Dollars, Distance, and Diversion:

Rural-Tailored Solutions for the Thomas Jefferson Solid Waste Planning Unit

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Mandatory Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

AI tools (specifically ChatGPT and Claude) were used to support this project by interrogating policy alternatives, improving clarity and structure, and refining written materials. All analysis, recommendations, source selection, and final judgments are my own.

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This project is dedicated to the residents of Central Virginia, the region I have been lucky to call home for the past five years. It is my hope that this work helps move us towards a system that works better for each member of the community and for the long term.

MaeEllen Megginson

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Glossary

Thomas Jefferson Planning District Commission (TJPDC): The regional planning body that serves the Thomas Jefferson area and oversees planning, coordination, and compliance support for the Thomas Jefferson Solid Waste Planning Unit.

Thomas Jefferson Solid Waste Planning Unit (TJ-SWPU): The regional solid waste planning unit made up of Albemarle, Fluvanna, and Greene Counties, and the City of Charlottesville. It is the geographic and institutional area covered in this report.

Municipal Solid Waste (MSW): Everyday discarded material generated by households, businesses, and institutions, such as trash, recyclables, and other routine solid waste streams.

Solid Waste Management (SWM): The full system for handling waste, including its generation, collection, transfer, processing, treatment, recycling, and final disposal.

Environmental Protection Agency (EPA): The federal agency responsible for national environmental regulation, guidance, and research.

Virginia Department of Environmental Quality (DEQ): The state agency specifically responsible for overseeing solid waste planning, reporting, and recycling requirements in Virginia. DEQ receives local data and enforces the planning and benchmark framework that shapes regional decision-making.

Pay-As-You-Throw (PAYT): A pricing system in which residents pay for waste disposal based on how much waste they throw away (priced per unit), rather than only through flat fees or taxes.

Inter-Municipal Cooperation (IMC): A governance arrangement in which multiple local governments share services, staff, contracts, equipment, or facilities.

Diversion: The redirection of waste away from landfill disposal through recycling, composting, reuse, source reduction, or other recovery strategies.

Convenience Center: A drop-off site where residents bring waste and recyclable materials, common in rural areas without curbside collection.

Economies of Scale: Cost advantages that occur when services or infrastructure operate at a larger scale, reducing average costs per unit.

Elasticity: A measure of consumers' price sensitivity, or the extent to which consumption of a good or service changes with a change in price.

Executive Summary

This report evaluates how the Thomas Jefferson Solid Waste Planning Unit can strengthen rural solid waste management in Albemarle, Fluvanna, and Greene Counties as it prepares for its next regional planning cycle. Rural jurisdictions in the region face a distinct set of challenges: limited diversion infrastructure, long travel distances to disposal and processing sites, constrained staffing capacity, inconsistent waste data, and rising long-term disposal pressures. These conditions make it harder for rural communities to reduce landfill disposal, control costs, and sustain compliance with state waste-reduction expectations.

Based on a review of existing research and interviews with industry experts, this report assesses four policy alternatives:

1. Improving convenience-center sorting and compaction infrastructure,
2. Adjusting current per-unit pricing policies,
3. Deepening regional coordination, and
4. Subsidizing household composting.

These alternatives were evaluated against five key criteria: effectiveness, cost, cost-effectiveness, administrative burden, and political feasibility. **Across the analysis, a targeted adjustment to existing pricing structures offers the best overall performance.** Relative to the other alternatives, it produces the largest projected disposal reductions at the lowest cost, while fitting within the region's existing convenience-center model. The analysis estimates that modest price adjustments could reduce disposal by roughly 5 to 13 percent, with implementation costs far below the more infrastructure- and staffing-heavy alternatives.

The report recommends introducing phased pricing reform beginning with a modest increase, paired with clear public communication and continued low-cost or free recycling access. This approach is the most practical and cost-effective first step toward a stronger rural waste system. If implemented carefully, it can both reduce disposal immediately and generate revenue and institutional momentum for future investments in composting, convenience-center improvements, and deeper regional coordination.

More broadly, the report concludes that rural waste challenges in the region will not be solved through large capital expansion alone. The most credible path forward is incremental and strategic: begin with a policy lever that works within the current system, demonstrate results, and reinvest in longer-term improvements. In that sense, this recommendation offers the Thomas Jefferson Planning District Commission and its member localities a realistic path to improve service performance, manage costs, and build a more sustainable rural waste system over time.

Introduction

Across the Thomas Jefferson Solid Waste Planning Unit (TJ-SWPU), rural localities face limited diversion infrastructure, persistent data and staffing constraints, and higher per-household costs, even as population growth and rising disposal costs intensify system pressures. These challenges are compounded by state and federal priorities emphasizing waste reduction and environmentally protective management, reinforcing the need for more effective approaches. This report synthesizes the institutional and operational context underlying these conditions and identifies evidence-informed pathways to strengthen rural waste systems. Drawing on planning documents, federal frameworks, and academic literature, four primary policy approaches emerge: targeted infrastructure improvements, pricing reforms, expanded regional coordination, and subsidized household composting. By situating local conditions within broader policy frameworks and distilling key insights from the literature and practitioners, this report advances a recommendation and outlines an implementation strategy to improve system performance, cost-efficiency, and environmental outcomes in the TJ-SWPU.

Client Overview

The Thomas Jefferson Planning District Commission (TJPDC) serves as the regional planning body for the TJ-SWPU, which includes Albemarle, Fluvanna, and Greene Counties and the City of Charlottesville (Figure 1). The TJPDC is responsible for overseeing the preparation of the regional Solid Waste Management (SWM) Plan, reporting recycling rates to the Department of Environmental Quality (DEQ), and coordinating compliance with state requirements on behalf of member jurisdictions. The current regional SWM Plan covers 2021-2026, with an updated plan due later this year. This report's analysis is timed to inform the next planning cycle and parallel internal work already underway to update regional data and strategies. The following analysis aims to produce recommendations that fit within the TJPDC's convening role and resource constraints, offering options that can be advanced through regional planning and guidance to member localities.

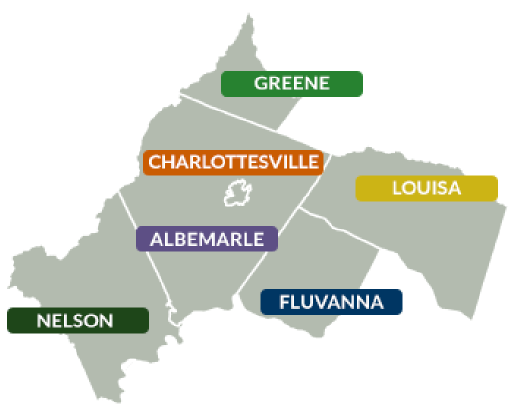

Figure 1: Map of the Thomas Jefferson Planning District

Problem Statement

Rural parts of the TJ-SWPU face rising costs, constrained infrastructure capacity, unreliable performance metrics, and increasing environmental and public health risks associated with long-term disposal. These challenges are driven by structural conditions such as dispersed populations, reliance on convenience-center systems, limited administrative capacity, and incomplete data that weaken both operational efficiency and planning accuracy. As regional population growth and statewide disposal pressures intensify, these constraints are expected to deepen, increasing fiscal strain and limiting the ability of rural jurisdictions to meet state waste reduction goals. **Addressing this problem requires identifying interventions that effectively reduce disposal, improve cost-efficiency, and strengthen system performance while remaining administratively feasible for resource-constrained rural jurisdictions.**

Background

Rural SWM in the TJ-SWPU is shaped by structural, fiscal, and administrative constraints that differ from those in the region's urban jurisdictions. Rural jurisdictions rely heavily on convenience centers rather than curbside service, requiring residents to travel longer distances on narrow rural roads and increasing hauling and operational costs. These local conditions mirror broader national patterns in which rural systems face higher per-household service costs, longer travel distances to disposal sites, and difficulty attracting private haulers because of low route density and limited economies of scale (RCAP, 2022).

While the TJPDC provides necessary technical and compliance support, the day-to-day operations, diversion practices, and contracting decisions remain the responsibility of individual localities. This division of labor functions reasonably well for larger, better-resourced jurisdictions like Albemarle but creates persistent challenges for rural counties that operate with minimal staff, limited infrastructure, and more fragmented systems. Within the TJ-SWPU, facilities are also concentrated near urban population centers, while rural counties operate convenience-center-based systems with fewer diversion opportunities and more limited staffing and operational capacity (Figure 2).

These challenges are occurring amid rising demand and broader statewide disposal pressure. The TJ-SWPU is projected to experience substantial population growth by 2050, with Albemarle expected to increase by more than 20 percent (TJPDC, 2021). Virginia remains one of the nation's largest importers of out-of-state waste, and landfill capacity pressures are likely to increase the long-term cost of disposal (Jennings, 2021). Together, these trends heighten concern about future hauling costs, tipping fees, and landfill life for rural localities that already face constrained service conditions.

