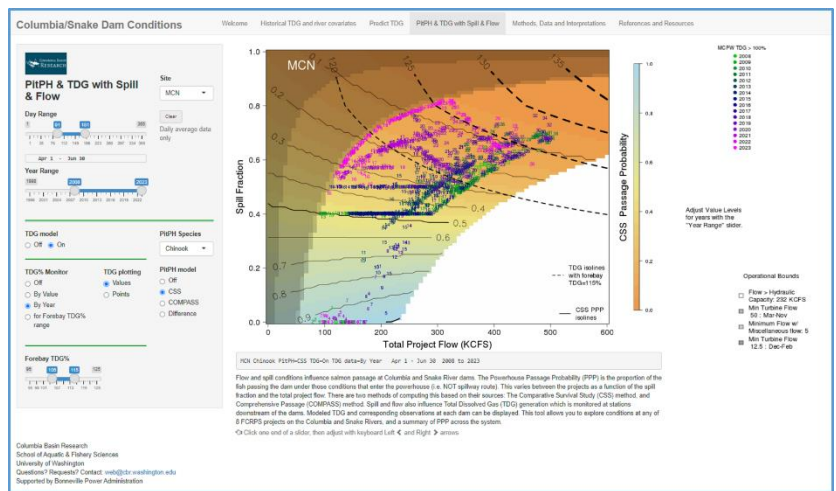


Spill-influenced trade-offs between fish passage-routing and total dissolved gas (TDG)



LARGER IMAGE on **back** to help with setup

1. Launch the DAM_CONDITIONS page in your browser: www.cbr.washington.edu/shiny/DAM_CONDITIONS/
2. Select the Tab: 'PitPH & TDG with Spill and Flow', then adjust all the other settings to match the image.
3. Adjust sliders and toggles to make comparisons, e.g. which PITPH model (Powerhouse Passage)?
4. Adjust sliders and toggles to reduce clutter and "drill" into more specific data of interest.
5. This is a 6-D view with: 1. Spill 2. Flow 3. Year 4. TDG 5. TDG-prediction 6. Routing-prediction

Some Interpretations:

- We are studying McNary Dam's Total Dissolved Gas generation during April, May, and June over the last 15 years.
- **TDG%:** Flow and spill conditions influence generation of TDG which is monitored at the Water Quality Monitoring (WQM) station 1.6 miles (2.6 km) downstream.
- **Colored** numerals each correspond to different years (key on the right-hand side). These values match the selection range of the year-filter slider. E.g. **14** is the TDG saturation >100% during **2018** and is plotted at the corresponding flow and spill point. These are ALL the data available in the selected Year-range and Day-range.
- **2023** spills were maximized while maintaining minimum turbine flows (which are the lightly greyed-out areas). For more detail on a specific year or day range, adjust the sliders to filter the data.
- At an historical prescribed spill level of 40% (0.4 fraction) there are many observations. These appear as a **greenish, but mostly dark blue** smear of color at: Spill fraction = 0.4.
- TDG model contours are shown with long dashed arcs. The iso-line value of TDG% is printed at one end. Importantly, they correspond to the selected forebay TDG% = 115. This is the high end of the "Forebay TDG% slider" which you can freely adjust to see the model response.
- **PITPH (PowerHouse Passage):** Flow and spill conditions influence the routing of salmon through dams. The Powerhouse Passage Probability (PPP) is the modeled proportion of the fish that enter the powerhouse (i.e. NOT spillway). This varies between the projects as a function of spill fraction, total flow physical configuration and operations of the dam. Two models are available, *and* they can be compared.
- The **colored background shading** is the inferred powerhouse probability for the chosen model (shown: the Comparative Survival Study, CSS). The isolines of PPP are on contours between the colors and illustrate how lower spill fraction corresponds with higher powerhouse passage. The alternative method (COMPASS), selected with a radio-button, has a slightly different response.

