Dalhousie Disposal Solutions
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Confined Disposal Facility

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1. Scope of Work

Problem:

- New wharf to be constructed in Nova Scotia, Canada and as a result will require 35,000m^3 of contaminated soil to be dredged and disposed of.

Solution:

- Build a confined disposal facility (CDF) where the soil can be properly contained and free of harm to humans and the environment.

2. Initial Conditions

2a. Dredged Material

Soil Classification: Organic Silt & Silty Sand
Hydraulic Conductivity: 10^{-4} to 10^{-6} cm/s
Water Content: 40-50%
Bulk Density: 19.8 kN/m^3

Metals exceeding the Environmental Quality Standards for Contaminated Sites:

- Cadmium
- Cobalt
- Iron
- Lead

2b. Site Location

Figure 1: Existing disposal cell (blue). Proposed disposal footprint (yellow). (Google Maps, 2019)

- 19 test pits taken, 17 within the proposed footprint
- Site slopes North to South
- Site soil is classified as silty sand with gravel, with fracture bedrock and the water table on average 3.2 meters below the ground surface

3. Design Process

3a. Earth Works

- Interior slopes: 2.5:1
- Exterior slopes: 3:1
- Top Berm width: 5m

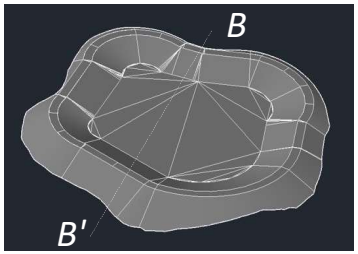


Figure 2: Civil 3D CDF Design.

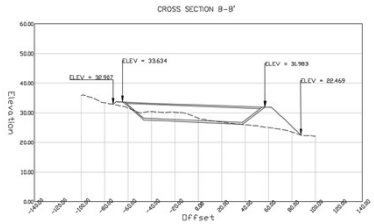


Figure 3: Cross section *B-B'* of final design. Existing ground (dotted line).

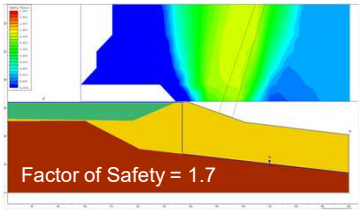


Figure 4: Cell filled with dredge material. Silty sand with gravel (yellow), fractured bedrock (red), dredge material (green).

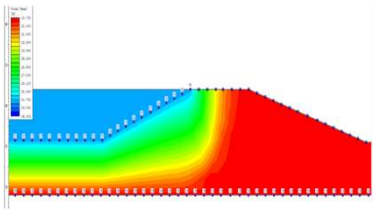


Figure 5: Seepage analysis for total head.

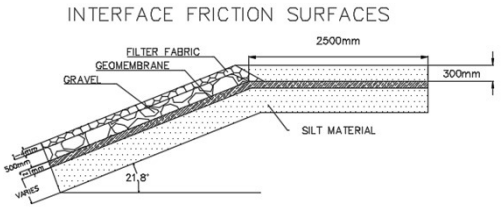


Figure 6: Infinite slope analysis components.

- Runout design of 2.5m for geomembrane
- Geomembrane must have minimum tensile strength of 5.4 kN/m
- Factor of safety = 1.5

3b. Liner System

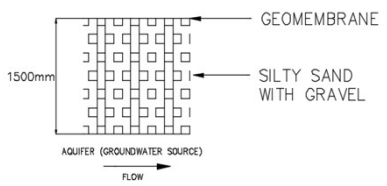


Figure 7: Liner system schematic with 1.5m of silty sand with gravel and 1mm thick geomembrane.

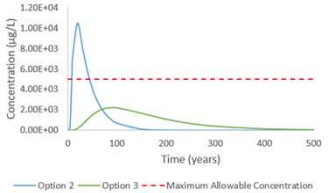


Figure 8: Contaminant (Zinc) concentrations into the aquifer over a period of time.

3c. Leachate Collection System

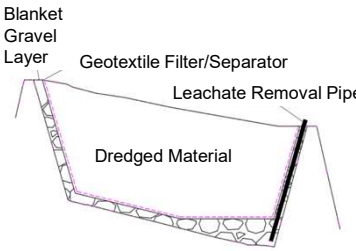


Figure 9: Cross section from the highest to lowest elevation point.

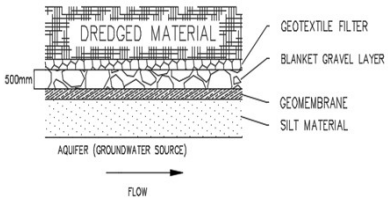
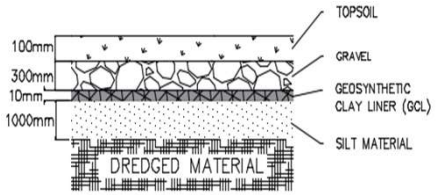


Figure 10: Leachate collection system schematic.

3d. Cover System



- Model generated using HELP software by US EPA
- Design allows for infiltration of 15 cm per year

4. Conclusion & Recommendations

- The CDF can hold a maximum of 48,500 m^3
- The berms are capable of encompassing the lateral flow and has an adequate factor of safety greater than the minimum required for permanent slopes.
- Estimated contamination levels in the aquifer are less than the maximum guidelines.
- Allowable infiltration through the cover system.
- Monitor leachate collection system. Collection trucks to periodically pump leachate out of the cell for treatment.

5. References & Acknowledgements

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- **Acknowledgements:** We would like to thank Dr. Craig Lake and Matthew Charles