BDCP NORTH DELTA IMPACTS
April 2013, MT

North Delta Landscape Impacts

North Delta Land Impacts

- Total surface area needed for intakes, tunnels, forebays is 2,700 acres. ***Chap 4, page 4-8.***
- A total of approx 1,220 acres would be allocated to borrow acquisition and/or spoil deposition [number or locations not provided] with max height of 12-ft. ***EIR/EIS, page 3C-56.***
- Muck storage areas ranging in size from about 100-570 acres for a total of about 1,595 acres devoted to muck storage. ***Chap 4, page 4-10.***
- Approximately 166 existing permanent structures would be removed or relocated within the water conveyance footprint under this alternative. This includes an estimated 43 residential buildings. Other structures affected would consist primarily of storage or agricultural support facilities; however, several private recreational structures would also be affected. One fire station in the community of Hood would also be affected. The physical footprints of intakes and intake pumping plant facilities, along with associated work areas, are anticipated to create the largest disruption to structures, conflicting with approximately 45 structures in the vicinity of the east bank of the Sacramento River. Among the three intake sites, 15 residential structures would be affected. Construction of pipelines to convey water between the intakes is estimated to create conflicts with another 17 structures, including 7 residential structures. These conflicts would be located where the conveyance pipeline from Intake 3 crosses the community of Hood. ***EIR/EIS, Land Use Chap, page 13-115.***
- Other features including tunnel shaft sites, tunnel muck areas, tunnel work areas, borrow areas, barge unloading facilities, and fuel stations would also create disruptions to existing structures. ***EIR/EIS, Land Use Chap, page 13-115/116.***
- Table 13-13, Estimated Water Conveyance Conflicts with Existing Structures: 43 Residential; 11 Recreational; 103 Ag Storage/Support; 9 Other (includes power/utility structures, bridges, and other types of infrastructure). ***EIR/EIS, Land Use Chap, page 13-116.***

North Delta Water Conveyance Facilities Components

EIR/EIS, Description of Alternatives Chap 3, page 3-53.

- Three north Delta intakes with fish screens along the east bank of the Sacramento River (Intakes 2, 3, and 5).
- Pipelines conveying water from intakes to intake pumping plants.
- Sedimentation basins and solids handling facilities.
- Intake pumping plants at each intake location: associated facilities include and access road; electrical substation; communication devices; and transformers.
- Discharge pipelines conveying water from intake pumping plants to an initial tunnel (Tunnel 1) or a transition structure.
- A surge tower at the pumping plant for Intake 2.

- Transition structures, such as stop logs and vents, between discharge pipelines and larger conveyance pipelines.
- Conveyance pipelines between transition structures and intermediate forebay transition structures with radial gates and stop logs.
- An intermediate forebay.
- An outlet control structure to convey water from the intermediate forebay to Tunnel 2.
- A 40-foot interior diameter dual-bore tunnel (Tunnel 2) between the intermediate pumping plant and Byron Tract Forebay.

New North Delta Intakes

- Three north Delta intakes with fish screens along the east bank of the Sacramento River (Intakes 2,3, and 5). ***EIR/EIS, Description of Alternatives Chap 3, page 3-53.***
- Three, 3,000 cfs, located between river mile 37, 40 and 41 with combined length of 6,360 feet (24,000; 1,560; 2,400=6,360) of levee embankment (more than one mile of facilities in four mile stretch). Permanently occupy between 1.1-2.1 acres of in-water habitat (5.1 acres total). Land surface area for each is 60 acres. Rise 55 feet from river bottom to top of structure, with intake rising above river's surface by 2-30 feet. Replacement of existing levees with new setback levees along with dredging and channel modification activities. ***Chap 4, page 4-6.***
- Three uncovered, concrete-lined solids lagoons at each intake, with footprint about 86 ft by 165 ft and 10 ft deep. ***EIR/EIS, page 3C-10.***
- Pumping plant's total height of the above ground structure is about equal to a 7-story building. ***EIR/EIS, page 3C-10.***
- Four 10-15 ft high surge shafts 16 ft diameter, requires excavate and export 263,895 cy; excavate, haul, stockpile, and compact 50,265 cy. ***EIR/EIS, page 3C-11.***

Cofferdams

- In the river to create a dewatered construction area, extending approximately 10-35 feet from the intake face, between 1,560-2,400 feet long, temporarily occupying between 1.6-3.1 acres of in water habitat (7.5 acres total), replace about 2.6 miles of low value steep-banked and riprapped shoreline habitat, and installed from upstream to downstream, with downstream end closed last. Cofferdam walls upstream and downstream of the intake will remain as transition walls. Upon removal of cofferdams, between 2.7-4.0 acres (12.1 acres total) of the riverbed in front of intakes will be dredged (total dredge volumes not yet determined). Between 4-6 years to construct. ***Chap 4, page 4-7.***

Forebay

- A 925-acre intermediate forebay built near Hood with 5,250 af of storage and gravity flow through an outlet control structure. Another 350-acres for emergency spillway adjacent to forebay. About 6 million cubic yards of each will be excavated to construct the intermediate forebay. ***Chap 4, page 4-10.***
- South end of forebay an approach channel, approx 1,500-ft long and 1,300-ft wide would connect the forebay outlet to the new gravity bypass system. ***EIR/EIS, page 3C-23.***
- Approx 6 million cy earth be excavated from portions of the forebay. Approx 4 million cy of fill material would be required for the forebay embankments (required embankment

material would be borrowed from within the the limits of the respective forebays). ***EIR/EIS, page 3C-24.***

Pumping Plants

- About 20 acres next to each intake with a new setback levee (ring levee) with cutoff walls to avoid seepage, filled to the elevation of the top of the levee as a building pad, and transition levees built to connect existing levees to new setback levees. Facilities include six sedimentation basins that are about 120 feet long by 40 feet wide by 55 feet deep with interior concrete walls, six solids handling facilities about 10 feet deep and sloped sides with a top width of 86 feet and a top length of 165 feet lined with concrete to prevent seepage to the groundwater or adjacent riverbed, transition structures, surge shafts or towers, one or two electrical substations, an electrical transformer, a mechanical room, and access road, and other associated facilities and utilities. ***Chap 4, page 4-7.***

