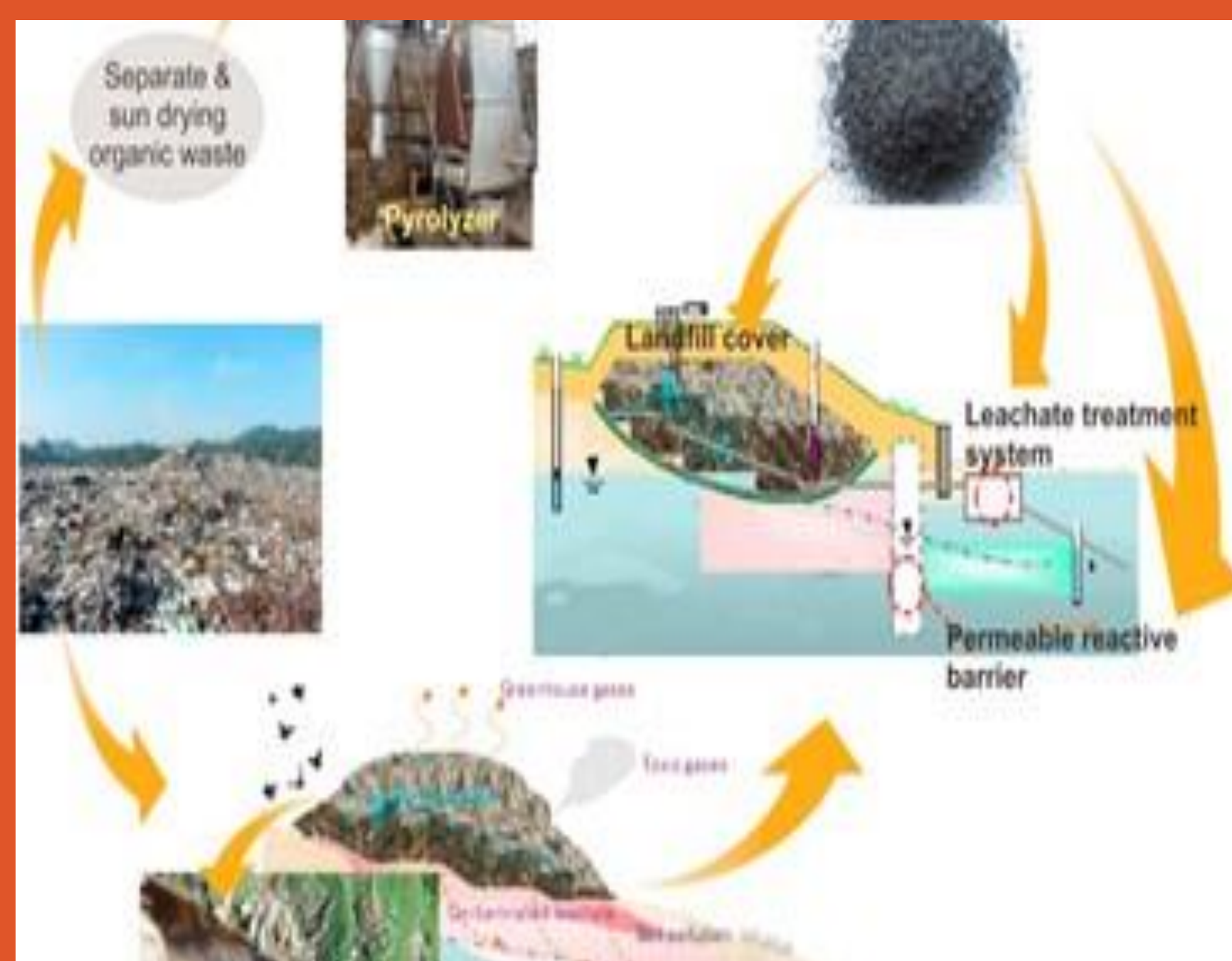


BACKGROUND

- **How is leachate formed?**
 - Leachate is mostly formed from the process of biodecay of organic material, chemical oxidation of waste materials, escape of gas from landfill...etc. Those various formation process lead high concentration of ammonia, organic compounds, heavy metals and inorganic compounds.
- **Why do people need to treat leachate?**
 - Contaminated leachate can impact human health, soil composition, ground water and surface water quality.
 - Some general health problems caused by consuming leachate contaminated water are acute toxic allergies, respiratory disease, infection disease, blood disorders and cancer effects.
 - The heavy metals, degradable and non-degradable pollutants in leachate will affect soil strength and stability by the process of percolation.
 - The pollutants in leachate such as ammonia chloride, heavy metals and sodium will disseminate to surface and ground water and leave water undrinkable.



TREATMENT OF THE TILLAMOOK CLOSED LANDFILL LEACHATE

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Problem Statement: Iron and ammonia concentrations present in leachate from Tillamook Closed Landfill are too high to discharge offsite and must be treated to below permit limits before release. Additionally, treatment system should be as passive as possible and require minimal chemical addition.