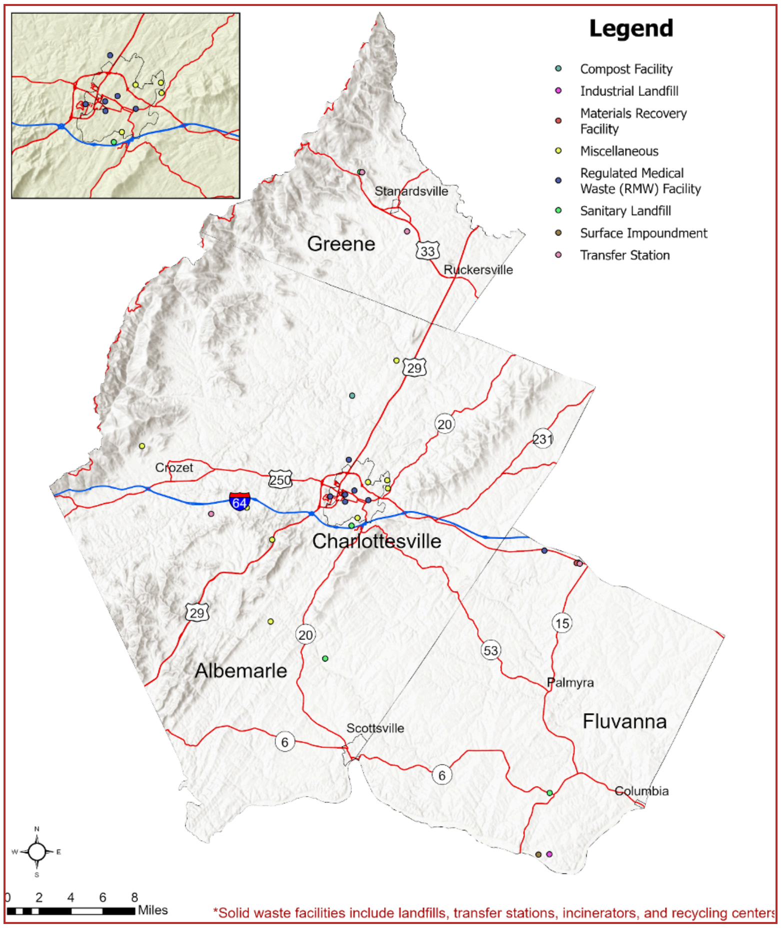

Figure 2: Map of Solid Waste Facilities in
the TJ-SWPU (TJPDC, 2021).

Data and administrative capacity are also central parts of the problem. Local waste and recycling data are often incomplete or inconsistent, as reporting varies across facilities and private haulers. Existing data document large anomalies in reported per-capita waste generation, including very high reported levels in Greene and very low reported levels in Fluvanna, driven by inconsistent capture of landfill and recycling tonnage rather than clear behavioral differences. These issues affect not only local planning, but also broader measures of regional recycling performance. Virginia mandates that planning units maintain long-term solid waste plans and demonstrate recycling performance of at least 25 percent in jurisdictions above the applicable population-density threshold (LIS, 2019). Meeting these requirements depends on consistent and accurate tonnage reporting, yet the current system includes barriers to collecting, interpreting, and reporting local waste data in rural jurisdictions.

Fiscal pressures further constrain system performance, as rural jurisdictions face ongoing burdens from hauling, equipment, maintenance, and regulatory compliance. Recycling markets are also thin and volatile, with many materials shipped out of the region and a particularly weak local market depth for glass (RCAP, 2022). Within this context, rural jurisdictions in the

TJ-SWPU rely on user-based pricing structures for disposal. Residents typically pay to dispose of municipal solid waste (MSW) at convenience centers through ticket- or volume-based systems, though the specific fee structures vary across counties. Despite this structure, current pricing levels do not consistently cover the full cost of service provision, particularly in lower-density rural areas with higher per-household service costs.

The environmental context adds further urgency. The EPA's national strategy prioritizes waste source reduction to minimize greenhouse gas emissions, prevent pollution, and conserve natural resources, with a 50 percent national recycling target by 2030 (EPA, 2025a; EPA, 2025b). Poorly managed waste streams increase the risk of groundwater contamination, PFAS-contaminated leachate, illegal dumping, and uncontrolled methane emissions– hazards that disproportionately affect communities with limited environmental monitoring and enforcement capacity (Coffin et al., 2023; Pelton, 2023). For rural counties often operating with constrained budgets and older facilities, these environmental risks translate into growing long-term liabilities, higher compliance burdens, and increased vulnerability to climate-related disruptions (RCAP, 2022).

Evidence Review

The literature on rural solid waste management spans both academic research and applied public policy studies, with a largely international focus and a growing U.S. evidence base. Existing research identifies four intervention areas relevant to the TJ-SWPU: sorting and data infrastructure, pricing policy reform, regional coordination, and upstream organics diversion. While the literature is relatively abundant on pricing and regionalization, it is more limited for low-density rural implementation and integrated system design. The evidence base treats these as distinct but related categories addressing technical processing, household incentives, institutional scale, and waste-stream composition.

Collection and Pre-Sorting Improvements

The literature on sorting techniques is largely focused on advanced mechanical and sensor-based systems. Studies emphasize combinations of mechanical methods alongside spectroscopic and computer-vision technologies that improve material recognition and separation in mixed waste streams (Lahtela & Kärki, 2018; Zhao & Li, 2022; Kokoulin et al., 2020; Gundupalli et al., 2016; Ionescu et al., 2015). There is more limited empirical work on scaled-down, modular systems tailored to low-throughput rural facilities, but this literature identifies capital cost, maintenance burden, and technical complexity as recurring constraints in rural applications (Lahtela & Kärki, 2018; Gundupalli et al., 2016).

More relevant to rural contexts are incremental improvements to collection and pre-sorting systems. The EPA emphasizes that many recycling systems require relatively modest infrastructure and operational upgrades to improve material recovery and reduce contamination

(EPA, 2024). These include improved container design and placement, standardized signage, basic sorting infrastructure, compaction equipment, and additional staffing to support on-site operations. Such updates are more relevant for rural drop-off systems, where separation occurs at the point of disposal rather than through curbside collection or centralized processing.

EPA guidance on transfer systems emphasizes that consolidating MSW into smaller loads reduces hauling costs, fuel consumption, and vehicle wear (EPA, 2002). Compaction makes transfer more cost-effective at longer haul distances, a key improvement in rural collection systems with dispersed drop-off sites. Consistent with this logic, EPA's more recent 2024 recycling infrastructure assessment identifies compactors and supporting infrastructure as part of investments needed to improve rural drop-off systems. Compaction is therefore a more relevant technology in rural contexts, functioning as a practical way to increase load density and reduce hauling burdens in low-density systems where transportation costs are high.

Pricing Policies

Pricing policies, especially pay-as-you-throw (PAYT) and other unit-based systems, are among the most extensively documented interventions in the literature. Tiller et al. (1997) find that rural households express significant willingness to pay for recycling access. Households consistently respond to higher disposal fees by increasing recycling participation and reducing household waste generation (Hong et al., 2017; Huang et al., 2011). Well-designed pricing systems consistently lead to lower disposal, higher recycling, and overall gains to system efficiency (Folz & Giles, 2002; Manni & Runhaar, 2014; Ukkonen & Sahimaa, 2021; Wright et al., 2019). In short, the literature provides strong empirical support for unit-based pricing as a tool to both reduce waste generation and increase recycling.

The literature also documents important caveats. Administrative burden, monitoring, billing, and enforcement concerns are commonly raised. There are also relatively few longitudinal studies of political acceptability or persistence over time. Concerns about illegal dumping are another recurring theme in the PAYT literature, but the evidence is mixed and should be interpreted cautiously. A Massachusetts study finds the PAYT effects on illegal disposal to be insignificant, while increased diversion and recycling were significant effects of program implementation (Callan & Thomas, 2006). Fullerton and Kinnaman (2017) find that while some illegal dumping occurs in response to pricing, its magnitude is limited and does not offset overall reductions in waste. The literature suggests that illegal disposal can occur at the margin, but is not a dominant outcome in most PAYT contexts.

Building Economies of Scale

The literature on inter-municipal cooperation (IMC) and regionalization identifies economies of scale as a central issue in rural SWM. Many rural municipalities operate below efficient scale, and there is substantial potential for cost reductions from shared facilities and resources across jurisdictions (Kojima, 2019; Llanquileo-Melgarejo & Molinos-Senante, 2021). The literature describes multiple forms of IMC, ranging from informal coordination to fully shared management bodies (Villalba Ferreira et al., 2020). Cooperative arrangements improve system efficiency and access to expertise, although benefits may emerge over time and vary with partnership size and governance structure (Sarra et al., 2020; Silva et al., 2020; Tobin & Zaman, 2022).

In short, regional coordination can expand planning capacity, reduce costs, and support more sophisticated waste-management systems for smaller jurisdictions. Still, the literature also notes limitations. Cooperation can involve transaction and coordination costs, disputes over siting or cost-sharing, political conflict, and diminishing returns when partnerships become too large or complex. Empirical work from rural U.S. settings remains limited and studies seldom integrate IMC design with other tools such as PAYT or shared advanced sorting infrastructure.

