

April 21 to 24, 2026

Harbour Colony Lagoon Design Presentation

Presented by:



BURNS MAENDEL
CONSULTING ENGINEERS LTD.



BURNS MAENDEL CONSULTING ENGINEERS LTD.

W | BMCE.CA
P | 204.728.7364
E | INFO@BMCE.CA
A | 903 ROSSER AVE, BRANDON

Head Office Located in: Brandon MB,

Satellite Offices Located in:
Mbosomin, SK, and Portage La Prairie, MB



Daniel Burns, P.Eng.



Michael Maendel, P.Eng.



Development Timeline & Approvals

Timeline of Completed Tasks



Preliminary Data & Regulatory Documents (Lagoon Related)

Municipality Zoning By-laws

- Review current site zoning and permitted/ conditional uses (both RMof Armstrong and RMof Gimli)

Nutrient Management Regulation – Part of the Environment Act

Site elevation and drainage

- Reviewed elevations and drainage patterns within the project area to determine a suitable location

Fisher Armstrong Planning District Development Plan

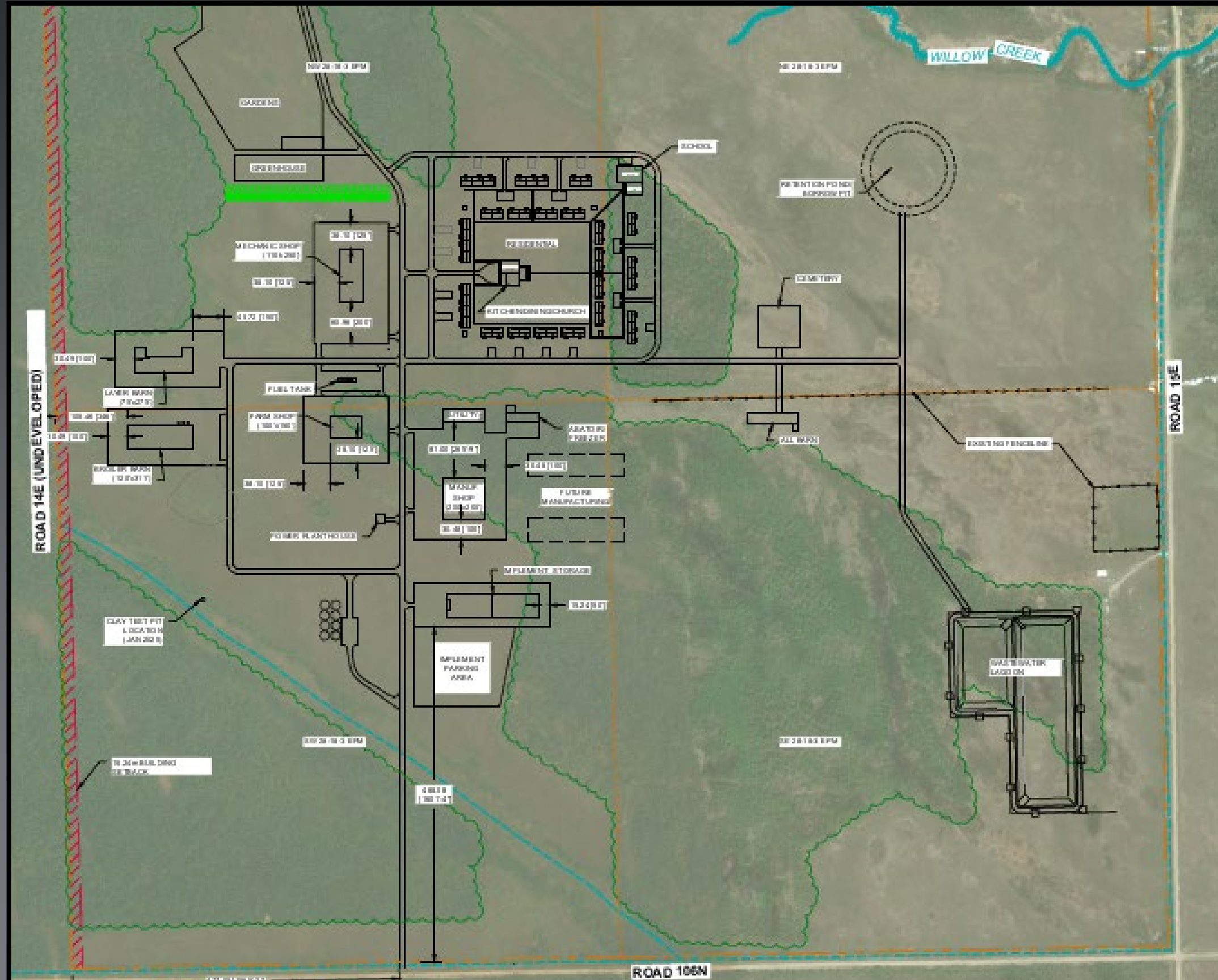
Design Objectives For Wastewater Treatment Lagoons Manitoba 2022

Completed by Manitoba Environment and Climate Change (MECC) – Last Updated in 2022.

