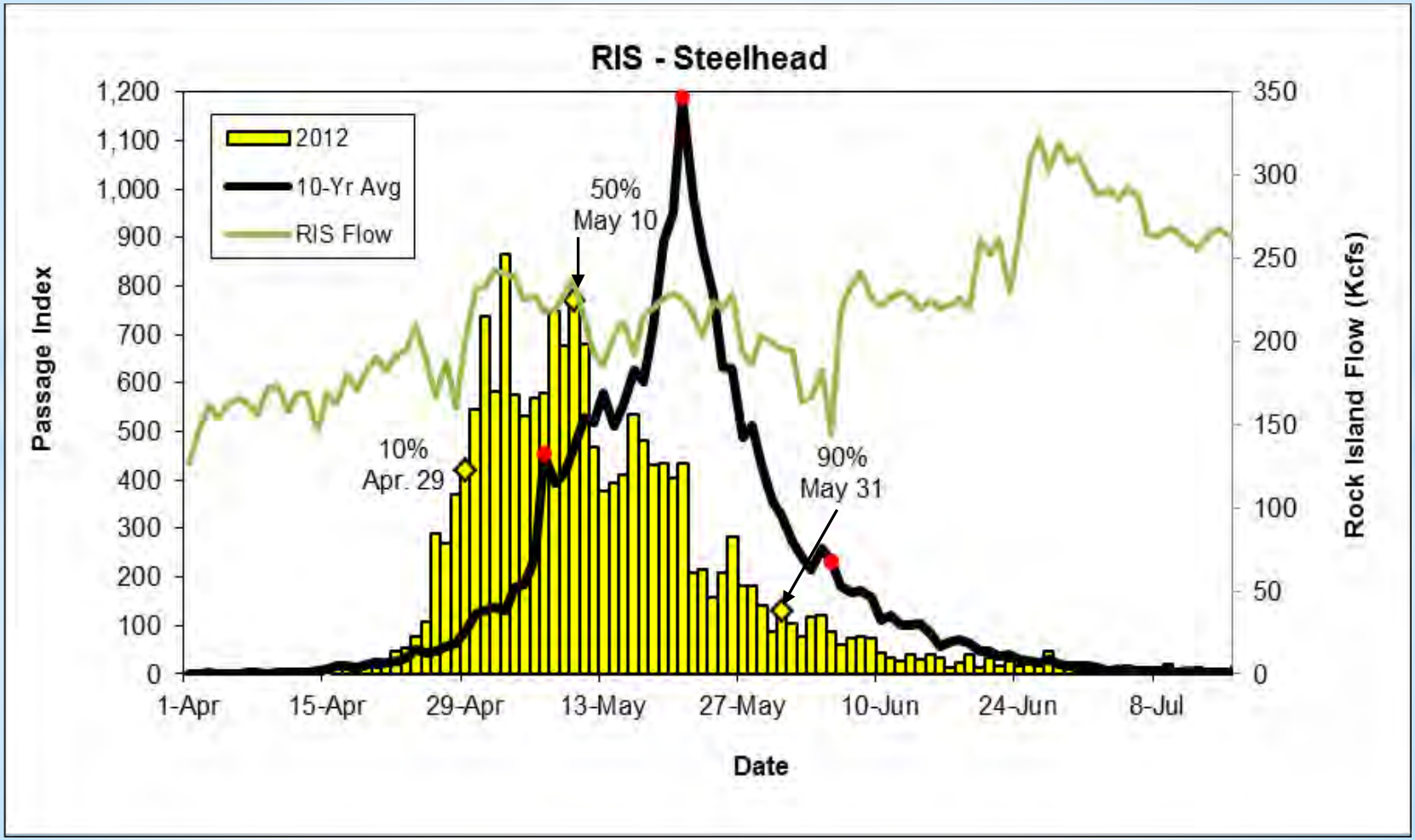
Dec. 5, 2012

Brandon R. Chockley
Fish Passage Center

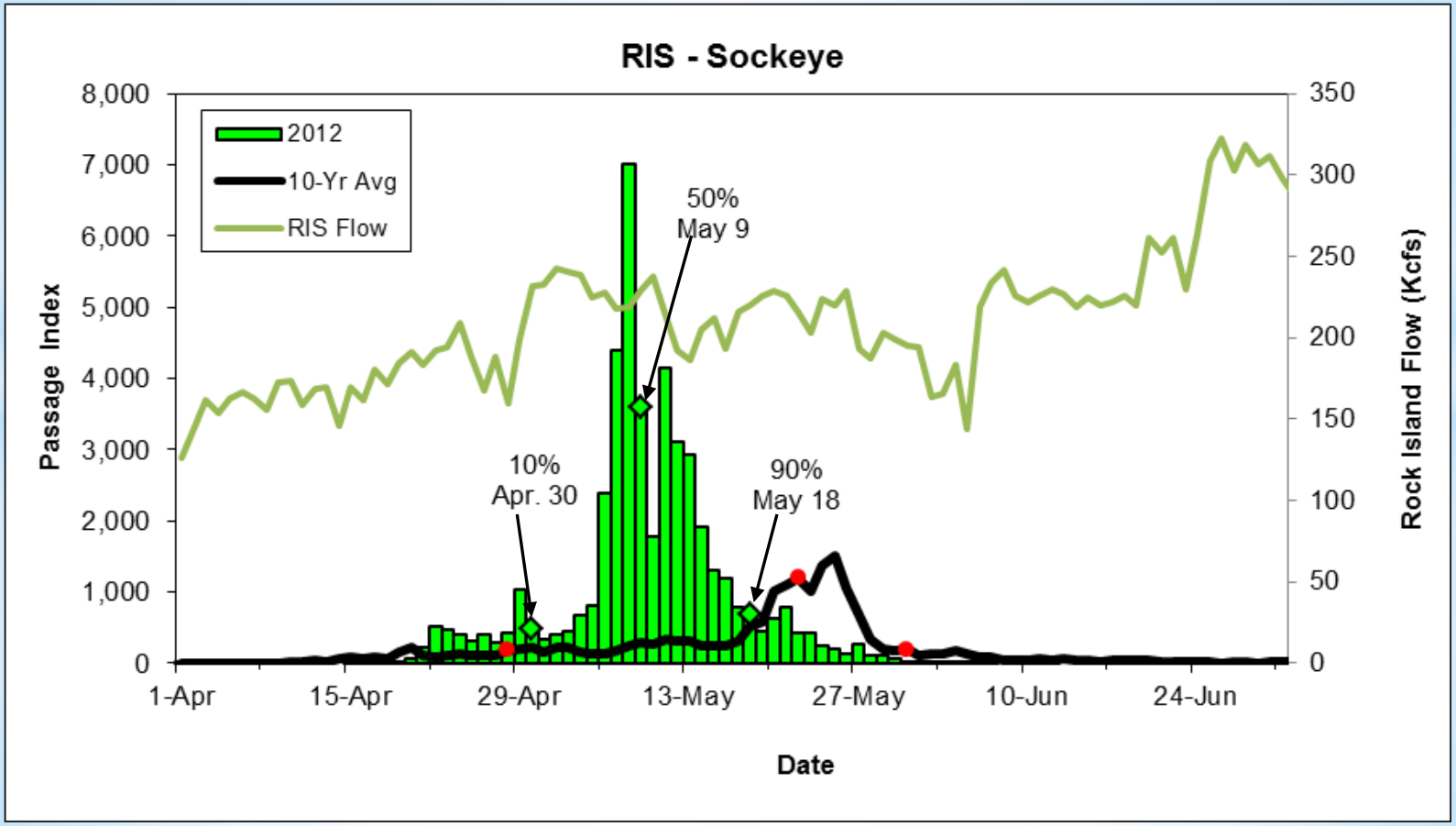
Rock Island Dam
Yearling Chinook



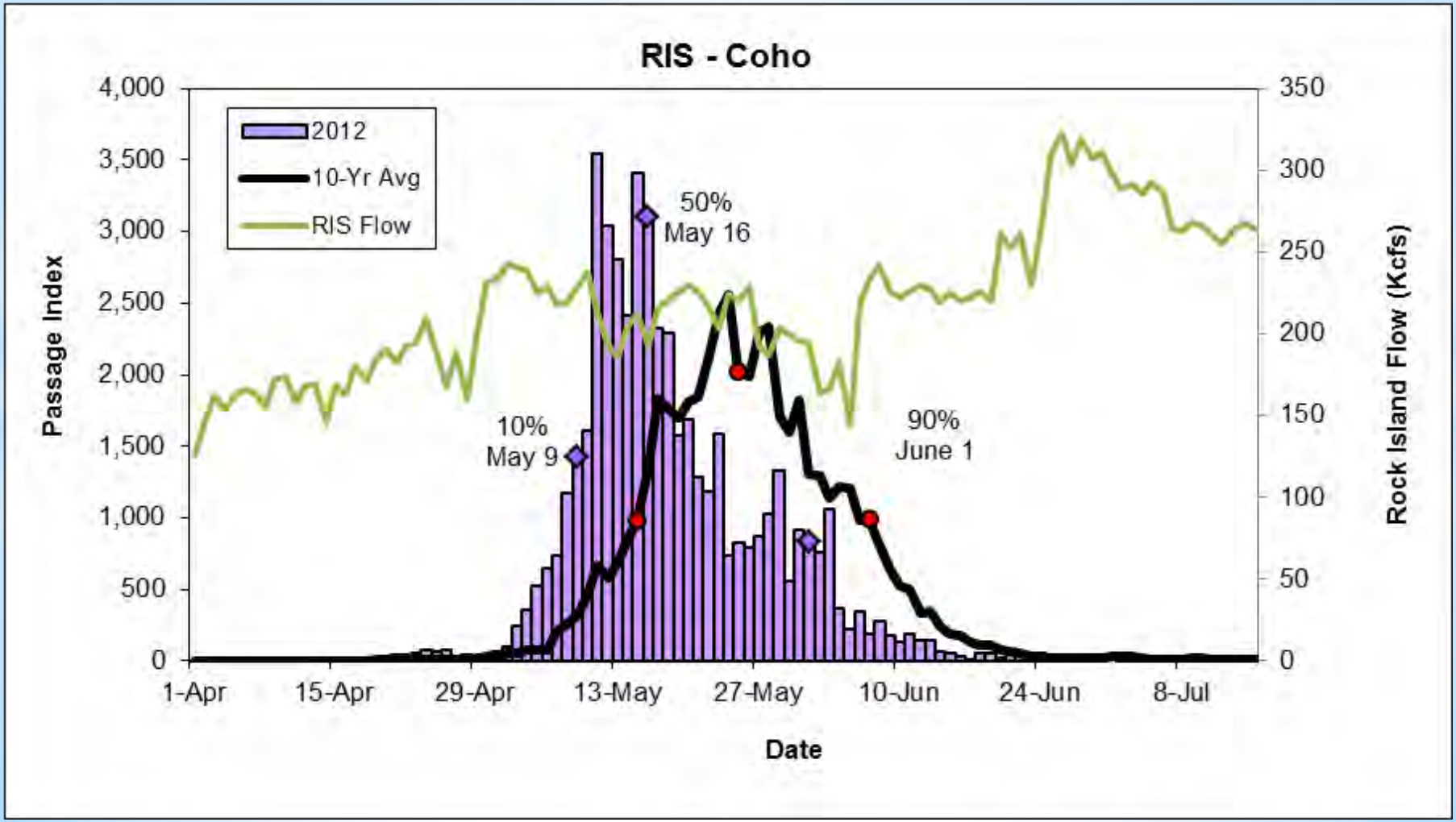
Rock Island Dam
Steelhead



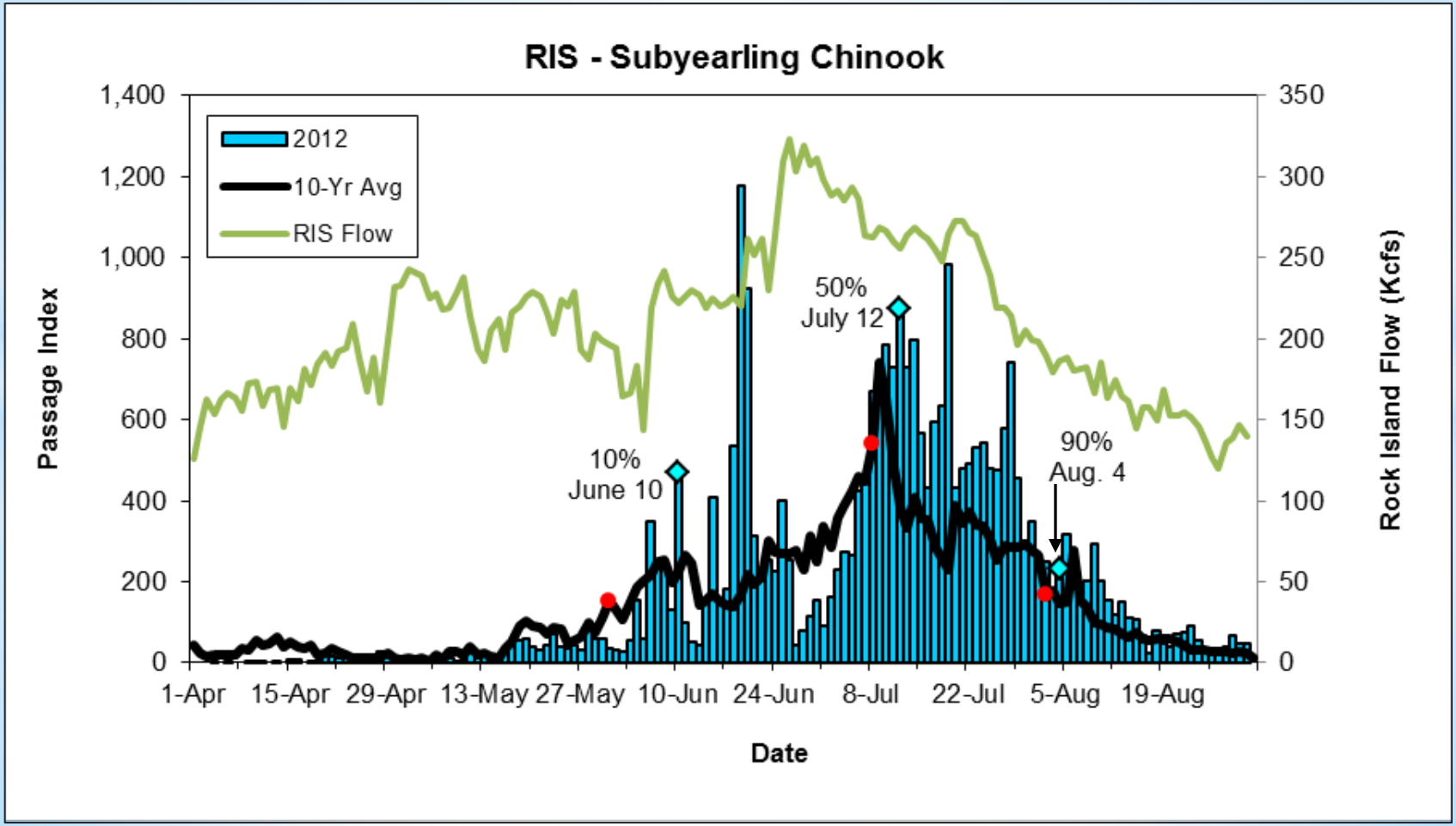
Rock Island Dam
Sockeye



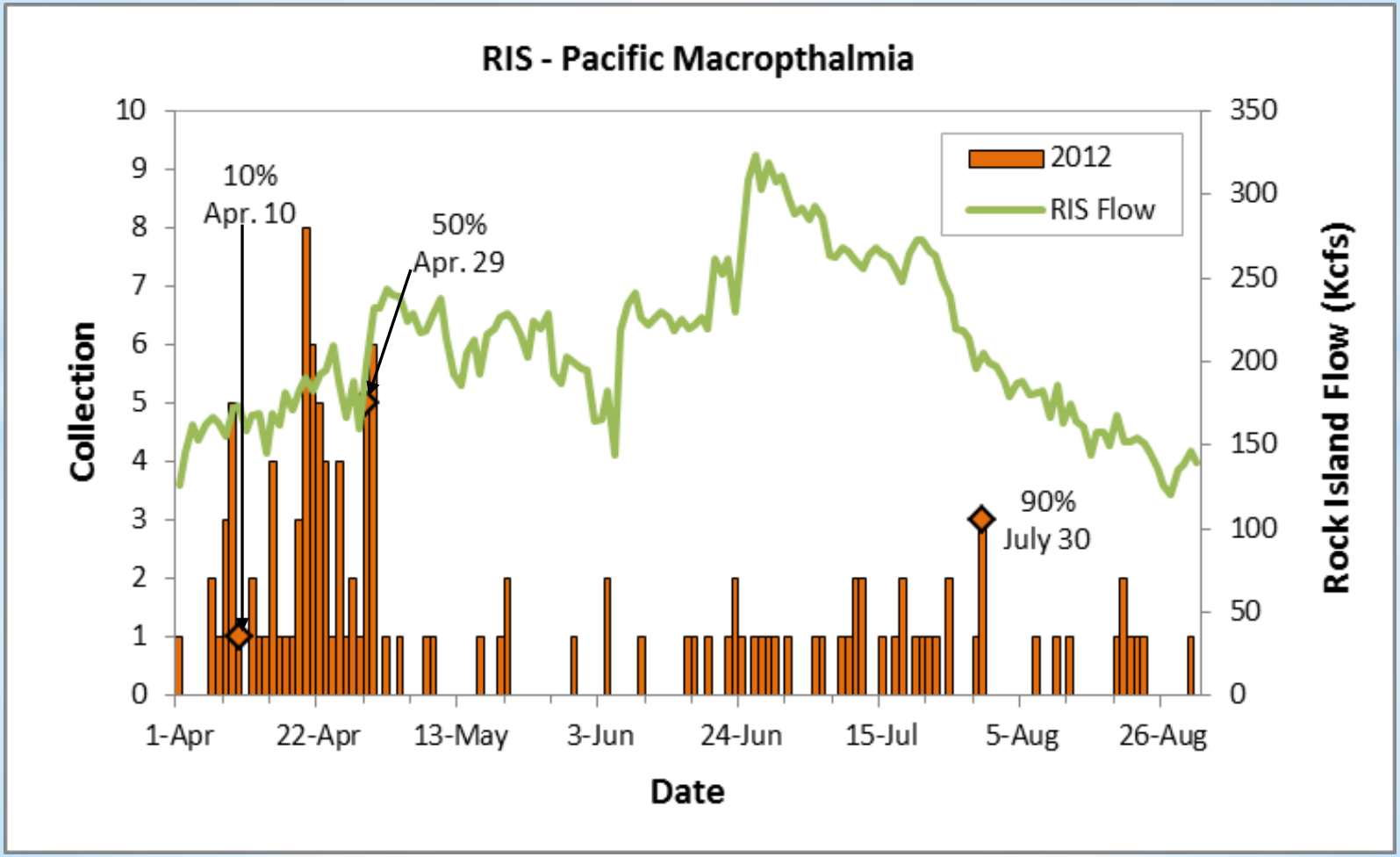
Rock Island Dam
Coho



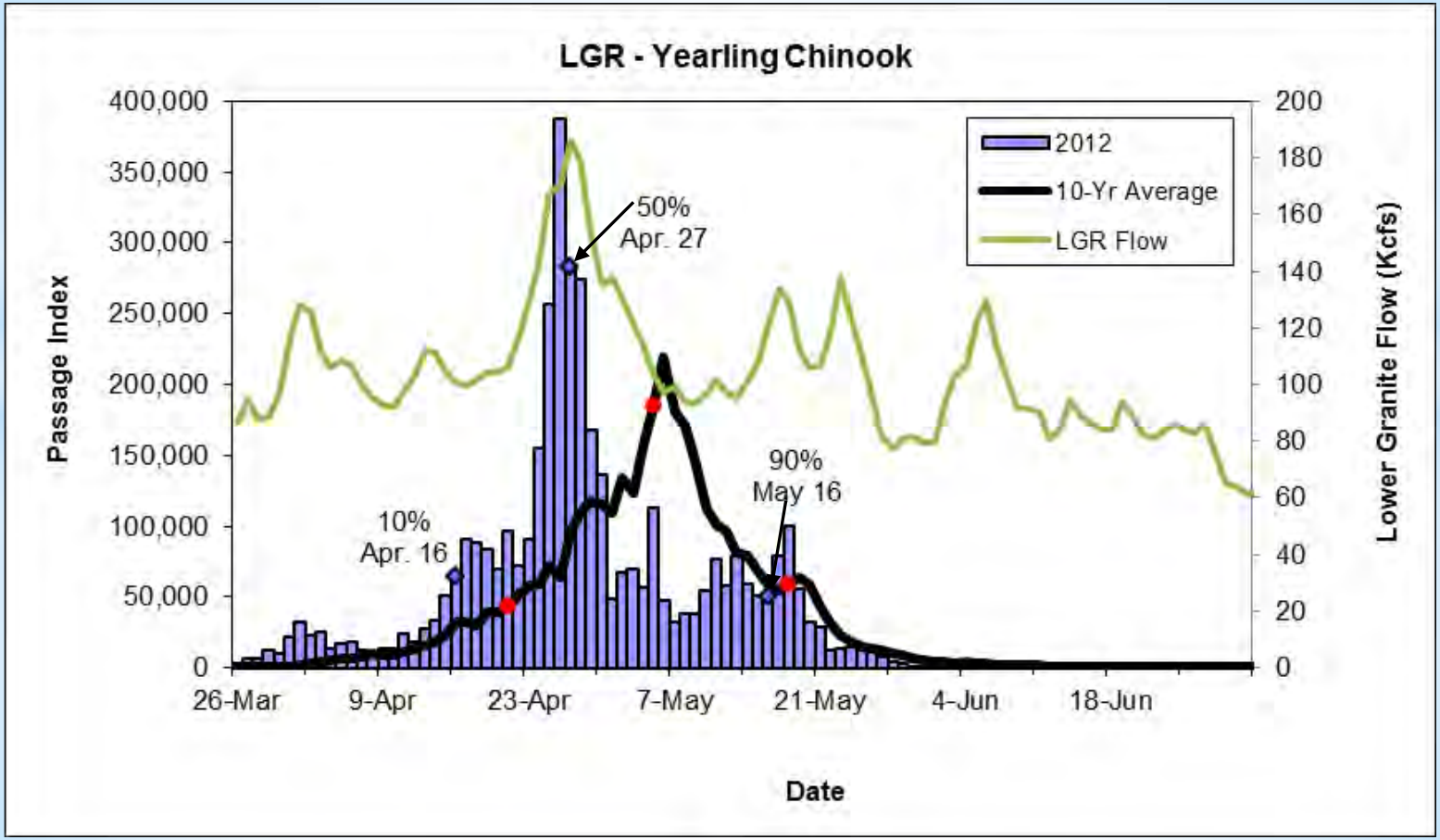
Rock Island Dam
Subyearling Chinook



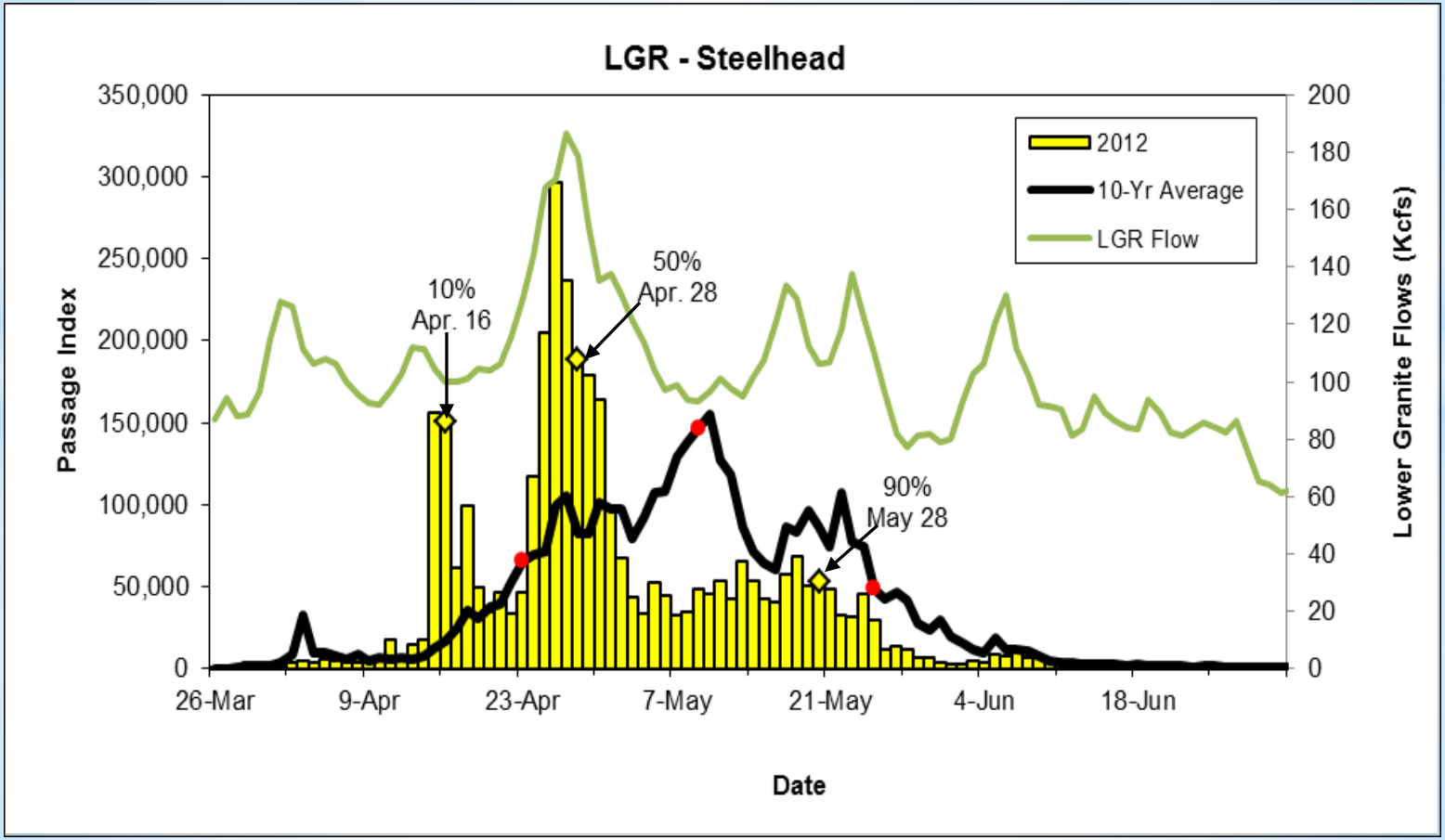
Rock Island Dam
