

Report for

**City of Hamilton**

CSO Facilities Assessment –  
MECP Order Items 4,7,8 and 9

October 31, 2018



City of Hamilton  
 CSO Facilities Assessment -  
 MECP Order Items 4,7,8 and 9

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October 31, 2018

10/31/18	1	Final	Mark Stirrup, M.Eng., P.Eng. 	Graeme Henderson, P.Eng., PMP 
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<b>HATCH</b>				

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## 1. Introduction and Background

On August 2, 2018, the Ministry of Environment, Conservation and Parks (MECP) issued Provincial Officer's Order #1-J25YB (hereinafter referred to as the Order) to the City in relation to the discharge of untreated wastewater to the environment.

This report addresses MECP Order Items 4, 7, 8 and 9, which include the following specific requirements:

Item 4 requires the City to inspect all CSO facilities and inventory all critical valves (bypass gates) and control points (overflows) which can be a source of discharge to the natural environment and which would not be captured by existing flow monitoring equipment, including confirmation of manual and SCADA valve position correlation and local or remote control.

Item 7 requires the City to evaluate the need for modification(s) to the Main/King CSO Facility, to improve monitoring, performance, reliability and to minimize bypasses/overflows/spills into the 2400 mm storm outfall from the (CSO tank) overflow trough and inlet chamber bypass.

Item 8 requires the City to evaluate the need for modification(s) similar to those required by Item 7 above for all other CSO facilities within the Hamilton Wastewater Collection System to minimize bypasses/overflows/spills.

Item 9 requires the City to prepare a written report which sets out the evaluation required by the Items 7 and 8 above, along with recommendations and timelines to implement these recommendations.

This report discusses the findings of the CSO facility inspections and evaluation of the need for modifications to improve the monitoring, performance and reliability of each facility to minimize the potential for unapproved bypasses/overflows/spills from the facilities (Items 4, 7 and 8); and provides recommendations required by Item 9 of the Order.

## 2. Methodology

Work on Order Item 4 began with a desktop assessment and review of existing as-built drawings; specific gate/valve equipment cut-sheets and maintenance manuals; and overall O&M manuals, process control narratives (PCNs), and standard operating procedures (SOPs) for all critical control points (CCPs) at each of the City's CSO facilities.

The purpose of the desktop review was to assist with the inventory of the specific gate/valve equipment installed at each of CSO facilities; and document the intended mode(s) of operation of the equipment under various flow conditions (dry weather flow (DWF) and wet weather flow (WWF)); and the potential for possible discharge to the natural environment under various gate positions and/or operating modes. It also helped to plan for the site visits to inspect the facilities, to focus on the information required to meet the requirements of MECP Order Items 4, 6, 7, 8 and 9.

Next, site visits were completed of all nine of the City's CSO facilities to: i) inspect all critical valves (bypass gates) and control points that could, under certain conditions, be a source of a discharge to the natural environment, and which would not be measured by existing flow monitoring equipment at each site; ii) confirm the ultimate outlet location of such discharges; and iii) confirm manual (actual) and SCADA valve position correlation, and local/remote control capabilities.

The site visits were used to confirm and/or augment the findings of the desktop review and finalize the assessment and inventory of the critical gate/valve equipment at each CSO facility, as presented in this report.

The following CSO facilities were visited and inspected in person by City and Hatch staff on October 2, 2018:

- 1) Greenhill CSO Tank #1 (HCS01)
- 2) Bayfront Park CSO Tank (HCS02)
- 3) James Street CSO Tank (HCS03), including Ferrie-Mary CSO Regulator Gate (HCG03)
- 4) Main/King CSO Tank (HCS04)
- 5) Eastwood Park CSO Tank (HCS05), including Burlington-Ferguson and Ferrie-Ferguson CSO Regulator Gates (HCG06 and HCG07)
- 6) Greenhill CSO Tank #2 (HCS06)
- 7) Red Hill Storage Facility (HCS07), including Lawrence Road, Queenston Road and Barton Street Gates (HCS7A, HCS7B and HCS7C)
- 8) Royal Avenue CSO Tank (HCS08)
- 9) McMaster/Ewen CSO Tank (HCS09)

The findings of the CSO facilities desktop review and site inspections were then combined and studied further to evaluate the need for and provide recommendations for any modifications needed to improve the monitoring and performance of each of the CSO facilities, and to minimize unapproved bypass events and/or increase the Operators' ability to identify and deal with such events.

- + For Order Item 7, this included the evaluation of possible modification(s) to the Main/King CSO facility, to improve monitoring, performance and reliability, and to minimize unapproved bypasses/overflows/ spills into the 2400 mm storm outfall from the CSO tank overflow trough and inlet chamber bypass.
- + For Order Item 8, this included the evaluation of similar modifications at the other eight CSO facilities within the Hamilton Wastewater Collection System to minimize unapproved bypasses/overflows/ spills into adjacent receiving waters.

This report presents the findings of the above investigation, covering all the deliverables related to Order Items 4, 7 and 8, for each inventoried Critical Control Point (CPP), and providing recommendations required under Order Item 9.

The remainder of this report is broken down facility by facility, including a separate section for each of the City's existing CSO facilities (at the locations noted above).

### **3. Discussion**

The following sections of the report provide a brief narrative description of each of the above CSO facilities and their purpose, and include a series of drawings/figures showing the location of the CCPs at each facility, and also indicating the potential for possible unapproved sewage discharges to the environment from each CCP, colour coded as follows:

- + Green indicates CCPs that convey sewage flows to the Woodward Avenue WWTP, with absolutely no potential for DWF or WWF discharges to the environment. This includes all manual and motorized flow control gates and pumps that convey sewage flows towards the WWTP during DWF and WWF.

- + Yellow indicates CCPs that convey sewage flows into the CSO storage facilities, which if operated correctly, have no potential for DWF discharges to the environment, and have the potential to contribute to WWF discharges to the environment only if the design capacity of the CSO storage facilities are exceeded and an overflow occurs following the normal course of events. This includes all manual and motorized flow control gates and manual stop logs/gates that divert sewage flows into the CSO storage facilities during WWF.
- + Red indicates CCPs that under default settings convey sewage flows to the WWTP or into the CSO storage facilities, so have no potential for discharge to the environment under normal operating conditions; but could cause a sewage discharge to the environment if they are moved from their default positions. This includes any manual or motorized gates or manual stop logs/gates that could be used to bypass the CSO storage facilities to allow isolation of the facilities to conduct maintenance inside them. It should be noted that this is unlikely to be done, and if it was, significant planning, approvals and mitigation measures would be required to be undertaken before implementing such a bypass.

Each section also includes a table providing an inventory of all the CCPs at each facility, including their name; SCADA tag name (where applicable); size/capacity; whether they are manually operated or motorized; their purpose in terms of flow control; their default position (as per the facility's PCN and/or SOP); their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

### 3.1 Greenhill CSO Tank #1 (HCS01)

The original Greenhill CSO Tank (HCS01) is an underground reinforced concrete structure that provides approximately 83,500 m<sup>3</sup> of CSO storage capacity, and was designed to capture the runoff from a 15 mm design storm. The storage volume is provided within a circular tank, which is approximately 54 m in diameter and 9 m deep, and includes two separate storage cells. The first cell provides approximately 13,900 m<sup>3</sup> of storage, and if the first cell fills, the second cell provides approximately 69,600 m<sup>3</sup> of additional storage.

Originally, HCS01 received sewage inflows directly from the combined trunk sewer running east along Greenhill Avenue, but with the addition of Greenhill CSO Tank #2 (HCS06), the original CSO tank now receives the overflows from the new CSO tank. The combined operation of the two CSO tanks is discussed in more detail below in Section 3.6.

HCS01 is filled by gravity from the overflow from HCS06, and drained by motorized flow control gates over the discharges from the two storage cells, into the Red Hill Creek Sanitary Interceptor Sewer (RHCSI), which conveys flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

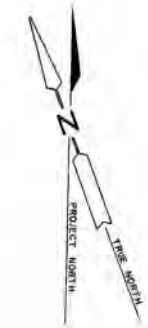
The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station.

Figures 1A and 1B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described above.

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Table 1 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 1A: Greenhill CSO Tank #1 (HCS01) – Site Plan



NOTES TO THE CONTRACTOR

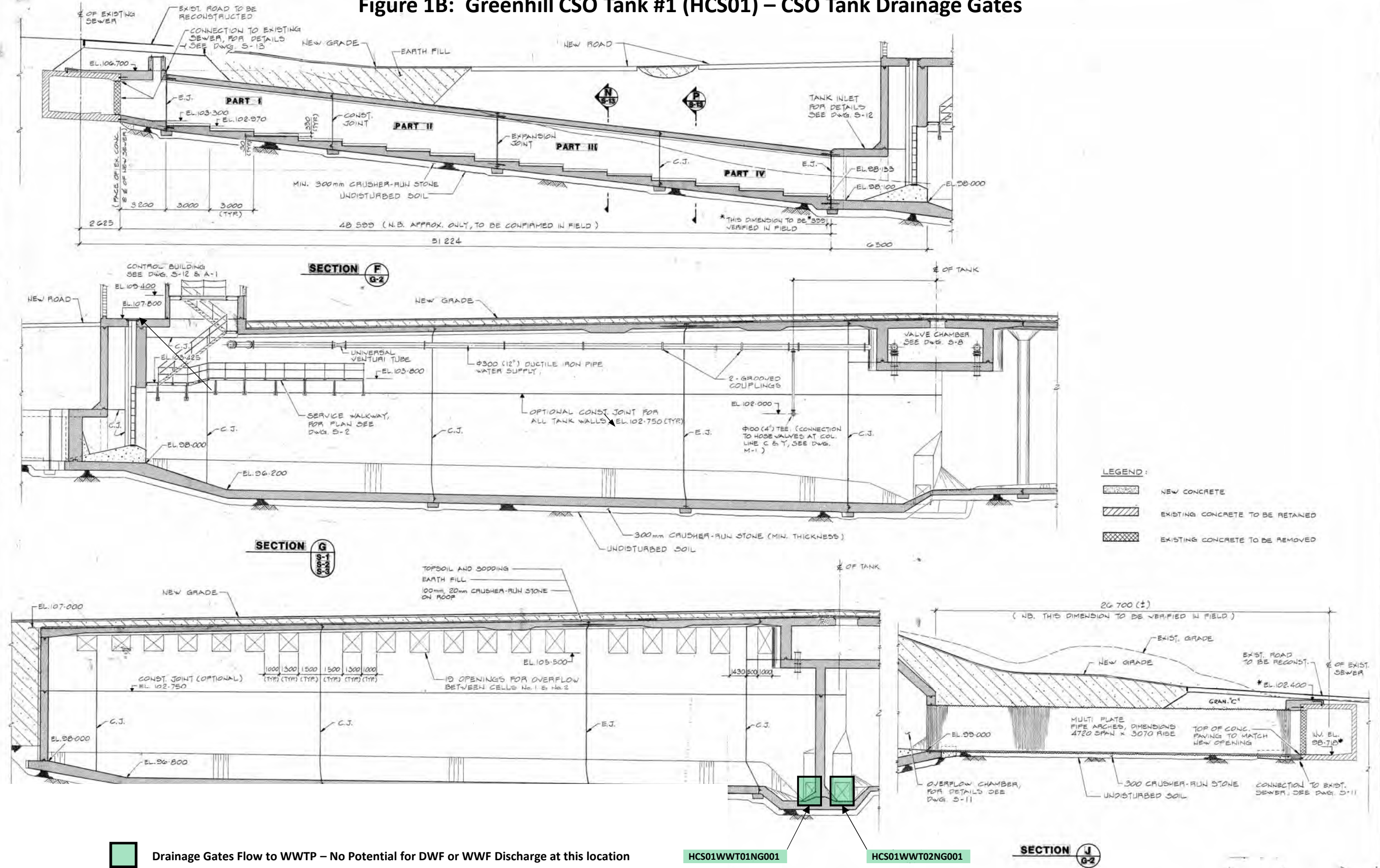
1. THE PROJECT BENCH MARK IS LOCATED ON THE NORTH FACE OF ROSEDALE ARENA, 2 m EAST OF UNION GAS METER; ELEVATION 115.820 m.
2. CONTRACTOR'S WORKING AREA, TO BE USED FOR CONVENIENCES, STORAGE OF MATERIALS AND STOCKPILING OF TOPSOIL AND EXCAVATED MATERIAL. NO TREES WITHIN THIS AREA SHALL BE CUT.
3. EXISTING ACCESS ROAD TO PLAYING FIELDS SHALL BE KEPT CLEAR AT ALL TIMES.
4. CONSTRUCTION AREA LIMITS. NO CLEARING WILL BE PERMITTED BEYOND THIS LINE.
5. APPROXIMATE EXTENT OF VERTICAL ADJUSTMENT OF GRADE. NEW ELEVATIONS SHALL BE BLENDED SMOOTHLY INTO EXISTING.
6. SHADED AREAS INDICATE THE LAYOUT OF GRAVEL ROADWAYS AND PARKING AREAS, NEW AND EXISTING, TO BE RECONSTRUCTED AND RAISED UNDER THIS CONTRACT; SEE SPECIFICATIONS, SECTION 1A.
7. WORK IN THIS AREA MAY BE DONE ONLY DURING THE PERIOD BETWEEN OCTOBER 20 AND MAY 15. ALL SURFACE FEATURES SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
8. EXISTING MANHOLE TOPS TO BE MODIFIED, AS PER DETAIL ON DRAWING G-3.
9. EXISTING REGULATOR CHAMBER TO BE MODIFIED UNDER THIS CONTRACT. SEE DETAILS ON DRAWING G-3.
10. FOR LOCAL GRADE ELEVATIONS AROUND CONTROL BUILDING, SEE DRAWING A-1.
11. APPROXIMATE LOCATION OF TERMINATION POLE AND UNDERGROUND CABLE ROUTE. FOR CONTINUATION SEE DRAWING E-1.
12. ASPHALT-PAVED PATHWAY, SEE SPECIFICATIONS, SECTION 1A.
13. THESE AREAS MAY BE USED FOR BURYING IMPORTED CONSTRUCTION RUBBLE. EARTH COVER ON RUBBLE TO BE A MINIMUM OF 1.200 m. SEE SPECIFICATIONS, SECTION 1A.
14. THIS SQUARE AREA TO BE GRADED LEVEL AT ELEVATION 107.900.
15. CONTROL POINT 'X' 11.00 m FROM CENTRE OF TANK ALONG C.L. 'A', OFFSET 1.00 m FROM C.L. 'A'.
16. 450 mm DIA. C.S.P. CULVERT AND CLEAN-OUT MANHOLE. SEE SPECIAL PROVISIONS, SECTION 1A.
17. ANGLE BETWEEN CONTROL LINE XYZ AND COLUMN LINE 'A' - 4.46°  
DISTANCES: XM = XZ = 76.500 m.
18. ALL GRASSED AREAS DISTURBED DUE TO CONSTRUCTION OPERATIONS, WITHIN AND OUTSIDE THE WORKING LIMITS SHOWN, SHALL RECEIVE TOPSOIL AND SOO AS SPECIFIED. REFER TO STANDARD SPECIFICATIONS FOR DESCRIPTION OF RESTORATION WORK.

Drainage Gates Flow to WWTP - No Potential for DWF or WWF Discharge at this location

<p>ROSEDALE ARENA (LOCATION N.T.S.)</p>	<p style="text-align: center;">K. M. PIORO CONSULTING ENGINEER</p>	<p style="text-align: center;">UMA Engineering Ltd. Engineers &amp; Planners</p>	<p><b>SITE DEVELOPMENT PLAN</b></p>	<p>APPROVED</p> <p style="text-align: center;">COMMISSIONER OF ENGINEERING DIRECTOR</p>	<p>THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING</p> <p><b>GREENHILL AVENUE STORAGE FACILITY</b></p> <p style="text-align: right; font-size: 1.2em;">3684</p>																														
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">REV.</th> <th style="width: 40%;">DESCRIPTION</th> <th style="width: 10%;">BY</th> <th style="width: 10%;">CHK</th> <th style="width: 10%;">DATE</th> </tr> <tr> <td>1</td> <td>ISSUED FOR TENDERS</td> <td>J.M.</td> <td>K.P.</td> <td>18/01/86</td> </tr> <tr> <td>2</td> <td>ISSUED FOR APPROVAL</td> <td>J.M.</td> <td>K.P.</td> <td>27/11/85</td> </tr> <tr> <td>3</td> <td>REVISION DESCRIPTION</td> <td>BN</td> <td>DES</td> <td>CHK</td> <td>ENG</td> </tr> </table>	REV.	DESCRIPTION	BY	CHK	DATE	1	ISSUED FOR TENDERS	J.M.	K.P.	18/01/86	2	ISSUED FOR APPROVAL	J.M.	K.P.	27/11/85	3	REVISION DESCRIPTION	BN	DES	CHK	ENG	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>UMA REF. No.</td> <td>CONTRACT No.</td> <td>PROJECT No.</td> </tr> <tr> <td>1831-028</td> <td>888-18-0114</td> <td>887-18</td> </tr> <tr> <td>SCALE: 1:500</td> <td>DATE: DEC. 28, 1984</td> <td>DRAWING No. G-2</td> </tr> </table>	UMA REF. No.	CONTRACT No.	PROJECT No.	1831-028	888-18-0114	887-18	SCALE: 1:500	DATE: DEC. 28, 1984	DRAWING No. G-2				
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Figure 1B: Greenhill CSO Tank #1 (HCS01) – CSO Tank Drainage Gates



REV.	D.	M.	Y.	REVISION DESCRIPTION	DRN	SUP	DES	CHK	ENG.
15	01	06		ISSUED FOR TENDER					J.H.
16	07	08		ISSUED FOR APPROVAL					J.H.



GENERAL STRUCTURAL SECTIONS		
UMA REF. No.	CONTRACT No.	PROJECT No.
1801-028	000-00-01181	007-13
SCALE	DATE	DRAWING No.
1:100	08.22.1988	0-4

APPROVED  
*[Signature]*  
 COMMISSIONER OF ENGINEERING  
*[Signature]*  
 DIRECTOR

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH  
 DEPARTMENT OF ENGINEERING  
 GREENHILL AVENUE STORAGE FACILITY

**Table 1: Inventory of Critical Control Points at Greenhill CSO Tank #1 (HCS01)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Cell No. 1 Drain Gate	HCS01WWT01NG001	1200 x 1200 mm	Motorized	To drain stored CSO from Storage Cell No. 1	Fully Closed; Opened only to drain the CSO Tank	None	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
Cell No. 2 Drain Gate	HCS01WWT02NG001	1200 x 1200 mm	Motorized	To drain stored CSO from Storage Cell No. 2	Fully Closed; Opened only to drain the CSO Tank	None	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
							<ul style="list-style-type: none"> <li>+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</li> </ul>

### 3.2 Bayfront Park CSO Tank (HCS02)

The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m<sup>2</sup>, and is over 6 m deep, providing approximately 21,000 m<sup>3</sup> of CSO storage capacity in two equally sized storage cells. A 4.0 m x 1.5 m box sewer (which later changes to 2,250 mm diameter) intercepts CSOs from the former Queen and Hess Street CSO outfalls and conveys them to the CSO tank. Flow into the tank is regulated by static CSO regulators at Queen/Barton, Stuart/Hess, and Stuart/Caroline, and by the Strachan Street Sewage Pumping Station (HC003). A flow regulating chamber is also provided upstream of the tank (near the CSO tank outfall), which includes three gates that can be operated to convey all flows into the CSO tank (in their default positions) or to provide a maintenance bypass of the tank (in their alternate positions). This is explained further below.

During DWF conditions, all flow is directed to the WWTP via the CSO regulators and the three (3) dry pit pumps in the pumping station (3 x 180 L/s).

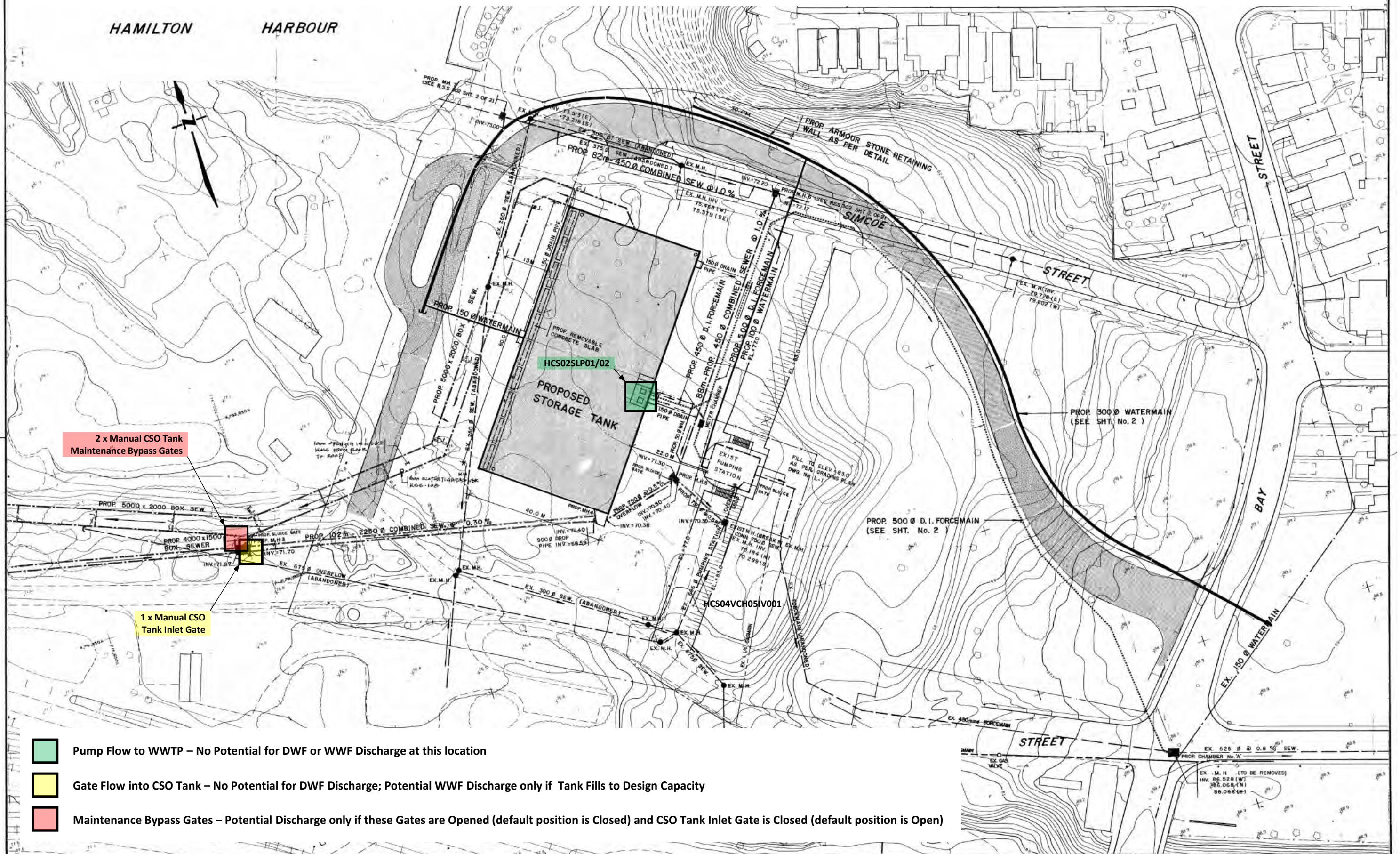
During WWF conditions, excess flows from the three static CSO regulators overflow into the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour via the outfall sewer that exits the north-west corner of the tank. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank. If the tanks fills completely, CSOs are conveyed via a 5,000 mm x 2,000 mm box sewer to the outfall that enters the Harbour at the east end of the inlet between the park and the railway lands.

Combined sewage retained in the tank during wet weather is subsequently returned to the Western Sanitary Interceptor (WSI) and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 200 L/s submersible pumps located in Cell 1. A flap gate between Cell 1 and Cell 2 allows the two cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the WSI near Strachan and MacNab Streets. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

The entire facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station. Stand-by power is provided for the sewage pumping station by a diesel power generator.

