Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Notice of Meeting and Meeting Agenda
Magic Lake Estates Water and Sewer Committee

Thursday, June 11, 2026 | **11:30 AM** | **Panorama Boardroom**
1885 Forest Park Dr., North Saanich

Members of the public can view the live meeting via MS Teams Link: **Click here**
Alternatively, to hear the meeting via telephone:
Call: 1-877-567-6843 and enter the Phone Conference ID: 950 296 271#

B. Mongeon (Chair), P. Brent (EA Director), C. Aldridge-Sanchez, J. Grelik, S. Koberski, H. Read

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. Territorial Acknowledgement

2. Election of Vice Chair

3. Approval of Agenda

4. Adoption of Minutes

26-0710 Minutes of the Magic Lake Estates Water and Sewer Committee Meeting of March 3, 2026

Recommendation: That the minutes of the Magic Lake Estates Water and Sewer Committee meeting of March 3, 2026 be adopted as circulated.

Attachments: Minutes: March 3, 2026

5. Chair's Remarks

6. Presentations/Delegations

The public are welcome to attend CRD meetings in-person.

Delegations will have the option to participate electronically. Please complete the online application at www.crd.ca/address no later than 4:30 pm two days before the meeting and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the Committee at LegServ@crd.bc.ca.

7. Commission Business

7.1. 26-0702 Senior Manager's Verbal Update - June 2026

Recommendation: There is no recommendation. This verbal update is for information only.

7.2. 26-0698 Capital Projects and Operational Update - Mid Year

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Capital Projects and Operational Update - Mid Year

7.3. 26-0699 2025 Annual Report

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: 2025 Annual Report - Cover Report

Appendix A: 2025 Annual Report

Appendix B: 2025 Statement of Operations and Reserve Balances

7.4. 26-0700 Captains Tank Conceptual Design

Recommendation: That staff be directed to:
1. Prepare a budget estimate for detailed design and refined cost estimate of storage tank replacement for consideration in the 2027 budget; and
2. Develop a proposed scope and community engagement process for a voter assent process in 2027-2028 for loan authorization.

Attachments: Staff Report: Captains Tank Conceptual Design

Appendix A: WSP Technical Memorandum

8. Notice(s) of Motion

9. New Business

10. Adjournment

The next meeting is October 27, 2026.

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Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Meeting Minutes

Magic Lake Estates Water and Sewer Committee

Tuesday, March 3, 2026 **11:30 AM** **Panorama Recreation Centre Boardroom**
1885 Forest Park Drive
North Saanich, BC V8L 4A3

PRESENT:
P. Brent (EA Director), J. Grelik (EP), S. Kobierski, B. Mongeon

STAFF: S. Henderson, General Manager, Electoral Area Services (EP); J. Starke, Senior Manager, Southern Gulf Islands Administration; J. Bilodeau, Manager, Water Wastewater Services Operations; L. Xu, Manager, Local Services and Corporate Grants (EP); M. Miklea, Deputy Corporate Officer/Manager, Legislative Services; M. MacDonald, Legislative Services Coordinator (Recorder)

EP - Electronic Participation

Regrets: C. Aldridge Sanchez, H. Read

The meeting was called to order at 11:30 am.

1. Territorial Acknowledgement

J. Starke provided a Territorial Acknowledgement.

2. Election of Chair

J. Starke called for nominations for the position of Chair of the Magic Lake Estates Water and Sewer Committee for 2026.

P. Brent nominated B. Mongeon. B. Mongeon accepted the nomination.

J. Starke called for nominations a second time.

J. Starke called for nominations a third and final time.

Hearing no further nominations, J. Starke declared B. Mongeon Chair of the Magic Lake Estates Water and Sewer Committee for 2026 by acclamation.

3. Election of Vice Chair

Chair Mongeon called for nominations for the position of Vice Chair of the Magic Lake Estates Water and Sewer Committee for 2026.

P. Brent nominated S. Kobierski. S. Kobierski declined the nomination.

Chair Mongeon called for nominations a second time.

Chair Mongeon called for nominations a third time.

MOVED by P. Brent, SECONDED by S. Kobierski,
That the election of the Vice Chair be referred to the next meeting of the Magic Lake Estates Water and Sewer Committee.
CARRIED

4. Approval of Agenda

MOVED by P. Brent, SECONDED by B. Mongeon,
That the agenda for the Magic Lake Estates Water and Sewer Committee meeting of March 3, 2026 be approved.
CARRIED

5. Adoption of Minutes

5.1. 26-0242 Minutes of the Magic Lake Estates Water and Sewer Committee meeting of November 13, 2025

MOVED by P. Brent, SECONDED by B. Mongeon,
That the minutes of the Magic Lake Estates Water and Sewer Committee meeting of November 13, 2025 be adopted as circulated.
CARRIED

6. Chair's Remarks

Chair Mongeon thanked staff for facilitating a recent tour of the wastewater treatment facility.

7. Presentations/Delegations

There were no presentations or delegations.

8. Committee Business

8.1. 26-0248 Senior Manager's Verbal Update - March

J. Starke and J. Bilodeau spoke to Item 8.1. and the following was noted:

- a mid-January rain event and the ensuing inflow impacted the microbiological population of the wastewater treatment bioreactor
- staff recently conducted a successful cleaning of the Frigate Tank
- minor corrosion noted on the hatch entrance, with mitigation discussions to come
- implementation of fall protection measures planned for wastewater treatment plant with broader safety upgrades being considered
- safety risk registry and other safe work procedures documentation in development
- the Magic Lake dam was repaired following the discovery of an animal burrow, with some work ongoing
- approval received for a fourth operator on Pender Island; an auxiliary role has now been made permanent

Discussion ensued regarding:
- the need for an analysis of infiltration and inflow
- determining the financial components and scope of future projects

8.2. 26-0234 Committee Orientation

J. Starke presented Item 8.2. for information.

Committee discussion ensued regarding:
- water billing and tiered water rate based on consumption
- kiosk insulation is a key initiative as pressure reduction valves are at risk of freezing
- timeline for AC sewer pipe replacement project
- penalties associated with improper private cross-connections to sewer system
- potential to leverage staff knowledge and processes from core area to support Magic Lakes

9. Notice(s) of Motion

There were no notices of motion.

10. New Business

10.1. Committee Roundtable

Chair Mongeon expressed a desire for staff to conduct a water quality test for Per- and polyfluoroalkyl substances (PFAS) in Magic Lake Estates finished water.

Discussion ensued regarding staff having received the request and will report back to the Committee once the results are finalized.

Chair Mongeon noted that an energy audit of the water treatment plant is concluding, results are being finalized and there are opportunities for improvements in efficiency. Some grant funding may be available through the Federation of Canadian Municipalities, but more investigation is required.

Discussion ensued regarding:
- grant coordination at the CRD and prioritizing of projects through engineering staff
- additional information needed to evaluate the suitability of certain grants or funding streams

Chair Mongeon noted that the water treatment plant does not currently have a generator so power outages can have a significant impact.

Discussion ensued regarding:
- a potential agreement whereby the standby generator at Fire Hall #2 might be utilized
- electrical staff will be onsite later in March to assess which equipment would need to be covered through back-up power and what other options might exist.

Chair Mongeon noted that there is currently one vacancy on the Committee and encouraged those present to reflect on potential nominees.

11. Adjournment

MOVED by B. Mongeon, SECONDED by P. Brent,
That the Magic Lake Estates Water and Sewer Committee meeting of March 3, 2026 be adjourned at 1:04 pm.
CARRIED

_____
Chair

_____
Recorder

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REPORT TO MAGIC LAKE ESTATES WATER AND SEWER COMMITTEE
MEETING OF THURSDAY, JUNE 11, 2026

SUBJECT **Capital Projects and Operational Update – Mid Year**

ISSUE SUMMARY

To provide the Magic Lake Estates Water and Sewer Committee with capital project status reports and operational updates.

BACKGROUND

The Magic Lake Estates (MLE) Water and Sewer Systems, located on the south shore of north Pender Island in the Southern Gulf Islands Electoral Area, provide drinking water services to approximately 1,082 customers, and wastewater services to approximately 651 customers. Capital Regional District (CRD) Infrastructure and Water Services is responsible for the overall operation of the water and wastewater systems with day-to-day operation, maintenance, design and construction of water and wastewater system facilities provided by the CRD Infrastructure, Planning and Engineering and Infrastructure Operations Divisions. The quality of drinking water provided to customers in the MLE Water System is overseen by the CRD Water Quality Division.

CAPITAL PROJECT UPDATE

Magic Lake Estates Water

25-01 | Captains Tank Upgrade – Concept Design

Project Description: Development of site investigation, options assessment, concept design, and cost estimates, to inform the future replacement of Captains Tank.

Project Rationale: The existing tank is beyond its anticipated service life and exhibiting signs of deterioration. Advancing planning for its replacement will support long-term system reliability and inform future capital investment decisions.

Project Update and Milestones: A consulting engineer was engaged in 2025 to complete a conceptual design. This work was finalized in 2026 and will be presented separately through a forthcoming staff report.

26-02 | Water Treatment Plant (WTP) Process Pipe Condition Assessment

Project Description: Conduct updated condition assessment of process piping in the Water Treatment Plant (WTP) with potential repairs or segment replacement.

Project Rationale: Weld deficiencies identified following completion of the WTP in 2012/2013 resulted in a settlement and funds to be utilized for future corrective work or replacement. Funding has been reallocated for 2025 to review the condition and address the most critical deficiencies.

Project Update and Milestones:

- After a leak developed at a weld location, CRD drafted a scope of work and specifications

for replacement of a segment of pipe that feeds Captain's Tank (570 pressure zone).

- Caird Mechanical Contractors Ltd. have visited the site and have been issued a purchase order to complete the fabrication and installation. Acuren contracted for weld inspection quality control.
- Piping factory fabricated and tested. Installation deferred until winter, to be facilitated in low demand season, and to align internal and contractor resourcing.
- Installation of critical pressure zone 570 process piping segment was completed in Q4 2025.
- Remaining project budget will be used for subsequent assessment and monitoring of other process piping within the facility.

Milestone	Completion Date
Budget setup complete	March 2025
Specifications developed for segment replacement and Contractor site visit	April 2025
Target fabrication and testing	Q3 2025
Installation	Q4 2025

21-04 | Buck Lake Dam Repairs – Phase 1

Project Description: Conduct additional inspections, minor repairs, and performance analysis highlighted in the 2019 Dam Safety Review. Phase 2 of the dam improvements is to be completed in the following five years.

Project Rationale: As a result from the Hatch 2019 Dam Safety Review, funds are required to conduct additional inspections, minor dam repairs, and performance analysis. Phase 2 dam improvements to be completed in the following five years.

The November 26, 2020, staff report outlines the detailed expenditure plan for Phase 1.

Project Update and Milestones:

- Detailed scope of work and acceptable options for preventing high live loads at Buck Lake Dam's west dam have been developed. This was reviewed during the 2022 annual inspection and a scope for warning signage is being proposed to be installed in 2023.
- Consultant was retained to conduct a dam breach analysis for both dams to confirm the dam flood area and improve the dam emergency plan. This report was finalized in January 2023.
- Operations to coordinate with CRD Protective Services so that dam emergencies are part of CRD's Public Alert Notification System (PANS).
- CRD staff are compiling required information for the Dam Emergency Plan and Operating and Maintenance Manuals. Updates were completed January 2023.
- In 2023, engineering assessed options for the installation of a v-notch weir to monitor lower flow seepage rates. This will continue with design work into 2024.
- Engineering consultant onboarded for design in July 2024.
- Design complete and weir plate fabrication underway in third quarter (Q3) 2024.
- Design complete and fabrication completed in Q4 2024.
- Constructability and field conditions being reassessed with the design, based on groundwater conditions observed in late 2025.

Milestone	Completion Date
Consultant retained to conduct dam breach analysis	December 20, 2021
Draft Dam Breach Analysis Complete and Comments returned	July 14, 2022
Final Dam Breach Analysis Complete	January 2023
Design of Seepage Weir on West Dam	Q2 2024
Fabrication of Weir Plate Complete	Q4 2024
Installation	TBD

WATER SYSTEM OPERATIONAL UPDATE

This is a water system operational update report from October 2025 through April 2026:

- Completed replacement of identified failed hydrant isolation valves (MLE060 and MLE047) at Chart Drive and Shoal Road. Corrective work was funded by the Operating Reserve Fund (ORF). 5 hydrant isolation valves have now been replaced from 2025 to Q1 of 2026.
- Magic Lake WTP corrective maintenance:
    - Saturator solenoids wired to UPS backup for improved plant startup following power failure
    - Responded to several communication failures at raw water pump stations. Added cellular communications to improve/rectify issues.
    - Dedicated SCADA PC configured to meet cyber security standards
    - Captains Reservoir UPS battery replacement
    - Annual DAF Tank cleaning
    - Frigate Reservoir drain, clean, inspection
    - Pulled WTP sludge pump for maintenance
- Water system leak repairs:
    - Privateers at Signal Hill (significant repair requiring external resources). Initial repairs completed during this reporting period, however additional repair work is required, and planning is underway. The leak has been temporarily isolated.
- During regular weekly dam inspections, a significant hole was observed on the face of the Magic Lake dam structure. Action was taken immediately, as per the Magic Lake DEP, triggering a level 1 response that included engaging a technical representative who prepared a work plan to address the issue and oversee the repairs as required by the Provincial Dam Regulators. The repair was completed in December.

Magic Lake Estates Sewer Utility

21-01 | Wastewater Improvements – Pump Station and Treatment Plant Upgrades

Project Description: To complete the renewal, replacement and upgrades to aging and failing sewer infrastructure in the MLE sewer service area. The original scope was to upgrade six pump stations and provide a second aeration tank and clarifier to Schooner Wastewater Treatment Plant (WWTP). The scope was revised during design and after the tender for several reasons, including consultant recommendations, operational requests, and escalating costs. The final revised scope was to upgrade two existing pump stations, install a new pump station at Cannon, and install a new membrane bioreactor (MBR) wastewater treatment process at Schooner WWTP.

Project Rationale: Successfully received an Infrastructure Canada grant to complete upgrades on pump stations, install a new pump station at Cannon to pump to Schooner WWTP, and upgrade Schooner WWTP to treat flow from Cannon and renew many components to bring the wastewater

system into compliance with environmental regulations.

