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July 2021

Optimization Study Report

Rock Cut Road Transfer Station

Onondaga County Resource Recovery Agency

cornerstone PLLC

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REPORT CERTIFICATION

The material and data in this report were prepared under the supervision and direction of the undersigned.

July 8, 2021

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EXECUTIVE SUMMARY

On behalf of the Onondaga County Resource Recovery Agency (OCRRA or Agency), Cornerstone Engineering and Land Surveying, PLLC (Cornerstone) initiated an Optimization Study during early 2021 in coordination with the OCRRA team to identify Options that will continue to develop the existing Rock Cut Road Transfer Station (RCR or Facility) as a foundation to progress OCCRA's long term solid waste management goals. The findings of the Optimization Study have been compiled within this Optimization Study Report (Report) to identify and evaluate options to increase the Rock Cut Road Transfer Station (RCR or Facility) throughput and guide optimal equipment investments. The Optimization Study focused primarily on improvements to enhance Facility operations and efficiency in the near-term.

The Facility currently services OCRRA's commercial customers and accepts construction and demolition debris and mixed municipal solid waste. Operation within each building includes sorting, resizing, and transferring waste to the Waste to Energy Facility (WTE Facility) or bypassing waste to landfills. Materials are also recovered from the waste stream for recycling, most notably metals.

The Facility is comprised of four (4) buildings and the site was recently modified during construction activities in 2019 and 2020. Building #1 was not modified, Building #2 was expanded, and Buildings #3 and #4 were new construction. It should be noted that Building #4 is not considered a primary Tipping Floor area and, as such, is not specifically considered as a subject of this Optimization Study.

The physical separation of multiple Tipping Floor areas segregated within three (3) Buildings requires that tipping, processing, and transfer activities occur in coincident areas. Structural obstructions also lead to substantial operational challenges and inefficiencies. Based on the low tonnage of outbound transfer vehicles (Transfer Trailers and Dump Trucks), it was determined that improvement for on-floor and in-truck material densities was critical for more efficient transfer operations. These impositions, coupled with the required material sorting and lack of accessible stockpile and Loadout Slots, requires that multiple "touches" of the received materials are needed prior to the culmination of off-site transfer. On-site equipment capabilities also result in reduced capability which subsequently affects throughput.

It is important to recognize that RCR is part of an integrated solid waste management system that relies on the capacity of the WTE Facility and the accessibility of local landfills. When capacity of the WTE facility is maximized (*which frequently occurs during period of planned maintenance*), waste must be transferred to landfills (*which are significantly further away*) and this puts a substantial stress on the Agency's abilities to transfer and manage the community's solid waste. As local landfill capacity continues to diminish, OCRRA must take proactive steps to plan for local solid waste capacity and anticipate significant changes to transfer and fleet operations. Additionally, the Ley Creek Transfer Station presents an opportunity for solid waste management needs. These topics are further discussed in Section 5.

The results of this Study include a variety of Optimization Options and Maintenance/Asset Preservation Options discussed in Sections 2 and 3. The overall value of each option is further explained in Section 6. In summary, the following options are presented and ranked in terms of overall value (*considering the benefits and associated costs of each option*):

Option #	Optimization Technique	Overall Value
2.1	Building #2 Loadout Location Improvements	☑ ☑ ☑
2.2	Improve Handling and Densification Capabilities	☑ ☑ ☑
2.3	Increase Available Floor Space	☑ ☑
2.4	Increase Number of Usable Tipping Bays	☑ ☑
2.5	Optimize Material Handling and Sorting	☑ ☑
2.6	Equipment Replacement – Sennebogen Upgrade	☑

Option #	Maintenance/ Asset Preservation	Overall Value
3.1	Tipping Floor Wear Resistant Topping	☑ ☑ ☑
3.2	Expand Camera Network	☑ ☑ ☑
3.3	Building Systems Relocation	☑ ☑
3.4	Doorway Protection/Bollards	☑
3.5	Pushwall Armoring	☑

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1.0 FACILITY BACKGROUND INFORMATION

1.1 PROJECT UNDERSTANDING AND INTRODUCTION

On behalf of the Onondaga County Resource Recovery Agency (OCRRA or Agency), Cornerstone Engineering and Land Surveying, PLLC (Cornerstone) initiated an Optimization Study during early 2021 in coordination with the OCRRA team to identify Options that will continue to develop the existing Rock Cut Road Transfer Station (RCR or Facility) as a foundation to progress OCCRA's long term solid waste management goals. The findings of the Optimization Study have been compiled within this Optimization Study Report (Report) as an aid for OCRRA's capital and operational planning efforts.

This Report is the culmination of an initial investigation, including review of historic documentation, interviews with the Facility's operational and engineering staff, and site observation; presentation of conceptual opportunities to improve operations; and gathering of real-time feedback from the Agency's Board of Directors, management, engineering, and "boots on the ground" operations staff.

OCRRA has conveyed plans to further consolidate operations at RCR by relocating residential drop off activities to this Facility from the current Ley Creek Transfer Station (Ley Creek). Consequential impacts or operational challenges that may result with the introduction of residential users has not been specifically evaluated within this Report. The Options presented within Sections 2 and 3 of this Report aim to improve operations and boost overall throughput capacity, with benefits that would confer to both commercial and residential waste streams.

Section 1, "Facility Background Information" of the Report provides a summary of the existing site and building conditions, with a focus on the key physical and operational challenges that currently impede increased Facility throughput.

Section 2 identifies and provides conceptual detail for potential optimization opportunities (Options) aimed at improving overall material handling operations and throughput efficiency given the existing geometries imposed by the existing Building envelopes, specifically to address the identified key challenges. While the opportunities developed as part of this Optimization Study are not "magic bullet" solutions to the challenges OCCRA's staff routinely encounter at the Facility, they do provide a progression of enhancements that should incrementally and synergistically improve efficiency and safety. As OCRRA's vision for the County's transfer operations includes continued consolidation of waste management activities and improved efficiency of the OCRRA waste management system, these steps represent prudent near team efforts to develop the existing RCR as a foundation from which to progress OCRRA's long term goals.

Opportunities presented for near-term operational enhancement were developed with intent to enable incorporation into the existing footprint of Buildings #1, #2, and #3 and focused on opportunities that would not require large planning efforts, capital outlay, or construction durations to implement. The operational enhancements are achieved primarily through creating more effective tipping and surge stockpile management areas within the existing operating areas and improving the agility and utility of the mobile equipment utilized for material management within each of the discreet operating areas of the RCR Buildings.

Each Option is assigned a relative "benefit" ranking on a scale of one (1) to three (3) star symbols (★) and is similarly ranked based on cost to implement on a scale of one (1) to six (6) dollar symbols ($). The designated benefit ranking is a relative qualification representing the magnitude of benefit, to either operational throughput or asset preservation, described within each text section. These symbols are summarized within the Section 6 tables, and contribute towards the Overall Value ranking applied in the tables.

Section 3 explores observed infrastructure components that have been identified as susceptible to premature damage or wear, and offers some mitigation strategies to address. Because existing transfer infrastructure RCR

is regularly burdened during normal operations, it is important that appropriate maintenance activities are undertaken to protect and preserve the existing investment to mitigate asset degradation from becoming an additional obstacle to operating in compliance with NYSDEC permitting expectations and at desirable throughput levels for the expected design life of the Facility.

The Options discussed in Section 4 require greater capital and planning coordination but will continue to expand the opportunities for improving and consolidating operations at RCR. The Optimization Study focused primarily on improvements to enhance Facility operations and throughput capability in the near-term. However, once the near-term enhancements have been considered and/or implemented, there are longer term infrastructure development options that can be advanced to progress towards effective consolidation of OCRRA's solid waste management goals.

Section 5 of the Report also briefly considers challenges and opportunities relating to the Bypass waste disposal strategy and OCRRA's other transfer station asset at the Ley Creek property. RCR is only one (1) component of OCRRA's complex solid waste management plan and disposal arrangement.

The goal of the Optimization Study and the resulting Report is to create a summary of opportunities and suggested improvements that can be applied to inform OCRRA's solid waste planning and the actions taken to improve their existing assets. While there is no "magic bullet" solution, the continued improvement of RCR will be made through a progression of cumulative investments that lead to meaningful gains via collaboration, input, and buy-in from the entire OCRRA team.

1.2 EXISTING SITE CONDITIONS

The RCR site is located across the street from the Waste to Energy (WTE) Facility. Vehicles enter the site to the west and exit the site to the east. There are four (4) Buildings on-site.

RCR is permitted to receive up to 800 tons per day of construction and demolition debris, municipal solid waste, and raggertail. Under the current Facility configuration, raggertail not currently accepted due to space constraints. On average, the Facility receives approximately 300 tons per day of waste which ranged between around 100 tons per day to over 430 tons per day, seasonally, during the first year of operations.

The RCR site entry is utilized for all inbound Tipping Vehicles, including Flat Rate Vehicles and those that must access the Inbound Scale. Vehicles are directed by staff once on site. The Inbound Scale is equipped with an exterior ladder and platform, that site staff must climb in varying weather conditions, to inspect Tipping Vehicle payloads. The staff at the Inbound Scale then coordinate with interior operational staff to direct the Tipping Vehicle to an appropriate Building and reverse numbered Tipping Bay.

The RCR currently has a total Tipping Floor area of approximately 16,100 square feet, which if thoughtfully apportioned and contiguously allocated, begins to approach that typically needed for the safe and effective management, sorting, and transfer of the desired materials throughput. However, the physical segregation of multiple tipping floor areas segregated within three (3) Buildings, tipping/processing/transfer activities required to occur in coincident areas, and structural obstructions all lend to substantial operational challenges and inefficiencies. These impositions, coupled with the required material sorting and lack of accessible stockpile and Loadout Slots, requires that multiple "touches" of the received materials are needed prior to the culmination of off-site transfer. Suboptimal loadout geometries and on-site equipment capabilities are also resulting in reduced on-floor and in-truck material densities which subsequently affect Facility throughput.

1.3 BUILDING #1 EXISTING CONDITIONS

Building #1 provides approximately 3,300 square feet of Tipping Floor (*35-foot x 94-foot*) with an additional twelve feet (12') of Building "depth" occupied by the currently inactive Push Pit area. The Push Pit area in Building #1 is covered at approximately Tipping Floor elevation and the space below provides storage space for maintenance supplies. The Building is equipped with three (3) 18-foot x 28-foot Tipping Bay Doors accommodating five (5) individual Tipping Bays. The internal clear height of the structure approximates twenty-one feet (21') but clearance is further compromised due to the presence of suspended conduits and fire suppression piping. Concrete Kneewalls are provided at a height of approximately three and one-half feet (3.5') along the north wall, supplemented by movable concrete jersey-type barriers along the east and west walls to protect the existing Building walls, utilities, and designated egress personnel doors. Moreover, the Building is not equipped with a dedicated Loadout Slot. This Building was not significantly modified during recent construction activities.

Due to the imposed height and depth constraints, no full-size commercial Tipping Vehicles utilize Building #1 for tipping and access is limited to single axle trailers that must be unloaded by hand. The limited operating area on the Tipping Floor creates a competition for space to conduct the basic functions of unloading, consolidation, and transfer. Insufficient area on the Tipping Floor limits the ability to conduct kick-sorting to recover recyclables or segregate Bypass waste, and the Kneewall and stockpile areas provided are not adequate areas for surge capacity or to accommodate mobile equipment activities to densify received materials.

The absence of a dedicated Loadout Slot requires waste materials received in Building #1 to be shepherded to Building #2 or Building #3 for processing and transfer (*which is laborious and exacerbates the throughput challenges in these other areas*) or requires at-grade loadout into transfer vehicles during off-peak hours.

The existing infrastructure and observed operations in Building #1 fosters operational inefficiency, maintenance challenges, and potential concerns for personnel safety.

1.4 BUILDING #2 EXISTING CONDITIONS

During recent construction activities, Building #2 was expanded, however its existing features were not significantly modified. Building #2, while slightly larger than Building #1, imposes many of the same physical and operational constraints observed in Building #1. Building #2 provides approximately 5,800 square feet of Tipping Floor (*64-foot x 90-foot*) with an additional twelve feet (12') of Building "depth" occupied by the currently inactive Push Pit area. The Push Pit area in Building #2 remains open and leads to the out of service Building #2 Conveyor/Compactor Area in the portion of the Building north of the Tipping Floor. Building #2 is equipped with three (3) 18-foot x 28-foot Tipping Bay Doors accommodating six (6) Tipping Bays. The internal clear height of the structure approximates twenty-one feet (21') but clearance is further compromised due to the presence of suspended conduits and fire suppression piping.

The Building #2 Loadout Slot location (*also referred to as the Short Loadout Slot*) is sized to accommodate only outbound Dump Trucks and is therefore only utilized for combustible waste materials bound for the adjacent WTE

Facility. Due to low Tipping Bay Door height (*18'*) and overhead utility obstructions, special care is required when accommodating Full-sized Commercial Vehicles (*e.g. roll-off trucks*), which dramatically slows vehicle unloading such that typically only Small Commercial Vehicles and Hand Unload Vehicles/Trailers are serviced in this Building. As a result, Full-Sized Commercial Vehicles and other Tipping Vehicles containing higher quantities of landfill-bound Bypass waste are directed away from Building #2 when possible to limit additional material "touches", which places further throughput processing stress on Building #3 operations. The three and one-half foot (3.5') high Kneewall provided along the northern wall of this Building profoundly limits surge pile management and capacity for material densification. Moreover, this Kneewall necessitates additional cleaning effort as waste routinely spills over this wall and into the abandoned Push Pit area.

The Building #2 low vertical clearance and obstructive column locations serve to restrict equipment selection and movement envelopes. While some operational improvement has been seen with the recent purchase of a smaller Wheel Loader, the Building #2 Loadout Slot geometry orientation and the waste densification process occupy a substantial portion of the available Tipping Floor area which profoundly limits usable surge pile space.

Low to no visibility is afforded to the Wheel Loader operator when loading out waste into the Building #2 Loadout Slot due to the height difference and sight line obstructions between Tipping Floor and the Loadout Slot floor below. This serves to increase loadout time, increase material spillage, and limit Dump Truck load grooming opportunities. Safety considerations concerning spillage into adjacent Bypass Loadout Slot, especially for bulky materials, as well as excessive dust generation due to the Wheel Loader loadout methods, have been noted by Facility staff.

1.5 BUILDING #3 EXISTING CONDITIONS

During recent construction activities, Building #3 was added in its entirety as new construction. Building #3 affords the largest Tipping Floor area and is the only location available on-site for the consistent, safe unloading of Full-Sized Commercial Vehicles. This Building provides approximately 7,000 square feet of Tipping Floor (*82-foot x 90-foot*), less the approximately 400 square foot area in the southeast corner identified as the Metals Storage Pit. Building #3 provides an interior clear height span of thirty-six feet (36'), with three (3) Tipping Bays accessible through three (3) 28-foot x 18-foot Tipping Bay Doors. These comparatively narrow Tipping Bay Doors may result in slower tipping and have increased risk to door jamb damage from Tipping Vehicle maneuvering.

Building #3 provides two (2) Loadout Slots that are at full grade separation from Tipping Floor height and both provide adequate length for a Transfer Trailer loadout: the Building #3 Loadout Slot to the north, and the Bypass Loadout Slot (*also referred to as the Long Loadout Slot*) to the northwest. The Building is equipped with a twelve foot (12') high concrete Pushwall along the eastern portion of the Tipping Floor, decreasing to a three and one-half foot (3.5') high Kneewall adjacent to the Loadout Slots on the north and northwest portions of the Tipping Floor.

The profound physical and operating limitations of Building #1 and #2 imposes, by necessity, an operational "domino effect" on Building #3 operations as the other two Buildings are not capable of safely receiving waste from Full-Sized Commercial Vehicles and are not provided adequate loadout areas to process and transfer Bypass waste (*or in the case of Building #1, the ability to loadout any material*). This operational cascade creates overdemand and competition of the limited Tipping Floor and surge stockpile management areas within Building #3. This, in turn, reduces or eliminates available areas for kick-sorting of Bypass waste or the densification of waste materials (*which further reduces tipping floor stockpile efficiency*).

The two (2) Loadout Slots are served by one (1) Building #3 Material Handler (*Sennebogen 818*). Full grade separation is provided in the Loadout Slots, but the Sennebogen 818 must still "lift and load" material over the Kneewall into an outbound Transfer Trailer or Dump Truck, thus impeding operator visibility and loadout efficiency.

Building systems, including conduit runs and roof drains, located along the Loadout Slot walls and in Tipping Bay lanes are unprotected and prone to damage, requiring hyper-vigilance from operators and Tipping Vehicle drivers. The misting dust suppression system in the Loadout Slots is easily damaged and is currently out-of-service due to its proximity to waste handling.

1.6 BUILDING #4 EXISTING CONDITIONS

Currently Building #4 is limited to servicing Hand Unload Vehicles and Flat Rate Vehicles (*generally pickup trucks and smaller box vans*) to keep these smaller vehicles from accessing the overburdened operational areas of Buildings #1, #2, and #3. As currently configured, Building #4 provides limited inbound queuing areas, and user traffic cannot access Buildings #1, #2, or #3 from the exit without re-entering a queue line near the Facility entrance at Rock Cut Road. As configured, user vehicles are not able to directly "engage" boxes for unloading and unloading of vehicles must be done in a more laborious, less efficient "side by side" orientation. The southern vehicle maneuvering area across from the Building #4 unloading doors is narrow and challenging for even a pickup truck to perform required back-in navigation movements.

As constructed, Building #4 is efficient for recyclables and "other" (*appliances, tires, e-waste, HHW*) drop-off, or small volume, bagged wastes.

Building #4 is only a small and specialized portion of the RCR operations and contributes little to the overall throughput capacity of the Facility. As such, it is not specifically considered as the subject of this Optimization Study.

1.7 SUMMARY OF KEY CHALLENGES

The below physical and operational challenges represent the most significant obstacles impeding efficient operations, as distilled from the above summary of existing conditions at RCR. The Optimization Study and findings of this Report have focused on addressing these key challenges.

- Tipping Floor Area: The approximately 16,100 square feet of Tipping Floor area provided in the Facility is apportioned in three (3) non-contiguous operating areas that lack either dedicated or sufficient Loadout Slot access, are equipped with insufficient Pushwall/stockpile areas or both. It has been observed that there is inadequate storage (*surge*) capacity in the Facility when the WTE Facility's processing capacity is diminished, which happens regularly during planned maintenance activities and unplanned operational downtime. Also, surges of incoming waste deliveries during peak seasonal deliveries are difficult to manage with limited physical storage ability.
- Building Height: Low ceiling (*<21'*) and low Tipping Bay door clearance (*18'*) in Buildings #1 and #2 limits access into tipping areas and precludes these areas from receiving Full-sized Commercial Tipping Vehicles. This, in turn, causes additional operational demand in Building #3.
- Limited # of Adequate Height Tipping Bays: The limited number of adequate Tipping Bays limits the rate at which inbound tonnage can be received. When combined with the limited floor space, creates competition for space and conflicts with material management and sorting, Tipping Vehicles and transfer activities.
- Material "Touches": The limited and segregated operating area requires a high number of "touches" for management and processing which slows throughput in each discreet operating Building. The need to shepherd waste materials from one Building to another for sorting, loadout and transfer causes cascading operational demand from Building #1 downstream to Buildings #2 and #3.
- Low Material Density (*On-Floor and In-Truck*): Limited Tipping Floor area, lack of adequate Pushwalls and limitations of on-site mobile equipment all result in decreased waste densification, both on the Tipping Floor and in Transfer Trailer/Dump Truck payloads. Lower waste density decreases the available

floor space for material handling and increases the number of required truck trips to remove material. Improving on-floor and in-truck material densities is critical to efficient transfer operations, by effectively increasing the quantity of materials that can be stored on the Tipping Floor during surge conditions and improving the efficiency of loadout by accommodating a greater tonnage in each transfer vehicle.

- Maintenance: A transfer station, under the best of circumstances, is subject to a high degree of wear and tear and requires routine maintenance to prevent deterioration from becoming an additional obstacle to efficient operations. The Facility is more likely to experience damage and excessive wear due to routine operations coming into conflict with Building components that are sub-optimally located and/or not capable to withstand the inherent rigor of the operating environment.

Additionally, challenges that significantly impact throughput time exist beyond the bounds of the Facility. The RCR is part of an interrelated system, depending on the capacity of the WTE Facility and landfill disposal locations to receive waste. The time it takes to move waste to its final disposition is dependent on travel time and dump time, in addition to the time it takes to receive, process and loadout materials. These issues are discussed in more detail in Section 5.

2.0 OPTIMIZATION OPPORTUNITIES

Opportunities presented for near-term operational enhancement were developed with intent to enable incorporation into the existing footprint of Buildings #1, #2, and #3 and focused on opportunities that would not require large planning efforts, capital outlay, or construction durations to implement. The operational enhancements are achieved primarily through creating more effective tipping and surge stockpile management areas within the existing operating areas and improving the agility and utility of the mobile equipment utilized for material management within each of the discreet operating areas of the RCR Buildings.

Below identifies potential optimization opportunities (Options) aimed at improving material handling and throughput efficiency given the existing geometries imposed by the existing Building envelopes, specifically to address the identified key challenges. While the opportunities developed as part of this Optimization Study are not a panacea of "magic bullet" solutions to the challenges OCCRA's staff routinely encounter at the Facility, they do provide a progression of enhancements that should incrementally and synergistically improve efficiency and safety. As OCRRA's vision for the County's transfer operations includes continued consolidation of waste management activities and improved efficiency of the OCRRA waste management system, these steps represent prudent near team efforts to develop the existing RCR as a foundation from which to progress OCRRA's long term goals. Consideration of prospective longer-term planning and infrastructure investments are presented under Sections 4 and 5 of this Report.

While these Options are intended to improve the conditions contributing to the identified challenges, it should be noted that modification to the ceiling and vehicle door heights in Buildings #1 and #2 have not been tendered as an optimization opportunity. Relocation of low hanging obstacles/utilities are discussed, but physical modifications to replace vehicle access doors or raise the ceiling height are longer duration and more expensive endeavors and are instead presented conceptually under the Future Site Investments in Section 4.

Each Option is assigned a relative "benefit" ranking on a scale of one (1) to three (3) star symbols (★) and is similarly ranked based on cost to implement on a scale of one (1) to six (6) dollar symbols ($). The designated benefit ranking is a relative qualification representing the magnitude of benefit, to either operational throughput or asset preservation, described within each text section. These symbols are summarized within the Section 6 tables, and contribute towards the Overall Value ranking applied in the tables.

Figure 1, "Rock Cut Road Transfer Station Floor Plan" provides a general indication of where each presented Option would be implemented in relation to the existing Facility layout.

2.1 BUILDING #2 LOADOUT LOCATION IMPROVEMENTS

2.1.1 Summary of Optimization Technique – Material Handler and Remove Obstacles

Because Tipping Floor area is at such a premium in Building #2, an operational strategy that frees Tipping Bays, even while loading, and improves on-floor and in-truck waste density would be highly advantageous in this operating area. The deployment of a Building #2 Material Handler with densification capabilities staged in the northeast corner of the Building would promote these operational aims. The Building #2 Material Handler would be equipped with an extended cab height for improved visibility into loadout areas, and the unit could also be programmable to minimize the chances for damage to the building systems or structural obstacles.

To further reduce the existing obstacles, it is envisioned that dry sprinkler and dust suppression piping in the immediate area of the Building #2 Loadout would require relocation, as well as the gas monitoring systems. Moreover, a modest reduction of the Kneewall height at the Building #2 Loadout would serve to improve loadout equipment visibility and movements.

Typical specifications for the proposed Building #2 Material Handler are included in Appendix A. These documents should be considered as qualitative guidance concerning initial equipment identification and desired features and are not intended to direct the Agency towards a specific brand or constitute a complete bid specification for procurement.

2.1.2 Benefits (★★★)

This Option helps to address the challenges associated with overall loadout efficiency, densification, as well as the number of times material is handled. The primary goal of this improvement is to allow the loadout equipment and process to increase waste densities to approximately 400 lbs/CY, or six to eight (±6-8) tons per truck, bound for the WTE Facility. This compares very favorably to the approximately two (2) tons per truck currently observed at this Building #2 Loadout location and is equivalent to the payloads achieved within the Building #3 Loadout. The purpose-driven grapple specification would have greater reach and material management and crushing/resizing capabilities, providing more efficient densification than the current scheme that relies primarily on the weight of the Wheel Loaders. Densification with a Material Handler grapple allows for a size reduction of dimensional materials (*e.g. bulky waste, dimensional lumber, etc.*), which is not generally achievable by the crushing action of a Wheel Loader tire and/or bucket. Unbroken dimensional materials create unfavorable voids during handling and within truck payloads, and oversized materials are unprocessible by the WTE Facility.

Additionally, the increased operator visibility and loading the improved loading dexterity that the Building #2 Material Handler will afford should minimize spillage while loading, thus improving both general housekeeping and safety in this area. Specifically, the improved dexterity and visibility of the proposed Building #2 Material Handler should decrease risk of dropping material on the Dump Truck/Transfer Trailer cab and, based on the alignment of the Loadout location, the Material Handler can be set up so that the grapple arm does not swing over the cab of the vehicle in the Short Loadout Location. Based on these conditions, drivers may be able to remain in the vehicle cab during Loadout activities. Further, implementation would enable keeping an additional Tipping Bay available even during loadout activities, as the Material Handler would be stationed away from the Tipping Bays in the northeastern portion of Building #2.

2.1.3 Costs ($ $ $ $)

The primary cost to implement this Option is the Building #2 Material Handler equipment cost, which is estimated to be approximately $322,800. Details of the expected pricing, as well as example specifications, are included within Appendix A.

To support the new Building #2 Material Handler equipment, the physical modifications are described below:

- Lower existing 3.5' Kneewall by 12" to improve excavator movements and operator visibility. Portions of the existing steel plating would have to be removed and the concrete cut down to the revised elevation. In addition, the existing steel spill shield would need to be temporarily removed and modified. After the concrete is cut new steel plating should be installed along the top of the wall and the steel spill shield remounted. The plating will have to be epoxy anchored into the existing wall. The plating should extend down to the slab to eliminate any locations where a steel edge can be caught on the grapple of the Building #2 Material Handler.
    - Based on the OSHA Walking-Working Surfaces standards (*29 CFR 1910.28(b)(1)(iii)*), if the use of fall protection systems is not feasible on the working side of a loading dock or rack platform, an employer can remove the effective guardrail protections (42" ±3") given each of the following requirements are met:
        - "The work operation for which fall protection is infeasible is in process" (*i.e. during operational loading hours*). A removable barrier or safety chain can be installed for use during inactive hours to reinstate the required guardrail height.

        - "Access to the platform is limited to authorized employees," and
        - "The authorized employees are trained in accordance with § 1910.30."
    - During detailed design and implementation, the training plan would have to be developed to accommodate coverage under this OSHA standard and OCRRA could consult with local Division of Safety and Health within the Worker Protection Bureau to verify the specific details of compliance.
- Relocate currently out-of-service dust suppression piping, fire suppression/dry sprinkler piping, and air monitoring equipment (*two (2) locations within the Building #3 Loadout and Bypass Loadout locations*) to reduce future damage/repair expense and improve excavator maneuverability.

Budgetary reserves to support implementation of the physical modification components of this Option are summarized below, including direct construction costs, contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. The estimate of probable cost and associated contingency percentage are consistent with an Association for the Advancement of Cost Engineering (AACE) International Class 5 Cost Estimate used for conceptual design screening. In addition, the 2022 material costs have been "deescalated" from current 2021 costs by approximately 2% as a result of the forecasts within the detailed Escalation Assumptions section of Appendix C.

These estimated expenses are in addition to the Building #2 Material Handler equipment cost described above, with the total estimated Option cost.

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 40,550
Contractor Markups (General Conditions, Overhead and Profit)	$ 10,550
Allowance for Indeterminates - 20%	$ 10,220
Design and Other Consulting Services - 14%	$ 8,600
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 4,900
Project Contingency (Class 5 Cost Estimate) - 25%	$ 19,300
Physical Modification Subtotal	**$ 97,000**
Building #2 Material Handler	$ 322,800
Total	**$ 419,800**

The Basis of Estimate used to obtain the above physical modification cost is included within Appendix C, "Cost Estimate Support" of this Report.

2.1.4 Schedule

- Kneewall modification and utility relocation: Duration and impacts to operations during implementation. Building #2 Loadout will be out of service one (1) week during knee wall modifications.
- Equipment: Demonstrate a proposed Building #2 Material Handler prior to purchase to optimize specification prior to purchase. Note, additional information was learned during OCRRA's spring 2021 demonstration of an excavator for this function and additional benefit would be gained to further refine the specification and optimize benefits prior to investment.

2.2 IMPROVE HANDLING AND DENSIFICATION CAPABILITIES

2.2.1 Summary of Optimization Technique – Increase Pushwall Area and Height

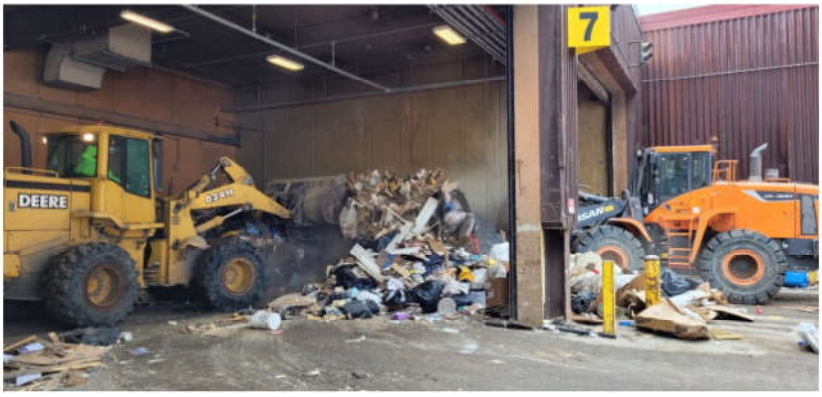
Because the three (3) Tipping Floor areas provided within the Facility are non-contiguous and limited in footprint, it becomes increasingly important to maximize the vertical capacity of the stockpile/surge areas that the existing Building envelopes afford. The most sensible means of accomplishing this is to provide increased Pushwall areas and heights in Buildings #1, #2, and #3. The proposed enhancements of the Pushwalls are as follows and further detailed within the Drawings section:

- Install 12' high Pushwalls in Buildings #1 and #2 along north, east, and west walls, with consideration given to abandon select existing personnel doors in these areas (*as permitted by building code requirements*). Refer to Option 2.3, as the ultimate location of the Pushwalls and removal of the Push Pits is linked with this enhancement Option. Further development of this Option will require a detailed life-safety code review to verify egress and fire safety requirements are satisfied if modifications to these components are considered.
    - For Building #1, an alternative Sub-Option was developed with OCRRA staff that involves installing a Pushwall on the north and east walls without expanding the Tipping Floor into the Push Pit area. To accommodate the geometry of this proposed mid-floor Pushwall and provide a spill shield to keep material from accumulating above the existing Push Pit, the Sub-Option would include a shorter vertical Pushwall and a sloped steel Pushwall/spill shield to tie into and protect the northern wall.
- Increase the existing 12' high Pushwalls to 16' in Building #3 along east and northeast walls to increase available stockpile volume to better enable operators to shepherd and stockpile waste material away from the Tipping Bay areas.

The use of steel components would provide future flexibility/re-use if the Buildings are reconfigured in the future (*see Section 4, "Future Site Investments" for references to expanding tipping floor/loadout in Building #2*).

2.2.2 Benefits (★★★)

This Option aids to address the challenges associated with densification and the number of times material is handled between tipping and loadout. This improvement also increases material surge/stockpile capacity in both plan view and in the vertical when combined with the Option 2.3 enhancement. This additional surge capacity will incrementally free the limited internal maneuvering areas and the improved Pushwalls would provide loading equipment with a suitable backstop to assist the efficiency of waste densification and bucket loading. Currently, waste material in Building #1 is often loaded for transport to a Building with appropriate loadout capabilities by using two (2) opposing Wheel Loaders to push material into the other (*see photo*). Obviously, this is an inefficient and potentially dangerous means of charging Wheel Loader buckets with waste material.



Pushwall implementation would work synergistically with the improvements and equipment modifications discussed elsewhere by improving handling and densification efforts as Wheel Loaders can now utilize Pushwalls for densification efforts. Improved waste densification means fewer trips to move material, the ability to store

more waste in a given area, expedited loadout, and increased in-truck material density in each outbound transfer vehicle. Additionally, the increased on-floor density incrementally affords more floor space for more effective kick-sorting and tipping activities, resulting in less Bypass waste and more efficient throughput. The reduced number of touches required by equipment and staff means that these resources can then be more productively allocated to manage more material in a day.

2.2.3 Costs ($ $ $ $ $)

- Buildings #1 and #2:
    - North wall: Steel frames will be placed in the pit spaced at 4'-0" on-center to support the slab. A W8x28 steel column will extend up above the slab 12'-0" to create a new Pushwall. 5/8" thick steel plates will span between the vertical columns. At the top of the Pushwall a spill guard will be constructed to prevent debris from falling behind the wall. A detail illustrating this concept is included in the Drawings section.
    - East and west walls: Install new steel 12'-0" tall Pushwalls. The Pushwall will consist of W8X28 columns drilled through the existing slab and embedded into the soil below the slab. The steel below grade will be encased in concrete. The vertical posts will be spaced at 4'-0" on-center with 5/8" thick steel plate spanning between the columns. A detail illustrating this concept is included in the Drawings section.
- Building #3:
    - Install a new steel pushwall on top of the existing concrete pushwall in Building #3. The new pushwall extension will consist of 4'-0" tall steel columns spaced at 4'-0" on-center bolted to the top of the existing wall. A ½" thick steel plate will span between the vertical columns. A 3/8" thick spill shield will be installed at the top of the wall to prevent debris from falling behind the wall. A detail illustrating this concept is included in the Drawings section.

In addition to the direct construction costs detailed within the Drawings and Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. The increase in available floor space (Option 2.3) is recommended to be completed at the same time as implementation of this Option. If they are completed separately, the construction sequence and methods will be modified and it is anticipated that the construction costs for both Options will be increased, potentially significantly. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 268,100
Contractor Markups (General Conditions, Overhead and Profit)	$ 69,770
Allowance for Indeterminates - 20%	$ 67,570
Design and Other Consulting Services - 14%	$ 56,800
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 32,400
Project Contingency (Class 5 Cost Estimate) - 25%	$ 124,300
Total	**$ 621,000**

The total budgetary estimate of probable cost for the combined Option 2.2 and Option 2.3 is approximately $1,650,000.

- Building #1 alternative Sub-Option:

- Although a concept design has not been compiled for this alternative Sub-Option, utilizing the unit prices for a Pushwall design similar to the combination of Section 1 and Section 3 on Sheet S2, an approximate cost is in the neighborhood of $437,000 total (*assuming ± 90 linear feet of 12' high Pushwalls*). As noted under Section 2.3 below, this Sub-Option removes the ability to recover approximately 1,100 square feet of Tipping Floor space.

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

2.2.4 Schedule

- Buildings #1 and #2: The proposed construction would be undertaken at the same time as Option 2.3 (*removal of existing 3.5' high Kneewall and filling over Push Pit*) and would have similar impacts to operations in these Buildings. Installation of the proposed Pushwalls and expanded Tipping Floor area is expected to take three (3) to four (4) weeks per Building, including an assumed seven (7) day concrete cure period.
- Building #3: The impact to operations required to accommodate the installation of the new Pushwall extensions would be minor, as portions of the new steel Pushwalls can be fabricated offsite, and the installation time is minimal.

2.3 INCREASE AVAILABLE FLOOR SPACE

2.3.1 Summary of Optimization Technique – Remove Building #1 and #2 Push Pits

Buildings #1 and #2 are challenged by limited Tipping Floor area, which is occupied by tipping, sorting, densification, storage, and material loading. By removing the existing Push Pits within Buildings #1 and #2 and installing additional reinforced Tipping Floor backed by new Pushwalls (*see Section 2.2*), operations can take advantage of the available Building "depth" to gain valuable Tipping Floor surge and maneuvering capacity.

Building	Existing Tipping Floor	Available Push Pit Area	Floor Area Increase
Building #1	± 3,300 square feet	± 1,100 square feet	± 30%
Building #2	± 5,800 square feet	± 1,100 square feet	± 20%

The Push Pit below the Tipping Floor elevation in Building #2 is currently unused space, but the Push Pit within Building #1 houses a maintenance supply area that would need to be relocated by OCRRA prior to commencing with construction. While not completely alleviating the operational challenges experienced in these Buildings, this improvement would meaningfully enhance the function of these operational areas, specifically when combined with the Pushwall improvements described within Option 2.2, "Improve Handling and Densification Capabilities".

2.3.2 Benefits (★★★)

This Option helps to address the challenges associated with limited Tipping Floor area. Additional Tipping Floor area allows more capacity to store material which allows operators to take fewer breaks from processing and thus allows more effective sorting (*less Bypass waste and better sorting of waste that is not processible by the WTE Facility*) as equipment will have more space to stockpile and maneuver. Operators are also in a better position to stockpile material which can then be moved out of the Building during downtimes, allowing them to be more available to oversee vehicle unloading activities. This, in turn, promotes more efficient vehicle unloading, as material can be moved out of the Tipping Bay opening and stockpiled in the additional Tipping Floor area.

Further, implementation would also eliminate the currently damaged Kneewalls and will prevent waste materials from accumulating within the Building #1 and Building #2 Push Pits.

2.3.3 Costs ($ $ $ $ $ $)

Implementation of this Option involves demolition and relocation of some existing features, including the existing 3.5' high Kneewalls and ancillary mechanical/electrical/plumbing (MEP) system components that may interfere with the proposed construction. While an initial review for conflicts was performed, the extent of impacted infrastructure would be defined within future bid document preparation and an allowance was included in the cost estimate for this assumed work.

The existing Push Pits on the Tipping Floor will be infilled with a steel frame to provide support for a new Tipping Floor slab and to enable the installation of a Pushwall (Option 2.2). The preliminary design for the new section of Tipping Floor slab over the Push Pit will be a minimum of 12" thick cast-in-place reinforced concrete with a two-inch (2") Wear Resistant Topping (*see Sheet S2 and Report Section 3.1 for details*).

In addition to the direct construction costs detailed within the Drawings and Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. Improvement of the handling and densification capabilities (Option 2.2) is recommended to be completed at the same time as implementation of this Option. If they are completed separately, the construction sequence and methods will be modified and it is anticipated that the construction costs for both Options will be increased. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 440,700
Contractor Markups (General Conditions, Overhead and Profit)	$ 114,680
Allowance for Indeterminates - 20%	$ 111,080
Design and Other Consulting Services - 14%	$ 93,300
Permitting and Other Agency Costs - Allowance	$ 10,000
Construction Administration Costs - 8%	$ 53,300
Project Contingency (Class 5 Cost Estimate) - 25%	$ 205,800
Total	**$ 1,029,000**

The total budgetary estimate of probable cost for the combined Option 2.2 and Option 2.3 is approximately $1,650,000.

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

2.3.4 Schedule

The construction activities would require segregation of a working area in the northern portion of Buildings #1 and #2, which may result in a significant reduction in floor space for the construction duration. However, importantly, the Building #2 Loadout Location would not be necessarily impacted for the majority of this work.

The proposed construction would be undertaken at the same time as Option 2.2 (*installation of Pushwalls*) and would have similar impacts to operations in these Buildings. Installation of the expanded Tipping Floor area and proposed Pushwalls is expected to take three (3) to four (4) weeks per Building, including an assumed seven (7) day concrete cure period.

2.4 INCREASE NUMBER OF USABLE TIPPING BAYS

2.4.1 Summary of Optimization Technique – Relocate Existing Shredder

Currently, Building #3 is the only Building on-site constructed with adequate clearance to safely accommodate Full-Sized Commercial Vehicle tipping. Additionally, it is the only Building equipped with dedicated Bypass waste loadout capability. As a result, it is most advantageous to exploit any inherent operational utility this Building may offer.

The Shredder staged at the current location (*adjacent to the western Tipping Bay opening in Building #3*) creates an ever-present obstacle and presents a continual opportunity for damage during unloading. Moreover, there is no efficient means to move waste material with mobile equipment out of this area without hyper-vigilance exercised by an equipment operator to avoid Shredder damage. Relocating the Shredder out of this area would serve to free up this third Tipping Bay, thus reducing the competition for vehicle tipping area in Building #3. This enhancement would require removal of the existing, dormant Conveyor and Compactors from the northern portion of Building #2 and relocation of the Shredder to this portion of this Building, positioned such that the relocated Shredder would direct/convey discharged material into a Dump Truck (*thus avoiding additional handling*). To remove the material from the working Tipping Floor, incoming mattresses and other bulky waste suitable for size reduction could be temporarily stockpiled in multiple areas prior to shredding. Temporary stockpile locations could include the vacated area in Building #3 where the Shredder currently exists, an exterior dedicated Roll-Off Container that can be moved to the Shredder during off-peak hours, or shorter-term placement within the Long Loadout Slot if no Transfer Trailer is staged for loadout.

The Shredder relocation will require utility improvements in the old Conveyor/Compactor area to power the relocated unit. Initial review of historic drawings demonstrated that the electrical capacity is available in this area based on historic Building use and electrical demand, but it is anticipated that the distribution of the electric power would need to be modified to connect to the Shredder and Stacking Conveyor.

Implementation of steel Pushwalls in the southwest corner of Building #3 would serve to protect existing utilities adjacent to current Shredder location so that material handling can occur in this area of the floor with a conventional Wheel Loader once the Shredder is removed. If the steel Pushwall is not installed in the southwest corner of Building #3 to allow larger Wheel Loaders to load materials (*and prevent spillage from the Wheel Loader bucket from potentially impacting the wall mounted utilities*), an alternative management tool in this area would be to employ maneuverable Wheeled Material Handlers (*Option 2.5*) to shepherd waste materials deposited in the westernmost Tipping Bay with more precision.

2.4.2 Benefits (★★)

This Option helps to address the challenges associated with limited number of Tipping Bays, which also contributes to increased Tipping Floor space and densification capabilities. Establishment of an extra vehicle Tipping Bay in Building #3 increases usable floorspace, reduces competition for vehicle tipping space and reduces the number of times material is touched by equipment. Currently, waste must be immediately and painstakingly removed from this area to allow for next Tipping Vehicle to access, without opportunity for segregation and densification.

Relocation of the shredding operations to unused space in Building #2 removes bulky, lightweight material from the current Tipping Floor of Building #3 to foster the more efficient management of more conventional, higher volume constituents of the solid waste stream. This serves to increase usable floorspace and on-floor waste density of the materials received within the Building on-site best equipped to manage them. In addition, removal of the existing, out of service Conveyor and Compactor system in Building #2 frees this unused space for other materials management such as future raggertail processing. As space on site is already at a premium to

accommodate the necessary materials management activities, the Building #2 Conveyor/Compactor Area presents a primary target that could be converted for higher utility use.

2.4.3 Costs ($ $ $ $)

While physically relocating the existing Shredder requires minimal investment, the Building #2 Conveyor/Compactor Area needs to be modified to house this equipment and processing.

