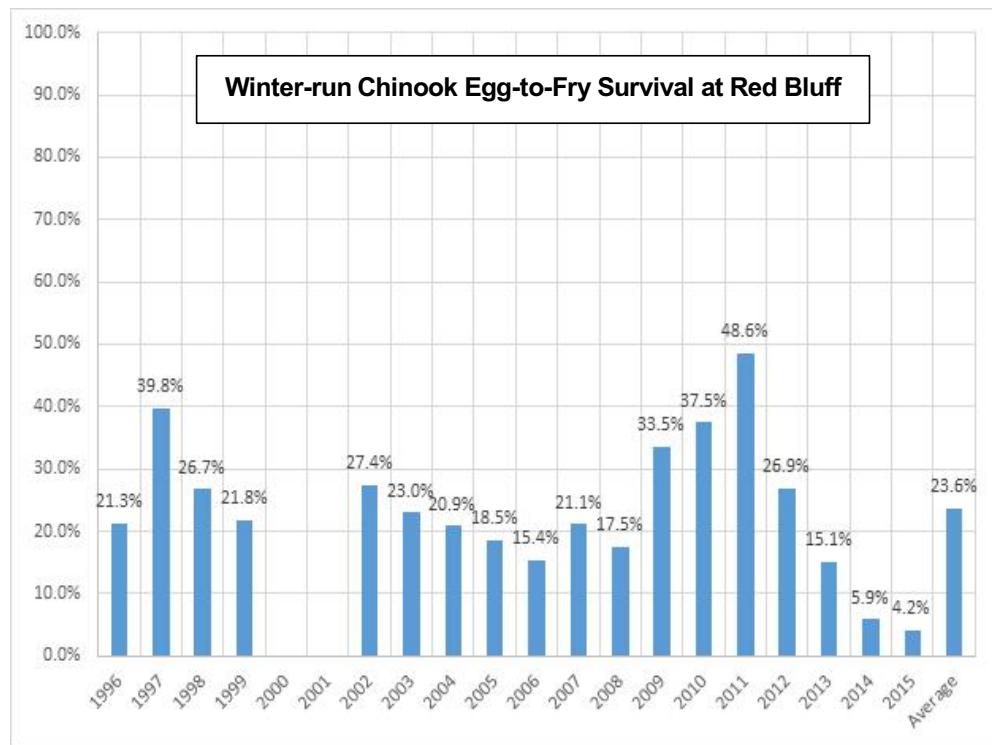


**Amendment to Shasta RPA Actions in
the 2009 Biological Opinion for the Long-
term Operation of the Central Valley Project
& State Water Project**

DRAFT--January 10, 2017

Below Average Rainfall and Snowpack in Last 5 Years → Serious Adverse Impacts to Winter-Run Chinook Salmon

- Sub-lethal and lethal temperatures led to record low survival rates in 2014 and 2015
- Temperature dependent mortality alone resulted ~77% population loss in 2014 and ~85% loss in 2015
- Temperatures and flow are main, but not only, stressors





Shasta RPA Amendment Overview and Rationale

- 2009 CVP/SWP Opinion describes challenges of maintaining adequate cold water for salmon in critically dry years and extended dry periods
- Using adaptive management provision of Opinion to make amendments based in part on:
 - Multiple years of drought conditions
 - New data demonstrating low population levels of winter-run Chinook salmon
 - New science and temperature survival modeling
 - Recommendations from annual independent science panel reviews
- 2017 amendments supersede the 2009 RPA with 2011 amendments
- Phased approach
 - 2017 amendments set interim operational changes necessary at this time
 - Changes made within this adjustment will be reviewed in the context of the larger reinitiation of consultation on CVP/SWP operations
 - Concurrently continue development of science work plan in coordination with Reclamation and Northern California Water Agencies



Amendment to RPA Action I.2.1: Objective-Based Management

Year Type	Critically Dry	Dry	Below Normal	Above Normal & Wet
Objectives	PROTECT <ul style="list-style-type: none">- Avoid critical loss of population- Avoid catastrophic changes to habitat	MAINTAIN <ul style="list-style-type: none">- Maintain river function with reduced reproductive capacity- Manage within dry-spell tolerance	RECOVER <ul style="list-style-type: none">- Improve ecological health and resilience- Improve recruitment opportunities	ENHANCE <ul style="list-style-type: none">- Maximize species recruitment opportunities- Restore key floodplain linkages- Restore key ecological flows
Priorities	<ul style="list-style-type: none">- Undertake emergency flows to avoid catastrophic changes- Carry-over water for critical environments in the following year	<ul style="list-style-type: none">- Provide priority flow components- Carry-over water for critical environmental components in the following year	<ul style="list-style-type: none">- Provide all in-bank flow components- Provide out-of-bank flows if reach dry-spell tolerance- Carry-over water for large watering events	<ul style="list-style-type: none">- Provide all ecological functioning flow components



