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5-Year Tactical Plan:

Transfer Station & Increased Recycling Capabilities



August 6, 2024



Innovative, Sustainable Solutions
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5-Year Tactical Plan: Transfer Station and Increased Recycling Capabilities

Campbell County, VA

August 6, 2024

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1 Background

In April 2024, the GBB Project Team Delivered a Technical Memorandum and presentation as Phase One of the Campbell County (County) solid waste management system assessment. Following the presentation, the County Board of Supervisors determined to proceed with the writing of a 5-Year Tactical Plan to construct and operate a transfer station within the County.

The purpose of this document is to provide a roadmap toward the implementation of a new Transfer Station to begin operating in 2029. This plan aims to support the following Project Goals:

- Develop a fully operational waste transfer station by 2029
- Ensure a seamless transition from landfill to transfer station
- Compliance with all regulatory and environmental standards

This document is based on the following Scenario and Option from the Phase One memo:

- **Transfer Station: County Waste County-Owned:** If the County were to build a transfer station, it would own it and use it solely for the disposal of County-generated waste.

This plan assumes that the Transfer Station facility will be County-owned and County-operated. It also includes information about adding material recovery facility (MRF) capabilities to the transfer station to increase recycling and help the County divert waste from the landfill-bound waste stream.

2 Transfer Station Timeline

Below is a general timeline toward the completion of a County-owned and operated Transfer Station. Each Phase is described in more detail in subsequent sections of this report.

Phase One: Siting and Budgeting

October 2024 – March 2025

- Site Study
- Development and Construction Budget
- O&M Budget
- Public Outreach
- Deliverable: Site Selection and Acquisition

Phase Two: Planning and Design

April – September 2025

- Facility Plan
- Facility Design
- Deliverable: Funding and Budget Approvals

Phase Three: Permitting and Approvals

October 2025 – September 2026

- Permit Applications
- Zoning and Regulatory Approvals
- Deliverable: Complete Permitting Process

Phase Four: Procurement and Engineering Design

April 2026 – September 2027

- Procurement
- Contractor Selection
- Deliverable: Detailed Engineering Designs

Phase Five: Construction and Commissioning

October 2027- December 2028

- Begin Construction
- Commissioning and Operational Testing
- Secure Final Material Destination Agreements
- Hauler Contracts / Service Agreements
- Deliverable: Complete Construction

Phase Six: Operational Transition

January 2029- September 2029

- Staff Hiring, Training & Operational Readiness
- Deliverable: Transition Operations

3 Phase One: Siting and Budgeting

Time frame: October 2024 – March 2025

3.1 Site Study

To select a site for the transfer station, the County will need to complete a Site Study. The study should identify potential viable locations based on the following specifications and include an evaluation framework to help determine location trade-offs. Final site identification and procurement are not required for certain portions of other phases but do need to be completed prior to the final detailed budget (purchase and upgrade price estimates) and prior to beginning the permitting process.

3.1.1 Site Selection Factors

3.1.1.1 Size (Acreage)

The size of the site can vary depending on what additional infrastructure would be co-located with the transfer station, but there are guidelines that can help identify potential parcels for transfer station siting. For the initial costing analysis for the transfer station model, a site of 20 acres was used. This is a reasonable size for a transfer station and other facilities, but convenience to transportation and utilities may be deemed more important than acreage. It is important to bear in mind that transfer stations in large cities move 1,000 tons per day (TPD) at sites that are less than 2 acres large. However, this is not recommended if larger sites are available.

All foreseeable transfer station needs can be served in a footprint of approximately 5 acres, and this would include the following (see sketch):

- Scalehouse with queue space
- Transfer Station building footprint
- Parking for staff and for trucks/trailers
- Maneuvering room for waste trucks and tractor trailers at bay entrances, loading entrance(s), and egress
- Areas for stormwater and leachate collection and management
- Administrative building
- Maintenance space (may be included as part of the Transfer Station building)

Other possible uses at this site would increase the necessary acreage to accommodate the necessary infrastructure. This would be especially important to consider for such co-located activities as recycling processing. Possible additional usages and the approximate acreage needed could include the following:

- Citizen Convenience/Recycling Center (approximately 2.5 acres)
- Vehicle/Bus/Rolling Stock Maintenance Building (2+ acres with maneuvering room)
- Recycling Processing (4-5 acres)
- Composting (minimum of 5 acres)

With the above potential future uses, the county should aim for a site of 20 usable acres, with additional vegetative buffers, to ensure room for future development.

3.1.1.2 Topography

While a relatively flat and even site is generally preferred, the topography of a site can either be challenging or helpful in the design and operations of a transfer station. There are various types of transfer station loading options for getting waste from a tip floor into a transfer trailer for transport, and can be implemented by taking advantage of topographical features:

1. **Level loading** – This requires a large enough loader to clear the top of a transfer trailer sitting at an equal level. The loader bucket requires a special front-pin tipping mechanism to dump at a height above the edge of the trailer (usually just under 13'). There can be a protective wall between the two vehicles, but the wheel loader needs to get fairly close to the truck to properly tip the material. This method tends to be the most difficult to achieve properly full and weighted loads and is generally considered more likely to damage the trailer during loading. There tends to be more spillage with this method as well. Many sites with level or near-level loading tend to utilize grapple material handlers instead of wheel loaders to load the trailers. This method tends to be cleaner and can better pack the trailers full, but it requires an additional piece of rolling stock equipment and an additional operator per shift.
2. **Submerged loading**—In this instance, the tractor and trailer are at a lower elevation level than the tip floor and loader, so the loader bucket does not have to lift as high from the tip floor to discharge material into the trailer. This frequently can be a faster and more accurate process than level loading. The topography can help dictate how much of an elevation change can be achieved between the tipping floor and the trailer loading lane(s).
3. **In-floor loading**—These transfer stations have loading lanes a full floor below the top floor, with the trailers being loaded through large openings in the floor at the same level as the tip floor. This has the advantage of not requiring a scoop-and-load process with a wheel loader but requires the largest elevation change between the two floors.

The following are some pictures of examples of the above types of trailer loading:



Figure 1 – Level Loading with Loader and Grapple Excavator



WIWMD's interior and pass-through exit and entrance (North Layton, Utah)



Fauquier County, Virginia's Transfer Station Interior and Pass-through

Figure 2 – (Above) Submerged Loading at WIWMD and Fauquier County (pass through, approximately 10' drop for both)



Figure 3 – In-Floor Loading at LCSWMA Transfer Station (pass-through)

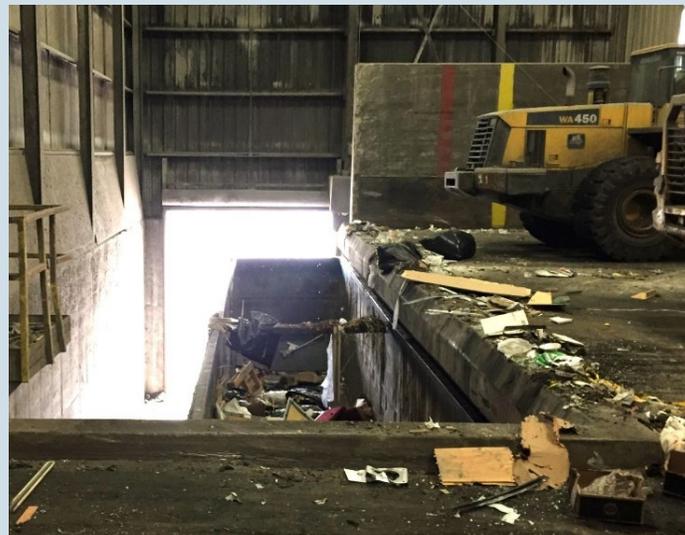


Figure 4 – In-floor Push Feed, Kent County, MI (back-in)

It is recommended that the transfer trailer loading area be a pass-through, if at all possible, as this eliminates the need for the truck and trailer to maneuver and back into the loading area. This is better for safety and usually for speed of swapping trailers. However, back-in loading still works, depending on the site needs. There could even be a dual type of loading, a pass-through for the MSW and a back-in for the Recycling.

In general, the lower the loading height, the easier and faster it is to load MSW or other materials into a trailer. Unfortunately, there are trade-offs in the acreage required and the cost of the pass-throughs. Also, there can be additional costs in the site preparation needs depending on the type of transfer station and the topography of the site.

It is recommended that once the sites have been narrowed down to work with a transfer station designer to create a preliminary design with the topography to help minimize the pre-construction site work needed and to establish a layout that takes the above considerations into account for both functionality and costs. This may help to decide the best site for the transfer station if other factors are equal.

3.1.1.3 Proximity to Population Centers

Siting the facility can be difficult as there are balances to consider, especially with proximity to the population centers in the area. Generally, a transfer station should be located so that most trucks coming to the site take no more than an hour of travel and unloading time to come from and return to a route. The facility needs to be located near the population centers to make this happen. However, many homes and businesses would prefer not to be neighbors with a transfer station (for various reasons). Identifying sites that can fulfill the timing needs of the trucks and still be in an acceptable location to the residents can be difficult and should be part of the siting study.

3.1.1.4 Proximity to Transit Routes

Similar to the proximity to population centers, the transfer station should also be located near regional transit routes to help facilitate both incoming trucks from local routes and for the transfer trailers driving to the regional landfills. It is ideal for one truck and trailer to be able to make two transfer trips per day, which means the round-trip time needs to be less than 4 hours (including tipping at the landfill which typically can take 30 minutes or more).

3.1.1.5 Utilities

Regardless of the transfer station location, the facility needs sewer, water, and electricity access. The sewer may constitute tapping into an area line or an on-site septic and leach line. It will likely also be necessary to have a separate system for leachate from the transfer station. Water might be able to be supplied by a well depending on the area or will need to tap into a regional supply. Electric will need to tap into the local grid. The further away the proposed transfer station is from these utilities, the higher the connectivity costs. The capacity of these utilities will need to be checked against the likely load of the operations at the transfer station and any other potential operations at the site to ensure adequate capacity.



3.1.1.6 Zoning

It is assumed that all potential sites in the County will need to be rezoned as there are very few industrial sites currently. Rezoning should not occur until the parcel is purchased or leased long-term. However, the siting study should look for potential issues for rezoning at any location under consideration.

3.1.1.7 Facilities

Before finalizing a site, a decision will need to be made as to what facilities and capabilities would likely be needed at this site (even if they are not being built yet). This would be needed to narrow down locations and ensure enough room and capacity in the utilities to support these facilities.

3.1.1.8 Cost

Once the size and utilities requirements are set, a cost can be estimated on a per acre basis. The other alternative would be to identify several candidates in the siting study and estimate the land cost from these sites (either from tax evaluations, representative sites nearby, or listed sales price if currently available). Not advertising potential locations before negotiating the purchase is recommended as this can adversely impact the asking price.

3.1.1.9 Current Ownership

Once several sites have been identified, the County would need to work with the current owner(s) to see if a purchase or a long-term lease would be possible. Having several options can increase the leverage of the County, although that is not always possible.

3.1.2 Sketch

The following shows a potential layout for several facilities in an 8-acre site. This shows the larger transfer station¹ at 32,000 ft² with 3 load-out bays, a maintenance shop, scales, and a citizen drop area. This sketch does not show a space for drainage ponds or other potentially necessary site needs but should help indicate the area needed for the different functionalities. Additional functions such as vehicle storage or recycling processing would require additional acreage.

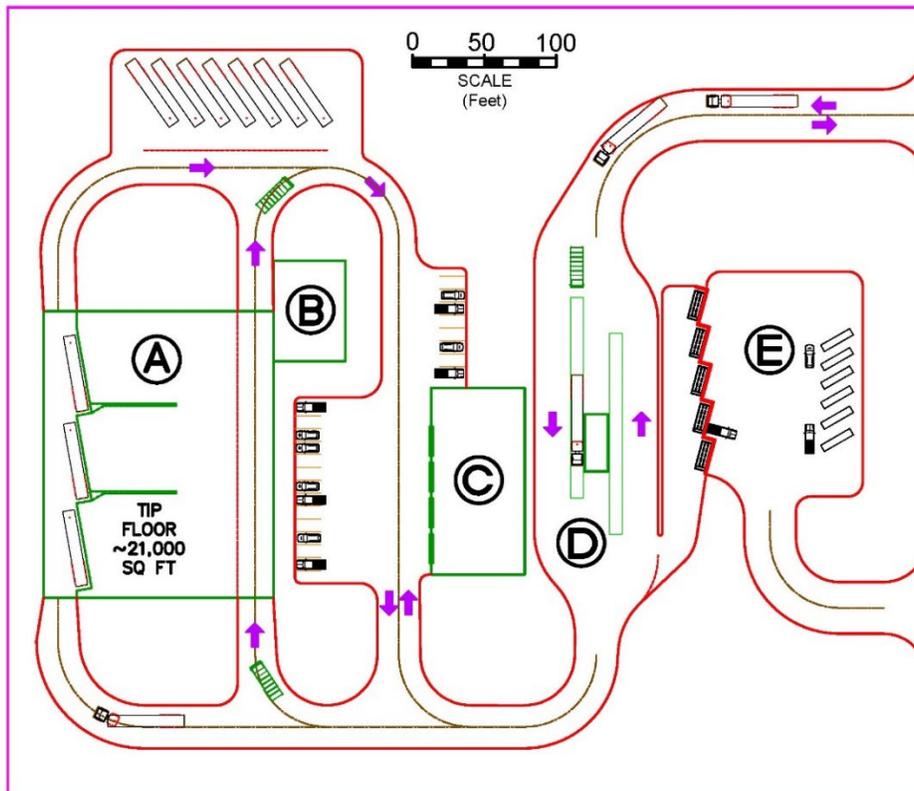


Figure 5 –Transfer Station Site Plan

¹¹ The smaller 20,000 ft² transfer station would look similar but smaller by removing one of the load-out bays. This would not significantly alter the overall layout in this particular case.

