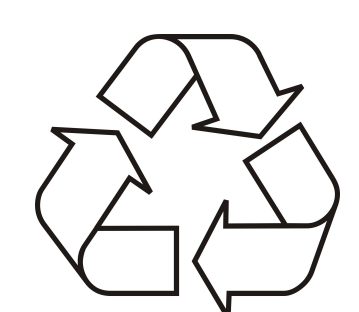
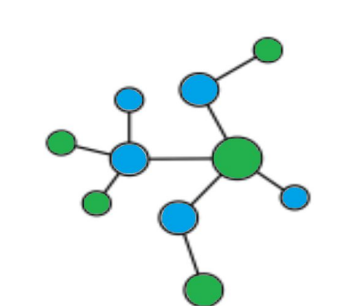


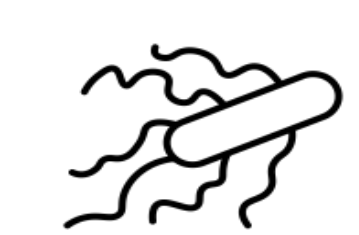
Background



Problem: ~64,000 tonnes/year of plastic is consumed in BC, but less than 50% is recycled



Biotechnology: IsPETase, an enzyme found in *Ideonella sakaiensis* that degrades PET plastic



Production: industrial scale production of 5,000 kilograms of IsPETase annually using *E. coli*

