Subject:	**South Delta Conveyance Facilities Operations & Maintenance Equipment and Facility Needs (Final Draft)**
Project feature:	South Delta Conveyance Facilities
Prepared for:	California Department of Water Resources (DWR) / Delta Conveyance Office (DCO)
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Copies to:	File
Date/Version:	December 23, 2021
Reference no.:	EDM_SC_CE_TMO_SDCF-O&M-Equip-and-Fac-Needs_000965_V03_FD_20211223

1. Purpose

The purpose of this technical memorandum (TM) is to identify the site footprint needs for general equipment and facilities required for the operations and maintenance (O&M) of the South Delta Conveyance Facilities (SDCF) for the Delta Conveyance System (Project). This TM is not intended to be a complete summary of equipment and facilities required O&M, nor is it intended to be a complete O&M manual with detailed descriptions of the equipment, trouble shooting and O&M procedures. Such manual(s) will be developed during final design and construction activities.

1.1 Background

Water diversions at intakes located along the Sacramento River are planned for the Project in the North Delta region between the Towns of Freeport and Courtland. These intakes divert water into a tunnel that conveys the water to facilities in the South Delta near the town of Byron. These facilities include the South Delta Pumping Plant, the Southern Forebay, and the SDCF. The SDCF will convey water from the Southern Forebay to the State-owned Banks Pumping Plant (Banks) and potentially to the Federally owned Jones Pumping Plant (Jones) utilizing the following facilities:

- Conveyance to Banks:
  - Southern Forebay Outlet Structure
  - Dual Southern Tunnels
  - South Delta Outlet and Control Structure
  - California Aqueduct Control Structure
- Conveyance to Jones:
  - Same facilities as required for Banks with the addition of the following:
    - Jones Control Structure added to the South Delta Outlet and Control Structure
    - Jones Tunnel to Delta Mendota Canal
    - Jones Outlet Structure at the Delta Mendota Canal
    - Delta Mendota Canal Control Structure

1.2 Summary of Facilities and Equipment

Table 1 below is a summary of the O&M facilities and equipment required for the SDCF.

Table 1. SDCF Operational Equipment and Facility Requirements

Unit	O&M Requirement	Facility and/or Equipment Needs	Comments
Southern Forebay Outlet Structure	Trashrack cleaning and repair.	• Backhoe or excavator mounted device for cleaning debris from trashrack • Hand-held rakes • Bin for storage of vegetation or other items removed from the trashrack	• This is all screened water, but the forebay has a large open surface that can collect debris. • Periodic cleaning can be performed manually as required by handheld rakes or machine mounted. • An automatic mechanical trashrack cleaning system could be considered during detailed design with possible access for the truck to be loaded directly from the trashrack during the high season.
	Tunnel inspections and maintenance.	• Bridge crane with 50-ton hoist and trolley for operating isolation stop log gates (ten (10) 34’ wide x 43’ high gates for isolation of shaft(s) and tunnel(s). • Stop logs stored in place within guide frames (open position). • Mobile crane for installation of life safety items (ventilation and lighting) and for lowering personnel in a cage for inspection. • Two-way mobile radio (also accounted for in access and security below)	• Stoplogs assumed stored open in frames and operated with gantry crane for quicker use during emergency conditions if the forebay were draining uncontrollably through a downstream breach. • Assume max weight to be picked is the stop log @ 30,000 pound (lb), size to be verified during design, bridge crane may also be configured for repair of trashrack if required. • Assume subcontracting for mobile crane service.

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Unit	O&M Requirement	Facility and/or Equipment Needs	Comments
South Delta Outlet and Control Structure	Tunnel inspections and maintenance.	• Twenty (20) 34’ wide x 21.5’ high stop logs for isolation of outlet tunnel. • Stop logs would be stored in a concrete masonry unit (CMU) enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings. • Vehicle Requirements: 25-ton boom truck, assumed parked at Southern PP (good for all SDCF uses). • Stop log transport is rare. Breakdown of gates and flatbed tractor trailer rig required. This rig would not be specifically provided. It can be dual purpose with other rigs or rented when needed. • Mobile crane for installation of life safety items (ventilation and lighting) and for lowering personnel in a cage for inspection. • Two-way mobile radio (also accounted for in access and security below)	• Installation of gates is assumed to not require as quick of mobilization as the upstream gates of the Southern Forebay Outlet as there is not a large quantity of stored water in this section of the system. • Assume max weight to be picked is the stop log @ 15,000 lb, size to be verified during design. • Assumed that two 21.5’ high stop logs will be stacked on top of each other to achieve a total height of 43’. • Assume subcontracting for mobile crane service.
	Isolation for inspection and maintenance	• Twelve (12) 24’ x 21.5‘ stop logs for isolation of large radial gates • Four (4) 17’ x 21.5’ stop logs for isolation of small radial gate • Stop logs would be stored in a CMU enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings.	• Assumed that two 21.5’ high stop logs would be stacked on top of each other to achieve a total height of 43’. • Stop logs provided for single isolation of two large and one small radial gates.

