# APPENDIX 4-E

## Preliminary Construction Schedule and Basis of Schedule

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# Container Capacity Improvement Program - Roberts Bank Terminal 2 Construction Schedule

**2015-03-10-01-20000-SCH-0029-Rev0-PMV-RBT2 Construction Schedule**

March 10, 2015

**Technical Report/Technical Data Report Disclaimer**

The Canadian Environmental Assessment Agency determined the scope of the proposed Roberts Bank Terminal 2 Project (RBT2 or the Project) and the scope of the assessment in the Final Environmental Impact Statement Guidelines (EISG) issued January 7, 2014. The scope of the Project includes the project components and physical activities to be considered in the environmental assessment. The scope of the assessment includes the factors to be considered and the scope of those factors. The Environmental Impact Statement (EIS) has been prepared in accordance with the scope of the Project and the scope of the assessment specified in the EISG. For each component of the natural or human environment considered in the EIS, the geographic scope of the assessment depends on the extent of potential effects.

At the time supporting technical studies were initiated in 2011, with the objective of ensuring adequate information would be available to inform the environmental assessment of the Project, neither the scope of the Project nor the scope of the assessment had been determined.

Therefore, the scope of supporting studies may include physical activities that are not included in the scope of the Project as determined by the Agency. Similarly, the scope of supporting studies may also include spatial areas that are not expected to be affected by the Project.

This out-of-scope information is included in the Technical Report (TR)/Technical Data Report (TDR) for each study, but may not be considered in the assessment of potential effects of the Project unless relevant for understanding the context of those effects or to assessing potential cumulative effects.

# Table of Contents

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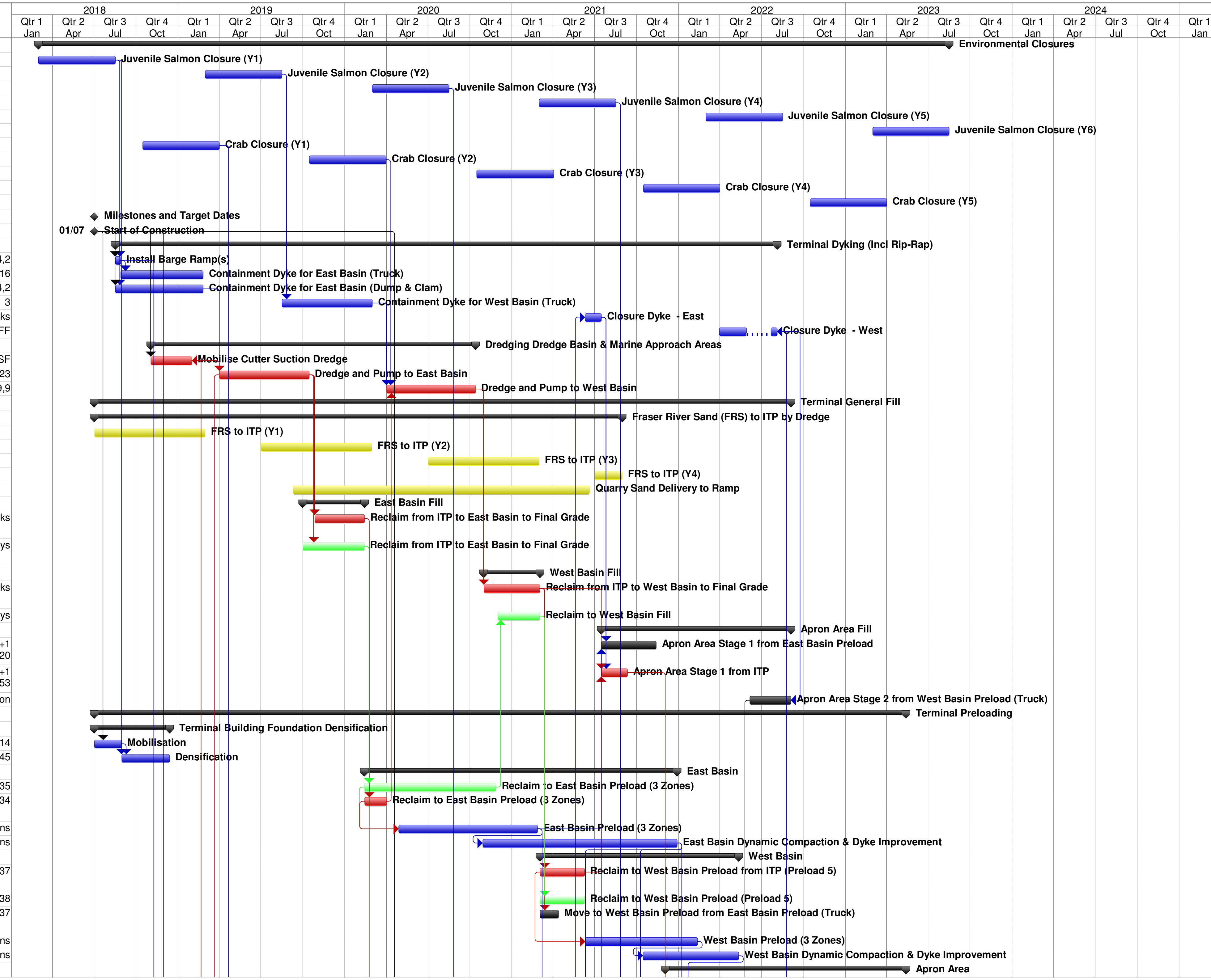
## CONTAINER CAPACITY IMPROVEMENT PROGRAM

## RBT2 CONSTRUCTION SCHEDULE

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | **Environmental Closures** | **1994 days** | **Thu 01/03/18** | **Tue 15/08/23** | |
| 2 | Juvenile Salmon Closure (Y1) | 168 days | Thu 01/03/18 | Wed 15/08/18 | |
| 3 | Juvenile Salmon Closure (Y2) | 168 days | Fri 01/03/19 | Thu 15/08/19 | |
| 4 | Juvenile Salmon Closure (Y3) | 168 days | Sun 01/03/20 | Sat 15/08/20 | |
| 5 | Juvenile Salmon Closure (Y4) | 168 days | Mon 01/03/21 | Sun 15/08/21 | |
| 6 | Juvenile Salmon Closure (Y5) | 168 days | Tue 01/03/22 | Mon 15/08/22 | |
| 7 | Juvenile Salmon Closure (Y6) | 168 days | Wed 01/03/23 | Tue 15/08/23 | |
| 8 | Crab Closure (Y1) | 168 days | Mon 15/10/18 | Sun 31/03/19 | |
| 9 | Crab Closure (Y2) | 168 days | Tue 15/10/19 | Mon 30/03/20 | |
| 10 | Crab Closure (Y3) | 169 days | Thu 15/10/20 | Thu 01/04/21 | |
| 11 | Crab Closure (Y4) | 168 days | Fri 15/10/21 | Thu 31/03/22 | |
| 12 | Crab Closure (Y5) | 168 days | Sat 15/10/22 | Fri 31/03/23 | |
| 13 | **Milestones and Target Dates** | **0 days** | **Sun 01/07/18** | **Sun 01/07/18** | |
| 14 | Start of Construction | 0 days | Sun 01/07/18 | Sun 01/07/18 | |
| 15 | **Terminal Dyking (Incl Rip-Rap)** | **1449.29 days** | **Thu 16/08/18** | **Thu 04/08/22** | |
| 16 | Install Barge Ramp(s) | 2 wks | Thu 16/08/18 | Mon 27/08/18 | 14,2 |
| 17 | Containment Dyke for East Basin (Truck) | 6.03 mons | Tue 28/08/18 | Sun 24/02/19 | 16 |
| 18 | Containment Dyke for East Basin (Dump & Clam) | 6.43 mons | Thu 16/08/18 | Sun 24/02/19 | 14,2 |
| 19 | Containment Dyke for West Basin (Truck) | 6.6 mons | Fri 16/08/19 | Sat 29/02/20 | 3 |
| 20 | Closure Dyke - East | 6 wks | Wed 09/06/21 | Thu 15/07/21 | 85FS-3.6 wks |
| 21 | Closure Dyke - West | 2.47 mons | Wed 30/03/22 | Thu 04/08/22 | 86FF |
| 22 | **Dredging Dredge Basin & Marine Approach Areas** | **711 days** | **Fri 02/11/18** | **Mon 12/10/20** | |
| 23 | Mobilise Cutter Suction Dredge | 3 mons | Fri 02/11/18 | Thu 31/01/19 | 14,97SF |
| 24 | Dredge and Pump to East Basin | 6.55 mons | Mon 01/04/19 | Mon 14/10/19 | 18,23 |
| 25 | Dredge and Pump to West Basin | 6.5 mons | Wed 01/04/20 | Mon 12/10/20 | 49,19,9 |
| 26 | **Terminal General Fill** | **1525.29 days** | **Sun 01/07/18** | **Sat 03/09/22** | |
| 27 | **Fraser River Sand (FRS) to ITP by Dredge** | **1156 days** | **Sun 01/07/18** | **Sun 29/08/21** | |
| 28 | FRS to ITP (Y1) | 8.1 mons | Sun 01/07/18 | Thu 28/02/19 | |
| 29 | FRS to ITP (Y2) | 8.1 mons | Mon 01/07/19 | Fri 28/02/20 | |
| 30 | FRS to ITP (Y3) | 8.1 mons | Wed 01/07/20 | Sun 28/02/21 | |
| 31 | FRS to ITP (Y4) | 2 mons | Thu 01/07/21 | Sun 29/08/21 | |
| 32 | Quarry Sand Delivery to Ramp | 650 days | Mon 09/09/19 | Sat 19/06/21 | |
| 33 | **East Basin Fill** | **135.5 days** | **Mon 30/09/19** | **Wed 12/02/20** | |
| 34 | Reclaim from ITP to East Basin to Final Grade | 3.65 mons | Sat 26/10/19 | Wed 12/02/20 | 24FS+2 wks |
| 35 | Reclaim from ITP to East Basin to Final Grade | 4.5 mons | Mon 30/09/19 | Wed 12/02/20 | 24FS-14 days |
| 36 | **West Basin Fill** | **123 days** | **Sat 31/10/20** | **Tue 02/03/21** | |
| 37 | Reclaim from ITP to West Basin to Final Grade | 4.1 mons | Sat 31/10/20 | Tue 02/03/21 | 25FS+3 wks |
| 38 | Reclaim to West Basin Fill | 3.08 mons | Mon 30/11/20 | Tue 02/03/21 | 48FS+4 days |
| 39 | **Apron Area Fill** | **414.87 days** | **Thu 15/07/21** | **Sat 03/09/22** | |
| 40 | Apron Area Stage 1 from East Basin Preload | 4 mons | Thu 15/07/21 | Fri 12/11/21 | 50FS+1 mon,85,20 |
| 41 | Apron Area Stage 1 from ITP | 1.91 mons | Thu 15/07/21 | Fri 10/09/21 | 37FS+1 mon,20,53 |
| 42 | Apron Area Stage 2 from West Basin Preload (Truck) | 3 mons | Sun 05/06/22 | Sat 03/09/22 | 21FF+1 mon |
| 43 | **Terminal Preloading** | **1777.29 days** | **Sun 01/07/18** | **Sat 13/05/23** | |
| 44 | **Terminal Building Foundation Densification** | **165 days** | **Sun 01/07/18** | **Wed 12/12/18** | |
| 45 | Mobilisation | 2 mons | Sun 01/07/18 | Wed 29/08/18 | 14 |
| 46 | Densification | 3.5 mons | Thu 30/08/18 | Wed 12/12/18 | 2,45 |
| 47 | **East Basin** | **684.8 days** | **Wed 12/02/20** | **Tue 28/12/21** | |
| 48 | Reclaim to East Basin Preload (3 Zones) | 9.6 mons | Wed 12/02/20 | Thu 26/11/20 | 35 |
| 49 | Reclaim to East Basin Preload (3 Zones) | 1.6 mons | Thu 13/02/20 | Tue 31/03/20 | 34 |
| 50 | East Basin Preload (3 Zones) | 10.13 mons | Mon 27/04/20 | Thu 25/02/21 | ;48SS+2.48 mons |
| 51 | East Basin Dynamic Compaction & Dyke Improvement | 14.2 mons | Wed 28/10/20 | Tue 28/12/21 | 50FS-4 mons |
| 52 | **West Basin** | **435 days** | **Wed 03/03/21** | **Wed 11/05/22** | |
| 53 | Reclaim to West Basin Preload from ITP (Preload 5) | 3.25 mons | Wed 03/03/21 | Tue 08/06/21 | 37 |
| 54 | Reclaim to West Basin Preload (Preload 5) | 3.25 mons | Wed 03/03/21 | Tue 08/06/21 | 37,38 |
| 55 | Move to West Basin Preload from East Basin Preload (Truck) | 1.35 mons | Wed 03/03/21 | Mon 12/04/21 | 37 |
| 56 | West Basin Preload (3 Zones) | 8.2 mons | Thu 10/06/21 | Thu 10/02/22 | 53SS+3.3 mons |
| 57 | West Basin Dynamic Compaction & Dyke Improvement | 7 mons | Thu 14/10/21 | Wed 11/05/22 | 56FS-4 mons |
| 58 | **Apron Area** | **527.07 days** | **Thu 02/12/21** | **Sat 13/05/23** | |