Lamprey Juveniles



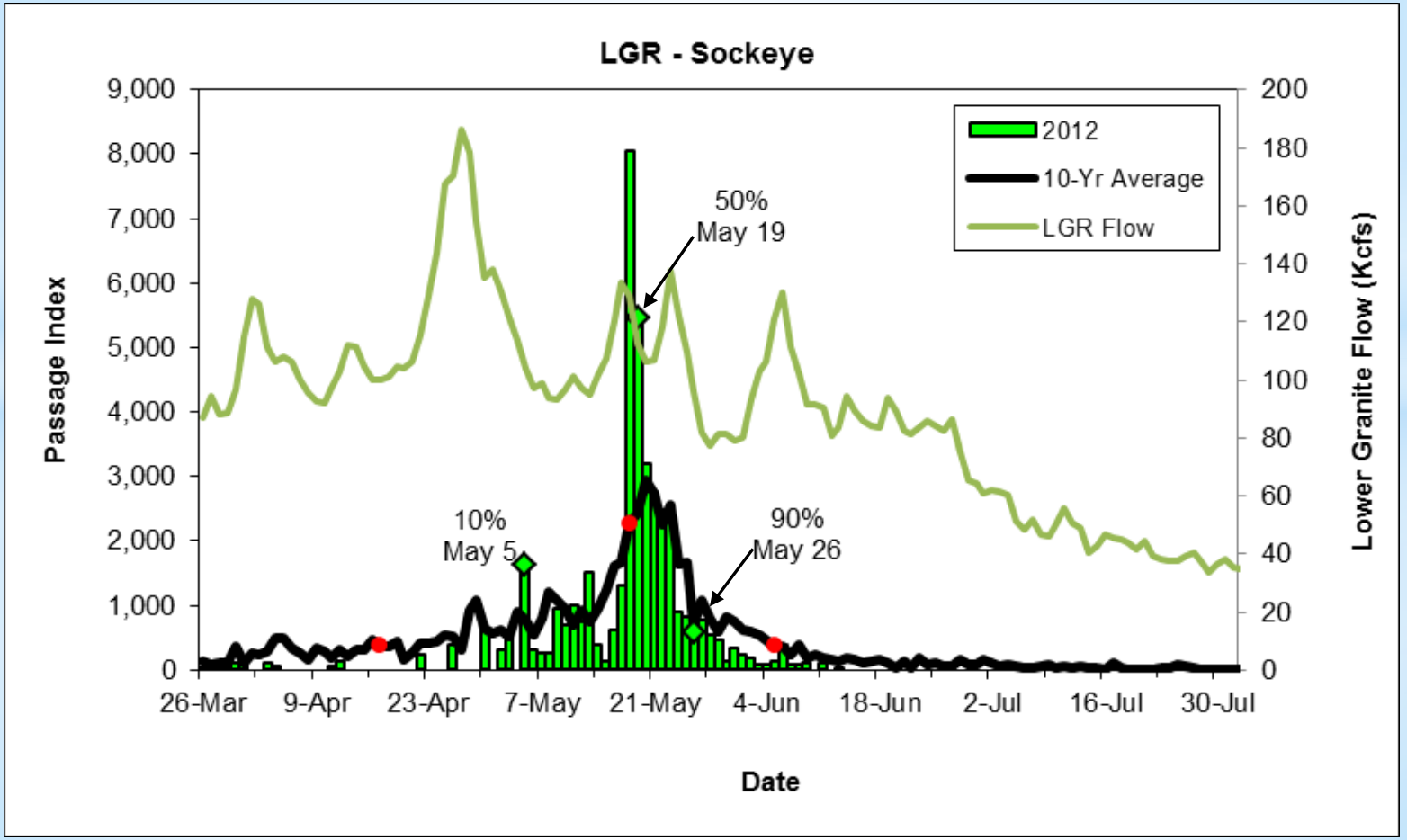
Lower Granite Dam
Yearling Chinook



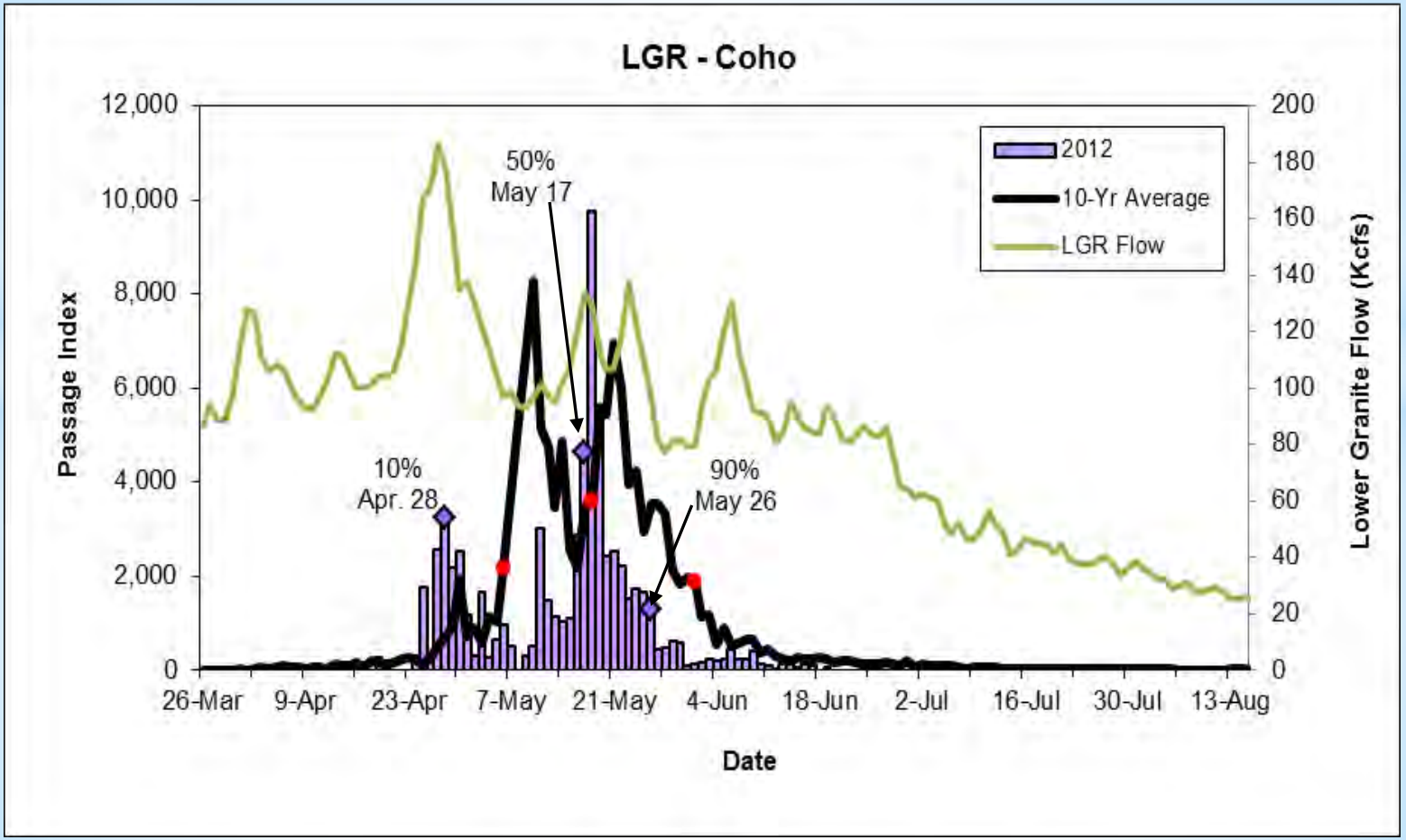
Lower Granite Dam
Steelhead



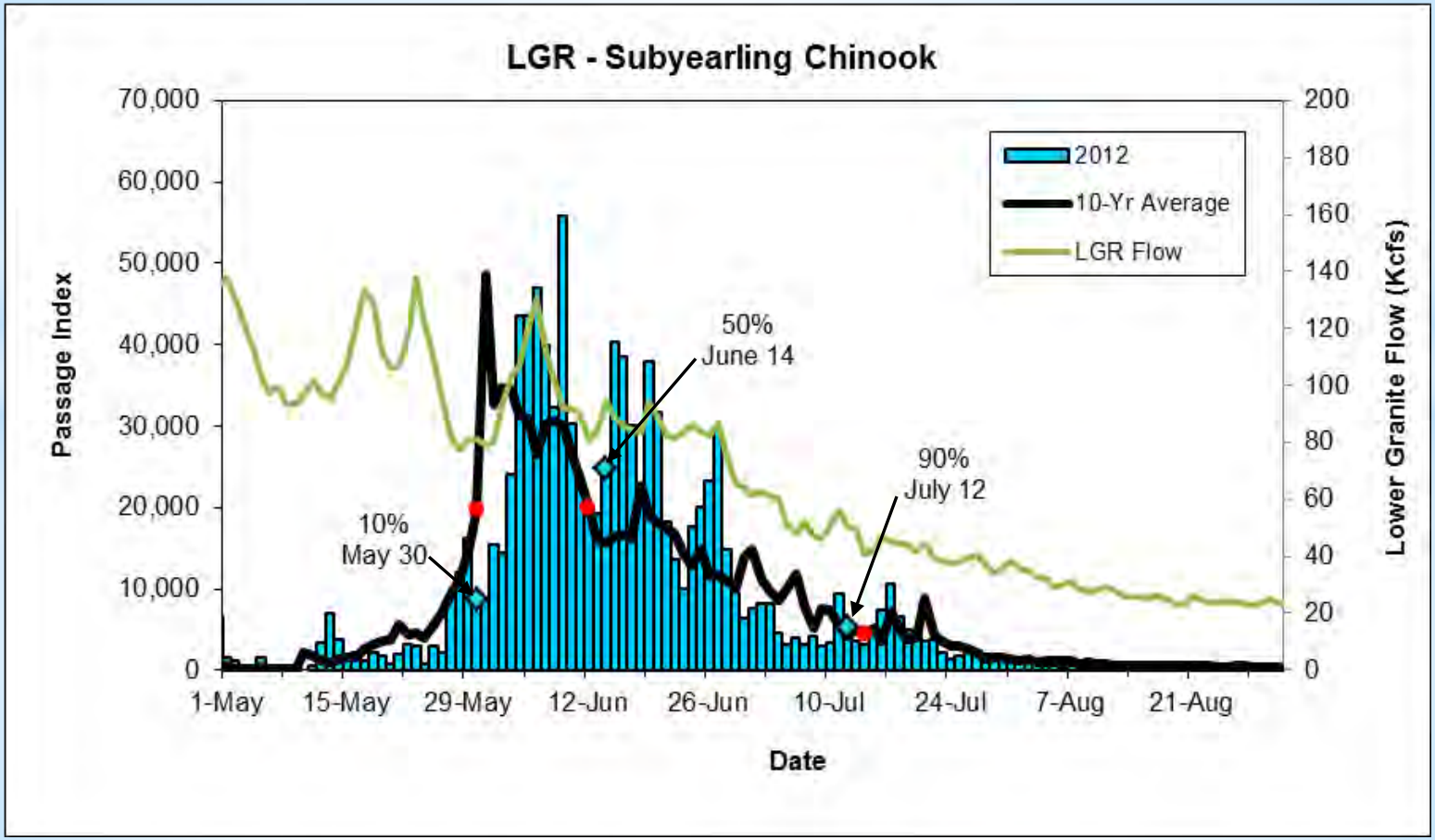
Lower Granite Dam
Sockeye



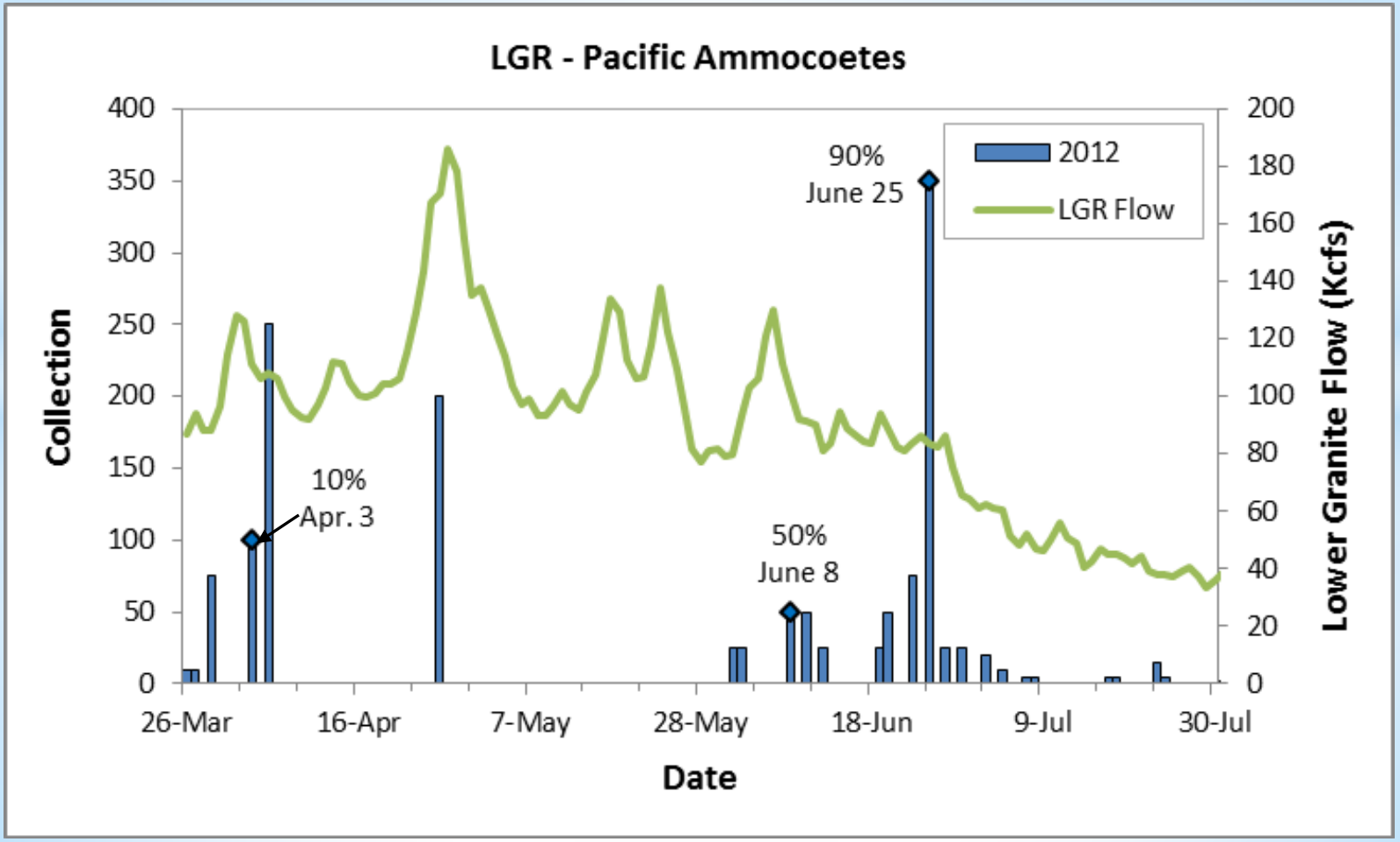
Lower Granite Dam
Coho



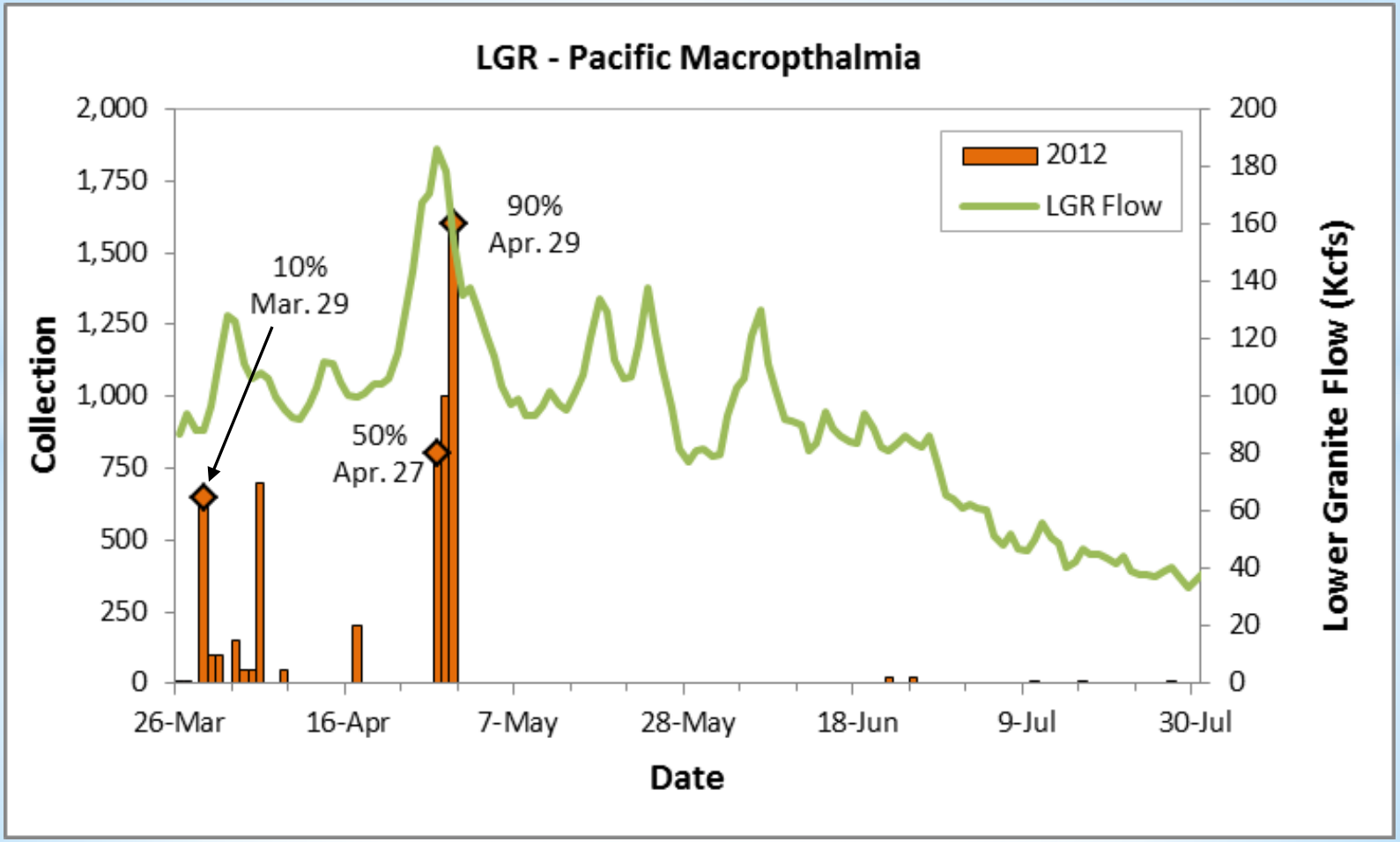
Lower Granite Dam
Subyearling Chinook



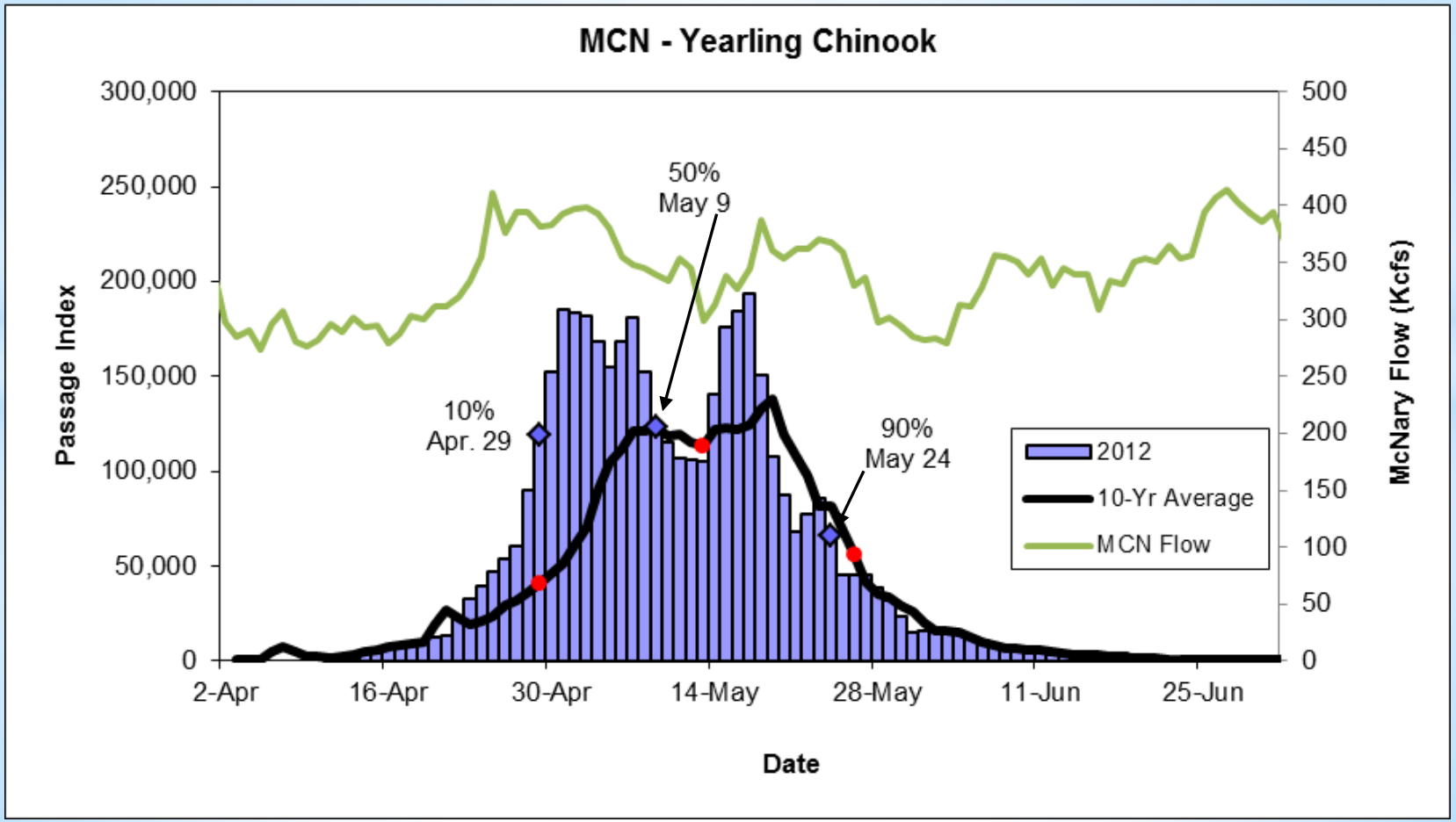
Lower Granite Dam
Lamprey Juveniles



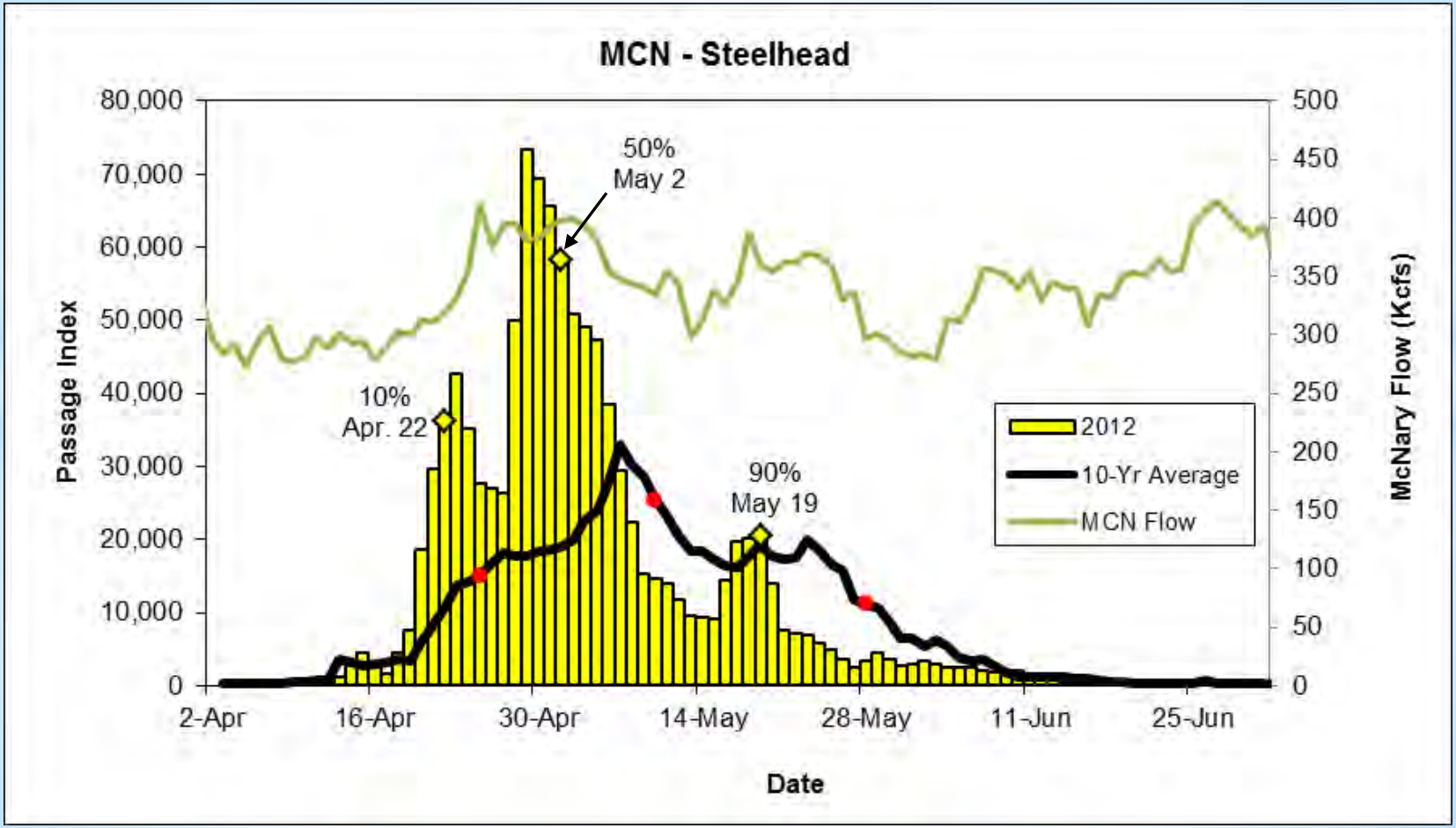
