William Blair

Equity Research
Global Services | Waste and Recycling

October 3, 2024
Industry Report

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Solid Waste and Recycling

One Man's Trash Is an Investor's Treasure: Structural Drivers of Greater Monetization Across the Solid Waste Stream

Contents

Introduction

Leading companies in the solid waste and recycling industry do much more than just pick up garbage and recycling from your curbside collection bins. Investors familiar with these names are likely aware of the positive attributes of their business models, such as strong pricing power, predictability and resilience, and steady earnings and cash flow growth. However, not as much attention has been paid, in our view, to the structural drivers and persistence of these significant advantages, particularly as we see increasing concern over high valuations and limited upside reflected in sell-side ratings (which are roughly split between buy and hold ratings for both WM and Republic Services).

In this report, we explore not only the ***what,*** but also the ***why;*** namely, we analyze the current and future U.S. landfill capacity situation, which suggests that nearly half of all open municipal solid waste landfills, representing over half of all annual tons accepted into landfills today, are currently expected to close by 2050. We dive deeper into state- and region-level analysis that paints an especially troubling picture in the coming decades for the Northeast, where waste exports to other regions are already growing.

As waste generation continues to grow alongside population growth and economic activity, ***we see an imbalance of waste generation (i.e., demand) and landfill disposal capacity (i.e., supply) that is set to tighten in the coming years.*** As a result, we see three main structural themes impacting companies in the North American waste and recycling industry:

1. Vertically integrated owners of existing disposal assets will maintain strong pricing power in their collection and disposal businesses for several years. This will produce consistent price-led revenue growth and margin expansion in the core solid waste and recycling business despite muted volume growth.

2. More sustainable and circular alternatives to landfill disposal (e.g., recycling and other waste diversion alternatives) will increase in importance and volume, as landfill options become more limited and costly and as urgency about environmental sustainability increases. Landfill byproducts like methane will also increasingly be beneficially used and monetized given regulatory support for renewable natural gas (RNG).

3. Ownership of scarce, hard-to-replicate assets at scale will enable the largest waste and recycling companies to strengthen their competitive positioning in an increasingly complex and costly operating environment. This will provide more opportunities for consolidation and investments in efficiency.

As we initiate coverage of three leading solid waste and recycling companies alongside this report (see separate initiation reports for Casella Waste Systems, Republic Services, and Waste Management and a summary of our investment thesis for each on the following page), we believe all three will benefit from these structural themes, which are enabling greater monetization across the entire solid waste and recycling value chain.

In other words, what's inside those bins on your curb may be worth more than you think.

Exhibit 1
Waste and Recycling Industry
Portfolio Manager's Summary of Investment Thesis for William Blair Covered Companies

	Casella Waste Systems, Inc.	Republic Services, Inc.	Waste Management, Inc.
Company Details			
Ticker:	CWST	RSG	WM
Market Cap ($M):	$6,244	$63,443	$83,837
Rating:	Outperform	Outperform	Outperform
Three Key Points of Investment Thesis			
Key Point 1:	Scarce landfill assets in capacity-constrained Northeast (most acute disposal shortage in the country) provide strong pricing power, competitive benefits, and favorable price/cost spread driving margin expansion.	Second-largest portfolio of scarce landfill assets provides strong pricing power, competitive benefits, and favorable price/cost spread, driving margin expansion for recycling and waste business.	Largest portfolio of scarce landfill assets provides strong pricing power, competitive benefits, and favorable price/cost spread, driving margin expansion for collection and disposal business.
Key Point 2:	Meaningful M&A runway with $500M+ pipeline, providing opportunities to increase density and expand into new regions without deviating from core solid waste.	Environmental solutions business potentially accretive to volume, revenue, and EBITDA growth. IIJA, PFAS, and manufacturing rebound could drive volumes; cross-sell and pricing opportunities still have runway.	Accelerated sustainability investments allow greater monetization of the entire solid waste stream; RIN contracts blending up to today's $3+ would drive RNG upside.
Key Point 3:	Organic investments paying off; recycling facility upgrades (Boston completed in 2023, Willimantic in progress, more opportunities in 2025 and beyond), RNG royalties with zero capital at risk (contributions ramping up next few years).	Balanced contributions from circularity/sustainability investments (polymer centers, RNG), and capital-light approach leaves room for future capital deployment (excess cash 6%-11% of market cap by end of 2026).	Stericycle deal provides entry into medical waste market, with structural volume tailwinds (potential for midsingle-digit volume growth) and cost synergy potential.
Typical Growth Algorithm			
Revenue:	Midsingle-digit organic growth, driven by 4%-6% price-led growth and flat/modestly growing volumes, supplemented with M&A	Midsingle-digit organic growth (4%+ core price with modest volume growth for recycling and waste; midsingle-digit growth for environmental solutions), supplemented by M&A	Midsingle-digit organic growth, driven by 3%-5% price-led collection and disposal growth and modest volume growth, supplemented with accelerated investments in RNG and recycling enhancements
Adjusted EBITDA:	40-50+ basis points of annual margin expansion with price ~100 basis points above cost inflation and organic efficiency initiatives	30-50+ basis points for recycling and waste with price ~100 basis points above cost inflation and organic efficiency initiatives; 75+ basis points for environmental solutions	30-50+ basis points of annual margin expansion with price ~100 basis points above cost inflation and organic efficiency initiatives; positive mix shift as RNG projects come online
Free Cash Flow:	10%-15%+ growth, driven both organically and inorganically	High-single-digit organic growth, supplemented with M&A	Mid/high-single-digit growth in core collection and disposal, supplemented with RNG and recycling contributions
Valuation			
EV/EBITDA:	16x WB 2025E	14x WB 2025E	14x WB 2025E
P/FCF:	36x WB 2025E	27x WB 2025E	25x WB 2025E (pro forma for Stericycle; ex. sustainability investments)

Source: William Blair Equity Research

Executive Summary

In conjunction with our initiations of three leading solid waste and recycling companies, this report sifts through the tightening landfill capacity situation in the United States and the associated structural trends that inform our investment thesis on the industry.

Structurally Tightening Landfill Capacity
Despite a municipal solid waste (MSW) stream that continues to grow with increasing population and economic activity, fewer new landfills have been created in recent years. Based on our analysis of EPA data, landfill closures are set to accelerate in the second half of this decade, and ***nearly half of all open MSW landfills are expected to close by 2050*** without expansions. The shortage is particularly pronounced in the Northeast, which is already exporting waste to other regions. As landfill creation and expansion have both become more difficult and capital intensive, we see an imbalance of waste generation and traditional waste disposal capacity that is set to structurally tighten in the coming years.

Strong Solid Waste Price/Cost Fundamentals Should Persist
We believe large-scale ownership of scarce, capital-intensive landfill assets has given large, vertically integrated waste and recycling providers significant pricing power across the waste and recycling value chain. Given the essential nature of waste collection, the relatively small cost to the customer (typically well below 1% of the total cost structure for commercial customers), increasing focus on open-market pricing, and increasingly sophisticated pricing algorithms, we see a long runway for solid waste and recycling providers to maintain pricing power in excess of their costs, driving resilient revenue growth and consistent margin expansion.

More Sustainable Landfill Alternatives Should Increase
Given the structural tightness of disposal capacity and increasing societal focus on environmental sustainability and circularity, we believe a gradually growing percentage of the waste stream will be diverted away from landfills and toward more circular alternatives like recycling and other waste diversion alternatives. We also believe negative byproducts of traditional disposal, like landfill gas, will increasingly be repurposed and used beneficially (i.e., renewable natural gas). As large waste and recycling companies accelerate investments in these areas, we believe this will not only improve the monetization of the entire waste stream, but also extend the life of core landfill assets.

Value Accruing to Largest Players
As holders of scarce assets that are increasingly difficult to replicate, the largest, vertically integrated providers are poised to accrue an increasing amount of value. The operating environment is becoming more complex and costly, driven by intensifying regulatory scrutiny, higher capital intensity, generational challenges, and significant increases in operating costs (e.g., labor and maintenance). While these headwinds disproportionately affect small, less integrated providers, we believe vertically integrated providers can handle the increasing burden by making strategic investments, improving operating efficiency, and acquiring smaller providers. This will drive more value to the largest players as key assets become increasingly concentrated among fewer owners in an oligopolistic market structure.

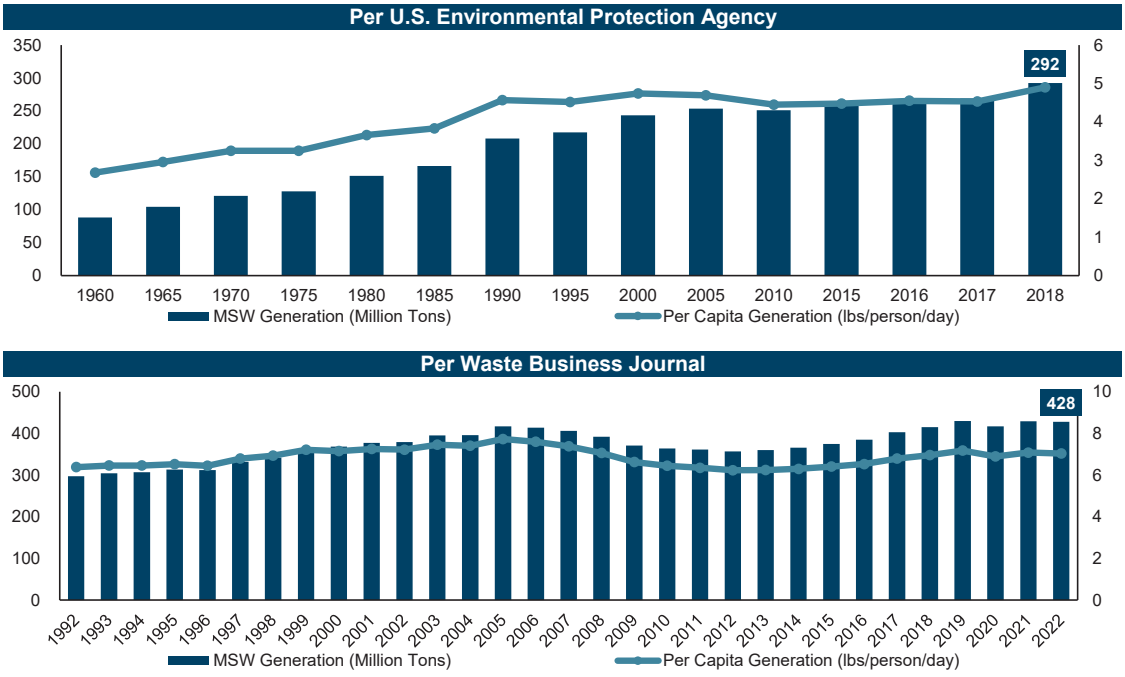
Strong Investment Case for Solid Waste and Recycling Companies
Alongside this industry report, we are initiating coverage of Casella Waste Systems, Republic Services, and Waste Management with Outperform ratings. Given the structural drivers listed above, our long-term outlook includes strong compound earnings growth and durable, resilient cash flow generation as these companies drive greater monetization across the entire solid waste and recycling value chain. While valuations in the sector reflect high quality, we believe average solid waste multiples of 15 times EV/EBITDA and 29 times P/FCF remain reasonable on both an absolute and relative basis compared with other high-quality global services companies with strong competitive moats (see page 40).

A Structurally Tightening Landfill Capacity Landscape

A Growing Waste Stream…

The volume of MSW has grown steadily over time. The most commonly quoted source of waste generation we have seen is from the U.S. Environmental Protection Agency (EPA), which has estimated that total MSW generation was 292 million tons in 2018, or just under 5 pounds per person per day. While this source has not been updated in several years, readily available information from Waste Business Journal (WBJ) suggests that total MSW generation was 428 million tons, or roughly 7 pounds per person per day, in 2022 (based on individual facility surveys of every waste processing and disposal operation across the United States). While the figures are different between the two sources, both suggest a compound annual growth rate (CAGR) of 1.2% for U.S. MSW over roughly the past 30 years (1990-2018 for the EPA data and 1992-2022 for the WBJ data). Both sources also suggest that MSW generation on a per capita basis has held relatively steady the past few decades.

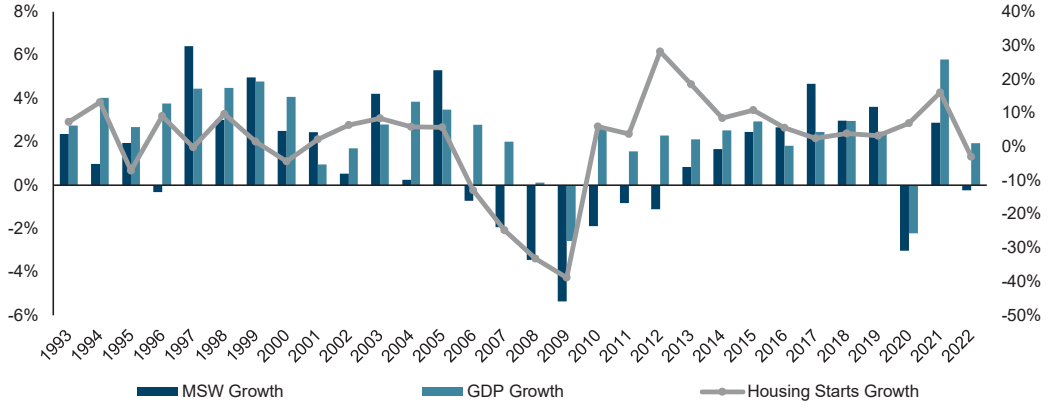
Exhibit 2
Waste and Recycling Industry
U.S. Municipal Solid Waste Generation



Sources: EPA, Waste Business Journal, and William Blair Equity Research

While U.S. population growth has decelerated in recent years, we expect total MSW generation to continue increasing along with population growth and economic activity in the future, albeit at slower rates than in past decades. Year-over-year growth of WBJ's MSW generation estimates had correlation coefficients of 0.68 with U.S. GDP growth and 0.45 with total U.S. housing starts (or 0.56 if lagged by one year) from 1992 to 2022.

Exhibit 3
Waste and Recycling Industry
Year-Over-Year Growth U.S. Municipal Solid Waste Generation and Other Economic Indicators

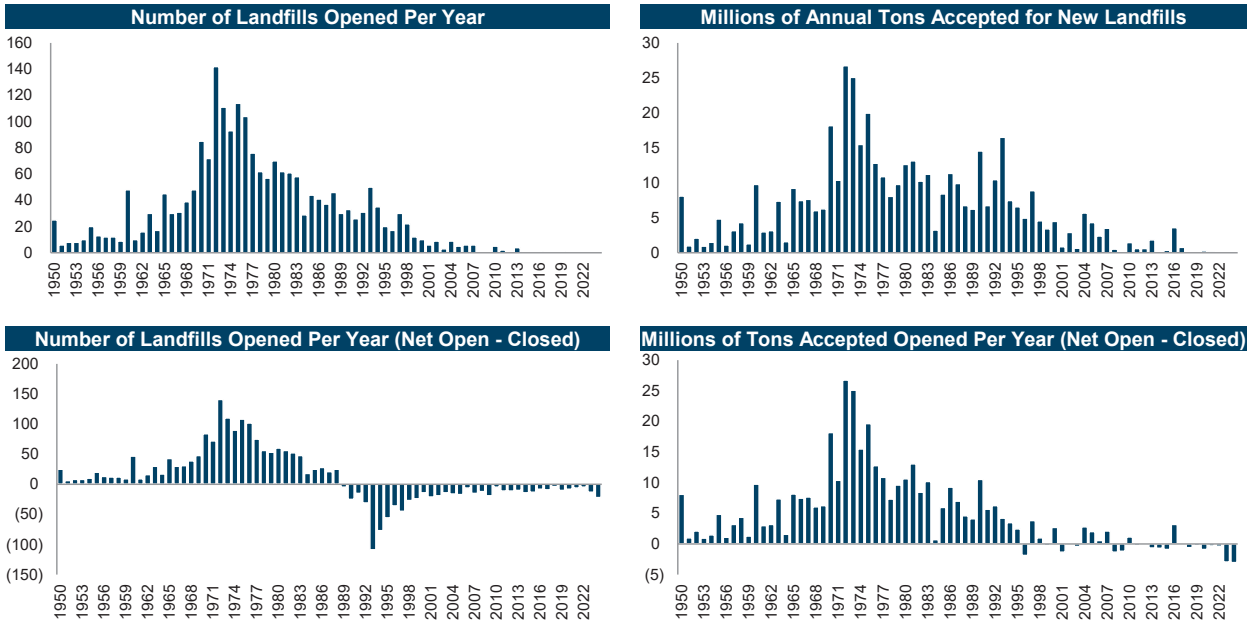


Sources: Waste Business Journal, Federal Reserve of St. Louis, Census Bureau, and William Blair Equity Research

...Yet Shrinking Disposal Capacity...