Project Update and Milestones:

- Substantial completion was attained on December 10, 2024. I Since then, the CRD has been operating and maintaining the new WWTP and pump stations. Several deficiencies and additional required improvements, including facility treatment process optimization, programing adjustments, installation of an additional membrane cassette for increased plant capacity, and additional need for onsite technical equipment to monitor the new treatment process have been completed or progressed. Several occupational health and safety items were identified as needing to be addressed to comply with WorkSafeBC regulatory requirements as well. These safety and required improvement items were not fully identified until the operations of the facility commenced.
- The estimated cost to complete the required improvements is $300,550 and is to be funded by interest earnings for a total revised project budget of $11,953,815 from the original budget of $11,653,265. This budget increase was added to the 2025 capital plan through a Financial Plan Amendment, which was approved by the CRD Board on November 12, 2025. Fall protection and pump extraction upgrades at the WWTP and sewer lift stations are now underway. Danger trees around the WWTP have been removed and a technical process review is ongoing to improve biological conditions with support from CRD Process Engineer.
- The 1-year deficiency walkthrough was completed, and a list of vetted deficiencies are being brought to Coast Contracting's attention for correction under warranty before December 10, 2026.
- Operations and Engineering staff received additional support and training by McElhanney including site walkthrough and a classroom training session on May 13, 2026.
- CRD is pursuing McElhanney for explanation and issue closure regarding the continuing design vs actual discrepancies with the RAS pump and chemical addition.

Milestone	Completion Date
Preliminary Design (30%)	September 2022
Detailed Design (90%)	December 2022
Tender Period	January 27 – March 14, 2023
Construction Period	May 2023 – November 2024
Commissioning Period	September - November 2024
Substantial Completion	December 10, 2024
Warranty Period	December 10, 2026

Schooner WWTP in Operation

WASTEWATER SYSTEM OPERATIONAL UPDATE

This is a wastewater system operational update report for October 2025 through April 2026.

- Operations of the new MBR WWTP:
  - Ongoing treatment optimization/commissioning continues.
  - Chemical pH control mixing and dosing system added into process
  - Project deficiency 1-year walkthroughs with Engineering and consultant
  - Bioreactor foaming has been problematic. Operations is looking at ways to reduce and manage foam including installing a fixed sprinkler system over bioreactor.
  - Effluent bypass occurred in February at the WWTP following heavy rain which negatively impacted process biology and limited membrane throughput.
- Sewer back-up on Schooner Way requiring emergency response, camera inspection, and remediation. A significant repair is needed to address root intrusion and low point in the sewer main. Additional preventative maintenance/inspections until repair can be executed. A job scope and estimate has been prepared.

Table 1: Operating Permit Regulatory Non-compliance reporting for October 2025 through April 2026

Facility	October to April Reports Issued	Reports YTD 2026	Total Reports 2026	Cause
Schooner WWTP	3	3	3	Environmental Incidence Reports are issued typically because of: 1. Exceedance of permitted daily maximum flows (756m3/day). Flow exceedances are due to excessive collection system inflow and infiltration (I&I). 2. Exceedance of permitted total suspended solids (TSS) (<45mg/l) or biochemical oxygen demand (CBOD) and other federal regulatory requirements such as toxicity tests 3. Emergency facility bypasses due to equipment failure or inflows that exceed treatment equalization and emergency storage capacity.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Justine Starke, RPP, MCIP, Senior Manager, Southern Gulf Islands Administration
Concurrence:	Stephen Henderson, MBA., PG.Dip.Eng., BSc, General Manager, Electoral Area Services

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REPORT TO MAGIC LAKE ESTATES WATER AND SEWER COMMITTEE
MEETING OF THURSDAY, JUNE 11, 2026

SUBJECT **2025 Annual Report – Cover Report**

ISSUE SUMMARY

Per the *Drinking Water Protection Act*, a water supplier must prepare and make public, within 6 months of the end of the calendar year, an annual report. The Annual Report provides a summary of the Magic Lake Estates Water Service for 2025.

BACKGROUND

The Magic Lake Estates (MLE) Water and Sewer Systems, located on the south shore of north Pender Island in the Southern Gulf Islands Electoral Area, provide drinking water services to approximately 1,082 customers, and wastewater services to approximately 651 customers. Capital Regional District (CRD) Infrastructure and Water Services is responsible for the overall operation of the water and wastewater systems with day-to-day operation, maintenance, design and construction of water and wastewater system facilities provided by the CRD Infrastructure, Planning and Engineering and Infrastructure Operations Divisions. The quality of drinking water provided to customers in the MLE Water System is overseen by the CRD Water Quality Division.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Justine Starke, RPP, MCIP, Senior Manager, Southern Gulf Islands Administration
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer & General Manager, Finance & Technology
Concurrence:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Luisa Jones, MBA, General Manager, Parks, Recreation & Environmental Services
Concurrence:	Stephen Henderson, MBA, P.G.Dip.Eng, BSc, General Manager, Electoral Area Services

ATTACHMENT(S)

Appendix A: 2025 Annual Report
Appendix B: 2025 Statement of Operations and Reserve Balances

Magic Lake Estates Water and Sewer System

2025 Annual Report

CRD | Drinking Water and Wastewater

Introduction

This report provides a summary of the Magic Lake Estates (MLE) Water and Sewer Service for 2025 and provides a description of the water and sewer services including: summary of the water supply, demand and production, drinking water quality, wastewater treatment flows, effluent quality, operations highlights, capital project updates and financial report.

WATER SYSTEM

Water Service Description

The community of Magic Lake Estates is primarily a rural residential development with some community properties located on Pender Island in the Southern Gulf Islands Electoral Area which was originally serviced by a private water utility and in 1981 the service converted to the Capital Regional District (CRD). The Magic Lake Estates water service is made up of 1,196 parcels, of which there are 1,082 single family equivalents (or approximately the same number of customers) obtaining service from the water system.

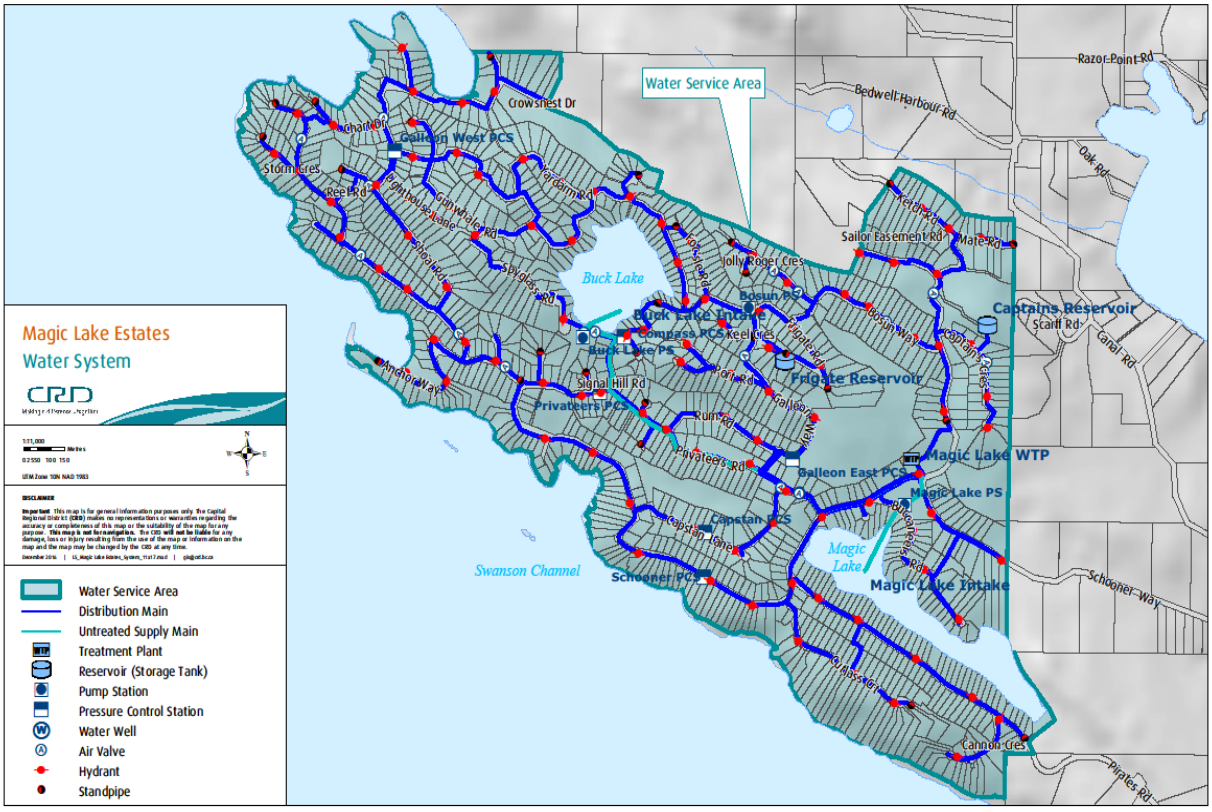

Figure 1: Map of Magic Lake Estates Water System

The Magic Lake Estates water system is primarily comprised of:

- Two raw water sources; Buck Lake (primary source) and Magic Lake (secondary source).
- Four earthen dam structures (two at Buck Lake and two at Magic Lake).
- Two raw water pump stations, one each related to the raw water supplies, with pretreatment oxidation equipment to treat and control dissolved manganese and iron in the raw water source.
- Centralized water treatment plant consisting of a dual process including dissolved air flotation (DAF), filtration, ultraviolet light disinfection, and chlorine disinfection.
- One booster pump station / pressure reducing station (Bosun).
- Two steel storage tanks, Frigate and Captains (volumes: Frigate 750 cubic metres or 200,000 USg and Captains 341 cubic metres or 90,000 USg).
- Supervisory Control and Data Acquisition (SCADA) system.
- Distribution system and supply pipe network (more than 27 kilometres of water mains).
- Other water system assets: 1082 water service connections and metres, approximately 70 fire hydrants, six pressure reducing valve stations, 100 gate valves and standpipes.

Water Supply

Surface water supply monthly water levels are provided in Figures 2 and 3 for Buck Lake and Magic Lake, respectively. It is important to note that under normal operating conditions, Buck Lake provides 80% and Magic Lake provides 20% of the annual raw water demand for the service. However, in 2025, due to an algae event in Magic Lake, Buck Lake provided 100% of the raw water supply from August through November.

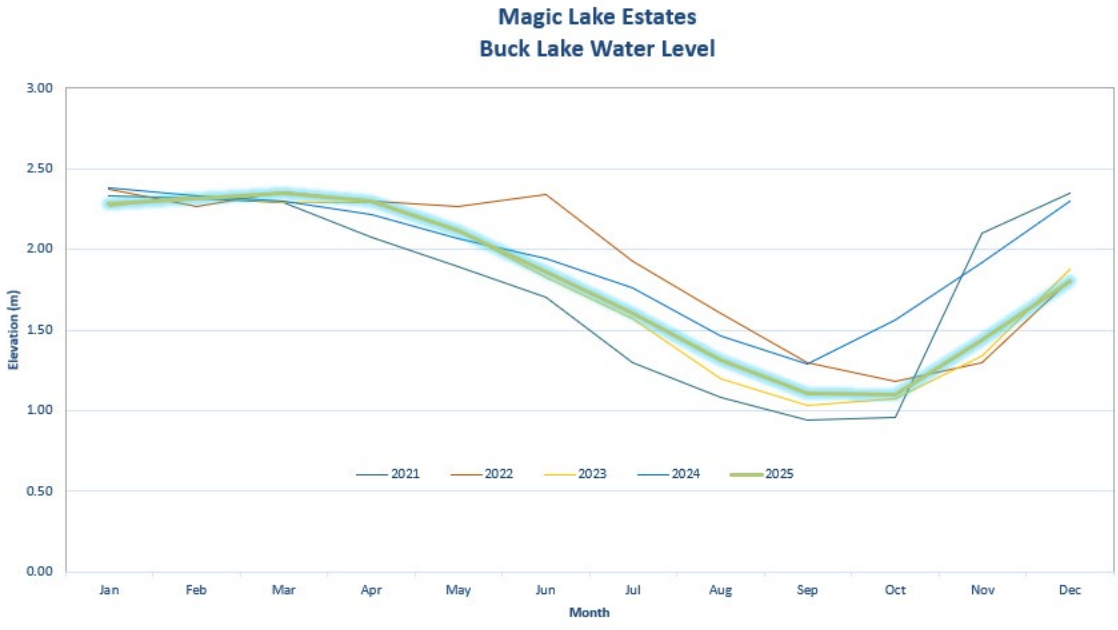

Figure 2: Buck Lake Monthly Water Level

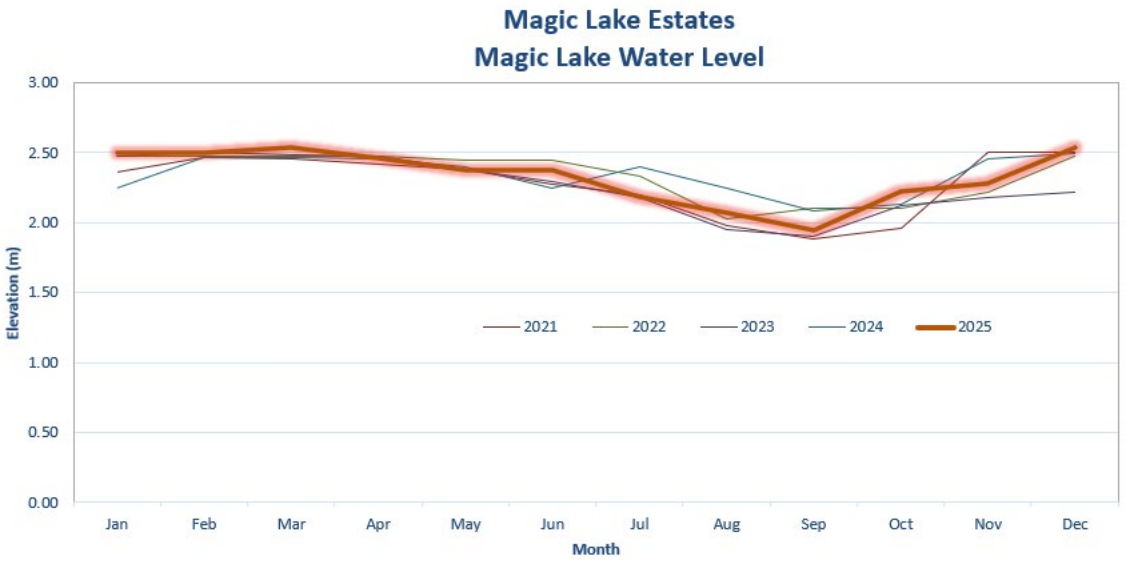

Figure 3: Magic Lake Monthly Water Level

Water Production and Demand

Referring to Figure 4, 186,146 cubic metres of water was extracted (water production) from both Buck Lake and Magic Lake water sources in 2025; a 21% decrease from the previous year and a 9% decrease in the rolling five-year average. Water demand (customer water billing) for the service totaled 131,632 cubic metres of water; a 1% increase from the previous year and 1% increase from the rolling five-year average.

