

Introduction and Background

- Diesel Forward is a distributor of aftermarket diesel engine fuel systems and technical components, based in Windsor, WI.
- Focus of the project lies in the remanufacturing of used fuel pumps and injectors for re-selling

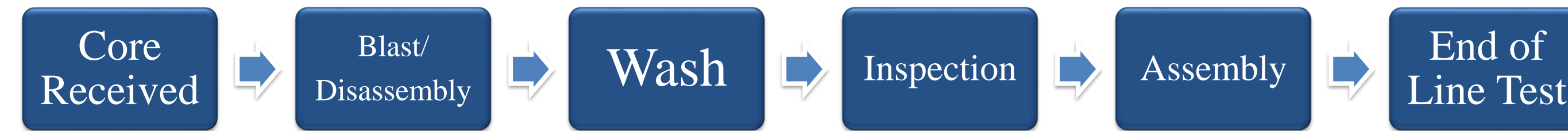


Figure 1: Process Flow Diagram

- Wash Line: Worker must transport parts from staging area to main wash line through pre-wash stations



Figure 2: Diesel Forward Wash Line

- High-Pressure Blasting: Ergonomic hazard created by hand loading and handling heavy parts



Figure 3: High-Pressure Blasting

Problem Statement and Scope

Diesel Forward has realized the need to implement a fully automated or semi-automated system between the wash basket staging area, the pre-wash stations and the main wash line to improve efficiency and minimize ergonomic hazards. The team will develop the proposal of three solutions, with no expectation of implementation or capital investment.

Proposal 1: Dip Tank Conveyor Belt

- Replace the pre-wash tanks with a dip tank conveyor belt, connected directly to main wash station
- Limitations:
 - Large initial capital investment
 - Limited agitation
 - Further testing of material capabilities necessary