| | | | |
|---|---|---|---|
| Task | Rolled Up Task | Split | Group By Summary |
| Milestone | Rolled Up Milestone | External Tasks | Inactive Task |
| Summary | Rolled Up Progress | Project Summary | Inactive Milestone |
| Inactive Summary | Manual Summary Rollup | Finish-only | |
| Manual Task | Manual Summary | Progress | |
| Duration-only | Start-only | Deadline | |

Date: Thu 15/01/15

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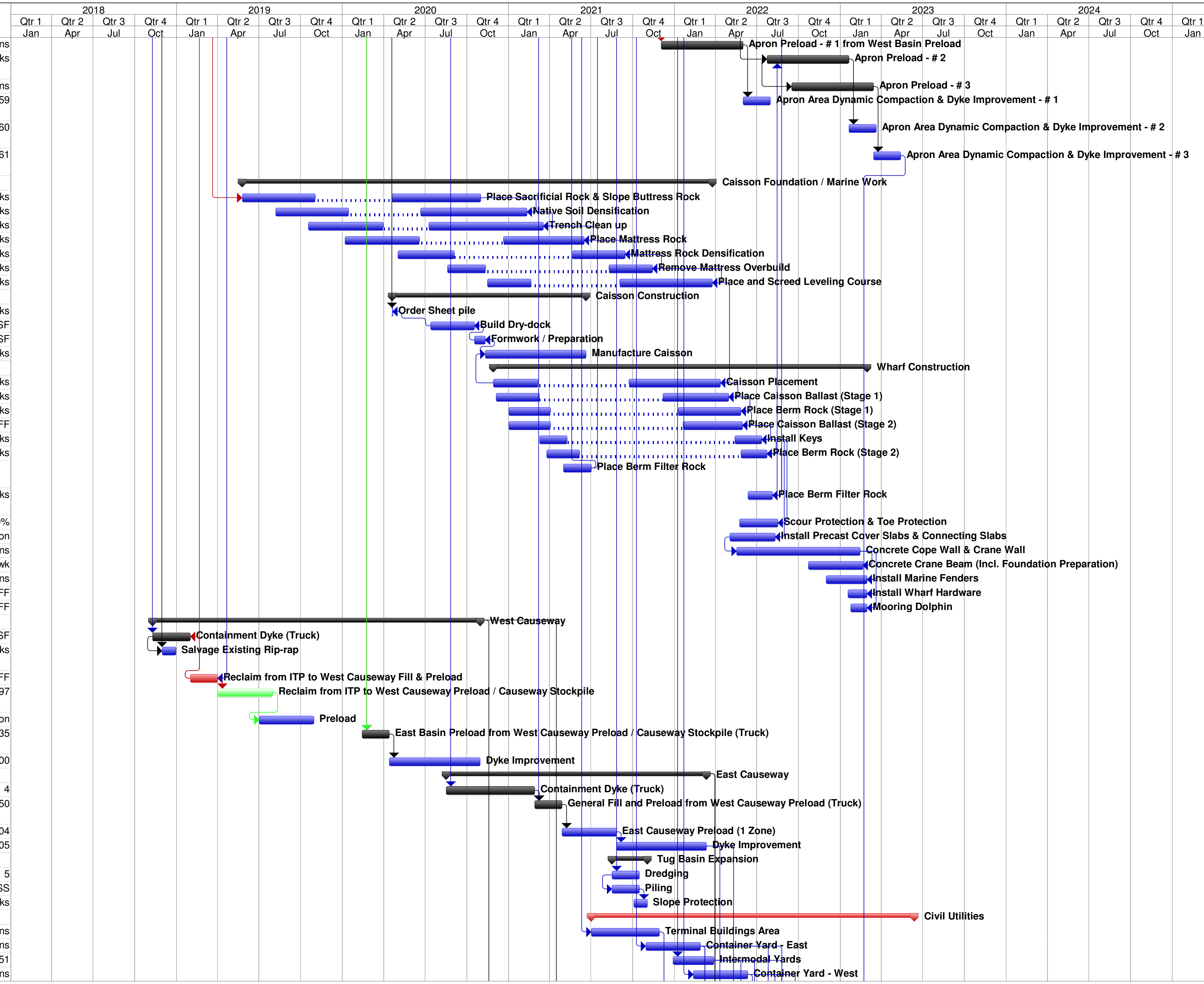
## CONTAINER CAPACITY IMPROVEMENT PROGRAM

## RBT2 CONSTRUCTION SCHEDULE

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 59 | Apron Preload - # 1 from West Basin Preload | 6 mons | Thu 02/12/21 | Tue 31/05/22 | 41FS+2.75 mons |
| 60 | Apron Preload - # 2 | 6 mons | Sat 23/07/22 | Thu 19/01/23 | 42SS,86FS-2 wks |
| 61 | Apron Preload - # 3 | 6 mons | Thu 15/09/22 | Tue 14/03/23 | 60SS+1.8 mons |
| 62 | Apron Area Dynamic Compaction & Dyke Improvement - # 1 | 2 mons | Tue 31/05/22 | Sat 30/07/22 | 59 |
| 63 | Apron Area Dynamic Compaction & Dyke Improvement - # 2 | 2 mons | Thu 19/01/23 | Mon 20/03/23 | 60 |
| 64 | Apron Area Dynamic Compaction & Dyke Improvement - # 3 | 2 mons | Tue 14/03/23 | Sat 13/05/23 | 61 |
| 65 | **Caisson Foundation / Marine Work** | **1035 days** | **Sat 25/05/19** | **Thu 24/03/22** | |
| 66 | Place Sacrificial Rock & Slope Buttress Rock | 59.5 wks | Sat 25/05/19 | Fri 30/10/20 | 24SS+9 wks |
| 67 | Native Soil Densification | 65.83 wks | Wed 07/08/19 | Tue 09/02/21 | 66FF+17 wks |
| 68 | Trench Clean up | 69.61 wks | Thu 17/10/19 | Wed 17/03/21 | 67FF+6 wks |
| 69 | Place Mattress Rock | 57 wks | Mon 06/01/20 | Tue 15/06/21 | 68FF+15 wks |
| 70 | Mattress Rock Densification | 40 wks | Sat 02/05/20 | Mon 13/09/21 | 69FF+15 wks |
| 71 | Remove Mattress Overbuild | 30 wks | Wed 19/08/20 | Fri 12/11/21 | 70FF+10 wks |
| 72 | Place and Screed Leveling Course | 50 wks | Sun 15/11/20 | Thu 24/03/22 | 71FF+22 wks |
| 73 | **Caisson Construction** | **427 days** | **Sun 19/04/20** | **Sat 19/06/21** | |
| 74 | Order Sheet pile | 1 day | Sun 19/04/20 | Mon 20/04/20 | 14,75SF-14 wks |
| 75 | Build Dry-dock | 16 wks | Mon 13/07/20 | Sat 17/10/20 | 76SF |
| 76 | Formwork / Preparation | 4 wks | Sat 17/10/20 | Tue 10/11/20 | 77SF |
| 77 | Manufacture Caisson | 37 wks | Tue 10/11/20 | Sat 19/06/21 | 79SS-3 wks |
| 78 | **Wharf Construction** | **822.29 days** | **Sat 28/11/20** | **Tue 28/02/23** | |
| 79 | Caisson Placement | 50 wks | Sat 28/11/20 | Mon 11/04/22 | 72FF+3 wks |
| 80 | Place Caisson Ballast (Stage 1) | 40 wks | Fri 04/12/20 | Fri 29/04/22 | 79FF+3 wks |
| 81 | Place Berm Rock (Stage 1) | 38.27 wks | Fri 01/01/21 | Thu 26/05/22 | 80FF+4 wks |
| 82 | Place Caisson Ballast (Stage 2) | 37.16 wks | Fri 01/01/21 | Mon 30/05/22 | 81FF |
| 83 | Install Keys | 20 wks | Tue 09/03/21 | Mon 11/07/22 | 82FF+7 wks |
| 84 | Place Berm Rock (Stage 2) | 21.72 wks | Thu 25/03/21 | Sat 23/07/22 | 83FF+2 wks |
| 85 | Place Berm Filter Rock | 10.17 wks | Sat 01/05/21 | Thu 01/07/21 | |
| 86 | Place Berm Filter Rock | 9.03 wks | Sat 11/06/22 | Thu 04/08/22 | 84FF+2 wks |
| 87 | Scour Protection & Toe Protection | 84.71 days | Mon 23/05/22 | Tue 16/08/22 | 83FF+30% |
| 88 | Install Precast Cover Slabs & Connecting Slabs | 100 days | Mon 02/05/22 | Wed 10/08/22 | 83FF+1 mon |
| 89 | Concrete Cope Wall & Crane Wall | 272 days | Tue 17/05/22 | Mon 13/02/23 | 88SS+0.5 mons |
| 90 | Concrete Crane Beam (Incl. Foundation Preparation) | 120 days | Sat 22/10/22 | Sun 19/02/23 | 89FF+1 wk |
| 91 | Install Marine Fenders | 90 days | Wed 30/11/22 | Tue 28/02/23 | 89FF+0.5 mons |
| 92 | Install Wharf Hardware | 7 wks | Tue 17/01/23 | Tue 28/02/23 | 91FF |
| 93 | Mooring Dolphin | 6 wks | Mon 23/01/23 | Tue 28/02/23 | 92FF |
| 94 | **West Causeway** | **721 days** | **Fri 09/11/18** | **Thu 29/10/20** | |
| 95 | Containment Dyke (Truck) | 2.77 mons | Fri 09/11/18 | Thu 31/01/19 | 16,97SF |
| 96 | Salvage Existing Rip-rap | 1 mon | Fri 30/11/18 | Sat 29/12/18 | 14,95SS+3.5 wks |
| 97 | Reclaim from ITP to West Causeway Fill & Preload | 2 mons | Thu 31/01/19 | Sun 31/03/19 | 8FF |
| 98 | Reclaim from ITP to West Causeway Preload / Causeway Stockpile | 4.05 mons | Mon 01/04/19 | Wed 31/07/19 | 97 |
| 99 | Preload | 4 mons | Mon 01/07/19 | Tue 29/10/19 | 98FS-1 mon |
| 100 | East Basin Preload from West Causeway Preload / Causeway Stockpile (Truck) | 2 mons | Thu 13/02/20 | Sun 12/04/20 | 34,35 |
| 101 | Dyke Improvement | 200 days | Mon 13/04/20 | Thu 29/10/20 | 100 |
| 102 | **East Causeway** | **573 days** | **Sun 16/08/20** | **Fri 11/03/22** | |
| 103 | Containment Dyke (Truck) | 6.5 mons | Sun 16/08/20 | Fri 26/02/21 | 4 |
| 104 | General Fill and Preload from West Causeway Preload (Truck) | 2 mons | Sat 27/02/21 | Tue 27/04/21 | 103,50 |
| 105 | East Causeway Preload (1 Zone) | 4 mons | Wed 28/04/21 | Wed 25/08/21 | 104 |
| 106 | Dyke Improvement | 6.6 mons | Thu 26/08/21 | Fri 11/03/22 | 105 |
| 107 | **Tug Basin Expansion** | **78 days** | **Mon 16/08/21** | **Mon 01/11/21** | |
| 108 | Dredging | 2 mons | Mon 16/08/21 | Thu 14/10/21 | 5 |
| 109 | Piling | 2 mons | Mon 16/08/21 | Thu 14/10/21 | 108SS |
| 110 | Slope Protection | 1 mon | Sun 03/10/21 | Mon 01/11/21 | 109FS-2 wks |
| 111 | **Civil Utilities** | **710.99 days** | **Thu 01/07/21** | **Mon 12/06/23** | |
| 112 | Terminal Buildings Area | 5 mons | Thu 01/07/21 | Sun 28/11/21 | 51FS-6 mons |
| 113 | Container Yard - East | 4 mons | Fri 29/10/21 | Sat 26/02/22 | 51FS-2 mons |
| 114 | Intermodal Yards | 3 mons | Tue 28/12/21 | Mon 28/03/22 | 51 |
| 115 | Container Yard - West | 4 mons | Fri 11/02/22 | Fri 10/06/22 | 57FS-3 mons |