Table 1 – Building Sizes for the Generic Transfer Station

Label	Site	Dimensions	Area
A	Transfer Station	160x200	32,000 ft ²
B	Admin/Break Room	50x70	3,500 ft ²
C	Vehicle Maintenance Shop	130x65	8,450 ft ²
D	Scalehouse	40x16	640 ft ²
E	Citizen MSW Drop/ Recycling Drop	N/A	
Total Lot Size		550x640	8 Acres

As another example, the figure below shows the layout at the Lancaster County Solid Waste Management Authority (LCSWMA) facility in Lancaster, PA. The total site size is approximately 14 acres and has a large administrative building, a commercial and residential tip area, two maintenance shops, a parking area for slow-fueling natural gas vehicles, and a fast-fill natural gas station. Note that there is some room remaining for additional expansion.

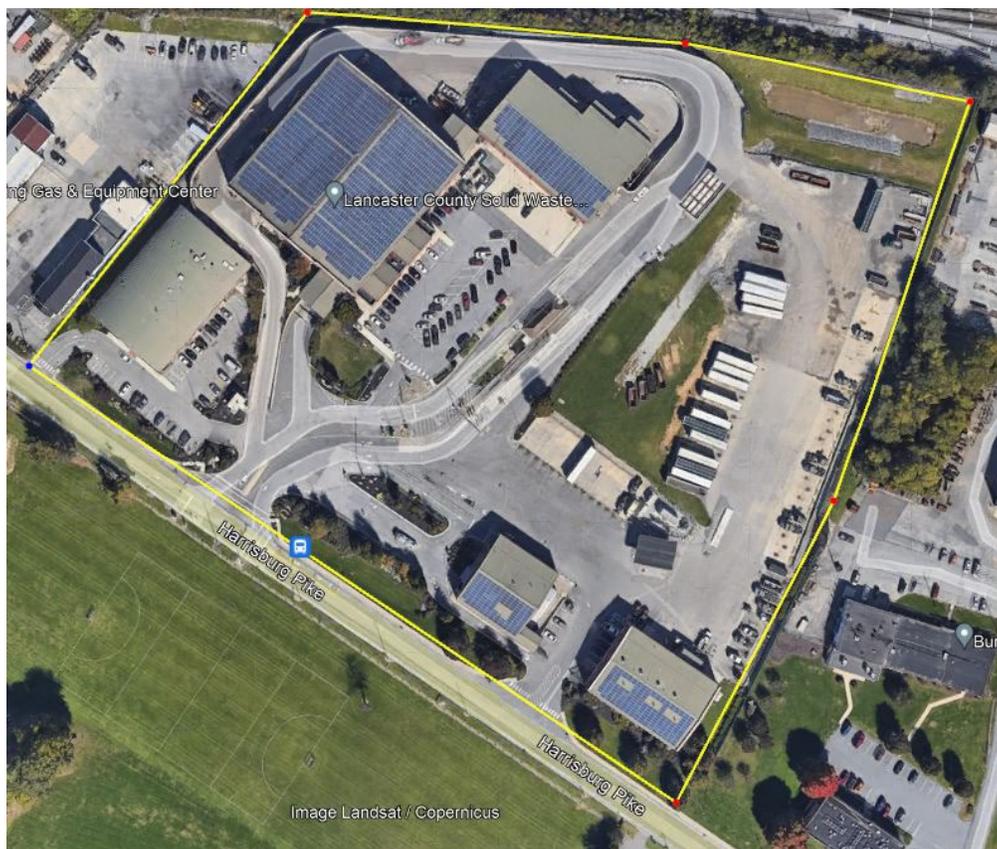


Figure 6 – LCSWMA Solid Waste Facility Site

3.2 Development and Construction Budget

The budget for the transfer station should be considered a living document that can be updated as more detailed and precise costs become available. As discussed in the siting section, the type of transfer station

and the loading options are somewhat dependent on the topography of the site, and this can also significantly affect the cost of site preparation and the cost of the transfer station structure and tipping area. For instance, a level floor loading pass-through setup has advantages for the operations and loading floor. Still, the height differential and cement bridge work will generally be more expensive than other loading setups. It is difficult to anticipate these costs until a site is confirmed and a preliminary design is established.

The detailed Development and Construction Budget captures the costs and funding sources of this project's development and construction stage. It does not include operation and maintenance costs but rather up-front project costs. This budget can also include a discussion about cost management strategies and financial controls. It must be updated regularly as real prices can replace estimates as inputs.

The budget described in the Phase One Memo is for a generic transfer station, sized for approximately 75,000 tons per year of waste and set up with submerged loading bays of medium depth. To calculate the size of tip floor needed, the EPA has a guideline for sizing tip floors.² Based on the expected tons per day.

Equation 1 – EPA Calculation for Sizing Tip Floor for MSW

$$\text{Tip Floor Area (ft}^2\text{)} = 4,000 \text{ ft}^2 + 20 \text{ ft}^2 / \text{TPD} * (\text{Tons per Day})$$

For this transfer station, the annual tonnage of 75,000 TPY is an average of 273 tons per day (TPD). To anticipate seasonal surges and growth, the sizing calculation utilized an estimated incoming tonnage of 300 TPD. The EPA calculation then indicates a necessary tip floor size of 10,000 ft². There are other needs within the transfer station, such as for the loading tunnels for storage and other operational needs. For the County transfer station, an additional 5,000 ft² of tip floor is assumed to be needed for receiving recyclables, loading areas, and maintenance space, and an additional 5,000 ft² of space is assumed for administrative and storage purposes for a total transfer station building size of 20,000 ft². Again, this may change as the development progresses, but this gives a starting point for the budget.

Facility Assumptions – Capital Costs

- The facility is sized to process 75,000 tons per year (TPY) with a single shift, based on Campbell County’s waste generation per year plus 50% capacity to accommodate additional disposal needs, such as natural disasters or regional contingency needs.
- Building square footage is estimated to be 20,000 ft on a 20-acre site.
- The building cost is only for a clear-span metal building with doors, and there are some added costs for the administration area breakroom and bathrooms.
- Site preparation costs include utilities, roads, and cement infrastructure for the building, including tip floor and push walls. This can vary significantly depending on the site.
- Equipment costs include a scale and scalehouse, software, and fire protection equipment.
- Permitting and facility design costs are discussed before the building costs.
- The total breakdown of the up-front capital costs (including a 20% contingency for all capital excluding the land) is shown below in Table 2.



Table 2 - Total breakdown of Fixed Initial Capital Costs w/ Contingency

Cost Item	Dollar Cost ¹
Building (\$130/sq. foot)	\$3,120,000
Site Prep Costs Estimate	\$2,400,000
Land Cost (\$50,000/acre)	\$1,000,000
Equipment Cost and Installation	\$900,000
Total	\$7,420,000

(1) Building, Site Prep, and Equipment Cost all have a 20% contingency adder (Building cost at \$130/ft² * 20,000 ft² = \$2.6 million. Contingency is an added \$520,000 (20% of \$2.6 million) for the total of \$3.12 million).

The County will also need to purchase or acquire rolling stock to operate the transfer station. Since rolling stock equipment needs to be replaced over the life of the operation, it is better to show those costs in the operations portion of the budget. These numbers only indicate the up-front or static costs of building the transfer station.

The following table presents a Development and Construction budget template, including estimated costs. **These costs may significantly vary depending on scope, contractor, and inflation.** All cost estimates are given in USD at the current-day value. Please note that all Professional Services estimates are based on the assumption that the County will hire an outside consultant to perform the given task. The Professional Services cost estimates are not based on actual quotes or hourly rates, but are rather broad estimates based on industry expertise. The figures can vary significantly based on the specific attributes of a site and other factors.

Table 3 - Transfer Station Development and Construction Budget (FY 2025-29)

Phase	Task	Estimated Cost (Present Day USD)	Fiscal Year	Notes
Phase One	Site Study	45,000	2025	Professional Services
	Public Outreach	30,000	2025	Professional Services
	Budgeting	150,000	2025-29	Professional Services
	Solid Waste Management Plan	200,000	2025	Professional Services
	Site Acquisition	1,000,000	2025	See Phase One Memo for land cost assumptions
Phase Two	Facility Plan	50,000	2026	Professional Services
	Facility Design	100,000	2026	Professional Services
Phase Three	Permitting	600,000	2027-29	Professional Services and Fees
Phase Four	Procurement Services	100,000	2027-28	Professional Services
	Engineering Designs	150,000	2028	Professional Services
Phase Five	Construction	6,420,000	2028-29	See Development and Construction Budget
	Project Management	200,000	2028-29	Professional Services
Phase Six	(See O&M Budget)			
TOTAL:		9,045,000		

3.3 Operation and Maintenance Budget

3.3.1 Operations Costs (Annual)

Operational costs are the annual costs associated with the operations of the transfer station. This includes the cost of labor, rolling stock costs, and maintenance of the facility. These tend to be relatively steady annual costs and can be refined as actual labor needs and rolling stock prices are quoted. Hauling and disposal costs can be more volatile and are discussed separately. Assumptions for the operating costs are as follows:

- Operating 276 days/year at 10-hour days, Monday through Friday for 10 hours/day, with a half-day on Saturday and 13 holidays. The Project Team estimated the cross-over shifts with the number of employees, including 20% for overtime labor costs. (Please note that this assumption was made for the purposes of calculating costs, with actual operations expected to be 312 days/year, Monday-Saturday.)
- A third party would handle hauling and disposal, which are a separate cost.
- Five (5) walking-floor trailers are included in the capital cost as spare trailers that the County would own for emergency overflow situations.
- Building capital costs are amortized over the 30-year lifetime of the facility at 6.0% interest.
- Rolling stock equipment is amortized over the assumed 6-year lifespan of the equipment³ at a 4.5% lending rate.
- The cost model includes a 10% contingency on operations and maintenance (O&M).
- Office expenses represent administrative costs associated with the operation of the transfer station but not other county operations.
- Facility security is assumed to be already maintained by Authority Personnel.
- Insurance is based on 1.0% of Building and Equipment and Labor Annual Costs. It should be noted that an increase in the number of fires at facilities due to lithium-ion batteries may increase this assumption in the near future.
- Sales Tax is assumed to be 4.0% on supplies.
- Labor applies the total annual cost of an employee, including benefits and employer-paid taxes. Salaried employees did not receive an overtime adjustment.
- Labor estimates include 20% overtime for hourly labor (Saturdays) and a 28.7% markup for associated benefit costs for all labor.

Table 4 – Estimated Rolling Stock Capital Costs

Capital Stock	Unit Cost	Quantity	Total Cost	Annual Cost
Front End Loader	\$330,000	1	\$330,000	\$62,861
Front End Loader (Small)	\$250,000	1	\$250,000	\$47,622
Skid Steer	\$45,000	1	\$45,000	\$8,572
Yard Dog Tractor	\$100,000	1	\$100,000	\$19,049
Roll-off boxes (lot of 5)	\$25,000	4	\$100,000	\$95,244
Spare (Emergency Volume) Walking Floor Trailers (53')	\$100,000	5	\$500,000	\$19,049
Total			\$1,325,000	\$252,397

³ The rolling stock may last longer than the indicated lifespan but frequently will require major overhauls and/or repairs at this juncture making the annual cost similar to the estimated annual cost.



Table 5 - Labor Estimates and Associated Costs

Personnel	Number of Personnel	Total Annual Cost
Facility Operations Manager	1	\$131,783
Office Manager	1	\$90,167
Admin Assistant	1	\$76,295
Scale Attendants	2	\$120,061
Shift Supervisors ¹	2	\$207,808
Wheel Loader Operators	3	\$249,808
Maintenance Mechanic	1	\$85,835
General Laborer	2	\$95,576
Annual Total Labor Cost		\$1,055,655

- (1) It is assumed that the shift Supervisors have a split schedule and, during overlap provide relief for loader operators as well as other potential site operations needs

The other operation costs consist of line items such as the above-mentioned administrative costs, building maintenance, water, sewer, fuel, insurance, etc. The total annual operating costs (without labor) are shown below in Table 6. This assumes a county-owned and operated facility. Private entities may also require additional overhead and profit costs.

Table 6 – Operations and Maintenance Costs (without Labor)

Facility Cost	Annual Cost
Equipment Parts and Maintenance	\$18,750
Supplies	\$3,000
Utilities (gas, water, sewer)	\$4,663
Mobile Equipment Fuel	\$84,822
Mobile Equipment Maintenance (Routine)	\$66,250
Environmental Testing/Monitoring	\$12,000
Plant Rental / Leasing	\$10,557
Safety Supplies	\$10,557
Subtotal Facility Costs	\$210,598
Other O&M Costs	Annual Cost
Office expense	\$3,000
Building Maintenance and Repairs	\$52,000
Security Expense	\$0
Insurance	\$43,037
State Sales Tax	\$3,451
Equipment Replacement Fund	\$0
Subtotal Other O&M Costs	\$102,549
Total O&M Costs (w/o Contingency)	\$313,147
Contingency (10%)	\$31,315
Total Annual O&M Costs	\$344,461

As the budget is refined, all these costs will need to be calculated and estimated based on actual rates and requirements for the County. The summary of these costs is shown in Table 8 below, along with the hauling costs discussed in the next section.

3.3.2 Hauling and Disposal Costs

Hauling and disposal costs make up the largest O&M expense at a transfer station, usually amounting to approximately 65% of the total annual costs. It is assumed that this will be performed under contract by a third party, although the County could also perform it. A cost of \$4 per mile (roundtrip) for the hauling of the waste was assumed for the annual budget. The average distance to each location was assumed to be 133 miles (roundtrip) for a total haul cost per trip (max of two trips per day) of \$532.00. The actual mileage will be dependent on the final transfer station location.

The costs for disposal may also change closer to the time of construction as well and will have to be negotiated with the disposal facilities to finalize the budget. The average tip fee (assuming a 20% discount from published) of two regional landfill locations calculates to approximately \$48 per ton. It is assumed that each trailer can haul 22 tons of material per load, which requires proper loading of each trailer to achieve these weights. The annual costs of hauling and disposal are shown in Table 7 below.

