Appendix 3C
Construction Assumptions for Water Conveyance Facilities

Project-level environmental review requires specific information about the timing, nature, and physical extent of those activities necessary to construct the water conveyance facilities proposed under the BDCP alternatives. Table 3C-1 provides a list of major construction activities and elements necessary in constructing these features, along with their anticipated timing and any important information or assumptions that further characterize the activity and provide necessary detail in evaluating their potential effects. These assumptions were developed from a number of sources, including conceptual engineering reports, GIS databases, and written and verbal correspondence with DWR technical staff. Areas required for features associated with BDCP alternatives, including ancillary areas for parking, lighting, fencing, etc., were included within GIS databases for the purposes of environmental review.

Not all construction assumptions found in this EIR/EIS are intended to include a level of analysis sufficient to support all permit decisions under Section 404 of the Clean Water Act and Sections 10 and 14 of the Rivers and Harbors Act of 1899 for all actions associated with the BDCP. Rather, the EIR/EIS may later be supplemented through additional environmental documentation, if necessary.

Table 3C-1 summarizes only major structures and activities; Tables 3C-~~.~~23 through 3C-8 summarize the Pipeline-/Tunnel Option Alternative (PTO, or pipeline/tunnel alignment) construction activities; Tables 3C-~~.~~319 through 3C-24 summarize the East Alignment construction activities; Table 3C-~~.~~326 through 3C-31 summarize West Alignment construction activities, and 3C-~~.~~432 through 3C-3~~7~~8 summarize Modified Pipeline/Tunnel Option (MPTO)/Alternative 4 construction activities.~~;~~ ~~c~~Construction components for Alternative 9, Through Delta/Separate Corridors Conveyance, are shown in Table 3C-~~541~~39 through 3C-~~43~~42. Additional construction assumptions are addressed in Appendix 22B, Air Quality Assumptions.~~.~~

A more detailed breakdown of construction ~~activities and timelines~~schedules for each ~~component~~ component can be found in ~~82in Table 3C-8 9 through Table 3C-181~~98 ~~and in~~ Appendix 22B, *Air Quality Assumptions*. Construction schedules for West Alignment alternatives are assumed to be the same as for East Alignment alternatives, except as noted.

Some components of Alternative 5 have different specifications than those in other pipeline/tunnel alignment alternatives; these specifications are provided for each component for which Alternative 5 differs.

~~Construction components for Alternative 9, Through Delta/Separate Corridors Conveyance, are shown in Table 3C-4, 3C-18 and in Appendix 22B, *Air Quality Assumptions*.~~

This appendix assumes five intakes would be built under any alternative (except Alternative 9); for any alternative~~s~~ with fewer than five intakes, schedules and data would change accordingly.

Under Alternatives 2A and 2B, a total of five intakes would be constructed and operated. Locations 1–3 and either 4 and 5~~,~~ or 6 and 7 are being considered. If alternative intake locations 6 and 7 are used, activity timing may be different than that shown in Table 3C-1. See the North Delta Intakes section of Table 3C-1~~, North Delta Intakes section~~.

~~The Activity Timing column shows the approximate start month and year of the first and last activities involved in constructing the component or set of components (e.g., five intakes). Where no time frame is provided, timing is assumed to be included in the total construction period for the main component. Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time nor does the insertion of an estimated time frame preclude the Lead Agencies from modifying the Activity Timing estimated dates or time frames. Tables 3C-8 9 through 3C-18 198 show the number of work days anticipated for each construction component. Work days are not necessarily consecutive.~~

Table 3C-1. Construction Assumptions for Water Conveyance Facilities

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
North Delta Intakes • Between one and five intakes would be constructed for Alternatives 1A–8. Sites would be selected from 12 possible on-bank locations on the Sacramento River between Clarksburg and Walnut Grove (between approximate river miles 34 to 44.5). • For Pipeline/Tunnel and East Alignment alternatives, there are seven possible sites on the east bank of the river; Alternatives 2A and 2B could utilize one or two alternate intake sites (Intake 6 or 7). The Mo~~fi~~dified Pipeline Tunnel Alignment would include three intake sites on the east bank of the Sacramento River. • For West Alignment alternatives there are five possible sites on the west bank of the river. • Intake construction would require from 3.5 to 4.5 years each; total construction time for five intakes would be 5 to 7 years. The intakes would be constructed simultaneously with in-water work, potentially beginning in February (East or West alignments) or March (Pipeline/Tunnel and Modified Pipeline/Tunnel alignments) of Year 2, depending on alignment. Alternatives 3, 4, 5, 7, 8 involve fewer intakes, and construction schedules may change accordingly. • For alternatives with five intakes, it was assumed that construction would start with Intake #1, followed by Intakes #3, #5, #2, and #4. Under alternatives with fewer intakes, this same order was assumed for those intakes that would be constructed. For example, under Alternative 3, construction would begin with Intake #1 followed by Intake #2. • Construction is to be continuous year-round with 5 day work-weeks and 10 hour days, unless noted otherwise. • Intake facilities including pumping plants (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, and 8) average approximately 60 acres per site; intake facilities for Alternative 4 (Modified Pipeline/Tunnel alignment) would average approximately 90 to 160~~0~~ acres per site. • Dimensions of all structures would be the minimum required for the facility to perform its intended function; house all required equipment and storage; and ensure the safety of the facility and all personnel. • For intake construction schedule detail, please see ~~Tables 3C-8 9 (Pipeline/tunnel alignments) and 3C-2517 (East alignments)~~ Appendix 22B, *Air Quality Assumptions*.		
Concrete ~~i~~Intake ~~s~~Structures (Intakes 1–5 and related components)	**~~Pipeline/ Tunnel Alignment (P/T)~~** ~~Intake 1:~~ ~~Mar. Yr. 2–Aug. Yr. 6~~ ~~Intake 2:~~ ~~Dec. Yr. 2–Sept. Yr. 6~~ ~~Intake 3:~~ ~~Oct. Yr. 2–Aug. Yr. 6~~ ~~Intake 4:~~ ~~Jan. Yr. 3–Oct. Yr. 6~~ ~~Intake 5:~~ ~~Nov. Yr. 2–Aug. Yr. 6~~ **~~Modified Pipeline/Tunnel Alignment (MP/T)~~** ~~Intake 2:~~ ~~Dec. Yr. 2–Sept. Yr. 6~~ ~~Intake 3:~~ ~~Oct. Yr. 2–Aug. Yr. 6~~ ~~Intake 5:~~ ~~Nov. Yr. 2–Aug. Yr. 6~~ **~~East or West Alignment (East or West)~~** ~~Intake 1:~~ ~~Feb. Yr. 2–Jun. Yr. 5~~ ~~Intake 2:~~	• Each intake would range from 40 to 60 feet (~~ft~~ft) wide and 700 to 2,300 ft long (depending on the alignment and intake location), with the long dimension parallel to the river flow. • Intakes would be approximately 55 ft tall from the river bottom to the top of the structure. • The intakes would rise above the surface of the river water between approximately 20 and 35 ft. • The intake structure would be made of structural concrete. • Intakes would be offset from the levee road by approximately 100~~–~~ to135 ft. • A 3.5 ft concrete guardrail would be constructed around the perimeter of the intakes and along the sides of the access bridges.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
	~~Feb. Yr. 3–Nov. Yr. 6~~ ~~Intake 3:~~ ~~Mar. Yr. 2–Dec. Yr. 5~~ ~~Intake 4:~~ ~~Apr. Yr. 3–Nov. Yr. 6~~ ~~Intake 5:~~ ~~May Yr. 2–Jul. Yr. 5~~ ~~West Alignment (West)~~ ~~Schedules assumed to be same as for East Alignment unless noted.~~	
Clearing and Grubbing/ Demolition (Alternatives 1A–8)		• Work sites would be cleared to the areas required for earthwork operations as approved. Vegetative material from clearing operations would be chipped, stockpiled, and spread over the topsoil after earthwork operations are completed. • Grubbing would consist of removing objects (e.g., stumps, tap roots, debris, organic material) larger than 2 inches in diameter to a depth of 1 foot below the cleared surface. • Clearing and grubbing work could include areas on the levee and berm, as well as along the low flow bank below the OHWM. Mature vegetation would be removed if it occurs where sheet piles would be installed if it occurs where permanent structures will be constructed, or if it hampers movement of equipment. • Timing: Assumed 1 day per intake site.
Construct ~~d~~Detour ~~r~~Roads		• Dewater. • Overexcavate/recompact. • Would require 971,500 cubic yards (cy) for import and compact (for five intakes). • See Table 3C-~~7~~8, *Access and Construction Work Areas*.
Construct ~~n~~New ~~p~~Perimeter ~~b~~Berm; ~~w~~Widen levee ~~t~~Top		• Widen levee top on landside of levee to realign roads ~~State Route 160~~ and/or to provide turnout access for construction and maintenance needs. • Pave with asphalt concrete surface over an aggregate base. • 800 – 2,500 ft. length along existing levee. • 80,000 cy imported fill, 694 cy aggregate base and 680 tons asphalt concrete. • Each intake, including the perimeter berm, would require between approximately 1,450,000 and 1,490,000 cy of borrow. • Fill space between old and new perimeter berms to create building pad for pumping plant. • Height from ground surface at landside to crest: 20–45 ft. • Width toe-to-toe: 180–360 ft. • Minimum crest width: 20 ft. • Construct cut-off walls.
Construct and ~~r~~Remove ~~s~~Sheetpile ~~c~~Cofferdam		• Work performed only during the allowed in-river work period of June 1 to October 31, when the potential for fish and aquatic species of concern to be in the vicinity of the in-water construction activities would be at a minimum, unless otherwise authorized by relevant permitting agencies. • Each intake site would require a temporary cofferdam to create a dewatered construction area encompassing the entire intake site.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
		The length of the temporary cofferdam at each intake site would vary depending on the alignment and intake but would range from 740 ft to 2,500 ft for the pipeline/tunnel alignment and modified pipeline/tunnel alignment, and 890 ft to 2,440 ft for the west alignment. • Top of sheet piles to align with approximate top of existing levee crown. • Bottom of sheet piles to be driven to a depth that achieves hydraulic cutoff, for an approximate total length of 145 ft with approximately 100 ft driven below ground. Dimensions of the sheet piles will be revised when additional site-specific geotechnical data becomes available. • Sheet piles would be driven from within the river by cranes mounted on barges and temporary decks. • Installation of steel sheet piles and/or king piles would require both impact and vibratory pile driving, depending on geotechnical conditions at the sites. • ~~From 8 to 12 piles could be installed per day per intake site. Impact-driven piles could require approximately 700 strikes each.~~ Sheet piles would be installed in two phases starting with a vibratory hammer and then switching to impact hammer if refusal were encountered before target depths. ~~Therefore, the number of strikes resulting from this two-phased installation method could be substantially lower~~Refer to Table 3C-2 for assumptions used to evaluate impacts from pile driving. • The in-water area temporarily isolated inside the temporary cofferdam would vary by intake location, but would range from 0.2 to 5 acres. • The distance between the face of the intake and the face of the cofferdam would depend on the foundation design and overall dimensions. It is assumed that the distance between the intake and the cofferdam would be between 10 and 35 ft. • Stone bank protection (or riprap), if present, would be cleared prior to installing sheet piles. • After intake construction is complete the cofferdam would be flooded and removed by underwater divers using torches or plasma cutters to trim the sheet piles at the finished grade/top of structural slab. • A portion of the cofferdam would remain in place to facilitate dewatering as necessary for maintenance and repairs. Depending on the alternative and intake, permanent cofferdams would range in length from 1,220 to 3,360 linear ft, including sheet pile transitions.
Intake Excavation		• Excavate within cofferdam to level of foundation design subgrade. Ground improvement (jet grouting and/or other methods, based on site-specific surface conditions) will be needed beneath the intake, gravity collector pipes, and portions of the pumping plant site. • Affects area enclosed by cofferdam, approximately 0.2–1.9 acres. Remove an approximate depth of 30 to 35 ft of soil, for an excavated volume of 22,600 cy. • An area next to each intake structure would be excavated approximately 750 ft upstream and downstream of the intake structure and approximately 250 ft from the sides of the structure, to facilitate sediment removal during facility operations. • Material excavated for levee foundation improvement would be

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
		exported offsite. • Dredging would be required at each of the intake locations on the river bank and in the river channel after the cofferdam is constructed. • Projected solid waste from intake excavation (not dredge material) to be disposed of in landfills estimated at 0.1%. •
Excavate Cell and Retrieval Pit		• Used to support earthwork activities. • Would result in the export of 111,500 cy of RTM (for five intakes). • Would require 57,750 cy to be excavated and hauled to the stockpile (for five intakes).
Foundation Pile Driving		• Intake foundation • Matrix of foundation piles, driven within the area enclosed by the cofferdam. • Refer to Table 3C-2 for assumptions used to evaluate impacts from pile driving.*~~Between 450 and 800 piles, depending on intake length*~~ • ~~Piles 24 in. diameter, approximately 130 ft long*~~ • • ~~Either cast-in-drilled-hole (CIDH) and/or steel pipe driven piles*~~ • ~~8 to 12 piles driven per site per day*~~ • ~~Up to an average of 700 strikes each for impact-driven piles~~ • May be done in the dry or in the wet. If done in the dry, conventional construction methods would be used within the cofferdam. If done in the wet, a barge-mounted rig positioned outside of the cofferdam or a deckmounted pile driving rig located on decking over the top of the cofferdam would be required. • Dredging is assumed to be minimal and to be localized along the fence of the intake at each intake site. * Type, dimensions, and number of piles and installation methods subject to change based on future site-specific geotechnical data and engineering design. If CIDH is chosen for foundation, impact pile driving will not be required.
Dewatering	~~Ongoing~~	• Dewatering would be used to keep the area within the cofferdam dry during construction. • Dewatering would take place 24 hours a day, 7 days per week throughout intake construction. • Water would be pumped from the cofferdam to tanks on the landside of adjacent levees. • Water pumped from the cofferdams would be treated (settling or removal of sediment) and returned to the river or used for dust control as needed.
~~Tunneling and~~ Pipe ~~Placement~~/conduit construction (for installing pipes under the levee)		• Installing gravity collector pipes/conduits between intakes and sedimentation basins; and carry water between intakes and intake pumping plants(except for Alternative 4). • A variety of construction methods may be used, including pipe jacking, shored trench, and open cut trench.~~Trenchless method or open-cut method would be used to install the pipes.~~ • Bored from within the cofferdam, through the levee embankment,~~, through the cofferdam face, below the river bed, under the levee and~~ to a retrieval pit at the site of the landside sedimentation basin to allow installation of pipe segments to connect the intake to the sedimentation basin.

Construction Element/ Activity	Activity Timing (Start dates)*	Key Construction Information or Assumptions
		• Soil cuttings from the tunnel boring machine (TBM) are mixed with conditioners or water to form a plastic soil or slurry muck to provide a positive pressure at the face of the tunnel. • The RTM is removed from the TBM using conveyors or pumps and is transferred to a separation plant to remove the suspended solids from the soil cuttings from the RTM. • The solids may be reused as fill after treatment. • Six, 420 ft long, 12 ft diameter pipes. • 15,876 cy of spoil (including slurry bulking) removed. • Top of tunnel approximately 10 ft from bottom of riverbed. • Approximately 3,000 cy of grout if ground improvement is required.
Cut and Cover Excavation and Pipe Placement		• Cut and cover construction would likely be used for landside pipe placement using long reach backhoes, scrapers and excavators placed on levees or on the landside of the levees. • Pipe installed underground on the landside of the levee and connected to the sedimentation basin. • Minimum of six 12-ft diameter, 420 ft long pipe; approximately 320 ft of length underground. • Potential 63,000 cy of excavation and 55,000 cy of bedding/backfill.
Cast-iIn-pPlace cConcrete (CIP)		• To form the base, walls and top deck of the intake structure. • 22,090 cy concrete, 1,700 kips of reinforcing bar.
Riprap		• Import 2,800 cy and place around perimeter of cofferdam/intake foundation for protection and to provide a transition from the river bottom to the intake structure. • Would take place only during the allowed in-river work period of June 1 to October 31. • Place riprap, bedding material, fabric.
Cleanup, dDemobilize	P/T: **Aug. Yr. 6–Oct. Yr. 6** MP/T: **Aug. Yr. 6–Oct. Yr. 6** East or West: **Jun. Yr. 5–Nov. Yr. 6**	• 5 days per intake site.
Fish sScreens		• Vertical stainless steel screen panels with stainless steel wire fabric. • Designed to meet delta smelt criteria of 5 sq ft/cfs, with mesh openings of 1/16 in. • Screen dimensions would vary depending on location, ranging from 10 to 22 ft high and from 915 to 1,935 ft long. • Several traveling brush screen cleaning systems would be installed on each of the long sides on the water side of the intakes, and a traveling gantry crane may be placed on the top deck of the intakes. • Screens also serve to filter large solids from entering the intake, minimizing sedimentation within the conduits and improving pump performance and longevity. • Under the modified pipeline/tunnel alignment, a sediment jetting system would be placed behind the fish screens.
Intake pPumping pPlants (PP) (Alternatives 1A, 1B, 1C, 2A,	P/T: PP 1: **Sept. Yr. 2–Jul. Yr. 3** PP 2: **Jan. Yr. 3–Feb. Yr. 5** PP 3: **Oct. Yr. 2–Oct. Yr. 4**	• Houses seven (six plus one spare) 500-cfs pumps; each discharges into a separate 8 ft diameter pipe. The mModified pPipeline/tTunnel Option alignment would 12 (10 plus two2 spares) 900-cfs pumps; each discharges into a separate 8-ft. diameter pipe. • Each intake pumping plant site would be approximately 1,000 ft by

Construction Element/ Activity	Activity Timing (Start dates)*	Key Construction Information or Assumptions
2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, 9) (Alternatives 1B, 2B, 6B, 1C, 2C, 6C)	PP 4: Jan. Yr. 3–Mar. Yr. 5 PP 5: Oct. Yr. 2–Dec. Yr. 4 MP/T: PP 22: Jan. Yr. 3–Feb. Yr. 5 PP 3: Oct. Yr. 2–Oct. Yr. 4 PP 5: Oct. Yr. 2–Dec. Yr. 4 East or West: PP 1: Feb. Yr. 2–Dec. Yr. 3 PP 2: Apr. Yr. 2–Oct. Yr. 5 PP 3: Mar. Yr. 2–Apr. Yr. 4 PP 4: Jun. Yr. 2–January/ Yr. 6 PP 5: Apr. Yr. 2–Jun. Yr. 4	1,000 ft (approximately 23 acres). Under the modified pipeline/tunnel alignment, each pumping plant site would be approximately 1,800 ft by 1,500 ft (approximately 60 acres). • Each intake pumping plant would be approximately 262 ft long by 98 ft wide. • Under the modified pipeline/tunnel alignment, each plant would be approximately 400 ft by 150 ft. • Cast-in-place (CIP) reinforced concrete structure and a superstructure. • Multiple floors would house mechanical and electrical equipment. • The majority of the site would be raised to match the elevation of the adjacent levee, with an approximate raise in grade of 25 ft. • Under East Alignment alternatives, to protect the site and ancillary structures from flooding, the pumping plant, sedimentation basins, and associated solids lagoons would be constructed on engineered fill, with a finished ground level of between 27.9 and 31.2 ft (NAVD88) depending upon the intake pumping plant location. • Primary structural support system of reinforced concrete slabs and walls at and below grade, with steel framing and exterior metal wall and roof panels for the above-grade building.
		• Under the mModified pPipeline/tTunnel Optionalignment, each intake site, including fill pad, would be approximately 1,800 ft by 1,500 ft (approximately 90 to 160 acres). • Each MPTO Iintake Ffacility wouldwill consist of the following components.: ○ A fish-screened intake structure that would employs state-of-the-art on-bank fish screens. ○ Twelve large gravity collector box conduits that willwould extend through the levee to convey flow to the sedimentation system. ○ A sedimentation system that would consisting of gravity settling basin to capture sand-sized sediment and a drying lagoon for sediment drying and disposal. ○ A sedimentation afterbay that willwould provide the transition from the sedimentation basins to a shaft that willwould discharge into a tunnel leading to the intake facility (IF). • A substation with transformers and switching equipment willwould be located on each site for electrical power supply. • Under Alternative 4, a pumping plant would not be included with each intake. A combined pumping plant would be located in the vicinity of Clifton Court Forebay, and would consist of two plants that would each be approximately 180 feet wide in diameter. • Pumping plants would consist of cast-in-place (CIP) reinforced concrete structure and a superstructure. • Multiple floors would house mechanical and electrical equipment. • The majority of the site would be raised to match the elevation of the adjacent levee, with an approximate raise in grade of 25 ft. • The intake facility would Hhouses 12 pumps: eight8 of the pumps willwould have a design capacity of 1,125 cfs and four4 willwould have a design capacity of 563 cfs. • Thes would be---thickThe discharge piping for the large pumps is 12 feet in diameter, and the discharge piping for the small pumps is 8.5 ft in diameter.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
~~**Clearing and Grubbing**~~		~~See Clearing and Grubbing/demolition under *Concrete iIntake sStructures*, above.~~
Pumping Plant Excavation & and Backfill		• Excavation and stockpile or haul to waste. • Place stockpiled material as backfill. • Import and place material. • Each intake pumping plant would require 117,120 cy to be excavated, hauled, stockpiled, and compacted. • ~~Each intake pumping plant would require 442,470 cy to be imported and compacted.~~ • Projected solid waste from pumping plant excavation (not dredge material) to be disposed of in landfills estimated at 0.1% of spoils. • ~~Pipeline/Tunnel alignment: 4,000 tons~~ • ~~East alignment: 3,335 tons~~ • ~~West alignment: 390 tons~~
Sedimentation Basin		The structural system of the basins would consist of reinforced concrete walls and mat slab foundations supported on piles (except under the modified pipeline/tunnel option). Approximately 6 inches of the perimeter and dividing walls would be above the surrounding grade. • Sedimentation basins would be set at depth based on river stage elevations, and at a minimum water depth of 3.5 ft. • Each basin segment would be approximately 120 ft ~~x~~ by 40 ft. Assuming an average water depth of 5 ft elevation, and allowing for flood elevation, the basin would be about 55 ft deep. Under the modified pipeline/tunnel alignment, each sedimentation basin channel would be approximately 1~~5~~00 ft ~~x~~ by 60~~2~~0 ft, and 23 ft deep.~~MPTO/-byby~~ • The bottom of the basins would be at an elevation between -~~20.9~~30 and -~~28.0~~35 ft, and the top of the walls of the basin would be at an elevation of +32.2 ft. • Uncovered basin with channels would be open to above, and a potentially 3-rail 3.5--ft--tall handrail around the perimeter. • Refer to Table 3C-2 for assumptions used to evaluate impacts from pile driving.~~Sedimentation foundation will be supported either on CIDH piles or driven steel pipe piles filled with concrete. About 1,500 to 1,600 piles are expected to support the foundation.~~ Type, dimension and installation method of piles are subject to change based on future site-specific geotechnical data and engineering design. • Sedimentation channels would contain permanent, mechanical solids collection systems, and collected solids would be transferred to solids lagoons. Under MPTO/Alternative 4, the triangular-shaped basins with base and height approximately 700 ft, for Intakes 2, 3 and 5. Normal settling depth would be 20 ft.
Solids ~~l~~Lagoon		• Three uncovered, concrete-lined solids lagoons at each intake or intake pumping plant. • Each lagoon would have a footprint of approximately 86 ft by 165 ft, and would be approximately 10 ft deep. Under the modified pipeline/tunnel alignment, the solids lagoons would be approximately 15 f~~ee~~t deep and would have a bottom width of 200

Construction Element/ Activity	Activity Timing (Start dates)*	Key Construction Information or Assumptions
		feetft and a bottom length of 400 feetft. • Below ground, with the basin lip at the finished grade level. • Under MPTO/Alternative 4, each intake would include four sediment storage and drying lagoons. The drying lagoon size for maximum case sediment quantity is 160 feet wide bottom, 350-feetft-long, 15-feetft-deep, with a 160-ft-wide bottom and 1:1 side slopes. The tops of the lagoons arewould be level with the site and protected from the design flood condition.
Pumping Plant Buildings		The main building above grade footprint would be approximately 100 ft by 320 ft . /Alternative 4by(150 ft by 400 ft for the modified pipeline/tunnel alignment), with Aan attached motor control room that would be approximately 25 ft by 110 ft (85 ft by 120 ft for the modified pipeline/tunnel alignment). Total height of the above ground structure is about 30 ftMPTO.. • Place gravel bedding, drive foundation piles, place concrete fill in piles. • Deep foundation supporting a common concrete mat. • Anticipated 24 inch concrete-filled pipe pile, with an estimated pile length of 40–45 ft below founding level. For the modified pipeline/tunnel alignment, 42-inch concrete filled pipe piles with estimated lengths of 65–75 ft below founding level are considered at conceptual level. Type, dimensions, and number of piles and installation methods subject to change based on future site-specific geotechnical data and engineering design. • Slab on grade concrete. • Concrete walls and roof. • Seven, 8--ft--diameter discharge pipes to outside; each passing through a concrete flow meter vault to a transition manifold or transition structure. Under MPTO/Alternative 4, the combined pumping plant facilities are approximately 3,000 ft by 900 ft. Total height of the above ground structure is about 100 ft under MPTO.
Dewatering/ Unwatering		Dewatering would be continuous during construction.
Transition Structure (Pipeline/ Tunnel, Modified Pipeline/ Tunnel, and West Alignments)		• The transition structure footprint would be approximately 70 ft by 210 ft, with the majority of the basin below ground, and concrete roof and walls. • The ground around the basin may be graded to slope to approximately 12 ft to the top of the structure deck with approximately 6 inches of the perimeter walls above the finished grade. • If the surrounding ground is not graded to slope to the structure, the perimeter wall would be approximately 13 ft above grade. • A structural deck would be permanently in place over the transition structure, with a potentially 3-rail handrail 3.5 ft tall around the perimeter. • A gantry crane would be placed on top of the deck with a frame that would be approximately 30 ft tall and 10 ft wide. • Excavate, haul, stockpile and compact 102,720 cy.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
Transition Structure (East Alignment)		• The transition structure footprint would be approximately 70 ft by 210 ft, with the majority of the basin below ground, and concrete roof and walls. • The ground around the basin may be graded to slope to approximately 8 ft to the top of the structure deck with approximately 6 inches of the perimeter walls above the finished grade. • If the surrounding ground is not graded to slope to the structure, the perimeter wall would be approximately 9 ft above grade. • A structural deck would be permanently in place over the transition structure, with a potentially 3-rail handrail 3.5 ft tall around the perimeter. • A gantry crane would be placed on top of the deck with a frame that would be approximately 30 ft tall and 10 ft wide. • Excavate, haul, stockpile and compact 198,960 cy.
Transition Manifold ~~and Surge Tower~~ at Sites 1 and 2 (Pipeline/ Tunnel ~~and Modified Pipeline/ Tunnel~~ Alignment~~s~~)		• The transition manifold would consist of a 16 ft diameter pipe manifold and valve vault that connects the seven 8 ft diameter discharge pipes from the pumping plant to two parallel 16 ft diameter pipes that discharge to Tunnel 1. ~~The transition manifold may be different under the modified pipeline/tunnel alignment.~~ • The manifold and the pipes would be underground. ~~• Elevation of the top rim of the surge tower would be approximately 65–70 ft (NAVD88).~~ • Driven or drilled foundation piles with reinforced concrete pile cap to support foundation. Intake to pumping plant manifold would require excavating, hauling, stockpiling and compacting 106,080 cy. ~~• Surge tower structures (pipeline/tunnel, modified pipeline/tunnel and west alignments):~~ ~~• Excavate, haul, stockpile; haul from stockpile and compact 50,265 cy.;~~ • ~~Excavate and export 263,895 cy.~~
Surge ~~t~~Towers/Shafts		• Connected to the pumping plant discharge piping. • Intake 1: Two, 16 ft diameter, rim at 70 ft NAVD88. • Intake 2: Two, 16 ft diameter, rim at 65 ft NAVD88. • Proposed height of structure will be 10 to 15 ft above the maximum hydraulic surge elevation. Under the modified pipeline/tunnel alignment, channels would be used around pumping plants, at an elevation of 29 ft. ~~• Under the modified pipeline/tunnel alignment, surge towers would be as follows:~~ ~~• Intake 2: One, 100 ft diameter, rim at 105 ft NAVD88~~ ~~• Intake 3: One, 100 ft diameter, rim at 96 ft NAVD88~~ • ~~Intake 5: One, 70 ft diameter, rim at 75 ft NAVD88~~
Substation and Exterior Transformers		Each intake facility would have a 69 kV substation. See *New ~~u~~Utility ~~c~~Corridors* below; Table 3C-~~5~~6, *Power Supply and Grid Connection;* and Appendix 22B~~Table 3C-14~~16, ~~*Temporary Power Construction Schedule.*~~
General ~~c~~Construction ~~w~~Work ~~a~~Areas (See Table 3C-~~7~~8, *Access and*		• The anticipated construction area for each intake pumping plant would range from approximately 60 acres to 16~~5~~0 acres. • Of this, approximately 20 acres would be specific to the area for temporary construction needs (including on-site temporary parking, office trailers, staging, equipment laydown, storage and access road).

