

## Scope of Work

The current wastewater treatment system does not meet wastewater systems effluent regulations being implemented in Nunavut; therefore, the community needs a wastewater system overhaul.

## Project Location

The hamlet of Naujaat is a small community located in the territory of Nunavut at the northern end of Repulse Bay. The tundra climate of Naujaat presents challenges such as year-round permafrost covering much of the territory as a result, water is transported to each residential building by truck and placed in a storage tank outside (Daley et al., 2014).

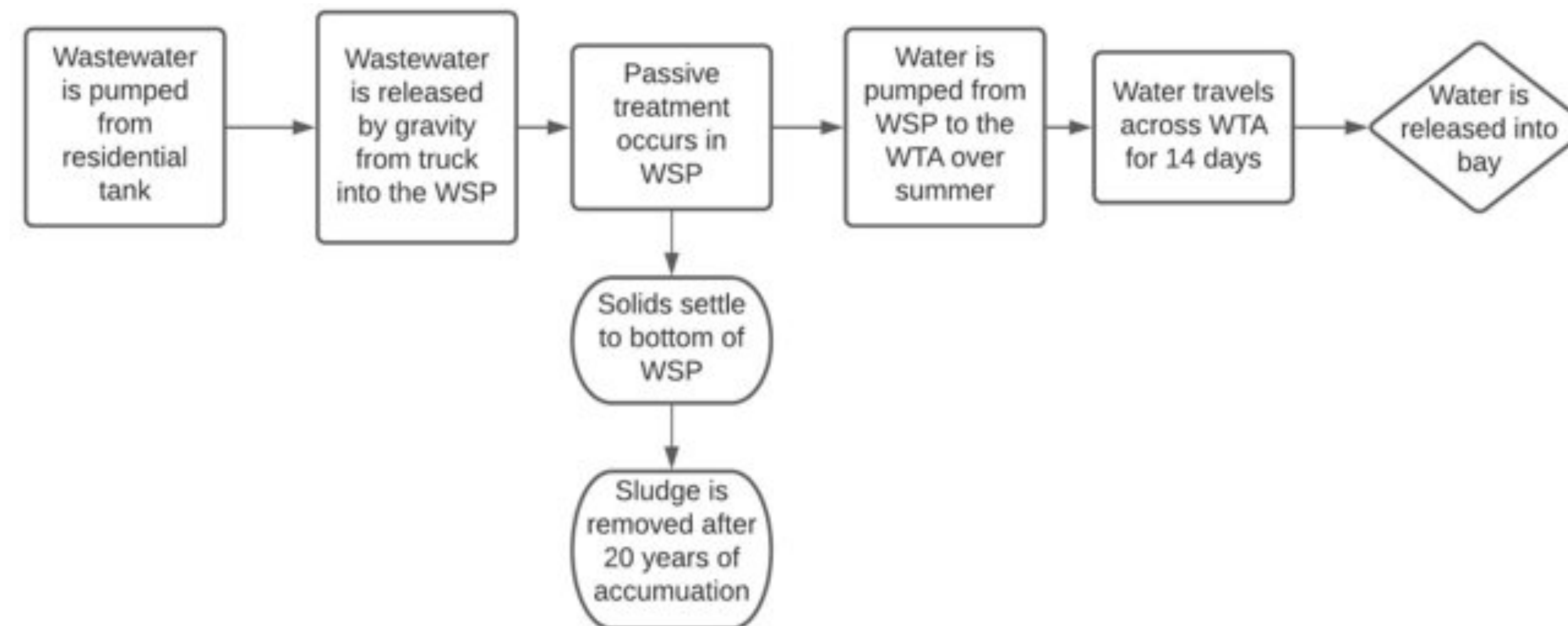


## Regulation

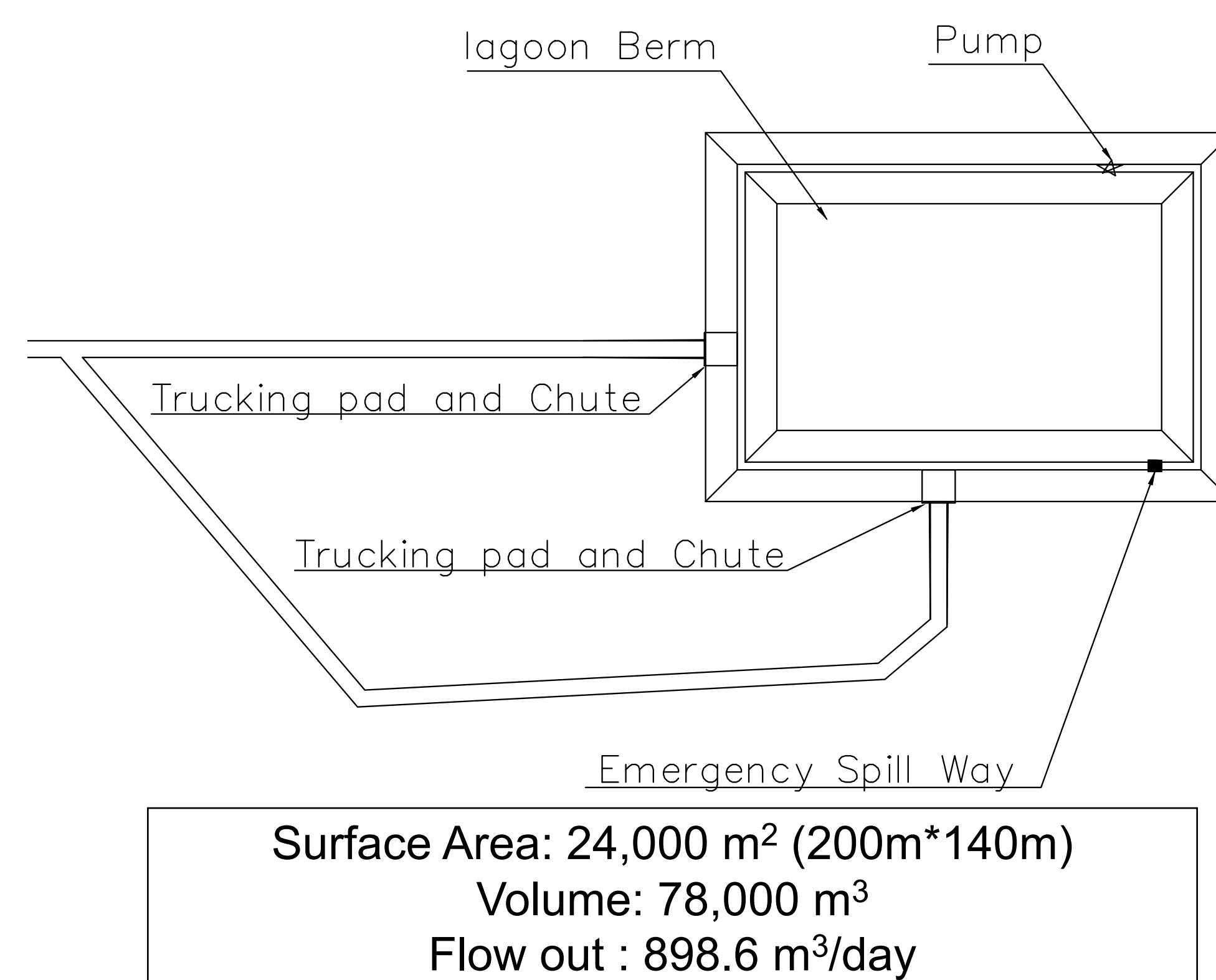
This conceptual design was created to be in accordance with the CSA standard for *Planning, design, operation, and maintenance of wastewater treatment in northern communities using lagoon and wetland systems* (2019). This guidance document sets minimum targets and sizing required for passive wastewater treatment in communities such as Naujaat. In the table below the allowable concentration of contaminants as set by the CSA (2019) can be observed. *E. coli* is not included in the guideline, but the Nova Scotia guideline of 200 CFU/100 mL was used in this design (CWRS, 2016).

Parameter	Allowable Concentration (mg/L)
CBOD <sub>5</sub>	<25
TSS	<25
TRC	<0.02
NH <sub>3</sub> -N	1.25