Table 7 – Hauling and Disposal Cost Estimates

Description	Annual Cost
Hauling Costs	\$1,468,320
Disposal Costs	\$2,470,997
Total - Hauling and Disposal Costs	\$3,939,317

Depending on how the third party negotiates its costs, hauling costs can be calculated on a per-mile basis or per day. If the County is doing the hauling, the costs can be calculated similarly, with the capital cost of the truck, trailer, driver, fuel, maintenance, and insurance wrapped up into the daily operations costs or the miles traveled per day.

Negotiating the disposal costs at the regional landfills, including details such as daily tonnage limits and actual contracted disposal costs with guaranteed tonnages, can significantly affect the overall annual cost. The County will need to negotiate the final fee with the final waste disposal sites.

The cost per ton will then be based on the total amount of tonnage received. This can vary depending on assumptions based on location and competition for commercial loads. As the tonnage increases, the cost per ton of the O&M and capital costs for the transfer station decrease, but the hauling and disposal cost per ton remains the same.

The total costs for the transfer station are summarized in Table 8 below, showing the total annual cost of operating the transfer station and hauling and disposing of the waste being \$6,130,885 per year. Of these costs, approximately 36% is the capital and O&M costs, while the hauling and disposal is 64% of the cost, highlighting the need to find the best value for disposing of the transfer station tonnage. With an incoming estimated tonnage of 51,402 TPY, the total cost equates to a cost of \$119.27 per received ton.

Table 8 – Summary of Capital, O&M w/ Labor, and Hauling and Disposal Costs for Transfer Station

Costs	Est. Annual Cost
Building and Grounds Improvement Capital Costs ¹	\$539,055
Rolling Stock Capital Costs	\$252,397
Total O&M (w/o labor) with Contingency, Overhead, & Profit	\$344,461
Labor Costs	\$1,055,655
Hauling and Disposal Costs	\$3,939,317
Total Annual Costs	\$6,130,885

(1) Annual Cost is the \$7.42 million amortized over 30 years at 6.0% interest. This is not the full cost as indicated in Table 3, but the costs only directly associated with the Transfer Station capital costs for a year-one annual operational cost estimate.

3.4 Public Outreach

The County may need to create a public and/or stakeholder engagement strategy based on the level of project buy-in necessary to move forward with the construction of a new transfer station. The strategy may include an online survey, phone survey, public meetings, and stakeholder interviews and can target specific groups (e.g., large waste generators, businesses, haulers, residents). The scope and timeline for outreach implementation will depend on the goals of the outreach strategy as determined by the Board of Supervisors and the level of public engagement and buy-in necessary to move this project forward.

3.5 Solid Waste Management Plan

Supposing the County were to discontinue its participation in Region2000 to meet its future solid waste management needs, it will need to draft its own Solid Waste Management Plan, submit it to the Commonwealth of Virginia every 20 years, and update it every five years. This is a significant effort that will likely require 16-20 months of staff work and will likely require an outside consultant as current staff will not have the capacity for this work. Virginia regulation 9VAC20-130-120 includes the following planning requirements:

A. Basic planning elements:

1. Objectives for solid waste management within the planning unit.
2. A discussion as to how the plan will be implemented and tracked, consisting of an integrated waste management strategy to support and promote the hierarchy set forth at [9VAC20-130-30](#); and giving preference to alternatives in the following order of priority: source reduction, reuse, recycling, resource recovery, incineration, and landfilling.
3. Definition of incremental stages of progress toward the objectives and schedule for their implementation, including for compliance with [9VAC20-81-450](#), specific solid waste management facility names, facility capacities, and life, based on 20-year need.
4. Strategy for the provision of necessary funds and resources.
5. Descriptions of the funding and resources necessary, including consideration of fees dedicated to future facility development.
6. Strategy for public education and information on source reduction, reuse, and recycling.
7. Consideration of public-private partnerships and private-sector participation in executing the plan. Existing private-sector recycling operations should be incorporated into the plan, and the expansion of such operations should be encouraged.

B. A minimum recycling rate as specified in § [10.1-1411](#) of the Code of Virginia for total municipal solid waste generated annually in each solid waste planning unit shall be met and maintained.

1. The plan shall describe how the minimum recycling rate shall be met or exceeded. The director may approve the solid waste management plans of units that do not currently meet the minimum recycling rate only if all other requirements of this chapter have been met and the solid waste planning unit demonstrates its commitment to implementing a strong and detailed action plan for recycling to meet the required rate.

2. When a solid waste planning unit's annual recycling rate falls below the minimum rate, it shall constitute evidence of a significant deviation from the plan. The plan may be subject to revocation by the department under [9VAC20-130-110](#) E unless the solid waste planning unit submits a recycling action plan acceptable to the department per subsection I of this section.

C. The solid waste management plan shall include data and analyses of the following type for each jurisdiction. Each item listed in this subsection shall be in a separate section and labeled as to content:

1. Population information and projections for 20 years of population growth and development patterns.

2. Urban concentrations, geographic conditions, economic growth and development, markets for the reuse and recycling of materials, transportation conditions, and related factors.

3. Estimates of solid waste generation from residential, commercial, institutional, industrial, construction, demolition debris, and other types of sources, including the amounts reused, recycled, recovered as a resource, incinerated, and landfilled. Entities engaged in the collection, processing, and marketing of recyclable materials should provide data for incorporation into the recycling rate calculation when requested by the planning unit.

4. A listing of existing and planned solid waste collection, storage, treatment, transportation, disposal, and other management facilities, their projected capacities, expected life, and systems for their use.

5. All milestones in the implementation of the solid waste management plan over the 20-year projection and the parties responsible for each milestone.

6. A description of programs for solid waste reduction, reuse, recycling, resource recovery, incineration, storage, treatment, disposal, and litter control.

7. A description of outreach programs for waste exchange, public education, and public participation.

8. The procedures for and results of evaluating solid waste collection, including transfer stations.

9. The assessment of all current and predicted needs for solid waste management for a period of 20 years and a description of the action to be taken to meet those needs.

D. All known solid waste disposal sites, closed, inactive, and active, within the area of the solid waste management plan shall be documented and recorded at a centralized archive authorized to receive and record information and a copy shall be sent to the department. All new sites shall be recorded at the same central data source.

E. A methodology shall be utilized to monitor the amount of solid waste of each type produced within the area of the solid waste management plan and to record the annual production by solid waste types at a centralized archive and a copy shall be sent to the department.

F. The solid waste management plan shall include, when developed locally, a copy of the local governing body's resolution adopting the solid waste management plan.

G. When the solid waste management plan is developed regionally, the solid waste management plan shall include a copy of the resolution of the solid waste planning unit approving the plan adopted in accordance with the Regional Cooperation Act, the Virginia Water and Waste

Authorities Act, the provisions of the Code of Virginia governing joint exercise of powers by political subdivisions (§ [15.2-1300](#) of the Code of Virginia), or other authority as applicable. The plan shall specify the solid waste planning unit's legal authority to adopt the solid waste management plan.

H. The solid waste management plan shall clearly and explicitly demonstrate the manner in which the goals of the planning requirements in this chapter shall be accomplished and actions to take if these requirements are not met.

I. A planning unit that does not meet the requirements of these regulations shall submit an action plan, by mail or electronic mail, for approval by the department. Such action plans shall include:

1. A description of the deficiency that requires the development of the action plan.
2. A time schedule to resolve the deficiency associated with the planning unit's failure to meet the requirements of the approved solid waste management plan.
3. A reporting requirement to the department of a minimum of once every six months, including activities or updates documenting how the action plan requirements are being met.
4. Plans and all subsequent reports and submittals shall be reviewed by the department within 30 days of receipt by the department.
5. All the department's requests for further information or responses shall be provided within 30 days of receipt at the planning unit. The department may grant reasonable extensions to these deadlines on a case-by-case basis.

3.6 Deliverable: Site Selection and Acquisition

Phase One concludes with selecting and acquiring a site for the transfer station. (Note that if a site requires rezoning, this may impact the overall timeline.)

4 Phase Two: Planning and Design

Time frame: April – September 2025

4.1 Facility Plan

Once the County has secured a site, it must create a detailed facility plan. The County may choose to engage an Architecture and Engineering (A&E) Firm at this stage in the process, or it can work with a Solid Waste Management Planning consultant to develop a more specific scope, and engage an A&E Firm once a basic facility plan is already in place. The plan should include the following components:

4.1.1 Maintenance Plan

- List of all equipment and associated maintenance needs
- Update maintenance costs

4.1.2 Risk Management Assessment

- Identification of potential risks and mitigation strategies.
- Contingency planning for delays, budget overruns, and technical issues.
- Options for waste outlets and cost requirements for prolonged diversion (if a final waste destination is no longer viable)
- Competitive analysis (if another transfer station opens nearby and draws tonnage away)

4.1.3 Staffing

- Create and describe new positions required for the transfer station operation.
- Update County organizational structure to include facility staff

4.2 Facility Design

Once the facility plan is complete, the County will need a detailed facility design. To do this, the County must finalize site functionality requirements and the associated approximate footprint of all site buildings and infrastructure. A design team will then be needed to provide both the preliminary and detailed designs.

The Facility Design should include the following components:

- Provide traffic flow needs, parking, and other outbuildings for either a specific or generic site.
- Design the transfer station requirements, including the square footage of the tip floor for MSW and recyclables, storage needs, and the number of bays/loading areas.
- Outline square footage and utility needs for all buildings.
- Design leachate and stormwater control systems.
- Address any special requirements based on location (offsets, traffic access, rail crossings).
- Ensure designs meet solid waste permitting requirements.
- Incorporate resilience considerations and future-proofing strategies.
- Specify materials and aesthetic requirements.

4.3 Zoning and Regulatory Approvals

The County must secure zoning approvals for the selected site, ensure designs meet all relevant regulatory standards, and obtain necessary approvals.

4.4 Deliverable: Funding and Budget Approvals

After Phase Two, the County will need to obtain approvals for funding and the overall budget for the project before breaking ground.

5 Phase Three: Permitting and Approvals

Time frame: October 2025 – September 2029

5.1 Permit Applications

The permitting process must begin with the correct site zoning in place.

Permitting will need to occur in conjunction with the Facility Design and Detailed Design phases, depending on the needs of the permits. Facilities need to be designed to an allowable completion necessary for the permitting based on the local requirements, which vary by location and are generally between 10% and 30% complete. The following permits will be necessary to obtain:

- Solid Waste Permit: This permit will be fundamental to accepting MSW at the site. The estimated tonnage daily limits and the Facility Design drawings should be sufficient to start this process.
- Utility and Groundwork permitting.
- Building permitting, including electrical, fire, and sewer.
- Final occupancy permitting.

5.2 Deliverable: Complete Permitting Process

At the end of Phase Three, the County must complete the permitting process.

6 Phase Four: Engineering Design

Time frame: April 2026 – October 2026

6.1 Procurement

To obtain the Engineering Designs, the County will need to establish the scope of procurement needs and requirements. This will require the County to establish how the construction will be managed (i.e., who acts as general contractor: the County or a contractor; does the County act as general contractor for land upgrades but another entity oversees buildings and structures). This will depend on the overall project structure.

The County will then need to generate and issue a Request for Proposals (RFP) with site needs and requirements, as well as selection criteria, and distribute it with enough time for qualified entities to respond properly (60 days). To procure the A&E firm, the County will need to allocate time to write the RFP (potentially with the assistance of an outside consultant), advertise, go through the bidding process, and go through the awarding process.

6.2 Contractor Selection

The County will then utilize the selection criteria from the previous task to narrow down and eventually select the contractor(s) for the transfer station and other requirements. The County can work with the chosen party to finalize the construction timeline.

6.3 Deliverable: Detailed Engineering Design

At the end of Phase Four, the County should have a final detailed engineering design in hand, including the final footprint and elevation drawings for all required buildings and necessary infrastructure for construction.

7 Phase Five: Construction and Commissioning

Time frame: October 2026 - April 2028

7.1 Construction

Over the course of the Transfer Station construction period, the County will need to execute its oversight plan, with Monitoring and Quality Control Checks performed by an outside firm, an existing staff position, or a new position).

7.2 Commissioning and Operational Testing

Once construction is complete, the County must oversee system testing, safety checks, and quality assurance for all systems.

7.3 Secure Final Material Destination Agreements

The County must secure daily, monthly, or yearly allowable tonnages and tipping fees with regional landfill locations. It should establish minimum and maximum permissible tonnages with multiple regional locations and agree upon a tip fee for these locations.

7.4 Hauling

The County must establish and sign hauling contracts for anticipated tonnages to contracted destinations. Timelines for these contracts will need to be negotiated. Contracts with haulers can be set for one year or multiple years with the possibility of extensions. Typically, a hauler contract cannot be extended beyond ten years.

Rather than contracting for hauling services, the County may purchase its hauling vehicles, hire drivers, and keep the hauling in-house. (Please note that this is not currently included in the budget but can be considered when the detailed budget is created.)

7.5 Deliverable: Complete Construction

Phase Five concludes at the end of the building period once facility construction is complete.

8 Phase Six: Operational Transition

January 2029 - September 2029

8.1 Staff Hiring, Training & Operational Readiness

The County must write job descriptions, advertise the positions, and complete the hiring process. The County must then develop detailed training programs covering all operational aspects, including waste handling, safety procedures, equipment use, and emergency protocols. It will need to allocate staff time, finalize job descriptions, make salary determinations, and hire staff. It must also create and finalize the necessary training manuals and standard operating procedures.

To ensure operational readiness, the County should perform comprehensive testing of all systems, including waste sorting, handling, and transportation mechanisms, and verify the functionality of safety systems, such as fire suppression and emergency shutdown procedures. When testing the systems, the County must ensure all operations comply with local, state, and federal regulations.

8.2 Deliverable: Transition Operations

At the end of Phase Six, the County will be ready to transition operations from the landfill to the transfer station.

9 Increased Recycling Capabilities

The following section discusses additional costs and infrastructural considerations if the County improves its recycling and resource recovery capabilities.