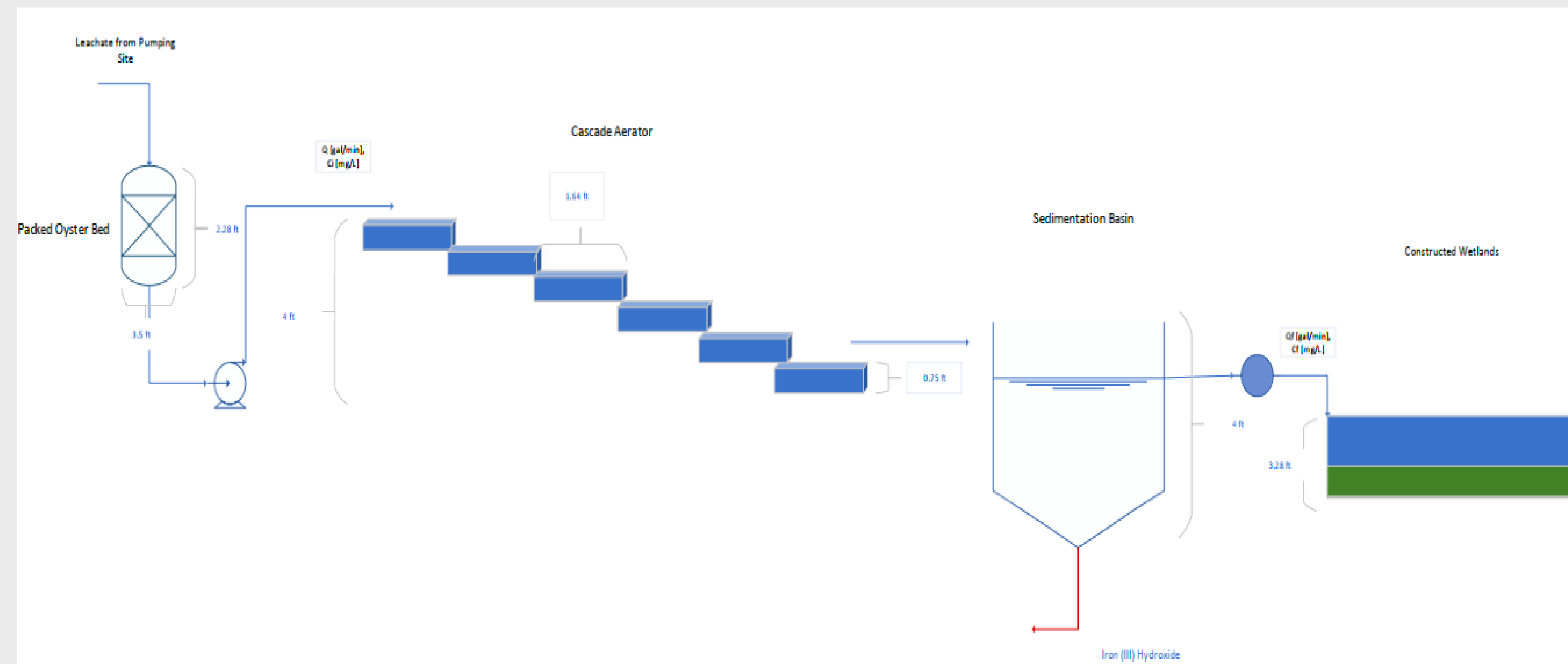


Figure 1: process flow diagram for pilot scale design

METHODOLOGY & APPROACH

The criteria for our design included high removal efficiency, limited chemical additives, passive or near-passive system, and ability to operate during high and low flows.

The team force-ranked these criteria and compared the values of four different alternatives for iron and ammonia treatment. The highest ranked methods were the ones we implemented in our design: Oyster shell packed bed, Cascade aerator with sedimentation basin, and vertical flow wetlands.

Advantages VS Disadvantages Of Approaches

- Oyster Shells Packed Bed
 - low cost for material sources/low land cover usage/low energy consumption/great design feasibility/pH adjustment
 - high maintenance requirement

- Cascade Aeration & Sedimentation
 - high iron removal efficiency/natural process/ low maintenance/inexpensive operation
 - odor emission to environment/high land usage/high cost for construction
- Vertical Flow Wetland
 - natural passive system/low maintenance/low-cost operation/high ammonia removal efficiency/tolerant different temperature/various loading rate
 - large land usage/high energy consumption of pumps implementation

DESIGN ELEMENTS

- Once leachate is collected, it is pumped up to an oyster shell packed bed for pH increase
- Once the pH has been increased to 9, the leachate is sent to a cascade aerator to oxygenate it and encourage iron floc formation
- The oxygenated leachate is then sent to a settling basin to allow the iron precipitate floc to leave the leachate
- Once settled, the semi-treated leachate is sent to a vertical flow wetland system to nitrify the ammonia present in the leachate
- The resulting treated leachate is released to a vegetated swale on the edge of the landfill property

FUTURE WORK

The next steps in our design process include:

- Refining hydraulics analysis for full treatment train
- Scaling up pilot design to full scale operation
- Complete cost analysis for pilot and full-scale design
- Lifecycle and sustainability assessment for the full-scale design

REFERENCES & ACKNOWLEDGEMENTS

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