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A Comparison of Shasta Temperature Management Processes

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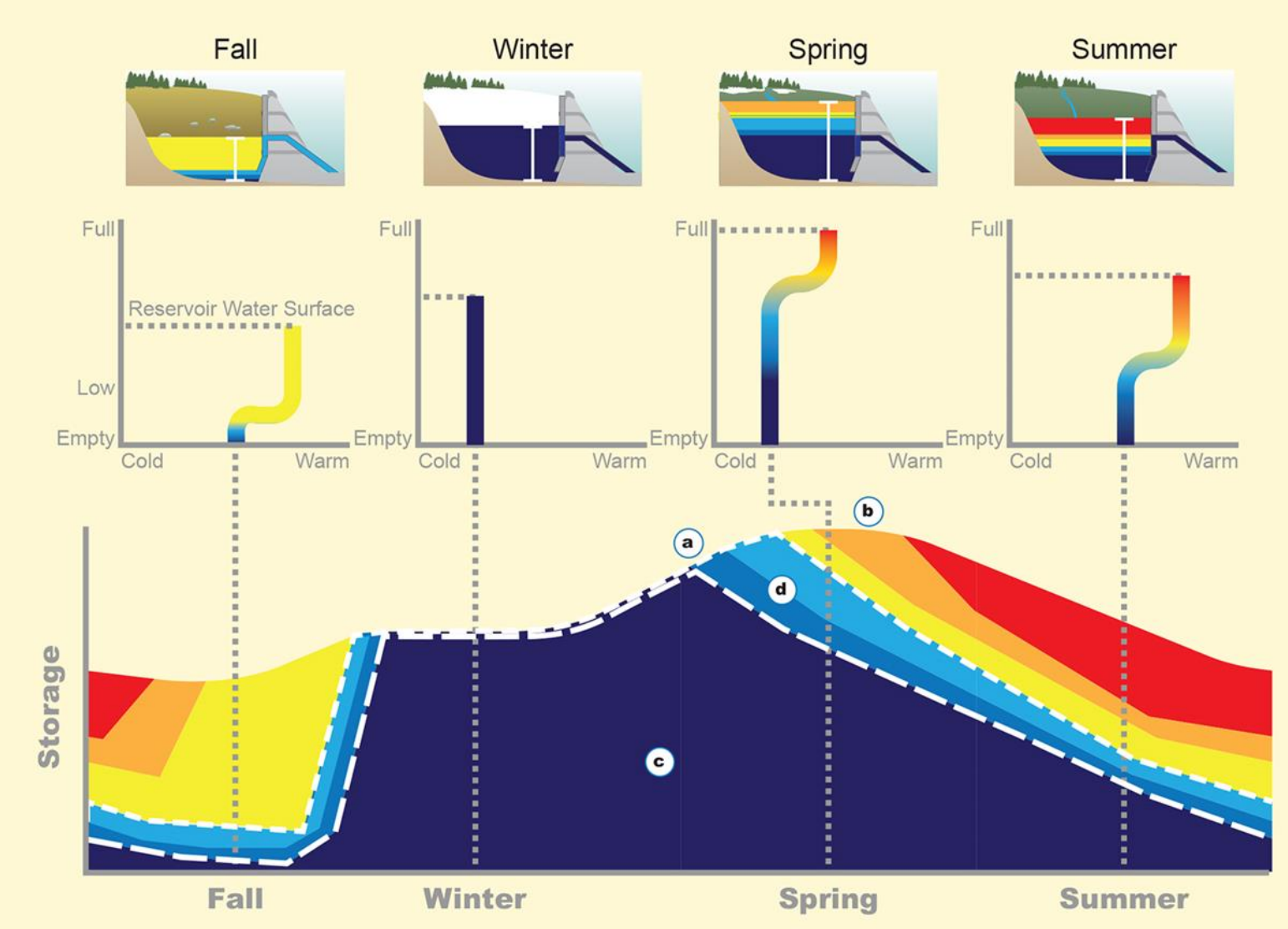
Overview