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
Construction Work Areas)		• During the different phases of construction approximately 2 to 8 acres would be used for staging, temporary parking, office trailers, storage and equipment laydown.
Intake ~~p~~Pipelines (Alternatives 1A–8)		• Six 12-ft diameter pipelines to carry water between intakes and intake pumping plants.~~MPTO Alternative~~ • Pipes connect intakes to sedimentation basins. • Construction could include microtunneling or open-cut trenching through levee, depending on depth of installation. • RTM from microtunneling would be removed using conveyors or pumps and transferred to a separation plant to remove suspended solids, treated, drained and transported to stockpiles. • Excavated material ~~from open-cut trenching~~, if of generally good quality, would be used as embedment and backfill material. Excess material would be transported offsite. • If native materials are not suitable as foundation for the trench, suitable materials would be imported to the site. • Excavate, haul, stockpile and compact 552,720 cy. • Excavate and export 382,480 cy. • Under the MPTO Alternative, (12) 12-ft diameter pipes or 12’ x 12’ box conduits would carry water from intakes to sedimentation collection channels.
Excavation and ~~b~~Backfill (Alternatives 1A~~–~~3, 5~~–~~–8)		Total for all intakes • Intake conduits: export 79,380 cy of RTM. • Excavate cell: export 111,500 cy of RTM.
Conveyance ~~p~~Pipelines		• Transport water to a point of discharge to the conveyance facility (pipeline/tunnel or canal conveyance, depending on the alternative). • Projected solid waste excavation (not dredge material) from conveyance pipelines to be disposed of in landfills is estimated at 0.1%. • ~~Pipeline/Tunnel alignment~~PTO Alignment: 620 tons. • Conveyance pipelines constructed under the ~~modified pipeline/tunnel alignment~~MPTO alternative would be much shorter and therefore, solid waste excavation associated with this alignment would be substantially lower. • East ~~a~~Alignment: 284 tons • West ~~a~~Alignment: 1,579 tons See tables for each alignment and Tables 3C-~~11a~~ 12 and 3C-~~11b~~ 13 for additional details of conveyance pipeline construction.
69 kV ~~s~~Substations		• Power would be delivered from the main 69 kV substation at the IPP over 69 kV subtransmission lines strung on ~~wood~~ poles or towers that would terminate at intake substations located adjacent to each intake structure. See *New utility corridors*, below, and Table 3C-~~5~~6, *Power Supply and Grid Connections*. • Substations at intake pumping plants would have a footprint of approximately 150 x 150 ft. to 350 x 350 ft. Footprints for substations at the intakes under the Modified Pipeline/Tunnel Alignment would be 175 ft by 130 ft. • Power poles or towers would be approximately 60 ft tall.
New ~~a~~Access ~~r~~Roads		See Table 3C-~~7~~8, *Access and Construction Work Areas.*

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
Perimeter Berms/ Levee Modifications		Import and compact 400,000 cy.
Parking, Lighting, Fencing (General)		• Temporary construction parking facilities are to be located within the pumping plant construction site staging areas. Parking facilities for construction employees may be located on the construction site, within the construction area, or off-site where practicable. • Temporary staging areas for storage, office trailers and equipment parking would be required. As the construction progresses, the on-site construction parking and staging areas may need to be relocated in order to maintain a minimal construction area footprint if required. • Any temporary on-site parking facilities or staging areas would be cleared and grubbed, roughly graded and spread with mixed, graded gravel and compacted and may be covered with thin asphalt binder mix surfacing. • If at a site soils are soft, expansive or permeable, semi-permanent • All permanent artificial outdoor lighting is to be limited to safety and security requirements. Temporary artificial outdoor lighting may also be employed for night work where permitted. • All lighting is to be shielded to direct the light only towards objects requiring illumination. • Lights shall be downcast, cut-off type fixtures with non-glare finishes set at a height that casts low-angle illumination to minimize incidental spillover of light onto adjacent properties, open spaces or backscatter into the nighttime sky. • Lights shall provide good color rendering with natural light qualities with the minimum intensity feasible for security, safety and personnel access. • All outdoor lighting would be high pressure sodium vapor with individual photocells and be designed per the guidelines of the • Security fencing with access control gates, on perimeter of intake structures and intake pumping plants. • 6 ft or 8 ft chain link with a climbing barrier; more stringent fencing with razor wire may be used around certain facilities. • Additional fencing around the substation and transformer yards may be required. • Masonry walls 6 to 8 ft tall may be used within the facilities.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions
		structures, such as office trailers, may require concrete pads or footings to support them. Illuminating Engineering Society (IES). • All lights are to be energy conserving and aesthetically pleasing. • Lights would have a timed on/off program or have daylight sensors and be programmed to stay on whether or not personnel are present.
Landscaping/ Vegetation (General)		• If possible, the natural environment would be preserved. Re-vegetation plans would be developed for restoration of areas disturbed by project activities. • Landscaping plans may be to enhance facility attractiveness, for the control of dust/mud/wind/unauthorized access, for reducing equipment noise/glare, for screening of unsightly areas from visually sensitive areas. • Planting would use low water-use plants native to the Delta or the local environment, with an organic/natural landscape theme without formal arrangements. • Low maintenance plants and irrigation designs would be chosen. • Planting plans would use native trees, shrubs or grasses and steps would be taken to avoid inducing growth of non-native invasive plant species/California Native Plant Society weedy species. • Planted vegetation would be compatible with density and patterns of existing natural vegetation areas and would be placed in a manner that does not compromise facility safety and access. • Planting would be done within the first year following the completion of the project and a plant establishment plan would be implemented.
New Utility Corridors	~~Feb. Yr. 1–Mar. Yr. 3~~	• A new 230 kV transmission line would deliver power to the new north Delta intake facilities. It is assumed that a new substation would be constructed within or adjacent to the providing utility's existing transmission right of way (ROW). ~~Under Alternative 4 (the modified pipeline/tunnel alternativealignment), this line would be 69kVit is assumed that operational power would be provided to the intakes through existing distribution lines. However, it is assumed that a 230kV transmission line would deliver power to the pumping plants northeast of Clifton Court Forebay.~~ • Alignment of transmission lines and location of interconnection point(s) would be determined based on selection of a conveyance alignment followed by selection of a power provider. • New overhead 69 kV subtransmission lines from the main 69 kV substation at the IPP would deliver power to intakes by looping into each intake substation (for those alternatives with an intermediate pumping plant). • Main launch shafts for constructing deep tunnel segments would require 69kV or 230kV temporary transmission lines.

Construction Element/ Activity	~~Activity Timing (Start dates)*~~	Key Construction Information or Assumptions			
		• 12 kV temporary power for construction would be provided at project work sites by local utilities. • Wherever possible, 12 kV line would be constructed on the same poles as the 69 kV subtransmission line. Under Alternative 4 (the modified pipeline/tunnel alignment), it is assumed that operational power would be provided to the intakes through existing distribution lines. However, it is assumed that a 230kV transmission line would deliver power to the pumping plants northeast of Clifton Court Forebay.			
		12 kV	**69 kV**	**230 kV**	
Site Prep		• ~~All poles sizes~~230 kV and 69 kV sites: 100 x 150 ft footprint, and 100 x 350 ft at conductor pulling locations • 12 kV sites: 40 x 50 ft footprint, and 50 x 200 ft at conductor pulling locations • Bulldozer and backhoe			
Tower Construction		Bulldozer, small crane, line truck, water truck, dump truck	Bulldozer, Man 222HD, 100T, 210' Boom (C85MA004), line truck, water truck, concrete truck	Bulldozer, Man 555, 150T, 250' Boom (C85MA005), line truck, water truck, concrete truck	
Line Stringing		Small crane, line truck, other equipment	Line crane, line truck, other equipment	Line crane, line truck, Helicopter (MD 500D/E)	
Pole Tower Spacing (ft)		125-300	450	750	
Pole Tower Height (ft)		35-45	60	95-130	
Pad Footprint		50' x 50'	100' x 150'	100' x 150'	
Permanent Poles (length)		0	10.73 miles	52.62 miles	
Number of Permanent Poles		0	1256~~.9~~	370~~.45~~	Total perm. poles: 4966~~.35~~
Temporary Poles (length)		22.47 miles	25.02 miles	0 miles	
Number of Temporary Poles		338~~.49~~	171~~.13~~	0	Total temporary poles: 51009~~.62~~
		Transmission line construction phasing and activities are assumed to be similar for the Proposed Project and all alternatives, but the number of poles and length of lines would vary by individual alternative. Specifications provided in this table reflect estimates for Alternative 1A.			

~~* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.~~
~~Yr. = Year~~

Table 3C-~~X~~2. Assumptions to Evaluate Pile Driving Impacts

Feature	On-land or In-water	Pile Type/ Sizes	Total Piles/ Site	Number of Concurrent Pile Drivers at Site	Piles/ Day	Strikes/ Pile	Strikes/ Day
Intake Cofferdam	In-water	Sheet pile	2,500	4	60	700	42,000
Intake Structure Foundation	In-water	42-inch diameter steel	500	4	60	1,500	90,000
SR-160 Bridge (Realignment) at Intake	On-land	42-inch diameter steel	150	2	30	1,200	36,000
Control Structure at Intake	On-land	42-inch diameter steel	650	4	60	1,200	72,000
Pumping Plant and Concrete Sedimentation Basins at Intake	On-land	42-inch diameter steel	1,650	4	60	1,200	72,000
Barge Unloading Facility	In-water	18-inch diameter steel	800	4	60	1,050	63,000
Inlet structure at Intermediate Forebay	On-land	14-inch concrete or steel pipe	1,700	2 or more~~1~~	15	750	11,250
Outlet structure at Intermediate Forebay	On-land	14-inch concrete or steel pipe	1,700	2 or more~~1~~	15	750	11,250
SR12 Improvement	On-land	14-inch steel pipe	40	1	6	1,500	9,000
Cofferdam for Modified Clifton Court Forebay Embankments	In-water	Sheet piles (AZ-28-700)	22,000	4 or more	60	700	42,000
Divider Wall for Modified Clifton Court Forebay	In-water	Sheet piles (AZ-28-700)	5,000	4 or more	60	700	42,000
Siphon at North Clifton Court Forebay Outlet	In-water	14-inch concrete or steel pipe	2,160	2 or more	30	1,050	31,500
Siphon under Byron Highway	On-land	14-inch concrete or steel pipe	1,600	2 or more	30	1,050	31,500
Cofferdam for Operable Barrier at Head of Old River	In-water	Sheet piles (AZ-28-700)	550	2 or more~~1~~	15	700	10,500
Foundation for Operable Barrier at Head of Old River	In-water	14-inch steel pipe or H-piles	100	1	15	1,050	15,750

Notes: All assumptions will be refined as part of next engineering phase when site-specific geotechnical data is collected.
Assumptions for the inlet and outlet structures at the intermediate forebay represent the worst case scenario. These structures could be supported on shallow foundations with ground improvement (i.e., no pile driving would be needed).

~~3C.3~~3C.4 Modified Pipeline/Tunnel Option (Alternative 4)

Table 3C-~~3~~2. Construction Assumptions for Water Conveyance Facilities by Alignment~~-~~—Alternative 4

Construction Element/Activity	Key Construction Information or Assumptions
~~**PIPELINE/TUNNEL ALIGNMENT (Alternatives 1A, 2A, 3, 5, 6A, 7, 8)**~~ **MODIFIED PIPELINE/TUNNEL ALIGNMENT (Alternative 4)** Chapter 3, *Description of Alternatives*, provides a summary of ~~pipeline/tunnel and~~ modified pipeline/tunnel physical characteristics.	
	~~**Descriptions specific to the Pipeline/Tunnel Alignment**~~ ~~**The pipeline/tunnel alignment is approximately 45 miles long, divided into nine separate reaches, beginning with Reach 1 between Intake 1 or 2 (depending on the alternative) and the confluence of Tunnel 1 and Intake 1 and 2 pipelines, and proceeding down the proposed alignment in ascending order ending with Reach 9 encompassing Byron Tract Forebay (BTF) and the approaches to the Harvey O. Banks Pumping Plant (Banks) and C. W. "Bill" Jones Pumping Plant (Jones) Pumping Plants. Intakes would be constructed with the corresponding alternatives as follows:**~~ ~~**Alternative 1A: Intakes 1, 2, 3, 4, and 5**~~ ~~**Alternative 2A: Intakes 1, 2, and 3; Intakes 4 and 5 or 6 and 7 (five total)**~~ ~~**Alternative 3: Intakes 1 and 2**~~ ~~**Alternative 5: Intake 1**~~ ~~**Alternative 6A: Intakes 1, 2, 3, 4, and 5**~~ ~~**Alternative 7: Intakes 2, 3, and 5**~~ ~~**Alternative 8: Intakes 2, 3, and 5**~~ ~~**The intake-specific descriptions below would only apply to those alternatives under which each intake would be constructed.**~~ ~~**Intake 1, approximately 1.5 miles west of Interstate 5 on the south side of the Sacramento River near Freeport, would divert water from the river and pump it through two 16 ft ID pipelines approximately 1.8 miles south to where Intake 2 pipelines connect to the head of Tunnel 1.**~~ ~~**Intake 2 would pump water through two 16 ft inside diameter (ID) pipelines approximately 800 ft to the head of Tunnel 1 and its junction with Intake 1 pipelines.**~~ ~~**Tunnel 1 is a single bore 29-ft ID tunnel approximately 20,000 ft long on the northern end of the project, which discharges water from Intakes 1 and 2 into an intermediate forebay (IF).**~~ ~~**Intakes 3, 4, and 5 would each convey water directly to the IF through two parallel 16 ft ID pipelines of the following approximate lengths.**~~ ~~**Intake 3: 19,700 ft.**~~ ~~**Intake 4: 7,820 ft.**~~ ~~**Intake 5: 4,150 ft.**~~ ~~**The IF would provide a hydraulic break before diverted water enters the intermediate pumping plant and longer, common tunnel conveyance that outlets to Byron Tract Forebay.**~~ ~~**An intermediate pumping plant (IPP) to be constructed at the southern end of the IF would discharge water to Tunnel 2.**~~ ~~**Tunnel 2 is a dual-bore, 33-ft ID/37-ft ED tunnel approximately 183,000 ft on the longer, southern end of the project that discharges water to a new forebay on Byron Tract.**~~ ~~**Under Alternative 5, tunnels 1 and 2 would both be 23-ft diameter and Tunnel 2 would be only single-bore.**~~ ~~**The new Byron Tract Forebay (BTF) (Alternatives 1A, 2A, 3, 5, 6A, 7, 8) would be constructed adjacent to Clifton Court Forebay (CCF) to balance daily variations in inflow and outflow to Banks and Jones Pumping Plants. See Table 3C-3, *Byron Tract Forebay*.**~~ **Descriptions specific to the Modified Pipeline/Tunnel Alignment**

Construction Element/Activity	Key Construction Information or Assumptions
	The modified pipeline/tunnel alignment is also approximately 45 miles long, divided into seven separate reaches, beginning with Reach 1 between Intake 2 and a junction structure near Intake 3, and proceeding down the proposed alignment in ascending order ending with Reach ~~8~~7 at the Clifton Court pumping plants, where water is delivered into ~~encompassing the~~ the north cell of the expanded Clifton Court Forebay and the approaches to the Harvey O. Banks Pumping Plant (Banks) and C. W. "Bill" Jones Pumping Plant (Jones) Pumping Plants. • A series of tunnels would convey water from the intakes to the IF, and from the IF to the combined pumping plants at Clifton Court Forebay. • ~~Intake 2 would convey water via gravity through one 28-foot ID tunnel (Tunnel 1a) approximately 11,350 ft to a junction structure near Intake 3.~~ • ~~Intake 3 would convey water via gravity through one 28-foot ID pipeline to a junction structure, which allows the flow from Intakes 2 and 3 to be conveyed to the IF through one 40-foot ID tunnel (Tunnel 1a) approximately 36,200 ft.~~ • ~~Tunnel 1a is a single bore tunnel approximately 48,000 ft long on the northern end of the project, which discharges water from Intakes 2 and 3 into an IF. The segment between Intakes 2 and 3 has an inside diameter of 28 ft and the segment between Intake 3 and the IF has an inside diameter of 40 ft.~~ • ~~Intake 5 would convey water through one 28-foot ID tunnel (Tunnel 1b) approximately 24,900 ft to the IF.~~ • The intermediate forebay would act as a pass through facility with an outlet structure to convey water into each main tunnel bore (Tunnel 2) via a vertical shaft. • ~~Tunnel 2 consists of two 40-foot ID tunnels (dual-bore) stretching approximately 159,300 ft between the intermediate forebay and a culvert siphon leading to a 9,000 cfs pumping plant to the northeast of the expanded Clifton Court Forebay.~~ • ~~Descriptions applicable to the Pipeline/Tunnel Alignment and Modified Pipeline/Tunnel Alignment~~ • Each tunnel includes a vertical drop shaft at the tunnel's upstream end, and a vertical rising shaft at the downstream end. • Tunnels would be lined with precast concrete bolted-and-gasketed segments. The tunnel concrete liner would serve as permanent ground support and would be installed immediately behind the Tunnel Boring Machine (TBM), forming a ~~continuous~~ near watertight liner~~vessel~~. • Temporary concrete plant would be required to produce tunnel segments (See Table 3C-8, *Access and Construction Work Areas*). • In alluvial soils with high groundwater pressures, the tunnel would be constructed at depths greater than 60 ft using mechanized closed-face pressurized tunneling machines. • Because of the high groundwater level throughout the proposed tunnel alignment area, extensive dewatering (via dewatering wells at tunnel shaft sites) and groundwater control in the tunneling operation and shaft construction would likely be required. • Each tunnel reach would include at least one launch shaft, intermediate shaft and retrieval shaft per bore, except the tunnel between Intake 2 and Intake 3 under Alternative 4. • ~~One or more 33-ft ID tunnel reaches requiring excavating a 37 ft (diameter) tunnel (May require a larger or smaller diameter if Alternative 4 or Alternative 5, respectively, is selected. See descriptions above for specific information regarding the internal diameter of tunnels under the various alternatives)~~ • RTM disposal shafts or tunnel(s) • • The pumping plant will have 150-ft internal diameter shafts.The pumping plant shafts are assumed to be constructed using slurry diaphragm walls 6 ft thick due to the large diameter and depth. The finished interior walls would be4- to 5-ft-thick.~~Architectural details of above-ground structures are to incorporate materials that blend well with the existing environment and surrounding structures.~~
Excavation	• Except where crossing under a major waterway, intake conveyance pipelines ~~would~~ may be installed using pipe jacking, shoring, or open cut~~via open cut~~. Excavation would include clearing, grubbing, excavation, storage of excess spoil material and dewatering. • All existing vegetation and trees would be cleared and grubbed along the pipeline easement and

Construction Element/Activity	Key Construction Information or Assumptions
	disposed of offsite. • Materials to be stockpiled may include: 1. Strippings from various excavations, for possible reuse in landscaping 2. RTM that is slated for reuse after treatment for embankment or fill construction 3. Peat spoils for possible use on agricultural land, or as safety berms on the landside of haul roads, or as toe berms on the landside of embankments (cannot be part of the structural section) 4. Other materials being stockpiled on a temporary basis prior to hauling to permanent stockpile areas • Such materials can be stockpiled in the construction areas of the project for later use. Some stockpiles may be used for material conditioning and potential reuse of the material. • Temporary stockpile areas may also allow for the staging of deliveries (offloading), for equipment/materials storage, and for temporary field offices for construction. • Tunnel conveyances excavation and backfill material: ○ Borrow and excavate for Tunnel Reach 7 and Combined Pumping Plants: 2,195,000 cy ○ Borrow and excavate for Tunnel Reaches 1-6: 3,403,000 cy ○ • Total Alternative 4 excavate, direct haul, and compact: 3,940,000 cy • Excavate and haul to stockpile: 7,518,000 cy • Excavate and export: 1,030,000 cy • 35,360,000 cy of borrowed, excavated, and dredged material. • 160,000 cy dredged at each intake site. • 1,030,000 cy dredged at IF. • Construction of Alternative 4 intakes would require 4,430,000 cy of borrow, total. Each intake, including the perimeter berm, would require between approximately 1,450,000 and 1,490,000 cy of borrow. • Under Alternative 4, the total amount of borrow material for engineered fill is approximately 21,000,000 cy (bank yards), based on the associated number of intakes, size of forebays, and conveyance requirements. The total amount includes approximately 3,000,000 cy for the tunnel shaft pads, 6,500,000 cy for the CCF embankments, 2,000,0000 cy for the IF embankments, and 6,700,000 cy at the three intake sites (approximately 2 million cy each), and 2,600,000 cy at the Clifton Court Pumping Plant site. • Approximately 1,029,000 cy of excavation and 2,045,000 cy of fill material are required for completing the IF embankments. • Approximately 9,300,000 cy of fill are required for the modified CCF embankments, which includes the divider embankment separating the NCCF from the SCCF, approach canal embankments, spillway pad, and siphon outlet pad.~~Excavate and haul to stockpile: 591,397 cy~~ • ~~Export RTM: 23,581,542 cy (under P/T)~~ • ~~Export RTM: 24,352,214 cy (under MP/T)~~ • ~~Import and compact: 6,141,800 cy~~
Tunnel 1	• Intake 2 would convey water via gravity through one 28-foot ID tunnel (Tunnel 1a) approximately 11,150 ft, or 1.99 miles, to a junction structure in the Intake 3 facilities. • Intake 3 would convey water via gravity from the junction structure through one 40-foot ID tunnel (Tunnel 1a) approximately 36,207 ft, or 6.74 miles, which allows the flow from Intakes 2 and 3 to be conveyed to the IF. • Intake 5 would convey water through one 28-foot ID tunnel (Tunnel 1b) approximately 25,180 ft, or 4.77 miles, to the IF. • ~~Descriptions specific to the Pipeline/Tunnel Alignment~~ • ~~Connects Intakes 1 and 2 to the IF.~~ • ~~20,000 ft long.~~ • ~~1 tunnel bore, 2 shafts.~~ • ~~Inside diameter: 29 ft~~

Construction Element/Activity	Key Construction Information or Assumptions
	• ~~Outside diameter: 33 ft~~ • ~~Under Alternative 5, tunnel would have an inside diameter of 23 ft and an outside diameter of 27 ft.~~ • ~~Descriptions specific to the Modified Pipeline/Tunnel Alignment~~ • ~~Tunnel 1a connects Intakes 2 and 3 to the IF, and is 46,700 ft long.~~ Tunnel 1a has one tunnel bore and ~~four~~ one shaft location with two shafts at Intake 2 and retrieval shaft at junction structure shaft~~s~~. Its inside diameter is 28 ft (with an outside diameter of approximately ~~24~~ 31 ft) between Intakes 2 and 3 ~~(Reach 1) and 40 ft (with an outside diameter of 33 ft) between Intake 3 and the IF (Reach 2)~~. • ~~Tunnel 1b connects Intake 5 to the IF (Reach 3), and is 25,100 ft long.~~ Tunnel 1b has one tunnel bore and three shaft locations between Intake 5 and the IF. Its inside diameter is 28 ft and its outside diameter is ~~24~~ aproximately 31 ft.
Tunnel 2	• Tunnel 2 consists of two 40-foot ID tunnels (dual-bore) stretching approximately 30.1 miles between the intermediate forebay and two 4,500 cfs pumping plants to the northeast of the expanded Clifton Court Forebay. • ~~Descriptions specific to the Pipeline/Tunnel Alignment~~ • ~~Connects IPP to Byron Tract Forebay.~~ • ~~183,000 ft long.~~ • ~~2 tunnel bores, 13 shaft sites, with one shaft for each bore.~~ • ~~Alternative 5 would require only a single tunnel bore connection from the IPP to Byron Tract Forebay.~~ • ~~Inside diameter: 33 ft.~~ • ~~Outside diameter: 37 ft.~~ • ~~Under Alternative 5, the single-bore tunnel would have an inside diameter of 23 ft and an outside diameter of 27 ft.~~ • ~~Descriptions specific to the Modified Pipeline/Tunnel Alignment~~ • ~~Connects IF to the expanded Clifton Court Forebay.~~ • ~~159,000 ft long.~~ • 2~~2~~ tunnel bores~~s~~, 10 ~~9~~ shaft sites~~, with one shaft for each bore~~. • Inside diameter: 40 ft. • Outside diameter: approximately 4~~45~~ ft.
Boring	• Earth pressure balance (EPB) tunnel boring machines (TBM) and slurry tunneling machines would likely be used to excavate tunnel spoils. • The distance between the two bores of Tunnel 2 would be twice the outside diameter of the tunnels, approximately 150 ft below grade. ○ 108 ft between bores under the modified pipeline/tunnel alignment (150 ~~feet~~ft centerline to centerline), and approximately 160 ft below grade. • In alluvial soils, the tunnel would be constructed at depths greater than 60 ft using mechanized closed-face ~~pressurized~~ tunneling machines. • If dense gravels, cobbles, or boulders are encountered in the older alluvium depth, other mining methods may be utilized, such as grouting, jet grouting, use of a slurry tunnel boring machine, or freezing and hand mining. • RTM would be transferred to storage areas by conveyor, wheeled haul equipment, or barges. • The tunnel invert elevation is assumed to be at 160 ft below msl under the San Joaquin River and Stockton Deep Water Channel to maintain sufficient cover between the tunnel and dredging operations in the shipping channel.
Tunnel shafts **Launch (construction) shaft**	• Shafts will be constructed t~~T~~o lower the TBMs to their initial working positions and to support their operation, accommodate construction and construction support operations. • For Tunnel 2, approximately 180 ft deep and approximately 120 ft wide. For Tunnel 1, approximately 160 ft deep and approximately 80-100 ~~feet~~ft wide. Potential construction methods include overlapping concrete caisson walls, panel walls, jet-grout column walls, secant piles walls, slurry walls, precast sunken caissons, and potentially other technologies. • Most~~All~~ shafts to be excavated from preconstructed fills built to required flood protection elevation. • Shaft bottoms would need to be stabilized to resist uplift associated with external hydrostatic

