

Semi-Aquatic Continuously Roving Utility Bot (S.C.R.U.B)

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PROJECT OBJECTIVES

Build an autonomous robot capable of removing 90-95% of the algae build up on the top of the plate settler assemblies at Ute Water Conservancy District

PROJECT REQUIREMENTS

- Remove 90-95% of visible algae build up
- Cleans one plate every 3 days
- Weigh less than 45 lbs
- Enclosure meets IPX4 rating
- Can last 3 hours on one charge
- Capability of being autonomous minus movement from one plate assembly to the next

RESULTS

- Averaging 96% removal rate
- Cleans 6 plates a day
- Lasts 3 hours on one charge
- Total project weight of 7.4 lbs
- Enclosure Meets IP46 standard
- Barth PLC to automatize

CONCLUSIONS

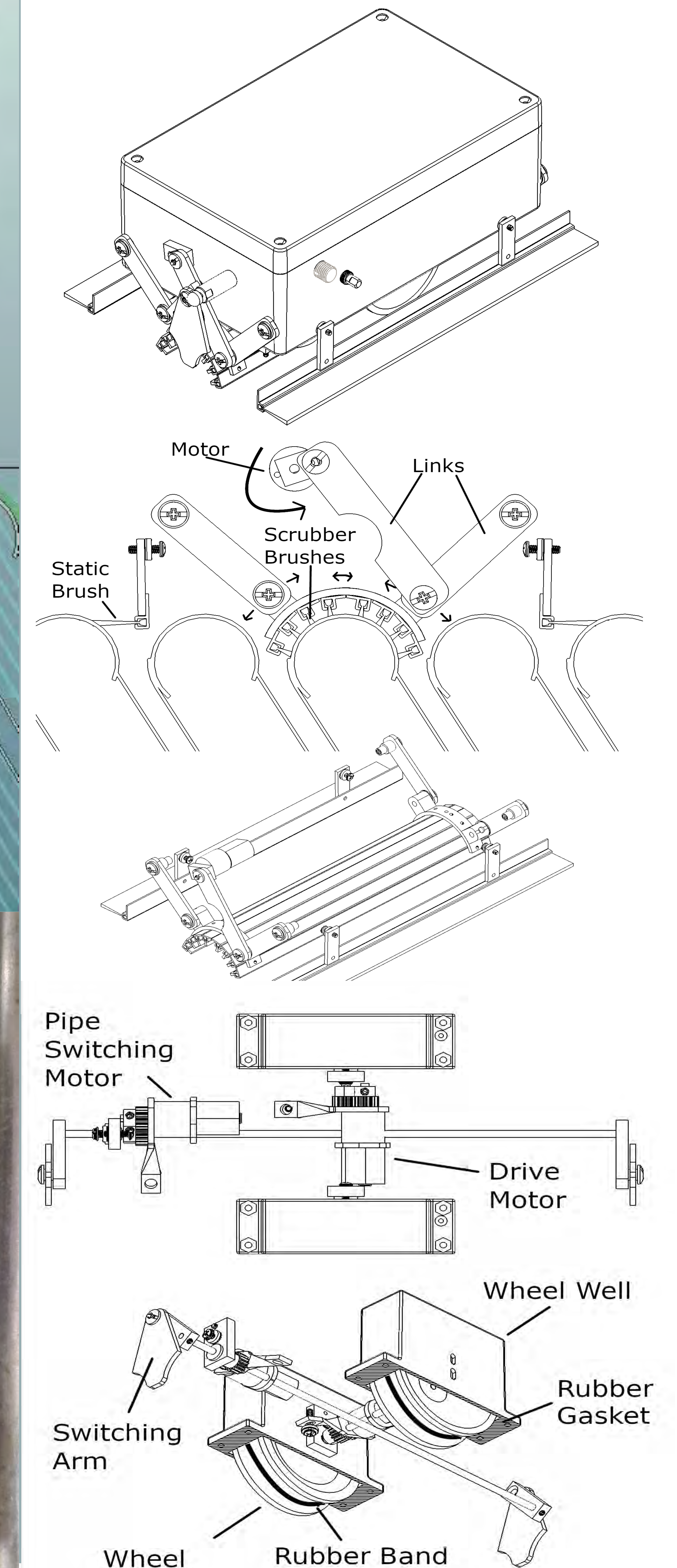
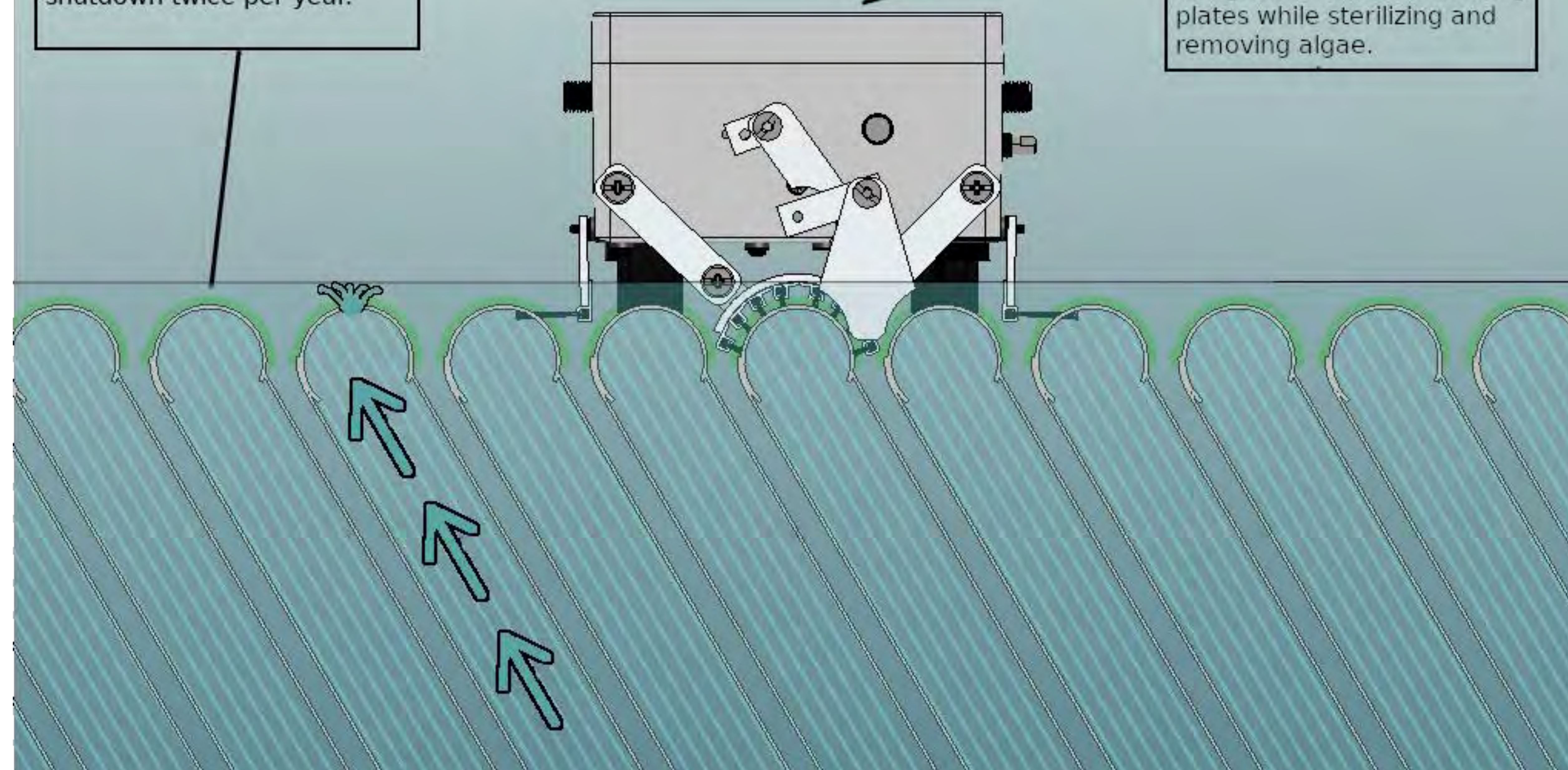
- Parts are easily replaceable
- Water will not compromise enclosure
- Current state of the product is finishing programming and testing