Dan Cook, USFWS / USFWS, Public Domain

- Shasta Temperature Management
- 2021 LTO Analyses
  - Converged temperature operations
  - Scenarios
- Temperature Comparison
- TDM Comparison
- Continuing Work

Shasta Temperature Management



Temperature Management

- Converged TCD operations
  - Iterate between the downstream compliance locations and release temperature until less than 0.1% change occurs with on the release temperature
  - Typically done per year followed by a full period-of-record run
  - Pulls/saves more cold water from the reservoirs to meet compliance
  - Conforms more closely with Reclamation operations

Temperature Management Logics

- Operations scenarios are commonly separated by different temperature compliance logics
- Temperature logics many be ran on different operations to highlight the affect of operations versus temperature logic
- Temperature logics determine how the limited cold-water pool is utilized

- NAA – 2019 & 2021 Tiers
- Exp1 – 90-5 (computational challenges)
- Exp3 – 90-5
- Alt 1 – 90-5
- Alt2 – Mixed Compliance Location
- Alt3 – Water year type target
- Alt4 – Carryover based target & 2021 Tiers

Shasta 2019 Temperature Tiers

- Developed as part of the 2019 BiOp
- Four primary tiers, with 3 subtiers in 2/3
- Keys off of the Shasta cold water pool for primary tier
  - Shifted tier transitions based on operator feedback
- Temperature timeseries
  - 60 F shoulder through May 15th
  - Includes 53.5 F, 54 F, 54.5 F, 55 F, and 56 F periods depending on tier and time
  - Holds temperature as long as possible until the end of the calendar year

90-5 Temperature Targets

- Shoulder period of 60.8 F January through March
  - From SRTTG temperature target development
- 56 F at the most downstream location feasible from April 1st through the end of the year
  - Uses total storage to determine compliance location
    - <3600 TAF Clear Creek
    - 3600 – 4000 TAF Balls Ferry
    - 4000 – 4400 TAF Jellys Ferry
    - >4400 Bend Bridge

Mixed Compliance Location Logic (PA)

- Implemented as the PA logic
- Shoulder of 60 F before 5/15, transitioning to 53.5 F
- Changing compliance location based on Shasta bin type
  - Type 1 – Airport Road
  - Type 2 – Clear Creek
  - Type 3 – Hwy 44
  - Similar to a fixed compliance point with a changing temperature

Water Year Type Target (NGO)

- Primarily based on water year type
  - Fixed location at Clear Creek
  - 61 F at clear creek before 5/15
  - 53.5 F unless critical dry, when 54.5 F
- Jelly's Ferry target
  - 5/1 – 5/15
  - 7-day average of daily maximum temperatures less than 61 F
  - Requires iteration between the daily and 6-hourly models