Columbia/Snake Dam Conditions

PIPH & TDG with Spill & Flow

Site: Clear

Day Range: - Daily average data only

Year Range: - Apr 1 - Jun 30

PIPH Species:

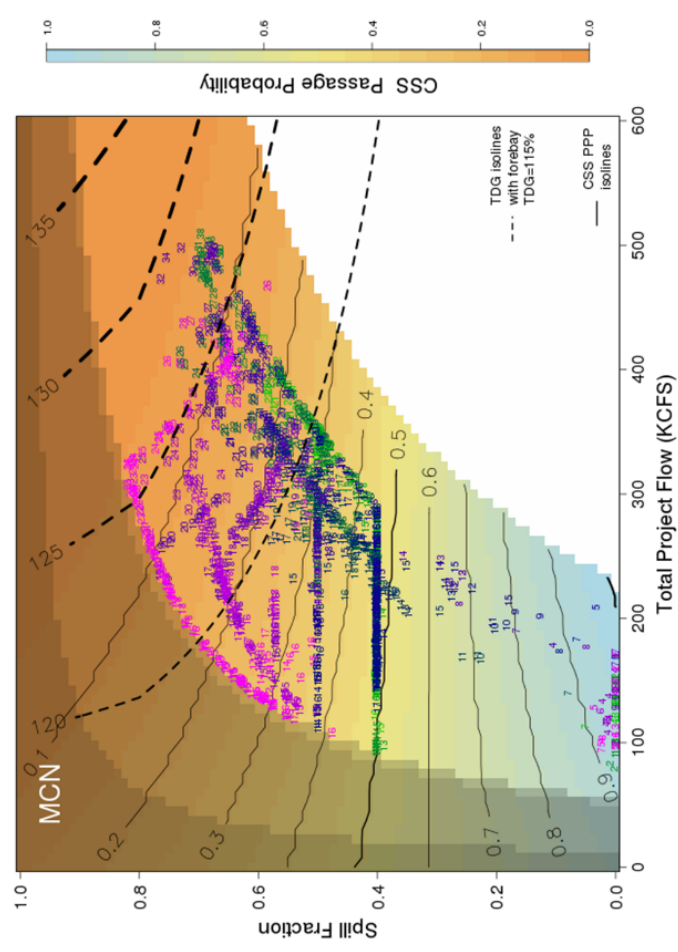
TDG model: Off On

TDG% Monitor: Off By Value By Year for Forebay TDG% range

TDG plotting: Values Points

PIPH model: Off CSS COMPASS Difference

Forebay TDG%: - - -



MCN Chinook PIPIH-CSS TDG-On TDG data=By Year Apr 1 - Jun 30 2008 to 2023

Flow and spill conditions influence salmon passage at Columbia and Snake River dams. The Powerhouse Passage Probability (PPP) is the proportion of the fish passing the dam under those conditions that enter the powerhouse (i.e. NOT spillway route). This varies between the projects as a function of the spill fraction and the total project flow. There are two methods of computing this based on their sources: The Comparative Survival Study (CSS) method, and Comprehensive Passage (COMPASS) method. Spill and flow also influence Total Dissolved Gas (TDG) generation which is monitored at stations downstream of the dams. Modeled TDG and corresponding observations at each dam can be displayed. This tool allows you to explore conditions at any of 8 FCRRS projects on the Columbia and Snake Rivers, and a summary of PPP across the system.

↔ Click one end of a slider, then adjust with keyboard Left ← and Right → arrows

Adjust Value Levels for years with the "Year Range" slider.

