DRAFT HCR and LOP IRRM Refill Impact Analysis

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RES-SIM Analysis

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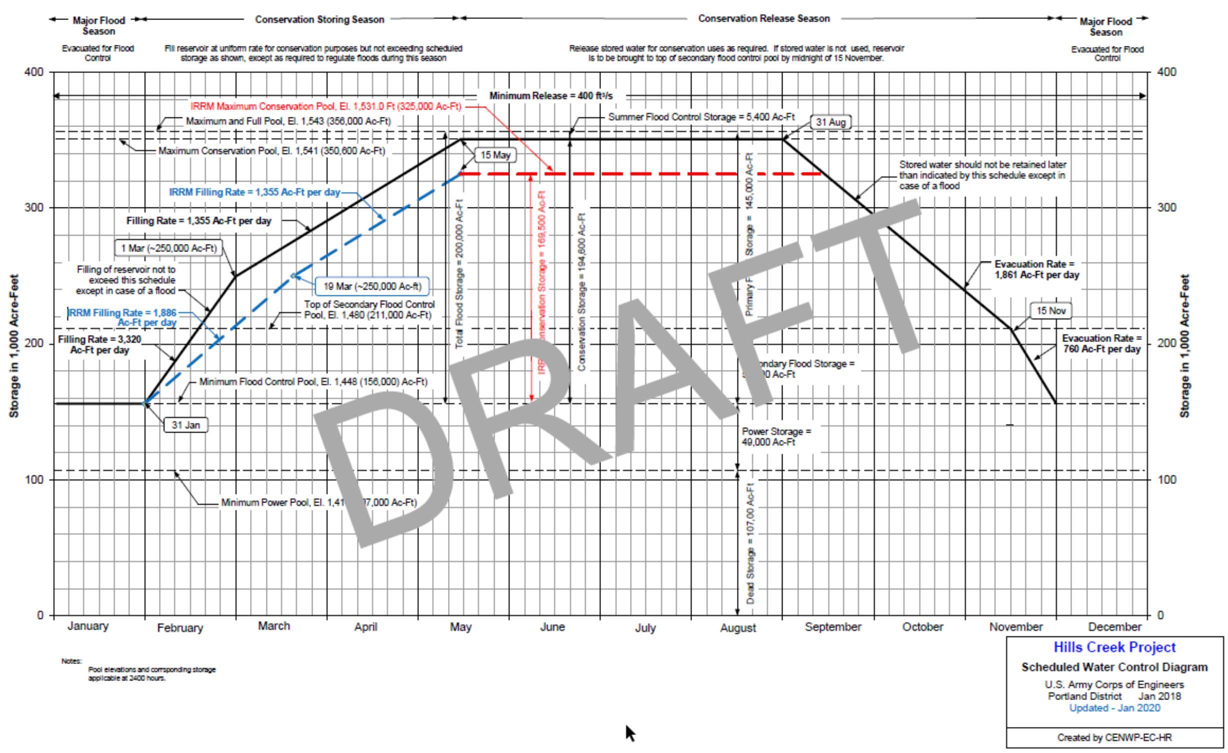
Background and Purpose

ENC-HY analyzed a number of potential pool restriction alternatives at Hills Creek and LOP using HEC-ResSim and assessed impacts to system water management objectives using methodology documented in the Pool Restriction Impact Analysis Report.