- Removal of existing Conveyor/Compactor system within Building #2
- Distribution of existing electrical utilities in the conveyor/compactor room to connect to the relocated Shredder and Stacking Conveyor
- Relocate existing Shredder and add a Stacking Conveyor (*to allow direct loadout to a Dump Truck without grooming by mobile equipment*)

In addition, retrofits to the Tipping Floor area of Building #3 vacated by the Shredder would be necessary to make this revived Tipping Bay fully functional.

- Install new steel Pushwalls to protect the existing utilities in the southwest corner of Building #3. Similar to the Pushwalls proposed for the east and west walls of Buildings #2 and #3 (Option 2.2), the Pushwall would consist of W8X28 columns drilled through the existing slab and embedded into the soil below the slab. The steel below grade will be encased in concrete columns, as depicted on Detail 1 of Sheet S2. The vertical posts will be spaced at 4'-0" on-center with 5/8" thick steel plate spanning between the columns.
- Steel plate over current Shredder conveyor cutout in the existing Kneewall to prevent waste from falling into this trailer loadout area. The steel plate would be 3/4" thick with 3/8" thick stiffener plates spaced at 2'-0" on-center. The plate will be anchored to the existing construction with 3/4" epoxy anchors spaced at 2'-0" on-center.

In addition to the direct construction costs detailed within the Drawings and Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 122,200
Contractor Markups (General Conditions, Overhead and Profit)	$ 26,180
Allowance for Indeterminates - 20%	$ 25,360
Design and Other Consulting Services - 14%	$ 21,300
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 12,200
Project Contingency (Class 5 Cost Estimate) - 25%	$ 47,000
Total	**$ 285,000**

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

2.4.4 Schedule

As the Building #2 Conveyor/Compactor Area is not currently in use, the removal of the existing equipment would pose insignificant disruptions to existing operations.

It is estimated that installation of the new steel Pushwall should take two (2) to three (3) weeks but would remain primarily out of the active Tipping Floor area.

2.5 OPTIMIZE MATERIAL HANDLING AND SORTING

2.5.1 Summary of Optimization Technique – Wheeled Material Handlers

Implementation of compact Wheeled Material Handlers for picking and sorting within Buildings #1, #2 and #3 would increase agility and effectively decrease the equipment footprint occupied for material sorting and recovery. This combination would serve to decreases the number of "touches" by equipment by improving the kick-sort efficiency.

To utilize the equipment most efficiently, the responsibility for densification would primarily rest with the larger Material Handlers, so that mobility increase associated with the compact Wheeled Material Handlers can be deployed for "kick-sorting" efforts. This increased handling capability would be further optimized with selection of appropriate attachments. The proposed equipment and grapple configuration is expected to perform well for "dig out" of frozen waste materials within Tipping Vehicles, but the option exists to also equip with easily interchangeable attachments so that a bucket and thumb could be utilized for select activities as desired.

Typical specifications for the proposed Wheeled Material Handler are included in Appendix B. These documents should be considered as qualitative guidance concerning initial equipment identification and desired features and are not intended to direct the Agency towards a specific brand or constitute a complete bid specification for procurement.

2.5.2 Benefits (★★)

Implementation would effectively increase floor space by increasing equipment maneuvering speed and agility. The increased equipment agility means that this equipment could operate in Building #1 to add kick-sorting of material in this Building, and further refine kick-sorting activities already taking place in Buildings #2 and #3. Further, equipment movement between Buildings #2 and #3 could be conducted more safely and rapidly than is currently possible.

2.5.3 Costs ($ $ $ $)

The primary cost to implement this Option is the Wheeled Material Handler equipment cost, which is estimated to be approximately $275,000. This cost is on a per machine basis, with an expectation that up to two (2) Wheeled Material Handlers would be required to fully realize the above benefits. The two (2) machines would replace the two (2) existing tracked compact Material Handlers, which are utilized as needed throughout the three (3) main processing Buildings.

Details of the expected pricing, as well as example specifications, are included within Appendix B.

If this Option is implemented while the existing tracked compact Material Handlers have remaining usable life, there is a potential opportunity to recoup value for the existing equipment through sale or salvage value, or possible repurposing on-site to assist with less intensive material handling.

2.5.4 Schedule

As guided by previous equipment purchases, it is recommended to rent or demo proposed equipment (*or similar*) prior to purchase, to refine and optimize equipment specifications.

Implementation of this Option would be timed to replace the currently operating Mini Excavators.

2.6 EQUIPMENT REPLACEMENT – BUILDING #3 MATERIAL HANDLER

2.6.1 Summary of Optimization Technique – Replace Building #3 Material Handler (Sennebogen 818)

The Sennebogen 818 currently utilized on-site was originally purchased for another use and has not been optimized for capacity, reach and pre-crushing ability to best suit the operating demands it now routinely encounters. To this end, capital planning for replacing the wheeled Sennebogen 818 with a tracked Material Handler should be strongly considered. The new equipment would provide increased crushing strength and would be equipped with a stronger grapple to allow for increased pre-crushing and densification capabilities. In addition, a unit with a larger working envelope would allow both the Bypass Loadout Slot and Building #3 Loadout Slot to be accessed by the Material Handler without requiring repositioning on the Tipping Floor, such that it can remain in the northwest corner of the Tipping Floor and comfortably reach the entire trailer length in both loadout locations. Finally, a more stable based unit without outriggers would enhance safety and allow the unit to position itself in a more favorable position closer to the Kneewall in the loadout areas.

Initial specification of the proposed Building #3 Material Handler revolves around a ±80,000-pound machine, with an optimized boom and stick configuration designed to reach a 44' to 53' trailer length in both Building #3 Loadout locations and equipped with a rotating grapple similar to that specified for the Building #2 Material Handler.

2.6.2 Benefits (★★)

The benefit of an optimized Material Handler within Building #3 would be to reduce loadout time through more efficient densification and through the expanded working envelope that allows both loadout areas to be accessed without requiring repositioning on the tipping floor. In addition, reduced loadout time would be anticipated because of the operator confidence engendered by operating a more inherently stable piece of equipment.

The increased densification capabilities and grapple capacity also provide the ability to free additional Tipping Floor space and reduce the time (*and associated number of touches*) to process material.

2.6.3 Costs ($ $ $ $ $)

The cost to implement this Option is solely the Building #3 Material Handler equipment cost. Dependent on discounts afforded to government entities, it is expected that a Material Handler meeting the above described specification would require capital planning in the range of $500,000 to $750,000.

If this Option is implemented while the existing Sennebogen 818 Material Handler has remaining usable life, there is a potential opportunity to recoup value for the existing equipment through sale or salvage value, or possible repurposing on-site to assist with less intensive material handling.

2.6.4 Schedule

The existing Sennebogen 818 Material Handler has remaining usable life, so possible upgrade should be included in the three (3) year capital planning process to prepare OCRRA for the future expense.

In the time prior to this expenditure, rental or demo of similar equipment prior to purchase would allow the RCR operators and management staff to refine the specification.

2.7 OPERATIONAL MODIFICATIONS

2.7.1 Addition of Second Shift

The consideration to consolidate residential transfer operations at the RCR would require a second shift of material handling operators to segregate residential traffic from commercial traffic by confining residents to an afternoon second shift only. The implementation of the second shift provides offer the opportunity to alleviate site intensity associated with commercial materials during peak periods.

The addition of a second shift at the Facility would serve to provide additional operating capacity, allowing either materials processing (*kick sorting and/or densification*) or loadout to be delayed until these off-peak hours. With the additional Tipping Floor area and stockpile capacity afforded by some of the enumerated Options above, operators have the flexibility to delay some of these actions while the Tipping Bays are heavily utilized and still accommodate the NYSDEC permitting requirements for prompt material loadout.

Further, a second shift would allow the potential to coordinate off-hour transport of materials to the WTE to enable more efficient loading and transport. In addition to allowing greater opportunity to conduct material transfer without conflicting with private waste haulers, this second shift scheduling could accommodate the possible utilization of full-size Transfer Trailers for WTE-bound waste. Currently, the large unloading area needed and comparatively long unloading time makes this mode of transport prohibitive during normal WTE Facility acceptance hours.

3.0 MAINTENANCE AND ASSET PRESERVATION

Because existing transfer infrastructure RCR is regularly burdened during normal operations, it is important that appropriate maintenance activities are undertaken to protect and preserve the existing investment to mitigate asset degradation from becoming an additional obstacle to operating in compliance with NYSDEC permitting expectations and at desirable throughput levels for the expected design life of the Facility.

Preservation of Facility function begins with the approach and attitude throughout the Agency staff, with a commitment to continuous housekeeping, operational awareness, and preemptive investment to promote a culture that conveys the importance of maintaining a safe, functional, and resilient asset.

The tangible benefits of implementing mitigation efforts are primarily realized through the Facility's ability to prevent operational downtime during unscheduled and frequent repairs, as well as preserve the desired functions established for Facility components (*e.g. environmental controls, sorting/recovery capabilities, and throughput capacity*).

The following discusses some observed infrastructure components most susceptible to damage or wear and offers some mitigation strategies to address.

3.1 TIPPING FLOOR WEAR RESISTANT TOPPING

3.1.1 Summary and Benefits (★★★)

Review of the Record Drawings and submittals for the recent Building #3 construction revealed that the concrete mix submittal for the Tipping Floor and other flatwork specified primary aggregate of sedimentary formation with a questionable hardness (*i.e. Moh's Number of less than 4*). Typical specification for tipping floor application includes a large aggregate that is resistant to abrasive wear (*igneous "trap rock" with a Moh's Number of* ±7). From this, it is anticipated that the Tipping Floors may experience increased rates of abrasive wear due to the presence of lower modulus aggregate. Further, the underlying steel reinforcing is placed two inches (2") below the initial top of slab elevation. The combination of these factors could result in damage to the structural components of the Tipping Floor after a relatively short period of operations, as the concrete surface is worn down to expose the steel reinforcing.

As such, it is recommended that OCRRA conduct 3D scans of the Tipping Floors on a regular schedule to track the wear before the underlying steel reinforcing is exposed and compromised. The first 3D scan of the Buildings was conducted in March 2021 to establish a baseline condition as early in the design life of the Tipping Floors as possible. A graphic representation of this Tipping Floor Survey is included in Appendix E of this Report, illustrated by Building.

As the Tipping Floor wear begins to approach the underlying reinforcement, but before structural damage can take place, it is recommended that a Wear Resistant Topping be applied to each Tipping Floor surface. While more expensive than traditional high strength concrete, a Wear Resistant Topping is the best fit for the configuration of the RCR Tipping Floors as they require the wear course to be limited to the top two inches (2") to avoid structural impacts. The Wear Resistant Topping would be installed to maintain existing leachate drainage patterns and conform to in-place components including the leachate drainage structure grate elevations. Based on direction from the Wear Resistant Topping installer, the existing grates and leachate drainage structure would not require modification to accommodate the Wear Resistant Topping.

The EucoFloor 404 High Strength Cementitious Metallic Topping should be considered as a holistic means of addressing floor wear while minimizing operational downtime. Implementation of Wear Resistant Toppings is highly dependent on proper preparation and installation, in addition to the product characteristics, so it is critical to

rely only on experienced installers and proven products. See Appendix D for information on the EucoFloor 404 High Strength Cementitious Metallic Topping and examples of use in high wear transfer station environments.

Optimized equipment selected for use in operations can be outfit with composite or rubber bucket edge attachments to minimize unnecessary wear of tipping surfaces. While these cutting edges can be beneficial for minimizing floor wear, they can also impact the "cutting edge" of a Wheel Loader bucket and compromise the ability to scoop and charge the bucket. With the application of a Wear Resistant Topping rubber bucket edges may not be necessary to protect the floor.

3.1.2 Costs ($ $ $ $)

A regional EucoFloor 404 High Strength Cementitious Metallic Topping installer, Infrastructure Repair Service LLC (IRS), has provided budgetary pricing for topping the Building #3 Tipping Floor. It is anticipated that only one (1) Building would be repaired at a time and the approximate unit pricing can be translated to the Building #2 and #1 Tipping Floors. This budgetary pricing is not a firm quote and is expected to vary in line with normal fluctuations in labor and material pricing.

Additionally, the budgetary pricing from IRS was also tendered as a phased approach, highlighting the unit cost premium that would be added if the Tipping Floor of Building #3 were divided into two (2) separate mobilizations.

As detailed within Appendix D of this Report, the total estimate cost to install Wear Resistant Topping on less than half of Building #3 (*Area A*) is just over $300,000 (*±$80/square foot*). If Wear Resistant Topping is installed on the whole of Building #3 (*Areas A & B*), the overall estimate is approximately $525,000 (*±$61.50/square foot*).

3.1.3 Schedule

As observed in the March 2021 3D Tipping Floor scan, the estimated wear since installation is approaching 0.5" to 0.75" in less than one (1) year. As there are only two inches (2") of sacrificial wear thickness available, it is recommended that a follow up Tipping Floor scan be performed approximately 9 to 12 months after this initial baseline scan. Based on the estimated wear to date, it is recommended that OCRRA prepare to install a Wear Resistant Topping in mid-2022 to avoid impacting the steel reinforcing.

Installation of the EucoFloor 404 High Strength Cementitious Metallic Topping is typically performed over a single weekend starting on a Friday afternoon, with the quick curing duration allowing normal operations to resume that following Monday morning.

3.2 EXPAND CAMERA NETWORK

3.2.1 Summary and Benefits (★★)

Due to the importance of segregating Bypass waste and WTE-bound waste, as well as recovering recyclable materials, and the limitations of Buildings #1 and #2 to accept larger vehicles, the proper directing and screening of inbound Tipping Vehicles is a critical step to minimize the tipping duration and reduce materials movements on the Tipping Floor. Currently, each inbound Tipping Vehicle is first either directed to the Flat Rate Booth or the Inbound Scale depending on vehicle type. Once a Tipping Vehicle is on the Inbound Scale, each load is visually inspected by OCRRA staff from an adjacent ladder. Expansion of the Facility's camera/intercom network could serve to more efficiently manage the inspection of inbound Tipping Vehicles and subsequent directing of customers to the appropriate Tipping Bay. This function can be performed by the Scalemaster within the existing Outbound Scale Booth, who is already tied into the real time operating conditions within the Buildings.

Facility safety would be enhanced as it would eliminate staff manually climbing an exterior ladder, in varying weather conditions, to inspect Tipping Vehicle payloads. Additionally, the labor freed from tending the Inbound Scale area could be redistributed elsewhere as needed.

3.2.2 Costs ($)

RCR has a comprehensive communications and security system that is connected to the Inbound and Outbound Scales, as well as the real-time views of each Tipping Floor. The expansion of cameras at the Inbound Scale will be coordinated with this existing system, and investments would be limited to installation of two (2) additional elevated cameras at the Inbound Scale and corresponding monitors within the existing Outbound Scale Booth.

This modification would result in added workload for the outbound Scalemaster, but initial discussions with staff have indicated that this additional task could be accommodated.

In addition to the direct construction costs detailed within Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, administrative*), and contingency allowances. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 11,400
Contractor Markups (General Conditions, Overhead and Profit)	$ 2,970
Allowance for Indeterminates - 20%	$ 2,870
Design and Other Consulting Services - 14%	$ 2,400
Construction Administration Costs - 8%	$ 1,400
Project Contingency (Class 5 Cost Estimate) - 25%	$ 5,300
Total	**$ 26,000**

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

3.2.3 Schedule

Installation of the proposed cameras and monitors should be limited to a few days of on-site work, with minimal impacts to operations.

3.3 BUILDING SYSTEMS RELOCATION

3.3.1 Summary and Benefits (★★)

To minimize the potential for damage during operations, relocation of the below enumerated utilities/building components would further improve the internal operating environment by moving these vulnerable features away from the most intense aspects of facility operations. These recommendations are separate from and additional to the proposed fire suppression and dust suppression piping proposed as part of Option 2.1 that seeks to improve the Building #2 Loadout location. The items identified for relocation are as follows:

- Building #1 – to protect existing utilities
    - Electric Service/Switch relocation along the eastern wall
- Building #2 – to gain ceiling clearance
    - Electrical Service Conduit realignment
- Building #3 – to remove obstacles from Loadout Tunnels
    - Sanitary Vent Piping realignment
    - Interior Roof Drain Downspout realignment to the exterior

- Water Supply Piping realignment
- Electric Service/Switch relocation

Relocation of the building systems will reduce downtime from damage during operations, and, in the case of impacted leachate collection, will improve the performance of the utility. Most notably, relocation of the utilities should have a material, positive improvement to mobile equipment operations as site operators are no longer required to exercise excessive degrees of care and vigilance to avoid the obstacles.

3.3.2 Costs ($ $ $)

In addition to the direct construction costs detailed within Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 59,250
Contractor Markups (General Conditions, Overhead and Profit)	$ 19,780
Allowance for Indeterminates - 20%	$ 15,810
Design and Other Consulting Services - 14%	$ 13,300
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 7,600
Project Contingency (Class 5 Cost Estimate) - 25%	$ 29,600
Total	**$ 148,000**

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

Due to the range of utilities that could be relocated to improve operations, the total estimated probable construction cost could be customized and is highly variable, subject to multiple mobilizations and unknowns relating to historic structures or undocumented as-built conditions.

3.3.3 Schedule

As described under Section 3.1, a full 3D Building scan has been performed, which captures the as-built location of utilities and piping. To utilize these as-built locations, and the alignment of adjacent Building components that would impact realignment, the next step will be to develop a 3D Building Information Model (BIM) to inform the detailed design of relocated building systems. The schedule and extent of realignment can be prioritized by OCRRA and guided by operational damage as it occurs.

Duration of construction and impacts to operations would be dependent on the number and location of impacted building systems included in the planned construction.

3.4 DOORWAY PROTECTION/BOLLARDS

3.4.1 Summary and Benefits (★)

The bollard design that was implemented with the construction of Building #2 and #3 has been demonstrated to be insufficient to withstand the impacts from Tipping Vehicles and mobile equipment, and multiple bollards have been either completely removed or significantly damaged. The installed design utilizes a surface bolting pattern,

which could be improved with installation of a subsurface receiver tube and concrete-filled pipe bollard that extends approximately four feet (4') below grade. This design provides stability through the receiver tube and accommodates replacement of damaged pipe bollards without significant construction or impacts to the Tipping Floor/paved surface. These heavy-duty interior and exterior bollards would serve to protect the existing Tipping Bay Door jambs/guide tracks.

Figure 2 provides a typical detail for the recommended pipe bollard with receiver tube, which can be utilized in interior and exterior applications.

3.4.2 Costs ($)

The proposed interior and exterior bollards would include the material costs for planned bollard replacement, as well as the coring and repair of the existing Tipping Floor and/or pavement. The total estimated probable construction cost presented below represents the total cost for installation of four (4) heavy-duty bollards.

In addition to the direct construction costs detailed within Figure 2 and Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 7,500
Contractor Markups (General Conditions, Overhead and Profit)	$ 1,950
Allowance for Indeterminates - 20%	$ 1,890
Design and Other Consulting Services - 14%	$ 1,600
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 900
Project Contingency (Class 5 Cost Estimate) - 25%	$ 4,100
Total	**$ 20,000**

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

3.4.3 Schedule

The replacement of existing bollards can be performed as the need arises due to damage to these in-place bollards, but there will be a premium price for additional mobilization events and smaller material quantities. To minimize the disturbance, OCRRA should consider replacement of high traffic bollards (*those subject to the most routine damage*) on the interior of each Building to be coordinated with the recommended Tipping Floor Wear Resistant Topping installation.

3.5 PUSHWALL ARMORING

3.5.1 Summary and Benefits (★)

Steel embed plating on the faces and caps of high usage Pushwalls can be employed to significantly reduce the wear potential on these critical concrete surfaces. The Pushwalls in Building #3 do not have accommodations for this surface protection, and damage from mobile equipment impact and wear is visible in some locations.

3.5.2 Costs ($ $)

While it is most efficient to install the steel plating during initial Pushwall construction, existing Pushwalls can be retrofit if the steel plate installation is coordinated with the recommended Tipping Floor Wear Resistant Topping to enable the plating to be embedded below the Tipping Floor slab surface. The steel plating should extend below the slab surface to eliminate locations where a steel edge can be caught on a Wheel Loader bucket, and the top edge of the plating will require beveling to reduce risk of catching the lip with a Wheel Loader during downward movements. The retrofit steel plating will then be epoxy anchored into the existing Pushwall. A detail illustrating this concept is included in the Drawings section.

The cost of this Option is highly dependent on prevailing steel market costs and will vary with the desired height of steel plating. A minimum height of four feet (4') of Pushwall armoring is recommended, with additional height up to approximately twelve feet (12') providing enhanced protection for the Pushwalls. The below costs assume a steel height of approximately four feet (4').

In addition to the direct construction costs detailed within the Drawings and Appendix C, "Cost Estimate Support" this Option includes contractor markups, the "soft" costs (*e.g. design, bid document preparation, permitting, administrative*), and contingency allowances. Budgetary reserves to support implementation of this Option are summarized below:

Cost Component	**Estimated Probable Construction Costs (mid-2022 $)**
Direct Construction Costs	$ 37,100
Contractor Markups (General Conditions, Overhead and Profit)	$ 9,650
Allowance for Indeterminates - 20%	$ 9,350
Design and Other Consulting Services - 14%	$ 7,900
Permitting and Other Agency Costs - Allowance	$ 2,500
Construction Administration Costs - 8%	$ 4,500
Project Contingency (Class 5 Cost Estimate) - 25%	$ 17,800
Total	**$ 89,000**

The Basis of Estimate used to obtain the above cost is included within Appendix C, "Cost Estimate Support" of this Report.

3.5.3 Schedule

In order to realize the required embedment of the plate steel within the Tipping Floor surface and protect the steel edge, installation would be coordinated with Tipping Floor Wear Resistant Topping so that the Wear Resistant Topping is placed over the plate steel.

The impact to operations required to accommodate the installation of the new Pushwall armoring would be minor, as portions of the new steel plating can be fabricated offsite, and the installation time is minimal.

4.0 FUTURE SITE INVESTMENTS

To this point, efforts have focused on improvements to enhance Facility operations and throughput capability in the near-term. However, once the near-term enhancements have been considered and/or implemented, there are longer term infrastructure development options that can be advanced to progress towards further effective transfer station optimization. These options require greater capital and planning coordination, and may cause a more significant impact to RCR operations during implementation, but will continue to expand the opportunities for improving and consolidating operations at RCR. Costs have not been developed for the future site investments due to a large range of variables and implementation priorities for these concepts.

4.1 BUILDING #3 EXPANSION

Expansion of Building #3 would provide the greatest opportunity to enhance Facility throughput capability. There are two (2) expansion options to consider.

The first option would be to "expand" the available Tipping Floor within the existing Building #3 footprint by filling in the existing "Metals Storage Pit" to create an additional vehicle tipping bay. Metals management would then be serviced by a roll-off box located within the area of Building #3 currently housing the Shredder or west of the Outbound Scale Booth. Both will require evaluation of the current Outbound Scale and Outbound Scale Booth location and relocation of an existing fire hydrant.

The second option would be to expand the entire Building to the east. As Building #3 is already constructed with appropriate interior clearance and dedicated Loadout areas, there would be minimal impact to the existing structure during expansion efforts. In an expanded footprint scenario, evaluation of utilizing the twelve foot (12') grade separation between the Tipping Floor and the Loadout Tunnel Floor to accommodate a full grade Loadout Chute could be established to profoundly increase waste loadout efficiency at the Facility. This option would also require a fire hydrant relocation as well as relocation of the Outbound Scale and Outbound Scale Booth.

4.2 BUILDING #2 EXPANSION

Building #2 utility would be enhanced by raising the height of the ceiling, Tipping Bay doors and overhead Utilities via vertical Building expansion. This improvement would better accommodate receiving of larger commercial vehicles. The increased ability to receive larger commercial vehicles and process the material without ceiling height constraints would provide more advantage to potential future removal of the northern wall of the Tipping Floor in Building #2 to connect this Tipping Floor space to the Compactor Area of Building #2, allowing the Compactor Area to be more effectively utilized for loadout, shredding, and/or raggertail processing.

4.3 BUILDING #2 AND #3 CONNECTIVITY

To enhance equipment and material movement between Buildings, consideration should be given to abandon or shorten the Bypass Loadout Slot within Building #3 and/or remove and bridge the existing structural columns between Buildings #2 & #3. The modified area would then be reestablished as clear floor areas that would greatly improve the continuity of these adjoining operating areas.

4.4 AUTOMATED C&D SORTING SYSTEM

The RCR's primary function is to efficiently receive, process and segregate C&D waste into a combustible fraction for use as feedstock utilized by the WTE from a non-combustible fraction destined for end-disposal. This task is currently being accomplished by various "manual" methods using mobile heavy equipment conducting on-floor

kick-sorting of received materials into combustible and non-combustible streams. Even under the best of operating environments this approach is laborious and inefficient at conducting high-volume floor sorting of C&D material. The forced geometries and adapted infrastructure that the RCR currently imposes on operations further challenges floor sorting efficacy. However, these geometric obstacles present less of an issue for a properly designed sorting system that is engineered to convey and segregate materials during transfer.

It is worth exploring options with sorting system manufacturers for implementation of automated C&D processing at the Facility. It is envisioned that an Automated C&D Sorting System could be configured to take advantage of the existing geometric obstacles impeding current Facility processes by including and engineered system of resizing, conveying, and sorting equipment that sequentially receives and processes material using the following methodology:

- Material would be initially fed into dual infeed shredders to resize material and enable conveyance to downstream sorting/separation equipment;
- The shredded material would then be screened to remove fines;
    - Fines would be conveyed to a Transfer Trailer for transport for end disposal;
- Material would then continue to be sorted into a "heavy and undersized" fractions and "light and oversized" fractions;
    - The "heavy and undersized" fractions would be screened for ferrous and non-ferrous materials and subsequently conveyed to a Transfer Trailer for end disposal;
    - The "light and oversized" fractions would also be screened for ferrous and non-ferrous materials and subsequently conveyed to a Dump Truck for transport to the WTE.

The benefits of an Automated C&D Sorting System include the following:

1. Building #1 and #2 were designed in the early 1970's to incorporate period methods of at-grade receipt and in-feed consolidation of material, implementing a semi-automated process line within the Facility. Pursuing an engineered solution that can accommodate the physical challenges presented by the configuration of Building #1 and #2 would be less in conflict with material movement utilizing current "lift and load" methodologies that the existing infrastructure was not originally intended to accommodate.
2. A sorting system would pre-emptively remove fines from the waste stream. This has two (2) benefits. First, the WTE will be provided with a more beneficial feedstock more uniformly meeting preferred specification. Second, the fine material may be suitable for use as landfill daily cover (which may result in off-set savings for disposal).
3. A sorting system would significantly improve the efficiency of material sorting and significantly increase the volume of material able to be sourced to the WTE, and conversely reduce the amount of Bypass waste requiring landfill disposal.
4. A sorting system would likely result in increased capture and diversion of ferrous and non-ferrous metals for beneficial reuse.
5. Materials could be conveyed and directly discharged into Transfer Trailers and Dump Trucks to avoid or minimize the need for material stockpiling and double-handling while streamlining housekeeping procedures.

4.5 PURSUE ELECTRIFICATION OF EQUIPMENT

An OCRRA long term goal for environmentally sustainable operations is to move away from fossil fuels and toward cleaner, more sustainable sources of energy. Heavy equipment manufacturers have made positive strides to improve selections and performance of material handling equipment, but viable, cost effective options to conduct the full range of tasks, like those undertaken at the RCR, using electric battery power are currently

unavailable or limited to “mini” class machines. There are instances of very positive experiences with full size diesel/electric hybrid wheel loaders operating at transfer facilities, which provide a significant reduction in fuel usage and improve indoor air quality and should be considered as a future equipment purchase. However, in terms of fully electric equipment to replace the current equipment functions, the industry is in the early stages of developing full suite equipment solutions to support the needs of waste handling facilities and other heavy equipment applications. Progress in this shift from diesel to electric power continues however as recent conversion from diesel to “plug-in” electric material handlers is currently being implemented by a number of solid waste facility operators.

With the initial production of retail electric semi-trucks in recent years, OCRRA may be able to evaluate a future shift of the Transfer Trailer fleet to electric battery power for short haul on-site “yard jockeys” and/or the Transfer Trailers for Bypass waste (*depending upon trip distance and payload*). While this equipment is still currently prohibitively expensive compared to similarly specified traditional tractor units and production is limited to just a couple manufacturers in North America, the industry is evolving and being trialed for delivery routes by larger logistics suppliers. Depending on the Bypass waste disposal location and industry developments, electrification of OCRRA’s Transfer Trailer fleet may be more price competitive in the next 10 years.

5.0 SOLID WASTE MANAGEMENT PLANNING

5.1 BYPASS WASTE DISPOSAL OPTIONS

OCRRA's current waste management system, and RCR in particular, is heavily reliant on the continued operation of the WTE to support its current operating structure. WTE Facility operational decisions and conditions, including scheduled downtime, unscheduled maintenance, and capacity limitations, impact the flow of materials through RCR. The WTE Facility's limited processing capability to accept inbound waste deliveries materially impacts throughput and truck turn time, thus further placing operational demand on the RCR to serve as the staging location of received waste materials. In addition to the short-term impacts from the WTE Facility's operations, OCRRA may be affected by a paradigm shift in the industry away from WTE technology in populous regions, resulting from regulatory challenges related to greenhouse gas emissions, air quality and environmental justice impacts.

Further, because WTE Facility downtime increases the amount of Bypass waste requiring alternate disposal, the RCR transfer station needs access to reliable and feasible secondary disposal options because municipal solid waste (MSW) cannot be bypassed for landfill disposal due to imposed flow control requirements.

Changes in available disposal options in the Syracuse region will impact OCRRA's Bypass waste disposal management strategy. The majority of Bypass waste volume is currently hauled to Camillus, NY for landfill disposal, which is a relatively short trip duration to and from the RCR (*approximately two (2) hours round trip*). Should Camillus not expand their landfill capacity in the near future, the nearest alternative disposal option currently available is the Seneca Meadows Landfill, which would increase the trip "turn time" from RCR to over four (4) hours.

With the potential future loss of available disposal capacity proximate to the Syracuse area, it is prudent that OCRRA evaluate the logistical and financial system impacts that utilizing more distant alternative disposal sites would impose as part of OCRRA's mid-term to long-term solid waste management waste planning efforts.

5.1.1 Long Haul Transport to Existing Landfills with Long-Term Capacity

At current waste receipt rates, the Camillus Landfill is expected to reach capacity in approximately two (2) years. The nearest alternate disposal option is at the Seneca Meadows Landfill, which would require more than double the trip duration time than that required to access Camillus currently. In addition, the Seneca Meadows Landfill permitted waste acceptance hours are from of 6:00 am to 2:00 pm, thus making it virtually impossible to conduct multiple live load turns of a Transfer Trailer per operating day from RCR to this facility. The logistical ramifications of this include:

- Additional costs for transportation and fleet expansion;
- Need to identify and develop areas for on-site trailer storage space and establish regulatory compliance of these areas; and
- Places additional importance on selection of trailer type to maximize each trip and manage more material in each trailer payload.

Long haul transport will require changes in the size and composition of the Bypass waste Transfer Trailer fleet. The existing fleet, comprised of approximately seven (7) tractors and nine (9) trailers, has been conveyed to be adequate for the Agency's current transportation needs. However, more Transfer Trailers with higher capacity, and more drivers, will be required to expand long haul transport abilities. It may be prudent to prepare capital plans and operating budgets for contingency measures if local disposal capacity for Bypass materials becomes unavailable.

5.1.2 Local Landfill Capacity

Development of local disposal option(s) would enable continuation of the current Bypass waste disposal arrangement. However, this solution would require OCRRA drive and bear the cost of this development and may require implementation of intermediate "bridge" solutions resulting during the period when the Camillus Landfill reaches capacity and the new disposal option is permitted, constructed and operational. Local disposal capacity is imperative to support the County's goal to manage solid waste locally.

5.2 LEY CREEK TRANSFER STATION

The Ley Creek Transfer Station currently supports residential drop-off activities as well as serves as the system contingency transfer facility should the WTE experience down time. However, taking a longer view, the Ley Creek Transfer Station asset may provide a pivotal role in providing system flexibility during the mid-term to long-term planning and management of OCRRA's solid waste management system. As previously noted, the effectiveness and appropriateness of RCR operations and its currently employed hauling infrastructure is heavily reliant upon the continued operation of the adjacent WTE and the local landfill operation at Camillus as disposal options for OCRRA to source waste material. The operational and financial dynamics of the OCRRA system would profoundly shift should one or both facilities cease operations. In the future, it is likely that an increasing amount of OCRRA waste will require final disposal at facilities much further removed from that currently accessed. As a result, it is prudent for the Agency to begin formulating how it will provide for an adequate facility and long-haul logistical network necessary to support this future contingency. As OCRRA has increasingly consolidated operations away from Ley Creek to the RCR, it provides a "blank slate" opportunity to explore redevelopment scenarios to define what role the Ley Creek will play within the LSWMP and OCRRA in the future. These development and operating scenarios range from continuing to provide ancillary services such as "enhanced" residential drop-off capabilities, contingency transfer capacity, or a wholesale redeveloped transfer and/or material processing facility. The location could serve new, unrealized opportunities that support OCRRA's solid waste management system.

6.0 OPTIMIZATION AND MAINTENANCE COMPARISON SUMMARIES

Each Option in Sections 2 and 3 have been assigned a relative "benefit" ranking on a scale of one (1) to three (3) star symbols (★) and is similarly ranked based on "cost" to implement on a scale of one (1) to six (6) dollar symbols ($). The cost/benefit evaluation is summarized within the below tables, with respective symbols qualitatively contributing towards assignment of an Overall Value ranking.

The Impact to Operations from Downtime is interpreted from the estimated construction schedules discussed under each Option in Section 2 and Section 3, based on the construction duration as well as the interference of this work with Facility operations.

As the goal of the Optimization Study is to improve the throughput and overall operations at RCR, the "benefit" ranking has been prioritized when assigning the Overall Value ranking.

Table 6-1. Optimization Technique Summary

Option #	Optimization Technique	Benefits	Costs	Impact to Operations from Downtime	Overall Value
2.1	Building #2 Loadout Location Improvements	★★★	$ $ $ $	Medium	☑ ☑ ☑
2.2	Improve Handling and Densification Capabilities	★★★	$ $ $ $ $	Medium	☑ ☑ ☑
2.3	Increase Available Floor Space	★★★	$ $ $ $ $ $	Medium	☑ ☑
2.4	Increase Number of Usable Tipping Bays	★★	$ $ $ $	Low	☑ ☑
2.5	Optimize Material Handling and Sorting	★★	$ $ $ $	Low	☑ ☑
2.6	Equipment Replacement – Sennebogen Upgrade	★★	$ $ $ $ $	Low	☑

Table 6-2. Maintenance and Asset Preservation Summary

Option #	Maintenance/ Asset Preservation	Benefits	Costs	Impact to Operations from Downtime	Overall Value
3.1	Tipping Floor Wear Resistant Topping	★★★	$ $ $ $	Low	☑ ☑ ☑
3.2	Expand Camera Network	★★	$	Low	☑ ☑ ☑
3.3	Building Systems Relocation	★★	$ $ $	Low-Medium	☑ ☑
3.4	Doorway Protection/Bollards	★	$	Low	☑
3.5	Pushwall Armoring	★	$ $	Low	☑

Calibrated by the range of costs obtained for the above Options, the assignment of dollar symbols ($) has been approximately based on the below overall implementation cost ranges.

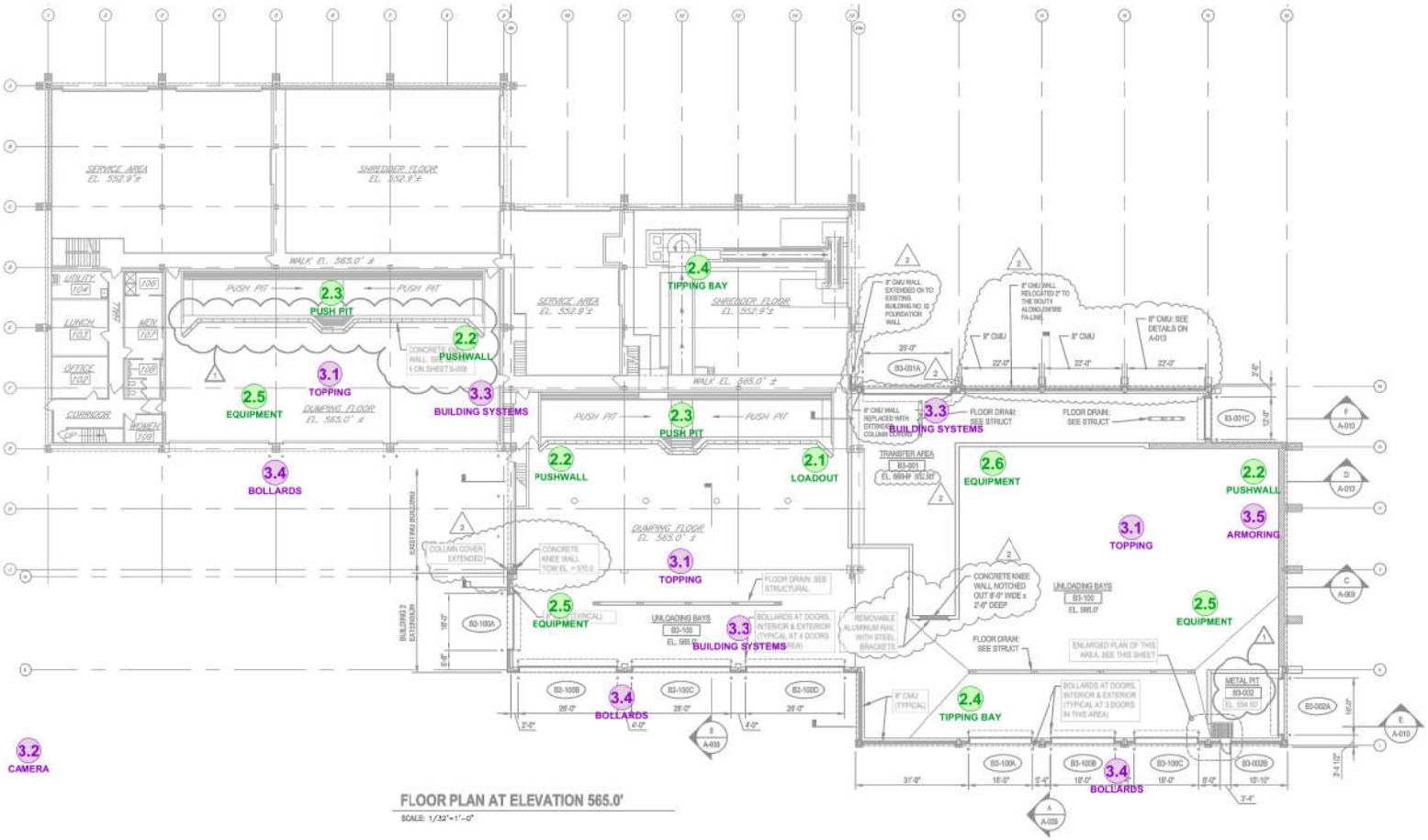
Low Range	High Range	Symbol
$750,001	$1,030,000	$ $ $ $ $ $
$500,001	$750,000	$ $ $ $ $
$250,001	$500,000	$ $ $ $
$100,001	$250,000	$ $ $
$50,001	$100,000	$ $
< $50,000	$50,000	$

7.0 LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (*unless previously agreed upon that a third party could rely on the work product*) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (*including opinions, conclusions, suggestions, etc.*) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone Engineering and Geology, PLLC shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

FIGURES



NOTE: BACKGROUND DRAWING IS SHEET NO. A-005 "BUILDING 1, 2, 3: SECOND FLOOR PLAN & PARTIAL THIRD FLOOR PLAN" PREPARED BY GHD CONSULTING SERVICES INC. OF SYRACUSE, NY, LAST REVISED 08/2020.

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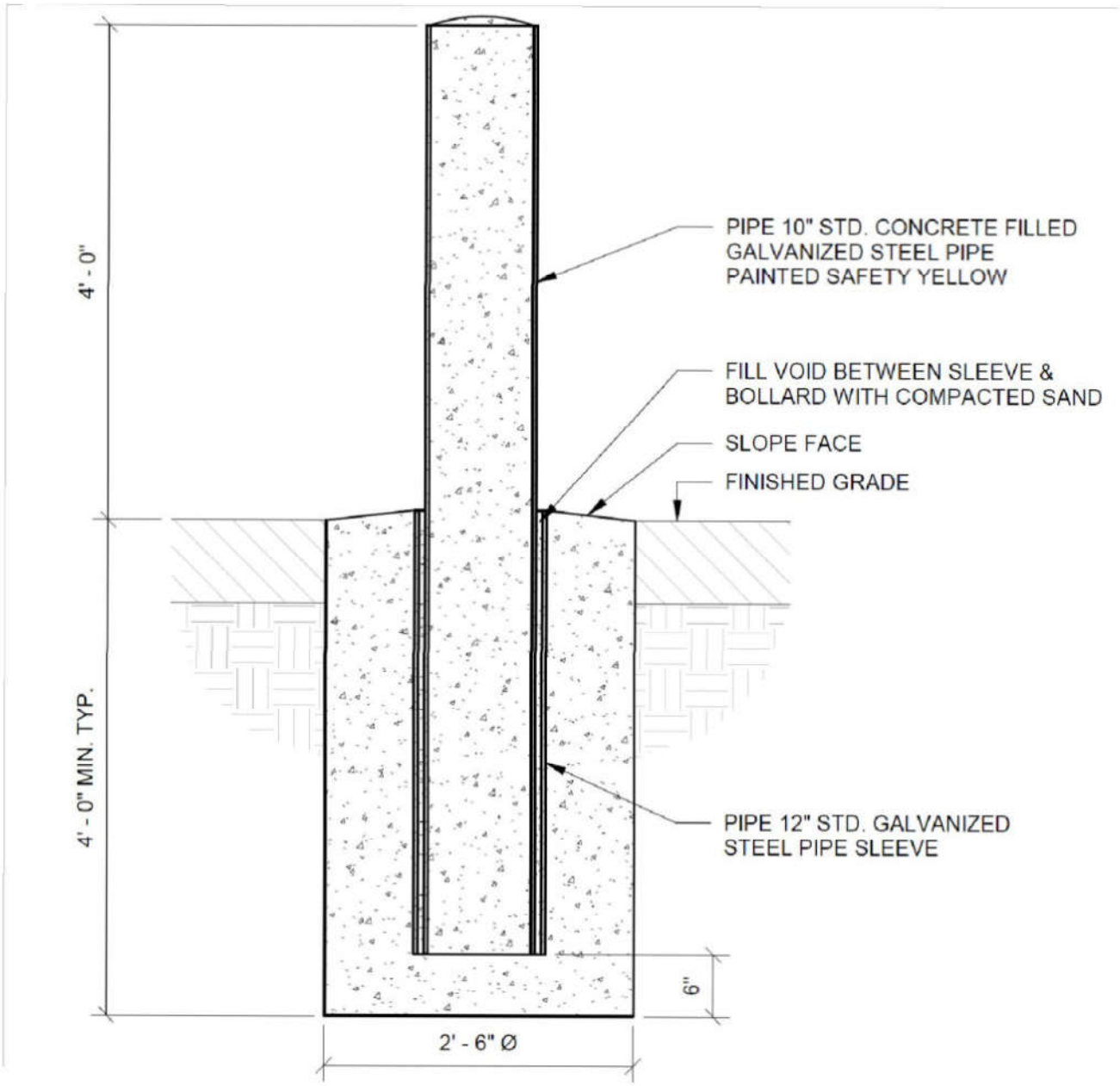
ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
RCR TRANSFER STATION OPTIMIZATION STUDY

ROCK CUT ROAD TRANSFER STATION
FLOOR PLAN

FIGURE NO.
1
PROJECT NO.
4213192



TYPICAL DETAIL - PIPE BOLLARD

SCALE: N.T.S.

