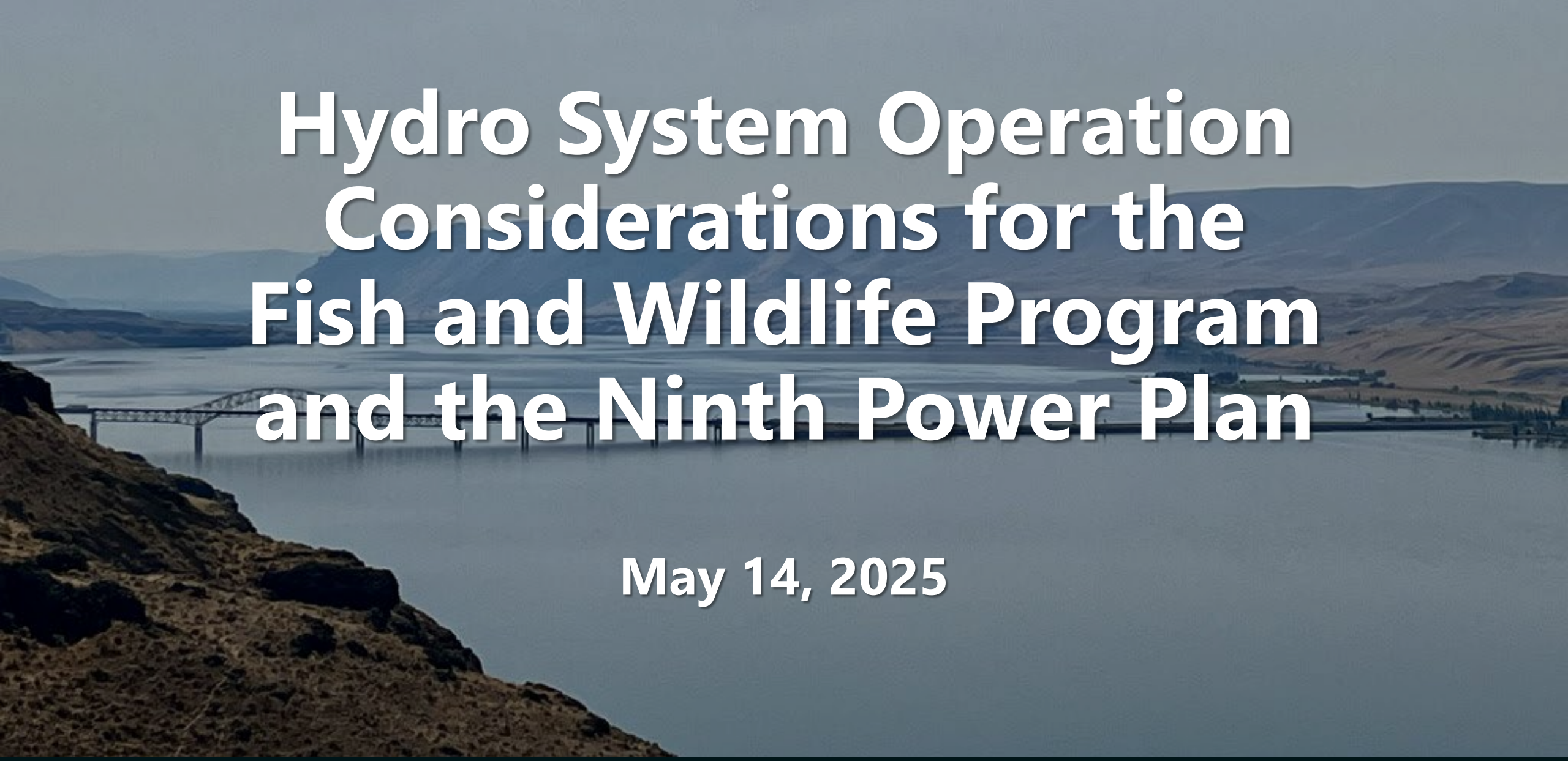

Hydro System Operation Considerations for the Fish and Wildlife Program and the Ninth Power Plan

May 14, 2025

Northwest **Power** and **Conservation** Council

Discussion Outline:

1. **Current Operations**
2. **What's Next?**
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Reminder of Previous Briefings and Other Supporting Material

Previous materials presented to the Council:

- Fish and Wildlife Program Performance: Hydrosystem Categorial Assessment
  - Presentation to Council (October 2023)
  - Presentation to Council (September 2024)
  - Supplementary documentation
- Presentation on Current Hydro Operations and Issues (January 2025)
- Program Tracker