Figures 2A to 2C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously. Table 2 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 2A: Bayfront Park CSO Tank (HCS02) – Site Plan



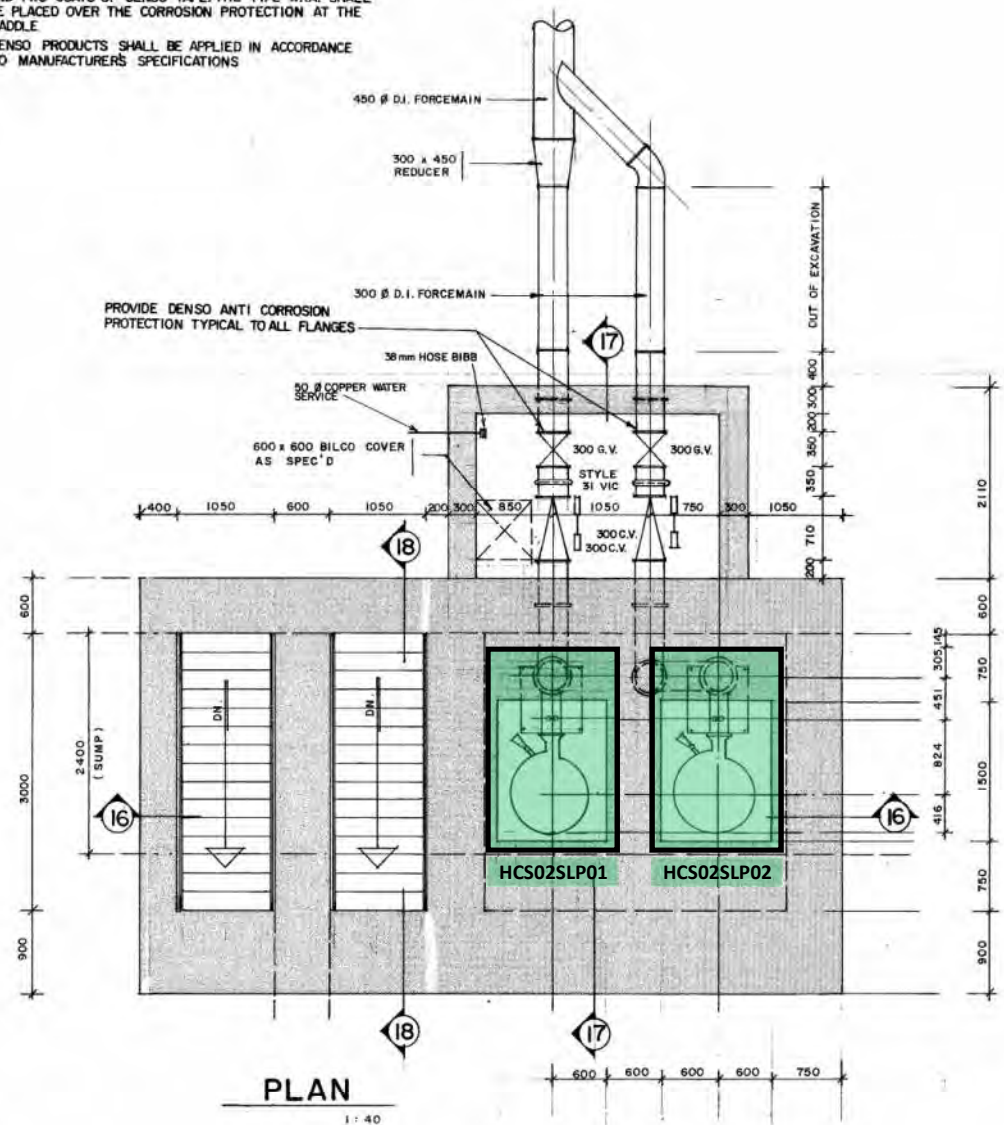
- Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Gates – Potential Discharge only if these Gates are Opened (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)


	NOTES:	T.HO	SCALES 1:500	 DIRECTOR	APPROVED  COMMISSIONER OF ENGINEERING	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING	PROPOSED STORAGE TANK STRACHAN STREET SITE PLAN
No.	REVISIONS	DATE	INITIAL			DATE: 92-02-17	PROJECT No. 819-118
						DRAWING No. 92-S-14	SHEET 1 OF 37

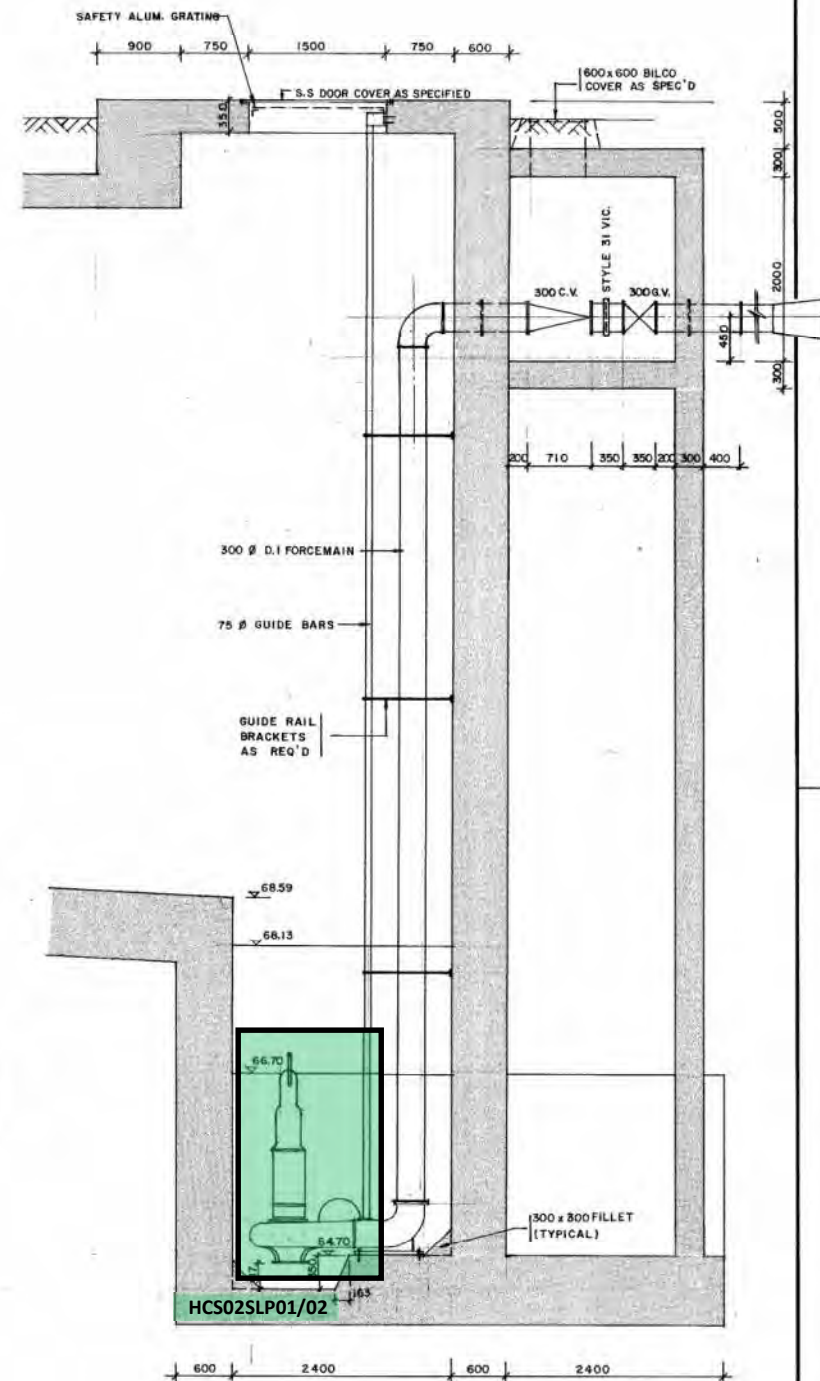
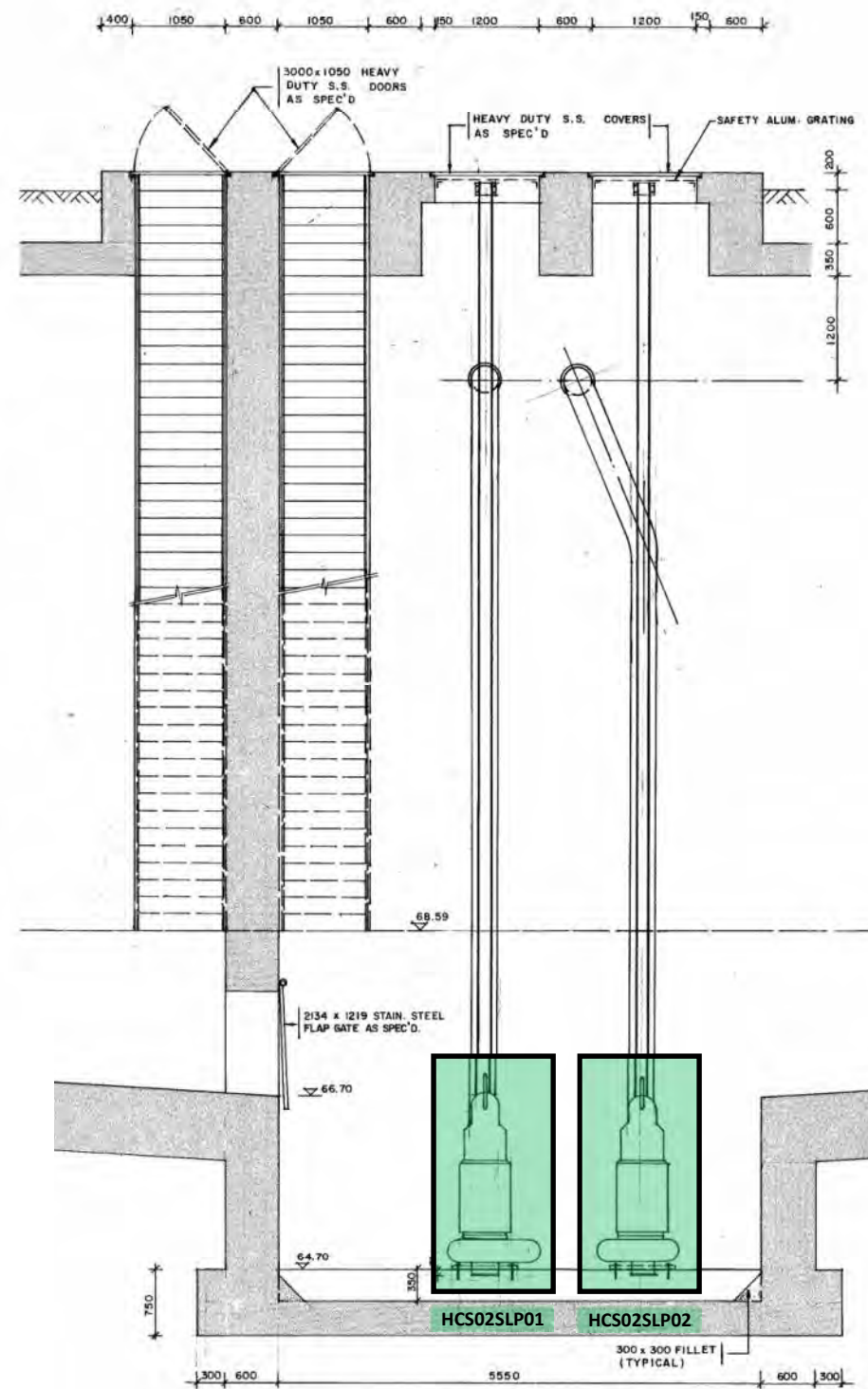


Figure 2C: Bayfront Park CSO Tank (HCS02) – Pumps

- NOTE:  
 1. DENSO PROTECTION SHALL CONSIST OF DENSO PRIMER AND TWO COATS OF DENSO TAPE. THE PIPE WRAP SHALL BE PLACED OVER THE CORROSION PROTECTION AT THE SADDLE.  
 2. DENSO PRODUCTS SHALL BE APPLIED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS



 Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location



			CHECKED BY	DRAWN BY T. HO	SCALES 1:40	 DIRECTOR	APPROVED <i>Tom Gier</i>	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING	PROPOSED STORAGE TANK STRACHAN STREET PLAN, SECTIONS
No.	REVISIONS	DATE	INITIAL				COMMISSIONER OF ENGINEERING	DATE: 92 - 02 - 17	PROJECT No. 819 - 118

**Table 2: Inventory of Critical Control Points at Bayfront Park CSO Tank (HCS02)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Tank Inlet Gate	N/A (Not on SCADA)	2280 x 2280 mm	Manual	Controls WWF into CSO Tank	Fully Open	In default Fully Open position: No potential for DWF discharge; and Potential for WWF discharge only if CSO tank fills to design capacity,	+ No significant changes required to PCN, but the operation of this manual Tank Inlet Gate should be covered in the SOP and/or other documents to be submitted in response to MECF Order Item 6
Maintenance Bypass Gate No. 1	N/A (Not on SCADA)	1800 x 1500 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed	In Default Fully Closed Position: No potential for DWF or WWF discharge. Potential for WWF discharge <u>only if</u> Tank Inlet Gate is Closed and one or both of these Maintenance Bypass Gates are Opened.	+ No significant changes required to PCN, but the operation of these manual Maintenance Bypass Gates should be covered in the SOP and/or other documents to be submitted in response to MECF Order Item 6 + Evaluate options to physically lock both gates in Fully Closed position
Maintenance Bypass Gate No. 2	N/A (Not on SCADA)	1800 x 1500 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed		
Sewage Lift Pump No. 1	HCS02SLP01	200 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling; On to drain the CSO Tank	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS02SLP02	200 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling; On to drain the CSO Tank	None	+ No significant changes required to PCN or SOP
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

### 3.3 James Street CSO Facility (HCS03 and HCG08)

The James Street CSO Storage Facility (HCS03) incorporates both off-line and in-line storage components, which provide a total CSO storage capacity of approximately 3,200 m<sup>3</sup>.

The off-line storage tank is an underground, reinforced concrete structure, which resides beneath the parking lot of the Royal Hamilton Yacht Club, located at the north end of James Street. The rectangular tank covers an area of approximately 900 m<sup>2</sup>, and is 0.8 to 2.1 m deep, providing approximately 1,400 m<sup>3</sup> of CSO storage capacity.

The off-line storage capacity is augmented by 1,800 m<sup>3</sup> of in-line storage, which is provided within the 1,400 mm diameter combined sewer downstream of the CSO tank. The additional in-line storage is created by the Ferrie-Mary CSO Regulator Gates (HCG08). The HCG08 sluice gates control the rate of flow from the James Street combined sewer system into the WSI at Ferrie and Mary Streets. These gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

During DWF conditions, the gates are set to allow all flow to enter the WSI. During WWF conditions, the gates can be partially or completely closed to throttle the flow of combined sewage into the WSI, and begin filling the storage facilities. The rate of filling is determined by the position of the gates. The in-line storage pipe will fill first, and as levels in this pipe increase, the off-line storage tank will also begin to fill. If the tank fills completely, CSOs are discharged to Hamilton Harbour via the pre-existing 1,200 mm x 900 mm CSO outfall at the north end of the tank. Stainless steel underflow baffles are employed above the tank overflow to retain floatable materials within the tank.

Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by gravity as the in-line storage pipe empties. The rate of drainage from the in-line storage pipe and the off-line storage tank is determined by the position of the HCG08 gates, which can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

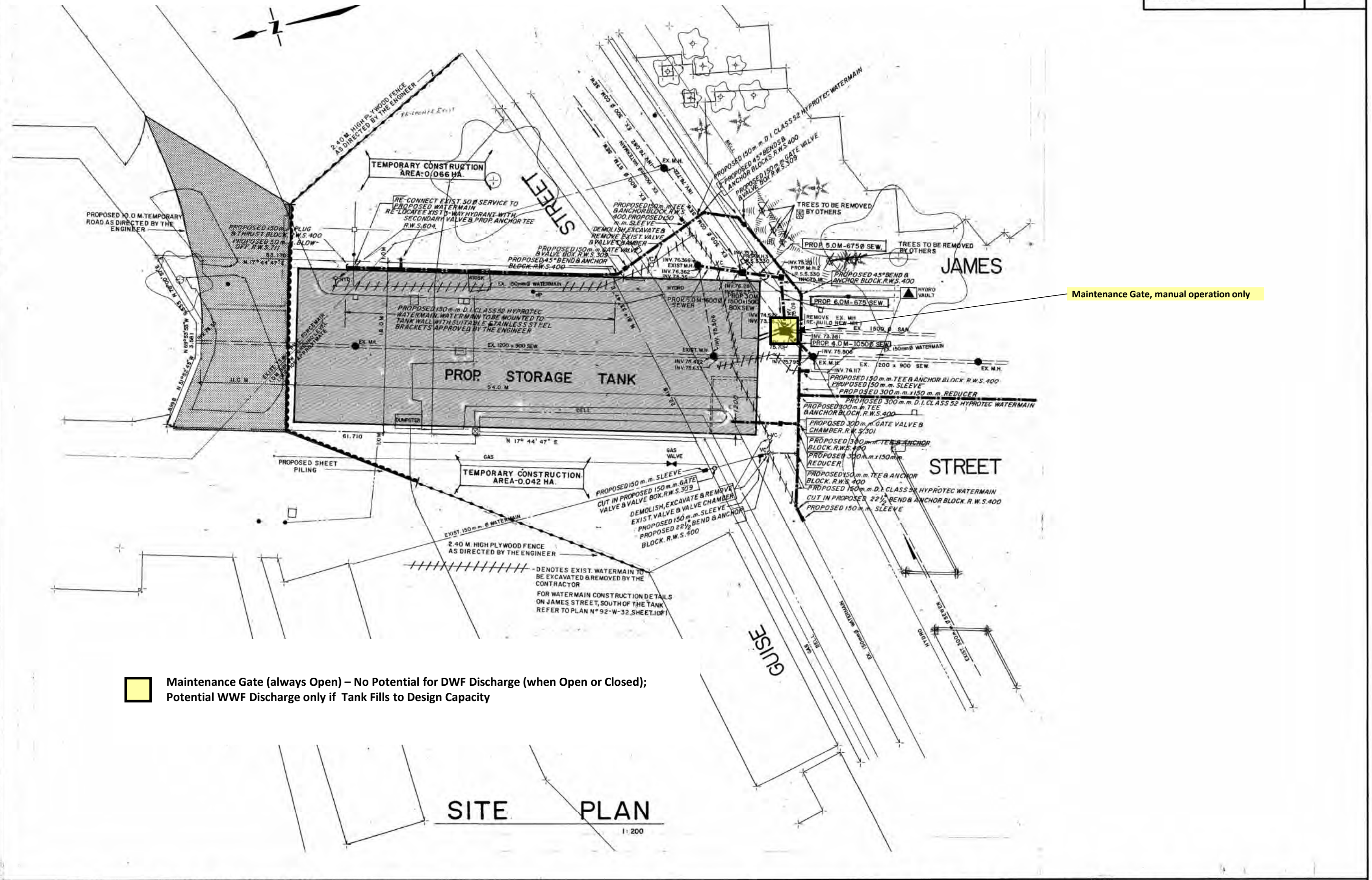
The facilities are monitored and controlled via SCADA by Operators at the WWTP.

Figures 3A to 3C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 3 provides an inventory of all the CCPs at the two facilities, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.



Figure 3A: James Street CSO Tank (HCS03) – Site Plan



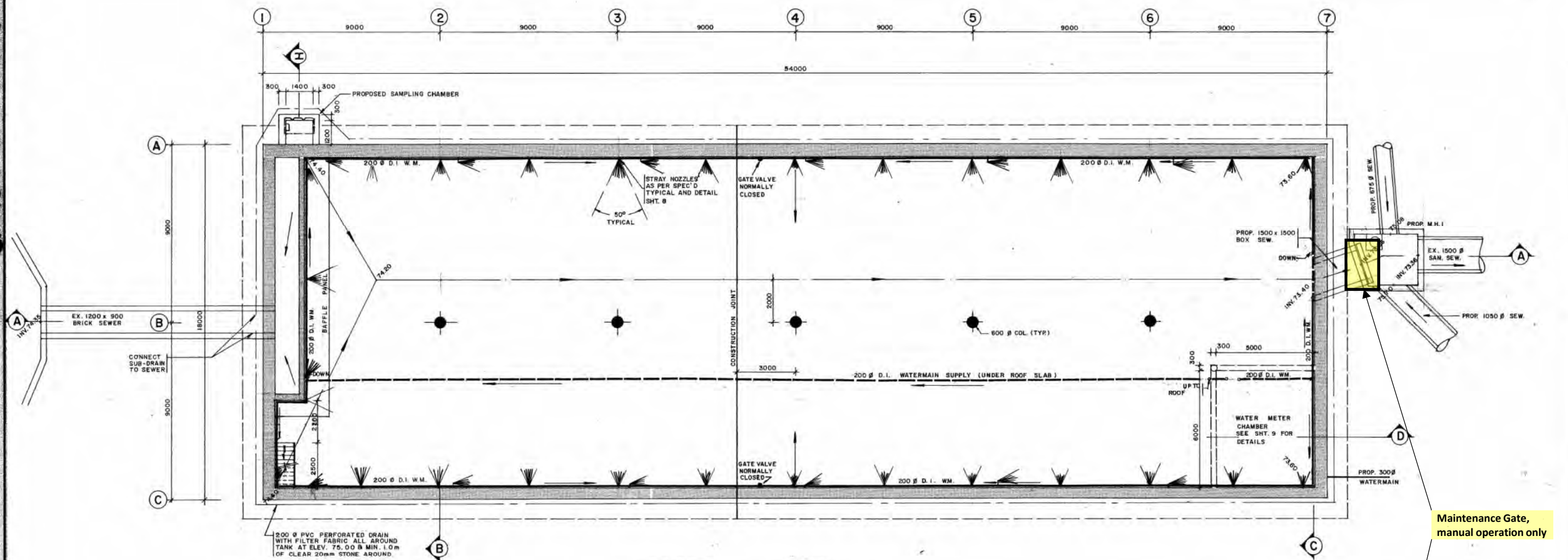
Maintenance Gate, manual operation only

Maintenance Gate (always Open) – No Potential for DWF Discharge (when Open or Closed); Potential WWF Discharge only if Tank Fills to Design Capacity

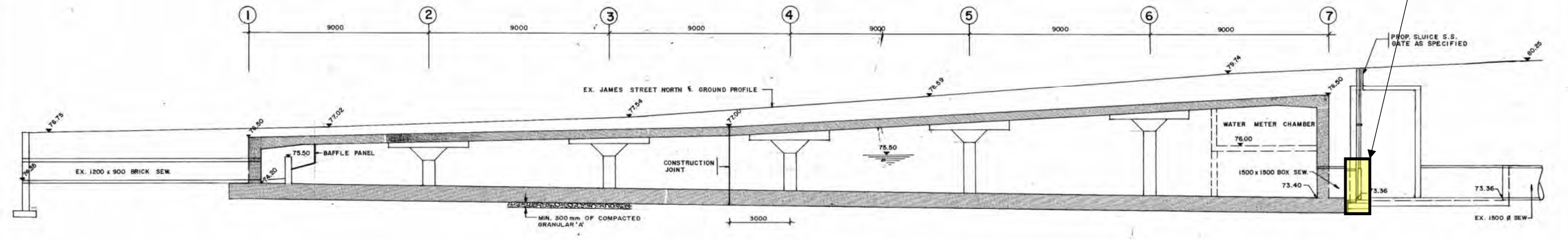
**SITE PLAN**  
 1: 200

No.	REVISIONS	INITIAL	DATE	DRAWN BY: T. HOAG & Assoc	DATE: SEPTEMBER 4, 1992	SCALES 	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH  <b>TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP</b>	PROPOSED STORAGE TANK
								JAMES STREET NORTH
								SITE PLAN
				DIRECTOR 	COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES 			

# Figure 3B: James Street CSO Tank (HCS03) – Maintenance Gate



**FLOOR PLAN**  
1:100

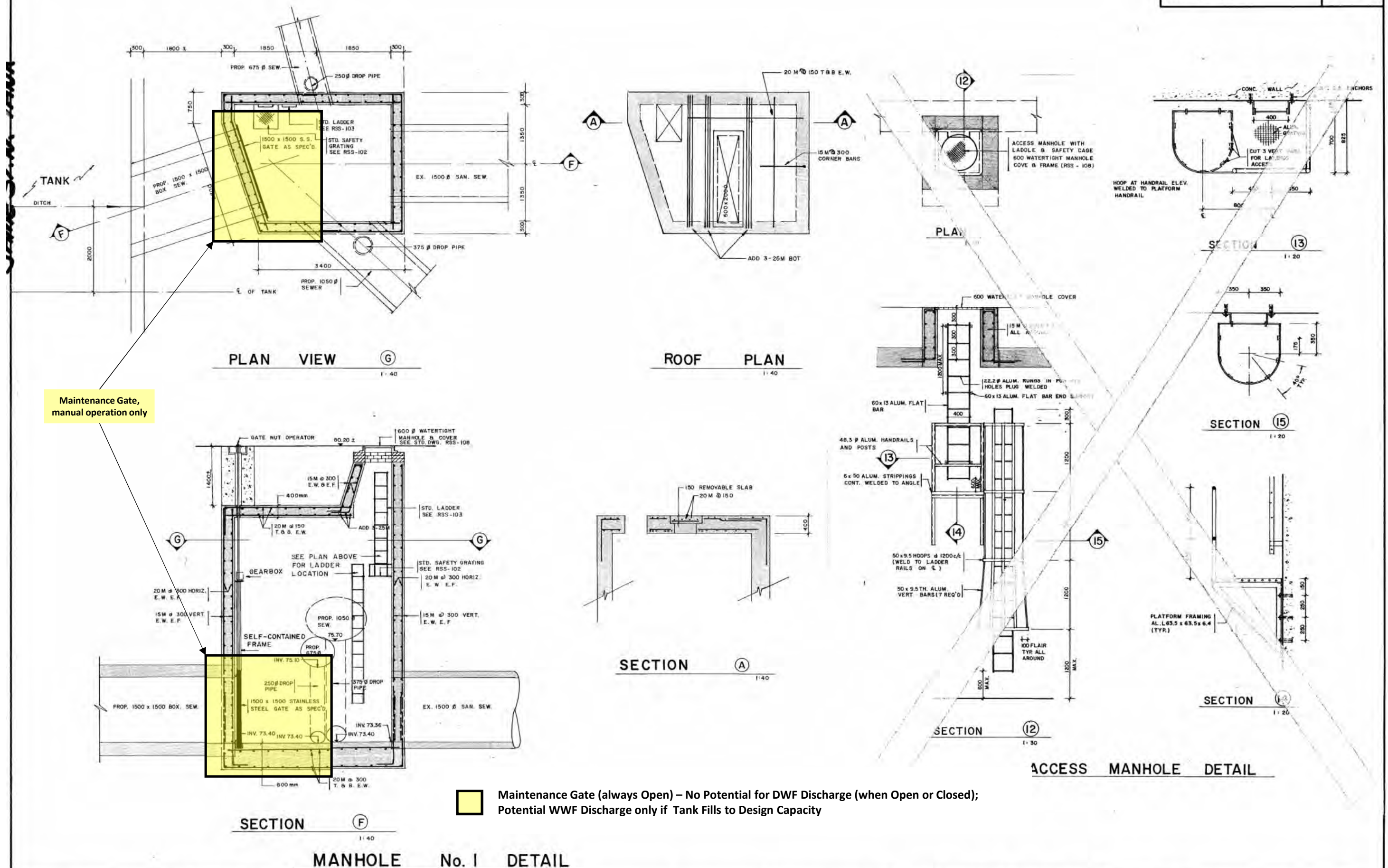


**SECTION A-A**  
1:100

Maintenance Gate (always Open) – No Potential for DWF Discharge (when Open or Closed); Potential WWF Discharge only if Tank Fills to Design Capacity

No.	REVISIONS	INITIAL	DATE	DRAWN BY: T. HO	DATE: SEPTEMBER 4, 1992	SCALES			
						1:100			
				REFERENCE MATERIAL:					
				<i>dx</i>					
				<i>[Signature]</i>					
				DIRECTOR					
				<i>[Signature]</i>					
				COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES					
THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH							PROPOSED STORAGE TANK		
<b>TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP</b>							JAMES STREET NORTH		
							FLOOR PLAN & CROSS SECTION		

# Figure 3C: James Street CSO Tank (HCS03) – Maintenance Gate



Maintenance Gate, manual operation only

Maintenance Gate (always Open) – No Potential for DWF Discharge (when Open or Closed); Potential WWF Discharge only if Tank Fills to Design Capacity

MANHOLE No. 1 DETAIL

No.	REVISIONS	INITIAL	DATE	DRAWN BY: T. HO	DATE: SEPTEMBER 4, 1992	SCALES		
				REFERENCE MATERIAL:				
							 DIRECTOR	 COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES
THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP								PROPOSED STORAGE TANK MANHOLE No. 1 DETAIL, ACCESS MANHOLE DETAIL & SECTION

**Table 3: Inventory of Critical Control Points at James Street CSO Tank (HCS03)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Maintenance Gate over CSO Tank Inlet/Outlet Pipe	N/A (Not on SCADA)	1500 x 1500 mm	Manual	Maintenance Gate that can be used to isolate the CSO tank if in-tank maintenance work is required	Fully Open	In default Open position: No potential for DWF discharge; and Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN, but the operation of this manual Maintenance Gate should be covered in the SOP and/or other documents to be submitted in response to MECF Order Item 6
Ferrie-Mary Control Gate No. 1	HCG08SG001	800 x 1200 mm	Motorized	Operated in tandem, these two gates create in-line storage in sewer downstream of HCS03; which ultimately also causes the tank to fill	Fully Open in DWF; Closed in WWF	In these default positions, no potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Ferrie-Mary Control Gate No. 2	HCG08SG002	800 x 1200 mm	Motorized		Fully Open in DWF; Closed in WWF		
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

### 3.4 Main/King CSO Tank (HCS04)

The Main/King CSO Tank (HCS04) covers an area of approximately 9,500 m<sup>2</sup>, and is over 8 m deep, providing approximately 77,100 m<sup>3</sup> of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m<sup>3</sup> of storage, and the second provides a further 53,800 m<sup>3</sup> of storage. The Main/King CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by three WWTP-controlled CSO regulators that were constructed in conjunction with the CSO tank. The former Glen Road CSO Outfall, which was located at the east end of Glen Road on the west side of Hwy 403, was effectively eliminated by installing a new WWTP-controlled CSO regulator gate at Glen/Macklin (Chamber 1) and constructing a new 1,350 mm diameter sewer to convey CSOs underneath Hwy 403 and into the CSO tank. The former McKittrick CSO Outfall, which previously diverted CSOs from the 1,980 mm diameter combined sewer that conveys flows to the WSI, was eliminated by constructing a new WWTP-controlled CSO regulator (Chamber 4) to divert CSOs into the new tank. Flow from the 2,100 mm x 2,250 mm box sewer which runs along the south side of Main Street was diverted into the new tank by a bulkhead placed in the sewer and a new WWTP-controlled CSO regulator located at the south-east corner of the tank (Chamber 5). Downstream of the bulkhead, this sewer is used to convey the overflows which will still occur from the tank when its design capacity is exceeded.