Task · Rolled Up Task · Split · Group By Summary · Inactive Summary · Manual Summary Rollup · Finish-only
Milestone · Rolled Up Milestone · External Tasks · Inactive Task · Manual Task · Manual Summary · Progress
Summary · Rolled Up Progress · Project Summary · Inactive Milestone · Duration-only · Start-only · Deadline



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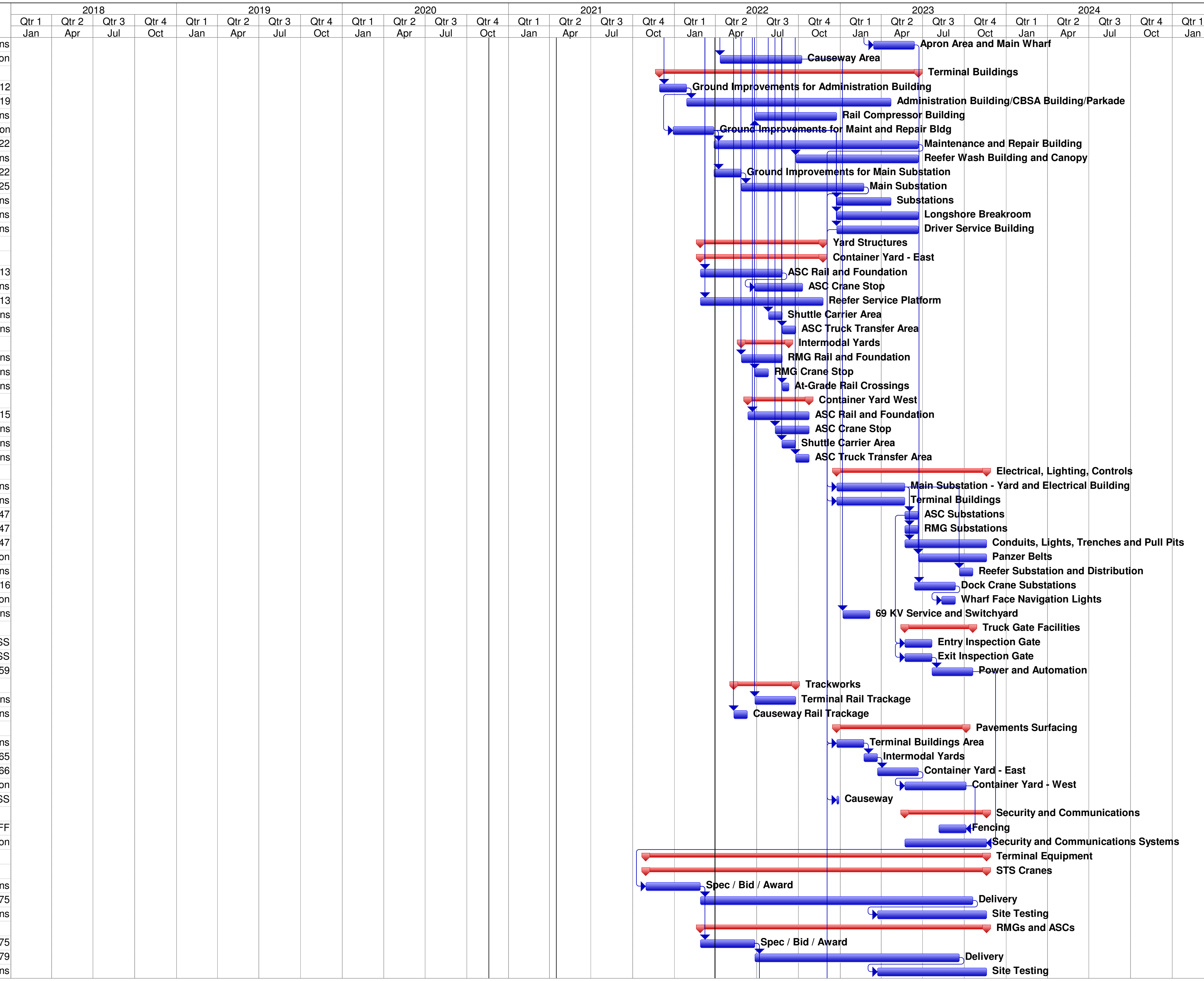
# CONTAINER CAPACITY IMPROVEMENT PROGRAM