September 2024 presentation

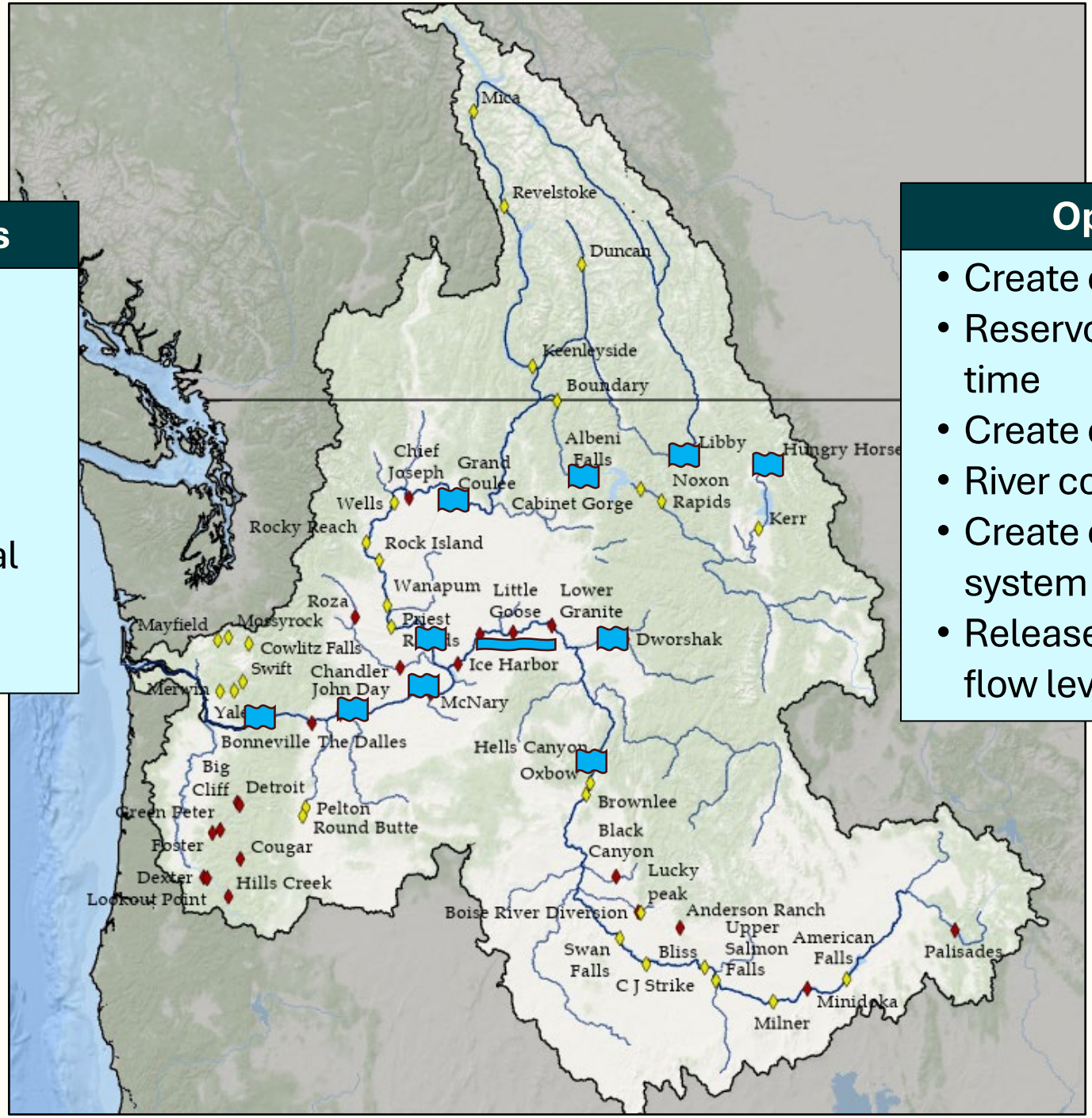
Supplementary documentation

January 2025 presentation

Program tracker

Structures at dams

- Juvenile bypass
- Spillway weirs
- Screens
- Adult ladders
- Trap and haul
- Selective withdrawal (temperature)
- TDG abatement



Operations at dams

- Create conditions above dams
- Reservoir elevation and retention time
- Create conditions below dams
- River conditions
- Create conditions elsewhere in system
- Release stored water to achieve flow levels or temperatures


Grand Coulee
Photo: USBR
Hanford Reach
Photo: Wikipedia
Albeni Falls
Photo: Wikipedia
Libby
Photo: Wikipedia
Hungry Horse
Photo: USBR
Bonneville
Photo: Wikipedia
Dworshak
Photo: Wikipedia
John Day
Photo: Wikipedia
McNary
Photo: Wikipedia
Lower Granite
Photo: Wikipedia
Hells Canyon
Photo: Wikipedia
Mica
Keenleyside
Boundary
Albeni Falls
Libby
Hungry Horse
Chief Joseph
Grand Coulee
Cabinet Gorge
Noxon Rapids
Kerr
Wells
Rocky Reach
Rock Island
Wanapum
Little Goose
Lower Granite
Roza
Priest Rapids
Dworshak
Mayfield
Mossyrock
Cowlitz Falls
Swift
Chandler
Ice Harbor
John Day
McNary
Merwin
Yale
Bonneville
The Dalles
Hells Canyon
Oxbow
Brownlee
Big Cliff
Detroit
Green Peter
Pelton Round Butte
Foster
Cougar
Black Canyon
Lucky peak
Anderson Ranch

Juvenile Migration

Salmon/Steelhead

- Columbia/Snake Storage reservoir operations: Water budget and seasonal flows
- Upper Snake River flow augmentation
- Passage
- Spill
- Transportation

Adult Migration

Salmon/Steelhead

- Summer flows
- Temperature management
- Passage structures and operations

Lamprey

- Passage
- General measures

Mainstem spawning and rearing

Hanford Reach Fall Chinook

- Seasonal flow
- Stable flow

Chum Salmon below Bonneville

- Seasonal flow

Resident fish, by location

Columbia/Snake River (Sturgeon)