The Problem

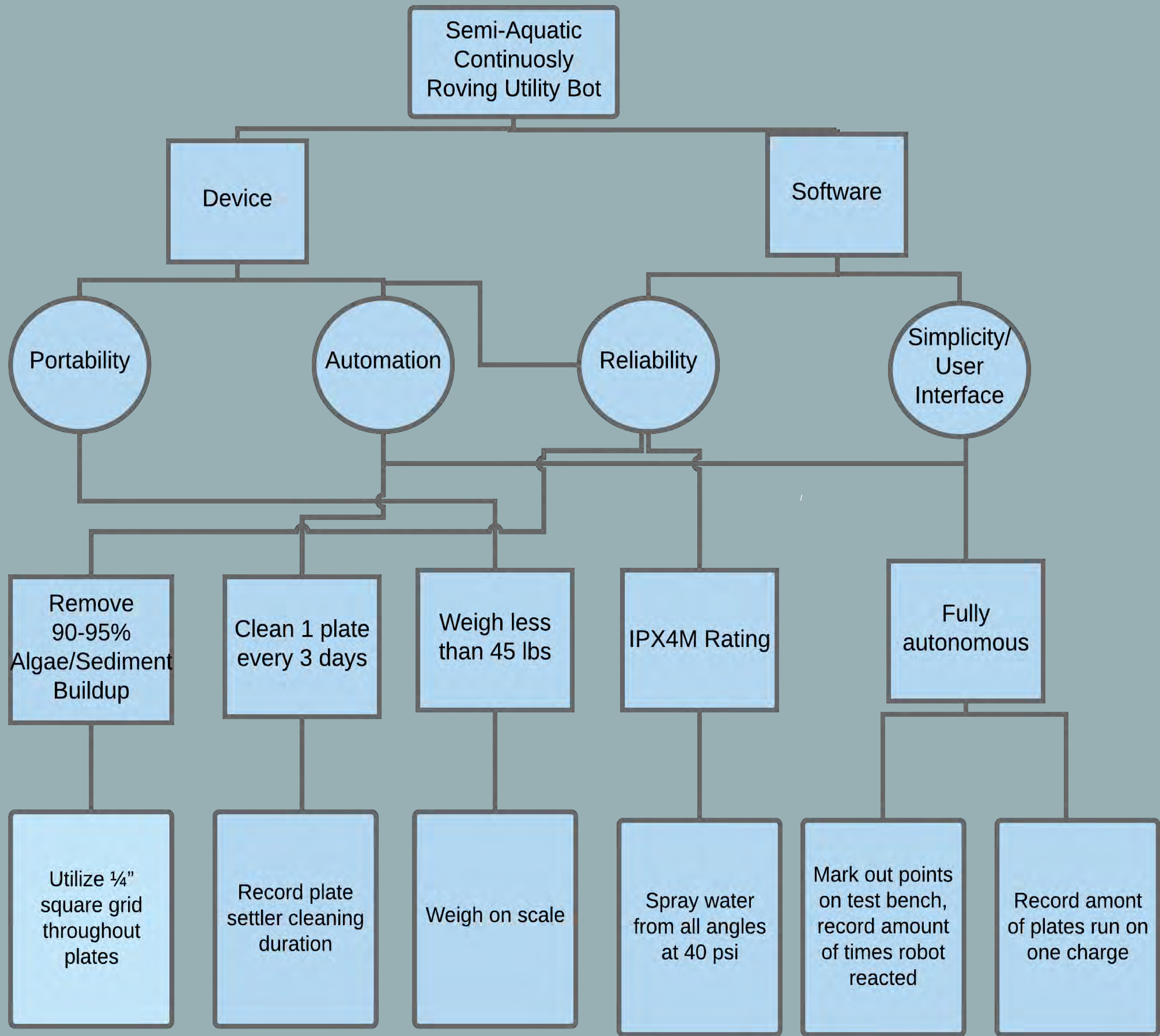
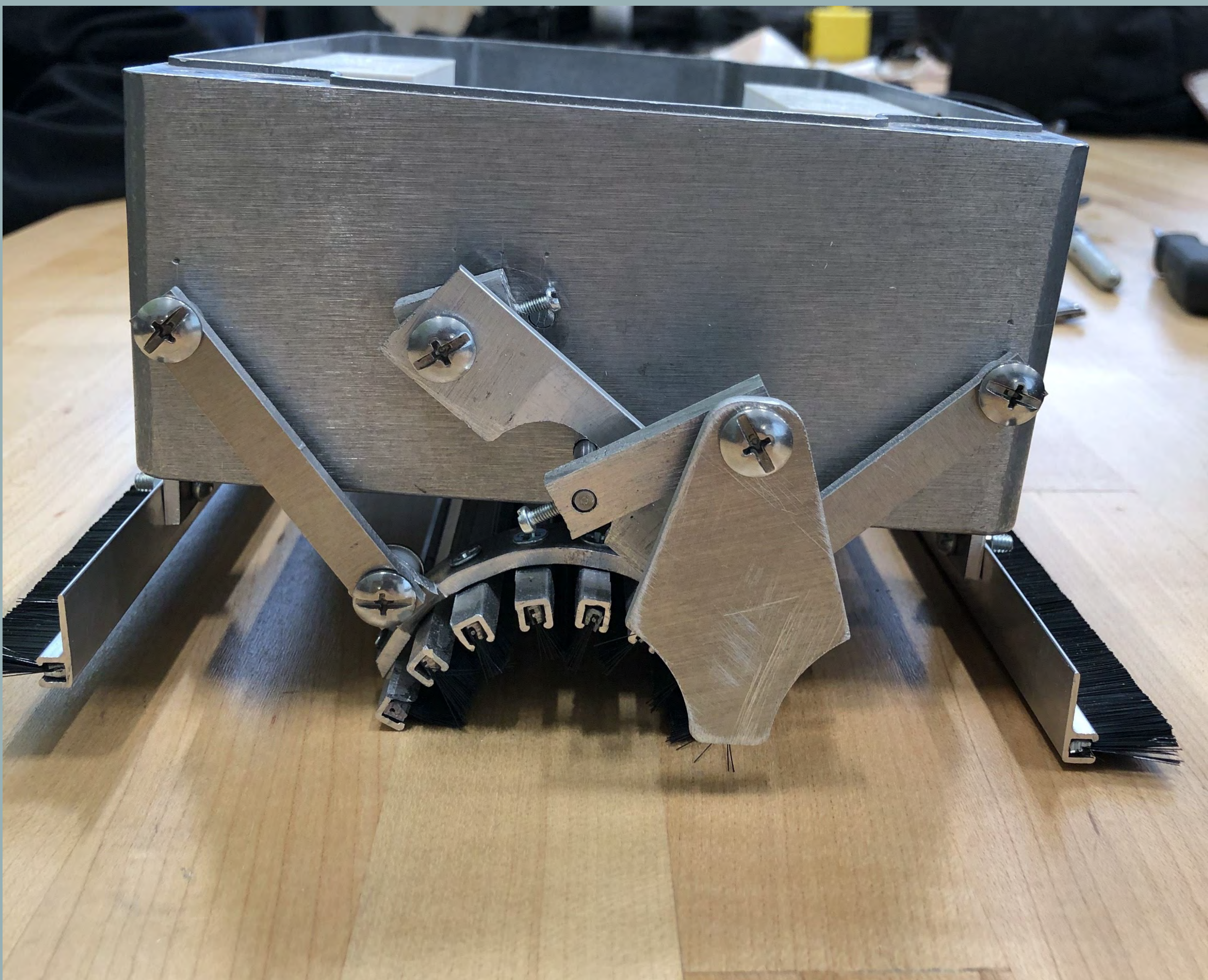
The plate settler assembly at the Ute Water Conservancy District's main plant are coated with algae over time. This leads to a full facility shutdown twice per year.