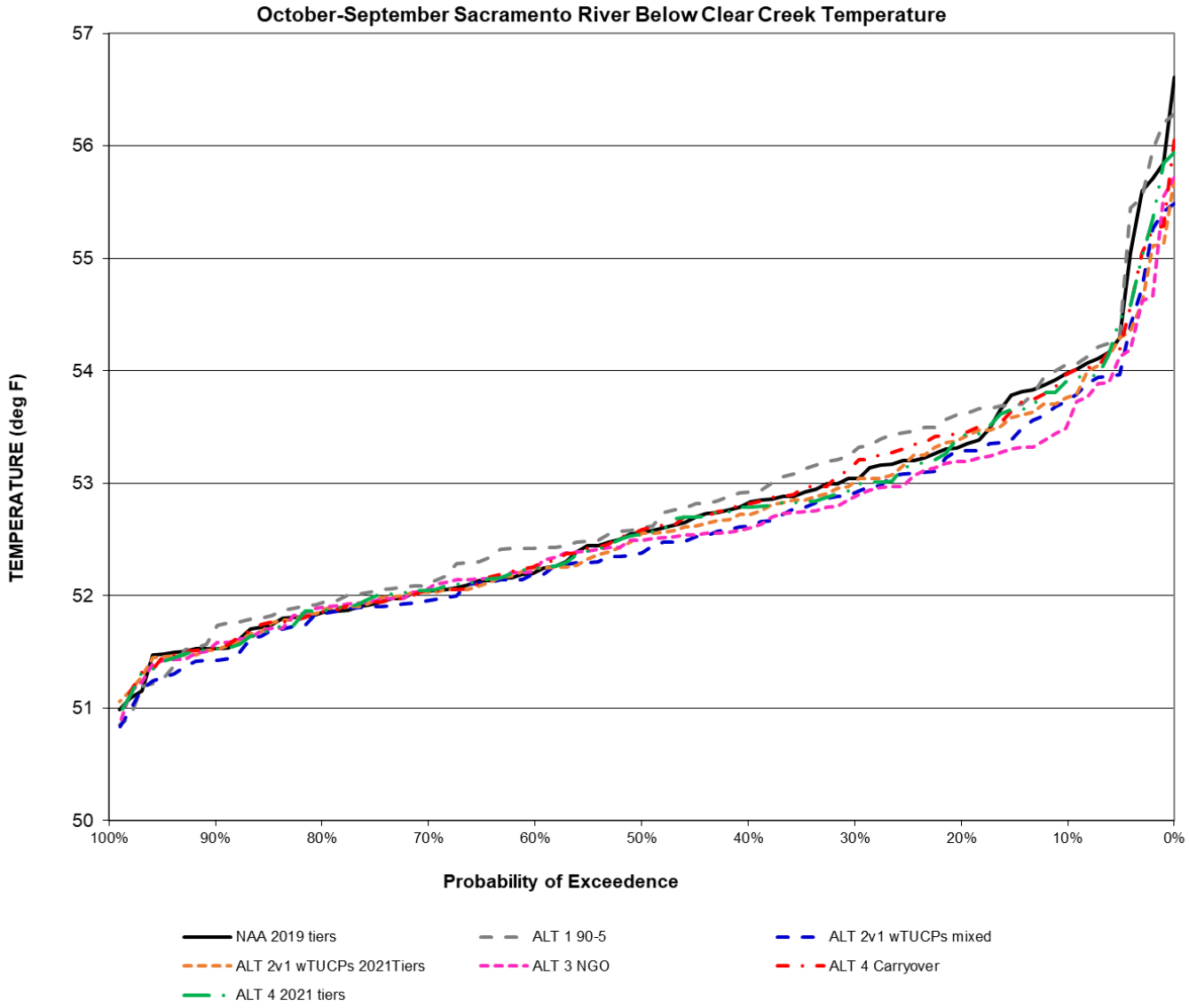
Carryover Based Target

- Targets end of September cold water pool volume (<52 F)
  - 60 F shoulder until 5/15 and after 12/1
  - 400,000 AF after unless 54 F cannot be maintained at Clear Creek
  - Reduce to 200,000 AF, targeting coldest temperatures that meet storage targets
  - Increases temperatures from 54 F to 56 F in monthly steps