- Flow and temperature
- Passage

Libby and Hungry Horse – downstream

- Minimum flow
- Sturgeon pulse
- Seasonal flows
- Ramp rates
- TDG
- Temperature

Libby and Hungry Horse – reservoir

- Reservoir drawdown
- Reservoir refill
- Stable reservoir elevation
- Reservoir end of summer draft

Grand Coulee

- Reservoir refill and stable elevations
- Fall draft limits for kokanee
- Water retention time

Albeni Falls/ Pend Oreille

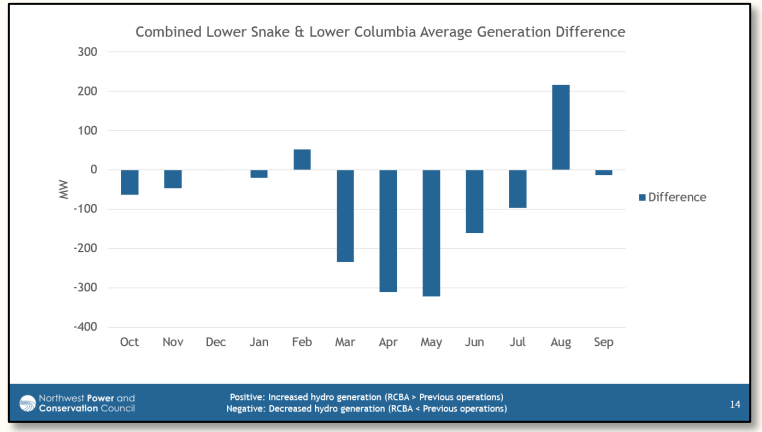
- Reservoir refill
- Reservoir drawdown
- Passage

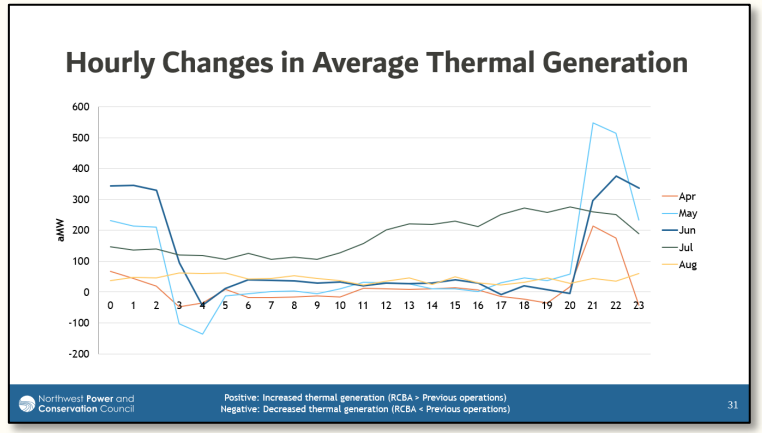
2023 Commitments
Resilient Columbia Basin Agreement

- Based on the timing of the commitments, the Council has not yet considered the newest operations in either its Fish and Wildlife Program or current Power Plan
- Council did incorporate these new operations into the GENESYS model for the 2029 adequacy assessment
  - May 2024 presentation walked through the changes

Summary of Power Staff Assessment of Changes

- Changes in hydro generation follow the changes to spill as you would expect:
  - Reduced spring and early summer generation, with greater generation changes in the Lower Snake
  - Minor reductions in the fall and winter
  - Increased August generation
- Minor changes to hydro generation flexibility
  - Reduction in flexibility in fall, increase in the spring
- Adequacy does not appear to be negatively impacted
  - Changes in regional thermal generation (often at night)
  - Greater market reliance (while staying within limits)





Assessment of fish benefits and implementation issues

- If the main point of the most recent changes in operations for fish is to ramp up spring spill as high as possible to 125% TDG, and evaluate whether we obtain the expected improvements in juvenile and especially adult survival, there is a need for consistent implementation of the operation over several years combined with rigorous monitoring and assessment of impacts on fish survival
- Increased spring spill came with a reduction in summer spill starting August 1; power benefits are obvious; hypothesis is that benefits from increased spill for spring migrants and standard spill for early summer migrants more than compensate for impacts of reduced spill on later summer migrants – also needs monitoring and assessment
- Council does not do that monitoring and assessment, but can hold others accountable; same would be true of any changes in operations for fish benefits
- Issues with implementation – see Lower Monumental example at end