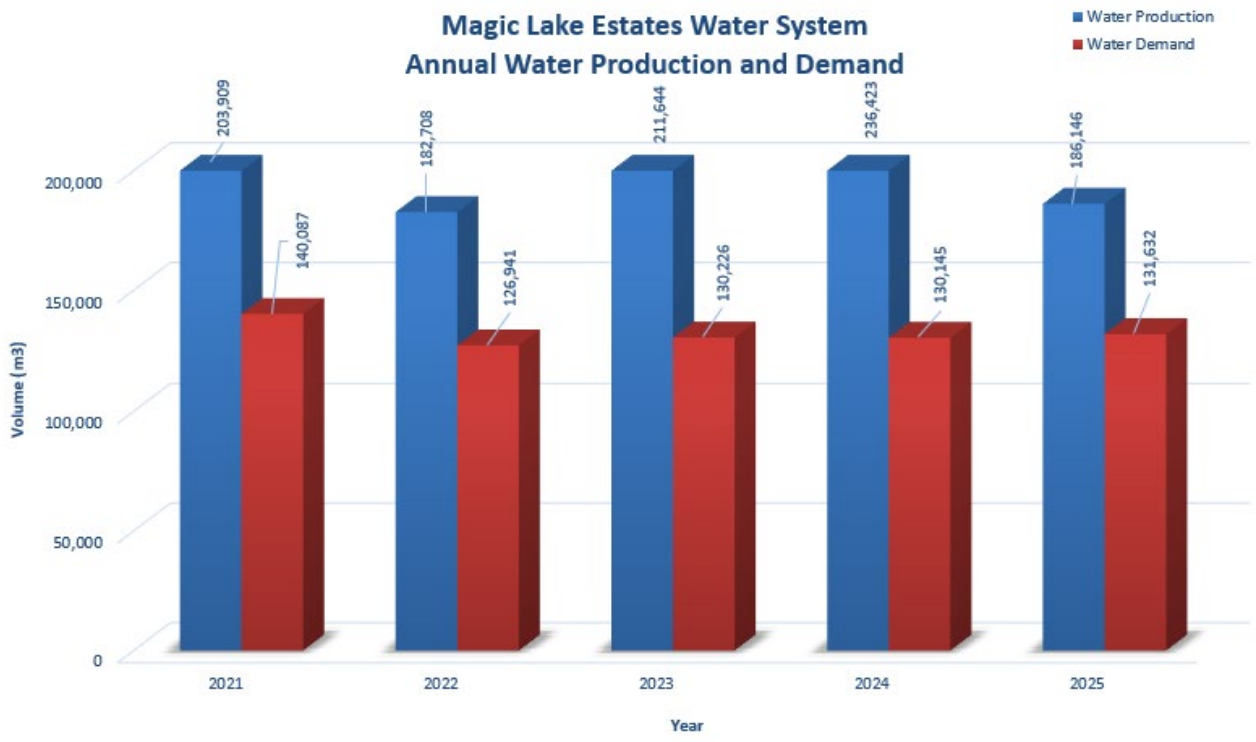

Figure 4: Magic Lake Estates Water System Annual Water Production and Demand

The difference between annual water production and annual customer water demand is referred to as non-revenue water and can include water system leaks, water system maintenance and operational use (e.g. water main flushing, filter system backwashing), potential unauthorized use and fire-fighting use.

The 2025 non-revenue water (54,514cubic metres) represents about 29% of the total water production for the service area. However, approximately 8,150 cubic metres of non-revenue water can be attributed to operational use. Therefore, the non-revenue water associated with system losses is approximately 25%, which is a decrease from the previous year, and is considered average for a water distribution system the size of Magic Lake Estates. Several water leaks were repaired in 2025 which significantly improved water loss from the previous year. Additional details of the repairs are provided in the operations update section of the annual report.

Figure 5 below illustrates the monthly water production for Magic Lake Estates for the past five years. The monthly water production trends are typical for smaller water systems such as Magic Lake Estates. In review of water production for 2025 (highlighted below), the monthly water production trends are typical for smaller water systems such as Magic Lake Estates, with the greatest demand during the summer months.

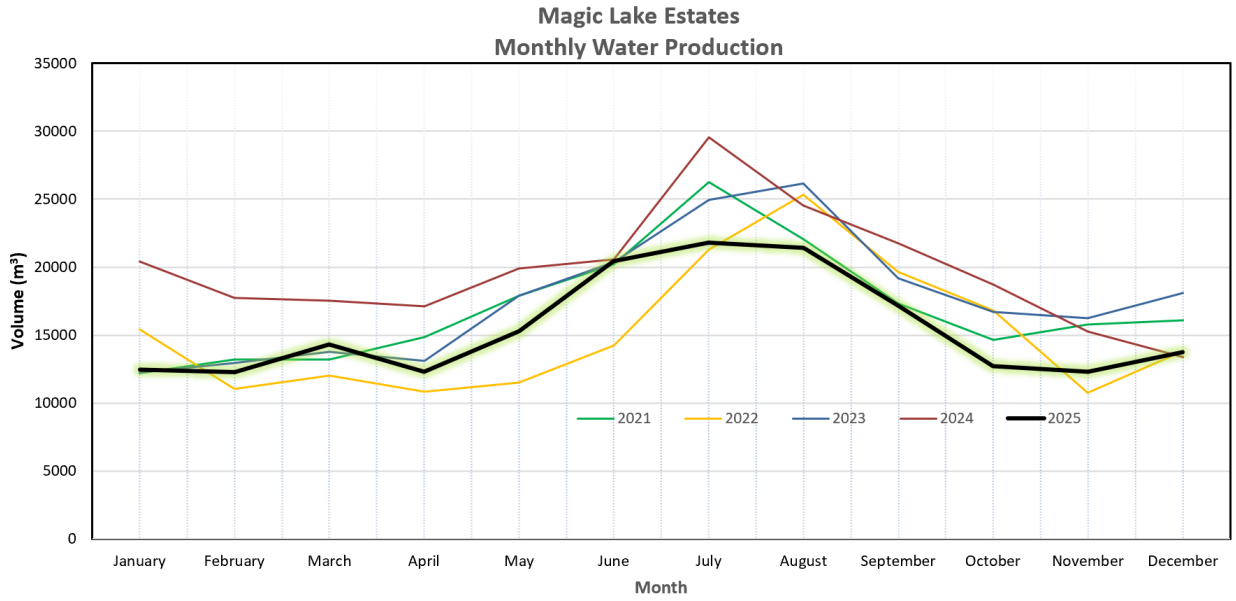

Figure 5: Magic Lake Estates Water System Monthly Water Production.

Drinking Water Quality

Two intake lines from Buck Lake and Magic Lake supplied blended source water to the DAF treatment plant. The typical blending ratio in 2025 was 80/20 Buck Lake to Magic Lake, with a brief shift to 100% Buck Lake in August to avoid a cyanobacteria bloom in Magic Lake. No cyanotoxins were detected in Magic Lake during this event, and the drinking water supplied to the service area remained safe throughout the year.

The treatment system reduced total organic carbon (TOC) by nearly 50%; however, the high organic loading of the raw water still resulted in elevated TOC in the treated water, which can contribute to taste, odour, and colour issues and can increase the potential for disinfection by-product formation. Testing for total trihalomethanes in the treated water showed concentrations in compliance with the Guidelines for Canadian Drinking Water Quality (GCDWQ).

As in previous years, operations staff effectively mitigated localized water quality issues related to aging or stagnant water through targeted spot-flushing.

Overall Magic Lake Estates drinking water quality characteristics for 2025 are summarized below.

Raw Water:

- Both lake sources showed low total coliform concentrations during the winter months, with higher levels during the warm-water period. Magic Lake typically exhibits much higher summer coliform concentrations than Buck Lake, recording peaks of 3,400 CFU/100 ml in June and 2,000 CFU/100 ml in July. Buck Lake recorded its highest total coliform concentration in July at 340 CFU/100 ml. Overall, these results reflect normal seasonal bacteriological patterns for both lakes.
- E. coli bacteria concentrations were generally low in both lakes throughout the year. During the summer months the concentrations were slightly higher than during the rest of the year. This is a typical pattern for lakes.
- Raw water from both sources was medium hard (55 – 72 mg/L CaCO3).
- Magic Lake experienced a cyanobacteria bloom from August 6 to 29. No microcystin toxins were detected during the bloom. During that time, the source supply was switched from the normal 80% Buck Lake and 20% Magic Lake to 100% Buck Lake supply. Buck Lake had no algal blooms in 2025.
- Buck Lake showed raw water turbidity ranging from 0.4 to 1.4 nephelometric turbidity units (NTU), with an annual median of 0.6 NTU. Magic Lake ranged from 0.6 to 2.8 NTU, with an annual median of 0.9 NTU. Higher turbidity typically occurred during the winter months, but also occasionally during summer algae blooms. Turbidity levels in both lakes were consistent with historical patterns; Magic Lake, due to reduced algal activity in 2025, had generally clearer water than in previous years.
- Buck Lake, with an annual median total organic carbon (TOC) of 6.5 mg/L, and Magic Lake, with a median TOC of 8.3 mg/L, are considered mesotrophic lakes with medium productivity. TOC levels in both lakes were similar to those observed in 2024, with Magic Lake slightly lower due to reduced algal activity.
- Buck Lake has higher colour results during the winter period. Magic Lake's water exceeds the aesthetic objective for water colour all year which correlates with the higher TOC values in this lake. The higher water colour is typically caused by elevated concentration of organics in the water.
- Both lakes showed seasonally elevated iron and manganese concentrations, with peaks of 254 µg/L (Fe) and 59 µg/L (Mn) in May in Magic Lake, and 194 µg/L (Fe) and 149 µg/L (Mn) in November in Buck Lake. Buck Lake has historically exhibited higher seasonal manganese concentrations than Magic Lake. The metal concentrations recorded in 2025 were consistent with long term trends.

Treated Water:

- Treated water was bacteriologically safe to drink with no E. coli or total coliform bacteria found in the treated water.
- Treated water turbidity (cloudiness) was typically well below the GCDWQ limit of 1 NTU except for one sample collected on October 22 at the treatment plant outlet (6 NTU). It was concluded that this unusual result was due to a sampling error.
- Total organic carbon (TOC median 3.8 mg/L) was consistent with results in previous years. A nearly 50% reduction of TOC compared with the source water TOC concentrations indicates a satisfactory performance of the DAF plant. TOC concentrations of > 4 mg/L are considered a strong precursor for disinfection by-product formation and potential guidelines exceedance.

- Metals remained below the maximum acceptable concentration (MAC) and were generally below the aesthetic objective (AO), confirming the effectiveness of the potassium permanganate treatment system in removing iron and manganese. Two samples collected on November 19 at the treatment plant and within the distribution system, showed manganese concentrations slightly above the GCDWQ aesthetic objective, indicating a sub-optimal pre-oxidation treatment result at that time. Both source lakes typically undergo their annual turnover in November, which can rapidly alter iron and manganese levels in the raw water. During this period, operators need to perform daily bench tests to quickly identify such changes and adjust treatment accordingly.
- Disinfection by-products such as total trihalomethanes (TTHM) were in compliance with the annual average requirement in the GCDWQ; no individual samples exceeded the GCDWQ limit of 100 µg/L. TTHM concentrations fluctuated between 58 and 79 µg/L for an annual average of 72 µg/L. Haloacetic acids (HAA) were not tested in 2025 but are typically low when TTHM are low.
- Periods with algal blooms or high algal activity in the source lakes occasionally affected the taste and odour of the drinking water.
- The water temperature exceeded the GCDWQ aesthetic limit of 15ºC between May and October.
- The newly established GCDWQ MAC for aluminum was at no time exceeded in 2025.

The attached Tables 1 and 2 provide a summary of the 2025 raw and treated water test results. Water quality data collected from this drinking water system can be reviewed on the CRD website:

https://www.crd.bc.ca/about/data/drinking-water-quality-reports

Water System Operational Highlights

The following is a summary of the major operational issues that were addressed by CRD Infrastructure and Water Services staff in 2025:

- Water Treatment Plant:
    - Replaced failed modulating valve on DAF train
    - Replaced failed DAF focculator gearbox
    - Replaced failing UPS batteries at WTP
    - Operational response to several extensive power failures which caused depletion of UPS and other instrumentation issues
    - WTP clearwell inspected by remote operated vehicle (ROV)
    - Replacement of failed radio communications antenna at Captains Reservoir
    - WTP HVAC system corrective maintenance and VFD replacement

- Water Intakes and Distribution System:
    - Signal Hill Rd – June service line repair
    - Privateers Rd – July Main break repair. Further repairs needed under road. Road crossing temporarily isolated.
    - Replaced several hydrant isolation valves
    - Operational response for Magic Lake Dam emergency repair to address animal burrow
    - Motor Vehicle Incident response to damaged Bosun Pump Station
    - Installation of new water conservation signage

Water System Capital Project Updates

The Capital Projects that were in progress or completed in 2025 included:

1. Replaced leaking stainless steel pipe replacement in basement
2. Captains Tank Upgrade – Concept Design

SEWER SYSTEM

Service Description

The community of Magic Lake Estates is primarily a rural residential development located on Pender Island in the Southern Gulf Islands Electoral Area which was originally serviced by a private sewer utility and in 1981 the service converted to the CRD. The sewer service is approximately 210 hectares in size and includes 735 parcels of which 651 have sewer connections and 709 are responsible for parcel tax payment. Some of the sewer infrastructure includes: 18.5 km of sewer pipe, 293 manholes, eight pump stations, and one treatment plant with an outfall into Swanson Channel. In the fall of 2024, Cannon wastewater treatment plant (WWTP) was replaced with a pump station and forcemain, which now pumps to an upgraded Schooner WWTP. Cannon WWTP is therefore no longer in service.