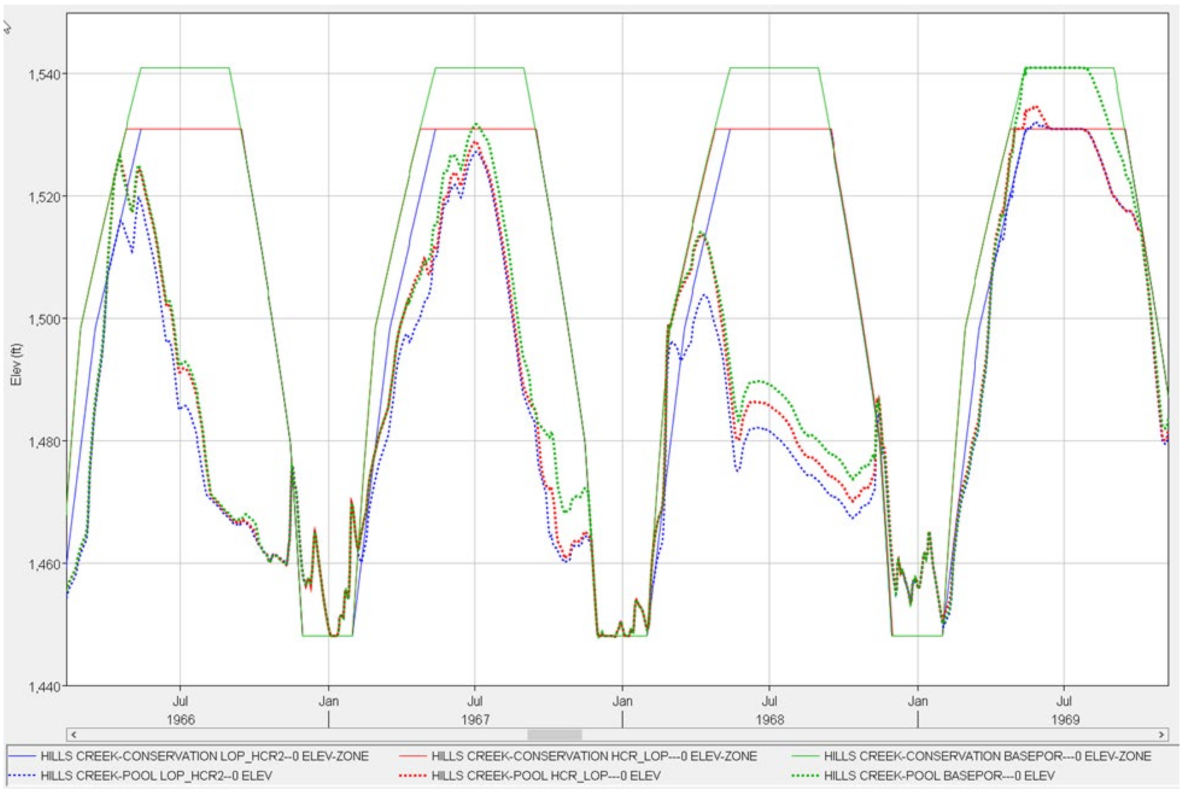
Recently proposed IRRMs include a pool restriction at Lookout Point (to 921 ft) and both a pool restriction and filling rate restriction at Hills Creek (to 1531 ft on 15 May, as shown by the blue and red dashed lines in the Water Control Diagram below). Previous analysis included pool restriction operations at LOP and HCR, but did not include analysis of the filling restriction (dashed blue line). In order to better understand impacts related to the ability to refill due to the filling rate IRRM, operations under the latest version of the proposed operation were simulated and refill performance was evaluated.



Methods

HEC-ResSim was used to model the scenario described above including the pool restrictions at LOP and HCR and the filling rate restriction at HCR. This alternative is compared to a baseline alternative where no IRRMs are in place, and an alternative with elevation IRRMs at LOP and HCR, but no fill IRRM.

Model output representing operations at Hills Creek for several alternatives: (1) no IRRMs (2) elevation IRRM and (3) an elevation + fill IRRMs, are shown in the Figure below in green, red, and blue, respectively. Solid lines represent the HCR rule curves simulated (following the IRRMs) and dashed lines represent the simulated operation in four example years.