At the same time, traditional disposal options have become more limited. The EPA's Landfill Methane Outreach Program (LMOP) regularly publishes data on MSW landfills, including location, capacity, ownership, and many other factors. The LMOP database does not include every MSW landfill nor does it include industrial or hazardous waste landfills, but we believe it is one of the most comprehensive, readily available sources of detailed information on MSW landfills. Our analysis of this database suggests that many landfills were developed in the second half of the 20th century, but few new landfills have been created in recent years, as shown in exhibit 4. According to our industry contacts, the siting and permitting process for new landfills has become increasingly difficult in recent decades, as local not-in-my-backyard opposition to landfills and environmental concerns (e.g., unwelcome effects of leachate and leakage of contaminants) have increased. In some cases, we believe it can take several years to reach approval for new landfill permits, and even expansions of current landfills can take upwards of a year to secure approvals. Although we believe recently created landfills have been larger on average than their predecessors, EPA data suggests that the annual tonnage of waste accepted at U.S. landfills has been declining on a net basis for most of the past two decades.

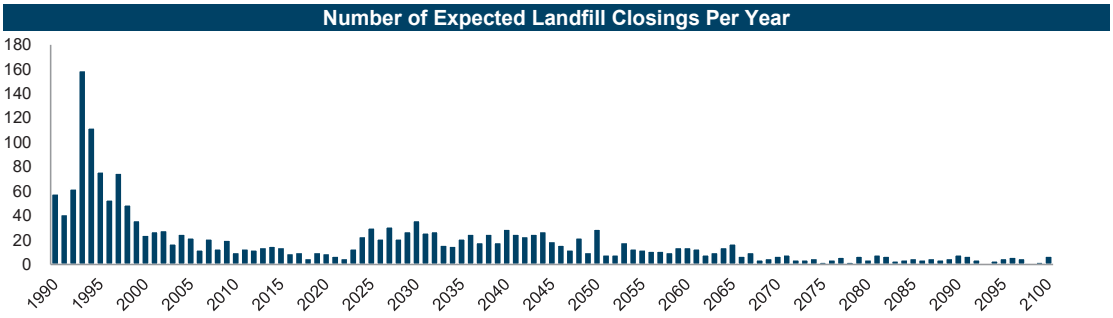
Exhibit 4
Waste and Recycling Industry
Historical Landfill Opening and Closing Statistics, 1950-2024

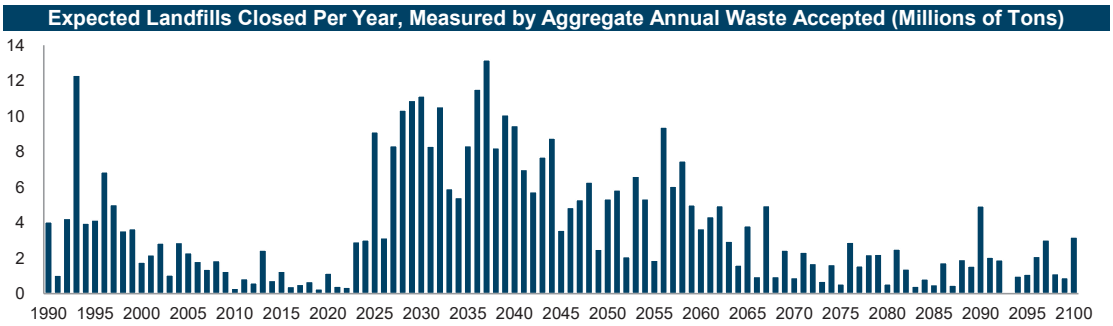


Source: EPA

Despite this declining capacity, our analysis of the EPA database suggests that a growing number of landfills will be closing in the coming years, as currently permitted airspace fills up, expansion permits become more difficult to obtain, and the cost of expanding landfills (capital equipment, surrounding land, regulatory compliance) increases. As shown in exhibit 5, estimated landfill closures noted in the database appear set to accelerate in the second half of the current decade. In total, the EPA lists 594 landfills with expected closing dates between 2025 and 2050, nearly half of the 1,265 landfills listed as being open today. Given the lack of meaningful new landfill creation and increasing difficulty in expanding existing landfills (space constraints, capital intensity, difficulty securing community approval or adjacent land), we see a shortage of waste disposal capacity that appears set to structurally worsen in the coming years.

Exhibit 5
Waste and Recycling Industry
Expected Annual Landfill Closings, 1950-2100

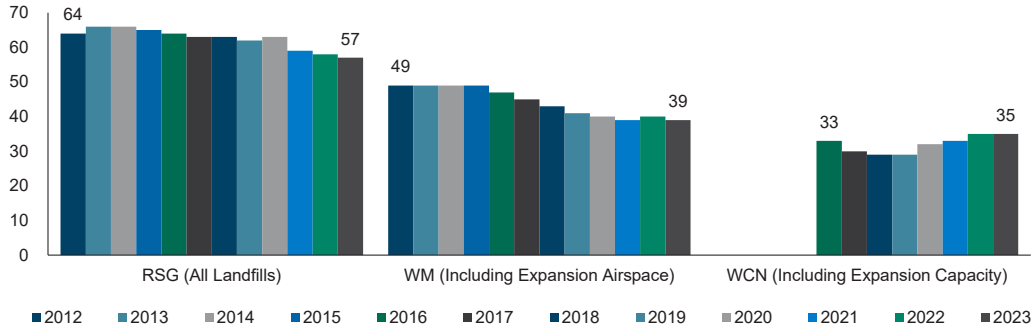




Source: EPA

Similarly, several public waste and recycling companies have reported the estimated remaining life of their landfills, as detailed in exhibit 6. While we do not see an immediate threat to these companies, which own some of the largest landfills in North America with decades of remaining life and have the ability to expand their existing landfill footprint (even if expansions have become more difficult), we believe their total landfill capacity will gradually decline over time.

Exhibit 6
Waste and Recycling Industry
Estimated Average Remaining Landfill Life (Years)



Sources: Company documents

...Has Created a Structural Imbalance

Although the stream of waste generation continues to increase, traditional capacity has contracted and appears set to contract further in the next several years. In exhibit 7, we use the LMOP database and future U.S. population projections from the University of Virginia to create an illustrative

scenario that estimates future supply and demand for landfill tons, based on capacity in place today (i.e., assuming no new capacity is added). If none of these variables were to change, we estimate a shortage of 72 million annual tons by 2030, growing to 178 million tons by 2040 and 245 million tons by 2050 (more than half of the expected demand by 2050). Of course, while we do not project any new capacity in this example (through either expansion of existing landfills or creation of new ones), we believe some new capacity will continue to come online over time out of necessity, likely weighted more heavily to expansions of existing landfills, in our view.

However, as existing landfills continue to fill up and eventually close, we believe new capacity added to the market will likely be pushed farther away from population centers. We believe this will necessitate increasingly larger capital outlays to create landfills and higher operational costs (e.g., transportation) to service them on an ongoing basis; we believe this in turn creates a self-fulfilling prophecy given reduced financial incentives to create new landfills and a shrinking number of market participants with enough capital to invest. Therefore, while these illustrative estimates of a shortage are overstated, our base-case assumption is that existing capacity will continue to close faster than new capacity comes online, resulting in gradual net decreases of capacity and rising concentration among fewer scaled, vertically integrated players that control existing landfills.

Exhibit 7
Waste and Recycling Industry
Illustrative Projected Landfill Supply/Demand Imbalance, Based on Existing Landfills and Currently Expected Closing Dates

Landfill Disposal Supply

	2023	2030	2040	2050
Open Landfills	1,265	1,076	856	648
Period-to-Period Change %		*-14.9%*	*-20.4%*	*-24.3%*
Annual Tons Accepted (Millions)	371	315	224	167
Period-to-Period Change %		*-15.1%*	*-28.9%*	*-25.5%*
Population (Millions)	335	350	362	372
Period-to-Period Change %		*4.4%*	*3.6%*	*2.6%*
Pounds Per Day Per Capita	6.1	4.9	3.4	2.5
Period-to-Period Change %		*-18.7%*	*-31.3%*	*-27.4%*

Generation and Disposal Demand

	2023	2030	2040	2050
Waste Generation Per Capita	6.1	6.1	6.1	6.1
Period-to-Period Change %		*0.0%*	*0.0%*	*0.0%*
Annual Disposal Demand (Millions of Tons)	371	388	402	412
Period-to-Period Change %		*4.4%*	*3.6%*	*2.6%*

Total Surplus/(Shortage)

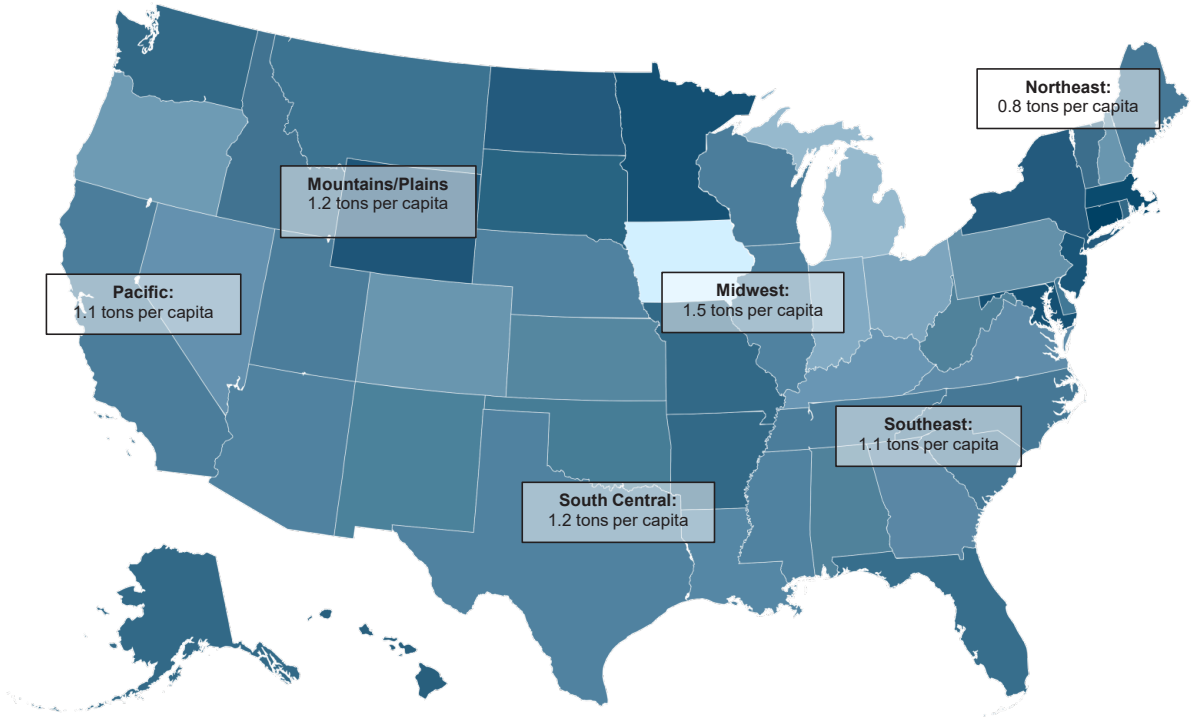
	2023	2030	2040	2050
Capacity Shortage (Millions of Tons)	**0**	**(72)**	**(178)**	**(245)**
% of Annual Demand		*18.7%*	*44.2%*	*59.5%*

Note: This analysis assumes no capacity additions through new landfills or expansion of existing landfills. While this is an unrealistic assumption, we present as an illustrative scenario given inherent difficulty projecting expansions.
Sources: EPA, University of Virginia Weldon Cooper Center for Public Service, and William Blair Equity Research

Severe Shortage in the Northeast, Possibly Spreading to Adjacent Regions

While landfill scarcity is gradually becoming more of a national issue, it is particularly acute in certain regions of the United States. As shown in exhibit 8, which displays states with high landfill tonnage per capita in light colors and states with low tonnage per capita in dark colors, there is a notable variance across different states. Based on our calculations, states with the lowest per-capita tonnage are Connecticut, Massachusetts, Minnesota, Maryland, New Jersey, Wyoming, New York, and North Dakota, which are all accepting less than 3 pounds of waste per person per day into their landfills, less than half the national average. Based on regional classifications used by the Environmental Research & Education Foundation (EREF), five of these eight states are in the Northeast region, which is older and more urbanized than many other regions of the country. This also aligns with population density data from the U.S. Census Bureau, which suggests that the seven most densely populated states are all located in the Northeast (again using the EREF regional classifications), led by New Jersey, Rhode Island, and Massachusetts. Conversely, the four states accepting the highest per capita tonnage (Iowa, Michigan, Indiana, and Ohio) are all in the Midwest region.

Exhibit 8
Waste and Recycling Industry
Estimated Tons of Annual Waste Acceptance Per Capita, by State



Note: States with the greatest tonnage per capita are shown with light colors and states with the least tonnage per capita with the dark colors.
Sources: EPA, EREF, Census Bureau, and William Blair Equity Research

In addition, we believe the situation in the Northeast is set to worsen in the next few decades. As shown in exhibit 9, which aggregates states into the EREF's regional classifications, despite already having the lowest number of landfills and annual tons of waste accepted per capita, the Northeast is also expected to see the largest relative declines in these metrics through 2040. This will reduce the Northeast's accepted tonnage per capita from about two-thirds of the national average today to just over one-half by 2040. The Midwest and Southeast regions, which are already accepting some of the waste exported from the Northeast, will also see declines in per capita capacity through 2040 that are slightly above the national average.

Exhibit 9
Waste and Recycling Industry
Regional Summary of Landfill Metrics, Current vs. Illustrative 2040 Scenario Assuming No Capacity Additions

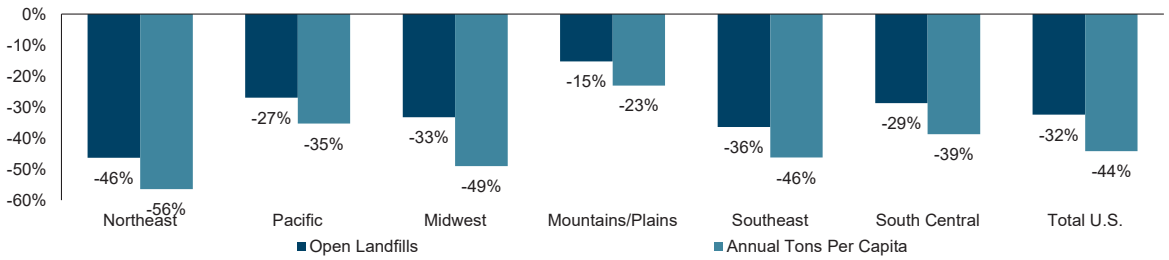
Current

	Open Landfills	Annual Tons Accepted (Millions)	Population (Millions)	Annual Tons Per Capita	Pounds Per Day Per Capita
Northeast	179	57	75	0.8	4.2
Pacific	226	73	66	1.1	6.0
Midwest	319	99	67	1.5	8.0
Mountains/Plains	105	15	13	1.2	6.5
Southeast	239	74	70	1.1	5.9
South Central	174	51	44	1.2	6.3
Total U.S.	**1,242**	**369**	**334**	**1.1**	**6.0**

2040[(1)]

	Open Landfills	Annual Tons Accepted (Millions)	Population (Millions)	Annual Tons Per Capita	Pounds Per Day Per Capita
Northeast	96	26	78	0.3	1.8
Pacific	165	52	73	0.7	3.9
Midwest	213	51	68	0.7	4.1
Mountains/Plains	89	14	15	0.9	5.0
Southeast	152	44	77	0.6	3.1
South Central	124	36	50	0.7	3.9
Total U.S.	**839**	**222**	**361**	**0.6**	**3.4**

Estimated Change in Number of Landfills and Annual Tons Accepted at Open Landfills Through 2040, By Region[(1)]



(1) Assumes no capacity additions through new landfills or expansion of existing landfills. While this is an unrealistic assumption, we present as an illustrative scenario given inherent difficulty projecting expansions.