Outlines design requirements for facultative lagoons constructed in Manitoba

- Maximum Organic Loading [56 kgBOD₅/ha]
- Assumptions for Hydraulic Loading
- Freeboard requirements [1m]
- Setbacks [300m]
- Effluent Quality Standards
- Construction Materials of Cells, Pipes, and Appurtenances
- Liner Requirements

Proposed Colony Site Plan



Geotechnical Investigation

Geotechnical Investigation

- Insitu soil suitability for lagoon liner,
- Location of groundwater table,
- Recommendations for building foundations,
- Recommendations for pavement structures.

Table 6. Soil Permeability Properties

Test Hole and Sample Number	Soil Description	Sample Depth Below Grade (m)	Remoulded Hydraulic Conductivity (cm/s)	Atterberg Limits			Grain Size Distribution (%)			
				PL ¹	LL ¹	PI ¹	Clay	Silt	Sand	Gravel
TH21-17 G216	Silt and Clay	0.2 to 1.5	1.78x10 ⁻⁸	14	40	26	32	46	22	0
TH21-16 G189	Silt and Clay	0.9 to 1.1	Not Measured	13	44	31	39	34	23	4

Note 1. PL- Plastic Limit, LL – Liquid Limit, PI- Plasticity Index

Hydrotechnical Modeling Investigation

Hydrotechnical Modeling Investigation

- Channel flow for various exceedance probabilities
- Flood elevations / flood protection elevations
- Water surface elevation through hydraulic structures

Table 2: Willow Creek - Flood Hydrology

Discharge Event	Regional Discharge Coefficients*	Mean Daily Discharge Willow Creek at Rd 107N Drainage Area = 131.3 km ² (m ³ /s)	Mean Daily Discharge Willow Creek at Rd 15E Drainage Area = 175.3 km ² (m ³ /s)
1%	0.607	25.3	31.6
2%	0.482	20.1	25.1
3%	0.416	17.4	21.7
5%	0.341	14.2	17.8
10%	0.250	10.4	13.0
20%	0.173	7.2	9.0
50%	0.084	3.5	4.4
3DQ10	0.199	8.3	10.4

* Updated discharge coefficients provided by MTI on November 09, 2022 (regional exponent n = 0.765).

Table 3: South Malonton Drain at the Confluence with Willow Creek - Flood Hydrology

Discharge Event	Regional Discharge Coefficient "C" * Willow Creek near Gimli Gauge 05SB002 Drainage Area = 236 km ²	Mean Daily Discharge Estimate for South Malonton Drain at the Confluence with Willow Creek (Rd 15E) Drainage Area = 41.8 km ² Regional Method (m ³ /s)
1%	0.607	10.6
2%	0.482	8.4
3%	0.416	7.2
5%	0.341	5.9
10%	0.250	4.3
20%	0.173	3.0
50%	0.084	1.5
3DQ10	0.199	3.5

* Updated discharge coefficients provided by MTI on November 09, 2022 (regional exponent n = 0.765).



Technical Design Methodology

Lagoon Hydraulic Loading Rate

Domestic Loading [75³/d]

- **Residential population** based on historical colony sizes. The Harbour Colony lagoon is sized for a population of 250 people.
- **Per Capita Loading** typically 283 to 300 L/ p/ d in Manitoba (statistics Canada), for a conservative estimate, 300L/ p/ d is chosen.

Abattoir Wash Water Loading [1.3³/d] - *Characterization of Provincial Inspected Slaughterhouse Wastewater in Ontario, Canada*

Truck Wash [3.89³/d] – Based on a 5GPM pressure washer and an assumed weekly usage of 4hrs/ d, 6d/ week.

Water Treatment Backwash Loading [13.2³/d] - backwash from the water treatment plant is disposed of in the wastewater system

Infiltration - assumed to be 15%.

Total Hydraulic Loading – equal to 24,742.8m³ with a daily rate of 107.5 m³/ d

Lagoon Organic Loading Rate

Residential Organic Loading Rate [0.077 kgBOD5/c/d]

- Industry standard value for organic loading of residential wastewater. Higher than average concentration of 0.06 kgBOD5/per/d (200mg/L).

