BDCP Effects Analysis Update: Preliminary Recommendations for Potential Refinements

BDCP Steering Committee Meeting

October 7, 2010

BDCP Effects Analysis: Preliminary Recommendations for Potential Refinements

- Preliminary results
- Analysis in progress
- Identified several specific areas where consideration of refinements to conservation actions may be beneficial

Adaptive Range

- Many of the potential refinements to BDCP operations can be accommodated through adaptive ranges over time
- Monitoring will inform decisions regarding several potential operating refinements (e.g., lower Sacramento River flows)
- Refinements to future operations to reflect changes in species abundance and limiting factors (e.g., fall habitat needs for delta smelt)

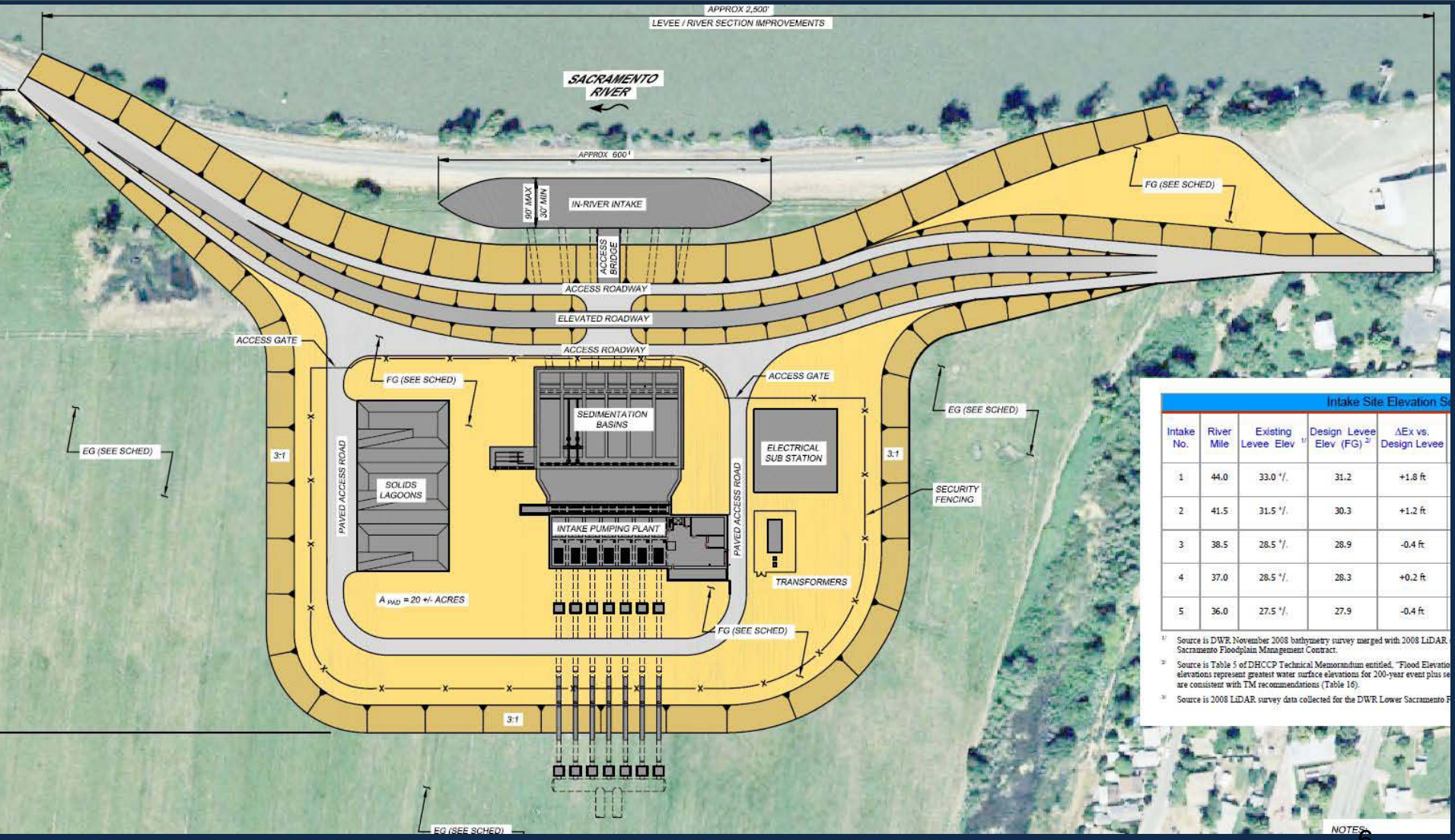
Effects Analyses are Ongoing

- Identification of areas for further investigation and potential refinement to operations are based on preliminary results of effects analysis and are subject to further consideration
- Recommendations to date are to consider areas for additional analyses and potential refinement
- No absolute changes to the BDCP conservation measures are recommended at this time