9.1 Volume and Composition

As the County has not performed a recent waste characterization, the following estimate of the volume of recyclable material in the waste stream is based on the following data sources:

1. Kent County Waste and Recycling Composition Study (2021)⁴

⁴ GBB Report

2. Pennsylvania Statewide Waste Composition Study (2022)⁵
3. Mecklenburg County, NC Single Stream Waste Composition Study (2019)⁶

9.1.1 Residential Volume and Composition

The following table shows the projected waste generation rate based on the current recycling programs and rates.

FY	Residential MSW	Residential Recycling	Residential Generation
FY 29-30	26,341	536	26,877
FY 39-40	27,006	549	27,555
FY 49-50	28,055	571	28,626
FY 58-59	29,037	591	29,628

The following table shows the estimated waste composition of Campbell County residential MSW for Fiscal Year 2029-30 and includes the total tons of recyclable material in the waste stream. The residential and commercial percentages of each material are the average of the composition from Kent County and the State of Pennsylvania studies. The tonnage of residential is assumed to be 26,341 TPY, and commercial is 25,061 per year (this is the same as the transfer station estimates for this year).

Material Category	Average Residential	Tons
Organics	26.8%	7,058
OCC	4.0%	1,060
Other Fibers	7.7%	2,041
Glass	2.3%	596
PET	1.9%	509
HDPE-N	0.4%	115
HDPE-C	0.6%	154
Mixed #1-#7	2.4%	639
Other Plastics	9.3%	2,451
Aluminum Cans	0.5%	137
Ferrous Cans	1.1%	291
Mixed Metals	2.0%	524
Other Residue	40.9%	10,785
Total	100%	26,361

⁵ https://files.dep.state.pa.us/Waste/Recycling/RecyclingPortalFiles/Documents/2022/PA_DEP_Report_FINAL_10-04-2022.pdf

⁶ GBB Report



Please note that Other Residue refers to non-recyclable content. Using the aforementioned waste characterization data to form the waste composition assumptions indicates that 59.9% of the residential MSW generated in the County is theoretically recyclable. Theoretically recyclable means that under very specific and special circumstances, that material may be recycled or at least diverted from landfilling disposal. However, realistically, the functional recycling rate would be much lower due to recoverability of certain items and the lack of current infrastructure and markets for all but the highest value materials found in the waste.

With approximately 60% of the residential waste stream comprised of recyclable material, this forms the base of the total tons of material that could potentially be recovered and recycled. There is currently no possibility of a 100% recovery rate through which all of this tonnage could be recovered.

9.1.2 Commercial Volume and Composition

The following table shows the commercial recycling volumes and projections, based on assumptions and calculations made in the Phase 1 Memo.

FY	Commercial MSW Landfilled	Commercial Recycling	Commercial Generation
FY 29-30	25,061	18,151	43,212
FY 39-40	25,694	18,609	44,303
FY 49-50	26,692	19,332	46,024
FY 58-59	27,627	20,009	47,636

The County currently does not handle any of the commercial recycling that is listed in the above table. It is assumed that regardless of what the County does regarding recycling and the transfer station, commercial recycling would remain mostly intact as it is and would not affect the County system. However, it is possible that additional commercial recycling may be separated and brought to a MRF once operational. There is potential for some recycling from the above-listed recycling tonnage to also end up at the MRF. The assumptions for commercial recycling participation are discussed in the MRF scenarios below.

The following table shows the estimated composition of the Campbell County commercial recycling stream for Fiscal Year 2029-30.

Material Category	Average Commercial	Tons
Organics	18.9%	4,738
OCC	9.2%	2,309
Other Fibers	6.6%	1,657
Glass	1.3%	330
PET	1.3%	336
HDPE-N	0.5%	122
HDPE-C	0.3%	83
Mixed #1-#7	6.3%	1,580
Other Plastics	12.6%	3,146
Aluminum Cans	0.3%	74
Ferrous Cans	0.6%	143
Mixed Metals	3.1%	765
Other Residue	39.1%	9,789
Total	100%	25,074

As notes above, that Other Residue refers to non-recyclable content. Using the aforementioned waste characterization data to form the waste composition assumptions indicates that 60.9% of the commercial MSW that is currently being disposed is recyclable. **As with residential waste, this figure represents the total tons of recyclable material in the waste stream and does not indicate the amount that is recoverable through collections and processing.**

9.2 Equipment and Infrastructure

In order to process the recyclable materials identified above, the County needs equipment and/or infrastructure to do so. The following is a description of the facilities needed to process recyclable materials in the County. The following section includes a description and cost of additional material recovery infrastructure to include the following possible streams for processing:

- Material Recovery Facility (MRF)
- Food and Organic Waste Recycling
- Glass
- Mixed Waste Processing

9.2.1 Material Recovery Facility (MRF)

If the county were to integrate material recovery at the transfer station, there would be two options for processing the recyclables on-site and this would be dependent on the amount of single stream recyclables likely to be collected. This is dependent on the type of collections within the County for both residential

and commercial streams. There are three options for recycling collections discussed in Section 9.3, which would require two different processing options. The smaller collected tonnages that would be estimated under the Enhanced Drop-off Recycling and the Curbside Recycling would require only a basic MRF consisting of an infeed conveyor, a sort conveyor and bunker platform, magnet, and a baler with an infeed conveyor. This system would be able to process approximately 2 tons of recyclables per hour. If there is a concerted effort (and perhaps regulations) to increase the recycling from both residential sites and from commercial locations, the tonnages of single stream would require additional equipment to process the materials over one shift. This upgraded MRF would include an OCC screen, fines screen, and an eddy current separator to recover aluminum cans. With proper planning, it is possible to design the smaller MRF system to be able to easily add this additional equipment in the future to accommodate a ramp-up in yearly tonnages.

Either MRF would have approximately equal labor needs, as sort labor that would be displaced due to the new equipment would be required at other sort locations due to the increased material flow.

9.2.1.1 Option 1 – Manual Sorting MRF with Baler – 2 TPH Capacity

This size of MRF would be relatively simple and would be able to handle the estimated tonnages produced with the Enhanced Drop-Off scenario or the tonnages collected with the Curbside Collection scenario.

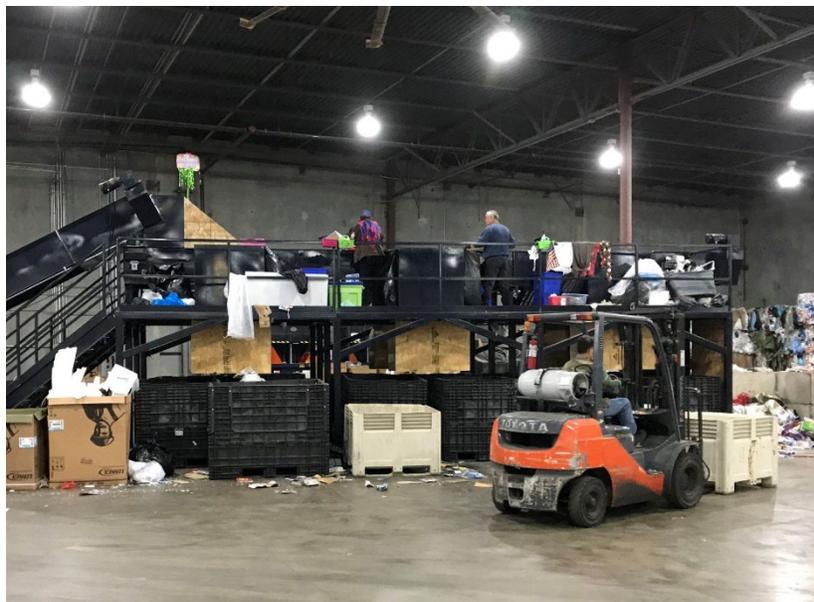


Figure 7 - Small Sorting Platform (GBB)

- Annual tonnage assumption of incoming single stream for processing. It is assumed that all scenarios will have a mix of residential and commercial recycling that is collected for the MRF to process. These tonnages are estimated from the composition study amounts and an estimate of materials that might be available from willing commercial entities to also participate in recycling. The total collected single stream is used in the processing models to estimate the recovery and revenue of the collected commodities.
 - For the Enhanced Drop-Off scenario: 2,000 TPY (roughly 1,400 from residential and 600 from commercial)
 - For the Curbside Collection scenario: 3,500 TPY (roughly 2,500 from residential and 1,000 from commercial)



Scenarios	Residential Single Stream TPY	Commercial Single Stream TPY	Total Collected Single Stream TPY
Enhanced Drop-Off (Option 1)	1,400	600	2,000
Curbside Collection (Residential) (Option 1)	2,500	1,000	3,500

- Major equipment elements:
 - Wheel Loader and Forklift for Material Handling
 - Infeed conveyor, sort conveyor, and bunker platform, magnet
 - Baling equipment: Infeed conveyor and baler
- Location: In a new 18,000 ft² MRF building on the same land as the transfer station. (There is a possibility of utilizing the transfer station for this smaller MRF but it would not be expandable, so this is not recommended).
- Additional labor estimates:
 - It is assumed that the labor needs would be a total of 16 personnel, including 10 sorters for the recovery of commodities. This may be a little high when processing less than 2,000 TPY, but it would be the appropriate number of personnel for tonnages beyond that amount.
- Equipment cost:
 - Capital costs: Estimated at \$2,000,000 for the processing equipment; \$2,800,00 for the building construction; and \$800,000 for additional grounds improvement; adjacent to a transfer station and not require additional utilities and infrastructure improvements.
 - Facility cost to operate: The capital cost would be approximately \$431,838 per year, with O&M, including labor (16 employees), being \$1,271,693 per year.
- Collection Methods:
 - Would require additional collections as described in Section 9.3.
- End markets
 - Recycling brokers/buyers of recycled commodities, such as Storelli Recycling or others.

9.2.1.2 Option 2: MRF with Additional Equipment to Process Additional Commercial Single Stream and Possible Single Stream from Outside the County (4-5 TPH)

This MRF would be an extension of the previous option with more equipment (in the same size building) and operate at a higher throughput to process more tons per year. The previous equipment should be designed with this option in mind for future expansion. The option assumes both the Enhanced Drop-off and additional Curbside collection of residential single stream along with enhanced recycling from Commercial locations as well as potential tonnage from outside the County.

- Annual tonnage assumption of the incoming single stream for processing. For this scenario is assumed that there may be slightly more recyclables collected from residential generated locations as well as a large increase in tonnages from the commercial locations:
 - For the Curbside with Commercial scenario: 6,000 TPY (roughly 2,800 from residential and 3,200 from commercial).

Scenarios	Residential Single Stream TPY	Commercial Single Stream TPY	Total Collected Single Stream TPY
Curbside w/ Commercial (Option 2)	2,800	3,200	6,000

- Major equipment elements:
 - Same as Option 1 with additional OCC and Fines Screen as well as an Eddy Current Separator (ECS) for aluminum cans.
- Location: In a new 18,000 ft² MRF building on the same land as the transfer station.
- Additional labor estimates:
 - It is assumed that the labor needs would be a total of 16 personnel, including 10 sorters for the recovery of commodities. The equipment would make sorting certain commodities more efficient, but the sorters would need to move to new sort locations due to the increased throughput (namely PET and Mixed Fiber).
- Equipment cost:
 - Capital costs: Estimated at \$2,500,000 (in total, additional equipment is \$500,000) for the processing equipment. The remaining capital (\$2,800,00 for the building construction and \$800,000 for additional grounds improvement) is the same as for Option 1. It is assumed to be on grounds adjacent to a transfer station and not require additional utilities and infrastructure improvements.
 - Facility cost to operate: The capital cost would be approximately \$460,753 per year, with O&M including labor (16 employees) being \$1,297,977 per year (slightly more than Option 1 due to increased maintenance costs for the new equipment).
- Collection Methods:
 - Would require additional collections as described in section 9.3.
- End markets
 - Recycling brokers/buyers of recycled commodities, such as Storelli Recycling or others.

9.2.2 Food and Organic Waste Composting

Composting transforms organic waste into valuable soil amendments rather than sending it to a landfill. While the concept of composting has been around for centuries, its commercial-scale applications have gained significant momentum in recent years. Successful commercial-level composting operations reduce the burden on landfills and generate valuable products that can be sold and reused in agriculture, landscaping, and other industries.

The most straightforward solution for managing organic waste generated in the county is establishing and leveraging a relationship with Royal Oak Farms, a robust composting facility in neighboring Bedford County.

If each green box site offered food waste drop-off, the County could anticipate the following:

- Annual tonnage assumption:
 - In-county source separated organics food and mixed organics collection assumes approximately 4,000 tons from residential and 2,400 from commercial sources. This represents approximately 60% of the available organics from residential sources and 50% of the available organics from commercial sources. This does not count additional land clearing or other yard-type waste that is normally external to the MSW. These tonnages represent a relatively aggressive program to target the organics from the waste stream.
- System size requirements
 - Ramping up collections will take several years and fluctuate throughout the year. A suggested approach is to start with a pilot at three green-box sites to collect yard and food waste from the community, haul it to Bedford County, and grow it based on experience.
 - If the County decides to develop its own composting facility, co-locating it with the Transfer Station could open additional opportunities in the future for waste diversion of the organic fraction of MSW (OFMSW).