Lower Granite Dam
Lamprey Juveniles



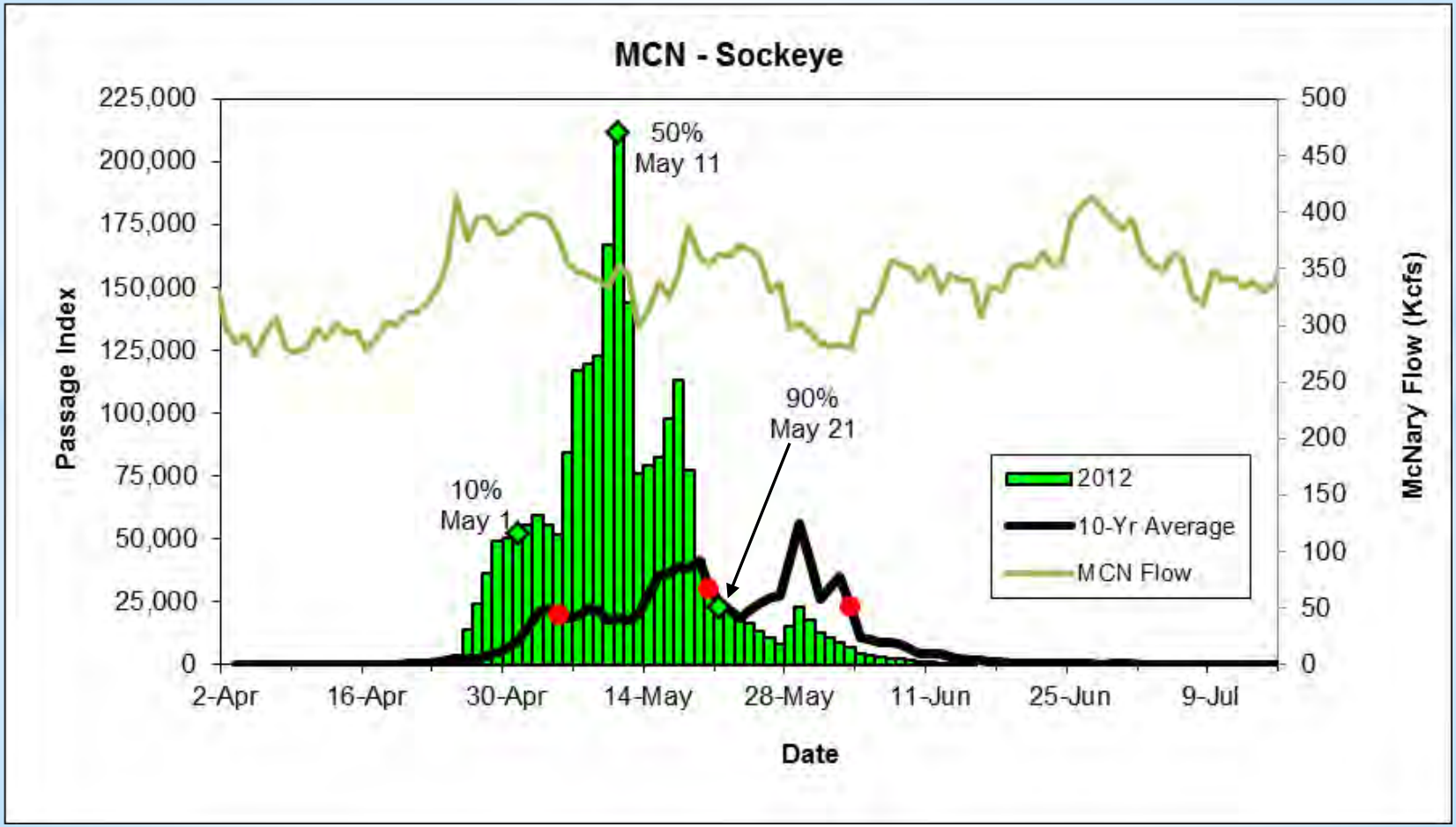
McNary Dam
Yearling Chinook



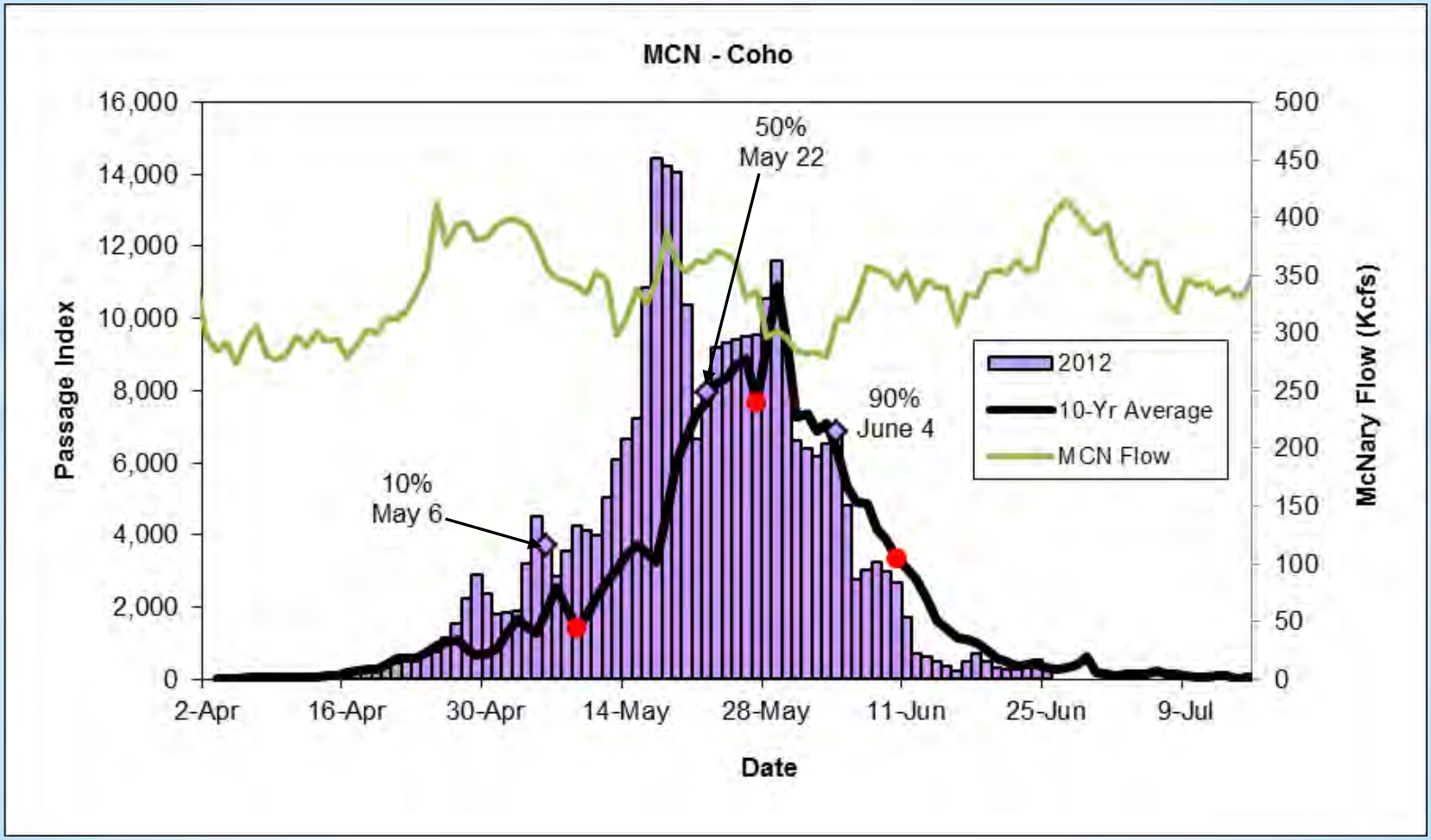
McNary Dam
Steelhead



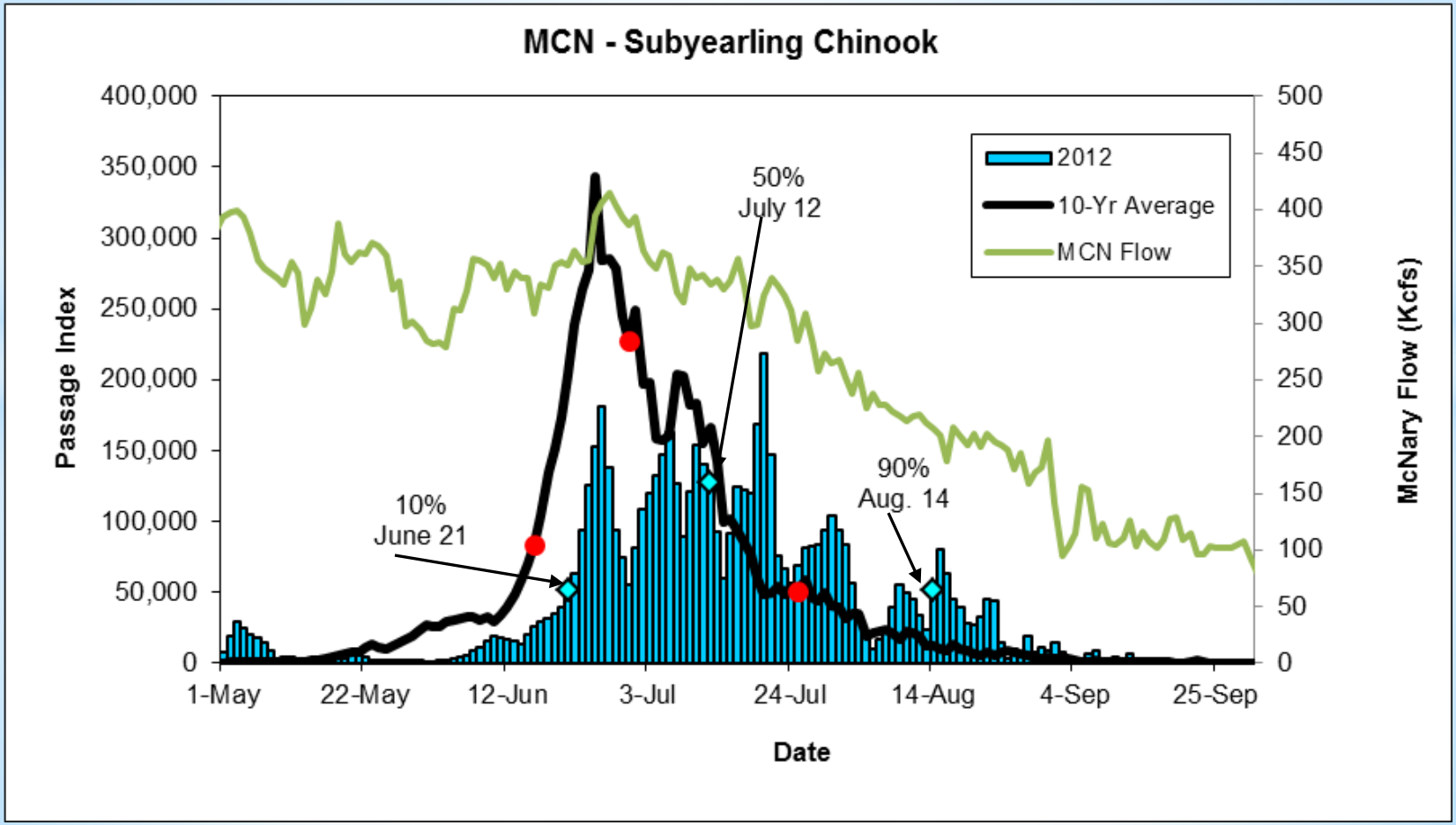
McNary Dam
Sockeye



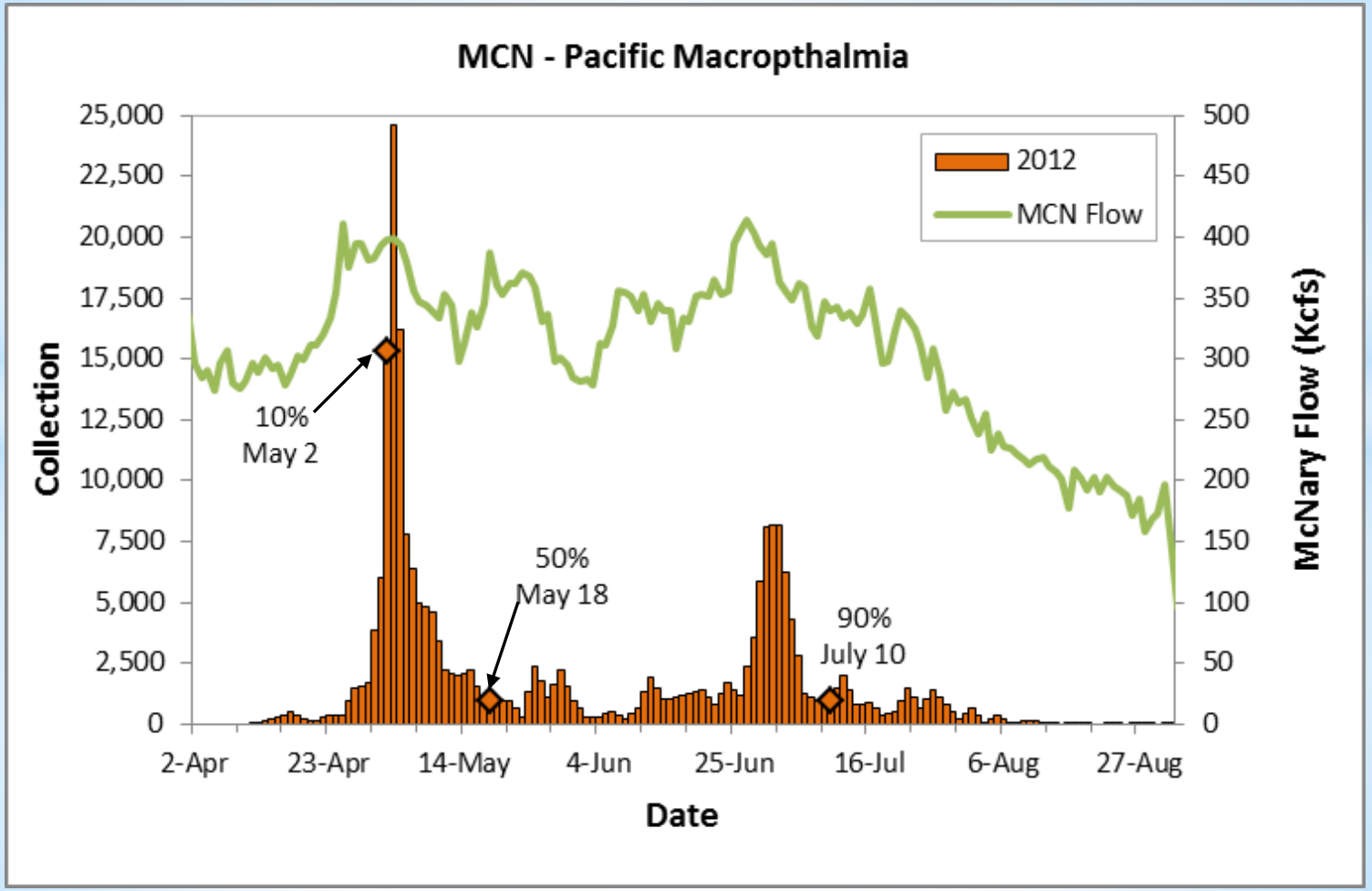
McNary Dam
Coho



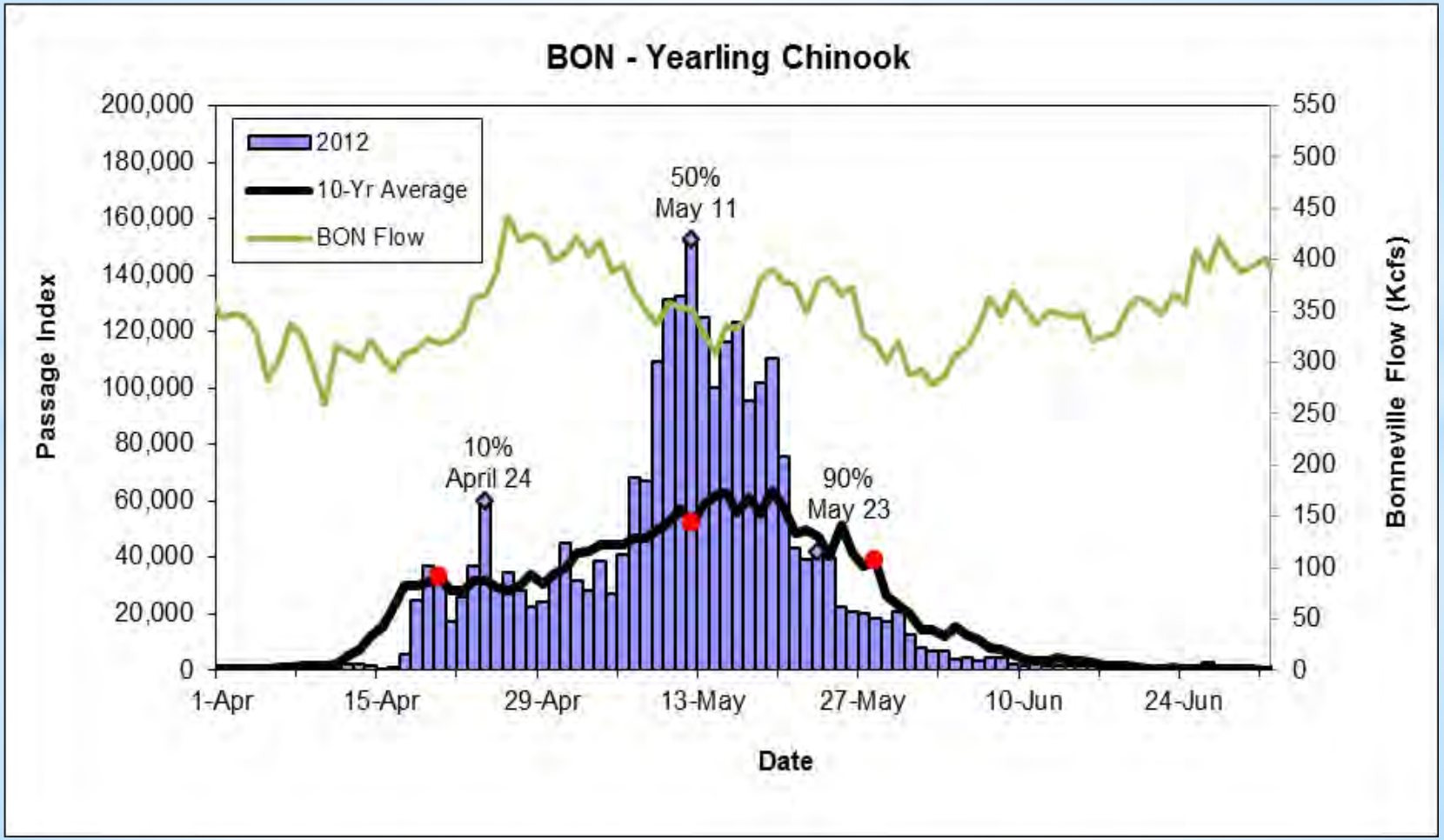
McNary Dam
Subyearling Chinook



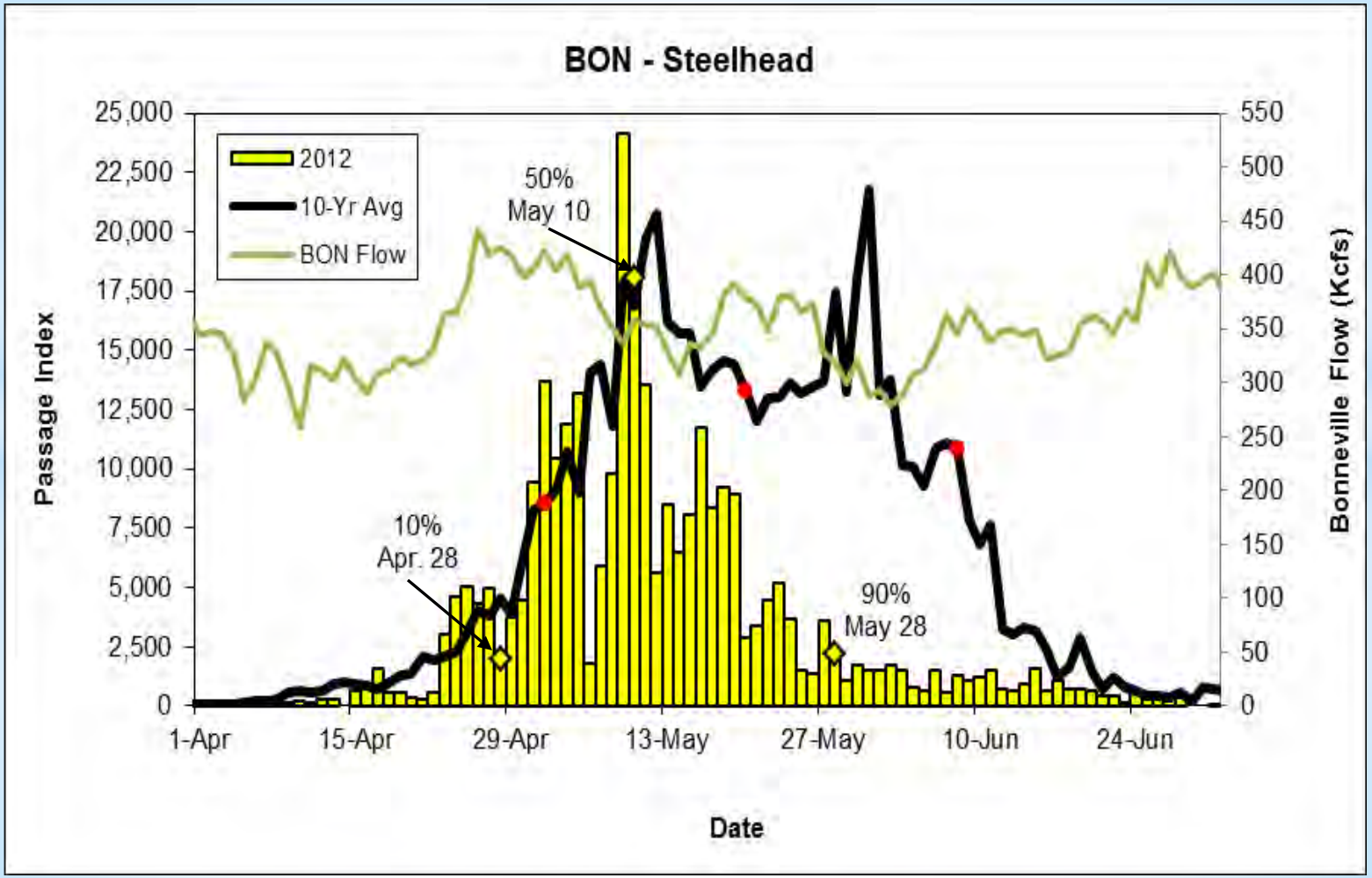
McNary Dam
Lamprey Juveniles



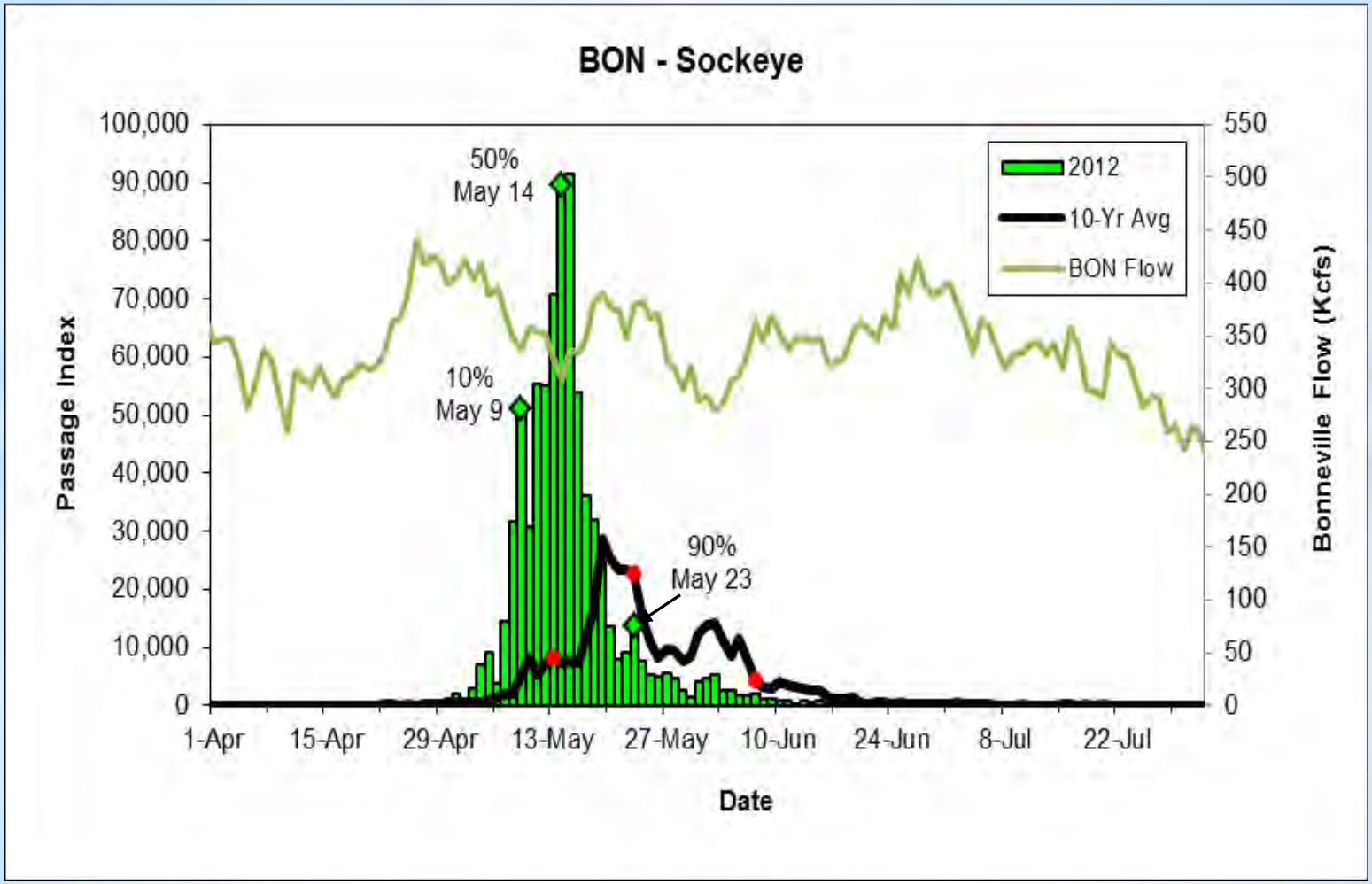
Bonneville Dam
Yearling Chinook