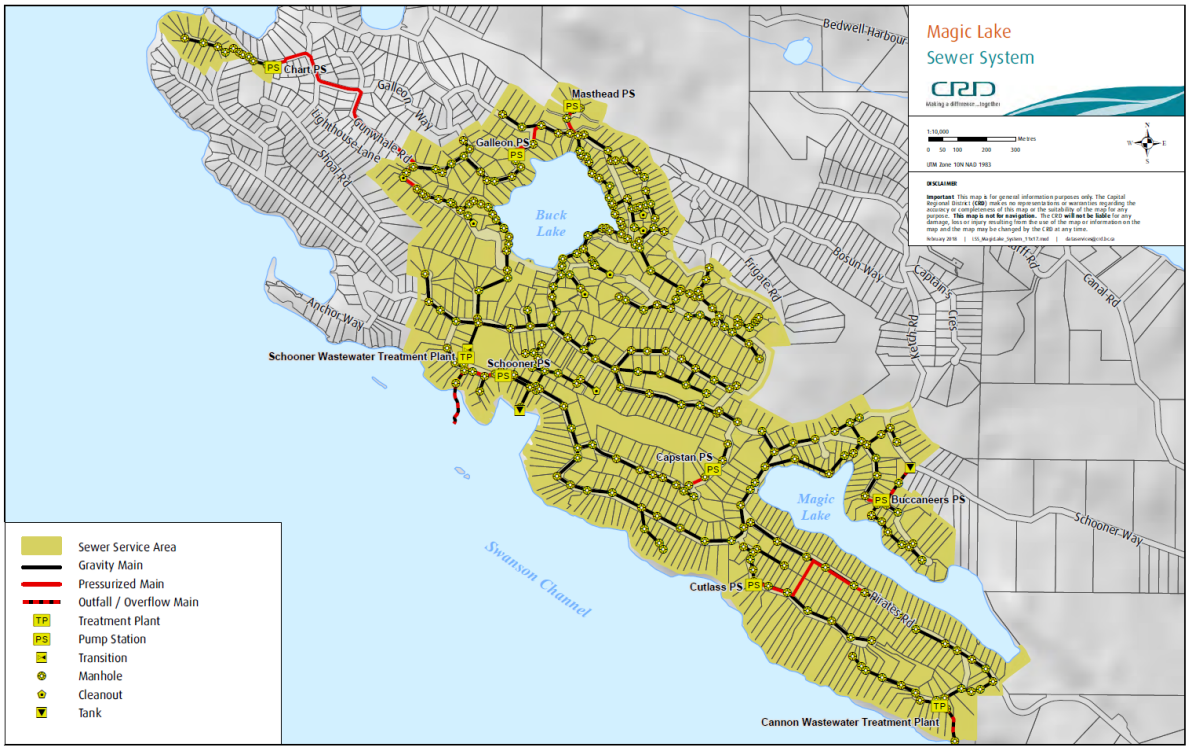

Figure 6: Map of Magic Lake Estates Sewer System

Wastewater Flows

The total monthly and 11-year total annual flows for the Schooner WWTP are shown in Figures 7 and 8 below. The graphs indicate that the 2025 wastewater flows were about 4.5% lower than in 2024, and about the same as the 11-year average, even with the flows diverted from the old Cannon side of the system. The monthly flows show lowest flows in the summer months when there is less rain, but the more significant variation occurs in the winter due to inflow and infiltration (where December had flows almost three-times the flow as September).

The Municipal Wastewater Regulation (MWR), under the Provincial Environmental Management Act, contains requirements for the treatment, reuse and discharge of municipal wastewater effluent. The regulation includes a requirement that sewer flows reaching treatment plants should not exceed 2 times Average Dry Weather Flow (ADWF) during storm events with less than a 5-year return period. If the flows do exceed 2 times ADWF, the discharger must develop a liquid waste management plan or conduct a study and develop and implement Inflow and Infiltration (I&I) reduction measures. Based on the measured flow rates, the Magic Lake Estates sewer system does at times exceed 2 times ADWF. The CRD completed a study in 2018 with recommendations to use CCTV inspection to identify defects that could be contributing to I&I and to fix those defects, and that the sewer system flows continue to be monitored to identify trends. Pipe upgrades were completed annually until 2024 when funding was paused to focus on the WWTP upgrade project. Works were planned to be continued in 2028 for CCTV inspection and continued pipe upgrades. An updated I&I study including development of mitigation measures and implementation of these measures is proposed for 2027.

Historically, the peak winter flows resulted in a number of total daily flow exceedances at each treatment plant. Since the Schooner WWTP was upgraded and Cannon flows diverted, there were no exceedances in 2025. However, there were four non-compliance events at the Schooner WWTP in 2025, including:

1) A heavy rain-related equipment failure in March.
2) A failed wastewater toxicity test in July.
3) A spill of foam to ground around the bioreactor in September
4) A heavy rain unplanned bypass in December.

Even with the upgraded Schooner WWTP, some blending of screened and tertiary treated effluent during large storm events is anticipated (which may meet the regulatory effluent requirements but will be reported when blending occurs). Non-compliances due to power outages should be eliminated at Schooner WWTP due to the permanent standby generator.

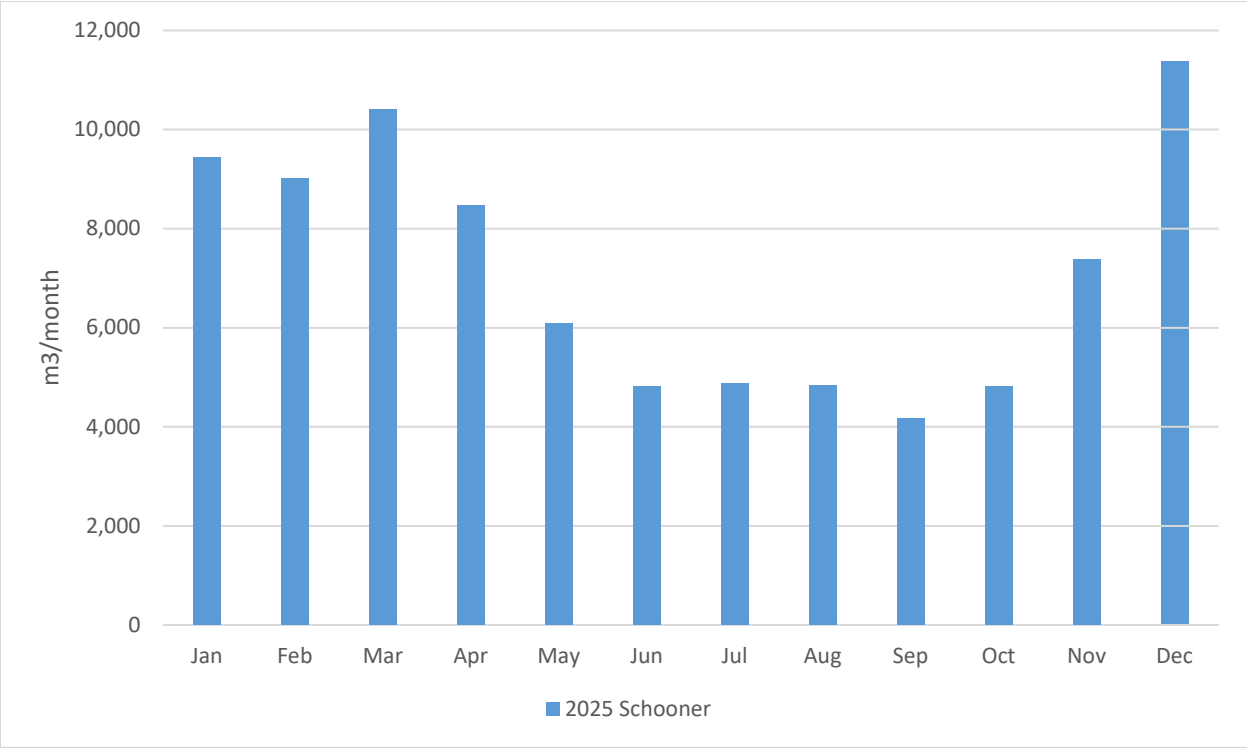

Figure 7: Total Monthly Flows 2025 (m^3/month)

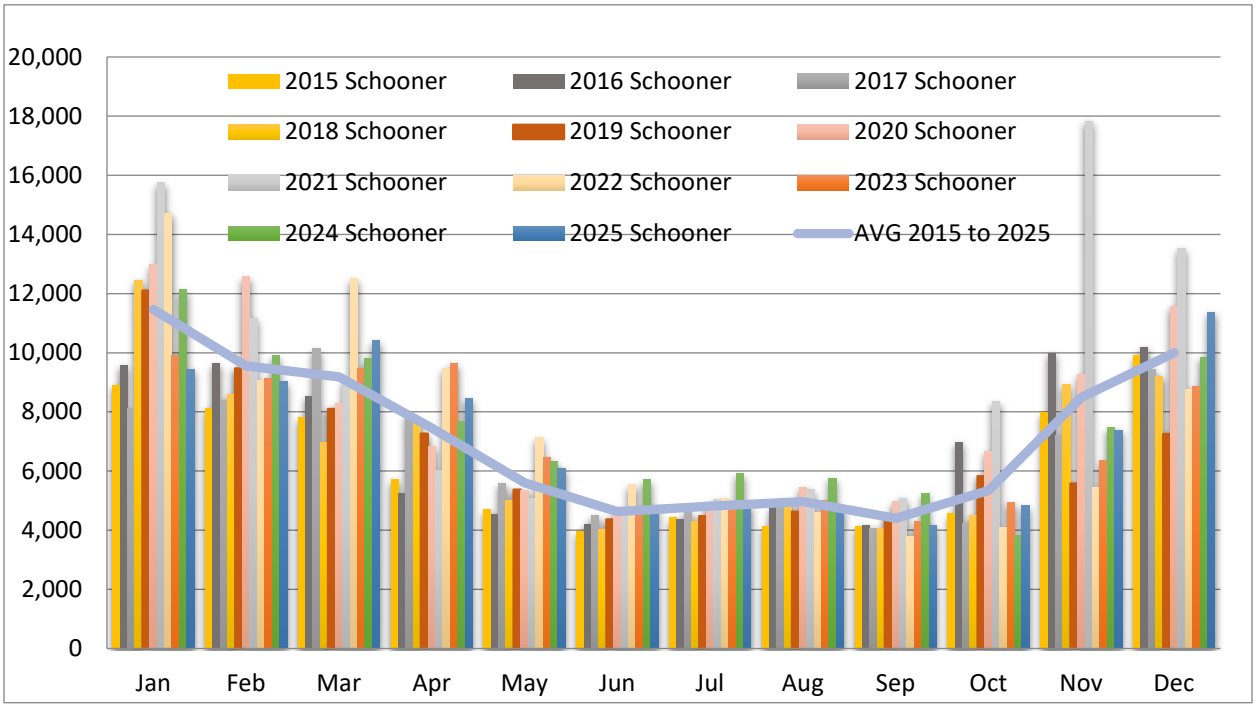

Figure 8: Total Wastewater Flows 2015-2025 (m^3/year)

Treated Effluent – Regulatory Compliance

Flow and effluent quality are assessed for compliance with provincial and federal regulatory limits on a daily and monthly basis. In 2025, treated wastewater from Schooner WWTP met all regulatory limits for total suspended solids (TSS) and carbonaceous biochemical oxygen demand (CBOD), but had one fecal coliform exceedance coincident with the heavy rain event in March when high flows were coincident with a partial system shut down.

As expected with the WWTP upgrades, there were far fewer non-compliance events in 2025 compared to previous years. In 2024, there were five presumed or documented compliance exceedances due to power outages, as well as two fecal coliform exceedances and three flow exceedances. These flow exceedances occurred with inflow and infiltration during storm events before the WWTP had been upgraded. The installation of a permanent backup generator at Schooner WWTP is designed to reduce the frequency of power outages at the facility.

Receiving Water

Routine monitoring of receiving water has historically been required every four years at the Schooner WWTP, with 2024 being the most recent planned sampling year. This sampling involves collecting 5 samples in a 30-day period ("5-in-30") for comparison to provincial guidelines, set to protect people who are recreating in the vicinity of the marine outfall or potentially harvesting shellfish (though the area around the outfall is closed for harvesting). An enhanced monitoring program was initiated in 2024 for 2 years, as required by the Ministry of Environment and Parks, after the commissioning of the new Schooner WWTP. This program consists of additional 5-in-30 sampling events over the course of 2025 and 2026, and includes bacteria (similar to the historic routine monitoring) as well as metals to assess risk to aquatic life.

The 2025 receiving environment bacteriological results were well below guidelines set to protect recreation and shellfish harvesting activities. These results confirm the outfall is working as expected. There were a few exceedances of metal water quality guidelines set to protect aquatic life, but it is too early in the enhanced monitoring program to confirm whether these exceedances were a result of the WWTP discharge or are representative of background conditions.

Receiving water sampling is also required if there are planned bypasses, WWTP failures/overflows, or wet weather overflows that exceed three days duration in the winter or one day duration in the summer. There was no non-routine receiving water sampling required in 2025.

