BURNS McDONNELL

IN ASSOCIATION WITH

SERA
SKUMATZ ECONOMIC RESEARCH ASSOCIATES

COLORADO INTEGRATED SOLID WASTE & MATERIALS MANAGEMENT PLAN

PREPARED FOR

Colorado Department of Public Health and Environment

June 2016

June 21, 2016

Mr. Joe Schieffelin
Solid Waste & Materials Management Program Manager
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Re: **Integrated Solid Waste and Materials Management Plan**

Dear Mr. Schieffelin:

The purpose of this Integrated Solid Waste and Materials Management Plan (Plan) is to develop a comprehensive evaluation of the current state of Colorado's waste disposal and materials management practices incorporating a public stakeholder process with feedback and input from regions of the state. This Plan is intended to facilitate the development of disposal, collection and diversion options for geographic regions and help capitalize on a collaborative effort to develop solutions for Colorado's future.

The results and recommendations within the Plan will guide the Colorado Department of Public Health and Environment (CDPHE) and stakeholders to develop short term and long term goals best suited for developing cost effective and environmentally protective waste management and waste diversion systems.

In association with Skumatz Economic Research Associates, Burns & McDonnell appreciates the opportunity to have partnered with the CDPHE to develop a Plan that is intended to serve as a planning resource for the entire state of Colorado. This effort would not have been accomplished without the extensive input and participation by CDPHE, multiple local government and private sector representatives, as well as other community stakeholders.

Should you have any questions regarding this Plan, please contact either Scott Pasternak at (512) 872-7141 or spasternak@burnsmcd.com or Josh Lee at (303) 474-2223 or jllee@burnsmcd.com.

Sincerely,

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Enclosure Attachment

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EXECUTIVE SUMMARY

Introduction

Purpose: The purpose of the Integrated Solid Waste and Materials Management Plan (Plan) is to develop a comprehensive evaluation of the current state of Colorado's waste disposal and materials management practices incorporating a public stakeholder process with feedback and input from regions of the state. This Plan is intended to facilitate the development of disposal, collection and diversion options for geographic regions and help capitalize on a collaborative effort to develop solutions for Colorado's future. The results and recommendations within the Plan will guide the Colorado Department of Public Health and Environment (CDPHE) and stakeholders to develop short term and long term goals best suited for developing cost effective and environmentally protective waste management and waste diversion systems.

Planning History: As declared within the Colorado Solid Waste Act, a statewide system of integrated solid waste management planning is necessary to meet Colorado's solid waste disposal needs, Colorado Revised Statutes (CRS) 30-20-100.5. The most recent solid waste management plan for Colorado was developed in 1992 and was intended to provide a road map for Colorado's waste management future. In 2015, CDPHE requested that the legislature grant additional spending authority for an updated state-wide integrated solid waste and materials management plan. The legislature granted that request for the 2016 state fiscal year. The goals of the Plan are to evaluate the current state of solid waste management practices in Colorado and develop recommendations on strategies that local communities can use to improve waste disposal and recycling activities going forward.

The 2016 Plan describes how CDPHE, local governments, private companies and citizens of Colorado can implement the transition from disposal of waste to sustainable materials management. The Plan also incorporates requirements from C.R.S. 30-20-100.5 (I) - (V), including:

i. How the integrated plan will meet the solid waste disposal needs over the next 20 years

ii. What types of facilities and quantity of facilities are necessary to meet the needs of local governments and citizens

iii. State and local efforts necessary to reduce the volume and toxicity of the waste stream

iv. Realistic waste reduction goals

v. State and local solid waste management goals through source reduction, recycling, composting

vi. Public education concerning solid waste and its impact on public health and the environment

vii. Minimizing illegal disposal of solid waste through the appropriate types of facilities needed to handle solid waste and materials in all areas of the state

Plan Overview: CDPHE retained the services of Burns & McDonnell and Skumatz Economic Research Associates (SERA) as the Project Team to develop the Plan. Burns & McDonnell led the overall project, as well as the transfer and disposal analysis. SERA was responsible for the stakeholder meetings and the solid waste collection and diversion materials management analysis. Table ES-1 summarizes the information that is included in each section of this Plan.

Table ES-1: Plan Organization

Section	Overview
Executive Summary	Provides a stand-alone summary of the Plan, inclusive of key findings, recommendations and conclusions.
1. Introduction	Provides an overview of the purpose of the Plan and history, as well as descriptions of the plan organization and content.
2. Stakeholder Meetings	In an effort to understand a broad range of stakeholder views and perspectives, the Project Team conducted 10 public input meetings across the State utilizing the Appreciate Inquiry technique. Prior to conducting the meetings, participants completed a pre-meeting survey.
3. Transfer and Disposal System	Review of the current transfer and disposal system, including analyses of the wastesheds, landfill adequacy, and overall facility needs. An analysis of costs, case studies and recommendations to improve the transfer and disposal system in Colorado.
4. Solid Waste Collection	Reviews solid waste collection issues for the residential, commercial and multi-family sectors.
5. Diversion Materials Management	Evaluates recycling collection and processing, as well as organics (yard waste and/or food scraps) collection and processing.
6. Collection and Diversion Analysis and Recommendations	Examines strategies for improving the system of collection and diversion in Colorado. The two topics are addressed together, because collections of solid waste and recyclables are delivered jointly. The systems and recommendations for these topics, are inevitably linked.

Using the Plan as a Resource: A key objective for this Plan is for it to serve as working resource guide for the entire state of Colorado. The preceding sections are intended to provide a wide range of guidance – from the cost models for disposal (Section 3) and collection and diversion programs (Section 6 and Appendix E) to resources for local and regional plan development. In addition to the six sections, the Plan includes a number of appendixes focused on providing on-going resources for the state. For example, Appendices C and D provide descriptions of case studies and potential funding sources, respectively.

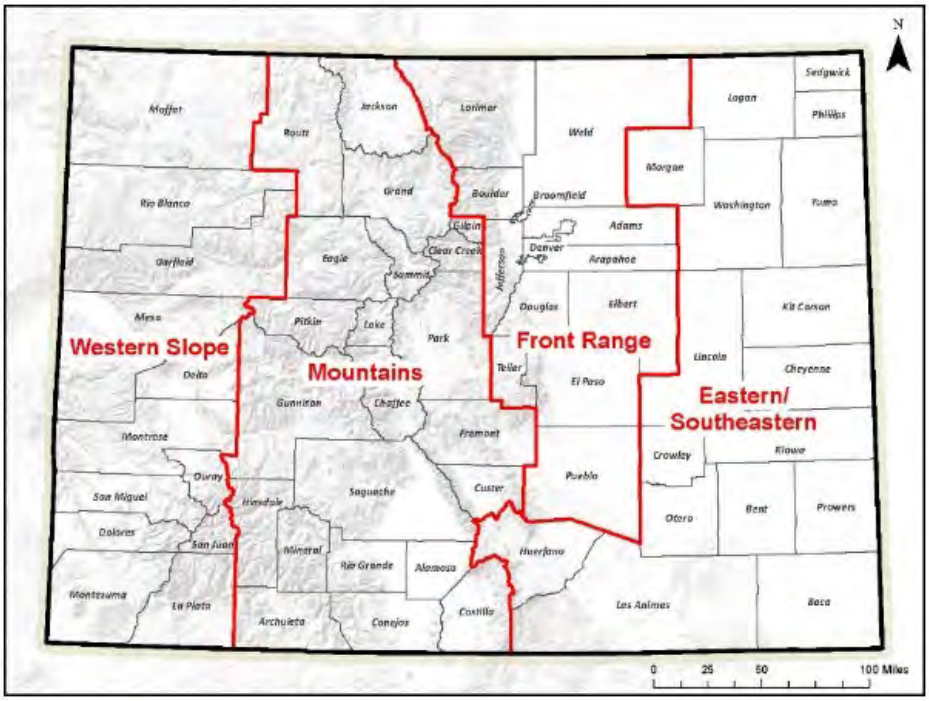

Figure ES-1: Geographic Regions

Communicating Information by Geographic Regions: In order to provide an understanding of disposal and materials management trends within the state, key aspects of the analysis within Sections 3 – 6 of the Plan are organized based on the geographic regions shown in Figure ES-1.

Stakeholder Meetings

The Project Team, at CDPHE's direction, focused on developing a tailored, responsive Plan. Given the diversity of solid waste management within the state of Colorado, it was essential to obtain input from the various areas of the state, to ensure the Plan reflects the range of current characteristics, barriers and opportunities and "acceptability" of potential changes in the different regions.

As described in Section 2, the Project Team organized and facilitated nine regional stakeholder meetings around the state, and one statewide webinar. The statewide webinar was organized for the convenience of stakeholders who could not attend a live meeting or had statewide knowledge that did not fit into a single meeting. Stakeholder meetings were held in the following locations from January – March 2016 (listed in chorological order):

- Alamosa
- Lamar
- Pueblo
- Durango
- Grand Junction
- Denver Metro
- Silverthorne
- Sterling
- Loveland

The feedback from each meeting was extensive and covered a wide array of topics. A selection of results from the stakeholder meetings have been included in Section 2 and the key insights have been integrated into the disposal, collection and diversion sections of the Plan.

Transfer and Disposal System

Having an adequate and cost effective transfer and disposal system in the State of Colorado is important to meet long-term disposal needs. Section 3 evaluates the state's transfer and disposal system in an effort to identify the type and quantity of facilities that are necessary to meet the needs of local governments and citizens.