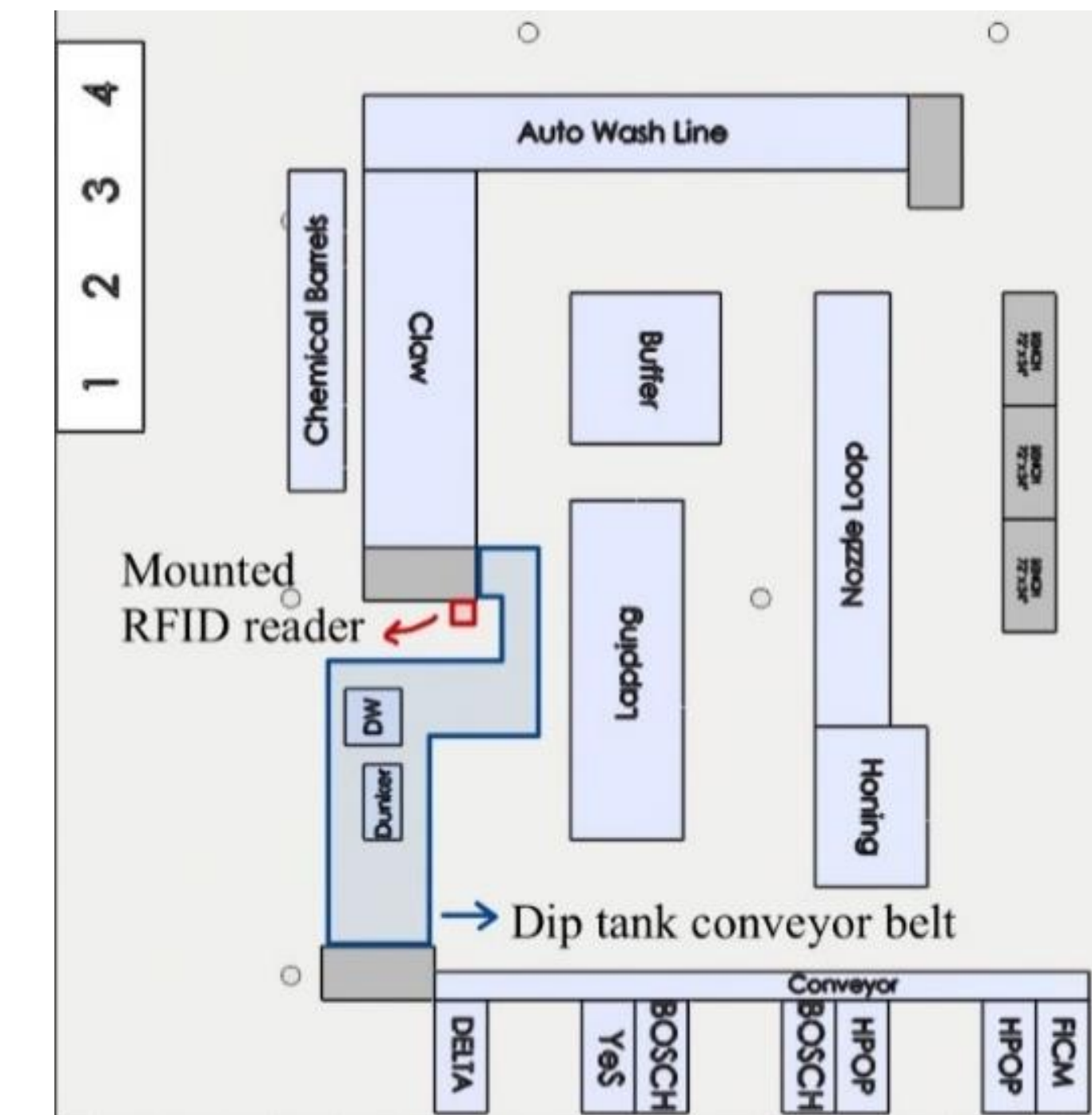


Figure 4: Dip Tank Conveyor Proposal

Proposal 2: Robotic Arm System

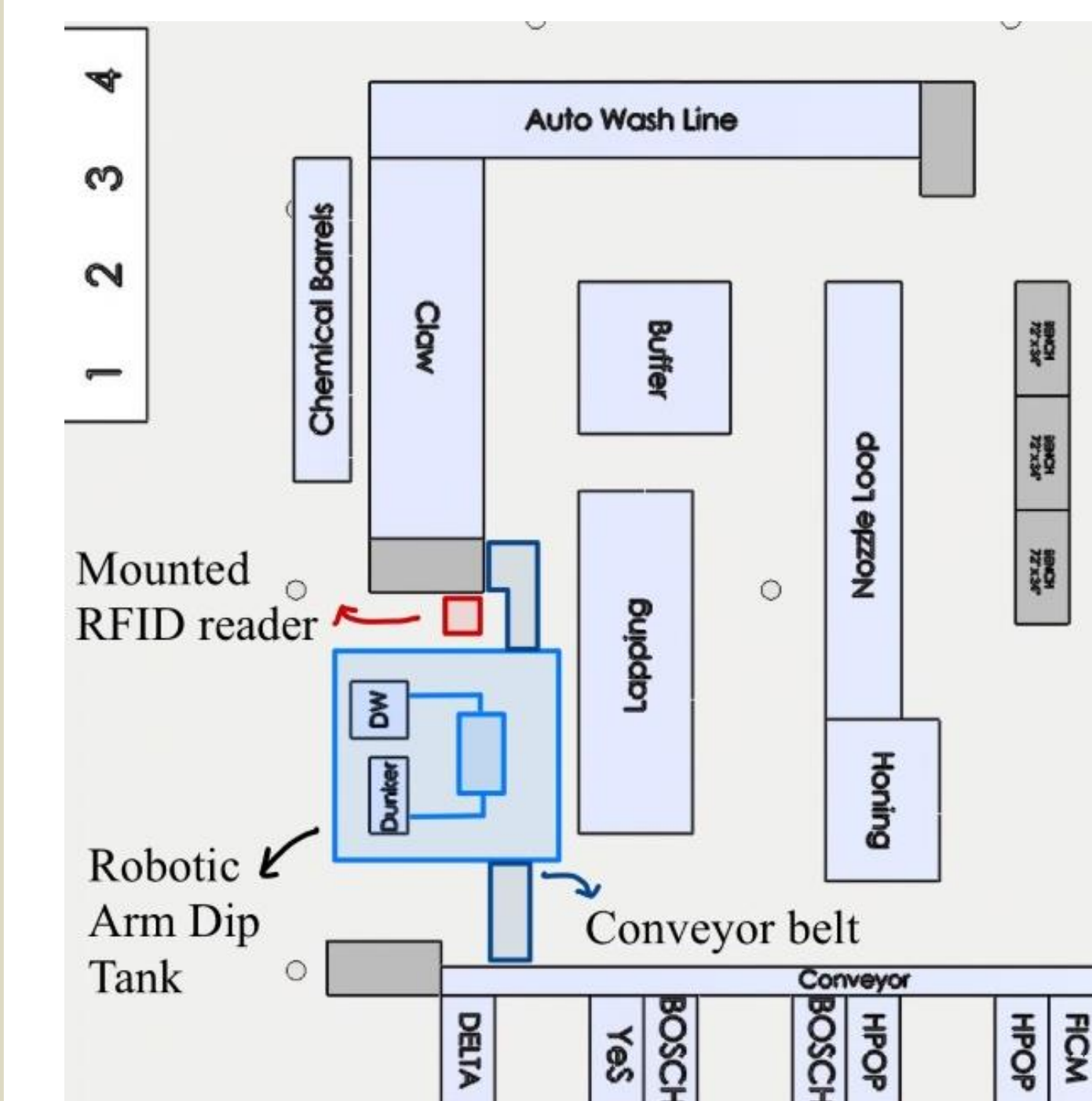


Figure 5: Robotic Arm Proposal

- Install a dip tank with an automated mechanical arm that dunks baskets into pre-wash tanks, connected with system of conveyor belts
- Limitations:
 - Increased learning curve before reaching full automation
 - Further compatibility testing required
 - Limited agitation