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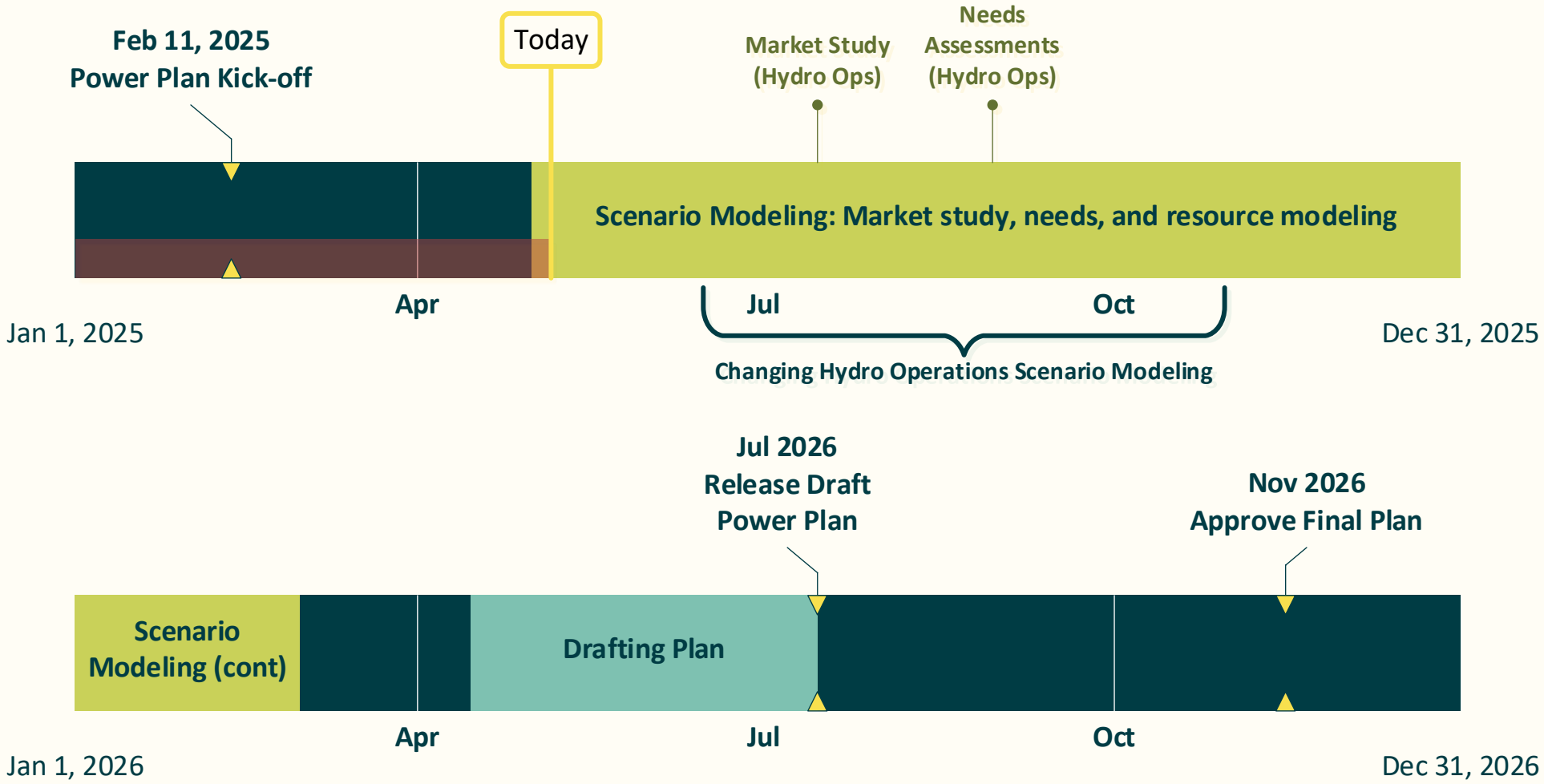
Analyzing Possible Changes in Operations

- Fish and Wildlife Program amendment process and work on the Ninth Power Plan provide an opportunity to consider possible further changes in operations
- Changes explored could be informed by:

Program Amendment Recommendations	Power System Considerations	Council Identified Issues
Examples: • Additional or enhanced fish operations • Reductions in fish operations	**Examples:** • Shifting operations for power system benefits • Changing operations for other purposes (e.g. CRT)	**Examples:** • Daily ramping flexibility considerations • Seasonal flexibility trade-off considerations

Analyzing Impacts to Power

Bring in the Changing Hydro Ops Scenario



Reminder on Scenario Modeling

Changing Hydro Operations Scenario

Aurora	GENESYS	OptGen/SDDP	GENESYS
Market Availability Study	Regional Needs Assessment	Regional Resource Optimization	Strategy Adequacy Check
Conduct a study for each sensitivity where **new resource** and transmission options change.	Conduct a study for each sensitivity where **existing system** operations change.	Conduct a study for **every** sensitivity.	Conduct a study for **every sensitivity & final recommended strategy**.

Framing out the Hydro Ops Scenario

- **Step 1, May – July:** Scope out 3-4 sensitivities to explore the implications of different hydro system operations on power system needs and potential new resource additions (May – July)
  - 1 sensitivity on current operations; 1 or 2 informed by recommendations into Fish and Wildlife Program amendment process; 1 or 2 informed by other considerations from the Council and others
- **Step 2, July – August +:** Update GENESYS model with relevant hydro operations
  - Every change is complex to implement and evaluate, but some are relatively easier than others
  - Changes higher upstream are generally easier to implement, as are changes to fuel use (e.g. spill, generation, reserves)
- **Step 3 (September):** Run needs assessment for each sensitivity scoped
  - Provide findings on how regional needs change with changing operations
  - Anticipate this will provide input into the Fish and Wildlife Program amendment process to inform AEERPS
- **Step 4 (September – November):** Run remaining elements of scenario modeling