Electrical Substations

- Three 69-kilovolt (kV), with one located at each intake pumping plant, about 270 by 270 feet with 40-ft tall power poles. ***EIR/EIS, page 3C-13.***

Pipelines

- Eighteen (six at each intake) 12-foot diameter pipelines from intake to adjacent pumping plant. Construction using either microtunneling or open-cut trenching, which will use excavated material from the trench as embedment and backfill materials with excess material exported off site (unidentified location). Long reach backhoes, scrapers, and excavators will be placed on levees or on the landside of the levees. Two to four 16-foot diameter conveyance pipelines will carry water between intake pumping plants and other facilities such as tunnels and forebays. ***Chap 4, page 4-9.***

Tunnels

- A single-bore 29-foot inside diameter tunnel to convey water 3.8 miles from intake 2 to a new intermediate forebay. A dual-bore 40-foot inside diameter tunnel to convey water 35 miles from new Hood forebay to new Byron Tract Forebay. The main construction or launching shafts for each tunnel will be about 60-feet in diameter to accommodate construction equipment. Tunnel-boring machine retrieval shafts will be about 45-feet in diameter and 12-foot diameter intermediate ventilation shafts will be located about every 3 miles. Because of high groundwater level, extensive dewatering by dewatering wells at tunnel shaft sites and groundwater control in tunneling operation and shaft construction will likely be necessary. ***Chap 4, page 4-9.***

Ventilation Shafts

- Placed approx every 3 miles along the tunnel alignment (about seven locations), 12-ft diameter with a 2.5-ft wide curb approx 1-ft above grade, with approx 150x150 work area and another 600x450-ft work area for TBM retrieval shafts. ***EIR/EIS, page 3C-20.***

Tunnel Muck Storage Areas

- The boring process creates a plastic mix consisting of soil cutting and soil conditioning agents (water, air, bentonite, foaming agents, and/or polymers/biopolymers). Daily volume of muck transported from tunnel to drying/chemical treatment areas is 7,000 cubic yards per day by trucks running 24 hours per day, seven days a week. Muck storage areas ranging in size from about 100-570 acres for a total of about 1,595 acres devoted to muck storage. A retaining dike (berm of compacted imported soil) will be build around the perimeter of each muck area to ensure containment, subdivided into a grid of interior earthen berms into a system of muck ponds for dewatering which will consist of surface evaporation and leaching through a drainage blanket (2-foot thick pea gravel or similar material placed over an impervious liner). Invert of the pond will be sloped a minimum of 1% toward a leachate collection system, with leachate pumped from the drainage system to leachate ponds for further treatment if needed. Depth of stored muck will be less than 25 feet (two stories high) from lowest exterior ground level and max capacity of individual muck storage ponds will be less than 50 acre-feet. To prevent contamination of underlying groundwater, the invert of the muck pond will be a minimum of 5-feet above the seasonal high groundwater table and an impervious liner will be placed on invert. Because groundwater tables are high, construction anticipates minimal excavation to build muck ponds. ***Chap 4, page 4-10.***

- Under Alt 4 tunnel muck will increase by approx 41%, but additional storage footprints not anticipated. ***EIR/EIS, page 3C-18.***
- Estimated volume of muck to be disposed from the tunnels and shafts is about 25 million cy. ***EIR/EIS, page 3C-56.***
- Tunnel muck areas may be temporary or permanent. ***EIR/EIS, page 3C-59.***

Borrow/Spoils Storage

- Spoils will be stored in designated areas [number of locations and locations unidentified]. ***Chap 4, page 4-12.***
- A total of approx 1,220 acres would be allocated to borrow acquisition and/or spoil deposition [number or locations not provided] with max height of 12-ft. ***EIR/EIS, page 3C-56.*** Borrow and spoils areas may be temporary or permanent. ***EIR/EIS, page 3C-59.***

Concrete Batch Plants

- Located at project works sites with adjacent fuel stations, each [total number not identified] will be about 2-40 acres in size. Precast segment yards for the tunnels may also be built adjacent to concrete batch plants. A suitable source of clean water [amount needed for each not identified] will be required for each batch plant. ***Chap 4, page 4-11.***
- Five concrete plants in the southern part of Sacramento County, each between 5-10 acres in size. Up to six precast segment plants: two in southern part of Sac Co and four in San Joaquin Co. ***EIR/EIS, page 3C-62.***

River Barges

- At least six river barge unloading facilities/docks for the delivery of construction materials (e.g., tunnel segments, batched concrete, major equipment) will be constructed located at: 1) State Route 160 west of Walnut Grove; 2) Tyler Island; 3) Bacon Island; 4) Woodward Island; 5) Victoria Island; and 6) Venice Island. Docks will be about 50 by 300 feet and supported by about 32 two-foot diameter steel piles. Will be removed following construction (no restoration of site mentioned). ***Chap 4, page 4-11.***

- Approx 3,000 barge trips are projected, averaging 1 trip per day thru 9-yr-long construction period. ***EIR/EIS, page 19-170.***

<u>Transmission Lines</u>

- New power lines from existing electrical grid to project substations for power to operate intakes, pumping plants, operable barriers, and gate control structures. Temporary power will be required during construction of water conveyance facilities. A single 230-kV transmission line owned either by the utility or the Implementation Office will operate the new north Delta pumping plants and interconnect with a local utility at a new substation. Line will extend south from intermediate pumping plant, generally following tunnel alignment, connecting to existing utility facilities at Banks. Construction of 230-kV and 69-kV transmission lines will require a corridor width of 100 feet and, at each tower or pole, 100-feet on one side and 50-feet on the other side for construction and 350-feet about every 2 miles of line at conductor pulling locations with turns greater than 15 degrees. ***Chap 4, page 4-12.***
- Require 496 new power polls and 509 temporary power poles. ***EIR/EIS, page 3C-15.***