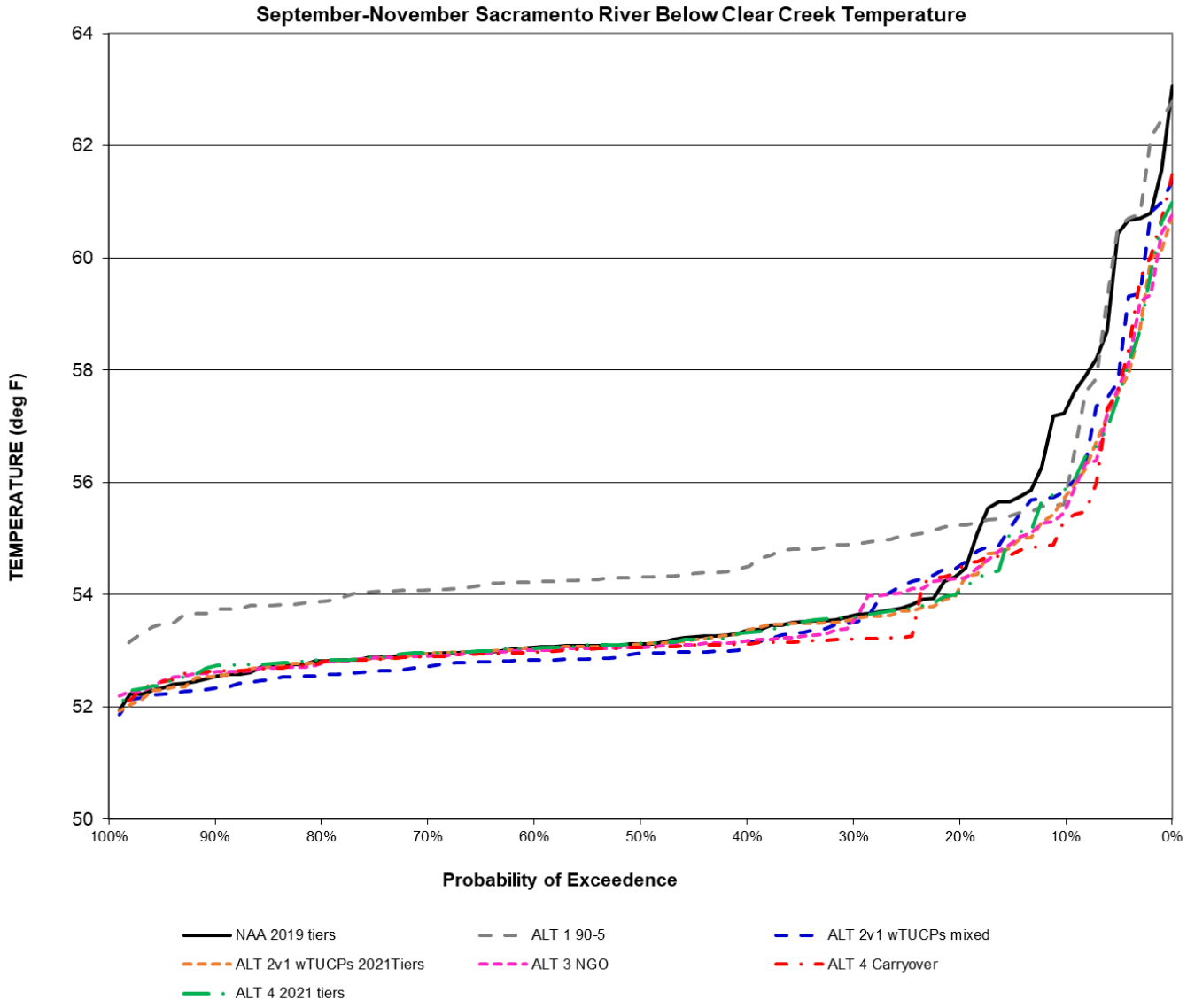
Shasta 2021 Temperature Tiers

- Developed as a revision to the 2019 temperature tiers
- Corporate lessons learned through Shasta temperature tier optimization
- Balance complexity with operational feasibility
- 60 F shoulder through May/June
- April cold water pool (<52 F) volume determines target
  - Less than 1.5 MAF 56 F
  - Between 1.5 MAF and 3.0 MAF 54 F
  - Greater than 3 MAF 53.5 F

Results


October-September Sacramento River Below Clear Creek Temperature
TEMPERATURE (deg F)
57
56
55
54
53
52
51
50
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Probability of Exceedence
NAA 2019 tiers
ALT 1 90-5
ALT 2v1 wTUCPs mixed
ALT 2v1 wTUCPs 2021Tiers
ALT 3 NGO
ALT 4 Carryover
ALT 4 2021 tiers