Sources: EPA, EREF, Census Bureau, University of Virginia Weldon Cooper Center for Public Service, and William Blair Equity Research

Core Investment Thesis for Solid Waste and Recycling Companies

Given the factors discussed above, ***we see an imbalance of waste generation (i.e., demand) and landfill disposal capacity (i.e., supply) that is set to tighten in the coming years.*** As a result, we see three main structural themes impacting companies in the North American waste and recycling industry:

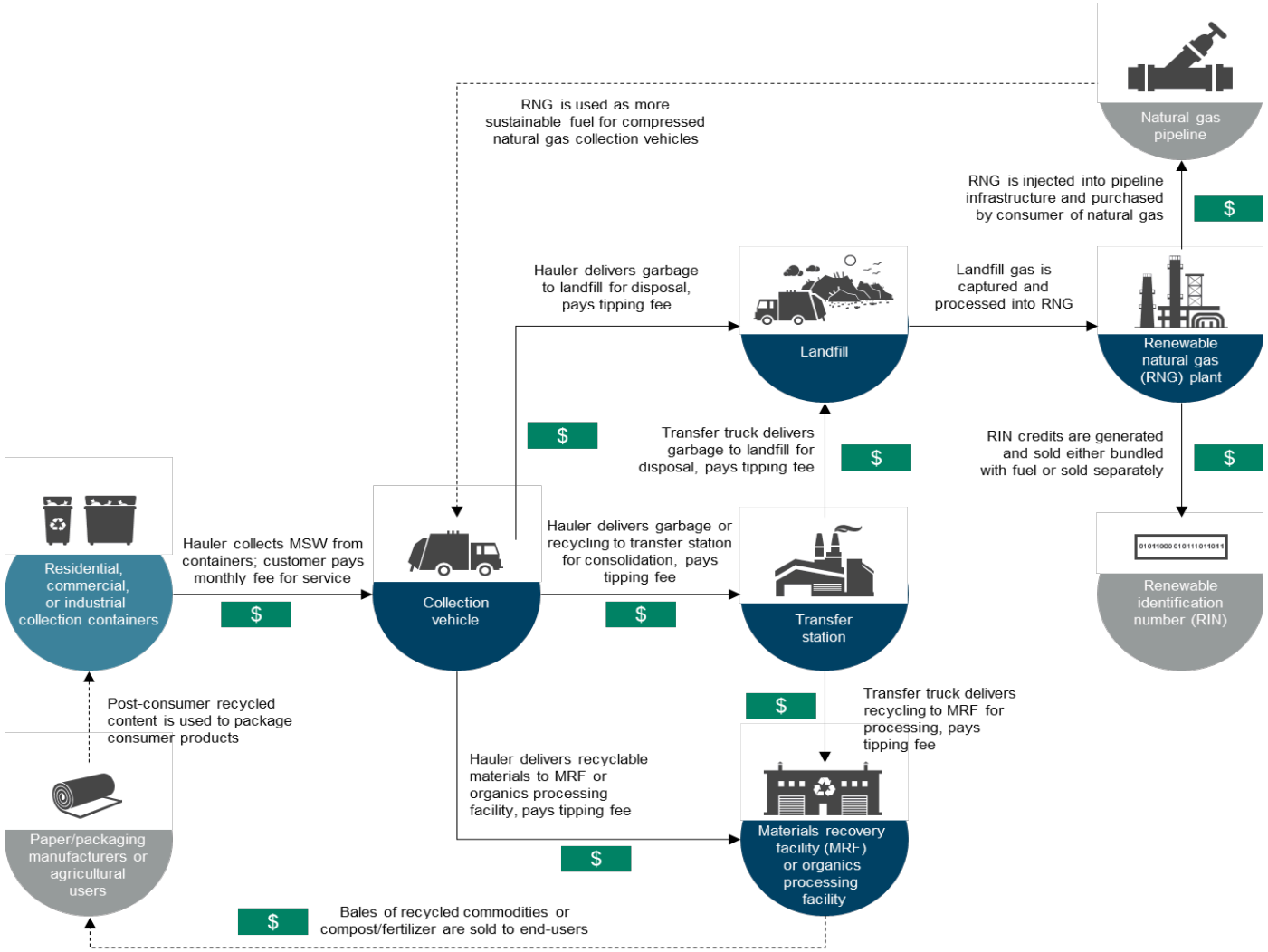
1. Vertically integrated owners of existing disposal assets will maintain strong pricing power in their collection and disposal businesses for several years. This will produce consistent price-led revenue growth and margin expansion in the core solid waste and recycling business despite muted volume growth.

2. More sustainable and circular alternatives to landfill disposal (e.g., recycling and other waste diversion alternatives) will increase in importance and volume, as landfill options become more limited and costly and as urgency about environmental sustainability increases. Landfill byproducts like methane will also increasingly be beneficially used and monetized given regulatory support for renewable natural gas (RNG).

3. Ownership of scarce, hard-to-replicate assets at scale will enable the largest waste and recycling companies to strengthen their competitive positioning in an increasingly complex and costly operating environment. This will provide more opportunities for consolidation and investments in efficiency.

As we initiate coverage of three leading solid waste and recycling companies alongside this report (see initiation reports for Casella Waste Systems, Republic Services, and Waste Management), we believe all three will benefit from these themes, which are enabling greater monetization across the entire solid waste and recycling value chain, as demonstrated in exhibit 10. Each theme is discussed in more detail in the following sections.

Exhibit 10
Waste and Recycling Industry
Simple, Illustrative Step-By-Step Monetization of the Municipal Solid Waste and Recycling Value Chain

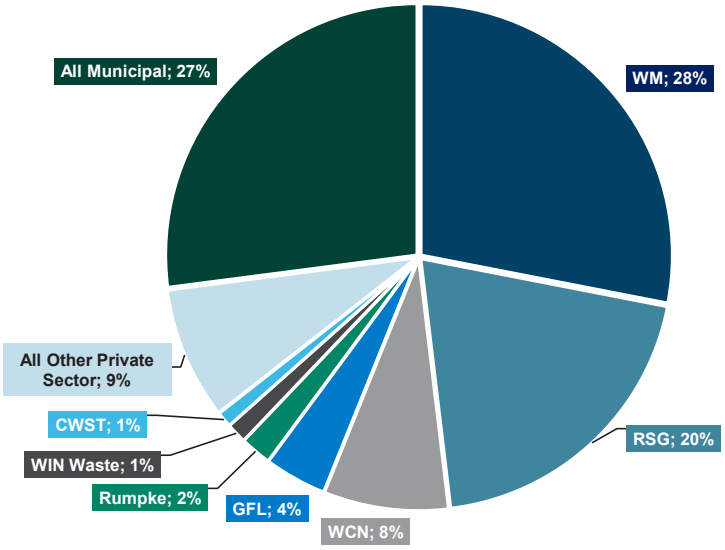


Note: Dollar signs represent monetization opportunities for vertically integrated waste and recycling companies.
Note: Does not include waste incineration, which accounted for 12% of MSW as of the latest EPA data from 2018 and is outside the scope of this report.
Source: William Blair Equity Research

Scarce Assets and Vertical Integration Will Drive Consistent Pricing Power and Margin Expansion

The waste and recycling industry is composed of a few very large competitors and many smaller local or regional providers. We believe ownership of scarce landfill assets is a source of significant competitive advantage for the largest competitors. According to Waste Business Journal, nearly half of all landfill volumes are managed by the two largest companies, WM and Republic. Further, only seven companies (the five public companies, Rumpke, and WIN Waste) manage at least 1% of total volumes. After the 27% managed by municipalities, this leaves less than 10% of total volumes to the remaining privately held providers. Therefore, in an environment in which new landfill airspace is increasingly difficult to obtain, most disposal capacity is concentrated among few players in what we view as an oligopolistic market structure.

Exhibit 11
Waste and Recycling Industry
Share of Total U.S. Landfill Volumes Managed



Source: Waste Business Journal

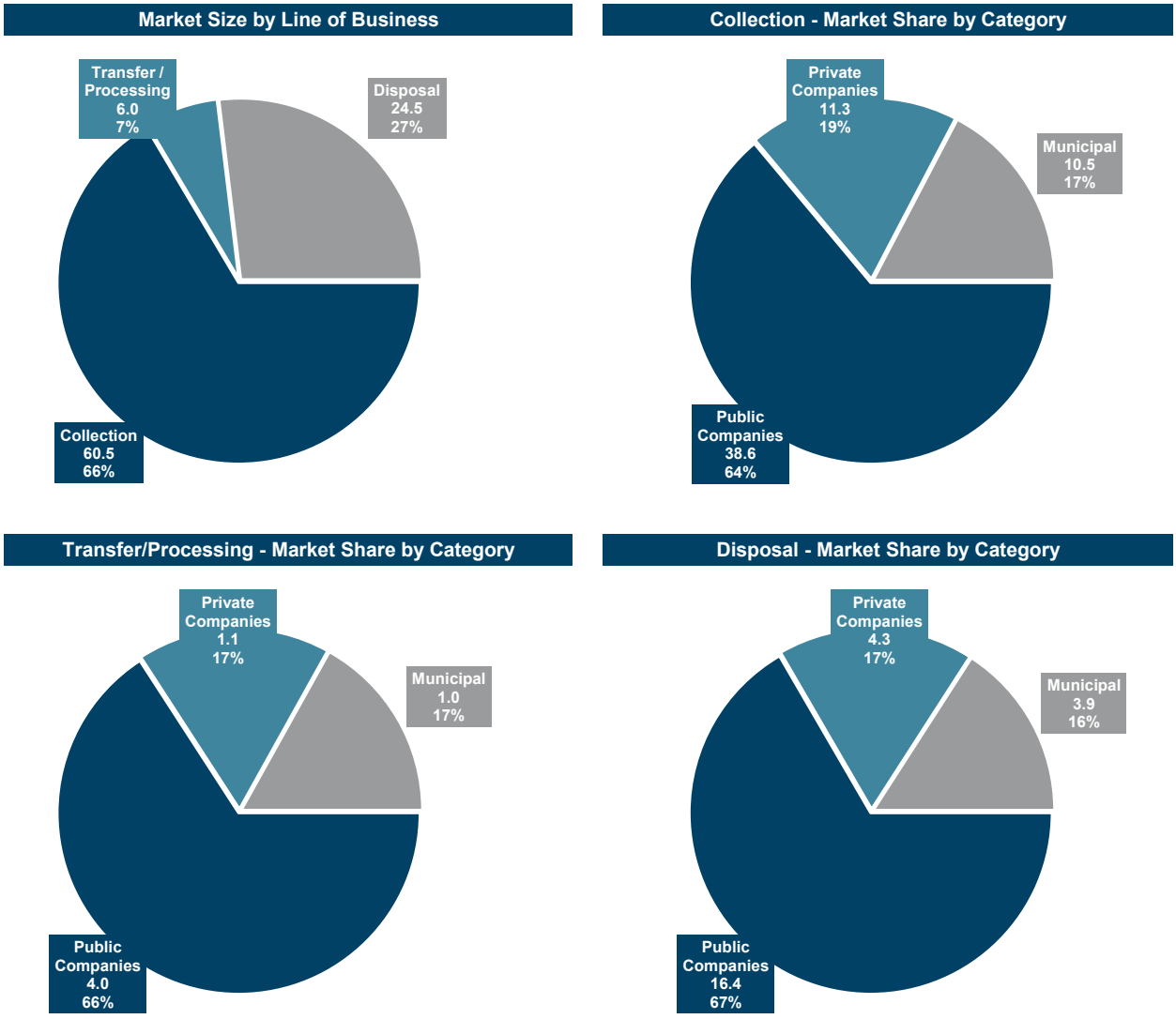
We believe large-scale ownership of these scarce, capital-intensive assets has given large, vertically integrated waste and recycling providers a significant pricing power, as waste haulers that do not own disposal capacity have an increasingly limited set of options. We discuss this and the associated flow-through impacts across the collection and disposal value chain in the remainder of this section.

Vertical Integration Enables Pricing Throughout the Value Chain

In addition to scarcity of disposal assets, vertical integration of the collection, transfer, and disposal businesses of the largest industry players has driven pricing power in the non-landfill portions of these companies. We believe much of the industry's pricing power ultimately manifests through the collection business, which has lower buyer power than the disposal business, making it easier for haulers to push through price increases. The loss of landfill tons also has a greater impact on the bottom line, given the high margins in the disposal business, which can make landfill operators a bit more hesitant to push too hard on price (although landfill pricing has improved recently as data analytics around next-best alternatives has become more robust).

While disposal represented less than 30% of the total waste and recycling industry's $91 billion of revenue in 2022, according to WBJ (see exhibit 12), we believe market shares are fairly similar across the collection, transfer, and disposal business lines, with public companies generating about 65% of industry revenue in each business line.

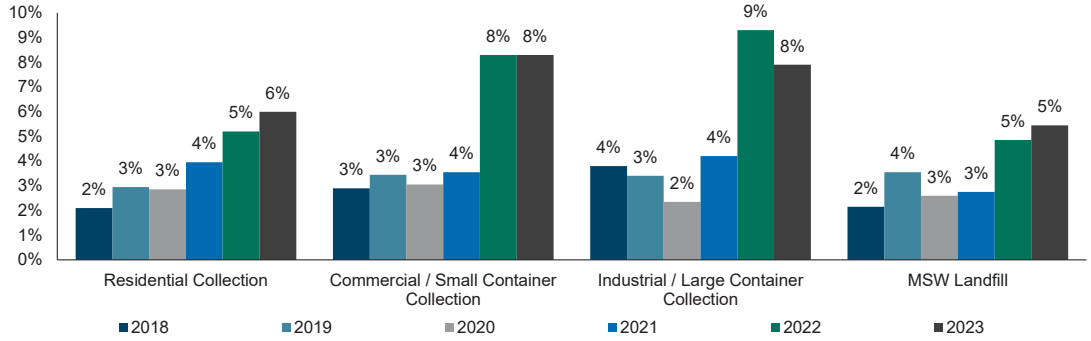
Exhibit 12
Waste and Recycling Industry
Market Size and Share by Line of Business and Category ($M, 2022)



Source: Waste Business Journal

Vertically integrated owners of scarce disposal capacity can internalize collected waste, which increases their competitive positioning. As landfill owners increase their tipping fees, this flows through to higher collection pricing, as disposal costs are often at least 30% of the cost structure for haulers that are not vertically integrated. We believe this enables a rising price environment across the collection landscape. At the same time, this inherently strengthens the margin profile and competitive positioning of the vertically integrated landfill owners because they do not face these increasing disposal costs for the waste they can internalize. Conversely, haulers that are not vertically integrated need to sacrifice margin by absorbing these higher disposal costs to remain competitive.

Exhibit 13
Waste and Recycling Industry
Annual Average Yield on Related Business (Average of RSG and WM)



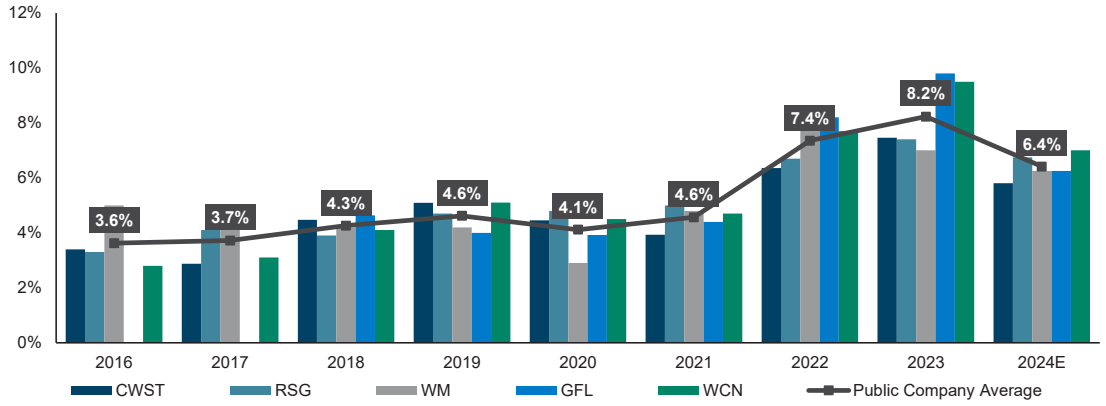
Sources: Company documents and William Blair Equity Research

Essential Service With Low Churn and Recession Resilience

Waste collection and disposal is an essential service, and we believe many collection customers do not want to disrupt the normal course of service by switching providers. Ultimately, waste collection services typically represent a very small percentage (typically well below 1%) of the total cost structure for commercial customers. Therefore, even a significant price increase on a percentage basis is de minimis to the customer on a dollar basis. Further, in many regions (particularly rural areas), customers are presented with few alternatives to their incumbent providers, as competition is limited in these areas. We believe these factors will continue to allow waste collection providers to avoid significant scrutiny on price increases, leading to high retention rates. For example, in the most recent earnings season, Republic disclosed its customer retention rate of 94% and WM disclosed a churn rate of 9% (implying 91% retention).

The essential nature of collection and disposal services, combined with the typical multiyear contract structures across the industry, also provides an annuity-like revenue component with consistent cash flow generation and significant resilience in economic downturns. While volumes typically decline slightly in recessions (particularly in the more cyclical temporary large container and construction and demolition categories), price increases can cushion some of the temporary volume softness.