Upstream Organics Diversion

The literature identifies organics as a central component of the waste stream and a key piece of the environmental case for diversion. Food waste accounts for approximately 24 percent of MSW generation, and approximately half of Virginia's surplus food comes from residential sources (EPA, 2025c; ReFED, 2025). Organic materials such as food decompose anaerobically in landfills and function as a major source of methane emissions, an especially potent greenhouse gas (Rath & Hoover, 2023). Upstream interventions targeting household organic waste have the potential to both decrease total MSW disposal and landfill methane emissions.

Some composting programs have been shown to generate a 45 percent increase in organics diversion, and interestingly, small user costs improve participation and long-term engagement (Ariely et al., 2018; Platt & Fagundes, 2018; Somers, 2025). Household composting has the potential to reduce waste generation upstream and at the source, lightening the burden on the MSW system. By intercepting organics at the household level, these programs not only increase diversion but also reduce hauling demands, extend landfill lifespans, and lower system-wide costs.

Policy Alternatives

Based on a review of the literature and analysis of local documentation and practitioner insights, four policy alternatives become clear. Each of these options addresses a different angle of the diversion problem, including limited infrastructure, misaligned economic incentives, limited administrative capacity, and significant source generation of waste. Targeting each of these angles will have different implications in terms of increases in diversion and associated costs and effects.

Alternative 1: Increase Convenience Center Performance

This alternative modernizes the region's existing rural drop-off system by adding targeted infrastructure upgrades at convenience center sites. Rather than building new sorting facilities or expanding pick-up services, this alternative improves system efficiency and haul-cost performance by increasing load density and separating a few high-volume recyclable streams at the point of delivery. These changes are consistent with the state's and EPA's emphasis on modernization of existing infrastructure (DEQ, 2025; EPA, 2024).

This alternative involves installing simple pre-sort infrastructure across the TJ-SWPU and adding sealed compactors at three pilot sites where long haul distances and variable traffic create frequent, expensive pulls. Consistent with EPA guidance, pre-sorting improvements would include adding clearly labeled, source-separated streams, improving site layout to reduce contamination and cross-flow, and standardizing signage and bin placement to make sorting easier for users (EPA, 2024). The alternative uses modular sorting and densification to improve outbound loads, drawing on findings that more advanced sorting technologies can be powerful but are often most viable as part of larger, higher-throughput facilities rather than as stand-alone rural investments (Zhao & Li, 2022; Kokoulin et al., 2020).

Alternative 2: Adjust Pay-As-You-Throw Pricing Structure

This alternative functions as an adjustment to existing unit-based pricing that allows the TJ-SWPU to better tailor to the realities of rural convenience-center disposal. Importantly, pricing mechanisms are already embedded in the TJ-SWPU rural drop-off system. Albemarle, Greene, and Fluvanna counties each use ticket- or weight-based pricing structures at convenience centers. The relevant policy question is therefore not whether to introduce pricing, but whether and how to adjust existing prices to shift disposal behavior.

Under this alternative, the unit price for MSW disposal is adjusted (e.g. a higher per-bag tag or per-load minimum depending on existing county pricing models), while recycling drop-off remains free or heavily subsidized, keeping the household "choice set" intact but changing the marginal cost of trash. Pricing is made salient through targeted communications in advance of implementation and standardized signage on-site.

EPA analysis of PAYT systems cautions that price adjustments should generally not exceed approximately 30 percent increases in consumer costs in order to avoid political backlash or adverse behavioral responses (Canterbury & Blume, 1994). Guided by this finding, the alternative begins with a 10 percent increase and models effects up to a 30 percent increase, following a phase-in of price increases once administrators can observe subsequent shifts in tonnage and site conditions.

Alternative 3: Deepen Regional Coordination

Alternative 3 functions as a shared-service backbone that lets small, capacity-constrained jurisdictions operate as if they were one larger system for the purposes of staffing, contracting, and reporting. This structure is consistent with how IMC can range from transactional service exchange to more collaborative shared management bodies, depending on what is politically feasible (Villalba Ferreira et al., 2020).

Member localities include Albemarle County, Fluvanna County, and Greene County, which share costs in proportion to their population share. The alternative creates a regional SWM coordinator position that rotates across rural convenience centers to build administrative capacity, system oversight, and data reporting to assist in preparing DEQ documentation. The new role also executes regional or multi-jurisdiction contracts for materials that rural counties struggle to market alone (e.g. glass, organics, certain mixed recyclables). These arrangements mirror evidence that cooperation improves efficiency as service areas reach a more efficient scale and that shared contracts and arrangements can drive cost reductions in regionalized projects (Kojima, 2019; Llanquileo-Melgarejo & Molinos-Senante, 2021).

Alternative 4: Subsidize Household Composting

This alternative establishes an opt-in subsidized backyard composting program with education support for rural households in the TJ-SWPU. Participating households would receive a subsidized backyard compost bin and educational materials, including mailers and online guidance, to encourage diversion of food waste and yard waste at the source. The program is heavily informed by the Institute for Local Self-Reliance's "Yes! In My Backyard" model, which emphasizes that household composting programs perform best when they combine modest financial support with outreach, rather than relying on free distribution alone (Platt & Fagundes, 2018).

Providing bins addresses one of the main barriers to composting adoption: startup cost and uncertainty. Evidence shows that participation is often stronger when materials are subsidized rather than free or full-price, because a modest household payment can increase commitment and reduce non-use and leverage program self-selection (Ariely et al., 2018; Platt & Fagundes, 2018). In addition, unlike organics collection systems that require new trucks, transfer arrangements, or composting facilities, backyard composting occurs at the household level. That makes it a comparatively accessible first-step organics strategy for a region where rural jurisdictions rely on convenience centers, have limited dedicated staff, and face infrastructure constraints.

Criteria for Evaluation

I. Effectiveness

Effectiveness captures how well an alternative increases diversion (i.e. reduces total material landfilled). Total annual diversion in tons is projected based on available data and estimates from the literature. Estimates are given as an annual percentage change across the rural subset of the TJ-SWPU from a defined baseline year.

II. Cost

Cost captures the total fiscal burden an alternative imposes on local governments and implementing partners, including upfront capital requirements and ongoing operating, outreach, and labor costs over a five-year period.

III. Cost-Effectiveness

Cost-effectiveness assesses "value for money": how much diversion (in tons) is achieved per dollar spent over a five-year period, enabling comparison across alternatives with different mechanisms.

IV. Administrative Burden

Administrative burden captures the practical workload and additional organizational complexity required to implement and sustain an alternative given rural capacity constraints: staffing, training, procurement, monitoring, reporting, enforcement, interagency coordination, and infrastructural readiness. This criterion is evaluated on a low-to-high scale.

V. Political Feasibility

Political feasibility reflects the likelihood an alternative can be authorized, funded, and sustained by local elected officials and key administrative leaders, especially in rural jurisdictions where fee changes, siting decisions, and regional governance can face resistance. A low-to-high scale considers stakeholder buy-in, institutional alignment, and durability potential.

Evaluation of Alternatives

Within the rural TJ-SWPU context, effectiveness and cost-effectiveness are key priorities as the region works towards meaningful diversion improvements with limited fiscal capacity. Still, political feasibility and administrative burden help determine what is realistic in practice. The following sections apply the above criteria to each potential alternative and synthesize results in an outcomes matrix to identify the most defensible recommendation given the region's combination of priorities and constraints.

Alternative 1: Increase Convenience Center Performance

A. Effectiveness

To estimate diversion effects from improved drop-off systems, I rely on the EPA's 2024 national assessment of the recycling system (EPA, 2024). In that analysis, investments in accessible drop-off infrastructure, such as improved material separation and standardized signage, were associated with an estimated 7.6 million tons of waste diverted annually at the national level. Scaling this estimate proportionally using TJ-SWPU population data from the same census period, and excluding urban populations in order to isolate rural self-haul users, this alternative is projected to reduce MSW disposal by about **2,222 tons annually**, representing a **5.78 percent decrease**. This reflects the behavioral effect of making correct sorting easier and more visible at the point of disposal to better capture recyclable materials. By employing EPA best practices, the intervention reduces cognitive costs for users and improves capture rates of recyclable materials.

Compaction, by contrast, does not directly increase diversion rates. It is a downstream efficiency tool rather than a behavioral lever. Available equipment specifications indicate that compactors can increase effective haul size by approximately 70 to 80 percent, substantially reducing hauling frequency and transportation costs (CRA, n.d.; Harmony Enterprises, n.d.). Compaction enables cleaner material handling and may support higher-value marketing of recyclables, but it does not reduce waste generation or change sorting behavior on its own.

Several assumptions shape this calculation. First, diversion is assumed to remain constant over the five-year period, with no degradation in participation or equipment performance. Second, the analysis assumes no ramp-up period. In practice, diversion may be lower in early months as users adjust to new site layouts and sorting expectations. Third, diversion estimates are derived from scaled national data rather than site-specific pilot evidence, introducing uncertainty.

B. Cost

The cost of this alternative includes both up-front capital investments and ongoing operating expenses over a five-year period. The primary capital cost is the purchase of three self-contained, sealed 30-cubic-yard compactors appropriate for MSW and wet materials, which on average are estimated at $30,000 per unit, or $90,000 total for this pilot program (City of Danville, 2016; City of Denton, 2025; Global Trash Solutions, n.d.; Stellar Waste, n.d.).