<u>Roads/Transportation</u>

- Detour roads needed for all intakes, temporary access roads constructed from each intake pumping plant to Sacramento River levee, and permanent roads build for intake site perimeter access road. ***EIR/EIS, page 3C-60.***
- Indirect effects on existing land uses may also arise from changes in access to parcels of land. For example, the removal of access for agricultural vehicles and machinery could jeopardize the ability of that land to continue serving productive agricultural uses. <u>The loss os access would not be considered an adverse effect under this impact.</u> ***EIR/EIS, Land Use Chap, page 13-116.***
- All construction related trucks are expected to generate eight trips per day. ***EIR/EIS, Transportation Chap 19, page 19-35.***
- Level of Service (LOS) thresholds are exceeded on a total of 16 roadway segments for at least 1 hour during the 6:00 am to 7:00 pm analysis period. LOS is a qualitative measure of traffic operating conditions. See Table 19-3. ***EIR/EIS, Transportation Chap 19, page 19-7.***
- Potential construction site access routes do not currently have adequate engineered pavement sections to withstand construction traffic, particularly heavy vehicles. ***EIR/EIS, Transportation Chap 19, page 19-13.***
- Construction associated with Alt 4 would cause LOS thresholds to be exceeded for at least 1 hour during the 6:00 am to 7:00 pm analysis period on a total of 33 roadway segments, which is 10 more segments than have at least one hour exceeded under existing conditions. ***EIR/EIS, Transportation Chap 19, page 19-40.***
- Figure 19-3 shows the study roadway segments that could experience substantial roadway effects. The highest concentration of roadway segments below applicable LOS threshold occurs on state roadways, including SR-12, I-80, SR-4, and I-205. Standards will also be exceeded on several local roadways, including all segments studied in West Sacramento. ***EIR/EIS, Transportation Chap 19, page 19-163.***
- Mitigation Measures TRANS-1a thru 1c collectively include requirements to avoid or reduce circulation effects, notify the public of construction activities, provide alternate

access routes, require direct haulers to pull over in the event of an emergency, limit/prohibit the amount of construction activity on congested roadways, and enhance roadway conditions. However, the BDCP proponents are not solely responsible for the timing, nature, or complete funding of required improvements. ***EIR/EIS, Transportation Chap 19, page 19-163.***

- ***CEQA Conclusion:*** Mitigation Measure TRANS-1a thru 1c would reduce the severity of the impact of exceeding LOS, but not to less-than-significant levels. The BDCP proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement that is identified in any mitigation agreement(s) contemplated by TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If however, all improvements required to avoid significant impacts prove to be feasible and if necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant. ***EIR/EIS, Transportation Chap 19, page 19-164.***
- BDCP proponents will ensure development of site-specific construction traffic management plans (TMPs) that address the specific steps to be taken before, during, and after construction to minimize traffic impacts, including mitigation measures and environmental commitments identified in the EIR/EIS. ***EIR/EIS, Transportation Chap 19, page 19-164.***
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BDCP Delta Habitat

Yolo Bypass Floodplain Restoration (CM2)

- Frequent inundation (every 1-3 years) of YB by diverting between 3,000-6,000 cfs for 30-75 days for one or more periods between Nov-May, covering between 11,000-27,000 acres with shallow water. Vegetation maintenance with clearing done in stripes to open areas for water flow and avoid islands, including pruning trees with over 4 inches of trunk diameter up 6-feet from the ground. Sediment maintenance expected to remove about 1 million cubic yards within 1-mile of the weir about every 5-years, with an additional 1 million cubic yards every other year removed inside the new channel. Sediment may be disposed on properties in immediate vicinity of Fremont Weir or be used as source material for levee or restoration projects, or otherwise beneficially used. ***Chap 4, page 4-17.***

Calhoun Cut/Lindsey Slough Restoration

- The Calhoun Cut Ecological Reserves is 927-acre property owned by CA Dept. Fish & Wildlife. Project will increase the area of functional intertidal freshwater marsh habitat. The restoration of the tidal system to Lindsey Slough consists of removing several existing features that restrict flow through the slough and excavate starter channels to restore Lindsey Slough's tidal channel system. **Environmental documentation is almost complete; however funding sources are still needed for permitting, design, and construction.** ***Chap 6, page 6-17.***

Lower Yolo Restoration

- Property owned by Westland's and project being developed by SFCWA as a tidal wetland mitigation requirement for the Operational Criteria and Plan (OCAP) Biological Opinions (BiOps). The projects entails breaching levees along the Stairstep Channel and channel excavation to return tidal action to approximately 50% of the 3,408-acre property known as Yolo Ranch in order to restore tidal marsh-open-water habitat and upland and riparian habitats. **CEQA documentation is currently being prepared and construction is anticipated to begin in 2013.** ***Chap 6, page 6-17.***

McCormack-Williamson Tract Restoration

- A 1,660-acre property bought by The Nature Conservancy using CALFED grant, restoration is anticipated to take place on approximately 1,500 acres. An element of the North Delta Flood Control and Ecosystem Restoration Program, the project is intended to help regulate peak flood flows and prevent flood surges in the North Delta where the Mokelumne and Cosumnes Rivers converge. Project will entail breaching the McCormack-Williamson Tract levees to restore ecosystem function, create floodplain and tidal marsh natural communities, and benefit native species. ***Chap 6, page 6-18.***

Grizzly Slough Restoration

- A 489-acre parcel bought by DWR as mitigation for the SWP, located about 2 miles northeast of the town of Thornton. Approximately 450 acres is planned as riparian and floodplain restoration to provide additional attenuation of peak flows in the North Delta. Part of the North Delta Flood Control and Ecosystem Restoration Project Final EIR released in 2010. **Funding for the project has not been identified but is needed for environmental documentation and permitting, design, and construction.** ***Chap 6, page 6-18.***