Scope of Recommended Areas for Further Consideration

1. North Delta intake configuration
2. Increased spring-run salmon egg mortality
3. Reduced Sacramento River flows downstream of the intakes
4. Refinement of April-May south Delta operations
5. Winter-Spring X2 and outflow effects on longfin smelt
6. Summer and Fall X2 and delta smelt habitat

North Delta In-River Intake Configuration Used in Analysis



Intake Site Elevation Sc

Intake No.	River Mile	Existing Levee Elev [1]	Design Levee Elev (FG) [2]	ΔEx vs. Design Levee
1	44.0	33.0 +/-	31.2	+1.8 ft
2	41.5	31.5 +/-	30.3	+1.2 ft
3	38.5	28.5 +/-	28.9	-0.4 ft
4	37.0	28.5 +/-	28.3	+0.2 ft
5	36.0	27.5 +/-	27.9	-0.4 ft

[1] Source is DWR November 2008 bathymetry survey merged with 2008 LiDAR (Sacramento Floodplain Management Contract.

[2] Source is Table 5 of DHCCP Technical Memorandum entitled, "Flood Elevatio elevations represent greatest water surface elevations for 200-year event plus se are consistent with TM recommendations (Table 16).

[3] Source is 2008 LiDAR survey data collected for the DWR Lower Sacramento F

Predation Estimates at North Delta In-River Intakes – Predation Risk is Greatest for Juvenile Spring-run Chinook Salmon

Summary of bioenergetics modeling results for striped bass predation associated with the North Delta in-river intake facilities.

Chinook Salmon Predation Losses at North In-River Delta Intakes				
	No Predator Control		50% Predator Reduction	
Race	Number	% of Total Juveniles	Number	% of Total Juveniles
Winter-Run	8,200	0.82	4,100	0.41
Spring-Run	342,000	2.28	171,000	1.14
Fall-Run	223,000	0.47	111,000	0.23

Results of the Effects Analysis to Date

- Greatest predation risk at the in-river intakes was for juvenile spring-run Chinook salmon although all runs of salmon, steelhead, and splittail would be vulnerable to north Delta predation
- Intake reconfiguration, localized predator control in combination with alternative pathways and habitat benefits would reduce adverse effects

North Delta Intake Issues & Recommendations

- Placement of the intakes on-bank would reduce effects of the intake structure, improve hydrodynamics, and reduce risk of predation
- Some local predator control might still be needed to reduce residual predation risk
- No difference in effectiveness of screens at minimizing impingment and entrainment

Sacramento River Spring-run Chinook Egg Mortality

- Approximately 10% or less of the spring-run Chinook salmon spawn in the mainstem Sacramento River
- Egg mortality for the Sacramento River spring-run salmon was increased approximately 10 percentage points under BDCP LLT operations in wet, above normal, and below normal water years when compared to existing conditions
- Increase in Sacramento River spring-run salmon egg mortality in wetter years may be addressed through operational refinement

Spring-Run Chinook Egg Mortality (%) in the Mainstem Sacramento River – Increased Mortality in Wetter Years

Water Year Type	EBC	EBC ELT	PP ELT	EBC LLT	PP LLT
Wet	8.9	14.0	17.3	24.8	34.7
Above Normal	9.8	16.0	21.5	35.0	43.4
Below Normal	11.8	21.1	23.5	41.3	53.6
Dry	22.5	40.7	37.1	76.4	75.1
Critical	71.2	92.1	85.2	96.3	96.2

Sacramento River Spring-run Egg Mortality Issues & Recommendations

- Egg mortality for Sacramento River winter-run, spring-run, and fall-run Chinook salmon increased in response to dry and critical water years and future changes in climate – the greatest increase occurred for spring-run salmon. Egg mortality was related to future climate change and hydrology, and was largely independent of BDCP operations
- Maximize salmonid access and habitat improvements to tributaries of the Sacramento River upstream
- Consider maximum extent of coordinated SWP/CVP operations to better meet coldwater pool goals
- Consider whether broader measures such as upstream passage, water rights, transfers, etc would be considered to improve coldwater pool and river flow conditions upstream