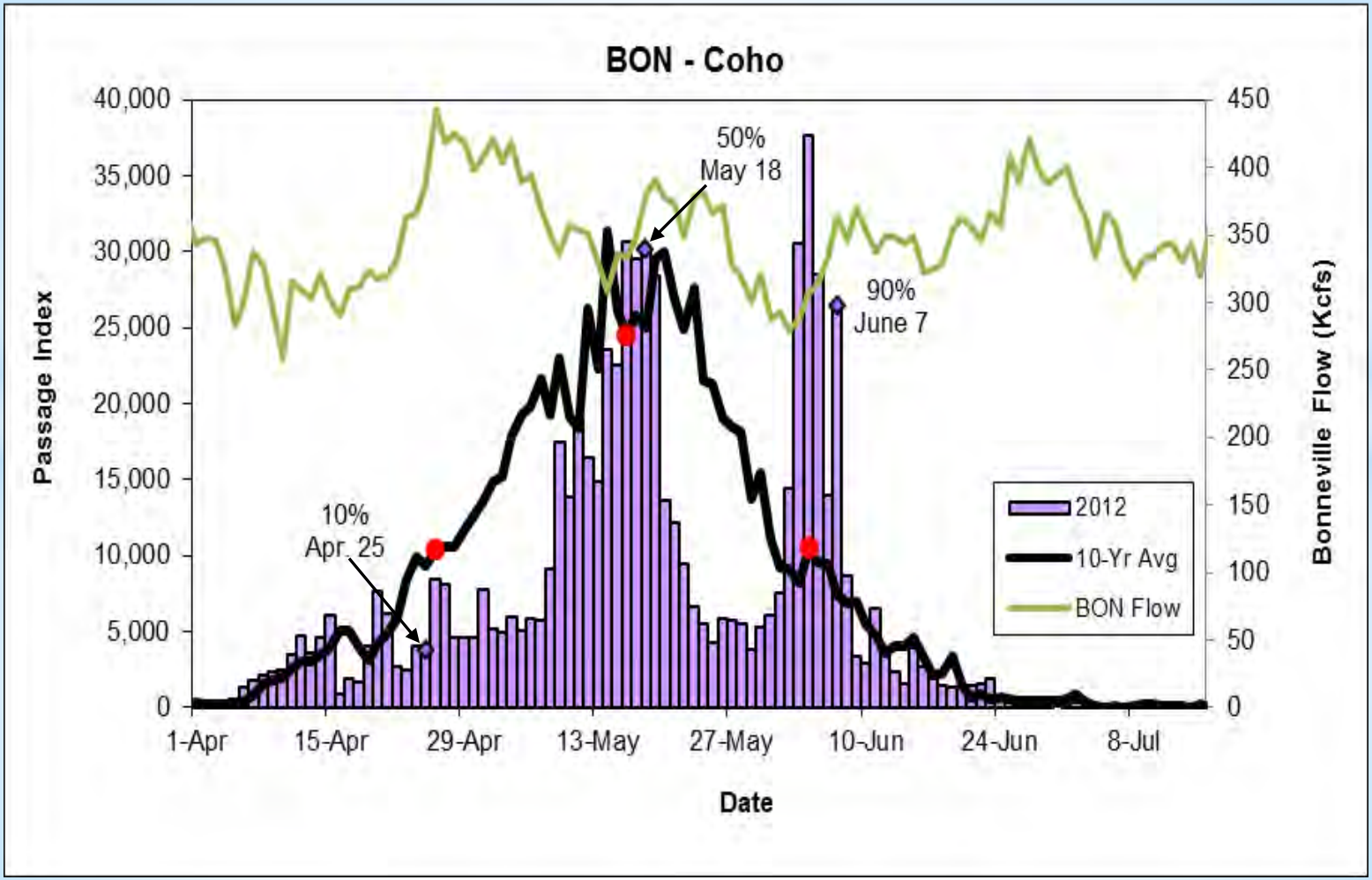
Bonneville Dam
Steelhead



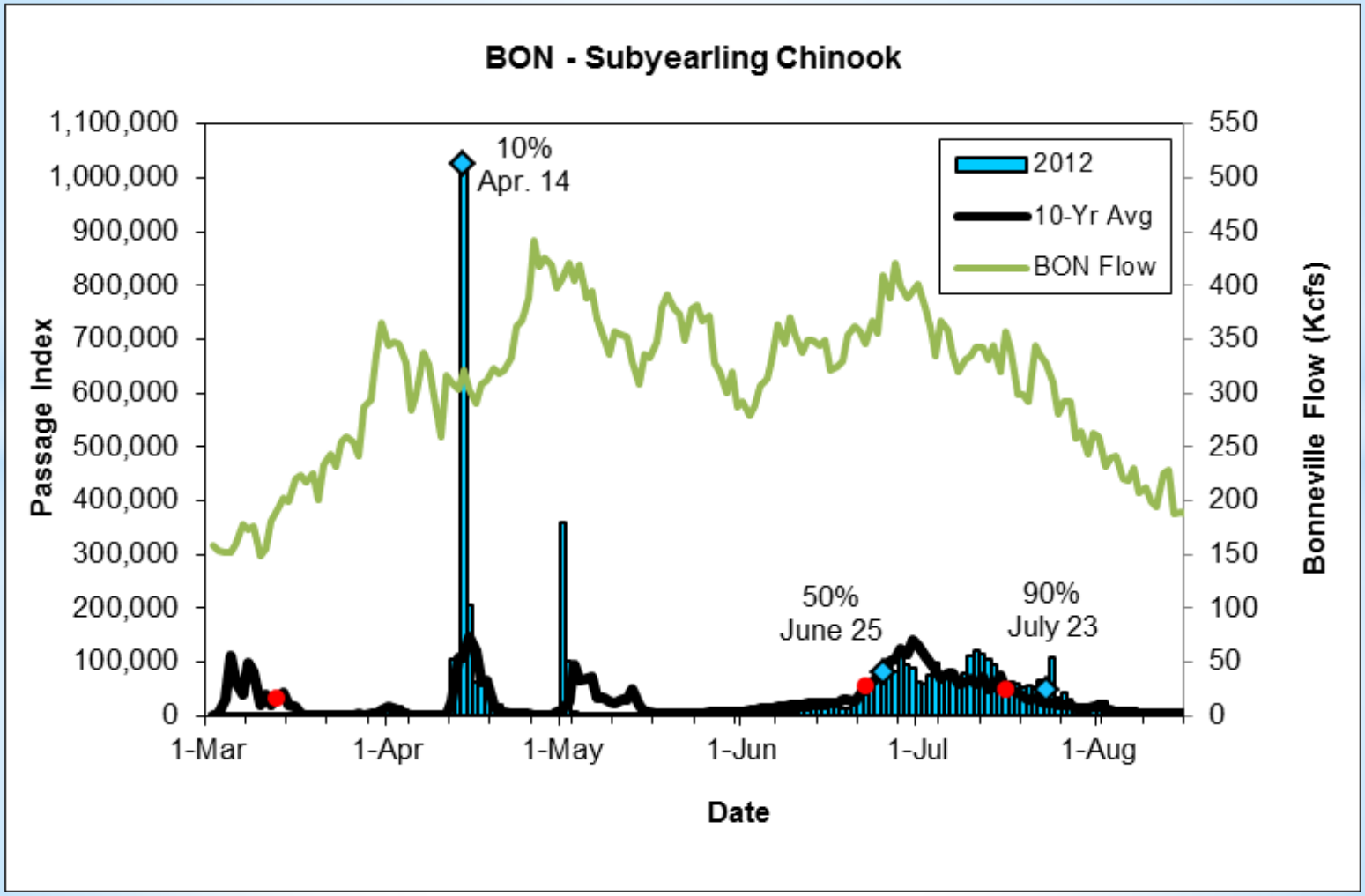
Bonneville Dam
Sockeye



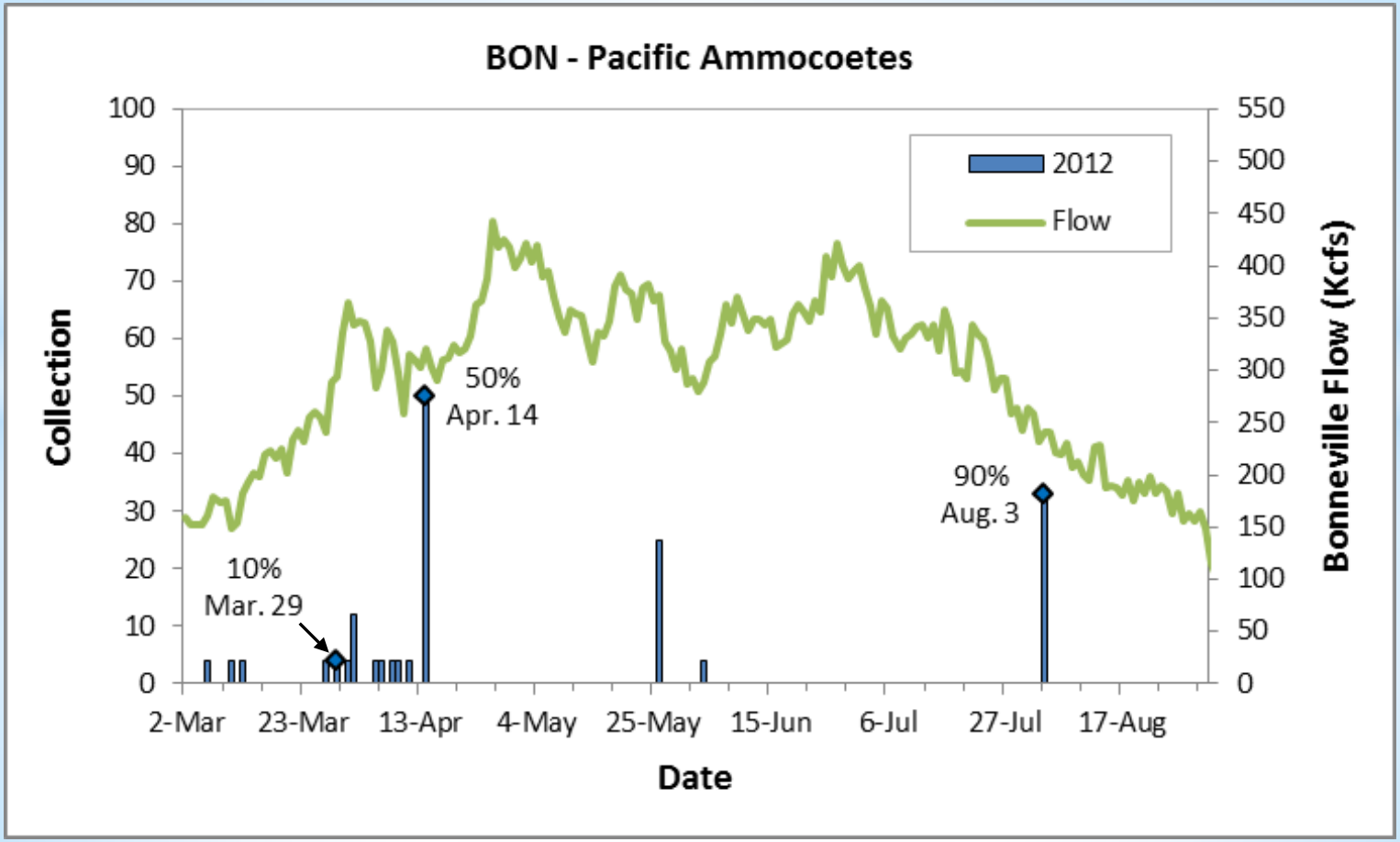
Bonneville Dam
Coho



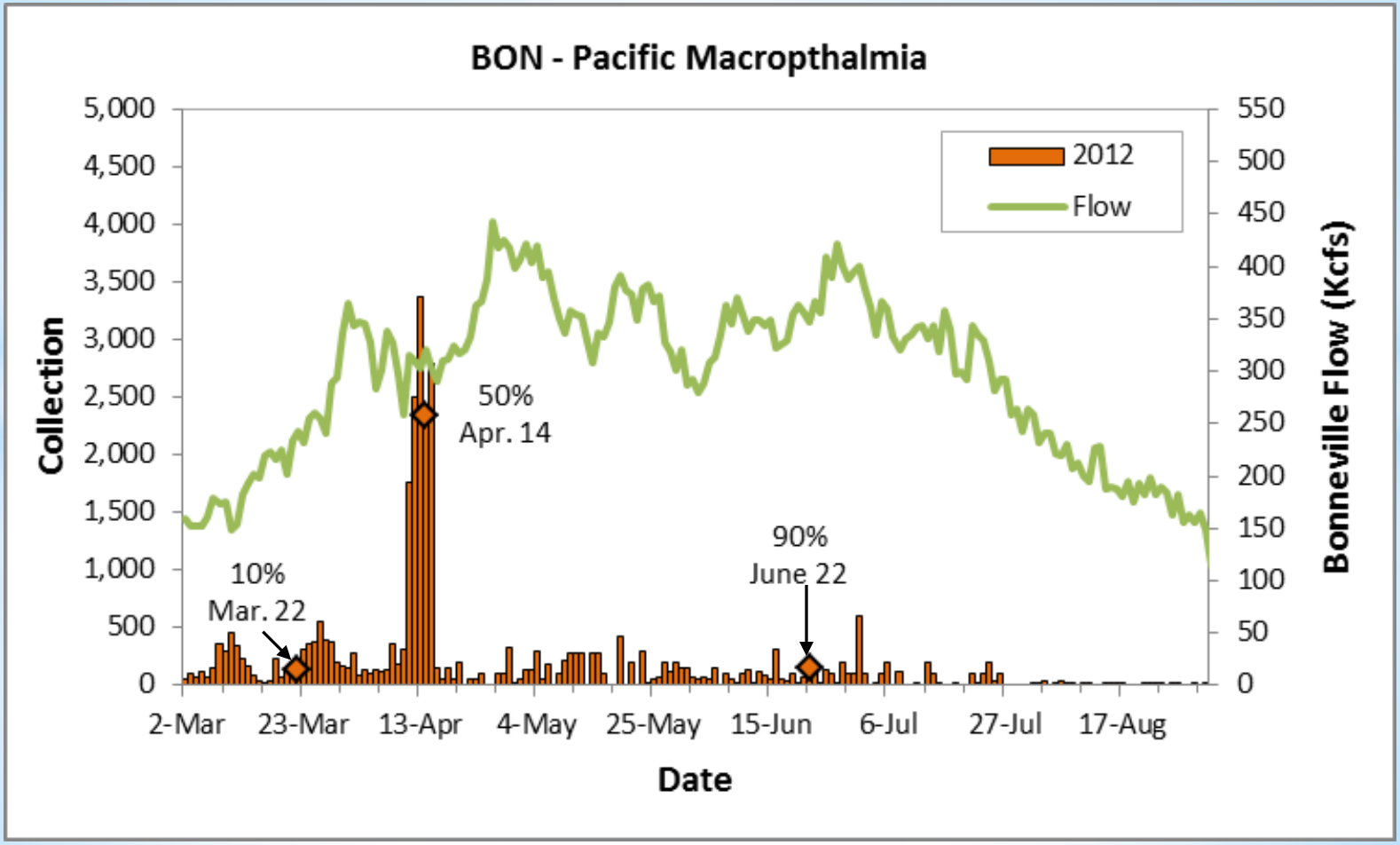
Bonneville Dam
Subyearling Chinook



Bonneville Dam
Lamprey Juveniles



Bonneville Dam
Lamprey Juveniles



Noteworthy Events
Mortalities

- High weighted average mortalities for subyearling Chinook, sockeye, and Pacific macropthalmia at BON and Pacific macropthalmia at MCN