The Solution

The Semi-aquatic Continuously Roving Utility Bot (S.C.R.U.B.), is a self contained, automated robot designed to traverse settling plates while sterilizing and removing algae.



Semi-Aquatic Continuously Roving Utility Bot (S.C.R.U.B): *Design Evaluation*



Semi-Aquatic Continuously Roving Utility Bot (S.C.R.U.B): *Results*

Table 1: Design requirements and test plan method for evaluation

Requirement	Target Value	Test Method
Fully autonomous	PASS	User testing
Remove 90-95% of algae	95%	User testing
Under 40 lbs	10 lbs	User testing
Waterproof to IP-X4M standard	PASS	User testing
Device works in operating conditions	PASS	User testing
Cleans plate settlers within 180 days (one plate assembly every 3 days)	1 day	Hand calculations and user testing
Labor cost	\$0	Hand calculations and user testing
3D printed wheels	PASS	User testing
Pipe-switcher mechanism	PASS	User testing
IR proximity sensor	1 in	User testing
Bump switch	PASS	User testing
Pipe-switcher switch	PASS	User testing

Table 2: Sediment/Algae Removal Percentage

	Trial 1	Trial 2	Trial 3
Sites Tested	4	7	9
Area Covered (Squares/Division)	5600	9800	12600
Uncleaned Instances recorded (Squares/Division)	183	200	344
Algae/Sediment removal (%)	96.7	98	97.3