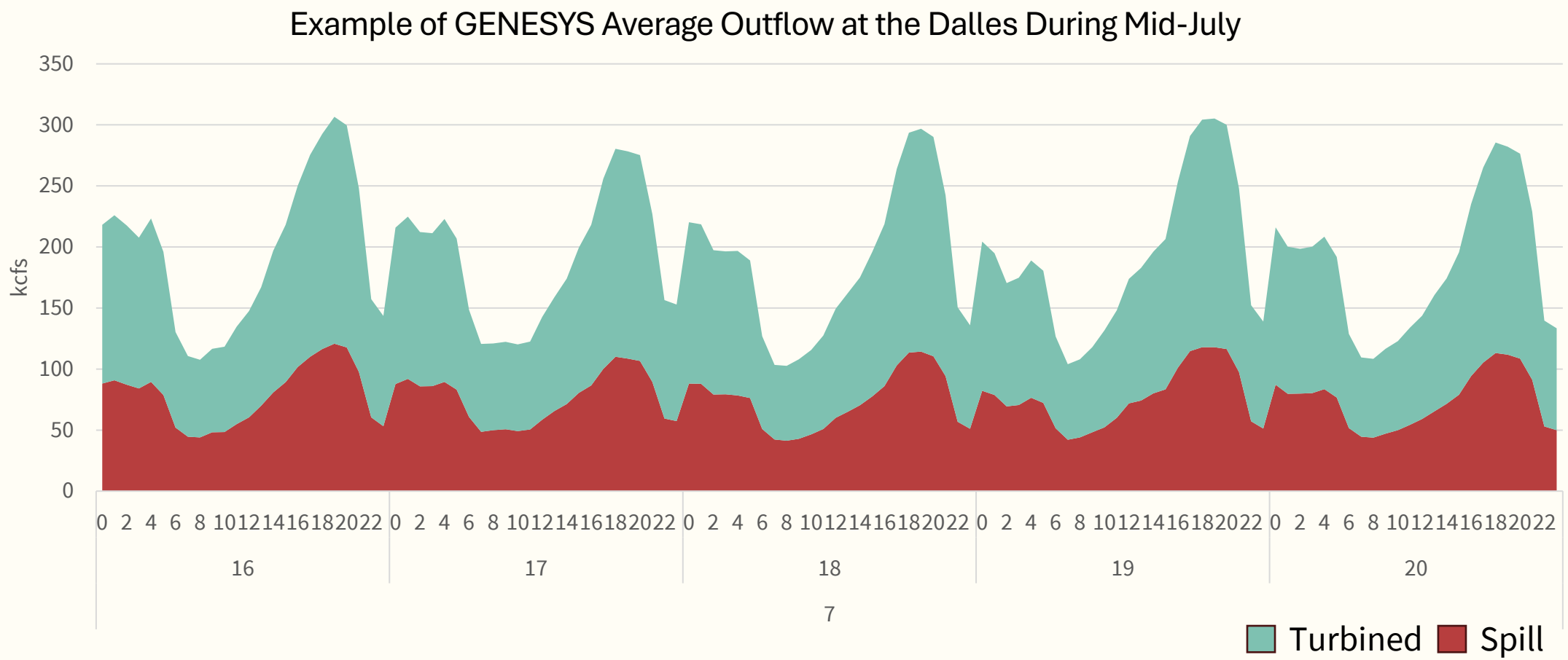
Analyzing Impacts to Fish

How to understand the effects on Salmon and Steelhead?

- The Council does not have its own passage or life-cycle model, others have
- The Council does have the experts and the expertise to make some qualitative assessments as to implications
- Can provide qualitative thoughts on this and identify the crux of issues
- If serious technical assessment is needed, we can use the program/plan processes to set in motion the work of others to determine the fish impacts

Example:
Limiting Daily Ramping

Current Daily Ramping from GENESYS Studies



Assessing Daily Ramping

Problem Statement: The Council's 2014 Fish and Wildlife Program contains measures recommended by the state and tribal fish managers calling on the system operations to minimize or reduce daily flow fluctuations, yet the 2021 Power Plan indicated that increasing these fluctuations may be one route for system adequacy as renewables and load are both added.

Fish and Wildlife Program	Power Plan
• Measures call for mimicking natural hydrograph and are driven by BiOps for salmon, steelhead, bull trout, and sturgeon. • Increased daily flow fluctuations can negatively affect: prey availability, fish migration times, egg desiccation, stranding juveniles, predation susceptibility, etc.	• Sensitivity scope can limit daily ramping to some specified amount. • Needs assessment will inform how needs change across the Council's various metrics (e.g. frequency, duration, magnitude)

Other examples

- Impacts of changes in operations and reservoir levels at Grand Coulee – what can the Council say about these impacts
- Examples from experience with recommendations calling for changes in reservoir operations
- Example of what to expect if Council receives recommendations for additional or different operations from considering the recent changes that increase spring spill and decrease summer spill

Example:
Current operations at Lower Monumental

Spring operations at Lower Monumental

Problem Statement: Current operations call for spill to 125% TDG Gas Cap (or 40% when adult passage delays are detected) from April 3 to June 20th at Lower Monumental, but implementation shows that barges for fish result in shutting the spill gates for short periods to allow for safe barge navigation.