Site	CH0	CH1	SO	ST	MP
LGR*	0.9	0.8	0.8	0.3	
LGS*	0.2	0.3		0.1	
LMN	0.5	0.3	0.0	0.2	
MCN	0.9	0.4	0.8	0.4	**2.9**
JDA	0.3	0.3	1.2	0.1	0.2
BON*	**2.5**	1.8	**6.8**	0.3	**8.9**

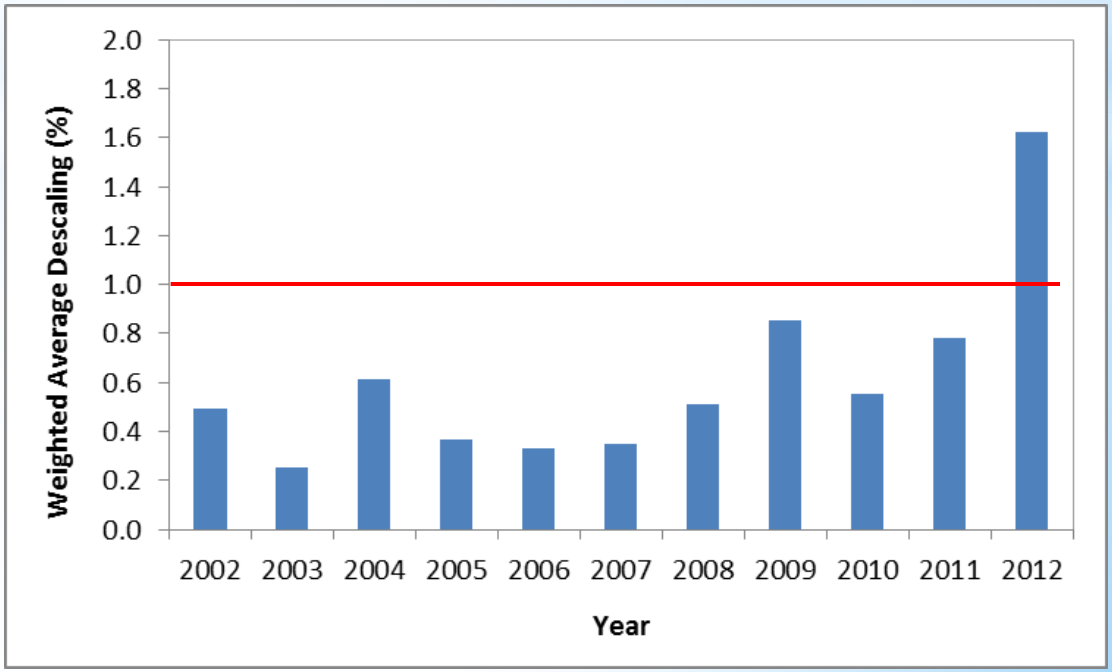
* Salmonid mortality data through Oct. 17

Noteworthy Events
Descaling

- Weighted average descaling for CH0 at LGR >1.0%
  - Only time weighted average descaling >1.0% since 2002

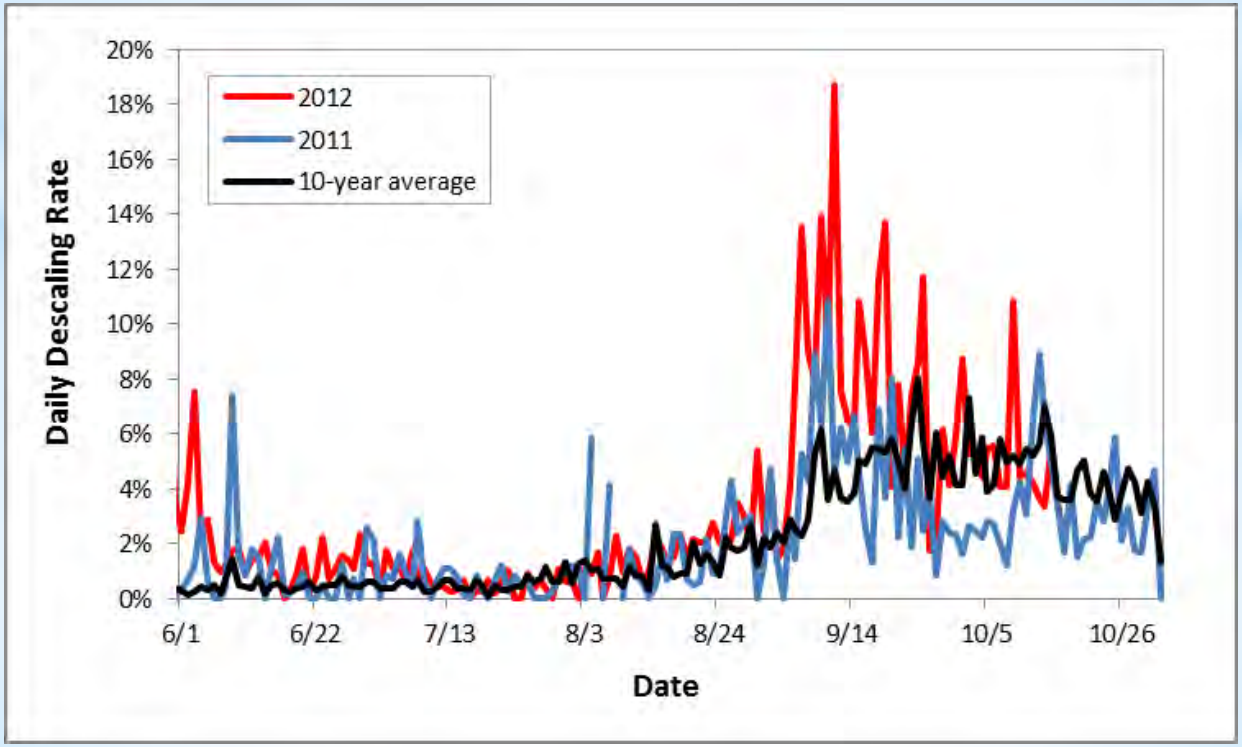
Site	CH0	CH1	SO	ST
LGR*	**1.6**	2.3	2.1	2.3
LGS*	0.4	0.8		0.6
LMN	1.0	2.5	3.1	3.3
MCN	1.5	2.9	4.4	3.9
JDA	1.0	2.5	5.8	3.6
BON*	0.8	4.3	15.1	2.7

* Descaling data through Oct. 17



Noteworthy Events
Descaling

- High descaling in September and October
- Cause of descaling still unclear



Kootenai Basin Operations for 2012

Joel Fenolio, P.E.

Upper Columbia Senior Water Manager

Seattle District

22 Oct 2012

US Army Corps of Engineers

BUILDING STRONG®

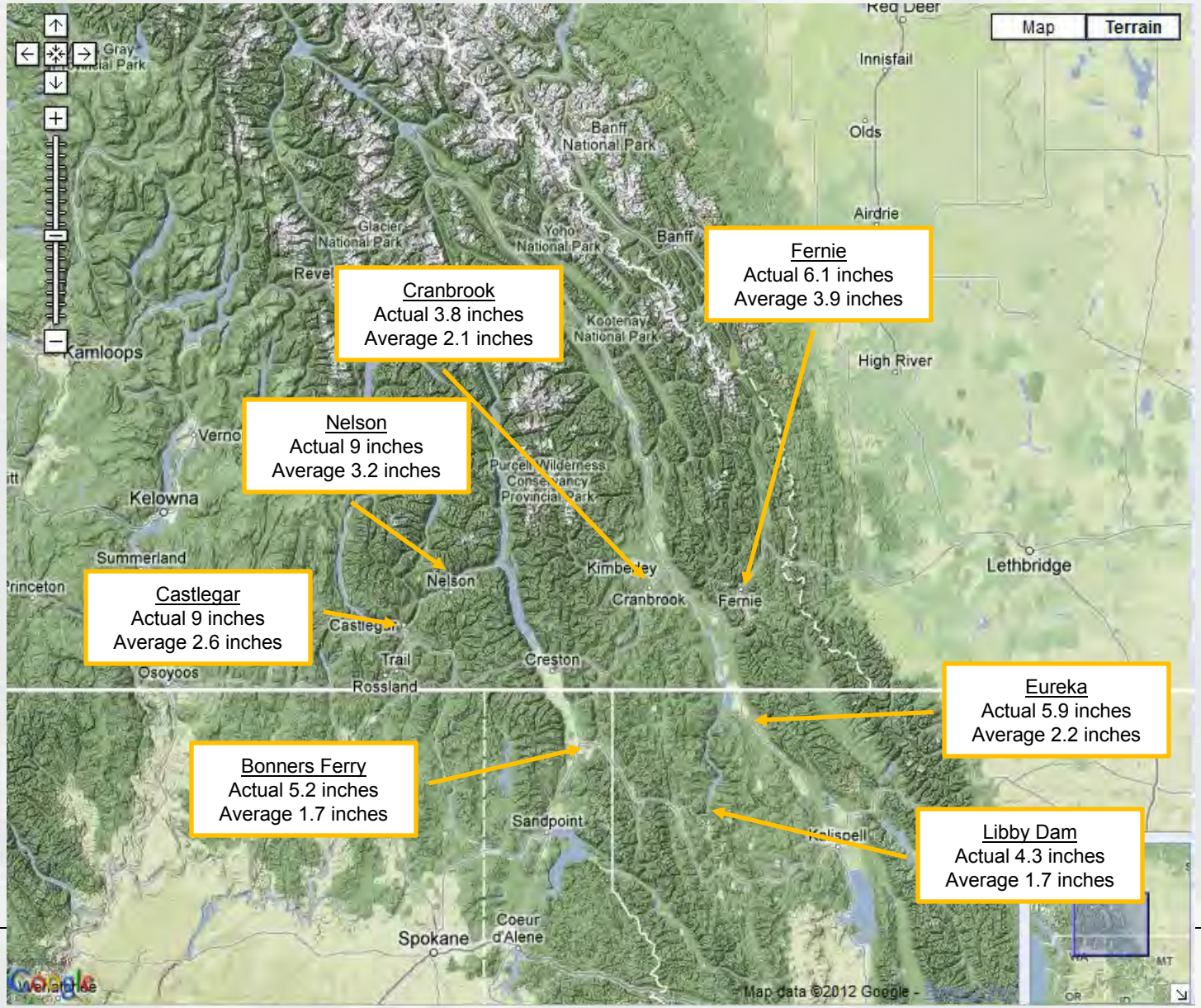
2012 Summary

- June highlighted by atypical conditions as unprecedented rains drove inflows, and seasonal water supply, sharply upwards.
  - Precipitation ranged from 200 to 400 percent of average throughout the Kootenai Basin.
  - Total Apr-Aug Inflow volume was 9.2 MAF (156% of average)
    - The May forecast was off by 28%
  - The Libby Dam forebay elevation reached a record peak of 2459.95 feet
  - The peak stage of Kootenay Lake at Queens Bay was 1753.8 feet—the highest since Libby Dam was completed.

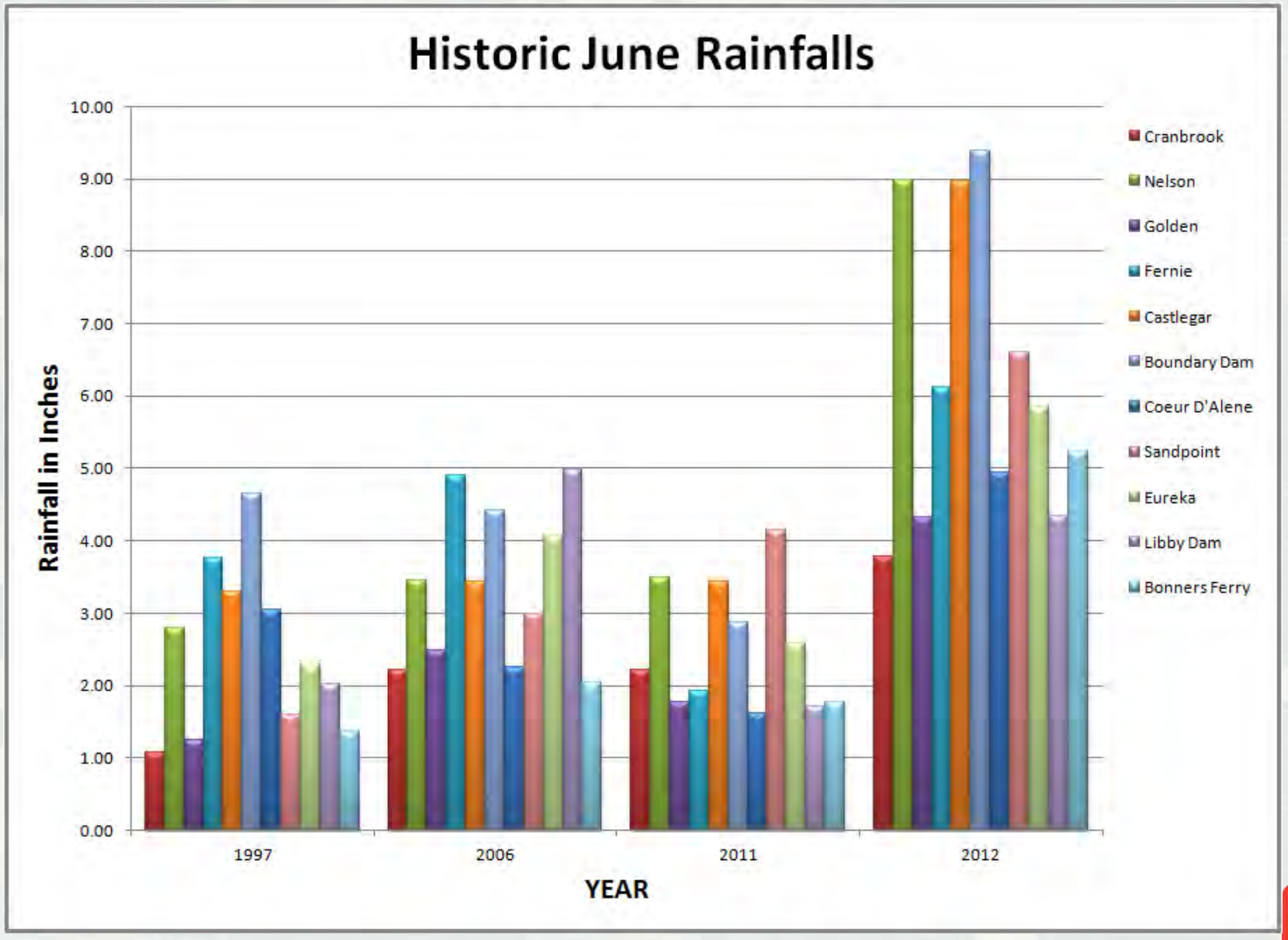
Operations

- The two main operational goals for this year, outside of flood control were
  - Fulfill last year of a 3 year experiment for spill to help with sturgeon operations
  - Coordination for reduced outflows in Sept – Nov to support KTOI habitat project
- During the flood event there was extensive coordination with Canada to surcharge Libby Dam
  - Two deviation requests were submitted and allowed for Libby Dam to not increase releases in early July

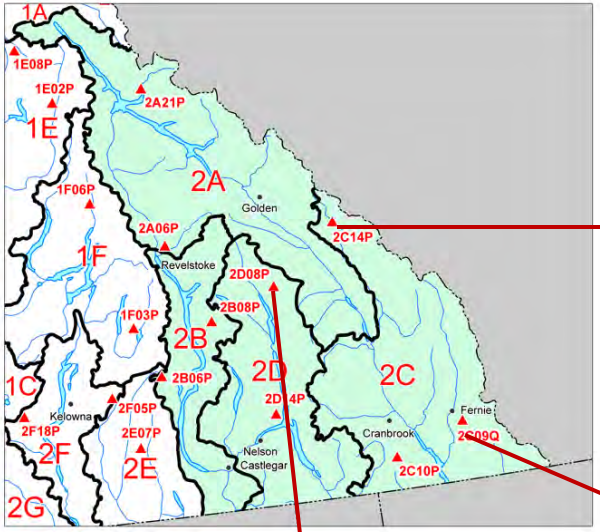
June 2012 Precipitation

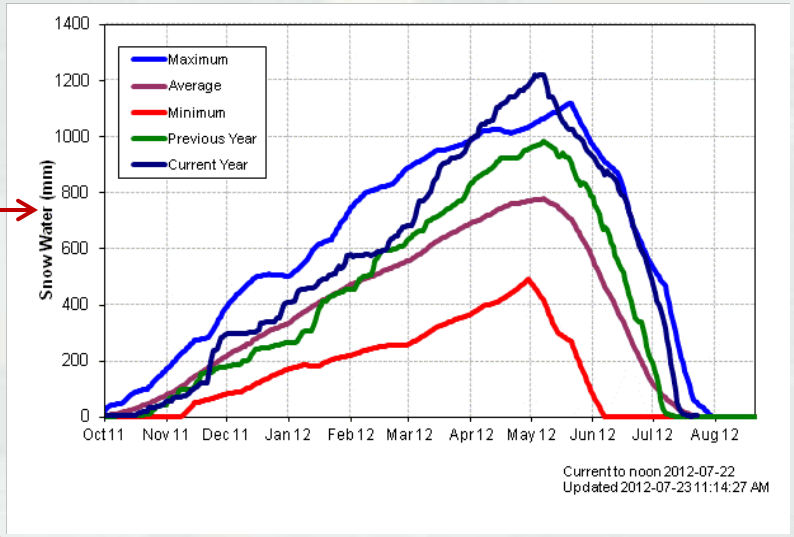


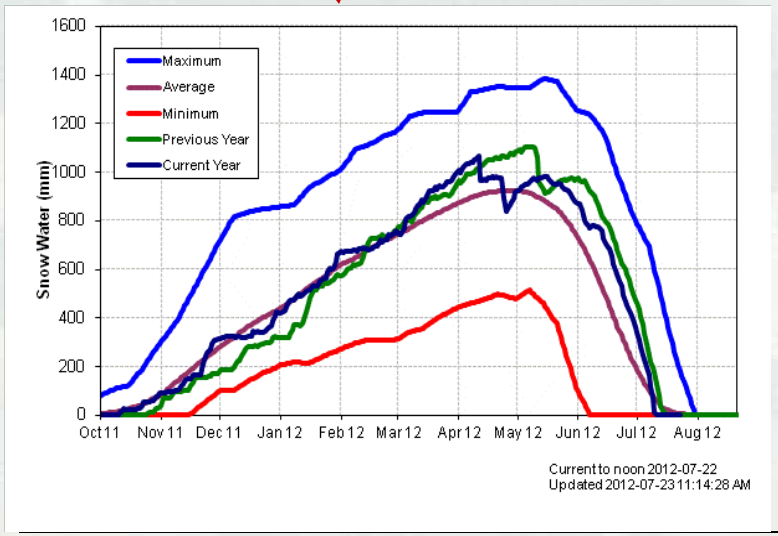
STRONG®

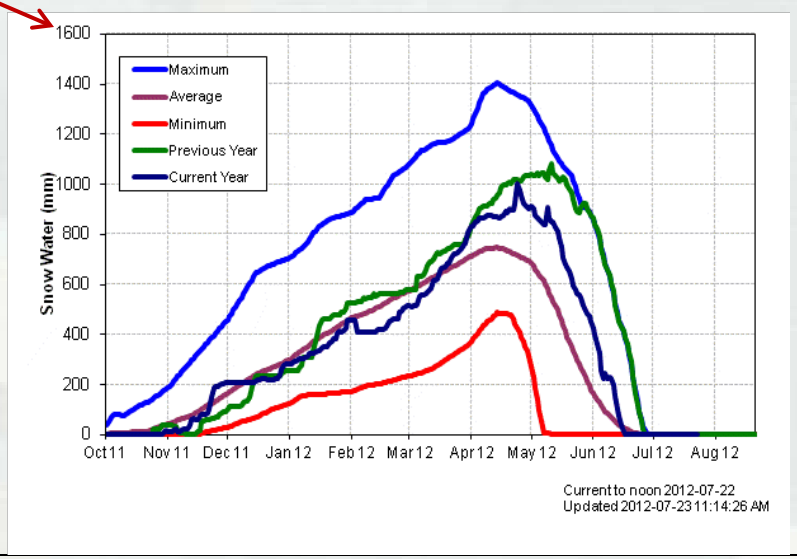

Historic June Rainfalls
Rainfall in Inches
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1997
2006
2011
2012
YEAR
Cranbrook
Nelson
Golden
Fernie
Castlegar
Boundary Dam
Coeur D'Alene
Sandpoint
Eureka
Libby Dam
Bonners Ferry