- Location: Royal Oak Farms is already established in Bedford County. If the County decides to develop its own composting facility adjacent to the future Transfer Station, having an additional 5-8 acres to locate a small-scale composting facility would be preferred.
- Major equipment elements
 - Containers for food waste collection and hauling are the primary equipment needed, along with a sludge truck body for hauling clean food waste, potentially mixed with clean yard waste, to Royal Oak Farms Bedford County.
 - If the County were to construct and manage a composting site located adjacent to the transfer station, the County would need a row turning machine and an additional loader to handle the materials, as well as piping and blowers for aeration. The County may also require renting a screen and a shredder at times, depending on the types of materials received.
 - The site would require grading, run-off management, and paving for the row locations.
- New labor estimates:
 - If the green box sites are utilized as collection sites, the current staffing can be utilized, plus 5%, to cover additional staff coverage at the pilot sites once weekly.
 - 0.25 full-time equivalent personnel would be needed to manage the pilot.
 - 0.20 full-time equivalent personnel would be needed to haul the materials to Bedford County once per week
 - Mileage costs would depend upon the sites selected for a pilot. If all pilot sites were collected on the same day, hauling would be minimized.
If located adjacent to the transfer station and MRF, it assumed an additional 2 people would be required to operate the composting site. It is possible these personnel could also be part-time operators at the MRF, depending on the needs and the tonnages of compost.
- Facility cost:
 - Capital costs: No additional capital costs for land or buildings if current green box sites are utilized as collection facilities.
 - Containers for food waste would be approximately \$3,000 to \$15,000 per green box site, depending on their size, placement, and level of complexity.
 - A sludge truck for hauling food waste: if the county does not already have such a vehicle that can be dedicated to food waste collection once per week, a designated truck with a sludge body will cost approximately \$250,000.
 - For the adjacent system, a row turner, wheel loader, and an aeration system would cost roughly \$950,000. The additional cost for land clearing and paving for the adjacent compost site is roughly estimated at \$1,000,000.
- Revenue estimates:
 - There would be a cost to an organics pilot; however, the county would establish an understanding of the potential pathways to diverting organics from landfilling, one of the heaviest and methanogenic material streams headed to landfills presently.
 - It is assumed that the compost would be roughly sold at load-out cost for a net zero revenue. However, there would be savings from reducing the amount of materials sent to landfill. If assuming the incoming organics have an estimated 10% residue, the recovered organics total from the MSW is approximately 5,796 TPY. At a hauling and disposal cost of \$76.64 per ton, the total disposal savings for composting would be \$444,205 per year.
- Collection methods:
 - Eventually, expand the collection of food waste and yard waste to all existing green box sites and increase the number of dumpsters available
- End markets
 - Royal Oak Farms composting facility in Bedford County
 - If the County decides to establish its own composting facility, there are many potential off-takers of compost, including residents and businesses, such as landscapers, farmers, gardeners,

and even government agencies, like Departments of Parks and Recreation, Transportation, or Public Works for the maintenance of local and state government-owned lands (parks, yards, medians, intersections).

9.2.3 Glass Processing

If each green box site offered a glass drop-off dumpster weekly, the county would benefit from a higher-value recycling stream while increasing waste diversion from landfills.

- Annual tonnage assumption:
 - Based on the composition of the MSW, there is approximately 926 TPY of recyclable glass in the County waste stream.
 - If approximately 60% were recovered from residential sources and 50% from commercial locations, this would equate to approximately 522 tons of glass per year.
- System size requirements
 - Ramping up collections will take several years and fluctuate throughout the year. A suggested approach is to start with a pilot “Purple Can Program,” which includes placing purple dumpsters designed for residential glass container collection at three green-box sites to collect glass containers from the community; when enough glass is collected, haul it to the closest SMI facility in North Carolina, or crush it and use it as a sand alternative in the underlayment beds of sewers and sidewalks. Several Virginia communities in the northern parts of the state have implemented such a program. Campbell County can contact Prince William County to understand how the program works in a rural-suburban community.
- Location: SMI is a processor of glass and other recyclable materials nationwide. We understand that they are always looking for sites to expand, particularly along the Northeast rail corridor or where there is a density of materials. The Norfolk Southern Railroad is near Campbell County; it may be worthwhile looking into the county’s real estate along railroads and reaching out to SMI or another glass processing company to see if there is interest in setting up a glass processing facility in Campbell County.
- Major equipment elements
 - Purple Can Program dumpsters are easily retrofitted waste dumpsters for recyclable glass container collection.
 - A strong roll-off truck capable of hauling a dumpster full of glass.
 - If processing glass for ditch-fill or other internal county uses is utilized, a glass crusher would need to be purchased.
- New labor estimates:
 - If the green box sites are utilized as collection sites, the current staffing can be utilized, plus 5%, to cover additional staff coverage at the pilot sites once weekly.
 - 0.10 full-time equivalent personnel would be needed to manage the pilot.
 - 0.10 full-time equivalent personnel would be needed to haul the materials to Bedford County once per week
 - Mileage costs would depend upon the sites selected for a pilot and the collection frequency. Unlike food waste, glass waste is stable. Purple cans only need to be emptied when they have reached a certain fullness threshold for hauling.
- Capital cost:
 - The cost for a 30-yard roll-off dumpster is approximately \$6,000.
 - Glass crusher and conveyor is estimated at \$150,000.
- Revenue estimates:
 - There would be a cost to an organics pilot; however, the county would establish an understanding of the potential pathways to diverting organics from landfilling, one of the heaviest and methanogenic material streams headed to landfills presently.
- Collection methods:

- Eventually, expand the collection of glass to all existing green box sites and increase the number of dumpsters available at other high-use locations.
- End markets
 - SMI might eventually be a useful outlet, but the crushed glass can also be used for alternative uses, such as aggregate replacement in ditches and other construction.

9.2.4 Mixed-Waste Processing

A mixed waste processing (MWP) facility is designed to handle unsegregated refuse by separating recyclable materials from the waste stream prior to disposal. There have been a number of these facilities built in the US, and most of them have shut down or have converted to single-stream processing. The current issue with MWP is that there are limited outlets for any materials that are not high-grade recyclables, meaning that most processed materials still need to be disposed of. MWP facilities are excellent at recovering PET and HDPE plastics and metal cans. They are OK at recovering OCC (cardboard) and relatively poor at recovering mixed fibers. The recovery for most MWP facilities, without additional (and very expensive) specific organics processing, is approximately 10% of the MSW stream.

This tends to make MWP not a viable option for reducing the amount of MSW landfilled under the current conditions. There may be breakthroughs in conversion technologies that would provide additional outlets to much of the remaining MSW materials from a MWP facility, but these are not currently at a commercial scale. A MRF for recyclables and composting of source-separated organics would recover more material from the MSW than current MWP technology, making this option unviable for now.

9.3 Residential Collection Programs

The following recycling collection programs and volumes use waste generation figures for FY 2029-30, with the understanding that the waste stream may change significantly over time. The following recovery rate assumes that the programs have been adequately planned, piloted, fully deployed, and matured. The results of these calculations were utilized to estimate the tons of single-stream processed by the MRF. The Estimated Collection Rate utilized below provides a rough composition resemblance to the combined results from recent single stream composition studies. As the composition studies are more accurate to common single-stream composition values, those numbers were used to estimate the tonnages and recovery from the MRFs. The numbers below help to highlight the materials available for recovery and the recovery percentages necessary to reach the processed tons estimated for the MRF operations.

9.3.1 Enhanced Drop-Off Single Stream Recycling

The following table shows the volume of material that could be recovered if the County were to upgrade its Green Box Sites to include areas for the drop-off of all the material categories listed below.

Material Category	Tons Generated	Estimated Collection Rate ¹	Tons Collected
Organics	7,058	0.5%	35.3
OCC	1,060	25%	264.9
Other Fibers	2,041	20%	408.2
Glass	596	3%	14.9
PET	509	25%	127.2
HDPE-N	115	25%	28.8
HDPE-C	154	25%	38.5
Mixed #1-#7	639	5%	32.0
Other Plastics	2,451	3%	61.3
Aluminum Cans	137	25%	34.3
Ferrous Cans	291	25%	72.8
Mixed Metals	524	5%	26.2
Other Residue	10,785	3%	269.6
Total	26,361	100%	1,414

(1) Recovery of Organics, Mixed/Other Plastics and Residue assume non-program materials that are included in collected single stream materials



9.3.2 Curbside Recycling

If the County were to implement every-other-week single stream residential curbside recycling collection, without charging residents an additional opt-in fee, but rather including the costs in the solid waste management budget, it could reasonably expect to collect and recover the following material volumes:

The Curbside Recycling model assumes that the Enhanced Drop-Off model is also in place.

Material Category	Tons Generated	Estimated Recovery	Tons Recovered
Organics	7,058	0.9%	63.5
OCC	1,060	45%	476.8
Other Fibers	2,041	36%	734.8
Glass	596	5%	26.8
PET	509	45%	229.0
HDPE-N	115	45%	51.8
HDPE-C	154	45%	69.3
Mixed #1-#7	639	9%	57.5
Other Plastics	2,451	5%	110.3
Aluminum Cans	137	45%	61.8
Ferrous Cans	291	45%	131.0
Mixed Metals	524	9%	47.2
Other Residue	10,785	5%	485.3
Total	26,361	100%	2,545

9.3.3 Curbside Recycling with Commercial Recycling

It is assumed that slightly better recovery and/or participation would occur from the residential side if additional commercial recycling were also implemented in the County. As the tonnage estimates originate from residential generators, this slight growth is still counted as coming from the residential tonnages (and composition), giving us the final estimation of possible tonnage collections of residential single stream recycling as the following:

Material Category	TPY	Estimated Recovery	TPY
Organics	7,058	1.0%	70.6
OCC	1,060	50%	529.8
Other Fibers	2,041	40%	816.4
Glass	596	5%	29.8
PET	509	50%	254.5
HDPE-N	115	50%	57.6
HDPE-C	154	50%	77.0
Mixed #1-#7	639	10%	63.9
Other Plastics	2,451	5%	122.5
Aluminum Cans	137	50%	68.7
Ferrous Cans	291	50%	145.5
Mixed Metals	524	10%	52.4
Other Residue	10,785	5%	539.3
Total	26,361	100%	2,828

This represents over 10% of the total residential waste MSW stream and equals approximately 252 lbs. of recyclables per occupied household in the County per year. This is a very robust number and would require significant participation and education, but this is used to show the potential for diversion from the MSW to save on hauling and disposal costs.

9.4 Commercial Recycling

It is assumed that if a County MRF is built, there will be some participation by Commercial businesses to also collect single stream materials and bring them to the MRF. It is estimated that a small amount would be brought to the MRF in addition to the collected residential single stream in both residential scenarios. The final tonnage estimate is that if commercial recycling collections were implemented as part of the collection requirements, this should greatly increase the total tonnage of recyclables collected. (The final estimated recovery percentages for the last commercial collection scenario is similar to the recovery percentages shown in the final residential collections estimate in the table above). The total assumed collected commercial recyclables are shown in the table below:

Material Category	Total Commercial Tons	Commercial TPY with Enhanced Residential Drop-Off	Commercial TPY with Residential Curbside	Commercial TPY w/ Increased Commercial Collections
Organics	4,738	9.5	16.6	47.4
OCC	2,309	230.9	404.1	1,154.6
Other Fibers	1,657	132.5	231.9	662.7
Glass	330	3.3	5.8	16.5
PET	336	33.6	58.9	168.2
HDPE-N	122	12.2	21.4	61.2
HDPE-C	83	8.3	14.5	41.3
Mixed #1-#7	1,580	31.6	55.3	158.0
Other Plastics	3,146	31.5	55.1	157.3
Aluminum Cans	74	7.4	13.0	37.2
Ferrous Cans	143	11.4	20.0	57.2
Mixed Metals	765	15.3	26.8	76.5
Other Residue	9,789	97.9	171.3	489.4
Total	25,074	626	1,095	3,128

9.5 Total Recycling Volume

The following table shows the total volume of recycled material collected based on the implementation of programs and capture of the various waste streams.

Material Category	Total MSW Tons ¹	Total TPY with Enhanced Residential Drop-Off	Total TPY with Residential Curbside	Total TPY w/ Increased Commercial Collections
Organics ²	11,796	44.8	80.1	118.0
OCC	3,369	495.8	880.9	1,684.4
Other Fibers	3,698	540.7	966.7	1,479.1
Glass	926	18.2	32.6	46.3
PET	845	160.9	287.9	422.7
HDPE-N	238	41.0	73.3	118.8
HDPE-C	237	46.8	83.8	118.3
Mixed #1-#7	2,220	63.6	112.8	222.0
Other Plastics	5,597	92.7	165.3	279.9
Aluminum Cans	212	41.8	74.8	105.9
Ferrous Cans	434	84.2	151.0	202.7
Mixed Metals	1,290	41.5	74.0	129.0
Other Residue	20,574	367.5	656.6	1,028.7
Total	51,434	2,040	3,640	5,956

(1) This is slightly different than the assumed 51,402 TPY of MSW for the transfer station tonnages due to rounding in the composition percentages

(2) The Organics indicated here are materials that are inadvertently placed in the single stream bins and not part of any separate organics collection that is discussed in a separate section

These totals are used to estimate the tons processed at the MRF (as well as the residue).

9.6 Total Recycling Recovery

As indicated in the above tables, the collected single stream will also contain non-program materials such as Organics and Other Residue, as well as materials that may not have a market and may not be recovered at the MRF, such as Mixed Plastics. In addition, not all recyclable items will be recovered at a MRF. Some get missed or placed in the wrong materials, meaning that 100% recovery of the incoming materials is not practical or possible. The MRF processing model looks at the estimated incoming materials and assumes they have an average composition similar to the single streams from Kent and Mecklenburg Counties (that also have a mix of residential and commercial single stream). The model also estimates the recovery based on other manual or equipment sorting from other similar MRFs. If the incoming tonnage is a little less than expected, it is possible that manual recoveries might be slightly higher, but this should give a good estimate of recovery at the designated tonnages.

The processed single stream tons are shown again in the table below:

Scenarios	Residential Single Stream TPY	Commercial Single Stream TPY	Total Collected Single Stream TPY
Enhanced Drop-Off (Option 1)	1,400	600	2,000
Curbside Collection (Res.) (Option 1)	2,500	1,000	3,500
Curbside w/ Commercial (Option 2)	2,800	3,200	6,000

9.6.1 Enhanced Drop-Off Single Stream Recovery

The total tonnage of the 2,000 TPY of single stream from the Enhanced Drop-Off Only estimated to be recovered from the Option 1 MRF are shown in the table below⁷:

Material Category	Total Processed Tons (TPY)	Recycling Recovery (%)	Recovered Tons (TPY)	Residue (TPY)
Organics	44	0.0%	0	44
OCC	610	75.0%	457	30
Other Fibers ¹	492	75.0%	491	123
Glass ²	117	25.0%	29	88
PET	107	75.0%	80	27
HDPE-N	33	85.0%	28	5
HDPE-C	58	85.0%	49	9
Mixed #1-#7	81	0.0%	0	81
Other Plastics	68	0.0%	0	68
Aluminum Cans	29	75.0%	22	7
Ferrous Cans	41	90.0%	37	4
Mixed Metals	20	75.0%	15	5
Other Residue	298	0.0%	0	298
Total	2,000		1,210	790

- (1) Some of the OCC will end up in the Mixed Fiber (roughly 20% of the OCC tonnage) so that skews the tonnage total of the Mixed Fibers from the incoming mixed fiber amount. This is true for all three scenarios
- (2) It is assumed that some glass bottles are in the recycling stream and could be recovered whole on the sort conveyor for eventual processing by the optional glass system

The diversion of 1,210 tons of recyclables is used in the Fiscal Implication section to calculate the savings from not having to haul this tonnage to a landfill as well as an estimate of the value of the commodities.