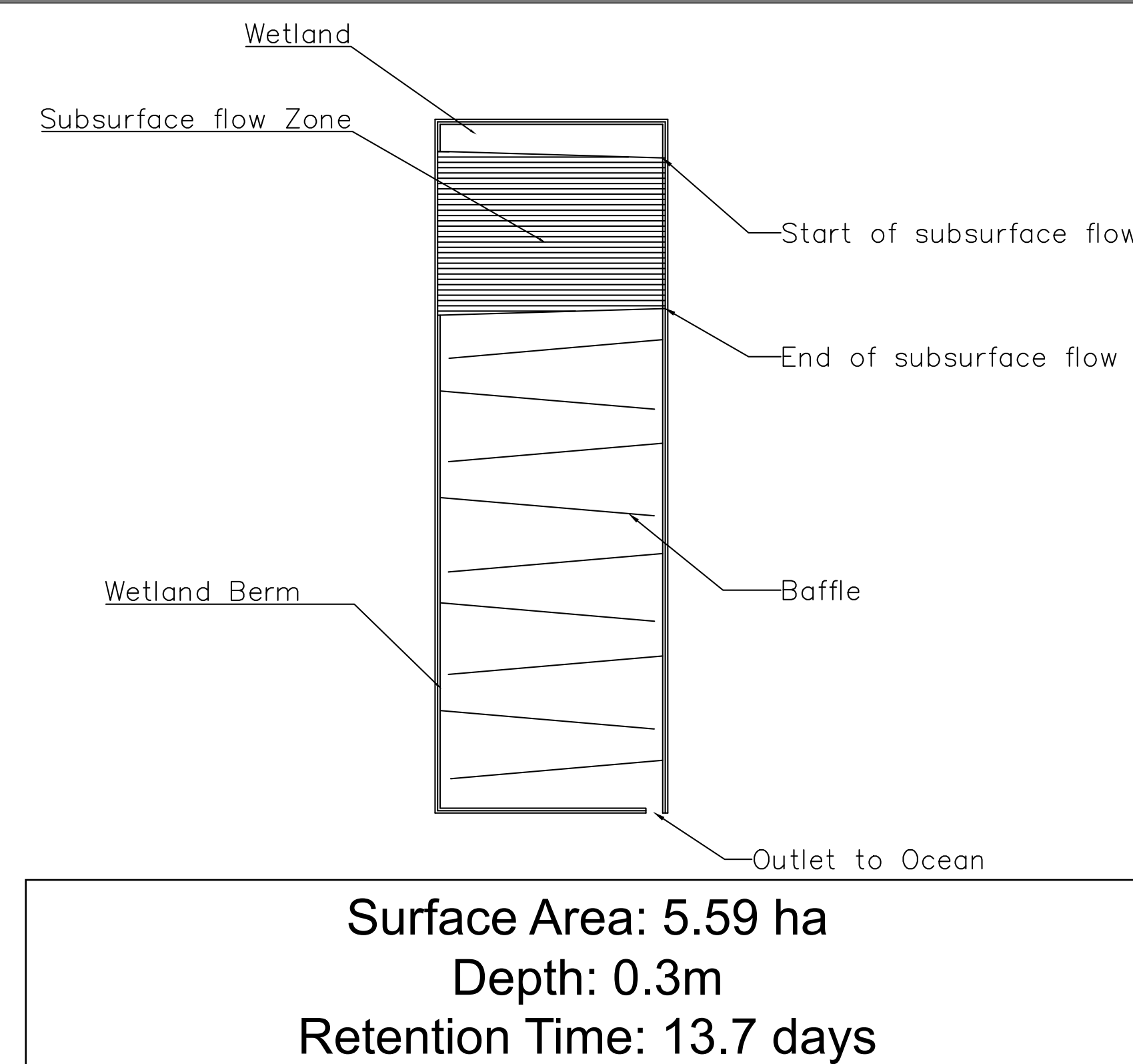
## Treatment Train



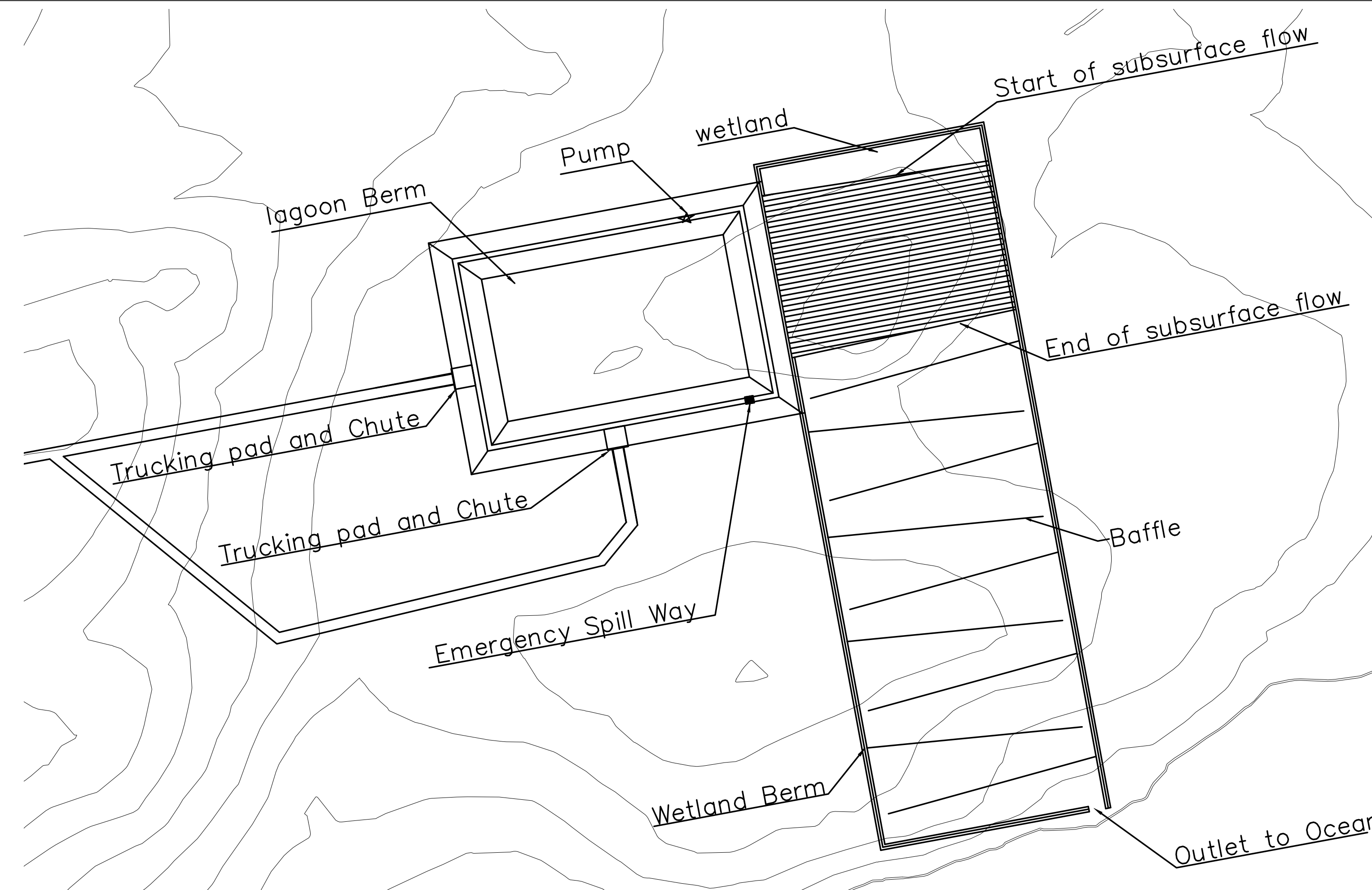
## Wastewater Stabilization Pond



## Wetland Treatment Area



## Project Layout



Overview of Wastewater Treatment System for Naujaat, NU with key features highlighted

## Performance Modelling

Modelling of the treatment performance was done using methods developed by the CWRS. The WTA was modeled as three tanks in series for a discharge period of 80 days. The design includes subsurface flow to further reduce contaminant concentrations which is not accounted for in the model. It is anticipated that reduction in concentration will be greater than shown below.

Parameter	Initial Concentration	% Reduction
<i>E. coli</i>	1.2x10 <sup>5</sup> CFU	97
CBOD <sub>5</sub>	462 mg/L	93
TSS	324 mg/L	90
TN	131 mg/L	91
TAN	94 mg/L	94
NH <sub>3</sub> -N	1.9 mg/L	95
TP	16 mg/L	64

## Economic Analysis

Capital costs sum: \$5,500,000  
Contingency fund (15%): \$717,305  
Operational & Maintenance sum (20 years, NPV): \$6,338,341.56

## Discussion and Recommendations

Due to the remote location of Naujaat, the availability of location specific data was limited. This has impacted all aspects of the project. Before the construction of a wastewater treatment system in Naujaat it is recommended that a complete site investigation be completed to determine the composition of the proposed location. Additionally, a site investigation would allow for the location of berms and baffles in the WTA to be adjusted based on site topography. This would allow for both the project size and performance to be optimized.

To further optimize the design, wastewater influent needs to be parameterized. This would allow for accurate representation of the community's wastewater conditions and all for adjustments to performance modelling of the system.

## Acknowledgements

This project would not have been possible without the help of the project's advisor, Dr. Rob Jamieson. He came prepared to listen to and challenge the team allowing each member to flourish individually while facilitating the growth of the group. The team is thankful for the hours of meeting time, words of guidance and innumerable resources which has provided.

## References

Canadian Standards Association (CSA). (2019). *Planning, design, operation, and maintenance of wastewater treatment in northern communities using lagoon and wetland systems*. CSA W203:19.  
Daley, K., Castleden, H., Jamieson, R., Furgal, C., & Ell, L. (2014). Municipal water quantities and health in Nunavut households: An exploratory case study in Coral Harbour, Nunavut, Canada. *International Journal of Circumpolar Health*, 73(1).  
CWRS. (2016, April 4). *Guidelines for the Design and Assessment of Tundra Wetland Treatment Areas in Nunavut* [Scholarly project]. Government of Nunavut.