Ongoing costs include annual maintenance contracts for the compactors, a reserve for unexpected service calls, and annual insurance premiums calculated as a percentage of equipment value (Bernard, 2025; CRA, n.d.; Merwin, 2025). Administrative and overhead costs were estimated using the methodology applied in a Costa Mesa Solid Waste Rate Study, which attributes approximately 8.2 percent of annual operating expenditures to administrative functions (excluding capital purchase) (NBS, 2024). Combined, these operating components total roughly $6,200 per year, or $31,100 over five years.

In addition to compaction equipment, modest investments in pre-sorting infrastructure are required to ensure that diversion gains are realized. Capital investment for improved collection infrastructure includes costs for bins, collection stations, and education per EPA guidelines (EPA, 2024). This scaled cost estimate, approximately $176,000, is consistent with the scaled effectiveness measure based on expected diversion rates resulting from infrastructure updates. When capital and five-year operating costs are combined, the total cost is about **$295,000**.

This cost estimate relies on several assumptions. First, the compactor price reflects midpoint market rates and assumes no significant installation, electrical, or site-preparation costs beyond current infrastructure capacity. Second, maintenance and service costs assume typical wear and do not account for major mechanical failure. Finally, the administrative cost percentage is derived from a municipal rate study in another state and applied proportionally, which may not perfectly reflect local overhead structures.

C. Cost-Effectiveness

Cost-effectiveness is calculated as total program costs over a five-year period divided by the total tons of MSW diverted over the same period. Dividing total costs ($295,000) by total diversion (11,110 tons) results in a cost-effectiveness rate of approximately **$26.55 per ton diverted**. The cost per ton reflects the durability of the intervention: once installed, sorting infrastructure and compaction capacity continue to generate diversion with modest ongoing costs. Cost-effectiveness would therefore improve over time, assuming compactors remain in use beyond the first five years.

Importantly, this estimate does not incorporate potential cost savings from reduced hauling frequency and transportation expenditures resulting from increased load density at convenience centers. Compaction can substantially increase the amount of waste transported per pull, which may reduce hauling costs over time. Because these avoided costs are excluded, the estimated cost-effectiveness should be interpreted as conservative. By bundling pre-sorting upgrades with compaction, this estimate reflects the performance of an integrated system that simultaneously improves material recovery and operational efficiency at rural convenience centers.

D. Administrative Burden

Drop-off systems depend heavily on consistent on-site operations, particularly monitoring and contamination prevention, and are especially vulnerable to contamination and illegal dumping when sites are not adequately staffed or monitored (National Academies, 2025). Practitioner guidance emphasizes that contamination reduction at drop-off sites depends on site design, monitoring, and operational practices, not simply the provision of bins and signage (Ford, 2022). Infrastructure upgrades alone are insufficient, and effectiveness depends on staffing support.

During the start-up phase, staff time is required for procurement, contracting, and installation coordination. Additional staffing is likely needed for training and standard operating procedure development, including contamination management protocols, equipment safety checks, and documentation procedures. In the steady state, ongoing operational oversight becomes the primary administrative responsibility. This includes monitoring site conditions, responding to contamination, and scheduling maintenance.

Still, this alternative leverages physical readiness, reducing burden. It operates within the established convenience-center model rather than creating a new curbside or franchise collection system. The use of relatively light infrastructure also keeps procurement simple and reversible if necessary. The overall burden is therefore **moderate**. Despite increased demand for site monitoring, the improvement of existing systems helps to counterbalance these effects.

E. Political Feasibility

This alternative builds on the existing rural service model and produces visible improvements that elected officials can readily defend. Residents would see clearer signage, better-organized containers, and smoother unloading experiences at convenience centers. Political support is often stronger when policy benefits are directly observable at the point of service delivery.

Studies of rural drop-off contexts have found positive willingness-to-pay for recycling access (even among non-recyclers), suggesting a baseline level of public receptivity when programs are framed as convenience and service quality rather than mandates (Tiller et al., 1997). The EPA identifies expanded and improved drop-off infrastructure as a central pathway to higher material capture, increasing the legitimacy of this approach (EPA, 2024). Local leaders can thus frame the proposal as consistent with national best practice, rather than as a local experiment.

However, capital expenditure may lead to skepticism and critiques that the investment is unnecessary unless clearly paired with a narrative about haul-frequency reductions and long-term operational savings. Some elected officials may worry that additional containers could increase contamination if not paired with consistent monitoring and site management.

Overall, this alternative demonstrates **high** political feasibility. It aligns with rural service norms, avoids fee increases, produces visible improvements, and fits cleanly within the regional planning cycle. While capital investments and maintenance demands present risks, these concerns are unlikely to outweigh strong structural and stakeholder alignment.

Alternative 2: Adjust Pay-As-You-Throw Pricing Structure

A. Effectiveness

Empirical research overwhelmingly finds that PAYT policies reduce MSW disposal and increase recycling (Bel & Gradus, 2016; Callan & Thomas, 2006; Dijkgraaf & Gradus, 2004). This alternative involves increasing key marginal price points in each county’s pricing structure, including bag stickers, ticket rates, and per-ton disposal rates. In Albemarle, for example, adjustments were applied to the Tag-A-Bag sticker and per-ton MSW rate; in Greene, increases were modeled across gallon tickets; and in Fluvanna, adjustments were applied to per-ton rates.

To project resulting changes in disposal, price elasticity of demand estimates were drawn from the PAYT literature. These estimates quantify consumers' behavioral responsiveness to price changes, measured in changes in consumption/disposal. Reported elasticities vary considerably across settings, but conservative estimates for household MSW disposal typically range from -0.2 to -0.4 (Bel & Gradus, 2016; Callan & Thomas, 2006; Dijkgraaf & Gradus, 2004; Huang et al., 2011).

For this analysis, I used moderate elasticity assumptions centered on -0.4 for Albemarle and Greene (where marginal pricing is more visible through tickets or bag tags) and -0.2 for Fluvanna (where minimum charges dampen marginal responsiveness). Using baseline disposal quantities, baseline prices, and adjusted price levels (10 to 30 percent increases), new disposal quantities were projected under standard elasticity formulas. With a 10 to 30 percent price increase, disposal is estimated to decrease by **5.4 to 13.3 percent**.

Yet, there are several limitations. First, elasticity estimates are drawn from the literature rather than locally estimated using TJ-SWPU-specific data and therefore represent informed assumptions rather than empirically identified local parameters. This analysis also assumes that reduced disposal translates primarily into increased recycling or source reduction. While illegal dumping and improper disposal are possible, these displacement effects are likely to be limited in magnitude with a small adjustment to existing pricing policies.

B. Cost

This alternative requires relatively modest administrative and communication investments, rather than major capital expenditures. The core pricing mechanism already exists within the TJ-SWPU rural convenience-center system: sticker and ticket purchases are routine transactions for users and do not represent a new category of costs.

The primary financial costs are administrative and outreach-related. Billing system and software updates are required to implement revised pricing structures and eliminate selected bulk-ticket discounts. Based on standard IT consulting rates, and assuming roughly 20 hours of configuration and testing time, software and billing adjustments are estimated at approximately $3,000. Additionally, public outreach is essential to ensure transparency and minimize backlash. This might include direct mail notification explaining the rationale for the price adjustment, new rates, and options for reducing costs through increased sorting. Mailing costs are based on case study examples and are projected to total approximately $13,700 (Platt & Fagundes, 2018).

Updated on-site signage reflecting new pricing schemes is also needed at convenience centers. Using market pricing for durable aluminum signage, this cost is estimated at approximately $330. Under a full outreach strategy that includes mailed notification, the total estimated implementation cost is approximately **$17,000**. If mail outreach were reduced or replaced with lower-cost communication channels (such as website updates, social media, and on-site notices only), total direct financial cost would fall to approximately $3,000.

These cost estimates do not include potential enforcement expenses, as the PAYT structure already operates through existing ticket and per-ton systems. They also do not include offsetting revenue effects. Importantly, PAYT adjustments are expected to generate additional disposal revenue per unit in the short term, even as total disposal declines. Over time, reduced tonnage may lower hauling and disposal costs, partially offsetting administrative expenses. These dynamic revenue and cost interactions are not modeled here, meaning the reported implementation costs most likely overstate net fiscal impact. While there are up-front costs associated with this price adjustment, these will be offset by revenue gains and potentially exceed costs in the long-run and generate a net gain.

C. Cost-Effectiveness

Cost-effectiveness is calculated by dividing total costs in the first five years (simply implementation costs) by the projected tons of MSW diverted under each price-adjustment scenario over the first five years. Under the 10 percent price increase scenario, which generates smaller diversion gains, cost-effectiveness is approximately $1.64 per ton diverted. Under the 30 percent price increase scenario, which produces the largest projected reduction in disposal, cost-effectiveness is approximately $0.67 per ton diverted. Cost-effectiveness therefore ranges from **$0.67 to $1.64 per ton diverted** based on the magnitude of price increase.