Sewer Service Operational Highlights

The following is a summary of the major operational issues that were addressed by CRD Electoral Area Services Water and Wastewater Operations staff in 2025:

- Schooner Wastewater Treatment Plant
    - Significant operational effort and support as part of the new Schooner Wastewater Treatment Plant capital upgrade project continued through 2025.
    - The plant has experienced challenges meeting design flows due to biological upsets from inflow and infiltration, as well as alkalinity and pH demand from the nitrification process. A temporary chemical pH control system was added to the process by Operations staff.
    - Foaming has been problematic in the bioreactor, and has required significant operational responses to manage it.
    - An additional membrane module was installed in May to support increased plant production demand.
    - UV disinfection lights were replaced and a new GFCI receptacle installed
    - Warranty related work was undertaken to address faulty generator equipment at WWTP and Galleon Pump Station
    - Danger tree removal around WWTP
    - Return activated sludge (RAS) pump rail adapter repair
    - Calibrated effluent flow meter
    - Deployed preventative maintenance plan for new equipment
    - Ongoing operational training for new WWTP

- Schooner Pump Station warranty pump repair

- Cannon WWTP decommissioning work by Operations
- Schooner Way sewer blockage emergency response and temporary remediation

Sewer Service Capital Project Updates

The capital projects that were in progress or completed in 2025 were all related to the capital project "Wastewater Infrastructure Renewal – Pump Station and Treatment Plant Upgrades." Substantial completion of the project was attained on December 10, 2024, but operational staff identified several deficiencies and additional required improvements, including facility treatment process optimization, programing adjustments, installation of an additional membrane cassette for increased plant capacity, and additional need for onsite technical equipment to monitor the new treatment process. Several occupational health and safety items were identified as needing to be addressed to comply with WorkSafeBC regulatory requirements as well. These safety and required capital project improvement items were not fully identified until the operations of the facility commenced in late 2024. The budget increase to address these was added to the 2025 capital plan through a Financial Plan Amendment, which was presented to and approved by the CRD Board on November 12, 2025. Staff progressed the required improvements and reviewed the project requirements versus deficiencies for the one-year walkthrough with the design engineering consultant.

Financial Report

Please refer to the attached 2025 Statement of Operations and Reserve Balances.

Revenue includes parcel taxes (*Transfers from Government*), fixed user fees (*User Charges*), interest on savings (*Interest earnings*), a transfer from the maintenance reserve account, and miscellaneous revenue such as late payment charges (*Other revenue*).

Expenses include all costs of providing the service. *General Government Services* include budget preparation, financial management, utility billing and risk management services. *CRD Labour and Operating Costs* include CRD staff time as well as the cost of equipment, tools, and vehicles. Debt servicing costs are interest and principal payments on long term debt. *Other Expenses* include other costs to administer and operate the water and sewer systems, including insurance, water testing and electricity.

The difference between Revenue and Expenses is reported as *Net revenue* (expenses). Any transfers to or from capital or reserve funds for the service (*Transfers to own funds*) are deducted from this amount and it is then added to any surplus or deficit carry forward from the prior year, yielding an Accumulated Surplus (or deficit). In alignment with *Local Government Act* Section 374 (11), any deficit must be carried forward and included in next year's financial plan.

Attachments: Table 1: Summary of Raw Water Test Results, MLEWS
Table 2: Summary of Treated Water Test Results, MLEWS
Appendix A: 2025 Statement of Operations and Reserve Balances

For questions related to this Annual Report please email IWSAdministration@crd.bc.ca

Table 1

Table 1: 2025 Summary of Raw Water Test Results, Magic Lake Estates Water System										
PARAMETER		**2025 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2015 - 2024 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
(ND means Not Detected by analytical method used)										
Physical/Biological Parameters										
Buck Lake										
Carbon, Total Organic	mg/L	6.5	12	5.7	7.1		6.7	114	5.3	9.84
Colour, True	TCU	15	17	8	22	≤ 15 AO	13	166	7	29
Hardness as $CaCO_3$	mg/L	68.95	4	66.9	71.7	No Guideline Required	65.3	43	57.9	73.5
pH	pH units	7.42	1	7.42	7.42	7.0 - 10.5 AO	7.605	24	6.86	8.3
Turbidity	NTU	0.6	17	0.4	1.4		0.9	168	0.36	10
Magic Lake										
Carbon, Total Organic	mg/L	8.25	12	7.7	9.9		8.705	110	6.4	11
Colour, True	TCU	27	17	21	35	≤ 15 AO	25	157	6	93
Hardness as $CaCO_3$	mg/L	58.05	4	55.1	63.5	No Guideline Required	60.2	41	50.7	80.6
pH	pH units	7.59	1	7.59	7.59	7.0 - 10.5 AO	7.4	19	6.9	8.02
Turbidity	NTU	0.9	17	0.6	2.8		1.6	159	0.49	24.5
Non-Metallic Inorganic Chemicals										
Buck Lake										
Silicon	mg/L as Si	3705	4	3570	5060		5110	43	1330	6070
Magic Lake										
Silicon	mg/L as Si	1158.5	4	473	2660		1450	41	281	5760
Metals										
Buck Lake										
Aluminum	ug/L as Al	6.15	4	< 3	16.5	2900 MAC / 100 OG	9.7	43	< 3	95.6
Antimony	ug/L as Sb	< 0.5	4	< 0.5	< 0.5	6 MAC	< 0.5	43	< 0.5	< 0.5
Arsenic	ug/L as As	0.345	4	0.32	0.44	10 MAC	0.38	43	0.31	0.48
Barium	ug/L as Ba	10.4	4	8.8	11.8	1000 MAC	10.1	43	7.5	15.2
Beryllium	ug/L as Be	< 0.1	4	< 0.1	< 0.1		< 0.1	43	< 0.1	< 0.1
Bismuth	ug/L as Bi	< 1	4	< 1	< 1		< 1	43	< 1	< 1
Boron	ug/L as B	< 50	4	< 50	< 50	5000 MAC	< 50	43	< 50	< 50
Cadmium	ug/L as Cd	< 0.01	4	< 0.01	< 0.01	7 MAC	< 0.01	43	< 0.01	< 0.01
Calcium	mg/L as Ca	18.6	4	18	19.5	No Guideline Required	18	43	13.9	20.5
Chromium	ug/L as Cr	< 1	4	< 1	< 1	50 MAC	< 1	43	< 1	< 1
Cobalt	ug/L as Co	< 0.2	4	< 0.2	< 0.2		< 0.2	42	< 0.2	< 0.5
Copper	ug/L as Cu	0.585	4	0.41	0.6	2000 MAC / ≤ 1000 AO	0.75	43	0.35	37.3
Iron	ug/L as Fe	71.85	4	17.3	194	≤ 100 AO	71.2	43	14.2	507
Lead	ug/L as Pb	< 0.2	4	< 0.2	< 0.2	5 MAC	< 0.2	43	< 0.2	0.58
Lithium	ug/L as Li	< 2	4	< 2	< 2		< 2	29	< 2	< 5
Magnesium	mg/L as Mg	5.45	4	5.33	5.62	No Guideline Required	4.97	43	4.26	5.79
Manganese	ug/L as Mn	38.35	4	14.9	149	120 MAC / ≤ 20 AO	41.4	43	12	372
Molybdenum	ug/L as Mo	< 1	4	< 1	< 1		< 1	43	< 1	< 1
Nickel	ug/L as Ni	< 1	4	< 1	< 1		< 1	43	< 1	1.6
Potassium	mg/L as K	1.23	4	1.19	1.29		1.18	43	0.509	1.38
Selenium	ug/L as Se	< 0.1	4	< 0.1	< 0.1	50 MAC	< 0.1	43	< 0.1	< 0.1
Silver	ug/L as Ag	< 0.02	4	< 0.02	< 0.02	No Guideline Required	< 0.02	43	< 0.02	< 0.02
Sodium	mg/L as Na	11.7	4	11.4	12.4	≤ 200 AO	11	43	9.95	12.7
Strontium	ug/L as Sr	128.5	4	125	136	7000 MAC	119	43	109	134
Sulphur	mg/L as S	3.05	4	< 3	3.1		< 3	43	< 3	4.1
Tin	ug/L as Sn	< 5	4	< 5	< 5		< 5	43	< 5	< 5
Titanium	ug/L as Ti	< 5	4	< 5	< 5		< 5	43	< 5	< 5
Thallium	ug/L as Tl	< 0.01	4	< 0.01	< 0.01		< 0.01	43	< 0.01	< 0.05
Uranium	ug/L as U	< 0.1	4	< 0.1	< 0.1	20 MAC	< 0.1	43	< 0.1	< 0.1
Vanadium	ug/L as V	< 5	4	< 5	< 5		< 5	43	< 5	< 5
Zinc	ug/L as Zn	< 5	4	< 5	< 5	≤ 5000 AO	< 5	43	< 5	32.5
Zirconium	ug/L as Zr	< 0.1	4	< 0.1	< 0.1		< 0.1	43	< 0.1	< 0.5
Magic Lake										
Aluminum	ug/L as Al	13.4	4	< 3	19.8	2900 MAC / 100 OG	20.9	41	3.6	713
Antimony	ug/L as Sb	< 0.5	4	< 0.5	< 0.5	6 MAC	< 0.5	41	< 0.5	< 0.5
Arsenic	ug/L as As	0.425	4	0.36	0.55	10 MAC	0.47	41	0.35	2.75
Barium	ug/L as Ba	13.3	4	12.6	15.6	1000 MAC	14.9	41	12.2	84.9
Beryllium	ug/L as Be	< 0.1	4	< 0.1	< 0.1		< 0.1	41	< 0.1	< 0.1
Bismuth	ug/L as Bi	< 1	4	< 1	< 1		< 1	41	< 1	< 1
Boron	ug/L as B	< 50	4	< 50	< 50	5000 MAC	< 50	41	< 50	64
Cadmium	ug/L as Cd	< 0.01	4	< 0.01	< 0.01	7 MAC	< 0.01	41	< 0.01	0.023
Calcium	mg/L as Ca	14.45	4	13.5	15.4	No Guideline Required	15	41	12.7	19.8
Chromium	ug/L as Cr	< 1	4	< 1	< 1	50 MAC	< 1	41	< 1	8.6
Cobalt	ug/L as Co	< 0.2	4	< 0.2	< 0.2		< 0.2	41	< 0.2	< 0.5
Copper	ug/L as Cu	1.09	4	0.52	2.25	2000 MAC / ≤ 1000 AO	1.1	41	0.28	8.12
Iron	ug/L as Fe	108.5	4	72.6	254	≤ 100 AO	208	41	48.6	4260
Lead	ug/L as Pb	< 0.2	4	< 0.2	< 0.2	5 MAC	< 0.2	41	< 0.2	0.69
Lithium	ug/L as Li	< 2	4	< 2	< 2		< 2	32	< 2	< 5
Magnesium	mg/L as Mg	5.4	4	5.06	6.07	No Guideline Required	5.41	41	4.5	7.63
Manganese	ug/L as Mn	24.7	4	12.1	59	120 MAC / ≤ 20 AO	42.3	41	2.8	5000
Molybdenum	ug/L as Mo	< 1	4	< 1	< 1		< 1	41	< 1	8.3
Nickel	ug/L as Ni	< 1	4	< 1	< 1		< 1	41	< 1	36.5
Potassium	mg/L as K	0.9705	4	0.58	1.28		1.13	41	0.17	1.62
Selenium	ug/L as Se	< 0.1	4	< 0.1	< 0.1	50 MAC	< 0.1	41	< 0.1	< 0.1
Silver	ug/L as Ag	< 0.02	4	< 0.02	< 0.02	No Guideline Required	< 0.02	41	< 0.02	< 0.02
Sodium	mg/L as Na	11.6	4	11.2	12.9	≤ 200 AO	11.2	41	9.79	15.4
Strontium	ug/L as Sr	107	4	97	118	7000 MAC	108	41	86	158
Sulphur	mg/L as S	< 3	4	< 3	< 3		< 3	41	< 3	3.7
Tin	ug/L as Sn	< 5	4	< 5	< 5		< 5	41	< 5	< 5
Titanium	ug/L as Ti	< 5	4	< 5	< 5		< 5	41	< 5	22
Thallium	ug/L as Tl	< 0.01	4	< 0.01	< 0.01		< 0.01	41	< 0.01	< 0.05
Uranium	ug/L as U	< 0.1	4	< 0.1	< 0.1	20 MAC	< 0.1	41	< 0.1	0.19
Vanadium	ug/L as V	< 5	4	< 5	< 5		< 5	41	< 5	< 5
Zinc	ug/L as Zn	< 5	4	< 5	5.1	≤ 5000 AO	< 5	41	< 5	7.8
Zirconium	ug/L as Zr	< 0.1	4	< 0.1	0.1		< 0.1	41	< 0.05	< 0.5
Microbial Parameters										
Indicator Bacteria (Buck Lake)										
Coliform, Total	CFU/100 mL	42	17	1	340	0 MAC	69	169	2	4700
E. coli	CFU/100 mL	< 1	17	< 1	9	0 MAC	< 2	169	< 1	30
Hetero. Plate Count, 7 day	CFU/1 mL	Not tested in 2025				No Guideline Required	1345	64	330	5800
Indicator Bacteria (Magic Lake)										
Coliform, Total	CFU/100 mL	220	17	10	3400	0 MAC	435	150	9	63000
E. coli	CFU/100 mL	< 1	17	< 1	8	0 MAC	< 2	159	< 1	115
Hetero. Plate Count, 7 day	CFU/1 mL	Not tested in 2025				No Guideline Required	2600	59	370	20000
Parasites (Buck Lake)										
Cryptosporidium, Total oocysts	oocysts/100 L	<1	2	<1	<1	Zero detection desirable	< 1	12	< 1	< 1
Giardia, Total cysts	cysts/100 L	<1	2	<1	<1	Zero detection desirable	< 1	12	< 1	< 1
Parasites (Magic Lake)										
Cryptosporidium, Total oocysts	oocysts/100 L	<1	2	<1	2.38	Zero detection desirable	< 1	13	< 1	5.3
Giardia, Total cysts	cysts/100 L	<1	2	<1	<1	Zero detection desirable	< 1	13	< 1	< 1