## RBT2 CONSTRUCTION SCHEDULE

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 116 | Apron Area and Main Wharf | 3 mons | Tue 14/03/23 | Mon 12/06/23 | 64FS-2 mons |
| 117 | Causeway Area | 6 mons | Mon 11/04/22 | Fri 07/10/22 | 106FS+1 mon |
| 118 | **Terminal Buildings** | **570 days** | **Sun 28/11/21** | **Wed 21/06/23** | |
| 119 | Ground Improvements for Administration Building | 2 mons | Sun 28/11/21 | Thu 27/01/22 | 112 |
| 120 | Administration Building/CBSA Building/Parkade | 15 mons | Thu 27/01/22 | Sat 22/04/23 | 119 |
| 121 | Rail Compressor Building | 6 mons | Sun 26/06/22 | Fri 23/12/22 | 122FS+3 mons |
| 122 | Ground Improvements for Maint and Repair Bldg | 3 mons | Tue 28/12/21 | Mon 28/03/22 | 119FS-1 mon |
| 123 | Maintenance and Repair Building | 15 mons | Mon 28/03/22 | Wed 21/06/23 | 122 |
| 124 | Reefer Wash Building and Canopy | 9 mons | Sat 24/09/22 | Wed 21/06/23 | 122FS+6 mons |
| 125 | Ground Improvements for Main Substation | 2 mons | Mon 28/03/22 | Fri 27/05/22 | 122 |
| 126 | Main Substation | 9 mons | Fri 27/05/22 | Tue 21/02/23 | 125 |
| 127 | Substations | 4 mons | Fri 23/12/22 | Sat 22/04/23 | 122FS+9 mons |
| 128 | Longshore Breakroom | 6 mons | Fri 23/12/22 | Wed 21/06/23 | 122FS+9 mons |
| 129 | Driver Service Building | 6 mons | Fri 23/12/22 | Wed 21/06/23 | 122FS+9 mons |
| 130 | **Yard Structures** | **270 days** | **Sat 26/02/22** | **Wed 23/11/22** | |
| 131 | **Container Yard - East** | **270 days** | **Sat 26/02/22** | **Wed 23/11/22** | |
| 132 | ASC Rail and Foundation | 6 mons | Sat 26/02/22 | Thu 25/08/22 | 113 |
| 133 | ASC Crane Stop | 3.5 mons | Sun 26/06/22 | Sun 09/10/22 | 132FS-2 mons |
| 134 | Reefer Service Platform | 9 mons | Sat 26/02/22 | Wed 23/11/22 | 113 |
| 135 | Shuttle Carrier Area | 1 mon | Tue 26/07/22 | Thu 25/08/22 | 113FS+5 mons |
| 136 | ASC Truck Transfer Area | 1 mon | Thu 25/08/22 | Sat 24/09/22 | 113FS+6 mons |
| 137 | **Intermodal Yards** | **105 days** | **Fri 27/05/22** | **Fri 09/09/22** | |
| 138 | RMG Rail and Foundation | 3 mons | Fri 27/05/22 | Thu 25/08/22 | 114FS+2 mons |
| 139 | RMG Crane Stop | 1 mon | Sun 26/06/22 | Tue 26/07/22 | 114FS+3 mons |
| 140 | At-Grade Rail Crossings | 0.5 mons | Thu 25/08/22 | Fri 09/09/22 | 114FS+5 mons |
| 141 | **Container Yard West** | **135 days** | **Sat 11/06/22** | **Sun 23/10/22** | |
| 142 | ASC Rail and Foundation | 4.5 mons | Sat 11/06/22 | Sun 23/10/22 | 115 |
| 143 | ASC Crane Stop | 2.5 mons | Wed 10/08/22 | Sun 23/10/22 | 115FS+2 mons |
| 144 | Shuttle Carrier Area | 1 mon | Thu 25/08/22 | Fri 23/09/22 | 115FS+2.5 mons |
| 145 | ASC Truck Transfer Area | 1 mon | Sat 24/09/22 | Sun 23/10/22 | 115FS+3.5 mons |
| 146 | **Electrical, Lighting, Controls** | **330 days** | **Fri 23/12/22** | **Sat 18/11/23** | |
| 147 | Main Substation - Yard and Electrical Building | 5 mons | Fri 23/12/22 | Mon 22/05/23 | 126FS-2 mons |
| 148 | Terminal Buildings | 5 mons | Fri 23/12/22 | Mon 22/05/23 | 126FS-2 mons |
| 149 | ASC Substations | 1 mon | Mon 22/05/23 | Wed 21/06/23 | 147 |
| 150 | RMG Substations | 1 mon | Mon 22/05/23 | Wed 21/06/23 | 147 |
| 151 | Conduits, Lights, Trenches and Pull Pits | 6 mons | Mon 22/05/23 | Sat 18/11/23 | 147 |
| 152 | Panzer Belts | 5 mons | Wed 21/06/23 | Sat 18/11/23 | 147FS+1 mon |
| 153 | Reefer Substation and Distribution | 1 mon | Tue 19/09/23 | Thu 19/10/23 | 147FS+4 mons |
| 154 | Dock Crane Substations | 3 mons | Mon 12/06/23 | Sun 10/09/23 | 116 |
| 155 | Wharf Face Navigation Lights | 1 mon | Fri 11/08/23 | Sun 10/09/23 | 154FS-1 mon |
| 156 | 69 KV Service and Switchyard | 2 mons | Fri 06/01/23 | Mon 06/03/23 | 117FS+3 mons |
| 157 | **Truck Gate Facilities** | **150 days** | **Mon 22/05/23** | **Thu 19/10/23** | |
| 158 | Entry Inspection Gate | 2 mons | Mon 22/05/23 | Fri 21/07/23 | 149SS |
| 159 | Exit Inspection Gate | 2 mons | Mon 22/05/23 | Fri 21/07/23 | 158SS |
| 160 | Power and Automation | 3 mons | Fri 21/07/23 | Thu 19/10/23 | 159 |
| 161 | **Trackworks** | **136.3 days** | **Wed 11/05/22** | **Sat 24/09/22** | |
| 162 | Terminal Rail Trackage | 3 mons | Sun 26/06/22 | Sat 24/09/22 | 114FS+3 mons |
| 163 | Causeway Rail Trackage | 1 mon | Wed 11/05/22 | Thu 09/06/22 | 106FS+2 mons |
| 164 | **Pavements Surfacing** | **285 days** | **Fri 23/12/22** | **Wed 04/10/23** | |
| 165 | Terminal Buildings Area | 2 mons | Fri 23/12/22 | Tue 21/02/23 | 123FS-6 mons |
| 166 | Intermodal Yards | 1 mon | Tue 21/02/23 | Thu 23/03/23 | 165 |
| 167 | Container Yard - East | 3 mons | Thu 23/03/23 | Wed 21/06/23 | 166 |
| 168 | Container Yard - West | 4.5 mons | Mon 22/05/23 | Wed 04/10/23 | 167FS-1 mon |
| 169 | Causeway | 5 days | Fri 23/12/22 | Wed 28/12/22 | 165SS |
| 170 | **Security and Communications** | **180 days** | **Mon 22/05/23** | **Sat 18/11/23** | |
| 171 | Fencing | 2 mons | Sat 05/08/23 | Wed 04/10/23 | 168FF |
| 172 | Security and Communications Systems | 6 mons | Mon 22/05/23 | Sat 18/11/23 | 160FF+1 mon |
| 173 | **Terminal Equipment** | **750 days** | **Fri 29/10/21** | **Sat 18/11/23** | |
| 174 | **STS Cranes** | **750 days** | **Fri 29/10/21** | **Sat 18/11/23** | |
| 175 | Spec / Bid / Award | 4 mons | Fri 29/10/21 | Sat 26/02/22 | 172FS-25 mons |
| 176 | Delivery | 20 mons | Sat 26/02/22 | Thu 19/10/23 | 175 |
| 177 | Site Testing | 8 mons | Thu 23/03/23 | Sat 18/11/23 | 176FS-7 mons |
| 178 | **RMGs and ASCs** | **630 days** | **Sat 26/02/22** | **Sat 18/11/23** | |
| 179 | Spec / Bid / Award | 4 mons | Sat 26/02/22 | Sun 26/06/22 | 175 |
| 180 | Delivery | 15 mons | Sun 26/06/22 | Tue 19/09/23 | 179 |
| 181 | Site Testing | 8 mons | Thu 23/03/23 | Sat 18/11/23 | 180FS-6 mons |




Legend: Task; Milestone; Summary; Rolled Up Task; Rolled Up Milestone; Rolled Up Progress; Split; External Tasks; Project Summary; Group By Summary; Inactive Task; Inactive Milestone; Inactive Summary; Manual Task; Duration-only; Manual Summary Rollup; Manual Summary; Start-only; Finish-only; Progress; Deadline



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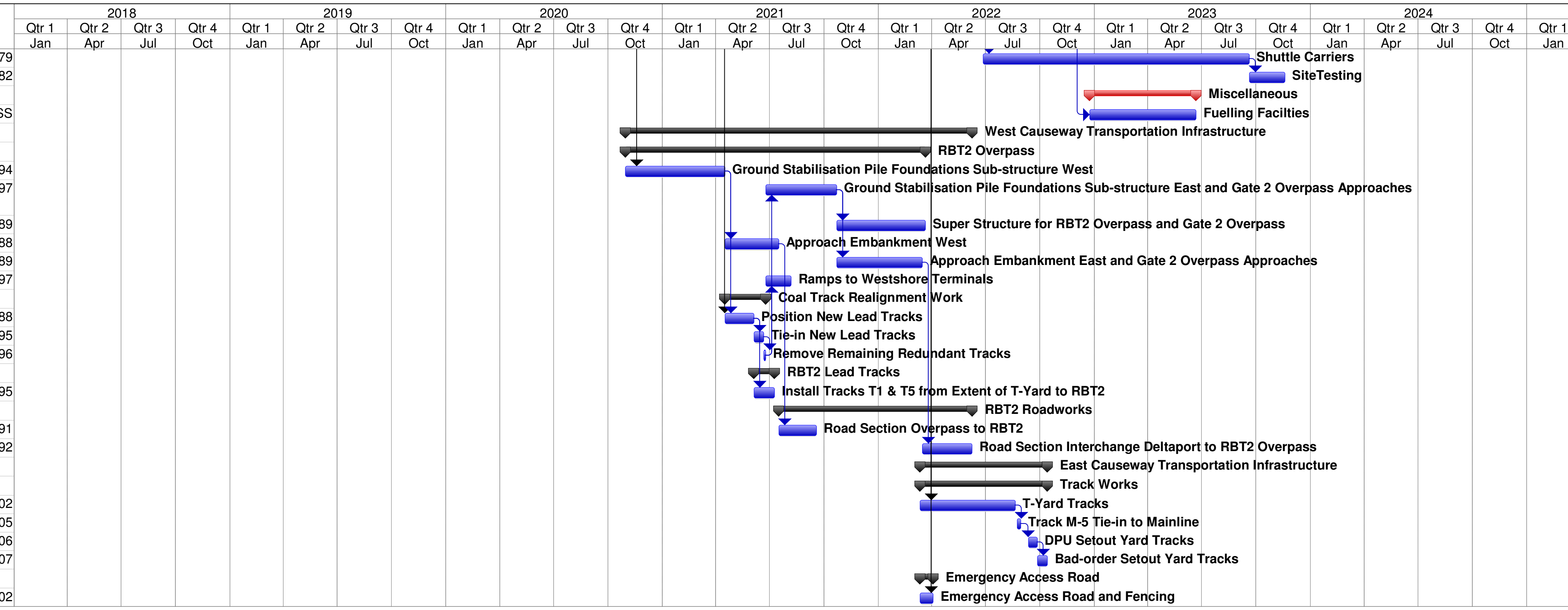
# CONTAINER CAPACITY IMPROVEMENT PROGRAM

## RBT2 CONSTRUCTION SCHEDULE

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 182 | Shuttle Carriers | 15 mons | Sun 26/06/22 | Tue 19/09/23 | 179 |
| 183 | SiteTesting | 2 mons | Tue 19/09/23 | Sat 18/11/23 | 182 |
| 184 | **Miscellaneous** | **180 days** | **Fri 23/12/22** | **Wed 21/06/23** | |
| 185 | Fuelling Facilities | 6 mons | Fri 23/12/22 | Wed 21/06/23 | 129SS |
| 186 | **West Causeway Transportation Infrastructure** | **586 days** | **Fri 30/10/20** | **Tue 07/06/22** | |
| 187 | **RBT2 Overpass** | **507 days** | **Fri 30/10/20** | **Sun 20/03/22** | |
| 188 | Ground Stabilisation Pile Foundations Sub-structure West | 168 days | Fri 30/10/20 | Thu 15/04/21 | 94 |
| 189 | Ground Stabilisation Pile Foundations Sub-structure East and Gate 2 Overpass Approaches | 120 days | Thu 24/06/21 | Thu 21/10/21 | 197 |
| 190 | Super Structure for RBT2 Overpass and Gate 2 Overpass | 150 days | Fri 22/10/21 | Sun 20/03/22 | 189 |
| 191 | Approach Embankment West | 91 days | Fri 16/04/21 | Thu 15/07/21 | 188 |
| 192 | Approach Embankment East and Gate 2 Overpass Approaches | 145 days | Fri 22/10/21 | Tue 15/03/22 | 189 |
| 193 | Ramps to Westshore Terminals | 43 days | Thu 24/06/21 | Thu 05/08/21 | 197 |
| 194 | **Coal Track Realignment Work** | **69 days** | **Fri 16/04/21** | **Wed 23/06/21** | |
| 195 | Position New Lead Tracks | 49 days | Fri 16/04/21 | Thu 03/06/21 | 94,188 |
| 196 | Tie-in New Lead Tracks | 17 days | Fri 04/06/21 | Sun 20/06/21 | 195 |
| 197 | Remove Remaining Redundant Tracks | 3 days | Mon 21/06/21 | Wed 23/06/21 | 196 |
| 198 | **RBT2 Lead Tracks** | **35 days** | **Fri 04/06/21** | **Thu 08/07/21** | |
| 199 | Install Tracks T1 & T5 from Extent of T-Yard to RBT2 | 35 days | Fri 04/06/21 | Thu 08/07/21 | 195 |
| 200 | **RBT2 Roadworks** | **327 days** | **Fri 16/07/21** | **Tue 07/06/22** | |
| 201 | Road Section Overpass to RBT2 | 64 days | Fri 16/07/21 | Fri 17/09/21 | 191 |
| 202 | Road Section Interchange Deltaport to RBT2 Overpass | 84 days | Wed 16/03/22 | Tue 07/06/22 | 192 |
| 203 | **East Causeway Transportation Infrastructure** | **215 days** | **Sat 12/03/22** | **Wed 12/10/22** | |
| 204 | **Track Works** | **215 days** | **Sat 12/03/22** | **Wed 12/10/22** | |
| 205 | T-Yard Tracks | 161 days | Sat 12/03/22 | Fri 19/08/22 | 102 |
| 206 | Track M-5 Tie-in to Mainline | 6 days | Tue 23/08/22 | Sun 28/08/22 | 205 |
| 207 | DPU Setout Yard Tracks | 15 days | Sun 11/09/22 | Sun 25/09/22 | 206 |
| 208 | Bad-order Setout Yard Tracks | 17 days | Mon 26/09/22 | Wed 12/10/22 | 207 |
| 209 | **Emergency Access Road** | **22 days** | **Sat 12/03/22** | **Sat 02/04/22** | |
| 210 | Emergency Access Road and Fencing | 22 days | Sat 12/03/22 | Sat 02/04/22 | 102 |