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ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
RCR TRANSFER STATION OPTIMIZATION STUDY

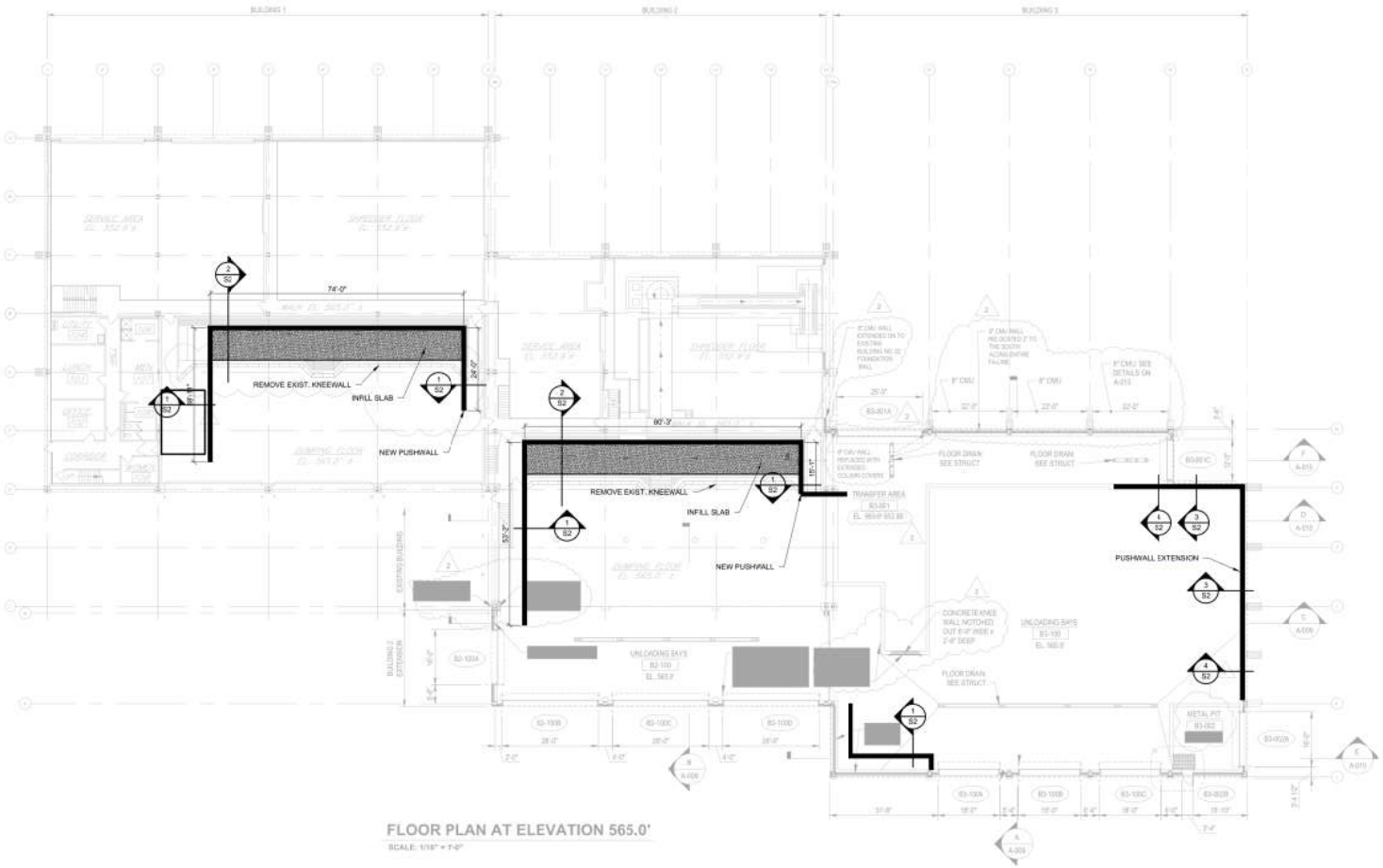
TYPICAL BOLLARD DETAIL

FIGURE NO.
2

PROJECT NO.
4213192

DRAWINGS

Sheet S1	Pushwall Modifications
Sheet S2	Pushwall Details



FLOOR PLAN AT ELEVATION 565.0'

SCALE: 1/16" = 1'-0"

CONCEPTUAL DESIGN FOR PLANNING PURPOSES ONLY - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
DATE OF ISSUE	04/28/2021	DRAWN BY VAG DESIGNED BY VAG	CHECKED BY VAG APPROVED BY VAG			

TETRA TECH

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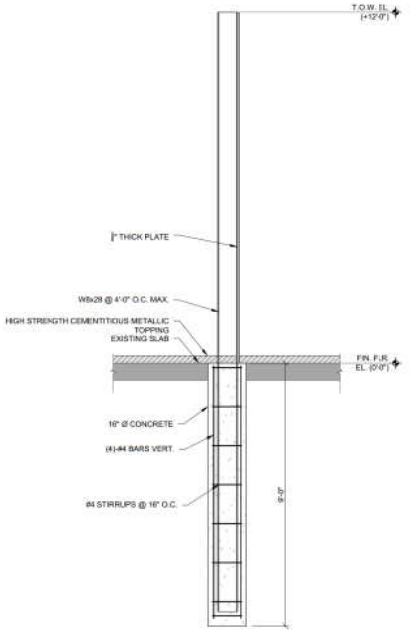
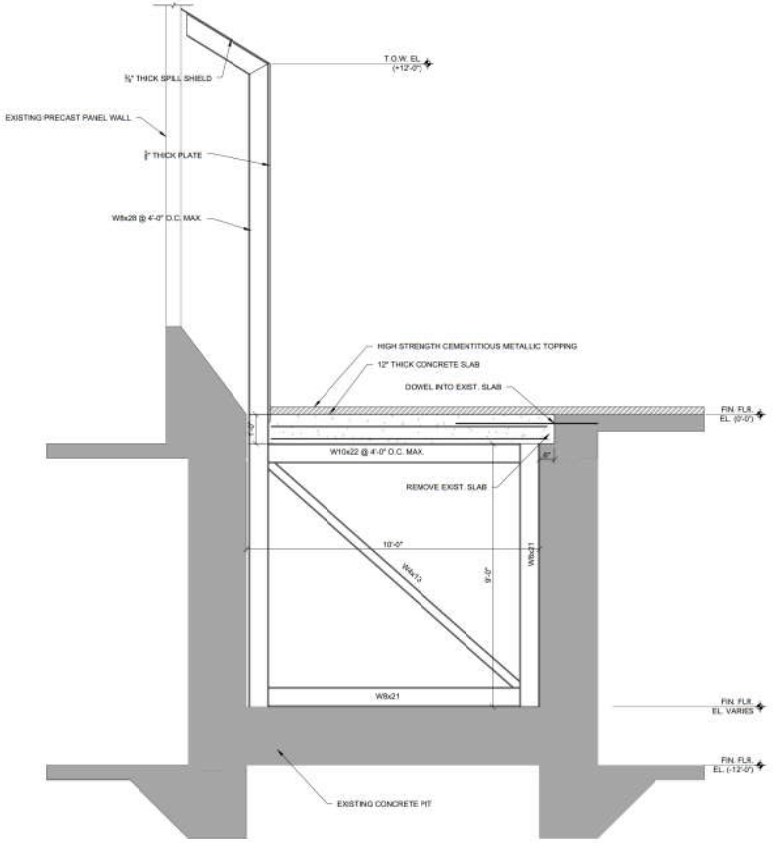
ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
ROCK CUT ROAD TRANSFER STATION

PUSHWALL MODIFICATIONS

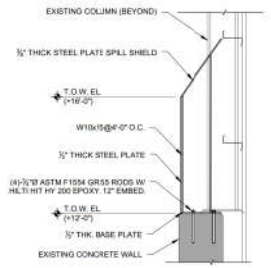
SHEET NO.
S1
PROJECT NO.
190221



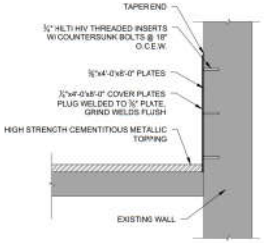
1/S2 SECTION- NEW PUSHWALL
SCALE: 1/2"=1'-0"



2/S2 SECTION- NEW PUSHWALL
SCALE: 1/2"=1'-0"



3/S2 SECTION- PUSHWALL EXTENSION
SCALE: 1/2"=1'-0"



4/S2 SECTION- PUSHWALL ARMORING
SCALE: 1/2"=1'-0"

CONCEPTUAL DESIGN FOR PLANNING PURPOSES ONLY - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
	DATE OF ISSUE 04/28/2021	DRAWN BY VAG DESIGNED BY VAG			CHECKED BY VAG APPROVED BY VAG	

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ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
ROCK CUT ROAD TRANSFER STATION

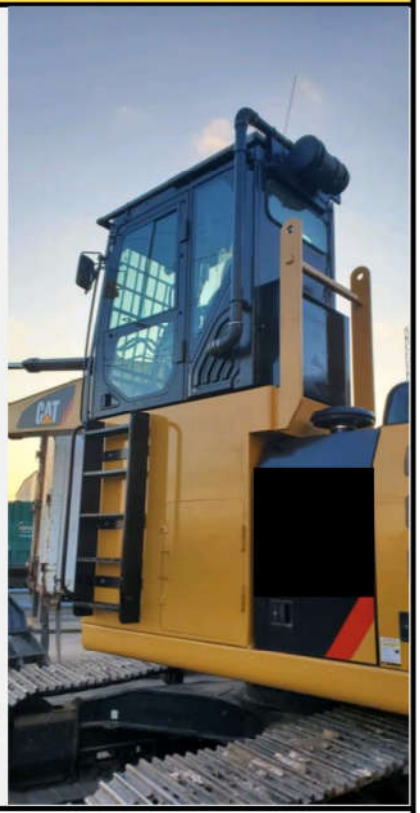
PUSHWALL DETAILS

SHEET NO. **S2**
PROJECT NO. 190221

APPENDIX A

BUILDING #2 MATERIAL HANDLER

Cost Estimate - Building #2 Material Handler



Make:	Case		
Model:	CX 145D SR		
Pricing:	Base Machine and Options - Factory Installed	Std Boom (15'-2"), Std. Stick (8'-2"), Dozer Blade	$180,000
		Aux. Hydraulic Circuit (grapple rotator)	
		Hose Burst Check Valve (HBCV)	
		27.6" Track with Rubber Pads	
		FOPS (Level 2)	
		Front Rock Guard (2 piece) OPG2	
		Side-view Camera (left)	
		Max View Monitor	
		(8) LED lights - (2) each front, rear, sides, cab	
		Telematics (require subscription)	
	Accessories - Dealer Installed	Raised Operator Cab (LRHR, LLC 4' Riser)	$49,000
		Waste Handling Package (including):	$8,500
		Reverable Cooling Fan	$4,000
		Rotating Grapple (2 over 3 tine)	$27,500
Estimated Total:			$269,000
Contingency:	20%		
Total with Contingency:			**$322,800**

Contact:
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East Syracuse, NY 13212
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(315) 506-9805 (cell)
mwisniewski@monroetractor.com

CASE CONSTRUCTION

CX145D SR

SHORT RADIUS EXCAVATOR

DOZER BLADE

TIER 4 FINAL CERTIFIED

ENGINE

Model	Isuzu AM-4JJ1X CEGR, SCR and DOC
Emissions Certification	Tier 4 Final
Fuel	Requires ultra low-sulfur fuel B5 biodiesel tolerant
Type	Water-cooled, 4-cycle, high pressure common rail system. Turbo-charged w/ air cooled intercooler
Cylinders	4-cylinder in-line
Displacement	183 in^3 (3.0 L)
Bore/Stroke	3.76 x 4.13 in (95.4 x 104.9 mm)
Fuel injection	Direct injection – electronic
Fuel filter	Replaceable, full flow spin-on cartridge
Air filter	Dry type element w/ warning restriction indicator
Oil filter	Replaceable, full flow spin-on cartridge
Engine gradeability:	
Side-to-side	35˚
Fore and aft	35˚
Net horsepower – SAE J1349 @ 2000 RPM:	102 hp (76.4 kW)
Net max. torque – SAE J1349 @ 1800 RPM:	257 lb·ft (349 N·m)
Cooling operating range:	109˚ to -13˚ F (43˚ to -25˚ C)
Oil	Requires low-ash oil CJ-4

DRIVETRAIN

Travel control	Dual stage relief/ counter balance design
Brakes	Mechanical disc
Service brakes	SAHR disc – each motor
Two speed travel:	
Max. high speed	3.5 mph (5.6 kph)
Max. low speed	2.1 mph (3.4 kph)
Automatic downshift	
Drawbar pull	26,100 lbf (116 kN)
Gradeability	70% – 35˚ slope

ELECTRICAL

Voltage	24 Volts
Alternator rating	50 amp
Batteries	2 x 12 Volt
Battery reserve capacity	72 Ah/5 hour
Work lights – 4 1 boom, 1 upper, 2 cab	24 Volt/70 watt

OPERATOR ENVIRONMENT

Air-conditioner output	13,492 BTU/hr
Heater output	12,897 BTU/hr
Sound level inside cab – ISO6395	70 dBA
Electrical outlet	12 Volt
Cab interior light	10 watt
Side view camera – right	Standard
Seat	Air-suspension

ATTACHMENT

Boom	15 ft 2 in (4 630 mm)
Arm	8 ft 2 in (2 500 mm)
Bucket digging force	20,200 lb·ft (90 kN)
w/ Auto Power-Boost	21,400 lb·ft (95 kN)

NOTE: *Digging force ratings based on ISO6015.

OPERATING WEIGHT

Operating weight	33,600 lb (15 200 kg)
w/ shoes	2 ft 0 in (600 mm)
w/ boom	15 ft 2 in (4 630 mm)
w/ arm	8 ft 2 in (2 500 mm)
w/ bucket	882 lb (400 kg)
w/ blade	8 ft 6 in (2 590 mm)
w/ counterweight	7,860 lb (3 570 kg)

NOTE: W/ operator/full fuel/standard equipment.

GROUND PRESSURE

@ Standard operating weight 5.9 psi (0.41 bar)
w/ 23.6 in (600 mm) triple grouser shoes,
8 ft 2 in (2.5 m) Arm, 0.65 yd^3 (0.5 m^3) bucket

HYDRAULICS

System design	Open center
Main pumps	Two-variable displacement/ axial piston
Max. rated flow per pump:	34.1 gpm (129 L/min) @ 2000 RPM
Max. rated flow total:	65.5 gpm (248 L/min) @ 2000 RPM
System pressures:	
Boom, arm and bucket	4,970 psi (343 bar)
w/ power boost	5,260 psi (363 bar)
Travel circuit	4,970 psi (343 bar)
Swing circuit	4,050 psi (279 bar)
Blade circuit	2,990 psi (206 bar)
Pilot pump	1 x gear design
Max. capacity	5.3 gpm (20 L/min)
Controls	w/ boom/arm holding valve
Right track travel, bucket, boom and arm acceleration.	1 x Four-spool section
Left track travel, auxiliary, swing, boom and arm acceleration.	1 x Five-spool section
Blade	1 x One-spool section
Work mode selections	SP: Speed Priority H: Heavy-Duty A: Automatic
Swing motor	Fixed displacement axial piston
Swing final drive	Planetary gear reduction
Travel motor	Two-speed independent travel/axial piston

HYDRAULIC CYLINDERS

Boom cylinders	Two (2)
Cylinder bore	4.1 in (105 mm)
Cylinder rod diameter	3.0 in (75 mm)
Cylinder stroke	44.1 in (1 120 mm)
Arm cylinder	One (1)
Cylinder bore	4.5 in (115 mm)
Cylinder rod diameter	3.1 in (80 mm)
Cylinder stroke	43.6 in (1 108 mm)
Bucket cylinder	One (1)
Cylinder bore	3.7 in (95 mm)
Cylinder rod diameter	2.6 in (65 mm)
Cylinder stroke	34.7 in (881 mm)
Blade cylinder	Two (2)
Cylinder bore	4.5 in (115 mm)
Cylinder rod diameter	2.8 in (70 mm)
Cylinder stroke	9.8 in (250 mm)

SERVICE CAPACITIES

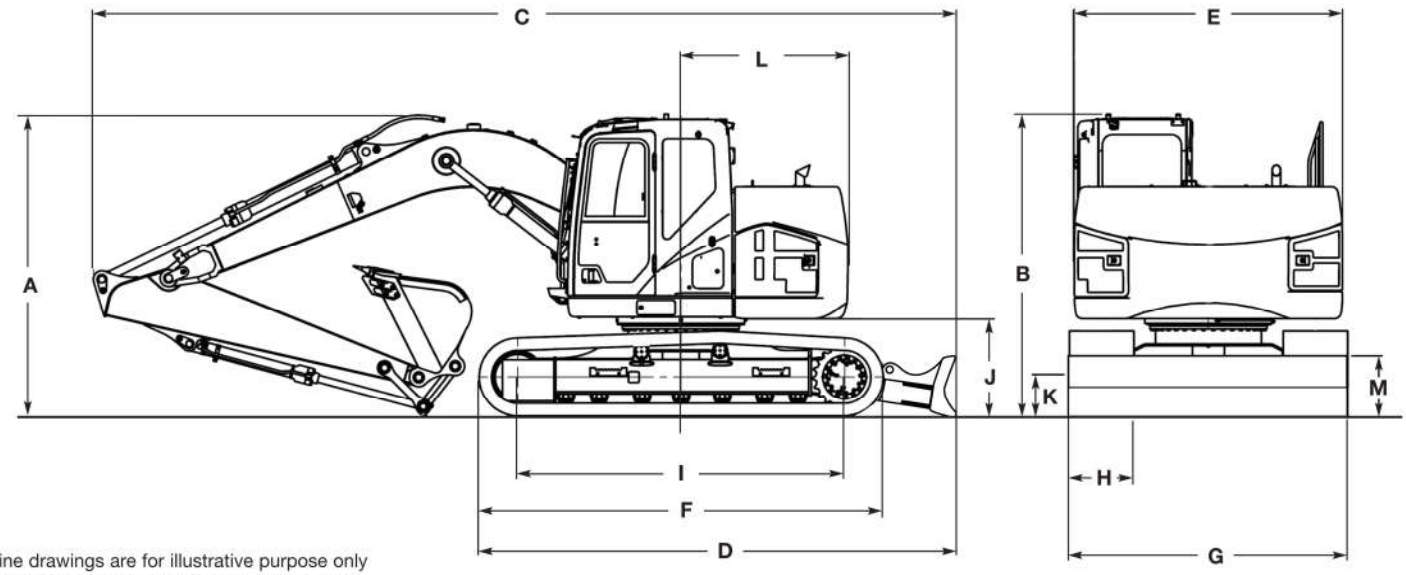
Fuel tank	53 gal (200 L)
Hydraulic system	42 gal (158 L)
Hydraulic tank	20 gal (75 L)
Engine oil w/ filter	4.5 gal (17 L)
Swing drive	0.6 gal (2.2 L)
Final drive	0.6 gal (2.1 L)
Cooling system	4.4 gal (16.5 L)
Def Tank	11.9 gal (45 L)

OTHER SPECIFICATIONS

Swing speed	0 – 12.5 RPM
Swing torque	27,400 lb·ft (37 000 N·m)
Swing brake	Mechanical disc
Undercarriage:	
Length	13 ft 8 in (4 160 mm)
Track gauge	6 ft 6 in (1 990 mm)
Carrier rollers – each side	1
Track rollers – each side	7
Shoes – triple grouser – each side	43
Shoe width – std.	2 ft 0 in (600 mm)
Link pitch	6.8 in (172 mm)
Track:	
Chain	Grease lubricated/strutted
Guides	Single
Adjustment	Hydraulic

BUCKETS

Application	Width	SAE Rated Capacity
Heavy-Duty Pin-On	18 in to 48 in (457 mm to 1 219 mm)	0.36 yd^3 to 1.08 yd^3 (0.28 m^3 to 0.83 m^3)
Heavy-Duty Hi-Capacity Pin-On	18 in to 42 in (457 mm to 1 067 mm)	0.42 yd^3 to 1.08 yd^3 (0.32 m^3 to 0.83 m^3)
Heavy-Duty Coupler	18 in to 48 in (457 mm to 1 219 mm)	0.31 yd^3 to 0.95 yd^3 (0.24 m^3 to 0.73 m^3)
Ditch Cleaning Pin-On	48 in to 60 in (1 219 mm to 1 524 mm)	0.64 yd^3 to 1.02 yd^3 (0.49 m^3 to 0.78 m^3)

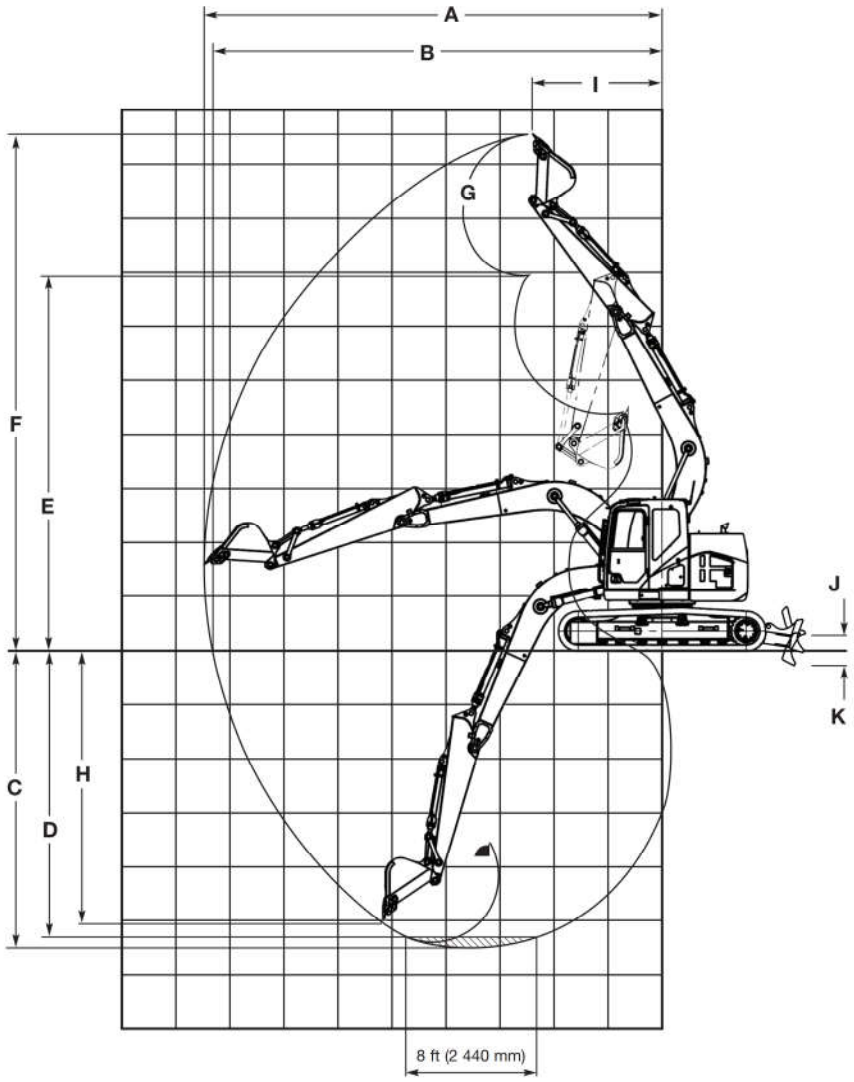


Line drawings are for illustrative purpose only and may not be exact representation of unit.

DIMENSIONS

	8 ft 2 in (2.50 m) Arm	9 ft 10 in (3.01 m) Arm	6 ft 11 in (2.11 m) Arm
A. Overall height – to top of boom	9 ft 4 in (2 840 mm)	8 ft 10 in (2 680 mm)	9 ft 0 in (2 750 mm)
B. Cab height	9 ft 3 in (2 820 mm)	9 ft 3 in (2 820 mm)	9 ft 3 in (2 820 mm)
C. Overall length – with attachment	25 ft 10 in (7 880 mm)	25 ft 9 in (7 860 mm)	25 ft 10 in (7 870 mm)
D. Overall length – without attachment	13 ft 8 in (4 160 mm)	13 ft 8 in (4 160 mm)	13 ft 8 in (4 160 mm)
E. Width of upper structure	8 ft 2 in (2 490 mm)	8 ft 2 in (2 490 mm)	8 ft 2 in (2 490 mm)
F. Track overall length	11 ft 6 in (3 500 mm)	11 ft 6 in (3 500 mm)	11 ft 6 in (3 500 mm)
G. Track overall width with 23.6 in (600 mm) shoes	8 ft 6 in (2 590 mm)	8 ft 6 in (2 590 mm)	8 ft 6 in (2 590 mm)
H. Track shoe width	2 ft 0 in (600 mm)	2 ft 0 in (600 mm)	2 ft 0 in (600 mm)
I. Center to center – idler to sprocket	9 ft 2 in (2 790 mm)	9 ft 2 in (2 790 mm)	9 ft 2 in (2 790 mm)
J. Upper structure ground clearance	2 ft 11 in (880 mm)	2 ft 11 in (880 mm)	2 ft 11 in (880 mm)
K. Minimum ground clearance	1 ft 5 in (425 mm)	1 ft 5 in (425 mm)	1 ft 5 in (425 mm)
L. Rear tail swing radius	5 ft 0 in (1 530 mm)	5 ft 0 in (1 530 mm)	5 ft 0 in (1 530 mm)
M. Blade Height	22 in (570 mm)	22 in (570 mm)	22 in (570 mm)

NOTE: *With 23.6 in (600 mm) track shoe, 1,067 lb (484 kg) bucket, 165 lb (75 kg) operator, full fuel and standard equipment.



PERFORMANCE SPECS

	8 ft 2 in (2.50 m) Arm	9 ft 10 in (3.01 m) Arm	6 ft 11 in (2.11 m) Arm
A. Maximum dig radius	27 ft 2 in (8 290 mm)	28 ft 8 in (8 740 mm)	26 ft 1 in (7 940 mm)
B. Dig radius at groundline	26 ft 8 in (8 140 mm)	28 ft 3 in (8 600 mm)	25 ft 6 in (7 780 mm)
C. Maximum dig depth	18 ft 1 in (5 510 mm)	19 ft 9 in (6 010 mm)	16 ft 9 in (5 110 mm)
D. Dig depth – 8 ft 0 in (2.44 m) level bottom	17 ft 4 in (5 290 mm)	19 ft 2 in (5 830 mm)	16 ft 0 in (4 870 mm)
E. Dump height	22 ft 9 in (6 940 mm)	23 ft 11 in (7 290 mm)	21 ft 10 in (6 660 mm)
F. Maximum reach height	30 ft 8 in (9 340 mm)	31 ft 9 in (9 690 mm)	29 ft 9 in (9 060 mm)
G. Bucket rotation	178°	178°	178°
H. Maximum vertical wall dig depth	16 ft 1 in (4 900 mm)	17 ft 4 in (5 280 mm)	15 ft 0 in (4 560 mm)
I. Minimum swing radius	7 ft 8 in (2 340 mm)	9 ft 0 in (2 750 mm)	6 ft 8 in (2 030 mm)
J. Blade Maximum lift above ground	1 ft 8 in (510 mm)	1 ft 8 in (510 mm)	1 ft 8 in (510 mm)
K. Blade Minimum drop below ground	1 ft 9 in (520 mm)	1 ft 9 in (520 mm)	1 ft 9 in (520 mm)
Arm digging force:			
Standard	13,900 lbf (62 kN)	12,600 lbf (56 kN)	15,700 lbf (70 kN)
Power Boost	14,800 lbf (66 kN)	13,500 lbf (60 kN)	16,600 lbf (74 kN)
Bucket digging force:			
Standard	20,200 lbf (90 kN)	20,200 lbf (90 kN)	20,200 lbf (90 kN)
Power Boost	21,400 lbf (95 kN)	21,400 lbf (95 kN)	21,400 lbf (95 kN)

LIFT CAPACITIES

8 ft 3 in (2.50 m) Arm *Lift capacities calculated using a 880 lb (400 kg) bucket, 7,860 lb (3 570 kg) counterweight with dozer blade on ground.*

Load (Lift Point Height)	MINIMUM REACH			5 ft (1.5 m)		10 ft (3 m)		15 ft (4.5 m)		20 ft (6 m)		25 ft (7.5 m)		MAXIMUM REACH		
	@	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	@	END	SIDE
+25 ft (7.5 m)	11 ft 1 in (3.43 m)	3,900 lb* (1 850 kg)*	3,900 lb* (1 850 kg)*					4,850 lb* (2 380 kg)*	4,850 lb* (2 380 kg)*					16 ft 8 in (5.24 m)	2,950 lb* (1 310 kg)*	2,950 lb* (1 310 kg)*
+20 ft (6 m)	12 ft 1 in (3.68 m)	7,100 lb* (3 250 kg)*	7,100 lb* (3 250 kg)*					6,350 lb* (2 980 kg)*	6,350 lb* (2 980 kg)*	4,800 lb* (2 340 kg)*	4,800 lb* (2 340 kg)*			21 ft 9 in (6.70 m)	2,450 lb* (1 110 kg)*	2,450 lb* (1 110 kg)*
+15 ft (4.5 m)	10 ft 7 in (3.18 m)	8,050 lb* (3 680 kg)*	8,050 lb* (3 680 kg)*					8,050 lb* (3 710 kg)*	8,050 lb* (3 710 kg)*	6,400 lb* (2 950 kg)*	5,500 lb (2 560 kg)	2,447 lb (1 110 kg)*	2,447 lb (1 110 kg)*	24 ft 7 in (7.52 m)	2,350 lb* (1 050 kg)*	2,350 lb* (1 050 kg)*
+10 ft (3 m)	4 ft 10 in (1.53 m)	16,300 lb* (6 850 kg)*	16,300 lb* (6 850 kg)*	28,250 lb* (12 814 kg)	28,250 lb* (12 814 kg)	15,650 lb* (7 270 kg)*	15,650 lb* (7 270 kg)*	11,450 lb* (5 280 kg)*	8,450 lb (3 920 kg)	8,300 lb* (3 880 kg)*	5,300 lb (2 450 kg)	4,500 lb* (2 320 kg)*	3,550 lb (1 660 kg)	26 ft 0 in (7.92 m)	2,350 lb* (1 060 kg)*	2,350 lb* (1 060 kg)*
+5 ft (1.5 m)	7 ft 1 in (2.15 m)	8,050 lb* (3 620 kg)*	8,050 lb* (3 620 kg)*			21,350 lb* (9 820 kg)*	15,000 lb (6 970 kg)	13,750 lb* (6 350 kg)*	7,900 lb (3 670 kg)	10,300 lb* (4 750 kg)*	5,000 lb (2 330 kg)	5,450 lb* (2 780 kg)*	3,450 lb (1 610 kg)	26 ft 3 in (8.00 m)	2,450 lb* (1 120 kg)*	2,450 lb* (1 120 kg)*
Groundline	4 ft 8 in (1.43 m)	5,800 lb* (2 630 kg)*	5,800 lb* (2 630 kg)*	6,200 lb* (2 770 kg)*	6,200 lb* (2 770 kg)*	19,250 lb* (8 350 kg)*	14,000 lb (6 510 kg)	14,650 lb* (6 760 kg)*	7,450 lb (3 460 kg)	10,600 lb* (4 890 kg)*	4,800 lb (2 230 kg)	4,450 lb* (2 490 kg)*	3,350 lb (1 570 kg)	25 ft 6 in (7.77 m)	2,750 lb* (1 250 kg)*	2,750 lb* (1 250 kg)*
-5 ft (-1.5 m)	0 ft 9 in (0.24 m)	8,000 lb* (3 590 kg)*	8,000 lb* (3 590 kg)*	11,500 lb* (5 170 kg)*	11,500 lb* (5 170 kg)*	21,350 lb* (9 630 kg)*	13,850 lb (6 460 kg)	14,150 lb* (6 550 kg)*	7,250 lb (3 370 kg)	10,050 lb* (4 660 kg)*	4,700 lb (2 190 kg)			23 ft 8 in (7.22 m)	3,350 lb* (1 510 kg)*	3,350 lb* (1 510 kg)*
-10 ft (-3 m)	1 ft 7 in (0.46 m)	13,000 lb* (5 810 kg)*	13,000 lb* (5 810 kg)*	18,250 lb* (8 110 kg)*	18,250 lb* (8 110 kg)*	17,250 lb* (8 000 kg)*	14,100 lb (6 560 kg)	11,750 lb* (5 490 kg)*	7,350 lb (3 420 kg)	6,750 lb* (3 530 kg)*	4,800 lb (2 250 kg)			20 ft 5 in (6.26 m)	4,650 lb* (2 070 kg)*	4,650 lb* (2 070 kg)*
-15 ft (-4.5 m)	6 ft 3 in (1.77 m)	11,650 lb* (5 760 kg)*	11,650 lb* (5 760 kg)*			9,350 lb* (4 530 kg)*	9,350 lb* (4 530 kg)*	5,000 lb* (2 670 kg)*	5,000 lb* (2 670 kg)*					15 ft 1 in (4.69 m)	4,700 lb* (2 220 kg)*	4,700 lb* (2 220 kg)*

9 ft 10 in (3.01 m) Arm *Lift capacities calculated using a 750 lb (340 kg) bucket, 7,860 lb (3 570 kg) counterweight with dozer blade on ground.*

Load (Lift Point Height)	MINIMUM REACH			0 ft (0 m)		5 ft (1.5 m)		10 ft (3 m)		15 ft (4.5 m)		20 ft (6 m)		25 ft (7.5 m)		MAXIMUM REACH		
	@	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	@	END	SIDE
+25 ft (7.5 m)	12 ft 10 in (3.95 m)	4,400 lb* (2 080 kg)*	4,400 lb* (2 080 kg)*							5,150 lb* (2 350 kg)*	5,150 lb* (2 350 kg)*					19 ft 1 in (5.96 m)	2,850 lb* (1 280 kg)*	2,850 lb* (1 280 kg)*
+20 ft (6 m)	13 ft 9 in (4.18 m)	6,150 lb* (2 800 kg)*	6,150 lb* (2 800 kg)*							6,000 lb* (2 760 kg)*	6,000 lb* (2 760 kg)*	4,950 lb* (2 300 kg)*	4,950 lb* (2 300 kg)*			23 ft 7 in (7.25 m)	2,500 lb* (1 120 kg)*	2,500 lb* (1 120 kg)*
+15 ft (4.5 m)	12 ft 6 in (3.76 m)	6,550 lb* (2 990 kg)*	6,550 lb* (2 990 kg)*							6,750 lb* (3 090 kg)*	6,750 lb* (3 090 kg)*	5,800 lb* (2 740 kg)*	5,600 lb* (2 610 kg)*	4,000 lb* (2 000 kg)*	3,750 lb (1 750 kg)	26 ft 2 in (8.00 m)	2,400 lb* (1 080 kg)*	2,400 lb* (1 080 kg)*
+10 ft (3 m)	7 ft 1 in (2.04 m)	9,650 lb* (4 610 kg)*	9,650 lb* (4 610 kg)*					9,900 lb* (4 640 kg)*	9,900 lb* (4 640 kg)*	9,200 lb* (4 260 kg)*	8,550 lb (3 960 kg)	7,550 lb* (3 510 kg)*	5,400 lb (2 510 kg)	5,400 lb* (2 570 kg)*	3,650 lb (1 700 kg)	27 ft 6 in (8.38 m)	2,400 lb* (1 080 kg)*	2,400 lb* (1 080 kg)*
+5 ft (1.5 m)	6 ft 10 in (2.08 m)	8,300 lb* (3 800 kg)*	8,300 lb* (3 800 kg)*					19,450 lb* (8 950 kg)*	15,400 lb (7 170 kg)	13,050 lb* (6 020 kg)*	8,050 lb (3 730 kg)	9,950 lb* (4 590 kg)*	5,100 lb (2 370 kg)	6,400 lb* (3 080 kg)*	3,500 lb (1 630 kg)	27 ft 9 in (8.46 m)	2,500 lb* (1 150 kg)*	2,500 lb* (1 150 kg)*
Groundline	4 ft 4 in (1.32 m)	5,650 lb* (2 560 kg)*	5,650 lb* (2 560 kg)*			6,350 lb* (2 840 kg)*	6,350 lb* (2 840 kg)*	22,300 lb* (9 660 kg)*	14,050 lb (6 540 kg)	14,450 lb* (6 670 kg)*	7,500 lb (3 480 kg)	10,500 lb* (4 860 kg)*	4,850 lb (2 240 kg)	6,700 lb* (3 290 kg)*	3,400 lb (1 570 kg)	27 ft 1 in (8.24 m)	2,800 lb* (1 270 kg)*	2,800 lb* (1 270 kg)*
-5 ft (-1.5 m)	0 ft 0 in (0.00 m)	8,650 lb* (3 900 kg)*	8,650 lb* (3 900 kg)*	8,600 lb (3 900 kg)*	8,600 lb (3 900 kg)*	10,550 lb* (4 730 kg)*	10,550 lb* (4 730 kg)*	21,600 lb* (9 440 kg)*	13,650 lb (6 370 kg)	14,350 lb* (6 640 kg)*	7,200 lb (3 340 kg)	10,300 lb* (4 770 kg)*	4,650 lb (2 170 kg)	4,250 lb* (2 430 kg)*	3,350 lb (1 550 kg)	25 ft 4 in (7.72 m)	3,350 lb* (1 500 kg)*	3,250 lb (1 480 kg)
-10 ft (-3 m)	0 ft 0 in (0.00 m)	11,400 lb* (5 160 kg)*	11,400 lb* (5 160 kg)*	11,400 lb (5 160 kg)*	11,400 lb (5 160 kg)*	15,650 lb* (6 940 kg)*	15,650 lb* (6 940 kg)*	18,950 lb* (8 780 kg)*	13,800 lb (6 430 kg)	12,750 lb* (5 920 kg)*	7,250 lb (3 360 kg)	8,700 lb* (4 100 kg)*	4,750 lb (2 190 kg)			22 ft 4 in (6.84 m)	4,400 lb* (1 970 kg)*	4,000 lb (1 800 kg)
-15 ft (-4.5 m)	3 ft 3 in (0.91 m)	18,950 lb* (8 240 kg)*	18,950 lb* (8 240 kg)*			19,350 lb* (9 240 kg)*	19,350 lb* (9 240 kg)*	12,550 lb* (5 950 kg)*	12,550 lb* (5 950 kg)*	8,200 lb* (3 960 kg)*	7,350 lb (3 430 kg)*					17 ft 6 in (5.42 m)	5,300 lb* (2 440 kg)*	5,300 lb* (2 440 kg)*

6 ft 11 in (2.11 m) Arm *Lift capacities calculated using a 900 lb (410 kg) bucket, 7,860 lb (3 570 kg) counterweight with dozer blade on ground.*

Load (Lift Point Height)	MINIMUM REACH			5 ft (1.5 m)		10 ft (3 m)		15 ft (4.5 m)		20 ft (6 m)		25 ft (7.5 m)		MAXIMUM REACH		
	@	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	END	SIDE	@	END	SIDE
+25 ft (7.5 m)	9 ft 8 in (3.01 m)	3,500 lb* (1 670 kg)*	3,500 lb* (1 670 kg)*			3,800 lb* (1 724 kg)	3,800 lb* (1 724 kg)	(1 990 kg)*	(1 990 kg)*					14 ft 7 in (4.63 m)	3,650 lb* (1 620 kg)*	3,650 lb* (1 620 kg)*
+20 ft (6 m)	10 ft 10 in (3.3 m)	7,350 lb* (3 520 kg)*	7,350 lb* (3 520 kg)*					6,900 lb* (3 210 kg)*	6,900 lb* (3 210 kg)*	3,800 lb* (2 190 kg)*	3,800 lb* (2 190 kg)*			20 ft 4 in (6.26 m)	3,000 lb* (1 350 kg)*	3,000 lb* (1 350 kg)*
+15 ft (4.5 m)	8 ft 3 in (2.46 m)	5,500 lb* (2 450 kg)*	5,500 lb* (2 450 kg)*			10,000 lb* (4 600 kg)*	10,000 lb* (4 600 kg)*	9,450 lb* (4 390 kg)*	8,650 lb (4 020 kg)	7,150 lb* (3 340 kg)*	5,350 lb (2 500 kg)			23 ft 4 in (7.14 m)	2,800 lb* (1 260 kg)*	2,800 lb* (1 260 kg)*
+10 ft (3 m)	6 ft 3 in (1.94 m)	14,450 lb* (6 550 kg)*	14,450 lb* (6 550 kg)*			17,400 lb* (8 050 kg)*	16,200 lb (7 520 kg)	12,050 lb* (5 560 kg)*	8,250 lb (3 830 kg)	9,450 lb* (4 410 kg)*	5,150 lb (2 400 kg)	3,594 lb (1 630 kg)*	3,109 lb (1 610 kg)	24 ft 10 in (7.57 m)	2,800 lb* (1 260 kg)*	2,800 lb* (1 260 kg)*
+5 ft (1.5 m)	8 ft 1 in (2.46 m)	8,700 lb* (3 910 kg)*	8,700 lb* (3 910 kg)*			21,600 lb* (10 000 kg)*	14,500 lb (6 750 kg)	14,050 lb* (6 510 kg)*	7,700 lb (3 580 kg)	10,400 lb* (4 800 kg)*	4,900 lb (2 280 kg)	3,350 lb* (2 180 kg)*	3,350 lb* (1 580 kg)	25 ft 1 in (7.65 m)	2,950 lb* (1 330 kg)*	2,950 lb* (1 330 kg)*
Groundline	6 ft 2 in (1.87 m)	6,750 lb* (3 050 kg)*	6,750 lb* (3 050 kg)*			17,600 lb* (7 640 kg)*	13,700 lb (6 370 kg)	14,550 lb* (6 720 kg)*	7,300 lb (3 400 kg)	10,500 lb* (4 850 kg)*	4,700 lb (2 190 kg)			24 ft 4 in (7.41 m)	3,300 lb* (1 490 kg)*	3,300 lb* (1 490 kg)*
-5 ft (-1.5 m)	2 ft 1 in (0.63 m)	8,850 lb* (3 970 kg)*	8,850 lb* (3 970 kg)*	12,450 lb* (5 600 kg)*	12,450 lb* (5 600 kg)*	20,300 lb* (9 350 kg)*	13,800 lb (6 440 kg)	13,700 lb* (6 340 kg)*	7,200 lb (3 350 kg)	9,550 lb* (4 450 kg)*	4,700 lb (2 170 kg)			22 ft 4 in (6.82 m)	4,000 lb* (1 810 kg)*	3,950 lb (1 800 kg)
-10 ft (-3 m)	3 ft 0 in (0.89 m)	15,850 lb* (7 030 kg)*	15,850 lb* (7 030 kg)*	18,750 lb* (8 340 kg)*	18,750 lb* (8 340 kg)*	15,400 lb* (7 170 kg)*	13,950 lb (6 500 kg)	10,600 lb* (4 980 kg)*	7,400 lb (3 430 kg)					18 ft 11 in (5.8 m)	5,700 lb* (2 520 kg)*	5,200 lb (2 340 kg)
-15 ft (-4.5 m)	9 ft 6 in (2.9 m)	6,945 lb* (3 150 kg)*	6,945 lb* (3 150 kg)*			6,790 lb (3 080 kg)*	6,790 lb (3 080 kg)*							12 ft 5 in (3.79 m)	4,982 lb (2 260 kg)*	4,982 lb (2 260 kg)*