These figures are notably lower than the first-year cost-effectiveness of infrastructure-heavy alternatives, reflecting PAYT's behavioral leverage. Here, relatively small administrative expenditures can generate meaningful disposal reductions. The 30 percent scenario demonstrates particularly strong cost-effectiveness because diversion increases as price adjustments rise, while implementation costs remain largely fixed. Overall, even under conservative assumptions, PAYT adjustments are highly cost-effective, particularly when outreach costs are minimized and price adjustments approach the upper politically acceptable bound.

D. Administrative Burden

Since the TJ-SWPU already has pricing mechanisms in place at drop-off facilities, moving to a formalized PAYT adjustment regime (10 to 30 percent increases tied to behavioral incentives) represents a refinement of an existing system rather than the creation of an entirely new administrative apparatus. Compared to a full PAYT conversion, there is very minimal added administrative complexity.

Administrative demands can still be divided into start-up (rate design and adoption) and steady-state (billing, enforcement, and communication), but these phases are not equally intensive. Start-up requirements include rate modeling, basic elasticity scenario testing, revenue forecasting, and structured public justification. Board approvals and public hearings may be required in each participating county. State implementation guidance for PAYT programs emphasizes that careful cost modeling, analysis, and communication strategy are important before adoption (MassDEP, 2025). This indicates that rate-setting is a structured governance process, though in this context it is a bounded, one-time adjustment rather than a recurring technical exercise. Both EPA and MassDEP guidance also emphasize that PAYT programs depend on clear public education, transparency, and responsiveness to resident concerns (Canterbury & Blume, 1994; MassDEP, 2025). Communication demands are thus front-loaded.

In steady-state, administrative demands are more limited and therefore **moderate** overall. The region's existing experience with pricing mechanisms lowers implementation barriers, and once new rates are established, the system is relatively hands-off. While some ongoing monitoring and public engagement are required, PAYT in this context does not fundamentally transform administrative structure, and is less administratively intensive than a full system redesign.

E. Political Feasibility

Pricing policies are widely recognized as socially efficient instruments that achieve diversion gains without large net cost increases (Manni & Runhaar, 2014). However, political feasibility does not depend solely on economic efficiency. In rural systems, visible price increases introduce distributional concerns, enforcement issues, and electoral risk. These concerns are especially important in an inflationary context, where households are already experiencing higher prices across food, fuel, utilities, and other essential goods. Rising costs can create an opening to frame waste-fee adjustments as a necessary response to broader cost pressures, but they can also make residents more likely to resist any additional visible charge.

Previous political feasibility assessments of PAYT programs rely on economic efficiency and fiscal performance as predictors of local government support, particularly in rural or fiscally conservative contexts (Miranda et al., 1996). In practice, the primary source of resistance is the visibility of price increases. Even modest adjustments of 10 to 30 percent are highly salient to self-haul households who purchase tickets or bag stickers at the point of disposal. In a period of elevated consumer prices, this visibility cuts both ways: residents may understand that disposal, hauling, labor, and equipment costs have also increased, but stretched household budgets may make them less willing to absorb another fee. Residents may perceive PAYT adjustments as regressive unless clearly paired with fairness arguments or rebate and reinvestment mechanisms.

Durability depends heavily on the magnitude of the price adjustment and the political framing surrounding it. Fee increases are highly reversible under leadership turnover. If public attention frames the change negatively, elected officials may respond by rolling back adjustments. For this reason, PAYT reform would likely be more feasible if framed not as a new environmental fee, but as a cost-recovery and fairness measure that keeps recycling affordable, protects lower-income households, and reinvests revenue into visible rural service improvements. Overall, this alternative demonstrates **moderate** political feasibility. It is economically strong and institutionally aligned, yet politically sensitive due to the visibility and distributional implications of price increases.

Alternative 3: Deepen Regional Coordination

A. Effectiveness

The strongest empirical literature on IMC in SWM focuses primarily on cost-efficiency and service quality. While IMC is rarely evaluated purely as a diversion instrument, it strengthens the institutional conditions under which diversion improvements occur. Recent empirical work finds that IMC can reduce residual waste by up to approximately 9 percent, with larger effects observed in more integrated systems that adopt substantial operational changes such as door-to-door collection (Bel & Bühler, 2025).

However, this upper-bound estimate reflects more fully developed IMC arrangements than the regional capacity package proposed here. This alternative does not create a fully integrated regional system, but instead introduces shared staffing, coordinated contracting, and standardized reporting as incremental steps toward greater alignment. As a result, a more realistic central estimate is that this alternative could reduce rural MSW disposal by approximately **4.5 percent**, corresponding to roughly **1,700 tons annually**.

Importantly, these gains are expected to materialize gradually rather than immediately. In the short term, diversion impacts may be limited (on the order of 1 to 2 percent) as systems are harmonized and new governance structures become established. Larger effects depend on whether coordination translates into concrete operational changes, such as improved sorting standards, expanded material acceptance, or future programmatic investments.

The empirical evidence linking IMC directly to diversion outcomes remains comparatively thin, and the estimated effects are sensitive to governance design and implementation depth. The projected 4.5 percent reduction assumes that the shared regional staffer has sufficient access and authority to influence operational decisions and that participating jurisdictions adopt at least partial alignment in contracting and reporting practices. If coordination remains limited to information sharing without meaningful standardization, diversion gains would likely be smaller. Conversely, if the arrangement evolves into deeper integration over time, impacts could approach or exceed the upper-bound range observed in more mature IMC systems.

B. Cost

The primary cost is the creation of a shared regional staff position. The proposed compensation for this role is modeled within Virginia's Pay Band 5 salary structure (Policy Analysis/Administrative classification), consistent with a mid-level regional policy or operations coordinator. The base salary is estimated at approximately $65,000 annually, with employee benefits estimated at approximately $19,500 per year, based on standard state-level benefit rates as a share of salary (BLS, 2025; DHRM, n.d.). Total annual personnel cost is therefore estimated at approximately $84,500. Over a five-year planning horizon, total salary and benefits expenditures would add up to **$422,500.**

Costs are allocated proportionally based on population shares within the rural service area (96,916 total rural residents). This allocation assumes that workload correlates roughly with rural population and corresponding waste generation. Using rural population as a proxy for service demand and system size, the five-year cost allocation would be distributed approximately as follows:

- Rural Albemarle (50 percent): $210,692
- Fluvanna (28 percent): $120,129
- Greene (22 percent): $91,679

This estimate assumes a single full-time equivalent position and includes no additional overhead costs beyond salary and benefits (additional office space, equipment, travel reimbursement), which may slightly increase total cost if not absorbed within existing administrative structures. While population share is used as a proxy for service demand, actual workload may differ depending on local needs and agreement among the participating counties.

C. Cost-Effectiveness

Cost-effectiveness for the regional coordination alternative is calculated by dividing total annual program cost by the projected annual reduction in MSW attributable to IMC, which gives a cost-effectiveness estimate of approximately **$48.84 per ton diverted**.

This calculation assumes that diversion gains are immediately realized. In practice, regional coordination benefits may phase in gradually, which would increase short-term cost per ton but potentially lower long-term cost per ton as institutional improvements compound. This estimate also treats the entire salary cost as attributable to waste reduction outcomes, although the position would likely generate additional benefits such as improved grant capture, cost savings from joint procurement, and enhanced data quality (none of which are monetized here). This calculation also does not incorporate potential system-wide cost savings (such as from economies of scale in hauling contracts or equipment procurement). If coordination produces measurable financial efficiencies in addition to diversion gains, the effective net cost per ton reduced would decline.

D. Administrative Burden

This alternative represents a clear administrative expansion, but its central purpose is to absorb constraints that rural localities are already experiencing rather than add new responsibilities to existing staff. A centralized regional coordinator would take on functions that are currently fragmented, under-resourced, or inconsistently performed across jurisdictions, including reporting, procurement coordination, vendor negotiation, and cross-county planning. In this way, the alternative shifts administrative burden away from individual rural departments and into a dedicated regional role designed specifically to manage it.

The IMC literature consistently finds that small jurisdictions achieve economies of scale by professionalizing administrative functions at the regional level (Kojima, 2019; Silva et al., 2020;

Tobin & Zaman, 2022). A study associating IMC participation with approximately 13 percent reductions in per capita waste generation attributes gains partly to improved professional management and coordination capacity, rather than capital investment alone (Bel & Bühler, 2025). This is particularly relevant in rural systems, where a limited administrative capacity can constrain performance more than infrastructure deficits.

However, formal agreements must still be structured, negotiated, and approved. Cost-sharing arrangements (such as the proposed population-weighted contributions) require political negotiation and periodic adjustment. Designated authority of the new role must be carefully structured to ensure cooperation and prevent gridlock or unclear lines of accountability. It is also important to note that benefits accrue gradually, meaning the start-up phase requires administrative effort before efficiencies and returns on investment are realized.

Overall, administrative burden is **low**. While it requires deliberate setup and political agreement, over time it reduces duplication, absorbs existing capacity constraints, and expands regional administrative capacity.

E. Political Feasibility

Regional coordination requires cross-county trust, shared authority, and governance clarity, which are factors that can be more delicate in rural contexts where local autonomy is highly valued. Still, political buy-in is plausible for several reasons. Framing the shared staffing model as enhancing the existing SWPU model rather than transferring local control can help to reduce political friction.