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Unit	O&M Requirement	Facility and/or Equipment Needs	Comments
Jones Control Structure	Isolation for inspection and maintenance of gate structures	• Eight (8) 18' x 21.5' stop logs for isolation of all radial gates and dual isolation of Jones Tunnel. • Two (2) 17' wide x 21.5' high stop logs for the smaller radial gate and dual isolation of Jones Tunnel. • Stop logs would be stored in a CMU enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings.	• Assumed that two 21.5' high stop logs will be stacked on top of each other to achieve a total height of 43'.
California Aqueduct Control Structure	Isolation for inspection and maintenance of gate structures	• Twenty-four (24) 26' x 16.5' stop logs for isolation of the 24' x 30' radial gates. • Four (4) 17' x 16.5' stop logs for isolation of the 15' x 8 ' radial gates. • Stop logs would be stored in a CMU enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings.	• Assumed that two 16.5' high stop logs will be stacked on top of each other to achieve a total height of 33' • Stop logs provided for dual isolation between CA Aqueduct and Clifton Court Forebay.
Delta Mendota Control Structure	Isolation for inspection and maintenance of gate structures.	• 12 x 26' x 13.5' stop logs for isolation of the 24 x 30' radial gates. • Four (4) 17' x 13.5' stop logs for the isolation of the 15' x 8' radial gates. • Stop logs would be stored in a CMU enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings.	• Assume that two 13.5' high stop logs will be stacked on each other. • Stop logs provided for dual isolation between upstream and downstream sections of the DMC.
Jones Outlet Structure	Double Isolation for maintenance of Jones Tunnel	• Sixteen (16) 33.5' x 20' for isolation of the Jones Tunnel. • Stop logs would be stored in a CMU enclosed storage area adjacent to the facility as shown on the Engineering Concept drawings.	• Assumes that two 20' high stop logs will be stacked on top of each other.

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Unit	O&M Requirement	Facility and/or Equipment Needs	Comments
Access and Security		• Automatic vehicle gates, where shown on drawings. • Security cameras at control, outlet and inlet structures (locations TBD). • Key card entry for access gates and to electrical buildings. • Short wave radio's for onsite communications. • Network equipment to support key cards and cameras.	• Southern Forebay Outlet Structure will be fenced within the Southern Forebay facilities and access will be via the associated roads and gates. • The Banks Outlet and Control Structure, the CA Aqueduct Control Structure, and the Jones Control Structure would be fenced in a common area. Access would be from North Bruns Road for the west side of the CA Aqueduct and Bruns Road for the east side. The existing canal patrol roads would remain and provide another point of access for DWR staff.
Electrical/ I&C	Control buildings	• Electrical and Control building at all radial gate structures (combined building at the CA Aqueduct and Banks Outlet and Control Structures). • Uninterruptable power supply for each programmable logic controller (PLC). • Spare PLC (or hot-swap). • Spare input/output and communication cards. • Back-up generator and fuel storage at each electrical building. • Spares for all instrumentations. • Network equipment to support control equipment.	• Fuel storage to be contained and surrounded by CMU wall.
Site Management	Landscape Management	• No facilities, weed control only.	• Assumed that no irrigation will be required, drought tolerant plants will be used were required.
	Site access	• No special vehicles provided.	• Site accessible by boom truck and flatbed tractor-trailer rigs.

2. Methodology

The methodology employed to determine the O&M facilities and equipment needs for the Project involved the following:

- Identification of the main facility components and their requirements for operational and maintenance activities. Review of manufactures recommended inspection/maintenance procedures including spares list.
- Incorporate feedback from DWR operations staff.
- Estimate material storage areas and facilities footprint based on equipment required for operation and maintenance activities.

2.1 Data and Information Sources

The following information was reviewed relative to O&M needs at the facilities:

- Supplier data – radial gates and generators.
- Assumptions – basic assumptions that apply to identifying and evaluating SDCF O&M needs include the following:
  - All supplier provided equipment will be operated and maintained in accordance with the supplier's recommendations.
  - Welfare facilities in accordance with California Employment Law.
  - Operations and Maintenance staff won't be permanently based at the facilities.
  - Some equipment will be utilized and stored at the South Delta Pumping Plant and Tracy Fish Facility (or wherever USBR determines is best location).
  - Facilities required for conveyance to Jones, will be owned and operated by the Central Valley Project and will require separate storage areas.