NOTE: *Following number indicates hydraulic capacity

STANDARD EQUIPMENT

ENGINE

Isuzu four-cylinder turbo-charged diesel
Tier 4 Final – CEGR, DOC, SCR
Electronic fuel injection
High pressure common rail system
Diesel Oxidation Catalyst System (DOC)
Neutral safety start
Auto-engine warm up
Glow-plug pre-heat
EPF (Engine Protection Feature)
Dual-stage fuel filtration
Dual element air filter
Remote oil filter
Green plug oil drain
500-hour engine oil change interval
24-volt system
Requires CJ-4 engine oil
Requires ultra low-sulfur fuel

FUEL ECONOMY SYSTEMS

Engine Idle/Fuel Economy System:
- Auto-idle
- One-touch idle
- Auto-idle shut-down

BEC – Boom Economy Control
AEC – Auto Economy Control
SWC – Swing Relief Control
SSC – Spool Stroke Control

HYDRAULICS

Auto power boost
Auto swing priority
Auto travel speed change
Selectable work modes
ISO pattern controls
Pre-set auxiliary pump settings
Auxiliary valve
5,000-hour hydraulic oil change interval
1,000-hour hydraulic filter change interval
SAHR brake
Free Swing
Control Pattern Selector

UPPER STRUCTURE

Right and left side mirrors
Isolation mounted cab (fluid and spring)
Common key vandal locks
Upper mounted work light (70 watt)
Swivel guard belly pan

ATTACHMENTS

Boom – 15 ft 2 in (4.63 m)
Arm – 8 ft 2 in (2.50 m)
Heavy-duty bucket linkage
Boom mounted work light (70 watt)
Auxiliary pipe brackets
Centralized grease fittings
Attachment cushion valve
Foldable hand rails
Arm and boom regeneration

OPERATOR ENVIRONMENT

ROPS protection
FOPS cab top guard (Level 1)
Pressurized cab
One-touch lock front window
AC/heat/defrost with auto climate control
Color monitor – 7 in (180 mm)
Interior dome light
Air-suspension seat (cloth)
Seatbelt – 3 in (76 mm)
Adjustable armrests
Tilting consoles – 4-position
Low-effort joystick controls
Sliding cockpit – 7 in (180 mm)
Straight travel
AM/FM Radio with Bluetooth, antenna and two speakers
Aux-in port for personal electronics
Rear-view camera
Anti-theft system (start code system)
Side view camera – right
Rubber floormat
12-volt electric outlet
24-volt cigarette lighter
External rearview mirrors
Windshield wiper/washer
Clear (polycarbonate) roof window with sunshade
Cup holder
Storage compartments
On-board diagnostic system
Travel alarm with cancel switch
One key start and lock-up

UNDERCARRIAGE

23.6 in (600 mm) steel shoes, triple grouser
Full overlap turntable bearing tub
Hydraulic track adjustment
X-pattern carbody

DOZER BLADE

Front dozer blade – 8 ft 6 in (2.59 m) width, 22 in (570 mm) height, comes with 23.6 in (600 mm) steel shoes

TELEMATICS

CASE SiteWatch™ Telematics – includes hardware and a 3-yr Advanced data subscription

OPTIONAL EQUIPMENT

HYDRAULICS

Auxiliary hydraulics:
- Single acting/joystick activated
- Double acting/joystick activated
- Multi-function/joystick activated
- Secondary low-flow/joystick activated

ATTACHMENTS

Standard arm – 9 ft 11 in (3.01 m)
Heavy-duty arm – 6 ft 10 in (2.11 m)
Coupler/Case multi-pin grabber
Buckets:
- Heavy-duty
- Extreme-duty

Load holding control
Hose Burst Check Valve (HBCV)

UNDERCARRIAGE

27.6 in (700 mm) steel shoes, triple semi-grouser
20.0 in (500 mm) rubber shoes
Double track chain guides

OPERATOR ENVIRONMENT

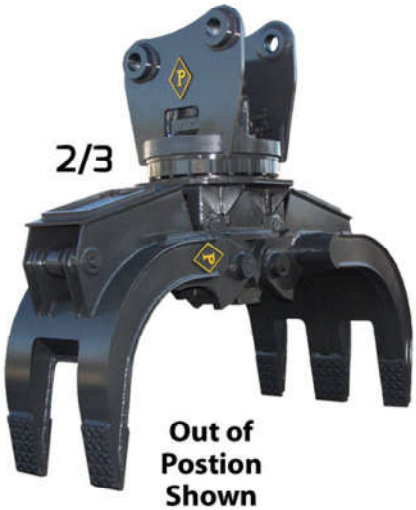
FOPS cab top guard (Level 2)
Front grill guard – 2 x 2 screen mesh
Front rock guard – vertical bars (two piece)/OPG 1
Front rock guard – vertical bars (fixed/one piece)/OPG 2
Vandal guard
Rain deflector
Sun visor
Side-view camera
Refueling pump

PEMBERTON®
QUALITY ATTACHMENTS

Out of Position Style Car Body Grapples

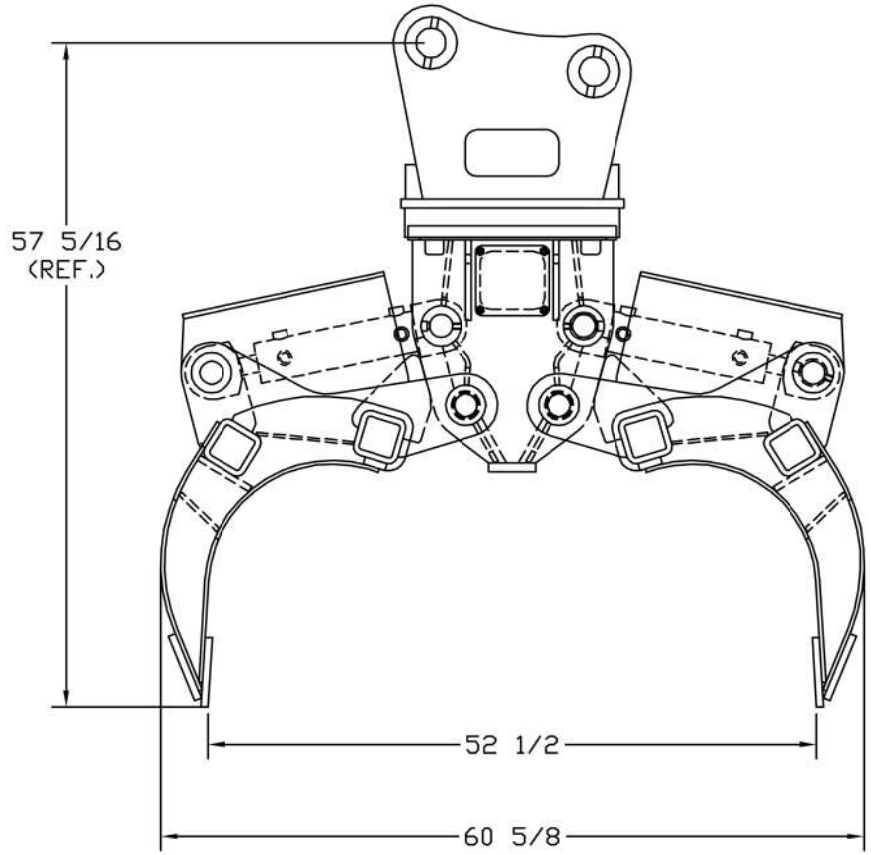
Excavator/Material Handler **Type:** Grapple

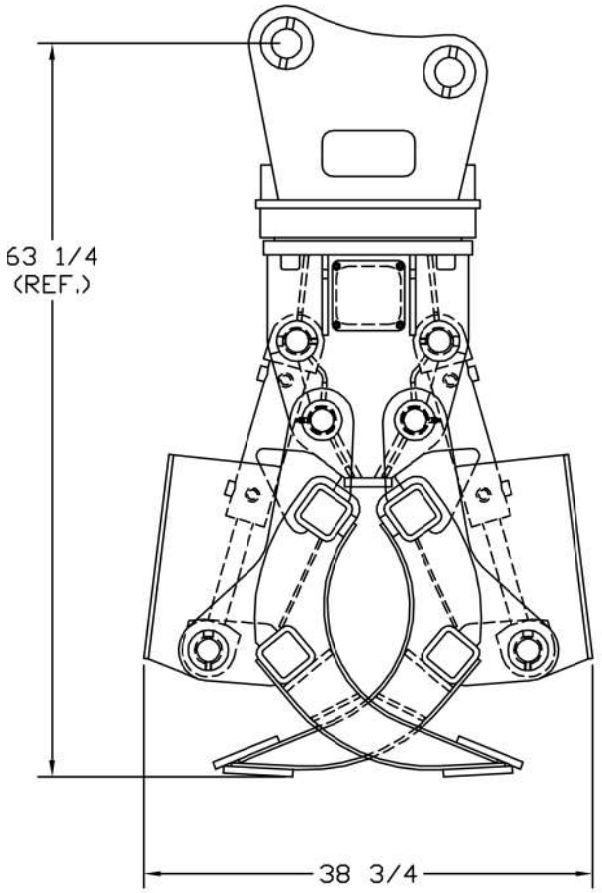
Applications: Auto Recycling General Recycling Waste Handling Logging etc



Quality Attachments Since 1978
PEMBERTON®

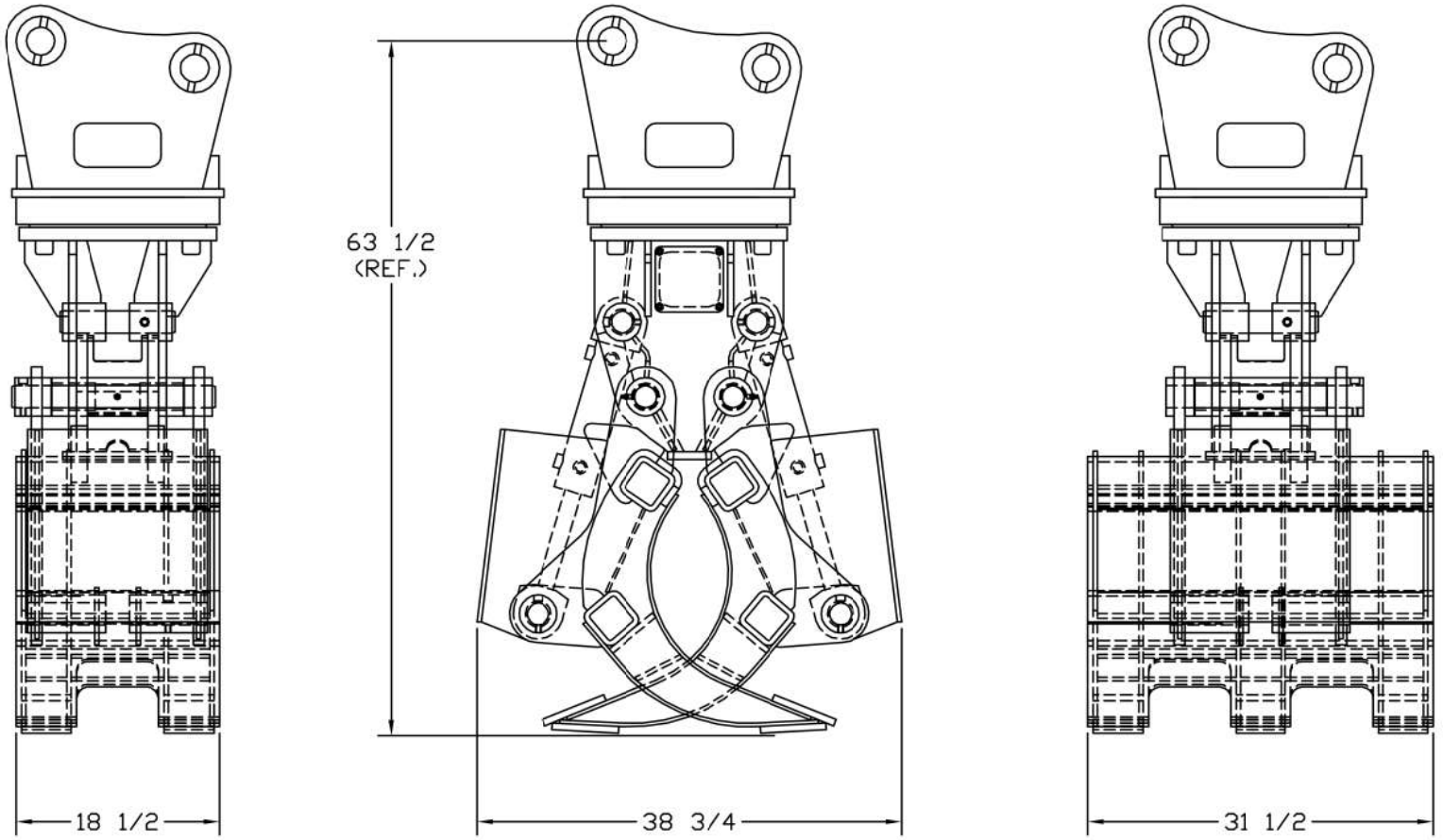
PO Box 521000, Longwood FL 32752-1000 USA · 800-393-6688





PEMBERTON INCORPORATED

120 - 140 SIZE,
WIDE TINE POSITIONED GRAPPLE
w/ 360° CONTINUOUS HYD. ROTATION



PEMBERTON INCORPORATED

120 - 140 SIZE, 2/3 TINE,
WIDE TINE POSITIONED GRAPPLE
w/ 360° CONTINUOUS HYD. ROTATION

CASE CONSTRUCTION

Excavators

D SERIES

CX130D
CX145D

CX160D
CX210D

CX245D
CX250D

CX290D
CX300D

CX350D
CX490D

CX500D
CX750D

SINCE 1842

CX130D

CX145D

CX160D

CX210D

CX245D

CX250D

CX290D

CX300D

CX350D

CX490D

CX500D

CX750D

The Rules Have Changed

More buckets per hour. More hours per tank. More done more quickly than ever before. All with less to maintain and worry about. Whatever the application – loading, trenching, mass excavation, moving pipe or breaking rock – the smarter, faster CASE D Series is rewriting the rulebook on performance and profitability.

+ Faster cycle times
+ Greater precision
+ CASE Intelligent Hydraulic System
+ Wider, more comfortable cab
+ Superior fuel economy
+ Outstanding visibility
+ No-hassle emissions control
+ Protected by ProCare

THE D SERIES GETS THE JOB DONE

CASE INTELLIGENT HYDRAULIC SYSTEM (CIHS)

Our exclusive CIHS easily delivers unmatched precision and greater fuel economy by actively managing hydraulic power throughout lift/dump and dig/curl movements. Thanks to an electronically controlled pump, a larger main valve and multiple hydraulic sensors, the D Series delivers up to 6% greater breakout force.

INTEGRATED CONTROL SYSTEMS

The D Series provides the perfect synergy between engine and hydraulic power. Advanced sensors continuously monitor the type of work being done and automatically respond with the right hydraulic pressure when and where it's needed.

- **Boom Economy Control** (BEC) reduces RPMs during down and swing.
- **Auto Economy Control** (AEC) lowers RPMs during idling.
- **Swing Relief Control** (SWC) efficiently regulates hydraulic swing power when coming out of a hole and moving toward a truck or pile.
- **Spool Stoke Control** (SSC) adjusts hydraulic pressure to optimal outputs and minimizes unneeded operational functions.

AUTO POWER BOOST

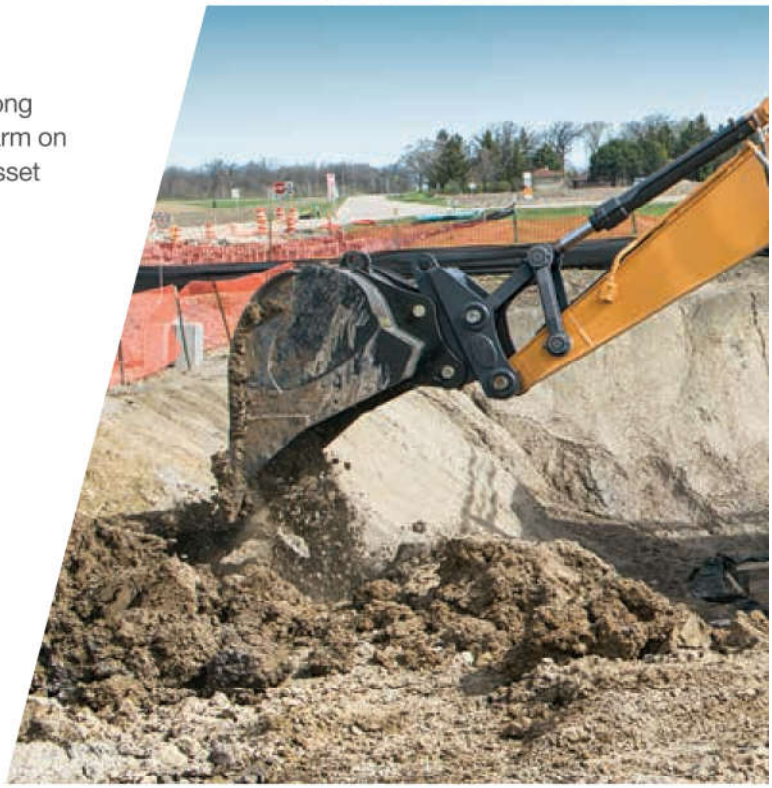
Increases hydraulic pressures according to the demand needed for the operating cycle.

MORE ROBUST BOOM AND ARM

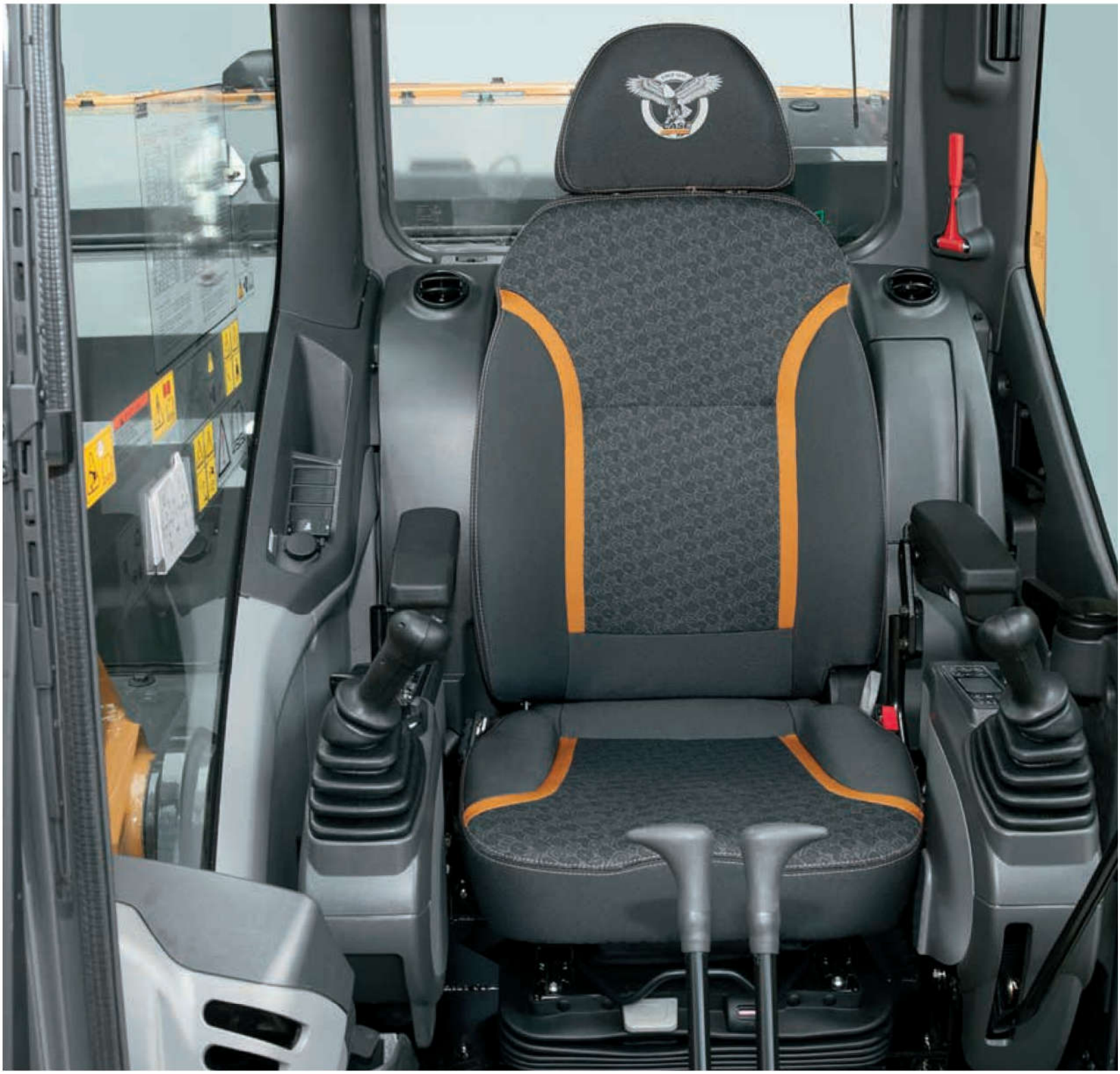
From short arms for faster production cycles to long arms and long reach models that maximize the work envelope, the boom and arm on all D Series models have been strengthened internally and in gusset areas for increased reliability and stress relief.

FREE SWING

Dramatically improves craning, laying, or lifting of offset loads.



SUPERIOR CAB COMFORT COMES STANDARD



WIDER, EXTRA-SPACIOUS, PRESSURIZED, VISCOUS-MOUNTED CAB

The D Series cushioning system lowers noise and vibration levels for the operator's ultimate comfort, providing ample legroom along with a spacious storage compartment and warm and cool box.

7-INCH LCD MONITOR

An optically bonded, anti-glare 7-inch LCD multi-function monitor displays an abundant amount of machine operating data as well as setup and service related screens. Press a button and get up-to-date information on fuel level, temperature and pressure valves. Another button provides information on hours and fuel usage for up to two trips.

STANDARD REAR AND SIDE VIEW CAMERAS AND OPTIONAL CASE MAX VIEW DISPLAY

The D Series standard rear and side view cameras provide increased awareness around the machine. Add the optional CASE Max View display for even greater visibility and safer operation with a 270-degree view of the machine.

AIR RIDE SEAT, HEATED

Operators who work up to a full day with few breaks need protection from shocks and vibrations in order to be more productive. With a wider cushion than a standard seat, wider armrests and adjustable height and backrest settings, there simply isn't a more comfortable seat to operate from in the industry.

ERGONOMICALLY DESIGNED LAYOUT

Each D Series excavator features a fully adjustable operator station and an ergonomic armrest with joystick controls and easy-to-reach function switches that allow for smooth operation and performance.

BLUETOOTH ENABLED RADIO

The D Series cab comes equipped with an AM/FM Bluetooth radio, auxiliary port and controls, remote auxiliary USB connection and phone charger.

OPTIONAL LED WORKLIGHTS PACKAGE

8 LED working lights positioned around the cab and boom provide over three times the brightness of halogen bulbs: two mounted on front of the cab, two mounted on the rear, and one on each side, on the house, and on the boom.

IMPROVE YOUR SPEED AND EFFICIENCY

FASTER CYCLE TIMES

Larger control valves and computer controlled redirection of hydraulic oil flow, improves cycle times by as much as 12%. The D Series provides productivity while maintaining controllability for the operator.

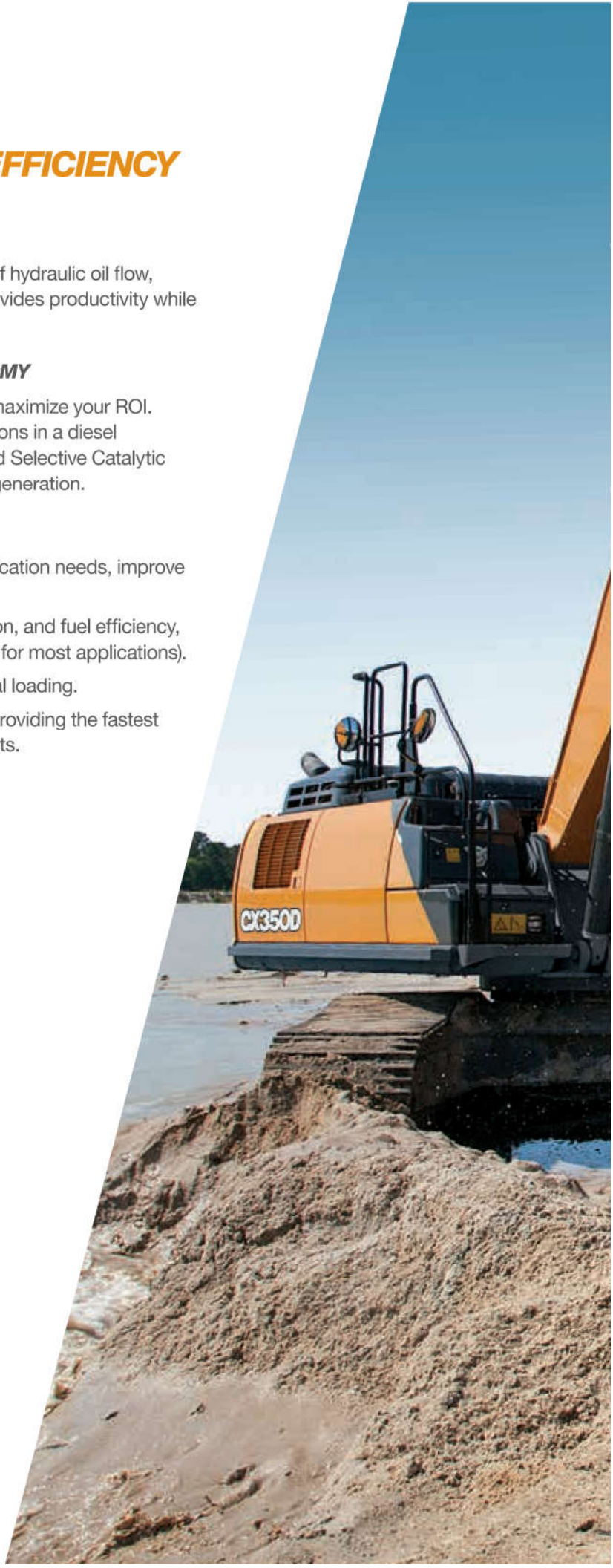
TIER 4 FINAL SCR PROVIDES SUPERIOR FUEL ECONOMY

Saving up to 14% on fuel helps slash operating costs and maximize your ROI. CASE excavators don't wastefully use fuel to control emissions in a diesel particulate filter. By using a combination of CEGR, DOC and Selective Catalytic Reduction (SCR), the emissions mandate is met without regeneration.

3 POWER MODES

The D Series offers 3 power modes to match different application needs, improve cycle times and maximize fuel economy:

- **Automatic** (A): The best balance between power, precision, and fuel efficiency, with Power Boost continuously engaged (Recommended for most applications).
- **Heavy** (H): Increased RPM for faster cycle times in general loading.
- **Speed Priority** (SP): Maximum RPM and hydraulic flow providing the fastest cycle times and maximum flow for demanding attachments.



MAINTENANCE MADE EASY

SERVICEABILITY IS IN OUR DNA

When you invest in CASE equipment, you need it to last. We make it simple. From ground-level site gauges to grouped service points, you can do daily maintenance in a matter of minutes. It's the easiest way to help you get the most performance and longest life out of your machine.

NO TOOLS NECESSARY

CASE excavators continue our hallmark of simple serviceability with features like tool-free access to routine maintenance points.

CASE EASY MAINTENANCE SYSTEM (EMS)

CASE uses stratified bushings and plated pins on most pivot points, which holds grease longer, increases lubrication intervals and prevents rattling.

Easy access to everything

1. Hydraulic fluid
2. Hydraulic oil filter
3. Engine oil
4. DEF fluid
5. Fuel pre-filter
6. Oil sample ports
7. Engine oil filter
8. Cab air filter
9. Battery
10. Coolers with protective removable screens
11. Engine coolant
12. Engine air filter
13. Grouped lubrication points
14. Green plug oil drain
15. Fuse box
16. Lubricated EMS bushings

IMPRESSIVE SERVICE INTERVALS

- Engine oil: 500 hours / best in class
- Boom & arm linkage pin grease: 1,000 hours
- Hydraulic oil: 5,000 hours

Protected by
ProCare
FACTORY WARRANTY
PLANNED MAINTENANCE
TELEMATICS

GO BIG, WE'VE GOT YOU COVERED

CASE ProCare is the industry's most comprehensive and standard-from-the-factory heavy machine support program that's as powerful as the equipment it protects. Best of all, ProCare comes standard on all new D Series excavators and keeps you covered for up to three years. It's the assurance businesses need to stay competitive, productive and profitable.

3-yr/3000-hr Full-Machine Factory Limited Warranty*
STANDARD

3-yr/2000-hr Planned Maintenance
STANDARD

3-yr Advanced SiteWatch™ Subscription
STANDARD

SPECIFICATIONS AND DIMENSIONS

SPECIFICATIONS	CX130D LC	CX145D MSR	CX160D STD LC	CX210D STD LC	CX245D MSR
Engine	Isuzu AR-4JJ1X	Isuzu AR-4JJ1X	Isuzu AR-4JJ1X	Isuzu AR 4HK1X	Isuzu AR-4HK1X
Engine Cylinders	4	4	4	4	4
Displacement – in^3 (L)	183 (3)	183 (3)	183 (3)	317 (5.2)	317 (5.2)
Net Horsepower – hp (kW)	102 (76.4)	102 (76.4)	112 (83.2)	160 (119.3)	160 (119.3)
Torque – lbf·ft (N·m)	257 (349)	257 (349)	257 (349)	457 (620)	457 (620)
Bucket Digging Force – lbf (kN)	21,400 (95)	21,400 (95)	26,500 (118)	34,600 (154)	34,600 (154)
Arm Digging Force – lbf (kN)	14,800 (66)	14,800 (66)	18,800 (84)	25,100 (112)	25,100 (112)
Operating Weight – lb (kg)	29,100 (13 200)	32,100 (14 600)	38,400 (17 400)	48,900 (22 200)	56,900 (25 800)
Drawbar Pull – lbf (kN)	26,100 (116)	26,100 (116)	36,100 (160)	42,300 (188)	45,000 (200)
Swing Speed – RPM	14.3	12.5	11.5	11.5	11.5
Travel Speed – mph (kph)	3.5 (5.6)	3.5 (5.6)	3.4 (5.4)	3.5 (5.6)	3.1 (5.0)
DIMENSIONS	**CX130D LC**	**CX145D MSR**	**CX160D STD LC**	**CX210D STD LC**	**CX245D MSR**
Overall Height with Attachment	9 ft 1 in (2 770 mm)	9 ft 4 in (2 840 mm)	9 ft 9 in (2 960 mm)	9 ft 9 in (2 980 mm)	9 ft 9 in (2 980 mm)
Cab Height	9 ft 3 in (2 830 mm)	9 ft 3 in (2 820 mm)	9 ft 9 in (2 970 mm)	9 ft 10 in (2 990 mm)	10 ft 0 in (3 040 mm)
Overall Length with Attachment	25 ft 1 in (7 650 mm)	24 ft 1 in (7 350 mm)	27 ft 9 in (8 460 mm)	30 ft 11 in (9 430 mm)	29 ft 0 in (8 830 mm)
Overall Length without Attachment	13 ft 3 in (4 030 mm)	12 ft 4 in (3 760 mm)	14 ft 6 in (4 430 mm)	16 ft 5 in (5 000 mm)	14 ft 8 in (4 470 mm)
Width of Upper Structure	8 ft 4 in (2 530 mm)	8 ft 2 in (2 490 mm)	8 ft 4 in (2 530 mm)	9 ft 1 in (2 770 mm)	9 ft 10 in (2 990 mm)
Track Overall Length	12 ft 4 in (3 760 mm)	12 ft 4 in (3 760 mm)	13 ft 1 in (3 990 mm)	14 ft 8 in (4 470 mm)	14 ft 8 in (4 470 mm)
Track Overall Width	8 ft 6 in (2 590 mm)	8 ft 6 in (2 590 mm)	8 ft 6 in (2 590 mm)	10 ft 6 in (3 190 mm)	10 ft 6 in (3 190 mm)
Track Shoe Width	2 ft 0 in (600 mm)	2 ft 0 in (600 mm)	2 ft 0 in (600 mm)	2 ft 7 in (800 mm)	2 ft 7 in (800 mm)
Upper Structure Ground Clearance	2 ft 11 in (895 mm)	2 ft 11 in (880 mm)	3 ft 4 in (1 020 mm)	3 ft 5 in (1 050 mm)	3 ft 4 in (1 020 mm)
Minimum Ground Clearance	1 ft 5 in (420 mm)	1 ft 5 in (440 mm)	1 ft 5 in (420 mm)	1 ft 5 in (440 mm)	1 ft 5 in (440 mm)
Rear Tail Swing Radius	7 ft 1 in (2 170 mm)	5 ft 0 in (1 530 mm)	8 ft 1 in (2 470 mm)	9 ft 2 in (2 790 mm)	5 ft 10 in (1 790 mm)
Maximum Digging Depth	18 ft 3 in (5 550 mm)	18 ft 1 in (5 510 mm)	19 ft 11 in (6 060 mm)	21 ft 10 in (6 650 mm)	21 ft 10 in (6 650 mm)
Maximum Reach @ Ground Level	26 ft 10 in (8 170 mm)	26 ft 8 in (8 140 mm)	29 ft 1 in (8 870 mm)	31 ft 11 in (9 730 mm)	31 ft 9 in (9 670 mm)
Other Available Configurations					

CX130D

CX145D

CX160D

CX210D

CX245D

CX250D

BUILDING A STRONG CASE.

Since 1842, we at CASE Construction Equipment have lived by an unwavering commitment to build practical, intuitive solutions that deliver both efficiency and productivity. We continually strive to make it easier for our customers to implement emerging technologies and new compliance mandates.

Today, our global scale combined with our local expertise enables us to keep customers' real-world challenges at the center of our product development. This focus has led to numerous innovations like Ride Control™, EZ-EH controls, blade shake, PowerLift™, over-center boom design and the peace of mind that only CASE ProCare provides.

Every CASE machine is backed by more than 300 North American dealer locations, thousands of OEM, remanufactured and all-makes parts, and flexible financing and insurance options that provide the kind of reliable, steadfast support you expect from a professional partner.

We are passionate about improving the lives of others, whether investing in our veterans or raising awareness about local infrastructure initiatives through Dire States. Our goal is to build both stronger machines — and stronger communities.

At the end of the day, we do what's right by our customers and our communities so that they can count on CASE.

CaseCE.com/DSeries

Form No. CCE201908DEXC
Replaces Form No. CCE201811DEXC

IMPORTANT: CASE Construction Equipment Inc. reserves the right to change these specifications without notice and without incurring any obligation relating to such change. Availability of some models and equipment builds vary according to the country in which the equipment is used. The illustrations and text may include optional equipment and accessories and may not include all standard equipment. Your CASE dealer/distributor will be able to give you details of the products and their specifications available in your area.

Biodiesel Ready — CASE Construction Equipment is biodiesel-friendly

NOTE: All engines meet current EPA emissions regulations. All specifications are stated in accordance with SAE Standards or Recommended Practices, where applicable.

SAFETY™ NEVER HURTS — Always read the Operator's Manual before operating equipment. Inspect equipment before using it, and be sure it is operating properly. Follow the product safety signs and use any safety features provided.

APPENDIX B

WHEELED MATERIAL HANDLER

Cost Estimate - Wheeled Material Handler

Make: Wacker Neuson
Model: EW100

Pricing:	Base Machine		$190,330
	Options - Factory Installed	FOPS Level II	$1,570
		I-Lock Hydraulic Quick Coupler	$5,795
		Telematics (require subscription)	$205
	Accessories - Dealer Installed	Mirror Kit (Right & Left)	$185
		3" Wide Seat Belt Kit	$65
		AM/FM Radio with USB	$350
		Rotating Beacon Light	$350
		(2) Front Mounted Lights	$215
		(1) Rear Mount Light	$110
		Bucket Pin Kit	$370
		Hydraulic Thumb	$4,540
		Hydraulic Thumb Host Kit	$835
		Solid Tires (4) Super Single	$14,000
		Contractor Grapple (2 over 3 tine)	$8,850
Estimated Total:			$227,770
Contingency:	20%		
Total with Contingency:			**$273,324**

Contact:
Todd Kasmer
ADMAR Construction Equipment & Supplies
7800 Brewerton Road
Cicero, NY 13039
(607) 798-0333
(315) 399-6962 (cell)
tkasmer@admarsupply.com

QUOTATION

ATTN: Andrew Schellberg- Ops Director
Tetra Tech-OCCRA
100 Elwood Davis Rd
Syracuse NY 13212
1-845-695-0203

FROM: Todd Kasmer
MOB: 315-399-6962
DATE: May 11, 2021

Quantity	Description	Unit Price	Amount
1	New Wacker Neuson EW100, wheeled excavator- see attached price sheet- Sourcewell Pricing # 040319 WAC - see attached quote	$ 256,524.00	$ 256,524.00
	Sales figure is for budgetary purposes, subject to change at time of ARO		
	Delivery Depends on Manufaturer Availability at Time of ARO		
	Pricing subject to change without notice due to manufacturer steel surcharges and import fees.		

Subtotal	$ 256,524.00
Tax %	
Tax Amount	$ -
Total	$ 256,524.00
Doc Fees	
Down Payment	
Lien Payoff	
Grand Total	$ 256,524.00

This Quotation is valid for 7 days from the date of quote. Pricing is for equipment purchase only and does not include applicable taxes, delivery, pickup, fuel, environmental fees, waivers or other charges unless otherwise indicated. All quotations are subject to the Admar Supply Terms and Conditions. Customer shall pay all amounts due before delivery unless otherwise stated and agreed upon in writing.

Accepted by:

Name

Date

CORPORATE
1950 Brighton Henrietta Town Line Road
Rochester, NY 14623
585.978.8800 | f 585.272.9185

www.admarsupply.com

a DiMarco Group company

ALBANY	518.690.0750	f 518.690.0757	878 Old Albany Shaker Road, Latham, NY 12110
BUFFALO	716.873.8000	f 716.873.8455	1394 Military Road, Tonawanda, NY 14217
BINGHAMTON	607.798.0333	f 607.798.0833	49 Commerce Road, Vestal, NY 13850
CANANDAIGUA	585.396.0031	f 585.396.0038	2390 Rochester Road, Canandaigua, NY 14424
CLEVELAND	216.465.3737	f 216.465.3633	16000 Brookpark Road, Cleveland, OH 44135
ERIE	814.833.7761	f 814.838.5048	3001 West 17th Street, Erie, PA 16505
PITTSBURGH	412.458.4421	f 412.458.4190	1990 McKees Rocks Road, McKees Rocks, PA 15136
ROCHESTER	585.272.9390	f 585.424.5699	330 Metro Park, Rochester, NY 14623
SYRACUSE	315.433.5000	f 315.431.0548	7800 Brewerton Road, Cicero, NY 13039
WILKES-BARRE	570.299.5505	f 570.299.5504	121 Armstrong Road, Pittston, PA 18640

EW100

Wheeled Excavators

The future of urban excavation

The new EW100 features a more powerful engine, significantly reduced turning radius, increased digging depth and simplified operation. Wheeled excavators save contractors and municipalities money with unparalleled mobility. With its power, reach and mobility, this excavator is the perfect solution for roadside digging and demolition in urban settings. Operators will also appreciate the new easy to use dial control system. Using this automotive-style feature, operators can easily select and save the auxiliary hydraulic flow settings depending on the attachment, eliminating the need for manual adjustments.

- Powerful Perkins 854E Tier 4 Final Turbo engine delivers superior horsepower. The 4-cylinder, 3.4 liter engine incorporates cutting edge technology including a common rail fuel injection system, charge-air cooler and diesel particulate filter (DPF).
- Articulated triple boom offers increased digging area through an extended dig range, allowing the operator to reach farther, dig closer to the blade and reach under the machine when needed
- All wheel steering feature delivers a turning radius of 13-feet making it even easier to maneuver in confined areas.
- Operator comfort with air conditioning, automatic climate control and a simplified layout.
- Driving speeds up to 18.6 mph make getting to and around the job site more efficient.