Sacramento River Flow Reduction

- Flow at Rio Vista was reduced in wet, above normal, and below normal years; increased in dry and critical years during the spring
- Olfactory cues may be reduced in lower Sacramento River; reduction in adult olfactory cues at Collinsville may increase straying but effects are uncertain
- The effects of flow reductions on adult salmonid attraction and juvenile survival and migration in the lower river are unknown

Sacramento River Flow at Rio Vista During Winter – the Reduction in Flows was Less During the Winter

Summary of CALSIM model analysis of the Sacramento River flow (cfs) at Rio Vista during the adult steelhead upstream migration period (December-March) – there was a small percentage difference in flow during the winter migration period

Water Year Type	*EBC*	*EBC ELT*	*PP ELT*	*EBC LLT*	*PP LLT*	*% Change LLT*
Wet	63,418	68,327	63,219	69,409	63,910	-8
Above Normal	39,018	40,845	37,051	41,683	37,121	-11
Below Normal	20,849	21,337	18,650	20,761	18,419	-11
Dry	15,891	15,890	14,359	15,929	14,515	-9
Critical	10,727	10,533	10,259	10,607	10,092	-5

Sacramento River Flow at Rio Vista during Spring – the Reduction in Flow is Greater During the Spring

Summary of CALSIM model analysis of the Sacramento River flow (cfs) at Rio Vista during the adult spring-run Chinook salmon upstream migration period (April-May).

Water Year Type	*EBC*	*EBC ELT*	*PP ELT*	*EBC LLT*	*PP LLT*
Wet	14,872	14,292	4,346	14,743	5,890
Above Normal	8,647	9,240	3,620	10,020	6,103
Below Normal	6,060	5,977	3,771	6,587	6,191
Dry	5,152	4,827	3,525	4,686	5,487
Critical	4,069	3,950	3,813	3,983	6,323

Results of the Effects Analysis to Date

- Sacramento River flows downstream of the north Delta intakes (at Rio Vista) were reduced under BDCP operations when compared to existing conditions
- Flow reduction was less during the winter and greatest during the spring, summer, and fall
- Flow reduction was greatest in wet, above normal, and below normal years; flows were increased under BDCP in dry and critical years

Results of the Effects Analysis to Date

- Current BDCP bypass criteria and range appear reasonable for fish protection
- Lower fall Sacramento River flows are primarily due to upstream operational (reservoir release) flexibility and bypass criteria
- Some reduction in fall flows is due to no fall X2 in current BDCP Proposed Project as compared to the baseline; comparisons to D1641 suggest that the flows are reduced but greater than the D1641 requirement

North Delta Operations Issues & Recommendations

- No changes to north delta bypass criteria
- Evaluate whether reduced flows are biologically significant; if yes, then consider priority south delta pumping during the fall to keep water in the river longer OR establish higher Rio Vista flows to meet biological needs

April and May South Delta Operations

- Entrainment risk reduced in south Delta for juvenile winter-run salmon (50-60%), steelhead (40-60%), and fall-run (5-20%)
- Reduction in south Delta entrainment less for spring-run salmon (± 10%)
- Entrainment risk was reduced substantially (40 to 60%) for adult delta and longfin smelt
- Entrainment risk for larval and juvenile delta and longfin smelt in April and May is greater than under existing conditions

Simulated Larval Delta Smelt, South Delta Entrainment – Results Show no Substantial Difference in Entrainment Risk Between Existing Conditions and BDCP Operations

Average difference between model scenarios in entrainment at South Delta diversions for particle tracking runs after 30 days (percent) for simulated larval delta smelt

Starting Distribution	*PP ELT v. EBC*	*PP LLT v. EBC*	*PP ELT v. EBC ELT*	*PP LLT v. EBC LLT*
Wetter Distribution				
Higher Entrainment	0.2	0.1	0.2	0.1
Lower Entrainment	-0.7	-1.5	-0.3	-1.2
Drier Distribution				
Higher Entrainment	0.3	0.1	0.2	0.1
Lower Entrainment	-1.0	-2.1	-0.4	-1.3

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Estimated Juvenile Delta Smelt South Delta Entrainment – Results Show a Reduction in Juvenile Entrainment Risk Under BDCP When Compared to Existing Conditions

Difference between scenarios at the SWP facility, all water years (percent) for juvenile delta smelt.