Southport Restoration

- The Southport Early Implementation Project will implement flood risk-reduction measures along the Sacramento River South Levee that protects the Southport community and will provide 280 acres of floodplain restoration. Owned by the City of West Sacramento and DWR, the ecosystem restoration portion of the project will satisfy an existing mitigation requirement. Partial funding for the project was secured through the DWR EIP program, however floodplain design and restoration funding has not been determined. A partner agency is needed to help fund the riparian floodplain restoration for the portion of the property that will not be used as mitigation for the flood control project. ***Chap 6, page 6-19.***

Prospect Island Restoration

- DWR owns 1,306 acres of island and intends to breach the levees on all sides to restore between 460 to 1,300 acres of tidal marsh, open water habitat, and some upland/riparian habitat. **The projects is fully SWP-funded through the Fish Restoration Program Agreement to fulfill OCAP BiOp mitigation requirement and CEQA documents being prepared now.** ***Chap 6, page 6-20.***

Delta Water Availability/Quality Impacts

Delta Flows

- BDCP will fundamentally change the hydrodynamics of the Delta. ***Chap 5, page 5.3-2.***
- The Sacramento River diversions into the proposed north Delta intakes along the Sacramento River between Freeport and Hood are the primary cause of BDCP changes in Delta flows. ***Chap 5, page 5.3-7.***
- The BDCP is expected to result in changes in flows primarily as a result of the change in export location (new north Delta intakes) and its associated specified changes in monthly Delta operational objectives, namely, required salinity objectives, outflow objectives, export/inflow objectives, OMR flow objectives, and maximum exports. ***Chap 5C.1-1.***
- Reduces some Sacramento River flows. ***Chap 5, page 5.3-2.***
- Overall, there would be minimal upstream changes but some substantial shifts in how water moves through the Delta. ***Chap 5, page 5C.0-1.***
- Restoration of 65,000 acres of tidal marsh (CM4) could result in changes in turbity and tidal excursion in specific Delta locations and subregions. ***Chap 5, page 5C.0-2.***
- In the North Delta, flow patters will be altered by the increased diversions to the Yolo Bypass (CM2) and operations of the new north Delta intake facilities (CM1). ***Chap 5, page, 5.3-2.***
- The average modeled annual inflow at Freeport for the evaluated starting operations was reduced by about 650,000 af compared to existing conditions, primarily as a result of the increased Fremont Weir Spills (CM2). ***Chap 5, 5.3-3.***
- The months with the greatest changes in Freeport flows for the high outflow scenario cases are increased flows in April and May, with reduced flows in June and July, caused by reduced reservoir storage from high spring releases and the goal of maintaining the existing biological condition carryover storage. The months with the major changes in Freeport flows for the low outflow scenario cases were reduced flow in September of about half of the years, with smaller reduction in November in fewer years. The Freeport median flows in January, February, and March for the evaluated starting ops cases were about 3,000 cfs less than existing conditions flows, reflecting the increased spills at the Fremont Weir into the Yolo Bypass (CM2). The Freeport median flows for the evaluated starting ops cases in July and August were reduced by about 3,000 cfs compared to existing conditions flows because of changes in upstream reservoir releases. The evaluated starting ops north Delta intakes allowed higher exports in April, May, and June and subsequently allowed reduced reservoir releases and reduced exports in July and August. ***Chap 5, page 5.3-4.***
- The general effect of each intake is the reduction of the downstream flow by about 3,000 cfs (when operated at capacity). ***Chap 5, page 5.3-6.***
- The evaluated starting ops outflows were slightly less than existing outflows because the north Delta intakes allowed higher exports in some months when the reverse OMR flow restrictions were limiting south Delta exports. The monthly median outflows in Oct thru Dec were generally controlled by the required Delta outflow in most years; higher outlflows (more than 15,000 cfs) were simulated in only a few years. ***Chap 5, page 5.3-16.***
- The highest monthly outflows were simulated in January thru March with many years having more than 50,000 cfs outflow in at least one month. Median outflow for the

evaluated starting ops was about 15,500 cfs in April, 13,500 cfs in May, and 8,500 cfs in June. The simulated evaluated starting ops outflows in July, August, and September were generally controlled by the required Delta outflow. There were only a few years with July outflows of more than 10,000 cfs, August outflows of more than 5,000 cfs, or September outflows of more than 15,000 cfs (required for Fall X2). ***Chap 5, 5.3-16.***

- These results reflect difference in the timing and duration of spills ≥3,000 cfs under existing and proposed Fremont Weir modifications. The median duration of floodplain over the 82-yr simulation period was 53-56 days per year under the evaluated starting ops scenarios and 13-16 days per year under existing conditions. Floodplain inundation periods of 30-days or more (representing one or more events during the annual flood season) would occur in 58 years under the evaluated starting ops (71% of the years) and 32-34 years under existing (39-41% of the years). In critical water years, median value of 4 days of floodplain (range: 0-34 days), inundation periods of 30-days or more would occur in 3 of the 12 critical years. In dry years, median duration would increase to 27 days (range: 0-56 days) compared to 0 days under existing, with 30-days or more of inundation in 6-7 of the 18 dry years. In below normal years evaluated starting ops would increase to 45 days (range: 0-100 days) compared to 0 days under existing, with 30-days or more inundation in 10-11 of the 14 dry water years. In above normal years median duration increase to 99-104 days (range: 32-133 days) compared to 38-52 days in existing conditions, with 30-days or more inundation occur in all above normal years (12 years) under evaluated starting ops and 7-9 of the 12 years under existing conditions. In wet years median duration in evaluated starting ops is 123-126 days (range: 67-175 days), with 30-days or more inundation occurring in all above normal years (26 years) under evaluated starting ops and 25 of 26 years under existing conditions. ***Chap 5, page 5C.5.4-18.***
- Overall, proposed operation of Fremont notch extended the duration of spills from 78 days under the EBC2_LLT to 117 days under the ESO_LLT, and the duration of floodplain inundation from 85 to 124 days, respectively. ***Chap 5, page 5C.5.4-28.***