Abattoir Organic Loading Rate [6.82 kgBOD5/d]

- Based on the "Characterization of Provincial Inspected Slaughterhouse Wastewater in Ontario, Canada"

Based on the Design Objectives for Wastewater Lagoons, primary cells cannot be loaded with more than 0.077 kgBOD5/ha/d

Primary Cell Sizing

The primary cell is utilized for organic treatment and the removal of organisms and pathogens.

- Utilizing the organic loading and the organic loading limit (56kg BOD5/ha/d) from the Design Objective for Wastewater Treatment Lagoons Manitoba 2022, a primary cell area is calculated, equal to 4,655.9 m² or 1.15 acres
- A cell width is chosen; in this case we choose a value of 70.2m.
- Active height of the cells is 1.2m based on the Design Objective for Wastewater Treatment Lagoons
- The primary cell has a hydraulic capacity of 5,596.3 m³

Additional capacity is added to the primary cell for trickle discharge

- 40 days of loading is added to account for this period of time [4,303 m³]
- In adding the additional capacity, the actual organic loading is reduced from 56kgBOD5/ha/d to 23.3 kg BOD5/ha/d

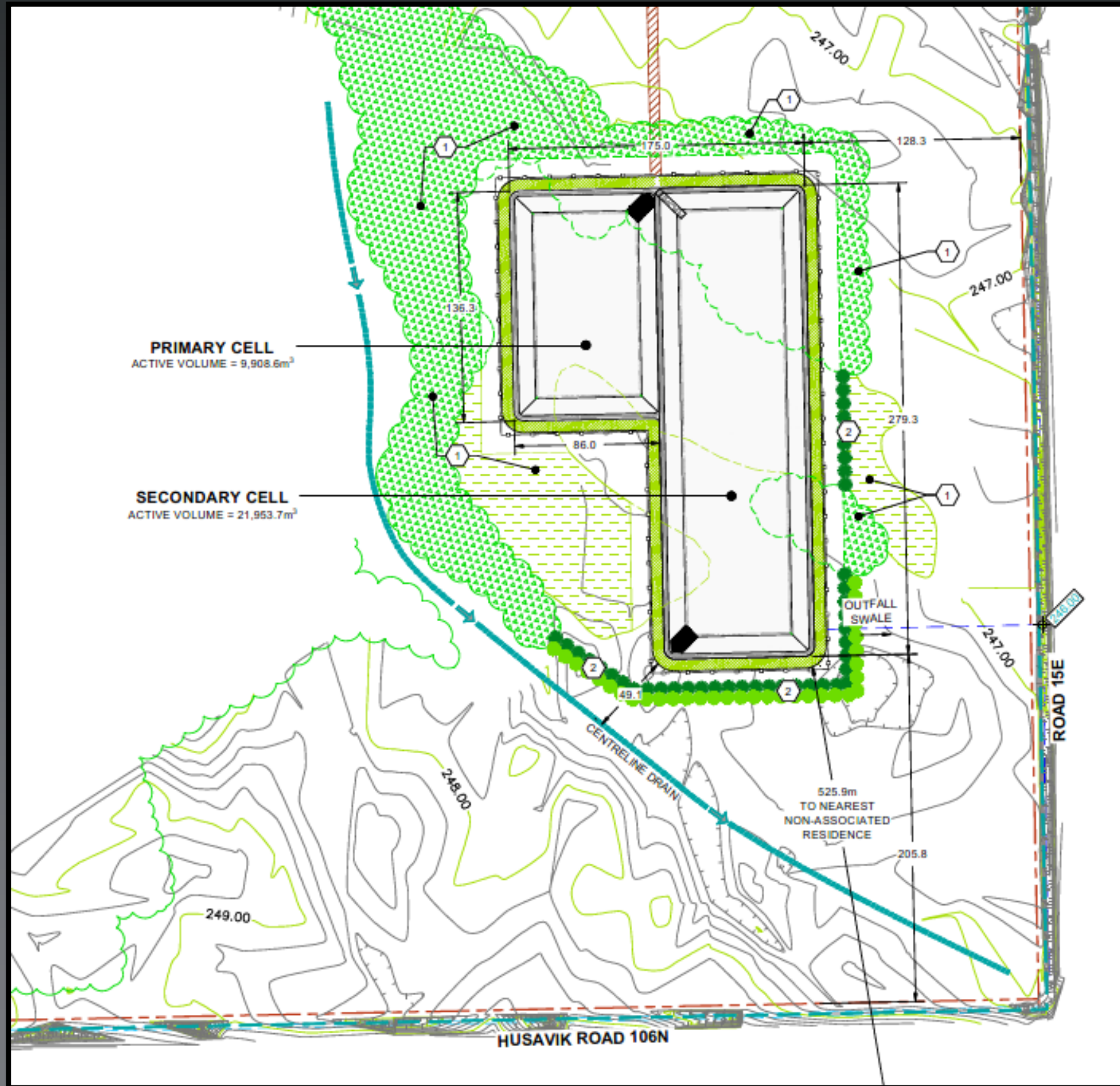
Secondary Cell Sizing

The secondary cell is utilized for the removal of total suspended solids (TSS), nitrogen, and pathogens as holding the remaining hydraulic capacity.