Table 2

Table 2: 2025 Summary of Treated Water Test Results, Magic Lake Estates Water System										
PARAMETER		**2025 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2015 - 2024 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min.	Range Max.	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
ND means Not Detected by analytical method used										
Physical Parameters										
Carbon, Total Organic	mg/L as C	**3.8**	18	3.4	6.5		3.8	188	2.2	43.5
Colour, True	TCU	**3**	50	< 2	5	15 AO	< 2	794	< 0.7	11
Hardness as CaCO3	mg/L	**66.7**	10	62.9	71.8		64.8	119	56.4	72.1
pH	No units	**7.045**	2	6.99	7.1	7.0-10.5 AO	7.16	30	6.89	7.7
Turbidity	NTU	**0.15**	51	0.05	6	1 MAC and ≤ 5 AO	< 0.14	990	0.05	13
Water Temperature	Degrees C	**12.3**	238	3.3	23	≤ 15 C°C	10.5	4121	0	24.7
Microbial Parameters										
Indicator Bacteria										
Coliform, Total	CFU/100 mL	**< 1**	196	< 1	< 1	0 MAC	< 1	1372	<1	45
E. coli	CFU/100 mL	**< 1**	196	< 1	< 1	0 MAC	< 1	1372	<1	< 1
Hetero. Plate Count, 7 day	CFU/1 mL	**85**	12	< 10	640	No Guideline Required	< 10	218	< 10	6700
Disinfectants										
Disinfectants										
Chlorine, Free Residual	mg/L as Cl2	**0.36**	239	0.05	1.76	No Guideline Required	0.42	4459	0	4.9
Chlorine, Total Residual	mg/L as Cl_2	**0.82**	1	0.82	0.82	No Guideline Required	0.6	3879	0.08	2.2
Disinfection By-Products										
Trihalomethanes (THMs)										
Bromodichloromethane	ug/L	**16**	6	15	20		18.5	69	12	24
Bromoform	ug/L	**< 1**	6	< 1	< 1		< 1	69	< 0.1	< 1
Chloroform	ug/L	**51.5**	6	39	60		49	69	30.3	87
Chlorodibromomethane	ug/L	**3.15**	6	2.6	4.2		3.25	69	<1	4.9
Total Trihalomethanes	ug/L	**71.5**	6	58	79	100 MAC	69	69	46	120
Haloacetic Acids (HAAs)										
HAA5	ug/L	Not tested in 2025				80 MAC	**33.5**	12	< 0.1	46
Metals										
Aluminum	ug/L as Al	**28.35**	10	16.6	65.2	2900 MAC / 100 OG	24.4	119	11.7	186
Antimony	ug/L as Sb	**< 0.5**	10	< 0.5	< 0.5	6 MAC	< 0.5	119	< 0.5	< 0.5
Arsenic	ug/L as As	**0.23**	10	0.16	0.29	10 MAC	0.22	119	0.14	0.36
Barium	ug/L as Ba	**8.75**	10	7.5	9	1000 MAC	8	119	5.7	10.7
Beryllium	ug/L as Be	**< 0.1**	10	< 0.1	< 0.1		< 0.1	119	< 0.1	0.1
Bismuth	ug/L as Bi	**< 1**	10	< 1	< 1		< 1	119	< 1	1
Boron	ug/L as B	**< 50**	10	< 50	< 50	5000 MAC	< 50	119	< 50	52
Cadmium	ug/L as Cd	**< 0.01**	10	< 0.01	< 0.01	7 MAC	< 0.01	119	< 0.01	0.035
Calcium	mg/L as Ca	**17.65**	10	16.2	19.6	No Guideline Required	17.4	119	15.2	19.8
Chromium	ug/L as Cr	**< 1**	10	< 1	< 1	50 MAC	< 1	119	< 1	< 1
Cobalt	ug/L as Co	**< 0.2**	10	< 0.2	< 0.2		< 0.2	119	< 0.2	< 0.5
Copper	ug/L as Cu	**8.1**	10	0.24	27.3	2000 MAC / ≤ 1000 AO	9.75	119	< 0.2	55.4
Iron	ug/L as Fe	**< 5**	10	< 5	14.7	≤ 100 AO	8.1	119	< 5	58.9
Lead	ug/L as Pb	**0.46**	10	< 0.2	1.16	5 MAC	0.47	119	< 0.2	2.39
Lithium	ug/L as Li	**< 2**	10	< 2	< 2		< 2	76	< 2	< 5
Magnesium	mg/L as Mg	**5.545**	10	5.07	5.88	No Guideline Required	5.04	119	4.31	5.7
Manganese	ug/L as Mn	**2.55**	10	< 1	33.2	120 MAC / ≤ 20 AO	3	119	< 1	190
Molybdenum	ug/L as Mo	**< 1**	10	< 1	< 1		< 1	119	< 1	< 1
Nickel	ug/L as Ni	**< 1**	10	< 1	< 1		< 1	119	< 1	2.8
Potassium	mg/L as K	**1.3**	10	1.18	1.37		1.37	119	1.17	1.63
Selenium	ug/L as Se	**< 0.1**	10	< 0.1	< 0.1	50 MAC	< 0.1	119	< 0.1	0.11
Silicon	ug/L as Si	**2865**	10	2450	4210		4030	119	2790	5140
Silver	ug/L as Ag	**< 0.02**	10	< 0.02	< 0.02	No Guideline Required	< 0.02	119	< 0.02	< 0.02
Sodium	mg/L as Na	**14.55**	10	13.2	15.6	≤ 200 AO	13.5	119	11.6	16
Strontium	ug/L as Sr	**123.5**	10	117	133	7000 MAC	118	119	102	133
Sulphur	mg/L as S	**< 3**	10	< 3	< 3		< 3	119	< 3	4.5
Tin	ug/L as Sn	**< 5**	10	< 5	< 5		< 5	119	< 5	< 5
Titanium	ug/L as Ti	**< 5**	10	< 5	< 5		< 5	119	< 5	< 5
Thallium	ug/L as Tl	**< 0.01**	10	< 0.01	< 0.01		< 0.01	119	< 0.01	< 0.05
Uranium	ug/L as U	**< 0.1**	10	< 0.1	< 0.1	20 MAC	< 0.1	119	< 0.1	< 0.1
Vanadium	ug/L as V	**< 5**	10	< 5	< 5		< 5	119	< 5	< 5
Zinc	ug/L as Zn	**5.7**	10	< 5	16.2	≤ 5000 AO	5.7	119	< 5	43.8
Zirconium	ug/L as Zr	**< 0.1**	10	< 0.1	< 0.1		< 0.1	118	< 0.1	< 0.5

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE WATER
Statement of Operations (Unaudited)
For the Year Ended December 31, 2025

		2025	2024
Revenue			
Transfers from government		597,460	580,060
User Charges		427,953	399,766
Water Sales		29,057	28,483
Leases		9,027	8,100
Other revenue from own sources:			
Transfer from Operating Reserve		45,000	27,172
MFA Debt Reserve Earning		30,848	-
Other revenue		4,524	5,312
Total Revenue		1,143,869	1,048,893
Expenses			
General government services		37,077	35,494
Contract for Services		18,579	31,830
CRD Labour and Operating costs		663,163	529,885
Debt Servicing Costs		209,878	216,983
Supplies		80,375	62,668
Other expenses		185,066	172,033
Total Expenses		1,194,138	1,048,893
Net revenue (expenses)		(50,269)	-
Transfers to own funds:			
Capital Reserve Fund		11,361	-
Operating Reserve Fund		26,885	-
Annual surplus/(deficit)		(88,515)	-
Accumulated surplus/(deficit), beginning of year		-	-
Accumulated surplus/(deficit), end of year	$	(88,515)	-

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE WATER
Statement of Reserve Balances (Unaudited)
For the Year Ended December 31, 2025

	Capital Reserves	
	2025	**2024**
Beginning Balance	1,123,078	1,176,250
Transfer from Operating Budget	11,361	-
Transfer from Completed Capital Projects	457,944	17
Transfer to Capital Projects	(150,000)	(105,000)
Interest Income	50,955	51,811
Ending Balance	1,493,338	1,123,078

	Operating Reserve	
	2025	**2024**
Beginning Balance	22,911	47,811
Transfer from Operating Budget	26,885	-
Transfer to Operating Budget	(45,000)	(27,172)
Interest Income	921	2,272
Ending Balance	5,717	22,911

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE SEWER
Statement of Operations (Unaudited)
For the Year Ended December 31, 2025

		2025	2024
Revenue			
Transfers from government		624,830	606,635
User Charges		317,767	290,078
Allocation recovery revenue		11,940	11,590
Other revenue from own sources:			
Interest earnings		-	392
Transfer from Operating Reserve		41,610	-
Other revenue		4,403	4,453
Total Revenue		1,000,550	913,148
Expenses			
General government services		33,999	31,285
Contract for Services		103,666	102,952
CRD Labour and Operating costs		485,296	377,648
Debt Servicing Costs		174,650	174,718
Waste Sludge Disposal		57,621	69,649
Screening Disposal		1,389	1,885
Repairs & Maintenance		17,031	12,062
Supplies		17,188	34,336
Other expenses		109,710	82,190
Total Expenses		1,000,550	886,725
Net revenue (expenses)		-	26,423
Transfers to own funds:			
Capital Reserve Fund		-	13,163
Operating Reserve Fund		-	13,260
Annual surplus/(deficit)		-	-
Accumulated surplus/(deficit), beginning of year		-	-
Accumulated surplus/(deficit), end of year	$	-	-

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE SEWER-DEBT ($6M)
Statement of Operations (Unaudited)
For the Year Ended December 31, 2025

		2025	2024
Revenue			
Transfers from government		229,484	229,459
Other revenue		2,767	2,985
Total Revenue		232,251	232,444
Expenses			
Debt Servicing Costs		232,251	232,444
Total Expenses		232,251	232,444
Net revenue (expenses)		-	-
Annual surplus/(deficit)		-	-
Accumulated surplus/(deficit), beginning of year		-	-
Accumulated surplus/(deficit), end of year	$	-	-

CAPITAL REGIONAL DISTRICT

MAGIC LAKE ESTATE SEWER
Statement of Reserve Balances (Unaudited)
For the Year Ended December 31, 2025

	Capital Reserve	
	2025	**2024**
Beginning Balance	425,103	393,385
Transfer from Operating Budget	-	13,163
Transfer from Completed Capital Projects	-	-
Transfer to Capital Projects	(60,000)	-
Interest Income	16,689	18,555
Ending Balance	381,792	425,103

	Operating Reserve	
	2025	**2024**
Beginning Balance	43,923	29,241
Transfer from Operating Budget	-	13,260
Transfer to Operating Budget	(41,610)	-
Interest Income	1,994	1,422
Ending Balance	4,307	43,923

Making a difference...together

REPORT TO MAGIC LAKE ESTATES WATER AND SEWER COMMITTEE
MEETING OF THURSDAY, JUNE 11, 2026

SUBJECT **Captains Tank Conceptual Design**

ISSUE SUMMARY

To present options for the replacement of the existing storage tank, Captains Tank, within the Magic Lake Estates Water System, located on North Pender Island.

BACKGROUND

The Magic Lake Estates Water System (MLEWS) on North Pender Island is operated by the Capital Regional District (CRD) and provides domestic and fire protection water service to the Magic Lake Estates community. The system relies on two primary storage tanks: the Frigate Tank and the Captains Tank. The Frigate Tank, which was replaced in 2012, is in good condition and supplies approximately 75% of system demand. The Captains Tank, constructed in approximately 1970, is over 50 years old and is in poor condition, with visible deterioration, leakage, and safety concerns.

The existing Captains Tank has a storage capacity of approximately 340 m^3 and currently serves a single pressure zone within the system. The MLEWS is divided into four pressure zones, with the remaining three zones primarily supplied by the Frigate Tank. During peak summer demand periods, CRD Operations have identified challenges maintaining water levels in the Frigate Tank, indicating limitations in system redundancy and operational flexibility.

Operational experience has identified several deficiencies associated with the Captains Tank and its supporting infrastructure. The existing 150 mm PVC supply/distribution watermain connection is located on a steep slope and is partially exposed due to erosion, making it vulnerable to mechanical damage, soil movement, and potential failure. Access to the tank is constrained by a steep and narrow road, limiting safe access for routine maintenance and complicating future construction activities.

Water quality considerations have also been identified within the system, including periodic challenges maintaining adequate chlorine residuals. Hydraulic residence time within the Captains Tank is understood to contribute to water age and associated water quality concerns. In addition, the existing tank configuration, which utilizes a combined inlet and outlet, can limit effective mixing and contribute to localized stagnation. The current drainage system is also suboptimal, discharging without dechlorination and in a location that has the potential to impact adjacent properties, resulting in both operational constraints and regulatory challenges.

In response to these issues, the CRD initiated a conceptual design study to evaluate replacement of the Captains Tank and associated infrastructure improvements. Under Standing Offer Agreement, WSP was retained in 2025 to complete a conceptual design and prepare a Class D cost estimate. The work included review of background information, coordination with CRD staff, and development of design options and recommendations.

The conceptual design, completed in February 2026, recommends replacement of the existing tank with a new Glass-Fused bolted steel tank with a storage capacity of approximately 530 m³. This sizing is based on current provincial design guidelines and incorporates requirements for balancing storage, fire protection, and equalization volumes. The proposed capacity represents a significant increase over the existing storage and is intended to improve fire flow capability and overall system resilience.

The conceptual design also identifies opportunities to improve system operations, including potential reconfiguration to allow the Captains Tank to supply additional pressure zones via the Bosun Booster Station. This change would help balance system storage, improve redundancy, and reduce hydraulic residence time, thereby supporting improved water quality. These operational changes require further review and confirmation during detailed design.

In addition to tank replacement, the conceptual design includes upgrades to associated infrastructure, such as a new watermain connection, improved drainage with dechlorination, and enhanced access, safety features, and instrumentation. Options for replacement of the existing watermain have been identified and will require further evaluation during the next phase of design.

The Class D cost estimate for the overall project is approximately $2.14 million (excluding GST), including contingency and engineering costs. The estimate reflects the complexity of the site, including steep terrain, access limitations, and anticipated geotechnical requirements.

ALTERNATIVES

Alternative 1
That staff be directed to:

1. Prepare a budget estimate for detailed design and refined cost estimate of storage tank replacement for consideration in the 2027 budget; and
2. Develop a proposed scope and community engagement process for a voter assent process in 2027-2028 for loan authorization.

Alternative 2
That staff be directed to:

1. Defer advancement of project in 2027; and
2. Keep the tank replacement project within the 5-year capital plan.

Alternative 3
That this report be referred back to staff for additional information.

IMPLICATIONS

Financial Implications

The conceptual design identifies a total Class D project cost of approximately $2.14 million (excluding GST), inclusive of construction, engineering, and a 40% contingency, reflecting the early stage of design and site complexities such as steep terrain, constrained access, and anticipated geotechnical requirements. This estimate represents a significant capital investment for the Magic Lake Estates Water System and will require confirmation of funding sources, which

may include a combination of reserves, debt financing, grants, and/or service area taxation.

Advancing the project to detailed design will refine cost estimates and reduce uncertainty, particularly with respect to geotechnical conditions, watermain replacement strategy, and construction methodology. While the conceptual estimate includes appropriate contingencies, costs may vary as project scope is confirmed and market conditions evolve. Deferring the project may result in increased future costs due to continued asset deterioration, escalating construction pricing, and the potential for unplanned emergency repairs.