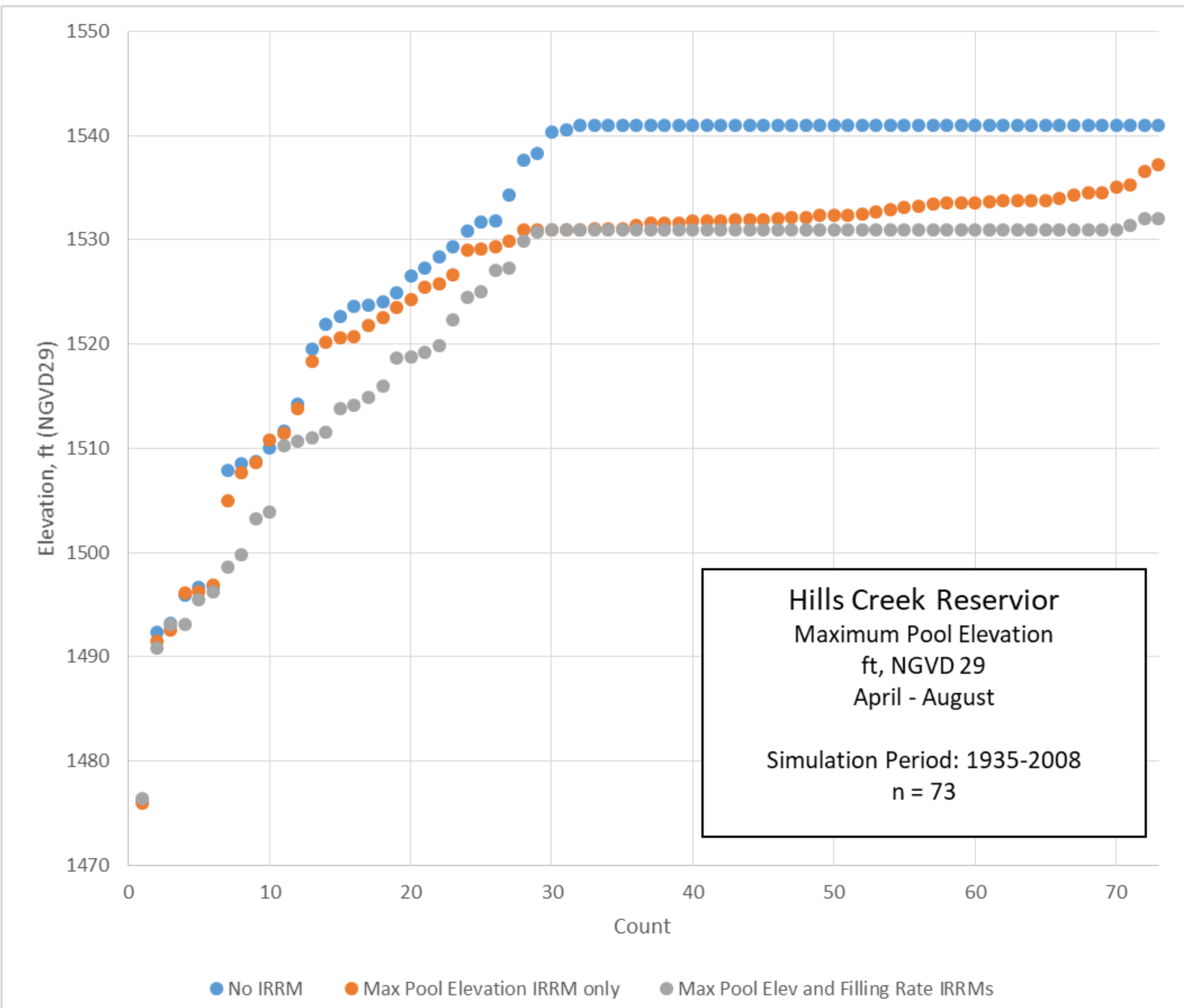


Results

HEC-RES-SIM model results show that the ability to refill when the elevation + fill IRRMs are in place is slightly reduced from the ability to refill with the elevation IRRM only in place. Refill to an elevation of 1531 ft at Hills Creek was achieved during the summer in 46 of 73 years with the elevation IRRM only and in 44 years in the elevation + fill IRRM operational scenario (see results in Table below). The corresponding probability is also included in the Table for reference.