As per the *Design Objectives for Wastewater Treatment Lagobal* of the primary cell can be accounted for as hydraulic loading capacity, while the remaining capacity is held by the secondary cell.

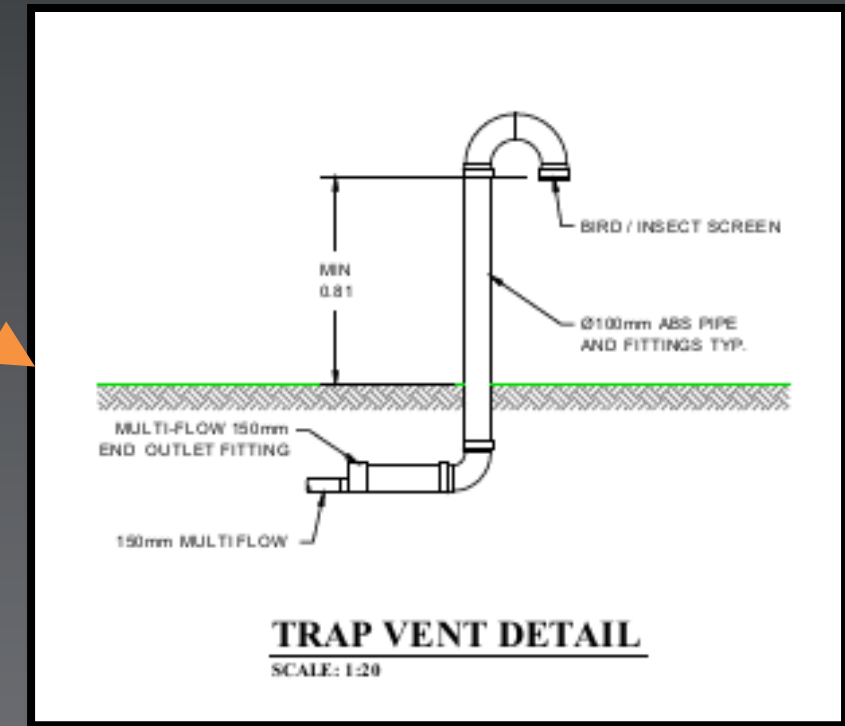
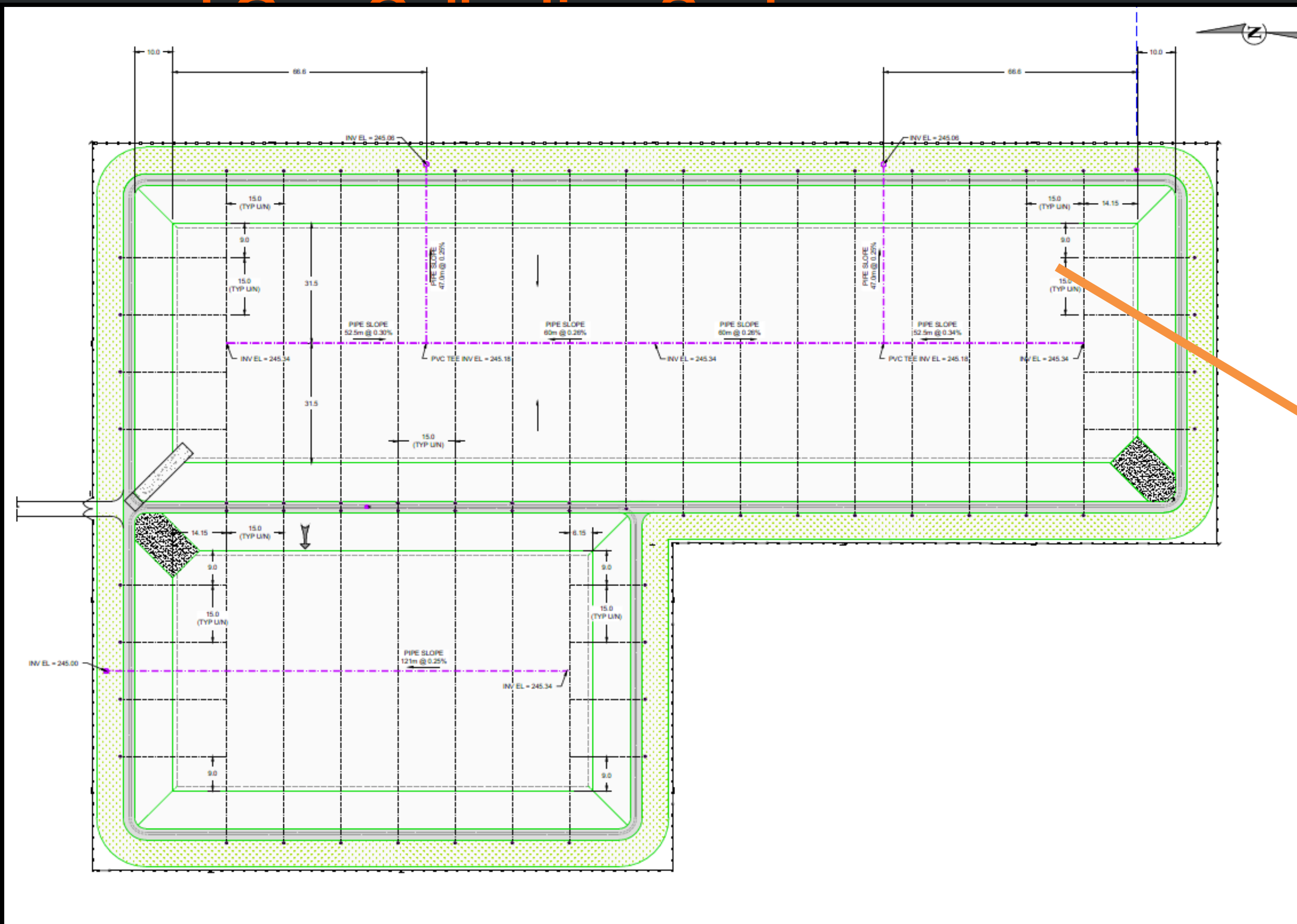
- The secondary cell requires a hydraulic capacity of 21,945 m³.