During DWF conditions, all flow is directed to the WWTP via the WSI. The gate in Chamber 4 (King Street Sewer) is set to be Fully Open; the gate in Chamber 5 (Interceptor Sewer) is set to 30% Open; and the gate in Chamber 1 (Glen Road Sewer) is always set at 35%. The Main Street Overflow Sewer, which maintains a base flow during dry weather due mainly to infiltration, is directed to the CSO tank's wet well and pumped into the interceptor sewer.

During WWF conditions, the pumps are taken out of auto mode and turned off; the opening of Gate 4 is reduced to 7%; and the opening of Gate 5 is reduced to 2%. Excess flow from the three regulators enters the pumping station wet well, which is located beneath the control building at the south-east corner of the facility. During dry weather and small storm events, the CSO tank's pumping station acts as a normal sewage pumping station. During larger storm events, two motorized sluice gates are opened to permit flow from the wet-well to enter the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged into Chedoke Creek near the Main Street overpass, via the original 2,100 mm x 2,250 mm box sewer outfall. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank's wet well includes an Influent Well Overflow Gate that can be operated to convey all flows into the CSO tank and pumping station (when Closed) or to provide a maintenance bypass of the tank (when Open). The current PCN for HCS04 incorrectly indicates that during DWF conditions this gate should be 5% open, and during WWF conditions this gate should be 100% open. The default settings for the gate should actually be Fully Closed during both DWF and WWF conditions.

Combined sewage retained in the tank during wet weather is subsequently returned to the Combined Sewer System (CSS) and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/s submersible pumps located in the pumping station wet well. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the original 1,980 mm sewer, which in turn discharges into the WSI near Hunt Street.

The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

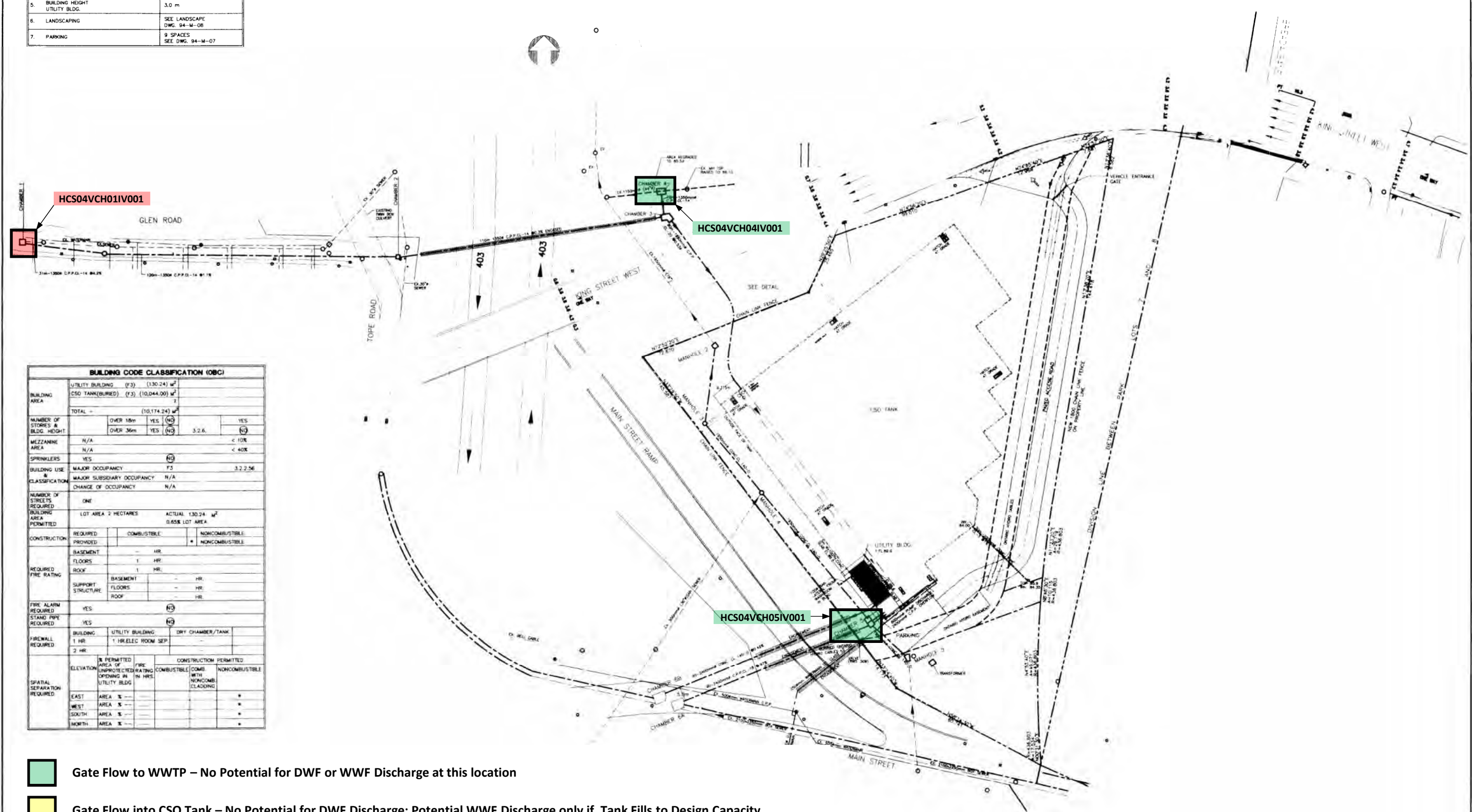
The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 4A to 4C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 4 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 4A: Main/King CSO Tank (HCS04) – Site Plan and External Flow Control Gates

SITE DATA	
ZONING: 'A' DISTRICT - "OPEN SPACE"	
1. LOT AREA	20,000 m <sup>2</sup>
2. LOT FRONTAGE	257.419 m
3. BUILDING AREA UTILITY BLDG. % OF LOT	0.65 % - UTILITY BUILDING (BURIED TANK - N/A)
4. BUILDING SETBACK	Minimum: 12.00 m Actual: 13.75 m
5. BUILDING HEIGHT UTILITY BLDG.	3.0 m
6. LANDSCAPING	SEE LANDSCAPE DWG. 94-M-08
7. PARKING	9 SPACES SEE DWG. 94-M-07



BUILDING CODE CLASSIFICATION (CBC)	
BUILDING AREA	UTILITY BUILDING (F3) (1,302.24) m <sup>2</sup> CSO TANK (BURIED) (F3) (10,044.00) m <sup>2</sup> TOTAL = (11,346.24) m <sup>2</sup>
NUMBER OF STORES & BLDG. HEIGHT	OVER 15m YES (NO) 3.2.6. YES (NO) OVER 36m YES (NO)
MEZZANINE AREA	N/A < 10% N/A < 40%
SPRINKLERS	YES (NO)
BUILDING USE & CLASSIFICATION	MAJOR OCCUPANCY F3 3.2.2.56 MAJOR SUBSIDIARY OCCUPANCY N/A CHANGE OF OCCUPANCY N/A
NUMBER OF STREETS REQUIRED	ONE
BUILDING AREA PERMITTED	LOT AREA 2 HECTARES ACTUAL 1,302.24 m <sup>2</sup> 0.65% LOT AREA
CONSTRUCTION	REQUIRED COMBUSTIBLE NONCOMBUSTIBLE PROVIDED
REQUIRED FIRE RATING	BASEMENT 1 HR. FLOORS 1 HR. ROOF 1 HR. SUPPORT STRUCTURE BASEMENT FLOORS ROOF
FIRE ALARM REQUIRED	YES (NO)
STAND PIPE REQUIRED	YES (NO)
FIREWALL REQUIRED	BUILDING UTILITY BUILDING DRY CHAMBER/TANK 1 HR. 1 HR/ELEC ROOM SEP. - 2 HR. -
SPATIAL SEPARATION REQUIRED	ELEVATION AREA % PERMITTED FIRE UNPROTECTED RATING OPENING IN UTILITY BLDG. IN HRS. CONSTRUCTION PERMITTED COMB. WITH NONCOMB. CLADDING NONCOMBUSTIBLE
	EAST AREA % * WEST AREA % * SOUTH AREA % * NORTH AREA % *

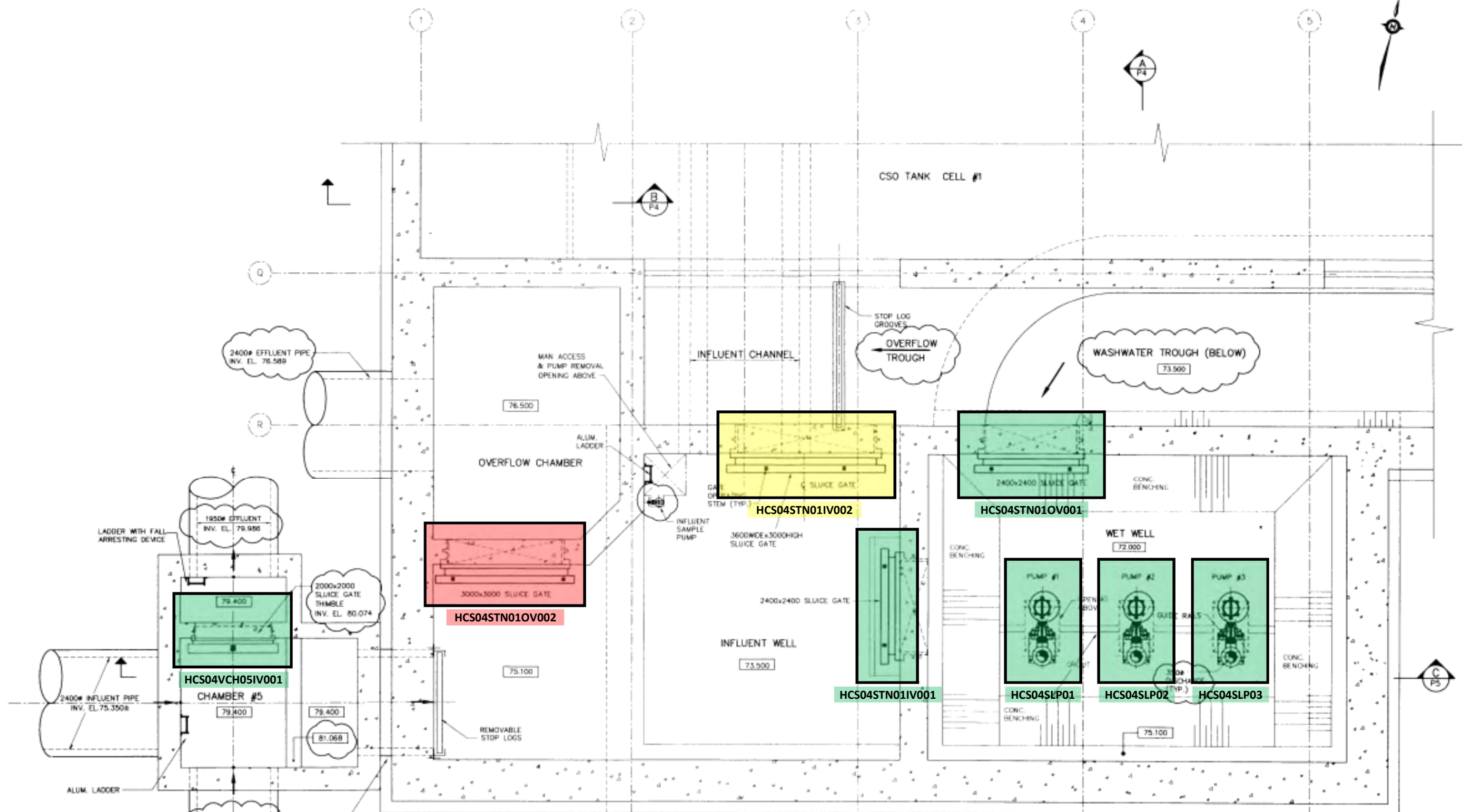
- Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Gate Flow to WWTP – Potential WWF Discharge only if Gate is Opened more than 35% (normal default position)

No.	REVISIONS	DETAIL	DATE	DRAWN BY:	DATE:	SCALE			
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94		OCT 94				
B	ISSUED FOR TENDER	T.R.	16/11/94						
C	RECORD DRAWING	D.W.	1997						

REFERENCE MATERIAL: X-REF. FILE - 390007MFASBL1.DWG	R.V. Anderson Associates Limited 100-1000 C.P.F.D.-14 84-78 ENCL.	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP	MAIN/KING CSO TANK SITE PLAN
DIRECTOR COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES			

Figure 4B: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps

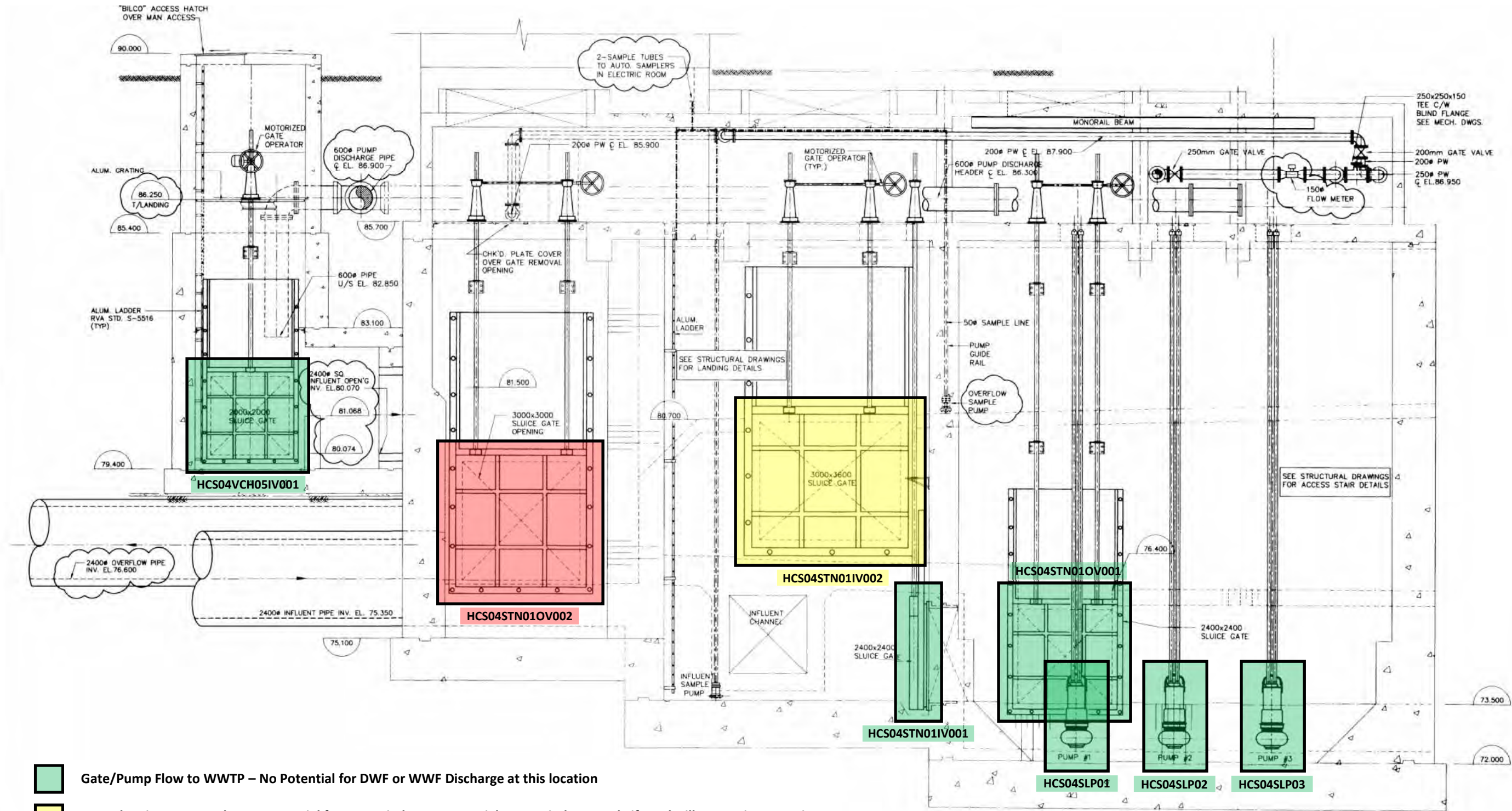


- Gate/Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Gate – Potential Discharge only if this Gate is Open (default position is Closed) and sewage level in Influent Well exceeds 76.600 m

<b>No.</b>	<b>REVISIONS</b>	<b>INITIAL</b>	<b>DATE</b>	<b>DRAWN BY:</b>	<b>DATE:</b> OCT '94	<b>SCALE</b>	 R.V. Anderson Associates Limited <small>consulting engineers and architects</small>	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH  <b>TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP</b>	<b>MAIN/KING CSO TANK</b>		
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94	REFERENCE MATERIAL:		1:50			DIRECTOR	COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES	PROCESS
B	ISSUED FOR TENDER	T.R.	10/11/94								<b>PUMP GALLERY</b> WET WELL PLAN
C	RECORD DRAWING	OW	1997								



Figure 4C: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps



- Gate/Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Gate – Potential Discharge only if this Gate is Open (default position is Closed) and sewage level in Influent Well exceeds 76.600 m

No.	REVISIONS	INITIAL	DATE	DRAWN BY:	DATE:
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94		OCT. '94
B	ISSUED FOR TENDER	T.R.	16/11/94		
C	RECORD DRAWING	DW	1997		

SCALE  
1:50

**R.V. Anderson Associates Limited**  
 consulting engineers and architect

DIRECTOR  
 COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH  
 TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP

MAIN/KING CSO TANK  
 PROCESS  
 PUMP GALLERY  
 SECTIONS (II)

**Table 4: Inventory of Critical Control Points at Main/King CSO Tank (HCS04)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Chamber 1 Gate, on Glen Road	HCS04VCH01IV001	1100 x 1700 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	35% Open in DWF; 10% Open in WWF	In default positions: No potential for DWF or WWF discharge at these locations; Potential for WWF discharge only if CSO tank fills to design capacity	<ul style="list-style-type: none"> <li>+ Consider simplifying the operation of these gates, to employ the same position during both DWF and WWF conditions</li> <li>+ Exact gate positions to be determined by further investigation, with recommendations included in response to MECP Order Item 6</li> <li>+ Consider removing electrical operation of the gate</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
Chamber 4 Gate, behind Cathedral	HCS04VCH04IV001	1220 x 1220 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	Fully Open in DWF; 7% Open in WWF		
Chamber 5 Gate, outside CSO tank control bldg	HCS04VCH05IV001	1500 x 1500 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	30% Open in DWF; 2% Open in WWF		
Influent Well Overflow Gate (Maintenance Bypass Gate)	HCS04STN01OV002	3000 x 3000 mm	Manual	Allows tank bypass if Opened and Tank Inlet Gate Closed	5% Open in DWF 100% Open in WWF	Potential for DWF and WWF discharges at this location based on current PCN	<ul style="list-style-type: none"> <li>+ PCN needs to be revised to correct default position of this gate, which should be Fully Closed at all times</li> <li>+ Note that this gate is padlocked in Fully Closed position</li> <li>+ Conduct engineering study to consider the feasibility of adding level sensor and/or flow meter in chamber on downstream side of gate (to confirm no flow through it)</li> </ul>
Wet Well Inlet Gate	HCS04STN01IV001	2400 x 2400 mm	Motorized	Controls flow from CSO Tank Influent Well into Wet Well; can be closed to isolate Wet Well for maintenance	Fully Open	None	<ul style="list-style-type: none"> <li>+ No changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
CSO Tank Cells Inlet Gate	HCS04STN01IV002	3000 x 3000 mm	Motorized	Controls flow into CSO tank storage cells from CSO Tank Influent Well	Closed in DWF; Open in WWF	Potential for WWF discharge only if CSO tank fills to design capacity	
CSO Tank Cells Outlet Gate	HCS04STN01OV001	2400 x 2400 mm	Motorized	To drain stored CSO from the CSO tank into Wet Well	Open in DWF; Closed in WWF	None	
Sewage Lift Pump No. 1	HCS02SLP01	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	<ul style="list-style-type: none"> <li>+ No changes required to PCN or SOP</li> </ul>
Sewage Lift Pump No. 2	HCS02SLP02	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	
Sewage Lift Pump No. 2	HCS02SLP03	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	
							<ul style="list-style-type: none"> <li>+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</li> </ul>

### 3.5 Eastwood Park CSO Tank (HCS05)

The Eastwood Park CSO Tank (HCS05) covers an area of approximately 4,000 m<sup>2</sup>, and is over 6 m deep, providing approximately 27,350 m<sup>3</sup> of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m<sup>3</sup> of storage, and the second provides a further 12,650 m<sup>3</sup> of storage. A sewer along Dock Service Road intercepts the CSOs from the two outfalls and conveys them to the CSO tank. The original Catharine Street (1,050 mm) and Ferguson Avenue (1,500 mm) CSO outfalls were left in place and are used to carry the overflow from the CSO tank on the infrequent occasions when the design capacity of the tank is exceeded. A flow splitter diverts the overflow from the tank between the two previously existing outfall sewers.

The Eastwood Park CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by static CSO regulators at Catharine/Brock, Picton/Ferguson and McAulay/Ferguson and by the two WWTP- controlled CSO regulators at Burlington/Ferguson and Ferrie/Ferguson.

During DWF conditions, the Burlington/Ferguson (HCG06) and Ferguson/Ferrie Streets (HCG07) sluice gates normally remain open, directing all flow to the WSI sewer and on to the WWTP.

During WWF conditions, excess flows from the Catharine/Brock CSO regulator and the five CSO regulators along Ferguson Avenue overflow into the tank. When rainfall occurs, the pumps in the CSO tank are turned off, and the HCG06 and HCG07 gates are fully closed, eliminating flow into the WSI at these locations. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour through either the Catharine Street or Ferguson Avenue CSO outfalls. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank inlet chamber at the north-east corner of the tank includes three gates that can be operated to convey all flows into the CSO tank (in their default positions, with the CSO tank inlet gate open and the two CSO tank maintenance gates closed) or to provide a maintenance bypass of the tank (in their alternate positions).