Number of Years that Maximum Summer Pool Elevation Exceeds 1531 ft			
	No IRRM	Max Pool Elevation IRRM only	Max Pool Elev and Refill Rate IRRMs
# years (73 total)	49	46	44
Probability	67%	63%	60%

For each alternative, maximum pool elevation in all years is plotted below in rank order. As described above, the elevation only IRRM alternative has a slightly higher rate of achieving an elevation of 1531 ft than the elevation + fill IRRM. The Elevation Results also show that the elevation + fill IRRM helps to reduce the likelihood of exceeding an elevation of 1531 ft.



Results Location:

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Water Temperature Impacts

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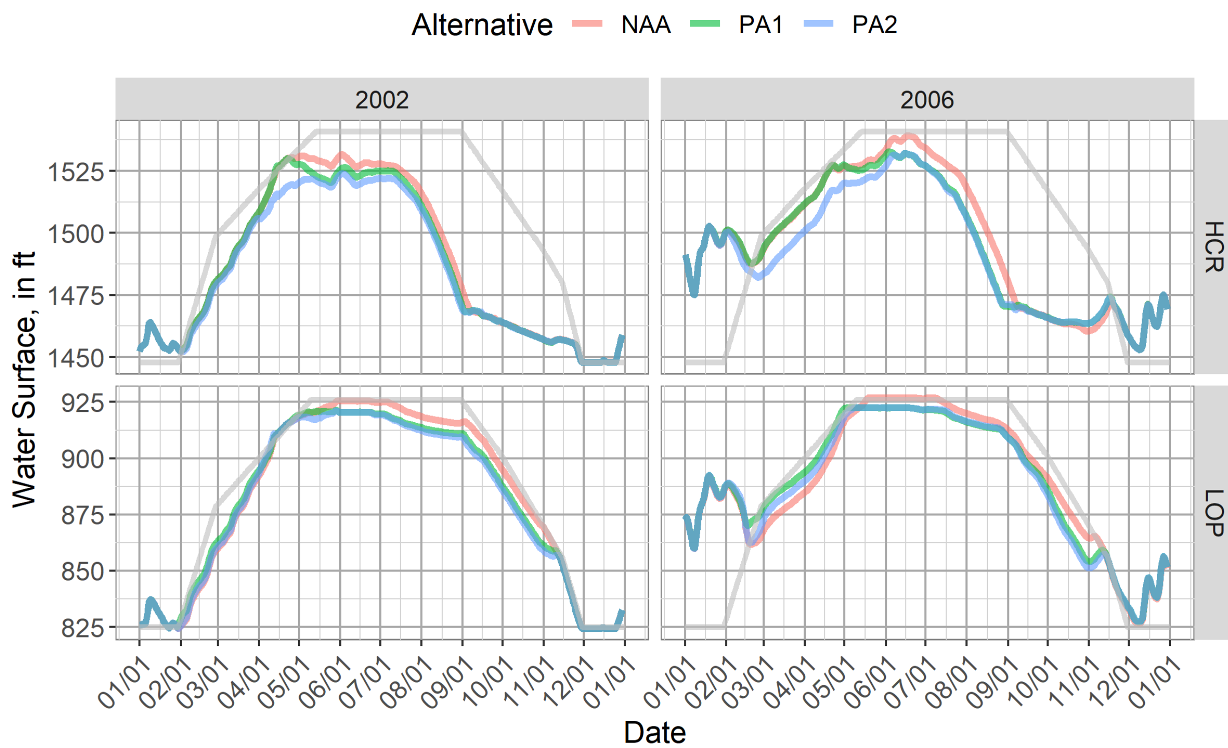
01-06-2020

Previous studies have shown simulated temperature impacts resulting from lower pool levels at Hills Creek and Lookout Point Dams to have meaningful temperature impacts only when other outlets (deeper and shallower than the penstocks; i.e., spillways, ROs) are used in combination with maximum summer pool level restrictions (Buccola et. al., 2016). Given the small difference in pool level (10 ft and 5ft reduction at HCR and LOP, respectively), and the limitation of using the power penstocks as the primary release point during April-November of the operation, negligible changes to water temperatures below Dexter Dam are expected as a result of this operation. Regardless, USACE is currently working to simulate the water temperature impacts resulting from these pool restriction operations to better understand the temperature impacts as they may be implemented in 2020.