Exhibit 14
Waste and Recycling Industry
Estimated Year-Over-Year Pricing Metrics

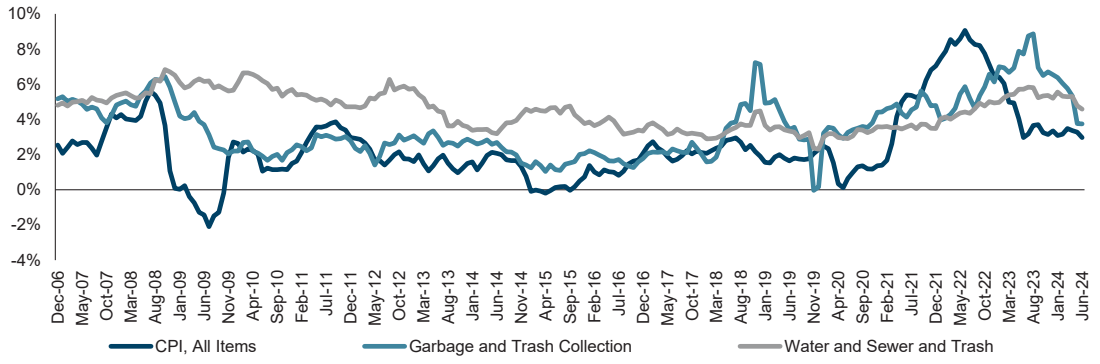


Note: Pricing metrics represent the following:
CWST: Solid waste price
RSG: Total company core price
WM: Total company core price
GFL: Solid waste core pricing (2022 and beyond); solid waste price and surcharges (before 2022)
WCN: Solid waste core price
Note: 2024E includes William Blair estimates for CWST, RSG, and WM and the midpoint of 2024 guidance for GFL and WCN.
Sources: Company documents and William Blair Equity Research

Stronger Pricing on Open-Market Contracts

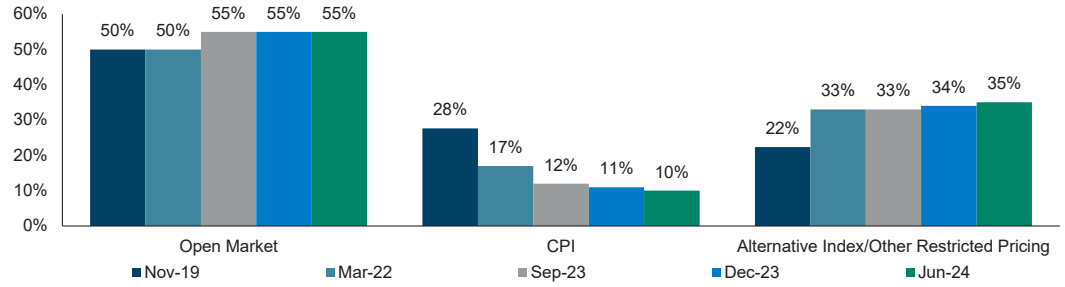
We believe a shift away from contracts indexed to CPI in favor of market-based pricing or alternative indices (like water and sewer and trash collection indices) that have typically increased faster than overall CPI should support pricing power. We see evidence of this in metrics provided by Republic, which has consistently demonstrated the ability to drive stronger pricing in its open-market contracts relative to its restricted contracts (i.e., linked to CPI, another index, or fixed rate increases). We believe both this and the company's shift away from CPI-indexed contracts (see exhibit 16, estimated based on investor presentations and management commentary) should structurally increase Republic's pricing power for years to come. Similarly, Casella management has commented that only about 10%-12% of the company's collection contracts are linked to CPI, and about 75% can be priced at will. In addition to stronger pricing, these open-market contracts can be adjusted on an as-needed basis rather than the lag on which index-based contracts typically reset, enabling faster matching of pricing and costs.

Exhibit 15
Waste and Recycling Industry
Year-Over-Year Growth of Consumer Price Indices

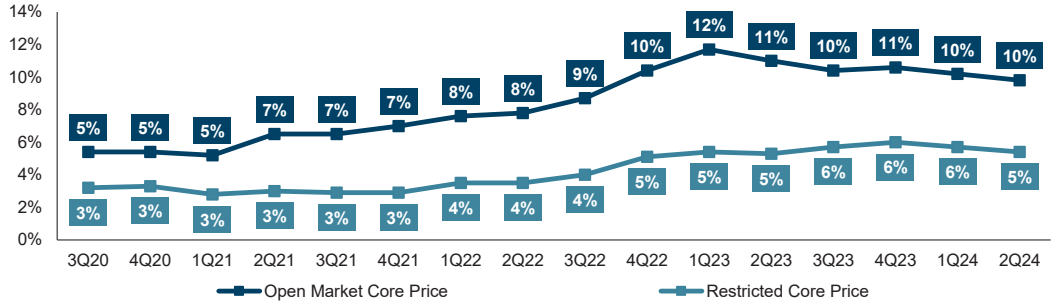


Source: BLS

Exhibit 16
Republic Services, Inc.
Estimated Percentage of Recycling and Waste Revenue Under Various Pricing Arrangements



Year-Over-Year Changes in Pricing, Open Market and Restricted Contracts

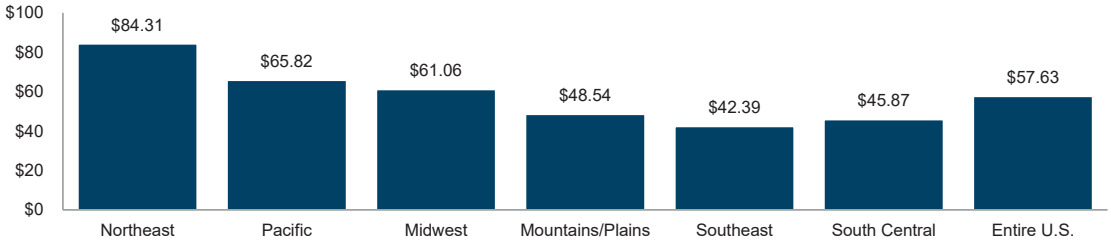


Note: Contracts with restricted pricing are linked to CPI, other indices, or fixed rate increases.
Note: Since 4Q22, open market and restricted core price metrics have been disclosed as a percentage of related revenue rather than total revenue.
Sources: Company documents and William Blair Equity Research

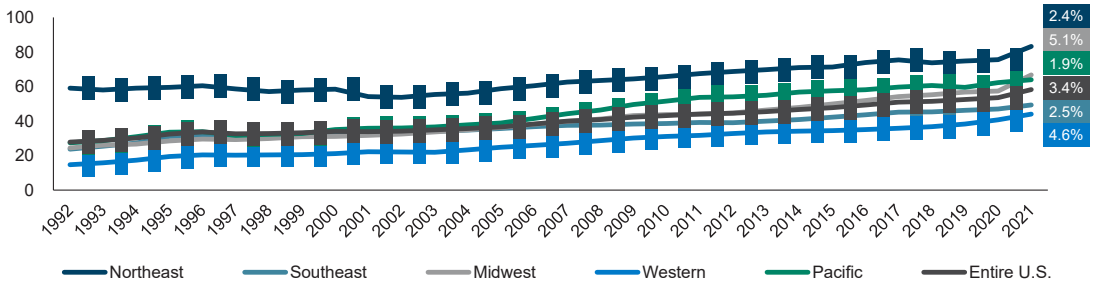
Regional Analysis

While we believe each region will become increasingly capacity constrained over a long enough period, regional differences have led to more intense shortages—and more pronounced pricing power—in certain areas of the country. For example, data from the EREF suggest that tipping fees (i.e., landfill toll charges) in the Northeast were 46% above the national average in 2023 (although the spread between the Northeast and other regions has shrunk over the past few decades, as shown in exhibit 17). We also believe tipping fees in adjacent areas like the Midwest have begun to increase, as a growing quantity of waste generated in the Northeast is exported to these areas.

Exhibit 17
Waste and Recycling Industry
2023 Landfill Tipping Fees Per Ton by Region, Per Environmental Research & Education Foundation



Landfill Tipping Fees Per Ton by Region, Per Waste Business Journal



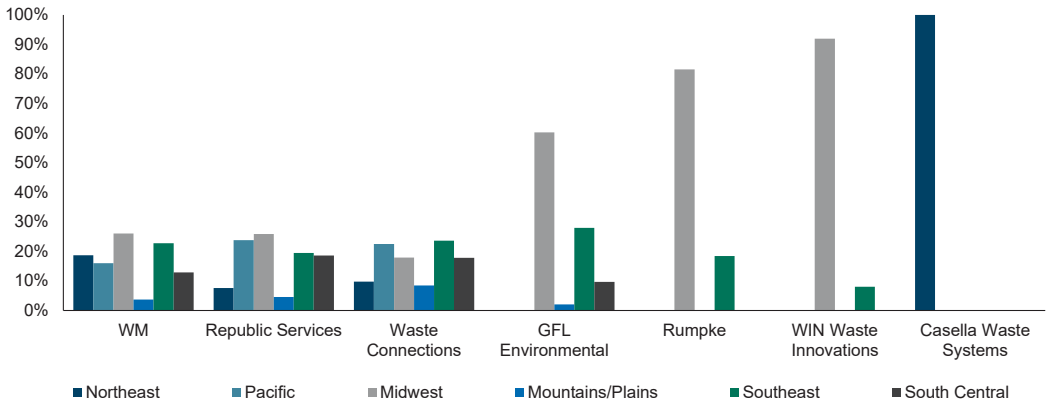
Note: Five-year CAGRs for each region are displayed to the right of the line chart.
Sources: Environmental Research & Education Foundation, Waste Business Journal

Market share and estimated regional mix for landfill operators

Using the LMOP database, we provide rough estimates for market share and regional mix for the top seven landfill operators, in terms of volumes managed. This analysis likely does not include every single landfill for each company (for example, the database includes 193 active landfills for WM, which reported 258 active solid waste landfills in its most recent 10-K filing), but we believe it is a good rough estimate and aligns with landfill share data at the national level published by WBJ. This analysis also includes only the disposal aspect of these companies and does not include collection or transfer, but we believe analyzing the landfill footprint can provide insight into the operating characteristics for the large competitors given the importance of disposal ownership and vertical integration, as we discuss throughout this report.

As shown in exhibit 18, WM, Republic, and Waste Connections have the most diverse geographic footprints, as they are the only companies with capacity in all six regions (as defined by EREF). GFL, Rumpke, and WIN are all concentrated in the Midwest, with more than half of their capacity in that region. Casella's footprint is entirely based in the Northeast.

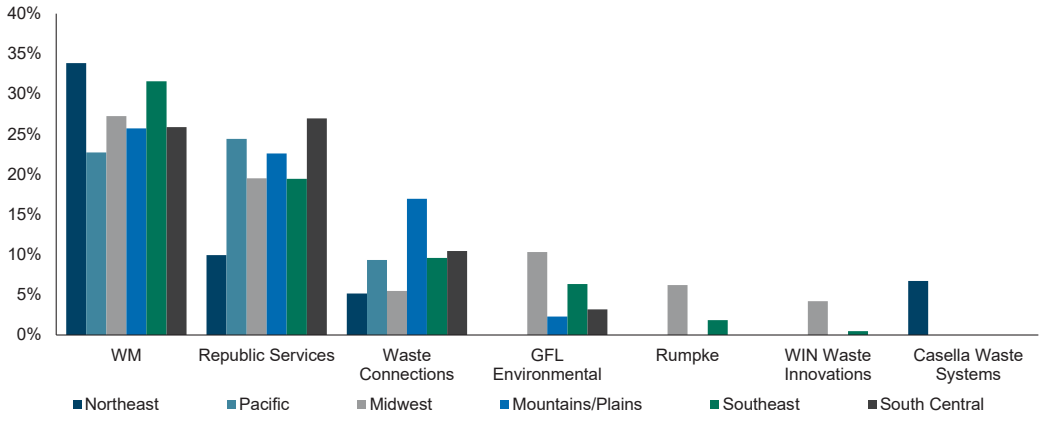
Exhibit 18
Waste and Recycling Industry
Estimated Regional Mix of MSW Disposal (Measured by Annual Tons Accepted), by Company



Sources: EPA, EREF, and William Blair Equity Research

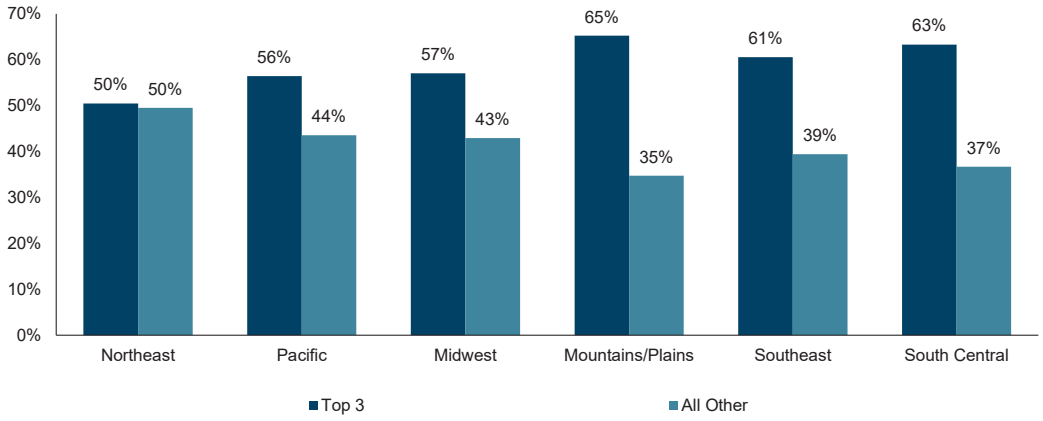
Similarly, WM, Republic, and Waste Connections have at least a 5% share of disposal capacity in all six region/s. WM holds the largest share in five of the six regions (all at least 25%), while Republic has a slight edge in the South Central. GFL, Rumpke, WIN, and Casella all maintain solid market share in their regional concentrations but lack much of a disposal presence elsewhere. In general, we expect regions with tight landfill capacity (e.g., the Northeast) or high concentration of ownership to have above-average pricing power. In the Mountains/Plains, Southeast, and South Central, the top three players hold more than 60% of the landfill capacity.

Exhibit 19
Waste and Recycling Industry
Estimated Regional Share of MSW Disposal (Measured by Annual Tons Accepted), by Company



Sources: EPA, EREF, and William Blair Equity Research

Exhibit 20
Waste and Recycling Industry
Estimated Regional Market Concentration of MSW Disposal (Measured by Annual Tons Accepted)



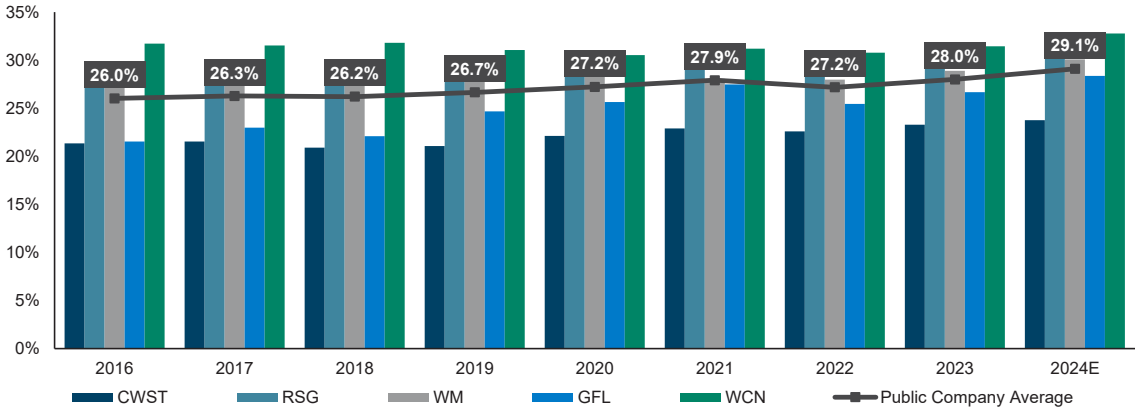
Sources: EPA, EREF, and William Blair Equity Research

Price/Cost Spread Should Remain Positive

We believe the factors discussed above, including ownership of scarce assets, control of the value chain through vertical integration, provision of essential services, greater reliance on open-market pricing, increasingly sophisticated pricing data and analytics, and an oligopolistic market structure, afford waste and recycling providers the ability to price in excess of internal cost increases. We believe most companies in this industry generally aim to maintain a price/cost spread of at least 100 basis points in the core solid waste and recycling business on an ongoing basis.

While higher inflation has led to strong cost increases in the past few years (discussed in more detail on pages 34-36), waste and recycling companies have consistently maintained a favorable price/cost spread and delivered margin expansion over the past several years. We believe price increases are likely to normalize toward the midsingle digits (down from high single digits in the past two years) as inflation has come down, but we believe lower market-based cost inflation and continued efficiency initiatives at these companies will enable continued margin expansion in the core business for years to come.