Amendments to RPA Actions

- RPA Action I.2.1 – Replace minimum 10-year running average end of September (EOS) carryover storage and temperature compliance location requirements with:
 - Temperature-dependent mortality objectives
 - Minimum annual peak April/May and End of September (EOS) storage targets
- RPA Action I.2.3 – Initial 90% exceedance hydrological outlook forecast must meet RPA I.2.1 objectives. If not, Reclamation would be subject to additional operational requirements.
- RPA Action I.2.4 – Develops a pilot study of 55°F 7-day average of daily maximum temperature or 53°F daily average surrogate at CCR CDEC gauge station or downstream most redds.



Amendment to RPA Action I.2.1: Temperature Dependent Mortality Objective

Existing Requirement: None

In 2016, the NMFS Southwest Fisheries Science Center developed a temperature dependent mortality model. They found that temperature dependent mortality by water year type between 1996 – 2016 was:

- Critically Dry 68%
- Dry 9%
- Below Normal 10%
- Above Normal 3%
- Wet 4%

Response: New objectives to reduce temperature dependent mortality*:

- Critically Dry <30%
- Dry <8%
- Below Normal <3%
- Above Normal <3%
- Wet <3%

*Final numbers subject to NMFS analysis



Amendment RPA Action I.2.1: Shasta Reservoir Storage Requirements – 10 Year Running Average

Existing Requirement and Performance: Meet minimum EOS carryover storage

	≥ 2.2 MAF EOS	≥ 2.2 MAF EOS & 3.8 MAF EOA	≥ 3.2 MAF EOS
BiOp Requirement	87%	82%	40%
Actual (2009-2016)	50%	50%	25%

Response: Annual minimum peak April/May and EOS carryover storage targets*

	Critically Dry	Dry	Below Normal	Above Normal	Wet
EOS storage (MAF)	1.9	2.2	2.8	3.2	3.2
April/May storage (MAF)	3.5	3.9	4.2	4.2	4.2

*Final numbers subject to Reclamation analysis



Amendment to RPA Action I.2.1: Temperature Compliance Location – 10 Year Running Average

Existing Requirement and Performance: Meet 56°F daily average temperature a % of time at various temperature compliance locations

	Clear Creek (RM 292)*	Balls Ferry (RM 275)	Jelly's Ferry (RM 266)	Bend Bridge (RM 257)
BiOp Requirement	95%	85%	40%	15%
Actual (2010-2016)	80%	67%	51%	37%

*For reference, Keswick Dam is RM 302

Response: Delete metric. Explained in RPA Action I.2.4.



Amendment to RPA Action I.2.3:

Initial Water Year Forecast and March 1 - May 14 Keswick Release Schedule

Initial 90% exceedance hydrologic outlook forecast shall:

- Use conservative meteorology inputs
- Include projected Shasta cold water pool volume based on a stratification model or hindcasts
- Meet:
 - RPA Action I.2.1 objectives
 - 51.5°F Keswick release temperature May 15 through October 31
 - Delayed full side gate access

If metrics cannot be met, then:

- Limit Keswick releases in April and May; model additional Keswick release schedules through October per NMFS' request

Water Year Type	Monthly Keswick release schedule (cfs)	
	April	May
Critically Dry	4,000	7,500
Dry	6,000	8,000
Below Normal	6,000	9,000
Above Normal	6,500	11,000
Wet	8,000	12,000



Amendment to RPA Action I.2.4: May 15 through October 31 Keswick Release Schedule

Existing Requirement: Not in excess of 56°F DAT at compliance locations between Balls Ferry and Bend Bridge

Response: Operations shall:

- Not exceed temperature-dependent mortality objectives in RPA Action I.2.1
- Conduct pilot study to operate:
 - Not in excess of 61°F 7DADM or 58°F daily average surrogate at Jellys Ferry for winter-run holding
 - Not in excess of 55°F 7DADM or 53°F daily average surrogate at CCR or most downstream redd for winter-run spawning, egg incubation, and fry emergence
- Continuation of pilot subject to year-end analysis

Amendment also establishes Shasta Water Interagency Management (SWIM) Team and responsibilities



Additional Scientific and Analytical Commitments

- New metrics the start of a conversation about how to manage Shasta resources for water supply and species. Consultation on the coordinated long-term operations fo the CVP and SWP will provide a comprehensive analysis of integrated operations.
- Committed to further dialog with stakeholders and scientists for the long-term

Specific additional commitments include:

- RPA Action I.2.5 – Post temperature management season winter-run egg-to-fry survival evaluation
- Review, analysis, and/or modeling
- Biological monitoring
- Continue to develop science work plan in coordination with Reclamation and Northern California Water Agencies

Questions?