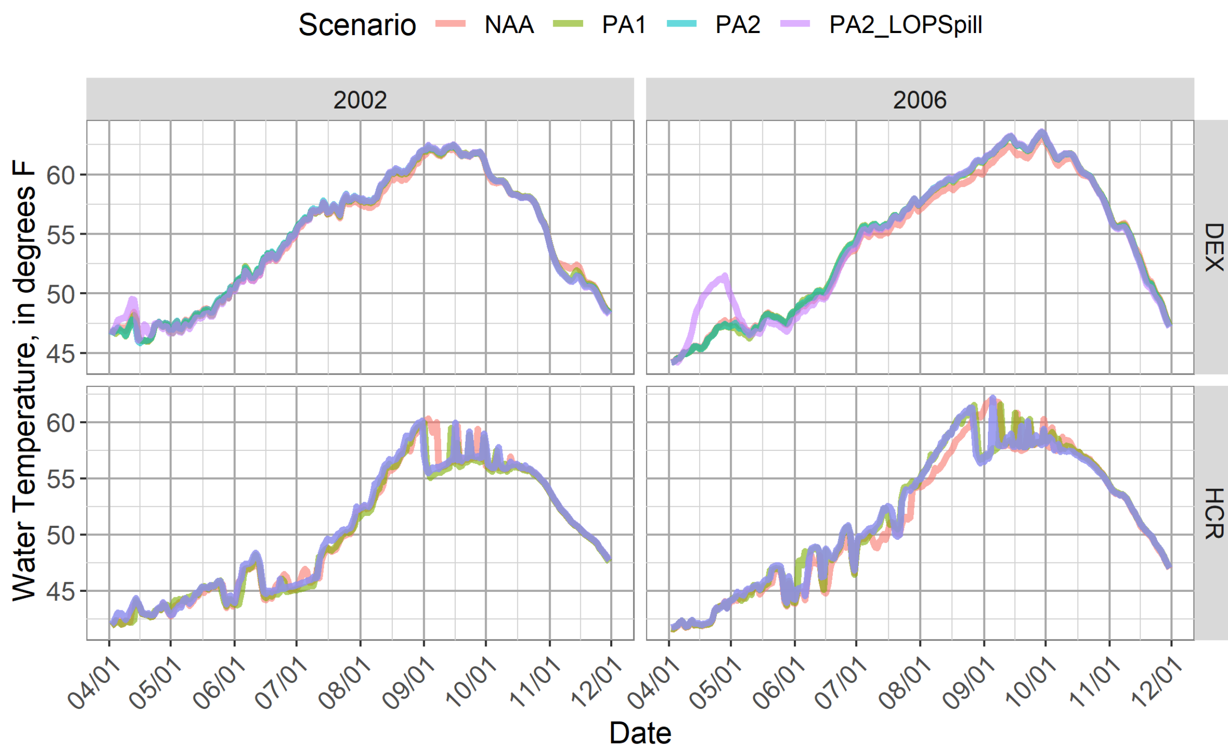
The following scenarios were simulated using the CE-QUAL-W2 models (version 4.1) of HCR, Middle Fork Willamette River between HCR and LOP, LOP, and DEX reservoirs:

- NAA (No Action Alternative): Baseline Simulation
- PA1 (Chosen Action Alternative): HCR and LOP (elevation IRRMs only)
- PA2 (Chosen Action Alternative (+ HCR Fill IRRM)): HCR (elevation and fill IRRM) and LOP (elevation IRRM)
- PA2_LOPSpill (Identical flows as PA2 except all outflow routed to LOP spillway when LOP lake level is between 2 and 25 feet above the spillway crest (887.5 ft [270.51 m]) from March 15 to June 30.