2012 Snowpack



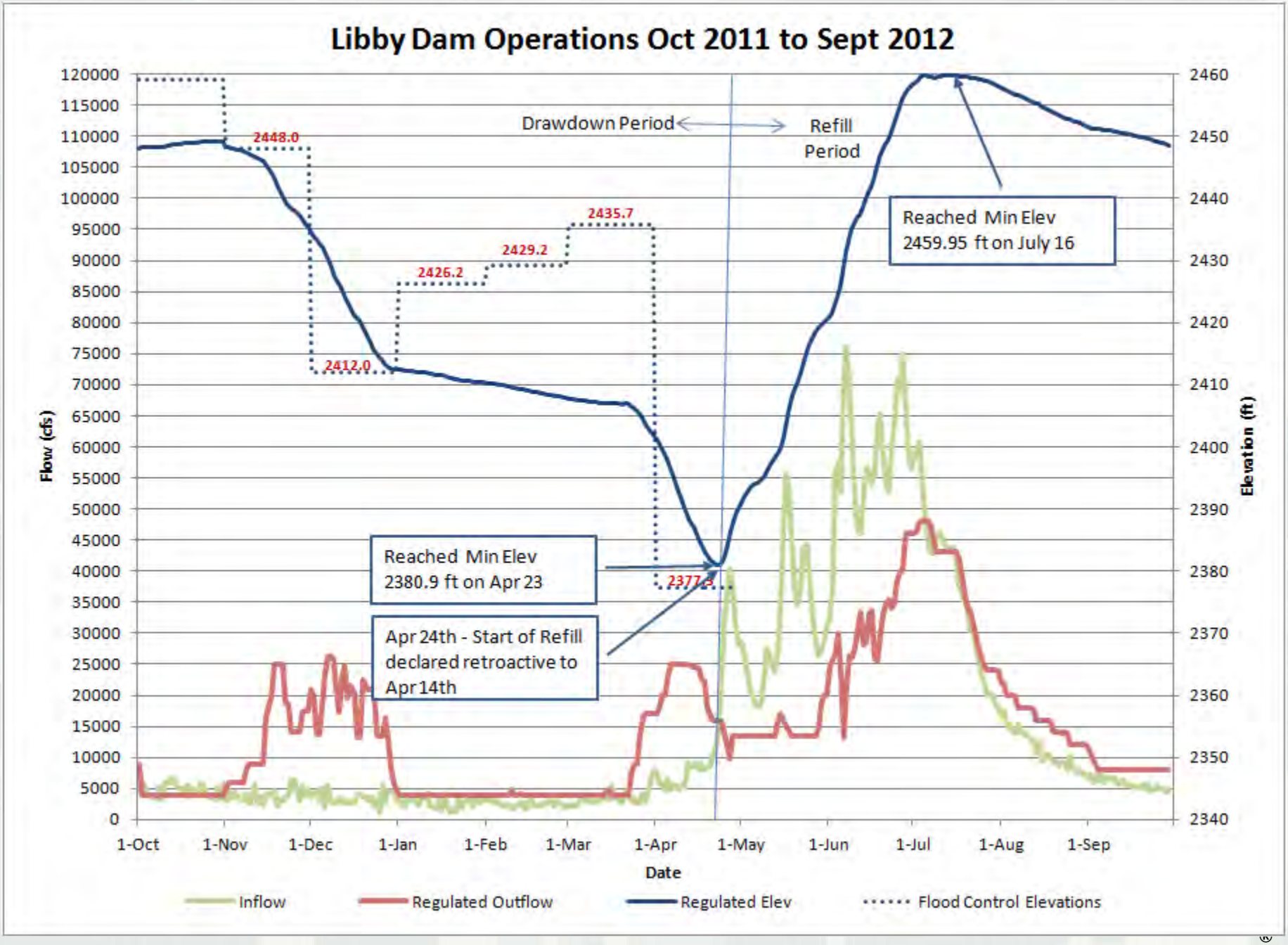




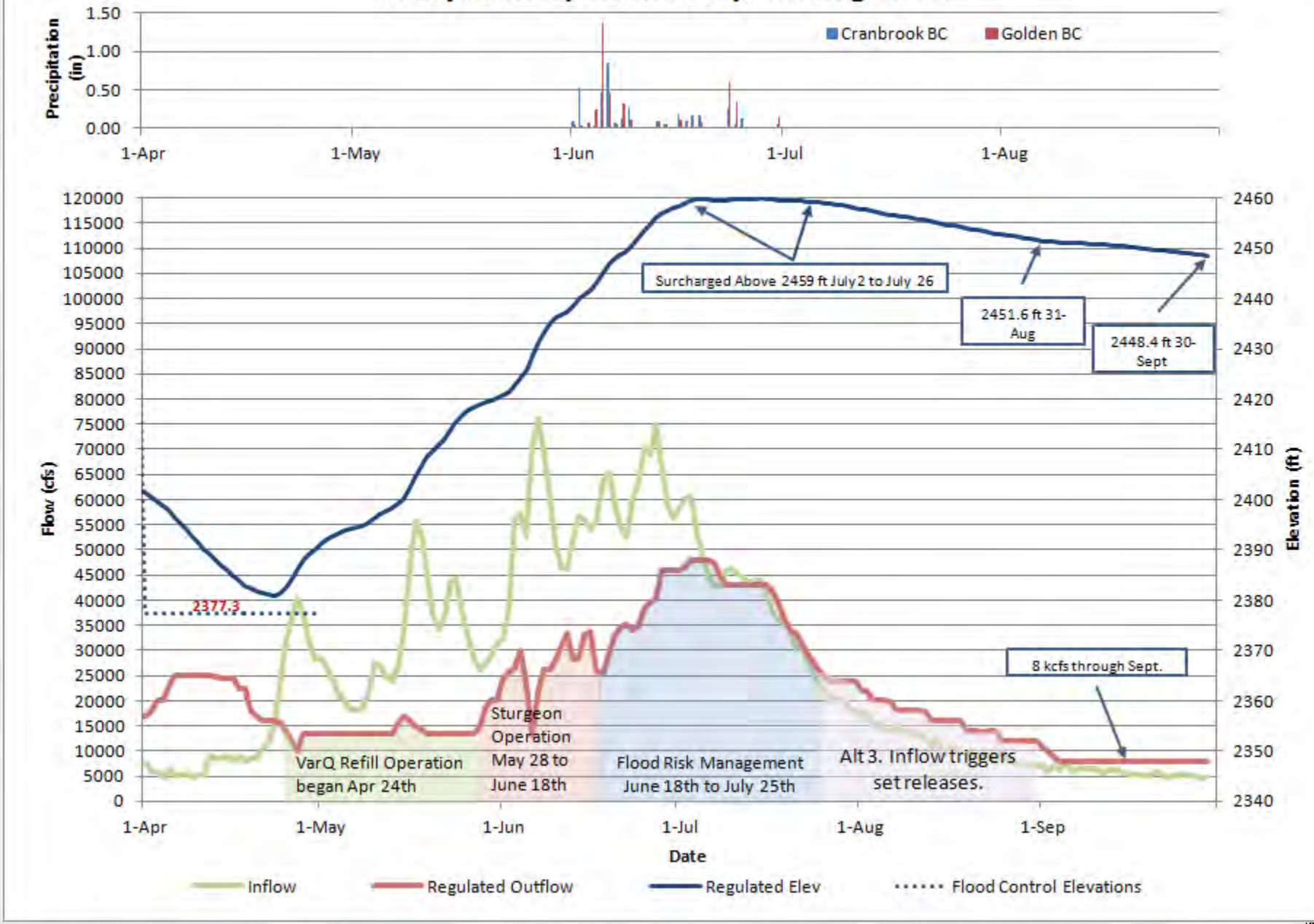


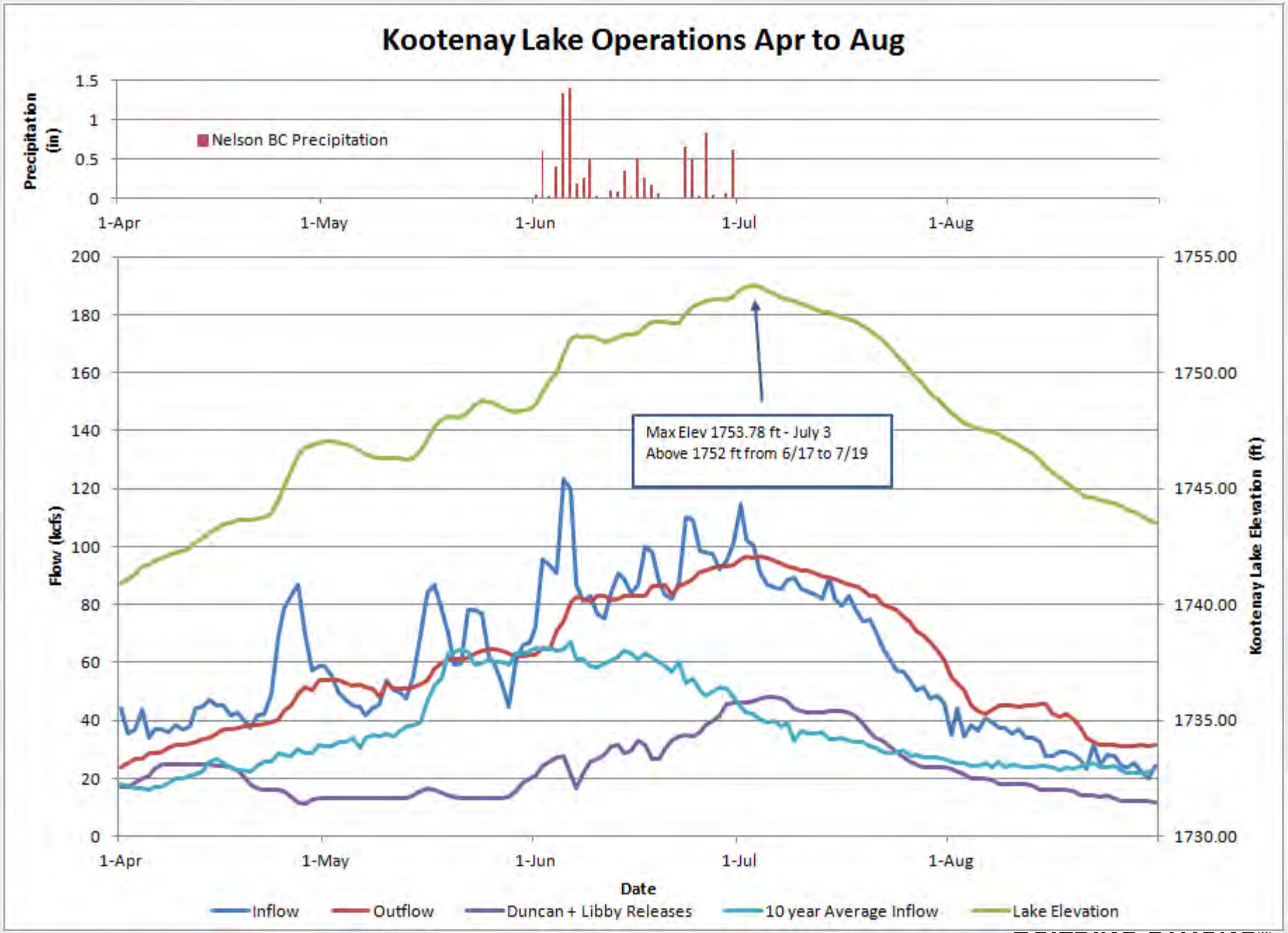
Libby Dam Forecast 2012

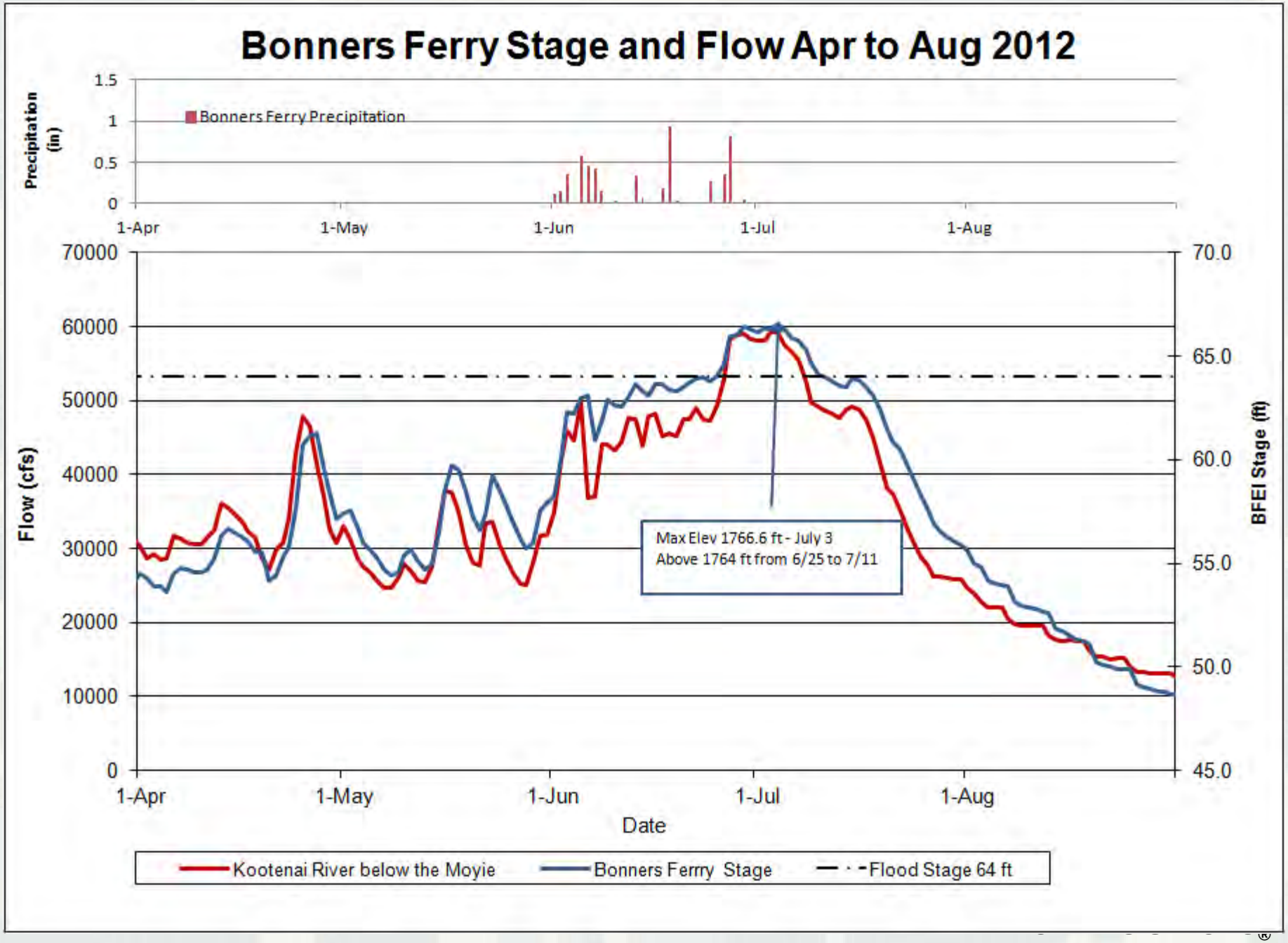
Month of Forecast	First-of-Month Apr-Aug Volume Forecast (MAF)	Model Standard Error	Number of Standard Errors Different Than Observed	End-of-Month Flood Control Target (FT)
Dec	5876	947	3.5	2412
Jan	5524	841	4.4	2410
Feb	5714	564	6.2	2408
Mar	5635	527	6.8	2402
Apr	6872	532	4.4	2390
May	7159	487	4.2	
June	7240	418	4.7	
Observed	9200			
Average	5900			


Libby Dam Operations Oct 2011 to Sept 2012
Drawdown Period
Refill Period
2448.0
2412.0
2426.2
2429.2
2435.7
2377.3
Reached Min Elev 2380.9 ft on Apr 23
Apr 24th - Start of Refill declared retroactive to Apr 14th
Reached Min Elev 2459.95 ft on July 16
Flow (cfs)
Elevation (ft)
Date
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Inflow
Regulated Outflow
Regulated Elev
Flood Control Elevations

Libby Dam Operations Apr to Aug 2012



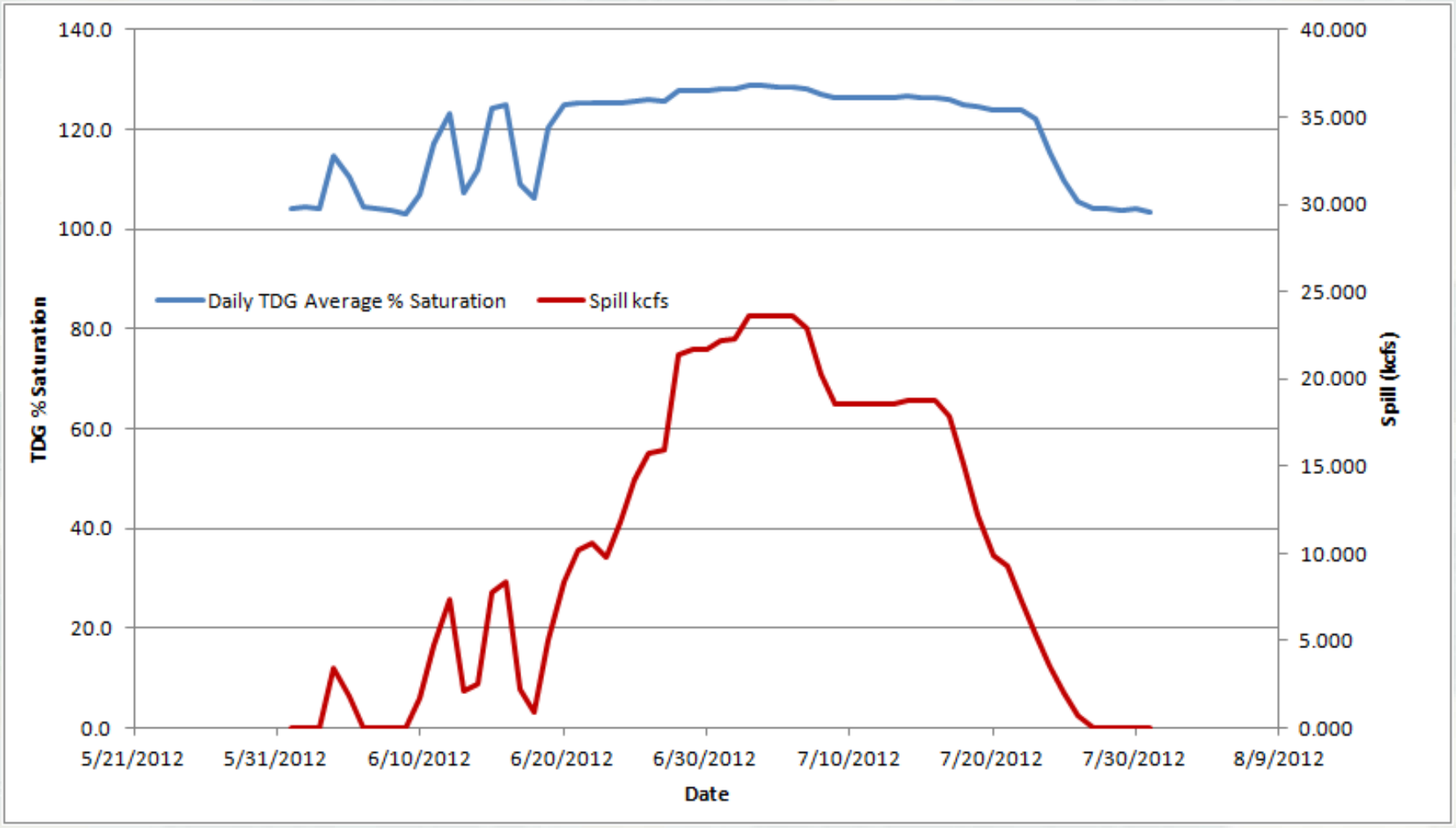

Kootenay Lake Operations Apr to Aug
Precipitation (in)
Nelson BC Precipitation
1.5
1
0.5
0
1-Apr
1-May
1-Jun
1-Jul
1-Aug
Flow (kcfs)
200
180
160
140
120
100
80
60
40
20
0
Kootenay Lake Elevation (ft)
1755.00
1750.00
1745.00
1740.00
1735.00
1730.00
Max Elev 1753.78 ft - July 3
Above 1752 ft from 6/17 to 7/19
Date
Inflow
Outflow
Duncan + Libby Releases
10 year Average Inflow
Lake Elevation


Bonners Ferry Stage and Flow Apr to Aug 2012
Precipitation (in)
1.5
1
0.5
0
Bonners Ferry Precipitation
1-Apr
1-May
1-Jun
1-Jul
1-Aug
70000
60000
50000
40000
30000
20000
10000
0
Flow (cfs)
70.0
65.0
60.0
55.0
50.0
45.0
BFEI Stage (ft)
Max Elev 1766.6 ft - July 3
Above 1764 ft from 6/25 to 7/11
Date
Kootenai River below the Moyie
Bonners Ferry Stage
Flood Stage 64 ft

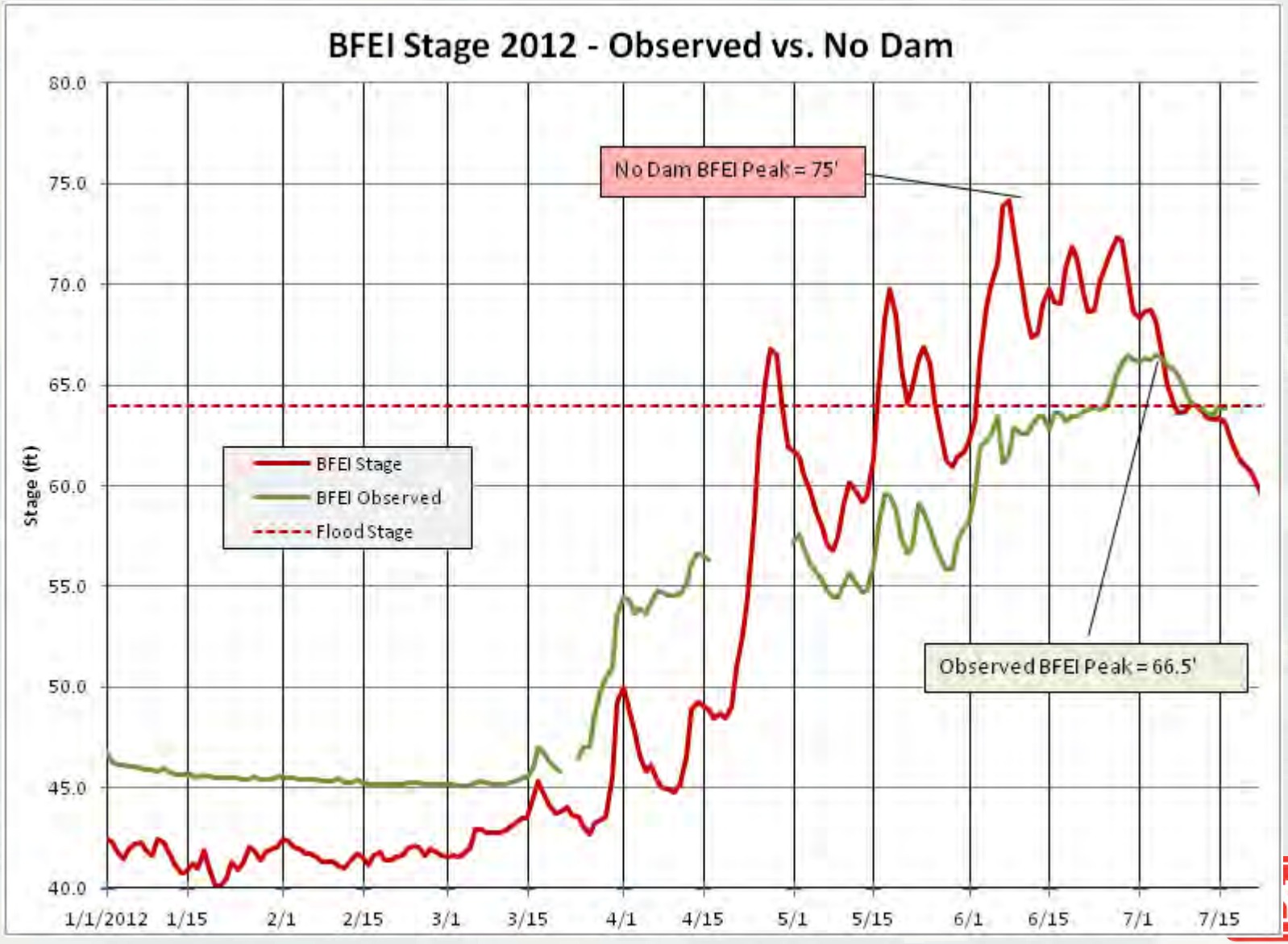
Summary

- Record June precipitation caused the largest inflow volume to Libby during the spring and summer since 1974.
- The forecast did not, cannot, accurately predict the amount of rain in June all the time
- Libby Dam surcharged above elevation 2459 ft in order to not increase releases and exacerbate downstream flooding
  - The surcharge was coordinated through Canada and the U.S. Entities of the Columbia River Treaty