Service Delivery Implications

Replacement of the Captains Tank is expected to significantly improve the reliability and resilience of water service within the Magic Lake Estates Water System. The proposed increase in storage capacity, combined with potential system reconfiguration to allow the tank to serve additional pressure zones, will enhance operational flexibility and reduce the risk of low storage levels during peak demand periods. The project will also address the existing infrastructure deficiencies identified at Captains Tank, including aging assets, vulnerable watermain connections, and substandard drainage and mixing conditions within the existing tank.

CONCLUSION

The Captains Tank is a critical component of the Magic Lake Estates Water System that is nearing the end of its service life and presents increasing risks to system reliability, water quality, and operational safety. The conceptual design completed by WSP confirms the need for replacement and provides a feasible path forward to address existing deficiencies while improving overall system performance. The proposed upgrades, including increased storage capacity, improved infrastructure configuration, and potential operational enhancements, are expected to strengthen system resilience and better support current and future service demands.

Advancing the project to detailed design will allow refinement of key elements including cost, constructability, and system integration, and will support informed decision-making regarding funding and implementation. While the project represents a significant capital investment, it also addresses ongoing risks associated with asset failure and service disruption. Proceeding with the next phase of work will position the Committee to proactively manage infrastructure renewal and maintain reliable water service for the Magic Lake Estates community.

RECOMMENDATION

That staff be directed to:

1. Prepare a budget estimate for detailed design and refined cost estimate of storage tank replacement for consideration in the 2027 budget; and
2. Develop a proposed scope and community engagement process for a voter assent process in 2027-2028 for loan authorization.

Submitted by:	Joseph Marr, P.Eng., Senior Manager, Infrastructure Engineering
Submitted by:	Justine Starke, RPP, MCIP, Senior Manager, Southern Gulf Islands Administration

Concurrence:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Stephen Henderson, General Manager, Electoral Area Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT(S)

Appendix A: WSP Technical Memorandum

TECHNICAL MEMORANDUM

Project:	Captains Tank Conceptual Design		
Project No.:	CA0014219.5332	**Date:**	2026-February-19
To:	Water Distribution Engineering and Planning, Capital Regional District	**From:**	Simon Kras, P.Eng.
Attention:	Katarina Konicek, P.Eng.	**Subject:**	Captains Tank Conceptual Design

INTRODUCTION

As part of the Standing Offer Agreement #2021-679, WSP undertook the conceptual design for the replacement of Captains Tank in the Magic Lakes Estates Water System (MLEWS) on Pender Island.

Project Understanding

CRD is seeking to replace the existing 340 m^3 Captains Tank, located on North Pender Island, which is over 50 years old and in poor condition. The proposed scope of work includes conceptual design and preparation of a Class 'D'[1] construction cost estimate. The Magic Lake Estates (MLE) Water System on North Pender Island is operated by the CRD Electoral Area Service Department (Operations). The system currently relies on two storage tanks for fire and domestic potable water storage (see Water System Map attached for reference):

- Frigate Tank, which was replaced in 2012, is in good condition, and supplies approximately 75% of the system demands, according to Operations. It has a capacity of 770 m^3 based on available record drawings.
- Captains Tank was constructed in 1970, and is in poor condition with visible deterioration, leakage and safety concerns. It has a capacity of 340 m^3 based on available record drawings.

The existing access road is very steep and will require improvements.

The tank's existing shared supply/distribution watermain is a 150 mm PVC pipe extending to the south down a steep slope (approximately 60% grade). The soil cover over the pipe has eroded and the pipe is now exposed. The pipe is currently vulnerable to further erosion, soil movement and mechanical damage. Joint separation is a concern with this pipe type.

Operations have reported occasional water quality concerns within the MLE water system, which could be a result of high residence times. Water quality may be further impacted if the Captains Tank storage volume is increased which would result in additional residence time. However, the CRD Operations have discussed system changes to increase water demand from Captains Tank by allowing the lower pressure zones to be fed from the Tank. Most importantly, these changes would also address low water levels in the Frigate Tank during high demand days.

There are four pressure zones within the MLEWS. Currently Captains Tank feeds one zone and Frigate three zones. Due to high water demand during summer it would be helpful to connect Captains Tank to the three other zones via the existing PRV at Bosun Booster Station. This system change requires additional review by the CRD.

[1] Per Association of Consulting Engineers of Canada guidelines

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Scope of Work

WSP's scope of work for this project included the following:

- Background information review including record drawings, previous reports, operational records, and any available geotechnical information.
- Kickoff meeting with CRD IWS attended by our Project Manager and Assistant Project Engineer. This meeting was hosted virtually on October 8, 2025.
- Conceptual Design Technical Memorandum documenting all calculations, design assumptions and recommended next steps
- Conceptual Site Plan
- Class 'D' construction cost estimate.

CONCEPTUAL DESIGN

Storage Tank Sizing

Tank sizing is based on the demands in the Captains Tank service area. Additional redundancy and overall system resilience would be achieved if Captains Tank is linked to the lower zones through the Bosun PRV.

The tank sizing was based on the BC Design Guidelines[2], which indicates the following:

Storage required = A + B + C

where

A = Balancing Storage = MDD / 4. The Captains Tank service area MDD was used.

B = Fire Storage

C = Equalization Storage = 0.25 x (A + B)

The following assumptions were used for tank sizing:

- Maximum Day Demand (MDD) = 245 m^3/day
  - Estimated future demand for Captains Tank per AECOM report[3]
- Fire Flow = 1.5 hrs @ 67 L/s
  - Based on FUS simplified method[4], Duration based on FUS Table 1.

The system-wide calculations are summarized below:

A = 245 m^3/day / 4 = **61.3 m^3**

B = 67 L/s x 1.5 hrs x 3600 s/hr = 361,800 L = **361.8 m^3**

C = 0.25 x (61.3 m^3 + 361.8 m^3) = **105.8 m^3**

V_{req} (required storage) = A + B + C = 61.3 m^3 + 361.8 m^3 + 105.8 m^3 = 528.9 m^3

A new tank with a 530 m^3 storage capacity is recommended to replace the existing Captains Tank. WSP has reached out to two reputable tank suppliers for quotes. Based on the quotes obtained, the nearest available tank size based on standard panel dimensions is 522.8 m^3, which is close enough to be acceptable for this project, since the shortfall is minimal.

[2] British Columbia Design Guidelines for Rural Residential Water Systems, Ministry of Forests, Lands, Natural Resource Operations & Rural Development (MFLNRORD), 2012.
[3] Magic Lake Estates – Pender Island, Water System Review, AECOM, September 2011
[4] Fire Underwriters Survey Water Supply for Public Fire Protection, A Guide to Recommended Practice in Canada, 2019. Simplified Method for One and Two Family Dwellings Up to 450 sq.m.

Water Quality and Future System Operation

Based on the current Captain Tank size of 340m^3 and an ADD of 1.1 L/s, the Hydraulic Residence Time (HRT) in the tank is approximately 3.6 days.

From discussions with Operations, low chlorine levels are a challenge at times. Given this concern, we recommend against further increasing the HRT. To mitigate water quality concerns associated with increasing the storage volume in Captains Tank, WSP recommends feeding the lower zones from the new Captains Tank, which could help to reduce the HRT.

This approach will require a Pressure Reducing Valve (PRV) at the Bosun Booster Station with appropriate piloting, as well as development of an effective control strategy. This approach will improve the overall system redundancy as well as improving turnover in Captains Tank. HRT in the Frigate Tank would be increased with this approach and more frequent sampling should be done to assess water quality during initial implementation to allow for fine tuning of the control strategy.

If it is assumed the new 530 m^3 Captains Tank and 740m^3 Frigate Tank equally share storage volumes for the entire MLEWS area and the total ADD is 5.6L/s[5], then the shared HRT in the tanks would be approximately 2.6 days.

If the new Captains Tank is constructed before the new control strategy is implemented, then the tank could be operated below full capacity if water quality is a concern, provided that system pressures are acceptable.

The CRD has indicated that the Captains Tank currently services lots with elevations between 80 and 156 m, which currently provides a static pressure of 255 kPa (37 psi) at the highest elevation home when the tank is full – not accounting for any head loss in the pipes. WSP notes that this is already slightly lower than the current provincial guidelines[6] which recommend a minimum system pressure of 280 kPa (40 psi) at Peak Hour Demand. System pressures will be a consideration when determining an operating strategy for the reservoir.

System pressures and water quality should be monitored during initial operation of the new tank. This will allow optimization of both water quality and system pressure.

Storage Tank Sizing Confirmation

The conceptual sizing is based on FUS requirements. However, fire protection needs to be balanced against water quality. Moreover, it may not be practical to provide fire flow capacity beyond the needs or capabilities of the fire department. Based on CRD's discussions with the Pender Island Fire Department, we understand that the proposed sizing would be acceptable, and represents a significant improvement to the existing storage volume.

Furthermore, the sizing assumes that the Captains Tank feeds its own zone and only supplements the lower zones during peak flows to allow for recovery of the Frigate Tank. This assessment focuses on the Captains Tank distribution zone and does not consider storage requirements for the lower zones.

Access Road Considerations

The existing access road is approximately 240 m long, climbing from an elevation of 133 m to 174 m (an average slope of 25%). Certain sections of the road are even steeper at slopes of around 35%. Access to the tank is challenging even for a small 4-wheel-drive vehicle. Tracked vehicles are likely to be required for any significant construction activity.

Constructing a new access road at a more reasonable grade is unlikely to be feasible within the scope of the storage tank replacement. A new roadway would need to be approximately 350 m long. It would require significant amounts of clearing and rock blasting. In addition to being expensive, these activities would require community engagement given that the site is on designated parkland.

[5] AECOM, 2011
[6] Design Guidelines for Rural Residential Community Water Systems, 2012, Utility Regulation Section, Water Management Branch, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Government of British Columbia.

Tank Materials and Shape

Based on the size and location of the proposed new storage tank, a steel tank is the most cost-effective and practical option. Concrete tanks are much more expensive for storage volumes less than 2,000 m^3. Moreover, supplying the required quantities of concrete at this site would be challenging given the extremely steep access road. Steel tank panels are much lighter and easier to transport to site.

Common types of steel tanks are (i) bolted and (ii) lined corrugated steel. Bolted tanks are more suitable for this location because they can be taller and more slender than lined corrugated tanks. Bolted steel tanks coatings can be either (a) glass-fused or (b) epoxy. Glass-Fused Steel (GFS) provides a longer lifespan than Epoxy Coated Steel, especially with the addition of cathodic protection.

WSP recommends a Glass-Fused bolted steel tank to replace the existing aging Captains Tank, with a steel floor, and cathodic protection for all glass-fused steel components including the side and roof access hatches.

Tank Access

The interior of the tank should be accessible from the ground level when the tank is empty through a hinged side-opening hatch designed to provide unrestricted entry.

The roof access hatch should be large enough to accommodate flexible ventilation ducting during confined space entry from the roof. The tank should feature an exterior roof access ladder with suitable safety cage, platforms as required. Safety guardrails and a suitable fall protection anchor should be provided on the roof of the tank to protect workers accessing rooftop features including the vents and the roof access hatch.

Instrumentation and Telemetry

The existing battery-powered wireless level transmitter requires access to the reservoir roof for battery replacement. For the new tank, WSP recommends a wired level transmitter (either pressure or ultrasonic) connected to the kiosk on Captains Crescent.

Hatch alarms can also be wired to the kiosk for security. WSP has not reviewed the existing control panel at the kiosk to confirm that the capacity for additional input/output connections. This should be confirmed during the detailed design phase.

Appurtenances

Appurtenances should include:

1) A check valve chamber to provide dedicated inlet and outlet piping into the storage tank from the shared supply/distribution main, complete with isolation valves to facilitate removal and servicing of the check valves.
2) Sampling stations on the storage tank inlet and outlet lines.

Watermain Connections

The existing watermain is exposed and vulnerable to mechanical damage, further erosion and soil movement in its current condition. The existing watermain alignment is on steep rocky terrain which is difficult to work on and requires harnesses and fall protection for safety. The three options below should be considered further in the preliminary design stage for replacing the watermain:

a) Replacement with a new insulated above-ground HDPE main extending down the slope.

b) Replacement with a new main in a trench along the access road.

c) Above-ground insulated pipe along access road.

Option A: Above-ground Insulated HDPE along existing pipe alignment

This option allows for a shorter watermain installation, without the need for excavation, backfill or imported bedding. This option also does not encumber the storage tank access road with construction activities.

The insulation would be protected with a polyethylene jacket, allowing the insulated pipe the ability to bend slightly, adapting to the contours of the terrain. Insulated pipe is typically ordered pre-insulated with the exception of the ends, which are joined on-site and field insulated. Once the new pipe is constructed, tested and tied in, the existing pipe could be removed if feasible, or else capped and abandoned.

The main consideration with this approach is constructability. The existing watermain connection is approximately 100 m long and will require 6-9 pre-insulated pipe segments to construct. It will likely not be feasible to butt-fuse HDPE on the steep rocky watermain alignment. Other alternative approaches could be considered including pre-fusing the line and either (a) winching the pipe up the slope, or (b) installation by helicopter.

Polyethylene pipe jackets can sometimes be vulnerable to damage from wildlife which can chew through the jacketing material and damage the insulation. Steel jacketing is likely not feasible for this installation because some flexibility is required to conform to the uneven terrain.

Option B: New watermain alignment along access road

Extending a new watermain along the access road would require approximately 240 linear meters of challenging pipe installation up a steep, narrow access road. Careful planning and staging would be required since there is no room to drive around an open trench along this alignment. Additional space may need to be cleared to provide laydown areas. Construction of the watermain would impede vehicle access to the storage tank for Operations during the installation, rendering the tank accessible only by foot.

This option is likely to be more costly than an above-ground pipe but provides a more robust final product. However, if there is a watermain failure along the access road, it could temporarily render the tank inaccessible, making it challenging to manually shut off the water supply and complete a repair.

Option C: Above-ground insulated pipe alongside access road

A hybrid approach would involve an insulated jacketed pipe alongside the access road alignment. The pipe could be aligned to minimize tree removals due to the flexibility of the polyethylene jacketing. This option may be more feasible to construct than Options A or B and allows easier access to the pipe for repairs if required.