Current System Review: Section 3 begins with a review of the current transfer and disposal system, including analyses of the wastesheds, landfill adequacy and regional facility needs. Understanding how solid waste moves from communities, via haulers and transfer stations, to landfills is meaningful in evaluating the current transfer and disposal system. Based on input provided by stakeholders via written survey and during the stakeholder meetings, as well as insight from CDPHE and the Project Team (including multiple phone calls to facilities and internet research), Figure ES-2 portrays the disposal wastesheds in the state as they are currently understood.

A key purpose of the Plan is to identify current and future waste management needs and offer recommendations for improvements that can be made to Colorado's waste management system. Central to this objective, is a candid assessment of the current solid waste landfill systems in Colorado. Based on existing federal and state laws and regulations[1], CDPHE assigned each site an adequacy score based on recent inspection information and review of the facility's approved design. Figure ES-2 identifies the levels of adequacy for landfills in the state based on three criteria categories - design and operation, groundwater monitoring, and closure requirements. The figure also defines the landfills by size which

[1] In the Resource Conservation and Recovery Act (RCRA) 1984 Hazardous and Solid Waste Amendments, the U.S. Congress directed the U.S. Environmental Protection Agency (EPA) to develop regulatory authority over landfills and directed the preparation of landfill design and operating criteria that were protective of human health and the environment. The federal regulation is known as Subtitle D. In Colorado, the regulations meeting the minimum requirements in Subtitle D went into effect October 9, 1993 with some exceptions as outlined in 6 Colorado Code of Regulations (CCR) 1007.2 based on the authorities defined and established in the Solid Waste Act, 30- 20-100.5, et seq, Colorado Revised Statutes (C.R.S.).

was determined based on the reported quantity of solid waste disposed of at the landfill in 2014. The following summarizes gaps and opportunities by region:

- **Front Range**: The landfills in the Front Range have been categorized as regional landfills, which is to be expected based on the quantities of solid waste generated throughout this region. Only one of the landfills in the Front Range region has been deemed inadequate by CDPHE. Moving forward it is expected that the haulers and regional landfills on the Front Range will continue to adapt to changing market conditions and provide services. There may be an opportunity for the Front Range regional landfills to expand their wastesheds beyond the highly populated areas of the Front Range.
- **Mountains**: The Mountain region consists primarily of a mix of medium and small landfills, with one regional landfill. Even with the small size of the landfills, regionalization is generally not a good fit for this area because of the difficulty associated with transporting solid waste between the counties. For these central mountain counties, the emphasis will include improvements to the few inadequate landfills to meet regulatory standards or consideration of transferring to a nearby adequate landfill.
- **Eastern/Southeastern:** This region has significant needs regarding the transport and disposal of solid waste. The Eastern/Southeastern region consists of large counties with small towns and a low population density. However, the region has a significant number of small landfills, owned by a combination of counties and towns. The vast majority of these landfills are inadequate with regard to the regulations. From the Project Team's perspective, continuing to operate many of the landfills in this region is a challenge due to the extensive number of facilities that are inadequate, as well as the relatively small solid waste quantities that are unlikely to generate sufficient revenue required to fund facility improvements.
- **Western Slope:** Transfer and disposal of solid waste on the Western Slope are considered medium and regional size landfills supported by a number of transfer stations spread throughout the counties. The system of having one county landfill accepting solid waste from transfer stations situated in the county is the working model for most of the counties. The three landfills inadequate in the groundwater category will need to make adjustments to meet the regulatory requirements. Closure of these landfills would leave large areas unsupported.

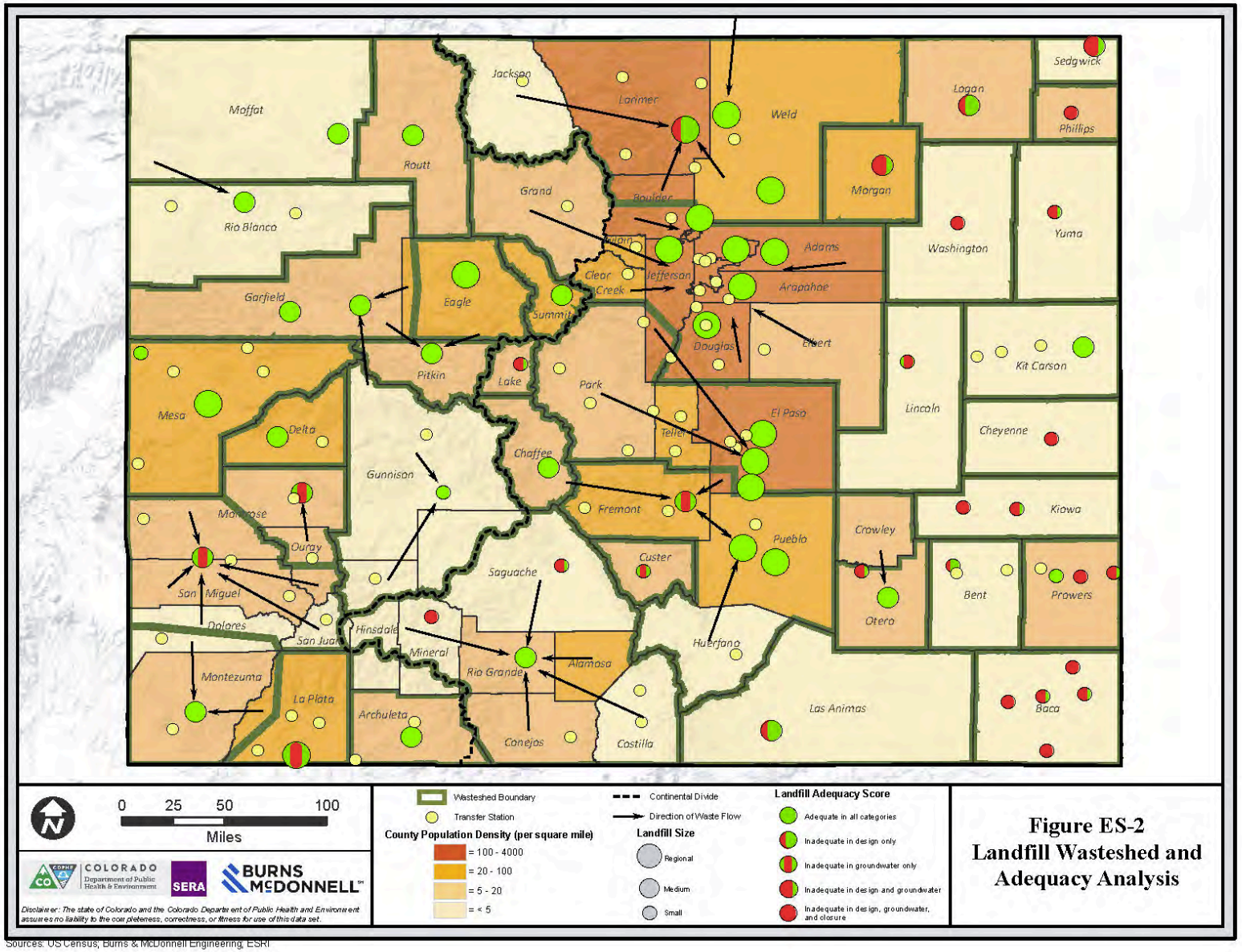

Figure ES-2
Landfill Wasteshed and Adequacy Analysis

Sources: US Census; Burns & McDonnell Engineering; ESRI

Cost Modeling and Conceptual Options Analysis: Based on the review of the current system, Section 3 includes an analysis of typical facility costs for transfer stations and landfills. Based on a range of facility sizes, the cost estimates for the landfills and transfer stations reflect the capital and operating costs associated with the facilities. Section 3 serves as a resource guide for the consideration of owners and operators of transfer and disposal facilities to improve the existing system. As an example of the analysis included in this section, Figure ES-3 summarizes the landfill costs, showing that as landfills increase in size, their costs per ton decrease.

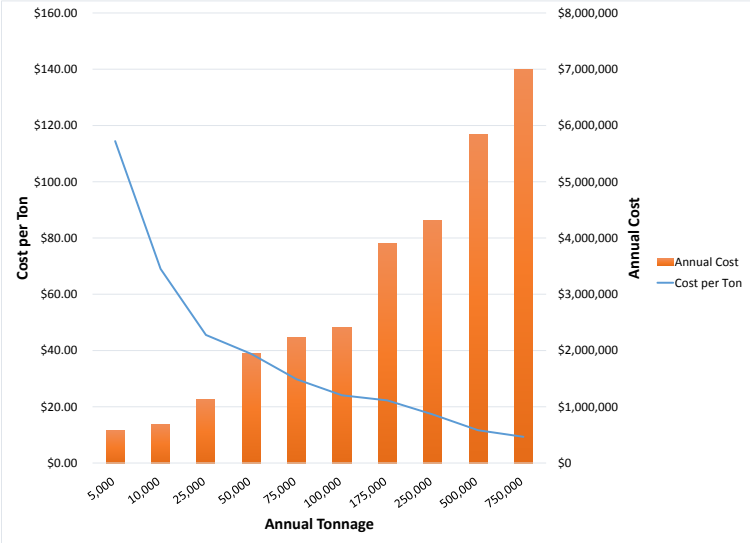

Figure ES-3: Landfill Cost Summary

The Project Team, with input from CDPHE staff, developed six conceptual options that reflect a mix of potential disposal scenarios for a range of community sizes. The purpose of these options is to provide a broad understanding of how costs would compare between different options. Table ES-2 summarizes the six conceptual options included in this section; and Table ES-3 provides a financial summary of the six conceptual options.