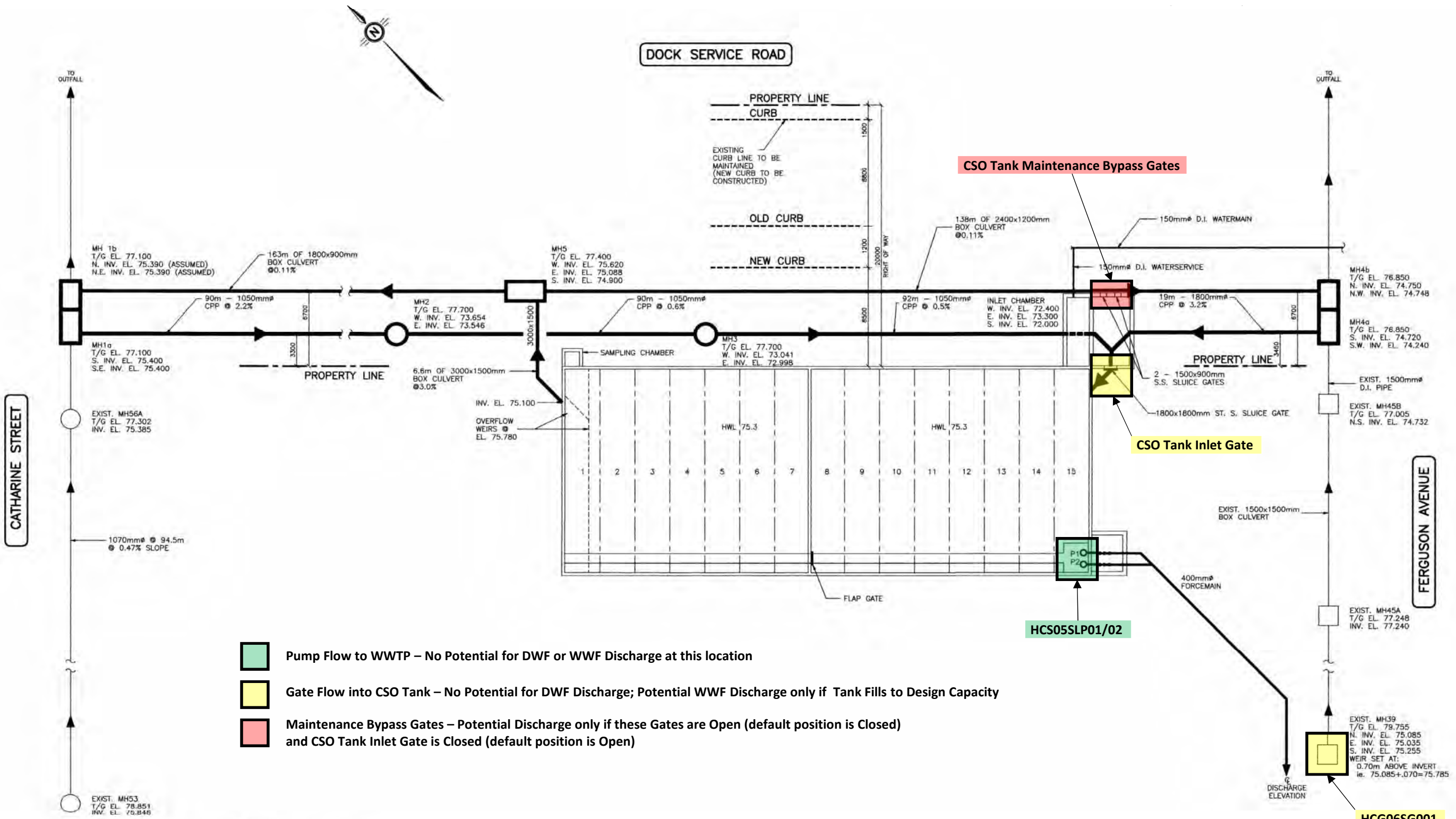
Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 289 L/sec submersible pumps located in Cell 1. One pump is used as a duty pump and the other as a stand-by pump. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the 900 mm portion of the WSI downstream of HCG06. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

The facilities are monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 5A and 5B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 5 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 5A: Eastwood Park CSO Tank (HCS05) – Site Plan



- Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Gates – Potential Discharge only if these Gates are Open (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)

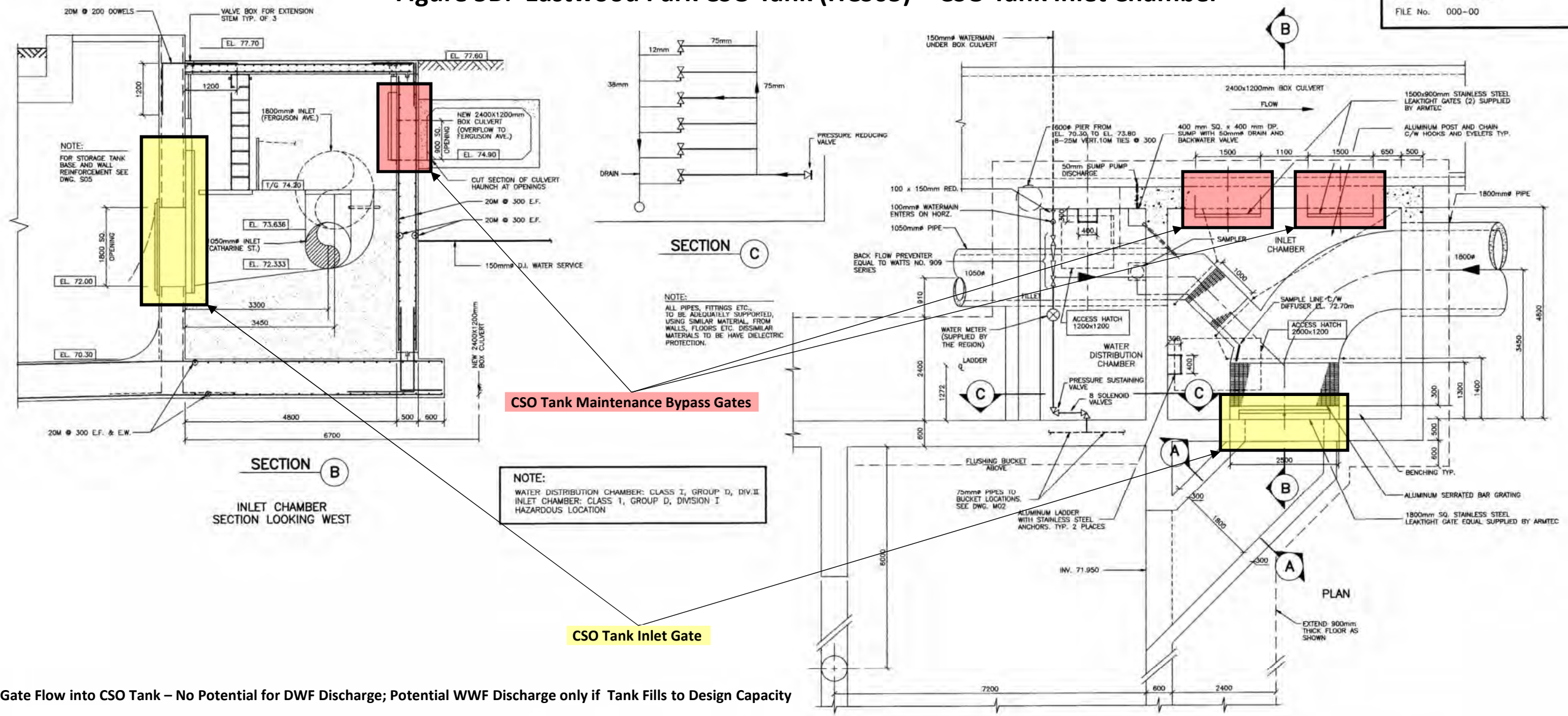
NOTE:  
HAMILTON HARBOUR HIGH WATER  
LEVEL EL. 75.80 GEODETIC  
WATER LEVEL JAN. 23/97  
EL. 74.98

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No.	REVISIONS	INITIAL	DATE																				
0	ISSUED FOR TENDER		DEC./95																				
1	ISSUED FOR CONSTRUCTION		FEB./96																				
2	AS RECORDED		MAR./97																				

96-5-29

03/08/96  
140.07005555

# Figure 5B: Eastwood Park CSO Tank (HCS05) – CSO Tank Inlet Chamber

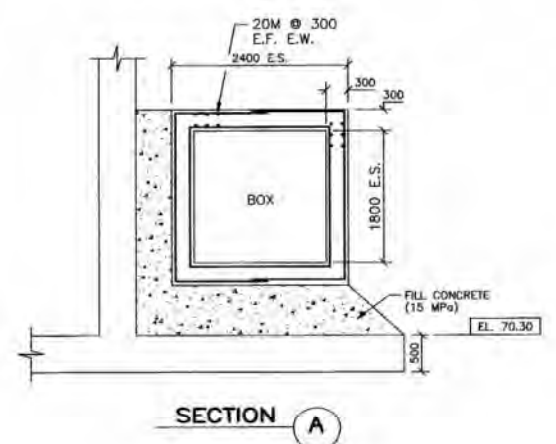


CSO Tank Maintenance Bypass Gates

CSO Tank Inlet Gate

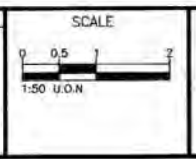
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Gates – Potential Discharge only if these Gates are Open (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)

- NOTES:**
1. THE PROPOSED ROOF SLABS FOR WATER DISTRIBUTION AND INLET CHAMBERS SHALL HAVE TOP OF CONCRETE ELEVATION OF 77.60. THE REVISED ACCESS HATCH FOR INLET CHAMBER SHALL BE ALUMINUM TWO SECTION 2000x1200 HATCH.
  2. THE SOLENOID VALVES FOR THE FLUSHING SYSTEM ARE TO BE ANGLE BODY TYPE, CAST IRON BODY, BRONZE PISTON AND PILOT VALVES, Buna 'N' CLIPS AND RUBBER SEATS. THE VALVE SHALL OPEN USING A THREE WAY INTRINSICALLY SAFE SOLENOID PILOT. PROVIDE A POSITION SWITCH, FOR "VALVE OPEN" POSITION, AS SPECIFIED IN SECTION 1111.1. BOTH OPENING AND CLOSING SPEEDS SHALL BE FULLY ADJUSTABLE. VALVE SHALL EQUAL TO GOLDEN ANDERSON FIGURE No. 7300DL.
  3. BACKFLOW PREVENTER SHALL BE EQUIVALENT TO WATTS SERIES 909, REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER.
  4. THE PRESSURE SUSTAINING VALVE SHALL BE AN ANGLE BODY TYPE WITH CAST IRON BODY, BRONZE PILOT VALVES AND Buna 'N' CLIPS AND RUBBER SEATS AS MANUFACTURED BY GOLDEN ANDERSON FIGURE No. 6600



**NOTE:**  
 FOR GENERAL NOTES SEE DWG. S02

No.	REVISIONS	INITIAL	DATE	DRAWN BY: A.J.F.	DATE: OCTOBER 1995
0	ISSUED FOR TENDER		DEC./95		
1	ISSUED FOR CONSTRUCTION		FEB./96		
2	AS RECORDED		MAR./97		



THORBURN PENNY  
 Consulting Engineers  
 Milton, Ontario

DIRECTOR  
 COMMISSIONER OF TRANSPORTATION  
 AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY  
 OF HAMILTON – WENTWORTH  
 TRANSPORTATION AND  
 ENVIRONMENTAL SERVICES GROUP

**EASTWOOD PARK  
 COMBINED SEWER OVERFLOW FACILITY  
 CHAMBER SECTIONS & DETAILS**

96-5-08

140.07/0056567 03/08/95

**Table 5: Inventory of Critical Control Points at Eastwood Park CSO Tank (HCS05)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Tank Inlet Gate	N/A (Not on SCADA)	1800 x 1800 mm	Manual	Controls WWF into CSO Tank	Fully Open	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN, but the operation of this manual CSO Tank Inlet Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6</li> <li>+ Evaluate options to physically lock the gate in Fully Open position</li> </ul>
CSO Tank Maintenance Bypass Gate No. 1	N/A (Not on SCADA)	1500 x 900 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge only if Tank Inlet Gate is Closed and one or both of these Maintenance Bypass Gates are Opened.	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN, but the operation of these two manual Maintenance Bypass Gates should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6</li> <li>+ Evaluate options to physically lock both gates in Fully Closed position</li> </ul>
CSO Tank Maintenance Bypass Gate No. 2	N/A (Not on SCADA)	1500 x 900 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed		
Sewage Lift Pump No. 1	HCS05SLP01	289 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	<ul style="list-style-type: none"> <li>+ No changes required to PCN or SOP</li> </ul>
Sewage Lift Pump No. 2	HCS05SLP02	289 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	<ul style="list-style-type: none"> <li>+ No changes required to PCN or SOP</li> </ul>
Burlington-Ferguson Regulator Gate	HCGG06SG001	900 x 900 mm	Motorized	To convey underflow to WWTP; and excess WWF to CSO tank	Fully Open in DWF; Fully Closed in WWF to fill the CSO tank	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
Ferrie-Ferguson Regulator Gate	HCGG05SG001	750 x 750 mm	Motorized				
							<ul style="list-style-type: none"> <li>+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</li> </ul>

### 3.6 Greenhill CSO Tank #2 (HCS06)

The second Greenhill CSO Tank (HCS06) is an underground reinforced concrete structure that was installed to augment the storage provided by the original Greenhill CSO Tank (HCS01). The rectangular tank covers an area of approximately 8,400 m<sup>2</sup>, and is 7.5 to 8.3 m deep, providing approximately 66,750 m<sup>3</sup> of CSO storage capacity in two equally sized storage cells. The new facility increased the combined CSO storage volume at the Greenhill site to approximately 150,250 m<sup>3</sup>.

HCS06 operates as an off-line facility, with combined sewage entering the tank only during larger CSO events. Flow into the storage tank is regulated by a WWTP-controlled CSO regulator located upstream of the tank. Cell 1 will fill first, and if it fills completely, excess flows overflow into Cell 2. If Cell 2 also fills, overflows will be conveyed into HCS01. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the new tank and prevent them from entering HCS01.

HCS06 is drained by gravity into the RHCSI via a 1,200 mm diameter sewer. The rate of drainage is regulated by a WWTP-controlled gate, based upon the current inflows at the WWTP.

The facility includes a bypass chamber between HCS06 and HCS01 that can be used to isolate HCS01 for maintenance purposes. To operate this bypass, the manual stop gate in the chamber has to be physically removed from its default position and inserted in the alternate position across the overflow channel from HCS06 to HCS01 (thereby diverting flow to Red Hill Creek). Only one stop log is provided, making it impossible to block the flow of both sewers at the same time.

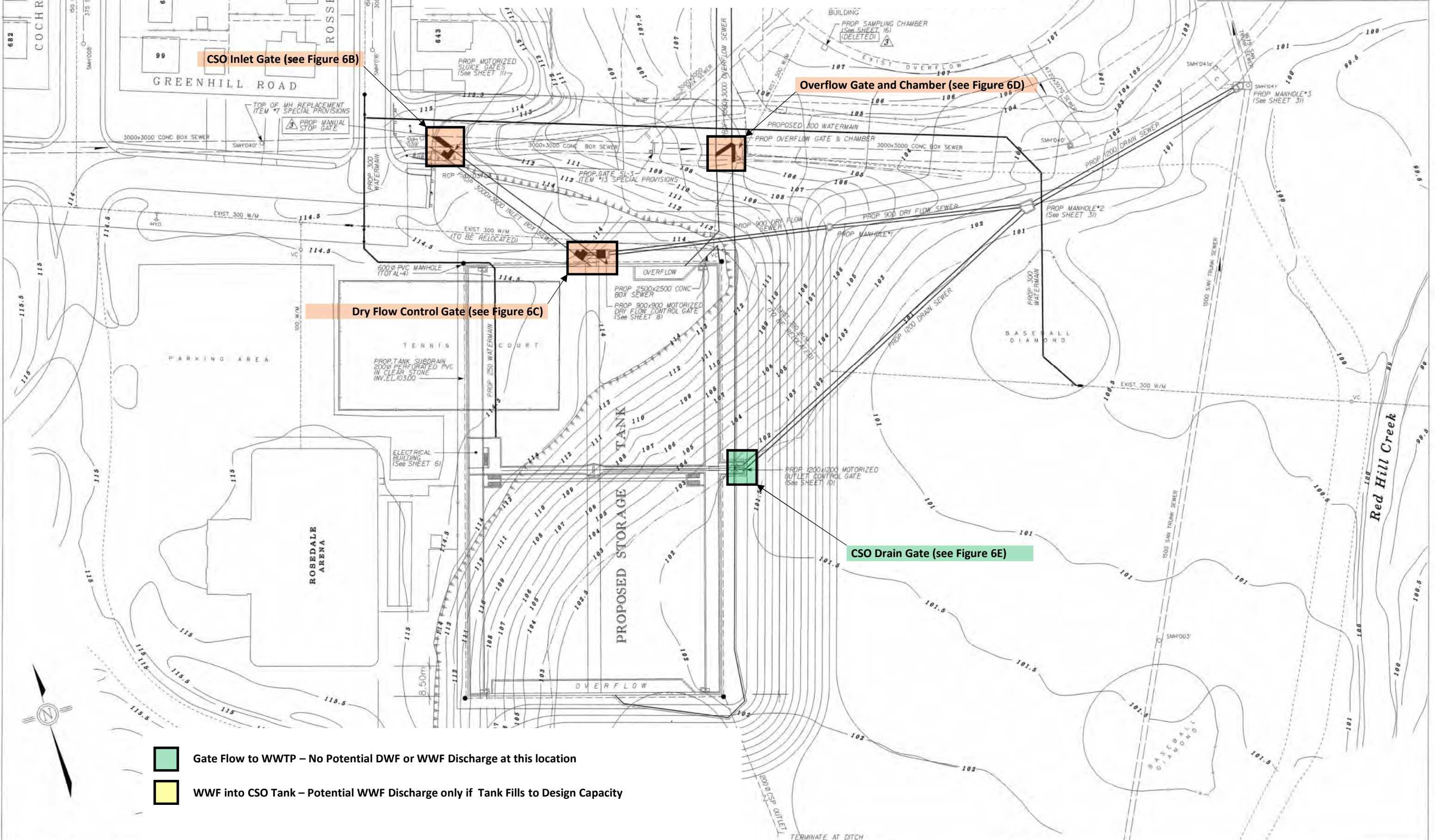
The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

HCS06 is also equipped with a biofilter odour control system to reduce the presence of unpleasant odours associated with the tank (possible when the tank is filling with sewage and air is being displaced from the tank).

Figures 6A to 6E show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 6 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 6A: Greenhill #2 CSO Tank (HCS06) – Site Plan



- Gate Flow to WWTP – No Potential DWF or WWF Discharge at this location
- WWF into CSO Tank – Potential WWF Discharge only if Tank Fills to Design Capacity

No.	REVISIONS	DATE	BY
1	ISSUED FOR APPROVALS	5/02/02	CNB
2	ISSUED FOR TENDER	5/03/02	CNB
3	AS CONSTRUCTED	10/24/03	JH

REFERENCE MATERIAL  
 Sewer Plans: C-201, R-157, R-179, R-185, V-46, 86-S-4  
 Sewer Sheets: 0-13, 0-14  
 Regional Surveyor: D. Lenko  
 Geodetic Bench Mark Index No. 6-24  
 Elevation: 115.820m



Director, Design and Construction  
 Doug Onishi, P. Eng.  
 Manager of Design  
 Gary Moore, P. Eng.

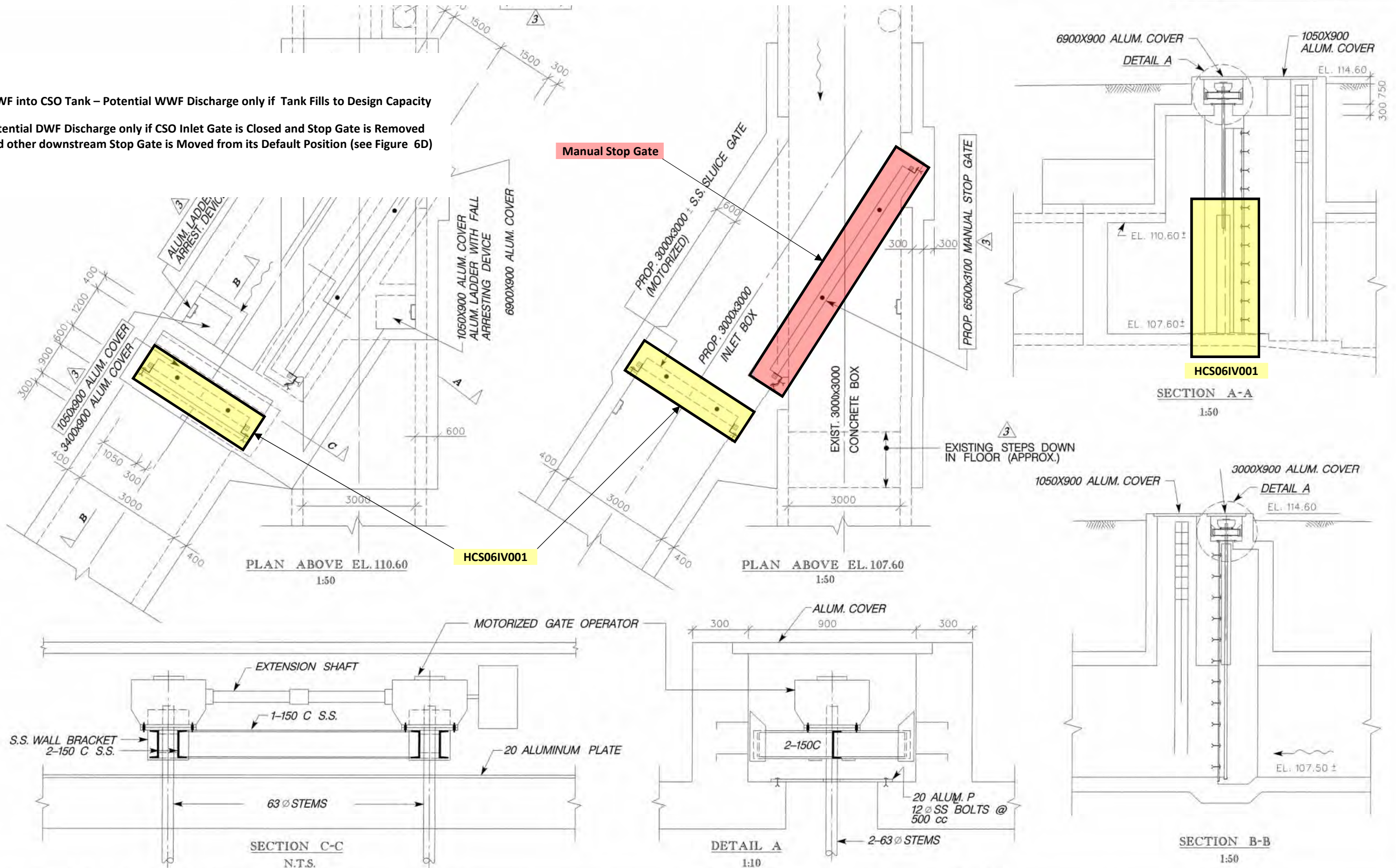
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**GREENHILL CSO TANK**  
 SITE PLAN-  
 PROPOSED UNDERGROUND WORK



**Figure 6B: Greenhill #2 CSO Tank (HCS06) – CSO Inlet Gate**

- WWF into CSO Tank – Potential WWF Discharge only if Tank Fills to Design Capacity
- Potential DWF Discharge only if CSO Inlet Gate is Closed and Stop Gate is Removed and other downstream Stop Gate is Moved from its Default Position (see Figure 6D)



No.	REVISIONS	INITIAL	DATE	DRAWN BY/RCP	DATE
1	ISSUED FOR APPROVALS	GNB	6/02/02	REFERENCE MATERIAL	JANUARY 22, 2002
2	ISSUED FOR TENDER	GNB	5/03/02	Road Plans Sewer Plans Water Plans	
3	AS CONSTRUCTED	JH	10/24/03	Regional Surveyor Geodetic Bench Mark Index No. Elevation	

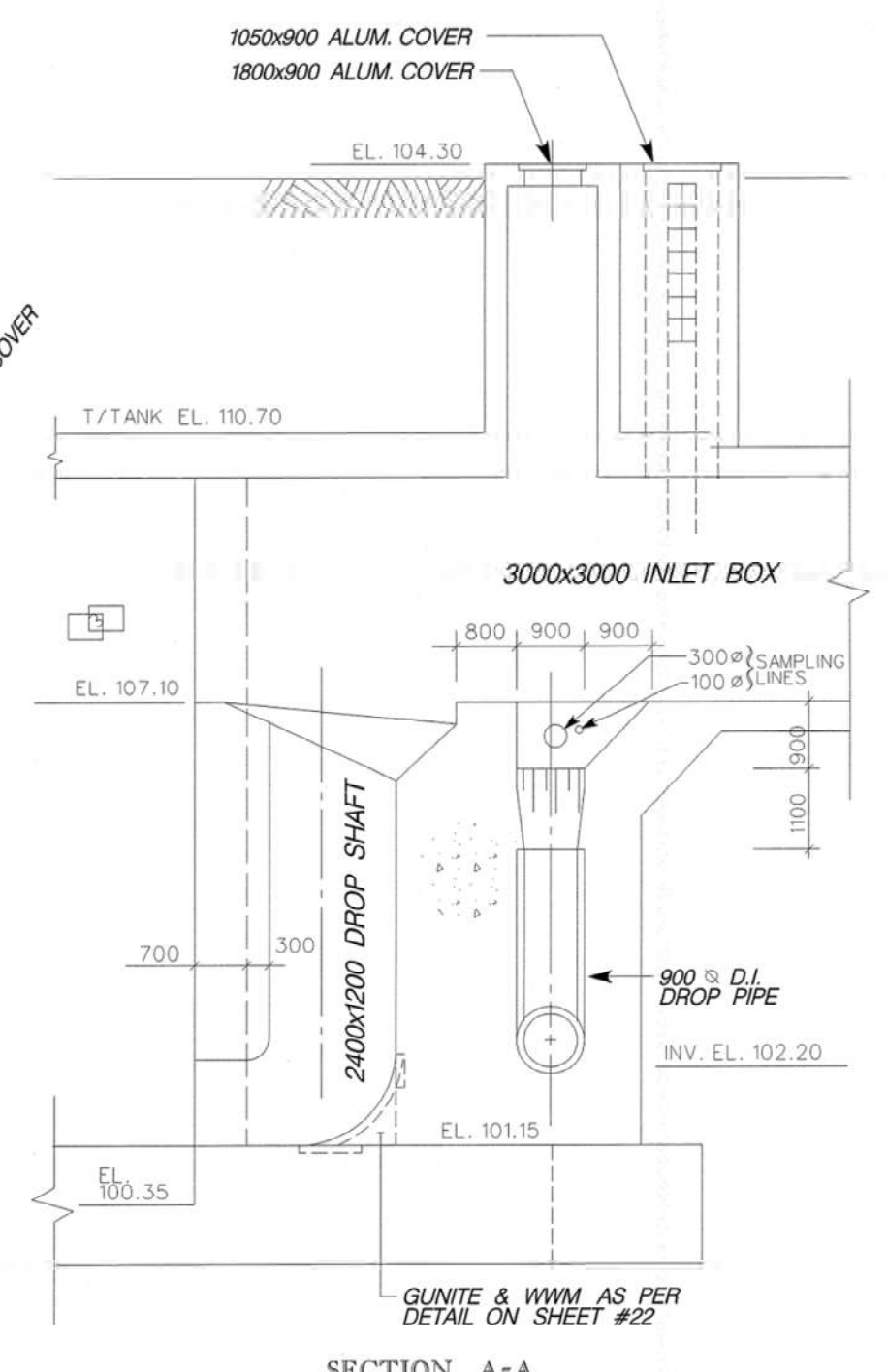
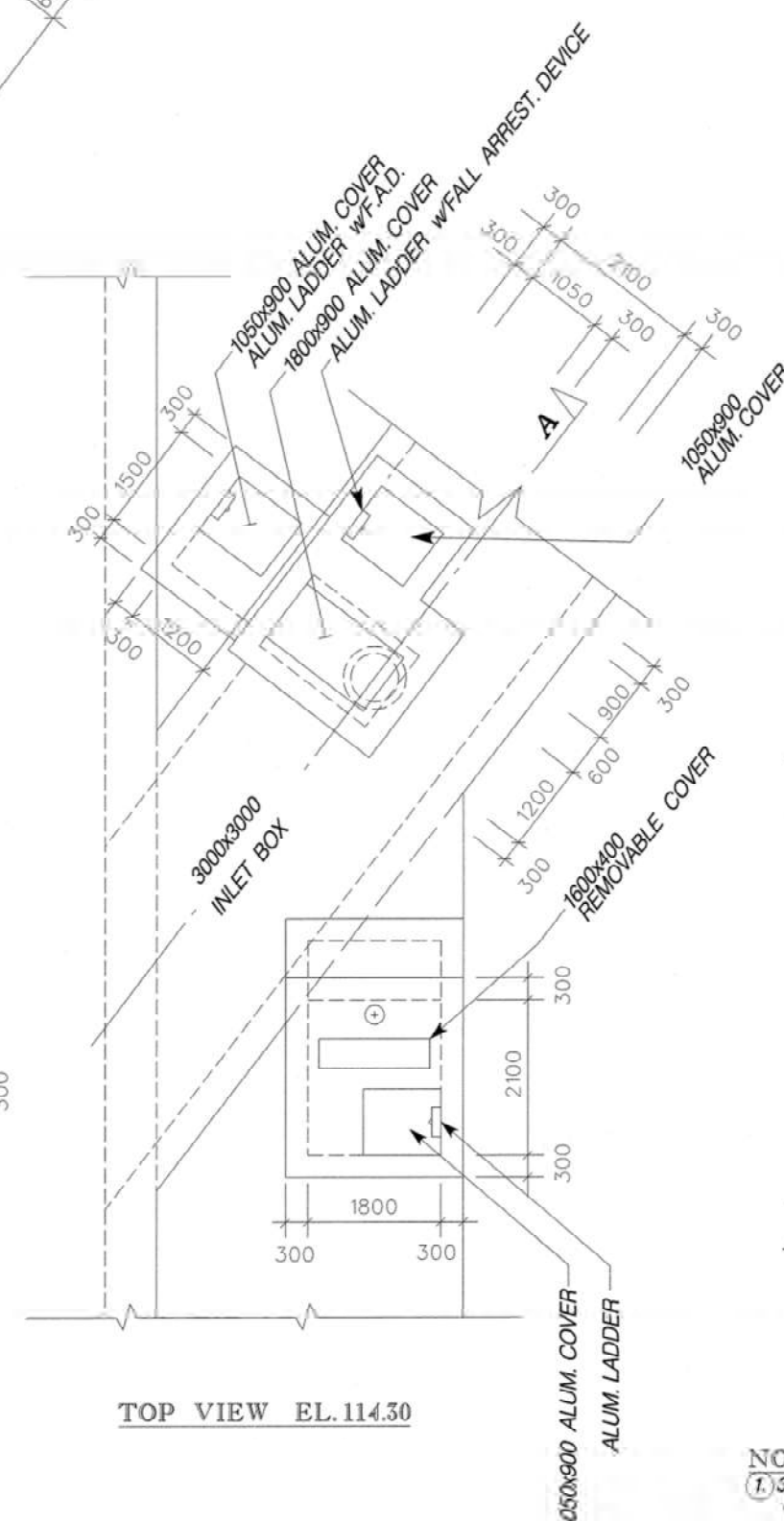
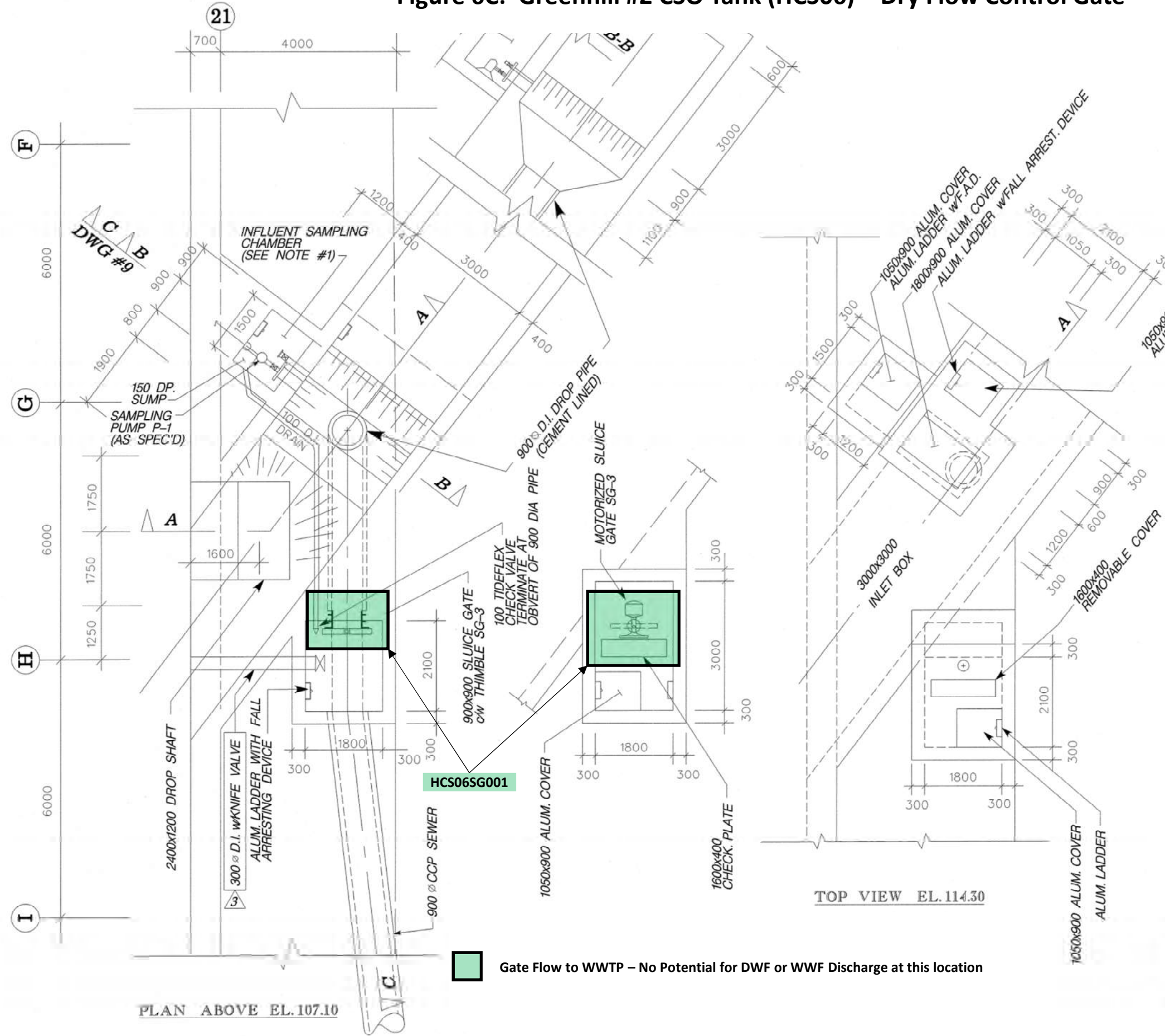
SCALES  
AS SHOWN