Total Dissolved Gas Concentration 2012



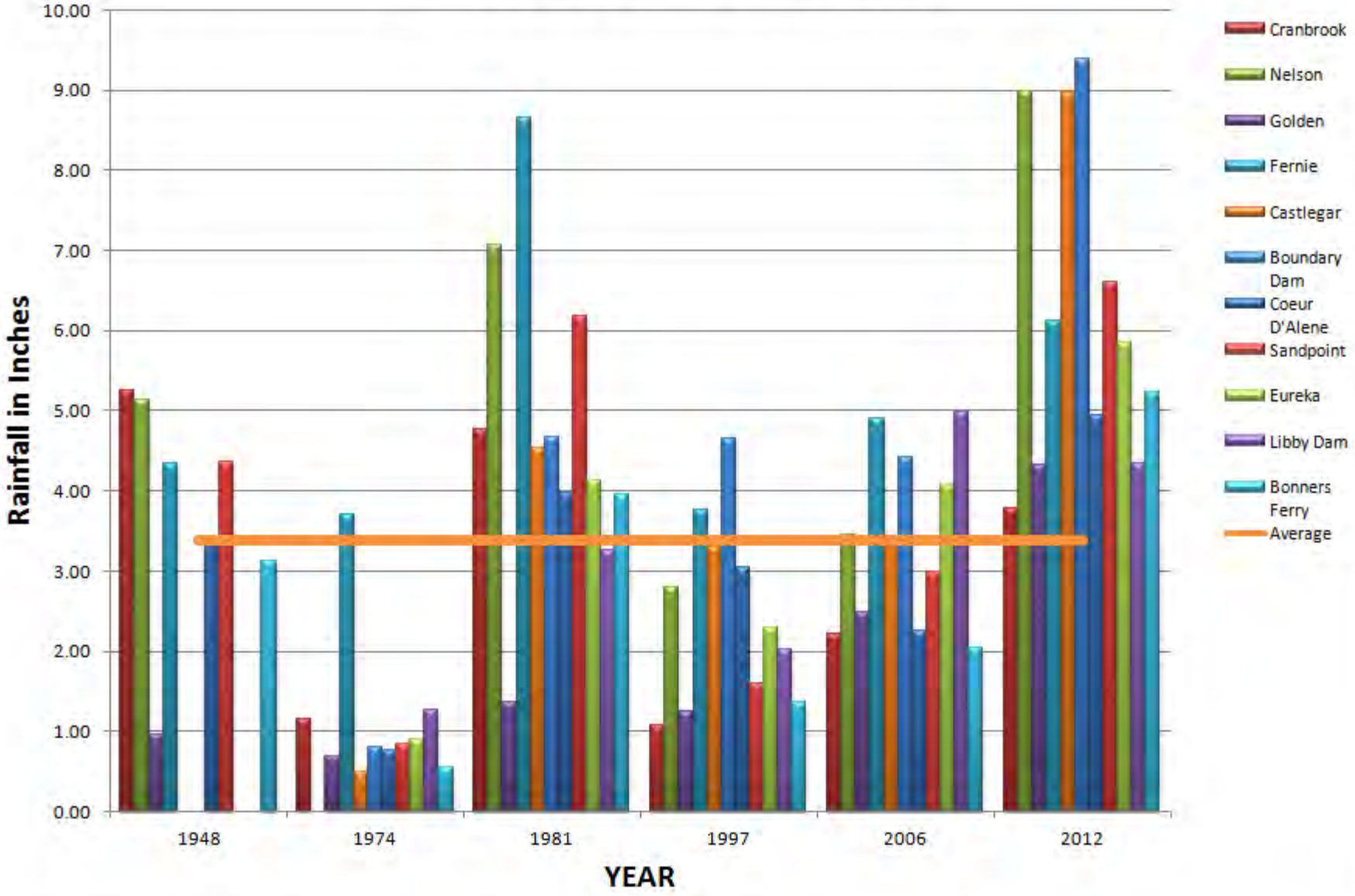
Additional Slides

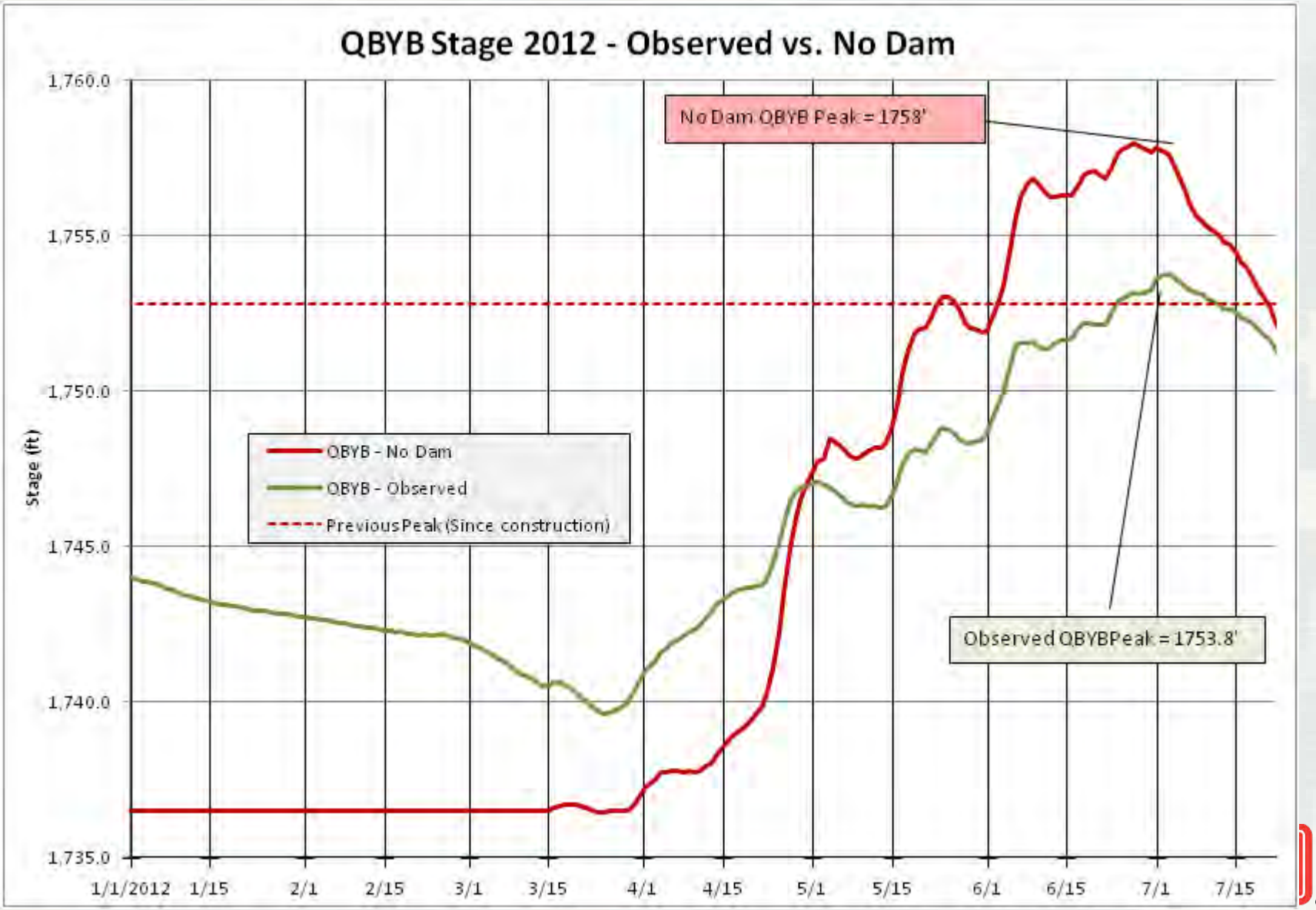

BFEI Stage 2012 - Observed vs. No Dam
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
Stage (ft)
1/1/2012
1/15
2/1
2/15
3/1
3/15
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
No Dam BFEI Peak = 75'
BFEI Stage
BFEI Observed
Flood Stage
Observed BFEI Peak = 66.5'

Results with 2011 forecasts

- Reservoir still surcharges to El. 2459.5 ft
- Peak release from Libby Dam 39 kcfs
- Bonners Ferry stage max 1764.5 ft

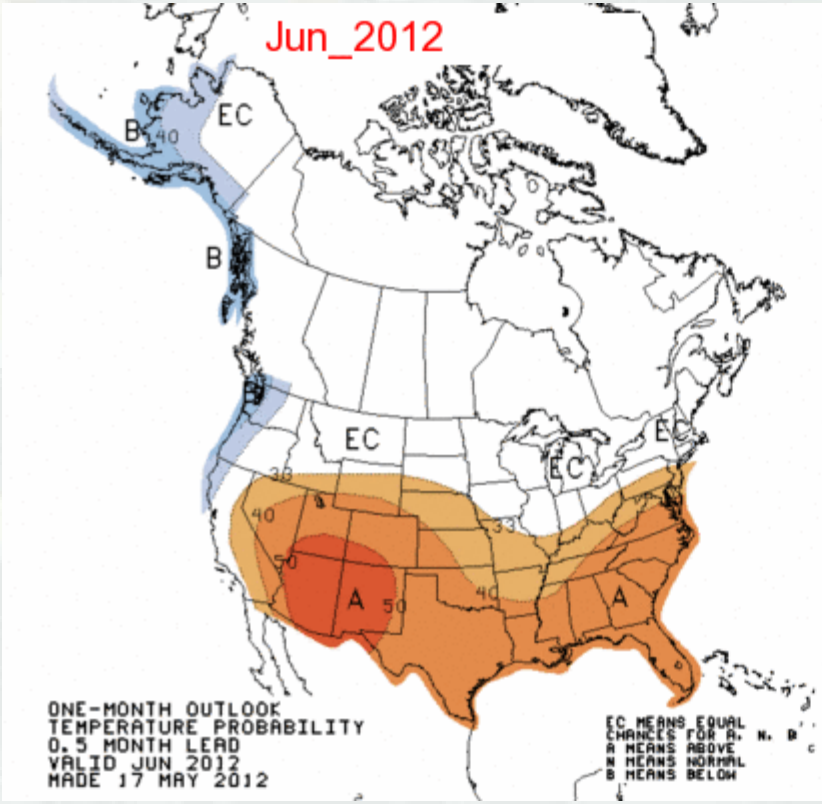
Historic June Rainfalls

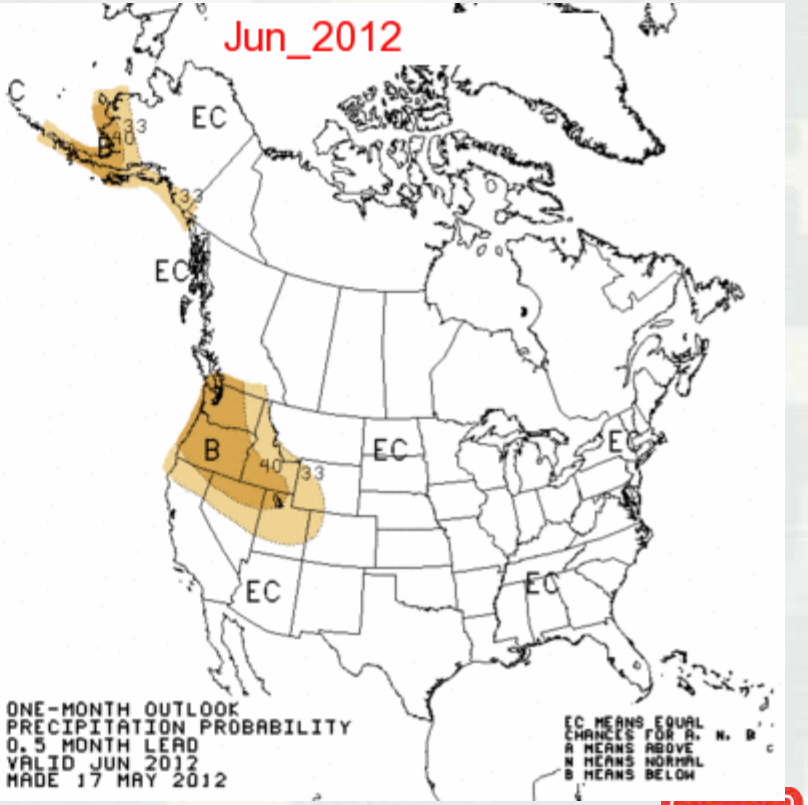



QBYB Stage 2012 - Observed vs. No Dam
No Dam QBYB Peak = 1758'
Observed QBYB Peak = 1753.8'
QBYB - No Dam
QBYB - Observed
Previous Peak (Since construction)
Stage (ft)
1,760.0
1,755.0
1,750.0
1,745.0
1,740.0
1,735.0
1/1/2012
1/15
2/1
2/15
3/1
3/15
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15

June 2012 Outlook

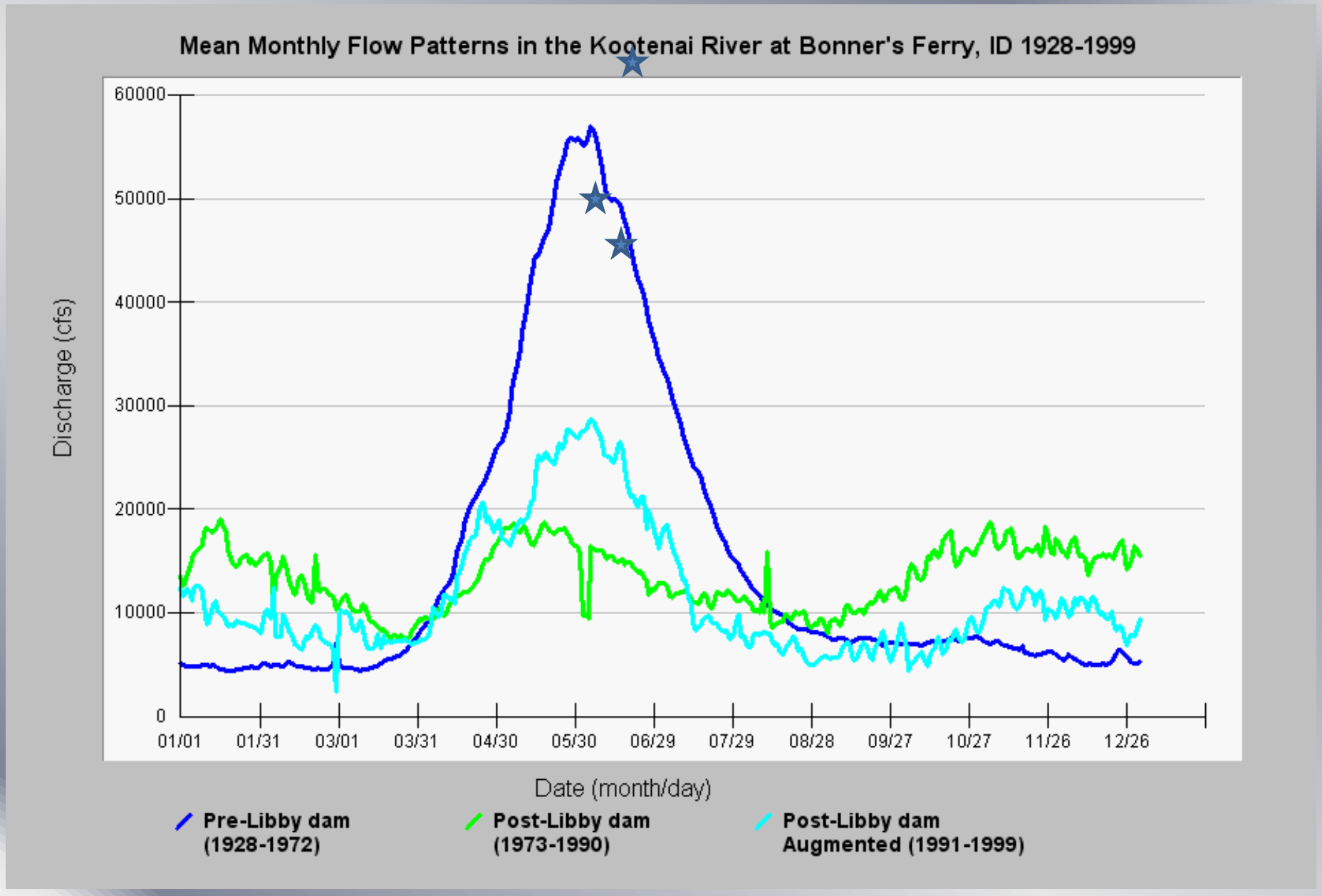
Created 17 May 2012





Summary of 2010-2012 Kootenai River Flow Tests with Spill from Libby Dam


Legend
Storage
Corps of Engineers
Bureau of Reclamation
Other
Run of River
Corps of Engineers
Bureau of Reclamation
Other
Gages
BRITISH COLUMBIA
Revelstoke
Duncan
Columbia Lake
Columbia River
Slocan Lake
Corra Linn
Upper Bonnington
South Slocan
Lower Bonnington
Arrow
Canal Plant
Brilliant
Kootenay Lake
Seven Mile
Waneta
Boundary
Box Canyon
Priest Lake
Bonners Ferry
Priest Lake
Albeni Falls
Cabinet Gorge
Noxon
Libby
Kootenai River
Columbia Falls
Hungry Horse
Kalispell
Flathead Lake
Pend Oreille Lake
Kootenay River
Elk River
Kettle River
Pend Oreille River
Columbia River
Middle Fork Flathead River


Mean Monthly Flow Patterns in the Kootenai River at Bonner's Ferry, ID 1928-1999
Discharge (cfs)
60000
50000
40000
30000
20000
10000
0
01/01
01/31
03/01
03/31
04/30
05/30
06/29
07/29
08/28
09/27
10/27
11/26
12/26
Date (month/day)
Pre-Libby dam (1928-1972)
Post-Libby dam (1973-1990)
Post-Libby dam Augmented (1991-1999)

2010:

- **Up to 7 kcfs was spilled at Libby Dam (9 kcfs for a very brief period to test TDG).**
- **Due to TDG constraints and a low water year, the river conditions that were to be tested were not achieved.**
- **No detectable change in Kootenai sturgeon migration and spawning behaviors.**

2011:

- **Due to the higher than normal water supply river stages targeted for the test generally were achieved without the need to spill.**
- **Flooding concerns downstream prevented additional releases or an extended period of higher river stages.**
- **No detectable change in Kootenai sturgeon migration and spawning behaviors.**

2012:

- **Spill of 5 kcfs began on June 4, and became an "on again, off again" spill over the next 2 weeks due, to flooding concerns, with spill peaking at 8.5 kcfs on June 16.**
- **Unusually high rainfall events caused the reservoir and river to rise rapidly, resulting in a flood control operation through July 11.**
- **Kootenai River exceeded flood stage of 1764' at Bonners Ferry.**
- **No detectable change in Kootenai sturgeon migration and spawning behaviors.**

Conclusion:
After three years of attempts to test the effects of extra Libby Dam flows, higher river stages, and temperature management on Kootenai sturgeon migration and spawning behavior, it seems (tentative and subject to revision pending additional data) that:

1. **River stages of up to 1766.5' (at Bonners Ferry) do not create conditions necessary to coax spawning sturgeon to migrate further upstream and spawn over rocky substrates.**
2. **The conditions necessary to utilize the spillway at Libby Dam to provide extra flows for sturgeon spawning augmentation are somewhat rare and difficult to achieve.**
3. **There does not appear to be major impacts to key fish populations (e.g. bull trout) downstream of Libby Dam from up to 10 kcfs of spill.**

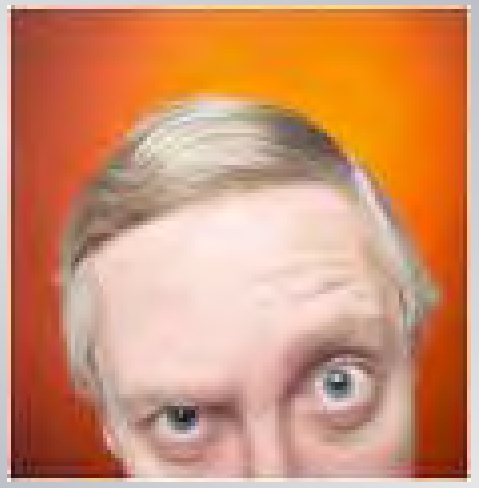
As a result …

- **Calls for additional flows via spill to augment the "sturgeon pulse" are unlikely.**

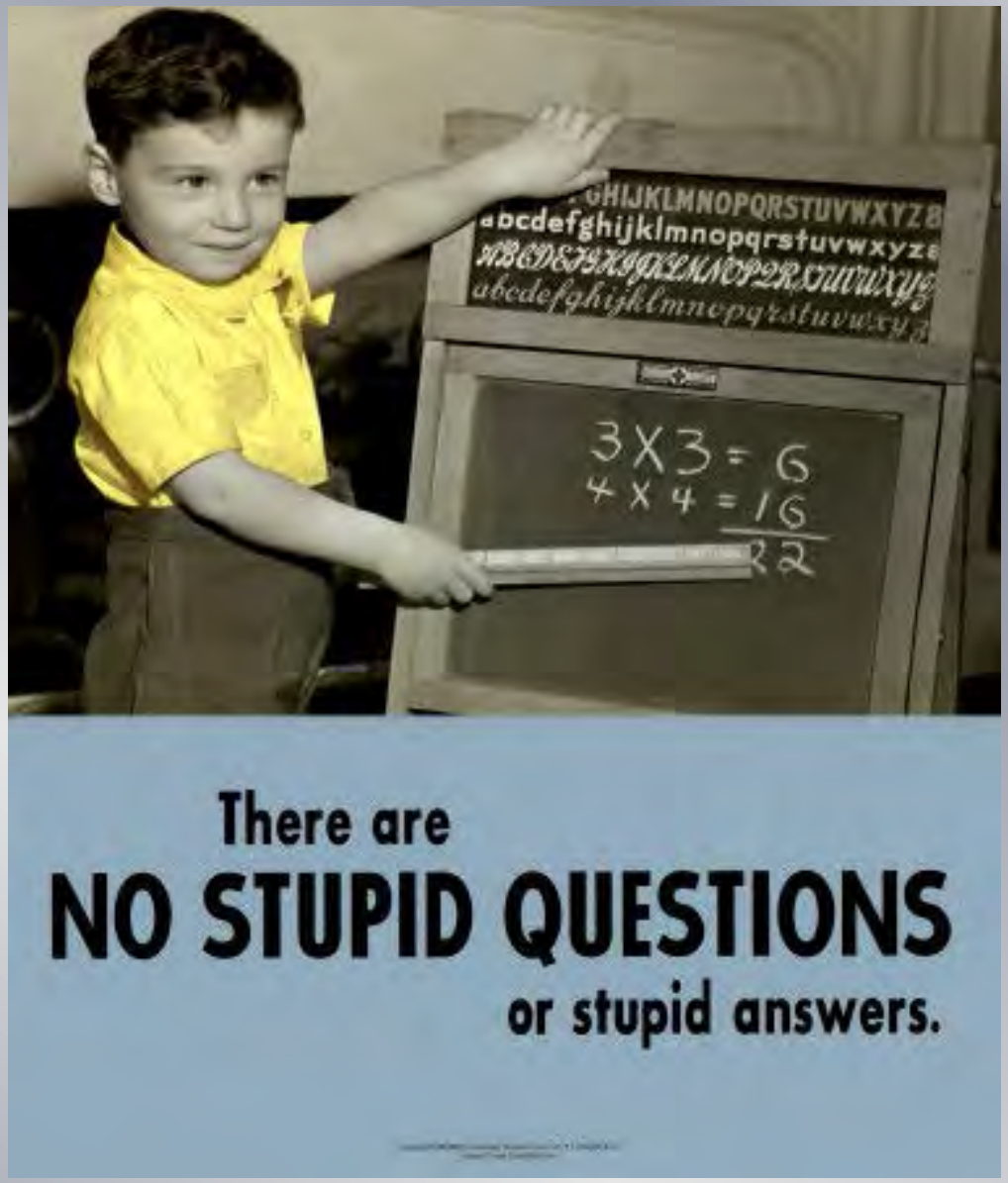
- **The 2006 Libby BiOp (and 2008 revised RPA) are still in place and will be followed.**