Table ES-2: Conceptual Options

Conceptual Option	Overview
Conceptual Option 1	Upgrade Existing Landfill to Current Standards
Conceptual Option 2	Single Drop-off Transfer Station
Conceptual Option 3	Single Compactor Transfer Station
Conceptual Option 4	Multiple Drop-off Transfer Stations Compared to Single Compactor Transfer Station
Conceptual Option 5	Moderate Size Top-Load Transfer Station
Conceptual Option 6	Large Top-Load Transfer Station with and without MRF

Table ES-3: Comparison of Conceptual Options

Conceptual Option	Type	Annual Solid Waste Tonnage	Annual Recycling Tonnage	Total Annual Cost	Cost Per Ton
1	Landfill	1,500	0	$253,462	$168.97
1	Landfill	4,500	0	$439,304	$97.62
2	Drop-off Transfer Station	1,500	0	$118,738	$79.16
3	Compactor Transfer Station	4,500	0	$490,697	$109.04
3	Compactor Transfer Station	15,000	0	$1,275,980	$85.07
3	Compactor Transfer Station	12,500	2,500	$1,222,563	$81.50
4	Three Drop-off Transfer Stations	4,500	0	$356,213	$79.16
4	Compactor Transfer Station	4,500	0	$490,697	$109.04
5	Top-Load Transfer Station	40,000	0	$2,698,545	$67.46
6	Top-Load Transfer Station	175,000	25,000	$11,288,379	$56.44
6	Top-Load Transfer Station	175,000	25,000 [1]	$9,810,890	$49.05

1. Recycling tonnage processed at a local MRF rather than hauled from a transfer station to a third-party MRF.

Transfer and Disposal Key Findings: Section 3 includes key findings on a statewide and regional perspective. Key statewide findings include:

1. Operating landfills outside of the requirements established by the EPA and adopted by the state of Colorado increases the risk to the human health and environment. Bringing landfills in Colorado into compliance with these regulations will help reduce the potential risk to human health and the environment.

2. The absence of adequate groundwater monitoring systems and adequate sampling and analysis of the monitoring systems at landfills in Colorado has the potential to lead to contamination. Capital costs for groundwater monitoring systems and annual costs for sampling and analysis pale in comparison to the cost of remediation necessary to clean up the contamination.

3. In the past the enforcement of the groundwater system and sampling requirements by CDPHE has been inconsistent. This inconsistency has left many owners frustrated with the inspection process and the approach of enforcement by CDPHE.

4. During the review of data provided by CDPHE, it was clear there was a lack of information collected from owners of landfills and transfer stations. As planning for future landfill development and potential partnerships moves forward, the access to total landfill capacity on a county, regional or state basis would benefit the planning process.

The largest need identified for most of the regions is the inadequacy of landfills in one or more categories. Table ES-4 shows the number of landfills by size in each region that are currently considered inadequate by category.

Table ES-4: Count of Inadequate Landfills by Region

Region	Landfill Size	Adequacy Category		
		Design & Operations	Groundwater	Closure
Front Range	Small	N/A [1]	N/A	N/A
	Medium	N/A	N/A	N/A
	Regional	1	0	0
Mountains	Small	3	4	1
	Medium	0	1	0
	Regional	0	0	0
Eastern/Southeastern	Small	15	15	9
	Medium	4	2	0
	Regional	N/A	N/A	N/A
Western Slope	Small	0	0	0
	Medium	0	2	0
	Regional	0	1	0

1. N/A means not applicable and means that there were no landfills of that size in the region.

Table ES-5 shows the capital cost range for each region to maintain the current number and upgrade the landfills. The cost ranges include closing existing disposal areas, constructing new disposal areas and constructing adequate groundwater monitoring systems. The Project Team estimated a statewide cost of $21 – 35 million to achieve adequacy for the landfills in the state. From Table ES-4, there are 23 landfills that are inadequate for design and operations. Correcting this inadequacy requires closure of the unlined areas of the landfill and construction of a new landfill cell. Based on the totals for cell closure and cell construction in Table ES-5, the average cost per landfill is between $875,000 and $1.46 million. For the 25 landfills that are inadequate for groundwater, the average cost per landfill is between $38,100 and $63,500.

Through the analysis provided in Section 3.3 (see Figure ES-3: Landfill Cost Summary), it is shown that the creation of regional landfills will reduce the per ton fees associated with operating landfills. Assuming landfills that are closed can be replaced by drop-off locations or transfer stations, there should minimal inconvenience to the public and may provide savings for the owner. With this in mind, some Colorado communities (refer to case studies for Bent and Hinsdale Counties in Appendix C) previously completed

studies to determine costs of building and operating adequate landfills and elected to close landfills and transport waste to other landfills.

Table ES-5: Total Estimated Planning Level Cost of Achieving Landfill Adequacy by Region

Region	Cell Closure [1]	Cell Construction [2]	Groundwater [3]	Total
Front Range	$900,000 - $1,500,000	$1,987,500 - $3,312,500	$0 - $0	$2,887,500 - $4,812,500
Mountains	$562,500 - $937,500	$1,237,500 - $2,062,500	$165,000 - $275,000	$1,965,000 - $3,275,000
Eastern/Southeastern	$4,612,500 - $7,687,500	$10,837,500 - $18,062,500	$487,500 - $812,500	$15,937,500 - $26,562,500
Western Slope	$0 - $0	$0 - $0	$300,000 - $500,000	$300,000 - $500,000
Cost Range[4]	$6,075,000 - $10,125,000	$14,062,500 - $23,437,500	$952,500 - $1,587,500	$21,090,000 - $35,150,000

1. Cell closure using water balance cover (Avg. costs: small - $250,000; medium - $600,000; regional - $1,200,000)
2. Cell construction using geosynthetic liner (Avg. costs: small - $550,000; medium - $1,550,000; regional - $2,650,000)
3. Groundwater wells to create adequate network (Avg. costs: small – $30,000; medium – $100,000; regional – $200,000)
4. Cost range is +/- 25% to account for variations in site conditions

Recommendations: Landfill owners can begin to make decisions regarding the future of the facilities under their care. The key objective is for facilities to begin working towards adequacy with regards to the regulations. The following provides recommendations and strategies for policies at the statewide level and considerations at the regional/local level to improve transfer and disposal of solid waste throughout Colorado.

Statewide recommendations are primarily focused on activities that can be implemented by CDPHE. Given the importance of addressing landfill adequacy issues, the expectation is that these recommendations will be implemented over the next five years. Key statewide recommendations include:

1. **Enforce Current Regulations:** There is a need to clearly and consistently enforce landfill regulations to reduce risk to human health and the environment.
2. **Develop and Implement Policy for Compliance Timeline:** Understanding that multiple landfills have been inadequate for a number of years, the CDPHE should outline the timing and requirements for landfills to improve operations, achieve adequacy or make decisions on future options (such as regionalization).
3. **Provide Technical Assistance:** A suggested key role for CDPHE is to provide technical assistance to cities and counties regarding landfill adequacy and related issues. Technical assistance can be provided through a combination of workshops, guidance documents, one-on-one meetings, etc.

4. **Support Sustainable Funding Strategies for Local Programs:** Through understanding that there is a substantial financial requirement to achieve landfill adequacy or to consider regional options, there is a need to promote funding strategies and sources.
5. **Capture Disposal Facility Data:** While there is an understanding of landfill adequacy in the state, there is a substantial level of additional information that could be tracked by CDPHE that would inform future solid waste planning in Colorado.

Based on the regional analysis included in Section 3, there are a number of recommendations that local communities throughout the state can consider to meet the regulatory requirements for their landfills, as well as to operate in a manner of greater focus on costs and increasing diversion. Key recommendations include:

1. **Consider Regionalization Options:** Given that there are a substantial number of relatively small landfills that are inadequate with regard to the regulations, there could be a substantial benefit for these communities to explore regionalization options.
2. **Evaluate Groundwater Monitoring:** In accordance with state of Colorado and EPA regulations, facility owners need to install, maintain and regularly sample a groundwater monitoring system consisting of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer.
3. **Implement Sustainable Funding Strategies:** Facilities owners need to better understand and pay for the costs of their disposal programs.

Solid Waste Collection

The collection and hauling of solid waste is integral to ensuring that solid waste, recyclables and organics reach their intended destinations for proper management. Due to the variety of collection systems in Colorado, Section 4 begins with a background discussion of existing solid waste collection services. The remainder of the section is organized geographically by the four regions of the state (Figure ES-1). For each geographic region, an evaluation of current regional systems, needs, gaps, support, cooperation and funding opportunities are provided.

Background on Existing Solid Waste Services: Curbside collection service is one of the programs found in Colorado. This is most commonly provided by private haulers for a monthly fee and less commonly provided by municipal staff. Occasionally, communities establish city-wide contracts for service.

In many small, rural communities, drop-off sites either at landfills or transfer station are the most common way to dispose of household solid waste. Pay-As-You-Throw collection systems involve variable rates where customers are charged on the volume of the trash they dispose.

For the commercial sector in Colorado, collection is most prevalent through private haulers. For both commercial collection and large multifamily collection, few municipalities are involved in providing solid waste service. Home owner associations (HOAs) frequently contract for services and can embed the cost in the HOA fees.

Table ES-6 provides the current system for solid waste services in the state.