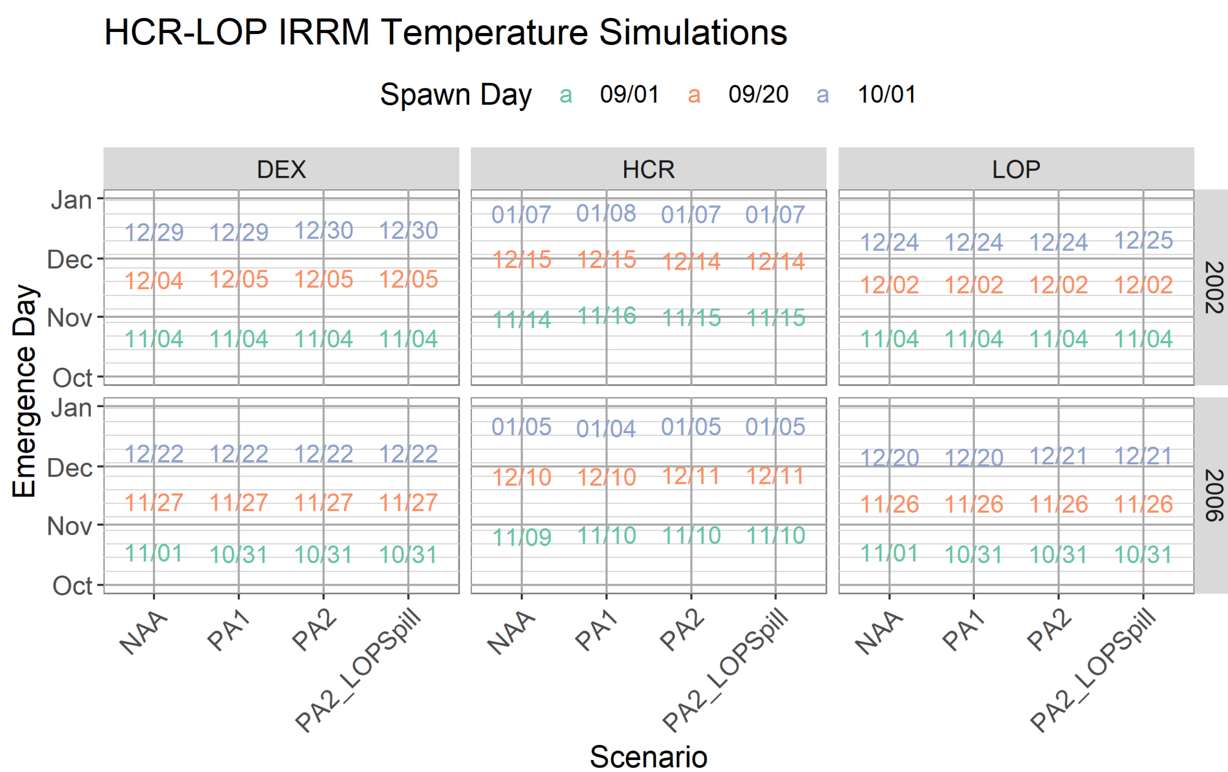
Outflows at HCR, LOP, and DEX were identical to those used in the RES-SIM runs described above in 2002 and 2006. While the RES-SIM simulations included many more years, these two years were the only years in which the Middle Fork Willamette CE-QUAL-W2 models were currently developed for (Buccola, et. al., 2013). All outflow at each dam was routed through the turbines during the summer period, except for the PA2_LOPSpill scenario, which is described above. Simulated water surfaces are shown below:



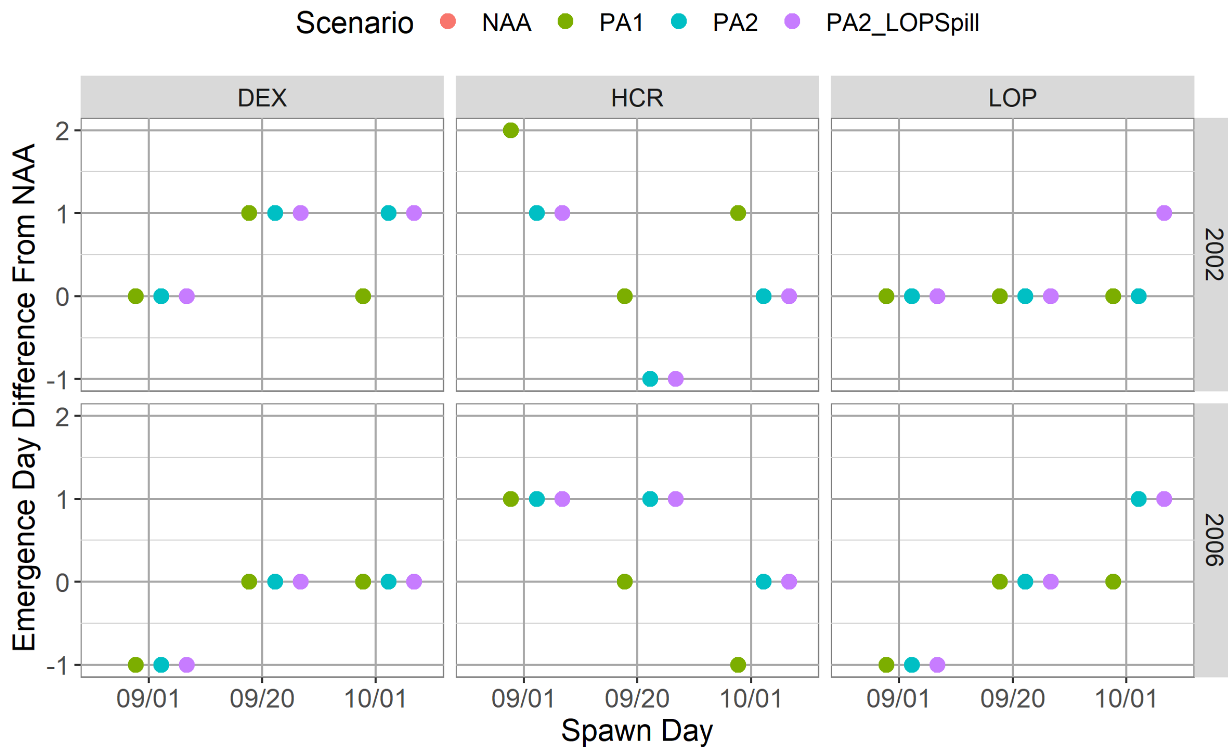
Outflow temperatures during April-November are shown below. IRRM scenarios were generally warmer than NAA in summer and slightly cooler than NAA during fall (2002 only). PA1, PA2, and PA2_LOPSpill IRRM scenarios were similar among each other aside from the warmer temperatures as a result of the spring spill period specified in PA2_LOPSpill.



The following plot shows the emergence timing in each scenarios from three assumed spawning days (depicted by colors).