Construction Element/Activity	Key Construction Information or Assumptions
	pressures, during both excavation and operation. ~~It may be necessary to treat the shaft area continuously from the surface to the bottom of the shaft to control blowouts.~~ It may be necessary to pretreat ground at the shaft area from the surface to the bottom of the shaft to control blowouts during excavation of the shaft. • Concrete working slabs capable of withstanding uplift would be required at all shaft locations to provide a stable bottom and a suitable working environment. • Temporary work areas associated with these shafts could range from approximately 10 to 40 acres. • After tunnel construction, shafts would be backfilled ~~around steel or formed concrete pipes~~leaving smaller permanent steel pipe or formed concrete shafts. • Shafts for parallel tunnels would be staggered but would be in the same general vicinity.
Intermediate ~~Ventilation~~ Shafts	• Approximately 11 intermediate shafts may be constructed (approximately 1 shaft per tunnel bore) t~~T~~o facilitate tunnel ventilation, access, and safety and TBM maintenance ~~and tunnel safety~~. • ~~Placed midway~~ Constructed between launch shafts along the tunnel alignment. • For Tunnel 2, approximately 180 ft deep and approximately 90 ft wide. For Tunnel 1, approximately 160 ft deep and approximately 80–100 ~~feet~~ft wide. • Potential construction methods include overlapping concrete caisson walls, panel walls, jet-grout column walls, secant piles walls, slurry walls, precast sunken caissons, and potentially other technologies. • Most~~All~~ shafts may ~~to~~ be excavated from preconstructed fills or surrounded by walls to furnish~~built to required~~ flood protection elevation. • Shaft bottoms would need to be stabilized to resist uplift associated with external hydrostatic pressures, during both excavation and operation. ~~It may be necessary to treat the shaft area continuously from the surface to the bottom of the shaft to control blowouts.~~ It may be necessary to pretreat ground at the shaft area from the surface to the bottom of the shaft to control blowouts during excavation of the shaft. • Concrete working slabs capable of withstanding uplift would be required at all shaft locations to provide a stable bottom and a suitable working environment. • Temporary work areas associated with these shafts could range from approximately 10 to 40 acres. • Shafts for the adjacent tunnel bores may be staggered if located ~~parallel tunnels would be staggered~~ but would be in the same general vicinity.
TBM Retrieval Shafts	• Located ~~the end of each machine drive to retrieve it at potentially six locations~~at the end of each TBM drive to enable TBM retrieval, potentially six locations. • For Tunnel 2, approximately 180 ft deep and approximately 90 ft wide. For Tunnel 1, approximately 160 ft deep and approximately 80–100 ~~feet~~ft wide. • Potential construction methods include overlapping concrete caisson walls, panel walls, jet-grout column walls, secant piles walls, slurry walls, precast sunken caissons, and potentially other technologies. • Most ~~All~~ shafts to be excavated from preconstructed fills built to required flood protection elevation. • Shaft bottoms would need to be stabilized to resist uplift associated with external hydrostatic pressures, during both excavation and operation. ~~It may be necessary to treat the shaft area continuously from the surface to the bottom of the shaft to control blowouts.~~ It may be necessary to pretreat ground at the shaft area from the surface to the bottom of the shaft to control blowouts during excavation of the shaft. • Concrete working slabs capable of withstanding uplift would be required at all shaft locations to provide a stable bottom and a suitable working environment. • Temporary work areas associated with these shafts could range from approximately 10 to 40 acres. • Shafts for the parallel tunnels would be staggered but would be in the same general vicinity. • After tunnel construction, shafts would be backfilled ~~around steel or formed concrete pipes~~leaving smaller permanent steel pipe or formed concrete shafts.
~~**Surge tower at IPP**~~	~~A surge shaft connected to the pumping plant discharge piping is recommended at the IPP. The surge shaft height is proposed to be 10 to 15 ft above the maximum operating hydraulic grade line.~~ ~~Under the modified pipeline/tunnel alignment, there would be no intermediate pumping plant and no~~

Construction Element/Activity	Key Construction Information or Assumptions
	associated surge tower.
RTM Storage/ Disposal Areas	• For additional details of RTM storage, see Table 3C-36, *Borrow/, Spoils/, and Reusable Tunnel Muck Material Storage*; Chapter 3, *Description of Alternatives*; and Appendix 3B, *Environmental Commitments*.
Construction Work Areas	• Construction work areas may include offices, parking, shop, short-term segment storage, fan line storage, crane, dry houses, settling ponds, daily spoils piles, temporary RTM storage, power supplies, air, water treatment, and other requirements. May also contain space for slurry ponds if slurry wall construction is required. • Work areas for RTM handling and permanent spoils disposal would also be necessary.
Pipelines **Clear and grub/ demolition** **Dewatering** **Excavate and export** **Excavate and haul off excess** **Excavate and stockpile** **Excavate and haul to stockpile** **Place pipe bedding** **Place backfill slurry** **Install and remove sheet piles** **Load, haul, compact from stockpile** **Regrade ROW** **Place invert concrete** **Flow meter vault concrete** **Place wall concrete** **Flow meter vault concrete** **Elevated slab** **Roof falsework**	*Pipeline Reaches* (See Table 3C-13a and 3C-13b for detailed construction schedules) **Descriptions specific to the Pipeline/Tunnel Alignment** Intake 1 to the junction with Intakes 2 and 3 (south side of the Sacramento River): Two parallel, 16-foot-diameter pipelines. Approximate length: 9,300 ft. Intake 2 to the junction with Intake 1: Two parallel, 16-foot-diameter pipelines. Approximate length: 800 ft Intake 3 to the IF: Two parallel, 16-foot-diameter pipelines. Approximate length: 19,700 ft Intake 4 to the IF: Two parallel, 16-foot-diameter pipelines. Approximate length: 7,820 ft Intake 5 to the IF: Two parallel, 16-foot-diameter pipelines. Approximate length: 4,150 ft **Descriptions specific to the Modified Pipeline/Tunnel Alignment** Intake 2 to Tunnel 1a: One 20-foot-diameter pipeline (an extension of the pump discharge header pipelines). Approximate length: 900 ft. Intake 3 to the junction structure at Tunnel 1a: One 20-foot-diameter pipeline (an extension of the pump discharge header pipelines). Approximate length: 1,200 ft.
Fencing	• Access openings would be provided where acceptable and necessary. • A woven wire fence (4 ft tall topped with barbed wire) or a barbed wire fence (4.5 ft tall) may be used. • More stringent fencing with 8-foot tall chain link fences and/or razor wire may be usedHigher security fencing with 8-foot tall chain link fences and/or razor wire may be used where appropriate. • The fencing requirements would be continuous for all intermediate facilities. • At intermediate facilities, the more stringent of the ROW or facility fencing requirements would be used. If the facility fencing is to be placed directly adjacent to the facilities, both ROW and facility fencing would be used.

Construction Element/Activity	Key Construction Information or Assumptions
Dismantling	• After construction of the tunnels, the launching and retrieval shafts would be backfilled around steel pipes or formed concrete pipes, or would be cast against reusable forms to the required finished diameter and geometry.
INTERMEDIATE FOREBAY (IF) Maintenance roads Dewater forebay Excavation Excavate Remove unsuitable Cut/fill build levees Moisture condition suitable soil Construct drying beds Load and haul to levee Slope finish Bottom finish Levee top finish Slope protection Place riprap, bedding material, fabric Concrete stilling basin Headwall concrete Gravity Bypass System or Outlet Control Structure	~~**Descriptions specific to the Modified Pipeline/Tunnel Alignment**~~ Conceptually designed as hydraulically isolated from other Delta waterways. The only source of water would be the Sacramento River via the new intakes. The only outlets from the intermediate forebay (IF) would be to the tunnels conveying water to the Clifton Court pumping plants and the expanded Clifton Court Forebay~~ via an outlet structure~~. The intermediate forebay would be designed as a pass-through facility that will not have regulating gates controlling flow to the main tunnels; therefore, no daily operational storage will be provided. • 245~~245~~-acre surface footprint (including both the intermediate forebay and the overflow containment area, and electrical substation). • 37~~41~~-acre water surface area at elevation 10 ft. • Active storage volume 75~~1~~0 af. • The IF would be developed by constructing a ring dike to surround the forebay. With the exception of the inlets and the outlet, the ring dike would be constructed of engineered fill. • A slurry cutoff trench will be included beneath the embankment to protect the foundation of the embankment from underseepage and piping. A drain is also included at the toe of the outer embankment slope to limit saturated conditions at the ground surface. ~~• The water surface area of the IF is approximately 40 acres at elevation 19 ft.~~ • The operating range would be a depth of +~~10~~25.0 to -~~+~~20.0 ~~feet~~ft. • The bottom elevation of the IF is proposed to be -2~~+~~0.0 ft except locally at the inlet and outlet connections. The incoming tunnels would transition to vertical shafts that terminate in the inlet structure, which would incorporate bulkhead gates. It is assumed f~~F~~low would then pass through a transition structure that would include roller gates to reduce incoming velocities. • It is assumed that a~~A~~t the south end of the IF, the outlet structure would consist of a concrete structure with a gated overflow weir at elevation +10.0 ~~feet~~ft. Flows over the gated weir would discharge to a transition structure directing flow to the vertical outlet shafts. • A ~~400~~130-foot-wide emergency spillway located on the east side of the IF would carry emergency overflow to a designated adjacent spillway containment area. • The planned embankment crest elevation for the IF would be +32.2 ~~feet~~ft, which includes considerations for SLR. The new embankments would be constructed by excavating the embankment foundations down to suitable material and then installing the slurry cutoff wall. After the cutoff wall is completed, the embankments will be constructed of compacted fill to the desired height. Dewatering will be required for excavation operations. • Approximately 1,029,000 cy of excavation and 2,045,000 cy of fill material are required for completing the IF embankments~~Approximately 1,000,000 to 1,900,000 cy of earth would be excavated from portions of the IF (including embankment foundation) to provide maximum invert elevation of +0.0 ft~~. ~~• Approximately 500,000 to 700,000 cy of excavation and 900,00 to 1,300,000 cy of fill material would be required for the IF embankments.~~ • The required embankment material would be borrowed from within the limits of the respective forebays to the extent possible or from borrow sites. • Moisture conditioning of the soils would likely be required.
IF Transition Structures	~~**Descriptions specific to the Pipeline/Tunnel Alignment**~~ ~~The pipeline conveyance from~~ Water would flow from Intake~~s 2 3, 4, and 5~~ through a 28-foot diameter tunnel to a junction structure at Intake 3, and from there via a 40-foot diameter tunnel to an IF structure. Water would flow from Intake 5 to an IF structure via a 28-foot tunnel. ~~would discharge to the IF through IF transition structures from each intake.~~ • Above-grade footprints: the inlet and outlet structure are approximately ~~90~~ 500 ft x ~~135~~ 360 ft. The majority of the structures would be below ground level. ~~• Approximately 2 ft of the perimeter and dividing walls would be above the surrounding grade.~~

Construction Element/Activity	Key Construction Information or Assumptions
	• ~~An access platform would be 2 ft above grade for the length of the structure across the forebay entrance.~~The embankment elevation of an IF structure would be between 27 ft and 30 ft above existing ground elevation. • Inside the top perimeter road would be a 2 ft high concrete barrier. A 6 ft high security fence would be placed on top of the concrete barrier. • Walls and access platforms would be concrete. A portion of the IF section in the vicinity of the transition structure would be armored with concrete. • The ~~grade for~~top of the structures would be set at the same elevation as the top of the forebay embankment (approximate elevation 32 feet~~ly 30 ft above the existing grade~~). • Uncovered channels would be open to above. • ~~A 3-rail, 3.5 ft tall handrail would be provided around the perimeter.~~ • A ~~gantry crane may be placed on top of the walls with a frame approximately 30 ft tall and 10 ft wide.~~ 17-ton gate hoist (with clear lift height of 25 ft) will be placed at the inlet side of the IF structure to move roller gates. A 54-ton gate hoist (with clear lift height of 34 ft) will be placed at the outlet side of IF structures. • Temporary parking areas during construction would be within the 1 to 5 acre construction staging area for each transition structure. • Parking during operation may be available on forebay maintenance roads adjacent to and around three sides of the facilities, approximately 24 ft wide x 400 ft long
Outer Structure (Alternative 4)	~~**Descriptions specific to the Modified Pipeline/Tunnel Alignment**~~ • Approximate footprint: 90 ft x 160 ft • Wall of facilities will be below site grade with the top of the walls/access decks at the same level as the site grade. • Walls and access platforms will be concrete. • Handrail and gates will be steel. • Control building approximately 20 ft x 20 ft x 20 ft tall • Control building could be framed of timber, CMU, steel or metal studs. Steel may be painted or galvanized.
~~**INTERMEDIATE PUMPING PLANT (IPP) (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 6A, 6B, 6C, 3, 5, 7, 8)**~~	~~• One intermediate pumping plant (IPP) would be constructed and operated to sustain water levels in the BTF required for optimal pump operations at both Banks and Jones Pumping Plants when the gravity bypass is not utilized.~~ ~~• Required to overcome head loss (energy loss) due to friction as the water is conveyed along the very flat terrain to the delivery pumping plants in the South Delta.~~ ~~• Location depends on choice of alignment.~~ ~~• **Pipeline/Tunnel Alignment:** At southern end of IF; 10 pumps with capacity of 1,500 cfs each (high head); 6 pumps with 1,500 cfs capacity (low head). (For the purposes of modeling, it was assumed that these parameters would apply to all P/T alternatives; however, fewer pumps and/or pumps with different capacities would likely be constructed under Alternatives 3, 5, 7, and 8)~~ ~~• **East Alignment:** About 3.5 miles south of the point where the alignment crosses the San Joaquin River, within canal footprint on Lower Roberts Island; 15 pumps with capacity of 1,000 cfs per pump; 2 pumps with 500 cfs capacity~~ ~~• **West Alignment:** approximately 1.2 miles east of the Sacramento River Deep Water Ship Channel. at the entrance to the tunnel segment, within canal footprint on Ryer Island; 15 pumps with capacity of 1,000 cfs per pump; 2 pumps with 500 cfs capacity~~ ~~• Structure would be constructed of reinforced concrete and would have multiple floors to house mechanical and electrical equipment.~~ ~~• The primary structural support system for the pumping plant would consist of reinforced concrete slabs and walls at and below grade, with steel framing and exterior metal wall and roof panels for the above-grade building.~~ ~~• The upper floor (operating level), located at grade level above the flood protection elevation, would be reinforced concrete floor slab that would support the vertically mounted pumps and motors. This level would be enclosed by a steel-framed building that includes a traveling 125-ton bridge crane.~~

Construction Element/Activity	Key Construction Information or Assumptions
	• The lower level would be a concrete mat slab wet well that includes reinforced concrete partition walls at each pump to separate and confine the water flow at each pump suction inlet. • Deep foundation piles are anticipated to be necessary to support the heavy dead and operating loads of the building. • Based on a preliminary pile foundation evaluation, 24-inch concrete-filled pipe pile, an estimated pile length of 60 to 65 ft below the founding level of the IPP would be required. • Main building above grade footprint is approximately 140 ft x 870 ft. • Tops of above ground walls approximately 75 ft above grade and the roof peak at 80 ft above grade. Total height of the above-ground structure is approximately equivalent to an 8-story building. • A concrete cantilevered deck over the pumping plant approach from the intermediate forebay would extend approximately 30 ft from the front of the main building and run the length of the building, approximately 740 ft. • A gantry crane would be located on the cantilevered deck. The frame of the gantry crane is approximately 30 ft tall and 20 ft wide. • The grade for the pumping plant and the top of the gantry crane deck would be set at the same elevation as the top of the forebay embankment, approximately 35–40 ft above the existing grade • Flow from the pumps would be discharged into a transition manifold for transfer to the pressurized tunnels.
Clearing/ Grubbing/ Dewatering	Dewatering is expected to be continuous during construction.
Excavation and backfill	Pipeline/Tunnel, East or West Alignment: • Excavate and haul to stockpile: 115,000 cy • Excavate and export: 94,401 cy • Haul from stockpile and compact: 115,000 cy
Pipelines excavation and backfill	Pipeline/Tunnel: IPP to tunnel • Excavate, haul to stockpile, haul from stockpile and compact: 125,168 cy • Excavate and export: 149,700 cy East: IPP to canal transition structure • Excavate and haul to stockpile, haul from stockpile and compact: 13,845 cy • Excavate and export: 120,962 cy West: IPP to tunnel • Excavate and haul to stockpile: 68,931 cy • Haul from stockpile and compact: 34,563 cy
Approach channel (Pipeline/ Tunnel Alignment)	• Flow from the IF would be directed to the IPP (outlet control structure under Alternative 4) via an approach channel at the southern side of the forebay. • Flow from the approach channel would be directed to each pump intake through wall openings with isolation gates to allow pump wells to be dewatered for maintenance. • Trash racks would be used upstream of the pumps for pump protection. • Discharge pipes from the 1,500-cfs lower head pumps each would be 132-inch diameter, • Discharge pipes from the 1,500-cfs higher head pumps each would be 144-inch diameter. (Pipe sizes would vary depending on the pump supplier.) • Flow from the pumps would be discharged into a transition manifold for transfer to the pressurized tunnels. • Requires excavation, stockpiling, placing stockpile material, and concrete work. • Excavate and haul to stockpile/haul from stockpile and compact: 11,520 cy; excavate and export: 172,560 cy

Construction Element/Activity	Key Construction Information or Assumptions
~~**Approach channel (East and West Alignments)**~~	• ~~The conveyance canal upstream of the intermediate pumping plant would expand from the typical canal width (340 ft at invert) to the width of the pumping plant combined pump bays (655 ft), forming a forebay of approximately 500 ft in length.~~ • ~~Flow from the forebay would be directed to each pump intake through wall openings with isolation gates to allow pump wells to be dewatered for maintenance.~~ • ~~Trash racks would be used upstream of the pumps for pump protection.~~ • ~~The discharge pipes from the 500 cfs pumps each would be 96-inch-diameter and the discharge pipes from the 1,000 cfs pumps would each be 132-inch-diameter.~~ • ~~Flow from the pumps would be discharged into a transition structure for transfer to the canal or tunnel.~~ • ~~Requires excavation, stockpiling, placing stockpile material, and concrete work.~~ • ~~Excavate, direct haul and compact 303,200 cy; import and compact 381,280 cy~~
~~**Transition manifold**~~	• ~~A maximum 33 ft diameter pipe manifold and valve vault that connects the 16 pipes (11 ft and 12 ft diameters) from the IPP to the two 33 ft diameter pipelines.~~ • ~~Manifold and all pipes are underground.~~ • ~~The valve vault is a concrete, enclosed underground structure, with an approximate 6" height of walls/roof above grade, and would have access through a manhole in the roof of the structure.~~
~~**Weir structure/ Surge towers**~~	~~Pipeline/Tunnel Alignment~~ • ~~Two, 33-ft diameter (minimum) surge towers.~~ • ~~Elevation approximately 105 ft (NAVD88) at the rim.~~ ~~West Alignment~~ • ~~Two, 33-ft diameter surge towers.~~ • ~~Elevation up to 70 to 80 ft (NAVD88) at the rim, depending on final pump selection and pipe arrangement.~~ ~~East Alignment: N/A~~ • ~~Dewatering~~ • ~~Excavate & Export 263,895 cy~~ • ~~Excavate & Stockpile/haul from stockpile and compact: 50,265 cy~~ • ~~Backfill~~ • ~~Place Bedding~~ • ~~Drive Foundation Piles~~ • ~~Place Concrete Fill In Piles~~ • ~~Invert Concrete~~ • ~~Flow Meter Vault Concrete~~ • ~~Wall Concrete~~ • ~~Flow Meter Vault Concrete~~
~~**Tunnel Outlets to Forebays**~~	• ~~Tunnel outlets would be concrete.~~ • ~~The level surface at each of the tunnel outlet sites (into the intermediate forebay and the Byron Tract Forebay) is approximately 160 ft x 140 ft.~~ • ~~The grade for the level surface would be set at the same elevation as the top of the forebay embankment (approximately 20–30 ft above the existing grade).~~ • ~~The majority of the tunnel outlet structures would be below grade/ground.~~ • ~~Gantry cranes for each tunnel, with an approximate 50 ft tall and 50 ft wide frame, and equipment for opening and closing tunnel gates would be set on top of grade.~~ • ~~Control buildings, possibly 20 ft x 20 ft and 20 ft tall, may be located at each tunnel outlet. These may be framed of timber, CMU, steel or metal studs.~~
Substation and Exterior Transformers	• ~~A main 230 kV substation and a main 69 kV substation would be constructed adjacent to the intermediate pumping plant (IPP), at the flood protection elevation, and provide power to the IPP, control structures and intake facilities.~~ See *Power Supply and Grid Connections*
~~**General Construction Work Areas**~~	• ~~Anticipated construction area for the IPP is approximately 110 acres.~~ • ~~Of this, approximately 20 acres would be specific to the area for temporary construction needs (including on-site temporary parking, office trailers, staging, equipment laydown and storage).~~ • ~~Under the East and West Alignments, the anticipated construction area for the IPP is approximately 40 acres.~~ • ~~Of this, approximately 15 acres would be specific to the area for temporary construction needs (including onsite temporary parking, office trailers, staging, equipment laydown and storage).~~
Utilities	• See Table 3C-35, *Power Supply and Grid Connections*.