Table ES-6: Current System Solid Waste Collection Service by Region

Region	Stakeholder Meeting Location	Available Curbside		
		Residential	Commercial	Multifamily
Front Range	Denver	Abundant	Abundant	Abundant
	Loveland	Abundant	Abundant	Abundant
	Pueblo	Abundant	Abundant	Abundant
Mountains	Alamosa	Limited	Common	Limited
	Silverthorne	Abundant	Abundant	Common
Eastern/ Southeastern	Sterling	Common	Abundant	None
	Lamar	Uncommon (self-haul)	Common	None
Western Slope	Durango	Abundant	Abundant	Limited
	Grand Junction	Abundant	Abundant	Limited

Consideration of Solid Waste Collection Gaps and Opportunities: Assessment of gaps are influenced by the requirements of the Plan authorization (see (C.R.S. 30-20-100.5 (I) - (V)). Gaps, as identified in this Plan, relate to realistic opportunities for change in solid waste-related strategies (services, incentives, policies, regulations, and supporting infrastructure). The following tables provide a snapshot of issues and gaps that were gathered through stakeholder meetings, surveys, and research of the four regions of Colorado.

Table ES-7: Collection Needs and Gaps by Region

Front Range	Findings	
Needs/Concerns	• The disposal system received a 3.5 on a scale from 1 to 5, where 5 is working well	• Low landfill tipping fees encourage unlimited disposal
Gaps	• PAYT requirements are in place in many, but not all, areas	• For some municipalities that provide or contract service, residents are not charged for solid waste collection, so do not realize the cost involved
Mountains	**Findings**	
Needs/Concerns	• On a scale of 1-5 (5= working well) the disposal system received a 3.6 • Education is lacking about effects of illegal dumping • Service needs can be inconsistent with large tourist population in northern mountains	• Some transfer stations/drop off sites do not have regular hours • Landfill rates stay low in part to avoid illegal dumping • People are resistant to paying landfill fees where some used to be free
Gaps	• In the southern area, there are fewer drop off sites and illegal dumping is a large problem; transfer stations and drop-off sites are more common in the northern part of the region • Transportation to the landfills are over large distances	• In some areas, regionalization opportunities are not being taken advantage of partly because of landfills being privately owned • State or regional help in identifying and facilitating progress or providing resources would be helpful
Eastern/Southeastern	**Findings**	
Needs/Concerns	• Illegal dumping is common • The sparse rural population necessitates long hauls for collection	• The disposal system received a 3.4 on a scale from 1 to 5, where 5 is working well
Gaps	• Landfills are spread far apart and are often small	• Limited hauling services/options
Western Slope	**Findings**	
Needs/Concerns	• This area of the state has difficulty due to long driving distances • Mountain passes in winter make it difficult for waste collection	• Illegal dumping is an issue • The disposal system received a 4.0 on a scale from 1 to 5, where 5 is working well
Gaps	• Services tend to be in southern and East-Central part of region	

Diversion Materials Management

A critical portion of this Plan involves evaluating how the state can begin to transition away from disposal and toward materials management. Similar to Section 4 on solid waste collection services, Section 5 starts with a background discussion of the types of recycling and organics activities currently found throughout Colorado. Existing condition tables list the services available, but not necessarily how commonly they are used. For each geographic region, this section describes the current system, needs, gaps, support, cooperation and funding opportunities.

Section 5 contains maps depicting the locations of recycling and composting facilities around the state, as well as two additional maps identify the extent to which recycling and organics collection and drop-off

programs are available. The majority of the services are located along the I-25 and I-70 corridors of the state.

Background on Existing Recycling Service and Processing: Recycling service is available in most regions of the state. Residential recycling services are provided as curbside pick-up or via drop-off service. The most common form of available recycling in very rural areas is drop-off recycling. There are good examples around the state including hub and spoke programs, which provide a central processing "hub" for multiple drop-off "spokes."

Multifamily recycling in Colorado is not widespread. Some small multifamily buildings may use containers for recycling, but larger buildings are normally treated like commercial buildings and use large dumpster style containers. Challenges include limited space, "split incentives" between generators and bill payers, high resident turnover and contamination due to anonymity and lack of education. HOAs can also be challenging for communities when implementing programs. Often they contract services for their members and do not always include recycling services. Generally, in Colorado, commercial recycling collection is provided by haulers using carts or dumpsters, charging by the number, size and frequency of recycling collection (parallel to commercial solid waste service).

Recycling Processing: Recycling processing facilities (MRFs) are scattered throughout the state, with concentration in both number and size surrounding the densely populated areas of the state, predominately in the Front Range. Colorado has a mix of private and public MRF operations. Single stream MRFs have sorting equipment that can handle incoming recyclable materials that are commingled and sorting is generally automated. There are several dual stream MRFs in Colorado as well as some dump and pick, baling only, or similar small manual operations. The state has numerous low-tech facilities, including hub and spoke, or facilities that conduct basic sorting on a tipping floor followed by baling of separated materials.

Background on Existing Organics Service and Processing: Curbside organic collection service is most commonly limited to yard waste only. However, a combined yard waste and food scraps service is becoming more popular in cities such as Boulder and Longmont. In Colorado, yard waste drop-off sites are available more often than curbside service. Commercial organics consist of food scraps from restaurants, grocery stores and cafeterias (hospitals, long term care, universities, etc.). There are few multifamily organics programs in the state, and HOAs rarely include curbside organics collections. Organics processing facilities, or composting sites, are scattered throughout the state (see Figure 5-1), with concentration in both number and size in the highly populated areas of the state. Tables ES-8

through ES-11 describe both the recycling and organics gaps and opportunities for each of the four regions.

Table ES-8: Diversion Gaps and Opportunities – Front Range

Population (and % of State) (5.2 M)	4,332,041 (83.5%)
Gaps in Recycling Access including Hub and Spoke/Drop-off Recycling	Pueblo area; Colorado Springs area; Western reaches of Larimer, Boulder, & Jefferson Counties; Weld County (except Greeley); parts of Douglas, Adams, Elbert Counties. *Gaps (Colorado Springs 439K; Pueblo 108K;* proxy estimate missing 13%)
Estimated Percent of Population with Coverage	87% of area population (preliminary estimate); 3.8 million
Active Organics Options	Bennet, Aurora, Colorado Springs, Pueblo, Boulder
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Organics siting guidelines
Special Opportunities	Density, facilities, organized collection fairly common, appetite for green and zero waste in areas
Potentially-Acceptable Strategies	Regional planning, hauler licensing, goals, some support for bans, EPR, PAYT, surcharges, mandated diversion, education

Table ES-9: Diversion Gaps and Opportunities – Mountains

Population (and % of State) (5.2 M)	319,969 (6%)
Gaps in Recycling Access including Hub and Spoke/Drop-off Recycling	Grand County; Jackson County; Clear Creek County; Gilpin County Gaps (Grand 15K, Jackson 1K, Clear Creek and Gilpin 15K)
Estimated Percent of Population with Coverage	90% of area population, 290K population covered
Active Organics Options	Milner Landfill, Snowmass Village, Saguache, Center, Hooper, Glenwood Springs, Dillon
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Transient populations/2nd home owners; lack transfer stations/no regionalization, compost processing missing
Special Opportunities	Have MRF; green ethic with interested industry
Potentially-Acceptable Strategies	Planning areas, hub and spoke, recycling goals (2-tiered), landfill surcharges, possibly PAYT, solid waste tax, consideration of waste to energy

Table ES-10: Diversion Gaps and Opportunities – Eastern/Southeastern

Population (and % of State) (5.2 M)	157,455 (3%)
Gaps in Recycling Access including Hub and Spoke/Drop-off Recycling	Plains, in general; Morgan County; Huerfano County. *Gaps (Plains 155K, Morgan 28K, Huerfano 6K)*
Estimated Percent of Population with Coverage	60% of area population (preliminary estimate of 94K)
Active Organics Options	Yuma, Ft. Lupton, Akron, Eaton, LaSalle, Erie, Keenesburg, Hudson, Fort Morgan
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Market access/transportation, want local control and want fewer landfill inspections/enforcement, lack MRFs, low incomes, illegal dumping concerns
Potentially-Acceptable Strategies	2 tier goals, WTE; some support for Hub and Spoke, severance funding, differential taxes by stream; environmental/generator fees, facility co-location incentives, bottle bill, economic development assistance, hauler contract fees, industry funded programs

Table ES-11: Diversion Gaps and Opportunities – Western Slope

Population (and % of State) (5.2 M)	388,115 (7.5%)
Gaps in Recycling Access including Hub and Spoke/Drop-off Recycling	Moffat County (one drop-off); Rio Blanco County; Garfield County; Western Slope, in General Gaps (Moffat and Rio Blanco 19.5K, Garfield 58K, Western Slope most; preliminary estimate missing 100K+)
Estimated Percent of Population with Coverage	75% of area; 288K population covered
Active Organics Options	Austin/Delta County, Grand Junction
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Lack transfer stations, hub and spoke in some areas, lack end markets, significant rural population
Special Opportunities	
Potentially-acceptable strategies	Partial support for regional planning, hub and spoke, two-tiered state goals, reporting, solid waste taxes, landfill surcharges, economic development assistance, industry-supported programs, severance funding, possible waste to energy, possible PAYT, card board bans

Collection and Diversion Going Forward

The current 23% diversion rate (as estimated by CDPHE) in Colorado falls below the national average – compared to 35% nationally (CDPHE reports 11% excluding some C&D, and 23% including more materials). Before appropriate strategies for progress could be considered and crafted, it was necessary to review the authorities that could be used to make recommendations meaningful and enforceable.