- **There will still be a "sturgeon pulse" in the spring that is based on the tiered approach outlined in the BiOp.**

The Service is currently working with co-managers and members of the Kootenai Sturgeon Recovery Team to develop an updated approach to managing the sturgeon pulse.



remember …



RECLAMATION

Managing Water in the West

Hungry Horse Operations 2012

U.S. Department of the Interior

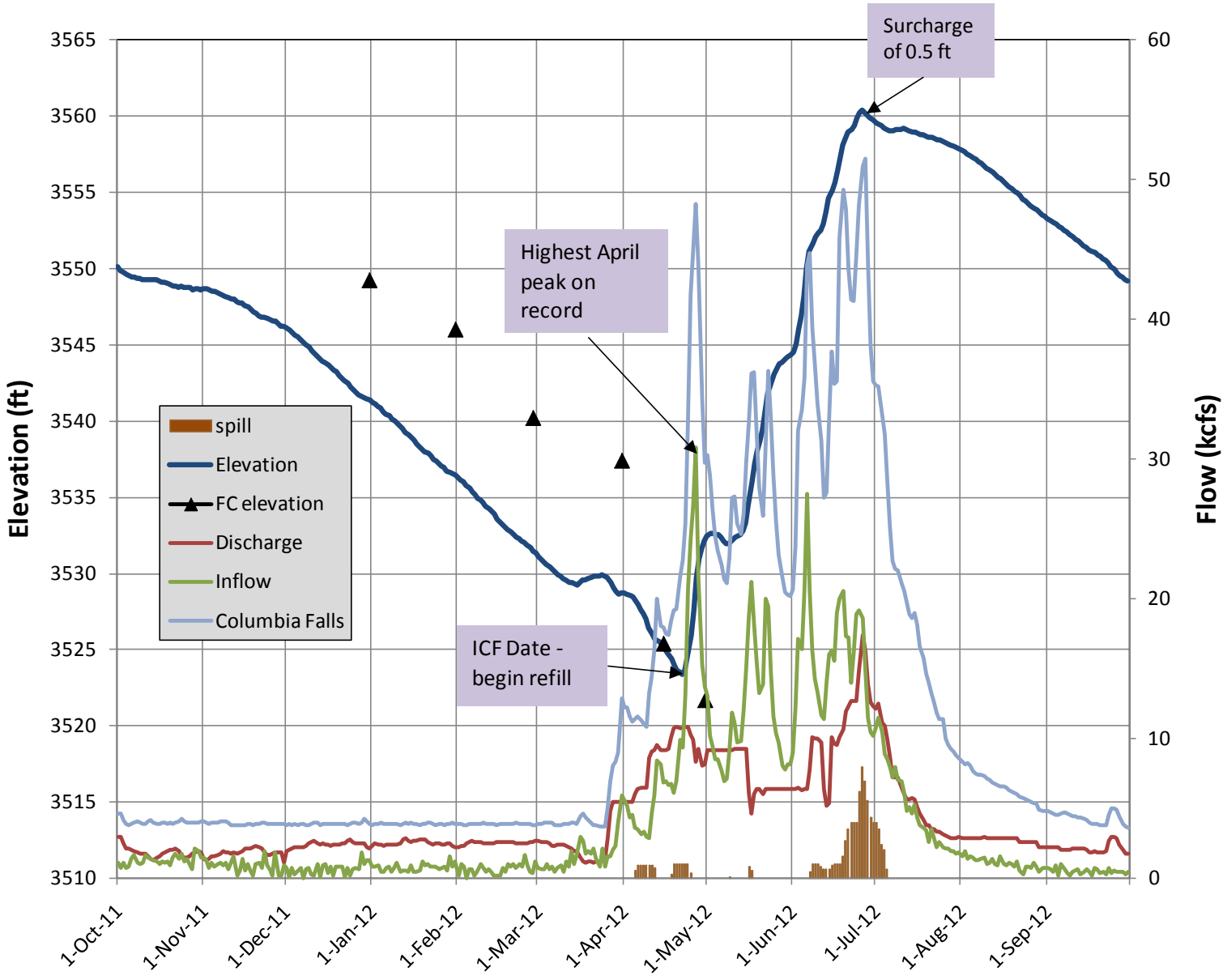
Bureau of Reclamation

Hungry Horse Forecasted and Actual Inflow for 2012

Forecast Month	Forecast Volume Jan-Jul (% of average)	Forecast Volume May-Sep (% of average)
Jan	92	92
Feb	96	97
Mar	93	95
Apr	102	104
May	105	94
June	107	94
Actual	**124**	**114**

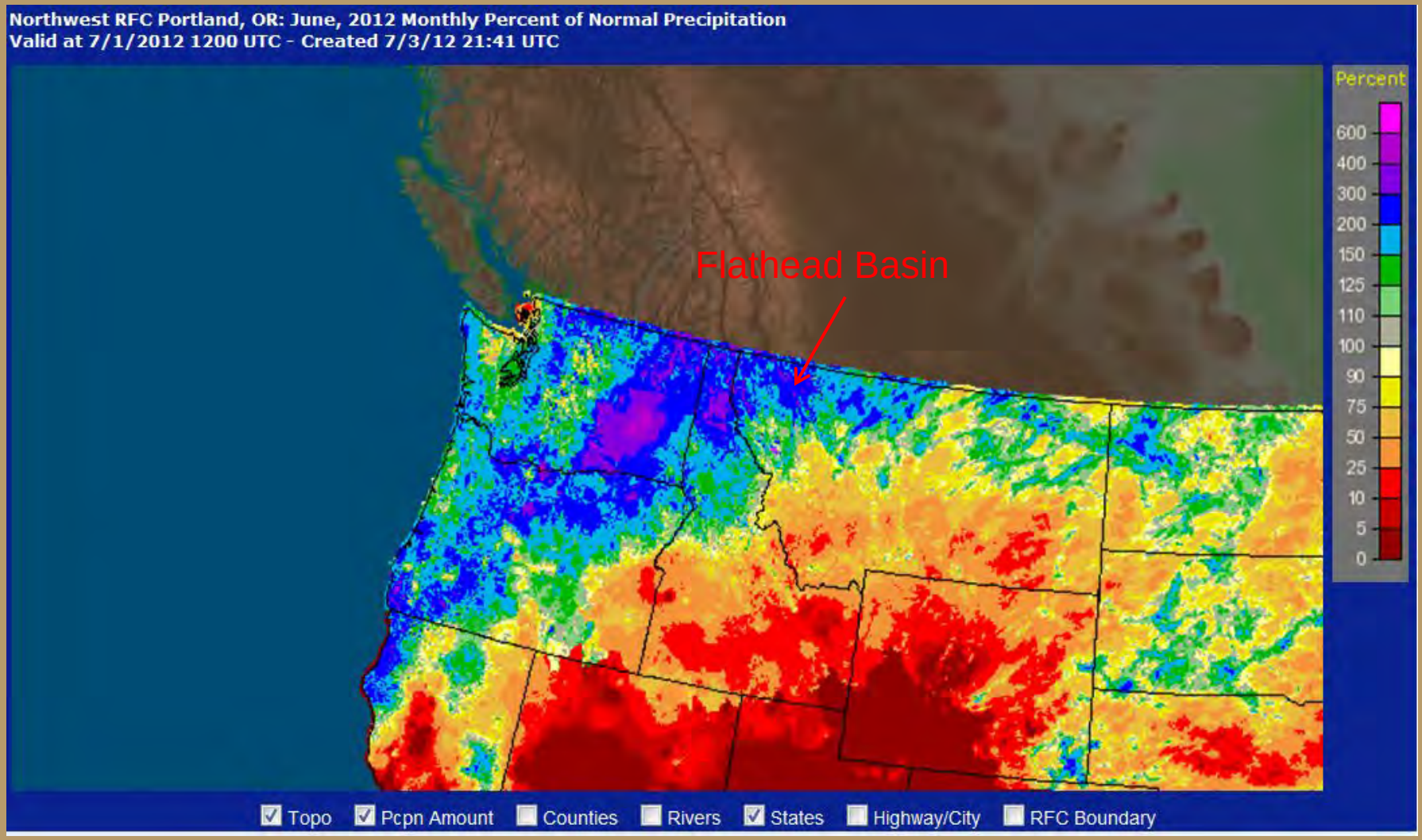
June-July runoff forecast was 880 kaf (92%). Actual June-July runoff was 1263 kaf (131%)

Hungry Horse Operations (Oct 2011 - Sep 2012)



RECLAMATION

June 2012 Precipitation (% of average)

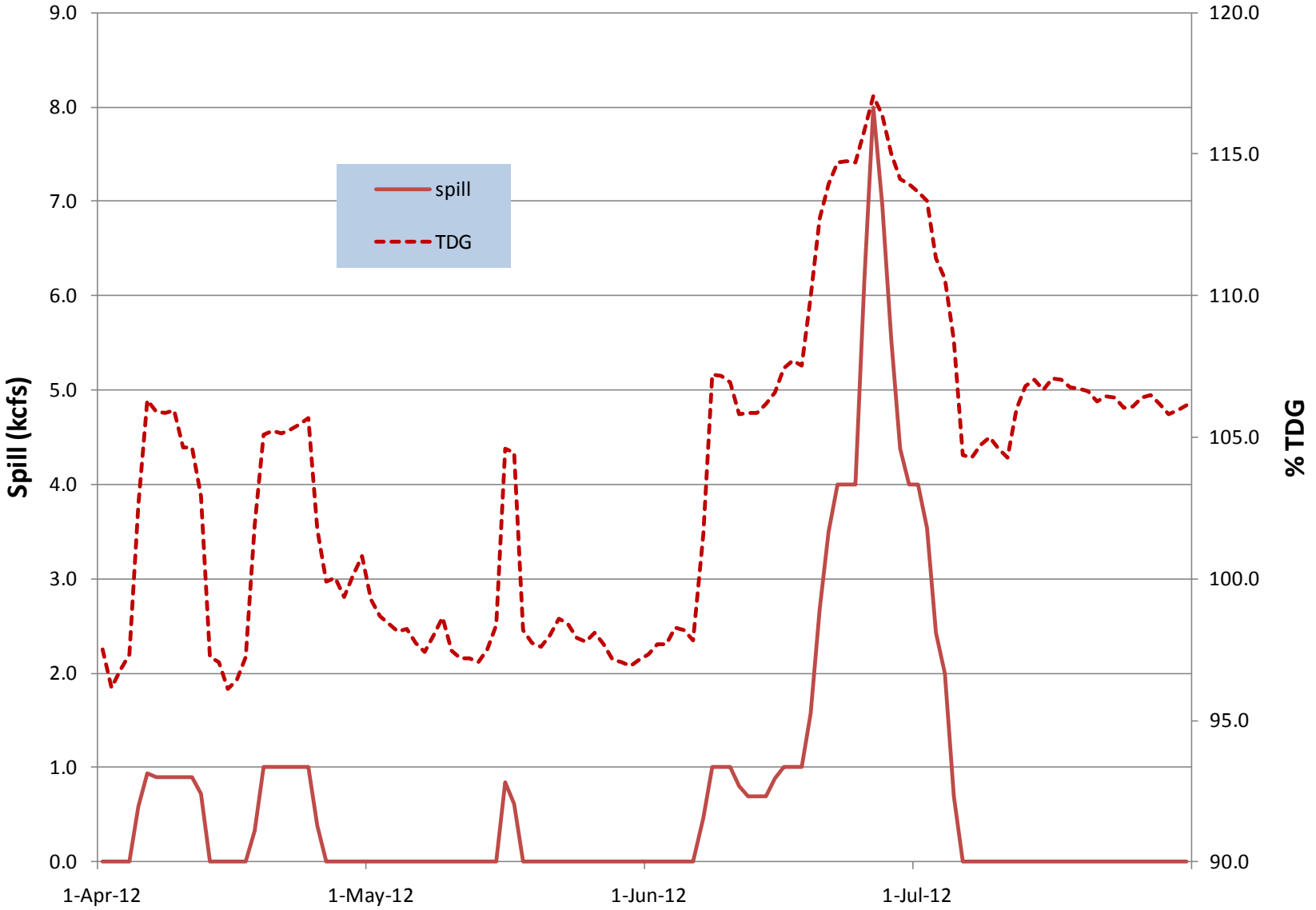


RECLAMATION

NWRFC ESP forecasts

- **June 4, 2012** – June-July volume of 784 kaf (82%)
- **June 15, 2012** – June-July volume of 951 kaf (99%)
- **June 25, 2012** – June-July volume of 1040 kaf (108%)
- **June 29, 2012** – June-July volume of 1173 kaf (122%)
- **Actual** - June-July volume of 1263 kaf (131%)

Hungry Horse Spill and %TDG in 2012



RECLAMATION

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~8.0 kcfs spill through hollow jet valves June 26, 2012

RECLAMATION

300 cfs-500 cfs through spillway outlet

RECLAMATION

RECLAMATION

Managing Water in the West

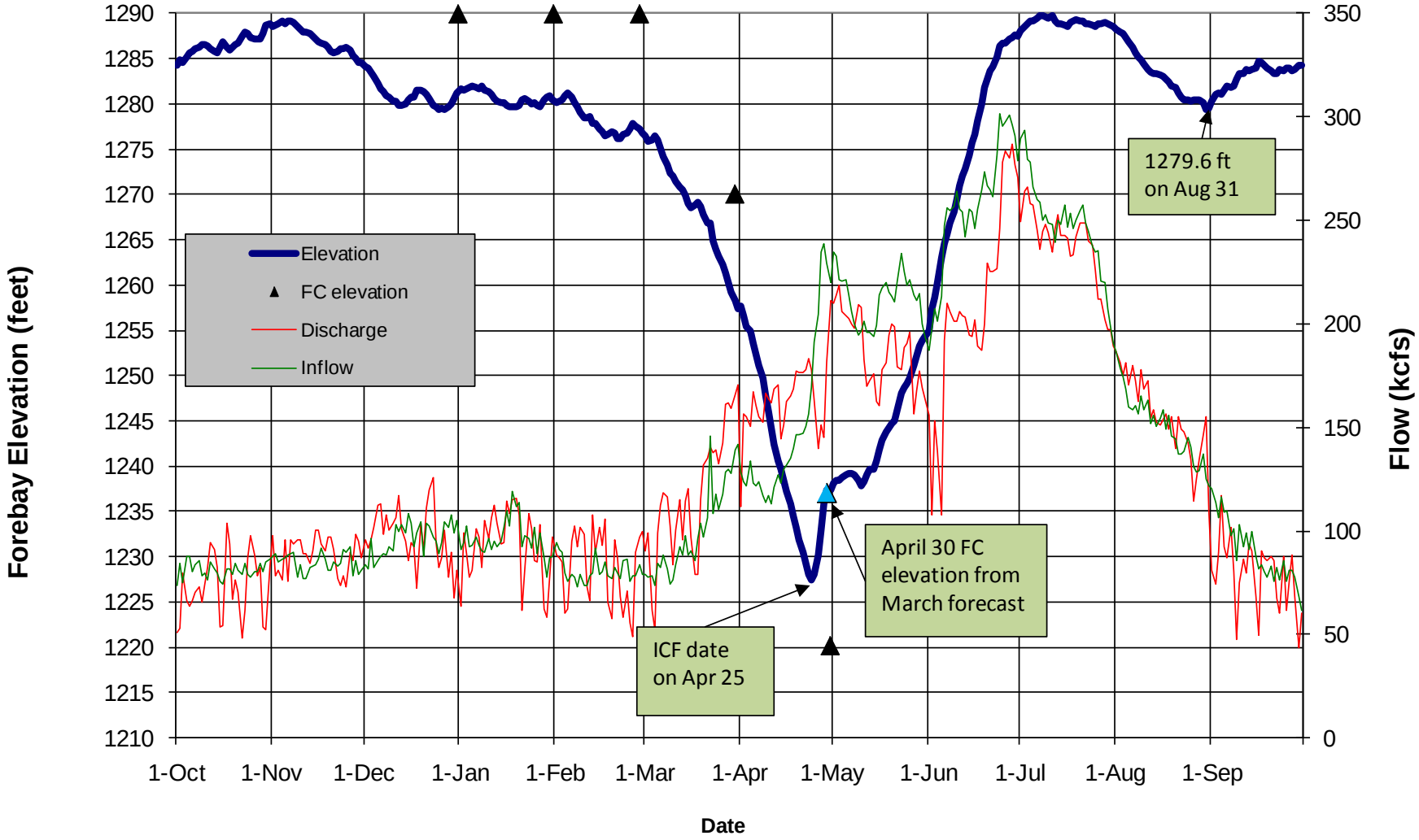
Grand Coulee Operations 2012

U.S. Department of the Interior
Bureau of Reclamation

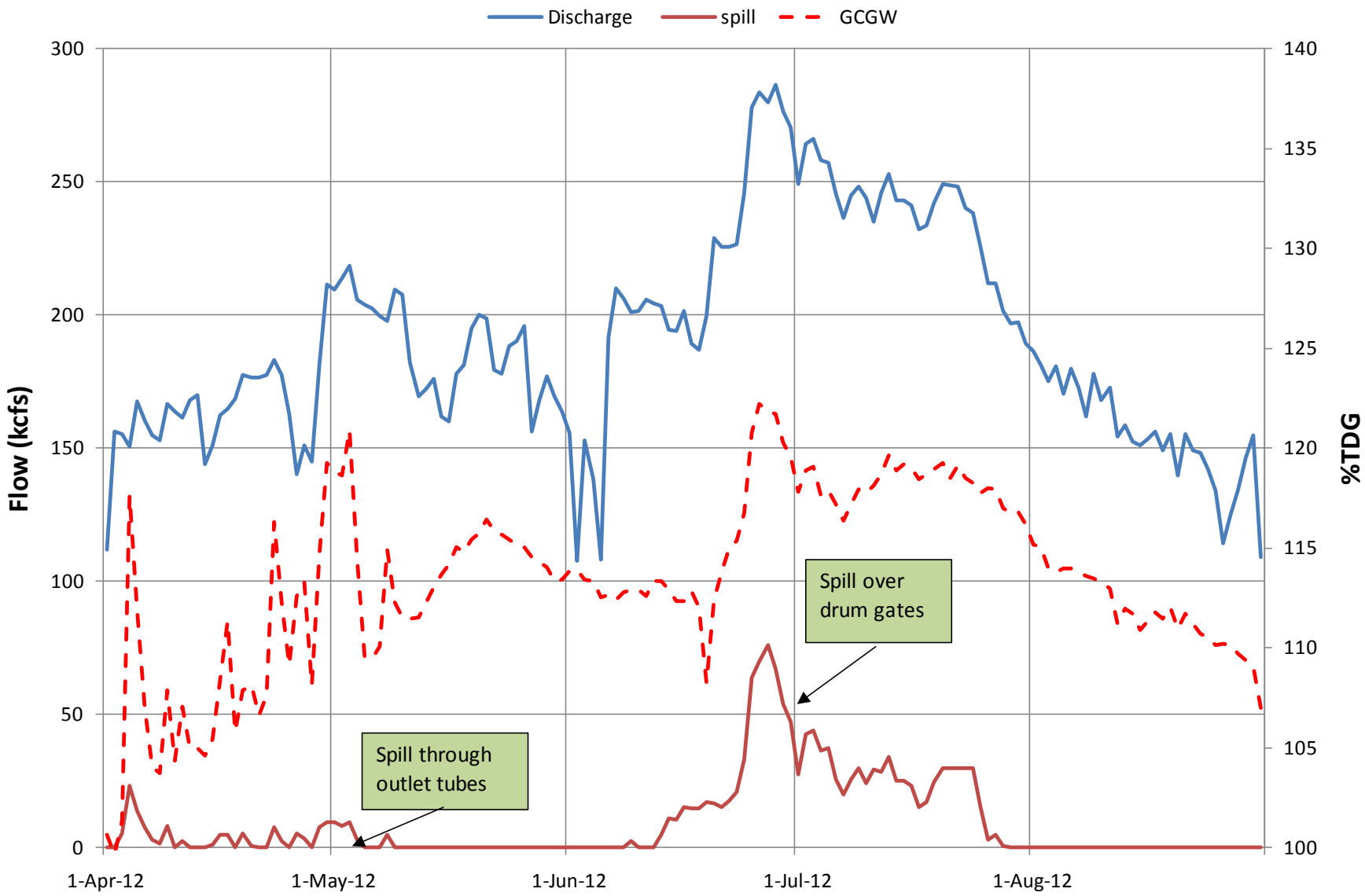
Water Supply Forecasts and Flood Control Elevations

	Jan	Feb	Mar	Apr	May	Jun	Jul
The Dalles Apr-Aug forecast (% of average)	**83**	**91**	**97**	**111**	**119**	**118**	**129**
Grand Coulee Apr 30 flood control elevation (feet)	**1276.2**	**1253.9**	**1237.0**	**1220.2**			

Grand Coulee Operations
(Oct 2011- Sep 2012)



Grand Coulee Daily Average Discharge, Spill, and Downstream %TDG



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Grand Coulee Daily Average %TDG: International Boundary (CIBW), Forebay (FDRW), and Downstream (GCGW)

RECLAMATION

- Drum gate maintenance was performed in 2012
- Completed work on 45FE-1 bank stabilization project
- Draft to 1279.6 ft on August 31
- Total volume of water released in 2012 for the Lake Roosevelt Incremental Storage Release Project was 25,500 acre-ft.

45FE-1 Bank Stabilization Work, view across lake from Boise Cove

RECLAMATION

Placing rock in Reno Mats up to 1275 ft – 1276 ft level

RECLAMATION

Workers placing mesh lids over filled Reno Mattresses

RECLAMATION