Sanitary System Design

Ahmed Elkamash, Hanan Ulusow, Harjiwan Kang, Jasman Bilna, Minglu Shao, Stead Mbala, Tommy Michelussi

Dr. Kerry Black, Ayla Lauret, Brock Dyck
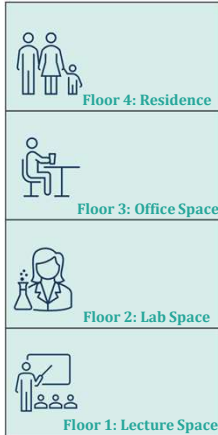
Phase 1

Phase 2

Problem & Goals

- CleanFlow Systems Ltd. are conducting a project to determine peak wastewater generation values for a proposed multi-use building on the UCalgary campus

- Current industry standards in Alberta that predict wastewater generation use values which are not specific to post secondary campuses.

Goals
- To develop a method for estimating peak wastewater flows on campus

- For more effective sizing of future sanitary systems.

Floor 4: Residence
Floor 3: Office Space
Floor 2: Lab Space
Floor 1: Lecture Space

- Cleanflow used the flowrates from Phase 1 to predict and model flows for the new proposed building

- In initial model, surcharging occurs in the existing pipes during peak flow

Goals
- To model and design a sanitary system for the proposed building using wastewater generation flows from Phase 1
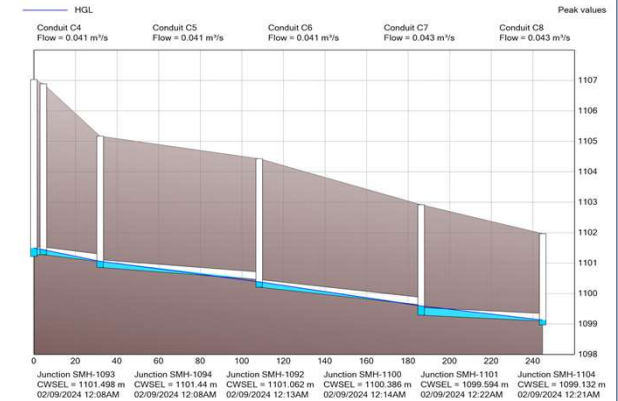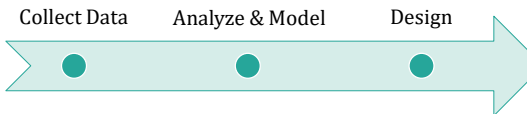
Collect Data   Analyze & Model   Design

Figure: Modelled Sanitary Pipe System Profile in PCSWMM

Design and Results

Phase 1

- We developed three alternative strategies to determine building populations and calculate the average daily design flow per capita (G), a crucial factor in sanitary system design.

Strategy
- Gathered data on the number of occupants attending lectures using classlists and floorplans

- Observed number of occupants in study spaces and common spaces

	Wastewater Flow Generation (L/day/capita)
Lecture Spaces	9.06
Lab Spaces	30.38
Library Spaces	65.65
Student Residence	63.09

Figure: Example Floor Plan of Student Residential Building

Figure: Lecture Spaces on Campus

Phase 2

- Final design is to reinforce the concrete pipe material and use pipes as a temporary storage during high flow This design is unique since it allows for brief durations of surcharging

- Reinforce concrete pipe with cured in place pipeline (CIPP) that has a life expectancy of 50-60 years [1]

Benefits of Final Design

⬇ Lifecycle cost than total pipe replacement

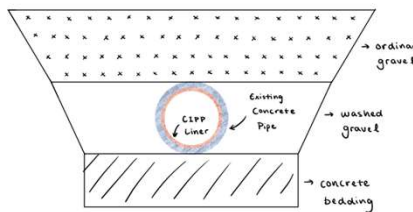⬇ Construction Time and Labor

⬆ Convenience for students

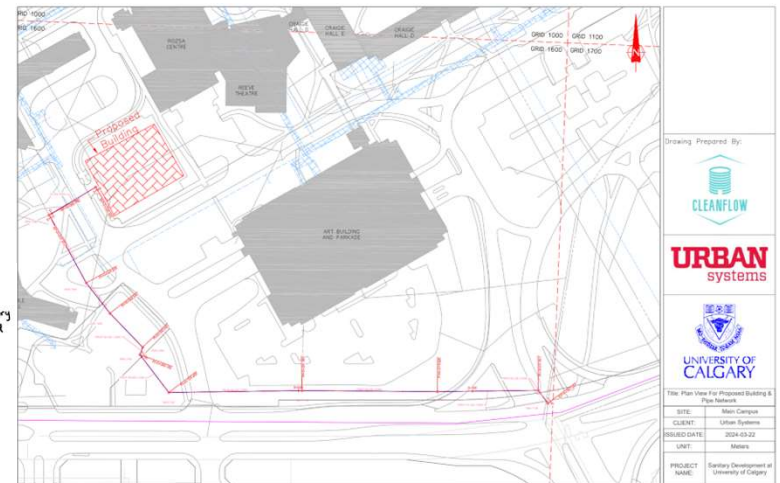Figure: Cross Section of Cured In-Place Pipeline (CIPP) Diagram

Figure: Final Plan View Drawing of Sanitary System Pipe Design

References

1. J. S., "How long does CIPP lining last?," Trenchless Pipe Repair, https://restorepipe.com/blog/how_long_CIPP_lining_last#:~:text=If%20properly%20maintained%2C%20CIPP%20lining,applied%20to%20it%20over%20time.Nunc consequat, metus ac sagittis aliquam, purus quam euismod purus, non ullamcorper augue orci eget ligula.