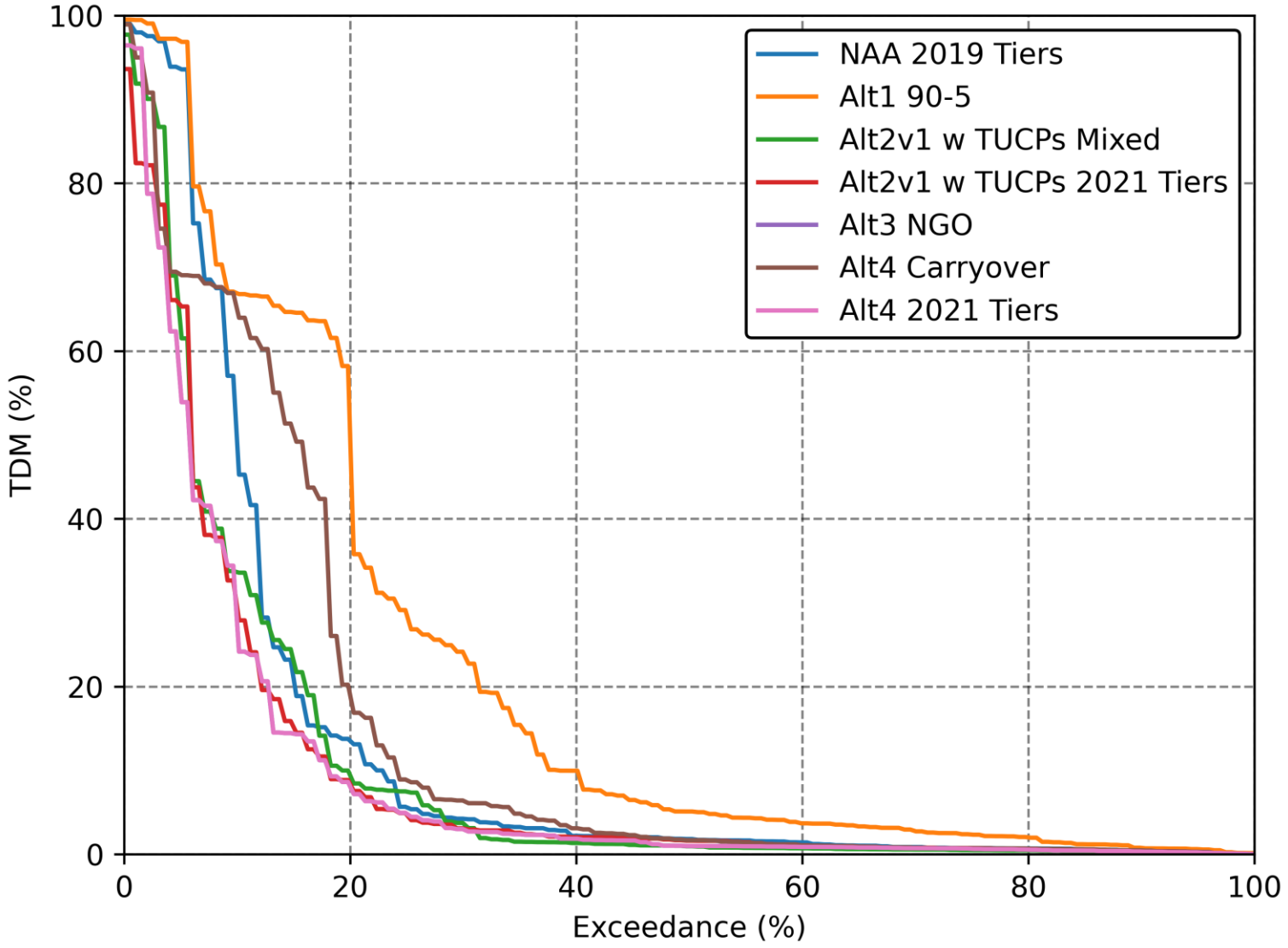
Results Cont.



Temperature Dependent Mortality

- Estimated egg mortality due to temperature affects in the Sacramento River
- Report using Martin model with fixed parameters
- Run 21 years of historic redd distributions for each year, taking the 80th percentile of TDM
  - Accounts for the uncertainty with annual redd locations
- Same Martin parameterization across all runs
  - Martin is sensitive to parameterization
  - Provides information on the relative performance of alternatives and temperature targets

TDM Results


NAA 2019 Tiers
Alt1 90-5
Alt2v1 w TUCPs Mixed
Alt2v1 w TUCPs 2021 Tiers
Alt3 NGO
Alt4 Carryover
Alt4 2021 Tiers
TDM (%)
Exceedance (%)
0
20
40
60
80
100