<u>Water Surface</u>

- Proposed tidal restoration will add substantial increment to the existing Delta surface area at high tide (+4 feet) and low tide (-2 feet). The mean higher water surface area upstream of Martinez will increase from about 90,000 acres to about 140,000 acres, an increase of more than 55%. The mean lower water surface area will increase from about 83,000 acres to 115,000 acres, an increase of more than 39%. Significant simulated increases tidal flow at the mouth of Montezuma Slough (+100%). Chipps Island (West Delta ROA), the tidal flows were reduced by about 5% as a result of Suisun Marsh restoration. The Suisun tidal restoration also caused tidal muting (reduced tidal amplitude and reduced tidal flows) throughout the Delta. ***Chap 5, page 5.3-37.***
- Tidal flows in the lower Sac River (West Delta ROA) were reduced by the downstream restoration in Suisun Marsh and were increased by the upstream restoration in Cache-Slough ROA. The net effect on tidal flows was an increase of about 3% in the lower Sac River flows. Tidal flows in the lower SJR (West Delta ROA) were reduced by about 10%. Simulated tidal elevations will be muted and tidal flows will be reduced in the Sac River. The tidal range (high tide to low tide elevation) was reduced from about 2 feet to

about 1.5 feet. The flows were always positive, but the tidal variation was reduced from 6,000 cfs to about 5,000 cfs. ***Chap 5, page 5.3-37.***

- A decrease of 6,000 cfs in the Sacramento River could result in as much as a 3-foot reduction in river stage, although understanding of how notch flows would affect river stage is incomplete. ***Chap 5, page 5C.5.4-6.***
  *** The tunnels call for 9000 cfs export, so would that result in a 4.5 foot reduction in river stage? If operated at capacity, or 15,000 cfs, doesn't that equate to -6.5 or worse reduction in tide?

<u>Salinity</u>

- There may be changes in salinity in some Delta locations caused by tidal flow missing effect from restoration actions and sea level rise. ***Chap 5, page 5.3-3.***
- Delta outflow is the primary driver of salinity in the Delta and of the X2 position. ***Chap 5, page 5.3-16.*** If there is no freshwater outflow in summer months on the lower Sacramento between Walnut Grove and Viera's, nor on Steamboat and Sutter Sloughs, how much salinity will encroach into these historically freshwater areas?
- In addition to flows from new north Delta intakes, BDCP habitat restoration may modify hydrodynamics in the Delta. These hydrodynamic changes in turn can change salinities, DO, turbidity, and flows. ***Chap 5, page 5C.1-1.***
- Because Delta outflow is the major factor determining salinity in the Delta channels, these salinity objectives are satisfied by increasing Delta outflow (normally by reducing exports). The D-1641 salinity objectives are assumed to apply to the EBC and the BDCP cases (ELT and LLT). ***Chap 5, page 5C.2-4.***

<u>Pumping/Water Ops</u>

<u>New North Delta Intakes</u>

- Operations result in changes in flow and potentially changes in water quality, habitat, and predation. ***Chap 4, page 4-20.***
- The general effect of each north Delta intake is the reduction of the downstream flow by about 3,000 cfs (when operated at capacity). ***Chap 5, page 5.3-6.***
- Always a downstream "bypass flow" requirement (e.g. 5,000 cfs in July thru Sept; 7,000 cfs in October thru Nov; and 10,000 cfs December thru June). ***Chap 5, page 5.3-7.***
- There ***almost always*** will be a net downstream tidal flow (sweeping velocity) below the operating north Delta intakes [*doesn't say when or how often or why there won't be downstream tidal flow below intakes*]. ***Chap 5, page 5.3-7.*** Imagine that the lowest of the intakes on the Sacramento River is operated full blast which then has the effect of pulling the water down river, creating greater velocity at the upper pumps. This is one way all freshwater could be diverted from the Sacramento River north of Walnut Grove. Require that the intake pumps be surface pumps, not bottom pumps, to assure fresh water is left on the Sacramento River?
- Modeling of the intakes included a downstream sweeping velocity criteria of 0.4 foot per second. ***Chap 5, page 5.3-7.*** How many cfs is this and why the change to a different reporting method?
- Major north Delta diversions could not begin until the Sacramento River flow was greater than a threshold of about 10,000-15,000 cfs. ***Chap 5, page 5C.2-5.***

- For example, with a Sacramento River flow of 10,000 cfs, the allowable north Delta diversion would be 5,000 cfs in July thru Sep and 3,000 cfs in Oct thru Nov. With a Sac River flow of 15,000 cfs, the allowable diversion would be 10,000 cfs in July thru Sept and 8,000 cfs in Oct thru Nov. ***Chap 5, page 5C.2-6.*** Leaves 5,000 cfs of flow for Steamboat, Sutter, Lower Sacramento, Georgiana…not enough!!!
- The north Delta diversions are often limited by the monthly inflow hydrology and the D-1641 outflow objectives and the operating rules include monthly minimum bypass flows for new intakes to reduce the effects of their diversions on migrating Sacramento River fish. ***Chap 5, page 5.3-7.*** Require water monitoring stations to be installed at lower Steamboat Slough and on the Sacramento River below Viera's. Monitors surface and bottom water quality and flow. Constant reporting of the conditions will be available to the public online. Independent water engineer/contractor to maintain and provide reports, or NDWA designates a board member to oversee the work. Costs paid for by state water contractors. Salinity, water temperature must constantly be monitored along with water level. If water salinity violates 1641, pumps are shut off. If water level is to low, which raises the water temperature, which in turn kills the native fish like adult salmon, the pumps area shut off. If navigation of the waterways is impeded, DWR must dredge or else shut off pumps. If low freshwater flow results in increase of tules or water weeds which capture sediment which then raises the river bed, DWR must dredge, remove the sediment and snags, and shut off pumps until such time as the navigable waterways are restored to their pre-1990 depth.
- There will be some level of north Delta diversions in almost every month with 9,000 cfs in at least 10% of the years in the months of January thru June. ***Chap 5, page 5.3-7.***
- Full diversions of 9,000 cfs would be allowed in July-Sept with a Sac River flow of 20,000 cfs, would be allowed in Oct-Nov with river flow of 22,000 cfs, allowed Dec-April for level III diversions with flow of 40,000 cfs and allowed May-June with flow of 27,500 cfs. ***Chap 5, page 5C.2-6.*** WHERE is the location of the Sacramento River "starting point" for cfs flow which triggers
- The median diversions were about 2,000 cfs in October, 2,000 and cfs in November; 1,000 cfs in December, 3,000 cfs in January, 6,000 cfs in February, 6,250 cfs in March, 3,500 cfs in Aprio, 2,000 cfs in May, 4,500 cfs in June, 2,000 cfs in July, 3,000 cfs in August, and 2,500 cfs in September. ***Chap 5, page 5.3-7.***
- The model assumed that there would be some level of south Delta exports in all months. ***Chap 5, page 5.3-7.***