Task | Rolled Up Task | Split | Group By Summary | Inactive Summary | Manual Summary Rollup | Finish-only
Milestone | Rolled Up Milestone | External Tasks | Inactive Task | Manual Task | Manual Summary | Progress
Summary | Rolled Up Progress | Project Summary | Inactive Milestone | Duration-only | Start-only | Deadline

Date: Thu 15/01/15

AECOM
Klohn Crippen Berger
Delcan

# Roberts Bank Terminal 2

# Basis of Schedule – Part 1

Port Metro Vancouver

# Robert Bank Terminal 2 (RBT2) Preliminary Design Construction Schedule – Basis of Schedule

**Prepared by:**

AECOM
3292 Production Way, Floor 4 604 444 6400 tel
Burnaby, BC, Canada V5A 4R4 604 294 8597 fax
www.aecom.com

**Project Number:**

60309294

**Date:**

January 15, 2015

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# Table of Contents

**Statement of Qualifications and Limitations**

# Introduction

The preliminary design-level Construction Schedule for the RBT2 Project covers all dredging, reclamation fills, preloading, wharf construction, granular sub-base/base, pavements, storm drainage, underground services, rail/other foundations, rail yards, buildings and other structures.

The RBT2 Schedule incorporates the reduced fill and preload volumes that are now required for the optimised narrower causeway widening and the rounding of the NW corner of the Terminal. The prescribed start date is July 1, 2018. Note that this is the "Start of Construction" date, not a contract award date. The RBT2 Construction Schedule includes the use of imported sand from the Fraser River Maintenance Dredging program and also from a second source from an existing quarry.

The reduced fill and preload volumes associated with a narrower causeway widening result in a slightly reduced construction schedule. Duration of on-terminal works is unchanged.

# 1. Scheduling Constraints

## 1.1 Environmental Constraints (Ref 1)

Fisheries Closures:

- Juvenile Salmon – applies to water column above EL -5.0 m (March 01 through to August 15)
- Crab – applies to seabed below EL -5.0 m (October 15 through to March 30)

Marine Mammals:

- Temporary work stoppage if specific marine mammals are observed in the area.

## 1.2 Other Constraints

Fraser River Maintenance Dredging program operates from June 15 through to February 28. The actual start date in any specific year may be delayed by the scale of the freshet.

Construction traffic on public highways and roads is to be kept to a minimum. All major quantities of fill materials are to be delivered by marine methods (i.e. barge and/or pumping).

"*Coasting Trade Act 1992*" is assumed to be applicable. Consequently, where suitable dredging equipment is available within Canada, dredging equipment will not be sourced from offshore.

## 1.3 Assumptions re application of Scheduling Constraints

### 1.3.1 Permitting

All necessary permits from Canadian Federal or Provincial agencies will be acquired by Port Metro Vancouver prior to award of a construction contract.

### 1.3.2 Dredging Equipment

Fraser River Pile & Dredge Inc. (FRPD) own and operate the only dredges on the BC coast capable of undertaking the work. Further, FRPD have the exclusive contract for the Fraser River Maintenance Dredging program. It has been established that no alternative Canadian-registered dredges are available, that are capable of dredging to EL -30 m (Chart Datum) at the production rate required for the Project (excavation by clamshell derrick is not a viable option). Consequently, the application of the "*Coasting Trade Act 1992*" dictates the use of FRPD equipment.

The development of the RBT2 Schedule is based on the assumption that the *Titan* and the *Columbia* are the only FRPD dredges utilised on this Project. FRPD recently purchased an additional trailing arm suction hopper dredge (*FRPD 309*), but it is assumed that this dredge is intended to replace the aging *Titan*, and so it has been assumed (for lack of real production data) that the dredging rate and general capability of this new dredge is similar to the *Titan*. The *FRPD 309* is now in service, and it has the ability to discharge sand directly into landside fills, which may help to reduce the overall schedule duration (due to less reliance on underwater stockpiling). However, in the absence of real production data, conservatively the schedule has maintained the previous assumption of *Titan* production rates and operational capability.

### 1.3.3 Underwater Stockpile – Intermediate Transfer Pit (ITP)

It is presumed that an underwater stockpile, referred to as the Intermediate Transfer Pit, of dredged sand will be used during the dredging and reclamation works. This ITP is assumed located southeast of the approach channel to the Deltaport Terminal wharf, in the same location as the underwater stockpile used during the recent construction of the Deltaport Berth 3 Expansion (DB3).

It is assumed that no restrictions will be imposed on placing Fraser River Sand (FRS) into the ITP; this is based on experience during DB3 construction. DB3 crab closures were relaxed with appropriate documentation and approval. Crab surveys and salvage may be required prior to, and during ITP operations.

Most of the underwater stockpile will sit below EL -5.0 m. It is assumed that reclaim of stockpiled FRS material sitting above EL -5.0 m will not be allowed during Juvenile Salmon closures. However, this is not likely to significantly impact reclaim operations.

### 1.3.4 Containment Dyke Construction (Terminal and Causeway)

All perimeter dykes that are required to contain dredged material or pumped FRS would be constructed on the seabed above EL -5.0 m.

Juvenile Salmon closures would apply during dyke construction. Note that for the DB3 project, dyke construction was allowed to continue through this closure.

The perimeter dykes will be extended to tie into the caisson wharf (closure dykes) after caisson placement and would be essentially a marine operation associated with the wharf construction.

### 1.3.5 Dredging the Dredge Basin and Marine Approach Areas

Crab closures will apply.

Temporary work stoppages will be mandated if specific marine mammals are present.

Dredge materials are to be placed only into contained (dyked) areas.

The dredge basin landside slope extends to approximately EL -4.0 m. This minor encroachment above EL -5.0 m is not considered a constraint with respect to the Juvenile Salmon closure.

### 1.3.6 Rip-Rap Placement

No restrictions based on DB3 experience.

### 1.3.7 General Fill Placement

All general fill (dredged material, FRS, sand and gravel from other sources) are to be placed only within dyked or otherwise contained areas, and so no further restrictions apply.

### 1.3.8 Disposal of Dredged Fines

Fines suspended in the water column within the contained (dyked) areas will be directed to an underwater disposal at sea (DAS) site. Seepage through the perimeter dykes is to be minimised by placing a filter layer on the inner face of the Terminal dykes. Sluice boxes would be managed to maximise the retention time of the contained water.

# 2. Terminal Area – Construction

## 2.1 Introduction

For the purposes of this Basis of Schedule document, the "Terminal Area" refers to that part of the final terminal that is located within the Containment Dykes. "Perimeter Dyke" is dyking that forms the outer perimeter of the final terminal. "Containment Dyking" is dyking to contain the dredged materials and other general fill within the Terminal Area. Containment Dyking includes all of the Perimeter Dyking. The crest of the Containment Dykes has been set at EL +6.0 m, which should be adequate for construction activities in most weather / tidal conditions (HHWL EL +4.8 m) and will be above the height required for dredgeate containment.

## 2.2 Dyking

### 2.2.1 Design Layout

Terminal Area dyking consists of 5 types:

a) South Face (Dyke TD1)
A rock fill Containment Dyke armoured only on the seaward face, parallel to and set back 162 m from the Wharf face. Typical section is as shown on **Drawing 60287593-MA-217** (Refer to EIS **Appendix 4-B**). Underlying native soil improvement is not required. The Dyke is either left in place or reclaimed in all, or in part, after the caissons are in place. Slope protection to be removed prior to Apron general fill placement.

b) East Face (Dyke TD2)
This Perimeter Dyke forms the east Containment Dyke, tying into the Westshore Terminals' perimeter. Seabed contours vary up from EL -4.0 m. Golder Associates (**Ref 2**) defines this as a Type 2 Dyke (**Ref 2, Fig. 9**) with underlying native soil improvement. Typical section is as shown on **Drawing 60287593-MA-216**.

c) West Face (Dyke TD3)
This Perimeter Dyke forms the west Containment Dyke and is categorised by Golder Associates (**Ref 2, Fig 9**) as Type 2 with underlying native soil improvement. Typical section is as shown on **Drawing 60287593-MA-216**. TD3 differs from TD2 in rip-rap details and in final elevation.

d) North Face (Dyke TD4)
This Perimeter Dyke forms the north Containment Dyke and is categorised by Golder Associates (**Ref 2, Fig 9**) as Type 2 with underlying native soil improvement. Typical section is as shown on **Drawing 60287593-MA-215**. TD4 differs from TD2 in rip-rap details and in final elevation.

e) Cross Dykes (Dykes TD5, TD6)
Containment Dyke TD5 completes the enclosure of the Terminal Area at the north-east corner and forms the interface with the causeway. Containment Dyke TD6 subdivides the Terminal Area into two basins, the west basin and the east basin. Typical section is as shown on **Drawing 60287593-MA-217**. TD6 may require rip-

rap, if TD3 is not in place. Underlying native soil improvement is not required since these dykes do not form the permanent perimeter of the terminal.

### 2.2.2 Dyke Materials

TD1 – crushed rock with no grading limits. No rip-rap bedding required as the rip-rap is designed for short-term incident wave climate (lower return period).