Exhibit 21
Waste and Recycling Industry
Annual Adjusted EBITDA Margins



Note: 2024E includes William Blair estimates for CWST, RSG, and WM and the midpoint of 2024 guidance for GFL and WCN.
Sources: Company documents and William Blair Equity Research

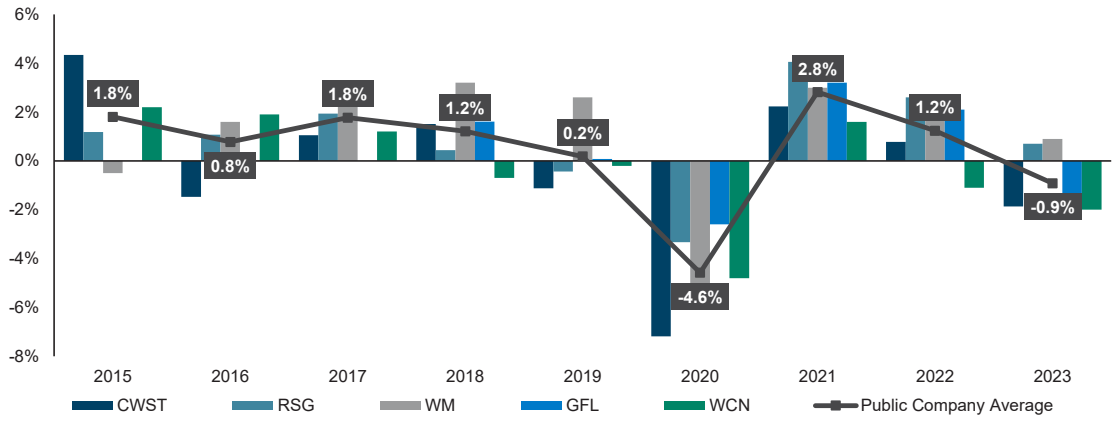
Fewer Landfill Options and Increasing Environmental Concerns Will Incentivize Sustainable Alternatives

Given the structural tightness of disposal capacity as discussed earlier in this report, coupled with increasing societal and political focus on environmental sustainability and circularity, we believe significant landfill expansions in North America are unlikely going forward. Instead, we believe a gradually growing percentage of the total waste stream will be diverted away from landfills and toward more sustainable and circular alternatives like recycling. We also believe negative byproducts of traditional disposal, like landfill gas, will increasingly be repurposed and used beneficially. In total, we believe this will not only improve the monetization of the waste stream, but also extend the life of core landfill assets owned by the large waste and recycling companies.

Volumes Into Landfills Have Stagnated as Alternatives Have Grown

We believe underlying volume growth of the waste stream has been fairly muted, although it has rebounded nicely following periods of declining economic activity. For example, aside from 2021, the year following COVID-driven volume declines, average solid waste organic volume growth for the public companies has remained below 2% for the past decade.

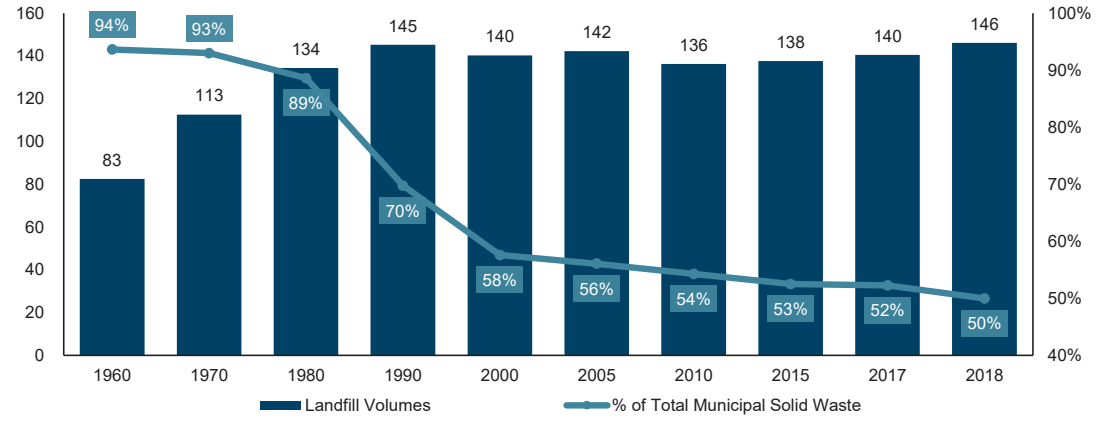
Exhibit 22
Waste and Recycling Industry
Estimated Year-Over-Year Solid Waste Volume Growth



Sources: Company documents and William Blair Equity Research

Further, according to EPA data, the percentage of total MSW that has ended up in landfills has been shrinking for years, although overall landfill volumes have held mostly steady as overall MSW generation has increased. At the same time, landfill diversion efforts have increased recycling and composting volumes, although the relative share of total MSW for these alternatives has also stagnated as of the most recent EPA data through 2018 (which is admittedly a bit dated).

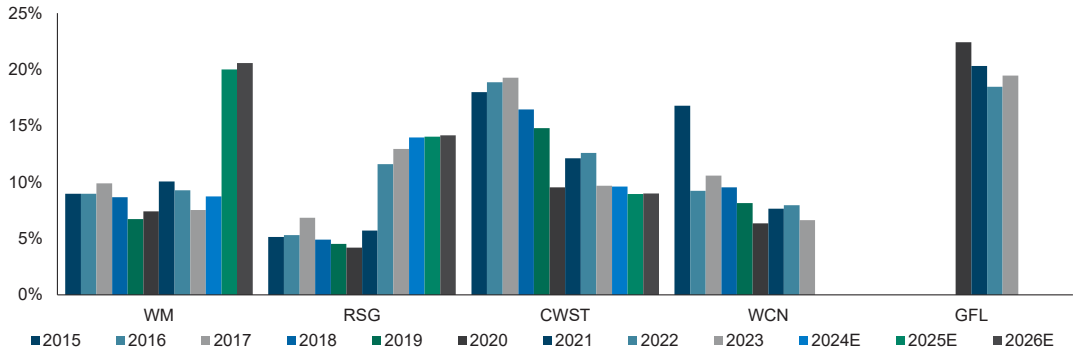
Exhibit 23
Waste and Recycling Industry
Landfill Volumes (Million Tons) Relative to Total Municipal Solid Waste Generation



Source: EPA

While we see plenty of price-led growth runway in the core collection and disposal business, we believe some alternatives may offer stronger volume growth as more waste is diverted away from landfills. As more volume shifts to landfill alternatives, this also extends the runway of the core landfill disposal business, which is structurally capacity constrained. While each company's strategy is unique, we generally believe the industrywide mix of volumes will gradually shift further toward sustainable alternatives and other adjacent lines of business over time. In the following sections, we detail potential avenues for increasing investment and growth for waste and recycling companies outside of collection and disposal.

Exhibit 24
Waste and Recycling Industry
Estimated Percentage of Total Revenue Outside Solid Waste Collection and Disposal



Note: WM 2025E and 2026E are pro forma for Stericycle acquisition, assuming a 1/1/2025 close.
Sources: Company documents and William Blair Equity Research

Recycling

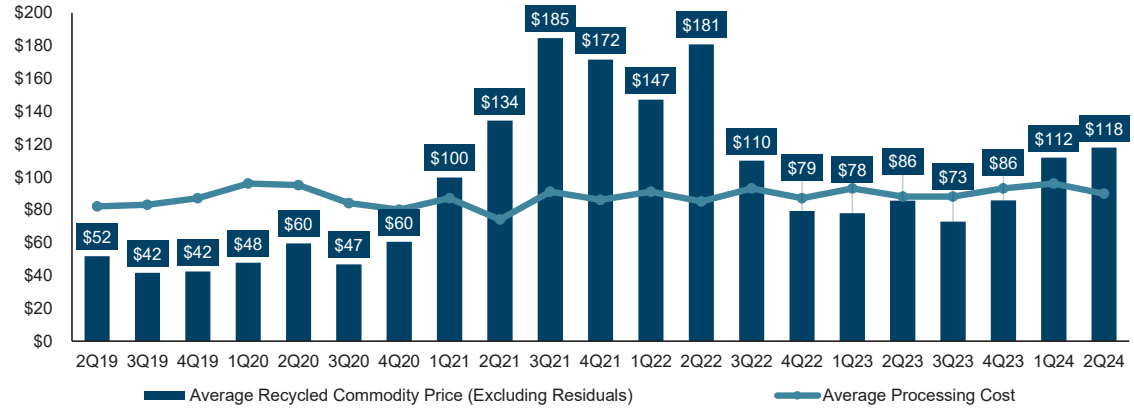
We expect recycling rates to gradually increase over the medium to long term, driven by structural tailwinds at both ends of the product lifecycle. With robust collection routes already in place providing a sufficient supply of materials, and capital to continue investing in processing facility upgrades, we believe the public waste and recycling companies are well positioned to capitalize on this increasing demand.

Demand for post-consumer recycled (PCR) content driving favorable economics

At the front end of a product's life, we believe consumers and manufacturers are increasingly demanding more sustainable packaging, including PCR content. In addition, several states (California, Maine, New Jersey, and Washington) have implemented minimum recycled content (MRC) legislation, which requires manufacturers to use a mandated percentage of PCR content in consumer products. We believe this will increase demand for PCR, translating to stable or improving recycled commodity prices over the long term (although these prices can be volatile depending on short-term supply and demand factors).

While recycled commodity prices dropped in the prior decade following the implementation of China's Green Fence and National Sword policies, which banned imports of low-quality plastics, prices rebounded significantly in 2021 and early 2022 before dropping again in the second half of 2022. Prices then began to rebound toward the end of 2023 and have continued to increase in the first half of 2024. According to the Northeast Recycling Council, which supports the recycling market in 11 states in the Northeast region, the average for blended recycled commodities has trended above $100 in 2024. Processing costs in the Northeast have remained near $90 per ton in recent quarters, although we believe processing costs for large or recently upgraded facilities, such as many of those owned by public waste and recycling companies, are likely below this average. To ensure favorable economics, many sellers of recycled commodities also mitigate price volatility through tipping fee adjustments, revenue sharing arrangements, or commodity-linked fees charged to collection customers.

Exhibit 25
Waste and Recycling Industry
Blended Quarterly Commodity Values Processed by Northeast Materials Recovery Facilities ($ Per Ton)



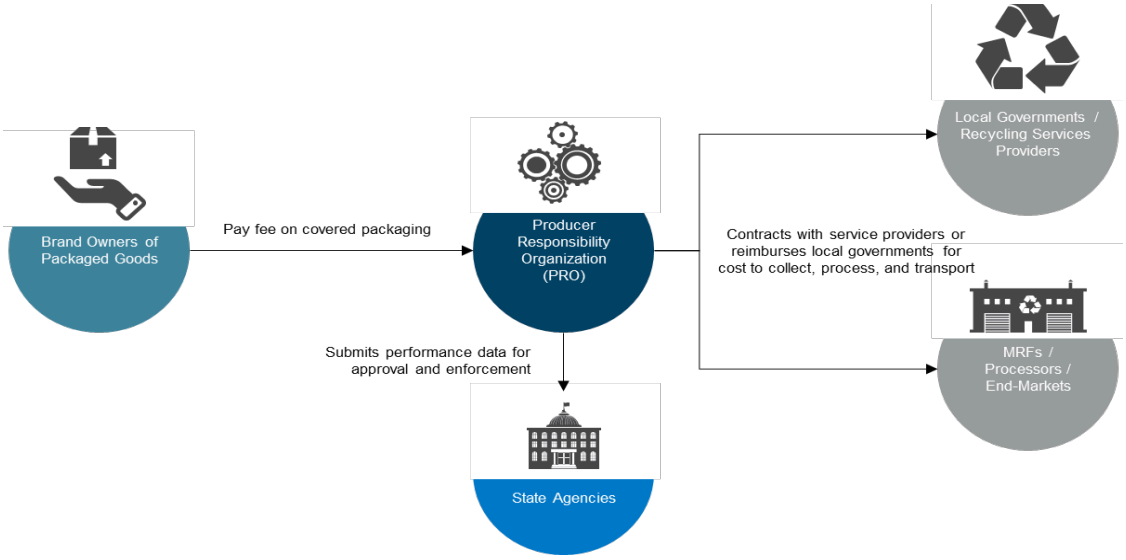
Source: Northeast Recycling Council

Extended producer responsibility (EPR) momentum increasing

In addition to increasing demand for PCR, we see a long-term tailwind from the implementation of laws focused on improving recycling rates and minimizing the environmental impact at the tail end of a product's life, such as EPR laws. To date, five states (California, Colorado, Maine, Minnesota, and Oregon) have signed packaging-focused EPR bills into law, and many other states, such as New Hampshire, New York, Rhode Island, and Washington, are reportedly considering similar laws. Most Canadian provinces have also passed packaging-focused EPR laws in recent years. These laws generally place liability or responsibility on producers of packaged goods through the entire life of a product, including the disposal of packaging. While there are varying types of EPR, many require packaged goods producers to pay for all or a portion of the recycling costs, and some include recycled content mandates. Various states have also enacted or considered EPR laws for other topics

outside packaging (like batteries, mattresses, paint, and textiles). We believe the implementation of these and potential new EPR laws could increase recycling volumes in the future, presenting incremental revenue opportunities for recycling companies.

Exhibit 26
Waste and Recycling Industry
Illustrative Summary of Common Extended Producer Responsibility Roles



Source: Signalfire Group, adapted by William Blair Equity Research

Improving material recovery capabilities

As demand for recycled materials increases, public waste and recycling companies are making significant capital investments in technology upgrades for materials recovery facilities (MRFs). As an example of the latest technology, Machinex, a developer of many advanced products used in several of these companies' MRFs, highlights its SamurAI Sorting Robot, which can perform up to 70 picks per minute, roughly double the 30-40 picks per minute for a typical human sorter, with up to 95% efficiency of product recognition. Machinex's MySpec Optical Sorter can distinctively recognize and separate plastics (PET, HDPE, PVC, etc.) and fibers by type, with over 28 million measurements per second.

We believe these upgrades will reduce labor intensity, a key contributor to profitability as labor is often the largest operating cost and many manual sorting and picking jobs are difficult to fill (putting upward pressure on wages). We also expect improving material quality, recovery yields, and contamination rates, which will drive stronger throughput and price realizations. This should ultimately improve the competitive positioning, efficiency, and margin profile of recycling operations.

We believe WM has been making the largest cumulative investment in MRF upgrades, as highlighted at the company's sustainability investor day in April 2023. The company announced plans for about $1 billion of incremental capex from 2022 to 2025 on 43 MRF projects (35 automation projects on existing MRFs and 8 new MRFs) and has since announced $350 million of incremental investment opportunities. Management believes automation initiatives can increase blended commodity values by 15%, process 30%-40% more tons per hour, and reduce labor cost by 30% per ton relative to non-automated MRFs.

Casella recently spent about $20 million retrofitting its Charlestown MRF, which is one of the largest in the country; since the completion of upgrades in 2023, management has highlighted a 40% increase in throughput and a nearly 40% reduction in labor. Casella is spending a similar amount in 2024 to upgrade its MRF in Willimantic, Connecticut, and we believe the company has other candidates for MRF upgrades in the future. Waste Connections management also recently discussed MRF upgrades that have resulted in labor reductions from "80 to 100 employees down into the high 20s" despite similar or higher processing volumes.

In addition to the public companies, notable private companies like Recology and Rumpke have also announced completion of large-scale MRF upgrades. The $100 million Rumpke Recycling & Resource Center, which Rumpke calls the "largest and most technologically advanced recycling facility in North America," opened in August 2024 in Columbus, Ohio. Recology and LRS have also made sizable investments in the last few years. A summary of certain notable MRF upgrades is presented in exhibit 27.

Exhibit 27
Waste and Recycling Industry
Reported Statistics on Notable Recent New or Upgraded Materials Recovery Facilities

	WM Germantown	WM Cleveland Recycling Facility	Casella Charlestown MRF	Republic Salt River Recycling Center	Rumpke Recycling & Resource Center	Recology Sonoma Marin MRF	LRS "The Exchange"
Location	Germantown, WI	Cleveland, OH	Boston, MA	Phoenix, AZ	Columbus, OH	Santa Rosa, CA	Chicago, IL
Announced Opening/Reopening	4/19/2024	9/8/2023	6/14/2023	1/24/2024	8/6/2024	1/26/2024	8/9/2023
Total Investment ($M)	39	30	20	38	100	35	50
Square Feet	149,000	100,000	130,000	51,000	226,000	85,000	
Employed People		50	50	18	60	35	50
Potential Tons Per Hour[1] *Improvement vs. Prior*	60 *20%*	53	50 *32%*	40 *60%*	60 *100%*	50 *167%*	25
Potential Tons Per Year *Improvement vs. Prior*	230,000 *53%*	144,000	230,000 *28%*		250,000 *56%*		112,000
Recovery Rate	88%	85%			98%	85%	78%
Technology Highlights	17 optical sorters, plastic film recovery system	14 optical sorters, glass recovery equipment, plastic film recovery system	9 optical sorters, 2 ballistic separators, AI reporting, robotic QC	5 optical sorters, AI technology, robotics	4 ballistic separators, 19 optical scanners, AI technology	7 optical sorters, computerized air sorters	6 optical sorters, 3 Fire Rover Units, 1 CP Auger Screen

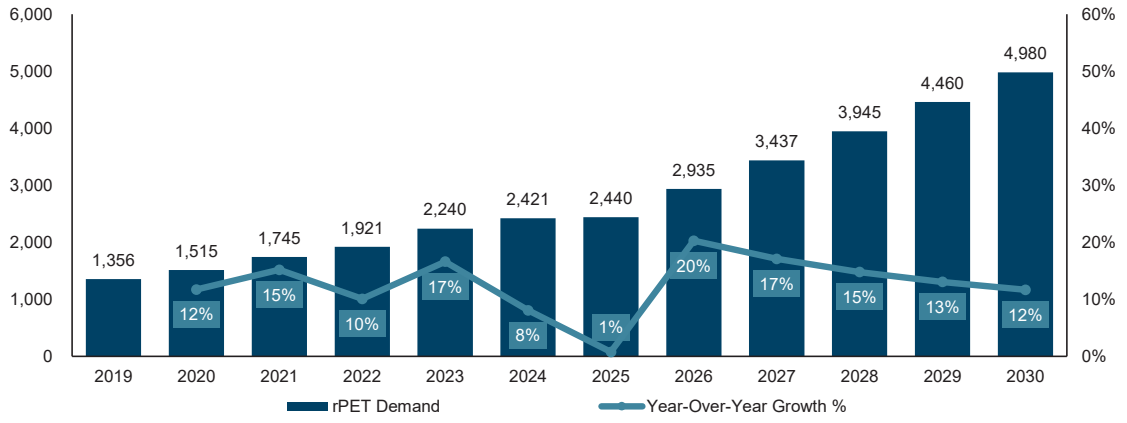
(1) Assumed 8 hours of runtime per day at stated capacity for facilities with capacity disclosed on a per-day basis.
Sources: Company documents, Recycling Today, various internet sources, and William Blair Equity Research

Bottle-to-bottle circularity

Lastly, we highlight Republic's investments in polymer centers, which enable PET- and olefin-based packaging to be reused in a circular fashion. While many recycled plastics are ultimately downcycled into products that have fewer options for further recycling (e.g., textiles, carpet, and industrial products), these polymer centers can process plastic bottles, jugs, and containers into rPET flake and other color-sorted plastics to be used in new sustainable packaging. Plastic bottles can then be turned into new bottles six to seven times, promoting greater bottle-to-bottle circularity. We believe few other companies have both the sufficient capital capacity and volume of collected material to successfully operate these facilities, which will help producers of packaged goods meet sustainability goals and comply with legal and regulatory requirements for recycled content.