Director, Design and Construction  
 Doug Onishi, P. Eng.  
 Manager of Design  
 Gary Moore, P. Eng.

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INLET CHAMBER WITH  
 MOTORIZED SLUICE GATES

Figure 6C: Greenhill #2 CSO Tank (HCS06) – Dry Flow Control Gate



**NOTE#1 INFLUENT SAMPLING CHAMBER CONTAINS:**  
 (1) 300 S.S. WALL PIPE WITH 300 S.S. FLANGE & BLIND FLANGE  
 50 S.S. OUTLET PIPE & 50 S.S. KNIFE VALVE AND SAMPLING  
 DRY WELL PUMP WITH DISCHARGE TO ELECTRICAL ROOM.  
 (2) 100 S.S. WALL PIPE WITH S.S. FLANGE  
 100 S.S. KNIFE VALVE AND 100 S.S. PRESSURE TRANSMITTER & BLIND  
 FLANGE WITH 32 DIA CAPPED AND VALVED CONNECTION  
 (3) 100 D.I. CHAMBER DRAIN WITH TIDEFLEX VALVE  
 AT SLUICE GATE CHAMBER.

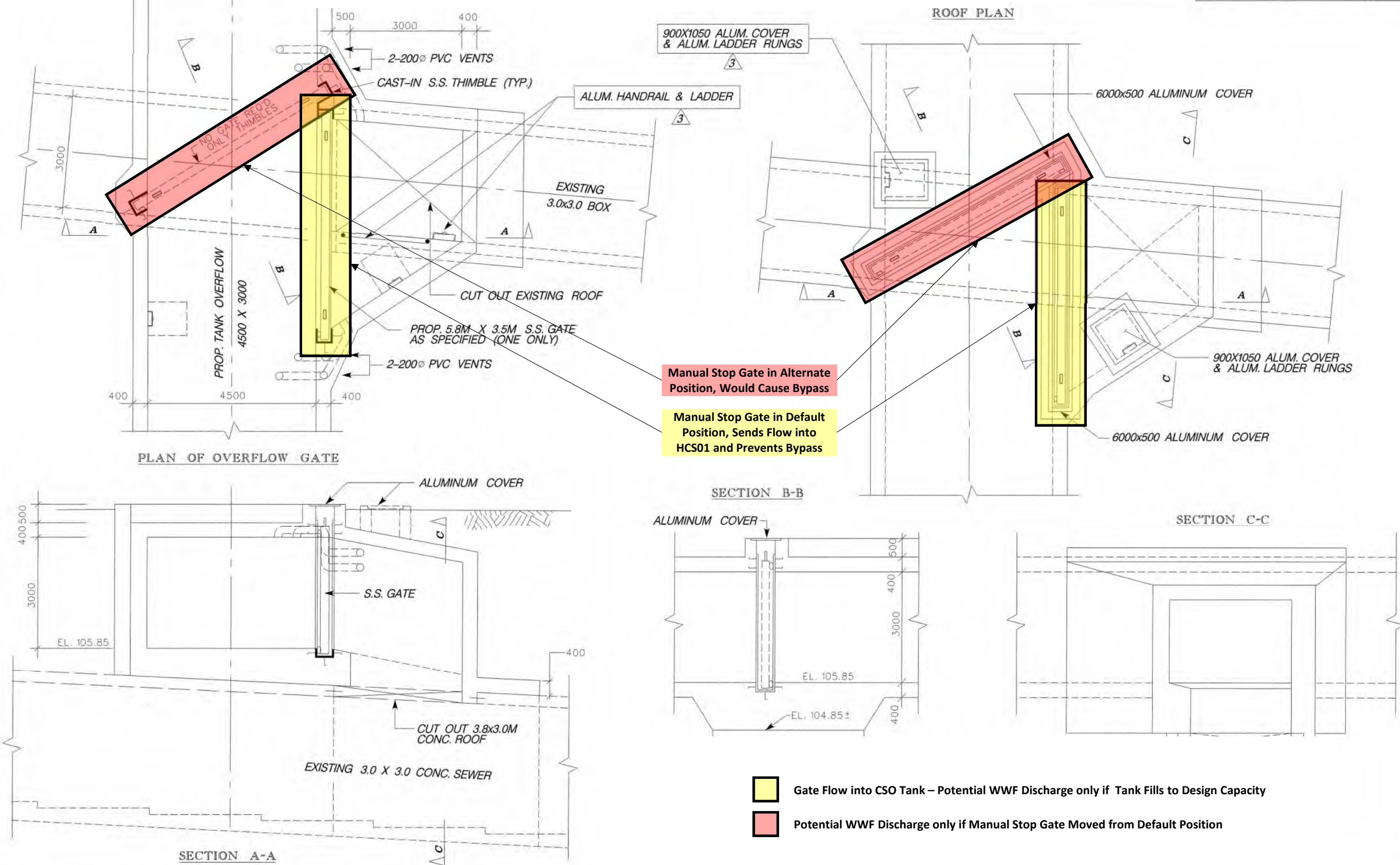
No	REVISIONS	INITIAL	DATE	DRAWN BY: RCP/AP	DATE FEBRUARY 22, 2002
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2	ISSUED FOR TENDER	GHS	5/13/02		
3	AS CONSTRUCTED	JH	10/24/03		

SCALES	1:50	Director, Design and Construction
		Doug Onishi, P. Eng Manager of Design
		Gary Moore, P. Eng

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 Transportation, Operations and Environment Department

**DRY FLOW CONTROL GATE and INFLUENT SAMPLING CHAMBER**

**Figure 6D: Greenhill #2 CSO Tank (HCS06) – Overflow Gate and Chamber**



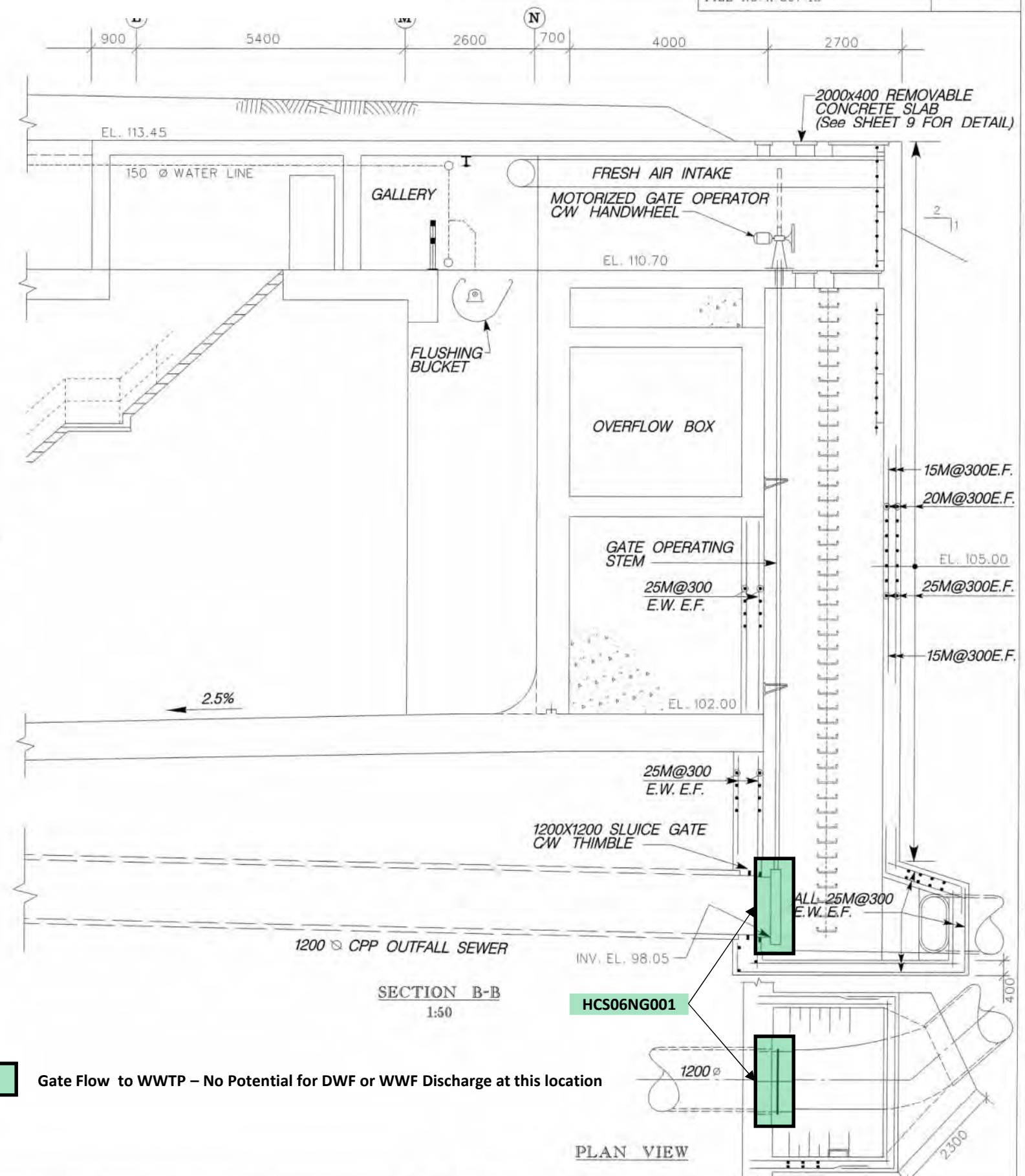
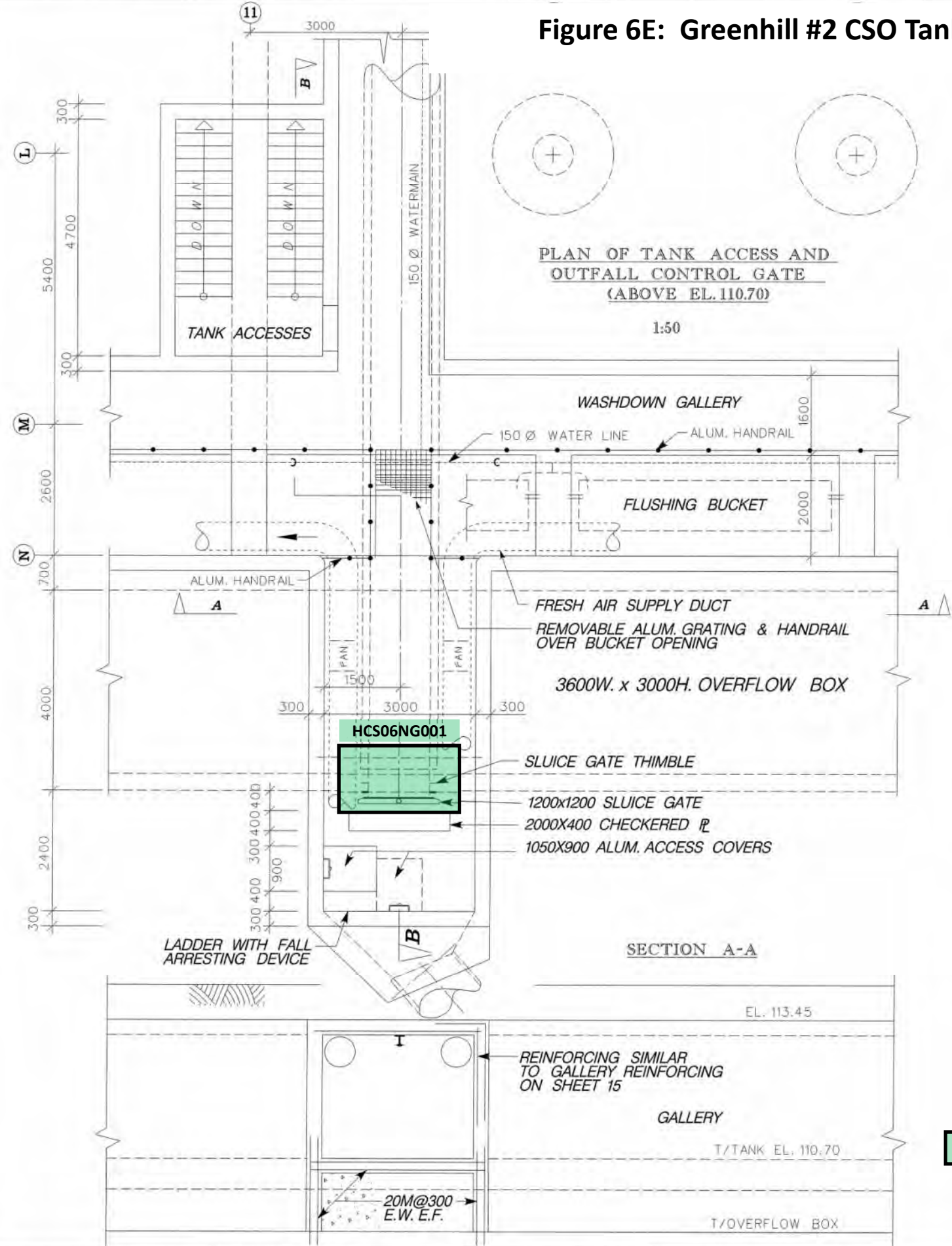
No.	REVISIONS	INITIAL	DATE	DRAWN BY/RCP	DATE
1	ISSUED FOR APPROVALS	GNB	6/02/02	REFERENCE MATERIAL:	JANUARY 22, 2002
2	ISSUED FOR TENDER	GNB	5/03/02	Road Plans	
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans	
				Water Plans	
				Regional Surveyor	
				Geodetic Bench Mark Index No.	
				Elevation	

SCALES	Director, Design and Construction
1:50	Doug Onishi, P. Eng. Manager of Design
	Gary Moore, P. Eng.

**CITY OF HAMILTON**  
 Transportation, Operations and Environment Department

**PROPOSED OVERFLOW GATE SECTIONS**

**Figure 6E: Greenhill #2 CSO Tank (HCS06) – CSO Drain Gate**



Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location

No.	REVISIONS	INITIAL	DATE	DRAWN BY/RCP	DATE
1	ISSUED FOR APPROVALS	GMB	6/02/02	REFERENCE MATERIAL	
2	ISSUED FOR TENDER	GMB	5/03/02	Road Plans	
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans Water Plans	

SCALES
AS SHOWN

Director, Design and Construction  
 Doug Onishi, P. Eng.  
 Manager of Design  
 Gary Moore, P. Eng.

**CITY OF HAMILTON**  
 Transportation, Operations and Environment Department

**OUTLET GATE CHAMBER**

**Table 6: Inventory of Critical Control Points at Greenhill CSO Tank #2 (HCS06)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Inlet Gate	HCS06IV001	3000 x 3000 mm	Motorized	Conveys DWF and WWF toward the Dry Flow Control Gate and the CSO Tank	Fully Open	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity.	+ No significant changes required to PCN or SOP + This gate is padlocked in Fully Open position
Manual Stop Gate in CSO Inlet Gate Chamber	N/A (Not on SCADA)	6500 x 3100 mm	Manual Stop Gate	Allows bypass of HCS06 tank if Stop Gate is removed and CSO Inlet Gate is Closed	Fully Closed	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge <u>only if</u> Tank Inlet Gate is Closed and stop gate is removed.	+ No significant changes required to PCN, but the placement of this manual Stop Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Dry Flow Control Gate	HCS06SG001	900 x 900 mm	Motorized	Allows CSO tank bypass if Stop Gate is removed and CSO Inlet Gate is Closed Conveys underflow to RHCSI and WWTP; and overflows into the CSO Tank	20% Open	No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity.	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Overflow Gate and Chamber between HCS01 and HCS06	N/A (Not on SCADA)	5800 x 3500 mm	Manual Stop Gate	Allows bypass of HCS01 tank if Stop Gate is moved from default position over CSO Outfall Pipe to alternate position over HCS01 Tank Inlet	In place over end of CSO Outfall Pipe	In default position: No potential for DWF or WWF discharge. Potential for WWF discharge <u>only if</u> Stop Gate moved to alternate position over HCS01 Tank Inlet.	+ No significant changes required to PCN, but the placement of this manual Stop Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
CSO Drain Gate	HCS06NG001	1200 x 1200 mm	Motorized	To drain stored CSO from the CSO Tank	Fully Closed during WWF; Opened during DWF	None	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

### 3.7 Red Hill Valley CSO Pipe Facility (HCS07)

The Red Hill Valley CSO Pipe Facility (HCS07) captures and stores CSOs from the former Lawrence, Queenston and Melvin CSO outfalls to Red Hill Creek. The facility stores the CSO in an oversized pipe running parallel to the existing RHCSI and along the Red Hill Parkway. The oversized storage pipe ranges in size from 2,000 to 2,250 mm in diameter, and a series of four (4) motorized sluice gates are used to convey flows into and create temporary storage within the pipe during WWF conditions, and also to control the subsequent drainage of the facility to the WWTP for treatment during DWF conditions.

HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m<sup>3</sup>. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C. HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded.

The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

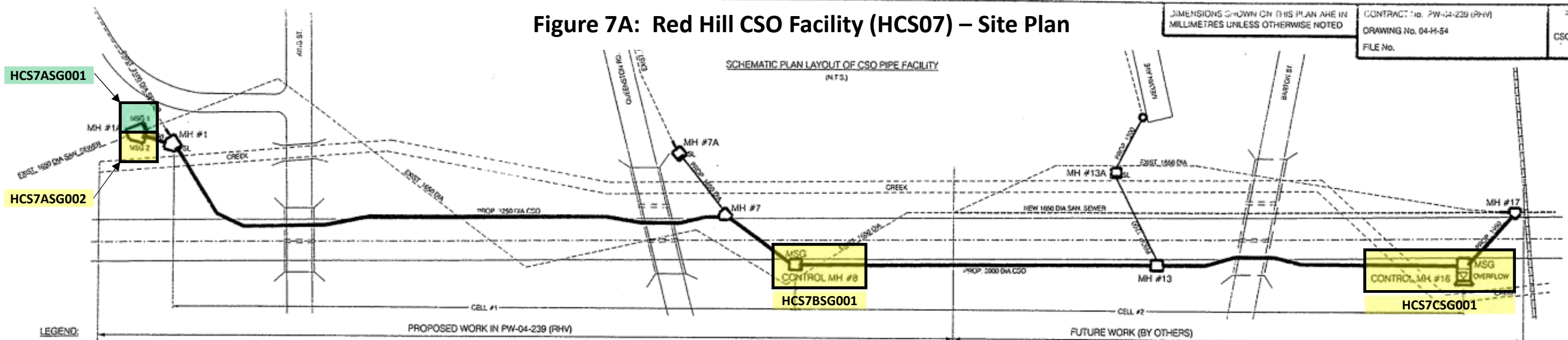
The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control buildings.

Figures 7A to 7D show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 7 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

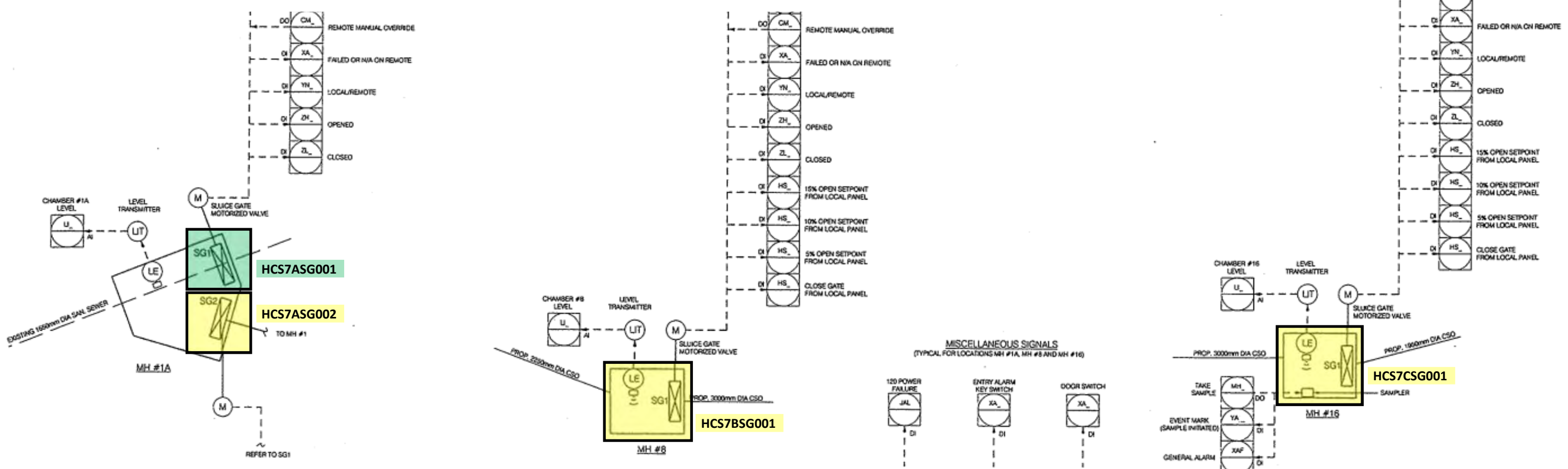
# Figure 7A: Red Hill CSO Facility (HCS07) – Site Plan

CONTRACT No. PW-04-239 (RHW)  
 DRAWING No. 04-H-54  
 FILE No. CSO 11 OF 11



LEGEND:  
 MSG - MOTORIZED SLUICE GATE  
 SL - STOP LOG

- Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if Pipe Fills to Design Capacity



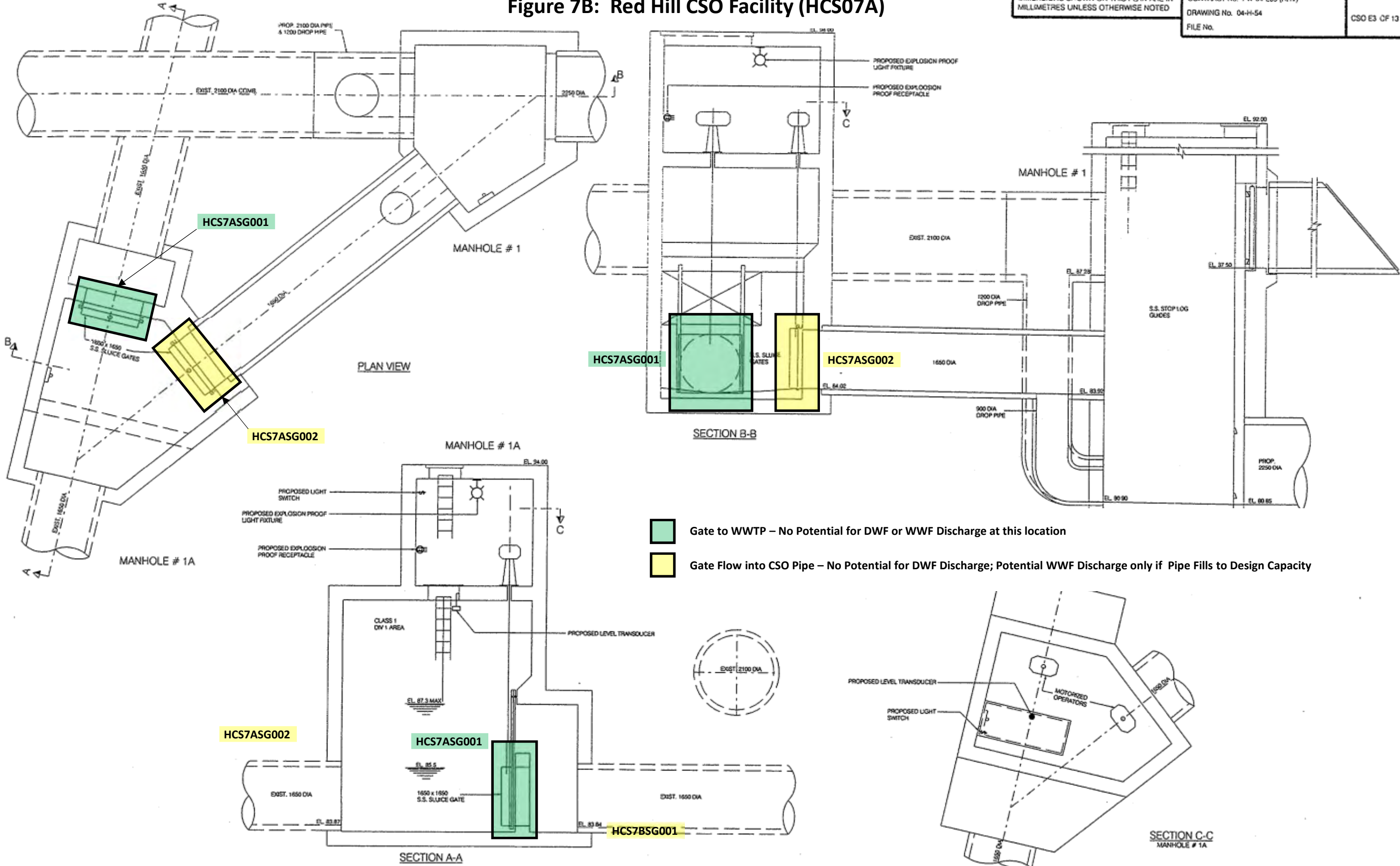
NO.	REVISIONS	INITIAL	DATE	DRAWN BY:	01/22/03	R.N.
				DESIGNED BY:	01/22/03	H.N.
				PROJECT MANAGER:		
				PROJECT DIRECTOR:		

SCALES: N.T.S.