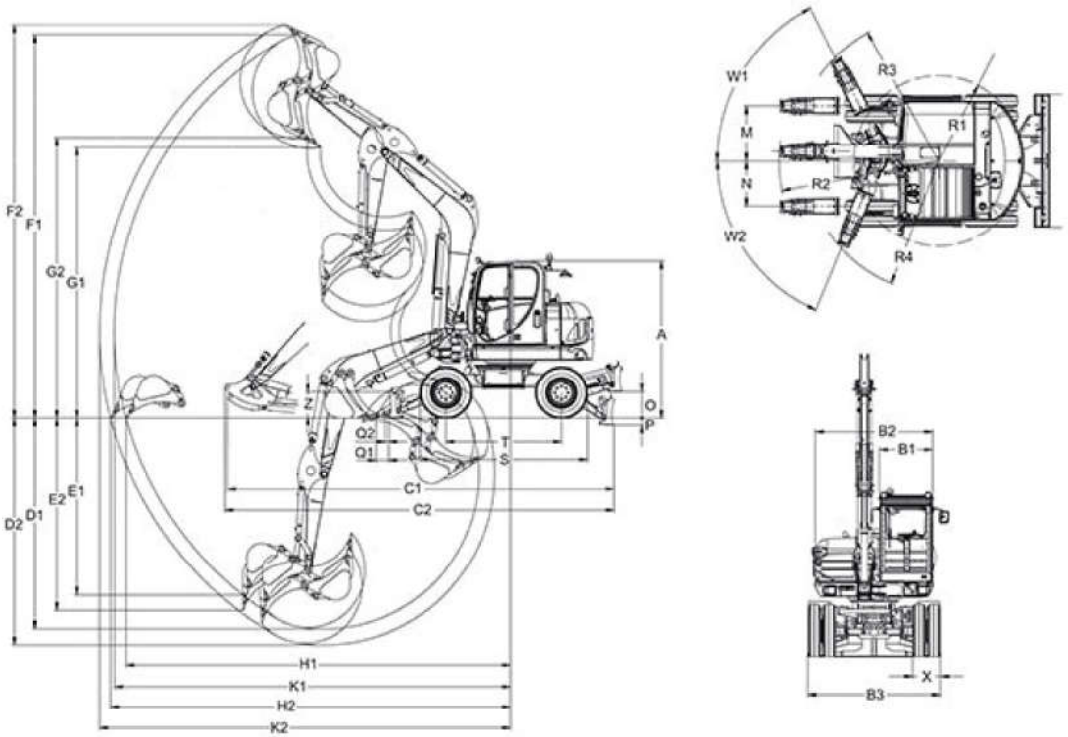
EW100 Technical specifications

EW100

Operating data	
Shipping weight min.	20,373 lb
Operating weight	21,352 - 24,330 lb
Biting force max.	10,566 lbf
Breakout force max.	11,308 lbf
Digging depth max.	167.21 in
Dumping height	233.76 - 244.32 in
Dump height max.	244.32 in
Digging radius max.	319.42 in
Engine / Motor	
Engine / Motor manufacturer	Perkins
Engine / Motor type	904J-E36TA
Engine / Motor	Water-cooled, 4-cylinder turbo diesel engine
Displacement	220.88 in^3
RPM / speed	1,850 rpm
Engine performance according to ISO	74.24 hp
Battery	100 CCA
Fuel tank capacity	44.9 US gal
Hydraulic system	
Duty pump	1-pump Load Sensing
Flow rate	47.6 US gpm
Max. flow rate	32.5 + 50.2 US gpm
Operating pressure for driving hydraulics	6,381.76 psi
Operating pressure for working hydraulics	4,206.16 psi
Hydraulic oil tank	31.7 US gal
Undercarriage	
Axles Front axle	Oscillating steering axle
Axles Rear axle	Rigid steering axle
Tires Standard	8.25-20 14 PR Twin Tires
Turning radius	219.3 in
Track width	76.5 in
Ground clearance	14.2 in
Travel speed	12.4 mph
Travel speed Option	18.6 mph
Dozer Blade	
Width	97.1 in
Height	19.7 in
Stroke - Above ground	19.86 in

Stroke - Below ground	5.2 in
Sound level	
Sound level (LwA)	99 dB(A)

EW100 Dimensions



A	Height	117.7 in
B	Width - Cab	38.9 in
B	Width - Revolving superstructure	85.6 in
B	Width - Chasiss	96.6 in
C	Transport length - short dipperstick	262.25 in
C	Transport length - long dipperstick	271.31 in
D	Digging depth max. - short dipperstick	155.28 in
D	Digging depth max. - long dipperstick	167.21 in
E	Insertion depth - short dipperstick	135.89 in
E	Insertion depth - long dipperstick	147.36 in
F	Insertion height - short dipperstick	318.63 in
F	Insertion height - long dipperstick	329.19 in
G	Dump height max. - short dipperstick	233.76 in
G	Dump height max. - long dipperstick	244.32 in
K	Digging radius max. - short dipperstick	307.79 in
K	Digging radius max. - long dipperstick	319.42 in
H	Range - short dipperstick	299.52 in
H	Range - long dipperstick	311.38 in
J	Rear swivel radius	62.05 in
M	Arm displacement to centre of bucket, right side	40.3 in

N	Arm displacement to centre of bucket, left side	33.1 in
O	Lift height - Above ground	19.8 in
P	Scraping depth - Below ground	5.2 in
S	Length - Track	125.7 in
W	Turning angle - Boom system to the right	63 °
W	Turning angle - Boom system to the left	67 °
R	Boom slewing radius - Middle	125.73 in
R	Boom slewing radius - Right	115.4 in
R	Boom slewing radius - Left	103.98 in
X	Width - Tires	20.2 in
Y	Width - Dozer blade	97 in
Z	Height - Dozer blade	20 in

ds...dipperstick

PEMBERTON
QUALITY ATTACHMENTS

EGR GENERAL MATERIAL GRAPPLE

For Excavators Type: Grapple Applications: Construction Demolition Storm Cleanup

2/3, 3/4, 4/5 TINE AVAILABLE

Pivot Pin and **Link Pin** Are **Fully** Heat Treated for **Maximum** Strength Then Chrome Plated for **Extra** Resistance to Wear & Friction

Extra Thick Internal Ribs in Body of Grapple

Body of Grapple Employs **T-1 Construction.** Built for **Strength,** Wear and **Extra** Long **Durability**

Extra Heavy 2 1/2" Alloy Steel, Stiff Leg Pins

Wear Strips, AR400 - F, (Formable AR - Plate)

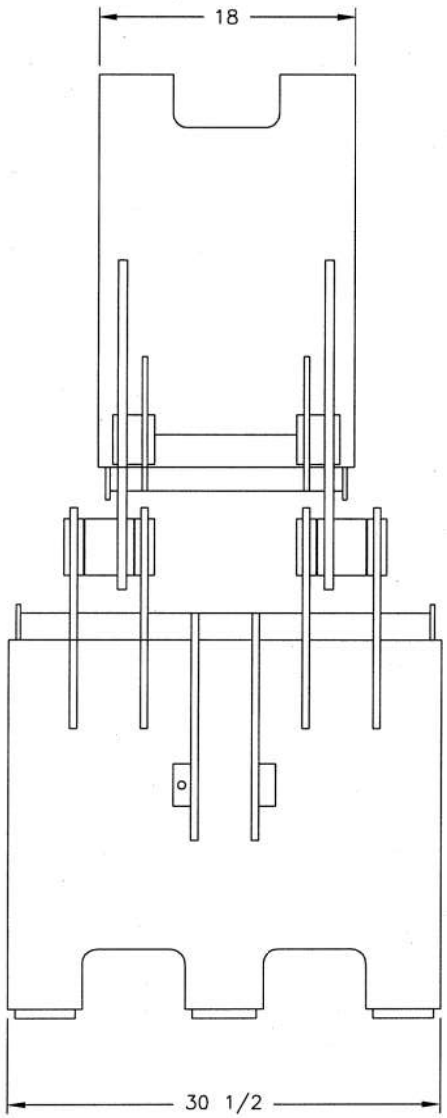
AR - Plate End Plate Wear Pads

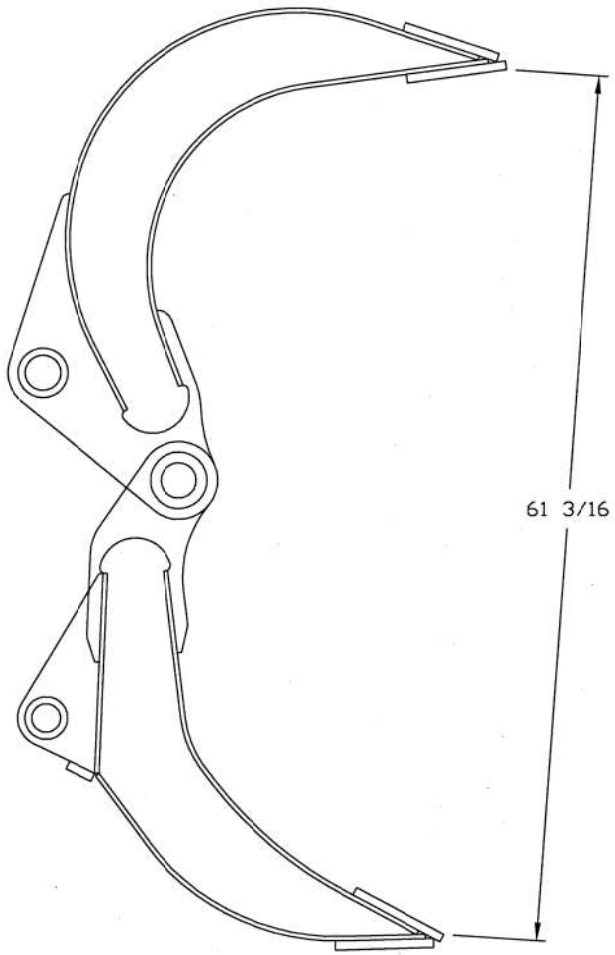
AR - Plate Grapple Tips. The **Most** Abrasion Resistant Material **AVAILABLE**

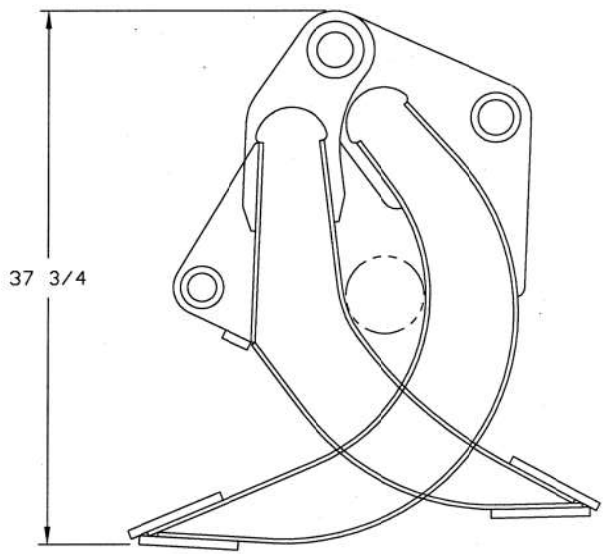
FOR: Excavators 8,000 lbs. - 200,000 lbs. 9 SIZES AVAILABLE

Quality Attachments Since 1978
PEMBERTON

PO Box 521000, Longwood FL 32752-1000 USA · 800-393-6688

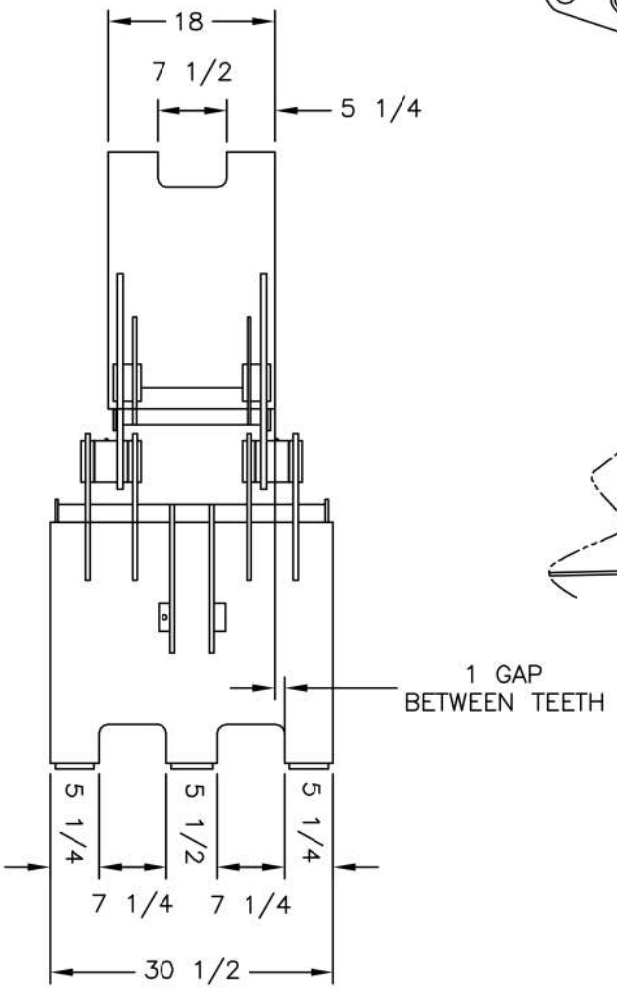




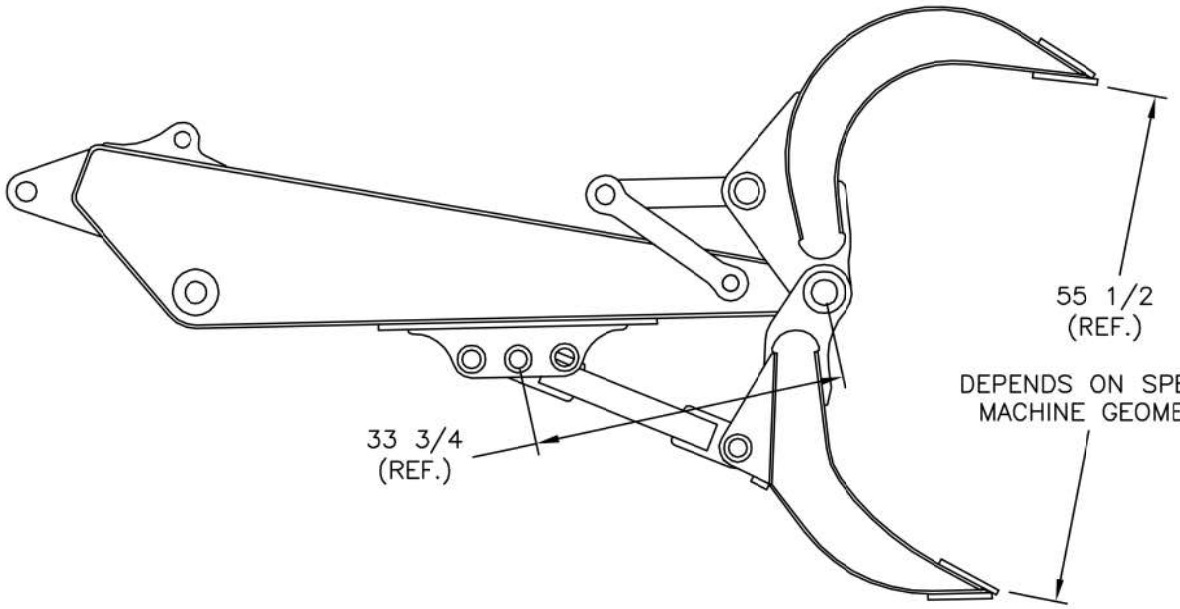


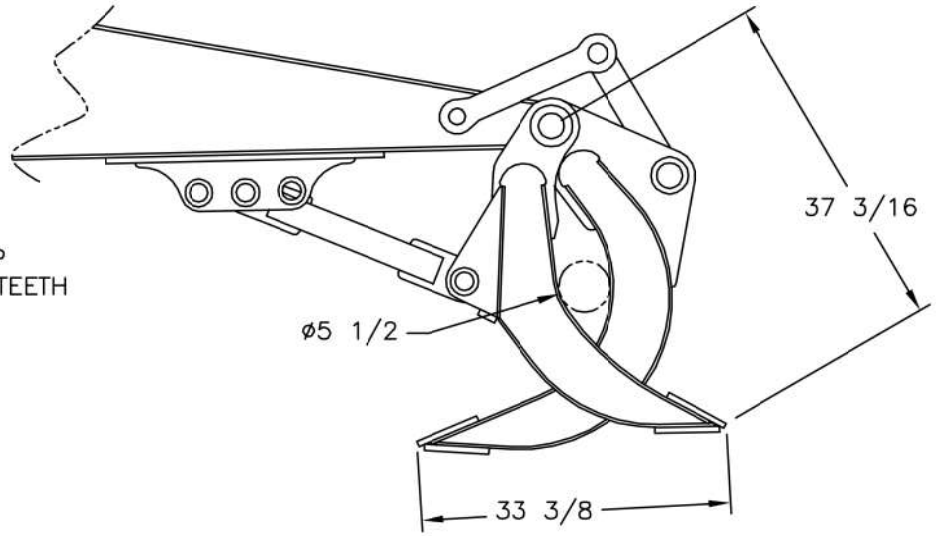
IT.	PART	QTY.	MATERIAL
CONFIGURATION: 2/3 COMBO			PEMBERTON INCORPORATED
PREV. ASSEMBLY:			EGR-100 GRAPPLE ASSEMBLY
APP'D.			
CHK'D.			
BY Andrew Swaziek 6/26/98			

CONFIDENTAL MATERIAL	SIZE	SCALE	PAGE		REV
	B	1/10	4	LGR1-04	1



REAR VIEW OF GRAPPLE





PEMBERTON INCORPORATED

EGR 100,
EXCAVATOR GRAPPLE
STD. 2/3 TINE CONFIGURATION

Lifting force tables EW100

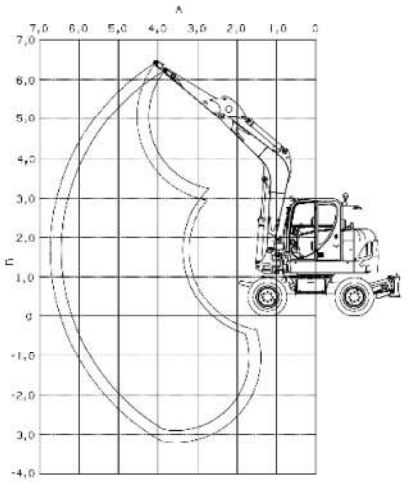


Fig. 1: Lifting force table EW100 - Boom

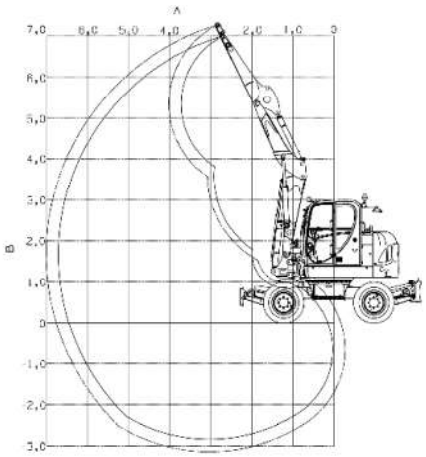


Fig. 2: Lifting force table EW100 - Adjustable boom

max	Permissible load with extended dipper stick
A	Outreach from middle of rotating assembly
B	Load hook height
*	Lifting force limited by hydraulics

All table values are specified in kg (lbs.), in a horizontal position on a solid surface and without a bucket or an attachment.

I Vehicle rearward facing with dozer blade support or stabilizer support, tipping through dozer blade or stabilizers
II Vehicle rearward facing without dozer blade support or stabilizer support, tipping through rear axle
III Vehicle in travel direction without dozer blade support or stabilizer support, tipping through front axle
IV Vehicle 90° to the travel direction without dozer blade or stabilizer support

The lifting force of the vehicle is limited by the settings of the pressure relief valves and hydraulic performance or by the tipping safety mechanism.

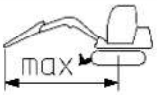
Neither 75% of the static tipping load nor 87% of the hydraulic lifting force are exceeded.

Base of calculation: according to ISO 10567. Set pressure on the lifting arm cylinder 29000 kPA (4206 psi).

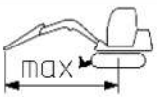
The lifting capacity applies for vehicles under the following conditions:

- Lubricants and operating materials at the prescribed levels.
- Full fuel tank.
- Cabin.
- Vehicle at operating temperature.
- Weight of the operator 75 kg (165 lbs.).

Lifting force tables EW100 - Boom

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	2039*	2039*	2039*
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4495)*	(4495)*	(4495)*
4,5 m	-	-	-	-	1815*	1521	1815*	1616	-	-	-	-	1823*	1236	1823*	1312
(14.8 ft)	-	-	-	-	(4001)*	(3353)	(4001)*	(3563)	-	-	-	-	(4019)*	(2725)	(4019)*	(2892)
3,0 m	2485*	2053	2485*	2201	2046*	1452	2046*	1545	1827*	1083	1695	1149	1847*	1046	1621	1107
(9.8 ft)	(5478)*	(4526)	(5478)*	(4852)	(4511)*	(3201)	(4511)*	(3406)	(4028)*	(2388)	(3737)	(2533)	(4072)*	(2306)	(3574)	(2441)
1,5 m	3260*	1842	2989	1982	2399*	1347	2145	1438	1959*	1034	1643	1099	1817*	926	1476	984
(4.9 ft)	(7187)*	(4061)	(6590)	(4370)	(5289)*	(2970)	(4729)	(3170)	(4319)	(2280)	(3622)	(2423)	(4006)*	(2041)	(3254)	(2169)
0,0 m	3438*	1742	2879	1878	2525*	1279	2072	1368	1951*	998	1605	1063	1846*	959	1541	1021
(0.0 ft)	(7579)*	(3840)	(6347)	(4140)	(5567)*	(2820)	(4568)	(3016)	(4301)*	(2200)	(3538)	(2344)	(4070)*	(2114)	(3397)	(2251)
-1,0 m	3190*	1735	2872	1872	2359*	1268	2061	1357	-	-	-	-	1853*	1062	1710	1132
(-3.3 ft)	(7033)*	(3825)	(6332)	(4127)	(5201)*	(2795)	(4544)	(2992)	-	-	-	-	(4085)	(2341)	(3770)	(2496)

Tab 1: Lifting force table EW100 – Boom, dual tires, dozer blade rear, short dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1724	1824*	1824*
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(3801)	(4021)*	(4021)*
4,5 m	-	-	-	-	1662*	1540	1662*	1636	-	-	-	-	1685*	1128	1685*	1196
(14.8 ft)	-	-	-	-	(3664)*	(3395)	(3664)	(3607)	-	-	-	-	(3715)*	(2487)	(3715)*	(2637)
3,0 m	2274*	2087	2274*	2236	1919*	1464	1919*	1558	1729*	1088	1702	1155	1672*	929	1468	986
(9.8 ft)	(5013)	(4601)	(5013*)	(4930)	(4231)*	(3228)	(4231)*	(3435)	(3812)*	(2399)	(3752)	(2546)	(3686)	(2048)	(3236)	(2174)
1,5 m	3115*	1860	3011	2002	2310*	1351	2150	1442	1899*	1030	1640	1096	1698*	861	1380	915
(4.9 ft)	(6867)*	(4101)	(6638)	(4414)	(5093)*	(2978)	(4740)	(3180)	(4187)*	(2271)	(3616)	(2416)	(3743)*	(1898)	(3042)	(2017)
0,0 m	3435*	1733	2871	1870	2508*	1269	2063	1358	1961*	985	1592	1049	1738*	886	1431	943
(0.0 ft)	(7573)*	(3821)	(6329)	(4123)	(5529)*	(2798)	(4548)	(2994)	(4323)*	(2172)	(3510)	(2313)	(3832)*	(1953)	(3155)	(2079)
-1,0 m	3276*	1711	2848	1848	2415*	1249	2042	1338	1794*	980	1587	1044	1755*	968	1568	1032
(-3.3 ft)	(7222)*	(3772)	(6279)	(4074)	(5324)*	(2754)	(4502)	(2950)	(3955)*	(2161)	(3499)	(2302)	(3869)*	(2134)	(3457)	(2275)

Tab 2: Lifting force table EW100 – Boom, dual tires, dozer blade rear, long dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	1962	2039*	2039*
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4325)	(4495)*	(4495)*
4,5 m	-	-	-	-	1815*	1461	1815*	1555	-	-	-	-	1823*	1184	1823*	1260
(14.8 ft)	-	-	-	-	(4001)*	(3221)	(4001)*	(3428)	-	-	-	-	(4019)*	(2610)	(4019)*	(2778)
3,0 m	2485*	1972	2485*	2119	2046*	1391	2046*	1484	1827*	1035	1644	1101	1847*	1000	1573	1062
(9.8 ft)	(5478)*	(4348)	(5478)*	(4672)	(4511)*	(3067)	(4511)*	(3272)	(4028)*	(2282)	(3624)	(2427)	(4072)*	(2205)	(3468)	(2341)
1,5 m	3260*	1761	2900	1900	2399*	1287	2080	1377	1959*	985	1592	1051	1817*	882	1430	940
(4.9 ft)	(7187)*	(3882)	(6393)	(4189)	(5289)	(2837)	(4586)	(3036)	(4319)*	(2172)	(3510)	(2317)	(4006)*	(1944)	(3153)	(2072)
0,0 m	3438*	1660	2789	1796	2525*	1218	2007	1307	1951*	950	1554	1015	1849*	913	1492	974
(0.0 ft)	(7579)*	(3660)	(6149)	(3960)	(5567)*	(2685)	(4425)	(2881)	(4301)*	(2094)	(3426)	(2238)	(4076)*	(2013)	(3289)	(2147)
-1,0 m	3190*	1654	2782	1789	2359*	1208	1996	1296	-	-	-	-	1853*	1011	1656	1081
(-3.3 ft)	(7033)*	(3646)	(6133)	(3944)	(5201)*	(2663)	(4400)	(2857)	-	-	-	-	(4085)*	(2229)	(3651)	(2383)

Tab 3: Lifting force table EW100 – Boom, balloon tires, dozer blade rear, short dipper stick

Lifting force tables EW100 - Boom

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")				max			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1657	1824*	1768
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(3653)	(4021)*	(3898)
4,5 m	-	-	-	-	1662*	1479	1662*	1575	-	-	-	-	1685*	1079	1685*	1148
(14.8 ft)	-	-	-	-	(3664)*	(3261)	(3664)*	(3472)	-	-	-	-	(3715)*	(2379)	(3715)*	(2531)
3,0 m	2274*	2005	2274*	2154	1919*	1404	1919*	1498	1729*	1040	1651	1107	1672*	886	1422	943
(9.8 ft)	(5013)*	(4420)	(5013)*	(4749)	(4231)*	(3095)	(4231)*	(3303)	(3812)*	(2293)	(3640)	(2441)	(3686)*	(1953)	(3135)	(2079)
1,5 m	3115*	1779	2922	1919	2310*	1290	2085	1381	1899*	982	1589	1048	1698*	819	1336	873
(4.9 ft)	(6867)*	(3922)	(6442)	(4231)	(5093)*	(2844)	(4597)	(3045)	(4187)*	(2165)	(3503)	(2310)	(3743)*	(1806)	(2945)	(1925)
0,0 m	3435*	1651	2782	1787	2508*	1208	1998	1297	1961*	937	1541	1001	1738*	842	1385	899
(0.0 ft)	(7573)*	(3640)	(6133)	(3940)	(5529)*	(2663)	(4405)	(2859)	(4323)*	(2066)	(3397)	(2207)	(3832)*	(1856)	(3053)	(1982)
-1,0 m	3276*	1630	2758	1765	2415*	1189	1977	1277	1794*	931	1536	996	1755*	921	1517	984
(-3.3 ft)	(7222)*	(3594)	(6080)	(3891)	(5324)*	(2621)	(4359)	(2815)	(3955)*	(2053)	(3386)	(2196)	(3869)*	(2030)	(3344)	(2169)

Tab 4: Lifting force table EW100 – Boom, balloon tires, dozer blade rear, long dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")				max			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	2039*	2039*	2039*
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4495)*	(4495)*	(4495)*
4,5 m	-	-	-	-	1815*	1761	1815*	1718	-	-	-	-	1823*	1444	1823*	1400
(14.8 ft)	-	-	-	-	(4001)*	(3882)	(4001)*	(3788)	-	-	-	-	(4019)*	(3183)	(4019)*	(3086)
3,0 m	2485*	2375	2485*	2340	2046*	1692	2046*	1647	1827*	1274	1645	1230	1847*	1226	1574	1184
(9.8 ft)	(5478)*	(5236)	(5478)*	(5159)	(4511)*	(3730)	(4511)*	(3631)	(4028)*	(2809)	(3627)	(2712)	(4072)*	(2703)	(3470)	(2610)
1,5 m	3260*	2164	2903	2121	2399*	1587	2083	1540	1959*	1225	1593	1180	1817*	1101	1431	1058
(4.9 ft)	(7187)*	(4771)	(6400)	(4676)	(5289)*	(3499)	(4592)	(3395)	(3516)*	(2701)	(3512)	(2601)	(4006)*	(2427)	(3155)	(2332)
0,0 m	3438*	2064	2793	2017	2525*	1519	2009	1470	1951*	1189	1556	1144	1849*	1143	1494	1099
(0.0 ft)	(7580)*	(4550)	(6158)	(4447)	(5567)*	(3349)	(4429)	(3241)	(4301)*	(2621)	(3430)	(2522)	(4076)*	(2520)	(3294)	(2423)
-1,0 m	3190*	2057	2785	2010	2359*	1508	1998	1459	-	-	-	-	1853*	1264	1657	1218
(-3.3 ft)	(7033)*	(4535)	(6140)	(4431)	(5201)*	(3325)	(4405)	(3217)	-	-	-	-	(4085)*	(2787)	(3653)	(2685)

Tab 5: Lifting force table EW100 – Boom dual tires, dozer blade rear, stabilizers front, short dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")				max			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1824*	1824*	1824*
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(4021)*	(4021)*	(4021)*
4,5 m	-	-	-	-	1662*	1662*	1662*	1662*	-	-	-	-	1685*	1321	1685*	1278
(14.8 ft)	-	-	-	-	(3664)*	(3664)*	(3664)*	(3664)	-	-	-	-	(3715)*	(2912)	(3715)*	(2818)
3,0 m	2274*	2274*	2274*	2274*	1919*	1704	1919*	1661	1729*	1279	1652	1236	1672*	1100	1424	1058
(9.8 ft)	(5013)*	(5013)*	(5013)*	(5013)*	(4231)*	(3757)	(4231)*	(3662)	(3812)*	(2820)	(3642)	(2725)	(3686)*	(2425)	(3140)	(2332)
1,5 m	3115*	2182	2925	2140	2310*	1590	2088	1544	1899*	1221	1591	1177	1698*	1027	1338	985
(4.9 ft)	(6867)*	(4810)	(6449)	(4718)	(5093)*	(3505)	(4603)	(3404)	(4187)*	(2692)	(3506)	(2595)	(3743)*	(2264)	(2950)	(2172)
0,0 m	3435*	2055	2785	2008	2508*	1509	2000	1460	1961*	1176	1543	1131	1738*	1060	1387	1016
(0.0 ft)	(7573)*	(4530)	(6140)	(4427)	(5529)*	(3327)	(4409)	(3219)	(4323)*	(2593)	(3402)	(2493)	(3832)*	(2337)	(3058)	(2240)
-1,0 m	3276*	2033	2761	1986	2415*	1489	1979	1440	1794*	1171	1538	1125	1755*	1157	1519	1112
(-3.3 ft)	(7222)*	(4482)	(6087)	(4378)	(5324)*	(3283)	(4363)	(3175)	(3955)*	(2582)	(3391)	(2480)	(3869)*	(2551)	(3349)	(2452)

Tab 6: Lifting force table EW100 – Boom, dual tires, dozer blade rear, stabilizers front, long dipper stick

Lifting force tables EW100 - Boom

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	2039*	2039*	2039*
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4495)*	(4495)*	(4495)*
4,5 m	-	-	-	-	1815*	1700	1815*	1658	-	-	-	-	1823*	1391	1803	1348
(14.8 ft)	-	-	-	-	(4001)*	(3748)	(4001)*	(3655)	-	-	-	-	(4019)*	(3067)	(3975)	(2972)
3,0 m	2485*	2294	2485*	2257	2046*	1631	2046*	1587	1827*	1226	1595	1182	1857*	1181	1526	1139
(9.8 ft)	(5478)*	(5057)	(5478)*	(4976)	(4511)*	(3596)	(4511)*	(3499)	(4028)*	(2703)	(3516)	(2606)	(4094)*	(2604)	(3364)	(2511)
1,5 m	3260*	2083	2814	2039	2399*	1527	2018	1480	1959*	1176	1542	1132	1817*	1057	1385	1014
(4.9 ft)	(7187)*	(4592)	(6204)	(4495)	(5289)*	(3366)	(4449)	(3263)	(4319)*	(2593)	(3399)	(2496)	(4006)*	(2330)	(3053)	(2235)
0,0 m	3438*	1982	2703	1935	2525*	1458	1944	1409	1951*	1141	1505	1096	1849*	1097	1445	1052
(0.0 ft)	(7579)*	(4370)	(5959)	(4266)	(5567)*	(3214)	(4286)	(3106)	(4301)*	(2515)	(3318)	(2416)	(4076)*	(2418)	(3186)	(2319)
-1,0 m	3190*	1976	2696	1928	2359*	1448	1933	1399	-	-	-	-	1853*	1213	1603	1167
(-3.3 ft)	(7033)*	(4356)	(5944)	(4251)	(5201)*	(3192)	(4262)	(3084)	-	-	-	-	(4085)*	(2674)	(3534)	(2573)

Tab 7: Lifting force table EW100 – Boom, balloon tires, stabilizers front, dozer blade rear, short dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1824*	1824*	1824*
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(4021)*	(4021)*	(4021)*
4,5 m	-	-	-	-	1662*	1662*	1662*	1662*	-	-	-	-	1685*	1272	1649	1230
(14.8 ft)	-	-	-	-	(3664)*	(3664)*	(3664)*	(3664)*	-	-	-	-	(3715)*	(2804)	(3635)	(2712)
3,0 m	2274*	2274*	2274*	2274*	1919*	1643	1919*	1600	1729*	1231	1601	1188	1672*	1057	1378	1015
(9.8 ft)	(5013)*	(5013)*	(5013)*	(5013)*	(4231)*	(3622)	(4231)*	(3527)	(3812)*	(2714)	(3530)	(2619)	(3686)*	(2330)	(3038)	(2238)
1,5 m	3115*	2101	2835	2058	2310*	1530	2023	1483	1899*	1173	1540	1129	1698*	985	1294	944
(4.9 ft)	(6867)*	(4632)	(6250)	(4537)	(5093)*	(3373)	(4460)	(3269)	(4187)*	(2586)	(3395)	(2489)	(3743)*	(2172)	(2853)	(2081)
0,0 m	3435*	1973	2695	1926	2508*	1448	1935	1400	1961*	1128	1492	1082	1738*	1016	1341	973
(0.0 ft)	(7573)*	(4350)	(5941)	(4246)	(5529)*	(3192)	(4266)	(3086)	(4323)*	(2487)	(3289)	(2385)	(3832)*	(2240)	(2956)	(2145)
-1,0 m	3276*	1952	2672	1904	2415*	1429	1914	1380	1794*	1122	1487	1077	1755*	1110	1469	1065
(-3.3 ft)	(7222)*	(4303)	(5891)	(4198)	(5324)*	(3150)	(4220)	(3042)	(3955)*	(2474)	(3278)	(2374)	(3869)*	(2447)	(3239)	(2348)

Tab 8: Lifting force table EW100 – Boom, balloon tires, stabilizers front, dozer blade rear, long dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	2039*	2039*	2039*
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4495)*	(4495)*	(4495)*
4,5 m	-	-	-	-	1815*	1574	1815*	1557	-	-	-	-	1823	1282	1740	1261
(14.8 ft)	-	-	-	-	(4001)*	(3470)	(4001)*	(3433)	-	-	-	-	(4019)	(2826)	(3836)	(2780)
3,0 m	2485*	2125	2485*	2121	2046*	1505	2046*	1486	1827*	1125	1536	1103	1847*	1085	1471	1063
(9.8 ft)	(5478)*	(4684)	(5478)*	(4676)	(4511)*	(3318)	(4511)*	(3276)	(4028)*	(2480)	(3386)	(2432)	(4072)*	(2392)	(3243)	(2344)
1,5 m	3260*	1913	2711	1902	2399*	1400	1943	1379	1959*	1076	1484	1052	1817*	965	1332	941
(4.9 ft)	(7187)*	(4217)	(5977)	(4193)	(5289)*	(3086)	(4284)	(3040)	(4319)*	(2372)	(3272)	(2319)	(4006)*	(2127)	(2937)	(2075)
0,0 m	3438*	1813	2601	1798	2525*	1332	1870	1309	1951*	1040	1447	1016	1849*	1000	1389	975
(0.0 ft)	(7579)*	(3997)	(5734)	(3964)	(5567)*	(2937)	(4123)	(2886)	(4301)*	(2293)	(3190)	(2240)	(4076)*	(2205)	(3062)	(2150)
-1,0 m	3190*	1806	2594	1792	2359*	1321	1859	1298	-	-	-	-	1853*	1107	1542	1082
(-3.3 ft)	(7033)*	(3982)	(5719)	(3951)	(5201)*	(2912)	(4098)	(2862)	-	-	-	-	(4085)*	(2441)	(3400)	(2385)

Tab 9: Lifting force table EW100 – Boom, dual tires, stabilizers rear, short dipper stick

Lifting force tables EW100 - Boom

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1782	1824*	1770
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(3929)	(4021)*	(3902)
4,5 m	-	-	-	-	1662*	1593	1662*	1577	-	-	-	-	1685*	1171	1590	1149
(14.8 ft)	-	-	-	-	(3664)*	(3512)	(3664)	(3477)	-	-	-	-	(3715)*	(2582)	(3505)	(2533)
3,0 m	2274*	2158	2274*	2156	1919*	1517	1919*	1499	1729*	1130	1543	1108	1672*	967	1326	944
(9.8 ft)	(5013)*	(4758)	(5013)*	(4753)	(4231)*	(3344)	(4231)*	(3305)	(3812)*	(2491)	(3402)	(2443)	(3686)*	(2132)*	(2923)	(2081)
1,5 m	3115*	1931	2733	1922	2310*	1403	1948	1383	1899*	1072	1482	1049	1698*	898	1243	874
(4.9 ft)	(6867)*	(4257)	(6025)	(4237)	(5093)*	(3093)	(4295)	(3049)	(4187)*	(2363)	(3267)	(2313)	(3743)*	(1980)	(2740)	(1927)
0,0 m	3435*	1804	2593	1790	2508*	1322	1861	1299	1961*	1027	1434	1003	1738*	924	1288	900
(0.0 ft)	(7573)*	(3977)	(5717)	(3946)	(5529)*	(2915)	(4103)	(2864)	(4323)*	(2264)	(3161)	(2211)	(3832)*	(2037)	(2840)	(1984)
-1,0 m	3276*	1783	2570	1768	2415*	1302	1840	1279	1794*	1022	1428	997	1755*	1010	1411	986
(-3.3 ft)	(7222)*	(3931)	(5666)	(3898)	(5324)*	(2870)	(4057)	(2820)	(3955)*	(2253)	(3148)	(2198)	(3869)*	(2227)	(3111)	(2174)

Tab 10: Lifting force table EW100 – Boom, dual tires, stabilizers rear, long dipper stick

A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	2014*	2014*	2014*	2014*	-	-	-	-	-	-	-	-	2039*	2030	2039*	2025
(19.7 ft)	(4440)*	(4440)*	(4440)*	(4440)*	-	-	-	-	-	-	-	-	(4495)*	(4475)	(4495)*	(4464)
4,5 m	-	-	-	-	1815*	1514	1815*	1497	-	-	-	-	1823*	1230	1684	1209
(14.8 ft)	-	-	-	-	(4001)*	(3338)	(4001)*	(3300)	-	-	-	-	(4019)*	(2712)	(3713)	(2665)
3,0 m	2485*	2043	2485*	2039	2046*	1444	1990	1425	1827*	1077	1485	1054	1847*	1040	1423	1018
(9.8 ft)	(5478)*	(4504)	(5478)*	(4495)	(4511)*	(3183)	(4387)	(3142)	(4028)*	(2374)	(3274)	(2324)	(4072)*	(2293)	(3137)	(2244)
1,5 m	3260*	1832	2622	1820	2399*	1340	1879	1318	1959*	1028	1433	1004	1817*	921	1285	897
(4.9 ft)	(7187)*	(4039)	(5781)	(4012)	(5289)*	(2954)	(4142)	(2906)	(4319)*	(2266)	(3159)	(2213)	(4006)*	(2030)	(2833)	(1978)
0,0 m	3438*	1732	2512	1716	2525*	1271	1805	1248	1951*	992	1396	968	1849*	953	1340	929
(0.0 ft)	(7580)*	(3818)	(5538)	(3783)	(5567)*	(2802)	(3979)	(2751)	(4301)*	(2187)	(3078)	(2134)	(4076)*	(2101)	(2954)	(2048)
-1,0 m	3190*	1725	2505	1709	2359*	1261	1794	1237	-	-	-	-	1853*	1056	1488	1031
(-3.3 ft)	(7033)*	(3803)	(5523)	(3768)	(5201)*	(2780)	(3955)	(2727)	-	-	-	-	(4085)*	(2328)	(3280)	(2273)

Tab 11: Lifting force table EW100 – Boom, balloon tires, stabilizers rear, short dipper stick

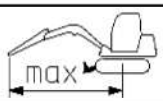
A / B	4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
6,0 m	-	-	-	-	-	-	-	-	-	-	-	-	1824*	1716	1824*	1703
(19.7 ft)	-	-	-	-	-	-	-	-	-	-	-	-	(4021)*	(3783)	(4021)*	(3754)
4,5 m	-	-	-	-	1662*	1532	1662*	1516	-	-	-	-	1685*	1122	1539	1101
(14.8 ft)	-	-	-	-	(3664)*	(3377)	(3664)*	(3342)	-	-	-	-	(3715)*	(2474)	(3393)	(2427)
3,0 m	2274*	2077	2274*	2074	1919*	1457	1919*	1439	1729*	1082	1492	1060	1672*	923	1281	901
(9.8 ft)	(5013)*	(4579)	(5013)*	(4572)	(4231)*	(3212)	(4231)*	(3172)	(3812)*	(2385)	(3289)	(2337)	(3686)*	(2035)*	(2824)	(1986)
1,5 m	3115*	1850	2644	1839	2310*	1343	1884	1322	1899*	1024	1431	1001	1698*	856	1199	833
(4.9 ft)	(6867)*	(4079)	(5829)	(4054)	(5093)*	(2961)	(4154)	(2915)	(4187)*	(2258)	(3155)	(2207)	(3743)*	(1887)	(2643)	(1836)
0,0 m	3435*	1722	2504	1707	2508*	1261	1796	1238	1961*	979	1383	955	1738*	880	1242	856
(0.0 ft)	(7573)*	(3796)	(5520)	(3763)	(5529)*	(2780)	(3960)	(2729)	(4323)*	(2158)	(3049)	(2105)	(3832)*	(1940)	(2738)	(1887)
-1,0 m	3276*	1701	2481	1686	2415*	1242	1775	1218	1794*	974	1377	949	1755*	962	1361	938
(-3.3 ft)	(7222)*	(3750)	(5470)	(3717)	(5324)*	(2738)	(3913)	(2685)	(3955)*	(2147)	(3036)	(2092)	(3869)*	(2121)	(3000)	(2068)

Tab 12: Lifting force table EW100 – Boom, balloon tires, stabilizers rear, long dipper stick

Lifting force tables EW100 – Adjustable boom

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	3025	3130*	3130*	2695*	1830	2695*	2075	2135*	1295	2085	1470	1835*	965	1565	1095	1720*	815	1350	935
(9.8 ft)	(6902)*	(6670)	(6902)*	(6902)*	(5942)*	(4035)	(5942)*	(4575)	(4708)*	(2855)	(4597)	(3241)	(4046)*	(2128)	(3451)	(2414)	(3793)*	(1797)	(2977)	(2062)
1,5 m	4715*	2600	4505	3015	3280*	1595	2700	1835	2400*	1180	1960	1350	1920*	905	1505	1035	1640*	760	1275	875
(4.9 ft)	(10397)*	(5733)	(9934)	(6648)	(7232)*	(3517)	(5954)	(4046)	(5292)*	(2602)	(4322)	(2977)	(4234)*	(1996)	(3319)	(2282)	(3616)*	(1676)	(2811)	(1929)
0,0 m	4850*	2330	4195	2735	3225*	1500	2600	1740	2395*	1110	1885	1280	1840*	870	1465	1000	1545*	790	1330	910
(0.0 ft)	(10694)*	(5138)	(9250)	(6031)	(7111)*	(3308)	(5733)	(3837)	(5281)*	(2448)	(4156)	(2822)	(4057)*	(1918)	(3230)	(2205)	(3407)*	(1742)	(2933)	(2007)
-1,0 m	3725*	2340	3725*	2740	2845*	1500	2600	1740	2145*	1100	1880	1270	1470*	880	1470	1010	1420*	875	1420	1005
(-3.3 ft)	(8214)*	(5160)	(8214)*	(6042)	(6273)*	(3308)	(5733)	(3837)	(4730)*	(2426)	(4145)	(2800)	(3241)*	(1940)	(3241)	(2227)	(3131)*	(1929)	(3131)	(2216)