⁷ Please note that in typical MRF operations, a small percentage of plastics, organics and residue do end up in some of the commodities. This dynamic is not accounted for in the analysis.



9.6.2 Curbside Recycling

The total tonnage of recyclables recovered from the Option 1 MRF and assuming 3,500 tons of incoming single stream collected from the implementation of Curbside Recycling are shown in the table below:

Material Category	Total Processed Tons (TPY)	Recycling Recovery (%)	Recovered Tons (TPY)	Residue (TPY)
Organics	77	0.0%	0	77
OCC	1,067	75.0%	801	53
Other Fibers	861	75.0%	859	215
Glass	205	25.0%	51	154
PET	188	75.0%	141	47
HDPE-N	58	85.0%	49	9
HDPE-C	101	85.0%	86	15
Mixed #1-#7	143	0.0%	0	143
Other Plastics	119	0.0%	0	119
Aluminum Cans	51	75.0%	38	13
Ferrous Cans	72	90.0%	65	7
Mixed Metals	35	75.0%	26	9
Other Residue	522	0.0%	0	522
Total	3,500		2,117	1,383

9.6.3 Curbside Recycling with Commercial Recycling

The total tonnage of recyclables recovered from the Option 2 MRF and assuming 6,000 tons of single stream collected from the implementation of Curbside Recycling with Commercial Recycling are shown in the table below:

Material Category	Total Processed Tons (TPY)	Recycling Recovery ¹ (%)	Recovered Tons (TPY)	Fines/Organics (TPY) ²	Residue (TPY)
Organics	131	0.0%	0	105	26
OCC	1,830	75.0%	1,372	0	91
Other Fibers	1,477	75.0%	1,473	148	221
Glass	351	25.0%	88	246	18
PET	322	75.0%	241	6	74
HDPE-N	100	85.0%	85	0	15
HDPE-C	174	85.0%	147	0	26
Mixed #1-#7	244	0.0%	0	12	232
Other Plastics	205	0.0%	0	10	194
Aluminum Cans	88	90.0%	79	2	7
Ferrous Cans	124	90.0%	111	0	12
Mixed Metals	60	75.0%	45	0	15
Other Residue	895	0.0%	0	90	806
Total	6,000		3,643	619	1,739

- (1) The additional equipment should help with enhanced recovery of some of the items, especially Aluminum
- (2) The Option 2 MRF has a fines screen to help separate materials and protect equipment which will produce a separate stream, but currently is assumed to be residue

There are significant tons of mixed plastics and other plastics (nearly 500 TPY) that are assumed to be in the recycling single stream as contamination from “wish cycling,” placing materials in recycling bins because they may be recyclable even if they are not, or from simple material misplacement. It is assumed that this would need to be treated as residue, but if other outlets could be found for these materials (even at \$0 net sales revenue), they could also be collected at the MRF (depending on the availability of the sorters) and would increase the diversion from landfill. Again, the revenue from these commodities and the savings from not hauling and landfilling the diverted tons (3,643 in this scenario) are discussed in the Fiscal Implication section.

9.7 Fiscal Implication

It is assumed that the MRF would be co-located with the Transfer Station and would require approximately 5 acres of space. The estimated building size required for all MRF options is 18,000 ft². For option 1, where there is less single-stream material being processed, it is assumed that the throughput of the equipment will be approximately 2 tons per hour. Functioning with 6 hours⁸ of actual material processing per day, this

⁸ 6 hours of runtime allows for breaks, maintenance, and stoppages due to jams or material issues over an 8-hour shift. 7 hours of runtime is considered the max runtime without incurring overtime costs.

equates to a capacity of roughly 3,100 TPY. As shown in the table above, the enhanced drop-off tonnage estimate is roughly 2,000 TPY of single-stream. This scenario may require slightly less staffing or part-time staffing during the heavier recycling collections months (usually summers and around the holidays). A single shift with a runtime of 7 hours per day has a capacity of 3,640 TPY and would cover the tonnages assumed in the second scenario with County curbside collections of single-stream. The equipment for these two scenarios is Option 1, as discussed previously.

The final scenario where there is additional commercial recycling collected would require some equipment enhancements to the processing system to handle the additional tonnages (this is Option 2 as discussed before). Option 2 would add an OCC screen to recover cardboard and a fines screen to remove small materials from the stream to improve commodity recovery, as well as an eddy current separator (ECS) to recover aluminum cans. This additional equipment should increase the capacity of the MRF to approximately 4 TPH, but this would need to be verified with the equipment manufacturer. (As stated before, Option 1 equipment should be designed with Option 2 equipment in mind so it could be added after construction if deemed desirable in the future).

Facility Assumptions – Capital Costs

- Building square footage is estimated to be 18,000 ft on a 5-acre site adjacent to the transfer station.
- The building cost is only for a clear-span metal building with doors and the cement requirements for the tip area and equipment processing structures.
- Site preparation costs include utilities, roads, and additional infrastructure for the building. Due to the location of the transfer station, utilities are assumed to be close by.
- Equipment costs do not include a scale and scale house(s), as it is assumed that the transfer station scales can be utilized.
- Site Prep costs also include permitting costs, as most are assumed to be included in the transfer station permitting, so the building would only require structural and fire permits.
- Equipment includes the processing system equipment and standard fire suppression requirements.
- The total breakdown of the up-front MRF capital costs (with no additional contingency) is shown below in Table 9 for the two processing options.

Table 9 - Total breakdown of Fixed Initial Capital Costs

Cost Item	Dollar Cost Option 1	Dollar Cost Option 2
Building & Flooring (\$156/sq. foot)	\$2,800,000	\$2,800,000
Additional Site Prep Costs Estimate	\$800,000	\$800,000
Equipment Cost and Installation (Option 1)	\$2,000,000	\$2,500,000
Total	\$5,600,000	\$6,100,000

- Option 1 equipment includes an infeed chain belt conveyor, a sort conveyor on a bunker platform, two transfer conveyors, a magnet, and a baler with a separate infeed conveyor.
- Option 2 includes all of Option 1 equipment as well as an OCC and Fines screen, an ECS unit, and an additional transfer conveyor for recovered materials.

9.7.1 MRF Operational Costs (Annual)

Operational costs are the annual costs associated with the operations of the MRF. This includes the cost of labor, rolling stock costs, and maintenance of the facility. These tend to be relatively steady annual costs and can be refined as actual labor needs and rolling stock prices are quoted.

Assumptions for the operating costs are as follows:

- The facility would operate for 260 days/year with a single 8-hour shift. The actual operational time (runtime) of the equipment will depend on the amount of single stream received that day.
- Hauling and disposal of any generated residue would be collected in roll-off boxes and hauled to the adjacent transfer station. Hauling and disposal costs were not calculated for the MRF as it is internal and not necessarily going over scales.
- Five (5) roll-off boxes are assumed to be purchased for the transfer of residue and for the collection of certain recyclables, such as mixed metals.
- Building capital costs are amortized over the 30-year lifetime of the facility at 6.0% interest.
- Rolling stock equipment is amortized over the assumed 6-year lifespan of the equipment⁹ at a 4.5% lending rate.
- The cost model includes a 10% contingency on operations and maintenance (O&M).
- Office expenses represent administrative costs associated with the operation of the MRF but no other county operations.
- Facility security is assumed to be already maintained by Authority Personnel for the transfer station site.
- Insurance is based on 1.0% of Building and Equipment and Labor Annual Costs. It should be noted that an increase in the number of fires at facilities due to lithium-ion batteries may increase this assumption in the near future.
- Sales Tax is assumed to be 0% on supplies.
- Labor applies the total annual cost of an employee, including benefits and employer-paid taxes. Salaried employees did not receive an overtime adjustment.
- It is assumed that this rolling stock would be sufficient for both processing options.

Table 10 – Estimated Rolling Stock Capital Costs

Capital Stock	Unit Cost	Quantity	Total Cost	Annual Cost
Front End Loader	\$330,000	1	\$330,000	\$62,861
Forklift	\$25,000	1	\$25,000	\$9,524
Man-Lift for Maintenance	\$8,000	1	\$8,000	\$1,524
Roll-off boxes (lot of 5)	\$25,000	1	\$25,000	\$4,762
		Total	\$413,000	\$78,671

- It is assumed that the labor would be the same for either processing option, as the equipment would make recovery of OCC and Aluminum much more efficient, the sort labor would be required at other locations due to the increased tonnage throughput (namely PET and Mixed Fiber sort locations).
- The MRF would require a facility manager and a shift supervisor, although these leaders could occasionally work on other aspects of the overall county site (such as glass crushing and compost operations).

⁹ The rolling stock may last longer than the indicated lifespan but frequently will require major overhauls and/or repairs at this juncture making the annual cost similar to the estimated annual cost.



Table 11 - Labor Estimates and Associated Costs¹

Personnel	Number of Personnel	Total Annual Cost
Facility Operations Manager	1	\$128,029
Shift Supervisors	1	\$94,337
Wheel Loader Operators	1	\$75,470
Sorters	10	\$400,452
Baler Operator	1	\$53,394
Maintenance Supervisor / Mechanic	1	\$80,090
General Laborer	1	\$40,045
Total		\$871,817

(1) Costs are slightly different than for the labor for the transfer station as limited overtime is assumed needed for this operation

The other operation costs consist of line items such as the above-mentioned administrative costs, building maintenance, water, sewer, fuel, insurance, etc. The total annual operating costs (without labor) are shown below in Table 12. This assumes a county-owned and operated facility. The costs between options 1 and 2 are slightly different, mostly due to the increased costs of equipment maintenance.



Table 12 – Operations and Maintenance Costs (without Labor)

Facility Cost	Annual Cost – Option 1	Annual Cost – Option 2
Equipment Parts and Maintenance	\$80,000	\$100,000
Supplies	\$3,000	\$3,000
Utilities (gas, water, sewer)	\$5,955	\$7,566
Mobile Equipment Fuel	\$45,150	\$45,150
Mobile Equipment Maintenance (Routine)	\$20,650	\$20,650
Environmental Testing/Monitoring	\$15,000	\$15,000
Plant Rental / Leasing	\$8,718	\$8,718
Safety Supplies	\$8,718	\$8,718
Subtotal Facility Costs	\$187,192	\$208,802
Other O&M Costs	Annual Cost – Option 1	Annual Cost – Option 2
Office expense	\$6,000	\$6,000
Building Maintenance and Repairs	\$56,000	\$56,000
Security Expense	\$0	\$0
Insurance	\$28,359	\$30,859
State Sales Tax	\$0	\$0
Equipment Replacement Fund	\$0	\$0
Subtotal Other O&M Costs	\$90,359	\$92,859
Total O&M Costs (w/o Contingency)	\$277,551	\$301,661
Contingency (10%)	\$27,755	\$30,166
Total Annual O&M Costs	\$305,306	\$331,827

- It is assumed that the costs for both options are similar, even though the cost per ton is different due to the variety of tonnages coming in. The actual costs may be different as tonnage estimates are refined and actual labor needs and costs are assessed, as labor is one of the largest costs for this type of MRF.
- Rough sorter needs calculations are included in Appendix A – O&M Assumptions for Transfer Station to show the estimated sorter needs for the incoming single-stream commodities.
- Residue costs are assumed to be wrapped into the diversion calculations below in “revenue”. This assumes that only the recovered tonnages are diverted from the transfer station tons, and the difference is the ratio of diverted over collected tons multiplied by the cost of disposal per ton from the transfer station (\$76.64/Ton).

As the budget is refined, all these costs will need to be calculated and estimated based on actual rates and requirements for the County. The summary of these costs is shown in Table 13 below.

Table 13 – Summary of Capital and O&M Costs for Transfer Station

Costs	Est. Annual Cost MRF Option 1	Est. Annual Cost MRF Option 2
Building, Equipment and Grounds Improvement Capital Costs ¹	\$406,834	\$443,158
Rolling Stock Capital Costs	\$78,671	\$78,671
Total O&M (w/o labor) with Contingency	\$305,306	\$331,827
Labor Costs	\$871,817	\$871,817
Total – Annual Capital & O&M Costs	\$1,662,628	\$1,725,474

(1) Annual Cost is Capital Cost amortized over 30 years at 6.0% interest

9.7.2 MRF Operational Revenue (Annual)

As there is no tip fee estimated for the recyclables for this model, the revenue from the sale of commodities is assumed to occur through a third-party broker. The revenue estimate from the sale of commodities is from Mid-Atlantic pricing from November of 2023. It should be noted that these prices can be volatile and should not be relied upon but can give an idea of the cost delta for processing single stream. In addition to the sale of commodities, there is also an inherent savings by not having to haul and dispose of the recovered materials. Not all collected materials are recovered, and some still have residue that needs to be disposed of. The recovery estimate tables are included in Appendix A – O&M Assumptions for Transfer Station.