**CITY OF HAMILTON**  
 Public Works Department

**RED HILL VALLEY PROJECT**  
 CSO PIPE FACILITY  
 PROCESS AND INSTRUMENTATION DIAGRAM

Figure 7B: Red Hill CSO Facility (HCS07A)

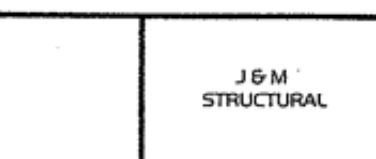


- Gate to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if Pipe Fills to Design Capacity

NO	REVISIONS	INITIAL	DATE

DRAWN BY:	03/22/03	I.N.
DESIGNED BY:	02/22/03	H.N.
PROJECT MANAGER:		
PROJECT DIRECTOR:		

SCALES	1:50
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**CITY OF HAMILTON**  
Public Works Department

**RED HILL VALLEY PROJECT**  
**CSO PIPE FACILITY**  
MH #1 & MH #1A - PROPOSED LOCATION FOR ELECTRICAL AND INSTRUMENTATION EQUIPMENT

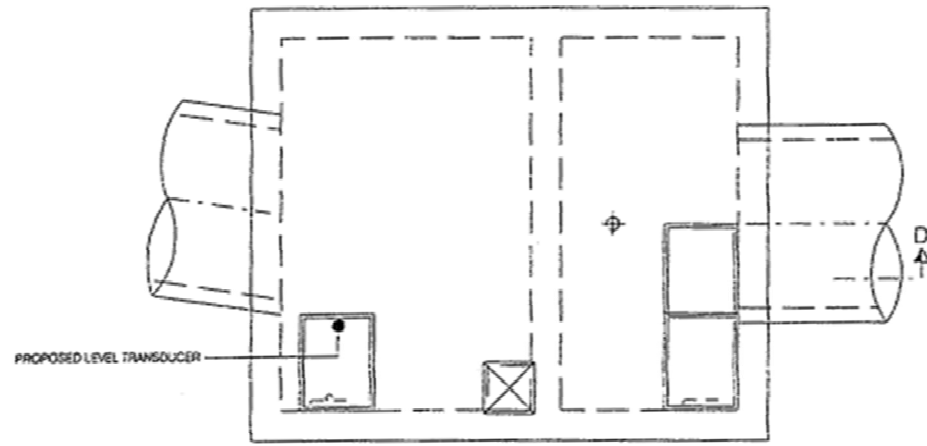


# Figure 7C: Red Hill CSO Facility (HCS07B)

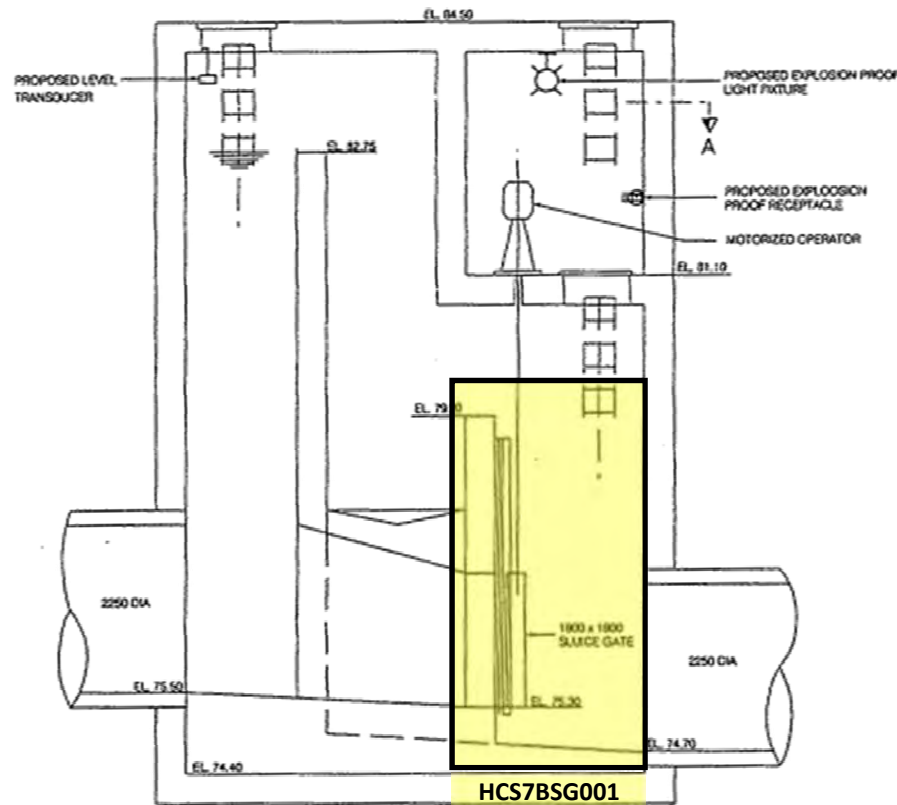
(DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED)

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DRAWING No. 04-H-54  
FILE No.

SHEET No.  
CSO E7 OF E13

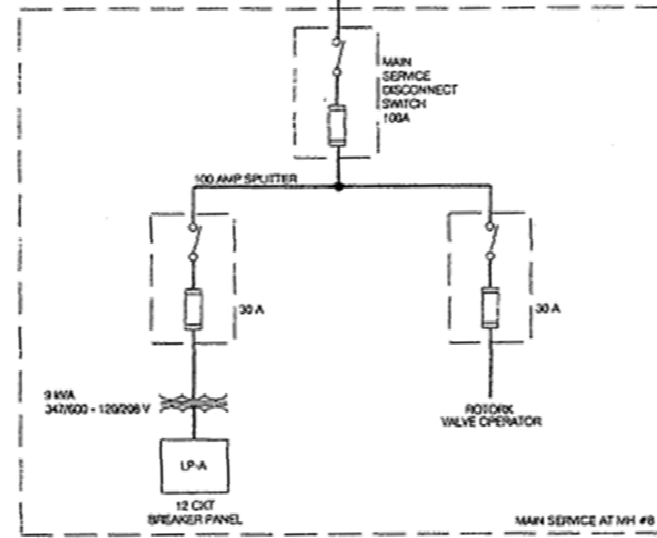
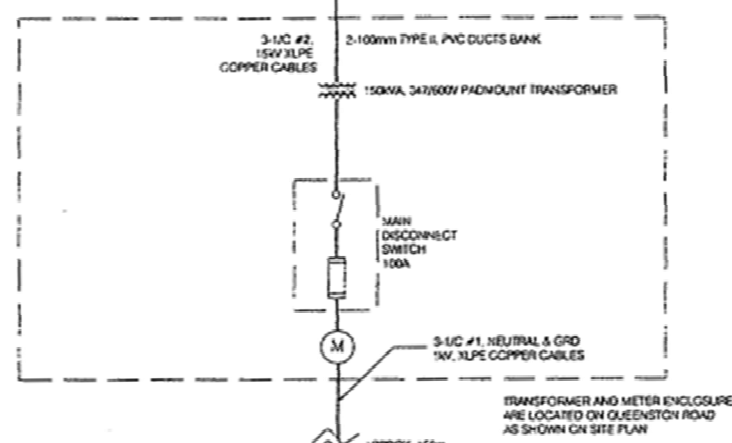


ROOF PLAN

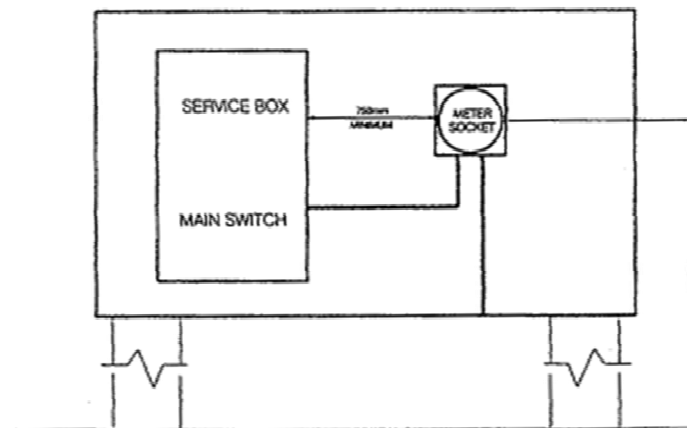


SECTION D-D

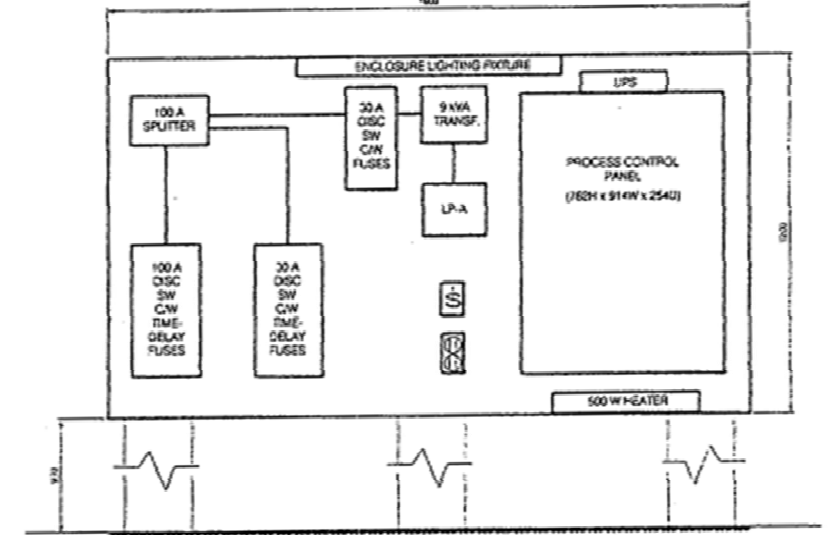
Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if Pipe Fills to Design Capacity



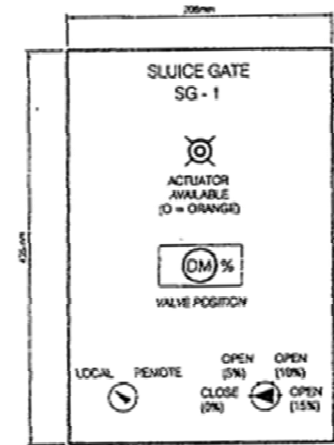
SINGLE LINE DIAGRAM  
N.T.S.



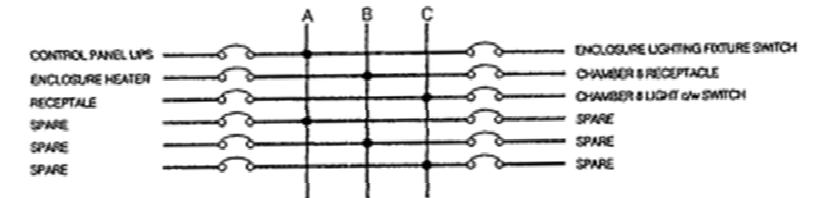
HYDRO METER ENCLOSURE  
N.T.S.



CONTROL ENCLOSURE  
(1600H x 1200W x 375D)  
N.T.S.



FUSED DISCONNECT SWITCH  
TYPICAL FOR SG-1  
N.T.S.

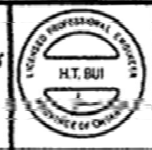
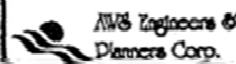


L.P.A. SCHEDULE (120 V / 208 V)  
N.T.S.

NO.	REVISIONS	INITIAL	DATE	DRAWN BY:	09/22/03	R.H.
				DESIGNED BY:	09/22/03	H.H.
				PROJECT MANAGER:		
				PROJECT DIRECTOR:		

SCALES

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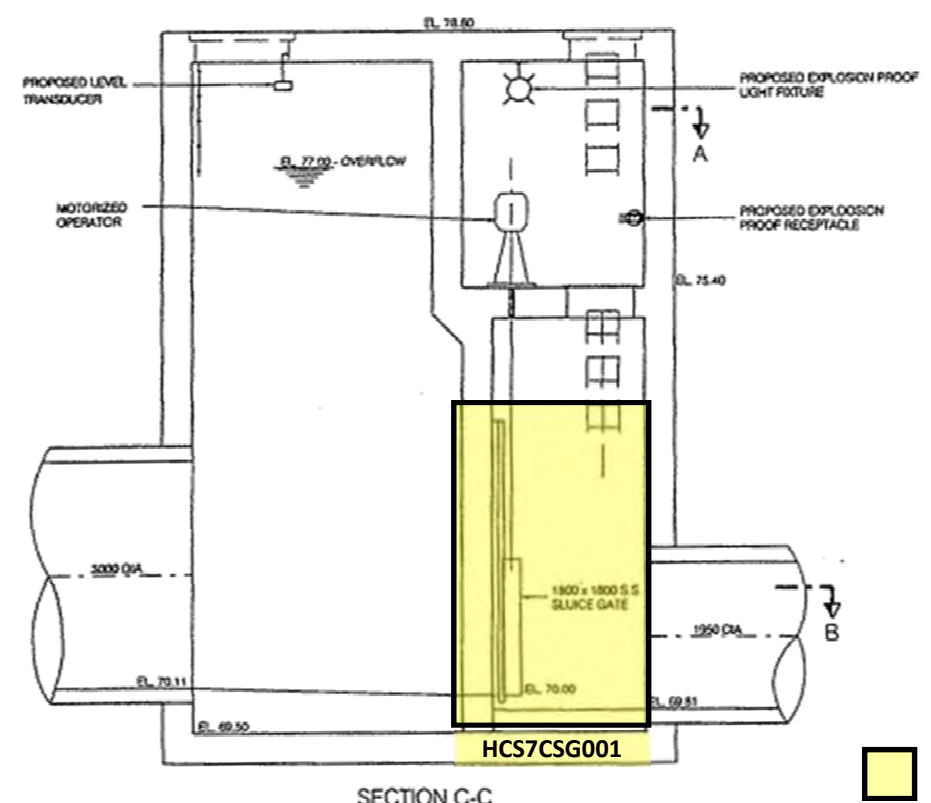
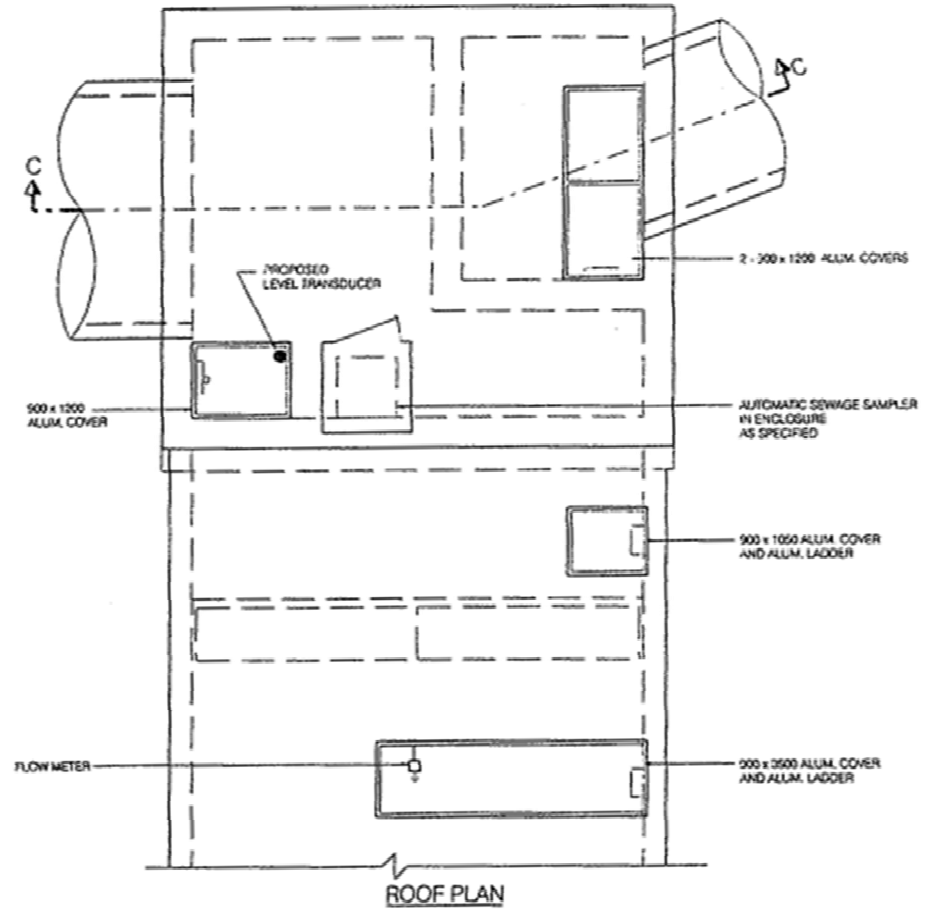


J & M  
STRUCTURAL

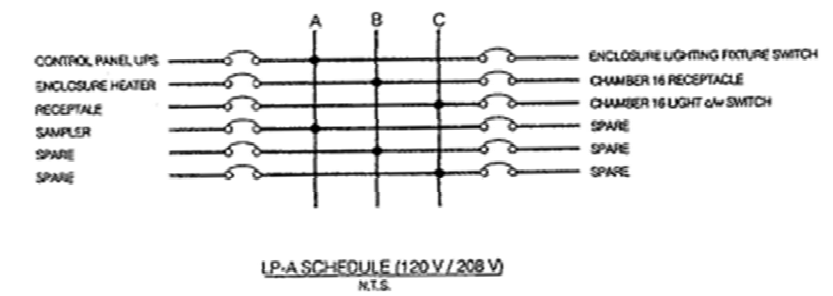
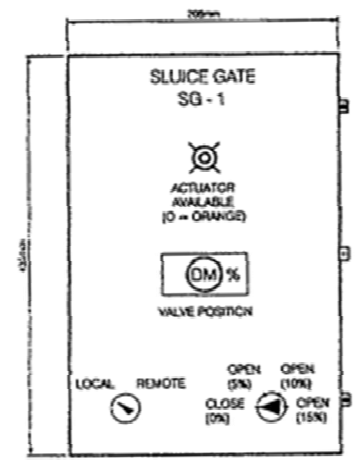
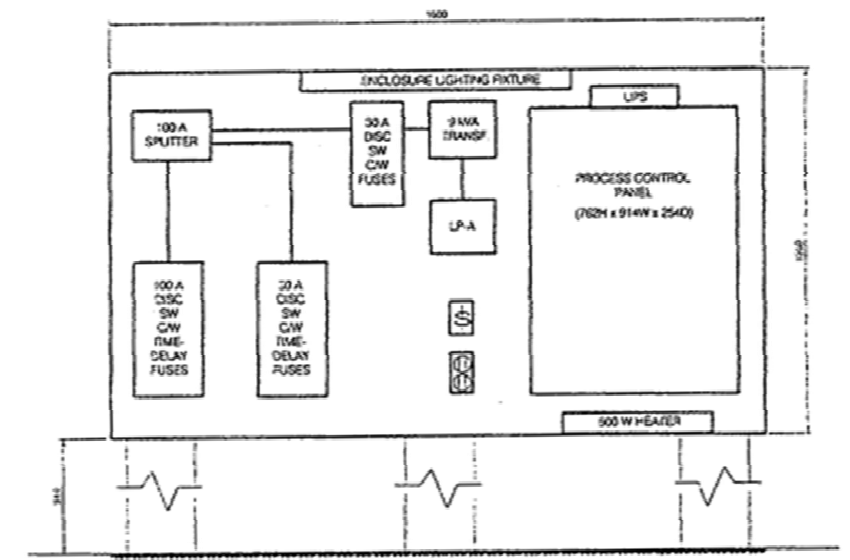
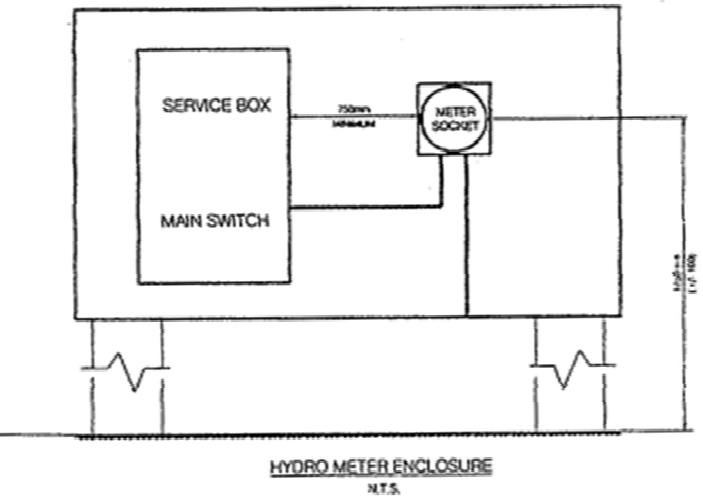
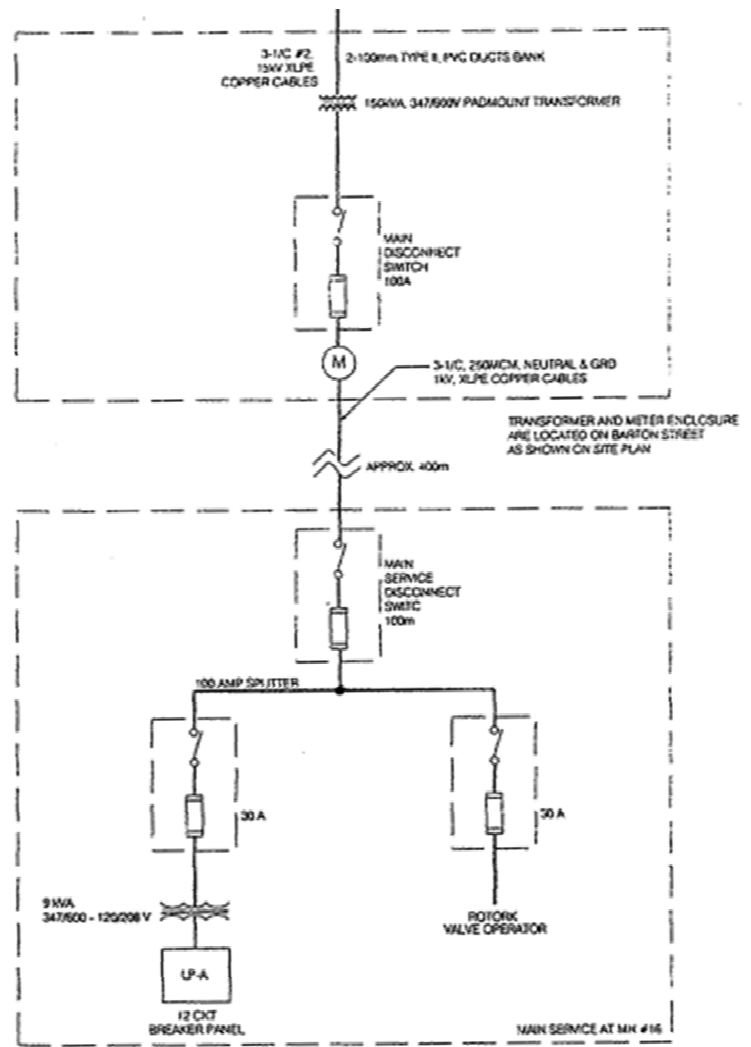
**CITY OF HAMILTON**  
Public Works Department

**RED HILL VALLEY PROJECT**  
**CSO PIPE FACILITY**  
SLUICE GATE CHAMBER #8  
SINGLE LINE DIAGRAM, L.P.A., HYDRO & CONTROL  
ENCLOSURE DIAGRAM AND EQUIPMENT LAYOUT

Figure 7D: Red Hill CSO Facility (HCS07C)



Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if Pipe Fills to Design Capacity



NO.	REVISIONS	INITIAL	DATE	DRAWN BY:	03/23/03	R.H.
				DESIGNED BY:	09/23/03	H.N.
				PROJECT MANAGER:		
				PROJECT DIRECTOR:		

SCALES: 1:50

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Public Works Department

**RED HILL VALLEY PROJECT**  
CSO PIPE FACILITY  
SLUICE GATE CHAMBER #16  
SINGLE LINE DIAGRAM, LP-A, HYDRO & CONTROL ENCLOSURE DIAGRAM AND EQUIPMENT LAYOUT

**Table 7: Inventory of Critical Control Points at Red Hill Valley CSO Pipe (HCS07)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
HCS7A Sluice Gate No. 1	HCS07ASG001	1650 x 1650 mm	Motorized	To convey flow to WWTP in DWF; or to CSO Storage Pipe in WWF	Fully Open in DWF; Fully Closed in WWF	No potential for DWF discharge at this location; Potential for WWF discharge at Barton Street only if CSO pipe fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
HCS7A Sluice Gate No. 2	HCS07ASG002	1650 x 1650 mm	Motorized		Fully Closed in DWF; Fully Open in WWF		
HCG05 Sluice Gate	HCG05SG001	1650 x 1650 mm	Motorized	To convey flow into RHCSI and on to WWTP in DWF; or to CSO Storage Pipe in WWF	Fully Open in DWF; Fully Closed in WWF	No potential for DWF discharge at this location; Potential for WWF discharge at Barton Street only if CSO pipe fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
HCS7B Sluice Gate No. 1	HCS07BSG001	1800 x 1800 mm	Motorized	To create in-line storage in CSO Storage Pipe between HCS7A and HCS7B in WWF; and drain the pipe in DWF	5% Open in DWF; Fully Closed in WWF	No potential for DWF discharge; Potential for WWF discharge at Barton Street only if CSO Storage Pipe fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
HCS7C Sluice Gate No. 1	HCS07CSG001	1800 x 1800 mm	Motorized	To create in-line storage in CSO Storage Pipe between HCS7B and HCS7C in WWF; and drain the pipe in DWF	5% Open in DWF; Fully Closed in WWF	No potential for DWF discharge; Potential for WWF discharge at Barton Street only if CSO Storage Pipe fills to design capacity	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> <li>+ Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem</li> </ul>
							<ul style="list-style-type: none"> <li>+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</li> </ul>

### 3.8 Royal Avenue CSO Tank (HCS08)

The Royal Avenue CSO Tank (HCS08) is an underground reinforced concrete structure that provides approximately 15,000 m<sup>3</sup> of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 41 long x 37 m wide x 10 m deep.