Comparison	*May*	*Jun*	*Jul*	*Cumulative Change*
PP_ELT v. EBC	20	-50	-53	-14
PP_LLT v. EBC	2	-62	-58	-29
PP_ELT v EBC_ELT	14	-47	-51	-15
PP_LLT v EBC_LLT	-5	-54	-53	-26

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Estimate Adult Delta Smelt South Delta Entrainment – Reduction in Entrainment at the South Delta Exports Under BDCP

Difference between scenarios at the SWP facility, all water years (percent) for adult delta smelt.

Comparison	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*Cumulative Change*
PP_ELT v. EBC	-20	-43	-66	-69	44	-46
PP_LLT v. EBC	-15	-55	-65	-76	33	-52
PP_ELT v EBC_ELT	-18	-44	-67	-69	40	-47
PP_LLT v EBC_LLT	-11	-55	-63	-75	26	-51

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Estimate Adult Longfin Smelt South Delta Entrainment – Reduction in Entrainment at the South Delta Exports Under BDCP

Difference between scenarios at the SWP facility, all water years (percent) for adult longfin smelt

Comparison	December	January	February	March	Cumulative Change
PP_ELT v. EBC	-20	-43	-66	-69	-55
PP_LLT v. EBC	-15	-55	-65	-76	-63
PP_ELT v EBC_ELT	-18	-44	-67	-69	-55
PP_LLT v EBC_LLT	-11	-55	-63	-75	-62

Estimated Juvenile Longfin Smelt South Delta Entrainment – Net Increase in Juvenile Longfin Smelt South Delta Entrainment Risk Under BDCP

Difference between scenarios at the SWP facility for all water years (percent) for juvenile longfin smelt.

Comparison	*Mar*	*Apr*	*May*	*Jun*	*Cumulative Change*
PP_ELT v. EBC	-69	44	20	-50	22
PP_LLT v. EBC	-76	33	2	-62	5
PP_ELT v EBC_ELT	-69	40	14	-47	16
PP_LLT v EBC_LLT	-75	26	-5	-54	-1

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Results for Delta Smelt South Delta Entrainment under BDCP

- Substantial reduction in adult delta smelt entrainment (40-50%)
- Substantial reduction in juvenile delta smelt entrainment (15-30%)
- Small changes in simulated larval delta smelt entrainment (± 1%)
- Substantial reduction in adult longfin smelt entrainment (55-62%)
- Increase in juvenile longfin smelt entrainment (-1 to 16%)

South Delta Operations

- OMR operations in the proposed project appear to be protective
- Dual conveyance achieves the FWS BO OMR objectives and often the NMFS SJR IE flow conditions (without being explicitly included) at a lower water cost than under current configuration
- During dry years/periods, dual conveyance will be limited in its diversion from the north Delta, likely returning to similar south Delta-focused operation
- SJR IE as part of NMFS BO, mandated for salmon, appears to cause the largest change to OMR in the spring; unknown whether salmonids are significantly benefited
- SJR IE is likely more targeted to the “inflow” side than the “export” side. Inflow changes are likely to have much greater effect than export reductions

South Delta April and May Operations Issues & Recommendations

- Maintain OMR requirements as described in the proposed operations
- Further evaluate the “most restrictive” of the FWS OMR requirements during April and May to focus on this protective period and provide some of the targeted NMFS benefits
- Increased SJR inflow would provide broad south Delta benefits to improve water quality, habitat, and toxicity
- Consider south Delta improvements since dry years/periods will continue to have considerable dependency on these exports

Longfin Smelt Abundance

- Abundance of longfin smelt is predicted by regression between late winter and spring outflow and X2 location and FMWT index
- Small change in X2 location (≈ 2-4 km or less)
- Approximately 5-20% reduction in longfin smelt predicted FMWT abundance under BDCP – but high level of uncertainty
- Increased habitat benefits to longfin smelt associated with increased food supplies appear to be important to increasing population abundance

X2 Location During Late Winter and Spring – Small Reduction in X2 Location Under BDCP Operations

Difference between model scenarios for December through May X2 (km).

Exceedance Percentile	*EBC vs. PP_ELT*	*EBC vs. PP_LLT*	*EBC_ELT vs. PP_ELT*	*EBC_LLT vs. PP_LLT*
20th Percentile	2.6	3.8	2.0	1.7
80th Percentile	3.1	4.1	1.6	0.2

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Delta Outflow and X2 Effect on Longfin Smelt Abundance – Small Reduction in Spring X2 Location Under BDCP

Predicted longfin smelt relative abundance index associated with the December through May X2 position.