Cost comparison

The following table provides a rough order-of-magnitude cost comparison for the two options, not including tie-ins:

Option A: Above-ground insulated HDPE watermain

Item	Unit Price	Qty	Amount
150 mm Insulated Jacketed HDPE supply	$200	100 linear metres	$20,000
Closure kits, couplings and miscellaneous materials	$15,000	Lump Sum	$15,000
Installation	$500	100 linear metres	$50,000
		Subtotal	$85,000
		40% Contingency	$34,000
		Total Excluding GST	**$119,000**

Option B: New watermain along access road

Item	Unit Price	Qty	Amount
150 mm HDPE supply and installation	$500	240 linear metres	$75,000
Access Road Restoration	$20	960 square metres	$19,200
		Subtotal	$94,200
		40% Contingency	$37,680
		Total Excluding GST	**$131,880**

Option C: Shallow-bury or above grade insulated pipe along access road

Item	Unit Price	Qty	Amount
150 mm Insulated Jacketed HDPE supply	$200	250 linear metres	$50,000
Closure kits, couplings and miscellaneous materials	$25,000	Lump Sum	$25,000
Installation	$300	100 linear metres	$30,000
		Subtotal	$105,000
		40% Contingency	$42,000
		Total Excluding GST	**$147,000**

Because the cost for all three options is comparable, the constructability and cost of Options B and C should be investigated further during the preliminary design phase, since they both provide a more robust final product than Option A.

Inlet and Outlet Sizing

The existing Captains Tank has a 150 mm diameter watermain connection which acts as a combined inlet and outlet. This configuration is not optimal for tank circulation and tends to create dead zones in tanks. Separate inlet and outlet pipes on opposite sides of the new tank are proposed.

Based on AECOM's record drawings for the Water Treatment Plant[7], the maximum ultimate flow to distribution from the treatment facility is 24.26 L/s. The existing inlet and outlet pipe sizing of 150 mm is adequate based on the maximum future flows from the WTP and the size of the existing distribution system mains.

[7] Magic Lake Estates Water System Upgrades, General Water Treatment Plant Process Flow Diagram, Issued for Record, AECOM, 2015-03-23

Tank Drainage and Overflow

The existing Captains Tank drain and overflow lines discharge into a common buried 150mm diameter pipe. The pipe outlet could not be located during WSP's site visit but is believed to be directly south of the tank based on the location of the valve box for the drain. Based on the steep terrain, it is likely that the pipe outlet has been covered by debris or vegetation. There is no-dechlorination manhole in the existing system.

The existing drain is problematic because it discharges directly above existing homes located south of Lively Peak Park. CRD Operations have indicated that when the tank needs to be drained for maintenance, it has to be done very slowly to avoid impacting the properties. Current provincial regulations require de-chlorination of water prior to discharge which is not practically feasible with the current system.

The new tank is proposed to drain over the north face of Lively Peak through a new de-chlorination manhole, with a concrete headwall on the rock face at the end of the pipe. Drainage released onto the north slope would flow down the slope into an existing ditch along the Lively Peak Park trail. The ditch is culverted under the trail, leading to a ravine with an ephemeral watercourse. Though care will still need to be taken to control the rate of discharge, this location is considered more suitable than the existing.

Storage Tank Foundation

The existing access road is too steep for concrete trucks, and any concrete delivery would likely require tracked vehicles or a helicopter lift. For this reason, a typical cast-in-place concrete foundation at this site is not practical. The design of bolted steel tanks allows them to be constructed on a gravel foundation. However, a low-profile concrete ring foundation with rock anchors should be considered to resist sliding and overturning forces. The required rock anchor size, spacing and depth should be determined during detailed design based on geotechnical requirements. The foundation should be designed to minimize the concrete volume required.

Geotechnical Considerations

There is a steep slope adjacent to the proposed storage tank site (approximately 38% grade). Slope stability should be assessed during the design of the new tank. Geotechnical exploration is recommended to determine:

- The depth of soil overlying the bedrock at the proposed tank site
- The nature and condition of the bedrock.

The conceptual design assumes blasting to a depth of approximately 0.5-1 m below existing grade to provide space for the tank. The geotechnical investigation at the design stage should comment on any safety and rock stability considerations related to blasting, and on the suitability of the bedrock for rock anchoring.

Because mobilization of drilling equipment to Pender Island is costly, a phased investigation approach is recommended. An initial investigation could be undertaken using an excavator with a pneumatic hammer. If the depth to competent bedrock exceeds the capabilities of the excavator, then a secondary drilling phase could be completed.

Cost Estimate

The Class D cost estimate is provided below.

Item	Cost
530 m^3 Glass-fused-steel tank with cathodic protection and steel floor	700,000
Rock Blasting (~170 m3)	70,000
Site Grading and Civil Works	80,000
10 x #18 Rock anchors	101,000
150mm HDPE watermain and access road restoration (Option C)	105,000
Check valve chamber	50,000
2 x 50 mm conduits to existing kiosk	50,000
150mm PVC drain, dechlorination manhole and headwall	30,000
Existing Tank and Watermain decommissioning	100,000
Electrical and Instrumentation	50,000
Subtotal	**$1,336,000**
40% Contingency	$534,400
20% Engineering	$267,200
Total Excluding GST	**$2,137,600**

Additional Cost for Increased Reservoir Size

Based on WSP's discussions with tank suppliers, the cost to upsize to a 622 m^3 tank (one size up) would be $28,000. The total additional project cost including contingencies would be approximately $50,000. This would provide approximately 18% more storage.

NEXT STEPS

WSP understands that delivery of this project will be subject to available funding. The following preliminary schedule is provided as an overview for discussion and planning purposes:

Spring 2026:

- Conduct a geotechnical investigation to assess bedrock conditions and slope stability.
- Identify environmental and archaeological requirements.
- Identify stakeholders to be engaged which might include Pender Island Parks.
- Expose existing storm drain outlet on slope.

Spring/Summer 2026:

- Detailed topographic survey of existing storage tank site, including existing watermain where exposed.
- Complete design, incorporating findings from investigations.

Fall/Winter 2026:

- Construction of new tank.
- Monitor water quality and during commissioning to fine tune optimal TWL and setpoints.
- Develop a control strategy and pilot a new PRV at the Bosun pressure station.

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Junior Project Engineer

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Senior Civil Engineer

WSP Canada Inc.
Engineers & Geoscientists BC
Permit #1000200

Attachments

- Attachment 01: Water System Map
- Attachment 02: Conceptual Site Plan
- Attachment 03: Conceptual Section

Magic Lake Estate Water System
Overview

Figure 1

Making a difference...together

1:11,000

0 100 200 400 600 Metres

UTM Zone 10N NAD 1983

DISCLAIMER

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

August 2025 | Captains Tank Reservoir.mxd | helpdesk@crd.bc.ca

North Pender Island

Razor Point Rd

Bedwell Harbour Rd

Water Service Area

Magic Lake Reduced HGL 84

Galleon Way

Galleon West PCS

Frigate Reservoir HGL 136

Yardarm Rd

Lighthouse Lane

Gunwhale Rd

Shoal Rd

Spyglass Rd

Buck Lake

Buck Lake Intake

Buck Lake PS

Compass PCS

Bosun PS

Frigate Reservoir

Frigate Rd

Foc'sle Rd

Jolly Roger Cres

Ketch Rd

Captains Reservoir HGL 182

Mate Rd

Captains Tank Reservoir Project Site

Captains Reservoir

Captains Cres

Bosun Way

Scarff Rd

Anchor Way

Port Rd

Privateers PCS

Rum Rd

Privateers Rd

Galleon East PCS

TP

Magic Lake WTP

PS

Magic Lake PS

Capstan Lane

Capstan PCS

Schooner Way

Schooner PCS

Swanson Channel

Magic Lake

Magic Lake Intake

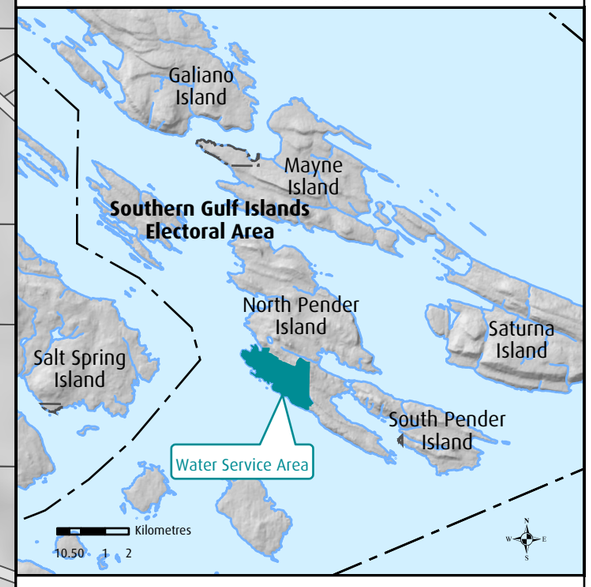
Magic Lake Pumped HGL 114

Buccaneers Rd

Pirates Rd

Cutlass Crt

Cannon Cres



- Water Service Area
- Distribution Main
- Untreated Supply Main
- TP Treatment Plant
- Reservoir (Storage Tank)
- PS Pump Station
- Pressure Control Station
- Captains Reservoir Zone - HGL 182
- Magic Lake Pumped Zone - HGL 114
- Magic Lake Reduced Zone - HGL 84
- Frigate Reservoir Zone - HGL 136

REVISION:				REVISION:			
REV	DATE	DESCRIPTION	BY	REV	DATE	DESCRIPTION	BY

SEAL:

DISCLAIMER: COPYRIGHT

ORIGINAL SCALE: 1:200
DATE: 2025-10-21
APPROVED BY: BJP
CHECKED BY: JCS
DRAWN BY (OPTIONAL): BJP
MDS
IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
25mm
DISCIPLINE: CIVIL

wsp
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301-3600 UPTOWN BLVD, VICTORIA, BC V8Z 0B9
T (250) 384-5510 | www.wsp.com

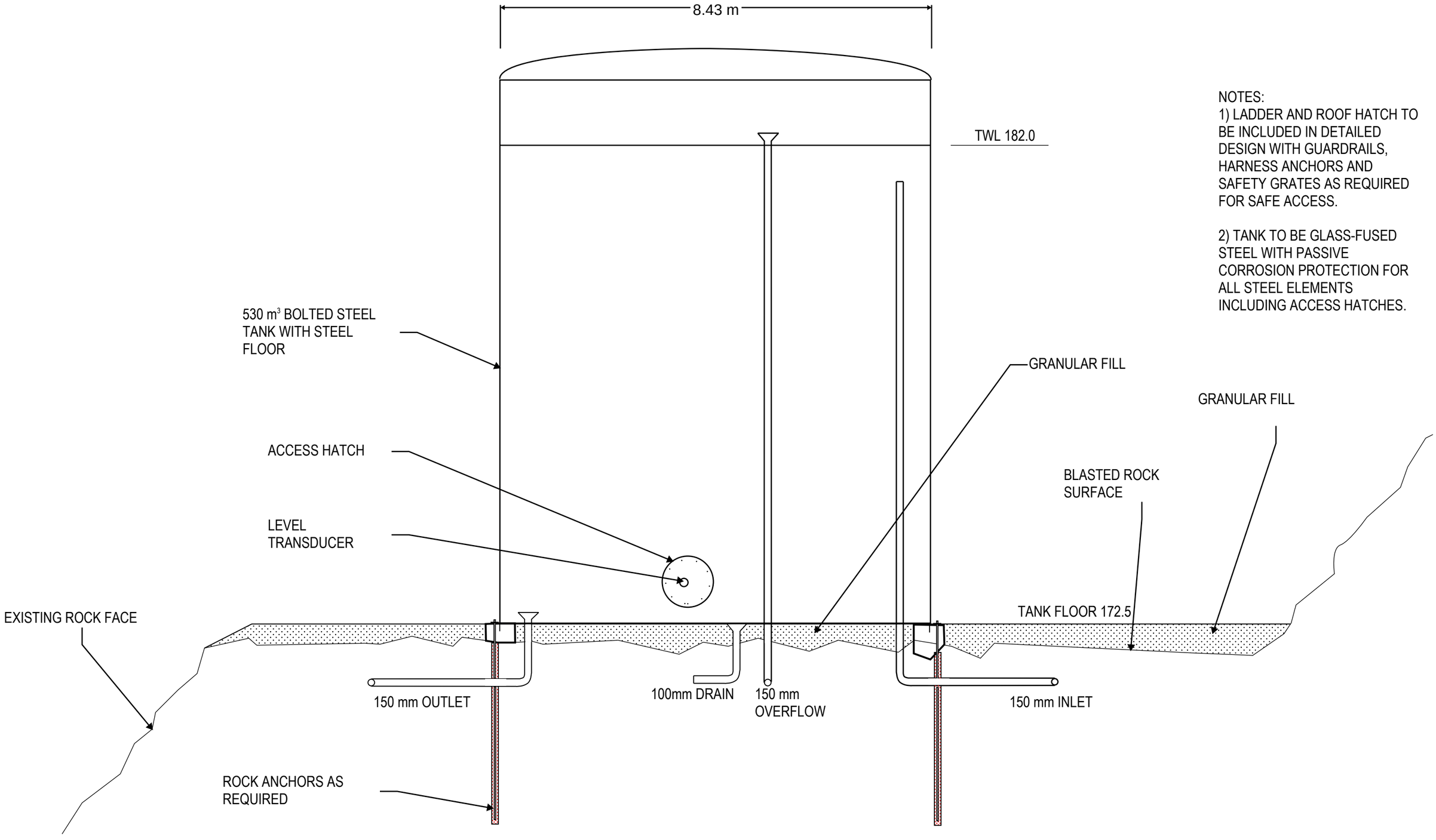
PROJECT NUMBER: CA0014219.5332

CLIENT: CAPITAL REGIONAL DISTRICT
CLIENT REF. #: --

TITLE: SITE PLAN
CAPTAINS TANK

PROJECT: CRD CAPTAINS TANK

DRAWING NUMBER: C-XXX
REV.: X



NOTES:
1) LADDER AND ROOF HATCH TO BE INCLUDED IN DETAILED DESIGN WITH GUARDRAILS, HARNESS ANCHORS AND SAFETY GRATES AS REQUIRED FOR SAFE ACCESS.

2) TANK TO BE GLASS-FUSED STEEL WITH PASSIVE CORROSION PROTECTION FOR ALL STEEL ELEMENTS INCLUDING ACCESS HATCHES.