



Before

- Leaf litter and other debris build up on storm drains, causing clogs and subsequent flooding/traffic on roads
- Debris inside the drain develops algae bloom, causing corrosion and damage to the internal sewer systems
- PENNDOT largely relies on drivers to report blocked storm drains - they cannot clear blockages on the surface until after flooding has occurred

impedebris

Passive Buoyant Storm Drain Filtration

After

- Leaf litter and other debris build up around the perimeter of Impedebris, allowing water to flow into the drain and reduce flooding
- PENNDOT can clear leaf litter around the perimeter on their own schedule, rather than responding to flood reports
- A reduction in leaf litter within the sewer system reduces algae bloom and subsequent damage

Ideation

Prototyping

Testing

Proof of Concept

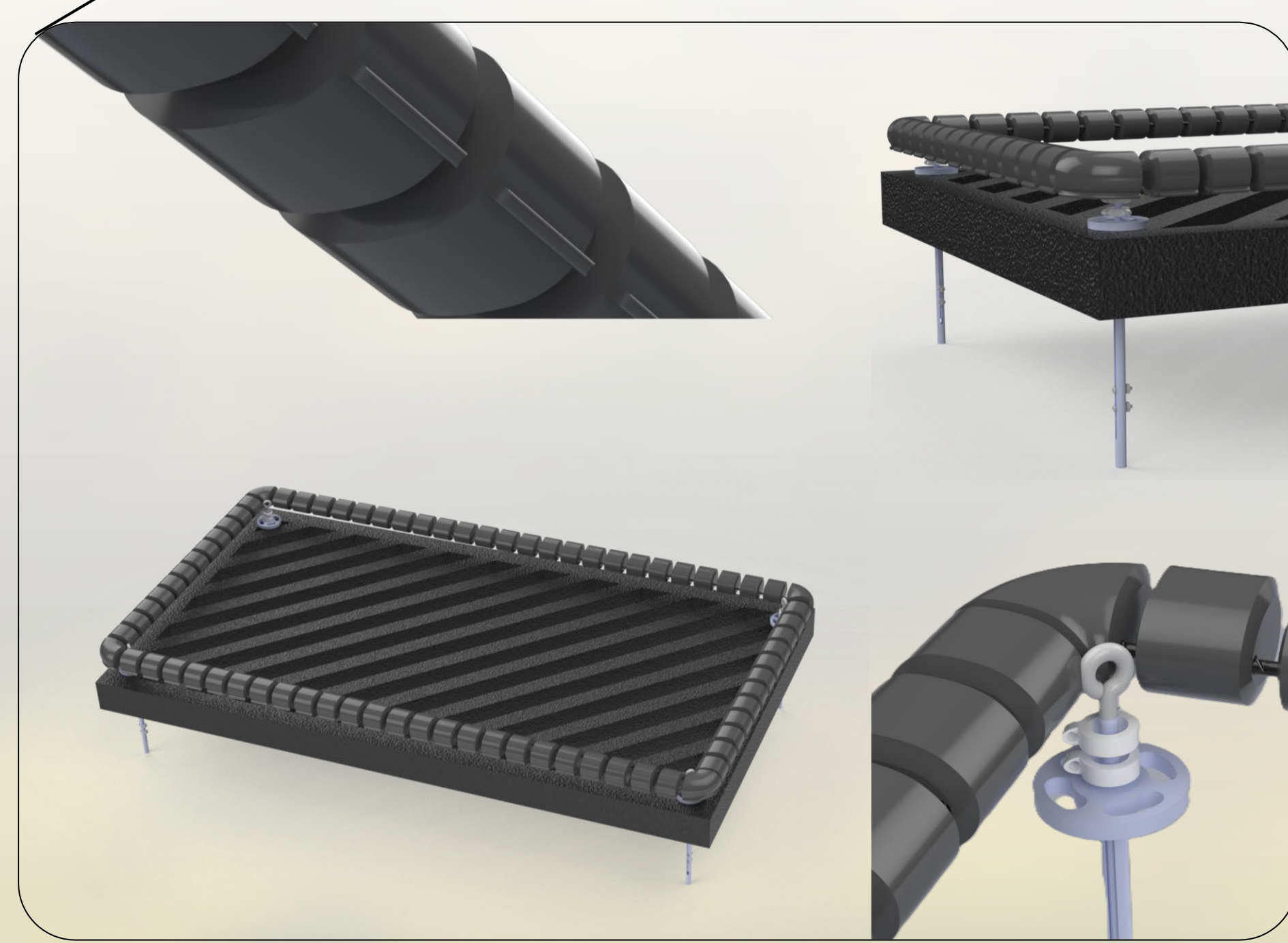
Full Prototype

Refine Testing

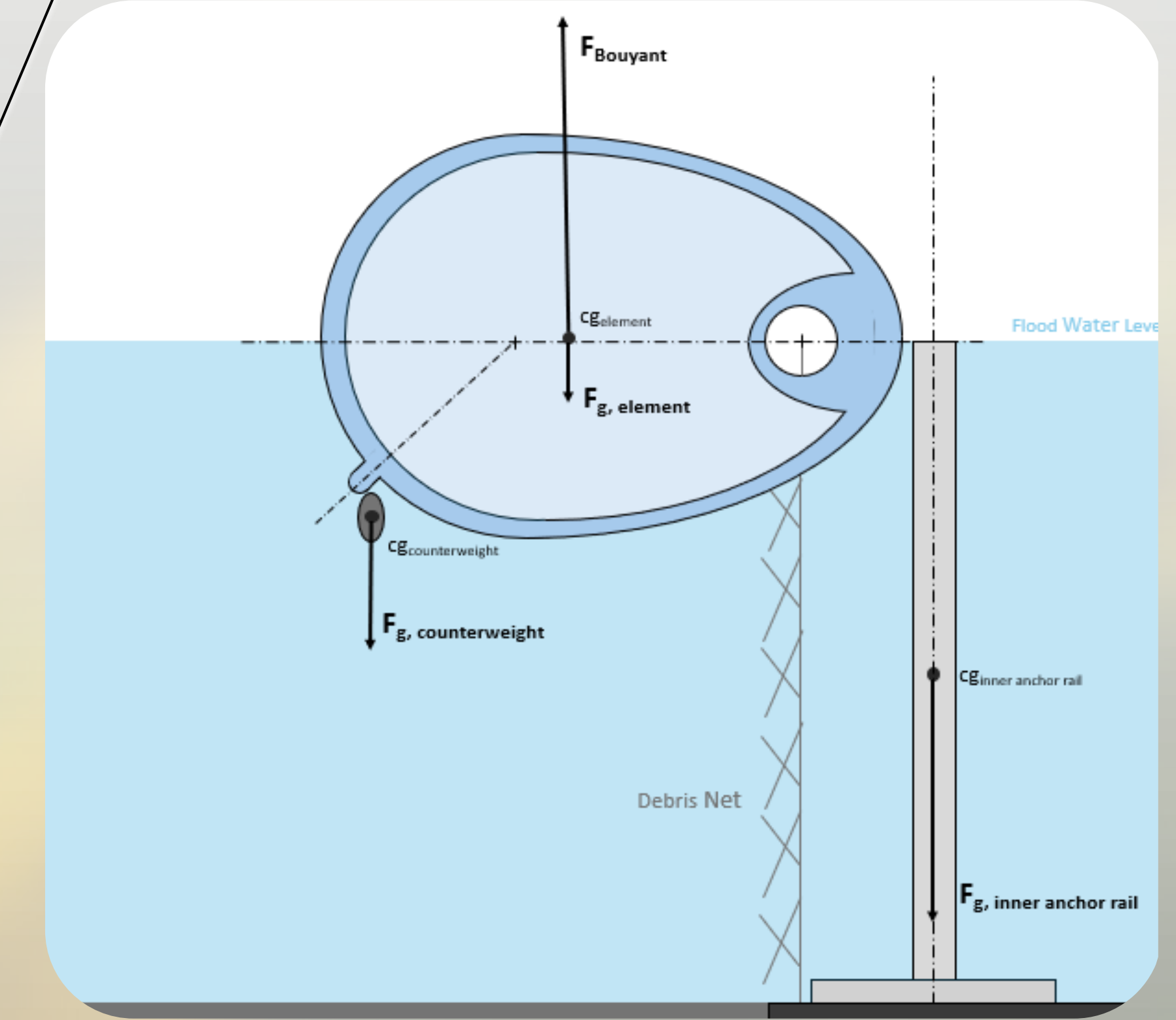
Wide-Scale Manufacturing R&D

COMPLETED

PLANNED



Methods



- A force balance approach was used on the cross section of a corner element to determine the required element size (cross-sectional area).
- For the system to function as a dam, half of each element body must be above water to catch debris - only half of the cross-sectional area creates a buoyant force.
- The buoyant force must be strong enough to counteract the effects of gravity on the element itself, the attached counterweights, the inner rail of the corner anchor system, and the debris mesh.
- A system of equations was used to balance forces and moments such that the system is in static equilibrium, yielding the cross-sectional area/element size required to lift an inner anchor rail of known weight.
- For maximum buoyancy, elements are hollow (air filled) rather than solid - For prototyping/manufacturing purposes, this means they were cast in halves, then sealed together.
- Using a custom water flume, Impedebris was tested for improved volumetric flow rate and buoyancy under various clogging conditions.