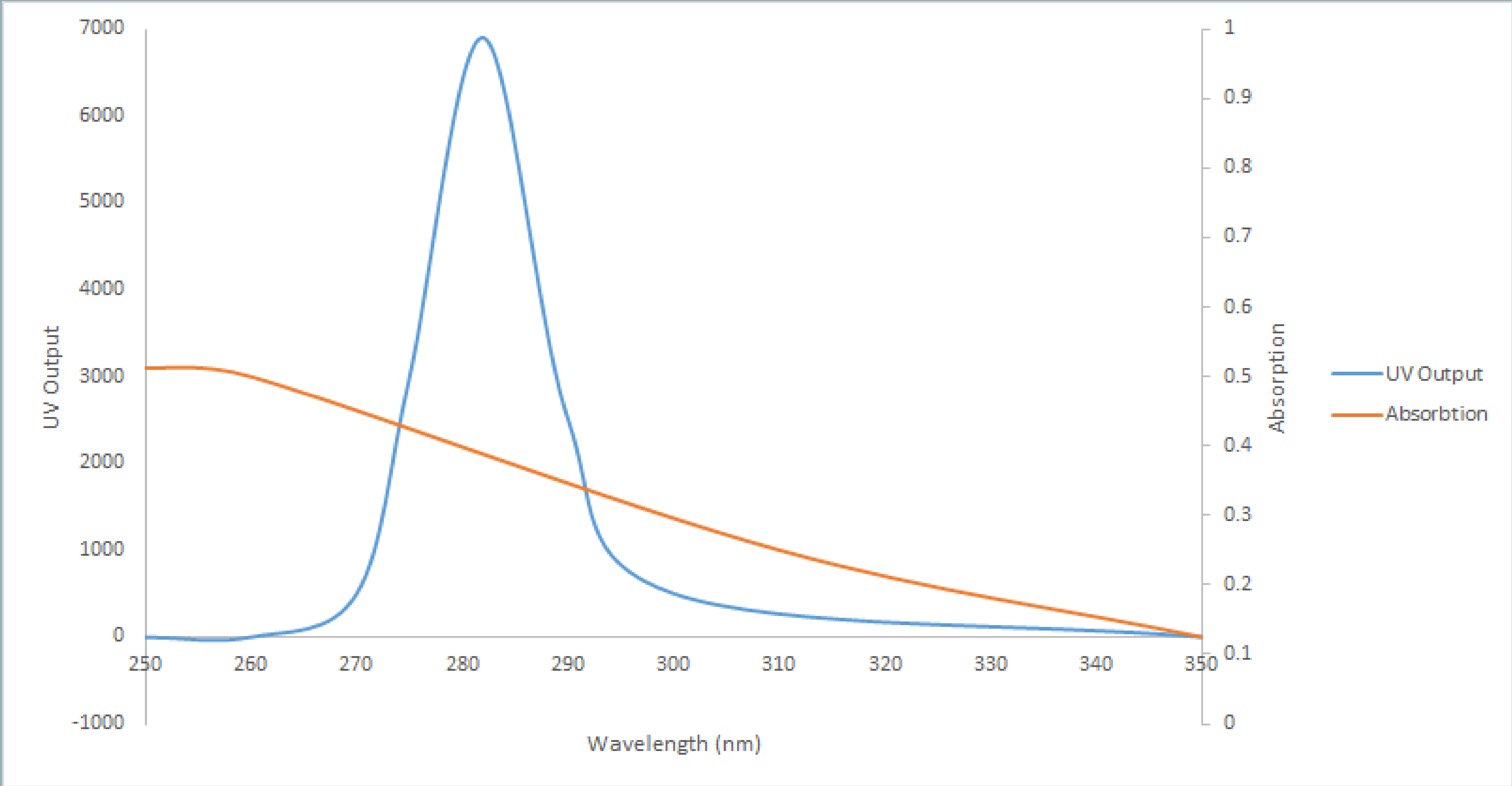


Figure 1: UV-C LED Output vs Absorption in Water Samples Collected After Agitation on the Settler Plates

Semi-Aquatic Continuously Roving Utility Bot (S.C.R.U.B): *Conclusions*

Table 3: Current Project Budget

Budget:			
Item:	Estimated:	Actual:	Variance
Total Budget:	\$6,000.00	\$6,000.00	
Testing and Prototyping	\$300.00	\$325.46	+/- \$100
Final Product	\$2,000.00	\$1,014.80	+/- \$500
Spent (YTD):	\$2,300.00	\$1,340.26	
Remainder:	\$3,700.00	\$4,659.74	