  <u>South Delta Pumps</u>
- The south Delta pumping was reduced by about half with annual average exports of 2,662 TAF. The median exports for evaluated starting ops were about 2,500 in October; 4,250 in November; 7,000 cfs in December; 4,250 cfs in January; 2,500 cfs in February; and 2,000 cfs in March; 1,500 cfs in April; and 2,000 cfs in June. Median exports under the early lont-term were about 7,000 cfs in July; 5,000 cfs in August; and 4,000 cfs in September. ***Chap 5, page 5.3-11.***
- The high outflow scenario caused large reductions from the south Delta exports of about 50 to 1,500 cfs in March through July. The reduction in March thru May were required to provide additional outflow, and the reduction in June and July were caused by reduced upstream reservoir storage releases to maintain carryover similar to existing conditions. The low outflow scenario caused increases of south Delta pumping of about 1,000 to

4,000 cfs in Sept thru Nov of about half of the years. The increased south Delta exports in these months (following above normal and wet years) were caused by the reduced outflow requirements. ***Chap 5, page 5.3-12.***

BDCP Water Ops

- Byron Tract Forebay – Limit diversions to two 6-hour ebb tide periods per day.
- Banks Pumping Plant – Pumping at near maximum capacity during off-peak electrical demand periods, and lower capacities during peak demand periods.
- Under maximum allowable export rules, BDCP assumes the CVP pumping capacity is 4,600 cfs and existing sough Delta SWP maximum diversion to Clifton Court Forebay of 6,680 cfs with additional diversions of 1/3 of the SJR flow at Vernalis (to a maximum monthly pumping of 8,500 cfs) between Dec 15 and March 15. SWP pumping to the maximum SWP Harvey O. Banks Pumping Plant physical capacity of 10,300 cfs was assumed for the BDCP using the north Delta intakes. ***Chap 5, page 5C.2-3.***
- New north Delta pumps assumed to be exempt from the 1995 WQCP E/I ratio rule that applies to south Delta exports. The south Delta pumping was limited by the E/I calculated with the inflow minus the north Delta diversions. ***Chap 5, 5C.2-3.***

BDCP Water Deliveries/Exports

- 1A – Avg annual total CVP deliveries and avg annual total south of Delta CVP deliveries would increase by 263 TAF (6%) and by 237 TAF (12%) respectively, compared to deliveries under NAA. North of Delta CVP deliveries would be reduced by 55 TAF (23%) compared to Existing Conditions. ***EIR/EIS, page 5-57.***
- 1A – Avg annual CVP north of Delta ag deliveries would increase by 17 TAF (11%) compared to NAA and exhibit an increase in almost 50% of the years. ***EIS/EIR, page 5-58***
- The proposed BDCP north Delta intakes will require a third category of Delta rules: rules governing maximum allowable north Delta diversions. The new rules governing the north Delta diversions may increase the allowable Delta exports by shifting the diversion location to the new north Delta facilities, where entrainment issue are expected to be substantially reduced compared with current ops. ***Chap 5, page 5C.2-3.***
- Because the BDCP will allow higher exports and fill San Luis Reservoir earlier each year, the BDCP will include higher SWP Article 21 "bonus" deliveries. ***Chap 5, page 5C.2-4.***
- The average annual total exports for evaluated starting ops (early long term) were 5,265 TAF with average north Delta diversions of 2,603 TAF (49% of total exports). The average annual total exports for evaluated starting ops (late long term) were 4,945 TAF with north Delta diversions of 2,435 TAF (49% of total exports). ***Chap 5, page 5.3-7.***
- The proposed BDCP north Delta intakes will require a third category of Delta rules: governing maximum allowable north Delta diversions. The new rules governing the north Delta diversions may increase the allowable Delta exports by shifting the diversion location to the new north Delta facilities, where entrainment issues are expected to be substantially reduced compared with current operations. ***Chap 5, page 5C.2-3.***
- Because the BDCP will allow higher exports and fill San Luis Reservoir earlier each year, the BDCP will include higher SWP Article 21 "bonus" deliveries. ***Chap 5, page 5C.2-4.***

Sutter/Steamboat Sloughs

- The median diversions into Sutter and Steamboat Sloughs are lower under the evaluated starting ops because of the Fremont Weir notch increases the diversions to the Yolo Bypass and because north Delta intakes reduce the Sacramento River flow at these two sloughs. In addition, tidal restoration in the Cache Slough Complex was simulated to shift the tidal elevations and reduce the Sutter/Steamboat diversion fractions. The BDCP median diversion flows were reduced by about 1,000 cfs in January, about 5,000 cfs in February, and about 3,500 cfs in March compared to the existing conditions. The reductions in the Sutter/Steamboat Slough diversions were about 40% of the simulated north Delta intake diversions. ***Chap 5, page 5.3-10.*** ***Meaning the water exported directly reduces Steamboat and Sutter Slough diversions by 40%!***