Proposed Lagoon





Lagoon Appurtenances & Safety Features

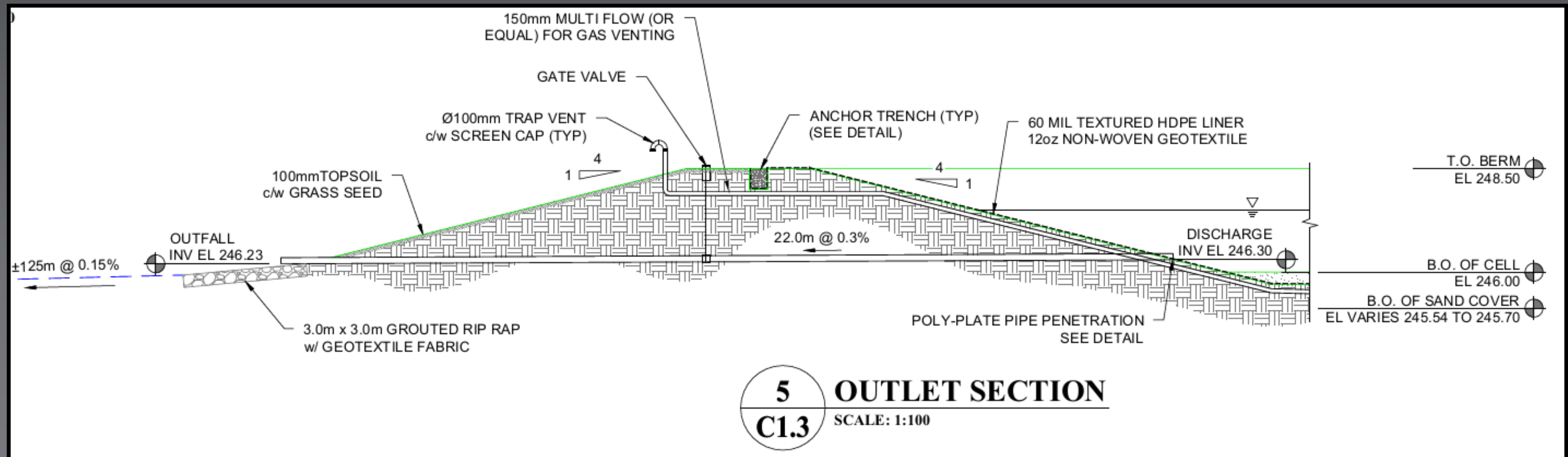


Inlet, Outlet, and Equalization Pipes

Outlet and cell equalization pipes are specified as HDPE due to its resistance to UV light, and sized at 150mm in diameter.