Construction Element/Activity	Key Construction Information or Assumptions
Roads	• See Table 3C-8, *Access and Construction Work Areas*.
Fencing	• Security fencing, with access control gates, would be placed along the perimeter of the pumping plant facilities. • A 6-foot chain link fence installed around the pumping plant and enclosing the surge towers and gravity bypass structure. • A substation adjacent to the pumping plant would be fenced with a 6-foot chain link fence with a climbing barrier. More stringent fencing with 8-foot tall chain link fences with climbing barrier and/or razor wire may be used at the pumping plant or substation facilities. • Masonry walls, 6 to 8 ft tall, may be used within the facilities.
Landscaping/ Vegetation	• See Landscaping/vegetation under North Delta Intakes, above.
Control Structures	While the types of control structures used within and among alignments would vary, controls generally affect the hydraulic grade line at low flow rate by creating additional headlosses to allow better pump selection and more efficient operation over the full range of flows, from 500 to 15,000 cfs. The proposed controls between the Clifton Court Forebay and the existing pumps in the South Delta include the following. • Control structures have approximate footprints ranging from 200 ft x 500 ft to 300 ft x 600 ft. • Approximate footprint of 90 x 100–160 ft. • Walls of the facilities would be below site grade with the top of walls/access decks at the same level as the site grade. • Control structure walls and access platforms would be concrete. • Site grade would be set at the same elevation as the top of the concrete lining that extends 280 ft up- and downstream of the facilities. • The top of the concrete lining is set 29 ft above the structure invert. • A handrail, potentially a 3-rail 3.5 ft tall, would be provided around the perimeter of the access decks. • Rolleradial gates would be installed and a control building, approximately 20 ft x 20 ft and 20 ft tall, would be located at the control structures. • Butterfly valves at Intakes 1 and 2 to start the pumps for operation at low flow or against low downstream water surface elevation (WSE) • Transition structures at Intakes 3, 4 and 5, with a weir crest elevation near 25 ft (the IF maximum WSE). These structures would provide back pressure on the pumps for operation at low flow or against low downstream WSE. • Weir structure on the 33-foot-diameter conveyance pipeline that leads to each of the two 33-foot-diameter tunnels, with a crest elevation near 30 ft (5 ft above the IF maximum WSE). The weirs would provide back pressure on the pumps for startup conditions, when pump operation is required to achieve flows in excess of the capacity of the gravity bypass. • Gravity bypass (one per tunnel) at the IPP, controlled by radial gates at the inlet structure. The gravity bypass system would operate during low flow conditions and when positive gradient is available between the two forebays. Each gravity bypass is sized for a design flow of 3,500 cfs (total capacity 7,000 cfs). • Under the modified pipeline/tunnel alignment, an outlet structure would operate in lieu of the IPP (see *Outlet Structure* under *Intermediate Forebay* features, above) • The gates, in the open position, and the control building may extend above the top of the canal embankment. The remainder of the facilities are likely not to be visible over the top of the embankment.
EAST ALIGNMENT (Alternatives 1B, 2B, 6B) **WEST ALIGNMENT (Alternatives 1C, 2C, 6C)** Chapter 3, *Description of Alternatives*, Tables 3-8 and 3-9 respectively, provide summaries of East Alignment and West Alignment physical characteristics. **No intermediate forebay would be constructed under East and West Alignment alternatives.**	

Construction Element/Activity	Key Construction Information or Assumptions
~~**Canal conveyance**~~	• ~~East Alignment would convey water through canals to the new Byron Tract Forebay, from which water would be conveyed via connecting canals to the existing pumping plants serving the State Water Project (SWP) and Central Valley Project (CVP).~~ • ~~West Alignment would convey water through canals, into a tunnel beginning on Ryer Island and terminating east of Oakley, to a southern canal flowing to the new Byron Tract Forebay, from which water would be conveyed via connecting canals to the existing pumping plants serving the State Water Project (SWP) and Central Valley Project (CVP).~~ • ~~East Alignment: 6,610 acres / West Alignment: 4,490 acres~~ • ~~Construction of the canal channel and embankments would proceed in three main phases:~~ • ~~Embankment foundation and channel excavation (approximately 67,000,000 cy)~~ • ~~Embankment construction (approximately 71,000,000 cy)~~ • ~~Spoils placement~~ • ~~Canals may be unlined (earthen) or lined with concrete.~~ • ~~Projected solid waste (not dredge material) excavated to be disposed of in landfill for each alignment is estimated at 0.1% of spoils.~~ • ~~East Alignment: 43,076 tons~~ • ~~West Alignment: 20,194 tons~~
~~**Canal excavation and backfill (all sections)**~~	~~East Alignment~~ • ~~Excavate, direct haul and compact: 28,192,036 cy~~ • ~~Excavate and export: 39,487,705 cy~~ • ~~Import and compact: 55,313,593 cy~~ ~~West Alignment~~ • ~~Excavate, direct haul and compact: 38,303,970 cy~~ • ~~Excavate and export: 16,328,401 cy~~ • ~~Import and compact: 33,247,610 cy~~
~~**Excavation and dewatering**~~	• ~~Excavation of unsaturated soils could be performed using scrapers or excavators loading into large dump trucks.~~ • ~~Excavated materials that are suitable for embankment fill could be hauled and placed directly into areas ready for embankment construction or stockpiled for future use; unusable material would be hauled to spoil disposal areas.~~ • ~~Additional embankment material from off-site borrow locations would be needed.~~ • ~~Organic materials would be removed and replaced with compacted engineered fill, requiring dewatering.~~
~~**Culvert Siphons**~~	~~See Chapter 3, *Description of Alternatives*, Table 3-8 and Table 3-9, for locations and specifications of culvert siphons under East and West Alignments, respectively.~~ • ~~Siphons consisting of (4) 26 x 26 ft box culverts would be constructed where canal crosses waterways or other features.~~ • ~~East Alignment would require 8 siphons; West Alignment would require 9 inverted culvert siphons to convey water under 10 shallow water courses and 1 rail line.~~ • ~~East Alignment: 160 surface acres / West Alignment: 170 surface acres~~ • ~~Would be constructed as large multiple box culvert structures using cofferdams and open cut-and-cover construction methods with conventional CIP concrete structures.~~ • ~~Either a bypass channel or a backup (setback) levee would be used as determined appropriate at each site; both would not be used at any one site.~~ • ~~In-water work would be conducted during June 1–~~ ~~Construction activities~~ ~~Upstream and downstream transitions~~ • ~~Dewatering, excavation/grading, place gravel bedding, place invert slab concrete, place wall concrete, backfill~~ ~~Upstream and downstream control structures~~ • ~~Excavation/grading, place gravel bedding, drive foundation piles, place invert slab concrete, place wall concrete, backfill~~ ~~Box culvert section~~ • ~~Overexcavate and recompact, install/remove cutoff, repair levee, dewatering, excavation, drive foundation piles, place gravel bedding, SOG concrete, wall concrete, roof concrete~~ ~~Backfill~~

Construction Element/Activity	Key Construction Information or Assumptions
	October 31 to the maximum extent possible. Because culverts/siphons need to be placed during low water, i.e., August through November, some in-water work may have to be conducted outside the June 1–October 31 time window.
Culvert siphon excavation and backfill (all culvert siphons)	East Alignment • Excavate and haul to stockpile: 6,460,311 cy • Haul from stockpile and compact: 5,113,801 cy West Alignment • Excavate and haul to stockpile 10,429,866 cy • Haul from stockpile and compact: 9,161,197 cy
Slough diversion and bypass channel	• Provides temporary realignment of the slough, diverting water around the siphon construction area so that work can be conducted year-round. • Would remain in place for the duration of the construction of the slough. • Channel would start upstream of the siphon construction area and end at the existing slough downstream of the construction area, using walls of sheetpiles across the slough to transition the water into and out of the bypass channel. • Bypass channel would consist of two parallel berms, which would be removed when siphon is completed. • Berms would be founded on 10-ft depth of overexcavated and recompacted in-situ soil and filled with imported and compacted fill. • Berms would be 25 ft tall above grade; have 3H:1V (Horizontal:Vertical)sloped exterior sides and 1H:1V sloped interior sides; a 20 ft wide level top; and overall width of approximately 120 ft. • The total width of the channel and two berms would vary depending on the width and flow of the slough being diverted, and the siphon layout. • Sections of levee would be removed and rebuilt after siphon is completed. Removal and rebuilding of the levee sections would be done within a 4-month work window during the low-water season of August 1–November 30.
Sheetpiling/ cofferdams at bypass channels	• Sheetpile walls would cross width of slough upstream and downstream of the siphon construction site, to divert water into and out of the bypass channel and allow siphon to be constructed across the slough channel in one stage. • Sheetpile walls would be constructed of ARBED-type steel sheet piles with the possibility of H king piles and sealing of sheetpile interlocks. • Sheetpiles may be driven from within the water by a barge-mounted crane, or from on top of the adjacent levee. • Top of sheet piles would align with the approximate top of the bypass channel. • 50 ft tall sheet piles would be driven approximately 20 ft below the bottom of the slough. • Linear length of sheetpiles walls would depend on the width of the slough. • Construction/removal within a 4-month work window during the low-water season of August 1–November 30. • Sheetpiles would remain in place for approximately 4 years and be removed at the end of construction.
Backup (setback) levee	• Constructed to allow potential removal of existing levee within the siphon construction area during open cut excavation and to maintain the width of the slough channel when a cofferdam is installed. • Backup levees would be installed when a cofferdam is installed partially across the slough channel and the siphon construction is done in stages. • Would tie in to the existing levee at each end of its length on either side of the construction area. • Founded on 10-ft depth of overexcavated and recompacted in-situ soil and would use import fill. • Backup levee would be 25 ft tall above grade; have 3H:1V sloped exterior sides and 1H:1V sloped interior sides; a 20 ft wide level top; and overall width of approximately 170 ft, depending on siphon layout. • Backup levees would be removed when siphon construction is completed and after the existing levee has been rebuilt.

Construction Element/Activity	Key Construction Information or Assumptions
Sheetpiling/ cofferdams at backup levees	• Encircles siphon work area and provides a dry workspace to allow construction to proceed year-round within the cofferdam. • Used with a backup levee, cofferdam would be built across one-half of the slough at a time and the siphon constructed in two stages, to allow continuous flow through the remaining open portion of the slough. • Sheetpile walls may be constructed in one of two ways: (1) of ARBED-type steel sheet piles with the possibility of H king piles and sealing of sheetpile interlocks; or (2) a series of 50 ft diameter circular sheet pile cells backfilled with compacted granular material. • Sheetpiles may be driven from within the water by a barge-mounted crane, or from on top of the adjacent levee. • Top of sheet piles would align with the approximate top of the backup levee. • 100 ft long sheetpiles would be driven to a depth below the base of excavation for the siphons, with approximately 70 ft of length driven below the bottom of the slough. • Linear length of sheetpiles walls would depend on the width of the slough. • Using vertical open cut excavation would affect a 250-ft length of the slough; using a 3H:1V cut would affect a 500 ft length of slough. • Construction/removal within a 4-month work window during the low-water season of August 1–November 30 • Each phase of the cofferdam would be in place for approximately 2 years and be removed at the end of construction.
Tunnel siphons (East Alignment Alternatives 1B, 2B, 6B)	Where canals cross existing water bodies, tunnels would be used as siphons to convey water between canal segments. • Dual bore, 33 ft ID concrete lined with pre-cast bolted-and-gasketed segments • 95 acres (subsurface) • The level surface at each of the tunnel inlet and outlet sites is approximately 150 ft x 480 ft. • The tunnel inlet and outlet transitions would be concrete. • The grade for the tunnel would be set at the same elevation as the top of the canal embankment (Under the East Alignment, approximately 25–40 ft above the existing grade; under the West Alignment, approximately 30 ft above the existing grade). • The majority of the tunnel inlet and outlet structures would be below grade/ground. • Steel gantry cranes for each tunnel (at inlet and outlet), with an approximate 50 ft tall and 50 ft wide frame, and equipment for opening and closing tunnel gates, would be set on top of grade. • Control buildings, possibly 20 ft x 20 ft and 20 ft tall, may be located at each tunnel inlet and outlet. The control building could be framed of timber, CMU, steel or metal studs. • Launching and retrieval shafts (similar to those described above under Pipeline/Tunnel Alignment) would be necessary. Lost Slough/ Mokelumne River tunnel Two parallel, 33-ft ID bores would be required to accommodate the maximum 15,000 cfs flow. • Excavate and haul to stockpile, haul from stockpile and compact 203,465 cy • Export RTM: 499,635 cy • Import and compact: 1,117,477 cy • Length: 7,450 ft (1.4 mi) • Tunnel bores: 2 • Tunnel shafts: 4 • Finished inside diameter: 33 ft San Joaquin River tunnel The canal flow would be transferred through a set of inlet control structures into two 33-foot ID tunnels, approximately 150 ft deep, and through outlet structures discharging into the canal. • Excavate and haul to stockpile, haul from stockpile and compact: 242,350 cy • Export RTM: 272,234 cy • Old River tunnel • Length: 1,920 ft (0.36 mi) • Tunnel bores: 2 • Tunnel shafts: 4 • Finished inside diameter: 33 ft • Excavate and haul to stockpile, haul from stockpile and compact: 106,987 cy • Export RTM: 195,930 cy • Import and compact: 1,078,162 cy

Construction Element/Activity	Key Construction Information or Assumptions
	• Import and compact: 982,952 cy • Length: 3,240 ft (0.6 mi) • Tunnel bores: 2 • Tunnel shafts: 4 • Finished inside diameter: 33 ft • Outlet structures would discharge to the new forebay
Tunnel (West Alignment Alternatives 1C, 2C, 6C)	West Alignment alternatives include a 17-mile, concrete-lined soft ground tunnel to convey diverted water from the IPP into a new canal leading to the new Byron Tract Forebay. • 75 acres (780 acres permanent subsurface easement) • Excavate and export: 149,226 cy • Export RTM: 10,574,601 cy • Import and compact: 2,844,666 cy • Length: 89,650 ft • Bores: 2 • Inside diameter: 33 ft. • The EPB TBM would bore the tunnel at a minimum of 100 ft below the ground surface. • Intermediate and emergency access shafts would be placed along the length of the tunnel at possibly (15) locations, in addition to any intermediate launch/retrieval shafts at potentially one location. • Intermediate/emergency shafts would be 10 ft diameter with a 2 ft wide curb approximately 1 ft above grade. • Intermediate launch/retrieval shafts would be adjacent to each other and would be at least 200 ft x 100 ft each, with a perimeter concrete slab poured at grade.
Tunnel outlet (West Alignment Alternatives 1C, 2C, 6C)	• The level surface at the tunnel outlet site (for the parallel tunnels) is approximately 150 ft x 480 ft. • The grade for the outlet would be at the same elevation as the top of the canal embankment (approximately 30 ft above the existing grade). • The majority of the tunnel outlet structure would be below grade/ground. • Gantry cranes for the tunnel, with an approximately 50 ft tall and 50 ft wide frame, and equipment for opening and closing tunnel gates would be set on top of grade. • Control buildings, possibly 20 ft x 20 ft and 20 ft tall, may be located at the tunnel outlet.
Pipelines	From intakes to intake pumping plants, and from pumping plants to canal transition structures.
Pipelines – Canal transition structure	• Pipelines from canal transition structures to main conveyance
Intermediate pumping plant	See information and assumptions for intermediate pumping plant under *Pipeline/Tunnel Alignment* • Water would travel in a lined or unlined canal between the intake pumping plants and the IPP, and between the IPP and BTF (East Alignment); or from the IPP through a dual-bore, 33 ft diameter tunnel to another lined or unlined canal leading to BTF (West Alignment). • West Alignment: A tunnel surge tower at IPP would be provided for each of the tunnels exiting from the IPP. Each tower would be approximately 35 ft diameter and approximately 30 ft tall. • No surge towers at the IPP would be required under the East Alignment.
Bridges (East Alignment Alternatives 1B, 2B, 6B) **Bridge Construction** **Roadway Embankment**	• 19 bridges (2 state highway and 17 local/county/private road bridges) needed to convey existing roads and highways over the canal. • Construction method for bridges over new canals would involve typical materials and bridge/roadway construction techniques. The construction of the bridge structures, and the disturbance it causes, including excavation, pile driving, and stockpiling of materials, would all probably occur within the overall footprint of the proposed canal construction. • Excavate, direct haul and compact: 3,001,687 cy • Excavate and export: 10,621,152 cy

Construction Element/Activity	Key Construction Information or Assumptions
~~**Load and haul borrow**~~ ~~**Place embankment**~~	• ~~Bridge type is assumed to be CIP or precast concrete superstructures supported on concrete pier walls and abutments, all founded on pile foundations.~~ • ~~*Deep Foundation Construction.* The bridge piers and abutments are anticipated to be founded on driven pile foundations typically installed with diesel hammer pile driving rigs.~~ • ~~The pile caps (footings) are to be constructed below the final canal invert with abutments founded in the levee embankments. Because scour depths in the canal are minimal, footings can be placed relatively shallow.~~ • ~~*Superstructure Type.* It is anticipated that the bridge superstructures, or main load carrying members, would be comprised either of CIP concrete, precast concrete girders or steel girders. The ability to prefabricate members would expedite construction and allow more flexibility in sequencing.~~ • ~~*Placement of Concrete.* While bridge superstructure material may vary, all substructure elements would be comprised of CIP concrete. Because groundwater levels along the alignment are relatively shallow, dewatering may be required to place concrete for pier pile caps (footings). Depending on the depth below groundwater, this can be accomplished through the use of well or sealed cofferdams.~~ • ~~Equipment to be used includes cranes, pile driving hammers, concrete trucks and concrete pumps. Existing roadways would be used for delivering materials, which would be stockpiled within the canal footprint.~~ • ~~Preliminary span lengths are based on a maximum 145 foot length corresponding to a practical limit for transportation of precast girders.~~ • ~~Length and overall footprint of the approach roadway would vary at each bridge location, dictated primarily by the height of the levee relative to the existing roadway.~~
~~**Bridges (West Alignment Alternatives 1C, 2C, 6C)**~~	• ~~Import and compact: 1,183,285 cy~~ • ~~A railroad bridge is proposed to carry the existing track over the canal near the California Aqueduct at the southern end of the water conveyance facilities.~~
~~**Byron Tract Forebay (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8)**~~	• ~~Byron Tract Forebay (BTF) would be constructed adjacent to CCF to balance daily variations in inflow and outflow to Banks and Jones pumping plants. See Table 3C-3, *Byron Tract Forebay*.~~
Utilities	• See Table 3C-35, Power Supply and Grid Connections.
~~**Control structures**~~	• ~~Siphon and control structures have approximate footprints of 70 ft x 160 ft at siphon inlets, 30 ft x 160 ft at siphon outlets and 90 ft x 160 ft at control structures.~~ • ~~The siphon and control structure walls and access platforms would be concrete.~~ • ~~The walls of the facilities would be below site grade with the top of walls/access decks at the same level as the site grade.~~ • ~~The site grade would be set at the same elevation as the top of the canal concrete lining that extends 280 ft up and downstream of the facilities.~~ • ~~Radial gates would be installed and a control building, approximately 20 ft x 20 ft and 20 ft tall, would be located at the siphon inlets and the control structures.~~ • ~~The gates, in the open position, and the control building may extend above the top of the canal embankment. The remainder of the facilities are likely not to be visible over the top of the embankment.~~ ~~**East Alignment**~~ • ~~At two new sites on the existing approach canals to the Jones and Banks pumping plants, adjacent to the new BTF outlets.~~ • ~~At two potential locations, control structures would provide a means of controlling system operation at intermediate structures, located no farther than 5 miles apart.~~ • ~~4 barrel, 26-foot-wide rectangular channels with radial gates~~ ~~**West Alignment**~~ • ~~At two potential locations, where the canal intersects Central Ave Bridge and Road 159 bridge; at a forebay outlet at the north of the forebay; two new sites on the existing approach canals to the Jones and Banks pumping plants, adjacent to~~

Construction Element/Activity	Key Construction Information or Assumptions
	(15,000 cfs). • 3 barrel, 24-foot-wide rectangular channels with radial gates (9,000 cfs). • Hood Franklin Control Structure, 1,670 foot long • Cal Pack Road inline control gate • The top of the concrete lining is set 29 ft above the canal invert and the canal invert is set 30–55 ft below the top of the embankment, making the site grade 1–25 ft below the top of the canal embankment. the new BTF outlets. • The canal invert is set 30–45 ft below the top of the embankment, making the site grade 1–15 ft below the top of the canal embankment. • A handrail, potentially 3-rail, 3.5 ft tall, would be provided around the perimeter of the access decks.
Forebay Outlet 1 Inline **Forebay Outlet 2 Inline** **California Aqueduct Inline** **Delta-Mendota Inline**	**East Alignment for all culvert siphons:** Excavate and haul to stockpile, haul from stockpile and compact: 138,316* cy for each siphon. * this quantity is included in totals for culvert siphon excavation and backfill
New aAccess Roads	• See Table 3C-8, Access and Construction Work Areas. • SR 160 would be permanently relocated from its current alignment along the top of the river levee to a new alignment established on top of the widened levee aligned approximately 220 feetft farther inland from the river.
General construction work areas **Rock Pile Protection**	See Table 3C-8, Access and Construction Work Areas • East Alignment: Temporary parking areas would be provided within the construction staging area. Staging areas could be in the range of 15 acres at the inlet and outlet of each of the culvert siphons and control gates. • Rock protection would likely be placed from a barge by a clam shell • Length of permanent bank protection would be 100–2,200 ft. • Area of dredging and channel reshaping would be approximately 2.5–7 acres.

Clifton Court Combined Pumping Plants	• Two combined pumping plants would be constructed and operated to sustain water levels in the Clifton Court Forebay required for optimal pump operations at both Banks and Jones Pumping Plants when the gravity bypass is not utilized.
	• The pump shafts provide multiple functions:
	  o 1) Provide for gravity flow when the system hydraulics allows via a spillway,
	  o 2) Provide surge protection via the spillway,
	  o 3) House the pumps and their controls. The gravity flow will bypass the pumps via three weir gates by allowing flow to discharge directly to NCCF if hydraulic conditions permit.
	• Final grade for the permanent pump station facilities, including switchyard, electrical buildings, and other infrastructure, will be at a minimum EL. 25 to provide protection from the 200-year flood level with sea level rise (El. 16.5), wave run up (5 ft.), and additional freeboard (3.5 ft.). The site grade of El. 25 will be established prior to construction of the shafts to provide flood protection during construction for the tunnels and pump stations.
	• For surface drainage, the final surface will be sloped at a minimum of 1%.
	• The combined pumping plant will encroach past the existing levee road into the Forebay, requiring the redevelopment of the existing levee road.
	• Required to overcome head loss (energy loss) due to friction as the water is conveyed along the very flat terrain to the delivery pumping plants in the South Delta.
	• To provide the firm design capacity of 9,000 cfs, a total of 12 pumps will be provided in the two Pumping Plants. Eight of the pumps will have a design capacity of 1,125 cfs and four will have a design capacity of 563 cfs.
	• The discharge piping for the large pumps is 12 feet in diameter and the discharge piping for the small pumps is 8.5 feet in diameter.

Construction Element/Activity	Key Construction Information or Assumptions
	• To the north of the combined pumping plants, a gravity bypass channel spillway would allow water to be diverted into the forebay rather than to the pumping plants. • The pumping plant facilities would include: o Water treatment facilities o Storage detention tanks o Electrical buildings
* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.	

Table 3C-3~~3~~3. ~~Byron Tract Forebay/~~Expanded Clifton Court Forebay~~—~~—Alternative 4

Construction Element/Activity	~~Activity Timing* (Start dates)~~	Key Construction Information or Assumptions
Expanded Clifton Court Forebay • For the modified pipeline/tunnel alignment, the existing Clifton Court Forebay (CCF) would be dredged and the forebay would be expanded to the southeast. A new embankment would be constructed to divide CCF into a northern cell (NCCF) and a southern cell (SCCF) of the forebay. In addition, a new embankment would be constructed within the existing CCF embankment (except for the southern embankment where it will be removed) and the area southeast of CCF. SCCF includes the existing southern portion of CCF and the area southeast of CCF. • Additionally, two culvert siphons would be constructed to convey water into the northern cell, between the northern cell and new approach canals to Banks and Jones Pumping Plants, and under Byron Highway and the Southern Pacific Railroad, connecting the new approach canal to the Banks Pumping Plant with the existing approach canal downstream of Skinner Fish Facility. • Construction may require short shut downs of the existing conveyance system to the Banks and Jones Pumping Plants, to add new control structures to the existing pumping plant approach canals and when new approach canals are connected to the existing canals. Water in CCF and Old River would be controlled to prevent blowout of the embankments due to seepage.		
Clearing and Grubbing **Dewatering** **Sheetpile Cell** **Excavation** **Embankment** **Remove Sheetpiles** **Area Restoration** **Demobilization**		• The modified pipeline/tunnel alignment would deliver water to the Clifton Court combined pumping plants near the ~~northeast~~ northwest corner of CCF. • A siphon structure would be situated underneath the existing CCF outlet to a new approach canal. The inlet to the siphon would be located at the southwest corner of NCCF and would daylight to the transition structure of the new approach canal system south of SCCF. • The area designated for the NCCF would be dredged to provide a bottom elevation -5.0 ft except locally at the inlet and outlet connections. The portion of SCCF that lies within the extent of the existing CCF would be dredged to an elevation of approximately -10.0 ft, which would be the bottom elevation of SCCF. Together, approximately 8 million cy of dredged material is expected to be removed from NCCF and SCCF. • The water surface area for NCCF would be approximately ~~1,220~~ 806 acres (at an elevation of 7.5 ft), with a normal operating range resulting in approximately 4,300 to 10,200 ~~AF~~af ~~6,070 af~~ of active storage availability. The water surface area for SCCF would be approximately 1,691 ~~413~~ acres, with a normal operating range resulting in approximately ~~26,000~~14,000 af of active storage availability at elevation 8.1 ft. • A new section of approach canals, approximately 2~~7~~,000 ft long, would connect NCCF to the existing approach canal to the Banks Pumping Plant. • The new approach canal would deepen from the forebay bottom elevation to match the depth at the existing approach canal to the Banks Pumping Plant. Two segments of this new canal would be connected by a ~~third~~ siphon, running under

Construction Element/Activity	~~Activity Timing* (Start dates)~~	Key Construction Information or Assumptions
		Byron Highway and the Southern Pacific Railroad. A radial gate control structure would be installed at the downstream end of this new approach canal to hydraulically isolate the existing SWP facilities from NCCF. • NCCF will also be connected ~~to the existing approach canal~~ to the Jones Pumping Plant by ~~the new section of canal system~~a new 4,000 ft canal. A branch off of the new canal section will connect to the existing Jones Pumping Plant approach canal. The invert of this canal would match the invert of the existing Jones Pumping Plant approach canal at the connection point. A radial gate control structure would be installed at the downstream end of the new canal to hydraulically isolate the existing CVP facilities from NCCF. This branch of the new canal would have a capacity of 4,600 cfs matching the capacity of the Jones Pumping Plant. • An emergency spillway located on the east side of NCCF will carry emergency overflow to the Old River. • Additional control structures would be installed within the existing approach canals to provide the ability to isolate NCCF from the Banks approach channel upstream of the Skinner Facility and to isolate NCCF from Old River upstream of the approach canal to the Jones Pumping Plant. The pumping plants themselves can also be isolated from the approach canals. • NCCF and SCCF would be developed by constructing an embankment within the existing CCF embankment and by constructing a divider embankment through the middle of the existing CCF. • The planned embankment crest elevation for the expanded NCCF, SCCF, divider embankment, and approach canals would be +24.5 ft, which includes considerations for SLR. The toe of the new embankment would be set at 25 ~~feet~~ft from the toe of the parallel existing embankment or levee. Excavation at the toe of the existing embankment and levees may require the use of tied-back sheet piles, dewatering, and other geotechnical precautions to prevent failures of existing embankments and levees. • The embankment cross-section would consist of engineered fill placed on suitable foundation material at a 4H:1V slope on both the inboard and outboard sides of the embankment. The embankment crest would be 32 ft wide, which consists of a 24-foot-wide, two-way maintenance access road with 4-foot shoulders on each side. In addition, maintenance roads would be provided at the new approach canal, joining the roads at the existing approach canal to the Banks Pumping Plant. • The existing CCF inlet structure would be modified to meet the new embankment elevation and would consist of a reinforced concrete structure with multi-gated bays. • The inside of the new embankment would include riprap slope protection. The riprap would be placed over an appropriate filter layer and would extend from the toe of the embankment to the crest. • New embankments would be constructed by excavating the embankment down to suitable material, dewatering, and installing the slurry cutoff wall. Approximately 9.3 million cy of fill would be required for the modified CCF embankments, which includes the divider embankment separating the NCCF from the SCCF, approach canal embankments, spillway pad, and siphon outlet pad. The required embankment material would be borrowed from within the limits of the respective forebays to the extent feasible, or from borrow sites. • Dewatering and/or moisture conditioning of the soils would likely be required.
Culvert Siphons		• The South CCF outlet siphon would include 4 box culverts, each of which would be 26 ft wide and 26.5 to 38.5 high. This siphon would include 4 radial gates and would be approximately 1,800 ft long.