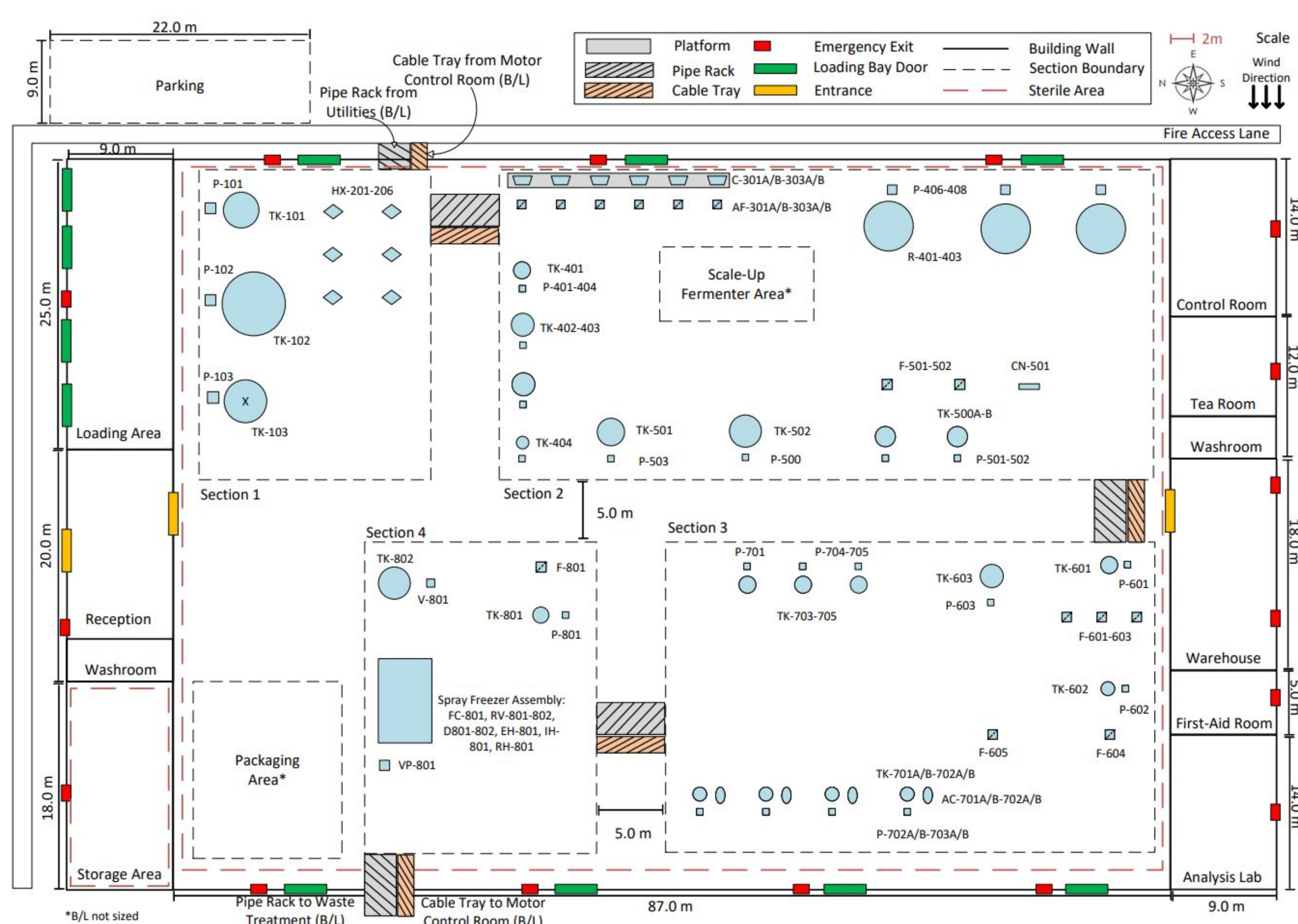


Application: degrade 20% of British Columbia's annual PET plastic waste (13,000 tonnes)



Objective: determine if industrial scale PET recycling utilizing IsPETase is feasible

Plant Layout



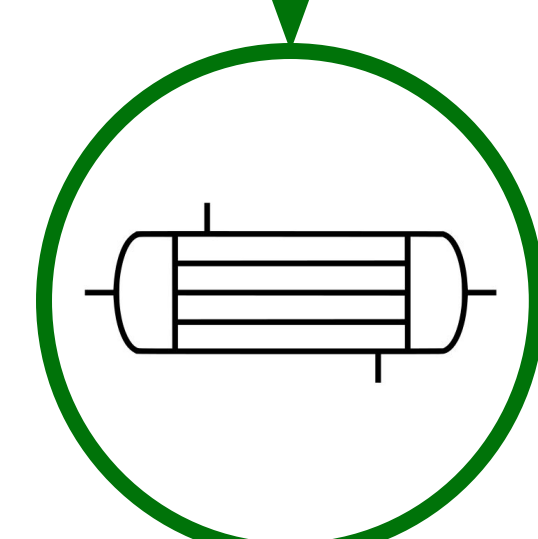
Plant Footprint: 6615 m²

Process Description



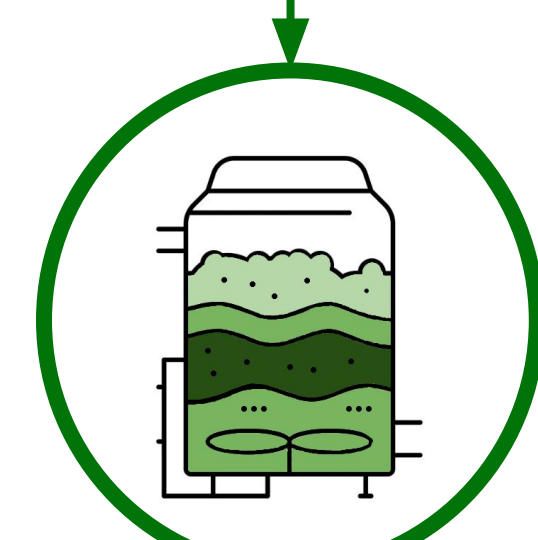
Media Preparation

Two separate concentrations of growth media are prepared for bioreactor startup and the fed-batch phase.



Media Sterilization

Growth media is sterilized using heat exchangers, medium pressure steam, and cooling water.



Fermentation

Three 66.7 m³ bioreactors undergo a total of 789 fed-batch fermentation cycles annually.

Downstream Processing

Biomass Separation

A rotary drum filter separates the biomass from the extracellular IsPETase.