Georgiana Slough/DCC

- Predicted reduced monthly median diversion flows to DCC and Georgiana Slough for evaluated starting ops because the north Delta intakes reduced the Sacramento River flow. The average annual diversions into the DCC and Georgiana Slough were about 3,750 TAF (24% of the Sacramento River flow at Freeport) for the existing conditions and were reduced to about 3,50 TAF (21% of Sac River flow) for the BDCP ops. ***Chap 5, page 5.3-10.*** So, of the 5,000 cfs of flow left after the pumps, DCC and Georgiana Slough receive about 1,000 cfs and Sutter, Steamboat and lower Sacramento "share" 4,000 cfs? Isn't this a reduction of flows by 75% for the Lower Sacramento and its natural or original tributaries?
- North Delta intakes combined with diversion of water into Yolo Bypass (CM2) inevitably would result in less Sacramento River flow below intakes with potential for greater incidences of Sac River flow reversals in the vicinity of Georgiana Slough and the DCC. ***Chap 5, page 5C.4-78.*** What about the effect on the lower Sacramento River down by Viera's? Those same pumps causing reverse flows in the Georgiana area would pull in the higher salinity water expected to encroach up to Rio Vista in some models. How does it affect the water quality at Oxbow Marina? Water levels at Oxbow?
- The analyses of reverse flows and flow entry into Georgiana Slough were based on 15-minute outputs form the DSM2- HYDRO simulations for each scenario. The results were computed for 16 years, starting from water year 1976 to water year 1991. Flow outputs for Sac River downstream of GS 9channel 423 at 1,000 feet or SAC_370, Sac River upstream GS (channel 433 at 1320 feet or SAC_36), GS (channel 366 at 0 feet or GEORG_SL), and the net DICU (Delta Island Consumptive Use) flow at node 343 were used. ***Chap 5, 5C.4-80.*** ***How does this change when claimed in-delta use is reduced due to sale or transfer of water rights by farmers?***

Threemile Slough

- Modeling indicates Threemile Slough flows are about 3% of the Rio Vista flows under existing conditions and were reduced slightly for the evaluated starting ops because the Rio Vista flows were reduced by about 80% of the north Delta intake diversions. Annual average flows were reduced from 1,000 TAF to about 700 TAF. There tidal exchange of water between the Sacramento River and the San Joaquin River thru Threemile Slough is predicted to remain similar. ***Chap 5, page 5.3-10.***

Tule Canal/Toe Drain

- Removal of road crossings and agricultural impoundments, earthwork and construction of structures to reduce Tule Canal/Toe Drain channel capacities. ***Chap 4, page 4-16.***

Yolo Bypass Western Edge

- Modification of existing configuration of the discontinuous channels along the western edge of the Yolo Bypass to reduce diversion of Delta water for Yolo Bypass irrigation. ***Chap 4, page 4-16.***

Head of Old River Barrier Operation

- Example scenario calls for aligning use of the HORB with the D-1641 fall pulse flow intended to cue immigrating adult Chinook salmon in the SJR system. Will fully close the HORB and suspend south Delta diversion operations during the D-1641 flow pulse in Oct, then operate 50% open for 2 weeks following pulse flow. After (sometime in Nov) the HORB will remain open thru Dec, but return to 50% closed ops when SJR juvenile salmonids are moving out of system. Also, HORB will be fully open when SJR flow greater than 10,000 cfs at Vernalis. Spring months (April, May, June) HORB ops conditioned on flows of SJR at Vernalis. April and May when below 5,000 cfs at Vernalis, an avg net OMR target of -2,000 cfs should benefit salmon and smelt. ***Chap 4, page 4-22 and 4-23. Navigation limits***

Cache Slough Complex Intakes

- At least 5,000 acres of habitat restoration will occur in Cache Slough Complex that will require the removal of an estimated 9 diversions by year 10 with an additional 15 diversions removed by end of yr 50. Habitat construction is expected to ultimately result in a reduction of the total number of existing diversions from 47 to 23. BDCP will remediate about 100 cfs of Cache Slough Complex (Cache Slough, Barker Slough, Ulatis Channel, Lindsey Slough, Hass Slough, Shag Slough, SDWSC, Miner Slough: area of about 29,000 acres) diversions per year up to a max of 5,000 cfs over the permit, thru a combo of removing diversion for restoration activities and remediation techniques including locating them elsewhere in plan area (remediation prioritized per CM21). Area includes about 55 intake pipes and 46 diversion (max diversion capacity if about 1,500 cfs, excluding NBA). BDCP will consider activities associated with capital projects to remediate these local diversions as covered activities with regulatory ESA coverage *if* the operators have executed a certificate of inclusion. If signed, these operators may be required to allow their diversions to be screened (some may be paid for others no). ***Chap 4, page 4-26. NBA is also planning a new intake in the area…what about those effects?***

Delta Levee Impacts

Fremont Weir/Yolo Bypass

- Removal and/or construction of berms, levees, and water control structures.

BDCP Levee Maintenance

- Maintained to provide 100-yr flood protection. All levee maintenance activities must be under the jurisdiction of a federal or state agency, an agency created by the federal or state law, or an agency of a community participating in the NFIP that assumes ultimate responsibility for maintenance. At a minimum, levee maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person, by name or by title, responsible for their performance. ***Chap 4, page 4-24.*** Maintaining the levees but ignoring the buildup of channel beds from the sediment captured along the banks growning "restoration" plants like tules will make it impossible to maintain the 100 year flood protection. Dredging of all North Delta sloughs must be included

Listed Species Impacts

New North Delta Intakes Impacts

- Operations result in changes in flow and potentially changes in water quality, habitat, and predation. Operational impacts on fish may include changes in spawning, migration, and rearing habitat associated with changes in reservoir operations, diversion of water, and the consequent changes in flow in the Sacramento River and water circulation and quality through the Delta. Placement and operation of intakes may also result in changes in the potential for predation. ***Chap 4, page 4-20.***

Temperature Impacts

- Temperature, for example, may have a lethal effect, and affects the metabolism of fish, which then require more food and more oxygen to survive. ***Chap 5, 5.3-19.***
- Comparisons of water temperature differences between existing conditions and evaluated starting ops were not conducted for the Plan Area. ***Chap 5, page 5.3-20.***
- There will be minimal changes in Sacramento river temps as a result of BDCP and no changes to SJR temps because there will be no change in SJR flows. ***Chap 5, page 5.3-20.*** FYI In 2012 local anglers monitored the water temperature on Steamboat Slough, Sutter Slough and lower Sacramento River at the beginning of Salmon season in July through September. Especially on Steamboat Slough, water temperatures were lethally high for migrating adult salmon and hopefully the salmon were wise enough to use different migration routes, probably Yolo Bypass area where the water flow seemed cooler. Discussion with UC Davis fish expert confirmed our concerns that the water temps on Steamboat and Sutter were lethal.