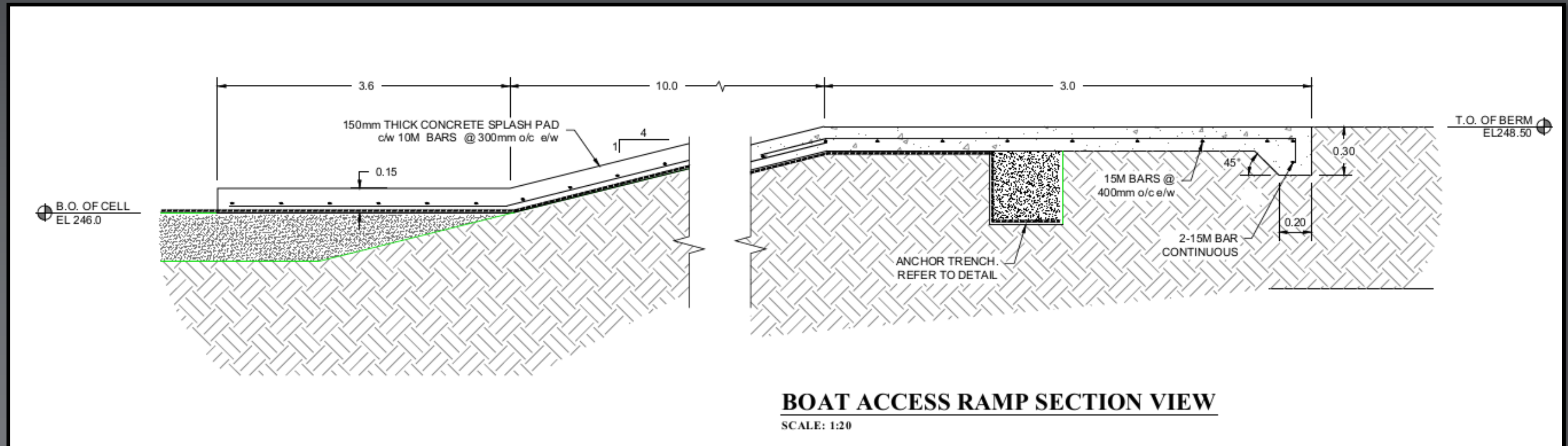
The inlet pipe is sized at 150mm based on pumping rates and head losses from the lift stations and force mains

Concrete splash pads are specified as *Manitoba Water Services Board construction specifications* for inlet, outlet, and equalization pipes.



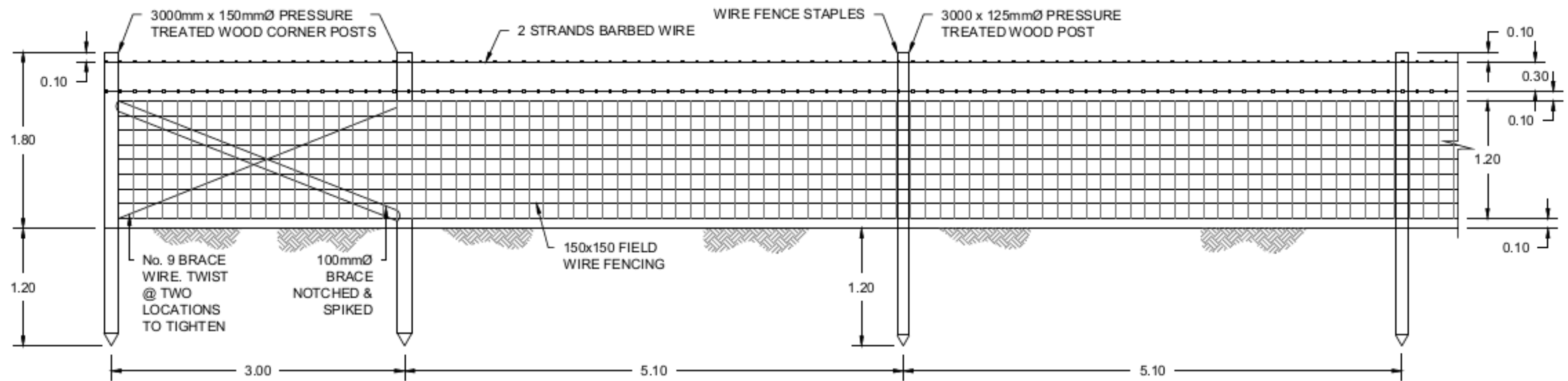
Concrete Access/Egress Ramp

Concrete ramps are provided for boat access into the cells for treatment processes, and as emergency egress paths for people or animals should they accidentally enter the cell.



Fencing and Signage

A 1.8m tall, page wire fence is to be constructed around the lagoon to prevent access from people and who may damage the liner.