Construction Element/Activity	Activity Timing* (Start dates)	Key Construction Information or Assumptions
		• The Byron Highway/Southern Pacific Railroad siphon would include 4 box culverts, each of which would be 26 ft wide and 26.5 to 38.5 high. This siphon would include 4 radial gates and would be approximately 1,300 ft long. • The culvert siphons would be constructed as large multiple-box culvert structures using cofferdams, shoring, and open cut-and-cover construction methods with conventional CIP concrete structures. A cofferdam would be used at the SCCF Outlet siphon, while shoring would be used at the Byron Highway/Southern Pacific Railroad siphon. Once the cofferdam or shoring were in place, cut-and-cover construction methods would be done within the enclosed space. • It is envisioned that the culvert siphon SCCF Outlet would have to be constructed in two phases. In the first phase, a temporary cofferdam would be installed approximately halfway along the length of the siphon. Half of the total length of the culvert siphon would then be constructed. During the second phase, the cofferdam would be re-installed across the other half of the siphon, and the remainder of the structure would be constructed and backfilled.
* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time. Yr. = Year		

Table 3C-34. Head of Old River Barrier-—Alternative 4

Construction Element/ Activity	Activity Timing* (Start dates)	Key Construction Information or Assumptions
Head of Old River Barrier (Alternatives 2A, 2B, 2C, 4) • Operable barrier (fish control gate) and boat lock would be located at the divergence of the head of Old River and the San Joaquin River, to prevent migrating and outmigrating salmon from entering Old River from the San Joaquin River. • Other components: fish passage (fishway); control building to house emergency generator, control panels for the control gates, circuit breakers; storage area for operation and maintenance equipment; boat lock operator's building; communications antenna • Gate would have an permanent storage area of 180 ft x 60 ft and operator parking. • Fencing and gates would control access to the structure. • Access road would be improved with 2 miles of private access road, minimum 16 ft wide with gravel surface, beginning at the end of Undine Road and running east to the San Joaquin River levee, then south and west along the levee to the gate site. • A construction staging area of approximately 10,000 square feet (ft) would be located on the south side of Old River just outside the levee roads. • A sheetpile retaining wall would be installed in the levee where the gate would be constructed. • Complete gate would require approximately 1,500 cy of concrete. • Approximately 11,000 square feet (450 linear feet) of riprap would be used as slope protection on levees near the gate and on the channel bottom. • Fine materials such as sand would be placed adjacent to the riprap to create a smooth slope from channel bottom to the gate sill.		
Fish Control Gate	Alternatives 2A, 4: Phase 1 Jan. Yr. 7 Phase 2	• Approximately 210 ft long x 30 ft wide, top elevation 15 ft (NJAVD 88). • Seven bottom-hinged gates approximately 125 ft long. • Fishway • Vertical slot, self-regulating, with four sets of baffles. • To be designed according to NOAA Fisheries and USFWS guidelines for species

Construction Element/ Activity	~~Activity Timing* (Start dates)~~	Key Construction Information or Assumptions

	~~Nov. Yr. 7~~
	~~Phase 3~~
	~~Dec. Yr. 8~~
	
	~~Alternatives 2B, 2C:~~
	~~Phase 1~~
	~~Jan. Yr. 9~~
	~~Phase 2~~
	~~Nov. Yr. 9~~
	~~Phase 3~~
	~~Dec. Yr. 10~~
		including salmon, steelhead, and green sturgeon.
		• ~~A~~Fish passage structure: approximately 40 ft long x 10 ft wide.
		• Constructed of reinforced concrete.
		• Stoplogs would be used to close the fishway in spring when not in use to protect it from damage.
		Operable barrier
		Two potential gate construction methods.
		• *Cofferdam:* Creates a dewatered construction area for ease of access and egress. Construction would take place in two phases and in-water work could continue through winter.
		  ○ Phase 1: Construct cofferdam in half the channel, dewater, and construct gates on the dewatered channel bottom and adjacent levee. Remove or cut off cofferdam at required invert depth. Construct cofferdam in second half of the channel.
		  ○ Phase 2: Construct gate in the other half of the channel using same methods, remove or cut off cofferdam, and incorporate into the final gate layout. Construct equipment storage area and remaining fixtures.
		  ○ Cofferdam construction would begin in August and last approximately 35 days.
		  ○ Construction activities in the cofferdam project area would last until approximately early November, and could continue through winter.
		• *In-the-wet:* Allows the river to flow unimpeded and eliminates the time, material, and cost of constructing a cofferdam. No cofferdam or dewatering, no levee relocation.
		  ○ The channel invert would be excavated to grade using a sealed clamshell excavator working off the levee or from a barge.
		  ○ ~~H-p~~Piles would be placed in the channel.
		  ○ Gravel and tremie concrete would be placed for the foundation within the confines of the ~~H-~~piles.
		  ○ Reinforced concrete structures would then either be floated in or cast in place using prefabricated forms to be placed on top of the gravel, tremie concrete, and ~~H-~~piles.
		  ○ Divers would complete the final connections between the concrete structures and the piles.
		  ○ All in-water work would occur between August 1 and November 30 to minimize effects on delta smelt and juvenile salmonids.
		  ○ Construction of other components would take place from a barge or from the levee crown and would occur throughout the year.

Boat Lock		• 20 ft wide x 13~~7~~0 ft long • Would be constructed using sheetpiles and include two bottom-hinged gates on each end measuring 20 ~~feet~~ft wide and 10 ~~feet~~ft high. • The invert of the lock would be at elevation –8.0 ~~feet~~ft msl, and the top of the lock wall would be at elevation 15 ~~feet~~ft.

* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.
Yr. = Year

Table 3C-35. Power Supply and Grid Connections—Alternative 4

~~**Table 3C-356. Power Supply and Grid Connections Alternative 4**~~

Construction Element/ Activity	Key Construction Information or Assumptions
Power Supply and Grid Connections	• A new temporary substation would be constructed at each of the drive/launch shaft locations. • Lower voltage subtransmission lines would be used to power intermediate and reception shaft sites between the main drive shafts. • A new substation would be constructed near the IF to support temporary construction load. • To serve permanent loads at the pumping plant located by the Clifton Court area, a new transmission line would be extended from an existing nearby substation to a new substation by the pumping plant area, where electrical power would be transformed from 230 kV to 115 kV for transmission to the tunnel shaft areas and to 13.8 kV or appropriate bus voltage for utilization by pumps. • For operation of the three intake facilities located by the Sacramento River and of the intermediate forebay facilities, existing distribution lines would be used wherever practical, which minimizes ROW issues associated with new higher voltage lines. However, if existing distribution lines cannot support the intake operation, there may be a need for a new 69 kV transmission line to serve intake operation. As such, electrical power would be transformed from 69 kV to 480V service, or appropriate equipment terminal voltage, for distribution and use for gate operation, lighting, and auxiliary equipment at the adjacent structures. • At the north end, the project could potentially connect to an existing WAPA 230 kV transmission line east of the IF. From this line, a new transmission line (at 230 kV, 115kV or 69kV, depending on the utility studies) would extend to a new substation at the IF to serve both the North Tunnel and Main Tunnel construction loads. At the south end, the project potentially connects to an existing WAPA 230 kV substation south of the existing CCF. From this substation, a new transmission line would extend north toward the pumping plant to a new 230 kV substation to serve both temporary construction and permanent loads. From the new substation, a new transmission line would continue to extend north toward and along the main conveyance system alignment to Bouldin Island to support construction at sites north of NCCF. Lower voltage lines would be used to power intermediate and reception shaft sites between the main drive shafts. • At the north, there is an existing PG&E 115 kV line from which a new line (either 115 kV or 69 kV, depending on utility studies) could be extended to the IF, where a new substation would be constructed to serve temporary construction loads. Northwest of CCF, there is an existing PG&E 230 kV substation from which a new 230 kV line could be extended toward CCF, where a new 230 kV substation would be built to serve the pumping plant. From this new substation, a new line would extend north to support construction at sites north of NCCF. • A new transmission line (at 230 kV, 115 kV or 69kV, depending on utility studies) could be extended from an SMUD-planned 230 kV substation to a new substation near IF. To serve construction loads, a new transmission line would be extended from this new substation north toward the intakes as needed and south to support construction sites along the northern tunnels and at the IF. • The Intake and Sedimentation Facilities (Intakes No.2, No.3, and No.5) and the Junction Structure located at Intake No.3 shall be fed from the Utility via two 480V, 3-phase incoming service feeders. Each incoming service feeder shall be routed into the electrical building and feed the arc-resistant, main-tie-main-tie-main configured switchgear, with a standby emergency generator as the backup. The switchgear will then distribute power to all the associated loads. The switchgear will be located within the electrical building's electrical room. • The IF shall be fed from the Utility via two 4160V, 3-phase incoming service feeders. Each incoming service feeder shall be routed into the electrical building to feed an arc-resistant,

Construction Element/ Activity	Key Construction Information or Assumptions
	main-tie-main configured switchgear. The switchgear will then distribute the 4160V to the major loads, including the dewatering pumps and the 4160V to 480V transformers. The switchgear will be located within the electrical building's medium voltage electrical room.

* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.

Table 3C-367. Borrow, Spoils, and Reusable Tunnel Material Storage-—Alternative 4

Construction Element/ Activity	Activity Timing* (Start dates)	Key Construction Information or Assumptions
Borrow/Spoils/Reusuable Tunnel Material (RTM) Storage		
• Final locations for storage of spoils, RTM, and dredged material would be selected based on the guidelines presented in Appendix 3B, *Environmental Commitments*. • Conventional earthmoving equipment, such as bulldozers and graders, would be used to place the spoil. Some spoil, with the exception of RTM, may be placed on the landside toes of canal embankments and/or setback levees. • This may require temporary placement of the soil in borrow pits or temporary spoil laydown areas pending completion of embankment or levee construction. Borrow pits created for this project would be the preferred spoil location. • In the event that limited dewatering is required to excavate a borrow pit, construction shall be timed to allow placement of spoil in the borrow excavation to prevent the creation of new wetlands, if appropriate.		
Pipeline/ Tunnel Alignment (Alternatives 1A, 2A, 3, 4, 5, 6A, 7, 8)		• A total of approximately 1,595 acres would be allocated to RTM storage for the pipeline/tunnel. • Designated RTM storage areas would range in size from approximately 100 to 570 acres. • The estimated volume of RTM to be disposed from the tunnels and shafts is approximately 25,000,000 cy. • RTM that may be have potential for re-use, such as levee reinforcement, embankment or fill construction, would be stockpiled. The process for testing and reuse of this material is described further in Chapter 3 and Appendix 3B. • A berm of compacted imported soil would be built around the perimeter of the RTM storage area to ensure containment. Berm would conform to U.S. Army Corps of Engineers guidelines for levee design and construction. • It was assumed that RTM would be stacked to a depth of 10 ft. • Maximum capacity of RTM storage ponds would be less than 50 af. • RTM areas may be subdivided by a grid of interior earthen berms in RTM ponds for dewatering. • Dewatering would involve evaporation and a drainage blanket of 2 ft-thick pea gravel or similar material placed over an impervious liner. • Leachate would drain from ponds to a leachate collection system, then pumped to leachate ponds for possible additional treatment. • Transfer of RTM solids to disposal areas may be handled by conveyor, wheeled haul equipment, or barges, at the contractor's discretion. • The invert of RTM ponds would be a minimum of 5 ft above seasonal high groundwater table • An impervious liner would be placed on the invert and along interior slopes of berms, to prevent groundwater contamination. • RTM would not be compacted. • Spoil placed in disposal areas would be placed in 12-inch lifts, with nominal

Construction Element/ Activity	~~Activity Timing* (Start dates)~~	Key Construction Information or Assumptions
		~~compaction.~~ • ~~A total of approximately 1,220 acres would be allocated to borrow acquisition and/or spoil deposition.~~ • ~~The maximum height for placement of spoil is expected to be 12 ft above preconstruction grade and have side slopes of 5H:1V or flatter.~~ • ~~After final grading of spoil is complete, the area would be restored based on site-specific conditions following project restoration guidelines.~~
Modified Pipeline/ Tunnel Alignment (Alternative 4)		• A total of approximately ~~3,500~~2,570 acres would be allocated to RTM storage and dredged material for the modified pipeline/tunnel alignment north and main tunnels. • Designated RTM storage areas would range in size from approximately 33~~25~~ to 1,208~~060~~ acres. • The estimated volume of RTM to be disposed from ~~the tunnels and shafts~~tunneling operations is approximately 31,000,000~~24,350,000~~ cy. • RTM that may be have potential for re-use, such as levee reinforcement, embankment or fill construction, would be stockpiled. The process for testing and reuse of this material is described further in Chapter 3 and Appendix 3B. • A berm of compacted imported soil would be built around the perimeter of the RTM storage area to ensure containment. Berm would conform to U.S. Army Corps of Engineers guidelines for levee design and construction. • It was assumed that RTM would be stacked to a depth of ~~6~~ 10-12 ft ~~(10 ft for the areas for the storage of RTM and dredged material near CCF)~~. ~~During future stages of engineering, it may be determined that it is preferable to store RTM at a height of 10 feet, as was assumed for alternatives under the pipeline/tunnel alignment. Using this assumption, approximately 1,800 acres would be required for the storage of RTM and dredged material under the modified pipeline/tunnel alignment.~~ • Maximum capacity of RTM storage ponds would be less than 50 af. • RTM areas may be subdivided by a grid of interior earthen berms in RTM ponds for dewatering. • Dewatering would involve evaporation and a drainage blanket of 2 ft-thick pea gravel or similar material placed over an impervious liner. • Leachate would drain from ponds to a leachate collection system, then pumped to leachate ponds for possible additional treatment. • Transfer of RTM solids to disposal areas may be handled by conveyor, wheeled haul equipment, or barges, at the contractor's discretion. Two conveyors were assumed to be used under this alignment: one going east from the intermediate forebay and stretching approximately 3,000 ft to an RTM area and another spanning a trenchless crossing from a shaft site northeaset of Clifton Court Forebay across Italian Slough to an RTM area on Byron Tract. At Italian Slough a trenchless crossing would be constructed to transport the RTM under the slough to the RTM storage area on Byron Tract. Construction of the trenchless crossing would entrail microtunneling or pipe jacking would be used to construct a small diameter pipe (approximately 72 inches in diameter) under Italian Slough. Once the pipe is in place, an electric conveyor belt would be installed in the pipe. Once construction the water conveyance structure for Alternative 4 has been completed, this pipe would be backfilled with concrete.~~stretching approximately 18,600 ft from a main construction shaft on northern Staten Island to an RTM area on southern Staten Island~~. • Where feasible, the invert of RTM ponds would be a minimum of 5 ft above seasonal high groundwater table. • An impervious liner would be placed on the invert and along interior slopes of berms, to prevent groundwater contamination.

Construction Element/ Activity	~~Activity Timing* (Start dates)~~	Key Construction Information or Assumptions
		• ~~RTM would not be compacted.~~ • Spoil placed in disposal areas would be placed in 12-inch lifts, with nominal compaction. • ~~A total of approximately 200 acres would be allocated to b~~Borrow acquisition and/or spoil deposition would occur on~~independent from~~ areas allocated for other project features, such as the SCCF and RTM storage areas (for example, the expanded area for CCF and RTM areas may be used as borrow sites prior to being used for other project purposes). • The maximum height for placement of spoil is expected to be 6-10 ft above preconstruction grade (except for sites adjacent to CCF and on Glannvale Tract, where it would be 10-15 ft~~10 ft above preconstruction grade for sites adjacent to CCF~~), and have side slopes of 5H:1V or flatter. • After final grading of spoil is complete, the area would be restored based on site-specific conditions following project restoration guidelines.
~~**East Alignment** (Alternatives 1B, 2B, 6B)~~	~~Mar. Yr. 2–Dec. Yr. 4~~	• ~~A total of approximately 440 acres would be allocated to RTM storage.~~ ~~The East Alignment can be divided into four distinct reaches for the purpose of identifying spoil areas.~~ • ~~For the northern reach, extending from the Pierson Tract to the Mokelumne River, it is anticipated that construction would consist of nearly balanced cut and fill. Minimal amounts of spoil would be generated and there is adequate room to dispose of spoils along the landside toe of the eastern canal embankment.~~ • ~~The north-central reach extends from the Mokelumne River south to White Slough. Minimal amounts of spoil would be generated and there is adequate room to dispose of spoils along the landside toe of the eastern canal embankment.~~ • ~~The south-central reach extends from White Slough to the San Joaquin River. A substantial quantity of spoil material would likely be generated during construction of this reach. Disposal of this soil material can be in areas immediately adjacent to the canal embankments, in addition to being placed on the landside toe of the canal embankments. Spoil would consist of organic soils, which would be placed on top of in situ organic soils;~~ • ~~The southern reach extends from the San Joaquin River to the CCF. A substantial quantity of spoil material would likely be generated during construction of this reach. Disposal of this soil material can be in areas immediately adjacent to the canal embankments, in addition to being placed on the landside toe of the canal embankments. Spoil would consist of organic soils, which would be placed on top of in situ organic soils.~~ • ~~If borrow material is sourced from one of the large contiguous borrow areas outside the project area, all spoil material may be disposed of in the off-site borrow area.~~ • ~~A total of approximately 10,830 acres would be allocated to borrow acquisition and/or spoil deposition.~~
~~**West Alignment** (Alternatives 1C, 2C, 6C)~~	~~Schedule assumed to be the same as East alignments~~	• ~~A total of approximately 920 acres would be allocated to RTM storage.~~ • ~~RTM would not be compacted.~~ ~~The ICF West Option can be divided into three distinct reaches for the purpose of identifying borrow and spoil areas.~~ • ~~The northern segment (Reaches 1 through 4) extends from the Lisbon District in the north to the tunnel portal near Cache Slough. It is anticipated that construction of this portion would consist of nearly balanced cut and fill. Amounts of spoil would be generated and disposed of along the landside toe of the eastern canal embankment. Spoil material generated should not be placed along the landside toe of the canal embankment in the area between the canal and the Sacramento Deep Water Ship Channel.~~ • ~~Along the tunnel reach, substantial quantities of RTM would be generated during~~

Construction Element/ Activity	Activity Timing* (Start dates)	Key Construction Information or Assumptions
		tunnel construction. When extracted, this material would contain fine-grained soil mixed with biodegradable polymers and have the consistency of a thick paste. Over time, the moisture content of the material would decrease and the polymers would break down, leaving workable soil as the end product. This process may take several years to complete, but farming of this material would accelerate the process. • Temporary spoil laydown areas near the tunnel and shaft portals may be used to store and possibly treat this material. Once treatment is complete, the spoil material, if suitable, can be spread over local agricultural land. If not suitable for this application, the spoil can be disposed of along the landside toe of canal embankments of both the north and south segments of the West Alignment and in borrow pits along the southern segment of the alignment. • Spoil generated during construction of the southern segment may be disposed of in borrow pits and along the landside toe of the canal embankment. • If borrow material is sourced from one of the large contiguous borrow areas outside the project area, all spoil material may be disposed of in the offsite borrow area. • Spoil placed in disposal areas would be placed in 12-inch lifts, with nominal compaction. • The maximum height for placement of spoil is expected to be 12 ft above preconstruction grade and have side slopes of 5H:1V or flatter. • After final grading of spoil is complete, the area would be restored based on site-specific conditions following project restoration guidelines. • A total of approximately 6,770 acres would be allocated to borrow acquisition and/or spoil deposition.
Through Delta/ Separate Corridors (Alternative 9)		• A total of approximately 2,050 acres would be allocated to borrow acquisition and/or spoil deposition.

* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.
Yr. = Year

Table 3C-37. Access and Construction Work Areas–Alternative 4

Construction Element/ Activity	Key Construction Information or Assumptions
General Construction Work Areas	• Work areas during construction may include areas for construction equipment and worker parking, field offices, a warehouse, maintenance shops, equipment and materials laydown and storage, RTM spoils areas, and stockpiles. Materials to be stockpiled may include: • Strippings from various excavations for possible reuse in landscaping. • RTM that is slated for reuse after treatment for embankment or fill construction. RTM areas may be • Other temporary work areas not specified at left include those associated with the construction of canals, control structures, forebays, intakes, levees, operable barriers, pipelines, pumping plants, safe haven zones, siphons, and tunnels. Areas would also be dedicated to temporary transmission lines.

Construction Element/ Activity	Key Construction Information or Assumptions	
	temporary or permanent. • Peat spoils for possible use on agricultural land, as safety berms on the landside of haul roads, or as toe berms on the landside of embankments (cannot be part of the structural section). • Other materials being stockpiled on a temporary basis prior to hauling to permanent stockpile areas. • Borrow and spoils areas may be temporary or permanent.	
Roads	• Dust abatement would be addressed in all construction areas at all times. • Asphalt-paved wet weather temporary access road to provide construction access to the conveyance pipe construction between the canal and the intake facility. • Asphalt-paved temporary access ramps to connect existing public and private roads to construction sites would be constructed to connect to the existing roadways at the existing grade. • Asphalt-paved permanent access ramps would be constructed to the elevated roadways at the final grades. • Heavy construction equipment, such as diesel-powered dozers, excavators, rollers, dump trucks, fuel trucks, and water trucks would be used during excavation, grading, and construction of access/haul roads.	• The physical extent of these areas (includes Bridge Work Areas, Highway Work Areas, Road Work Areas, and Temporary Access Road Work Areas) would depend on the conveyance alignment. Additionally, some road work areas are subsumed within the construction footprints associated with other features (i.e., Intakes, Safe Haven Work Areas, etc.).
Detour Roads	• *Intakes:* Detour roads needed for all intakes, for traffic circulation around the work areas. It is expected that earthen ramps would be required to realign the roadways from levee crown to landside ground elevation. • Roadway detours would likely be needed around each intake's construction zone (including intake pumping plant construction area) to provide site security and safety.	• It is expected that earthen ramps would be required to realign the roadways from levee crown to landside ground elevation.
Temporary and New Access/Haul Roads	• Temporary and permanent access roads would be constructed for features such as intakes, reusable tunnel material areas, the intermediate forebay, work areas, shaft sites, the combined pumping plants, and barge unloading facilities. • 24-foot-wide	

Construction Element/ Activity	Key Construction Information or Assumptions
	• Excavated alluvial mineral soils may be used, though additional material may have to be imported onsite.
Parking	• See Table 3C-1, *Construction Assumptions for Water Conveyance Facilities*.
Temporary Barge Unloading Facility Construction and Removal	• May be located at each of the intake structure worksites, tunnel worksites, and culvert siphon worksites, to be used for the delivery and removal of construction materials and equipment. • Barges would be required to use existing barge landings where possible and maintain minimum waterway width greater than 100 ft (assuming maximum barge width of 50 ft). • Under the modified pipeline/tunnel alignment, it is assumed that barge activities would take place on levees using a ramp barge in conjunction with a crane/excavator barge, conveyor, crane or excavator positioned on or near the levee. • The physical extent of these areas would depend on the conveyance alignment: • Pipeline/Tunnel Alignment: approximately 180 acres. • Approximately 300 ft ~~by~~x 50 ft, pile-supported dock to provide construction access and construction equipment to portal sites. — Refer to Table 3C-2 for assumptions used to evaluate impacts from pile driving.~~24 inch steel piles placed approximately every 25 ft under the dock for a total of 36 piles.~~ • — ~~Impact pile driving may take up to an average of 700 strikes per pile, depending on hammer type and subsurface conditions.~~ • A pier would be built within the worksite footprint of the intake or tunnel and removed at the end of construction. • Facility would be in use during the entire construction period at each location. • Barges could be used for pile-driving rigs and barge-mounted cranes, suction dredging equipment, and microtunnel drives from the in-river cofferdam, transporting RTM, crushed rock and • Temporary barge unloading facilities for Alternative 4 would be built at the following locations: Snodgrass Slough, Potato Slough, San Joaquin River, Middle River, Connection Slough, Old River, and the West Canal.

Construction Element/ Activity	Key Construction Information or Assumptions
	aggregate, pipeline sections, etc., post-construction underwater debris removal, and other activities. • Access roads to construction work areas would be necessary.
Concrete Plants and Precast Segment Plants	• Due to the large amount of concrete required for construction and the schedule demands of the program, it is anticipated that the contractor(s) would set up their own concrete plant at the job sites. Five concrete batch plants are expected for the MPTO alignment, ranging from 1 to 40 acres. • While it is anticipated that precast tunnel segments would be purchased and transported from existing plants, it is possible that one or more temporary plants would be constructed. If constructed, these would be located adjacent to concrete plants. • It is likely that each precast segment plant would require approximately 10 acres for offices, concrete plant, materials storage, and casting facilities. • Additional acreage for segment storage would be needed at the precast segment plant site, and could run several times the space required for the plant. • The segments can be transported by barge, rail, or truck where these modes of transport are available; however, it is most likely that trucking of segments would be required.
Fuel Stations	• Would be constructed adjacent to concrete plants and occupy approximately 2 acres.