Tangential Flow Filtration

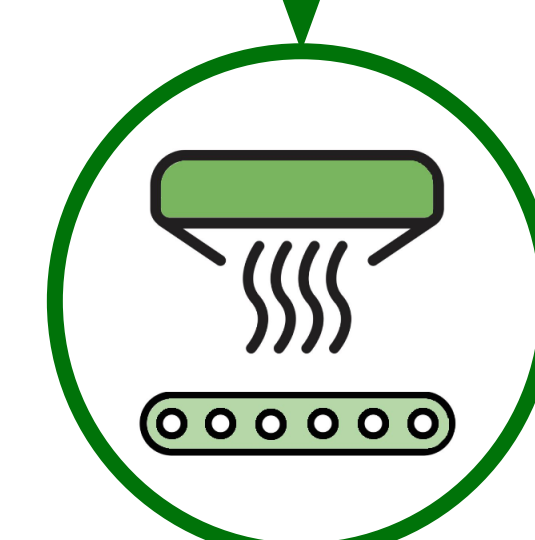
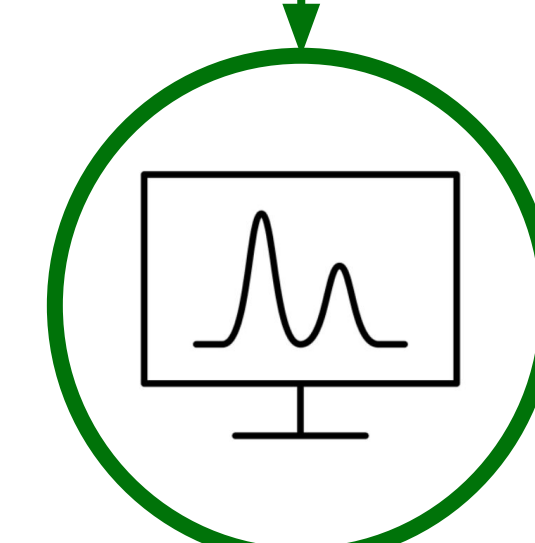
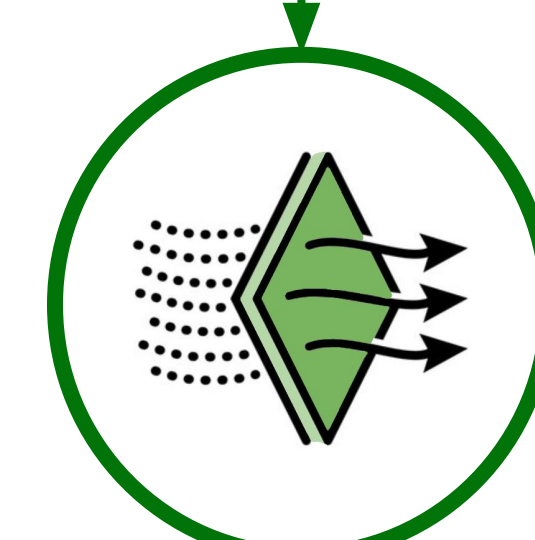
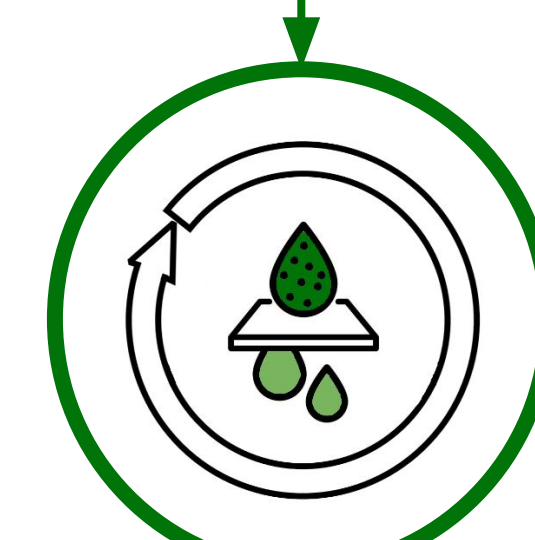
Three stages of tangential flow filtration concentrate IsPETase for further downstream processing.

Product Purification

Two 565L HIS-tag affinity chromatography columns are run in parallel to isolate IsPETase.

Drying

IsPETase exits an innovative spray-freeze drying system in its final product form as a powder.