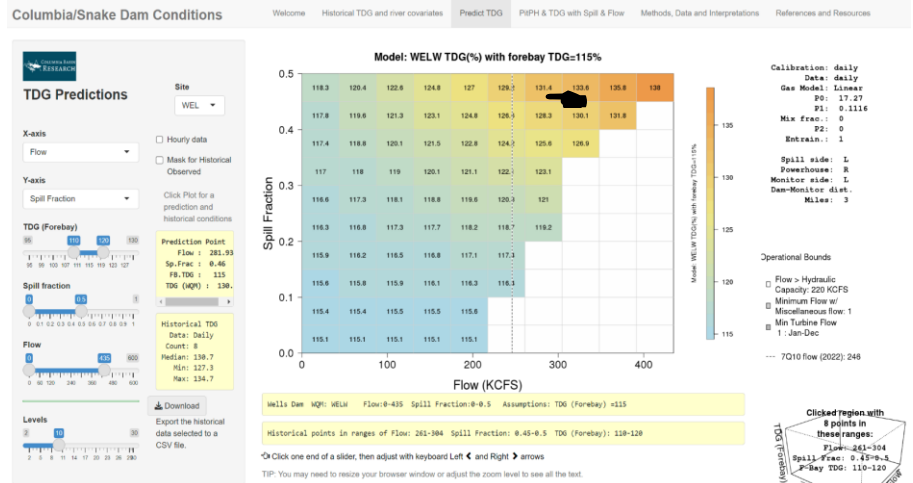
Operational Bounds


- Flow > Hydraulic Capacity: 232 KCFS
- Min Turbine Flow
- 50 : Mar-Nov
- Minimum Flow w/ Miscellaneous flow: 5
- Min Turbine Flow
- 12.5 : Dec-Feb

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 University of Washington
 Questions? Requests? Contact: web@cbr.washington.edu
 Supported by Bonneville Power Administration


Forecast total dissolved gas (TDG) based on dam operations and environmental conditions

LARGER IMAGE on p.2 to help with setup



1. Launch the DAM_CONDITIONS page in your browser: www.cbr.washington.edu/shiny/DAM_CONDITIONS/
2. Select the Tab: 'Predict TDG', then adjust all the other settings to match the image.
3. Click on the plot (where the  icon is). Also, you may need to adjust browser "zoom".
4. Adjust sliders and toggles to reduce clutter and "drill" into more specific data of interest.
5. There is a lot to see as you filter the past precisely to reveal possibilities in the future.

Some Interpretations:

- There are **4 yellow text-areas**. Two are below the plot that show: your settings, and an historical data summary. Two are to the left and show: a prediction at the clicked point, and historical Water Quality Monitor (WQM) TDG metrics.
- A **clicked-point** on the plot identifies **Flow** and **Spill Fraction** and makes a TDG% prediction for the downstream WQM site. This is displayed in the "Prediction Point" text-area.
- The prediction needs a Forebay TDG% (115%) which you control with the slider. The value is the mean of the "TDG (Forebay) " slider range and printed in the title. Adjust the slider controls to see the influence of this variable.
- The **clicked-volume** identifies a range of historical conditions. Their scope and resolution are defined by the dimensions of the plot and levels adjusted with the 4 sliders.
- The filtered data are identified with: 1) a graphic on the right, 2) text-area below the plot, 3) a summary of WQM TDG% for those conditions in the "Historical TDG" text-area.
- You can mask conditions that have never been observed within the constraints of the data filters using a checkbox that will turn areas without data to **pink**.
- Decrease (increase) granularity w/ fewer (more) "Levels" and wider (narrower) "Flow", "Spill-Fraction", and "TDG (Forebay)" ranges.
- At Wells Dam, historical conditions in the **clicked-volume** have happened. We have had 8 distinct days in the past with ranges of flow: 261-304 KCFs; spill: 45-50%; and forebay TDG: 110-120%. On those days, the median WQM TDG% was **130.7%** (range: 127.3-134.7%). The TDG model point prediction at the **clicked-point** is **130%**.
- The exact location of your click may report a prediction slightly different than shown here. If you click outside of the range of observations you will still get a TDG% Prediction, but NULL results in the Historical TDG text-area.
- These flow conditions were beyond the 7Q10 flow (246 KCFs). This triggered a shift in operations-priorities. Downstream water-quality concerns may have been superseded by safety and system-integrity operations.
- Click  **Download** to obtain a *.csv file with these specific data records.