Proposal 3: Wash Line Expansion

- Expand the main wash line to include two 550 Jayco Ultrasonic tanks for the pre-wash stations
- Limitations:
 - Largest capital investment
 - Complete line upscaling with larger tanks is not appropriate for current demand
 - May slow down

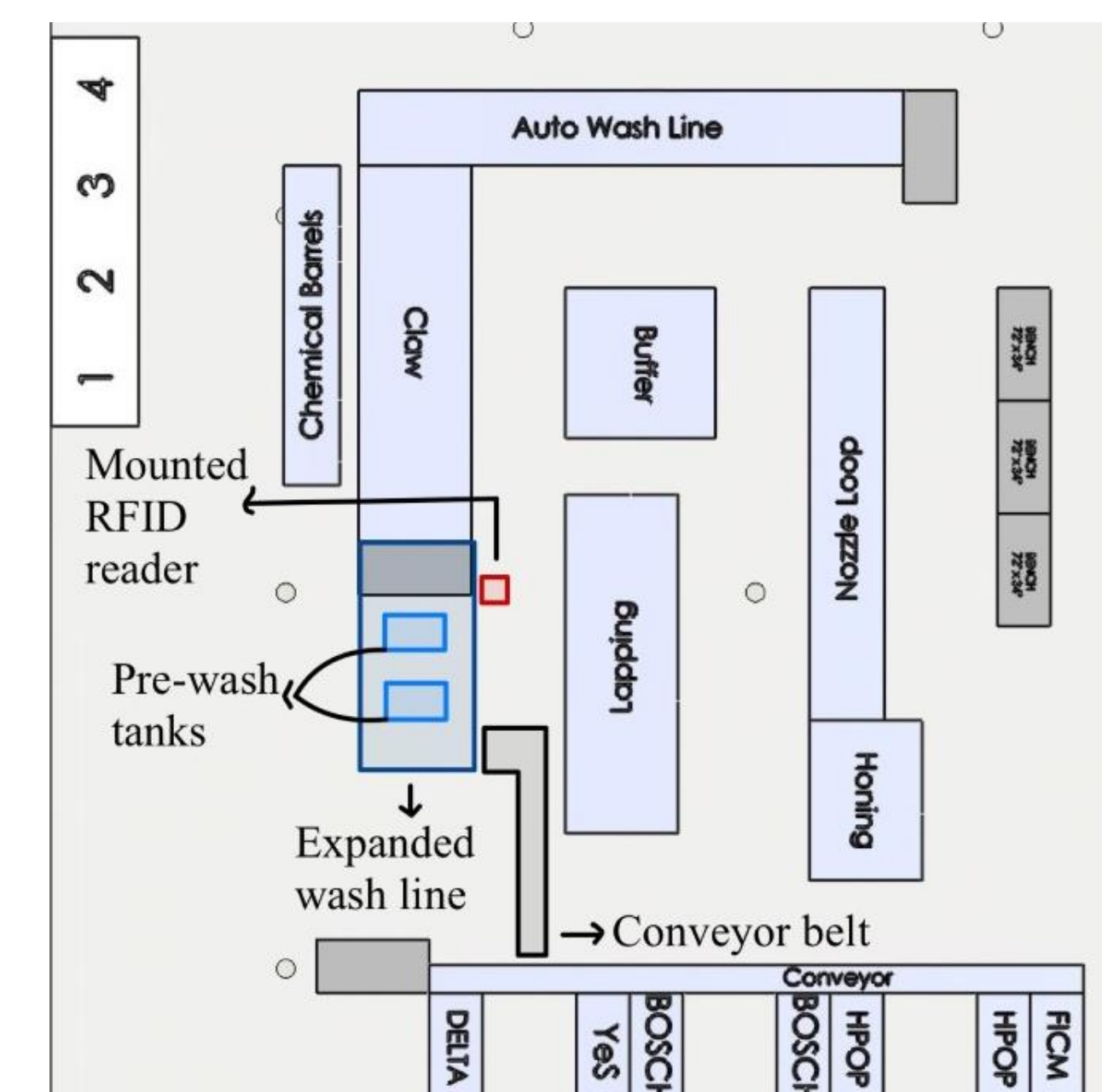


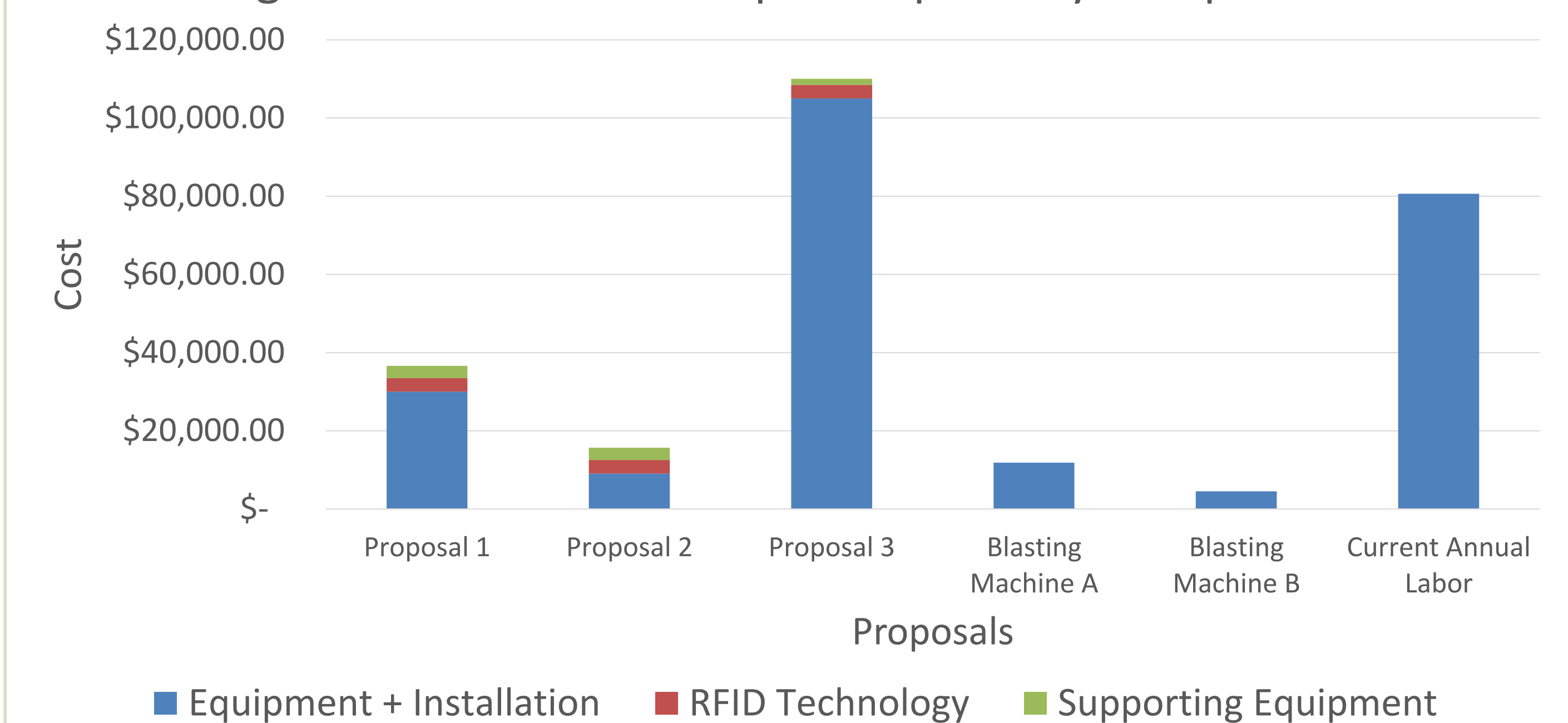
Figure 6: Wash Line Expansion Proposal

Additional Proposals

- Implementation of Radio Frequency Identification (RFID) technology, replacing pre-existing barcodes and scanners with RFID tags and autonomous RFID readers
- Replace current high-pressure blaster with one of two alternatives to reduce ergonomic hazards and increase efficiency.
- Install a new alarm system in the current machine with a mobile buzzer that will inform a technician if problems arise

Evaluation and Analysis

Figure 7: Estimated Cost per Proposal by Component



- Calculated payback period to compare each proposal
- Assumptions:
 - Average cost for each solution
 - Cycle time remains the same
 - Current annual labor fee will be \$80,640

Table 1: Payback Period per Proposal

Proposal	Proposal 1	Proposal 2	Proposal 3	Blasting Machine A	Blasting Machine B
Payback Period (years)	0.45	0.19	1.38	0.15	0.06

Conclusion and Future Steps

- Recommend Proposal 1 as optimal solution, considering automation goal and payback period
- Testing with various potential suppliers, focusing on material resistance, potential errors and level of automation
- Implementation of chosen technology
- Long-run improvement measurements and documentation, considering cycle time and reduced cost