For each option (and collections scenario), the total recovery of commodities is estimated, and this is assumed to be the total diverted material from the transfer station. The calculated cost per ton for hauling and disposal of waste (for the county-only waste scenario) is \$76.64 per ton, so the assumed savings would be the total tons diverted per year multiplied by the cost of disposal. The results are shown below:

Table 14 – Estimated Commodity Revenue and Disposal Savings with Recycling

	Enhanced Drop-Off Collections (Option 1)	Curbside Residential Collections (Option 1)	Curbside with Commercial Collections (Option 2)
Revenue Estimate (Nov. 2023 Prices)	\$134,010	\$234,518	\$417,965
Estimated Hauling and Disposal Diversion Savings	\$92,720	\$162,261	\$279,170
Total Annual Revenue & Disposal Diversion	\$226,730	\$396,778	\$697,135
Annual Capital and Processing Costs	\$1,662,628	\$1,662,866	\$1,725,474
Net Difference	(\$1,435,898)	(\$1,266,087)	(\$1,028,339)

Table 14 shows that the savings for all the scenarios are in the \$100k range while the costs are in the millions. None of the scenarios created enough savings to cover the annual costs of recovery. The results are shown below along with cost-per-ton for the recovered recyclables.

Table 15 – Cost Difference Between Capital & Operation Costs, Commodity Revenue & Disposal Savings

	Tons Processed	Annual Cost Difference	Cost Difference per Processed Ton
Enhanced Drop-Off Collections (Option 1)	2,000	(\$1,435,898)	(\$717.95)
Curbside Residential Collections (Option 1)	3,500	(\$1,266,087)	(\$361.74)
Curbside with Commercial Collections (Option 2)	6,000	(\$1,028,339)	(\$171.39)

The costs per ton for Option 1 seem to indicate that utilizing the transfer station to collect the recyclables and hauling them to a regional MRF might be less expensive than constructing and operating a local MRF. However, Option 2 indicates that the cost per ton to process recyclables at a local MRF may be near equivalent to hauling the materials to a regional MRF.

9.7.3 Costs and Diversion Savings for Combined MRF, Organics, and Glass

To show the overall best possible scenario, the inclusion of a composting operation for collected source-separated organics along with the separate collection of glass at a location adjacent to the MRF was also calculated to compare the costs to the total possible savings of not having to haul and dispose of this material. The MRF was assumed to be Option 2 and processing 6,000 TPY of recyclables, so the commodity sales would equal the third scenario in Table 14 above at \$697,135.

The costs would include the additional equipment and space required for the compost operations and the crushing of the glass, as well as 2 extra operator-level personnel. It is assumed no net revenue from these materials, but the additional diversion is removed from the materials needing to be hauled and disposed of by the transfer station. A residue estimate of 10% is assumed for both the glass and the organics (which would have to be disposed of through the transfer station). The resulting collections of different materials is estimated to be 12,900 TPY of processed materials from the County MSW.

The results are shown in the tables below:

Table 16 – Annual Costs of MRF with Composting and Glass Recovery

Cost Description	Annual Estimated Costs	Cost per Ton (12,900 TPY)
Total Annual Capital Costs	\$724,030	\$56.13
Operation and Maintenance Costs (w/ Labor)	\$1,434,975	\$111.24
Total Costs	\$2,159,005	\$167.36

Table 17 – Estimated Revenue and Disposal Savings with MRF, Compost and Glass

Revenue Description	Annual Estimated Revenue/Cost	Revenue/Cost per Ton (12,900 TPY)
Revenue Estimate (Nov. 2023)	\$417,965	\$32.40
Estimated Hauling and Disposal Diversion Savings	\$755,105	\$58.54 ¹
Total Annual Revenue & Disposal Diversion	\$1,173,070	\$90.94
Annual Capital and Processing Costs	\$2,159,005	\$167.36
Net Difference	(\$985,935)	(\$76.43)

(1) Calculation is based in incoming tons and counts the disposal of residue from the material processing

A processing cost of \$76.43 per ton for this all-in scenario is surprisingly close to the estimated disposal cost of \$76.64 per ton for MSW at the transfer station. This would make this scenario seem similar in cost to disposing of the materials, but this is already accounted for in the Hauling and Disposal Diversion Savings estimate. To be similar in cost to disposal, this cost difference needs to be close to zero. This could only be achieved by charging a tipping fee for the collected materials or by expanding the MRF to accept additional tonnages of materials from outside of the County to increase the efficiency of the Option 2 system and to increase the recovery of recyclables to increase the overall revenue.

If the MRF can accept outside single stream, and the residue is less than currently anticipated, there will be additional economies of scale that may make the MRF more financially viable for both the recovery of commodities and the diversion of material from the cost of hauling and disposal. This would require a separate study to look at the potential anticipated tonnages and residue rates, but it is unlikely that the above recovery scenarios would be less expensive than the transfer station and disposal option, unless there are drastic changes in the disposal options and costs.

9.8 Additional Considerations

9.8.1 Funding Sources

Funding sources for transitioning a community away from landfill-dominant disposal are expanding. In the past few years, we have seen federal grants from agencies like the EPA, DOE, and USDA, as well as private foundations like the Recycling Partnership, to support local governments in increasing waste diversion.

- **Solid Waste Infrastructure for Recycling (SWIFR), US, EPA¹⁰**

On September 13, 2023, the EPA announced the selectees for the Solid Waste Infrastructure for Recycling grants for Communities and the recipients of the recycling grants for States and Territories. Then, on November 15, 2023, EPA announced the selectees for the Solid Waste Infrastructure for Recycling Grants for Tribes and Intertribal Consortia. [Check out the list of recipients and selectees.](#) The next round of SWIFR funding will likely be made available in 2025. As of the publication of this report, the RFP has yet to be released.

- The entities eligible to apply for the Solid Waste Infrastructure for Recycling Grants for Communities are political subdivisions of states and territories. EPA considers counties, cities,

¹⁰ Source: US EPA SWIFR Grant webpage: <https://www.epa.gov/infrastructure/solid-waste-infrastructure-recycling-grants-communities>

towns, parishes, and similar units of governments that have executive and legislative functions to be political subdivisions of states and territories.

- The Bipartisan Infrastructure Law provides \$275,000,000 total from Fiscal Year 2022 to Fiscal Year 2026 for grants authorized under the Save Our Seas 2.0 Act. Projects funded through the funding opportunity will:
 - Implement the “building a circular economy for all strategy series.”
 - Improve local post-consumer materials management programs, including municipal recycling.
 - Make improvements to local waste management systems.
- Eligible Activities: Materials and waste streams within the scope of this funding opportunity include municipal solid waste, including plastics, organics, paper, metal, glass, and construction and demolition debris. This also includes the management pathways of source reduction, reuse, sending materials to material recovery facilities, composting, industrial uses (e.g., rendering, anaerobic digestion), and feeding animals.
- **The Recycling Partnership (a private foundation)**

The Recycling Partnership works with communities and recycling facilities, including materials recovery facilities, processors, and secondary processors, across the U.S. to improve access, collections, operations, and processing through various grant and technical assistance opportunities. Campbell County would be eligible for all of TRP’s grant programs.

 - [Residential Curbside Recycling Cart Grants](#): Through The Recycling Partnership’s Residential Curbside Recycling Cart Grant, communities are provided grant funding, technical assistance, and the design of education and outreach materials to help advance recycling and improve recycling access and capacity for U.S. residents. Communities considering any of the following three system improvements are encouraged to apply:
 - Implementing a new cart-based curbside recycling program
 - Converting existing bin or bag-based programs to carts
 - Expanding service area to improve access and equity
 - [Residential Drop-Off Recycling Grant Program](#): Communities are provided grant funding, technical assistance, and the design of education and outreach materials to help advance recycling and improve drop-off access and capacity for residents. Communities considering any of the following system improvements are encouraged to apply:
 - Constructing new drop-off sites to expand recycling access.
 - Infrastructure enhancements to connect to regional MRFs or transfer stations through hub-and-spoke model transportation.
 - Converting existing drop-off sites from unstaffed to staffed sites.
 - Implementing commingled compaction for collection efficiency.
 - [Multifamily Recycling Program Grants](#): To advance recycling and increase equity at multifamily properties to develop new and improve existing recycling programs
 - Among other grants that may support MRF development.

9.8.2 Programs and Policies

9.8.2.1 Education

In Campbell County, Virginia, it is crucial to educate residents and businesses about the significance of recycling and composting to support new and expanded waste diversion programs. While quantifying the exact payback of education programs can be challenging, their benefits are most apparent compared to areas with no educational initiatives.

The impact of education may not be immediate, but with sustained or increased investment in education for County residents and businesses, its effects will gradually materialize. Education has the potential to inspire local groups or individuals to invest their time or capital into waste management processes or infrastructure. Additionally, it can reduce contamination in recycling streams, reduce illegal dumping in areas historically affected by this issue, and decrease litter in local waterways.

9.8.2.2 Solid Waste Management Plans (SWMPs)

Should the County decide to divorce its waste management future from the Region 2000 Services Authority, it will need to develop a solid waste management plan to comply with Virginia Code, Article 2 – Solid Waste Management (§ 10.1-1411. Regional and local solid waste management plans), which

Of note to Campbell County if it separates from Region 2000 after July 1, 2007, no permit for a new sanitary landfill, incinerator, or waste-to-energy facility, or an expansion, increase in capacity, or increase in the intake rate of an existing sanitary landfill, incinerator, or waste-to-energy facility shall be issued until the solid waste planning unit within which the facility is located has a solid waste management plan approved by the Board per the regulations, except as provided in subsection (§ 10.1-1411).¹¹ Failure to attain a mandated municipal solid waste recycling rate shall not be the sole cause for the denial of any permit or permit amendment, except for sanitary landfills, incinerators, or waste-to-energy facilities, provided that all components of the solid waste management plan for the planning unit comply with the regulations. While the provisions of this subsection shall not apply to permits or permit amendments required for the operation or regulatory compliance of any existing facility, regardless of type, it will also not cause the delay of any technical or administrative review of pending amendments.

The County should clarify with the Virginia Department of Environmental Quality quickly to determine if it will require the development and approval of a separate Campbell County-only SWMP prior to permitting a new facility. If so, the County should begin developing its own SWMP immediately, as this effort can take up to a year.

9.8.2.3 Other Programs and Policies

To increase the recycling rate, the County may consider implementing hauler requirements, material bans, and recycling mandates for select materials.

¹¹ Source: <https://law.lis.virginia.gov/vacode/title10.1/chapter14/section10.1-1411/>

10 Next Steps

10.1 Transfer Station

Campbell County will need to determine its future solid waste management needs so it can proceed with the construction of a transfer station if that is its preferred path forward. A critical decision point at the beginning of the process will need to be whether the facility should accept waste originating outside of the County or just in-county waste because that decision will influence the facility’s capacity and sizing.

The table below summarizes the estimated costs of the transfer station. It does not include any calculations of revenue offsets from tonnage tipping fees; it is just the facility's gross costs.

Table 18 – Summary of Capital, O&M w/ Labor, and Hauling and Disposal Costs for Transfer Station

Costs	Est. Annual Cost	Est. Cost per Ton ¹	Percentage of Total Cost
Annual Capital Costs	\$791,452	\$15.40	13%
Total O&M w/ Labor	\$1,400,116	\$27.24	23%
Hauling and Disposal Costs	\$3,939,317	\$76.64	64%
Total Annual Costs	\$6,130,885	\$119.27	100%

(1) Calculated based on in-county tonnage only (51,402 TPY)

10.2 Increased Recycling Capabilities and Associated Costs

As it is difficult to make an economic case for the construction of a material recovery facility if it were to exclusively process materials originating in the County, it is worthwhile considering whether or not a regional approach to a recovery facility may be mutually advantageous to the County and its neighboring jurisdictions.

Any additional infrastructure to divert additional materials from disposal via the transfer facility will also require capital and O&M costs, and any residue from these operations that is not diverted still needs to be disposed of using the transfer station. Currently, it appears that the costs of diversion are greater than the savings incurred from not sending that tonnage to the landfill via the transfer station, no matter the scenario.

Keep in mind that the transfer station's costs remain regardless of the additional recycling scenario. (Refer to Table 19 below.) The capital and labor remain the same, and the reduction in hauling and disposal costs by diverting tonnages is reflected in the Total Annual Revenue & Disposal Diversion row, which also includes the revenue from the sale of recyclable commodities.)

Table 19 – Estimated Total Costs with Recycling

Description	Enhanced Drop-Off Collections (Option 1)	Curbside Residential Collections (Option 1)	Curbside with Commercial Collections (Option 2)
Total Annual Revenue & Disposal Diversion ¹	\$226,730	\$396,778	\$697,135
Annual Capital and Processing Costs	\$1,662,628	\$1,662,866	\$1,725,474
Transfer Station Costs	\$6,130,885	\$6,130,885	\$6,130,885
Total Net Difference	(\$7,566,783)	(\$7,396,973)	(\$7,159,224)
Net Cost per Ton ²	(\$147.21)	(\$143.90)	(\$139.28)

(1) This is the combination of sold commodities and the diversion of tons hauled and disposed at the transfer station

(2) Net Cost per Ton is calculated from the overall tonnage collected at 51,402 TPY

Similar to the above, if more diversion is implemented for glass and organics diversion, the increase in diversion costs still outweighs the savings in diverting from hauling and disposal. This is only calculated for materials within Campbell County. Including tonnages from other nearby counties may increase the overall diversion, and the economies of scale could make the overall cost of implementing these diversion projects more palatable on a per ton basis.

Table 20 – Estimated Net Total Costs with Glass and Organics Recovery with Option 2 MRF

Revenue Description	Annual Estimated Revenue/Cost
Total Annual Revenue & Disposal Diversion	\$1,173,070
Annual Capital and Processing Costs	\$2,159,005
Transfer Station Costs	\$6,130,885
Net Diff	(\$7,116,820)
Cost per Ton ¹	(\$138.45)

(1) Calculated from incoming total tonnage of 51,402 TPY.

This scenario cost is only about \$19 per ton more than just the transfer station option, which may be negated with certain tip fees or allowing external tonnages with an accompanying tip fee if the residents of the region desire these facilities and diversion.