TD2, TD3, TD4 – crushed rock with 4" maximum particle size (to permit probe penetration for subsequent native soil densification). Inside surface faced with filter gravel (crushed rock).

TD5, TD6 – gravel fill with no grading limits.

All slopes exposed to wave action to be protected with rip-rap (slope armour rock) as construction advances.

### 2.2.3 Construction Sequence

- Causeway containment area for FRS fill, preload and stockpile for Stage 1 (from terminal entrance to Sta. 22+200);
- East basin Terminal Area. It is critical to complete the east basin Containment Dyking prior to commencement of Season 1 dredging (Year 2, Apr 01); and
- West basin Terminal Area.

All Containment Dyke construction is scheduled outside the Juvenile Salmon closures. To ensure timely delivery of dyke materials, at least two potential existing quarry sources of rock core and rip-rap materials are identified:

| | |
|---|---|
| Rock, rip-rap: | Texada Island (Lafarge), Pitt River |
| Gravel: | Sechelt, Mainland Sand & Gravel |

## 2.3 Dredge Basin Dredging

### 2.3.1 Extent

Scope of dredging is shown on **Drawing 60287593-MA-501**.

### 2.3.2 Dredging Sequence

Dredging is to be undertaken in a manner that would allow subsequent wharf construction activities to commence in Season 1 (Year 2). For the purposes of schedule development, when 300 m of trench at EL -30 m is available, placement of sacrificial stone and slope support mattress would commence. These activities would not advance closer than 200 m from the active dredge cut face. Dredging is assumed to be performed by FRPD's "*Columbia*" with an extended ladder. The maximum depth of dredging is the same as at DB3 where the "*Columbia*" completed similar dredging works successfully. Dredging to be undertaken outside Crab Closures (i.e., dredging performed only from April 1 through to October 15).

### 2.3.3 Dredge Mobilisation

The *Columbia* fills a dual role: dredging at the dredge basin, and reclaim from the ITP. FRPD has advised that installation of the ladder extension would require 4 weeks. In addition, the reclaim pipeline would be installed in the corridor between Westshore Terminals and Deltaport Terminal. A total of 3 months have been allocated for this pipeline set-up.

## 2.4 General Fill/Preload

### 2.4.1 Dredged Spoil (dredgeate)

Dredged spoil is to be placed to a reasonably uniform, slightly inclined, surface across the full extent of the Terminal Area. Season 1 (Year 2) dredgeate to be directed to the east basin. Dyke TD6 is to be located so that the capacity of the east basin corresponds to the expected volume of Season 1 dredging. For scheduling purposes:

- Dredge spoil bulking factor = 0.90;
- Dredge spoil retained = 85%;
- Dredge spoil to underwater ocean DAS site = 15% (remainder); and
- 50% dredged spoil volume placed in Season 1.

### 2.4.2 Fraser River Sand (FRS)

This material sourced from the Fraser River Maintenance Dredging program forms the bulk of the imported sand for the reclamation. Sand would be delivered to the ITP located southeast of the Deltaport Terminal approach channel by FRPD's hopper dredge. The sand would be reclaimed by FRPD's *Columbia*, augmented by a second dredge of lesser capacity where necessary.

- ITP Capacity = 2,400,000 $m^3$
- Maximum annual supply to ITP = 2,500,000 $m^3$

FRS from the Fraser River Maintenance Dredging program is the most economical source of general fill. If not augmented by another source of sand, or an increase in dredging equipment, the limit of 2,500,000 $m^3$/year would dictate the duration of the overall Project schedule.

The *Columbia* reclaim rate from the ITP can be significantly greater than the input by the Fraser River hopper dredge. However, if reclaim from the ITP is done only by the *Columbia* between and after dredging seasons, the total volume of FRS in place will be less than that available from FRS deliveries. This can be partially offset by using the *Columbia* prior to Season 1 dredging, to pump from the ITP to a land stockpile located in the Causeway area. The time available for this pumping would be restricted by completion of suitable containment dyking.

If an additional reclaim dredge unit with a minimum capacity of 3,500 $m^3$/day was utilised, then the Fraser River hopper dredge capacity could be fully utilised.

By June 20, Year 4:

| | Reclaim Scenarios | FRS Available | FRS In Place |
|---|---|---|---|
| **(1)** | *Columbia* reclaim between and after dredging season (i.e. no reclaim before Season 1 dredging) | 7.5 x $10^6$ $m^3$ | 5.65 x $10^6$ $m^3$ |
| **(2)** | *Columbia* reclaim as in 1 above plus 2 months prior to Season dredging | 7.8 x $10^6$ $m^3$ | 6.72 x $10^6$ $m^3$ |
| **(3)** | *Columbia* reclaim as in 2 above plus additional equipment at 3,500$m^3$/day | 7.5 x $10^6$ $m^3$ | 7.50 x $10^6$ $m^3$ |

Note: For scheduling purposes, scenario (3) above has been assumed.

No suitable BC-based dredge to augment the *Columbia* has been located. Dredging equipment capable of moving 3,500 $m^3$/day has been located in Eastern Canada, but would require mounting on a larger BC scow to survive in the local wave/wind climate. Also, since FRPD equipment is already presumed fully committed to the RBT2 Project, it may be reasonable to assume that a suitable dredge registered in another jurisdiction would be permitted under the *Coastal Trade Act 1992* for a defined period.

There is no advantage in early (i.e. pre-award) filling of the proposed ITP, since withdrawal can only commence after completing Season 1 dredging (Terminal) or completion of containment dyking (Causeway stage 1).

### 2.4.3 Additional Sand

The assumption of 1,088,000 $m^3$ of sand from an existing second source has been incorporated into the schedule. This material would be delivered by barge from an established quarry either to the ITP, or unloaded directly to the Terminal area. For the purpose of scheduling, placement into the ITP is assumed. The delivery rate information was provided by Lafarge Sechelt, and it is substantially lower than the delivery rate achieved for the YVR runway extension project. The consequences of including a second source of sand include:

- Project duration is shortened by 3 months;
- Superior quality sand is deposited in the upper limits of the general fill; and
- Schedule risk is reduced.

### 2.4.4 Terminal Area Preloading

The preload in the Terminal Area is specified as 6.0 m height plus a settlement allowance of around 1.5 m (typically 7.5 m total placed), applied for 4 months duration. In order to match the availability of FRS, three separate preloads are defined for each basin, all with some time overlaps. Priority is given to preloading the IY track area. The east basin preloads are moved in succession to the west basin with additional reclaimed FRS make-up. As the west basin preload duration expires, the material would be moved to Apron general fill and preload.

### 2.4.5 Construction Sequence

General Fill placement commences with the onset of Season 1 dredging.

| | |
|---|---|
| Step 1 | Dredged spoil into east basin (*Columbia*) |
| Step 2 | FRS pumped (*Columbia* and second dredge) into east basin over dredged spoil to final sand grade. This operation may require raising the level of the sand in stages to avoid displacement of newly placed dredged |

| | |
|---|---|
| | spoil. |
| Step 3 | Continue pumping FRS for preloading. |
| Step 4 | Season 2 dredged spoil into west basin (*Columbia*). |
| Step 5 | Repeat Step 2 operation in west basin. |

The second dredge reclaims FRS in a continuing operation.

### 2.4.6 Apron Area General Fill

This is discussed in **Section 3**.

## 2.5 Native Soil Improvement

### 2.5.1 Terminal Building Foundations

Native soil improvement is required under the Maintenance Building, Administration Building, CBSA Building, Parking Structure, and the main Substation, which are all located within the initial perimeter dyke system. This soil improvement extends to EL -42 m and is only feasible if undertaken prior to the general fill placement (i.e., prior to dyke closure). It will require the equipment to be mounted on a jack-up platform or grounded barge, due to limited water depth (although barge-mounted equipment may be feasible at mid to high tide). This activity is scheduled simultaneously with Year 1 dyke construction and must be completed, and the containment dyke closed, before the dredging operation can commence.

Some soil foundation improvement is also required under the Longshore Break Room (located at the west end of the main wharf apron), but native soil densification is assumed not required for this relatively small building.

### 2.5.2 Perimeter Dykes

The improvement of native soil underlying Type 2 Dykes applies to Terminal Area Perimeter Dykes TD2, TD3, and TD4. The extent of native soil improvement is shown on **Drawings 60287593-MA-214**, **215**, and **216**. This activity would be performed by land based, bottom feed equipment. This work is scheduled to follow the preload as it advances westward. Dykes TD2 and TD3 will be extended later to tie into the caisson wharf. The required densification under these extensions is covered in **Section 3**.

# 3. Wharf Construction

## 3.1 Introduction

This section covers all construction activities following the dredging of the trench through to completion of the wharf face and the Apron area. All these activities are south of containment Dyke TD1.

## 3.2 Construction Sequencing

When dredging has advanced to expose 300 m of trench at EL -30.0 m, the caisson foundation work would commence. An advancing front, constrained by the progress of the dredging, of foundation preparation, caisson installation, retained fill placement and finishing work would ensue, with separation dictated by the safe space requirements for the marine equipment. There would be a hiatus in wharf construction when the first Season dredging is stopped by the crab closure and would recommence when the second Season dredging starts.

Starting at the east end, the wharf construction sequence would be:

- Place sacrificial rock and buttress mattress rock;
- Improvement of the native soil;
- Clean-up dredging (by *Columbia*) of fines generated by native soil improvement (to DAS site);
- Place mattress rock and overbuild;
- Densify mattress rock;
- Remove excess mattress rock (remaining overbuild);
- Place levelling course and screed;
- Install wharf face caissons;
- Place caisson ballast Stage 1;
- Place Stage 1 berm rock;
- Install keys between caissons;
- Complete placement of berm rock and caisson ballast; and
- Place berm rock filter.

At this time:

- Prepare foundation for end caisson C30A;
- Improve native soil under east closure dyke (marine-based equipment);
- Place end caisson C30A; and
- Construct the east closure dyke including the sheet pile wall.

This work provides a partially enclosed bay, allowing Apron work to commence.

- Place general fill in Apron area behind caissons (FRS from terminal area preloads);
- Place 1st preload on general fill north of the Apron limit;
- Densify berm rock, berm filter, and general fill under Apron;
- Place and compact upper level of Apron fill (likely using dynamic compaction and roller compaction methods);
- Dynamically compact general fill north of the Apron (after preload removal);
- Construct cope wall, rail beams, etc.; and
- Install fenders.

When caisson C1 is in place:

- Prepare foundation for end caisson C1A;
- Improve native soil under west closure dyke (marine based equipment);
- Place end caisson C1A; and
- Construct the west closure dyke including the sheet pile wall.

The construction of the closure dykes is scheduled during Juvenile Salmon closures. Work above EL -5 m may require to be deferred. For schedule development purposes, a silt curtain containment is envisioned, enabling the work to continue to final elevation. If this proves not to be practicable, Apron general fill placement would commence further to the west with no material impact on the schedule.