	EBC	*EBC_ELT*	*EBC_LLT*	*PP_ELT*	*PP_LLT*
Midwater Trawl					
20th percentile	1,703	1,577	1,330	1,266	1,102
80th percentile	16,258	13,641	10,350	11,328	10,115
Bay Midwater Trawl					
20th percentile	3,002	2,739	2,231	2,103	1,780
80th percentile	45,008	36,459	26,176	29,172	25,465
Bay Otter Trawl					
20th percentile	3,780	3,448	2,809	2,648	2,241
80th percentile	56,662	45,899	32,954	36,726	32,059

PP = proposed project; EBC = existing biological conditions; ELT = early long-term climate conditions; LLT = late long-term climate conditions.

Longfin Smelt Issues & Recommendations

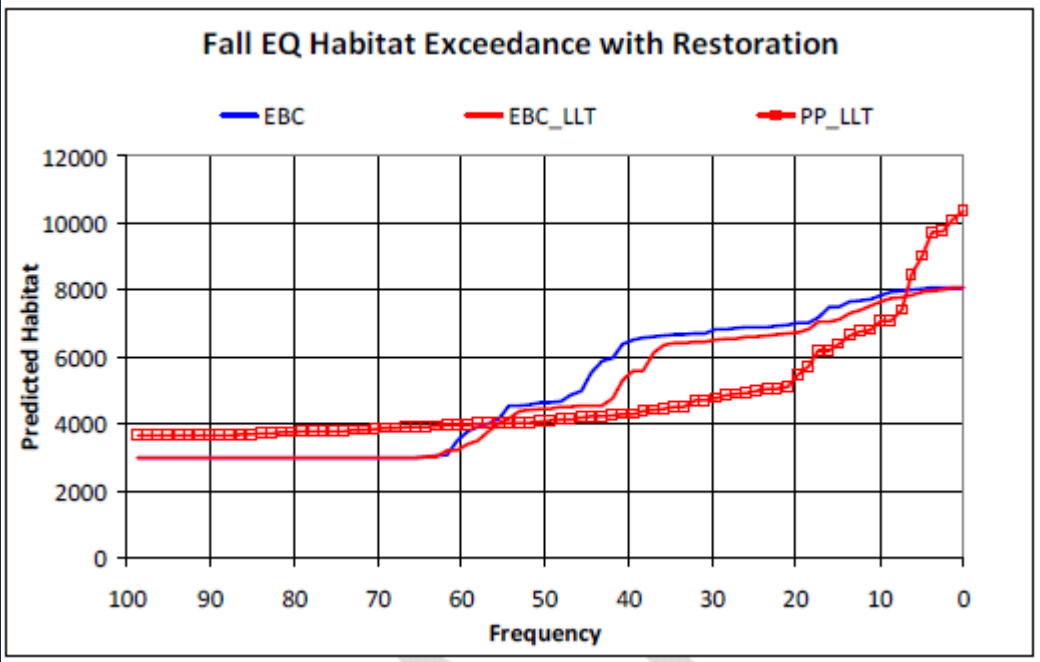
- Spring delta outflow is largely a result of hydrology and restrictions on total exports
- It would be difficult to substantially increase outflow objectives without causing upstream storage (coldwater pool) concerns at Shasta
- Any outflow increases would need to come from export reductions or other sources due to Shasta storage effects on coldwater pool
- Maintain D1641 delta outflow objectives in BDCP
- Higher delta outflow objectives could be incorporated in the adaptive range, but should be accompanied with some agreement on how the adaptive range will be applied without impacting other BDCP objectives
- Increasing food supplies for longfin smelt through expansion of habitat is expected to result in increased abundance

Results –X2

- Decrease in Fall X2 abiotic habitat surface area under BDCP relative to existing conditions in above normal and wet years
- BDCP habitat restoration increases habitat in critical, dry, and below normal years relative to existing conditions
- Conflicting comments have been received as to significance of this effect – high uncertainty for fall X2 benefits
- Expansion of brackish shallow habitat in Suisun Marsh increases habitat access independent of X2, but effects analysis of habitat functions are ongoing

Changes in Summer and Fall X2

- Exceedance plot of Fall abiotic habitat area with restoration, September through December



X2 Issues & Recommendations

- Maintain D1641 Delta outflow objectives in BDCP
- Higher Delta outflow objectives could be incorporated in the adaptive range, but should be accompanied with some agreement on how the adaptive range will be applied without impacting other BDCP objectives
- Fall outflow/X2 has a high degree of uncertainty with near-term implications – fall habitat does not appear currently to be limiting abundance

Questions and Comments