According to a September 2023 study published by McKinsey & Company, demand for rPET flake is expected to grow at a 12% compound annual rate from 2023 to 2030, based on consumer brands' stated recycled content commitments. At the same time, supply of rPET is expected to grow only about 1% per year.

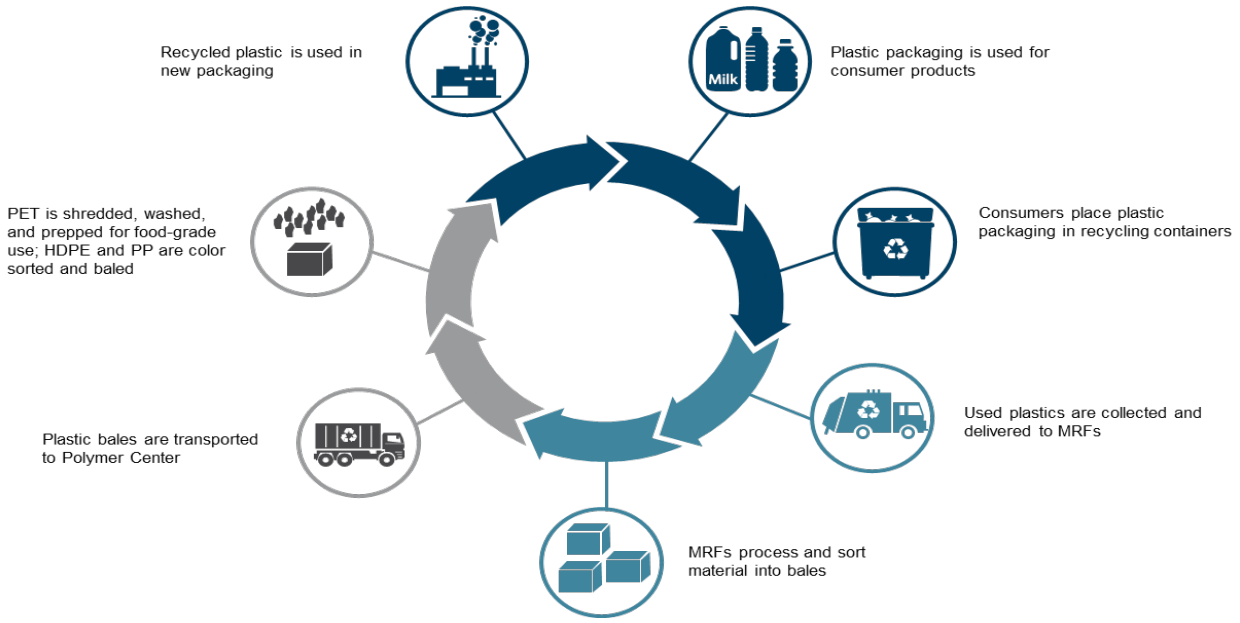
Exhibit 28
Waste and Recycling Industry
U.S. Demand for Recycled Polyethylene Terephthalate (rPET) Flake (Millions of Pounds)



Source: McKinsey & Company

Republic's first polymer center in Las Vegas, which opened in December 2023, can produce over 100 million pounds of recycled plastic annually, sorted by plastic type and color. Prominent customers include Coca-Cola, which is purchasing rPET from the polymer center to fulfill its goal of using at least 50% recycled material in its packaging by 2030. Republic plans to complete its second polymer center in Indianapolis by the end of 2024, with two additional facilities to be announced and completed in the coming years. Republic has also been investing in Blue Polymers, a joint venture with Ravago, a global leader in polymer recycling and distribution. Blue Polymers facilities, including one co-sited with Republic's Indianapolis polymer center, will produce custom-formulated, drop-in resins to be used in both food-grade (e.g., milk jugs) and non-food-grade (e.g., detergent containers) plastic packaging.

Exhibit 29
Republic Services, Inc.
Flow of Plastic Materials Through Polymer Center



Source: Republic Services, adapted by William Blair Equity Research

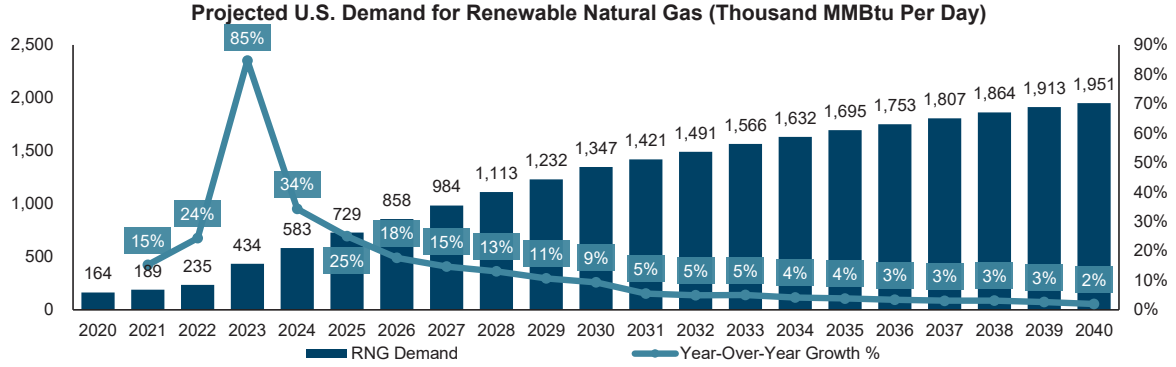
Renewable Natural Gas (RNG)

As waste in MSW landfills decomposes, the landfills produce large quantities of gas containing methane, a powerful greenhouse gas. This landfill gas (LFG) can be captured and beneficially used in direct thermal applications or in landfill gas to energy (LFGTE) projects to generate electricity (to be either used onsite or sent to the electric grid), which landfill owners have been doing for decades. LFG can also be treated further to increase its methane content and remove impurities, resulting in pipeline-quality renewable natural gas (RNG). While RNG can be produced from other feedstocks, like livestock manure, food waste, and wastewater treatment facilities, LFG currently feeds the majority of RNG production. According to the EPA, there were 536 operational LFG projects in the United States, with 64% currently LFGTE projects, 19% RNG projects, and the remaining 17% employed in direct use (boilers, dryers, etc.).

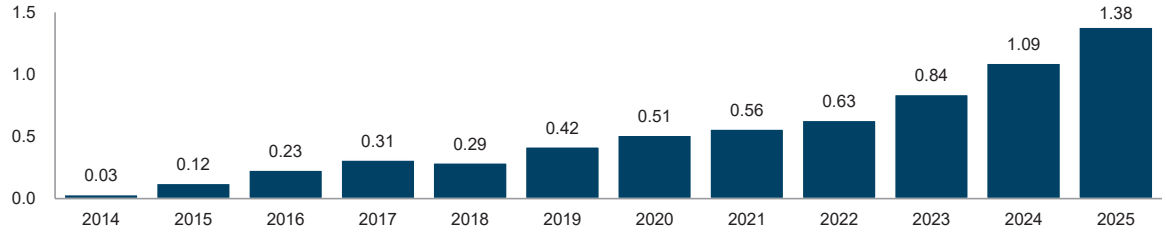
According to a June 2023 report from Boston Consulting Group (BCG), total U.S. demand for RNG is expected to grow at a 9% compound annual rate from 2023 through 2040, including an 18% CAGR from 2023 through 2030. Beyond the environmental benefits from lower carbon intensity relative to fossil natural gas and other fuels like diesel, a significant driver of this demand growth is the EPA's renewable fuel standards (RFS). The RFS program requires certain obligated parties, like refiners of gasoline and diesel, to purchase a minimum number of credits tied to renewable fuels, or renewable identification numbers (RINs). These credits can be either purchased bundled with the fuel itself, as the RNG is blended into the fuel supply, or traded separately. The EPA's most recent RFS rule, announced in June 2023, established a target for 1.38 billion D3 RINs (which include RNG and other cellulosic biofuels) by 2025, more than double the 2022 target. In addition to renewable volume obligations (RVOs) in the transportation sector, we believe demand for RINs in the voluntary market will continue to increase as utilities, industrials, and other organizations aim to meet

internal decarbonization goals. Lastly, California, New Mexico, Oregon, and Washington have also enacted low carbon or clean fuel standards at the state level, which should provide incremental monetization opportunities for RNG in those states.

Exhibit 30
Waste and Recycling Industry
Projected U.S. Demand for Renewable Natural Gas (Thousand MMBtu Per Day)



EPA Renewable Fuel Standard Targets for D3 Cellulosic Biofuels (Billions of RINs, or Ethanol-Equivalent Gallons)



Sources: Boston Consulting Group, EPA

Given that large waste and recycling companies own most of the existing landfill assets (and therefore control the methane stream from these assets), we see a significant opportunity to monetize LFG, a byproduct of the core solid waste business. As detailed in exhibit 31, each public waste and recycling company has approached the RNG opportunity differently. WM has committed by far the largest amount of capex into in-house development of RNG projects and expects the largest incremental contribution to adjusted EBITDA (aided in part by a substantial fleet of vehicles that run on compressed natural gas [CNG]). Conversely, others like Republic and Casella have partnered with third-party developers, such as Archaea Energy (owned by BP), Ameresco, and Waga Energy, in exchange for royalty streams and/or equity income from ownership of the LFG-producing assets.

Exhibit 31
Waste and Recycling Industry
Summary of Incremental Targets and Commentary From Public Companies Regarding Renewable Natural Gas

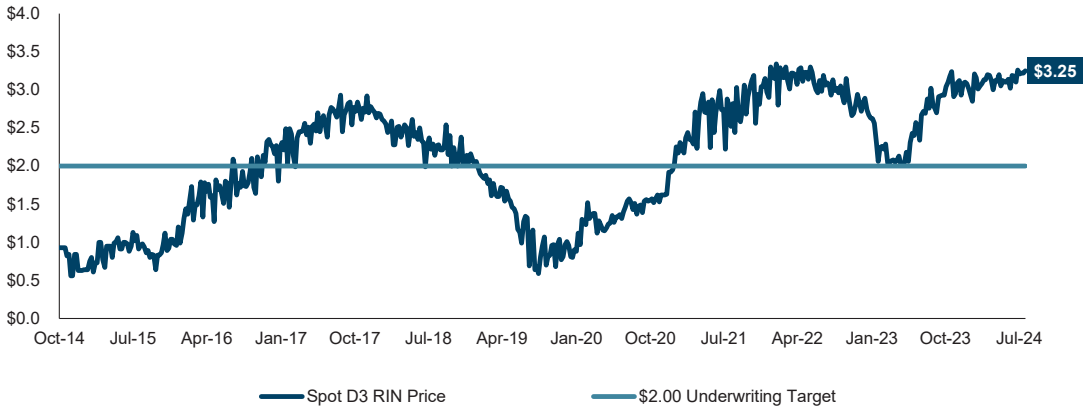
	CWST	RSG	WM	GFL[1]	WCN[2]	Total / Average
Approach	Third-Party Development	Joint Venture	Owned and Developed	Part Joint Venture / Part Owned and Developed	2/3 Partnership / 1/3 Owned and Developed	
Target Year	2026 or 2027	2028	2026	2026	2026	
Estimated Cumulative RNG Capex	0	375	1,499	246	200	**2,320**
Adjusted EBITDA Run-Rate ($M)[3]	8	120	510	130	200	**967**
% of Consolidated Adjusted EBITDA (2023)	*3%*	*3%*	*9%*	*9%*	*8%*	***7%***
EBITDA % of Cumulative Capex	*NA*	*32%*	*34%*	*53%*	*100%*	***42%***
Number of RNG Sites Under Development	5	57	20	21	12	**115**
EBITDA Per Site ($M)	*1.5*	*2.1*	*25.5*	*6.2*	*16.7*	***8.4***
Annual MMBtu (Millions)	2.6	12.5	25.0	14.5	13.0	**67.6**
EBITDA Per MMBtu ($)	*2.9*	*9.6*	*20.4*	*8.9*	*15.4*	***14.3***
MMBtu per Site (Millions)	*0.5*	*0.2*	*1.3*	*0.7*	*1.1*	***0.6***

(1) GFL financial metrics presented in USD, converted from reported CAD at assumed exchage rate of 0.74. Assumed capex equal to 1.9 times expected EBITDA cc
(2) WCN annual MMBtu estimated based on about 23.6 million MMBtu of landfill gas recovered times an assumed 55% used for RNG.
(3) We believe most of these targets assume D3 RIN prices of $2.00 and natural gas prices of $2.50, which roughly translate to a value of $26/MMbtu.
Sources: Company documents and William Blair Equity Research

We believe there are pros and cons to each approach. On one hand, in-house development creates the most lucrative opportunity for EBITDA to flow through the P&L statement, assuming optimal RIN monetization (e.g., the ability to use internally developed RNG to operate internal CNG vehicles), while third-party development limits operating income potential somewhat as some of the economics shift to the project developer. For example, Casella management commented at an investor conference in March 2024 that the company would receive about 30% of the cash flow stream from its projects, with the remaining cash flows accruing to the developer. However, these third-party development arrangements require little to no capital from the landfill owner, whereas in-house development requires significant upfront capex and ongoing operating expenses (for example, WM has committed to about $1.2 billion of capex on RNG projects).

Both company-owned RNG projects and many third-party royalty streams remain dependent on RIN pricing to achieve attractive economics, as the RIN represents most of the economic value in sales of RNG. As shown in exhibit 32, RIN prices can fluctuate significantly, although recent spot prices have remained above the $2.00 per MMbtu assumed by several of the landfill owners when underwriting their project economics targets. Spot prices are not always reflective of revenue potential, given a preference for some companies (such as WM) to sell some RNG forward at fixed prices, as this increases the consistency and predictability of cash flows. Still, if spot and/or forward RIN prices remain above stated targets, there could be upside to each company's initial EBITDA expectations.

Exhibit 32
Waste and Recycling Industry
Weekly Spot D3 RIN Prices ($ per MMBtu)



Sources: FactSet, company documents, and William Blair Equity Research

Disposal Tightness and Other Industry Challenges Driving Value to the Largest Providers

The waste and recycling industry is composed of a few very large, vertically integrated competitors and many smaller local or regional providers. For example, according to *Waste Today,* the 50 largest waste haulers generated $54 billion of revenue in 2021, and roughly 90% ($50 billion) was generated by the top 10 companies.

We believe the inherent advantages of the largest waste and recycling companies—economies of scale, vertical integration, technological sophistication, and sufficient capitalization to absorb a greater regulatory burden and make strategic investments—provide a significant competitive advantage over the many small waste and recycling companies that now face an increasingly complex and costly operating environment. As an increasingly tight disposal capacity situation ripples throughout the waste value chain and other operating challenges place disproportionate pressure on smaller, less integrated providers, we believe an increasing amount of value will accrue to the largest providers. This would further concentrate the asset base among a smaller group of key competitors in an oligopolistic market structure.

Structural Industry Challenges Disproportionately Impactful for Small Companies
First, we believe the high capital intensity of operating landfills is a significant barrier to entry to the disposal business. The five public solid waste and recycling companies have spent an average of 12%-13% of consolidated revenue on capital expenditures the last few years, and we believe the disposal business is considerably more capital intensive than those company averages. As discussed throughout this report, ownership of landfill capacity is a significant competitive advantage for large waste and recycling companies, as the scarcity of new landfill creation drives increasing value to existing capacity. As landfill owners exercise their pricing power and drive disposal costs higher, it is becoming more difficult for smaller and less integrated waste haulers to operate without vertical integration.