Tab 13: Lifting force table EW100 – Adjustable boom, dual tires, dozer blade rear, short dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510*	1860	2510*	2110	2025*	1305	2025*	1480	1755*	965	1570	1100	1600*	750	1250	860
(9.8 ft)	-	-	-	-	(5535)*	(4101)	(5535)*	(4653)	(4465)*	(2878)	(4465)*	(3263)	(3870)*	(2128)	(3462)	(2426)	(3528)*	(1654)	(2756)	(1896)
1,5 m	4450*	2625	4450*	3040	3180*	1605	2720	1850	2330*	1180	1960	1350	1875*	900	1500	1030	1535*	700	1185	805
(4.9 ft)	(9812)*	(5788)	(9812)*	(6703)	(7012)*	(3539)	(5998)	(4079)	(5138)*	(2602)	(4322)	(2977)	(4134)*	(1985)	(3308)	(2271)	(3385)*	(1544)	(2613)	(1775)
0,0 m	4965*	2285	4150	2685	3260*	1480	2580	1720	2400*	1095	1870	1265	1860*	850	1450	985	1455*	725	1235	835
(0.0 ft)	(10948)*	(5038)	(9151)	(5920)	(7188)*	(3263)	(5689)	(3793)	(5292)*	(2414)	(4123)	(2789)	(4101)*	(1874)	(3197)	(2172)	(3208)*	(1599)	(2723)	(1841)
-1,0 m	4085*	2285	4085*	2685	2970*	1470	2565	1710	2220*	1075	1850	1245	1645*	845	1445	980	1355*	795	1345	915
(-3.3 ft)	(9007)*	(5038)	(9007)*	(5920)	(6549)*	(3241)	(5656)	(3771)	(4895)*	(2370)	(4079)	(2745)	(3627)*	(1863)	(3186)	(2161)	(2988)*	(1753)	(2966)	(2018)

Tab 14: Lifting force table EW100 – Adjustable boom, dual tires, dozer blade rear, long dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	2940	3130*	3130*	2695*	1775	2695*	2010	2135*	1255	2030	1420	1835*	930	1520	1060	1720*	785	1310	900
(9.8 ft)	(6902)*	(6483)	(6902)*	(6902)*	(5942)*	(3914)	(5942)*	(4432)	(4708)*	(2767)	(4,76)	(3131)	(4046)*	(2051)	(3352)	(2337)	(3793)*	(1731)	(2889)	(1985)
1,5 m	4715*	2520	4385	2915	3280*	1540	2625	1770	2400*	1135	1900	1300	1920*	875	1460	1000	1640*	730	1235	840
(4.9 ft)	(10397)*	(5557)	(9669)	(6428)	(7232)*	(3396)	(5788)	(3903)	(5292)*	(2503)	(4190)	(2867)	(4234)*	(1929)	(3219)	(2205)	(3616)*	(1610)	(2723)	(1852)
0,0 m	4850*	2250	4075	2635	3225*	1445	2520	1675	2395*	1065	1830	1230	1840*	835	1420	960	1545*	760	1290	875
(0.0 ft)	(10694)*	(4961)	(8985)	(5810)	(7111)*	(3186)	(5557)	(3693)	(5281)*	(2348)	(4035)	(2712)	(4057)*	(1841)	(3131)	(2117)	(3407)*	(1676)	(2844)	(1929)
-1,0 m	3725*	2260	3725*	2645	2845*	1445	2520	1675	2145*	1060	1820	1225	1470*	845	1435	975	1420*	840	1420	970
(-3.3 ft)	(8214)*	(4983)	(8214)*	(5832)	(6273)*	(3186)	(5557)	(3693)	(4730)*	(2337)	(4013)	(2701)	(3241)*	(1863)	(3164)	(2150)	(3131)*	(1852)	(3131)	(2139)

Tab 15: Lifting force table EW100 – Adjustable boom, balloon tires, dozer blade rear, short dipper stick

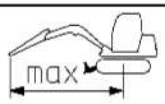
A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510*	1805	2510*	2045	2025*	1265	2025*	1435	1755*	935	1525	1060	1600*	720	1215	830
(9.8 ft)					(5535)*	(3980)	(5535)*	(4509)	(4465)*	(2789)	(4465)*	(3164)	(3870)*	(2062)	(3363)	(2337)	(3528)*	(1588)	(2679)	(1830)
1,5 m	4450*	2545	4415	2945	3180*	1550	2640	1785	2330*	1135	1905	1300	1875*	865	1455	995	1535*	675	1150	775
(4.9 ft)	(9812)*	(5612)	(9735)	(6494)	(7012)*	(3418)	(5821)	(3936)	(5138)*	(2503)	(4201)	(2867)	(4134)*	(1907)	(3208)	(2194)	(3385)*	(1488)	(2536)	(1709)
0,0 m	4965*	2205	4025	2590	3260*	1425	2505	1660	2400*	1050	1815	1215	1860*	820	1405	945	1455*	695	1195	805
(0.0 ft)	(10948)*	(4862)	(8875)	(5711)	(7188)*	(3142)	(5524)	(3660)	(5292)*	(2315)	(4002)	(2679)	(4101)*	(1808)	(3098)	(2084)	(3208)*	(1532)	(2635)	(1775)
-1,0 m	4085*	2200	4025	2585	2970*	1415	2490	1645	2220*	1035	1795	1200	1645*	815	1400	940	1355*	760	1305	880
(-3.3 ft)	(9007)*	(4851)	(8875)	(5700)	(6549)*	(3120)	(5490)	(3627)	(4895)*	(2282)	(3958)	(2646)	(3627)*	(1797)	(3087)	(2073)	(2988)*	(1676)	(2878)	(1940)

Tab 16: Lifting force table EW100 – Adjustable boom, balloon tires, dozer blade rear, long dipper stick

Lifting force tables EW100 – Adjustable boom

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	3130*	3130*	3130*	2695*	2080	2695*	2175	2135*	1485	2040	1540	1835*	1115	1535	1155	1720*	955	1320	985
(9.8 ft)	(6902)*	(6902)*	(6902*)	(6902)*	(5942)*	(4586)	(5942)*	(4796)	(4708)*	(3274)	(4498)	(3396)	(4046)*	(2459)	(3385)	(2547)	(3793)*	(2106)	(2911)	(2172)
1,5 m	4715*	2985	4410	3165	3280*	1850	2640	1935	2400*	1370	1915	1420	1920*	1060	1470	1095	1640*	895	1245	925
(4.9 ft)	(10397)*	(6582)	(9724)	(6979)	(7232)*	(4079)	(5821)	(4267)	(5292)*	(3021)	(4223)	(3131)	(4234)*	(2337)	(3241)	(2414)	(3616)*	(1973)	(2745)	(2040)
0,0 m	4850*	2715	4100	2880	3225*	1755	2540	1840	2395*	1300	1840	1350	1840*	1020	1435	1060	1545*	930	1300	965
(0.0 ft)	(10694)*	(5987)	(9041)	(6350)	(7111)*	(3870)	(5601)	(4057)	(5281)*	(2867)	(4057)	(2977)	(4057)*	(2249)	(3164)	(2337)	(3407)*	(2051)	(2867)	(2128)
-1,0 m	3725*	2725	3725*	2890	2845*	1755	2540	1840	2145*	1290	1835	1345	1470*	1030	1445	1070	1420*	1025	1420	1065
(-3.3 ft)	(8214)*	(6009)	(8214)*	(6372)	(6273)*	(3870)	(5601)	(4057)	(4730)*	(2844)	(4046)	(2966)	(3241)*	(2271)	(3186)	(2359)	(3131)*	(2260)	(3131)	(2348)

Tab 17: Lifting force table EW100 – Adjustable boom, dual tires, stabilizers front, dozer blade rear, short dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510*	2115	2510*	2210	2025*	1495	2025*	1555	1755*	1120	1535	1160	1600*	880	1225	910
(9.8 ft)	-	-	-	-	(5535)*	(4664)	(5535)*	(4873)	(4465)*	(3296)	(4465)*	(3429)	(3870)*	(2470)	(3385)	(2558)	(3528)*	(1940)	(2701)	(2007)
1,5 m	4450*	3010	4445*	3190	3180*	1860	2660	1950	2330*	1370	1915	1425	1875*	1050	1465	1090	1535*	825	1160	855
(4.9 ft)	(9812)*	(6637)	(9801)*	(7034)	(7012)*	(4101)	(5865)	(4300)	(5138)*	(3021)	(4223)	(3142)	(4134)*	(2315)	(3230)	(2403)	(3385)*	(1819)	(2558)	(1885)
0,0 m	4965*	2670	4055	2840	3260*	1735	2520	1820	2400*	1285	1825	1335	1860*	1005	1415	1040	1455*	855	1205	885
(0.0 ft)	(10948)*	(5887)	(8941)	(6262)	(7188)*	(3826)	(5557)	(4013)	(5292)*	(2833)	(4024)	(2944)	(4101)*	(2216)	(3120)	(2293)	(3208)*	(1885)	(2657)	(1951)
-1,0 m	4085*	2670	4050	2835	2970*	1725	2510	1805	2220*	1265	1810	1320	1645*	1000	1410	1035	1355*	935	1315	970
(-3.3 ft)	(9007)*	(5887)	(8930)	(6251)	(6549)*	(3804)	(5535)	(3980)	(4895)*	(2789)	(3991)	(2911)	(3627)*	(2205)	(3109)	(2282)	(2988)*	(2062)	(2900)	(2139)

Tab 18: Lifting force table EW100 – Adjustable boom, dual tires, stabilizers front, dozer blade rear, long dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	3130*	3130*	3130*	2695*	2025	2695*	2110	2135*	1445	1985	1495	1835*	1080	1490	1115	1720*	925	1280	950
(9.8 ft)	(6902)*	(6902)*	(6902)*	(6902)*	(5942)*	(4465)	(5942)*	(4653)	(4708)*	(3186)	(4377)	(3296)	(4046)*	(2381)	(3285)	(2459)	(3793)*	(2040)	(2822)	(2095)
1,5 m	4715*	2900	4290	3065	3280*	1790	2565	1870	2400*	1325	1860	1375	1920*	1025	1430	1055	1640*	865	1205	890
(4.9 ft)	(10397)*	(6395)	(9459)	(6758)	(7232)*	(3947)	(5656)	(4123)	(5292)*	(2922)	(4101)	(3032)	(4234)*	(2260)	(3153)	(2326)	(3616)*	(1907)	(2657)	(1962)
0,0 m	4850*	2630	3980	2785	3225*	1700	2460	1775	2395*	1255	1785	1305	1840*	985	1390	1020	1545*	900	1260	930
(0.0 ft)	(10694)*	(5799)	(8776)	(6141)	(7111)*	(3749)	(5424)	(3914)	(5281)*	(2767)	(3936)	(2878)	(4057)*	(2172)	(3065)	(2249)	(3407)*	(1985)	(2778)	(2051)
-1,0 m	3725*	2640	3725*	2795	2845*	1700	2465	1775	2145*	1250	1780	1295	1470*	1000	1400	1030	1420*	995	1390	1025
(-3.3 ft)	(8214)*	(5821)	(8214)*	(6163)	(6273)*	(3749)	(5435)	(3914)	(4730)*	(2756)	(3925)	(2855)	(3241)*	(2205)	(3087)	(2271)	(3131)*	(2194)	(3065)	(2260)

Tab 19: Lifting force table EW100 – Adjustable boom, balloon tires, stabilizers front, dozer blade rear, short dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510*	2060	2510*	2145	2025*	1455	2000	1505	1755*	1085	1495	1120	1600*	850	1185	880
(9.8 ft)	-	-	-	-	(5535)*	(4542)	(5535)*	(4730)	(4465)*	(3208)	(4410)	(3319)	(3870)*	(2392)	(3296)	(2470)	(3528)*	(1874)	(2613)	(1940)
1,5 m	4450*	2925	4325	3095	3180*	1805	2585	1885	2330*	1325	1860	1375	1875*	1020	1425	1050	1535*	800	1120	825
(4.9 ft)	(9812)*	(6450)	(9537)	(6824)	(7012)*	(3980)	(5700)	(4156)	(5138)*	(2922)	(4101)	(3032)	(4134)*	(2249)	(3142)	(2315)	(3385)*	(1764)	(2470)	(1819)
0,0 m	4965*	2585	3935	2740	3260*	1680	2445	1755	2400*	1240	1770	1290	1860*	970	1370	1005	1455*	825	1165	855
(0.0 ft)	(10948)*	(5700)	(8677)	(6042)	(7188)*	(3704)	(5391)	(3870)	(5292)*	(2734)	(3903)	(2844)	(4101)*	(2139)	(3021)	(2216)	(3208)*	(1819)	(2569)	(1885)
-1,0 m	4085*	2585	3930	2735	2970*	1670	2430	1740	2220*	1225	1750	1270	1645*	965	1365	1000	1355*	905	1275	935
(-3.3 ft)	(9007)*	(5700)	(8666)	(6031)	(6549)*	(3682)	(5358)	(3837)	(4895)*	(2701)	(3859)	(2800)	(3627)*	(2128)	(3010)	(2205)	(2988)*	(1996)	(2811)	(2062)

Tab 20: Lifting force table EW100 – Adjustable boom, balloon tires, stabilizers front, dozer blade rear, long dipper stick

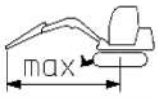
Lifting force tables EW100 – Adjustable boom

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	3070	3130*	3130*	2695*	1860	2695*	2045	2135*	1320	2005	1445	1835*	980	1505	1075	1720*	835	1290	915
(9.8 ft)	(6902)*	(6769)	(6902)*	(6902)*	(5942)*	(4101)	(5942)*	(4509)	(4708)*	(2911)	(4421)	(3186)	(4046)*	(2161)	(3319)	(2370)	(3793)*	(1841)	(2844)	(2018)
1,5 m	4715*	2650	4335	2965	3280*	1625	2595	1800	2400*	1200	1880	1325	1920*	925	1445	1020	1640*	775	1220	855
(4.9 ft)	(10397)*	(5843)	(9559)	(6538)	(7232)*	(3583)	(5722)	(3969)	(5292)*	(2646)	(4145)	(2922)	(4234)*	(2040)	(3186)	(2249)	(3616)*	(1709)	(2690)	(1885)
0,0 m	4850*	2380	4025	2680	3225*	1530	2490	1705	2395*	1130	1805	1255	1840*	885	1405	980	1545*	810	1275	890
(0.0 ft)	(10694)*	(5248)	(8875)	(5909)	(7111)*	(3374)	(5490)	(3760)	(5281)*	(2492)	(3980)	(2767)	(4057)*	(1951)	(3098)	(2161)	(3407)*	(1786)	(2811)	(1962)
-1,0 m	3725*	2390	3725*	2690	2845*	1530	2490	1705	2145*	1125	1800	1245	1470*	900	1415	990	1420*	895	1405	985
(-3.3 ft)	(8214)*	(5270)	(8214)*	(5931)	(6273)*	(3374)	(5490)	(3760)	(4730)*	(2481)	(3969)	(2745)	(3241)*	(1985)	(3120)	(2183)	(3131)*	(1973)	(3098)	(2172)

Tab 21: Lifting force table EW100 – Adjustable boom, dual tires, stabilizers rear, short dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510*	1895	2510*	2080	2025*	1330	2020*	1455	1755*	985	1510	1080	1600*	765	1200	845
(9.8 ft)	-	-	-	-	(5535)*	(4178)	(5535)*	(4586)	(4465)*	(2933)	(4454)	(3208)*	(3870)*	(2217)	(3330)	(2381)	(3528)*	(1687)	(2646)	(1863)
1,5 m	4450*	2675	4365	2990	3180*	1640	2610	1820	2330*	1200	1880	1325	1875*	920	1440	1010	1535*	715	1135	790
(4.9 ft)	(9812)*	(5898)	(9625)	(6593)	(7012)*	(3616)	(5755)	(4013)	(5138)*	(2646)	(4145)	(2922)	(4134)*	(2029)	(3175)	(2227)	(3385)*	(1577)	(2503)	(1742)
0,0 m	4965*	2335	3975	2635	3260*	1515	2475	1690	2400*	1115	1790	1240	1860*	870	1390	965	1455*	740	1180	820
(0.0 ft)	(10948)*	(5149)	(8765)	(5810)	(7188)*	(3341)	(5457)	(3726)	(5292)*	(2459)	(3947)	(2734)	(4101)*	(1918)	(3065)	(2128)	(3208)*	(1632)	(2602)	(1808)
-1,0 m	4085*	2335	3975	2635	2970*	1500	2460	1675	2220*	1100	1775	1220	1645*	865	1385	960	1355*	810	1285	895
(-3.3 ft)	(9007)*	(5149)	(8765)	(5810)	(6549)*	(3308)	(5424)	(3693)	(4895)*	(2426)	(3914)	(2690)	(3627)*	(1907)	(3054)	(2117)	(2988)*	(1786)	(2833)	(1973)

Tab 22: Lifting force table EW100 – Adjustable boom, dual tires, stabilizers rear, long dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	3130*	2990	3130*	3130*	2695*	1805	2695*	1980	2135*	1275	1950	1395	1835*	950	1460	1040	1720*	805	1255	880
(9.8 ft)	(6902)*	(6593)	(6902)*	(6902)*	(5942)*	(3980)	(5942)*	(4366)	(4708)*	(2811)	(4300)	(3076)	(4046)*	(2095)	(3219)	(2293)	(3793)*	(1775)	(2767)	(1940)
1,5 m	4715*	2565	4210	2865	3280*	1570	2515	1740	2400*	1160	1825	1275	1920*	890	1400	980	1640*	745	1180	825
(4.9 ft)	(10397)*	(5656)	(9283)	(6317)	(7232)*	(3462)	(5546)	(3837)	(5292)*	(2558)	(4024)	(2811)	(4234)*	(1962)	(3087)	(2161)	(3616)*	(1643)	(2602)	(1819)
0,0 m	4850*	2295	3900	2585	3225*	1475	2415	1640	2395*	1090	1750	1205	1840*	855	1360	940	1545*	780	1235	855
(0.0 ft)	(10694)*	(5060)	(8600)	(5700)	(7111)*	(3252)	(5325)	(3616)	(5281)*	(2403)	(3859)	(2657)	(4057)*	(1885)	(2999)	(2073)	(3407)*	(1720)	(2723)	(1885)
-1,0 m	3725*	2305	3725*	2595	2845*	1475	2390	1640	2145*	1085	1740	1200	1470*	865	1370	955	1420*	860	1365	950
(-3.3 ft)	(8214)*	(5083)	(8214)*	(5722)	(6273)*	(3,252)	(5270)	(3616)	(4730)*	(2392)	(3837)	(2646)	(3241)*	(1907)	(3021)	(2106)	(3131)*	(1896)	(3010)	(2095)

Tab 23: Lifting force table EW100 – Adjustable boom, balloon tires, stabilizers rear, short dipper stick

A / B	3 m (9'-10")				4 m (13'-1")				5 m (16'-5")				6 m (19'-8")							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
3,0 m	-	-	-	-	2510	1840	2510	2015	2025	1290	1960	1410	1755	950	1465	1040	1600	740	1160	810
(9.8 ft)	-	-	-	-	(5535)	(4057)	(5535)	(4443)	(4465)	(2844)	(4322)	(3109)	(3870)	(2095)	(3230)	(2293)	(3528)	(1632)	(2558)	(1786)
1.5 m	4450*	2590	4245	2890	3180	1585	2535	1755	2330	1160	1825	1275	1875	885	1395	975	1535	690	1100	760
(4.9 ft)	(9812)*	(5711)	(9360)	(6372)	(7012)	(3495)	(5590)	(3870)	(5138)	(2558)	(4024)	(2811)	(4134)	(1951)	(3076)	(2150)	(3385)	(1521)	(2426)	(1676)
0,0 m	4965*	2250	3855	2540	3260	1460	2395	1625	2400	1075	1735	1190	1860	835	1345	925	1455	710	1140	785
(0.0 ft)	(10948)*	(4961)	(8500)	(5601)	(7188)	(3219)	(5281)	(3583)	(5292)	(2370)	(3826)	(2624)	(4101)	(1841)	(2966)	(2040)	(3208)	(1566)	(2514)	(1731)
-1,0 m	4085*	2250	3850	2535	2970	1445	2380	1610	2220	1060	1715	1175	1645	830	1340	920	1355	780	1245	860
(-3.3 ft)	(9007)*	(4961)	(8489)	(5590)	(6549)	(3186)	(5248)	(3550)	(4895)	(2337)	(3782)	(2591)	(3627)	(1830)	(2955)	(2029)	(2988)	(1720)	(2745)	(1896)

Tab 24: Lifting force table EW100 – Adjustable boom, balloon tires, stabilizers rear, long dipper stick

APPENDIX C

COST ESTIMATE SUPPORT

Rock Cut Road Transfer Station Cost Estimate

May 13, 2021

Prepared by

Value Management Strategies, Inc.

SUMMARY

The following details the conceptual construction cost estimate for the Onondaga County Resource Recovery Agency (OCRR) Rock Cut Road Transfer Station (RCR) project. The purpose of this project is to optimize usage of the existing RCR by making improvements to the facility. The RCR project will support improved loadout geometries and on-site equipment capabilities to improve material handling and throughput efficiency.

The following sections are included as part of the RCR estimate:

- Basis of Estimate
- Detailed Cost Estimate
- Interface Register
- RCR Escalation Index

BASIS OF ESTIMATE

This estimate was prepared to establish an Association for the Advancement of Cost Engineering (AACE) International Class 5 Cost Estimate to provide order of magnitude costs that will support the budgeting process with an accuracy in the range of -20% to +50% for Total Construction Costs. Value Management Strategies, Inc. (VMS), prepared this Basis of Estimate (BOE) after receiving the OCRRA Optimization Study Report, dated 4-28-2021, and drawings prepared by Tetra Tech. This Basis of Estimate reflects VMS's best understanding of scope for this project, as explained by the Tetra Tech Engineering team.

Scope

The project major scope items are summarized in the following breakdown for the estimate:

- **2.0 – Optimization Opportunities**
  - 2.1 – Building #2 Loadout Location Improvements
    - Demo existing equipment
    - Lower existing knee wall by 12-inches
    - Relocate dust suppression piping, gas monitoring systems (2 locations), and dry sprinkler system piping
  - 2.2 – Improve Handling and Densification Capabilities
    - Install new steel 12-ft tall push walls in Buildings #1 and #2
    - Install new steel push wall on top of existing concrete wall in Building #3
  - 2.3 – Increase Available Floor Space
    - Removal of existing push pits within Buildings #1 and #2
    - Replace with additional reinforced tipping floor, 12-inch cast-in-place reinforced concrete, backed by new push walls and spill guard
    - Relocate ancillary MEP system components
  - 2.4 – Increase Number of Usable Tipping Bays
    - Remove existing conveyor and compactor within Building #2
    - Relocation of the shredder

        - Utility improvements in existing conveyor/compactor area for new shredder location
        - Install steel push walls in southeast corner of Building #3
        - Install steel plate over current shredder loadout
- **3.0 – Maintenance and Asset Preservation**
    - 3.2 – Expand Camera Network
        - Install two cameras at inbound scale
        - Install monitor at outbound scale
    - 3.3 – Building Systems Relocation
        - Building #1 relocate electric service/switch
        - Building #2 ~~realignment of dry sprinkler system piping~~ and electrical service conduit
        - Building #3
            - Realignment of sanitary vent piping, and interior roof drain downspout
            - ~~Relocate gas monitoring system (2 locations)~~
            - Realignment of water supply piping
            - Relocate electric service/switch
    - 3.4 – Doorway Protection/Bollards (Set of 4)
        - Demo existing bollards
        - Install new bollards
    - 3.5 – Push Wall Armoring
        - Building #3 retrofit push walls with steel embed plating

Planning

The following planning basis assumptions were made for the project estimate:

- The estimate assumes a traditional design-bid-build procurement method.
- Construction is anticipated to start Spring 2022. The total duration will depend on accepted work elements and coordination between individual work elements.
- No unusual site conditions have been considered as part of this estimate.
- Construction will be completed by area and/or type of work during weekend and evening non-operating hours.
- The estimated durations are the impacts to operations during implementation. See the OCRRA Interface Register for additional information regarding durations, constraints, and any noted logic/relationships between work elements.

Key Assumptions

The RCR project is comprised of work elements for optimization of the facility and preservation of existing investments. Due to active operations of the facility, construction will be completed by area and/or type of work during weekend and evening non-operating hours, potentially with construction activities requiring multiple instances for mobilization/remobilization. Mobilization of weekend work is assumed to start mid-day Friday through Sunday to allow the facility to continue taking waste on Mondays.

Cost Basis

This estimate includes all purchases, fabrications, installations, subcontracts, contractor overheads, labor productivities, construction change order allowances, allowance for indeterminates, and miscellaneous costs not specifically excluded elsewhere in this document.

Comprehensive Total Field Costs are generated from historical allowances, sources such as RS Means, and historical databases of the estimating provider. All costs included in the estimate reflect the best understanding of requirements as they existed at the time this estimate was prepared.

Methods and sources used to determine all material and labor pricing, and indirect costs are listed below:

- All construction, direct and indirect costs were estimated utilizing local unit price analysis and RS Means Building Costs.
- A labor premium was applied for evening and weekend hours.
- Estimated labor costs reflect current published wage rates for Onondaga County, New York.
- All costs were estimated in 2nd quarter 2021 dollars.
- Unit prices as identified in the Estimate reflect the complexity and scope of the project, as identified.

Allowances

The level and types of allowances used in the estimate are as follows:

Direct Cost Mark-ups

- A 16.7% premium time allowance was added to construction labor costs to account for anticipated evening and weekend hours.
- A 2% productivity allowance for construction labor costs is included to account for the unique project working conditions, including material logistics, work congestion, and scale of project.
- A 2.53% increase for labor pricing is included to account for escalation to the assumed construction period of 2022.
- A -2.03% decrease for material pricing is included to account for escalation to the assumed construction period of 2022.

Contractor Mark-ups

- A 10% markup for – Contractor General Conditions and Requirements is included to account for site management, temporary facilities, equipment and tools, and mobilization/demobilization.
- A 3% markup for - Home Office Overhead
- An 8.5% markup for – Profit
- A 1.5% markup for - Insurance
- A 1% markup for - Bonding

Contingency Mark-ups

- A 20% Allowance for Indeterminates is applied to Direct Construction Costs; this mark-up is to cover the known ‘unknowns’ within the construction scope that have not been identified within the concept level documents.

Owner's Costs

- An 11.5% allowance for – Design and Other Consulting services. This allowance is for remaining Architectural and Engineering design fees for work through 100% design.
- A $20,000 allowance for – Building Permits.
- A 5% allowance for – Construction Administration Costs.
- Excluded – other OCRRA allied costs.

All categories are currently assuming a degree of complexity that reflects this project.

Exclusions

All potential items of cost which might be associated with the project, but for which no costs have been included are listed below:

- No hazardous materials removal costs are included.
- No estimated costs or efficiencies for alternative procurement methods are accounted for.
- No costs are included for any additional scope beyond that as detailed in the current scope of work.
- Moving, storing, or providing new furniture, furnishings or equipment unless specifically included.
- No costs are included for sampling, testing and/or abatement of the site and the existing building.

Escalation Assumptions

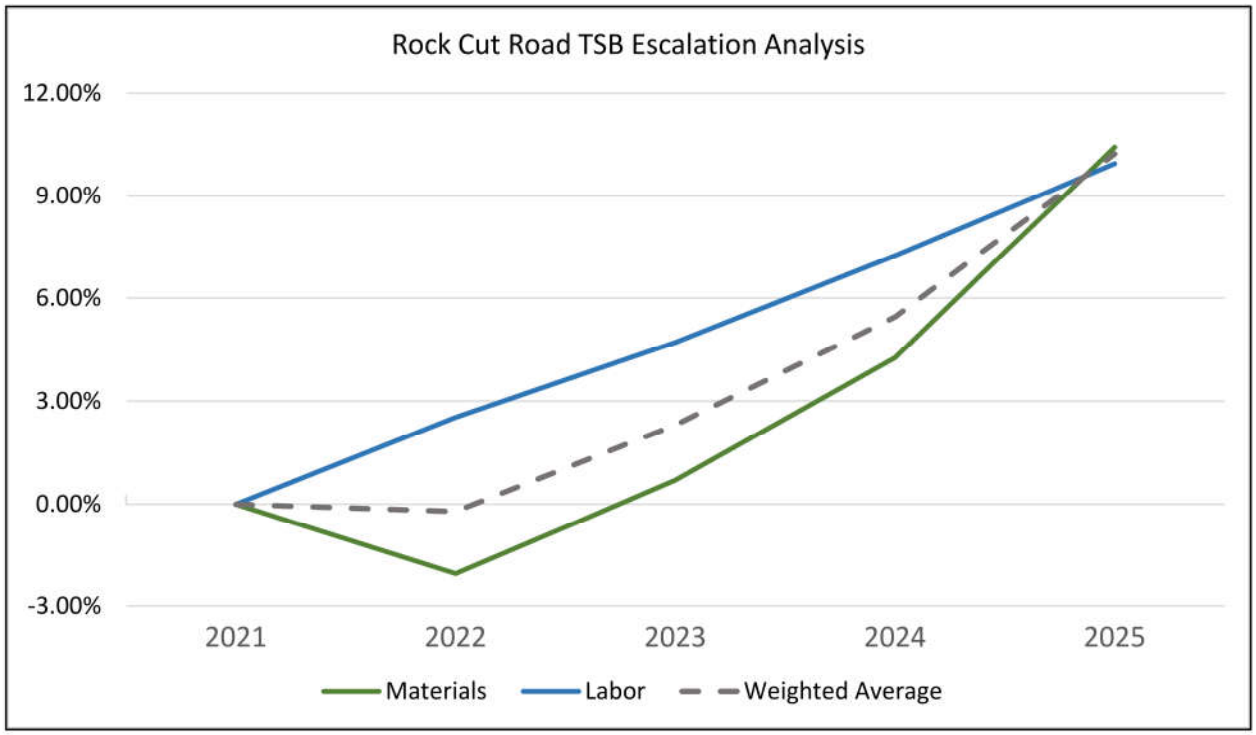
An escalation analysis of material and labor escalation inherent to the project was prepared as part of the estimating effort. The escalation analysis considers labor and material pricing, including the highly cyclical nature of steel prices, as part of its forecast of future pricing. The attached based cost estimate includes current pricing of steel, concrete, and other commodities in Q2 of 2021 and escalated to 2022.

A few forecasted indices have been prepared as part of the analysis. The basis of information used to derive the indices is the US Bureau of Labor Statistics (BLS) data. Producer Price Index (PPI) data and information was used as a basis for equipment and materials. Consumer Price Index data and information was used as a basis for employment and inflation. The employment, labor, and inflation related data are directly captured and compiled by BLS for the New York area. The other indices for materials are adapted in the presented models using market intelligence information from regional suppliers and contractors.

The following summarizes the various elements used in constructing the composite index used in developing the annualized escalation forecast.

Material References (PPI)	Construction Labor Costs
• Concrete	• Employment Cost Index (Construction Labor)
• Structural Steel	• Bureau of Labor Statistics Compensation
• Rebar	• Consumer Price Index (Inflation)
• Pipe and Tube Alloy	
• Wiring and Cable	
• All Commodities (Other Construction)	

The labor and materials forecasts were used to create a composite index, representative of the anticipated basic escalation conditions of the market. The following chart summarizes the forecasted New York composite escalation forecast that is analogous to the application of escalation applied by to the RCR project.



Year	2021	2022	2023	2024	2025
Materials	0.00%	-2.03%	0.70%	4.26%	10.42%
Labor	0.00%	2.53%	4.71%	7.23%	9.94%
Weighted Average	0.00%	-0.21%	2.30%	5.45%	10.23%

The forecasted price trends for material and construction labor are shown in the table above. Material costs are calculated using the sum of the product of indices and a weighted index of materials for the project. Construction Labor is based on the Employment Cost Index and Construction Labor indices. The weighted escalation is based on the breakdown of labor and material as a percentage of total construction cost. See *Escalation Index* for additional information.

DETAILED ESTIMATE

Estimate Class 5 - AACEI					
Project Name:	Rock Cut Road Transfer Station - Optimization Study Report			**Date:**	5/13/2021
Description:	The Rock Cut Road Transfer Station (RCR) is an existing facility with an approximate area of 19,000 SF. The Optimization Study has identified a number of opportunities for modifications to the facility to improve operational inefficiencies.			**Estimators and Reviewers:**	Alex Mannion (VMS) Lisa Stensby (VMS) Greg Brink (VMS)
Location	North Syracuse, New York			**Version:**	2

WBS	Task Name	Quantity	Units	Unit Cost	Item Cost
	ESTIMATED PROBABLE CONSTRUCTION COSTS				
	Note: The cost items below are priced from Q2, 2021 and escalated to assumed mid-year 2022 construction.				
2.1	Loadout Location Improvements	1	LS	$ 35,990	$ 35,990
2.1	*Direct Construction Costs*				*$ 23,800*
2.1	*General Conditions, Overhead and Profit*				*$ 6,190*
2.1	*Allowance for Indeterminates - 20%*				*$ 6,000*
2.2	Improve Handling and Densification Capabilities	1	LS	$ 405,440	$ 405,440
2.2	*Direct Construction Costs*				*$ 268,100*
2.2	*General Conditions, Overhead and Profit*				*$ 69,770*
2.2	*Allowance for Indeterminates - 20%*				*$ 67,570*
2.3	Increase Available Floor Space	1	LS	$ 666,460	$ 666,460
2.3	*Direct Construction Costs*				*$ 440,700*
2.3	*General Conditions, Overhead and Profit*				*$ 114,680*
2.3	*Allowance for Indeterminates - 20%*				*$ 111,080*
2.4	Increase Number of Usable Tipping Bays	1	LS	$ 184,800	$ 184,800
2.4	*Direct Construction Costs*				*$ 122,200*
2.4	*General Conditions, Overhead and Profit*				*$ 31,800*
2.4	*Allowance for Indeterminates - 20%*				*$ 30,800*
3.2	Expand Camera Network	1	LS	$ 17,240	$ 17,240
3.2	*Direct Construction Costs*				*$ 11,400*
3.2	*General Conditions, Overhead and Profit*				*$ 2,970*
3.2	*Allowance for Indeterminates - 20%*				*$ 2,870*
3.3	Building Systems Relocation	1	LS	$ 114,940	$ 114,940
3.3	*Direct Construction Costs*				*$ 76,000*
3.3	*General Conditions, Overhead and Profit*				*$ 19,780*
3.3	*Allowance for Indeterminates - 20%*				*$ 19,160*
3.4	Doorway Protection Bollards	4	EA	$ 2,835	$ 11,340
3.4	*Direct Construction Costs*				*$ 7,500*
3.4	*General Conditions, Overhead and Profit*				*$ 1,950*
3.4	*Allowance for Indeterminates - 20%*				*$ 1,890*
3.5	Push Wall Armoring	1	LS	$ 56,100	$ 56,100
3.5	*Direct Construction Costs*				*$ 37,100*
3.5	*General Conditions, Overhead and Profit*				*$ 9,650*
3.5	*Allowance for Indeterminates - 20%*				*$ 9,350*
	TOTAL CONSTRUCTION COSTS				***$ 1,492,310***
	INDIRECT: OTHER CAPITAL CHARGES				
	Construction Change Order Allowance				*Not Included*
	Owner Furnished Equipment	1	LS	$ -	$ -
	INDIRECT: NON-CONSTRUCTION COSTS				
	Design and Other Consulting Services	14.0	PCT		$ 208,920
	Permitting and Other Agency Costs	1	LS		$ 20,000
	Construction Administration Costs	8	PCT		$ 119,380
	TOTAL INDIRECT NON-CONSTRUCTION COSTS				***$ 348,300***
	Project Contingency (Owner Controlled)	25.0	PCT		$ 460,150
	TOTAL PROJECT COST				***$ 2,301,000***

DETAILED SUMMARY	Loadout Location Improvements								
DATE	5/13/2021							9050	Square Feet
			Labor		Material		Total Unit Rate	TOTAL COST	
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		
1.00	*EXISTING CONDITIONS*								
	Demolition								
1.01	Remove Existing Steel Plating	1	LS	$ 560.00	$ 560.00		$ -	$ 560.00	$ 560.00
1.02	Saw Cut Existing Knee Wall	42	LF	$ 8.30	$ 348.60		$ -	$ 8.30	$ 348.60
1.03	Breakup and Remove Wall	42	CF	$ 14.40	$ 604.80		$ -	$ 14.40	$ 604.80
1.04	Demolish Dust Supression System	1	LS	$ 500.00	$ 500.00		$ -	$ 500.00	$ 500.00
2.00	*NEW CONSTRUCTION*								
	Knee Wall								
2.01	Steel Plate	3,020	LBS	$ 0.72	$ 2,174.40	$ 1.88	$ 5,677.60	$ 2.60	$ 7,852.00
2.02	Epoxy Anchors	56	EA	$ 22.60	$ 1,265.60	$ 25.20	$ 1,411.20	$ 47.80	$ 2,676.80
	Miscellaneous								
2.03	Misting Sytem	1	LS	$ 1,800.00	$ 1,800.00	$ 3,500.00	$ 3,500.00	$ 5,300.00	$ 5,300.00
2.04	Water Supply Piping								*With 3.3*
2.05	Misc. Patch / Repair and Match Existing	9,050	SF	$ 0.25	$ 2,262.50	$ 0.20	$ 1,810.00	$ 0.45	$ 4,072.50
PREMIUM TIME				16.7%	$ 1,586.30				$ 1,586.30
PRODUCTIVITY				2.0%	$ 222.04				$ 222.04
ESCALATION				2.53%	$ 286.50	-2.03%	$ (251.70)		$ 34.81
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 11,610.75	**Material**	$ 12,147.10		$ 23,757.85
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 23,800.00**
				DIRECT: PRIME CONTRACTOR MARK-UPS					
				Contractor General Conditions and Requirements (Includes Mobilization)				10.00%	$ 2,380.00
				Home Office Overhead				3.00%	$ 785.40
				Contractor Profit				8.50%	$ 2,292.06
				Insurance				1.50%	$ 438.86
				Bonding				1.00%	$ 296.96
				SUB-TOTAL PRIME CONTRACTOR MARK-UPS					$ 6,190.00
				Allowance for Indeterminates				20.00%	$ 6,000.00
				ESTIMATED PROBABLE CONSTRUCTION BID					**$ 35,990.00**

Dry Sprinkler Piping: $15,950
Relocate Gas Monitoring System: $800
[moved from Option 3.3 (Building Systems Relocation) as requested by OCRRA]

DETAILED SUMMARY	Improve Handling and Densification Capabilities								
DATE	5/13/2021							16100	Square Feet
				Labor		Material		Total Unit Rate	TOTAL COST
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		
1.00	*EXISTING CONDITIONS*								
	Site Preparation								
1.01	Specialty Equipment Mobilization	1	LS	$ 1,100.00	$ 1,100.00	$ 4,200.00	$ 4,200.00	$ 5,300.00	$ 5,300.00
1.02	Scaffolding / Platforms	1	LS	$ 1,100.00	$ 1,100.00	$ 350.00	$ 350.00	$ 1,450.00	$ 1,450.00
1.03	Phasing	1	LS	$ 4,200.00	$ 4,200.00	$ 2,600.00	$ 2,600.00	$ 6,800.00	$ 6,800.00
2.00	*NEW CONSTRUCTION*								
	Push Walls								
2.01	Drill Into Existing Slab and Foundation	270	VLF	$ 28.30	$ 7,641.00	$ 9.80	$ 2,646.00	$ 38.10	$ 10,287.00
2.02	16" Dia. Concrete Pile	270	VLF	$ 10.20	$ 2,754.00	$ 55.00	$ 14,850.00	$ 65.20	$ 17,604.00
2.03	Steel Columns, 4'-0" O.C.	11,760	LBS	$ 0.95	$ 11,172.00	$ 2.18	$ 25,636.80	$ 3.13	$ 36,808.80
2.04	5/8" Steel Plate	44,064	LBS	$ 0.72	$ 31,726.08	$ 1.88	$ 82,840.32	$ 2.60	$ 114,566.40
	Push Wall Extension								
2.05	Steel Columns, 4'-0" O.C.	1,560	LBS	$ 0.95	$ 1,482.00	$ 2.18	$ 3,400.80	$ 3.13	$ 4,882.80
2.06	1/2" Steel Plate	8,160	LBS	$ 0.72	$ 5,875.20	$ 1.88	$ 15,340.80	$ 2.60	$ 21,216.00
2.07	3/8" Spill Shield	3,825	LBS	$ 0.72	$ 2,754.00	$ 1.88	$ 7,191.00	$ 2.60	$ 9,945.00
2.08	1/2" Base Plate	26	EA	$ 18.00	$ 468.00	$ 52.00	$ 1,352.00	$ 70.00	$ 1,820.00
2.09	3/4" Epoxy Anchors, 12" embed	104	EA	$ 22.60	$ 2,350.40	$ 25.20	$ 2,620.80	$ 47.80	$ 4,971.20
	Miscellaneous								
2.09	Special Inspections	2	WK	$ 4,800.00	$ 9,600.00		$ -	$ 4,800.00	$ 9,600.00
2.10	Misc. Patch / Repair and Match Existing	16,100	SF	$ 0.25	$ 4,025.00	$ 0.20	$ 3,220.00	$ 0.45	$ 7,245.00
PREMIUM TIME				16.7%	$ 14,377.49				$ 14,377.49
PRODUCTIVITY				2.0%	$ 2,012.50				$ 2,012.50
ESCALATION				2.53%	$ 2,596.73	-2.03%	$ (3,374.84)		$ (778.11)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 105,234.40	**Material**	$ 162,873.68		$ 268,108.08
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 268,100.00**
					DIRECT: PRIME CONTRACTOR MARK-UPS				
							Contractor General Conditions and Requirements (Includes Mobilization)	10.00%	$ 26,810.00
							Home Office Overhead	3.00%	$ 8,847.30
							Contractor Profit	8.50%	$ 25,819.37
							Insurance	1.50%	$ 4,943.65
							Bonding	1.00%	$ 3,345.20
							SUB-TOTAL PRIME CONTRACTOR MARK-UPS		$ 69,770.00
							Allowance for Indeterminates	20.00%	$ 67,570.00
							ESTIMATED PROBABLE CONSTRUCTION BID		**$ 405,440.00**

Alternative Sub-Option (Building #1 Pushwall without Tipping Floor Expansion)
- 90 LF of 12' High Pushwalls (Item Nos. 2.01 - 2.04): 90 LF * $1280/LF = $115,200
- 74 LF of Push Wall Extension (Item Nos. 2.05 - 2.09): 74 LF * $430/LF = $31,820
- Allowance for Site Preparation and Miscellaneous (12%): $17,650
- Premium Time and Productivity (18.7%): $30,800
- Contractor Mark-Ups and Indeterminants (44%): $86,000
- Design and Permitting (15%): $42,200
- Construction Administration (8%): $25,900
- Project Contingency (25%): $87,400

Alternative Sub-Option (Building #1 Pushwall without Tipping Floor Expansion) Total: $ 437,000