Fish and Wildlife Program
• Transportation has required some modification in spill some days • This is a fish priority vs fish priority example – no power implication • Concern: may be hard to measure the effect of new spill operation if it is changing in season

Power Plan

• This specific operation is not something that we currently model in GENESYS, nor anticipate having the ability to explore through a sensitivity, as
  • Operations are not regular
  • Timing is sub-hourly

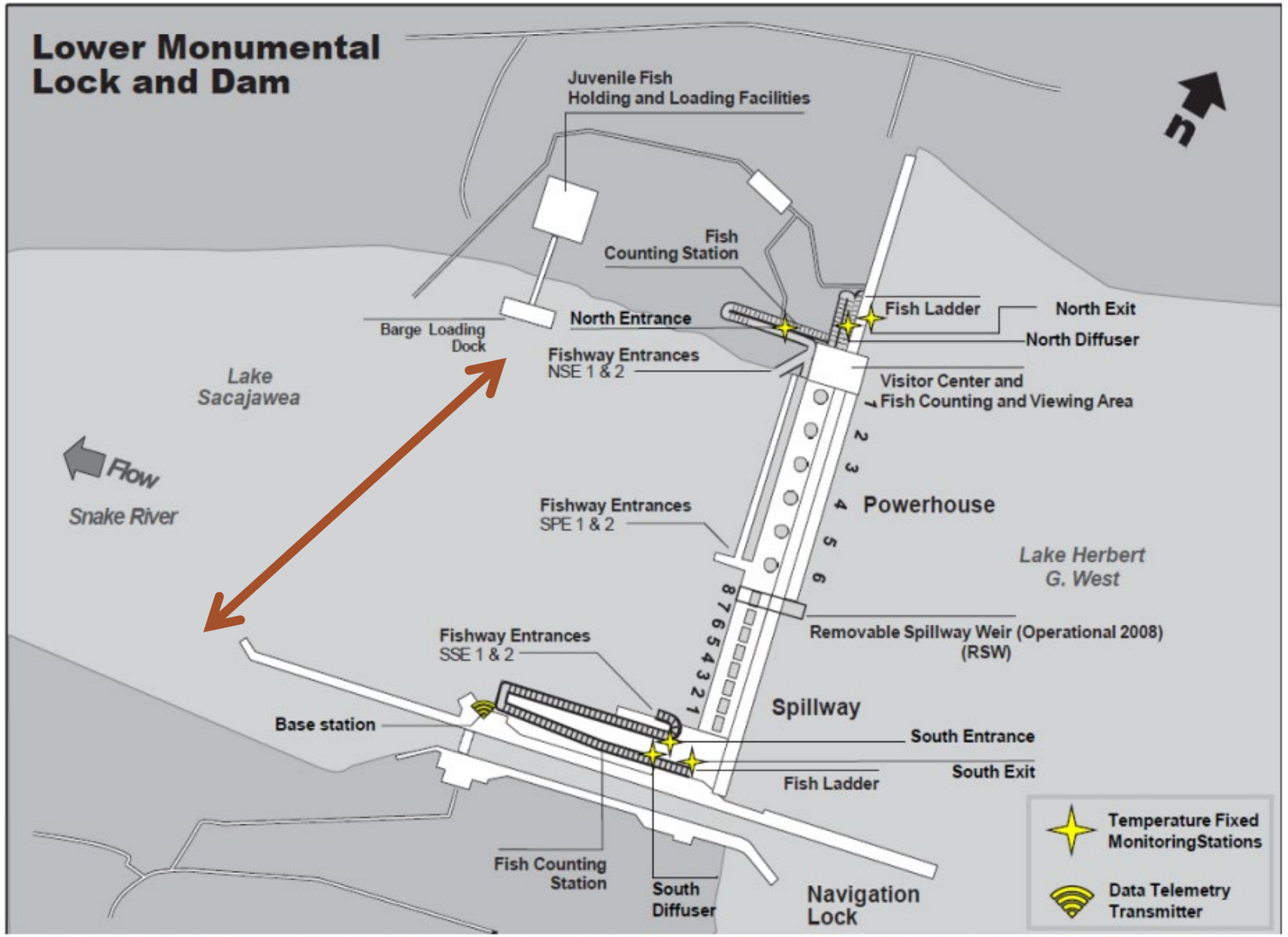
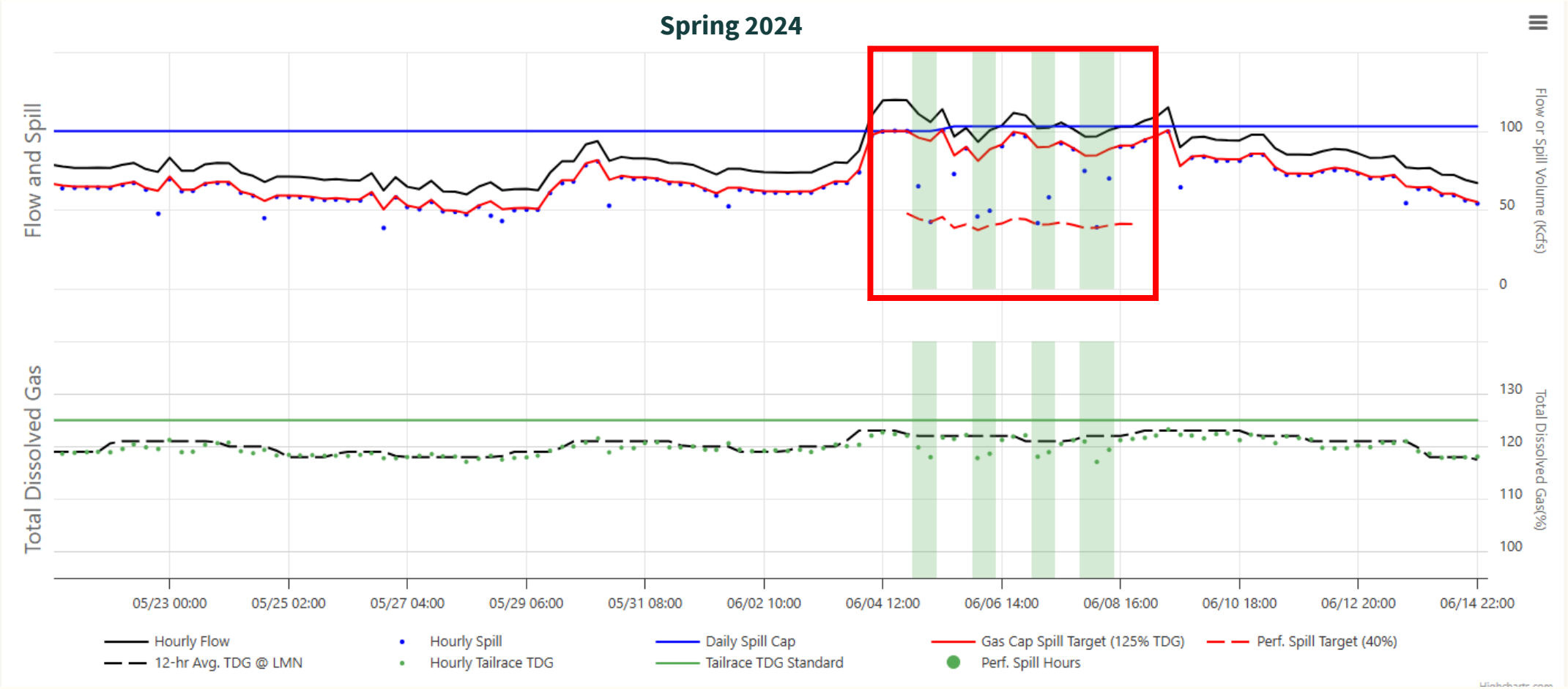