In addition, increasingly stringent regulation of fleet emissions, landfill emissions, post-closure landfill liability, and other aspects of the waste and recycling business have made operating these already capital-intensive businesses even more costly. In effect, this has created an environment

in which only the largest providers with sufficient scale and capital resources are able to operate these businesses effectively. For example, PFAS (per- and polyfluoroalkyl substances), potentially harmful contaminants that can be found in landfill leachate, has come under increasing scrutiny in recent years (see William Blair analyst Tim Mulrooney's February 2023 report, *"Forever Chemicals": A Deep Dive Into the Evolving and Rapidly Growing PFAS Market*, for a detailed summary of PFAS and the market for remediation and destruction services). This has led to some speculation that waste and recycling companies could face additional regulation, remediation costs, or penalties if PFAS are found in their landfills. In response to a question on Waste Connection's second-quarter earnings call about PFAS and leachate management, CEO Ron Mittelstaedt said the following:

> This type of federal regulation that is uniform for at least all of the competitors we compete with has historically been a very positive development for our industry. The public companies have the capital depth to comply with the legislation, and it is a pricing opportunity to recover not only the investment, but some incremental margin on top of that. And so, we don't view this opportunity any differently.

Further, we believe many family-owned waste and recycling businesses are facing generational succession challenges as founders age and the structural challenges mentioned above take their toll. As a recent example that encapsulates many of these issues, family-owned Sanitation Service, Inc. was acquired by Rumpke in February 2024. In a social media post announcing the transaction to its customers, the company provided the following statement:

> Unfortunately, the days of the single-family-owned landfill have faded away. We have, however, outlasted most all other single-family-owned landfills in the Midwest. Most people don't realize that in the landfill business there is/ a post-closure liability of 30 years after we take our last bag of trash. When we opened Landfill 33, closure liability was only 5 years. This gets passed down to the next generation as well. This is also the driving force that has [led] us to the difficult decision to pass on our waste collection and disposal company to another family-owned and -operated company that shares our same values.

Overall, we believe this increasing operating complexity and regulatory burden favor larger players with significant capitalization and propensity to invest in solutions and comply with these regulations. As more local and regional providers are driven to sell their companies, this should present a steady stream of opportunities for the largest players to consolidate the fragmented long tail of the industry.

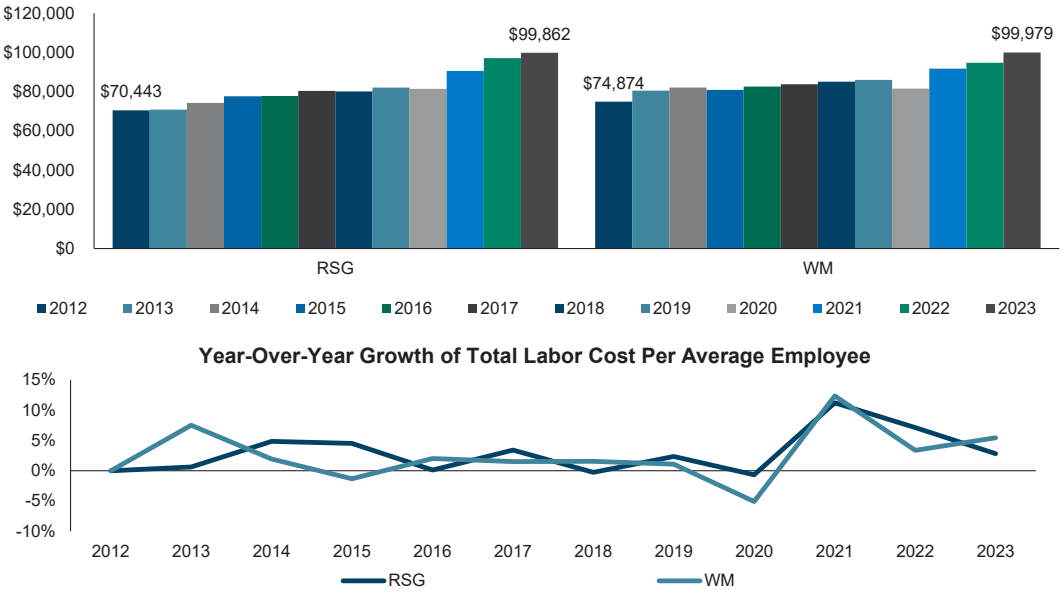
Recent Cost Headwinds Exacerbating Structural Challenges

We believe these structural issues have been exacerbated by material operating cost increases in recent years. Two prime examples of this are sharp increases in labor and maintenance-and-repair costs over the past several years, as discussed below. With less sophisticated pricing models, we believe many subscale waste and recycling providers have fallen behind and faced significant margin pressure in the last few years.

Labor headwinds as jobs remain difficult to fill

Labor costs, on an absolute and per-employee basis, have grown significantly in recent years, as driver and technician shortages have become more severe and wage inflation has increased. While unit labor costs have not increased quite as much as maintenance per vehicle, they are a material margin driver as labor costs represent the largest individual expense item for many waste and recycling companies. For instance, we estimate that total labor cost per average employee for WM and Republic have increased at a compound annual rate of 2.9% from 2012 to 2023, including a 4.3% CAGR from 2019 to 2023 (see exhibit 33). While the largest competitors have sufficient capital for significant investments in advanced technology and automation to increase unit labor productivity, small waste and recycling operators with fewer resources may not be able to make similar investments and therefore remain more exposed to increasing labor costs.

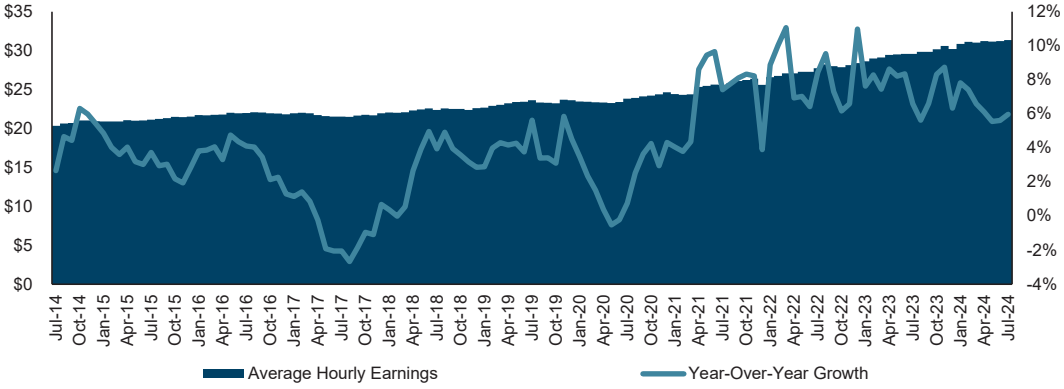
Exhibit 33
Waste and Recycling Industry
Total Labor Cost Per Average Employee



Sources: Company documents and William Blair Equity Research

Recent data from the Bureau of Labor Statistics suggests that average hourly earnings for waste collection employees have continued to increase about 6% so far in 2024, down from the levels from 2021 through 2023, but still well above the long-term average of about 3%.

Exhibit 34
Waste and Recycling Industry
Average Hourly Earnings for Waste Collection Employees (Seasonally Adjusted)



Sources: BLS

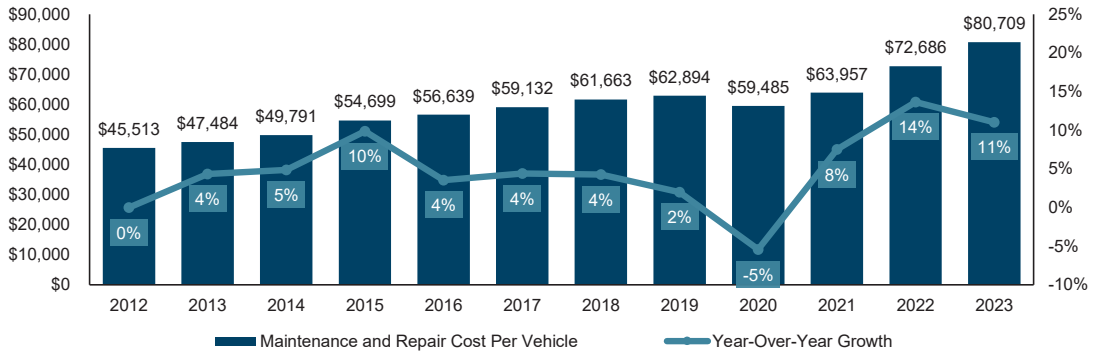
Maintenance and repair costs have accelerated

We can assess maintenance and repair costs at the unit level for Republic, which discloses the size of its vehicle fleet annually (see exhibit 35). Although some maintenance and repair costs are applicable to containers and other equipment, we believe the largest portion of this cost item is applicable to vehicles. Per vehicle, estimated annual maintenance and repair costs have nearly doubled since 2012, including double-digit percentage increases in the past two full years. While

higher maintenance costs on aging fleets also play a role, we believe the underlying unit cost of maintenance has also increased given labor shortages, cost inflation for key parts and supplies, and other factors.

Providers can mitigate these operating cost increases by investing in fleet upgrades and new vehicle purchases, but the capital cost of new vehicles has increased. Alternative fuel vehicles, like compressed natural gas (CNG) or electric vehicles, typically carry lower ongoing maintenance cost than diesel vehicles but are more expensive to purchase. These higher costs are a meaningful impediment for small operators with less capital.

Exhibit 35
Republic Services, Inc.
Annual Maintenance and Repair Cost Per Vehicle



Sources: Company documents and William Blair Equity Research

Large Public Companies Continue to Ramp Up Strategic Investment Spending

As capital costs and operating complexity increase across the industry, we believe the largest players in this industry remain focused on strengthening their competitive advantages through increasing organic investments. We see evidence of this in capex spending from the public companies in recent years, as shown in exhibit 36. As the capital intensity of the industry remains elevated, particularly for disposal assets, we believe the competitive moat for vertically integrated providers will widen further as it becomes increasingly difficult for smaller competitors to make the requisite capital investments to stay competitive. Some examples of strategic investment and the associated benefits include the following:

- ***Internal technology investments,*** which allow large competitors to increase the sophistication of their pricing models, improve the user experience of digital customer interfaces, and improve customer service capabilities.

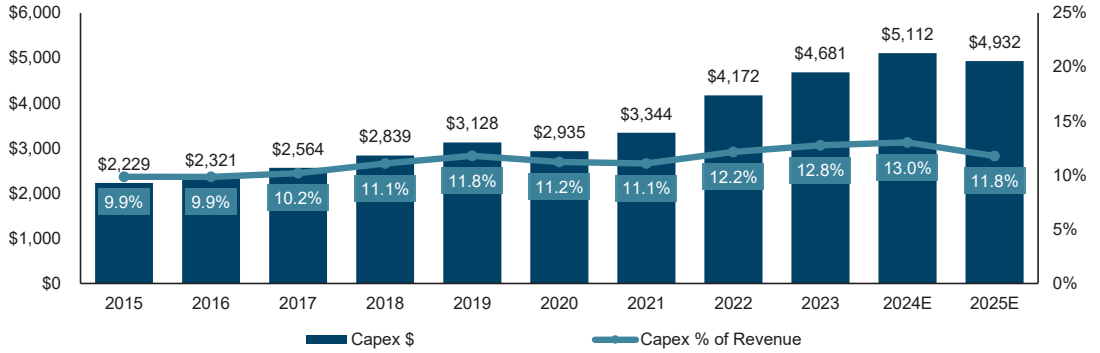
- ***Expansion of existing landfills,*** which are scarce and difficult-to-replicate assets. Given fewer approvals of new landfill sites, expansions of existing landfills extend their valuable life.

- ***Fleet upgrades,*** which can increase fuel efficiency, reduce maintenance costs, and reduce emissions by using CNG or electricity.

- ***Automation of routing technology, collection, and material recovery,*** which can reduce errors, improve safety, increase speed and throughput, and minimize labor cost.

- ***Expansion of service line capacity*** to include adjacencies, increasing the total customer value proposition through cross-selling and bundling. This can also be accelerated with acquisitions in adjacent business areas.

Exhibit 36
Waste and Recycling Industry
Aggregate Capital Expenditures for CWST, RSG, and WM ($M)

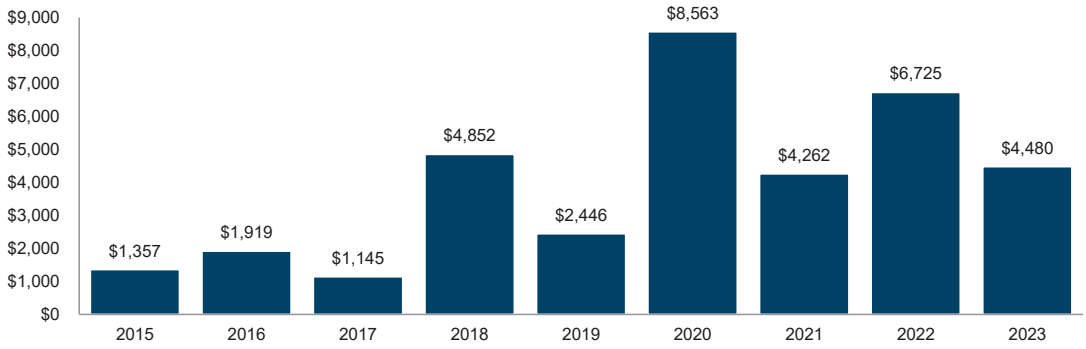


Sources: Company documents and William Blair Equity Research

M&A Activity Remains Strong

Beyond organic investment, M&A activity in the waste and recycling industry has increased. Large acquisitions tend to be lumpy and can skew comparisons between years, but the amount of capital the public companies have allocated to M&A activity has generally increased over the past decade, as shown in exhibit 37. This year appears set to be even stronger; this is primarily driven by WM's $7.2 billion acquisition of Stericycle, but we believe all five public companies have also remained active with core solid waste tuck-in acquisitions this year. We see two broad pathways for acquisitions in the waste and recycling industry, as discussed below.

Exhibit 37
Waste and Recycling Industry
Aggregate Annual Cash Used for M&A Spending by Public Companies ($M)



Sources: Company documents and William Blair Equity Research

Tuck-in solid waste consolidation

With abundant free cash flow generation, we believe the vertically integrated solid waste and recycling companies can purchase smaller companies for EV/EBITDA multiples in the high single or low double digits, well below the trading multiples of the public waste and recycling companies, which have recently bounced around the mid- to high teens. In addition to immediate value accretion from this multiple arbitrage, larger operators can typically extract significant cost synergies from increasing route density, reducing corporate overhead, and internalizing more collected waste, which can further reduce the effective multiple of these deals. Given the structural challenges facing subscale, less integrated companies in the industry, we expect strong M&A activity to continue.

Entry into, or rapid scaling in, adjacent markets

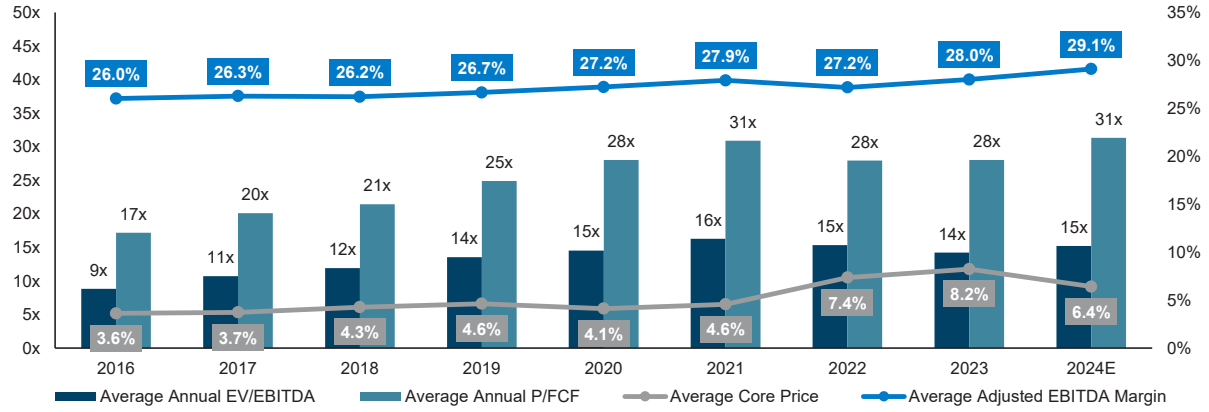
In addition to consolidation in the core solid waste business, several public companies have entered or rapidly expanded in adjacent markets through acquisition in recent years. Examples include Republic's 2022 acquisition of U.S. Ecology, which increased Republic's environmental services business from roughly a $400 million run-rate to a $1.6 billion run-rate, expanded Republic's solution set, and strengthened cross-selling potential to its existing base of manufacturing customers. Similarly, WM's pending acquisition of Stericycle will add a leading medical waste platform with both strong volume growth potential and opportunity for significant cost synergies. In addition to incremental growth and synergy opportunities, we believe many adjacent business lines are less capital intensive and operate with stronger free cash flow conversion than solid waste and recycling businesses.