- **At the State Level**: The state of Colorado faces an unusual situation in regards to planning and recommendations related to diversion. Under the Colorado Solid Waste Act, CDPHE has authorities almost exclusively in the realm of disposal at landfills. There are resolutions that discuss the state's interest in waste diversion, but generally its **enforceable authorities beyond disposal facilities do not exist**. Given this is a 20-year plan, the study also explores possible avenues for the state to extend existing authorities with and without action by the legislature.
- **At the Local Level**: Many local governments within Colorado have not asserted any of the authorities that are authorized to them in the waste management area. Counties are generally assumed to have waste management authorities; municipalities do as well. However, they do not register firms providing collection or programs, nor do they regulate service, rates or other elements regarding solid waste management, or provide access to solid waste or diversion services or infrastructure. There are notable exceptions provided in Section 6. Most importantly, recycling is hampered because Colorado has low landfill tipping fees and, outside the Front Range, long transportation distances to get recyclables to market.

A majority of the state's population resides in areas with somewhat difficult, but not impossible, waste management economics, and in areas with interest in pursuing diversion as a policy direction. Progress in other regions may be encouraged through the changes in waste management economics, realized from

decisions related to landfill closures and compliance issues. Without state authority to mandate or enforce change, and without a dramatic change in actual and relative costs between solid waste disposal and recycling, localities that have not undertaken change will not have specific motivation to do so, and it is unlikely the state will make widespread, meaningful movement toward improved materials management. Local activism, persuasion and local policy leadership may be the main motivators of change.

At the local level, locally-suitable programs are suggested that are as effective and cost-effective as possible. More advanced or aggressive suggestions are suitable in some areas (Front Range and possibly Mountains), but the waste management market economics of the state of Colorado make even basic programs a challenge in other regions of the state. From the state perspective, this is very important, because universal access to programs, and effective programs are certainly attractive goals. From a practical standpoint, it can also be recognized that **truly remote economics, and the challenges they imply, affect about half of the land area of the state, but about 10% of the state's population and waste volumes** (about 7-8% in the Western Slope and 3-4% in the Eastern/Southeastern). Further, these populations are scattered in communities with populations substantially smaller than 7,000-10,000 (about one or two efficient solid waste truck's worth of business).

Mindful of the situation, a menu of strategies and recommendations were developed in this Plan; they are designed to:

- Work within the state's current regulatory and authority structure, but also be suitable if updates in authority arise that would improve the opportunities to drive materials management in the state
- Clearly recognize that there are distinct differences in the feasibility and suitability of strategies in different areas of the state, particularly in the Front Range compared to other areas of the state
- Provide recommendations for local and regional progress, identifying strategies for improving access to recycling and diversion, and also more aggressive strategies for areas of the state with interest in stronger progress
- Serve as a resource for future local or regional planning efforts, should these activities be undertaken as part of local initiatives, or through incentives or initiatives coming from the state

Successful strategies will need to provide access to diversion options, address barriers and motivations, consider economics and tradeoffs, and include enforcement options to make the strategies meaningful. Local acceptability (based on discussions at the stakeholder meetings) was considered in assessing options for recommendations. Recognizing the state's unique authorities situation, four levels of

strategies were developed, outlined in Tables below. Level 1 and 2 strategies focus on the state level. Level 3 and Level 4 strategies are locally-focused, and provide guidance for local and regional planning.

- **Level 1 Strategies**: This group includes state strategies that can be implemented in the near term, generally within current authorities.
- **Level 2 Strategies**: These strategies include recommended state activities that would support the achievement of Level 1 recommendations, if additional authorities are assigned to CDPHE.
- **Level 3 Strategies**: Level 3 includes a menu of 12 strategies to be recommended for implementation at the local and regional level, focused on improving access to recycling and diversion by households and businesses across the state. To reflect the varying situations in different parts of the state, the number of strategies recommended for adoption in regions differ: eight strategies in the Front Range, five in the Mountains, and four each in the Eastern/Southeastern and Western Slope.
- **Level 4 Strategies**: This tiered group of progressively more advanced strategies is particularly suited to implementation in areas of the state with reasonably favorable economics and densities, like the Front Range.

Table ES-12: Level 1 Collection and Diversion Recommendations

1. **Adopt Goals**: Adopt the recommended Two-Tier Diversion Goals – Short and Long Term – and Support/Conduct Activities to Achieve the Goals
2. **Improve Tracking**: Improve Performance Tracking and Reporting (to the Legislature)
3. **Training Focus**: Enhance CDPHE Diversion Training/Technical Assistance and Outreach on Collection and Diversion
4. **Inspections & Incentives**: Increase Inspection efforts on non-Adequate Landfills with an Emphasis on Providing Clear and Substantial Economic Incentives for Compliance and Diversion
5. **Regional Planning Initiative**: Establish Regionalized Solid Waste Planning Emphasizing Diversion Alternatives
6. **Supporting Funding**: Support/Fund Regionalized Solid Waste Planning emphasizing Diversion by use of revised RREO grant priorities
7. **Recycling Access Statewide**: Fill Gaps in Recycling Opportunities/Drop-off Networks in the State and Support Existing Infrastructure
8. **Materials Management in CDPHE Operations**: Implement Zero Waste (ZW), Extended Producer Responsibility (EPR), Life Cycle Cost Analysis (LCA), Materials Management (MM), Reduction, and other policies and principles in CDPHE operations
9. **Support MM**: Support ZW, MM and LCA where possible
10. **Supporting Authorities**: Seek additional Supporting Authorities and Identify Collaborative Working Arrangements with Other Agencies/Actors for near/longer term Diversion and Materials Management Progress in Colorado

Table ES-13: Level 2 Collection and Diversion Recommendations[1]

1. **Enforce Goals**: Ability to Enforce Adopted Diversion Goals
2. **Hauler Licensing**: State Licensing of Haulers
3. **Require Regional Planning**: Authority to Require Regional Planning and Establish Planning Authorities
4. **Funding for Planning**: Authority to Provide Designated Funding Source for Regional Planning Activities
5. **Implement/Enforce State-Level Strategies**: Ability to Implement and Enforce Collection and Diversion Strategies Best Applied at the State Level
6. **Landfill Surcharges**: Authority to Increase Landfill Surcharges
7. **Supporting Legislation**: Pursue Legislation to Obtain Authorities
8. **If/as authorities are gathered, establish prescriptive and performance-based strategies:** Recommend flexible, well-suited options for two tiers of prescriptive options[1] for communities in addition to enforceable performance goals.

1. These minimum programmatic/opportunity to recycle standards are listed as Level 3 in Section 6

Table ES-14: Level 3 Collection and Diversion Recommendations[1]

1. Enhanced education program by communities or counties or designated actors, annually. 2. Recycling depots/drop-offs with regular, convenient hours, in each town of at least 4,000 population. 3. Curbside recycling offered, single family homes (at least bi-weekly, with minimum requirements for program elements). 4. Curbside recycling, fee embedded in solid waste bill (not separate or options), single family households (at least bi-weekly with minimum requirements for program elements). 5. PAYT rate structure required for single family households (with minimum program elements). 6. Multifamily recycling of at least four materials in buildings with 5+ units, with education provided (minimum program elements), in communities greater than 10,000 population.	7. Yard waste (or yard and food) collection program (single family), at least weekly, or drop-off site open weekends and at least one weekday. 8. Program available for monthly or more frequent on-route collection of yard waste (or food and yard waste) from single family customers, with an education component. 9. Commercial recycling program available for all businesses with 10+ employees or 1,000 square footage, or with 10 CY or greater service per week. 10. Collection and composting program for all businesses generating large quantities or targeted business types (designated by CDPHE Memo, updated). 11. Commercial recycling required for businesses generating large amounts of recyclables. 12. C&D recovery program requiring separate bins at generation or post-separation.

1. Communities in Front Range recommended to implement eight strategies; communities in Mountains recommended to implement five strategies, and the Eastern/Southeastern and Western Slope regions implement four strategies. Number of recommendations increases over time. Communities exempted if they demonstrate they have reached the numeric diversion goals

Table ES-15: Level 4 Collection and Diversion Recommendations

Year 1 • Transfer stations/drop-offs must take recyclables at no fee • Food scrap generators of 104 TPY must divert material to any certified facility within 20 miles **Year 2** • PAYT statewide (volume or weight) • Recyclables banned from landfill • Transfer stations/drop-offs must accept leaf and yard debris • Haulers must offer residential recycling at no extra charge (embedded) • Public buildings must provide recycling containers adjacent to solid waste containers (except restrooms) • Food scrap generators of 52 TPY must divert material to any certified facility within 20 miles	**Year 3** • Leaf, yard and clean wood waste banned from landfill • Haulers must offer leaf and yard debris collection • Food scrap generator threshold at 26 TPY **Year 4** • Transfer stations and drop-offs must accept food scraps • Haulers must offer food scrap collection • Food scrap generator threshold to 18 TPY **Year 5** • Food scraps banned from landfill

Operationalizing the Plan at the State Level: The Plan provides the state and CDPHE with real and positive recommendations on ways to help motivate implementation of these changes (RREO grant incentives, etc.). However, at least in the near term, the ability to drive change is limited in Colorado at the statewide level under CDPHE's current regulatory authority of the Colorado Solid Waste Act. Several specific elements are needed to operationalize the Plan.