Figure LMN-1. Lower Monumental Lock & Dam General Site Plan. ***AUGUST 2024: updated ladder temperature monitoring locations.***

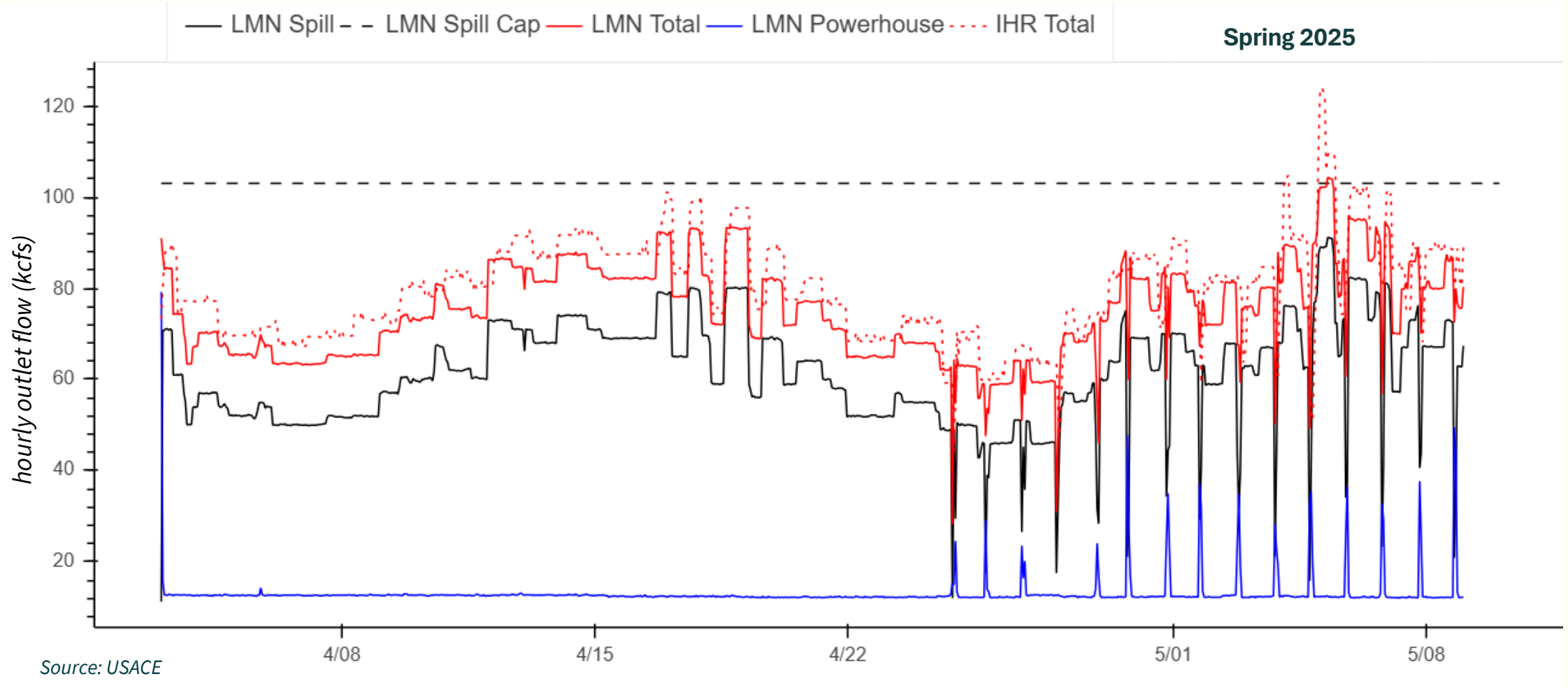
Source: USACE

Modification of spring spill at Lower Monumental in response to adult delays



Source: Fish Passage Center

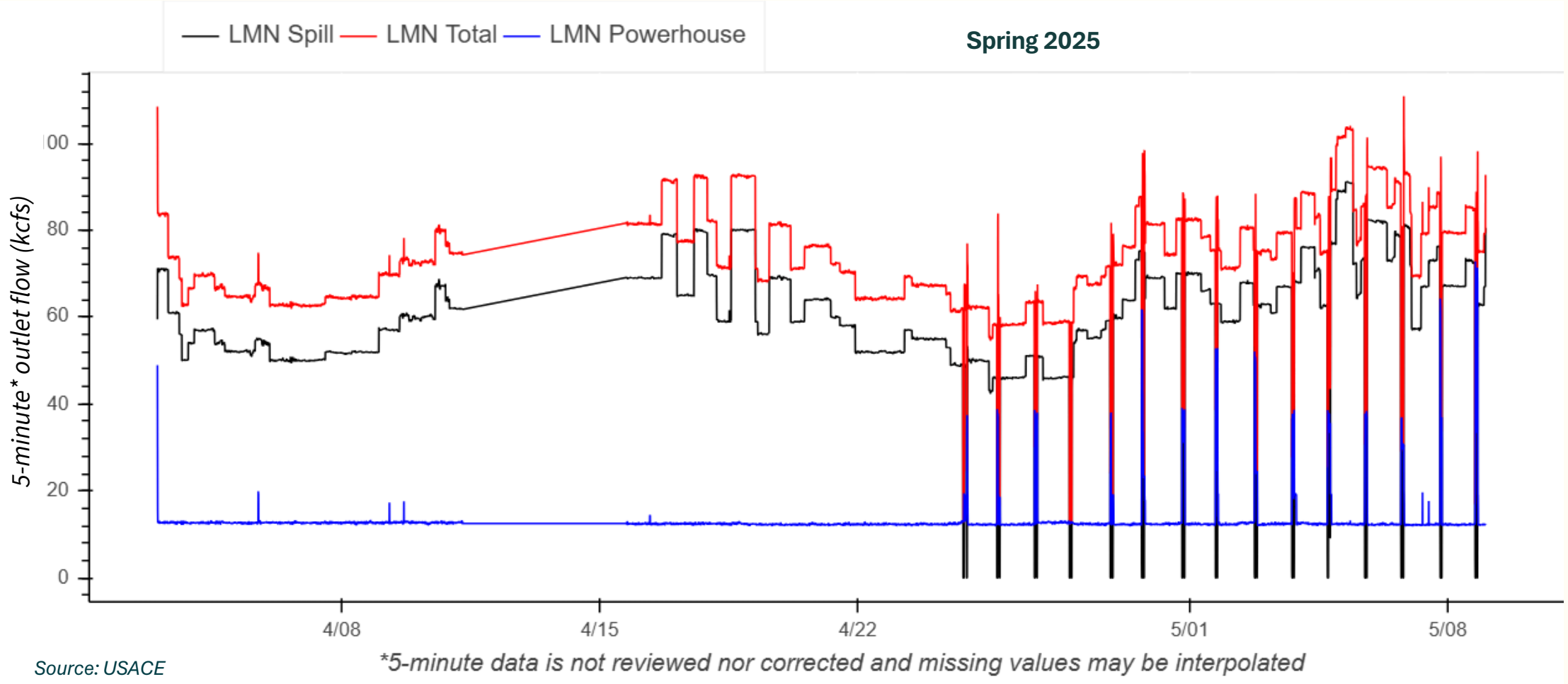
Modification of spring spill at Lower Monumental to allow for smolt transportation



Source: USACE

Hourly data

Modification of spring spill at Lower Monumental to allow for smolt transportation



Source: USACE

5-min interval data

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Council's Role

- Council has two opportunities to make decisions here that are relevant:
  - Fish and Wildlife Program measures on operations
  - Ninth Power Plan resource strategy that can describe the interplay of new resources and efficient use of the existing system to deliver power system adequacy
- Council can also set in motion some iterative dialog between the program and plan to assess and evolve operations through a couple of decision-making steps
- Including specific program measures or resource recommendations is step toward implementation
  - Power Act requires Bonneville to implement fish and wildlife actions and acquire conservation and generation resources consistent with the Council's program and plan
  - For the dam operators – Corps and Bureau in particular – the Council's program is an important consideration in implementation, and the influence can be strong, particularly if the Council does our work well to make a strong case for the recommended operations. Examples:
    - 1980s/90s – flows and passage measures
    - 2000s – Libby/Hungry Horse operations

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Timeline

May

FW + P: Initial discussion on Process

June

FW: Summary of recommendations

FW + P: Scoping discussion on potential sensitivities

July

FW: Continued discussion of recommendations/comments

P: Proposed scope of hydro flexibility scenario