DETAILED SUMMARY	Increase Available Floor Space								
DATE	5/13/2021							9050	Square Feet
			Labor		Material		Total Unit Rate	TOTAL COST	
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		
1.00	*EXISTING CONDITIONS*								
	Site Preparation								
1.01	Specialty Equipment Mobilization	1	LS	$ 850.00	$ 850.00	$ 2,600.00	$ 2,600.00	$ 3,450.00	$ 3,450.00
1.02	Scaffolding / Platforms	1	LS	$ 650.00	$ 650.00	$ 200.00	$ 200.00	$ 850.00	$ 850.00
1.03	Phasing	1	LS	$ 2,400.00	$ 2,400.00	$ 1,400.00	$ 1,400.00	$ 3,800.00	$ 3,800.00
	Demolition								
1.03	Demolish 3.5' Push Walls	180	LF	$ 52.50	$ 9,450.00		$ -	$ 52.50	$ 9,450.00
1.04	Saw Cut Existing Slab, 12"	162	LF	$ 8.30	$ 1,344.60		$ -	$ 8.30	$ 1,344.60
1.05	Breakup and Remove Existing Slab	81	CF	$ 14.40	$ 1,166.40		$ -	$ 14.40	$ 1,166.40
1.06	Salvage MEP Systems	1	LS	$ 2,280.00	$ 2,280.00		$ -	$ 2,280.00	$ 2,280.00
2.00	*NEW CONSTRUCTION*								
	Tipping Floor Pits								
2.01	Structural Steel Frames	31,400	LBS	$ 0.95	$ 29,830.00	$ 2.18	$ 68,452.00	$ 3.13	$ 98,282.00
2.02	Misc. Steel Connections	3,140	LBS	$ 1.15	$ 3,611.00	$ 2.35	$ 7,379.00	$ 3.50	$ 10,990.00
2.03	Dowel Into Existing Slab	108	EA	$ 15.50	$ 1,674.00	$ 23.50	$ 2,538.00	$ 39.00	$ 4,212.00
2.04	12" Reinforced Concrete Slab, Elevated	1,730	SF	$ 10.85	$ 18,770.50	$ 14.30	$ 24,739.00	$ 25.15	$ 43,509.50
2.05	High Strength Cementitious Metallic Topping								*With Item 3.1*
	Push Wall								
2.06	Drill Into Existing Slab and Foundation	-	VLF	$ 28.30	$ -	$ 9.80	$ -	$ 38.10	$ -
2.07	16" Dia. Concrete Pile	-	VLF	$ 10.20	$ -	$ 55.00	$ -	$ 65.20	$ -
2.08	Steel Columns, 4'-0" O.C.	13,104	LBS	$ 0.95	$ 12,448.80	$ 2.18	$ 28,566.72	$ 3.13	$ 41,015.52
2.09	5/8" Steel Plate	47,124	LBS	$ 0.72	$ 33,929.28	$ 1.88	$ 88,593.12	$ 2.60	$ 122,522.40
2.10	Steel Members at Spill Shield	3,822	LBS	$ 0.95	$ 3,630.90	$ 2.18	$ 8,331.96	$ 3.13	$ 11,962.86
2.11	3/8" Spill Shield	8,250	LBS	$ 0.72	$ 5,940.00	$ 1.88	$ 15,510.00	$ 2.60	$ 21,450.00
2.12	Misc. Steel Connections	5,537	LBS	$ 1.15	$ 6,368.01	$ 2.35	$ 13,012.89	$ 3.50	$ 19,380.90
	Miscellaneous								
2.12	Reinstall Ancillary MEP System Components	1	LS	$ 3,420.00	$ 3,420.00	$ 350.00	$ 350.00	$ 3,770.00	$ 3,770.00
2.13	Special Inspections	2	WK	$ 4,800.00	$ 9,600.00		$ -	$ 4,800.00	$ 9,600.00
2.14	Misc. Patch / Repair and Match Existing	9,050	SF	$ 0.25	$ 2,262.50	$ 0.20	$ 1,810.00	$ 0.45	$ 4,072.50
PREMIUM TIME				16.7%	$ 24,942.65				$ 24,942.65
PRODUCTIVITY				2.0%	$ 3,491.37				$ 3,491.37
ESCALATION				2.53%	$ 4,504.92	-2.03%	$ (5,348.70)		$ (843.78)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 182,564.93	**Material**	$ 258,133.99		$ 440,698.93
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 440,700.00**

DETAILED SUMMARY	Increase Available Floor Space									
DATE	5/13/2021							9050	Square Feet	
				Labor		Material		Total Unit Rate	TOTAL COST	
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost			
DIRECT: PRIME CONTRACTOR MARK-UPS										
	Contractor General Conditions and Requirements (Includes Mobilization)							10.00%	$	44,070.00
	Home Office Overhead							3.00%	$	14,543.10
	Contractor Profit							8.50%	$	42,441.61
	Insurance							1.50%	$	8,126.32
	Bonding							1.00%	$	5,498.81
	SUB-TOTAL PRIME CONTRACTOR MARK-UPS								$	114,680.00
	Allowance for Indeterminates							20.00%	$	111,080.00
	ESTIMATED PROBABLE CONSTRUCTION BID								**$**	**666,460.00**

DETAILED SUMMARY	Increase Number of Usable Tipping Bays								
DATE	5/13/2021							7000	Square Feet
				Labor		Material		Total Unit Rate	TOTAL COST
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		
1.00	*EXISTING CONDITIONS*								
	Site Preparation								
1.01	Specialty Equipment Mobilization	1	LS	$ 700.00	$ 700.00	$ 2,650.00	$ 2,650.00	$ 3,350.00	$ 3,350.00
1.02	Scaffolding / Platforms	1	LS	$ 650.00	$ 650.00	$ 200.00	$ 200.00	$ 850.00	$ 850.00
1.03	Protect In-Place Existing	1	LS	$ 900.00	$ 900.00	$ 600.00	$ 600.00	$ 1,500.00	$ 1,500.00
	Demolition								
1.04	Remove Conveyor/Compactor	1	EA	$ 2,400.00	$ 2,400.00	$ 1,260.00	$ 1,260.00	$ 3,660.00	$ 3,660.00
1.05	Site Cleanup at Shredder Floor	2,000	SF	$ 0.50	$ 1,000.00		$ -	$ 0.50	$ 1,000.00
2.00	*NEW CONSTRUCTION*								
	Push Wall								
2.01	Drill Into Existing Slab and Foundation	108	VLF	$ 28.30	$ 3,056.40	$ 9.80	$ 1,058.40	$ 38.10	$ 4,114.80
2.02	16" Dia. Concrete Pile	108	VLF	$ 10.20	$ 1,101.60	$ 55.00	$ 5,940.00	$ 65.20	$ 7,041.60
2.03	Steel Columns, 4'-0" O.C.	4,032	LBS	$ 0.95	$ 3,830.40	$ 2.18	$ 8,789.76	$ 3.13	$ 12,620.16
2.04	5/8" Steel Plate	12,850	LBS	$ 0.72	$ 9,252.00	$ 1.88	$ 24,158.00	$ 2.60	$ 33,410.00
	Shredder								
2.05	Relocate Shredder	1	EA	$ 3,640.00	$ 3,640.00	$ 400.00	$ 400.00	$ 4,040.00	$ 10,000.00
2.06	Telescoping Conveyor	1	EA	$ 5,000.00	$ 5,000.00	$ 25,000.00	$ 25,000.00	$ 30,000.00	$ 30,000.00
2.07	Feeder for Shredder Power	1	LS	$ 780.00	$ 780.00	$ 840.00	$ 840.00	$ 1,620.00	$ 15,000.00
2.08	Equipment Connections	1	EA	$ 225.00	$ 225.00	$ 120.00	$ 120.00	$ 345.00	$ 345.00
2.09	3/4" Steel Plates with Stiffeners	975	LBS	$ 0.95	$ 926.25	$ 2.18	$ 2,125.50	$ 3.13	$ 3,051.75
2.10	Epoxy Anchors	1	LS	$ 135.00	$ 135.00	$ 150.00	$ 150.00	$ 285.00	$ 285.00
	Miscellaneous								
2.11	Special Inspections	1	WK	$ 4,800.00	$ 4,800.00		$ -	$ 4,800.00	$ 4,800.00
2.12	Misc. Patch / Repair and Match Existing	7,000	SF	$ 0.25	$ 1,750.00	$ 0.20	$ 1,400.00	$ 0.45	$ 3,150.00
PREMIUM TIME				16.7%	$ 6,692.45				$ 6,692.45
PRODUCTIVITY				2.0%	$ 936.78				$ 936.78
ESCALATION				2.53%	$ 1,208.73	-2.03%	$ (1,516.24)		$ (307.51)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 48,984.61	**Material**	$ 73,175.42		$ 122,160.03
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 122,200.00**
				DIRECT: PRIME CONTRACTOR MARK-UPS					
				Contractor General Conditions and Requirements (Includes Mobilization)				10.00%	$ 12,220.00
				Home Office Overhead				3.00%	$ 4,032.60
				Contractor Profit				8.50%	$ 11,768.47
				Insurance				1.50%	$ 2,253.32

DETAILED SUMMARY	Increase Number of Usable Tipping Bays									
DATE	5/13/2021							7000	Square Feet	
				Labor		Material				
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost	Total Unit Rate	TOTAL COST	
							Bonding	1.00%	$	1,524.74
							SUB-TOTAL PRIME CONTRACTOR MARK-UPS		$	31,800.00
							Allowance for Indeterminates	20.00%	$	30,800.00
							ESTIMATED PROBABLE CONSTRUCTION BID		**$**	**184,800.00**

DETAILED SUMMARY	Expand Camera Network								
DATE	5/13/2021							0	Square Feet
				Labor		Material		Total Unit Rate	
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		TOTAL COST
1.00	*NEW CONSTRUCTION*								
	Camera Network								
1.01	Security Cameras	2	EA	$ 975.00	$ 1,950.00	$ 2,780.00	$ 5,560.00	$ 3,755.00	$ 7,510.00
1.02	Elevated Mounting Brackets	2	EA	$ 105.00	$ 210.00	$ 225.00	$ 450.00	$ 330.00	$ 660.00
1.03	Connect to Existing Comm System	1	LS	$ 600.00	$ 600.00	$ 220.00	$ 220.00	$ 820.00	$ 820.00
1.04	Monitoring Station at Outbound Scale	1	EA	$ 450.00	$ 450.00	$ 650.00	$ 650.00	$ 1,100.00	$ 1,100.00
1.05	Systems Testing	1	LS	$ 600.00	$ 600.00		$ -	$ 600.00	$ 600.00
PREMIUM TIME				16.7%	$ 635.13				$ 635.13
PRODUCTIVITY				2.0%	$ 88.90				$ 88.90
ESCALATION				2.53%	$ 114.71	-2.03%	$ (139.66)		$ (24.95)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 4,648.74	**Material**	$ 6,740.34		$ 11,389.08
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 11,400.00**
DIRECT: PRIME CONTRACTOR MARK-UPS									
Contractor General Conditions and Requirements (Includes Mobilization)								10.00%	$ 1,140.00
Home Office Overhead								3.00%	$ 376.20
Contractor Profit								8.50%	$ 1,097.88
Insurance								1.50%	$ 210.21
Bonding								1.00%	$ 142.24
SUB-TOTAL PRIME CONTRACTOR MARK-UPS									$ 2,970.00
Allowance for Indeterminates								20.00%	$ 2,870.00
ESTIMATED PROBABLE CONSTRUCTION BID									**$ 17,240.00**

DETAILED SUMMARY	Building Systems Relocation								
DATE	5/13/2021							16100	Square Feet
			Labor		Material		Total Unit Rate		
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		TOTAL COST
1.00	*EXISTING CONDITIONS*								
	Site Preparation								
1.01	Scaffolding / Platforms	1	LS	$ 1,100.00	$ 1,100.00	$ 350.00	$ 350.00	$ 1,450.00	$ 1,450.00
1.02	Phasing	1	LS	$ 2,100.00	$ 2,100.00	$ 1,300.00	$ 1,300.00	$ 3,400.00	$ 3,400.00
	Site Preparation								
1.03	Demolish Electrical Service/Switch	2	LS	$ 85.00	$ 170.00		$ -	$ 85.00	$ 170.00
1.04	Demolish Dry Sprinkler Piping	5,800	SF	$ 0.45	$ 2,610.00		$ -	$ 0.45	$ 2,610.00
1.05	Demolish Vent/Drain Piping	60	LF	$ 44.50	$ 2,670.00		$ -	$ 44.50	$ 2,670.00
1.06	Demolish Water Piping	1	LS	$ 1,700.00	$ 1,700.00		$ -	$ 1,700.00	$ 1,700.00
1.07	Minor Demolition of Protection Elements	1	LS	$ 600.00	$ 600.00		$ -	$ 600.00	$ 600.00
2.00	*NEW CONSTRUCTION*								
	Building #1								
2.01	Install New Service/Switch	1	EA	$ 225.00	$ 225.00	$ 210.00	$ 210.00	$ 435.00	$ 435.00
2.02	Install Wiring and Conduit	1	LS	$ 650.00	$ 650.00	$ 350.00	$ 350.00	$ 1,000.00	$ 1,000.00
	Building #2								
2.03	Dry Sprinkler Piping	5,800	SF	$ 1.60	$ 9,280.00	$ 1.15	$ 6,670.00	$ 2.75	$ 15,950.00
2.04	Realign Electrical Service Conduits (6)	200	LF	$ 72.00	$ 14,400.00	$ 22.00	$ 4,400.00	$ 94.00	$ 18,800.00
	Building #3								
2.05	Install Sanitary Vent Piping and Connections	30	LF	$ 24.00	$ 720.00	$ 32.00	$ 960.00	$ 56.00	$ 1,680.00
2.06	Roof Drain Downspout	30	LF	$ 24.00	$ 720.00	$ 32.00	$ 960.00	$ 56.00	$ 1,680.00
2.07	Relocate Gas Monitoring System	2	LS	$ 360.00	$ 720.00	$ 40.00	$ 80.00	$ 400.00	$ 800.00
2.08	Water Supply Piping (for Misting Sytem)	1	LS	$ 1,160.00	$ 1,160.00	$ 1,480.00	$ 1,480.00	$ 2,640.00	$ 2,640.00
2.09	Install New Service/Switch	1	EA	$ 225.00	$ 225.00	$ 210.00	$ 210.00	$ 435.00	$ 435.00
2.10	Install Wiring and Conduit	1	LS	$ 650.00	$ 650.00	$ 350.00	$ 350.00	$ 1,000.00	$ 1,000.00
	Miscellaneous								
2.11	Testing and Inspections	24	HRS	$ 85.00	$ 2,040.00		$ -	$ 85.00	$ 2,040.00
2.12	Misc. Patch / Repair and Match Existing	16,100	SF	$ 0.25	$ 4,025.00	$ 0.20	$ 3,220.00	$ 0.45	$ 7,245.00
PREMIUM TIME				16.7%	$ 7,629.03				$ 7,629.03
PRODUCTIVITY				2.0%	$ 1,067.88				$ 1,067.88
ESCALATION				2.53%	$ 1,377.89	-2.03%	$ (416.96)		$ 960.92
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 55,839.79	**Material**	$ 20,123.04		$ 75,962.83
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 76,000.00**
DIRECT: PRIME CONTRACTOR MARK-UPS									

= moved to Option 2.1 (Building #2 Loadout Location Improvements) as requested by OCRRA

DETAILED SUMMARY	Building Systems Relocation								
DATE	5/13/2021							16100	Square Feet
				Labor		Material			
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost	Total Unit Rate	TOTAL COST
	Contractor General Conditions and Requirements (Includes Mobilization)							10.00%	$ 7,600.00
	Home Office Overhead							3.00%	$ 2,508.00
	Contractor Profit							8.50%	$ 7,319.18
	Insurance							1.50%	$ 1,401.41
	Bonding							1.00%	$ 948.29
	SUB-TOTAL PRIME CONTRACTOR MARK-UPS								$ 19,780.00
	Allowance for Indeterminates							20.00%	$ 19,160.00
	ESTIMATED PROBABLE CONSTRUCTION BID								**$ 114,940.00**

DETAILED SUMMARY	Doorway Protection Bollards								
DATE	5/13/2021							0	Square Feet
				Labor		Material		Total Unit Rate	TOTAL COST
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		
1.00	*NEW CONSTRUCTION*								
	Interior and Exterior Bollards								
1.01	Demolish and Dispose Existing Bollards	4	EA	$ 90.00	$ 360.00	$ 20.00	$ 80.00	$ 110.00	$ 440.00
1.02	Coring Through Existing Tipping Floor	4	EA	$ 145.00	$ 580.00	$ 50.00	$ 200.00	$ 195.00	$ 780.00
1.03	10" Pipe Bollards, Concrete Filled 10'L, 6'D hole	4	EA	$ 175.00	$ 700.00	$ 845.00	$ 3,380.00	$ 1,020.00	$ 4,080.00
1.04	12" SCH 40 Steel Pipe	4	EA	$ 110.00	$ 440.00	$ 350.00	$ 1,400.00	$ 460.00	$ 1,840.00
PREMIUM TIME				16.7%	$ 346.74				$ 346.74
PRODUCTIVITY				2.0%	$ 48.53				$ 48.53
ESCALATION				2.53%	$ 62.62	-2.03%	$ (102.72)		$ (40.09)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				**Labor**	$ 2,537.90	**Material**	$ 4,957.28		$ 7,495.18
TOTAL DIRECT CONSTRUCTION COSTS COST									**$ 7,500.00**
DIRECT: PRIME CONTRACTOR MARK-UPS									
Contractor General Conditions and Requirements (Includes Mobilization)								10.00%	$ 750.00
Home Office Overhead								3.00%	$ 247.50
Contractor Profit								8.50%	$ 722.29
Insurance								1.50%	$ 138.30
Bonding								1.00%	$ 93.58
SUB-TOTAL PRIME CONTRACTOR MARK-UPS									$ 1,950.00
Allowance for Indeterminates								20.00%	$ 1,890.00
ESTIMATED PROBABLE CONSTRUCTION BID									**$ 11,340.00**

DETAILED SUMMARY	Push Wall Armoring								
DATE	5/13/2021							0	Square Feet
				Labor		Material		Total Unit Rate	
Item No.	Description	Quantity	Unit	Unit Cost	Total Labor	Unit Cost	Total Cost		TOTAL COST
2.00	*NEW CONSTRUCTION*								
	Push Wall Armoring								
2.01	3/8" Steel Plates	6,120	LBS	$ 0.72	$ 4,406.40	$ 1.88	$ 11,505.60	$ 2.60	$ 15,912.00
2.02	3/4" Epoxy Anchors, 18" O.C.E.W.	192	EA	$ 22.60	$ 4,339.20	$ 18.40	$ 3,532.80	$ 41.00	$ 7,872.00
2.03	1/4" Cover Plates	4,080	LBS	$ 0.72	$ 2,937.60	$ 1.88	$ 7,670.40	$ 2.60	$ 10,608.00
2.04	Taper End of 3/8" Plate	100	LF	$ 4.80	$ 480.00	$ 0.40	$ 40.00	$ 5.20	$ 520.00
PREMIUM TIME				16.7%	$ 2,027.61				$ 2,027.61
PRODUCTIVITY				2.0%	$ 283.82				$ 283.82
ESCALATION				2.53%	$ 366.21	-2.03%	$ (461.80)		$ (95.59)
SUB-TOTAL DIRECT CONSTRUCTION COSTS				Labor	$ 14,840.83	Material	$ 22,287.00		$ 37,127.83
TOTAL DIRECT CONSTRUCTION COSTS COST									$ 37,100.00
DIRECT: PRIME CONTRACTOR MARK-UPS									
Contractor General Conditions and Requirements (Includes Mobilization)								10.00%	$ 3,710.00
Home Office Overhead								3.00%	$ 1,224.30
Contractor Profit								8.50%	$ 3,572.92
Insurance								1.50%	$ 684.11
Bonding								1.00%	$ 462.91
SUB-TOTAL PRIME CONTRACTOR MARK-UPS									$ 9,650.00
Allowance for Indeterminates								20.00%	$ 9,350.00
ESTIMATED PROBABLE CONSTRUCTION BID									$ 56,100.00

INTERFACE REGISTER

Interface Register: OCRRA Rock Cut Road Transfer Station

No.	Improvements	Logic/Relationship Description	Constraints	Duration
2.0 Optimization Opportunities				
2.1	Building #2 Loadout Location Improvements	Individual Element		2 weeks for lowering knee wall and installation of misting system
2.2	Improve Handling and Densifications Capabilities	2.2 to be completed before/with 2.3	• Buildings #1 and #2: undertaken at same time as relocation of push wall and filling over push pit. Installation of the push walls should take two to three weeks • Building #3: Insignificant impact to operations as steel push walls can be fabricated in advance and installation time is minimal	4 weeks for installation of push walls at Buildings #1 and #2
2.3	Increase Available Floor Space	2.3 has to be completed after/with 2.2	Install push walls and frames prior to concrete flooring Work to be phased and completed during non-operating hours and weekends	8 weeks for installation of push walls and new slab
2.4	Increase Number of Usable Tipping Bays	Individual Element	No constraints, the Conveyer/Compactor area is not currently in use.	2 weeks
3.0 Maintenance and Asset Preservation				
3.1	Tipping Floor Wear Resistant Topping	Independent Element	No constraints identified	Reference OCRRA Optimization Study Report
3.2	Expand Camera Network	Independent Element	No constraints identified	1 week
3.3	Building Systems Relocation	Building #1 electric service switch relocation completed with 2.2 pushwall Building #3 water supply piping realignment to be coordinated with 2.1	No constraints identified	4 weeks
3.4	Doorway Protection / Bollards	Interior replacement of high traffic bollards to be completed with 3.1	No constraints identified	1 work week. Assume 6 sets of 4 bollards completed in 1 work week period
3.5	Push Wall Armoring	Install with 3.1	No constraints identified	2 weeks

ROCK CUT ROAD TRANSFER STATION ESCALATION ANALYSIS

Rock Cut Road Transfer Station Escalation Analysis

Estimated by	Value Management Strategies, Inc.							Date	May-21	
MATERIALS (PPI)	**REFERENCE INDICES**	***Source***	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Concrete	PCU327320327320	LINK	3.37%	2.86%	1.94%	3.51%	1.96%	3.24%	3.07%	3.53%
Structural Steel	PCU331110331110	LINK	8.79%	5.38%	-14.18%	38.65%	-10.87%	1.90%	4.33%	11.02%
Rebar	WPU1074051	LINK	12.09%	-2.89%	1.25%	8.30%	2.34%	2.56%	3.14%	3.87%
Pipe and Tube Alloy	PCU33121033121003	LINK	20.45%	-7.67%	5.31%	21.76%	7.54%	6.72%	7.89%	5.56%
Wiring and Cable	WPU10260314	LINK	-1.52%	-0.64%	14.71%	3.24%	4.44%	3.33%	-1.71%	-4.16%
Other Construction	WPU00000000	LINK	2.39%	-1.00%	0.80%	9.17%	1.63%	2.08%	2.56%	3.32%
LABOR	**REFERENCE INDICES**	***Source***	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Construction Labor	BLS, Compensation, Construction US	LINK	3.00%	3.33%	3.15%	3.48%	3.84%	3.49%	3.49%	3.49%
New York Compensation	ECI - New York	LINK	3.10%	3.80%	1.90%	2.45%	2.45%	1.14%	2.47%	2.37%
Inflation (CPI)	New York CPI	LINK	2.00%	1.70%	1.30%	2.00%	1.30%	1.75%	1.25%	1.72%
Other	**REFERENCE INDICES**	***Source***	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
U.S. Comparison Check Value	Tunern Building Cost Index	LINK	5.60%	5.50%	1.80%					
WEIGHTED INDEX FOR MATERIALS										
% of Materials and Subcontract	Concrete	30%	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	Structural Steel	35%	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
	Rebar	8%	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Pipe and Tube Alloy	7%	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
	Wiring and Cable	5%	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Other Construction	15%	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
INDICES FOR APPLICATION	**ASSUMPTIONS**		**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Material Weighted	Per above (see note below)		6.77%	1.79%	-3.05%	18.30%	-2.03%	2.79%	3.54%	5.90%
Construction Labor	Average		2.70%	2.94%	2.12%	2.65%	2.53%	2.13%	2.40%	2.53%

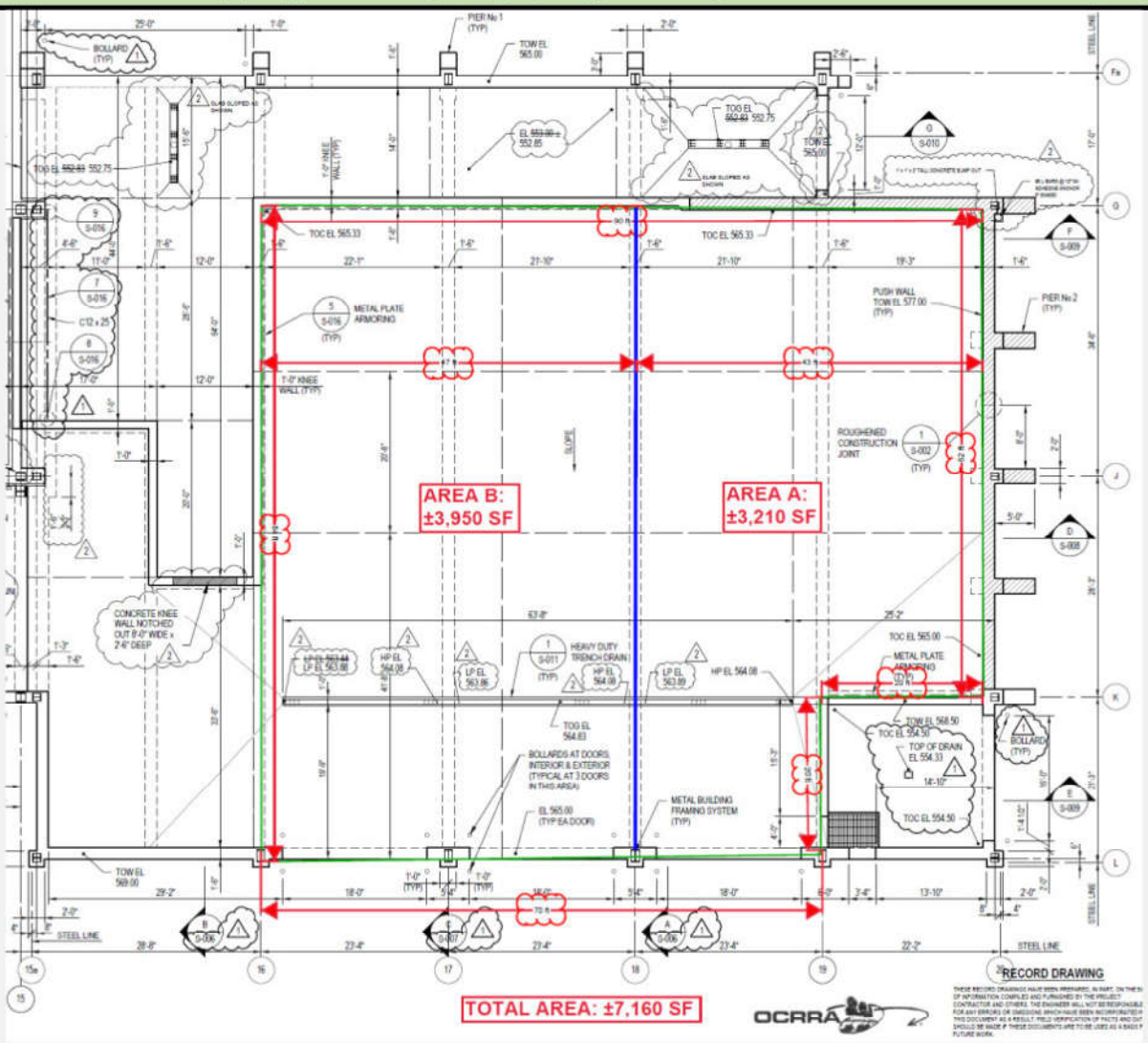
Analysis

	Year	2021	2022	2023	2024	2025		
Forecast Trends	Materials	1.00	0.98	1.01	1.04	1.10		
	Labor	1.00	1.03	1.05	1.07	1.10		

APPENDIX D

HIGH STRENGTH CEMENTITIOUS METALLIC TOPPING

Cost Estimate - Tipping Floor Repair (w/ High Strength Cementitious Metallic Topping)



Manufacturer:	Euclid Chemical Company				
Material:	EucoFloor 404				
Price:	Area A:	Unit Price: ($/ft^2)			$79.22
		Area	3,210	ft^2	
Estimated Total - Area A:					$254,296
Total with Contingency - Area A:					$305,155
Price:	Areas A & B:	Unit Price: ($/ft^2)			$61.50
		Area	7,160	ft^2	
Estimated Total - Area A & B:					$440,340
Total with Contingency - Area A & B:					$528,408
Contingency:	20%				

Contact:
Otto De Jager
Infrastructure Repair Service LLC
163 Beaver Brook Rd.
Lincoln Park, NJ 07035
(973) 692-0002
(973) 953-6308 (cell)
otto@infra-repair.com

EucoFloor 404

Wear, Impact, and Abrasion Resistant Floor Topping

Description

EUCOFLOOR 404 is an extremely high strength, iron aggregate floor topping. The product is used in areas subject to heavy wear, impact and abrasion. EUCOFLOOR 404 consists of iron aggregates combined with a high-strength cement- based mortar. The product was developed specifically for high abrasion applications and is designed for waste transfer station tipping floors. EUCOFLOOR 404 exceeds 8 times the abrasion resistance of plain cured concrete. The floor may be returned to high wear service within 48 hours of topping placement at 70°F (21°C).

Primary Applications

- Waste transfer station tipping floors
- Industrial floors

Features/Benefits

- High wear, abrasion, and impact resistance
- High early strength for quick turnaround time

Technical Information

PROPERTY	STANDARD	RESULT		
Unit Weight	-	169 lb/ft³ (2,704 kg/m³)		
Flow	ASTM C 1437	132%		
Slump	ASTM C 143	10 inches (25.4 cm)		
Compressive Strength	ASTM C 109	1 day: 9,100 psi (63 MPa) 3 days: 12,000 psi (83 MPa) 7 days: 14,400 psi (99 MPa) 28 days: 18,600 psi (128 MPa)		
Flexural Strength	ASTM C 348	7 days: 1,560 psi (11 MPa) 28 days: 2,130 psi (15 MPa)		
Set Time	ASTM C 403	Initial Set: 4 to 5 hours Final Set: 5 to 6 hours		
Length Change	ASTM C 157		Air Cure	Water Cure
		3 days:	-0.009%	+0.003%
		7 days:	-0.019%	+0.003%
		14 days:	-0.026%	+0.003%
		28 days:	-0.029%	+0.003%
Modulus of Elasticity	ASTM C 469	7 days: 7.7 x 10^6 psi (5.3 x 10^4 MPa) 28 days: 8.1 x 10^6 psi (5.6 x 10^4 MPa)		
Absorption	ASTM C 642	7 days: 2.14%		
Splitting Tensile Strength	ASTM C 496	7 days: 850 psi (5.8 MPa) 28 days: 990 psi (6.8 MPa)		
Salt Scaling Resistance	ASTM C 672	Rating at 50 cycles: 0		
Abrasion Resistance	ASTM C 779	7 days: -0.008 in (-0.002 mm) at 30 minutes		
Rapid Chloride Permeability	ASTM C 1202	7 days: 1780 coulombs (low) 28 days: 310 coulombs (very low)		
Chaplin Abrasion	-	7 days: -0.008 in (-0.002 mm) at 15 minutes -0.024 in (-0.006 mm) at 30 minutes 28 days: -0.002 in (-0.0005 mm) at 15 minutes -0.006 in (-0.002 mm) at 30 minutes		

Data above was determined at laboratory conditions.

The Euclid Chemical Company
19218 Redwood Rd. • Cleveland, OH 44110
Phone: [216] 531-9222 • Toll-free: [800] 321-7628 • Fax: [216] 531-9596
www.euclidchemical.com

Specification

A. Cementitious Metallic Topping: Heavy-Duty iron aggregate topping shall be a pre-formulated specially processed and graded iron aggregate, tested cement and other high performance proprietary complementary components. Material shall be formulated and processed under stringent quality control free from non-ferrous material and rust, in manufacturer's owned and controlled facilities. Product must attain a minimum strength of 14,000 psi (96 MPa) @ 7 days and 18,000 psi (124 MPa) @ 28 days.

"EUCOFLOOR 404".....The Euclid Chemical Co.

Packaging/Yield

One 50 lb (22.7 kg) bag of EUCOFLOOR 404 will cover 1.75 ft^2 (0.16 m^2) at 2 inch (5.1 cm) depth. EUCOFLOOR 404 is also available in 3,000 lb (1,361 kg) super sacks.

Shelf Life

1 year in original, unopened package.

Directions For Use

Surface Preparation: Concrete surfaces must be structurally sound, free of loose or deteriorated concrete, and free of dust, dirt, paint, efflorescence, oil and all other contaminants. Mechanically abrade (a heavy shotblast is strongly suggested) the surface to obtain a surface profile of 1/8 in. (1.6 mm) or equal to CSP 5-6 in accordance with ICRI Guideline 310.2. Properly clean the profiled area. If the concrete is questionable (weak, punky, heavily contaminated, etc.), it is suggested that cores be taken and analyzed by a qualified petrographer for suggestions on proper surface preparation prior to the topping being placed.

Perimeter Keyway: At the termination point of the topping, feather-edging the material to meet the surrounding concrete is not acceptable. The topping needs to be secured around the perimeter of the placement by saw cutting and "keying" into the base slab. The keyway should be a minimum of 1 in. (2.5 cm) deep and ideally undercut back into the base concrete.

Priming: Apply properly mixed EUCOFLOOR EPOXY PRIMER (see product data sheet for mixing instructions) to the prepared concrete at a rate of 75 to 100 ft^2/gal (1.8 to 2.5 m^2/L) over a highly textured surface (coarse aggregate showing). Squeegee the epoxy into place, mechanically scrub the epoxy into the surface of the base concrete and then backroll to ensure a uniform application. Remove any puddles of epoxy that may occur. While the epoxy primer is still wet, broadcast a washed and dried silica sand (recommended 16/30 mesh gradation) until the surface is completely covered with sand and appears dry. If any of the sand looks damp, apply more sand to that area. Allow the epoxy to cure, preferably over night. After the epoxy has cured, remove all loose, un-bonded sand by sweeping and vacuuming prior to the topping application. **Note:** The epoxy primer will form a vapor barrier on the surface. The moisture vapor transmission (MVT) rate of the base slab must be tested prior to application of the primer to ensure it is under an acceptable amount (3 lbs/1,000 ft^2/24 hour period).

Mixing: At least 24 hours prior to placement, condition all materials to the proper temperature range; between 55° - 85° F (13° - 29° C). The mixing water for EUCOFLOOR 404 is from 7.5%-8.5% by weight. This equates to 27 to 30 gal (102 to 113 L) per bulk bag. Mix in a ready-mix truck for 7 to 10 minutes. For 50 lb (22.7 kg) bags, use .45 to .51 gal (1.7 to 1.9 L) per bag. Mix each bag in a pail with a drill and mortar mixing paddle for 2 to 3 minutes. The product will have a flowing, self-consolidating appearance.

Placement: Flow the material onto the primed floor and move it into place with shovels and concrete rakes. Use of a light-duty vibratory or roller screed for large placements is necessary. Immediately after screeding, apply a coat of diluted EUCOBAR evaporation retarder (see product data sheet). This will reduce evaporation and aid in floating. Once the material is in place, float the surface to a smooth finish. **Note:** EUCOFLOOR 404 can NOT be given a hard steel finish. Once the material has sufficiently cured, saw cut it accordingly. It is suggested that the cuts in the underlying substrated be honored up through the topping.

Curing: Immediately after floating, cure EUCOFLOOR 404 with a high solids curing compound, such as SUPER DIAMOND CLEAR VOX at a rate of 200 to 250 ft^2/gal (4.9 to 6.1 m^2/L). After the EUCOFLOOR 404 with curing compound has dried and set sufficiently enough to walk on, wet the surface with water and cover with plastic sheeting or curing blankets for a duration of 2 to 5 days.

Precautions/Limitations

- Product is mixed to a self-consolidating consistency. Do not add or subtract from the total amount of mixing water.
- The final finish of EUCOFLOOR 404 is slightly textured. This material can not be given a hard steel trowel finish.
- Always use good concrete practices in hot & cold weather per ACI guidelines.
- In all cases, consult the Material Safety Data Sheet before use.

Rev. 12.11

SOLAR TESTING LABORATORIES, INC.
Geotechnical and Environmental Engineering, Materials Testing, and Construction Inspection

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Phone (216) 741-7007 • Fax (216) 741-7011
www.solartestinglabs.com

PROJECT:	ENGINEERING PROPERTIES OF DELTATOP 404	**FILE NO.:**	A08023X02
CLIENT:	THE EUCLID CHEMICAL COMPANY	**REPORT NO.:**	0006
	CLEVELAND, OHIO	**DATE(S):**	1/8/08 – 2/12/08
DESCRIPTION:	PERFORMANCE TESTING OF DELTATOP 404		
TECHNICIANS:	ROBERT SPELLACY AND DOUG MCCLUGGAGE		

The following tests were conducted on DeltaTop 404, an extremely high strength floor topping material containing iron aggregate, to determine compliance to the protocols of various ASTM procedures. All test specimens were moist-cured until tested.

The applicable ASTM standards follow:

Laboratory Temperature..... 72°F/22°C
Relative Humidity, % 50

ASTM C-1437	Standard Test Method for Flow of Hydraulic Cement Mortar
ASTM C-143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C-39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C-109	Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in or 50-mm Cube Specimens)
ASTM C-157	Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C-157 (modified)	Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete (Modification: One day of curing)
ASTM C-348	Test Method for Flexural Strength of Hydraulic-Cement Mortars
ASTM C-469	Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C-642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C-496	Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C-666	Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C-672	Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
ASTM C-1202	Test Method for Electrical Indication for Concrete's Ability to Resist Chloride Ion Penetration
ASTM C-779	Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
Chaplin Abrasion	Standard Method for Measuring the Wear Resistance of Floors Using the Chaplin Abrasion Tester
Chemical Testing	In-House Method for Determining the Compressive Strength Loss of Mortar Submerged in Chemical Solutions

The results of testing follow. All numbers are reported in averages.

Mix Water, % 7.75
Unit Weight, lb/cu ft 169.37

PROJECT:	ENGINEERING PROPERTIES OF DELTATOP 404	**FILE NO.:**	A08023X02
CLIENT:	THE EUCLID CHEMICAL COMPANY	**REPORT NO.:**	0006
	CLEVELAND, OHIO	**DATE(S):**	1/8/08 – 2/12/08
DESCRIPTION:	PERFORMANCE TESTING OF DELTATOP 404		
TECHNICIANS:	ROBERT SPELLACY AND DOUG MCCLUGGAGE		

ASTM C-1437

Flow, % 132

ASTM C-143

Slump, in 10

ASTM C-39 (4- by 8-inch Cylinders), Compressive Strength, psi

1 Day 8882
3 Days 10763
7 Days 12916
28 Days 15545
90 Days 16893

ASTM C-109, Compressive Strength, psi

1 Day 10110
3 Days 13349
7 Days 15999
28 Days 20655
90 Days 20720

ASTM C-157 (28 days of curing in lime water prior to the start of testing), Length Change, %

Duration	Air Cure	Water Cure
3 Days	-0.009	+0.003
7 Days	-0.019	+0.003
14 Days	-0.026	+0.003
28 Days	-0.029	+0.003
90 Days	-0.035	+0.005
6 Months	-0.033	+0.009
1 Year	-0.046	+0.017

ASTM C-157 Modified (1 day of curing in the mold and then exposed to air and water) Length Change, %

7 Days	-0.068	+0.012
14 Days	-0.081	+0.009
21 Days	-0.085	+0.009
28 Days	-0.090	+0.008
90 Days	-0.092	+0.008
6 Months	-0.093	+0.014
1 Year	-0.100	+0.014

PROJECT:	ENGINEERING PROPERTIES OF DELTATOP 404	**FILE NO.:**	A08023X02
CLIENT:	THE EUCLID CHEMICAL COMPANY	**REPORT NO.:**	0006
	CLEVELAND, OHIO	**DATE(S):**	1/8/08 – 2/12/08
DESCRIPTION:	PERFORMANCE TESTING OF DELTATOP 404		
TECHNICIANS:	ROBERT SPELLACY AND DOUG MCCLUGGAGE		

ASTM C-348, Flexural Strength, psi

7 Days	1726
28 Days	2358
90 Days	2419

ASTM C-469, Modulus of Elasticity, psi

7 Days	7.7×10^6
28 Days	8.1×10^6

ASTM C-642, Absorption, %

7 Days	2.14
90 Days	1.90

ASTM C-496, Splitting Tensile Strength, psi

7 Days	935
28 Days	1095

ASTM C-666, Procedure A, Relative Dynamic Modulus of Elasticity, %

301 Cycles	104

ASTM C-672, Salt Scaling

Rating at 50 Cycles	0 Scaling

ASTM C-779, Revolving Disk Method, Abrasion Loss, in, 7 Days

30-minute loss	-0.008
60 minute loss	-0.019

ASTM C-1202, Rapid Chloride Permeability, coulombs

7 Days	1788-Low
28 Days	314-Very Low

Chaplin Abrasion, Abrasion Loss, in

7 Days	15 minute loss	-0.008
	30 minute loss	-0.024
28 Days	15 minute loss	-0.002
	30 minute loss	-0.006

PROJECT:	ENGINEERING PROPERTIES OF DELTATOP 404	**FILE NO.:**	A08023X02
CLIENT:	THE EUCLID CHEMICAL COMPANY	**REPORT NO.:**	0006
	CLEVELAND, OHIO	**DATE(S):**	1/8/08 – 2/12/08
DESCRIPTION:	PERFORMANCE TESTING OF DELTATOP 404		
TECHNICIANS:	ROBERT SPELLACY AND DOUG MCCLUGGAGE		

Chemical Testing, Compressive Strength, psi

All specimens had 3 days of moist curing prior to being submerged into solution. The reference specimens were cured in the moist room:

28 Days

Reference	19373
Coke	18917
Orange Juice	18483
Whole Milk	19555
5% Salt Water Solution	19380
10% Caustic Soda	20008
Beer	19908
V-8 Juice	19861
Energy Drink	19784
Windex with Ammonia	18734
DI Water	20228

1 Year

Reference	22776
Coke	25342
Orange Juice	23185
Whole Milk	24425
5% Salt Water Solution	24222
10% Caustic Soda	21297
Beer	23361
V-8 Juice	24096
Energy Drink	25315
Windex with Ammonia	22710
DI Water	24392

STATE OF OHIO
GEORGE J. ATA
E-47[illegible]
REGISTERED PROFESSIONAL ENGINEER

SOLAR TESTING LABORATORIES, INC.

George J. Ata, P.E., President

slh 3/23/09

EUCOFLOOR EPOXY PRIMER

Epoxy Bonding Agent for EucoFloor Concrete Toppings

EUCLID CHEMICAL

Description

EucoFloor Epoxy Primer is a 100% reactive, dual-component, moisture insensitive epoxy bonding agent for EucoFloor concrete floor toppings.

Primary Applications

Bonding agent for EucoFloor floor toppings

Features/Benefits

- Excellent adhesive for bonding EucoFloor toppings to properly prepared concrete substrates
- Moisture insensitive for bonding to dry or damp surfaces

Technical Information

TENSILE BOND STRENGTH (ASTM D 1144)	325 - 425 psi (2.2 - 2.9 MPa)

Coverage

50 to 100 ft²/gal (1.2 to 2.4 m²/L) for use with EucoFloor products. Actual coverage rate will vary depending upon base concrete surface profile.