A shared coordinator also addresses a visible management gap without introducing new infrastructure or raising fees. The IMC literature provides an evidence-based rationale for cooperation, including waste generation reductions and cost and service improvements from administrative consolidation (Bel & Bühler, 2025; Kojima, 2019; Silva et al., 2020; Tobin & Zaman, 2022). These findings allow leaders to frame expanded coordination as fiscally responsible and performance-enhancing.

However, rural jurisdictions may resist perceived erosion of autonomy. Population-based cost allocation could prompt fairness debates, particularly if one county perceives unequal benefit relative to its financial contribution. Durability depends almost entirely on governance design. A full-time regional staff position creates institutional continuity, which can survive election cycles more easily than politically contentious fee increases. Salary funding embedded in annual budgets is generally more stable than initiatives requiring continued reauthorization.

Overall, this alternative demonstrates **moderate** political feasibility. It avoids direct resident cost increases and fits within existing regional structures, but success depends on leadership commitment and carefully structured authority-sharing arrangements.

Alternative 4: Subsidize Household Composting

A. Effectiveness

The effectiveness of this alternative depends on two assumptions. First, that a meaningful share of rural households will enroll and continue composting over time. Second, that home composting can divert a measurable amount of organic waste from disposal. Research from the Institute for Local Self-Reliance finds that for every 10,000 households composting at home, between 1,400 and 5,000 tons per year could be diverted from curbside collection (Platt & Fagundes, 2018). Based on these diversion estimates, I use a mid-range estimate of 0.3 tons diverted annually per actively composting household. Assuming a 20 percent uptake and 90 percent ongoing usage based on previous case study findings, the program would result in about 6,800 active composting households, and an estimated **2,058 tons** diverted annually. This represents an estimated **5.35 percent annual reduction** in disposal across the rural TJ-SWPU.

Still, the effectiveness estimate has important limitations. Home composting is inherently difficult to verify. Unlike drop-off systems or processed tonnage at facilities, household diversion is largely unobserved. As a result, this estimate depends heavily on assumed participation and continued-use rates. The diversion factor is drawn from literature and case studies rather than direct local measurement, and baseline household composting rates are not accounted for. Still, case studies across the U.S. suggest these patterns are largely generalizable.

B. Cost

The program would subsidize a simple backyard bin, and costs for the alternative are centered around material costs and distribution labor. Based on ILSR case studies, simple municipal compost bins average approximately $38 per unit in bulk procurement, while a resident contribution in the range of $20 to $25 is associated with stronger regular use than full free distribution (Platt & Fagundes, 2018). Consistent with that evidence, this alternative assumes a $25 household payment and public coverage of the remaining bin cost of approximately $13.

Under the participation assumptions outlined above, the total cost of compost bins is estimated at about $99,068. Educational mailers are estimated at $2,743, based on a cost of approximately $900 per set of 2,500 postcards drawn from the ILSR model (Platt & Fagundes, 2018). Labor costs are included for both distribution and program management. Distribution labor is estimated at 10 minutes per bin, yielding about $33,000 in labor costs using an estimated hourly compensation rate of $26, which reflects a roughly $20 hourly wage plus 30 percent benefits. Program management is estimated at 0.25 FTE, or 520 hours annually, at a cost of $13,520 per year.

Taken together, total costs are estimated at **$202,500** over five years, including startup costs and five years of program management. This alternative spreads much of the cost across one-time household provisioning, rather than permanent capital obligations.

The cost estimate is still subject to several limitations. Bulk procurement prices may vary depending on vendor, shipping, and order size. Program management could be lower if folded into existing staff responsibilities, or higher if the program expands into workshops, technical assistance, or more intensive follow-up. Even so, the overall cost profile remains modest for a regional waste-diversion strategy of this scale.

C. Cost-Effectiveness

Using the five-year total program cost of $202,500 and the estimated annual diversion of 2,058 tons, the cost-effectiveness is approximately **$19.68 per ton diverted** over five years.

This ratio reflects the fact that backyard composting shifts part of the waste-management function to households themselves. The public sector provides bins, basic education, and coordination, but households perform the ongoing separation and processing at home. In effect, this allows the region to capture organics diversion without incurring the full costs of collection, transfer, or processing infrastructure. That is a major advantage in a rural planning unit where long hauling distances, small tax bases, and fragmented service systems make centralized organics systems more expensive and difficult to implement.

D. Administrative Burden

Compared with infrastructure-intensive organics diversion strategies, household backyard composting requires relatively little permitting, procurement complexity, or intergovernmental coordination. The program can be administered largely through existing county solid waste offices, with potential for support from other local partners. Because composting occurs at the site of generation, this model avoids many of the regulatory and operational burdens associated with collecting, transporting, and processing separated food waste through a public system.

Still, the alternative requires several operational tasks: procuring bins, handling registrations or pickups, distributing educational materials, coordinating communication, and tracking participation. If the program expanded to include workshops, technical assistance, or follow-up outreach, staff needs would increase. The inclusion of 0.25 FTE of ongoing program management in the cost estimate reflects the reality that even a relatively simple voluntary program requires sustained coordination to function well. In a rural context, this burden matters because local governments already face limited dedicated solid waste staffing and depend heavily on regional support for planning and compliance. Because household composting occurs privately, outcomes are difficult to monitor with precision. That is a limitation in a planning context where local data are already incomplete and sometimes unreliable.

Even so, the administrative burden is overall **moderate**. Counties begin with bin distribution and educational mailers, then expand later into workshops, demonstration events, or master composter partnerships if uptake proves promising. This makes the program comparatively manageable for jurisdictions with limited capacity.

E. Political Feasibility

Several features make this alternative especially well suited to the rural TJ-SWPU context. It is voluntary rather than mandatory. Households can opt in if they are interested, which avoids the political resistance associated with mandates or enforcement-based policies. It can also be framed positively as a household support program that helps residents save money, garden more effectively, and reduce waste, rather than as a punitive or regulatory intervention.

The rural context may actually strengthen the political case, as rural residents are more likely to compost than their urban counterparts, which supports the plausibility of household demand for this kind of program (Niles, 2020). Because many rural households already have yards and some degree of separation from neighbors, backyard composting is more practically feasible than it would be in denser or more apartment-dominated settings. The fact that the program bypasses the infrastructure problem entirely also strengthens its political appeal. Unlike organics collection systems that require trucks, facilities, and continuing operating expenditures, this strategy can be implemented without major physical system changes. For fiscally cautious localities, that is a significant advantage.

There are still political constraints. Not all residents will view composting as desirable or convenient. Some households may worry about odor, pests, labor, or confusion over what can be composted. The program may be appealing mainly to environmentally motivated households rather than seen as a broad public service. The intervention may also be viewed as too small-scale or too behavior-dependent to address the region's larger structural disposal problems. For that reason, the strongest political framing should present the alternative not as a stand-alone solution, but as a low-cost, upstream, voluntary program that complements broader strategies.

The political feasibility of this alternative is overall **high**. It aligns with rural household behavior, avoids visible coercion, keeps public costs manageable, and can be introduced incrementally. Among organics-related policy options, it is likely one of the least controversial and most immediately implementable.

Outcomes Matrix

	Effectiveness *% Reduction in Annual Disposal Rate*	**Cost** *Total Costs Across First 5 Years*	**Cost-Effectiveness** *Cost per Ton Over 5 Years*	**Administrative Burden**	**Political Feasibility**
Alternative 1: Increase Convenience Center Performance	5.78%	$295,000	$26.55	Moderate	High
Alternative 2: Adjust PAYT Pricing Structure	**5.4-13.3%** *(10-30% price increase)*	**$17,000**	**$0.67-$1.64** *(10-30% price increase)*	**Moderate**	**Moderate**
Alternative 3: Deepen Regional Coordination	4.5%	$422,500	$48.84	Low	Moderate
Alternative 4: Subsidize Household Composting	5.35%	$202,500	$19.68	Moderate	High

Recommendation

Based on this evaluation, I recommend Alternative 2, a targeted price adjustment for rural TJ-SWPU convenience-center systems. Among the evaluated options, price adjustment most consistently advances the core objective (reducing disposal) while remaining comparatively low-cost and operationally feasible within the region's existing service model. The strongest case for PAYT is that it directly targets household disposal behavior, and the empirical literature shows unit-based pricing reliably reduces MSW disposal with positive recycling responses.

PAYT also performs well on cost and cost-effectiveness. Even when paired with a robust outreach campaign, the cost per ton diverted remains low relative to the other alternatives. PAYT generates substantial behavioral gains without requiring major capital or staffing investments, shifting a greater share of disposal costs toward users based on waste generation. This is a key advantage in a rural system with constrained budget flexibility and limited staff capacity.

Still, the tradeoffs are real and define how the recommendation should be implemented. First, PAYT is politically sensitive because it is experienced as a direct price increase at the point of disposal. Even modest increases can generate pushback, especially if residents perceive the change as regressive. Second, pricing reform requires ongoing governance including periodic rate review, staff time for administration, and the capacity to respond to complaints.