Manifestation of Structural Factors Into Investment Thesis on Public Companies

Valuations Are High but Continue to Appear Reasonable in Context of Quality

As the structural forces we discuss throughout this report have increasingly played out, core price, adjusted EBITDA margins, and other metrics for solid waste and recycling companies have demonstrated underlying improvement. Consequently, valuations for solid waste and recycling companies have increased over the past decade, as illustrated in exhibit 38.

Exhibit 38
Waste and Recycling Industry
Average Valuations for Solid Waste and Recycling Companies Compared Against Average Price and Margin Metrics



Note: Metrics represent average of CWST, RSG, WM, GFL, and WCN. 2024E includes William Blair estimates for CWST, RSG, and WM and the midpoint of 2024 guidance for GFL and WCN.

Sources: FactSet, company documents, and William Blair Equity Research

While some investors may understandably express concerns over high valuations in the waste and recycling sector (sell-side analysts are roughly split between buy and hold ratings for both WM and Republic), we believe the quality, structural competitive advantages, and consistent earnings growth compounding potential of these companies justify current valuations. We also expect strong earnings growth across the group for the next few years as contributions from accelerated sustainability investments begin to flow through income statements. As shown in exhibit 39, we believe many other high-quality earnings growth compounders with wide competitive moats in the global services sector have experienced similar—if not steeper—increases in valuations over the past decade. In particular, we highlight several companies in the information services and commercial services industries.

Information services companies typically own scarce, proprietary data assets (analogous in this case to the landfill capacity owned by waste and recycling companies) that command significant pricing power and margin expansion potential. In total, the average EV/EBITDA multiple for companies in these two industries is currently about 18% above the 5-year average and 37% above the 10-year average; on a P/FCF basis, the average multiple is 20% above the 5-year average and 35% above the 10-year average. Both valuation metrics for information and commercial services companies have increased faster than for solid waste and recycling companies. While these are not perfect comparisons (e.g., information services companies are typically far less capital intensive than waste and recycling companies), we believe waste and recycling valuations remain reasonable on both an absolute and relative basis, in the context of high-quality service-based business models.

Exhibit 39
Waste and Recycling Industry
Current and Historical Valuation Comparison Against Other High-Quality Service-Based Business Models

	NTM EV/EBITDA					NTM P/FCF				
	Current	5-Year Average	Variance	10-Year Average	Variance	Current	5-Year Average	Variance	10-Year Average	Variance
Waste and Recycling										
CWST	16.5x	17.9x	*-8%*	13.8x	*19%*	37.6x	39.8x	*-6%*	32.8x	*14%*
RSG	14.6x	13.2x	*11%*	11.6x	*27%*	26.9x	24.3x	*11%*	22.6x	*19%*
WM	14.2x	13.8x	*3%*	12.1x	*17%*	31.3x	28.1x	*11%*	23.5x	*33%*
GFL-TSE	12.4x	13.1x	*-6%*	13.1x	*-6%*	23.3x	24.0x	*-3%*	24.0x	*-3%*
WCN	17.3x	17.2x	*1%*	14.5x	*20%*	31.4x	28.5x	*10%*	23.9x	*32%*
Waste Average	**15.0x**	**15.1x**	***0%***	**13.0x**	***15%***	**30.1x**	**28.9x**	***4%***	**25.4x**	***19%***
Information Services										
VRSK	24.5x	23.2x	*6%*	19.7x	*25%*	37.3x	33.1x	*13%*	29.4x	*27%*
EFX	19.2x	17.1x	*12%*	15.6x	*23%*	29.4x	28.9x	*1%*	25.7x	*14%*
TRU	15.6x	15.7x	*0%*	15.1x	*4%*	30.0x	26.8x	*12%*	25.9x	*16%*
SPGI	24.9x	20.9x	*19%*	17.5x	*42%*	31.6x	27.2x	*16%*	24.2x	*31%*
MCO	26.8x	22.6x	*19%*	18.5x	*45%*	36.5x	29.3x	*25%*	24.8x	*47%*
IT	26.2x	22.9x	*14%*	20.4x	*29%*	32.5x	27.7x	*17%*	26.6x	*22%*
FICO	46.4x	27.6x	*68%*	22.5x	*106%*	68.9x	48.5x	*42%*	38.9x	*77%*
MSCI	27.6x	31.0x	*-11%*	24.3x	*14%*	35.1x	40.0x	*-12%*	33.7x	*4%*
Info Services Average	**26.4x**	**22.6x**	***17%***	**19.2x**	***38%***	**37.7x**	**32.7x**	***15%***	**28.6x**	***31%***
Commercial Services										
ROL	29.5x	30.7x	*-4%*	26.9x	*10%*					
CTAS	30.5x	22.4x	*36%*	18.0x	*70%*	45.5x	32.6x	*40%*	29.6x	*54%*
ECL	21.5x	20.1x	*7%*	17.4x	*24%*	35.4x	33.9x	*5%*	29.0x	*22%*
URI	9.3x	6.6x	*40%*	6.1x	*52%*	25.7x	15.0x	*71%*	12.8x	*101%*
FIX	16.8x	12.1x	*39%*	10.6x	*58%*	27.0x	21.3x	*27%*	21.3x	*27%*
EME	13.7x	10.0x	*37%*	9.3x	*48%*	22.6x	17.8x	*27%*	16.8x	*35%*
Commercial Services Average	**20.2x**	**17.0x**	***19%***	**14.7x**	***37%***	**31.3x**	**24.1x**	***30%***	**21.9x**	***43%***
Average of Info and Commercial Services	**23.8x**	**20.2x**	***18%***	**17.3x**	***37%***	**35.2x**	**29.4x**	***20%***	**26.0x**	***35%***

Sources: FactSet and William Blair Equity Research

Company-Specific Thoughts on the Three Structural Growth Themes
In this section, we discuss our views on each of our three covered companies through the lens of the industry's three structural growth themes we discuss in this report.

Casella Waste Systems, Inc (CWST; Outperform). For more detail on Casella and our investment thesis, see our initiation report: Initiating at Outperform; Unique, Northeast-Focused Solid Waste and Recycling Midcap With Substantial Growth Runway.

- ***Price/cost spread.*** We see a strong opportunity for price-led growth given Casella's ownership of scarce disposal assets in the structurally constrained Northeast, increasing focus on extracting more value through stronger landfill pricing, and a large mix of open-market contracts (75%). As Casella continues its expansion into new geographies, we see potential for further margin upside as Casella continues to build route density in its new geographies.

- ***Sustainability and circularity***. We believe that Casella's processing business will benefit from recent and ongoing MRF upgrades (Boston completed in 2023, Willimantic in progress) in the form of improving material recovery yields and stronger cost efficiency. While the magnitude of the RNG opportunity is relatively smaller for Casella than for the others given the company's third-party royalty approach, we see minimal risk in this business given that the company's royalty agreements require zero capital from Casella.

- ***Competitive moat.*** Although Casella is the smallest of the five public solid waste and recycling companies, we believe the company benefits from being one of the largest players with significant disposal capacity in its core region, the Northeast. We believe Casella has the most meaningful and longest runway for core solid waste M&A relative to its size and current regional footprint, with potential for both geographic expansion along the Eastern Seaboard and fortification of the company's presence and route density in existing geographies.

Republic Services, Inc. (RSG; Outperform). For more detail on Republic and our investment thesis, see our initiation report: Initiating at Outperform; Steady Cash Flow Growth With Balanced Upside Potential Is Attractive.

- ***Price/cost spread.*** We believe Republic remains well positioned for strong price-led growth, given a robust nationwide asset base, a shift toward more open-market contract structures, over 50% of total revenue in franchise or small and midsize markets, and sophisticated pricing algorithms across each business line. With continued investments in automation and labor cost reduction, we believe price/cost spreads will remain positive for the next several years.

- ***Sustainability and circularity***. We view Republic as a leader in sustainability. On top of the company's already strong MRF footprint, we believe Republic can capitalize on increasing demand for recycled plastics through its polymer centers and Blue Polymers joint venture. Investments in RNG should also ramp up and contribute to the income statement in the coming years, with less relative exposure to RIN price volatility.

- ***Competitive moat.*** We believe Republic can maintain its strong competitive position as the second-largest North American waste and recycling company. We also see opportunity for Republic's differentiated environmental solutions business to be accretive to consolidated growth and margin expansion over time as the company aims to increase cross-selling to

customers that are increasingly demanding a broader set of solutions. We expect Republic to focus on tuck-in acquisitions across both its core solid waste and environmental solutions businesses.

Waste Management, Inc. (WM; Outperform). For more detail on WM and our investment thesis, see our initiation report: Initiating at Outperform; Market Leader Only Getting Stronger With Internal and External Upside Levers.

- ***Price/cost spread.*** We see a strong and balanced opportunity for price-led growth given WM's diversified and leading asset base across North America (including optimal landfill locations in 16 of the top 20 metropolitan areas) and sophisticated pricing algorithms across each business line. With continued investments in automation and labor cost reduction, we believe price/cost spreads will remain positive for the next several years.

- ***Sustainability and circularity.*** We believe WM has made the largest investments in both recycling upgrades and RNG, two key pillars of sustainability in this industry. Combined investments are expected to approach $2.9 billion from 2022 to 2026, with a target run-rate EBITDA contribution of $800 million. While WM's in-house development of RNG projects increases exposure to volatile RIN prices, it allows the company to capture the largest share of the economics, particularly as WM's large CNG fleet enables full monetization of RIN credits.

- ***Competitive moat.*** We believe that WM can maintain its leading position as the largest North American waste and recycling company through continued investments in its industry-leading asset base and operating efficiency programs. We expect continued focus on core solid waste tuck-in acquisitions, although these have become relatively less material to the income statement as the company's size has increased. We also see opportunity for WM to extend its operating expertise to the medical waste market through its pending acquisition of Stericycle.

The prices of the common stock of other public companies mentioned in this report follow:

Ameresco, Inc. (Market Perform)	$37.31
BP p.l.c.	£4.01
Casella Waste Systems, Inc. (Outperform)	$98.52
Coca-Cola Company	$71.71
GFL Environmental Inc	C$53.60
Republic Services, Inc. (Outperform)	$201.28
Stericycle, Inc.	$60.94
Waga Energy SA	€14.74
Waste Connections, Inc.	$177.79
Waste Management, Inc. (Outperform)	$207.93

IMPORTANT DISCLOSURES

William Blair or an affiliate is a market maker in the security of Casella Waste Systems, Inc., Republic Services, Inc. and Waste Management, Inc.

William Blair or an affiliate expects to receive or intends to seek compensation for investment banking services from Casella Waste Systems, Inc., Republic Services, Inc. and Waste Management, Inc. or an affiliate within the next three months.

Officers and employees of William Blair or its affiliates (other than research analysts) may have a financial interest in the securities of Casella Waste Systems, Inc., Republic Services, Inc. and Waste Management, Inc.

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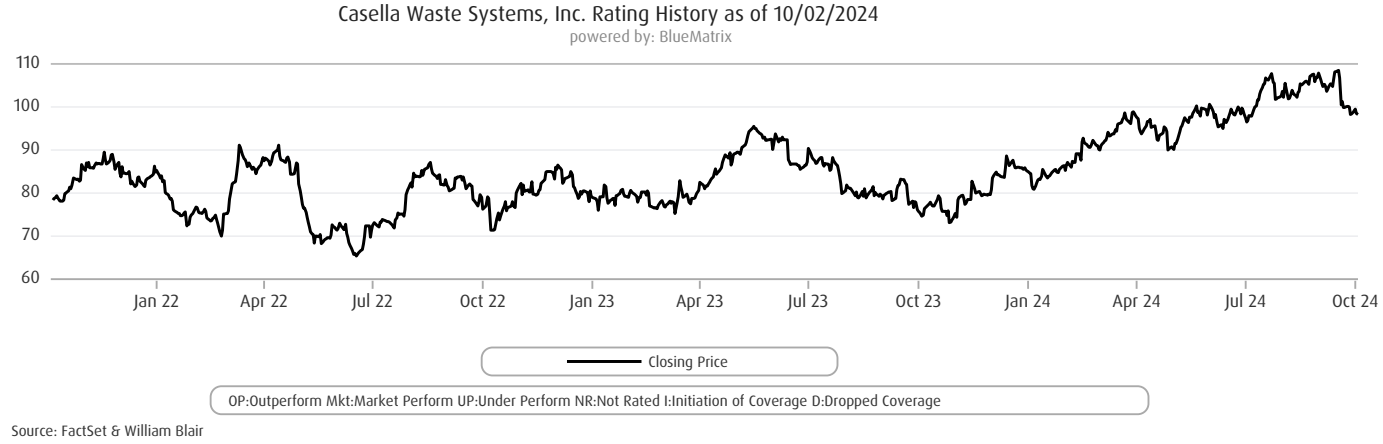
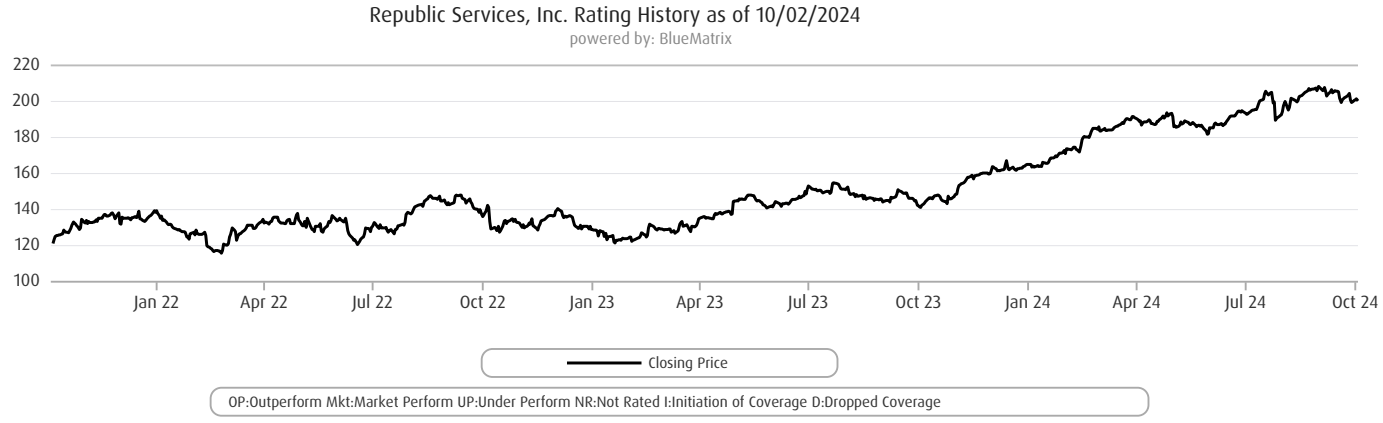
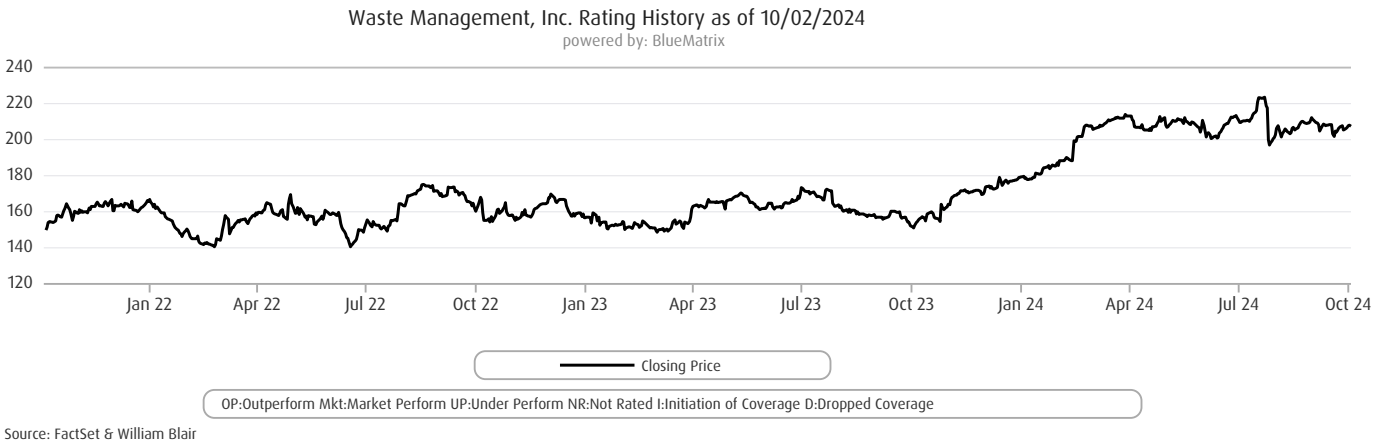
DOW JONES: 42011.60
S&P 500: 5699.94
NASDAQ: 17918.50



Source: FactSet & William Blair



Source: FactSet & William Blair



Source: FactSet & William Blair

Additional information is available upon request.

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Coverage Universe	Percent	Inv. Banking Relationships *	Percent
Outperform (Buy)	71	Outperform (Buy)	8
Market Perform (Hold)	28	Market Perform (Hold)	1
Underperform (Sell)	1	Underperform (Sell)	0

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