### 3.3 General Fill in Apron Area

The general fill between the caisson wall and containment Dyke TD1 would be drawn from the terminal area preloads and would be placed from east to west.

### 3.4 Apron Area Preload

The preload requirements set out in **Section 2.4.4** are applicable to the zone of general fill between Dyke TD1 and the northern edge of the Apron. (Preloads 7-8-9). This preloading would be done in 3 stages. Material from preload 8 and the Stage 2 (east) causeway preload would be used to complete the apron general fill. Preload 9 would utilise stockpiled Terminal granular base.

# 4. Causeway Construction

### 4.1 Introduction

The causeway, for construction scheduling purposes, is deemed to run from Containment Dyke TD 5 to the shoreline at Station 19+968; a length of approximately 5.3 km. The causeway would be constructed in two stages. Stage 1 (west causeway) extends from Dyke TD5 to Station 22+200 (a length of approximately 3,080m). Stage 2 (east causeway) runs from station 22+200 to Station 19+968 (a length of approximately 2,230m).

### 4.2 Construction Sequencing

Stage 1 Dyking would be constructed simultaneously with the Terminal east basin Containment Dykes. This will:

- Permit an early start on reclaim from the ITP prior to start of dredging for general fill and preload;
- Provide a location where FRS could be stockpiled for subsequent use in the Terminal Area. Without this stockpile, the full volume of available supply of FRS will not be utilised;
- Provide improved landside access to the Terminal Area; and
- Permit early reclaim of existing Pods 2 and 3 shore protection material for reuse on the Perimeter Dykes.

Causeway Stage 2 dyking would be constructed in the second season crab opening. FRS for general fill and preload would be relocated from the completed Causeway Stage 1 preload and stockpile. Preloading for Causeway Stage 2 would be done in a single step.

### 4.3 Perimeter Dyking

Perimeter Dykes must be in place before general fill placement can commence. This dyking consists of 3 types:

a) Dyke CD1 extends from Dyke TD5 to Station 22+000. The dyke would be constructed with imported 4” minus rock and/or gravel trucked from unloading ramps located in the Terminal Area. Placement of slope protection using imported and reclaimed materials would closely follow the lead of the dyke core construction. Native soil improvement is required under the CD1 dyke. A typical section is shown on **Drawing 60287593-MA-214**.
b) Dyke CD2 connects CD1 to the shoreline. Native soil improvement is required under the western portion of Dyke CD2. In this zone, the dyke would be constructed with 4” minus rock or gravel. Where native soil improvement is not required, the dyke could incorporate quarry tailings and gravel reclaimed from Pods 2 and 3 slope protection.
c) Dyke CD3 separates Stage 1 and Stage 2 and provides Stage 1 general fill containment and site access. Built with reclaimed quarry tailings and gravel. Native soil improvement is not required under Dyke CD3.

For both CD1 and CD2, slope protection would be imported material with minor augmentation from salvaged rip-rap bedding.

### 4.4 General Fill / Preload

Refer to **Section 2.4.2** for reclaim of FRS from the ITP. Causeway Stage 1 general fill and preload is FRS sourced from the ITP and placed directly by pump. Causeway Stage 2 general fill and preload is sourced from Causeway Stage 1 preload (after Stage 1 settlement) which is relocated along the causeway by truck. The preload on the Causeway fill is specified as 3.0 m height plus a settlement allowance of between 0.3 m and 0.5 m (varies along causeway), applied for 3 months duration.

# 5. Other Construction Activities

### 5.1 Granular base

Placement of granular base and fine grading for terminal pavements and other structures would be undertaken after the dynamic compaction work had advanced sufficiently and all underground services have been installed. Material would be delivered by barge and unloaded via a barge ramp or barge mounted conveyor. The import and placement of the terminal pavement structure is not included in this schedule, with the exception of the granular base material imported for use as preload in the Apron (Terminal Area Preload Stage 9).

### 5.2 Tug Basin Expansion

The existing tug basin would be expanded and additional mooring facilities provided. The work consists, in part, of salvage/removal of slope protection materials, dredging by clam shell derrick, installation of slope protection and crest protection, and installation of mooring piles (all involving marine equipment). These operations are in water depths both above and below EL -5.0 m. Thus, both juvenile salmon and crab closures will likely apply. The work is scheduled between August 15 (end of Juvenile Salmon closure) and October 15 (start of Crab Closure). A two-month duration is feasible for the scale of the work involved.

# 6. Production Rates – Terminal Area

### 6.1 Work Days

For scheduling purposes:

- Dredging, FRS reclaim from stock pile:
  3 shifts/day, 7 days per week, 30/31 days per month.
- Other marine equipment (clam shell dredge, densification equipment, etc.):
  2 - 10 hour shifts/day, 6 days per week, 26 days per month.
- All land operations except dynamic compaction:
  2 shifts/day, 6 days per week, 26 days per month.
- Dynamic compaction:
  1 shift/day, 6 days per week because of noise levels

## 6.2 Sources of Information

AECOM is indebted to a number of contractors for their input. FRPD provided input on dredging, FRS import and reclaim technologies. The production rates suggested by FRPD have been reviewed, and adjusted where judged necessary, in the light of experience on earlier projects at Roberts Bank. Lafarge Sechelt provided information on supply of sand from their Sechelt pit; their suggested rate is judged to be conservative. JJM Construction Ltd. provided suggestions and rates for dyke construction, which reflected their experience with DB3 construction. Delta Aggregates provided input on preload relocation rates. For wharf construction (including native soil improvement, marine based and land based densification, caisson construction, backfill) production rates were abstracted from records for Deltaport Terminal Berths 1 & 2 and the Deltaport Berth 3 Expansion project. Finally, some production rates were developed internally (e.g. preload relocation).

## 6.3 Production Rates

See following Table:

| # | Item | Production Rate | Unit | Notes |
|---|---|---|---|---|
| **A** | Dyke Construction: | | | |
| | Supply and place core rock and gravel | | | |
| | Place by end dumping from scow and by clam | 4,250 | $m^3$/d/barge | Up to 2 – 5,000 t barges/day, includes 15% weather delay |
| | Place from ramp by truck | 4,250 | $m^3$/d/barge | Up to 2 ramps used, each at 1 – 5,000 t barge / day, includes 15% weather delay |
| | Slope Protection: | | | |
| | Place from scow by clam | 700 | $m^3$/d | Up to 2 clams used |
| | Place from dyke | 700 | $m^3$/d | Up to 2 backhoe /clams used |
| | Raise perimeter dykes | 500 | $m^3$/d | Done in concert with native soil improvement |
| **B** | Dredge Marine Approach Areas and Dredge Basin | | | |
| | Mobilise *Columbia* | | | 4 weeks to install ladder extension<br>6 weeks to install reclaim pipeline |
| | Dredge | 13,500 | $m^3$/d | Weighted average of FRPD rates above and below EL-15 m |
| **C** | General Fill | | | |
| | Dredged Spoil | | | Dredged volume reduced by loss (15%) and compaction (10%) |
| | FRS to ITP | 10,500 | $m^3$/d | FRPD input |
| | ITP capacity | 2,400,000 | $m^3$ | FRPD input |
| | Reclaim by *Columbia* | 15,000 | $m^3$/d | FRPD input |
| | Reclaim by second dredge | 3,500 | $m^3$/d | Set by Project demand |
| | Second sand source | 50,000 | $m^3$/month | Lafarge Sechelt input |
| **D** | Preload | | | |
| | 9 preloads on Terminal Area | | | |
| | 2 preloads on Causeway | | | |
| | Reclaim by *Columbia* | 12,000 | $m^3$/d | Reduced FRPD rate to reflect elevation |
| | Reclaim by second dredge | 3,500 | $m^3$/d | Set by Project demand |
| | Relocate preload | | | |
| | - Max haul 1.5 km | 16,000 | $m^3$/d | Utilising 20 $m^3$ articulated dump trucks, 15 minute cycle time |
| | - Max haul 6 km | 8,000 | $m^3$/d | Utilising 20 $m^3$ articulated dump trucks, 25 minute cycle time |
| **E** | Native Soil Improvement | | | |
| | Building Foundations (marine based) | 800 | $m^3$/d/rig | 4 rigs used, double shift. Golder Associates rate of 100 linear m/shift with 10% weather delays |

| # | ITEM | PRODUCTION RATE | UNIT | NOTES |
|---|---|---|---|---|
| | Caisson foundation (marine based) | 730 | $m^3$/d/rig | 6 rigs used in Base, DPI rate 1,090 $m^3$/d / 1.5 rigs |
| | Closure dykes (marine based) | 730 | $m^3$/d/rig | 2 rigs used |
| | Perimeter dykes (land based) | 1,500 | $m^3$/d/rig | 3 rigs used, rate controlled by preload removal |
| **F** | Dynamic Compaction | 500 | $m^2$/d/rig | 6 rigs used |
| **G** | Wharf Construction – marine operations | | | Rates based on previous experience which are adequate to keep abreast of dredging progress |
| | Place buttress rock and sacrificial stone | 4,000 | $m^3$/d | Bottom dump scow, trimming by 2 clams |
| | Remove sacrificial rock | 2,000 | $m^3$/d | By clam to barge for ocean disposal |
| | Place mattress rock and overbuild | 6,000 | $m^3$/d | Bottom dump barge, trimming by 3 clams |
| | Densify mattress rock | 1,000 | $m^3$/d/rig | 6 rigs in 2 fronts used |
| | Remove mattress rock overbuild | 2,000 | $m^3$/d/rig | By clam, 2 rigs used |
| | Place and screed levelling course | 100 | $m^2$/d | |
| | Construct concrete caissons | 1 | #/wk | |
| | Place caisson ballast | 4,000 | $m^3$/d | 1-5,000 t barge / day placed by 2 clams |
| | Place Rock Berm | 4,000 | $m^3$/d | Bottom dump barges, trimming by 2 clams |
| | Place Berm Filter | 2,000 | $m^3$/d | Bottom dump barges, trimming by clam |
| | Place Scour Protection | 800 | $m^3$/d | By clam |
| **H** | Wharf Construction – Land operations | | | |
| | Apron area soil densification | 1,500 | $m^3$/d/rig | 3 rigs used |
| | Apron area general fill | | | |
| | Dynamic compaction | 500 | $m^2$/d/rig | 2 rigs used |
| | Wharf infrastructure (including cope wall, rail beams, etc.) | | | All rates from DB3 |

# 7. Critical Path Activities – Marine Construction

## 7.1 Critical Path

The Critical Path for the RBT2 construction schedule is essentially unchanged from the "T2 Option 2 – Early Start Date" Schedule. The Critical Path for the construction of the Terminal Area and Causeway for RBT2, through to the final grading prior to granular sub-base placement, flows through the following activities:

a) Mobilisation for construction of the containment dyking (including installation of barge unloading ramps with storm protection);
b) Construction of the Terminal Area east basin and Causeway Stage 1 containment dyking;
c) Native soil improvement for 5 Terminal Area building foundations (a gap must be kept open in the containment dykes until this operation is complete and the equipment withdrawn);
d) Season 1 dredging with emphasis on providing maximum trench for wharf construction;
e) Placement of FRS in the east basin;
f) Installation of Terminal Area preloads 1, 2, and 3;
g) Season 2 dredging;
h) Continuing wharf construction;
i) West closure dyke construction;
j) Apron area general fill (west end);
k) Apron area preload 9; and
l) Apron area dynamic compaction (west end).