Packaging

EucoFloor Epoxy Primer is packaged in 3 gallon (11.3 L) units.

Shelf Life

2 years in original, unopened package

Directions for Use

Surface Preparation: Concrete: The surface must be structurally sound, dry, free of grease, oils, coatings, dust, curing compounds and other contaminants. Surface laitance must be removed. Oil contaminated surfaces should be degreased. Remove defective concrete down to sound material. Route cracks and blow dust and debris from them with oil-free, compressed air. The preferred method of surface preparation is abrasive blasting or other mechanical means per ICRI Guideline 310.2. **Follow the surface preparation instructions on the EucoFloor topping you are using to obtain the proper profile depth. Following surface preparation, the cleaned surface should pull concrete when tested with a pull tester, or an elcometer (ASTM D 4541).

Mixing: Mix the epoxy primer at or near the desired application area. Premix Part A and B separately with a slow speed motor and "Jiffy" mixer. Pour the entire contents of Part A into a clean mixing container and slowly add the Part B. Mechanically mix slowly for 3 to 5 minutes. Scrape the sides and bottom of mixing container while mixing. Do not whip or aerate while mixing. Transport the mixed epoxy primer to the placement area.

Application: Application and surface temperatures should be at least 50°F (10°C) and rising. Apply the mixed epoxy by brush, roller or squeegee to the prepared, existing concrete substrate. **Follow further application directions on the EucoFloor topping product being used on the project.

Clean-Up

Clean tools and equipment with solvent such as EUCO SOLVENT, acetone, toluene or MEK. Do not allow the epoxy to harden on equipment.

Precautions/Limitations

- Bring materials as close to 70°F (21°C) as possible before using. Store indoors at 45°F to 110°F (7°C to 43°C).
- Do not apply over hardened primer or old epoxy without proper surface preparation.
- Not recommended for use when base concrete is at a temperature under 50°F (10°C).
- In all cases, consult the Safety Data Sheet before use.

Schellberg, Andrew

From: Pat Griffin <Pat@infra-repair.com>
Sent: Wednesday, April 28, 2021 11:42 AM
To: Schellberg, Andrew; Otto De Jager
Subject: FW: Tipping Floor Repair - Budgetary Pricing for OCRRA (Syracuse) Rock Cut Road TS

Good Afternoon Andrew,

Otto asked me to forward the following for your budgetary pricing:

To install two (2)inch average Euco Floor 404:
3,210 sq.ft.@ $79.22 sq.ft = $254,296.00

If both areas are applied simultaneously:
Mobilization: 7,160 sq.ft. @ $61.50 per sq ft =$440,340.00

In addition I will be sending you **project photos of the Eucofloor 404 application** which will be sent under separate cover shortly.

Please feel free to reach out to Otto either here at the office, or on his cell phone 973 953 6308.

Kind Regards,

Pat Griffin, Office Manager

Infrastructure Repair Service LLC
163 Beaver Brook Rd.
Lincoln Park, NJ 07035
973 692 0002

From: Schellberg, Andrew [mailto:Andrew.Schellberg@tetratech.com]
Sent: Tuesday, April 27, 2021 1:41 PM
To: Otto De Jager; John De Jager
Cc: Piedmont-Fleischmann, Bodhi
Subject: RE: Tipping Floor Repair - Budgetary Pricing for OCRRA (Syracuse) Rock Cut Road TS

Otto and John,

Thank you again for speaking with us about the OCRRA last Wednesday. Have you had an opportunity to develop budgetary pricing for the EucoFloor 404 tipping floor restoration?

Also, do you have any photos from the DSNY MTS project that depict the wear comparison between the conventional concrete and the EucoFloor 404? If so, we would like to share them with this client to provide additional evidence of the benefits to be realized once this material is installed.

Kin regards,

Andrew C. Schellberg | Operations Director | Tetra Tech | Solid Waste East
Direct **+1 (845) 695-0203** | Mobile **+1 (845) 820-2607** | andrew.schellberg@tetratech.com

---

From: Schellberg, Andrew
Sent: Wednesday, April 21, 2021 1:57 PM
To: otto@infra-repair.com; john@infra-repair.com
Cc: Piedmont-Fleischmann, Bodhi <bodhi.pf@tetratech.com>
Subject: Tipping Floor Repair - Budgetary Pricing for OCRRA (Syracuse) Rock Cut Road TS

Otto and John,

Thank you for taking the time to speak with us today regarding the proposed floor repair of the Onondaga County Resource Recovery Agency (OCRRA) Rock Cut Road Transfer Station.

Attached are .PDFs of select structural and architectural "record" drawings that should provide the information needed to develop budgetary pricing for the repair of the tipping floor within Building #3.

Until then, enjoy your time in Hancock and let me know if we can be of further assistance as you develop your estimate.

Be well and speak with you soon,

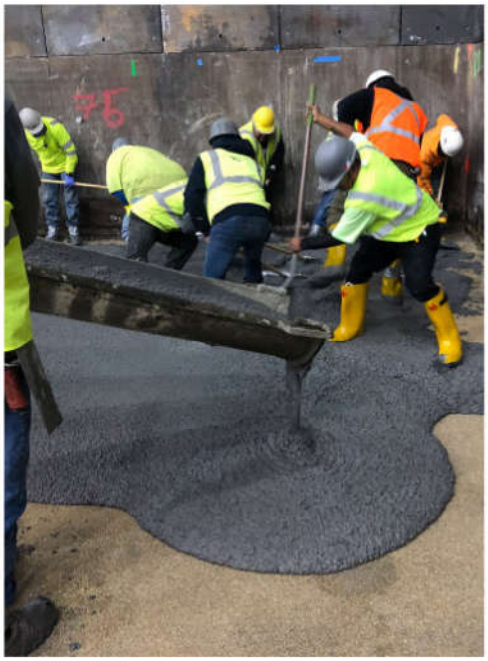
Andrew C. Schellberg | Operations Director
Direct **+1 (845) 695-0203** | Business **+1 (877) 294-9070** | Mobile **+1 (845) 820-2607** | Fax **+1 (877) 845-1456** |
andrew.schellberg@tetratech.com

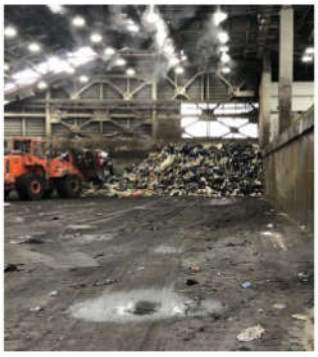
Tetra Tech | *Leading with Science®* | Solid Waste East
100 Crystal Run Road, Suite 101 | Middletown, NY 10941 | tetratech.com | tetratech.com/waste

PROJECT PROFILE

NEW YORK SANITATION NORTH MARINE TRANSFER STATION

EUCLID CHEMICAL





PROJECT DATA

Location – Flushing, NY

Application – Tipping Floor Overlay

Architect/Engineer – HDR Inc.

Material Supplier – Euclid Chemical

Applicator – Infrastructure Repair Services

Total Area – 25,000 ft² (2,322 m²)

PRODUCTS FEATURED

EUCOFLOOR™ 404
Wear, Impact and Chemical Resistant Concrete Topping

EUCOFLOOR™ EPOXY PRIMER
Medium Viscosity Epoxy for Bonding Concrete Toppings and Underlayments

SUPER DIAMOND CLEAR VOX
High Solids, Water-Based Cure & Seal

SCOPE OF PROJECT

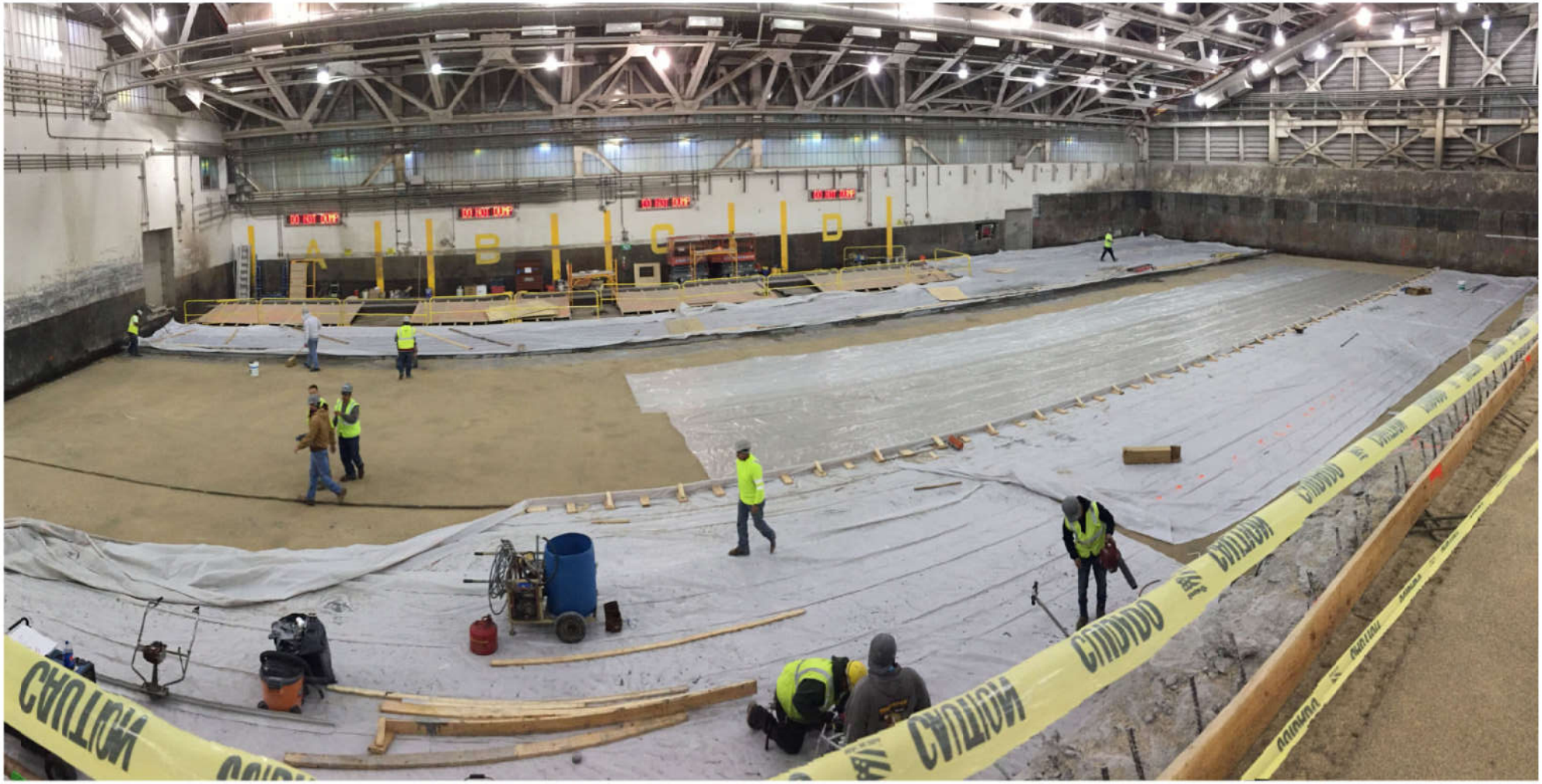
Application of High Performance Topping to give longer life to a solid waste facility concrete tipping floor.

PROJECT SUMMARY

This New York City Solid Waste transfer station averages 2,500 tons of municipal waste every day. Trucks enter through the upper level then drop the trash from an elevated weigh scale area onto the tipping floor 15 feet below. Loaders then move the trash into a series of compactors where barges haul away the MSW to a landfill. The tipping floor was designed with a 15 in (38 cm) thick structural slab topped with 3 in (8 cm) of 6,000 psi non-structural (no rebar) concrete. As the topping wore down to the base slab every few years, it would be replaced. Surface prep, placement and cure time caused the facility to be taken off-line for at least 10 days. NY Sanitation had tried other toppings to get around the long shutdown times with poor results.

Solution: In 2018 management installed a 1,000 ft² (93 m²) mock-up using EucoFloor 404 in the highest wear area. After monitoring the topping for 6 months the NYC Department of Sanitation told HDR they wanted EucoFloor 404 everywhere. The floor has been in service since Oct 2019 and management is well pleased with the results.

Infrastructure Repair Services is part of a network of qualified contractors across the U.S. who have the expertise to install a variety of Euclid Chemical products, including EUCOFLOOR 404. For additional information call Bob Swan: 702-239-1027.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CAUTION
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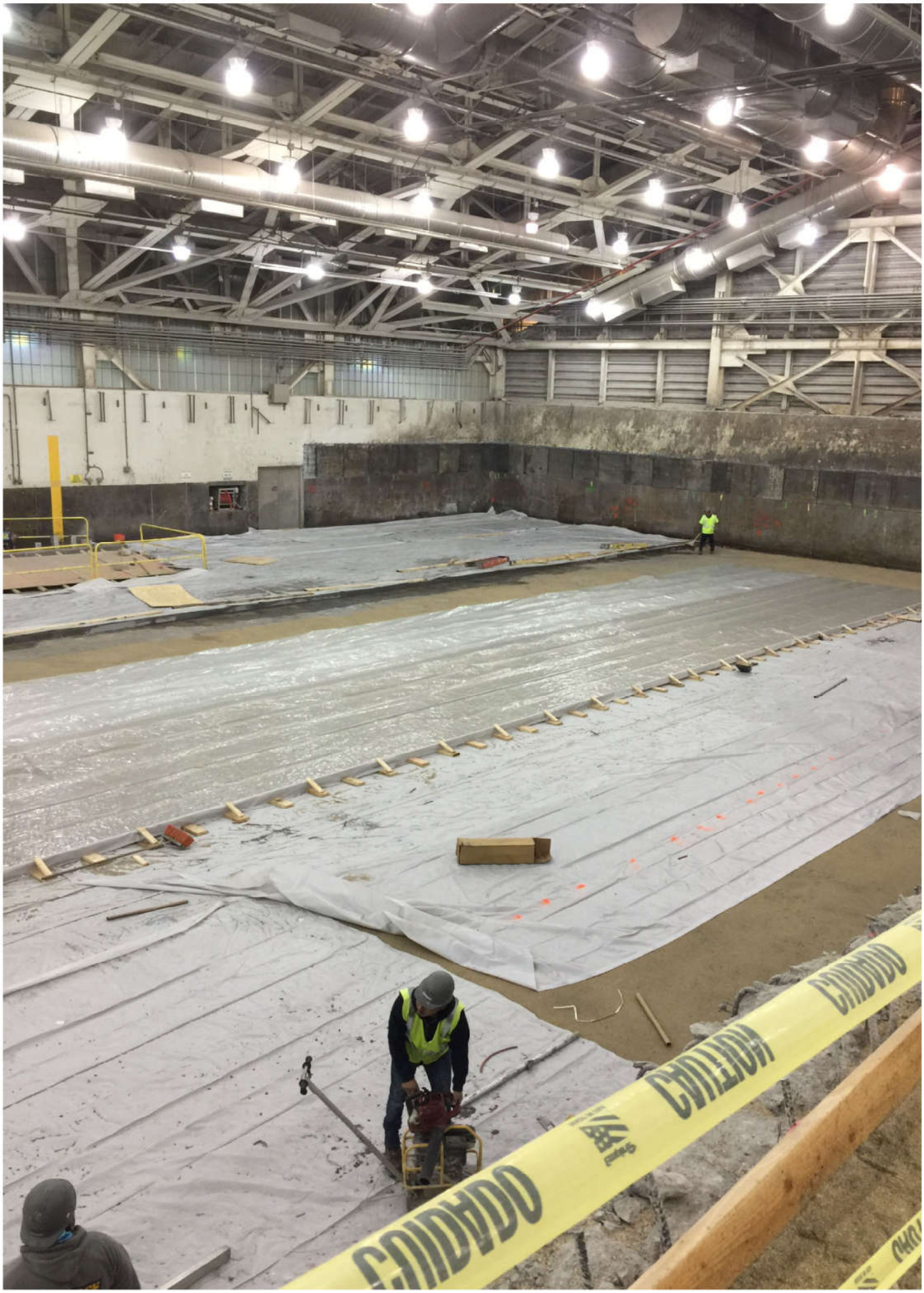
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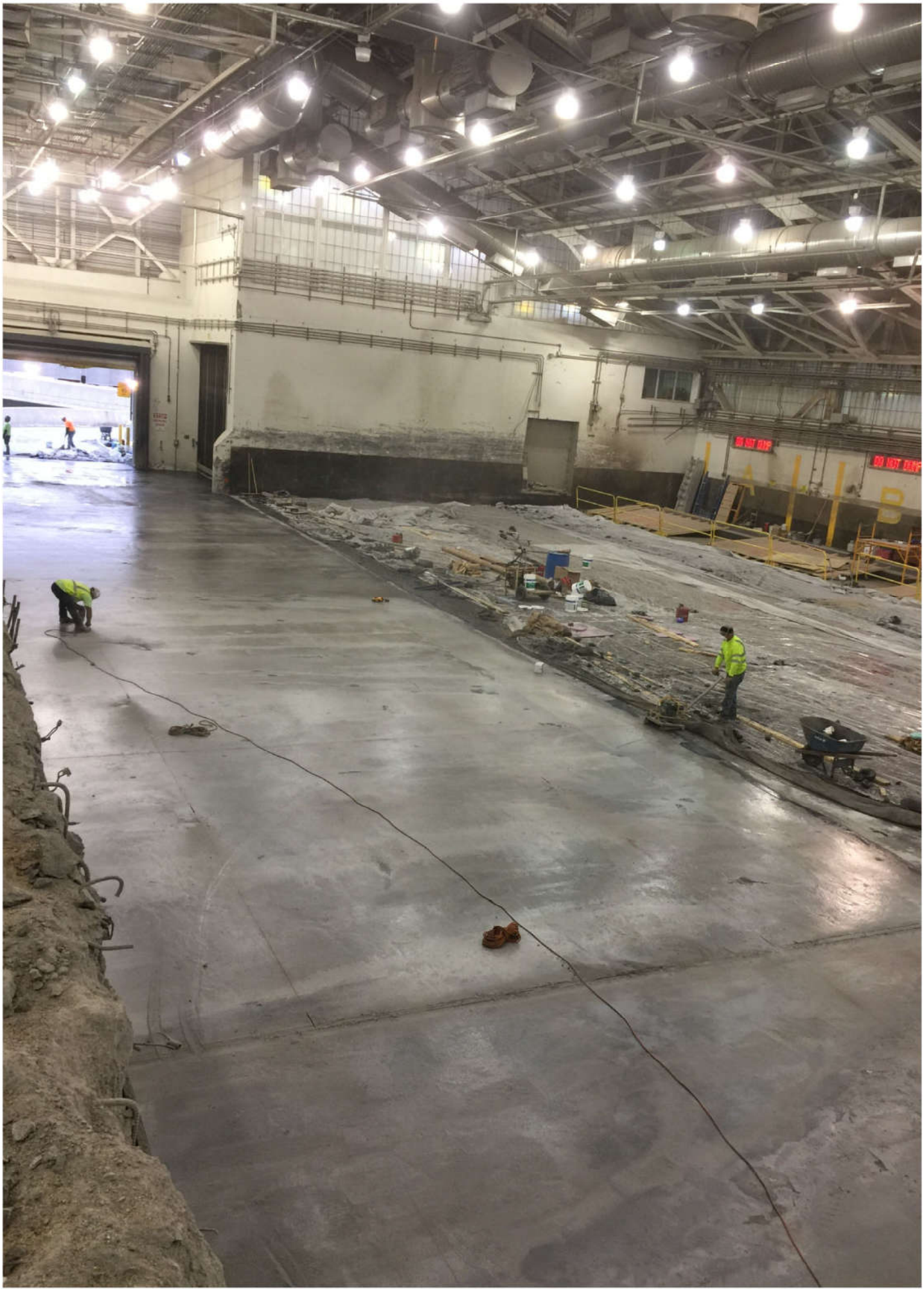



LOWER
TAILGATE
BEFORE
EXITING

EucoFloor 404 References

These projects represent the most recent installs by experienced Heavy-Duty Flooring Installers. We have references for EucoFloor 404 that go back to 2005. Most of the installs listed below are Transfer Station facilities that have used EucoFloor 404 in the past and wanted more of their floor overlaid using the same material. MSW tonnage ranges between 500 Tons/Day to over 3,000 T/D.

#1 **Project Name:** Sunnyvale SMaRT Station
Owner: City of Sunnyvale
D**escription of Work:** Transfer Station Floor Overlay
Square Feet Installed: 9,000 SF **Installed Completion Date:** February 23, 2018

#2 **Project Name:** CLARTS
Owner: City of Los Angeles
Description of Work: Transfer Station Floor Overlay at Ports
Square Feet Installed: 7,200 SF & 7,000 SF **Installed Completion Date:** November 19, 2016 & January 27, 2018.

#3 **Project Name:** SBWMA Transfer Station & MRF Floor Repair
Owner: South Bayside Waste Management Authority
Description of Work: Repair Main Tipping Floor & MRF
Square Feet Installed: 7,800 SF & 4,970 SF **Installed Completion Date:** April 15, 2016 & November 5, 2017

#4 **Project Name:** American Waste Transfer Station
Owner: Republic Services
Description of Work: Cast & Repour Port Edge / Overlay Main Transfer Station
Square Feet Installed: 7,620 SF **Installed Completion Date:** November 11, 2017

#5 **Project Name:** Grand Central Recycling & Transfer Station
Owner: Pete Perez
Description of Work: Transfer Station Floor Overlay
Square Feet Installed: 6,800 SF **Installed Completion Date:** June 6, 2015

#6 **Project Name:** Henderson Transfer Station
Owner: Republic Services
Description of Work: Overlay Main Tipping Floor / Cast & Repour Port Edge
Square Feet Installed: 3600 SF, 3600 SF, 3000 SF
Installed Completion Date: March 30, 2014 & April 12, 2015 & March 14, 2017

#7 **Project Name:** NARS Waste Tipping Floor
Owner: County of Sacramento
Description of Work: Overlay Main Tipping Floor / Repair Steel Port Edge
Square Feet Installed: 27,182 SF **Installed Completion Date:** November 11, 2014

#8 **Project Name:** Hawthorne Transfer Station Tipping Floor Repair - HWMA
Owner: Humboldt Waste Management Authority
Contact Person: Jill Duffy **Phone:** (707) 268-8680
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 3,820 SF **Installed Completion Date:** March, 8, 2015

#9 **Project Name:** Holt CAT San Antonio
Owner: Holt CAT
Description of Work: Install Iron Rich Floor to Bay Floors
Square Feet Installed: 7,524 SF **Installed Completion Date:** August 29, 2014

#10 **Project Name:** Del Norte Crescent City Solid Waste WMA
Owner: Del Norte County
Description of Work: Overlay Main Tipping Floor & Fill Pit
Square Feet Installed: 1,050 SF **Installed Completion Date**: February 4, 2018

#11 **Project Name:** Del Norte Transfer Station Oxnard
Owner: City of Oxnard
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 2,300 SF **Installed Completion Date**: January 28, 2017

#12 **Project Name:** Kings County Waste Management Authority KCWMA
Owner: Kings County
Contact Person: Nicole Riley **Phone:** (583) 8829 xt. 203
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 5,000 SF **Installed Completion Date**: February 16, 2016

#13 **Project Name:** Tri-CED Recycling Tipping Floor
Owner: Tri-CED Recycling
Description of Work: Overlay Main Tipping Floor & MRF
Square Feet Installed: 3,596 SF **Installed Completion Date**: November 4, 2017

#14 **Project Name:** Culver City Transfer Station
Owner: City of Culver City
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 1,820 SF **Installed Completion Date**: December 6, 2017

#15 **Project Name:** Recology Eel River
Owner: Recology
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 4,200 SF **Installed Completion Date**: August 11, 2018

#16 **Project Name:** South San Francisco Scavenger Blue Line Transfer Station
Owner: John Rossi
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 2,550 SF **Installed Completion Date**: September 15, 2018

#17 **Project Name:** Redding Solid Waste Transfer Floor Repair
Owner: City of Redding
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 10,715 SF **Installed Completion Date**: September 29, 2018

#18 **Project Name:** Industrial Carting Santa Rosa Floor Repair
Owner: Republic Services
Description of Work: Overlay Main Tipping Floor & Repair Pit
Square Feet Installed: 5,600 SF **Installed Completion Date**: October 20, 2018

#19 **Project Name:** Horry County (Myrtle Beach, NC) Tipping Floor
Owner: Horry County, NC
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 6,500 SF **Installed Completion Date**: April 6, 2019

#20 **Project Name:** Alpha Ridge - Howard County, MD (Baltimore)
Owner: Howard County
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 6,000 SF **Installed Completion Date**: March 26, 2019

#21 **Project Name:** Roanoke Transfer Station
Owner: Republic Services
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 1500 SF **Installed Completion Date**: May 11, 2019

#22 **Project Name:** Sevierville County Composting Facility
Owner: Sevierville, TN
Description of Work: Overlay Main Tipping Floor
Square Feet Installed: 3500 SF, 4000 SF, 4500 SF
Installed Completion Date: 2009, 2018, 2020

#23 **Project Name:** North Shore Marina Transfer Station
Owner: New York City Sanitation Department
Description of Work: Overlay both Tipping Floor and Transfer Floor
Square Feet Installed: 25,000 SF **Installed Completion Date**: Oct 11, 2019

#24 **Project Name:** Clarkstown Transfer Station
Owner: Rockland County Solid Waste Management Authority - NY
Description of Work: Overlay Tipping Floor
Square Feet Installed: 4,800 SF **Installed Completion Date**: Oct 27, 2019

#25 **Project Name:** Tinker Creek Transfer Station
Owner: Roanoke Valley Resource Authority, VA
Description of Work: Cast & Repour Port Edge / Overlay Main Transfer Station
Square Feet Installed: 4,000 SF
Installed Completion Date: Nov. 2010 with previous installs dating back to 2001.

#26 **Project Name:** Wheelabrator Portsmouth, VA - RDF (Formerly Southeast Public Service Authority)
Owner: Wheelabrator
Description of Work: Overlay Tipping Floor
Square Feet Installed: 8,000 SF **Installed Completion Date**: Oct 27, 2019

#27 **Project Name:** Lancaster, PA
Owner: LCSWA
Description of Work: Overlay Tipping Floor
Square Feet Installed: 7000 SF, 6500 SF
Installed Completion Date: May 2019 and May 2020

#28 **Project Name:** Buckman Road Recycling & Transfer Station
Owner: SFSWMA – Sante Fe Solid Waste Management Authority
Description of Work: Overlay Tipping Floor
Square Feet Installed: 2700 SF **Installed Completion Date**: Oct 12, 2018

#29 **Project Name:** Rainbow Disposal
Owner: Republic Services – Huntington Beach, CA
Description of Work: Overlay Tipping Floor
Square Feet Installed: 3500 SF **Installed Completion Date**: Jun 2004

#30 **Project Name:** SPSA – Norfolk, VA
Owner: Southeastern Public Service Authority
Description of Work: Overlay Tipping Floor
Square Feet Installed: 4,000 SF **Installed Completion Date**: Jun 2008

#31 **Project Name:** Warren CAT – Midland TX
Owner: Warren Caterpillar
Description of Work: Maintenance Bays and Wash Rack Area
Square Feet Installed: 3,500 SF **Installed Completion Date**: Apr 2016

#32 **Project Name:** Killeen TX Transfer Station
Owner: Killeen Texas Solid Waste Authority
Description of Work: Transfer Station Tipping Floor
Square Feet Installed: 25,000 SF **Installed Completion Date**: Jun 2020

#33 **Project Name:** Sussex County New Jersey Convenience Center
Owner: Sussex County Public Works
Description of Work: Rut repairs in dumpster load out area
Square Feet Installed: 500 sq. ft. **Completion Date:** November 2018

#34 **Project Name:** Smith Gap Transfer Station
Owner: Roanoke Valley Resource Authority, VA
Description of Work: Overlay Tipping Floor
Square Feet Installed: 4,000 SF **Completion Date:** Jul 2007, Nov. 2017

#35 **Project Name:** Benning Rd. Transfer Station
Owner: Washington DC Department of Solid Waste
Description of Work: Overlay Tipping Floor
Square Feet Installed: 4,000 SF **Installed Completion Date:** Spring, 2009

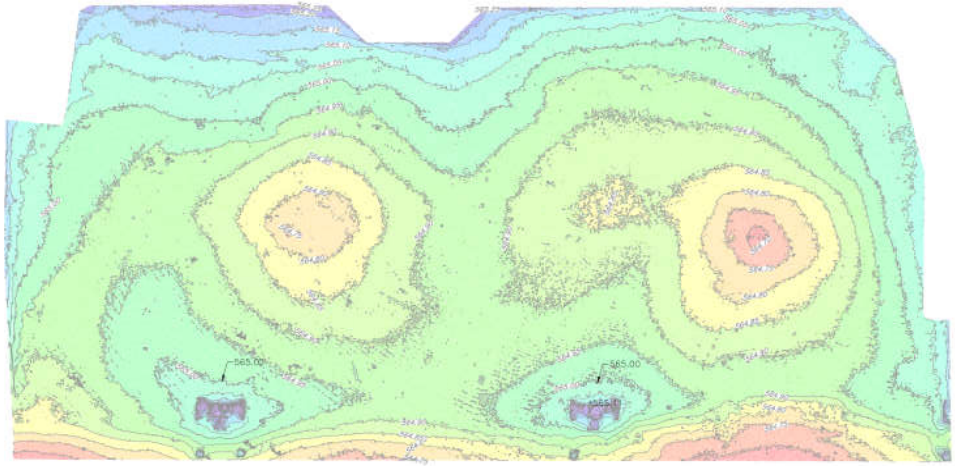
APPENDIX E

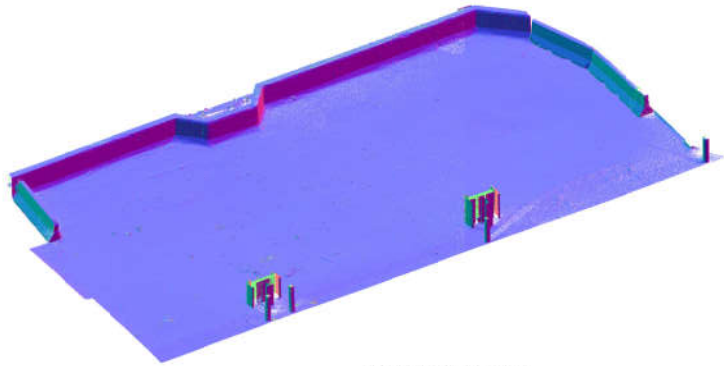
TIPPING FLOOR 3D SCAN (MARCH 20, 2021)

Building #1 – Tipping Floor 3D Scan

3D Scan of the OCRRA Rock Cut Road Transfer Station performed by Jason T. Anderson Architect, P.C. dba Anderson Design Group – Architecture, Planning, Interiors on March 20 and 21, 2021.

Analysis and presentation of the resulting model prepared by Cornerstone Engineering and Geology, PLLC.





ISOMETRIC VIEW
NOT TO SCALE

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	564.48	564.65	
2	564.65	564.70	
3	564.70	564.75	
4	564.75	564.80	
5	564.80	564.85	
6	564.85	564.90	
7	564.90	564.95	
8	564.95	565.00	
9	565.00	565.05	
10	565.05	565.10	
11	565.10	565.15	
12	565.15	565.20	
13	565.20	565.25	
14	565.25	565.30	
15	565.30	565.66	

ISSUED FOR REVIEW

0 5 10
SCALE IN FEET

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
DATE OF ISSUE	05/2021	DRAWN BY SSW	CHECKED BY			
		DESIGNED BY	APPROVED BY			

cornerstone PLLC
PREPARED BY:
CORNERSTONE ENGINEERING AND GEOLOGY, PLLC

ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
ROCK CUT ROAD TRANSFER STATION
JAMESVILLE, NEW YORK

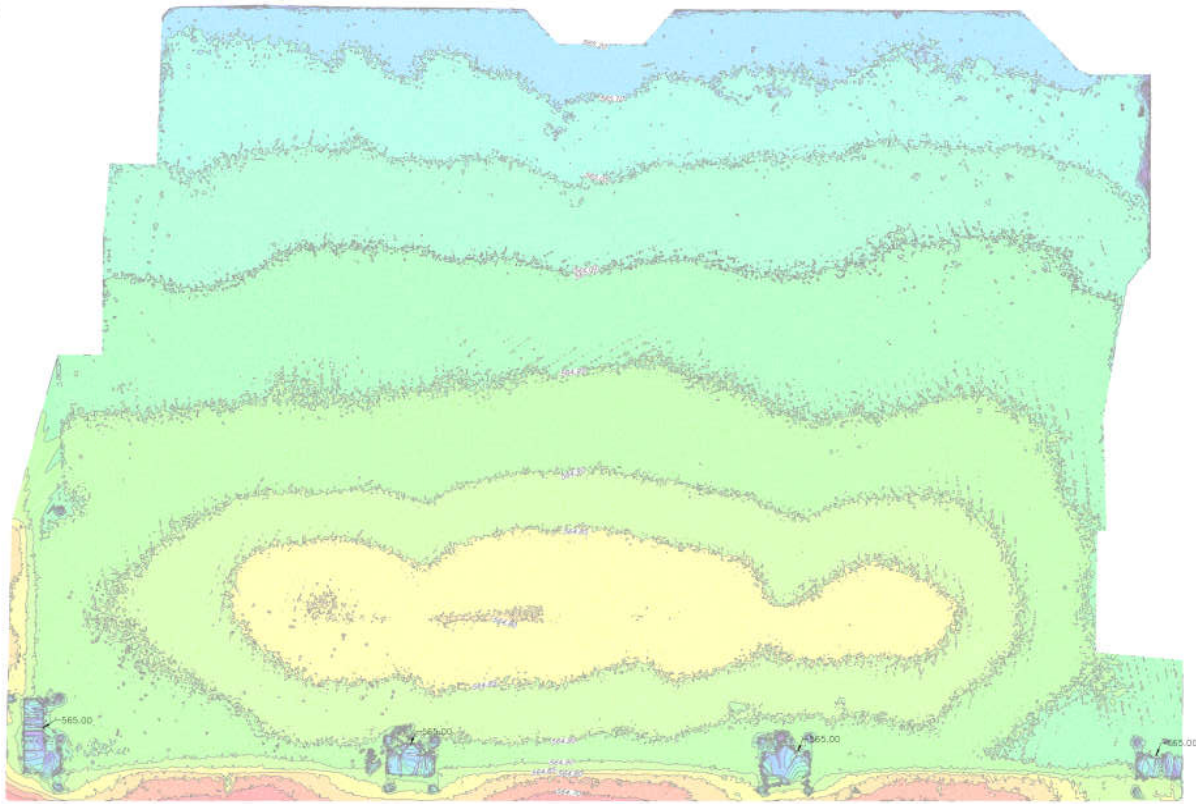
EXISTING BUILDING #1
TIPPING FLOOR 3D SCAN/SURVEY - 03/24/21

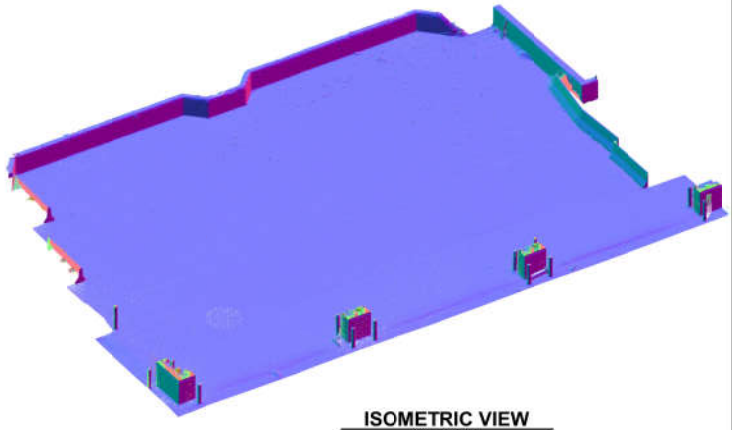
SHEET NO.
SC-1
PROJECT NO.
4213192

Building #2 – Tipping Floor 3D Scan

3D Scan of the OCRRA Rock Cut Road Transfer Station performed by Jason T. Anderson Architect, P.C. dba Anderson Design Group – Architecture, Planning, Interiors on March 20 and 21, 2021.

Analysis and presentation of the resulting model prepared by Cornerstone Engineering and Geology, PLLC.





ISOMETRIC VIEW
NOT TO SCALE

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	564.48	564.65	
2	564.65	564.70	
3	564.70	564.75	
4	564.75	564.80	
5	564.80	564.85	
6	564.85	564.90	
7	564.90	564.95	
8	564.95	565.00	
9	565.00	565.05	
10	565.05	565.10	
11	565.10	565.15	
12	565.15	565.20	
13	565.20	565.25	
14	565.25	565.30	
15	565.30	565.66	

0 5 10
SCALE IN FEET

ISSUED FOR REVIEW

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
DATE OF ISSUE	04/2021	DRAWN BY SSW	CHECKED BY			
		DESIGNED BY	APPROVED BY			

cornerstone PLLC
PREPARED BY:
CORNERSTONE ENGINEERING AND GEOLOGY, PLLC

ONONDAGA COUNTY RESOURCE RECOVERY AGENCY
ROCK CUT ROAD TRANSFER STATION
JAMESVILLE, NEW YORK

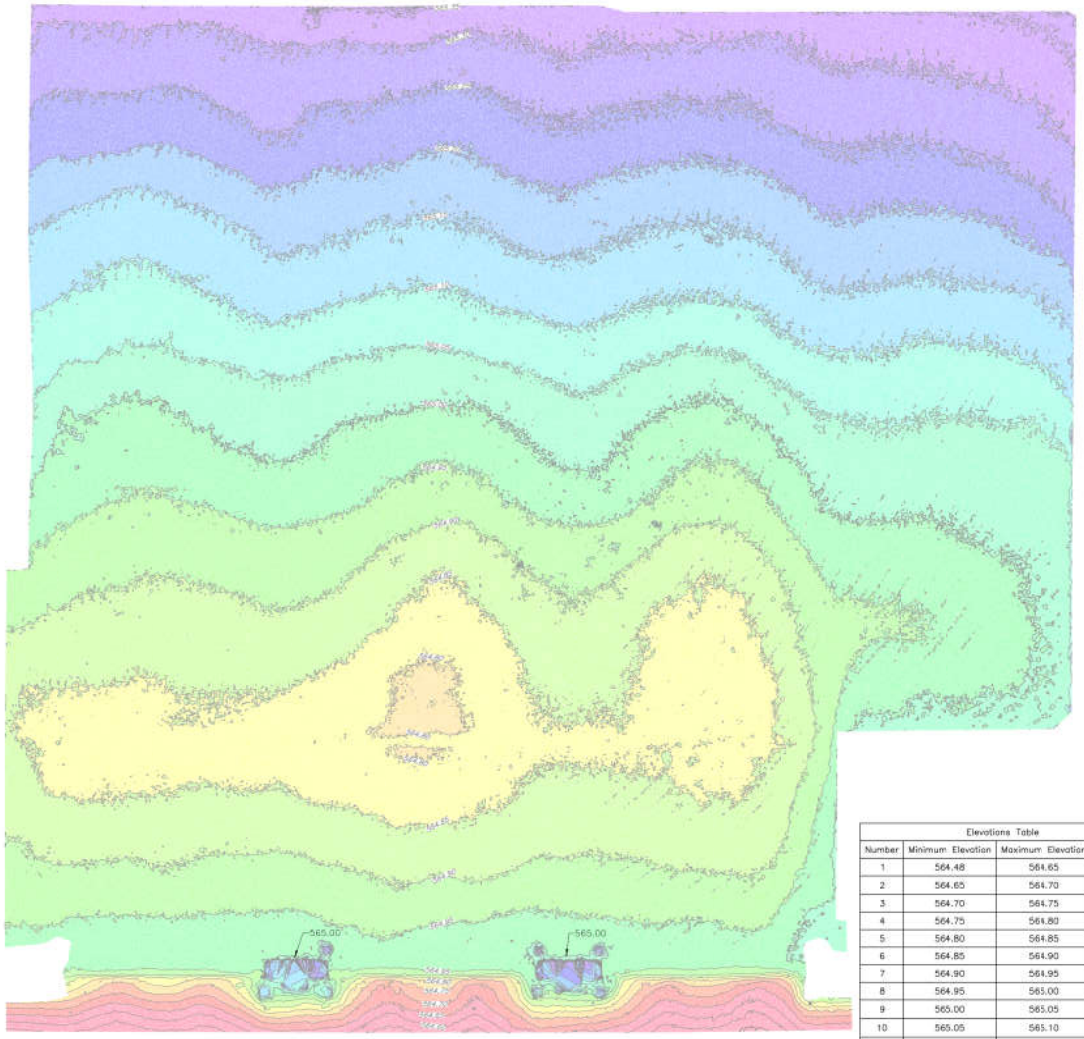
EXISTING BUILDING #2
TIPPING FLOOR 3D SCAN/SURVEY - 03/24/21

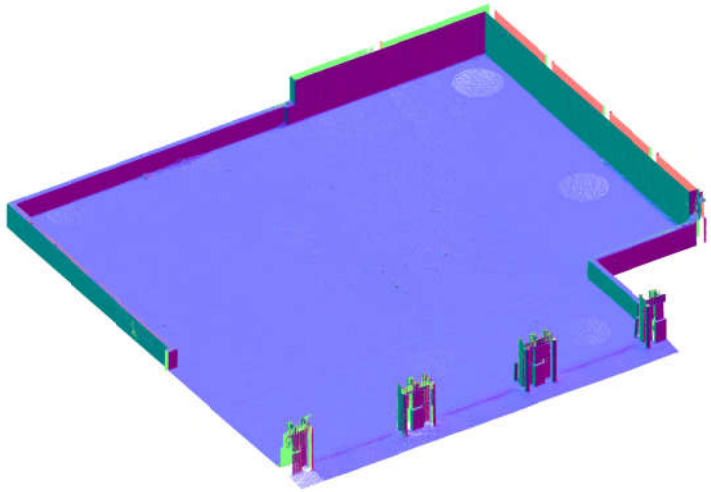
SHEET NO.
SC-1
PROJECT NO.
4213192

Building #3 – Tipping Floor 3D Scan

3D Scan of the OCRRA Rock Cut Road Transfer Station performed by Jason T. Anderson Architect, P.C. dba Anderson Design Group – Architecture, Planning, Interiors on March 20 and 21, 2021.

Analysis and presentation of the resulting model prepared by Cornerstone Engineering and Geology, PLLC.





ISOMETRIC VIEW
NOT TO SCALE

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	564.48	564.65	
2	564.65	564.70	
3	564.70	564.75	
4	564.75	564.80	
5	564.80	564.85	
6	564.85	564.90	
7	564.90	564.95	
8	564.95	565.00	
9	565.00	565.05	
10	565.05	565.10	
11	565.10	565.15	
12	565.15	565.20	
13	565.20	565.25	
14	565.25	565.30	
15	565.30	565.66	

0 5 10
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EXISTING BUILDING #3
TIPPING FLOOR 3D SCAN/SURVEY - 03/24/21

SHEET NO.
SC-1
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4213192