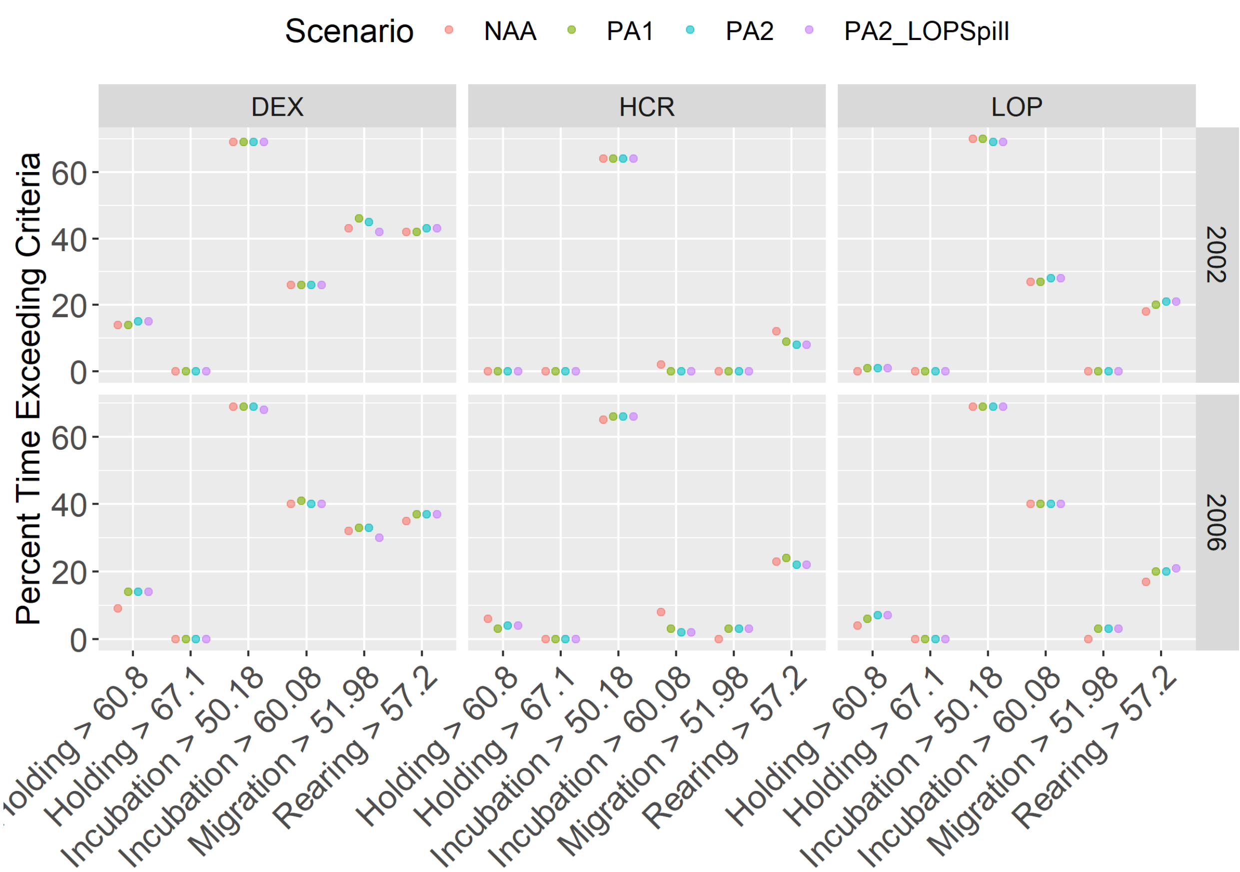


The emergence day difference between each scenario and NAA (all negligable/minor differences; no difference exceeds 2 days):



Percentage of time exceeding a threshold temperature for each calendar-year scenario is shown below. Life stages span the following timeframes as follows: Migration (May 1 to July 15), Holding (May 1 to Sep 15), Rearing (May 1 to Sep 15), Spawning (Sep 1 to Oct 15), and Incubation (Sep 1 to Dec 31).

Downstream of DEX, there is a greater amount of time in which temperatures exceed 60.8 degrees F (16 degrees C) under the PA1 and PA2 scenarios compared with NAA, notably during the Holding period of 2006.



Citations:

Buccola, N.L., Stonewall, A.J., Sullivan, A.B., Kim, Yoonhee, and Rounds, S.A., 2013, Development of CE-QUAL-W2 models for the Middle Fork Willamette and South Santiam Rivers, Oregon: U.S. Geological Survey Open-File Report 2013-1196, 55 p. http://dx.doi.org/10.3133/ofr20131186

Buccola, N.L., Turner, D.F., and Rounds, S.A., 2016, Water temperature effects from simulated dam operations and structures in the Middle Fork Willamette River, western Oregon: U.S. Geological Survey Open-File Report 2016–1159, 39 p., http://dx.doi.org/10.3133/ofr20161159.