The site originally included a CSO Regulator chamber that employed a motorized sluice gate to dynamically control the rate of flow conveyed to the Woodward Avenue WWTP. This sluice gate was removed, and control of the flow conveyed to the WWTP and the CSO tank is accomplished passively by a 525 mm diameter drop pipe located in the diversion chamber at the east end of Royal Avenue. During dry weather and small storm events, the 525 mm drop pipe conveys all flow into the downstream 900 mm sanitary sewer and on to the WWTP. During larger storm events, the 525 mm drop pipe will fill to capacity and excess flows will be diverted to the CSO tank after passing through a coarse bar screen included in the CSO Tank Inlet Chamber. Filling of the CSO Tank occurs passively without any actions having to be initiated by the Operators at the WWTP.

CSOs are conveyed to the storage tank by a 2,400 mm x 2,400 mm step sewer. The inlet sewer is designed to operate under surcharge, dependent upon the level of the sewage in the CSO storage tank, which provides some additional volume.

The inlet chamber also includes provision to isolate the CSO storage tank in emergencies and during special maintenance activities, and a 2,400 mm wide x 2,000 mm deep box culvert is provided to divert flow to Chedoke Creek for those activities. The chamber includes two sets of guides for alternate placement of a single stop log to control the direction of flow. Under normal operation, the stop log will be inserted in the guides over the upstream end of the emergency bypass sewer, sending all excess WWF into the CSO tank. To operate the bypass, the stop log has to be physically removed from its default position and inserted in the alternate position over the upstream end of the CSO tank inlet sewer. Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. A removable stainless steel bar screen is provided at the upstream end of the CSO tank inlet sewer to capture debris to protect the sewage pumps in the storage tank.

Inside the storage tank, a stainless steel baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the tank, so they can be subsequently pumped from the tank and conveyed to the Woodward WWTP for treatment. A 5,400 mm wide x 1,800 mm deep box culvert is provided at the northeast corner of the site to convey any overflows from the facility into Chedoke Creek.

Three (3) submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during dry weather, when the capacity is available to treat these flows. Three (3) pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps will be conveyed south via three (3) 400 mm diameter ductile iron forcemains into the relocated 900 mm sanitary sewer running east along the south wall of the tank. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 8A to 8C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

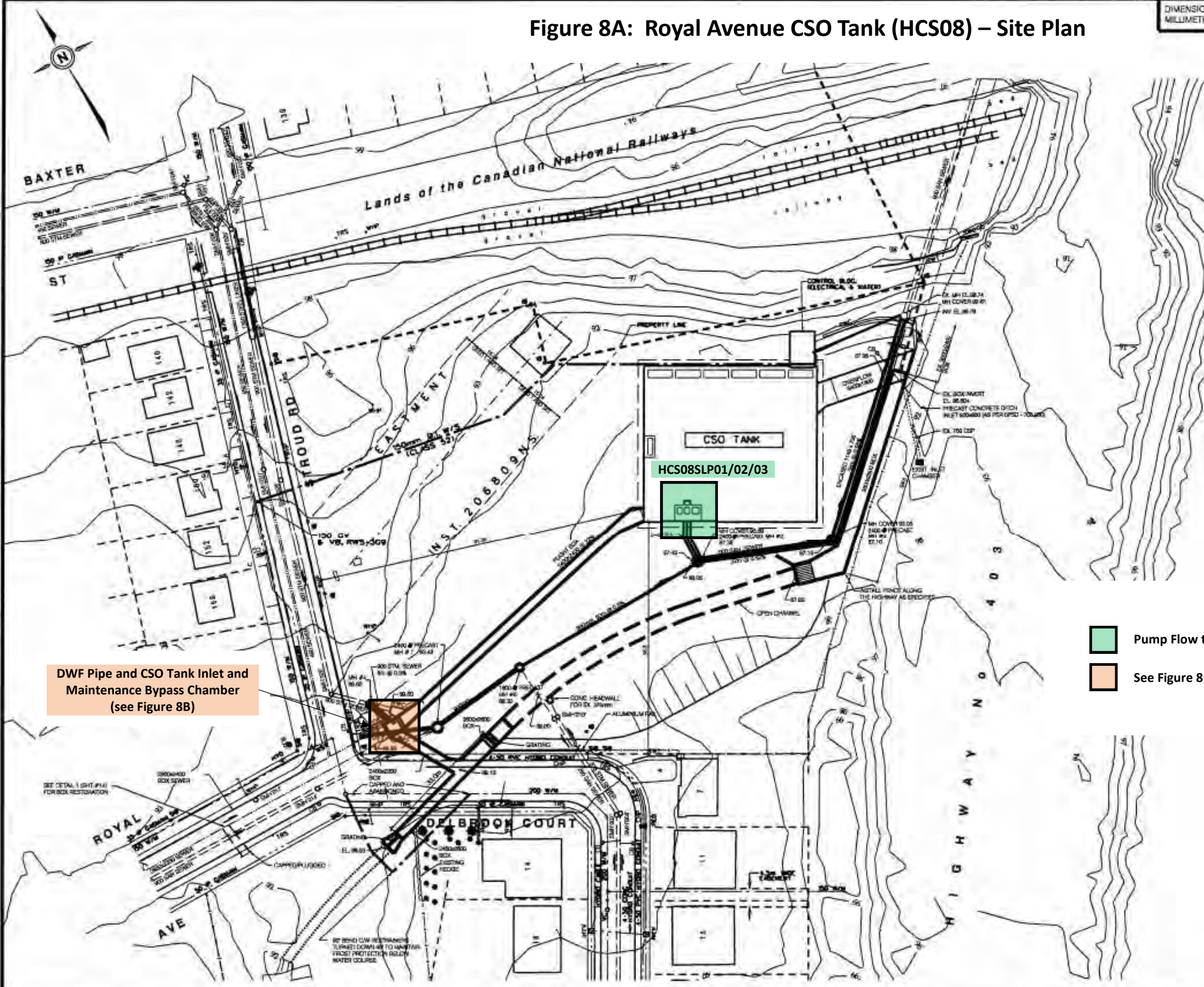
Table 8 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 8A: Royal Avenue CSO Tank (HCS08) – Site Plan

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

CONTRACT No. PY-05-06 (CSO)  
DRAWING No. 05-S-13  
FILE No. 816-43

SHEET No.  
1 OF 20



DWF Pipe and CSO Tank Inlet and Maintenance Bypass Chamber (see Figure 8B)

- Pump Flow to WWTP – No Potential DWF or WWF Discharge at this location
- See Figure 8B

No.	REVISIONS	INITIAL	DATE	DRAWN BY	DATE
1	ISSUED FOR APPROVALS		01/03	Hatch Mott MacDonald	
2	ISSUED FOR M.O.E. APPROVAL		02/03	Road Plans	
3	ISSUED FOR TENDER		04/03	Sewer Plans	
4	AS BUILT		10/07	Valley Plans	

Original Subject  
Geomatics Bench Mark Index No. 1-14  
Elevation = 92.50m

SCALES	1:500
ORIGINAL DWG. SEALED BY J. HEDGECOCK	

 J & M STRUCTURAL	Manager of Construction Gary Moore, P. Eng.
	Manager of Design Gary Moore, P. Eng.

**CITY OF HAMILTON**  
 Public Works Department

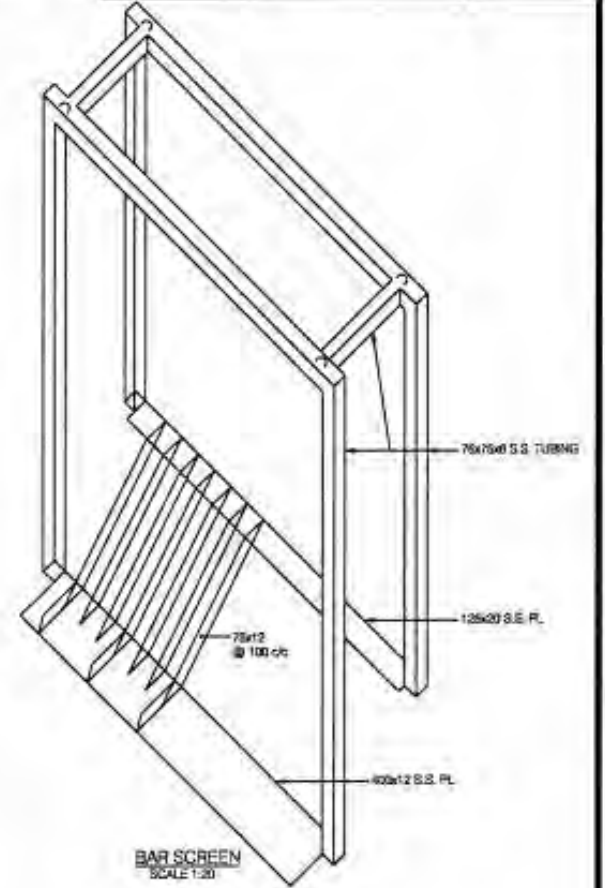
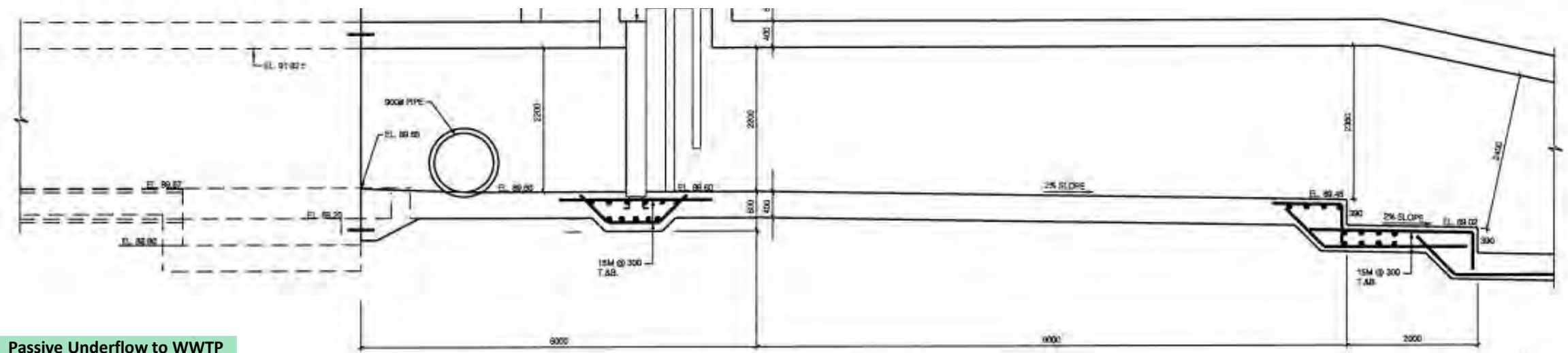
**CITY OF HAMILTON**  
 ROYAL AVENUE COMBINED SEWER  
 OVERFLOW STORAGE TANK  
 SITE PLAN

Figure 8B: Royal Avenue CSO Tank (HCSO8) – CSO Tank Inlet Chamber

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

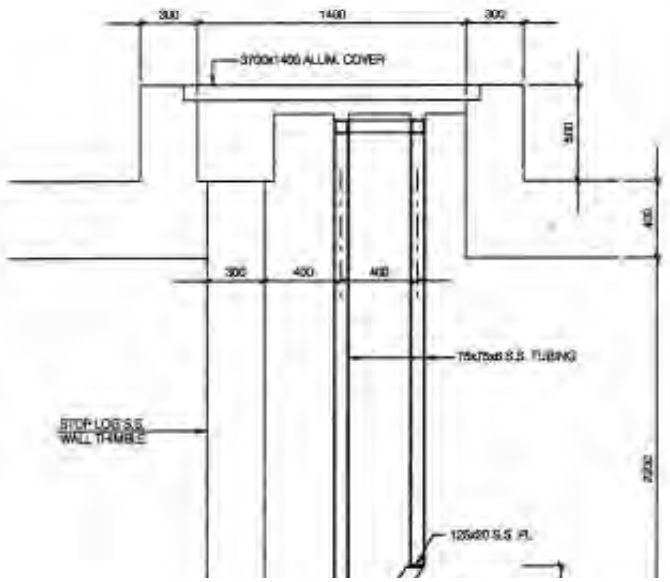
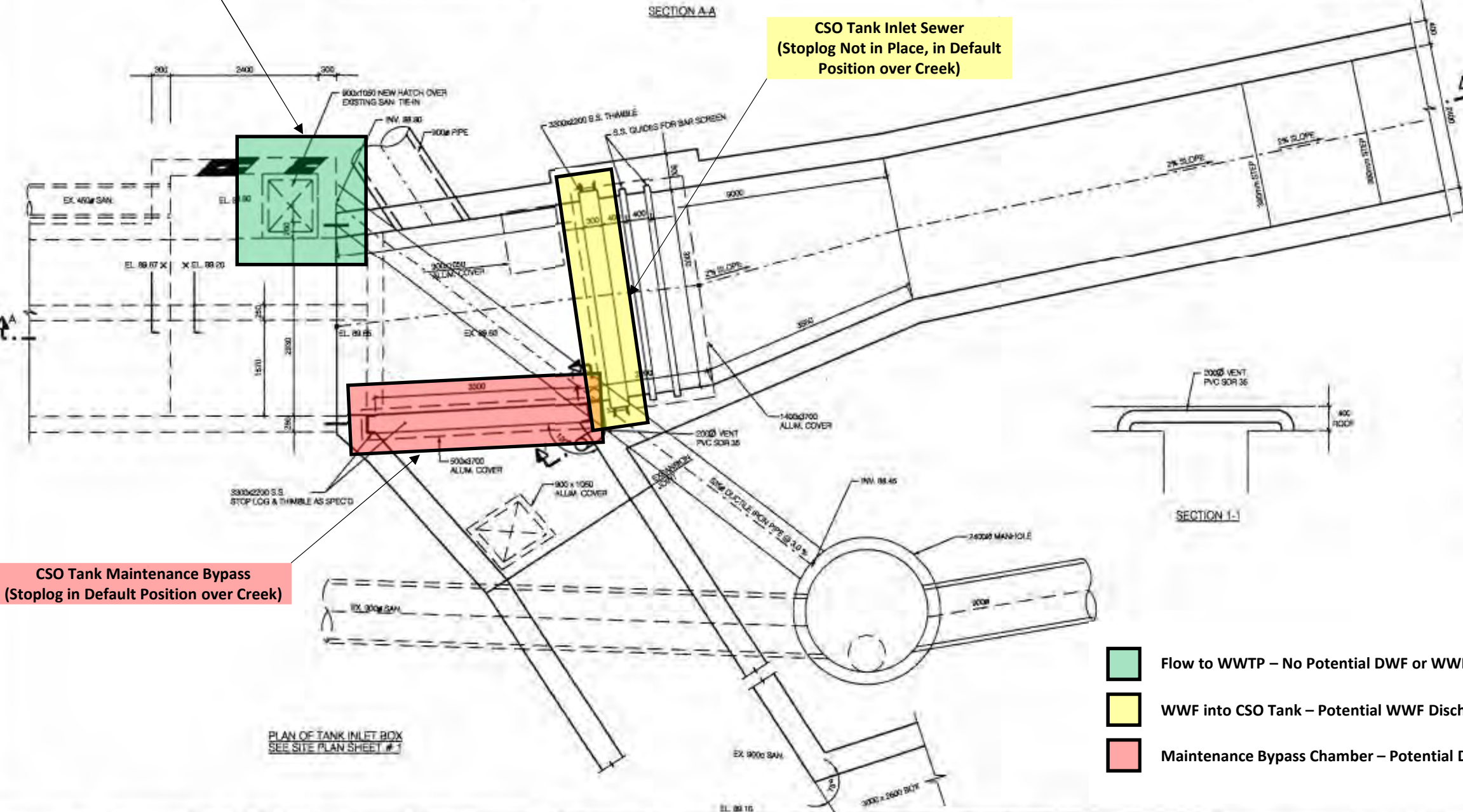
CONTRACT No. PW-05-06 (CSO)  
DRAWING No. 05-S-13  
FILE No. B18-43

SHEET No.  
10 OF 20



Passive Underflow to WWTP

CSO Tank Inlet Sewer  
(Stoplog Not in Place, in Default Position over Creek)



CSO Tank Maintenance Bypass  
(Stoplog in Default Position over Creek)

- Flow to WWTP – No Potential DWF or WWF Discharge at this location
- WWF into CSO Tank – Potential WWF Discharge only if Tank Fills to Design Capacity
- Maintenance Bypass Chamber – Potential DWF Discharge only if Stop Log Moved from Default Position

PLAN OF TANK INLET BOX  
SEE SITE PLAN SHEET # 7

REVISIONS	INITIAL	DATE	DRAWN BY	REV.	DATE
1. ISSUED FOR APPROVALS		01/06			08/04
2. ISSUED FOR MOE APPROVAL		05/05			
3. ISSUED FOR TENDER		08/05			
4. AS BUILT		10/07			

SCALES	ORIGINAL DWG
1:40	SEALED BY J. HUDOBA 08/09/05

**Hatch Mott MacDonald**  
Manager of Construction  
Jerry Palodis, P. Eng  
Manager of Design  
Gary Moore, P. Eng

J & M STRUCTURAL

**CITY OF HAMILTON**  
Public Works Department

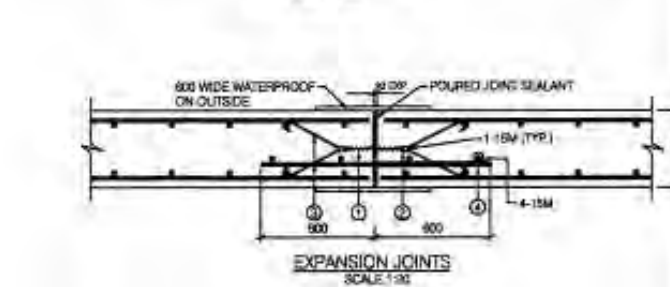
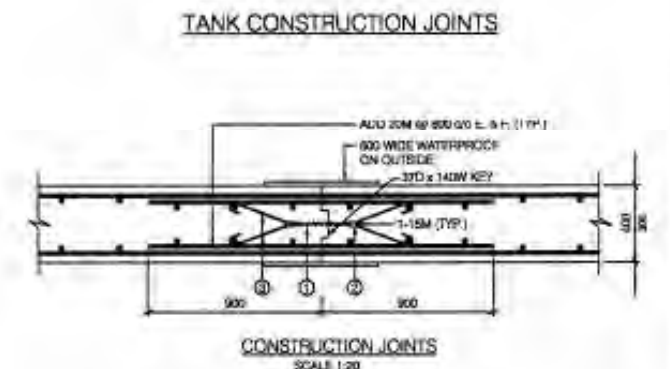
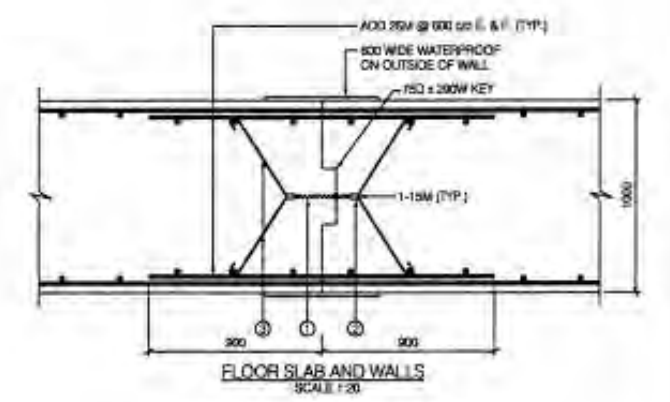
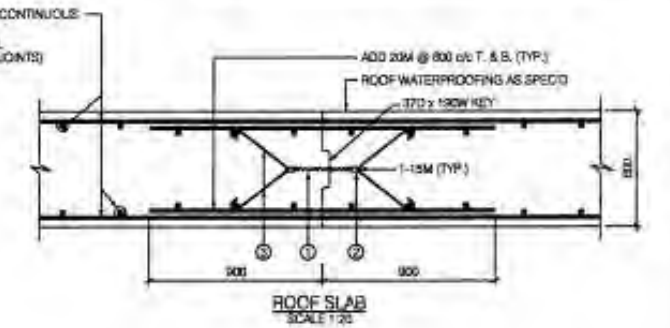
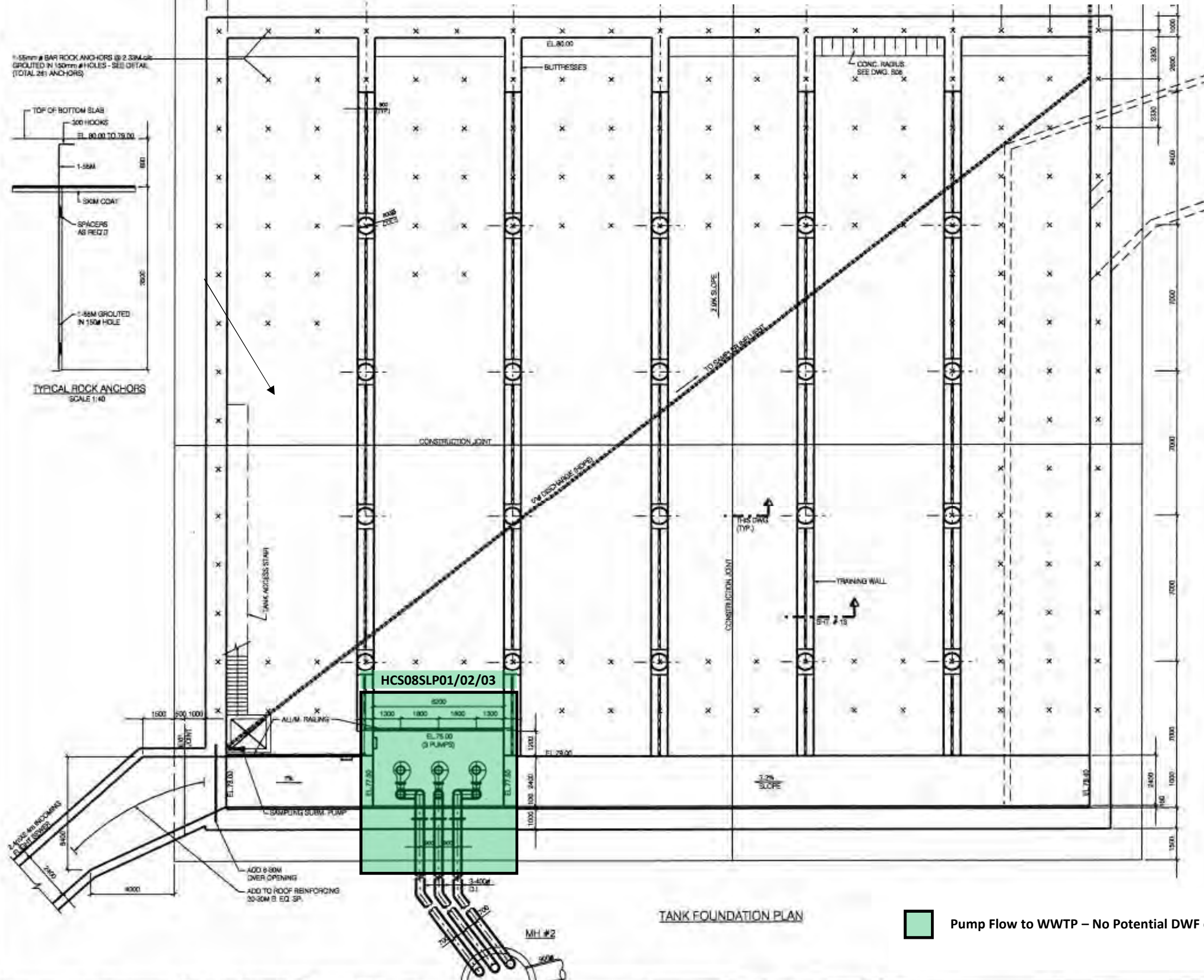
**CITY OF HAMILTON**  
ROYAL AVENUE COMBINED SEWER  
OVERFLOW STORAGE TANK  
PLAN AND SECTION OF TANK INLET BOX

# Figure 8c: Royal Avenue CSO Tank (HCS08) - Pumps

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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 DRAWING No. 05-S-13  
 FILE No. 818-43

SHEET No.  
 2 OF 20



TYPICAL FOR ALL REMAINING JOINTS

PLASTIC WATERSTOP AS SPECIFIED

**LEGEND:**  
 (1) PLASTIC WATERSTOP AS SPECIFIED

Pump Flow to WWTP - No Potential DWF or WWF Discharge at this location

<p>REVISIONS</p> <table border="1"> <tr> <th>NO.</th> <th>DESCRIPTION</th> <th>INITIAL</th> <th>DATE</th> </tr> <tr> <td>1.</td> <td>ISSUED FOR APPROVALS</td> <td></td> <td>01/06</td> </tr> <tr> <td>2.</td> <td>ISSUED FOR MCE APPROVAL</td> <td></td> <td>02/06</td> </tr> <tr> <td>3.</td> <td>ISSUED FOR TENDER</td> <td></td> <td>08/05</td> </tr> <tr> <td>4.</td> <td>AS BUILT</td> <td></td> <td>11/07</td> </tr> </table>	NO.	DESCRIPTION	INITIAL	DATE	1.	ISSUED FOR APPROVALS		01/06	2.	ISSUED FOR MCE APPROVAL		02/06	3.	ISSUED FOR TENDER		08/05	4.	AS BUILT		11/07	<p>DESIGNED BY: R.J.                  DATE: 08/04</p>	<p>SCALE: 1:100</p>	<p>ORIGINAL DWG. SEALED BY: J. HUDOBA 08/05/05</p>	<p><b>Hatch Mott MacDonald</b>                  Manager of Construction: Jenny Parisotto, P. Eng.                  Manager of Design: Gary Motte, P. Eng.</p>	<p><b>CITY OF HAMILTON</b>                  Public Works Department</p>	<p><b>CITY OF HAMILTON</b>                  ROYAL AVENUE COMBINED SEWER OVERFLOW STORAGE TANK                  TANK FOUNDATION PLAN</p>
NO.	DESCRIPTION	INITIAL	DATE																							
1.	ISSUED FOR APPROVALS		01/06																							
2.	ISSUED FOR MCE APPROVAL		02/06																							
3.	ISSUED FOR TENDER		08/05																							
4.	AS BUILT		11/07																							



**Table 8: Inventory of Critical Control Points at Royal Avenue CSO Tank (HCS08)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Tank Inlet Chamber Stop Log	N/A (Not on SCADA)	3300 x 2200 mm	Manual Stop Log	In default position over end of Bypass Culvert, conveys WWF into CSO Tank; In alternate position over CSO Tank Inlet Sewer, provides CSO Tank Maintenance Bypass	In place over end of Bypass Culvert	In default position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN, but the operation of this manual Stop Log should be covered in the SOP and/or other documents to be submitted in response to MECF Order Item 6
Sewage Lift Pump No. 1	HCS08SLP01	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS08SLP02	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 3	HCS08SLP03	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
							+ Establish appropriate inspection program for the facility, including visual inspection of manual Stop Log to confirm correct position

### 3.9 McMaster CSO Tank (HCS09)

The McMaster CSO Tank (HCS09) is an underground reinforced concrete structure that provides approximately 5,935 m<sup>3</sup> of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 50 m long x 18 m wide x 6.6 m deep. When the tank is full, some additional CSO storage volume is provided within the upstream CSO tank inlet sewer.