* Activity Timing provides an estimate for planning purposes only, and should not be considered certain at this time.
Yr. = Year

Table 3C-203738. Alternative 4 (Modified Pipeline/Tunnel Alignment) Construction Schedule

Phase	Start Month	Start Year	Days
Intake 2	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Intake 3	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Intake 5	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Pumping Plant 2	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Pumping Plant 3	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Pumping Plant 5	Same as Pipeline/Tunnel Alignment (see Table 3C-9)		
Pipelines	Same as Pipeline/Tunnel Alignment (see Tables 3C-12 and 3C-13)		
Utilities			
Temporary Power SMAQMD (230 kV)	February	Year 1	272
Temporary Power SJVAPCD (34.5 kV)	November	Year 1	76
Temporary Power SJVAPCD (230 kV)	November	Year 1	1309
Temporary Power BAAQMD (230 kV)	February	Year 2	864
Permanent Power SMAQMD (69 kV)	September	Year 1	17
Permanent Power SMAQMD (230 kV)	September	Year 1	998
Forebays			
Intermediate Forebay	Same as Pipeline/Tunnel Alignment (see Table 3C-17)		
Byron Tract Forebay (Clifton Court)			

~~Phase~~	~~Start Month~~	~~Start Year~~	~~Days~~
~~Dewatering~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Pump Install & Maintain~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Remove Unsuitable-Export~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Cut/Fill-Build Levees~~			
~~Scraper Cut/Fill~~	~~March~~	~~Year 4~~	~~218~~
~~Slope Finish~~	~~March~~	~~Year 4~~	~~47~~
~~Bottom Finish~~	~~March~~	~~Year 4~~	~~81~~
~~Levee Top Finish~~	~~March~~	~~Year 4~~	~~12~~
~~Export Suitable~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Slope Protection~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Primary Maintenance Road~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-17)~~		
~~Control Structures~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-18)~~		
~~Head of Old River Barrier~~	~~Same as Pipeline/Tunnel Alignment (see Table 3C-18)~~		
~~Expanded Clifton Court~~			
~~East Side Embankment~~			
~~Clearing and Grubbing~~	~~October~~	~~Year 3~~	~~30~~
~~Dewatering/Underwatering~~	~~October~~	~~Year 3~~	~~545~~
~~Sheetpile Cell~~	~~October~~	~~Year 3~~	~~208~~
~~Excavation~~	~~November~~	~~Year 4~~	~~109~~
~~Embankment~~	~~December~~	~~Year 4~~	~~277~~
~~Remove Sheetpiles~~	~~January~~	~~Year 6~~	~~104~~
~~Area Restoration~~	~~March~~	~~Year 6~~	~~30~~
~~Demobilization~~	~~May~~	~~Year 6~~	~~21~~
~~West Side Embankment~~			
~~Clearing and Grubbing~~	~~July~~	~~Year 4~~	~~30~~
~~Dewatering/Underwatering~~	~~July~~	~~Year 4~~	~~528~~
~~Sheetpile Cell~~	~~July~~	~~Year 4~~	~~206~~
~~Excavation~~	~~September~~	~~Year 5~~	~~103~~
~~Embankment~~	~~October~~	~~Year 5~~	~~262~~
~~Remove Sheetpiles~~	~~September~~	~~Year 6~~	~~103~~
~~Area Restoration~~	~~January~~	~~Year 7~~	~~30~~
~~Demobilization~~	~~January~~	~~Year 7~~	~~21~~
~~Partition Forebay~~			
~~Clearing and Grubbing~~	~~April~~	~~Year 5~~	~~30~~
~~Dewatering/Underwatering~~	~~April~~	~~Year 5~~	~~686~~
~~Sheetpile Cell~~	~~April~~	~~Year 5~~	~~369~~
~~Excavation~~	~~December~~	~~Year 6~~	~~202~~
~~Embankment~~	~~January~~	~~Year 7~~	~~257~~
~~Remove Sheetpiles~~	~~January~~	~~Year 8~~	~~185~~
~~Area Restoration~~	~~March~~	~~Year 8~~	~~30~~
~~Demobilization~~	~~September~~	~~Year 8~~	~~21~~
~~North Side Embankment~~			
~~Clearing and Grubbing~~	~~April~~	~~Year 5~~	~~30~~
~~Dewatering/Underwatering~~	~~April~~	~~Year 5~~	~~497~~

Phase	Start Month	Start Year	Days
Sheetpile Cell	April	Year 5	188
Excavation	March	Year 6	98
Embankment	April	Year 6	249
Remove Sheetpiles	March	Year 7	94
Area Restoration	June	Year 7	30
Demobilization	July	Year 7	21
CCF Embankment Removal			
Clearing and Grubbing	April	Year 6	30
Dewatering/Underwatering	April	Year 6	740
Sheetpile Cell	April	Year 6	573
Excavation	January	Year 9	127
Remove Sheetpiles	March	Year 9	144
Demobilization	December	Year 9	21
Dredge Forebay			
Dredge Forebay	September	Year 6	534

Phase	Start Month	Start Year	Days
Clifton Court Forebay			
Mobilization	January	9	8
Contr. Mngmt., Supervision, Admin.	January	9	1,072
Access Construction	January	9	241
Temporary Facilities	January	9	261
Batch Plant	May	9	998
Temp Facility Operations	April	10	819
SCCF Dike - SW Corner	October	9	249
SCCF Dike - SE Corner	January	11	252
SCCF Dike - Gate to Dike	June	9	253
CCF Dredging	January	9	1,518
CCF Partition Dike	April	12	306
NCCF Dike - West Side	September	10	251
NCCF Dike - North Side	December	11	251
Relocate Byron Highway	January	9	102
Relocate Railroad	January	9	100
NCCF Siphon (Phase 1) Excavate	December	8	278
NCCF Siphon (Phase 1) Concrete	May	9	228
NCCF Siphon (Phase 1) Backfill	September	9	77
NCCF Siphon (Phase 2) Excavate	October	9	256
NCCF Siphon (Phase 2) Concrete	January	10	229
NCCF Siphon (Phase 2) Backfill	May	10	74
Byron Highway Bridge over Canal	October	9	108
SP Railroad Bridge over Canal	April	10	110
NCCF Outlet Canal	October	9	306
Control Structure # 1 Excavate	March	11	102
Control Structure # 1 Concrete	September	11	151
Control Structure # 2 Excavate	March	11	108

~~Phase~~	~~Start Month~~	~~Start Year~~	~~Days~~
~~Control Structure # 2 Concrete~~	~~October~~	~~11~~	~~156~~
~~Control Structure # 3 Excavate~~	~~October~~	~~12~~	~~104~~
~~Control Structure # 3 Concrete~~	~~April~~	~~13~~	~~156~~
~~Control Structure # 4 Excavate~~	~~October~~	~~12~~	~~104~~
~~Control Structure # 4 Concrete~~	~~April~~	~~13~~	~~179~~
~~Old River Structure Excavate~~	~~October~~	~~11~~	~~104~~
~~Old River Structure Concrete~~	~~April~~	~~12~~	~~152~~
~~New Spillway Excavate~~	~~April~~	~~12~~	~~105~~
~~New Spillway Concrete~~	~~October~~	~~12~~	~~152~~
~~Routine supply delivery for duration of const.~~	~~December~~	~~8~~	~~1,561~~
~~Geotechnical Exploration~~			
~~Onland geotechnical explorations~~	~~January~~	~~1~~	~~823~~
~~Overwater geotechnical explorations~~	~~January~~	~~1~~	~~823~~
~~Temporary access roads for exploration sites~~	~~January~~	~~1~~	~~823~~
~~Intakes~~			
~~Contractor Mobilization~~	~~November~~	~~6~~	~~48~~
~~Contractor Staff~~	~~November~~	~~6~~	~~1,850~~
~~Erect Temp Contractor Facilities~~	~~December~~	~~6~~	~~88~~
~~Operate Temp Facilities~~	~~January~~	~~7~~	~~1,810~~
~~Erect Batch Plant~~	~~December~~	~~6~~	~~76~~
~~Operate Batch Plant~~	~~April~~	~~7~~	~~1,650~~
~~Intake 5 Construction Wharf~~	~~April~~	~~7~~	~~68~~
~~Intake 5 Substation & Elect Distribution~~	~~April~~	~~8~~	~~44~~
~~Intake 5 Initial Site Work~~	~~January~~	~~7~~	~~304~~
~~Intake 5 SR 16 Bridge~~	~~April~~	~~7~~	~~108~~
~~Intake 5 Cofferdam~~	~~April~~	~~8~~	~~140~~
~~Intake 5 Final Site Work~~	~~March~~	~~11~~	~~160~~
~~Intake 5 Ground Improvement~~	~~August~~	~~8~~	~~120~~
~~Intake 5 Excavate Inside Cofferdam~~	~~January~~	~~9~~	~~40~~
~~Intake 5 Drilled Piers~~	~~February~~	~~9~~	~~190~~
~~Intake 5 Tremie Concrete~~	~~November~~	~~9~~	~~20~~
~~Intake 5 Dewater Cofferdam~~	~~December~~	~~9~~	~~28~~
~~Intake 5 Structure Concrete~~	~~January~~	~~10~~	~~288~~
~~Intake 5 Gates~~	~~May~~	~~11~~	~~32~~
~~Intake 5 Fish Screens~~	~~May~~	~~10~~	~~248~~
~~Intake 5 MEP~~	~~May~~	~~11~~	~~64~~
~~Intake 5 Finish Out~~	~~August~~	~~11~~	~~40~~
~~Intake 5 Sed Basin Deep Wells~~	~~March~~	~~8~~	~~456~~
~~Intake 5 Sed Basin Excavation~~	~~April~~	~~8~~	~~236~~
~~Intake 5 Sed Basin Finish Grade & Pave~~	~~July~~	~~9~~	~~32~~
~~Intake 5 Sed Basin Piles~~	~~January~~	~~9~~	~~108~~
~~Intake 5 Sed Basin Concrete~~	~~February~~	~~9~~	~~308~~
~~Intake 5 Sed Basin Gates~~	~~June~~	~~10~~	~~64~~
~~Intake 5 Sed Basin MEP & Finish~~	~~September~~	~~10~~	~~48~~
~~Intake 3 Construction Wharf~~	~~April~~	~~8~~	~~68~~
~~Intake 3 Substation & Elect Distribution~~	~~April~~	~~9~~	~~56~~

Phase	Start Month	Start Year	Days
Intake 3 Initial Site Work	January	8	256
Intake 3 SR 16 Bridge	April	8	108
Intake 3 Cofferdam	April	9	125
Intake 3 Final Site Work	February	12	160
Intake 3 Ground Improvement	September	9	145
Intake 3 Excavate Inside Cofferdam	February	10	68
Intake 3 Drilled Piers	June	10	120
Intake 3 Tremie Concrete	November	10	24
Intake 3 Dewater Cofferdam	January	11	32
Intake 3 Structure Concrete	February	11	240
Intake 3 Gates	April	12	28
Intake 3 Fish Screens	May	11	116
Intake 3 MEP	May	12	56
Intake 3 Finish Out	August	12	40
Intake 3 Sed Basin Deep Wells	April	9	596
Intake 3 Sed Basin Excavation	April	9	128
Intake 3 Sed Basin Finish Grade & Pave	June	10	60
Intake 3 Sed Basin Piles	February	10	108
Intake 3 Sed Basin Concrete	August	10	268
Intake 3 Sed Basin Gates	October	11	64
Intake 3 Sed Basin MEP & Finish	January	12	18
Intake 3 Conveyance to Junction Structure	April	11	240
Intake 3 Concrete Junction Structure	July	11	140
Intake 3 Junction Structure MEP	October	11	100
Intake 3 Junction Structure Final Finish & Cleanup	March	12	40
Intake 2 Construction Wharf	April	9	68
Intake 2 Substation & Elect Distribution	April	10	44
Intake 2 Initial Site Work	January	9	304
Intake 2 SR 16 Bridge	April	9	108
Intake 2 Cofferdam	April	10	155
Intake 2 Final Site Work	March	13	160
Intake 2 Ground Improvement	September	10	120
Intake 2 Excavate Inside Cofferdam	February	11	40
Intake 2 Drilled Piers	April	11	190
Intake 2 Tremie Concrete	January	12	20
Intake 2 Dewater Cofferdam	February	12	28
Intake 2 Structure Concrete	March	12	288
Intake 2 Gates	July	13	32
Intake 2 Fish Screens	July	12	248
Intake 2 MEP	July	13	64
Intake 2 Finish Out	September	13	40
Intake 2 Sed Basin Deep Wells	December	10	516
Intake 2 Sed Basin Excavation	January	11	252
Intake 2 Sed Basin Finish Grade & Pave	March	12	60
Intake 2 Sed Basin Piles	November	11	108
Intake 2 Sed Basin Concrete	December	11	252

~~Phase~~	~~Start Month~~	~~Start Year~~	~~Days~~
~~Intake 2 Sed Basin Gates~~	~~January~~	~~13~~	~~64~~
~~Intake 2 Sed Basin MEP & Finish~~	~~February~~	~~13~~	~~48~~
~~Routine supply delivery for duration of const.~~	~~November~~	~~6~~	~~2,016~~
~~Intermediate Forebay~~			
~~Mobilization~~	~~July~~	~~9~~	~~65~~
~~Contr. Mngmt., Supervision, Admin.~~	~~July~~	~~9~~	~~1,300~~
~~Access Construction~~	~~July~~	~~9~~	~~84~~
~~Temporary Facilities~~	~~August~~	~~9~~	~~52~~
~~Batch Plant~~	~~April~~	~~13~~	~~260~~
~~Temp Facility Operations~~	~~July~~	~~9~~	~~1,300~~
~~Intermediate Forebay Earthworks~~	~~July~~	~~9~~	~~650~~
~~Intermediate Forebay Inlet Ground Improvements~~	~~January~~	~~12~~	~~195~~
~~Intermediate Forebay Inlet Sitework~~	~~October~~	~~12~~	~~130~~
~~Intermediate Forebay Inlet Concrete~~	~~April~~	~~13~~	~~260~~
~~Intermediate Forebay Inlet Gates~~	~~January~~	~~14~~	~~130~~
~~Intermediate Forebay Inlet Mech & Elect~~	~~April~~	~~14~~	~~65~~
~~Intermediate Forebay Outlet Ground Improvements~~	~~December~~	~~11~~	~~195~~
~~Intermediate Forebay Outlet Sitework~~	~~September~~	~~12~~	~~130~~
~~Intermediate Forebay Outlet Concrete~~	~~March~~	~~13~~	~~260~~
~~Intermediate Forebay Outlet Gates~~	~~December~~	~~13~~	~~130~~
~~Intermediate Forebay Outlet Mech & Elect~~	~~March~~	~~14~~	~~65~~
~~Routine supply delivery for duration of const.~~	~~July~~	~~9~~	~~1,300~~
~~Pumping Plants and Tunnel Reach 7 (Bacon Island to Clifton Court Forebay)~~			
~~Mobilizaton~~	~~January~~	~~3~~	~~60~~
~~Contractor's Site Staff-Surface Tunnel Support~~	~~January~~	~~3~~	~~1,715~~
~~Contractor's Site Staff-Pump Plants~~	~~December~~	~~11~~	~~540~~
~~Access Construction~~	~~February~~	~~3~~	~~60~~
~~Temporary Facility Construction~~	~~March~~	~~3~~	~~92~~
~~Batch Plant Operation~~	~~September~~	~~3~~	~~2,092~~
~~Temporary Facility Ops- Surface Tunnel Support~~	~~February~~	~~3~~	~~1,695~~
~~Temporary Facility Ops-Pump Plant~~	~~December~~	~~11~~	~~540~~
~~Clifton Court Cofferdam~~	~~May~~	~~3~~	~~64~~
~~Old River Wharf~~	~~August~~	~~3~~	~~72~~
~~Initial Earthwork~~	~~May~~	~~3~~	~~88~~
~~Complete Embankment to El. 25~~	~~December~~	~~12~~	~~92~~
~~Final Site Work~~	~~June~~	~~13~~	~~120~~
~~East and West Tunnel Completion Dates~~	~~December~~	~~11~~	~~52~~
~~West Pump Shaft Slab Concrete @ El -50~~	~~March~~	~~12~~	~~32~~
~~West Pump Shaft Wall Concrete Below Op Deck~~	~~April~~	~~12~~	~~92~~
~~West Pump Shaft Operating Deck Concrete~~	~~September~~	~~12~~	~~60~~
~~West Pump Shaft Pumps & Operators~~	~~June~~	~~13~~	~~80~~
~~W Pump Plant Pipe to Discharge Splash Area~~	~~December~~	~~12~~	~~60~~
~~East Pump Shaft Slab Concrete @ El. -50~~	~~December~~	~~11~~	~~32~~
~~East Pump Shaft Wall Concrete Below Op Deck~~	~~January~~	~~12~~	~~92~~
~~East Pump Shaft Operating Deck Concrete~~	~~May~~	~~12~~	~~60~~
~~East Pump Shaft Pumps & Operators~~	~~March~~	~~13~~	~~80~~

Phase	Start Month	Start Year	Days
E Pump Plant Pipe to Discharge Splash Basin	July	12	60
Pump Plants Surge Channel & Splash Basin	May	12	120
Excavation & Piling for Splash Basin	March	12	40
Backfill Splash Basin	December	12	20
Pump Plant Construction Plant Operation	October	11	304
West Pump Plant Walls above Op Deck	December	12	80
East Pump Plant Walls above Op Deck	August	12	80
West Pump Plant Overhead Crane	April	13	36
East Pump Plant Overhead Crane	December	12	36
West Pump Plant Roof	April	13	28
East Pump Plant Roof	December	12	28
West Pump Plant Finish Out	September	13	52
East Pump Plant Finish Out	June	13	52
Pump Plant MCC/Electrical Buildings (2 ea)	June	13	68
Pump Plant Substation & Electrical Distribution	August	13	68
Pump Plants Drywell Access Bldgs & Finish	July	13	80
Pump Plants Water Treatment Facility	July	13	80
TunnelMob Concurrent With Surface Activities	January	4	22
Setup East Pump Plant	February	4	10
Slurry Wall Installation	September	3	130
Excavate East Wet Well	May	4	76
Tie Rebar Tremie Slab	August	4	6
Setup & place tremie Slab	September	4	4
Pump Water From Shaft	September	4	3
Cure Time Tremie Slab	September	4	7
Tie Rebar Work Slab	September	4	6
Setup & Place Work Slab	October	4	1
Tie Rebar Thrust Ring	October	4	12
Set breakout forms & assemble Wall Forms	October	4	4
Form Thrust Ring	October	4	9
Jet Grout Anular Ring	March	4	39
Assemble East TBM	November	4	78
Place Thrust Ring	November	4	9
Order & Manufacture East TBM	January	3	380
Order & Manufacture West TBM	April	3	380
Excavate East Tunnel	March	5	1,283
E Pump Plant Set & Strip Elbow forms	April	11	9
Tie Rebar	May	11	7
Set & Strip Shaft Forms	May	11	10
Place wet well shaft Concrete	May	11	34
Excavate Pump Plant Annular Ring	August	11	34
Pump Plant Wall Rebar Below EL -2	September	11	20
Assemble Pump Plant Wall Forms	October	11	5
Set & Strip Pump Plant Wall Forms	October	11	12
Place Pump Wall Concrete	November	11	12
Muck Disposal CONVEYOR SET UP	February	4	36

Phase	Start Month	Start Year	Days
Backfill Around Wet Well	July	11	16
Setup West Pump Plant	February	4	10
Slurry Wall Installation	December	3	130
Jet Grout Anular Ring	August	4	39
Excavate West Wet Well	September	4	76
Tie Rebar Tremie Slab	January	5	6
Setup & place tremie Slab	January	5	4
Pump Water From Shaft	January	5	3
Cure Time Tremie Slab	February	5	7
Tie Rebar Work Slab	February	5	6
Setup & Place Work Slab	February	5	1
Tie Rebar Thrust Ring	February	5	12
Set breakout forms & assemble Wall Forms	March	5	4
Form Thrust Ring	March	5	9
Place Thrust Ring	March	5	9
Assemble West TBM	April	5	78
W. Pump Plant Set & Strip Elbow Forms	August	11	9
Tie Rebar	September	11	7
Set & Strip Shaft Forms	September	11	9
Place wet well shaft Concrete	October	11	8
Excavate Pump Plant Annular Ring	November	11	34
Pump Plant Wall Rebar Below EL -2	December	11	19
Assemble Pump Plant Wall Forms	January	12	5
Set & Strip Pump Plant Wall Forms	January	12	12
Place Pump Wall Concrete	February	12	12
Excavate West Tunnel	July	5	1,277
West TBM Conveyor, Grout, Utilities & Cle	August	10	264
Slurry Wall East Access Shaft	March	4	16
Excavate & Support East Access Shaft	April	4	9
Excavate & Support East Access Tunnel	April	4	5
Line East Access Tunnel & Shaft	May	4	26
Operate Muck Disposal Area	March	4	1,640
Slurry Wall West Access Shaft	August	4	16
Excavate & Support West Access Shaft	August	4	9
Excavate & Support West Access Tunnel	September	4	5
Line West Access Tunnel & Shaft	September	4	26
Operate Tunnel Water Treatment Plant	February	4	2,051
E& W Intervention Grout Zone #1	September	4	84
Indirects Tunnel & Shaft	March	4	2,027
E&W Site, Grout & Slurry Wall Safe Haven	January	5	155
East Excavate Safe Haven Shaft #1	October	5	37
Excavate & Berm Muck Disposal Area	July	3	85
East Concrete Safe Haven Shaft #1	December	5	31
Final Dress & Cleanup Muck Disposal Area	September	10	100
East Backfill Safe Haven Shaft #1	June	6	21
West Excavate Safe Haven Shaft #1	December	5	37

Phase	Start Month	Start Year	Days
Backfill around Wet Well Shaft	October	11	16
West Concrete Safe Haven Shaft # 1	February	6	31
Turn Over To East Pump Plant Crew	December	11	1
West Safe Haven Shaft #1Backfill	June	6	21
East TBM, Grout, Conveyor, Utilities & Cl	April	10	265
E&W Restore Safe Haven Shaft #1	July	6	22
Turn Over To West Pump Plant Crew	March	12	1
E&W Intervention Grout Zone # 2	October	5	85
E&W Site, Grout, & Slurry Wall Safe Have	March	6	155
East Safe Haven #2 Shaft Excavate	October	6	50
East Safe Haven Shaft #2 Concrete	December	6	31
West Safe Haven Shaft #2 Excavate	December	6	50
West Safe Haven Shaft #2 Concrete	March	7	31
E&W Intervention Grout Zone #3	October	6	88
East Backfill Safe Haven Shaft #2	August	7	21
West Backfill Safe Haven Shaft # 2	January	8	21
E&W Intervention Grout Zone # 4	February	7	85
E&W Site, Grout & Slurry Wall Recovery S	October	7	200
East Excavate Reception Shaft	August	8	102
East Recovery Shaft Concrete	December	8	49
West Recovery Excavate Shaft	December	8	102
West Recovery Concrete	May	9	49
E&W Intervention Grout Zone #5	June	7	85
Routine supply delivery for duration of const.	January	3	2,878
Tunnel Reach 4 (Intermediate Forebay to Staten Island)			
Tunnel Mob Concurent With Surface Activities	October	4	22
Setup East Launch Shaft Sta Stationing 0+00	November	4	10
East Slurry Wall Installation	August	4	77
Excavate East Launch Shaft	February	5	86
East Tie Rebar Tremie Slab	June	5	10
East Setup & place tremie Slab	July	5	6
East Pump Water From Shaft	July	5	3
East Cure Time Tremie Slab	July	5	7
East Setup & Place Work Slab	August	5	1
East Tie Rebar Thrust Ring	August	5	21
East Set breakout forms	September	5	2
East Form Thrust Ring	September	5	10
East Jet Gout Break in Break out Blocks	November	4	64
East Place Thrust Ring	September	5	7
Setup For West Launch Shaft Sta Stationing 0+00	June	5	10
West Slurry Wall Installation	November	4	77
Excavate West Launch Shaft	June	5	86
West Jet Grout Break in Break out Blocks	March	5	64
West Tie rebar Tremi Slab	October	5	10
West Setup & Place Tremi Slab	November	5	6
West Tie Rebar Thrust Ring	December	5	21

Phase	Start Month	Start Year	Days
West Breakout Ring Forms	January	6	2
West Assemble Thrust Ring Forms	January	6	3
West Set & Strip Thrust Ring Forms	January	6	10
West Place Thrust Ring Concrete	January	6	7
Excavate East Tunnel	January	6	1,425
West Pump Water From Shaft	December	5	3
West Cure Time Tremie Slab	November	5	7
East Assemble Thrust Ring Forms	September	5	3
West Working Slab	December	5	1
East Launch Shaft Backfill & Line	July	12	85
West Launch Shaft Backfill & Line	May	13	85
Muck Disposal Conveyor Set Up	November	4	36
Assemble West TBM	February	6	78
Assemble East TBM	October	5	78
Excavate West Tunnel	June	6	1,425
West Rem TBM Conveyor, Utilities, Grout &	July	12	220
Operate Muck Disposal Area	January	5	1,793
Operate Tunnel Water Treatment Plant	November	4	2,123
E& W Intervention Grout Zones Sta Stationing 48+33	June	5	88
Indirects Tunnel & Shaft	November	4	2,124
EW Grout / Slurry Wall Safe Haven Shaft S	October	5	155
Set up Docks, Berm & Work Site	November	3	256
East Excavate Safe Haven Shaft Sta Stationing 96+66	May	6	33
Excavate & Berm Muck Disposal Area	June	4	85
East Concrete Safe Haven Shaft Sta Stationing 96+66	July	6	47
Final Dress & Cleanup Muck Disposal Area	August	12	100
East Backfill Safe Haven Shaft Sta Stationing 96+66	July	7	18
Batch Plant Operations	November	4	2,244
West Excavate Safe Haven Shaft Sta Stationing 96+66	July	6	33
West Concrete Safe Haven Shaft Sta Stationing 96+66	September	6	47
East Rem TBM Conveyor, Utilities, Grout &	September	11	219
E&W Restore Safe Haven Shaft Sta Stationing 96+66	December	7	60
E&W Intervention Grout Zone Sta Stationing 148+50 +	May	6	88
West Safe Haven Backfill Sta Stationing 252+18	November	9	18
E&W Safe Haven Restoration Sta Stationing 252+18	December	9	70
E&W Intervention Grout Zone Sta Stationing 200+34	May	7	88
E&W Grout / Slurry Wall Safe Haven Sta Stationing 2	October	6	155
East Excavate Safe Haven w/ Shaft Sta Stationing 25	May	7	33
West Excavate Safe Haven W/ Shaft Sta Stationing 2	June	7	33
East Safe Haven W/ Shaft Conc Sta Stationing 252+18	June	7	47
West Safe Haven W/ Shaft Conc Sta Stationing 252+18	August	7	47
East Safe Haven Backfill Sta Stationing 252+18	July	9	18
West Backfill Safe Haven Shaft Sta Stationing 96+66	November	7	18
E&W Intervention Grout Zone Sta Stationing 309+22	September	7	88
E/W Complete Recovery Shaft Area	December	12	70
E&W Intervention Grout Zone Sta Stationing 425+38	May	8	88

Phase	Start Month	Start Year	Days
East Recovery Shaft Liner Concrete & Ba	October	11	97
E&W Intervention Grout Zone Sta Stationing 366+20	January	8	88
West Recovery Shaft Liner Concrete & Bac	August	12	97
Routine supply delivery for duration of const.	November	3	2,462
Tunnel Reach 5 (Staten Island to Bouldin Island)			
Tunnel Mob Concurent With Surface Activities	January	6	22
Grout/Slurry Wall E/W Recovery Shafts St	November	5	88
Set Up East Recovery Shaft	March	6	10
Excavate East Recovery Shaft	March	6	63
East Tie Rebar Tremie Slab	June	6	10
East Setup & place tremie Slab	July	6	6
East Pump Water From Shaft	July	6	3
East Cure Time Tremie Slab	July	6	7
East Setup & Place Work Slab	August	6	1
East Tie Rebar Thrust Ring	August	6	24
East Set breakout forms	September	6	2
East Form Thrust Ring	September	6	10
East Place Thrust Ring	September	6	7
Setup For West Recovery Shaft	June	6	10
Excavate West Recovery Shaft	July	6	63
West Tie rebar Tremi Slab	October	6	10
West Setup & Place Tremi Slab	October	6	6
West Tie Rebar Thrust Ring	November	6	24
West Breakout Ring Forms	December	6	2
West Assemble Thrust Ring Forms	December	6	3
West Set & Strip Thrust Ring Forms	December	6	10
West Place Thrust Ring Concrete	January	7	7
Excavate East Tunnel	February	7	698
West Pump Water From Shaft	November	6	3
West Cure Time Tremie Slab	November	6	7
East Assemble Thrust Ring Forms	September	6	3
West Working Slab	November	6	1
Muck Disposal Conveyor Set Up	March	6	36
Assemble West TBM	February	7	87
Assemble East TBM	October	6	87
Excavate West Tunnel	June	7	701
W Remove TBM Conveyor, Utilities, Grout &	March	10	105
Operate Muck Disposal Area	April	6	1,003
Operate Batch Plant	March	6	1,087
Operate Tunnel Water Treatment Plant	March	6	767
E& W Intervention Grout Zones Sta Stationing 668+39	March	6	88
Indirects Tunnel & Shaft	March	6	1,154
E&W Grout/Slurry WallSafe Haven Shafts St	November	6	155
Surface Mobilize Work Site	March	5	252
East Excavate Safe Haven Shaft Sta Stationing 577+/	July	7	32
Excavate & Berm Muck Disposal Area	October	5	85