Finally, there is a nontrivial risk of illegal disposal if fees are perceived as punitive and enforcement is weak. Illegal dumping concerns are legitimate, but the available evidence does not justify treating them as a sufficient reason to reject PAYT outright. The literature reviewed does not find statistically significant evidence that the direct response to price increases translates into illegal disposal; instead, the significant response operates through increased recycling (Callan & Thomas, 2006). Illegal dumping should be treated as a design and enforcement concern to mitigate, not as evidence that pricing systems are inherently ineffective.

These tradeoffs do not outweigh PAYT's advantages, but they do point to the importance of a tailored design approach. In short, PAYT is recommended because it is the strongest all-around performer across effectiveness, cost, and cost-effectiveness, while remaining institutionally aligned with the existing convenience-center model. The core tradeoff is political risk and ongoing administrative monitoring. A careful rollout can manage these risks, while still capturing the substantial diversion potential of pricing reforms.

Following the implementation of Alternative 2, other options should be considered as part of a phased strategy. Notably, all four interventions generate similar incremental diversion gains (roughly 5 to 10 percent), despite substantial differences in cost and administrative burden. The greatest impact comes from layering complementary interventions over time so that their effects compound. In this sense, PAYT serves as a foundational first step, both because it is cost-effective and because it can generate additional revenue to support subsequent investments. If the region pursues additional interventions after implementing Alternative 2, rollout should follow strategic priorities and evaluations from the Outcomes Matrix.

Composting is the most natural follow-up because it complements pricing reforms, offers moderate cost-effectiveness and a moderate administrative burden, and has high political feasibility. There is clear linkage between the policies as well. Once households face a clearer disposal price signal, offering subsidized backyard composting gives them a practical way to reduce their waste generation and avoid disposal costs (Platt & Fagundes, 2018).

Next, Alternative 1 should follow, focusing on low-cost convenience-center sorting, signage, and reporting improvements. This works best once PAYT has already increased demand for better sorting behavior and once counties can justify targeted reinvestment. Although more expensive, its high political feasibility and potential long-term returns make it a logical next step once adequate financial resources become available. Alternative 3 should come last, not because it lacks value, but because deeper regional staffing and governance are harder to negotiate politically and are easier to sustain after earlier, smaller successes have built trust.

Implementation

Overview

The recommended policy is a calibrated adjustment of fee structures already operating in parts of the TJ-SWPU. Rural households already rely heavily on convenience centers, travel long distances to dispose of waste, and face rising disposal pressures alongside limited local administrative capacity. The implementation challenge is therefore to refine the current structure so fees better align with waste volume while preserving affordability and political legitimacy.

The core implementation problem is political and managerial, not technical. A strong pricing signal can reduce waste, but only if local officials present it as fair and gradual. The most durable version of this recommendation is a phased adjustment. Practically, this means starting near the lower end of the adjustment range (around 10 percent), pairing the change with visible fairness measures (maintaining or reducing minimum charges where appropriate), and communicating clearly that households can lower costs through better sorting. If early results show disposal reductions without a spike in dumping complaints, the region can credibly scale toward a stronger price signal (closer to 20 to 30 percent) with a clearer justification.

Process and Stakeholder Management

The TJPDC should serve as the implementation manager because it already coordinates regional planning and is well positioned to align the recommendation with the upcoming planning cycle. County governments and solid waste departments should execute the adjustments, since they control site operations, fee ordinances, and local communication. Site managers and convenience center staff are the frontline workers. They will see confusion, evasion, and resident complaints first, so they must be included early rather than treated as passive implementers.

The most important stakeholders outside government are rural residents, especially frequent convenience-center users; low-income households and seniors who may be especially fee-sensitive; and regional partners who could later support follow-on investments in sorting, composting, or shared contracts. Stakeholder alignment will be mixed. Fiscal and planning staff may support PAYT as a cost-recovery and demand-management tool, while elected officials may fear that any visible price increase will be framed as punitive.

Residents are likely to resist if they interpret the reform as "paying more for the same service," but may be more supportive if it is framed as a consumer-autonomy mechanism (households that generate less waste can pay less, while recycling remains low-cost or free). That framing is consistent with rural PAYT implementation guidance emphasizing transparency, simple pricing, and clear explanations of how households can reduce bills. Municipalities may also choose to include an access layer, implemented through discounted tags or annual vouchers for income-qualified households (Hong et al., 2017; Manni & Runhaar, 2014).

Sequencing and Rollout

Stage 1: Design and coalition-building (0-6 months). The TJPDC should convene a small intergovernmental working group with representatives from Albemarle, Fluvanna, and Greene. Its immediate tasks are to document the current fee structures, identify which charges can be adjusted administratively versus legislatively, define fairness protections, and establish a baseline dashboard. That dashboard should track, at minimum: disposal tonnage, recycling tonnage, complaint volume, illegal dumping reports, contamination rates, and net revenue.

Stage 2: Soft launch and public communication (6-12 months). Before any price change takes effect, localities should run a communication campaign built around three messages: first, the existing system is not keeping pace with hauling and disposal costs; second, households retain control over their bills; and third, recycling and proper sorting are the easiest way to save money. Messaging should also specify where any added revenue will go. Revenue should be visibly earmarked for rural convenience-center improvements, fee relief for vulnerable households, and clearer signage or operating upgrades rather than disappearing into general budgets.

Stage 3: First-phase adjustment (Year 1). The initial increase should stay close to the low end of the recommended range and be paired with fairness measures such as lowering minimum charges where feasible, preserving free or very low-cost recycling, and considering targeted relief for seniors and low-income households. A modest first move is important because increasing costs for residents will be best received if the policy is viewed as measured and justified.

Stage 4: Evaluation and scale-up (Years 2-3). After 9-12 months of operation, the TJPDC and the counties should review whether the initial adjustment reduced disposal, stabilized revenues, or triggered meaningful dumping complaints. Only if those indicators move in the desired direction should the region scale toward the stronger 20 to 30 percent price signal. This second move should be presented as an evidence-based response to early results.

Worst-Case Scenarios and Mitigation

The most important implementation risk is not administrative overload, but political backlash from residents who perceive the reform as unfair. The best mitigation includes gradualism and visible benefits. Implementation should phase in price changes and clearly show what households get in return. A second risk is illegal dumping or burning. This risk is real but often overstated in PAYT debates. The implementation response should be targeted monitoring at known dumping hotspots, a simple public complaint mechanism, and early coordination with code and law enforcement rather than a large new enforcement bureaucracy. A final risk is county divergence, where one locality moves ahead and another hesitates. The TJPDC's role is to offer a common template with room for local adaptation rather than insisting on uniformity.

Potential Funding Sources

The most relevant funding source is likely a mix of state recycling funds, federal solid-waste infrastructure programs, and rural utility financing. The strongest near-term state option is Virginia DEQ's Litter Prevention and Recycling Fund. DEQ provides annual non-competitive grants to localities, and localities already receiving those grants are also eligible for competitive grants that can fund regional recycling education programs and pilot projects. That is a particularly good fit for PAYT communication, signage, outreach, and small pilot efforts.

The strongest federal infrastructure option is EPA's Solid Waste Infrastructure for Recycling (SWIFR) program. SWIFR supports improvements to local post-consumer materials management and local waste management systems, and the Political Subdivisions program explicitly includes organics, paper, metal, glass, C&D debris, reuse, composting, and related system improvements. For rural capital needs, USDA Rural Development's Water & Waste Disposal Loan and Grant Program can finance solid waste collection, disposal, and closure projects in eligible rural areas and can combine grants with loans where needed to keep user costs reasonable. That is more suitable for later infrastructure phases than for PAYT itself, but it could support convenience-center improvements tied to Alternatives 1 or 2.

Conclusion

The TJ-SWPU does not need a sweeping overhaul to make meaningful progress; it needs a strategy that is fiscally disciplined, behaviorally effective, and realistic for capacity-constrained rural jurisdictions. A targeted adjustment to the existing pricing structure best meets these needs. It offers the strongest combination of meaningful disposal reduction, highly favorable cost-effectiveness, and compatibility with the region's existing convenience-center system. Just as importantly, it creates a practical path forward that begins with modest, well-communicated changes, builds public trust through fairness protections and visible reinvestment, and positions the region to fund future improvements in composting, sorting infrastructure, and regional coordination. In that sense, this recommendation is not simply a narrow pricing reform, but the most credible first step toward a stronger rural waste system. If implemented carefully, the future of solid waste management in the TJ-SWPU can be one in which rural communities are supported by a system that is more efficient, more sustainable, and better equipped to meet the region's long-term environmental and fiscal challenges.