Removal of preloads 1, 2, and 3 (see item "f" above) would permit the start of native soil improvement under the east basin perimeter dyking, and the dynamic compaction of the upper general fill in the east basin. When these activities have advanced sufficiently, installation of underground services could commence. Also preparation for laying the eastern end of the IY trackage could start.

## 7.2 Construction Activities with Significant Risk

### 7.2.1 Delays due to Adverse Weather

The berth and adjacent areas are exposed to weather systems originating from the south-east, westward to the north-west. This is the sector where high winds combined with lengthy reaches result in wave action that would require marine equipment to be moved to a sheltered location. June through to September are the quieter months, but waves of sufficient height to shut down some marine operations can occur in any season.

The most serious impacts of adverse weather would be:

- Damage to unloading ramps;
- Interruptions during the east basin containment dyke construction, including damage to dykes already constructed, but inadequately protected by rip-rap;
- Interruption to the native soil improvement for the Terminal building foundations;
- Interruption and delays in material deliveries by barge and from the ITP;
- Interruption to dredging, and possible disruption to dredgeate pipeline;
- Interruptions in wharf construction, especially native soil improvement; and
- Damage to stored caissons.

### 7.2.2 Dredging and FRS Reclaim

The only equipment available for Project dredge basin dredging and reclaim of FRS from the ITP is the *Columbia*. If this dredge becomes unavailable for more than 3 weeks during the dredging season, the completion of the dredging as contemplated would be unlikely. If sand delivery to the ITP (by the Fraser River hopper dredge) is interrupted for 2 months during the Fraser River Maintenance Dredging program, delay in the placement of general fill and preloads will ensue.

### 7.2.3 Native Soil Improvement

Native soil improvement has been utilised on previous wharf projects at Roberts Bank. Native soil improvement under the perimeter dykes falls within the experience of most specialty contractors. However, native soil improvement under five Terminal buildings extends down to EL -42 m, which is probably close to the limit of current technology. This activity is on the critical path. Because of the confined site, adding additional equipment to compensate for slow progress may not be an option.

Native soil improvement in the dredge basin extends the full length of the berth and extends down to EL -47 m, which is probably close to the limit of current technology. Similar work, but only down to EL -32 m, was undertaken at Deltaport Terminal Berths 1 & 2 where some difficulties were encountered requiring additional equipment to maintain scheduled progress. Specialty contractor experience in underwater improvement at these depths is very limited.

Progress in underwater soil improvement is controlled by the rate of trench availability. The width of the soil improvement zone is sufficient to accommodate multiple vibro-densification units (on multiple barges) if required.

### 7.2.4 Dredged Spoil Quantity Variation

The volume of dredged spoil retained in the dyked Terminal Area is subject to two variables:

- The percentage retained (nominal assumption is 85% retained); and
- Degree of consolidation of in-place spoil (bulking factor, 0.9 assumed).

Variation in these factors could result in significant change to the assumed volume of sand reclamation fill available from the dredge basin dredging operation:

| | | | | |
|---|---|---|---|---|
| % retained at 0.9 bulking factor | 95% | 85% | 75% | 65% |
| In-place volume $m^3 \times 10^6$ | 3.56 | 3.19 | 2.81 | 2.44 |

If 95% retention is attained (unlikely), the dredged spoil will extend into the lower level of the 6 m cap of compacted sand. If retention is less than 85% (considered more likely), additional FRS will be required to compensate.

The values used were arrived at after discussions with FRPD and Golder Associates. By raising the baffles at the discharge, the Contractor has the ability to increase retention time of the discharge water.

# 8. Assumptions for Terminal Surface Works

## 8.1 Civil Utilities Construction Sequence Assumptions

1. The surface civil works will follow the preloading and dynamic compaction work sequence in the causeway and terminal areas.
2. The deep utilities – buried water, sewer and drainage pipes – will be installed first into the completed and densified fill areas.
3. The shallow utilities – buried power, communication lines, natural gas (if required) lines – will be installed after, and usually overtop of, the deep utilities.
4. The terminal building area, consisting of most of the administrative infrastructure for operating the terminal, will be the first area with completed servicing in order to start the major building work as early as possible.

# 9. Terminal Buildings Construction

The major buildings identified on the Terminal Layout Concept Plan have various construction durations due to their inherent differences in size and complexity. Virtually all of these are presumed to be constructed on-site. Five buildings will require additional ground improvement operations to achieve the seismic resistances required by the National Building Code of Canada. The primary building construction activities and their durations are estimated to be:

| | |
|---|---|
| Ground improvements for admin building | 2 months |
| Administration/CBSA and Parkade Buildings | 15 months |
| Rail Compressor Building | 6 months |
| Ground Improvements for M & R Building | 3 months |
| Maintenance and Repair (M & R) Building | 15 months |
| Reefer Wash Building and Canopy | 9 months |
| Ground Improvements for Main Substation | 2 months |
| Main Substation | 9 months |
| Substations | 4 months |
| Longshore Breakroom | 6 months |
| Driver Service Building | 6 months |

For the ground improvement works it is assumed that 2 vibro rigs will be needed to complete the M & R building followed by one on each of the other four buildings. The substations are assumed to be prefabricated offsite and their construction durations are for onsite installation only.

# 10. Yard Structures

The foundation and structures work in the IY, the Container Yard, and apron areas follows behind the civil utility sequencing. Several contractors involved in the original Deltaport Terminal construction provided budget productivity rates for supply and installation of crane rails and their foundation structures to estimate work durations of the various staged yard areas. An important productivity rate used in the schedule was:

| | |
|---|---|
| ASC and RMG Rail and Foundation | 100 m/day |

Smaller total area durations were developed for miscellaneous structure works such as lighting bases and minor foundations.

# 11. Construction Productivity Rates for Electrical, Pavements, and Railway Tracks

| | |
|---|---|
| Conduit Installation | 150 m / day |
| Asphalt c/w gravels | 5,500 $m^2$ / day |
| Railway Turnouts | 3 days / turnout |
| Railway Track/ties/ballast | 305 track m / day |

# 12. Terminal Equipment

Major terminal equipment delivery schedules used were:

STS Cranes:

- Specification, bid, and award:  4 months;
- STS Crane delivery: 18 – 20 months (4 STS units at a time); and
- STS Crane site testing: Unit #1 – 2 months; subsequent units 2-3 weeks/unit.

RMGs & ASCs:

- Specification, bid, and award:  4 months;
- Deliveries: 12 - 15 months (8 units/delivery); and
- Site Erection and testing: Unit #1 – 2 months; subsequent units 2-3 weeks/unit.

Mobile Horizontal-Transfer Equipment (Shuttle Carriers assumed):

- Specification, bid, and award:  4 months;
- Deliveries: 12 - 15 months (10 units/delivery); and
- Site testing: 10 units per month after delivery.

As part of the system/equipment start-up, there should be an allowance of 2 months of training for the remote crane operators with the terminal operating systems and consoles.

# REFERENCES

Ref 1 Worley Parsons “Dredging and Reclamation Study”

Ref 2 Golder Associates “Geotechnical Evaluation for Land Reclamation and Perimeter Dykes”

# Roberts Bank Terminal 2

# Basis of Schedule – Part 2

# 2.0 BASIS OF SCHEDULE – PART 2 – CAUSEWAY INFRASTRUCTURE CONSTRUCTION

The production of the construction schedule for the causeway infrastructure utilised the following sources of information:

- The preliminary Delcan/DMD design drawings as included in EIS **Appendix 4-C** and represented on:
  - Civil Infrastructure **Drawings 34-247-CI-1159** to **1166**;
  - Rail **Drawings 34-347-RL-1050** to **1060**; and
  - Lighting **Drawings 34 347 EL 4000** to **4005**.
- **Basis of Schedule Part 1**: AECOM Basis of Schedule.

There are no seasonal or environmental constraints to be considered for the causeway infrastructure construction.

## 2.1 INTRODUCTION

The causeway infrastructure is a vital Project component to the overall success of the Project. Although not explicitly implied in Part 1 of the Basis of Schedule, it has been assumed that uninterruptable access to the new terminal will be required to complete the civil utilities in a timely fashion. Bringing the RBT2 overpass online as soon as possible will be beneficial, if not essential for the completion of the terminal civil works.

The causeway infrastructure schedule has been created based on the following assumptions:

- The schedule tasks for the causeway infrastructure work will begin as the land filling program is completed.
- The scheduled preload and dyke improvement items take over a year to complete. There are infrastructure tasks which could be started early before these activities are complete, but the schedule has been based on the fixed completion date with the exception of minor mobilisation.
- The AECOM schedule divides the causeway into two zones, west and east causeway. Most of the causeway infrastructure of the main rail T-yard straddles the boundary between the west and east zones. The schedule assumes all of the T-yard work will only begin once the east zone is released for construction.

## 2.2 CONSTRUCTION COMPONENTS DESCRIPTION

### 2.2.1 West Causeway Transportation Infrastructure

The majority of the causeway transportation infrastructure construction takes place in the vicinity of the west causeway. This work program includes track realignment, track construction, RBT2 overpass structural construction, and road construction. The primary objective is to realign the Westshore Terminals' dumper entrance and exit tracks, and build a grade separated span over the tracks.

This work is assumed to start when the west causeway earthworks, including preload removal and dyke improvement, is substantially complete. The key to being able to complete the RBT2 overpass is the realignment of the entry and exit tracks in the vicinity of the east (south approach) causeway curve. The main purpose of this work is to lay new coal rail tracks in this vicinity. The newly placed tracks are tied in one track at a time to allow minimal disruptions to the coal operations. The original tracks that interfered with the RBT2 overpass structure are removed after the new tie-in, in order to progress the RBT2 Overpass.

The completion of the RBT2 Overpass and the road construction is critical in order to provide access for labour, material, and equipment to the new terminal to complete terminal buildings and yard structures. The Deltaport Gate 2 grade separation is constructed in concert with the RBT2 Overpass.

### 2.2.2 East Causeway Transportation Infrastructure

Following the completion of the overpass structures, the rail tracks are constructed within the T-Yard and DPU/Bad Order Setout Yard. The rail track tie-in to the mainline is also constructed within the same timeframe.

The final activity within the causeway infrastructure is the construction and grading of the north causeway emergency access road.

## 2.3 CONCLUSION

The causeway infrastructure construction can be carried out within the overall RBT2 Preliminary Design construction schedule without interfering with any of the critical items therein.