Phase	Start Month	Start Year	Days
East Concrete Safe Haven Shaft Sta Stationing 577+/	August	7	41
Final Dress & Cleanup Muck Disposal Area	April	10	80
East Backfill Safe Haven Shaft Sta Stationing 577 +	October	8	17
West Excavate Safe Haven Shaft Sta Stationing 577 +	August	7	32
West Backfille Safe Haven Shaft Sta Stationing 577	February	9	17
E Remove TBM Conveyor, Utilities, Grout &	November	9	105
E&W Restore Safe Haven Shaft Sta Stationing 577+/-	March	9	22
E&W Intervention Grout Zone Sta Stationing 622+60	July	6	88
E&W Intervention Grout Zone Sta Stationing 529+90	July	7	88
West Concrete Safe Haven Shaft Sta Stationing 577 +	October	7	41
Routine supply delivery for duration of const.	March	5	1,503
Tunnel Reach 6 (Bouldin Island to Bacon Island)			
Tunnel Mob Concurent With Surface Activities	January	5	22
Setup East Launch Shaft	March	5	10
East Launch Shaft Slurry Wall Installation	November	4	77
Excavate East Launch Shaft	March	5	56
East Tie Rebar Tremie Slab	June	5	10
East Setup & place tremie Slab	June	5	6
East Pump Water From Shaft	July	5	3
East Cure Time Tremie Slab	June	5	7
East Muck / Service Shaft Slurry Wall & J	February	5	111
East Setup & Place Work Slab	July	5	2
East Tie Rebar Thrust Ring	July	5	22
East Set breakout forms	August	5	2
East Form Thrust Ring	August	5	10
East launch Jet Gout Break in Break out	February	5	64
East Muck/ Service Excav & Concrete	June	5	74
East Place Thrust Ring	September	5	6
Setup For West Launch Shaft	June	5	10
West Launch Shaft Slurry Wall Installation	February	5	77
Excavate West Launch Shaft	June	5	56
West Launch Jet Grout Break in Break out	May	5	64
West Tie rebar Tremi Slab	September	5	10
West Setup & Place Tremi Slab	October	5	6
West Tie Rebar Thrust Ring	October	5	22
West Breakout Ring Forms	November	5	2
West Assemble Thrust Ring Forms	December	5	3
West Set & Strip Thrust Ring Forms	December	5	10
West Place Thrust Ring Concrete	December	5	6
Excavate East Tunnel	January	6	1,325
West Pump Water From Shaft	October	5	3
West Cure Time Tremie Slab	October	5	7
East Assemble Thrust Ring Forms	August	5	3
West Working Slab	October	5	20
West Muck / Service Shaft Slurry Wall &	June	5	111
East Muck / Service Shaft Backfill	April	12	26

Phase	Start Month	Start Year	Days
West Muck / Service Excavate & Concrete	September	5	74
West Muck / Service Shaft Backfill	August	12	28
Muck Disposal Conveyor Set Up	March	5	36
East Launch Shaft Liner & Back fill	May	10	49
West Launch Shaft Liner & Backfill	August	10	49
East Launch Shaft Area Complete Pad	June	12	18
West Launch Shaft Area Complete Pad	September	12	18
Assemble West TBM	December	5	87
Assemble East TBM	September	5	87
Excavate West Tunnel	May	6	1,325
West Rem TBM Conveyor, Utilities, Grout &	July	11	264
Operate Muck Disposal Area	April	5	1,595
Operate Tunnel Water Treatment Plant	March	5	1,881
E& W Intervention Grout Zones Sta Stationing 756 +/	August	5	88
Indirects Tunnel & Shaft	March	5	1,917
E&W Grout & Slurry Wall Safe Haven Shafts	January	6	155
Set up Docks, Berm & Work Site	March	4	252
East Excavate Safe Haven Shaft Sta Stationing 796 +	August	6	32
Excavate & Berm Muck Disposal Area	October	4	85
East Concrete Safe Haven Shaft Sta Stationing 796 +	September	6	42
Final Dress & Cleanup Muck Disposal Area	August	11	100
East Backfill Safe Haven Shaft Sta Stationing 796+/	March	7	18
Operate Batch Plant	March	5	1,261
West Excavate Safe Haven Shaft Sta Stationing 796 +	September	6	32
West Concrete Safe Haven Shaft Sta Stationing 796 +	November	6	42
West Backfille Safe Haven Shaft Sta Stationing 796	July	7	18
East Rem TBM Conveyor, Utilities, Grout &	April	11	268
E&W Restore Safe Haven Shaft Sta Stationing 796 +/	August	7	22
E&W Intervention Grout Zone Sta Stationing 845 +/-	August	6	88
E&W Grout & Slurry Wall Safe Haven Shaft	December	6	155
East Excavate Safe Haven Shaft Sta Stationing 894+/	July	7	32
East Safe Haven Concrete Sta Stationing 894+/-	September	7	42
East Backfill Safe Haven Sta Stationing 894 +/-	November	7	18
W Excavate safe Haven Shaft Sts tioning 894+/-	September	7	32
West Concrete Safe Haven Sta Stationing 894 +/-	October	7	42
West Backfill Safe Haven Sta Stationing 894+/-	March	8	18
E&W Restore Surface Safe Haven Sta Stationing 894	March	8	22
E&W Intervention Grout Zone Sta Stationing 947 +/-	July	7	88
E&W Intervention Grout Zone STA Stationing 1000 +/-	December	7	88
E&W Intervention Grout Zone Sta Stationing 1052 +/-	April	8	88
E&W Intervention Grout Zone Sta Stationing 1105+/-	August	8	88
E/W Complete Recovery Shaft Area	January	12	70
East Recovery Shaft Liner Concrete & Ba	July	11	49
West Recovery Shaft Liner Concrete & Bac	October	11	49
Routine supply delivery for duration of const.	March	4	2,141

Tunnel Reaches 1, 2, and 3 (Intakes to Intermediate Forebay)

Phase	Start Month	Start Year	Days
Tunnel Mob Concurent With Surface Activities	May	4	22
Setup Reach # 2 Launch Shaft Sta Stationing 0+00	July	4	10
Reach # 2 Slurry Wall Installation	March	4	77
Excavate Reach # 2 Launch Shaft	September	4	86
Reach # 2 Tie Rebar Tremie Slab	January	5	10
Reach # 2 Setup & place tremie Slab	February	5	6
Reach # 2 Pump Water From Shaft	February	5	3
Reach # 2 Cure Time Tremie Slab	February	5	7
Reach # 2 Setup & Place Work Slab	March	5	1
Reach # 2 Tie Rebar Thrust Ring	March	5	21
Reach # 2 Set breakout forms	April	5	2
Reach # 2 Form Thrust Ring	April	5	10
Reach # 2 Jet Gout Break in Break out Bl	June	4	64
Reach # 2 Place Thrust Ring	April	5	7
Setup For Reach #3 Launch Shaft Sta Stationing 0+00	January	5	10
Reach #3 Slurry Wall Installation	June	4	77
Excavate Reach # 3 Launch Shaft	January	5	86
Reach # 3 Jet Grout Break in Break out B	October	4	64
Reach # 3 Tie rebar Tremi Slab	May	5	10
Reach # 3 Setup & Place Tremi Slab	June	5	6
Reach # 3 Tie Rebar Thrust Ring	July	5	21
Reach # 3 Breakout Ring Forms	August	5	2
Reach # 3 Assemble Thrust Ring Forms	August	5	3
Reach # 3 Set & Strip Thrust Ring Forms	August	5	10
Reach # 3 Place Thrust Ring Concrete	August	5	7
Excavate Reach # 2 Tunnel	August	5	1,078
Reach # 3 Pump Water From Shaft	June	5	3
Reach # 3 Cure Time Tremie Slab	June	5	7
Reach # 2 Assemble Thrust Ring Forms	April	5	3
Reach # 3 Working Slab	July	5	1
Reach # 2 Launch Shaft Backfill & Line	February	12	85
Reach # 3 Launch Shaft Backfill & Line	July	8	85
Reach 2 3 Turnover To Complete Launch Sh	June	12	1
Muck Disposal Conveyor Set Up	July	4	36
Assemble Reach # 3 TBM	August	5	63
Assemble Reach #2 TBM	May	5	78
Reassemble 28 Ft TBM Reach # 1	January	10	50
Excavate Reach # 3 Tunnel	November	5	564
Reach 3 Rem TBM Conveyor, Utilities, Grout	February	8	102
Excavate Reach # 1 Tunnel	April	10	260
Remove Reach #1-#2 TBM, Conveyor, Grout e	April	11	204
Operate Muck Disposal Area	August	4	1,716
Operate Tunnel Water Treatment Plant	July	4	2,009
Reach # 2 Intervention Grout Zones Sta Stationing 4	January	5	44
Indirects Tunnel & Shaft	July	4	2,010
Reach #2 Grout / Wall Safe Haven Shaft S	March	5	77

Phase	Start Month	Start Year	Days
Set up Docks, Berm & Work Site	July	3	253
Reach # 2 Excavate Safe Haven Shaft Sta	July	5	33
Excavate & Berm Muck Disposal Area	March	4	85
Reach #2 Concrete Safe Haven Sta Stationing 98+79	August	5	45
Final Dress & Cleanup Muck Disposal Area	May	11	100
Reach # 2 Backfill Safe Haven Shaft Sta	November	6	18
Batch Plant Operations	July	4	2,009
Reach # 3 Grout/Wall Safe Haven Shaft St	July	5	77
Reach # 3 Excavate Safe Haven Shaft Sta	October	5	47
Reach # 2 Remove TBm & Trailing Gear	November	9	43
Reach 2 & 3 Restore Safe Haven Shaft St	December	6	60
Reach # 2 Intervention Grout Zone Sta Stationing 20	May	5	44
Reach # 2 Grout /Wall Safe Haven W/ Shaft	October	5	77
Reach #3 Concrete Safe Haven Shaft Sta	December	5	45
Reach # 3 Backfill Safe Haven Sta Stationing 147+47	May	7	18
Reach 2&3 Restore Safe Haven @ Sta Stationing 148+/	May	7	60
Reach # 2 Intervention Grout Zone Sta Stationing 30	November	5	44
Reach # 2 turnover Junction Shaft to surf	July	11	1
Reach # 2 Intervention Grout Zone Sta Stationing 254	September	5	44
Reach # 2 Excavate safe Haven Shaft Sta	March	6	33
Reach # 3 Excavate Safe Haven Sta Stationing 147+47	July	6	46
Reach # 2 Concrete Safe Haven Shaft Sta	April	6	45
Reach # 3 Safe Haven Conc Sta Stationing 147+47	September	6	50
Reach #2 Backfill Safe Haven Sta Stationing 148+18	June	7	18
Reach # 3 Backfill Safe Haven Shaft Sta	November	6	18
reach # 3 Intervention Grout Zone Sta Stationing 49	March	5	44
Reach #3 Backfill Safe Haven Shaft Sts 1	May	7	18
Reach # 3 Intervention Grout Zone Sta Stationing 19	July	5	44
Reach # 1 Intervention Grout Zone Sta Stationing 41	January	6	44
Reach #2-1 Junction Shaft Excav/Conc Com	April	7	150
Reach #3 Recovery Shaft Excavation & Co	August	6	76
Reach # 1 Recovery Shaft Lining / B'fill	July	11	52
Reach # 3 Recovery Shaft Lining & B'fill	May	8	52
Reach # 3 Grout/Wall SafeHaven 147+47	February	6	102
Reach # 2 Grout & Wall Junction Shaft St	December	6	86
Reach # 1 Recovery Shaft Grout & Wall	April	7	109
Reach # 3 Recovery Shaft Grout & Wall	March	6	109
Reach # 1 Recovery Shaft Exacavation & Co	November	7	76
Routine supply delivery for duration of const.	July	3	2,164
Utilities			
Intake 2 Temporary Power 69kV	September	8	325
Intermediate Forebay to Intake 3 Temporary Power 69kV	July	4	325
Intermediate Forebay to intake 5 Temporary Power 69kV	January	7	325
Intermediate Forebay to Staten Temporary Power 230/115kV	September	2	520
Bouldin to Staten Temporary Power 230/115 kV	August	3	325
Bouldin to Bacon Temporary Power 230/115 kV	August	3	325

Phase	Start Month	Start Year	Days
Clifton Court to Bacon Temporary Power 230 kV	August	2	325
Repurposing Temporary Lines to Permanent	January	12	128
Equipment and material delivery (power, intake 2)	September	8	325
Equipment and material delivery (power, intake 3)	July	4	325
Equipment and material delivery (power, intake 5)	January	7	325
Equipment and material delivery (power, IF)	September	2	520
Equipment and material delivery (power, reach 5)	August	3	325
Equipment and material delivery (power, reach 6)	August	3	325
Equipment and material delivery (power, reach 7)	August	2	325
Equipment and material delivery (power, CCF)	January	12	128

Table 3C-2138. Alternative 4 (Modified Pipeline/Tunnel Alignment) Construction Schedule

Tunnel							
Reach #1							
Retrieval Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Muck Disposal Shafts			
Muck Disposal Shafts	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Load & Haul excavated materials	July	Year 4	244.33
23' ID Tunnel 115+00 => 267+00 *				33 ft Tunnel A *			
Set Up For Tunnel Excavation	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Set Up For Tunnel Excavation	July	Year 4	6.00
TBM & Vertical Conv. Assy.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			TBM & Vertical Conv. Assy.	April	Year 4	83.00
Mine 26' Tunnel	December	Year 4	342	Mine 37' Tunnel	July	Year 4	1302
Tunnel Mining Surface Support	December	Year 5	503.00	Tunnel Mining Surface Support	July	Year 4	1562
Sunday Maint.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Sunday Maint	November	Year 7	29.33
Remove TBM @ Launch Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			TBM Removal @ Retrieval Shaft	February	Year 8	2.00
Grout	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Grout Leakage	November	Year 7	87.00
Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	February	Year 8	70.00
Final Lining over TBM Skin	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Equip Op Cost 24/7	April	Year 4	1452.33
Equip Op Cost 24/7	Same as Pipeline Tunnel Alignment (see Table 3C-14)			33 ft Tunnel B *			
Muck Disposal Tunnel	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Set Up For Tunnel Excavation	August	Year 4	6.00
Reach #2				TBM & Vertical Conv. Assy.	August	Year 4	83.00
Launch Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Mine 37' Tunnel	November	Year 4	1302
Intermediate Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Tunnel Mining Surface Support	November	Year 4	1562
Retrieval Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Sunday Maint	March	Year 8	29.33
Muck Disposal Shafts	Same as Pipeline Tunnel Alignment (see Table 3C-14)			TBM Removal @ Retrieval Shaft	May	Year 8	2.00
33 ft Tunnel *				Grout Leakage	March	Year 8	87.00
Set Up For Tunnel Excavation	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	May	Year 8	70.00
TBM & Vertical Conv. Assy.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Equip Op Cost 24/7	August	Year 4	1452.33
Mine 37' Tunnel	March	Year 4	827	Muck Disposal Tunnels			
Tunnel Mining Surface Support	March	Year 4	959.33	Muck Disposal	March	Year 4	342.00
Sunday Maint.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Reach #6			
Remove TBM @ Retrieval Shaft	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Launch Shaft A			
Grout Leakage	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Excavate and Support Shaft	October	Year 2	30.00
Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Invert work slab	January	Year 3	2.67

Tunnel							
Equip Op Cost 24/7	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Shaft Invert & Wall Rebar	January	Year 3	7.33
Muck Disposal Tunnel	Same as Pipeline Tunnel Alignment (see Table 3C-14)			Place invert slab	January	Year 3	1.00
Reach #3				Form Shaft Walls	January	Year 3	6.00
Launch Shaft				Place Shaft Walls	January	Year 3	2.00
Excavate and Support Shaft	February	Year 3	30	Clean Shaft Invert	January	Year 3	1.00
Invert work slab	December	Year 2	3	Shaft Tunnel Invert Pour	January	Year 3	0.67
Shaft Invert & Wall Rebar	February	Year 3	7	Tunnel & Riser Rebar	January	Year 3	6.00
Place invert slab	February	Year 3	1	Tunnel & Riser Forms	January	Year 3	9.67
Form Shaft Walls	February	Year 3	6	Place tunnel & Riser concrete	March	Year 3	1.67
Place Shaft Walls	February	Year 3	2	Controlled Density Fill	April	Year 3	14.00
Clean Shaft Invert	February	Year 3	1	Launch Shaft B			
Shaft Tunnel Invert Pour	February	Year 3	1	Excavate and Support Shaft	August	Year 2	30.00
Tunnel & Riser Rebar	February	Year 3	6	Invert work slab	November	Year 2	2.67
Tunnel & Riser Forms	February	Year 3	10	Shaft Invert & Wall Rebar	February	Year 3	7.33
Place tunnel & Riser concrete	February	Year 3	2	Place invert slab	February	Year 3	1.00
Controlled Density Fill/Backfill	April	Year 3	14	Form Shaft Walls	February	Year 3	6.00
Intermediate Shaft				Place Shaft Walls	February	Year 3	2.00
Form & Place Shaft Collar	December	Year 3	1	Clean Shaft Invert	February	Year 3	1.00
Excavate and build tunnel / shaft collar	November	Year 3	3	Tunnel & Riser Rebar	February	Year 3	6.00
Install ladder / Vent & Cover	December	Year 3	1	Tunnel & Riser Forms	February	Year 3	9.67
Backfill Shaft	January	Year 4	3	Place tunnel & Riser concrete	April	Year 3	1.67
Retrieval Shaft				Controlled Density Fill	June	Year 3	14.00
Excavate Retrieval Shafts	September	Year 2	2	Intermediate Shaft A			
Invert prep	October	Year 2	5	Form & Place Shaft Collar	January	Year 4	1.33
Invert Rebar	October	Year 2	5	Excavate and build tunnel / shaft collar	December	Year 3	3.00
Place invert slab	January	Year 3	8	Install ladder / Vent & Cover	January	Year 4	0.67
Clean Shaft Invert	January	Year 3	8	Backfill Shaft	January	Year 4	2.67
Tunnel Forms	January	Year 3	8	Intermediate Shaft B			
Tunnel Rebar	January	Year 3	8	Form & Place Shaft Collar	March	Year 4	1.33
Place tunnel concrete	January	Year 3	8	Excavate and build tunnel / shaft collar	February	Year 4	3.00
Controlled Density Fill	January	Year 3	8	Install ladder / Vent & Cover	March	Year 4	0.67
Muck Disposal Shafts				Backfill Shaft	March	Year 4	2.67

Tunnel							
Load & Haul excavated materials	February	Year 3	244	Retrieval Shaft			
33 ft Tunnel *				Excavate Retrieval Shafts	August	Year 4	8.00
Set Up For Tunnel Excavation	February	Year 4	6	Invert prep	June	Year 4	0.67
TBM & Vertical Conv. Assy.	February	Year 4	76	Invert Rebar	June	Year 4	0.67
Mine 37' Tunnel	April	Year 4	623	Place invert slab	September	Year 4	0.33
Tunnel Mining Surface Support	June	Year 4	503	Clean Shaft Invert	September	Year 4	1.00
Sunday Maint	May	Year 7	11	Tunnel Rebar	September	Year 4	1.46
TBM Removal @ Retrieval Shaft	August	Year 7	2	Tunnel Forms	September	Year 4	4.00
Grout Leakage	May	Year 7	38	Place tunnel concrete	September	Year 4	1.00
Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	August	Year 7	33	Controlled Density Fill	September	Year 4	5.52
Final Lining over TBM Skin	July	Year 7	4	Muck Disposal Shafts			
Equip Op Cost 24/7	February	Year 4	611	Load & Haul excavated materials	November	Year 4	199.33
Muck Disposal Tunnels				33 ft Tunnel A *			
Muck Disposal	April	Year 8	317	Set Up For Tunnel Excavation	February	Year 4	6.00
Reach #4				TBM & Vertical Conv. Assy.	February	Year 4	76.00
Launch Shaft A				Mine 37' Tunnel	April	Year 4	1344
Excavate and Support Shaft	July	Year 2	30.00	Tunnel Mining Surface Support	April	Year 4	1613
Invert work slab	October	Year 2	2.67	Sunday Maint	September	Year 7	27.00
Shaft Invert & Wall Rebar	December	Year 2	7.33	TBM Removal @ Retrieval Shaft	September	Year 7	8.67
Place invert slab	December	Year 2	1.00	Grout Leakage	August	Year 7	83.00
Form Shaft Walls	January	Year 3	6.00	Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	September	Year 7	68.00
Place Shaft Walls	January	Year 3	2.00	Final Lining over TBM Skin	September	Year 7	4.00
Clean Shaft Invert	January	Year 3	1.00	Equip Op Cost 24/7	February	Year 4	1500.00
Shaft Tunnel Invert Pour	January	Year 3	0.67	33 ft Tunnel B *			
Tunnel & Riser Rebar	January	Year 3	6.00	Set Up For Tunnel Excavation	May	Year 4	6.00
Tunnel & Riser Forms	January	Year 3	9.67	TBM & Vertical Conv. Assy.	May	Year 4	76.00
Place tunnel & Riser concrete	January	Year 3	1.67	Mine 37' Tunnel	July	Year 4	1344
Controlled Density Fill	February	Year 3	14.00	Tunnel Mining Surface Support	July	Year 4	1613
Launch Shaft B				Sunday Maint	November	Year 7	27.33
Excavate and Support Shaft	July	Year 2	30.00	TBM Removal @ Retrieval Shaft	January	Year 8	8.67
Invert work slab	October	Year 2	2.67	Grout Leakage	November	Year 7	83.00
Shaft Invert & Wall Rebar	January	Year 3	7.33	Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	January	Year 8	68.00

Tunnel							
Place Invert Slab	January	Year 3	1.00	Final Lining over TBM Skin	January	Year 8	4.00
Form Shaft Walls	January	Year 3	6.00	Equip Op Cost 24/7	May	Year 4	1,500.00
Place Shaft Walls	January	Year 3	2.00	Muck Disposal Tunnels			
Clean Shaft Invert	January	Year 3	1.00	Muck Disposal	April	Year 8	327.00
Shaft Tunnel Invert Pour	January	Year 3	0.67	Reach #7			
Tunnel & Riser Rebar	January	Year 3	6.00	Launch Shaft A			
Tunnel & Riser Forms	January	Year 3	9.67	Excavate and Support Shaft	December	Year 2	30.00
Place tunnel & Riser concrete	February	Year 3	1.67	Invert work slab	October	Year 2	2.67
Controlled Density Fill	March	Year 3	14.00	Shaft Invert & Wall Rebar	January	Year 3	7.33
Intermediate Shaft A				Place invert slab	January	Year 3	1.00
Form & Place Shaft Collar	November	Year 3	1.33	Form Shaft Walls	January	Year 3	6.00
Excavate and build tunnel / shaft collar	October	Year 3	3.00	Place Shaft Walls	January	Year 3	2.00
Install ladder / Vent & Cover	November	Year 3	0.67	Clean Shaft Invert	January	Year 3	1.00
Backfill Shaft	November	Year 3	2.67	Shaft Tunnel Invert Pour	January	Year 3	0.67
Intermediate Shaft B				Tunnel & Riser Rebar	January	Year 3	6.00
Form & Place Shaft Collar	November	Year 3	1.33	Tunnel & Riser Forms	January	Year 3	9.67
Excavate and build tunnel / shaft collar	October	Year 3	6.67	Place tunnel & Riser concrete	March	Year 3	1.67
Tunnel / Shaft Collar	November	Year 3	3.00	Controlled Density Fill	April	Year 3	14.00
Install ladder / Vent & Cover	November	Year 3	0.67	Launch Shaft B			
Backfill	November	Year 3	2.67	Excavate and Support Shaft	February	Year 3	30.00
Retrieving Shaft A				Invert work slab	December	Year 2	2.67
Excavate Retrieval Shafts	March	Year 4	8.00	Shaft Invert & Wall Rebar	February	Year 3	7.33
Invert prep	April	Year 4	0.67	Place invert slab	February	Year 3	1.00
Invert Rebar	April	Year 4	0.67	Form Shaft Walls	February	Year 3	6.00
Place invert slab	July	Year 4	0.33	Place Shaft Walls	February	Year 3	2.00
Clean Shaft Invert	July	Year 4	0.33	Clean Shaft Invert	February	Year 3	1.00
Elbow & Riser Forms	July	Year 4	8.67	Shaft Tunnel Invert Pour	February	Year 3	0.67
Elbow & Riser Rebar	July	Year 4	9.33	Tunnel & Riser Rebar	February	Year 3	6.00
Place Elbow & Riser concrete	July	Year 4	2.33	Tunnel & Riser Forms	February	Year 3	9.67
Controlled Density Fill	July	Year 4	2.67	Place tunnel & Riser concrete	April	Year 3	1.67
Retrieving Shaft B				Controlled Density Fill	June	Year 3	14.00
Excavate Retrieval Shafts	May	Year 4	8.00	Intermediate Shaft A			

Tunnel							
Invert prep	May	Year 4	0.67	Form & Place Shaft Collar	December	Year 3	1.33
Invert Rebar	May	Year 4	0.67	Excavate and build tunnel / shaft collar	November	Year 3	3.00
Place invert slab	September	Year 4	0.33	Install ladder / Vent & Cover	December	Year 3	0.67
Clean Shaft Invert	September	Year 4	0.33	Backfill Shaft	December	Year 3	2.67
Elbow & Riser Forms	September	Year 4	8.67	Intermediate Shaft B			
Elbow & Riser Rebar	September	Year 4	9.33	Form & Place Shaft Collar	March	Year 4	1.33
Place Elbow & Riser concrete	September	Year 4	2.33	Excavate and build tunnel / shaft collar	February	Year 4	3.00
Controlled Density Fill	September	Year 4	2.67	Install ladder / Vent & Cover	March	Year 4	0.67
Muck Disposal Shafts				Backfill Shaft	March	Year 4	2.67
Load & Haul excavated materials	October	Year 4	322.67	Retrieval Shaft A			
33 ft Tunnel A *				Excavate Retrieval Shafts	April	Year 4	1.67
Set Up For Tunnel Excavation	January	Year 4	6.00	Invert prep	May	Year 4	5.00
Mine 37' Tunnel	March	Year 4	1,027	Invert Rebar	May	Year 4	5.00
Tunnel Mining Surface Support	March	Year 4	1,232	Place invert slab	May	Year 4	8.00
Sunday Maint	September	Year 6	22.00	Clean Shaft Invert	May	Year 4	8.00
TBM Removal @ Retrieval Shaft	October	Year 6	8.67	Tunnel Forms	May	Year 4	8.00
Grout Leakage	October	Year 6	66.00	Tunnel Rebar	May	Year 4	8.00
Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	October	Year 6	52.00	Place tunnel concrete	May	Year 4	8.00
Equip Op Cost 24/7	January	Year 4	1130.33	Controlled Density Fill	August	Year 4	8.00
33 ft Tunnel B *				Retrieval Shaft B			
Set Up For Tunnel Excavation	February	Year 4	6.00	Excavate Retrieval Shafts	June	Year 4	1.67
TBM & Vertical Conv. Assy.	February	Year 4	83.00	Invert prep	August	Year 4	5.00
Mine 37' Tunnel	March	Year 4	1,027	Invert Rebar	August	Year 4	5.00
Tunnel Mining Surface Support	March	Year 4	1,232	Place invert slab	November	Year 4	8.00
Sunday Maint	January	Year 7	22.00	Clean Shaft Invert	November	Year 4	8.00
TBM Removal @ Retrieval Shaft	January	Year 7	8.67	Tunnel Forms	November	Year 4	8.00
Grout Leakage	April	Year 7	66.00	Tunnel Rebar	November	Year 4	8.00
Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	January	Year 7	52.00	Place tunnel concrete	November	Year 4	8.00
Equip Op Cost 24/7	February	Year 4	1130.33	Controlled Density Fill	November	Year 5	8.00
Muck Disposal Tunnels							
Muck Disposal	May	Year 7	266.33	Muck Disposal Shafts			