Columbia/Snake Dam Conditions

TDG Predictions

Site: WEL

Hourly data
 Mask for Historical Observed

Click Plot for a prediction and historical conditions

Prediction Point
 Flow : 278.07
 Sp.Frac : 0.46
 FB-TDG : 115
 TDG (WQM) : 130.3

Historical TDG
 Data: Daily
 Count: 8
 Median: 130.7
 Min: 127.3
 Max: 134.7

Download

Export the historical data selected to a CSV file.

X-axis Flow

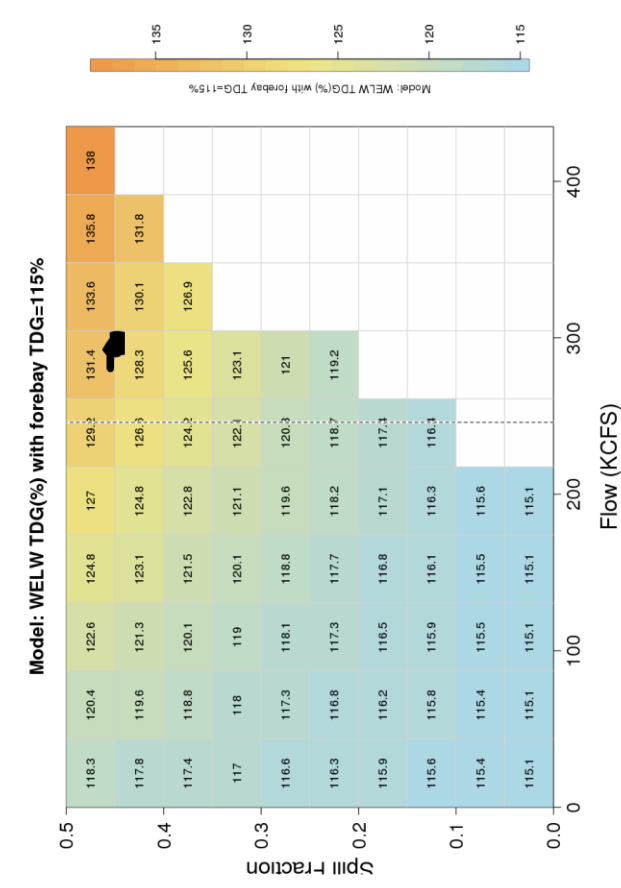
Y-axis Spill Fraction

TDG (Forebay) 110 120 130

Spill fraction 0 0.5

Flow 0 435 600

Levels 2 10 30



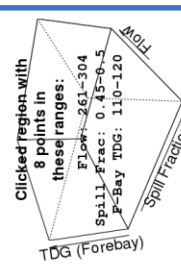
Calibration: daily
 Data: daily
 Gas Model: Linear
 P0: 17.27
 P1: 0.1116
 Mix frac.: 0
 P2: 0
 Entrain.: 1

Spill side: L
 Powerhouse: R
 Monitor side: L
 Dam-Monitor dist.:
 Miles: 3

Operational Bounds

- Flow > Hydraulic
- Capacity: 220 KCFs
- Minimum Flow w/ Miscellaneous flow: 1
- Min Turbine Flow
- 1: Jan-Dec

--- 7Q10 flow (2022): 248



Wells Dam WQM: WELW Flow: 0-435 Spill Fraction: 0-0.5 Assumptions: TDG (Forebay) =115

Historical points in ranges of Flow: 261-304 Spill Fraction: 0.45-0.5 TDG (Forebay) : 110-120

Click one end of a slider, then adjust with keyboard Left and Right arrows

TIP: You may need to resize your browser window or adjust the zoom level to see all the text.