- **Regional Partners**: Regional planning is one of the central tenets of the recommendations, but authority to require regional planning does not currently exist. To achieve progress, the Plan suggests that the state may establish partnerships to work with existing regional planning agencies. The state has a number of Councils of Government (COGs) and other agencies spread throughout the state that already conduct regional planning work on other topics (transportation, water, etc.), and have existing working relationships and agreements with counties and communities. A list of candidate regional planning agencies across the state is included within Section 6.
- **CDPHE Work Plan**: Several key CDPHE activities are needed to implement the initial phases of the Plan. The Recycling Resources Economic Opportunity RREO grant program needs revision to focus the funding more on regional plans, and to modify eligibility criteria to incentivize the completion of regional Plans (the recommendation is to phase in a disqualification of submittals from stakeholders outside areas with regional plans). Coordinating with the Environmental Leadership Program (ELP) staff is needed to explore incorporating additional incentives in ELP for completing plans. Developing materials and beginning a series of webinars/outreach/training sessions geared toward diversion is another operationalizing step.

Stakeholder meetings, and meetings with the Solid Waste and Hazardous Waste Commission, to encourage cooperation and support with the Plan's recommendations are key activities in the work plan. Upgrading measurement and data collection efforts, waste composition studies, and improved compliance activities comprise the major steps in the CDPHE near-term work plan.

- **Funding Options**: The Plan lists more than a dozen funding sources that are used by other states. Very few of these funding options are currently available to Colorado, or have the flexibility that would support strong progress. However, the Level 1 strategies do not call for multiple major new efforts by CDPHE staff, partly because there are few available near-term funding sources.

Wasteshed and Local Strategy Recommendations: Level 3 and Level 4 recommendations provide suggestions (or stronger impetus if additional authorities are achieved by CDPHE) for strategies that could, at the local or regional level, provide improved access to recycling (Level 3) or aggressive "next steps" for motivated or advanced jurisdictions (Level 4). These options are suitable for consideration development of comprehensive plans by local communities or regional/waste shed planning agencies. Section 6 provides planning level estimates of the new diversion and the cost per ton to achieve that diversion, applying the Level 3 recommendations. The results are presented in Figure ES-4. These estimates are the sum of the tonnage and cost contributions from the implementation of four strategies in the Eastern/Southeastern Region, four strategies in Western Slope, five strategies in the Mountains and eight strategies implemented in the Front Range. The tonnage and cost results for each of the four Plan regions is provided in Appendix H of the report and the strategies are fully described in Section 6.

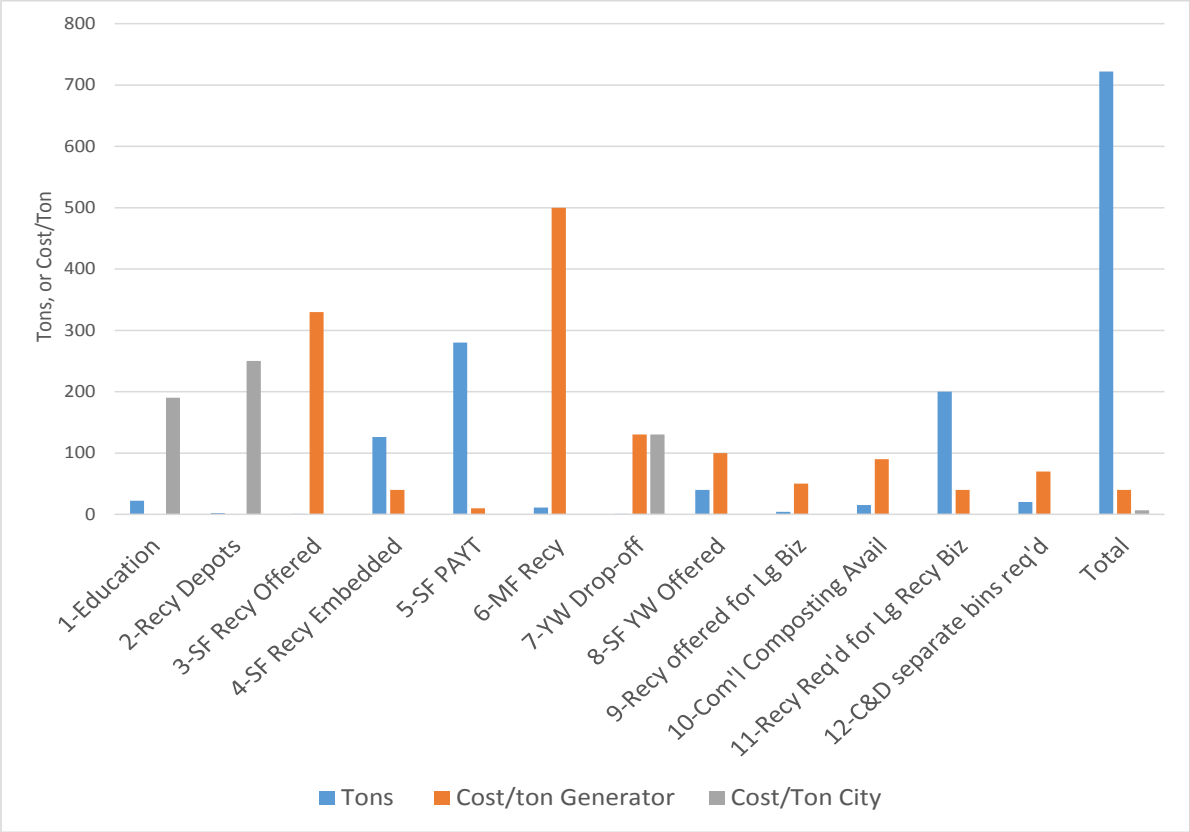

Figure ES-4: Planning Level Estimates of Tonnages and Costs for Selected Level 3 Strategies[2]

The recovered tonnages by region, and the weighted average of achieving that diversion, is presented in Table ES-16. This assumes each region adopts the recommended number of Level 3 strategies. The data show that achieving diversion in the Front Range and Mountains is about $40-60 per ton (recycling and organics), but that costs are more than twice or four times as high to implement fewer (and less-aggressive) strategies in the Eastern/Southeastern and the Western Slope.

[2] Assumes Front Range implements: 1, 4, 5, 6, 8, 10, 11, 12 (8 programs); Mountains implement: 1, 4, 5, 6, 9 (5 programs); Western Slope and Eastern/Southeastern implements: 1, 2, 3, 7 (4 programs)

Table ES-16: Weighted Average Cost per Ton for Level 3 Options by Region[1]

For Selected Subsets of Level 3 Options	Front Range	Mountains	Eastern/ Southeastern	Western Slope	Statewide
Diverted Tons (in thousands)	675	41	2	4	722
Weighted Cost per Ton - Generator	$38	$58	$38	$75	$39
Weighted Cost per Ton - Community	$5	$5	$154	$167	$7
Weighted Cost per Ton - Total	$43	$62	$192	$242	$46

1. (Selected subset of strategies for each region) Assumes Front Range implements: 1, 4, 5, 6, 8, 10, 11, 12 (8 programs); Mountains implement: 1, 4, 5, 6, 9 (5 programs); Western Slope and Eastern/Southeastern implements: 1, 2, 3, 7 (4 programs)

These costs are derived from program design assumptions and detailed cost modeling that is included in the Plan (Appendix E). The costs are presented in contributing "elements" (collection, transport, tip fee, etc.), allowing communities in different regions to adapt the estimates to their local distance and facility characteristics. The results show that, if each region adopts the recommended number of Level 3 ("access to recycling") options, an additional 722,000 tons per year can be diverted statewide at a weighted average cost of about $46-$53 per ton. This is 65% of the cost of implementing all 12 strategies in all areas, and delivers 71% of the tonnage. Table ES-17 presents planning level costs for key collection and diversion options. The ranges reflect differences in assumptions for costs, profits and other inputs.

Table ES-17: Planning Level Estimates: Cost per Ton Options by Region[1]

Total Costs	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Voluntary Residential Collection				
Trash	$70-$80	$80-$100	$90-$110	$90-$110
Recycling	$10-$30	$140-$190	$200-$290	$280-$410
Organics	$90-$110	$100-$110	$110-$130	$110-$130
Mandatory Residential Collection				
Trash	$60-$70	$70-$80	$80-$90	$80-$90
Recycling	$-10-$10	$120-$170	$180-$270	$260-$380
Organics	$80-$90	$80-$90	$90-$100	$90-$100
Every Other Week Residential Collection				
Trash	$50-$50	$60-$70	$60-$70	$60-$70
Recycling	$-20-$-10	$100-$140	$160-$240	$230-$350
Organics	$60-$70	$60-$70	$60-$70	$60-$70
Commercial Collection				
Trash	$60-$70	$70-$90	$80-$100	$80-$100
Recycling	$0-$20	$120-$180	$190-$280	$260-$390
Organics	$80-$90	$80-$90	$90-$100	$90-$100
Drop-off Recycling				
Range	$140-200	$230-$360	$600-$800	$300-$600

1. Includes collection, transport, processing, and tip fees; does not include avoided cost per ton

The figures in Table ES-17 show that:

- Recycling in the Front Range is generally profitable, and the challenges to diversion in the Eastern/Southeastern and Western Slope areas are substantial.
- Organics collection does not appear profitable, especially with zero market value as assumed in this report. Adding in a $30 avoided tipping fee improves the situation relative to trash.
- Every other week collection can help make collection of recyclables more cost-effective, and studies indicate that the loss in tons is relatively minor.

What is not shown in the table is the costs for distant locations could improve by a factor of as much as eight per ton if the transport was made via trailer instead of roll-off. This is relevant in the Eastern/Southeastern and the Western Slope regions, and might attract attention from the RREO grant program. However, determining where best to site such a facility within some of these large geographic regions could be difficult.