3. Analysis and Evaluation

The SDCF would achieve their primary functions of conveying, isolating and controlling flows, using the following primary systems:

- Southern Forebay Outlet Structure – conveys flow from the Southern Forebay to the approach channels to Banks and Jones.
- Dual tunnels between the Southern Forebay Outlet Structure and the South Delta Outlet and Control Structure adjacent to Banks approach channel.
- South Delta Outlet and Control Structure with radial gates - controls and isolates flow rate through the conveyance system.
- Tunnel between the South Delta Outlet and Control Structure and Jones approach channel.

The following ancillary systems and requirements would be required for operating, maintaining and controlling the primary systems:

- Access and security
- Electrical, communications, instrumentation and control.
- General site management.

These systems would require regular operational and maintenance activities to run reliably and efficiently in order to do this the following operational equipment and facilities where identified for the SDCF's primary and ancillary systems listed above.

3.1 Primary Systems

3.1.1 Southern Forebay Outlet Structure

The Southern Forebay Outlet Structure would convey the flows into the dual tunnels from the Southern Forebay and into to the inlet channels for the state-owned Banks and/or the federally owned Jones. To allow for the maintenance of the dual downstream tunnels stop log gates would be lowered into place within piers constructed upstream of the tunnel inlet shafts. There would be 10 stop log gates to provide double isolation for one downstream tunnel. Stop logs would be stored in the open position in place at the structure. For actuating the stop log gates, a bridge crane would be permanently located at the outlet structure. Each shaft is separated by a concrete wall to allow for one tunnel to be in operation while the other is isolated.

To prevent large floating debris from entering the outlet structure a sloped trach rack will be installed upstream of the stop log piers. Manual and mechanical rakes will be used to clear the screens and vegetation stored within a metal bin for off-site disposal.

3.1.2 South Delta Outlet and Control Structure with Tunnel to Jones Pumping Plant

The South Delta Outlet and Control Structure with would convey flows from the dual tunnels to Banks approach channel and potentially to another tunnel that would extend to Jones approach channel.

Isolation of one of the dual tunnels from the Southern Forebay Outlet Structure would be achieved by the installation of two rows of 10 stop logs, each 34-feet wide by 21.5-feet high. Two rows would provide the double isolation for inspections and maintenance. Stop logs would be double stacked to achieve a total isolation height of 43.0-feet. Each tunnel would be separated by a concrete wall for separate isolation of each tunnel. The stop logs would be portable when broken down into their original modular size and stored within a CMU enclosure at the site and would be moved and placed with a mobile crane.

Isolation of the Jones Control Structure would use stop logs on both sides of the radial control gates. There would be 8-feet by 18-feet wide by 21.5-feet high stop logs for the larger radial gates and 2-feet x 17-feet wide by 8-feet tall stop logs for the smaller radial gate. It is assumed that the stop logs would be portable when broken down into their original modular size and stored within a CMU enclosure at the site and would be moved and placed with a mobile crane.

The South Delta Outlet and Control Structures would include radial gates with isolation stop log guides for each gate. The control structure would consist of 6 large radial gates and 1 smaller control gate, and three (3) gates would have two sets of stop logs (one on each side) to enable the isolation of the radial gates for inspections and repairs. The larger gates would require 12 stop logs, each 26-feet wide and 21.5-feet tall and would be double stacked to achieve a total isolation height of 43-feet. The smaller radial gates would include four (4) stop logs, each 17-feet wide and 21.5-feet tall.

3.1.3 California Aqueduct Control Structure

The California Aqueduct Control Structure would regulate flows from the existing Clifton Court Forebay into Banks approach canal. The control structure would consist of six large radial gates and one small radial gate. This structure requires both isolation for individual gate bays and full isolation of the upstream mand downstream portions of the CA Aqueduct. For isolation, 24 stop logs, each 26-feet wide and 16.5-feet high would be used to isolate all gate bays. The stop logs would be double stacked to achieve a total isolation height of 33-feet. Similarly, the smaller radial gates require four (4) 17-feet wide by 16.5-feet high stop logs for isolation.

The stop logs would be portable when broken down into their original modular size and stored within a CMU enclosure at the site and would be moved and placed with a mobile crane.