11 Appendices

Appendix A – O&M Assumptions for Transfer Station

Processing O & M Estimate	Assumptions	Annual \$	\$/Ton	
Wages & Benefits		\$1,055,655	\$20.54	From Labor estimate page
Equipment Maintenance - Parts	2.5%	\$18,750	\$0.36	of Process Equipment Capital (Not including Rolling Stock)
Processing Plant Supplies	\$250	\$3,000	\$0.06	Allowance for miscellaneous operational supplies (\$83 per month per Transfer Station)
Utilities		\$4,663	\$0.09	Estimated On Utilities Sheet
Fuel Cost (Mobile Equipment)		\$84,822	\$1.65	Estimated on Fuel Sheet
Mobile Equipment Maint.	5.0%	\$66,250	\$1.29	of Capital Rolling Stock
Environmental Testing/Monitoring		\$12,000	\$0.23	(Allowance for Sewer Discharge, Air Monitoring etc.)
Plant Rentals / Leases	1.0%	\$10,557	\$0.21	of labor allowance
Safety Supplies	1.0%	\$10,557	\$0.21	of labor allowance
Total Annual Cost		\$210,598	\$4.10	
Other O&M Costs				
Office Expense	\$250	\$3,000	\$0.06	Assuming added \$250 per month per Transfer Station to existing office expenses
Building Maintenance & Repairs	2.0%	\$52,000	\$1.01	of Building Costs (Allowance for Door, Panel, Roof, HVAC and other costs)
Mobile Equipment Depreciation/Amortization				Estimated Separately and based on Capital Rolling Stock
Security		\$0	\$0.00	Assumed part of Landfill Operations
Insurance	1.0%	\$44,057	\$0.86	of Building, Equipment and Labor
State Sales Taxes	4%	\$3,492	\$0.07	AL rate on Parts, Supplies, Equip. & Bldg... Maintenance, Safety and Office Expenses
MRF Residue Transportation Costs		\$0	\$0.00	Shown Elsewhere
MRF - Residue Landfill Costs		\$0	\$0.00	Shown Elsewhere
Equipment Replacement Fund				Not included
Subtotal Other O&M Costs		\$102,549	\$2.00	
Total Cost Per Ton Operations		\$313,147	\$6.09	



Utilities Estimate for Transfer Station

Cost Description	Cost Calculation	Notes
KWh per ton MSW Process Equipment	0.0	Assuming no processing equipment
KWh per ton Building	1.0	Allowance for 1 building
Tons processed	51,402	
Annual KWH load/Purchased	51,402	
Rate Per kwh	\$0.08	Est.
Total Power	\$4,112	
Potable Water Usage Estimate		
GPM Per Person	0.04	= ~19.2 gallons per person, 8 hour shift
Gallons Per Person per shift	19.20	
Number of Employees	13	
Gallons Per Day	249.60	
Operating days per Year	310.00	
Gallons of Potable Water Consumed/Purchased	68,890	
Rate Per Gallon US	\$0.003	
Potable Water Est.	\$207	
Sanitary Sewer		
Sanitary Sewer Outflow Gallons	27,556	Allocated 40% of Annual Potable
Rate Per Gallon	\$0.0125	
Sanitary Sewer Est.	\$344	
Utility Estimate Summary		
Power Purchased	\$4,112.16	
Potable Water	\$206.67	
Sanitary sewer	\$344.45	
Natural Gas Facility Heating (Not Needed?)	\$0.00	
Total Utilities	\$4,663	



MRF Sort Labor Pick Calculations (without Pre-Sort) (Option 1)

	Tons per Hour	2	Pics per Minute		40			
	Comp	TPH	Lbs per Hour	Items per Lb	Items per Hour	Items per Minute	Sorts needed	Sorters
Organics	2.2%	0.04	87.6	5	437.8	7.3	0.18	
OCC	30.5%	0.61	1,220.0	3.5	4,270.0	71.2	1.78	2
Other Fibers	24.6%	0.49	984.4	12	11,812.2	196.9	4.92	2
Glass	5.9%	0.12	234.1	4	936.3	15.6	0.39	
PET	5.4%	0.11	214.5	18	3,861.3	64.4	1.61	2
HDPE-N	1.7%	0.03	66.4	15	995.6	16.6	0.41	1
HDPE-C	2.9%	0.06	115.7	12	1,388.2	23.1	0.58	
Mixed #1-#7	4.1%	0.08	163.0	18	2,933.7	48.9	1.22	
Other Plastics	3.4%	0.07	136.5	30	4,094.7	68.2	1.71	
Aluminum Cans	1.5%	0.03	58.5	30	1,755.9	29.3	0.73	1
Ferrous Cans	2.1%	0.04	82.4	20	1,648.7	27.5	0.69	0
Mixed Metals	1.0%	0.02	40.2	5	200.8	3.3	0.08	
Other Residue	14.9%	0.30	596.8	5	2,984.2	49.7	1.24	
							Total	8

MRF Total Sorters

Sorting Labor Worksheet		Option 1	Option 2
Sort Station			
Single Stream			
Pre-Sort		2	2
OCC		2	1
Mixed Paper		2	2
PET		2	3
HDPE		1	2
Aluminum Cans		1	0
Ferrous		0	0
Total Sorters per shift		10	10

MRF Recovery Estimates

Residential Enhanced Drop-Off (Option 1 MRF)

	Material	SS Percentages ¹	Tons per Year	Recycling Recovery	Tons Recovered ²	Organics/Fines	Tons Fines / Organics	Residue	Tons Residue	Total
Organics	Organics	2.2%	44	0.0%	0	0.0%	0	100.0%	44	100%
OCC	OCC	30.5%	610	75.0%	457	0.0%	0	5.0%	30	80%
Other Fibers	Mixed Fiber ³	24.6%	492	75.0%	491	0.0%	0	25.0%	123	100%
Glass	Glass	5.9%	117	25.0%	29	0.0%	0	75.0%	88	100%
PET	PET	5.4%	107	75.0%	80	0.0%	0	25.0%	27	100%
HDPE-N	HDPE-N	1.7%	33	85.0%	28	0.0%	0	15.0%	5	100%
HDPE-C	HDPE-C	2.9%	58	85.0%	49	0.0%	0	15.0%	9	100%
Mixed #1-#7	Mixed #1-#7	4.1%	81	0.0%	0	0.0%	0	100.0%	81	100%
Other Plastics	Other Plastics	3.4%	68	0.0%	0	0.0%	0	100.0%	68	100%
Aluminum Cans	Aluminum	1.5%	29	75.0%	22	0.0%	0	25.0%	7	100%
Ferrous Cans	Ferrous	2.1%	41	90.0%	37	0.0%	0	10.0%	4	100%
Mixed Metals	Mixed Metals	1.0%	20	75.0%	15	0.0%	0	25.0%	5	100%
Other Residue	Residue	14.9%	298	0.0%	0	0.0%	0	100.0%	298	100%
					Recycling		Fines		Residue	
					1,210		0		790	2,000

(1) Composition is combination of single stream studies from Mecklenburg County, NC and Kent County, MI



Residential with Curbside (Option 1 MRF)

	Material	SS Percentages ¹	Tons per Year	Recycling Recovery	Tons Recovered ²	Organics/Fines	Tons Fines / Organics	Residue	Tons Residue	Total
Organics	Organics	2.2%	77	0.0%	0	0.0%	0	100.0%	77	100%
OCC	OCC	30.5%	1,067	75.0%	801	0.0%	0	5.0%	53	80%
Other Fibers	Mixed Fiber ³	24.6%	861	75.0%	859	0.0%	0	25.0%	215	100%
Glass	Glass	5.9%	205	25.0%	51	0.0%	0	75.0%	154	100%
PET	PET	5.4%	188	75.0%	141	0.0%	0	25.0%	47	100%
HDPE-N	HDPE-N	1.7%	58	85.0%	49	0.0%	0	15.0%	9	100%
HDPE-C	HDPE-C	2.9%	101	85.0%	86	0.0%	0	15.0%	15	100%
Mixed #1-#7	Mixed #1-#7	4.1%	143	0.0%	0	0.0%	0	100.0%	143	100%
Other Plastics	Other Plastics	3.4%	119	0.0%	0	0.0%	0	100.0%	119	100%
Aluminum Cans	Aluminum	1.5%	51	75.0%	38	0.0%	0	25.0%	13	100%
Ferrous Cans	Ferrous	2.1%	72	90.0%	65	0.0%	0	10.0%	7	100%
Mixed Metals	Mixed Metals	1.0%	35	75.0%	26	0.0%	0	25.0%	9	100%
Other Residue	Residue	14.9%	522	0.0%	0	0.0%	0	100.0%	522	100%
					Recycling		Fines		Residue	
	Total	100.0%	3,500		2,117		0		1,383	3,500

Curbside with Commercial (Option 2 MRF)

	Material	SS Percentages ¹	Tons per Year	Recycling Recovery	Tons Recovered ²	Organics/Fines	Tons Fines / Organics	Residue	Tons Residue	Total
Organics	Organics	2.2%	131	0.0%	0	80.0%	105	20.0%	26	100%
OCC	OCC	30.5%	1,830	75.0%	1,372	0.0%	0	5.0%	91	80%
Other Fibers	Mixed Fiber ³	24.6%	1,477	75.0%	1,473	10.0%	148	15.0%	221	100%
Glass	Glass	5.9%	351	25.0%	88	70.0%	246	5.0%	18	100%
PET	PET	5.4%	322	75.0%	241	2.0%	6	23.0%	74	100%
HDPE-N	HDPE-N	1.7%	100	85.0%	85	0.0%	0	15.0%	15	100%
HDPE-C	HDPE-C	2.9%	174	85.0%	147	0.0%	0	15.0%	26	100%
Mixed #1-#7	Mixed #1-#7	4.1%	244	0.0%	0	5.0%	12	95.0%	232	100%
Other Plastics	Other Plastics	3.4%	205	0.0%	0	5.0%	10	95.0%	194	100%
Aluminum Cans	Aluminum	1.5%	88	90.0%	79	2.0%	2	8.0%	7	100%
Ferrous Cans	Ferrous	2.1%	124	90.0%	111	0.0%	0	10.0%	12	100%
Mixed Metals	Mixed Metals	1.0%	60	75.0%	45	0.0%	0	25.0%	15	100%
Other Residue	Residue	14.9%	895	0.0%	0	10.0%	90	90.0%	806	100%
					Recycling		Fines		Residue	
	Total	100.0%	6,000		3,643		619		1,739	6,000

Appendix B – Residential Curbside Collection

Single-Stream Curbside Collection

Modern material recovery facilities (MRFs) operating today tend to process two categories of recyclable material streams: single-stream or dual-stream. Single-stream recyclables are where all acceptable recyclable materials are commonly commingled into one bin, and dual-stream recyclables are often grouped into two primary categories in separate bins: 1) containers (plastics, metals, glass, etc.) and 2) fiber-based materials (paper, newspaper, cardboard). While glass is less often on the list of accepted materials, it is still somewhat common to see glass containers acceptable in single- and dual-stream programs; however, glass acceptance is declining. Once the collected materials arrive at a single-stream or dual-stream MRF, the MRF accepts them, sorts them into their component material types, and removes contamination (other residue or non-programmatic materials) that should not have been placed in the recycling bins in the first place.

The majority of MRFs operating in North America process single-stream recyclables because single-stream collection programs are the predominant recyclable material collection method. This method makes the sorting of materials easier on waste generators (customers). The result of the single-stream format was that America saw increased volumes of materials collected nationwide. However, Campbell does not currently offer a single-stream collection format for its residents.

While a uniform stream of materials (like plastics only or metal only) collected in a multi-stream collection format can be run through a MRF for sorting, it begs the question why. If the materials are already source-segregated into their commodities like in a multi-stream collection scheme, why send them through a MRF? Campbell County offers its customers a multi-stream collection scheme (plastics go into a plastics-only dumpster, and metals go in a metals-only dumpster, etc.) at its Concord and Livestock Road rural waste transfer sites. This multi-stream format ensures that the materials require minimal processing, potentially making marketing the materials by the County to brokers/buyers easier. A primary drawback is the contamination level in these material collection locations, which can be very high relative to the purity of a material baled at the MRF and, therefore, would prohibit direct baling from the sources. A strong education and management system is needed to minimize this condition.

Case Study: Charles County

Charles County provides residential recycling programs through curbside collection or delivery by residents to recycling drop-off centers. The curbside residential collection program provided for the unincorporated areas of the County differs from the curbside programs for the Towns of Indian Head and La Plata. The County operates four (4) recycling centers that accept recyclable materials from county residents. The County currently contracts with a privately owned waste collection company to provide curbside residential recyclables and yard waste in unincorporated areas of the County.

Curbside collection is currently available to 48,139 households throughout the County. Due to the growing number of homes within Charles County, annual Route Audits are conducted to identify new growth and determine the expansion of the program. Collection services for residential recyclables and yard waste in the unincorporated areas of the County are paid through an environmental service fee. There are approximately 60,000 households paying the ESF of which approximately 1,500 homes are not being serviced by the County's curbside residential recycling program. Each household within the collection area is provided with a 95-gallon recycling cart to collect their recyclables and to place at the curb for every-other-week collection. Recyclables collected include metal containers, plastic bottles and containers, glass bottles and jars, paper, and cardboard.



The collection company collects the single stream recyclables and hauls them to the Tri-County Recyclables Depot in Hughesville, and then transfers them to the Olive Street Processing Facility located in Capitol Heights, MD.

Records of all materials processed at the facility are provided to the County and are incorporated in the annual Maryland Recycling Act (MRAO).

MRA report. Yard Waste consisting of grass, leaves, and small branches is also collected on a weekly basis, nine (9) months a year, from the same households. The County currently contracts with Calvert Wood Recycling in La Plata, a privately owned company. The facility processes the yard waste into mulch that is then available for purchase to be used in garden and landscape projects throughout the community.

The residential recycling program in unincorporated areas currently has a 66% set-out rate. Additionally, In Calendar Year 2019, Charles County’s Maryland Recycling Act (MRA) recycling was 44.68 percent. The MRA recycling rate exceeds the mandated State recycling goal of 35 percent for a county with more than 150,000. The County recovered 60,672 tons of MRA Recyclables and 251,459 of Non-MRA Recyclables. The MRA calculation only includes MRA Recyclables recovered from MRA Waste.

Curbside Recycling Participation			
Year	House Count	Set Out	Percentage
2019	46,479	26,278	57%
2020	47,554	29,329	62%
2021	48,139	31,925	66%