The document also provides a list of specific strategy recommendations that could be considered seriously in each region if the state gains authority to require programs, or if regional planning agencies elect to develop plans. The suggestions incorporate the findings from the regional stakeholder meetings on gaps, opportunities, and strategies with potential support in the region. The table includes region-specific recommendations for:

- residential and commercial access, collection and diversion options
- composting and recycling processing and infrastructure needs, including drop-offs
- construction and demolition infrastructure
- longer term sustainable materials management and zero waste strategies
- bans, education and other cross-sector strategies
- state level strategies and their appropriateness within regions

State Tonnages and Performance Goals: Households and businesses within the state generate almost seven million tons of solid waste annually (Table ES-18). Given growth rates projected by the state, this number is expected to grow to more than nine million tons in 20 years – without major changes in upstream waste generation, product stewardship or other structural changes in the market. Table ES-19 shows that current diversion in the state is about 23%, or about 1.6 million tons annually (estimated by CDPHE). If the selected Level 3 strategies are implemented, diversion would be expected to increase to 31% statewide.

Table ES-18: Projected Generation by Region (Tons)

Region	2015	2016	2021	2026	2031	2036
Front Range	5,840,000	5,946,000	6,492,000	7,043,000	7,582,000	8,121,000
Mountains	296,000	301,000	328,000	363,000	396,000	431,000
Eastern/Southeastern	194,000	197,000	215,000	233,000	248,000	263,000
Western Slope	485,000	494,000	545,000	602,000	660,000	717,000
Statewide	6,815,000	6,938,000	7,580,000	8,241,000	8,886,000	9,532,000

Table ES-19: Projected Diversion under Adoption of Selected Level 3 Strategies (Tons)

2014 Total Diversion (per CDPHE)	2,018,264
2014 MSW Generation	8,765,610
2014 Diversion Rate	23%
Additional Generation (1% growth per year)	175,312
Additional Base Diversion (1% growth per year)	40,365
Additional Tons from Level 3 "Access" Strategies	722,000
Diversion Rate including basic access improvements (Level 3)	31%

One of the requirements of the Plan is to set a diversion goal for the state. The Project Team determined that the state would benefit from the use of two metrics.

- Diversion rate is the combination of recycling and organics diversion as a proportion of generation. This is the traditional measurement method used by the state and provides a good comparison to the past and to performance reporting by other states, and nationally.
- Percent recoverables remaining (PRR) uses waste composition studies to identify the percent of recoverable recyclables and organics (separately) that remain in the waste stream. The metric provides a gauge of how well households and businesses are cooperating with the goals of most programs (diverting materials from the trash) and provides information about which programs or materials should be the next target for education or programs in communities.

The Plan develops recommended goals, setting higher recommended goals for the Front Range than for the other regions to recognize the different levels of achievement that are feasible and reasonable to expect. The primary goal for the Plan should be the diversion goal; the PRR goal is secondary.

Setting goals that require legislation changes to be successful would be inappropriate; rather, the goals would be expected to be revised at that time to reflect the actual levels of authority granted. Therefore, the goals presented in Table ES-20 will appear very conservative. The main progress reflected in these goals is continued growth in access and use of organics programs, improved efficiencies in collection, and growth of infrastructure, making programs more feasible and cost-effective. Some of the growth may also occur as landfill compliance is enhanced, and diversion becomes an increasingly attractive alternative. Note that the goals are not intended to limit the achievement of motivated communities.

Should the full range of authorities envisioned in Levels 1-4 of the strategies list be adopted, the state could potentially expect to achieve goals of perhaps 30% by 2021, 35-40% by 2026, and 45%-50% or more by 2026, with higher levels achieved in the Front Range. The secondary PRR goals are presented in Section 6. The recommended goals are presented in Table ES-20.

Table ES-20: Diversion Goals for Recycling in Colorado[1]

Diversion Goals[2]	2016	2021	2026	2036
Front Range	N/A	32%	39%	51%
Rest of State	N/A	10%	13%	15%
Statewide	23% [3]	28%	35%	45%

1. Conservative goals reflecting no new legislative authorities
2. Combines recycling and organics
3. Based on information provided by CDPHE

The study also estimated the value of the unrecovered recyclables being landfilled annually in Colorado. The calculations in Table ES-21 use five-year average market prices. Additional recovery of recyclables can have real value, and a tremendous share of this value is in the Front Range, where economics for recycling and diversion (at least at five-year average recycling market prices) are not unfavorable.

Table ES-21: Buried Value of Recyclables in Colorado[1]

Region	Front Range	Mountains	Eastern/ Southeastern	Western Slope	Statewide
Value of Recyclables Being Landfilled	$218 million	$12 million	$11 million	$26 million	$267 million

1. Using five-year average market revenues

Landfills, Recycling Value and Relative Costs — What the Plan Shows for Colorado

The Plan provides critical information on the economics of sustainable materials management in Colorado. Running a Subtitle D-compliant landfill is expensive, especially for small facilities. Table ES-3 notes these small facilities can cost as much as $170/ton to operate. Furthermore, bringing an inadequate landfill up to compliance is very expensive, and the costs in the Eastern/Southeastern region are estimated to cost between $16 million and $27 million.

The Plan also examined the value of the unrecovered recyclables currently being landfilled, shown in Table ES-21. This value – on order of $267 million statewide (at five-year average market prices). Finally, the Plan estimated the cost of recycling programs. There are "levels" of costs for diversion options, from low-cost PAYT options, to recycling and organics collection options, and more expensive alternatives.

Beyond the planning, programmatic, and policy recommendations, the Plan finds that:

- Running a transfer station can be considerably less expensive than running a small landfill
- The per-ton surcharge needed to transform inadequate landfills into compliant landfills is notably higher than changing operations to a transfer station at the site and moving materials to a larger, compliant site
- The cost per ton of diverting materials from landfills via recycling and other strategies can help mitigate costs in some areas
- Revenues from removing recyclables is a loss; there are dollars to be mined by removing more recyclables, even with processing and transportation costs included

- Recycling and diversion can be a way of avoiding some costs and diverting materials from the facility

Overall, the Plan shows that individual communities, counties, and landfills would benefit by reconsidering the methods of materials management. There are substantial savings to be realized by:

- Closing some compliant landfills and establishing a roll-off collection at the site, transferring materials to a larger, compliant landfill, and making the same change for some inadequate landfills
- Reducing tonnages in some landfills by introducing and promoting low cost recycling and diversion programs

Regional planning will identify additional opportunities and help realize economies that will be win/win – reducing costs and improving the safety of solid waste management in the state.

1.0 INTRODUCTION

1.1 Purpose

The purpose of the Integrated Solid Waste and Materials Management Plan (Plan) is to develop a comprehensive evaluation of the current state of Colorado's waste disposal and materials management practices incorporating a public stakeholder process with feedback and input from regions of the state. This Plan is intended to facilitate the development of disposal, collection and diversion options for geographic regions and help capitalize on a collaborative effort to develop solutions for Colorado's future. The results and recommendations within the Plan will guide the Colorado Department of Public Health and Environment (CDPHE) and stakeholders to develop short term and long term goals best suited for developing cost effective and environmentally protective waste management and waste diversion systems.

1.2 Planning History

As declared within the Colorado Solid Waste Act, a statewide system of integrated solid waste management planning is necessary to meet Colorado's solid waste disposal needs, Colorado Revised Statutes (CRS) 30-20-100.5. The most recent solid waste management plan for Colorado was developed in 1992 and was intended to provide a road map for Colorado's waste management future. Given that the plan was developed more than 20 years ago and substantial changes have occurred in the industry since that time, the 1992 plan no longer fulfills the solid waste and materials management planning needs of the state. In 2015, CDPHE requested that the legislature grant additional spending authority for an updated state-wide integrated solid waste and materials management plan. The legislature granted that request for the 2016 state fiscal year. The goals of the Plan are to evaluate the current state of solid waste management practices in Colorado and develop recommendations on strategies that local communities can use to improve waste disposal and recycling activities going forward.

The 2016 Plan describes how CDPHE, local governments, private companies and citizens of Colorado can implement the transition from disposal of waste to sustainable materials management. The Plan also incorporates requirements from C.R.S. 30-20-100.5 (I) - (V), including:

i. How the integrated plan will meet the solid waste disposal needs over the next 20 years

ii. What types of facilities and quantity of facilities are necessary to meet the needs of local governments and citizens

iii. State and local efforts necessary to reduce the volume and toxicity of the waste stream

iv. Realistic waste reduction goals

v. State and local solid waste management goals through source reduction, recycling and composting

vi. Public education concerning solid waste and its impact on public health and the environment

vii. Minimizing illegal disposal of solid waste through the appropriate types of facilities needed to handle solid waste and materials in all areas of the state

1.3 Plan Overview

1.3.1 Project Team: Burns & McDonnell and SERA

CDPHE retained the services of Burns & McDonnell and Skutmatz Economic Research Associates (SERA) as the Project Team to develop the Plan. Burns & McDonnell led the overall project, as well as the transfer and disposal analysis. SERA was responsible for the stakeholder meetings and the solid waste collection and diversion materials management analysis. Table 1-1 acknowledges key contributors to the Plan.