Salinity Impacts

- Salinity elicits direct responses from organisms depending on their ability to adapt to salinity gradients. ***Chap 5, page 5.3-19.***
- Increased tidal mixing associated with the addition of tidal marsh restoration areas under the BDCP may allow more salt into the western Delta. ***Chap 5, page 5.3-25***.
- Under BDCP scenarios outflows will be nearly the same during the low-flow months of July thru Oct in many years, so that X2 will remain unchanged. However, outflows under the low-outflow scenario would be lower than under evaluated starting ops or the high-outflow scenario in Sept thru Nov of wet and above-normal years (about 50% of the

years). Under the low-outflow scenario outflow would be operated to meet the D-1641 objectives, so the salinity in the western Delta would be higher than the evaluated starting ops or high-outflow scenario. The X2 will move upstream to the historical positions under D-1641. The outflow salinity relationships may shift with sea level rise, so that the X2 position for an outflow of 3,000 cfs or 4,000 cfs may be more upstream than historically observed. ***Chap 5, page 5.3-26.***

- Relatively small changes in salinity were simulated for the ROAs. Changes in salinity form historical conditions depend on the assumed locations of the ROAs and their connections to the existing channels. Tidal trapping on Grizzly Island increased the salinity at Chipps Island and upstream. Reductions in the net diversions from the Sacramento River to the SJR (through DCC, Georgiana Slough, and Threemile Slough) reduced the freshening effect from the Sac River and increased the salinity at the SJR stations. South Delta ROAs tended to increase the tidal mixing of seawater into the south Delta and to the south Delta pumps. ***Chap 5, 5.3-26.***

Dissolved Oxygen Impacts

- The saturation concentration of DO is reduced at warmer temperatures and fish must move water over their gills at a faster rate when water has a lower DO concentration. ***Chap 5, page 5.3-19.***
- Modeling simulations found only minor differences among the BDCP scenarios. ***Chap 5, page 5.3-23.***
- Stockton Deep Water Ship Channel is declared impaired by SWRCB. CM 14 will provide shared funding of the long-term operation and maintenance costs associated with an aeration facility will occur. ***Chap 5, page 5.3-23.***

Turbidity/Sediment Impacts

- Excessive turbidity can have direct effects on organisms, causing irritation or in some instances suffocation. Turbidity also has indirect effects such as providing cover from predators, or providing a visual background (contrast) that makes prey items easier to acquire. ***Chap 5, page 5.3-19.***
- Implementation of dual conveyance under CM1 was estimated to result in around 8-9% less sediment entering the Plan Area. Less sediment entering the Plan Area may cause greater water clarity, although the extens of the effect is uncertain. Capture of sediment in upstream ROAs (particularly Cache Slough and West Delta) could also lead to greater water clarity in downstream areas such as Suisun Bay. ***Chap 5, page 5.3-24.***
- It is unclear whether sediment supply will be sufficient to maintain the current extend of tidal marsh. ***Chap 5, page 5.3-25.***

Impacts Outside Plan Area

- Feather River will have lower flows and higher water temperatures due to changes in the timing of releases from Oroville Dam. ***Chap 5, page 5.3-3.***

<u>North Delta Construction Impacts</u>
Appendix 3C

- Clearing all vegetation and other objects on levee, berm and along the low flow bank.
- Construct detour roads, requires 971,500 cy for impart and compact (five intakes)
- Widen levee top on landside of levee to provide turnout access for construction
- Pave levee with asphalt concrete surface over and aggregate base
- 80,000 cy imported fill, 694 cy aggregate base, and 680 tons asphalt concrete
- Cofferdam work performed only during the allowed in-river work period June 1-Oct 31
- Build temporary cofferdam in river to create dewatered construction area between 0.2 and 5 acres
- Dewatering of cofferdams 24hrs, 7 days per week throughout intake construction, pumped to tanks on the landside of adjacent levees, treated and returned to river
- Between 450-800 sheet piles driven from within river by a barge mounted crane for intakes
- 551 piles for sedimentation basin
- 493 piles for pump house locations
- From 8-12 pile installed per day, per intake site, requiring about 700 strikes each
- Excavate from river bed (cofferdam area) an approximate depth of 30-35 ft of soil, for an excavated volume of 22,600 cy
- Excavate next to each intake structure about 750 ft upstream and downstream
- Each intake requires 117,120 cy to be excavated, hauled, stockpiled, and compacted
- Each intake requires 442,470 cy to be imported and compacted
- Dredging on river bank and in river channel at each cofferedam
- Pipeline/tunnel Alignment: 4,000 tons.
- An additional 30% of tunnel muck material is expected due to larger outside diameter tunnel (44 ft) under Alt 4.
- Tunnel boring, four pipes (12 ft diameter) from intakes to forebay and forebay to PC tunnel, from cofferdam area under levee, potential 63,000 cy of excavation and 55,000 cy of bedding/backfill
- Intake cast-in-place concrete: 22,090 cy concrete; 1,700 kips of reinforcing bar
- Import 2,800 cy riprap place around cofferdam
- Import and compact 400,000 cy fill for new levees
- Tunnel conveyance excavation and backfill material: excavate and haul to stockpile 591,397 cy; export much 23.5 million cy (under Alt 4 tunnel muck will increase by approx 41%, but additional muck storage footprints not anticipated); import and compact 6.1 million cy.