3.1.4 Delta Mendota Canal Control Structure

The DMC Control Structure would be used for regulating flows from the DMC to Jones. The control gates could also be used to isolate the DMC from Jones.

The control structure would consist of three large radial gates and one small radial gate for finer flow control. This structure requires both isolation for individual gate bays and full isolation of the upstream mand downstream portions of the DMC. For isolation, 12 stop logs, each 26-feet wide and 13.5-feet high would be used to isolate all gate bays. The stop logs would be double stacked to achieve a total isolation height of 27-feet. Similarly, the smaller radial gates require four (4) 17-feet wide by 13.5-feet high stop logs for isolation.

The stop logs would be portable when broken down into their original modular size and stored within a CMU enclosure at the site and would be moved and placed with a mobile crane.

3.1.5 Jones Outlet Structure

The Jones Outlet Structure would be located on the downstream end of the Jones Tunnel. This structure includes isolation channels to provide double isolation of the Jones Tunnel.

The structure would include four isolation channels, each with two 33.5-feet wide by 20 feet high stop logs on each end, for a total of 16 top logs. The stop logs would be double stacked to achieve the full isolation.

The stop logs would be portable when broken down into their original modular size and stored within a CMU enclosure at the site and would be moved and placed with a mobile crane.

3.1.6 Radial Gates

Table 2 summarizes the number and size of radial gates at each control structure.

Table 2. SDCF Radial Gates Requirements

Control Structure name	Gate sizes
South Delta Outlet and Control Structure	6 x 24’ x 40’ and 1 x 15’ x 8’
Jones Control Structure	2 x 16’ x 40‘ and 1 x 15’ x 8’
California Aqueduct Control Structure	6 x 24’ x 30’ and 1 x 15’ x 8’
Delta Mendota Control Structure	3 x 24’ x 30’ and 1 x 15’ x 8’

Note: One or more sluice gates would also be considered for the 15’ x 8’ gates.

Depending on the type of radial lifting mechanism used, additional spare gates, spare motors, and spare steel lifting cables for the radial gates would be required. Corrosion prevention in the form of cathodic protection using spare sacrificial anodes would be required for the gates.

Emergency back-up power would be required at the radial gates, A diesel or natural gas-powered generator would be housed adjacent to the local control building at each structure. The fuel tank with enough fuel for 48 hours operation would be sited within a CMU structure with proper containment and would also be adjacent to the local control building.

3.2 Ancillary systems

3.2.1 Access and Security

Access to the facilities would be restricted to authorized personal. All vehicle and pedestrian access gates would require key card entry to enter the facility. Vehicle gates would be automatic, roller type where practical. Electrical and control buildings would also require separate key card entry. Main entrances would be covered by close circuit tv (CCTV) connected to the site office at the Southern PP and relayed to a central control room. The site office would be able to open gates to allow entrance for vehicles without key card access. Additional CCTV would be located through the sites for surveillance. Each building would be connected with fiber cable to the main control room at the South Delta Pumping Plant and each building would have a hardwired land line for communications.

3.2.2 Electrical and Instrumentation/Controls

Instrumentation and controls and associated network equipment would be located within small CMU building (about 24-feet by 12-feet) located adjacent to the structures. The building would house the electrical panels and instrumentation and control for displaying flow through the radial gates. A 40-kilowatt, 50 horsepower stand by power generator would be provided adjacent to the building.

Control signals would be relayed back to the main site office at the South Delta Pumping Plant.

3.2.3 Site Management

The outlet and control facilities would have several supplementary operational and maintenance requirements to maintain the aesthetics and safety of the facility and staff and visitors. Parking for two vehicles would be provided for operations and maintenance staff.

Vegetation control is expected to involve weed control only.

Offices, kitchen, showers, and restrooms for operators and visitors would be located at the South Delta Pumping Plant. No specific employee welfare facilities would be provided.

4. Conclusions and Recommendations

For the successful O&M of the SDCF, the elements described in Table 1 would be provided.

5. Document History and Quality Assurance

Reviewers listed have completed an internal quality review check and approval process for deliverable documents that is consistent with procedures and directives identified by the Engineering Design Manager (EDM) and the DCA.

Approval Names and Roles			
Prepared by	**Internal Quality Control review by**	**Consistency review by**	**Approved for submission by**
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This interim document is considered preliminary and was prepared under the responsible charge of Philip K. Ryan, California Professional Engineering License C41087.

Note to Reader

This is an early foundational technical document. Contents therefore reflect the timeframe associated with submission of the initial and final drafts. Only minor editorial and document date revisions have been made to the current Conformed Final Draft for Administrative Draft Engineering Project Report version.