Tunnel							
Reach #5				Load & Haul excavated materials	November	Year 4	244.33
Launch Shaft A				33 ft Tunnel A *			
Excavate and Support Shaft	July	Year 2	30.00	Set Up For Tunnel Excavation	May	Year 4	6.00
Shaft Invert & Wall Rebar	November	Year 2	7.33	TBM & Vertical Conv. Assy.	May	Year 4	76.00
Place invert slab	November	Year 2	1.00	Mine 37' Tunnel	July	Year 4	1345
Form Shaft Walls	November	Year 2	6.00	Tunnel Mining Surface Support	July	Year 4	1614
Place Shaft Walls	November	Year 2	2.00	Sunday Maint	September	Year 7	26.67
Clean Shaft Invert	November	Year 2	1.00	TBM Removal @ Retrieval Shaft	November	Year 7	8.67
Shaft Tunnel Invert	November	Year 2	0.67	Grout Leakage	September	Year 7	83.00
Tunnel & Riser Rebar	November	Year 2	6.00	Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	November	Year 7	68.00
Tunnel & Riser Forms	January	Year 3	9.67	Equip Op Cost 24/7	May	Year 4	1373.06
Place tunnel & Riser concrete	February	Year 3	1.67	33 ft Tunnel B *			
Controlled Density Fill	March	Year 3	14.00	Set Up For Tunnel Excavation	August	Year 4	6.00
Launch Shaft B				TBM & Vertical Conv. Assy.	October	Year 4	1345
Excavate and Support Shaft	July	Year 2	30.00	Mine 37' Tunnel	October	Year 4	1614
Invert work slab	November	Year 2	2.67	Tunnel Mining Surface Support	December	Year 4	1177.00
Shaft Invert & Wall Rebar	January	Year 3	7.33	Sunday Maint	January	Year 8	26.67
Place invert slab	January	Year 3	1.00	TBM Removal @ Retrieval Shaft	January	Year 8	8.67
Form Shaft Walls	January	Year 3	6.00	Grout Leakage	January	Year 8	83.00
Place Shaft Walls	January	Year 3	2.00	Remove Rail, Utilities, TBM, Ventilation, and Clean Tun.	January	Year 8	68.00
Clean Shaft Invert	January	Year 3	1.00	Equip Op Cost 24/7	August	Year 4	1373.00
Shaft Tunnel Invert Pour	January	Year 3	0.67	Muck Disposal Tunnels			
Tunnel & Riser Rebar	January	Year 3	6.00	Muck Disposal	May	Year 8	322.00
Tunnel & Riser Forms	January	Year 3	9.67				
Place tunnel & Riser concrete	March	Year 3	1.67				
Controlled Density Fill	May	Year 3	14.00				
Intermediate Shaft A							
Form & Place Shaft Collar	December	Year 3	1.33				
Excavate and build tunnel / shaft collar	December	Year 3	3.00				
Install ladder / Vent & Cover	December	Year 3	0.67				
Backfill Shaft	December	Year 3	2.67				
Intermediate Shaft B							

Tunnel								
Form & Place Shaft Collar	November	Year 3	1.33					
Excavate and build tunnel / shaft collar	November	Year 3	3.00					
Install ladder / Vent & Cover	November	Year 3	0.67					
Backfill	December	Year 3	2.67					
Retrieving Shaft A								
Excavate Retrieval Shafts	May	Year 4	8.00					
Invert prep	June	Year 4	0.67					
Invert Rebar	June	Year 4	0.67					
Place invert slab	September	Year 4	0.33					
Clean Shaft Invert	September	Year 4	1.00					
Elbow & Riser Forms	September	Year 4	1.46					
Elbow & Riser Rebar	September	Year 4	4.00					
Place Elbow & Riser concrete	September	Year 4	1.00					
Controlled Density Fill	September	Year 4	5.52					
Retrieving Shaft B								
Excavate Retrieval Shafts	May	Year 4	8.00					
Invert prep	June	Year 4	0.67					
Invert Rebar	June	Year 4	0.67					
Place invert slab	September	Year 4	0.33					
Clean Shaft Invert	September	Year 4	1.00					
Elbow & Riser Forms	September	Year 4	0.67					
Elbow & Riser Rebar	September	Year 4	1.46					
Place Elbow & Riser concrete	September	Year 4	4.00					
Controlled Density Fill	September	Year 4	1.00					
* Tunnel size for modeling purposes only. Please refer to tables above for actual tunnel diameters.								

Table 3C-2239. Alternative 4 (Modified Pipeline/Tunnel Alignment) Construction Schedule

Siphons							
Main Tunnel Siphon				Phase 2	March	Year 6	20
Phase 1				Clearing & Grubbing / Demolition	March	Year 6	477
Clearing & Grubbing / Demolition	June	Year 3	20	Dewatering / Unwatering	March	Year 6	507
Dewatering / Unwatering	July	Year 3	448	Erosion & Sediment Control BMP's	April	Year 6	60

Siphons							
Erosion & Sediment Control BMP's	July	Year 3	478	Sheetpile Cell	September	Year 6	33
Sheetpile Cell	July	Year 3	60	Excavation	October	Year 6	24
Excavation	February	Year 5	25	Pile Installation	October	Year 6	32
Pile Installation	March	Year 5	15	Slab On Grade	November	Year 6	52
Slab On Grade	April	Year 5	20	Siphon Walls	February	Year 7	32
Siphon Walls	May	Year 5	33	Siphon Roof	February	Year 7	58
Siphon Roof	June	Year 5	20	Backfill & Embankments	May	Year 7	21
Backfill & Embankments	July	Year 5	39	Waterway Reconstruction	June	Year 7	170
Waterway Reconstruction	August	Year 5	21	Inlet & Outlet Transition Structure			
Inlet & Outlet Transition Structure	September	Year 5	170	Upstream & Downstream Transitions	May	Year 5	4
Upstream & Downstream Transitions				Excavation/Grading	May	Year 5	2
Excavation/Grading	September	Year 5	4	Place Gravel Bedding	May	Year 5	30
Place Gravel Bedding	September	Year 5	2	Place Invert Slab Concrete:Plant & Operations	June	Year 5	7
Place Invert Slab Concrete:Plant & Operations	September	Year 5	30	Place Invert Slab Concrete:Placing Crews	June	Year 5	7
Place Invert Slab Concrete:Placing Crews	October	Year 5	7	Place Invert Slab Concrete:Finish	July	Year 5	3
Place Invert Slab Concrete:Finish	October	Year 5	7	Place Invert Slab Concrete:Point and Patch	July	Year 5	3
Place Invert Slab Concrete:Point and Patch	November	Year 5	3	Place Invert Slab Concrete:Treat CJ	July	Year 5	49
Place Invert Slab Concrete:Treat CJ	November	Year 5	3	Place Invert Slab Concrete:Cure & Cleanup	August	Year 5	18
Place Invert Slab Concrete:Cure & Cleanup	November	Year 5	49	Place Invert Slab Concrete:Formwork	June	Year 5	60
Place Invert Slab Concrete:Formwork	December	Year 5	18	Place Wall Concrete:Plant & Operations	June	Year 5	20
Place Wall Concrete:Plant & Operations	October	Year 5	60	Place Wall Concrete:Placing Crews	June	Year 5	6
Place Wall Concrete:Placing Crews	October	Year 5	20	Place Wall Concrete:Point and Patch	July	Year 5	6
Place Wall Concrete:Point and Patch	October	Year 5	6	Place Wall Concrete:Treat CJ	July	Year 5	4
Place Wall Concrete:Treat CJ	December	Year 5	6	Place Wall Concrete:Cure & Cleanup	July	Year 5	60
Place Wall Concrete:Cure & Cleanup	December	Year 5	4	Place Wall Concrete:Formwork	October	Year 5	2
Place Wall Concrete:Formwork	December	Year 5	60	Backfill (Including Embankment)			-
Backfill (Including Embankment)	February	Year 6	2	Upstream & Downstream Control Structures	July	Year 5	3
Upstream & Downstream Control Structures			-	Excavation/Grading	July	Year 5	1
Excavation/Grading	November	Year 5	3	Place Gravel Bedding	July	Year 5	15
Place Gravel Bedding	November	Year 5	1	Drive Foundation Piles	August	Year 5	15
Drive Foundation Piles	November	Year 5	15	Place Invert Slab Concrete:Plant & Operations	August	Year 5	4
Place Invert Slab Concrete:Plant & Operations	December	Year 5	15	Place Invert Slab Concrete:Placing Crews	August	Year 5	4
Place Invert Slab Concrete:Placing Crews	December	Year 5	4	Place Invert Slab Concrete:Finish	August	Year 5	1

~~Siphons~~							
~~Place Invert Slab Concrete:Finish~~	~~December~~	~~Year 5~~	~~4~~	~~Place Invert Slab Concrete:Point and Patch~~	~~August~~	~~Year 5~~	~~1~~
~~Place Invert Slab Concrete:Point and Patch~~	~~December~~	~~Year 5~~	~~1~~	~~Place Invert Slab Concrete:Treat CJ~~	~~August~~	~~Year 5~~	~~10~~
~~Place Invert Slab Concrete:Treat CJ~~	~~December~~	~~Year 5~~	~~1~~	~~Place Invert Slab Concrete:Cure & Cleanup~~	~~August~~	~~Year 5~~	~~5~~
~~Place Invert Slab Concrete:Cure & Cleanup~~	~~December~~	~~Year 5~~	~~10~~	~~Place Invert Slab Concrete:Formwork~~	~~September~~	~~Year 5~~	~~20~~
~~Place Invert Slab Concrete:Formwork~~	~~December~~	~~Year 5~~	~~5~~	~~Place Wall Concrete:Plant & Operations~~	~~September~~	~~Year 5~~	~~6~~
~~Place Wall Concrete:Plant & Operations~~	~~January~~	~~Year 6~~	~~20~~	~~Place Wall Concrete:Placing Crews~~	~~September~~	~~Year 5~~	~~12~~
~~Place Wall Concrete:Placing Crews~~	~~January~~	~~Year 6~~	~~6~~	~~Place Wall Concrete:Point and Patch~~	~~October~~	~~Year 5~~	~~15~~
~~Place Wall Concrete:Point and Patch~~	~~January~~	~~Year 6~~	~~12~~	~~Place Wall Concrete:Cure & Cleanup~~	~~October~~	~~Year 5~~	~~3~~
~~Place Wall Concrete:Cure & Cleanup~~	~~February~~	~~Year 6~~	~~15~~	~~Backfill (Including Embankment)~~	~~February~~	~~Year 8~~	~~30~~
~~Backfill (Including Embankment)~~	~~February~~	~~Year 6~~	~~3~~	~~Remove Sheetpiles~~	~~February~~	~~Year 8~~	~~30~~
~~Remove Sheetpiles~~	~~June~~	~~Year 6~~	~~30~~	~~Area Restoration~~	~~March~~	~~Year 8~~	~~20~~
~~Area Restoration~~	~~June~~	~~Year 6~~	~~30~~	~~Demobilization~~	~~March~~	~~Year 6~~	~~20~~
~~Demobilization~~	~~July~~	~~Year 6~~	~~20~~	~~Byron Highway~~			
~~Phase 2~~				~~Clearing & Grubbing / Demolition~~	~~September~~	~~Year 4~~	~~20~~
~~Clearing & Grubbing / Demolition~~	~~September~~	~~Year 6~~	~~20~~	~~Dewatering / Unwatering~~	~~September~~	~~Year 4~~	~~529~~
~~Dewatering / Unwatering~~	~~September~~	~~Year 6~~	~~817~~	~~Erosion & Sediment Control BMP's~~	~~September~~	~~Year 4~~	~~559~~
~~Erosion & Sediment Control BMP's~~	~~September~~	~~Year 6~~	~~847~~	~~Build Highway Detour and Railroad Shoofly~~			
~~Sheetpile Cell~~	~~October~~	~~Year 6~~	~~60~~	~~Detour Road~~			
~~Excavation~~	~~March~~	~~Year 7~~	~~25~~	~~Demolition (Remove Road)~~	~~October~~	~~Year 4~~	~~20~~
~~Pile Installation~~	~~April~~	~~Year 7~~	~~15~~	~~Place Road and Bedding~~	~~November~~	~~Year 4~~	~~44~~
~~Slab On Grade~~	~~May~~	~~Year 7~~	~~20~~	~~Pave Road/Striping~~	~~December~~	~~Year 4~~	~~24~~
~~Siphon Walls~~	~~June~~	~~Year 7~~	~~33~~	~~Shoofly~~			
~~Siphon Roof~~	~~July~~	~~Year 7~~	~~20~~	~~Rails/Ballast/subBallast~~	~~October~~	~~Year 4~~	~~84~~
~~Backfill & Embankments~~	~~July~~	~~Year 7~~	~~39~~	~~Excavation~~	~~April~~	~~Year 5~~	~~30~~
~~Waterway Reconstruction~~	~~October~~	~~Year 7~~	~~21~~	~~Pile Installation~~	~~May~~	~~Year 5~~	~~24~~
~~Inlet & Outlet Transition Structure~~	~~April~~	~~Year 8~~	~~170~~	~~Slab On Grade~~	~~June~~	~~Year 5~~	~~33~~
~~Upstream & Downstream Transitions~~				~~Siphon Walls~~	~~June~~	~~Year 5~~	~~53~~
~~Excavation/Grading~~	~~April~~	~~Year 8~~	~~4~~	~~Siphon Roof~~	~~August~~	~~Year 5~~	~~33~~
~~Place Gravel Bedding~~	~~April~~	~~Year 8~~	~~2~~	~~Backfill & Embankments~~	~~September~~	~~Year 5~~	~~30~~
~~Place Invert Slab Concrete:Plant & Operations~~	~~April~~	~~Year 8~~	~~30~~	~~Railroad and Highway Reconstruction~~			
~~Place Invert Slab Concrete:Placing Crews~~	~~May~~	~~Year 8~~	~~7~~	~~Highway~~			
~~Place Invert Slab Concrete:Finish~~	~~May~~	~~Year 8~~	~~7~~	~~Place Road and Bedding~~	~~October~~	~~Year 5~~	~~80~~
~~Place Invert Slab Concrete:Point and Patch~~	~~June~~	~~Year 8~~	~~3~~	~~Pave Road/Striping~~	~~November~~	~~Year 5~~	~~24~~
~~Place Invert Slab Concrete:Treat CJ~~	~~June~~	~~Year 8~~	~~3~~	~~Railroad~~			

~~Siphons~~							
~~Place Invert Slab Concrete:Cure & Cleanup~~	~~June~~	~~Year 8~~	~~49~~	~~Rails/Ballast/subBallast~~	~~October~~	~~Year 5~~	~~80~~
~~Place Invert Slab Concrete:Formwork~~	~~July~~	~~Year 8~~	~~18~~	~~Inlet & Outlet Transition Structure~~	~~February~~	~~Year 6~~	~~170~~
~~Place Wall Concrete:Plant & Operations~~	~~May~~	~~Year 8~~	~~60~~	~~Upstream & Downstream Transitions~~			
~~Place Wall Concrete:Placing Crews~~	~~May~~	~~Year 8~~	~~20~~	~~Excavation/Grading~~	~~February~~	~~Year 6~~	~~4~~
~~Place Wall Concrete:Point and Patch~~	~~May~~	~~Year 8~~	~~6~~	~~Place Gravel Bedding~~	~~February~~	~~Year 6~~	~~2~~
~~Place Wall Concrete:Treat CJ~~	~~July~~	~~Year 8~~	~~6~~	~~Place Invert Slab Concrete:Plant & Operations~~	~~February~~	~~Year 6~~	~~30~~
~~Place Wall Concrete:Cure & Cleanup~~	~~July~~	~~Year 8~~	~~4~~	~~Place Invert Slab Concrete:Placing Crews~~	~~March~~	~~Year 6~~	~~7~~
~~Place Wall Concrete:Formwork~~	~~July~~	~~Year 8~~	~~60~~	~~Place Invert Slab Concrete:Finish~~	~~March~~	~~Year 6~~	~~7~~
~~Backfill (Including Embankment)~~	~~September~~	~~Year 8~~	~~2~~	~~Place Invert Slab Concrete:Point and Patch~~	~~April~~	~~Year 6~~	~~3~~
~~Upstream & Downstream Control Structures~~			~~-~~	~~Place Invert Slab Concrete:Treat CJ~~	~~April~~	~~Year 6~~	~~3~~
~~Excavation/Grading~~	~~June~~	~~Year 8~~	~~3~~	~~Place Invert Slab Concrete:Cure & Cleanup~~	~~April~~	~~Year 6~~	~~49~~
~~Place Gravel Bedding~~	~~June~~	~~Year 8~~	~~1~~	~~Place Invert Slab Concrete:Formwork~~	~~May~~	~~Year 6~~	~~18~~
~~Drive Foundation Piles~~	~~June~~	~~Year 8~~	~~15~~	~~Place Wall Concrete:Plant & Operations~~	~~March~~	~~Year 6~~	~~60~~
~~Place Invert Slab Concrete:Plant & Operations~~	~~July~~	~~Year 8~~	~~15~~	~~Place Wall Concrete:Placing Crews~~	~~March~~	~~Year 6~~	~~20~~
~~Place Invert Slab Concrete:Placing Crews~~	~~July~~	~~Year 8~~	~~4~~	~~Place Wall Concrete:Point and Patch~~	~~March~~	~~Year 6~~	~~6~~
~~Place Invert Slab Concrete:Finish~~	~~July~~	~~Year 8~~	~~4~~	~~Place Wall Concrete:Treat CJ~~	~~May~~	~~Year 6~~	~~6~~
~~Place Invert Slab Concrete:Point and Patch~~	~~July~~	~~Year 8~~	~~1~~	~~Place Wall Concrete:Cure & Cleanup~~	~~May~~	~~Year 6~~	~~4~~
~~Place Invert Slab Concrete:Treat CJ~~	~~July~~	~~Year 8~~	~~1~~	~~Place Wall Concrete:Formwork~~	~~May~~	~~Year 6~~	~~60~~
~~Place Invert Slab Concrete:Cure & Cleanup~~	~~July~~	~~Year 8~~	~~10~~	~~Backfill (Including Embankment)~~	~~July~~	~~Year 6~~	~~2~~
~~Place Invert Slab Concrete:Formwork~~	~~July~~	~~Year 8~~	~~5~~	~~Upstream & Downstream Control Structures~~			~~-~~
~~Place Wall Concrete:Plant & Operations~~	~~August~~	~~Year 8~~	~~20~~	~~Excavation/Grading~~	~~April~~	~~Year 6~~	~~3~~
~~Place Wall Concrete:Placing Crews~~	~~August~~	~~Year 8~~	~~6~~	~~Place Gravel Bedding~~	~~April~~	~~Year 6~~	~~1~~
~~Place Wall Concrete:Point and Patch~~	~~August~~	~~Year 8~~	~~12~~	~~Drive Foundation Piles~~	~~April~~	~~Year 6~~	~~15~~
~~Place Wall Concrete:Cure & Cleanup~~	~~September~~	~~Year 8~~	~~15~~	~~Place Invert Slab Concrete:Plant & Operations~~	~~May~~	~~Year 6~~	~~15~~
~~Backfill (Including Embankment)~~	~~September~~	~~Year 8~~	~~3~~	~~Place Invert Slab Concrete:Placing Crews~~	~~May~~	~~Year 6~~	~~4~~
~~Remove Sheetpiles~~	~~November~~	~~Year 8~~	~~30~~	~~Place Invert Slab Concrete:Finish~~	~~May~~	~~Year 6~~	~~4~~
~~Area Restoration~~	~~November~~	~~Year 8~~	~~30~~	~~Place Invert Slab Concrete:Point and Patch~~	~~May~~	~~Year 6~~	~~1~~
~~Demobilization~~	~~January~~	~~Year 9~~	~~20~~	~~Place Invert Slab Concrete:Treat CJ~~	~~May~~	~~Year 6~~	~~1~~
~~North Forebay~~				~~Place Invert Slab Concrete:Cure & Cleanup~~	~~May~~	~~Year 6~~	~~10~~
~~Phase 1~~				~~Place Invert Slab Concrete:Formwork~~	~~May~~	~~Year 6~~	~~5~~
~~Clearing & Grubbing / Demolition~~	~~February~~	~~Year 4~~	~~20~~	~~Place Wall Concrete:Plant & Operations~~	~~June~~	~~Year 6~~	~~20~~
~~Dewatering / Unwatering~~	~~February~~	~~Year 4~~	~~477~~	~~Place Wall Concrete:Placing Crews~~	~~June~~	~~Year 6~~	~~6~~
~~Erosion & Sediment Control BMP's~~	~~February~~	~~Year 4~~	~~507~~	~~Place Wall Concrete:Point and Patch~~	~~June~~	~~Year 6~~	~~12~~

Siphons							
Sheetpile Cell	March	Year 4	60	Place Wall Concrete:Cure & Cleanup	July	Year 6	15
Excavation	August	Year 4	33	Backfill (Including Embankment)	July	Year 6	3
Pile Installation	September	Year 4	24	Area Restoration	October	Year 6	30
Slab On Grade	October	Year 4	32	Demobilization	December	Year 6	20
Siphon Walls	October	Year 4	52				
Siphon Roof	December	Year 4	32				
Backfill & Embankments	January	Year 5	58				
Waterway Reconstruction	April	Year 5	21				
Inlet & Outlet Transition Structure	May	Year 5	170				
Upstream & Downstream Transitions							
Excavation/Grading	April	Year 8	4				
Place Gravel Bedding	April	Year 8	2				
Place Invert Slab Concrete:Plant & Operations	April	Year 8	30				
Place Invert Slab Concrete:Placing Crews	May	Year 8	7				
Place Invert Slab Concrete:Finish	May	Year 8	7				
Place Invert Slab Concrete:Point and Patch	June	Year 8	3				
Place Invert Slab Concrete:Treat CJ	June	Year 8	3				
Place Invert Slab Concrete:Cure & Cleanup	June	Year 8	49				
Place Invert Slab Concrete:Formwork	July	Year 8	18				
Place Wall Concrete:Plant & Operations	May	Year 8	60				
Place Wall Concrete:Placing Crews	May	Year 8	20				
Place Wall Concrete:Point and Patch	May	Year 8	6				
Place Wall Concrete:Treat CJ	July	Year 8	6				
Place Wall Concrete:Cure & Cleanup	July	Year 8	4				
Place Wall Concrete:Formwork	July	Year 8	60				
Backfill (Including Embankment)	September	Year 8	2				
Remove Sheetpiles	January	Year 6	30				
Area Restoration	January	Year 6	30				
Demobilization	February	Year 6	20				

Table 3C-2340. Alternative 4 (Modified Pipeline/Tunnel Alignment) Construction Schedule

Canals							
Clear and Grub	October	Year 4	23	Dewater Canal Exc Area			
Demolition of Structures	October	Year 4	23	Excavate Trenches	December	Year 4	184
Overexcavate & Replace Under Embankments				Operate Pumps	January	Year 5	276
Dewatering Embankment Area				Pump Install and Maintain	January	Year 5	276
Excavate Trenches	October	Year 4	23	Construct/Remove Sedimentation Ponds	January	Year 5	69
Operate Pumps	October	Year 4	92	Import and Place as Embankment			
Pump Install and Maintain	October	Year 4	46	Import and Place : Haul from Borrow, 100 T Truck <2,500	February	Year 5	276
Construct/Remove Sedimentation Ponds	October	Year 4	23	Embankment Finish			
Waste Unsuitable Material				Slope Finish	November	Year 5	92
Unsuitable to ROW Spoil Berm	October	Year 4	23	Channel Bottom Finish	November	Year 5	92
Unsuitable to Borrow Backfill 5 Truck	October	Year 4	23	Embankment Top Finish	November	Year 5	92
Scarify and Recompact Canal Invert	October	Year 4	10	Other Flat Area Finish	November	Year 5	92
Flip Flop Non Organics	November	Year 4	23	Haul Roads			
Import and Replace to OG : Truck from Borrow 2.5 m to 7 m Haul, Truck :	November	Year 4	92	Overexc and Recompact 40'W X3'Dx <7 Miles : Excavate Overburden to 3' Depth :	November	Year 4	35
On-Site Excavation				Overexc and Recompact 40'W X3'Dx <7 Miles : Refill from Borrow :	November	Year 4	35
Export Unsuitable Material				Remove Haul Road Base	December	Year 5	46
Unsuitable from Canal Excavation to ROW Berms	January	Year 5	92	Maintain Haul Roads	November	Year 4	46
Unsuitable from Canal Excavation to Borrow BF 2.5 m to 7 m truck	January	Year 5	92	Drainage			
Cut and Fill Suitable Material				Export Unsuitable Material	May	Year 5	69
Canal Exc To Replace Unsuit Exc Under Embankment	February	Year 5	161	Finish Grade Ditch	May	Year 5	69
Canal Exc To Canal Embankment Lower Section	February	Year 5	161	SWPPP	October	Year 4	85
Canal Exc To Dry Bed For Emb. Top Out	February	Year 5	161				
Canal Exc To Dry Bed Reach To Reach	February	Year 5	161				
Moisture Condition Suitable Material							
Construction Drying Beds	January	Year 5	184				
Double Handle Suitable	January	Year 5	184				
Operate Drying Beds	January	Year 5	184				