Continuing Work

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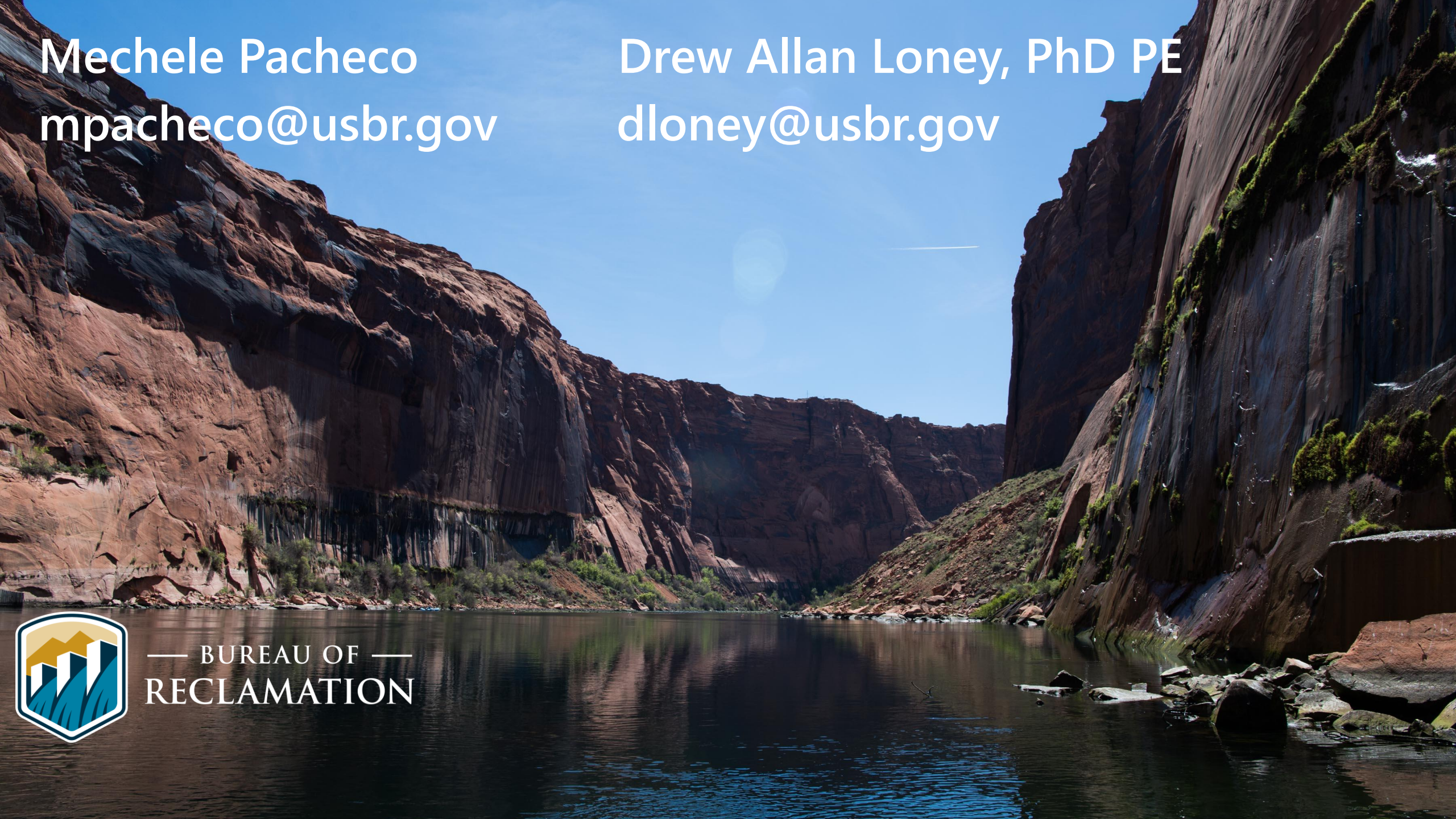
- Final EIS to be published shortly
- Repeat optimization under new operations with model extension
- Opportunities to refine mortality models



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