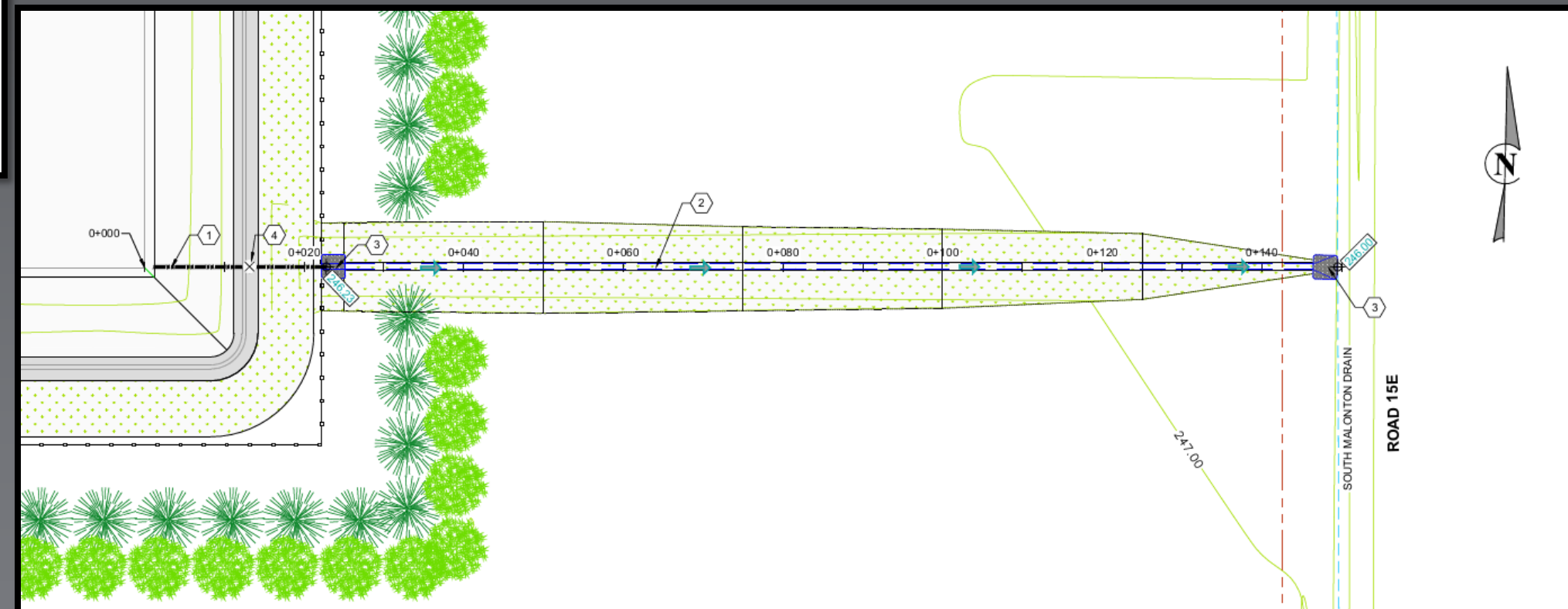
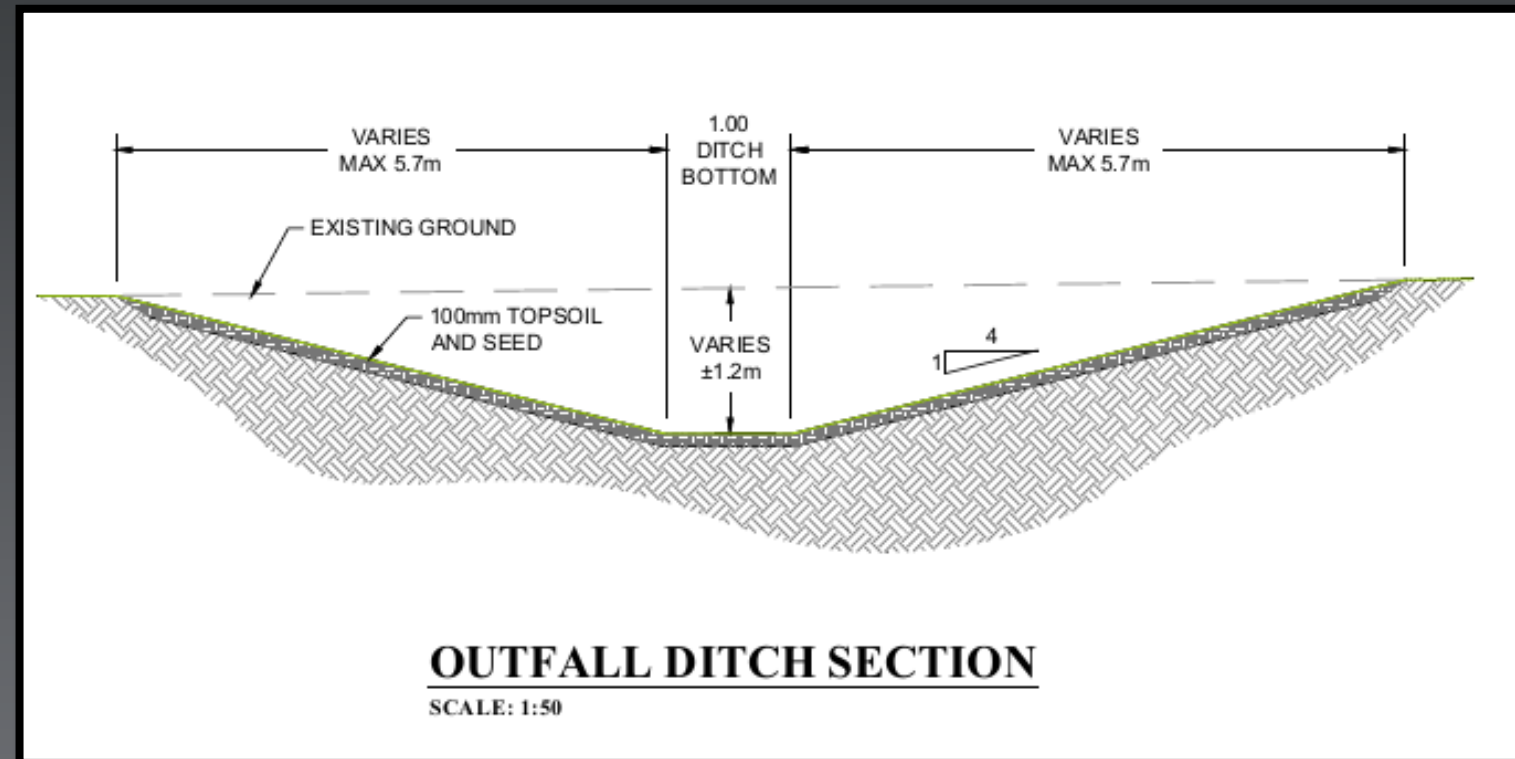