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Appendix

Effectiveness:

County	Population
Rural Albemarle (rural 43% in 2020 census; 112,395 total population 2020).	48329.85
Fluvanna (data xlsx)	27,556
Greene (data xlsx)	21,030
Total TJSWPU Rural Areas (from above)	96,916
Percent Rural within TJSWPU	**0.4527**
Total VA (2020 census)	8,631,393
Percent of VA (TJSWPU Rural)	**0.0112283**
US Population (2020 census)	331,449,281
Percent of US (TJWSPU Rural)	**0.0002924**

TJSWPU: (historical waste xlsx, 2021)

Material Type	Tons
Principle Recycled Material (PRM)	48,853
Municipal Solid Waste (MSW)	84,923

Rural TJWSPU:

Material Type	Tons
Principle Recycled Material (PRM)	22115.24
Municipal Solid Waste (MSW)	38443.75

Entity	Expected Diversion from drop-off upgrades (in tons)
U.S. (EPA report)	7600000
TJSWPU Rural	**2222.24184**

Percent Change in Disposal:	**-5.78**

Cost:

Item	Cost
Up-front costs: compactors x3	90000
Ongoing maintenance annual contract	3000
Unexpected service calls	1000
Annual insurance	1800
Capital invesmtent for EPA collection	176024.9457
5 year sum:	**295024.9457**

Cost Effectiveness:

	Cost-Effectiveness ($/tons)
Rate for years 1-5:	26.55201072

Figure 3: Cost and Effectiveness Calculations for Alternative 1

Cost:

Item	Cost
Billing system and software updates (IT consultation for setup)	3000
	13717.1376
Signage with updated pricing sys	329.58

Total (with mail outreach)	17046.7176
Total (without mail outreach)	3329.58

Households (census data)

County	Houshold Number
Albemarle	*45,912*
Rural Albemarle (rural 43% in 2020 census).	19742.16
Fluvanna	10,329
Greene (data xlsx)	8,032
Total Rural TJSWPU Households	38103.16

Cost Effectiveness:

Cost Effectiveness (mail included)

Low end estimate:	High end estimate:
1.643038104	0.6673096243

Cost Effectiveness (no mail)

Low end estimate:	High end estimate:
0.3209196597	0.1303395076

Price Adjustments/Effectiveness:

Albemarle:

Component	Baseline ($)	Small Adjustmnet (~10%)	Moderate (~20%)	Threshold Test (~30%)	Adjustment Notes
Tag-A-Bag sticker (up to 32 gal)	2.00	$2.20	$2.40	$2.60	Increase bag costs
MSW rate (per ton)	$60	$66	$72	$78	Keep per-ton stable
Minimum charge	$6	$5.40	$4.80	$4.20	Reduce minimum/incentivize smaller drop offs
Service Fee	$1	$1	$1	$1	Maintain status quo

Greene:

Component	Baseline ($)	Small (~+10%)	Moderate (~+20%)	Threshold (~+30%)	Adjustment Notes
30-gal ticket	$1.00	$1.10	$1.20	$1.30	10% increments
50-gal ticket	$2.00	$2.30	$2.50	$2.70	15% increments
90-gal ticket	$3.00	$3.60	$3.90	$4.20	20% increments
Ticket book discount (30-gal)	$2	$1	$0	$0	Cut bulk discount
Ticket book discount (50-gal)	$3	$1.50	$0	$0	Cut bulk discount for larger quantities more

Fluvanna:

Component	Baseline ($)	Small (~+10%)	Moderate (~+20%)	Threshold (~+30%)	Adjustment Notes
Household Trash (per ton)	$60	$66	$72	$78	
Brush & Yard Waste (per ton)	$60	$66	$72	$78	
Minimum charge	$10	$11	$12	$13	Increase minimum (small-load signal)
C&D (per ton)	$65	$72	$78	$85	

Elasticity estimates:

County	Low	Central	High	Notes
Greene	−0.2	−0.4	−1.0	Central (Podolsky & Spiegel (E= −0.39)), Low (Bel & Gradus (inelastic but nonzero meta analysis), High (Huang et al PAYT upper bound)
Albemarle	−0.1	−0.3	−0.8	Central (Podolsky & Spiegel (E= −0.39) but more uncertainty), bag sticker users could respnod similar to Fullerton/Kinnaman (volume-based marginal decisions), but convenience-center self-haul reduces frequency
Fluvanna	−0.05	−0.15	−0.25	when a minimum charge dominates, the marginal price for small loads is effectively flat, so response to the posted per-ton rate is dampened - hence low end of elasticity ranges)

Disposal rates:

County	Household MSW (tons)	PRM (tons)	Commercial MSW (tons)	Percent of Household MSW
Albemarle/Charlotesville	*44394*	*40098*	*406*	
Rural Albemarle only	13318.2	12029.4	121.8	0.2473
Greene	39079	6547	3790	0.7257
Fluvanna	1451	2211	0	0.0269
Total Rural SWPU:	**53848.2**	**20787.4**	**3911.8**	**100**

$$E = \frac{\text{Qnew-Qold/Qold}}{\text{Pnew-Pold/Pold}}$$

Qnew = (E * (Pnew-Pold/Pold) * Qold) + Qold

Using moderate elasticities:

County	Elasticity	Category	Old P	New P (low)	New P (high)	Old Q	New Q (low)	New Q (high)	Estimated diversion	Percent change (lo	Estimated diversion (high)	Percent change (high)
Albemarle	-0.4	tag a bag	2.00	2.20	2.60	13,318.20	12,785.47	11,720.02	532.73	-4.00	1,598.18	-12.00
Albemarle	-0.4	MSW rate (per ton)	60.00	66.00	78.00	13,318.20	12,785.47	11,720.02	532.73	-4.00	1,598.18	-12.00
Greene	-0.4	30-gal ticket	1.00	1.10	1.30	39,079.00	37,515.84	34,389.52	1,563.16	-4.00	4,689.48	-12.00
Greene	-0.4	50-gal ticket	2.00	2.30	2.70	39,079.00	36,734.26	33,607.94	2,344.74	-6.00	5,471.06	-14.00
Greene	-0.4	90-gal ticket	3.00	3.60	4.20	39,079.00	35,952.68	32,826.36	3,126.32	-8.00	6,252.64	-16.00
Fluvanna	-0.2	Household Trash (per ton	60.00	66.00	78.00	1,451.00	1,421.98	1,363.94	29.02	-2.00	87.06	-6.00
Fluvanna	-0.2	Brush & Yard Waste (per	60.00	66.00	78.00	1,451.00	1,421.98	1,363.94	29.02	-2.00	87.06	-6.00

Population percent as a proxy for rural albemarle:

County	Population
Albemarle (total population 2020).	112,395
Rural Albemarle (rural 43% in 2020 census).	48329.85
Charlottesville (total population 2020)	46,553
Total Charlottesville + Albemarle	158,948
Fluvanna (data xlsx)	27,556
Greene (data xlsx)	21,030
Percent rural albemarle (out of total Charlottesville + Albemarle)	**0.3**
Total TJSWPU Rural Area	**96,916**

Rural TJWSPU:

Material Type	Tons
Principle Recycled Material (PRM)	22115.24
Municipal Solid Waste (MSW)	38443.75

Weighted average percent change in disposal:

Low end estimate:	High end estimate:
-5.397558321	-13.28977385

Weighted average change in disposal (tons):

Low end estimate:	High end estimate:
-2075.024013	-5109.08789

Figure 4: Cost and Effectiveness Calculations for Alternative 2

Program Cost Estimates:	

Financial Costs	Estimate
Employee Salary	65,000
Employee Benefits	19500
Total annual salary expenditure:	84,500
Total salary expenditure over 5 years:	**422500**

County	Expenditure (proportional to population)
Albemarle	210691.6632
Fluvanna	120129.0604
Greene	91679.2764

County	Population
Albemarle (total population 2020).	112,395
Rural Albemarle (rural 43% in 2020 census).	48329.85
Percent rural Albemarle (of rural TJSWPU)	**0.50**
Fluvanna (data xlsx)	27,556
Percent Fluvanna (of rural TJSWPU)	**0.28**
Greene (data xlsx)	21,030
Percent Greene (of rural TJSWPU)	**0.22**
Total TJSWPU Rural Area	96,916

Effectiveness:

Rural TJWSPU:

Material Type	Tons
Principle Recycled Material (PRM)	22115.24
Municipal Solid Waste (MSW)	38443.75

waste reduction (percent) from (Bel Buhler, 2025)	0.045
waste reduction (tons)	1729.968905

Cost Effectiveness:

Cost effectiveness (full time position):	48.84480858

Figure 5: Cost and Effectiveness Calculations for Alternative 3

Program Cost Estimates:

Item	Cost
Compost Bins	99068.216
Postcard Mailers	2743.42752
Estimated hourly compensation	26
Labor: bin distribution	33088.78414
Labor: program management	13520
Total:	202500.4277

Cost-Effectiveness:

5 year costs/diversion (tons)	19.68344841

Effectiveness:

Households (census data)

County	Houshold Number
Albemarle	*45,912*
Rural Albemarle (rural 43% in 2020 census).	19742.16
Fluvanna	10,329
Greene (data xlsx)	8,032
Total Rural TJSWPU Households	38103.16
20% uptake (# Households)	**7620.632**
90% ongoing usage (# Households)	6858.5688

Rural TJWSPU:

Material Type	Tons
Principle Recycled Material (PRM)	22115.24
Municipal Solid Waste (MSW)	38443.75

Waste Reduction:

Estimated diversion per household in tons annually	0.3
Estimated total tons diverted annually	2058
Percent reduction in disposal annually	5.35

Figure 6: Cost and Effectiveness Calculations for Alternative 4