Environmental Analysis

Energy Cogeneration Water Reclamation



5 GWh/year

Produced via biomass cogeneration

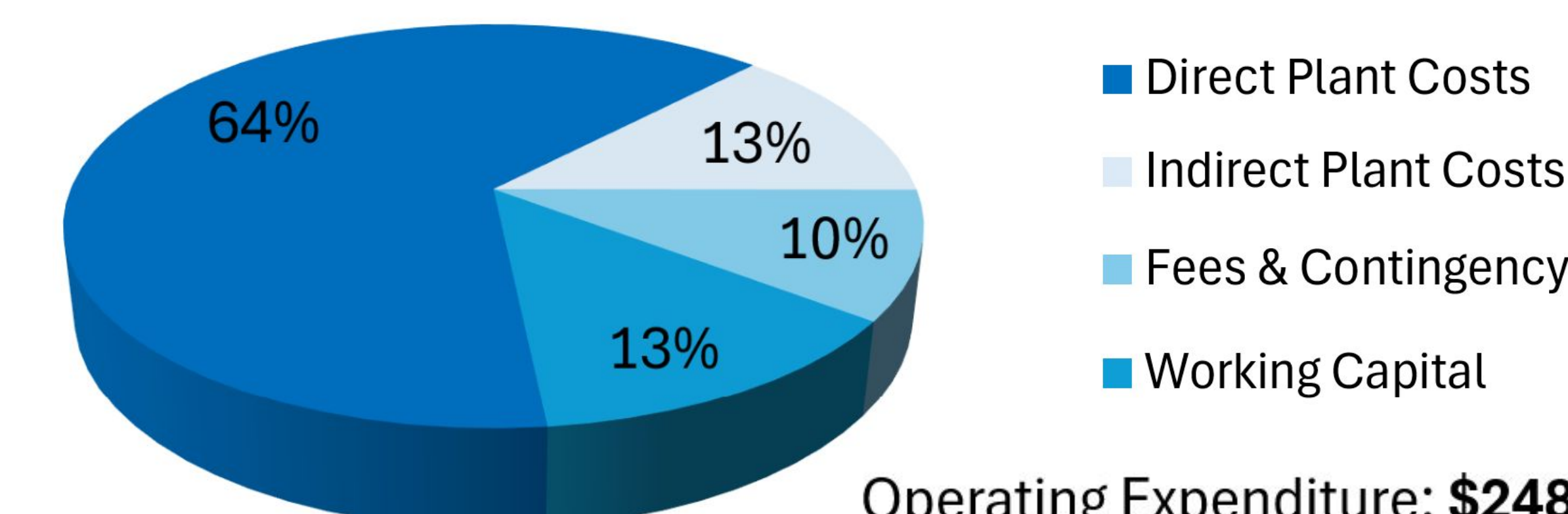


196,525 tons/year

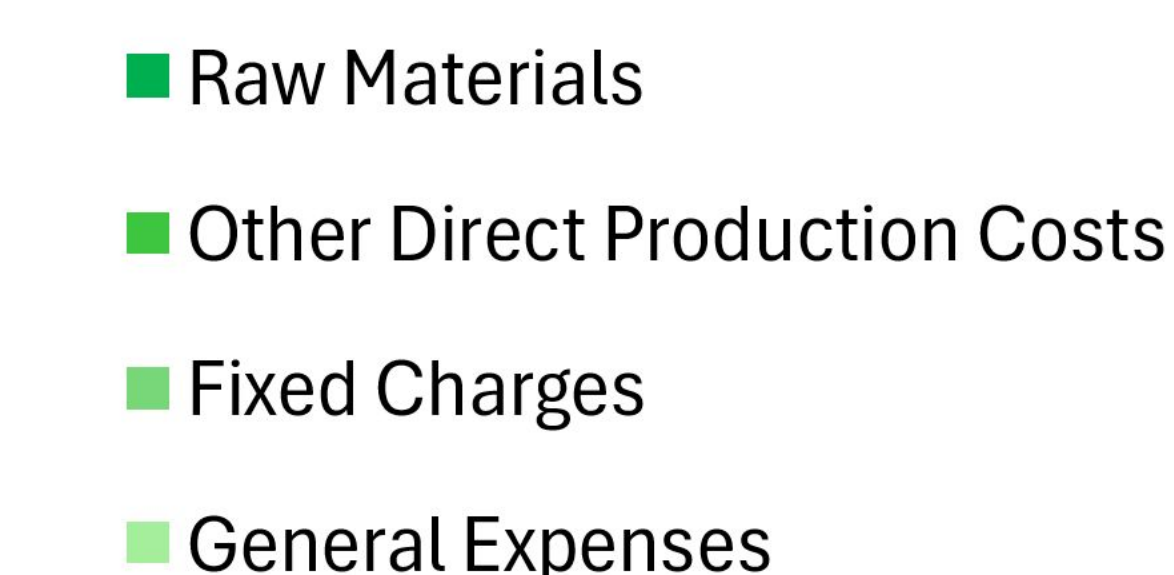
Treated and reused in the process

Economic Analysis

Capital Expenditure: **\$82.5 M CAD**



Operating Expenditure: **\$248 M CAD**



Estimated Price:
\$53.90/kg

Breakeven Price:
\$48,400/kg

900X increase in enzyme activity or product yield required for venture to breakeven.

Conclusion: the project is infeasible