PAGE WIRE FENCE DETAIL

SCALE: N.T.S.

Drainage Path

A small drainage channel was designed to convey water from the lagoon to the existing roadside ditch adjacent to Rd15E (the South Malontor Drain).





Lagoon Operation Procedures

Operation of a Facultative Lagoon

1) Isolation of Secondary Cell

- Prevents additional raw wastewater from entering the cell.
- Allows settling of solids and UV treatment of pathogens.
- Total isolation time is 2 weeks.

2) Effluent Testing

Samples are collected from the secondary cell. Samples are sent to an accredited laboratory for testing, including;

- E.coli,
- Nitrogen,
- TSS,
- Phosphorus,
- And BOD.

3) Trickle Discharge

Following successful test results, the outlet valve is partially opened, allowing treated effluent to exit the secondary cell slowly. The valve is adjusted as the water level lowers to maintain a uniform flow.

Failed Tests

Should the test results of the effluent samples fail, the wastewater will be allowed to sit for an additional 2 weeks, before retesting.

No effluent is allowed to be released until it meets the criteria as outlined in *Design Objectives for Wastewater Treatment Lagoons* and the Lagoon's specific *Environmental Act License*

Emergency Discharge

Emergency Discharge: Discharge of effluent from the lagoon outside of license requirements (effluent quality / timeframe) due to possibility of overflowing the lagoons berms

Reporting of Non-Compliance Events

- Outlined within the lagoon's license, requires operators to inform MECC should maximum depth ever be exceeded
- Excessive exceedance leads to third party review

Freeboard Requirements

Design Objectives for Wastewater Treatment Lagoons specifies the requirement of 1m of freeboard in all cells.

This provides an additional volume of 9,980 m³ which equates to an additional 92 days of storage which can be utilized prior to needing an emergency discharge.

Conclusion

- A lagoon in Manitoba is designed in accordance with “Design Objectives for Wastewater Treatment Lagoons”, Published by MECC. These objectives in Manitoba are empirically based with a concentration-based discharge vs a site-specific discharge criteria.
- Harbor Colony’s lagoon EAP was submitted in 2023 and has been subject to extensive review by TAC, the lagoon has been designed in accordance with applicable Acts and Regulations.
- MECC has recommended that an Environmental License be issued as the EAP has been reviewed by all Provincial Departments and no objections have been filed.
- The Phosphorus loading to lake Winnipeg has been calculated at 27.05kg/ year, this is 0.0000367% of total loading to Lake Winnipeg
- We are here today to provide details to CEC answer all questions and ask that a recommendation for the license to be issued be made to the Minister of Environment