A maintenance bypass is provided at the southwest corner of the storage tank, where the CSO inflow sewer enters the tank, to provide a means to bypass flows around the storage tank, to permit future isolation of the CSO storage tank in emergencies and during special maintenance activities.

Under normal operation, the CSO tank inlet gate is fully open and the stop log over the end of the CSO tank overflow sewer is removed (sitting in guides above the end of the CSO tank overflow sewer), to allow all incoming flow to enter the tank. To operate the CSO tank bypass, in order to fully isolate the CSO tank from the CSO outfall pipe, the CSO tank inlet gate must be fully closed and the stop log removed from its default position and inserted in the alternate guides provided over the end of the CSO tank overflow sewer. This bypass was employed during the construction of the CSO storage tank and inlet sewer.

Inside the storage tank, a stainless steel underflow baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the CSO storage tank, so they can be subsequently pumped from the tank and conveyed to the WWTP for treatment. A 2,400 mm wide x 1,000 mm (sloped) overflow trough is provided at the northwest corner of the tank to safely convey any overflows from the facility into the 1,800 mm overflow sewer discharging to Lower Ancaster Creek

Three (3) submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during DWF conditions, when capacity is available to treat these flows. Three pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps is lifted via three (3) 200 mm diameter, ductile iron forcemains, which feed a single 350 mm diameter forcemain running around the east and south walls of the storage tank, then south through the City's easement within the Hydro One corridor, and finally east through the City's right-of-way at the west end of Sanders Boulevard, to connect to the gravity operated CSS along Sanders Boulevard.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized CSO tank inlet gate and the pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 9A and 9B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

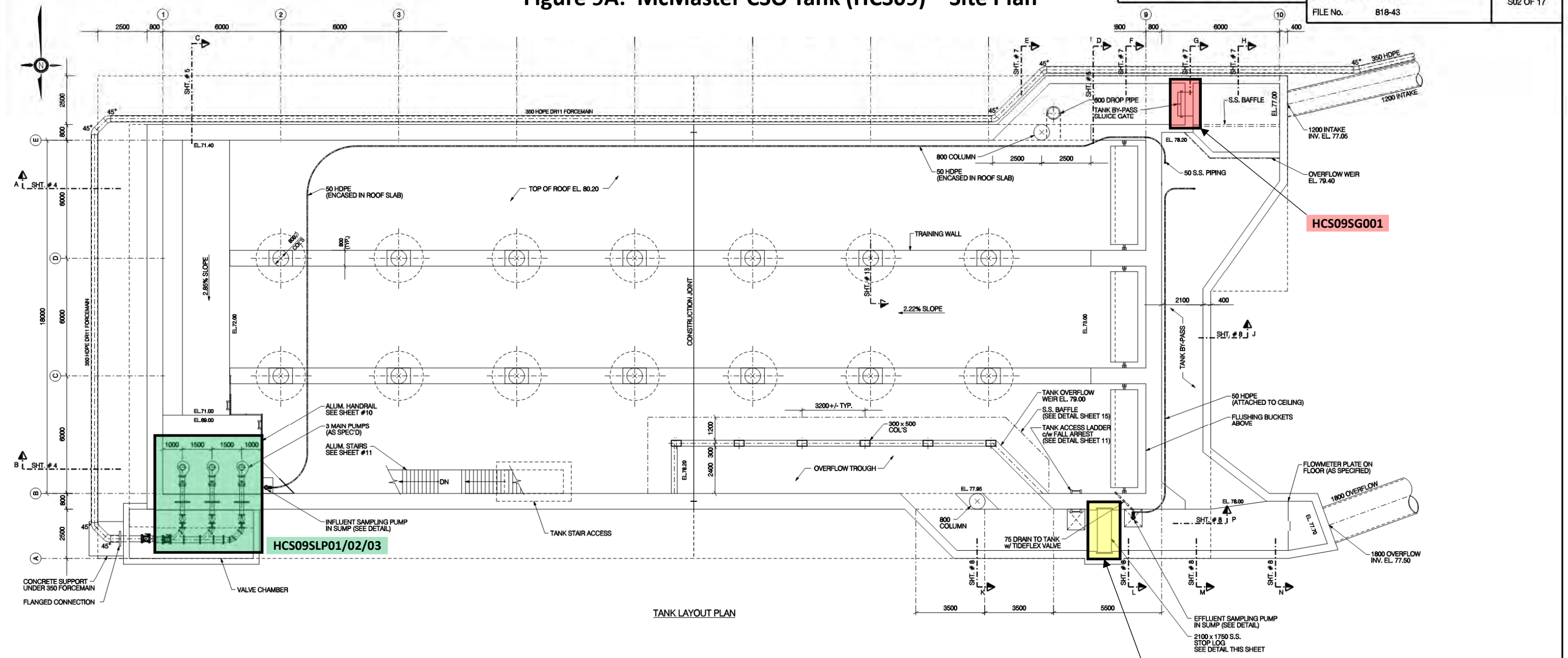
Table 9 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

# Figure 9A: McMaster CSO Tank (HCS09) – Site Plan

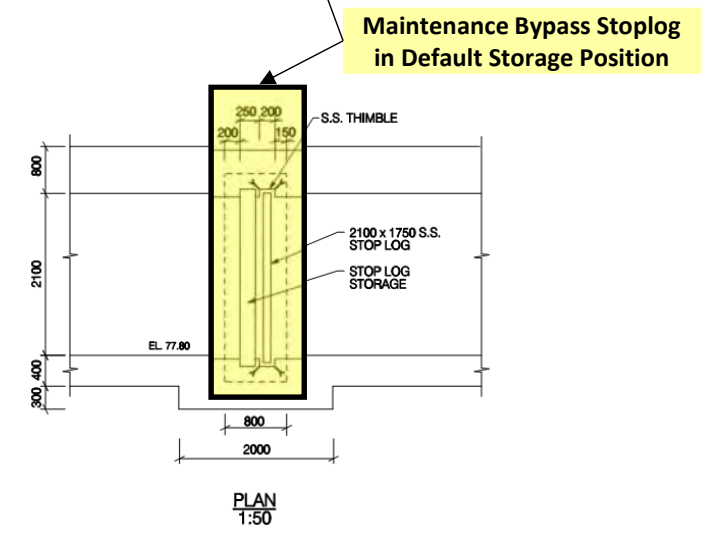
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

CONTRACT No. PW-08-13 (CSO)  
DRAWING No. 08-S-38  
FILE No. 818-43

SHEET No.  
S02 OF 17



- Pump Flow to WWTP – No Potential DWF or WWF Discharge at this location
- CSO Tank Overflow Stoplog – Potential WWF Discharge only if Tank Fills to Design Capacity
- CSO Tank Inlet Gate – Potential Discharge only if Gate is Closed (Default Position is Open)



REVISIONS	INITIAL	DATE	DRAWN BY: A.J.F.	DATE: 10/07
0. ISSUED FOR TENDER	A.J.F.	12/08		
1. ISSUED FOR CONSTRUCTION	A.J.F.	02/09		
2. AS CONSTRUCTED	A.J.F.	09/10		

SCALES	1:100
ORIGINAL DRAWING SEALED BY J. HUDOBA FEBRUARY 2009	

**Hatch Mott MacDonald**  
J & M STRUCTURAL

Manager of Construction  
Jerry Parisotto, P. Eng.  
Manager of Design  
Susan Jacob, P. Eng.

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Public Works Department

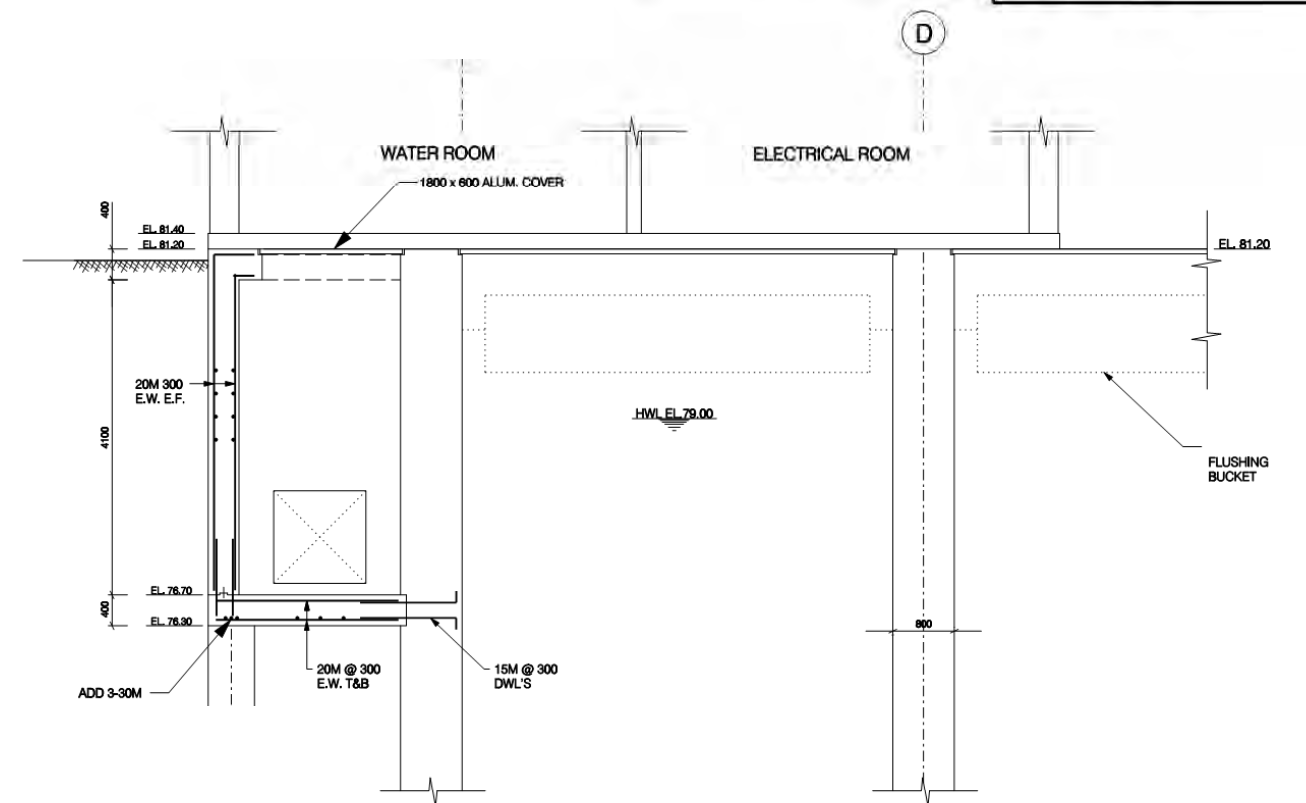
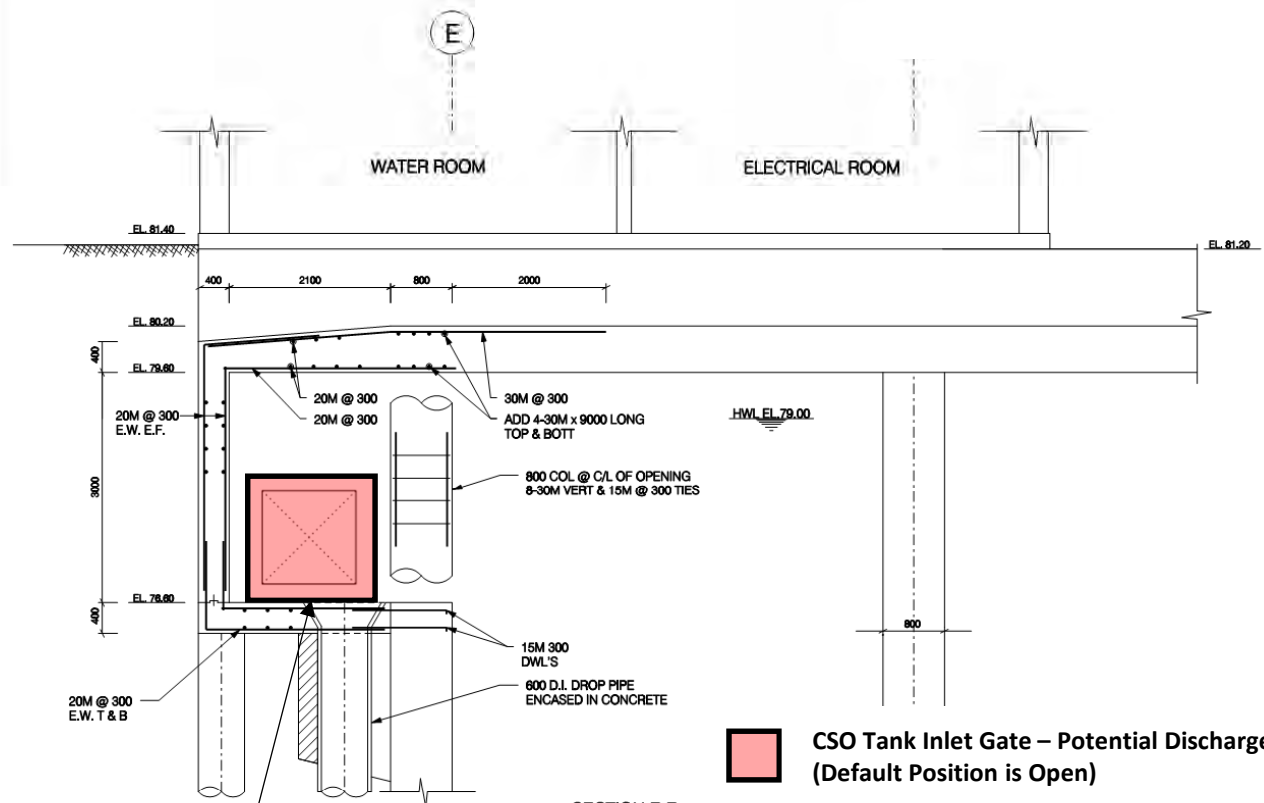
**CITY OF HAMILTON**  
McMASTER COMBINED SEWER  
OVERFLOW STORAGE TANK  
TANK LAYOUT PLAN

Figure 9B: McMaster CSO Tank (HCS09) – CSO Tank Inlet Gate

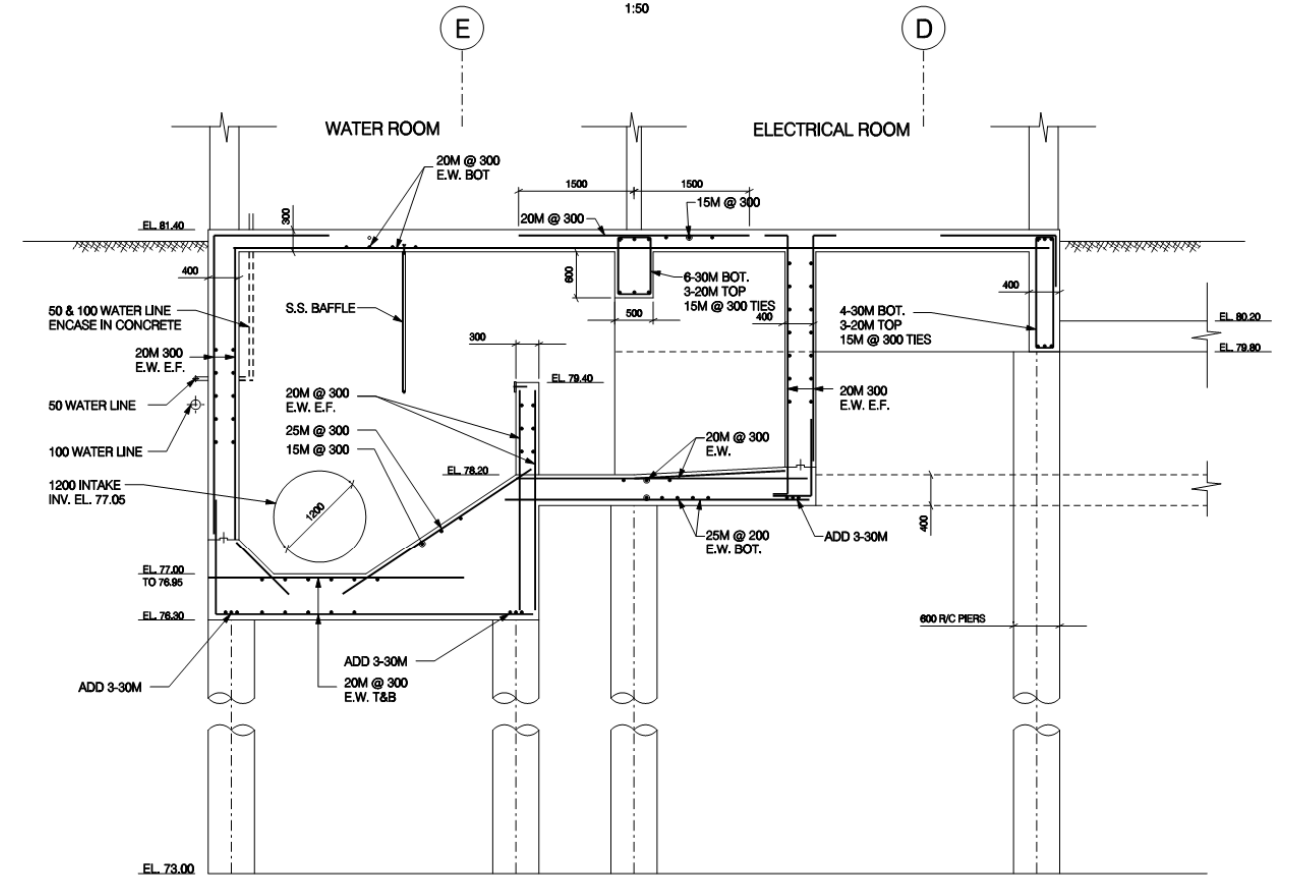
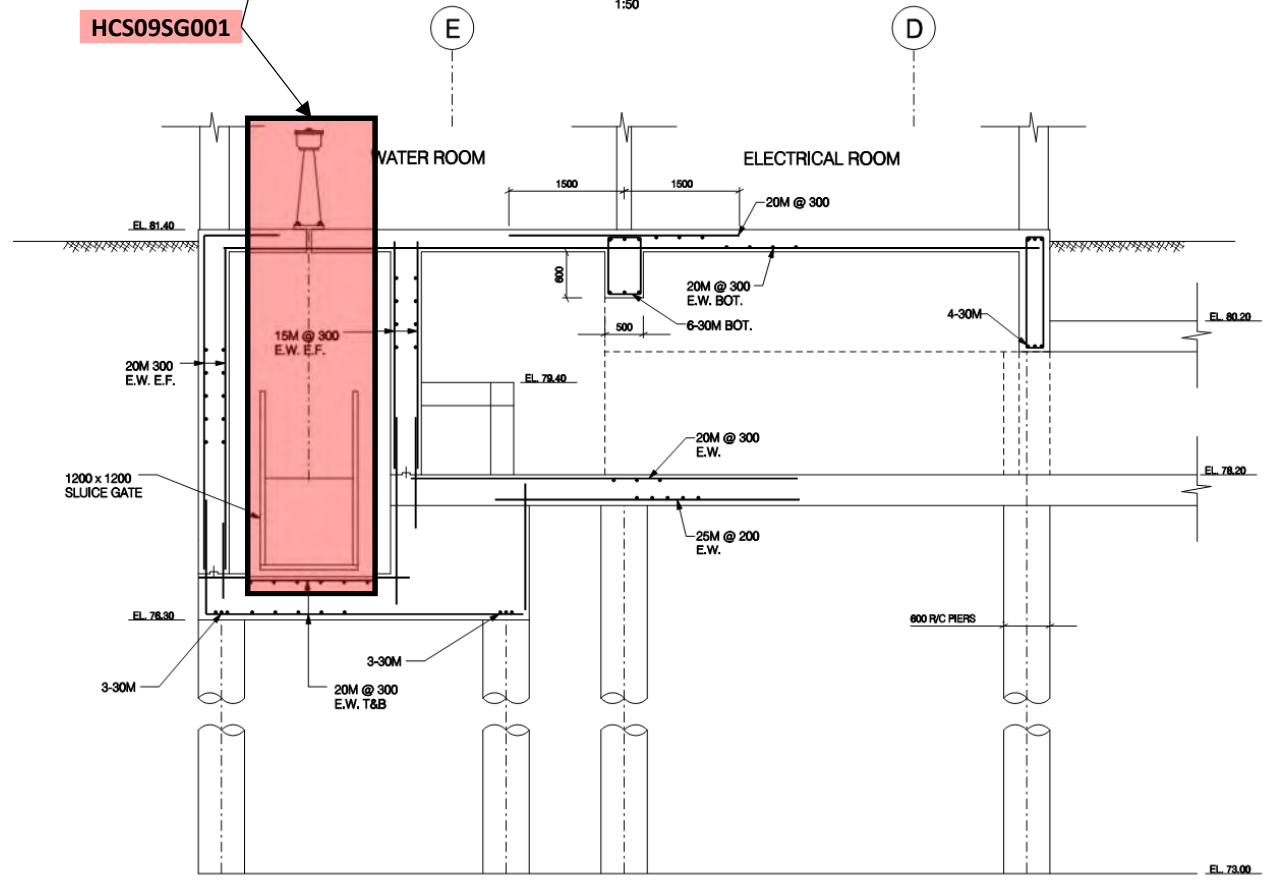
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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DRAWING No. 08-S-38  
FILE No. 818-43

SHEET No.  
S07 OF 17



HCS09SG001



REVISIONS	INITIAL	DATE	DRAWN BY: A.J.F.	DATE: 10/07
0. ISSUED FOR TENDER	A.J.F.	12/08		
1. ISSUED FOR CONSTRUCTION	A.J.F.	02/09		
2. AS CONSTRUCTED	A.J.F.	09/10		

SCALES
1:50

ORIGINAL DRAWING SEALED BY J. HUDDOBA FEBRUARY 2009

J & M STRUCTURAL

Manager of Construction  
Jerry Parisotto, P. Eng.  
Manager of Design  
Susan Jacob, P. Eng.

**CITY OF HAMILTON**  
Public Works Department

**CITY OF HAMILTON**  
**McMASTER COMBINED SEWER OVERFLOW STORAGE TANK**  
TANK INFLOW AND TANK BY-PASS SECTIONS

**Table 9: Inventory of Critical Control Points at McMaster CSO Tank (HCS09)**

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Inlet Sluice Gate	HCS09SG001	1200 x 1200 mm	Motorized	In default Open position, conveys WWF into CSO Tank; If Closed, provides CSO Tank Maintenance Bypass	Fully Open	No potential for DWF discharge. In default Open position, Potential for WWF discharge only if CSO tank fills to design capacity. Potential for WWF discharge only if the gate is Closed during WWF, which it never should be.	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN, but the operation of this Inlet Sluice Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6</li> <li>+ This gate should be Fully Open at all times, and is currently padlocked in this position</li> </ul>
Overflow Stop Log	N/A (Not on SCADA)	2100 x 1700 mm	Manual Stop Log	Purely for maintenance. In default position above CSO Tank Overflow Channel, has no impact on operation of the CSO Tank. If moved to alternate position over end of CSO Tank Overflow Channel, can be used to isolate the Storage Tank for maintenance.	Sitting in guides provided above the end of the CSO Tank Overflow Channel	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge only if Tank Inlet Gate is Closed and stop gate is removed.	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN, but the operation of this manual Stop Log should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6</li> </ul>
Sewage Lift Pump No. 1	HCS09SLP01	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> </ul>
Sewage Lift Pump No. 2	HCS09SLP02	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> </ul>
Sewage Lift Pump No. 3	HCS09SLP03	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	<ul style="list-style-type: none"> <li>+ No significant changes required to PCN or SOP</li> </ul>
							<ul style="list-style-type: none"> <li>+ Establish appropriate inspection program for the facility, including visual inspection of manual Stop Log to confirm correct position</li> </ul>

#### 4. Recommendations

Specific detailed recommendations to improve the reliability of operation and monitoring of each of the CSO facilities were provided in Tables 1-9 included in Section 3.

Key recommendations aimed at improving the monitoring, performance, operational reliability of the CSO facilities and minimizing the potential for unapproved discharge to the environment include the following:

- + Conduct engineering study to determine the feasibility of adding redundant gate position sensors on the motorized gates (on the gates themselves), to backup existing sensors on the gate stems. This is to provide redundancy in case a gate becomes disconnected from the gate stem (where the sensor on the gate stem would give a false reading).
- + Conduct engineering study to determine the feasibility of adding new or redundant level sensors and/or flowmeters on the downstream side of any maintenance bypass gates or stop logs (to provide additional confirmation the gates are closed and not leaking).
- + Consider simplifying the operation of the CSO regulator gates at some of the CSO facilities (e.g. the external CSO regulators at the Main/King CSO tank), to employ the same gate position during both DWF and WWF conditions. Exact positions would need to be determined based on further investigation and discussions amongst City operations staff, and this suggestion would also need to be considered within the context of the objectives of the City's Real Time Control (RTC) system.
- + Most PCNs and SOPs do not require significant changes, but where they do not already do so, these documents should include a discussion of how to operate any manual or motorized gates that can be used to bypass flows around the facilities (mainly to ensure they are placed and left in their intended normal default positions).
- + Wherever possible, any maintenance bypass gates should be physically locked in their intended normal default positions, minimizing the potential for unapproved discharge to the environment. Note this has already been done to the CSO Tank Inlet Gate at the Greenhill CSO tanks, the Influent Well Overflow Gate (Maintenance Bypass Gate) at the Main/King CSO Tank, and the Inlet Control Gate at the McMaster CSO Tank. Options to do the same could be evaluated for the Bayfront Park and Eastwood Park CSO tanks.
- + Establish appropriate inspection programs for each of the CSO facilities, including visual inspection and exercising of CCPs based on the function and criticality of operation of each individual CCP.