Table 1-1: Project Team

Burns & McDonnell	SERA
Scott Pasternak Joshua Lee Seth Cunningham Grant Cox Brad Coleman Jenna Barker	Lisa Skumatz Dana D'Souza Dawn BeMent Gary Horton

1.3.2 Plan Organization

Table 1-2 summarizes the information that is included in each section of this Plan. A key objective of this Plan is to make recommendations for an integrated and sustainable materials management system. Toward that end, this Plan has provided a concise and specific set of strategies that communities can consider to help reduce their waste management costs and realize benefits, both in terms of cost savings and liability management, if they implement the Plan recommendations. It is understood that moving toward an effective materials management program will require extensive activity and collaboration among a variety of stakeholders at the state, regional and local levels. Correspondingly, Section 6 of this Plan includes a more in-depth discussion of the collection and diversion strategies and recommendations.

Table 1-2: Plan Organization

Section	Overview
Executive Summary	Provides a stand-alone summary of the Plan, inclusive of key findings, recommendations and conclusions
1. Introduction	Provides an overview of the purpose of the Plan and history, as well as descriptions of the plan organization and content
2. Stakeholder Meetings	In an effort to understand a broad range of stakeholder views and perspectives, the Project Team conducted 10 public input meetings across the state utilizing the Appreciate Inquiry technique. Prior to conducting the meetings, participants completed a pre-meeting survey
3. Transfer and Disposal System	Review of the current transfer and disposal system, including analyses of the wastesheds, landfill adequacy and overall facility needs. An analysis of costs, case studies and recommendations to improve the transfer and disposal system in Colorado
4. Solid Waste Collection	Reviews solid waste collection issues for the residential, commercial and multi-family sectors
5. Diversion Materials Management	Evaluates recycling collection and processing, as well as organics (yard waste and/or food scraps) collection and processing
6. Collection and Diversion Analysis and Recommendations	Examines strategies for improving the system of collection and diversion in Colorado. The two topics are jointly addressed, because collections of solid waste and recyclables are delivered jointly and the systems – and recommendations – are inevitably linked

The Plan also includes the following appendices:

- Appendix A: Terms and Definitions
- Appendix B: Landfill Adequacy Summary
- Appendix C: Case Studies
- Appendix D: Funding Sources
- Appendix E: Cost Models for Collection and Diversion
- Appendix F: Level 1 and Level 2 Collection and Diversion Recommendations – Supporting Rationales and Potential CDPHE Authority Opportunities
- Appendix G: Estimated 2016 Tonnages by Region
- Appendix H: Opportunities and Gaps by Region

1.3.3 Communicating Information by Geographic Regions

In order to provide an understanding of disposal and materials management trends within the state, key aspects of the analysis within Sections 3 – 6 of the Plan are organized based on the geographic regions shown in Figure 1-1. These regions are only intended to communicate information in the Plan in an organized manner, as the analysis and recommendations may involve multiple geographic regions.

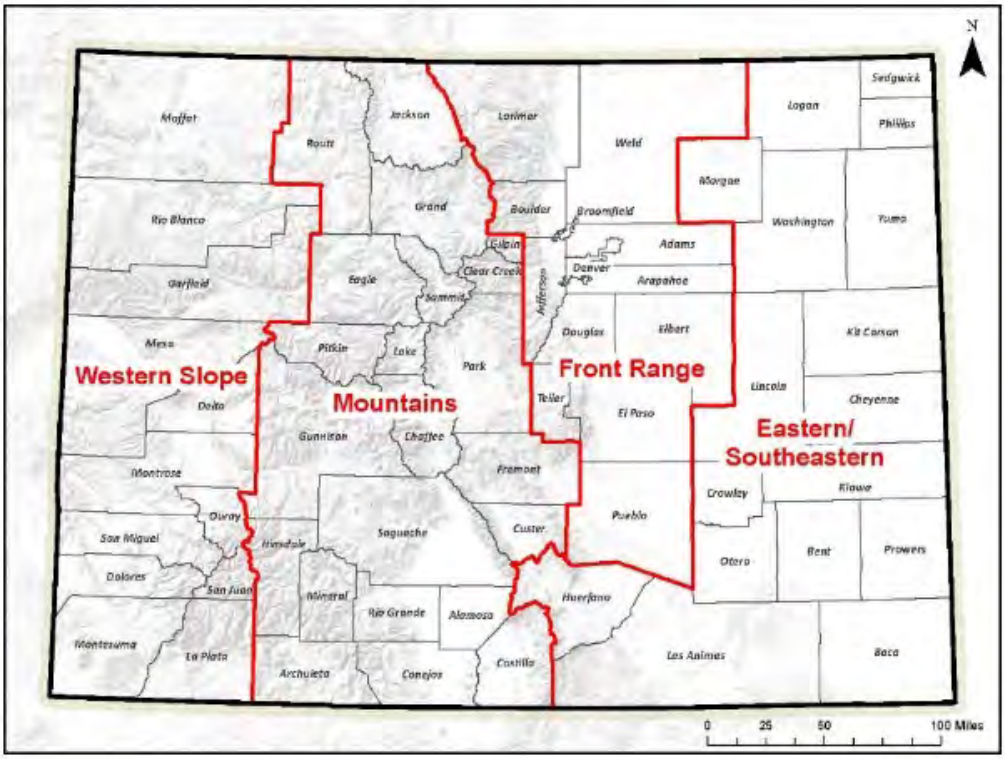

Figure 1-1: Geographic Regions

Front Range: The Front Range includes, for purposes of this Plan, all the counties along the IH-25 corridor from Pueblo County to Larimer County. Generally, the flow of materials within these counties travel toward the major urban areas along IH-25.

Mountains: The Mountain region includes counties along the continental divide and the San Luis Valley. Materials in mountain communities generally are not transported far due to weather induced travel difficulty during much of the year. Therefore, the wastesheds are more localized based on topography. It is understood that, while the San Luis Valley has been included in the Mountains category, the San Luis Valley has very different needs, gaps, demographics, infrastructure and economies. Correspondingly, the needs for the San Luis Valley will be discussed specifically within the Plan as appropriate.

Eastern/Southeastern: The Eastern/Southeastern region consists of the counties along the eastern border of the state and the lower population counties neighboring the Front Range counties. The region also includes Huerfano and Las Animas counties south of Pueblo because they have characteristics similar to

the counties in the eastern portion of the state. Due to low population density and large geographic areas in these counties, a relatively high number of landfills exist to service small communities surrounding these respective facilities.

Western Slope: The Western Slope consists of all counties touching the Utah border as well as the counties of Delta, Ouray, San Juan and La Plata. The flow of materials generally stays within each county or is transported in a north/south direction to other counties as opposed to going east.

1.3.4 Conceptual Options

Sections 3 and 6 (as well as Appendix E) of the Plan includes several conceptual options that are intended to provide communities with an understanding of the costs and alternatives to improve their solid waste and/or diversion system. Recognizing that communities may need to consider multiple options, the Plan includes several conceptual options within Sections 3 and 6 and Appendix E that are intended to reflect the various types of options that may be considered. The Project Team organized the conceptual options by types that are representative of the different characteristics of the state. Characteristics may include, but are not limited to, community size, location and proximity to disposal or materials management infrastructure. A conceptual option could be applicable to an individual community or region of the state.

1.4 Plan Limitations

Extensive efforts occurred to develop the facility and service cost estimates and geographic information system (GIS) analysis included in the Plan. However, as with any planning effort, there are limitations to the degree of detail provided and intended use of the information. Facility and collection services probable cost estimates were estimated using construction cost data, bid tabulations from previous projects, price indices and past experiences. Costs are considered high level for use in planning and alternatives comparison, and are not reflective of specific sites or circumstances. Probable costs are used in modeling to provide budgetary estimates for prescribed scenarios with necessary assumptions stated. Prior to implementing any of the recommendations included in this Plan, communities should develop specific and more detailed cost estimates that are focused on their planned activity.

Content for the maps included in the Plan was developed based on extensive collaboration between CDPHE and the Project Team, as well as based on input from multiple stakeholders. Due to the dynamic nature of the solid waste and recycling system in the state, the facilities and services communicated via these maps will change over time. These maps are based on information made available as of March 2016. Recognizing that these maps will change over time, key GIS layers have been provided to CDPHE by the Project Team, which can facilitate future updates.

2.0 STAKEHOLDER MEETINGS

The Project Team, at CDPHE's direction, focused on developing a tailored, responsive Plan. Given the diversity of solid waste management within the state of Colorado, it was essential to obtain input from all areas of the state, to ensure the Plan reflects the range of current characteristics, barriers and opportunities and "acceptability" of potential changes in the different regions.

The Project Team organized and facilitated nine regional stakeholder meetings around the state and one statewide webinar. The statewide webinar was organized for the convenience of stakeholders who could not attend a live meeting or had statewide knowledge that did not fit into any specific region-focused meeting. Figure 2-1 shows the locations of the stakeholder meetings.

To attract diversity in attendees to the meetings, the Project Team reached out through multiple rounds of emails and phone calls to invite the following entities to the meetings:

- landfill recycling and composting facilities
- county commissioners and other elected officials
- city and county officials and staff
- haulers, recycling businesses, brokers
- regional planning agencies
- Colorado/Rocky Mountain Solid Waste Association of North America (SWANA) and Colorado Association for Recycling (CAFR) members
- Recycled Resource Economic Opportunity (RREO) grant applicants/winners

In addition, contacted stakeholders were asked to forward the invitation to appropriate representatives and to other interested parties. The Project Team focused on obtaining information and feedback from each meeting to ensure full understanding of the region's current solid waste systems and future needs. Information gathering occurred via an on-line pre-meeting survey, as well as discussion and voting during each stakeholder meeting. The pre-survey gathered regional data that were used and presented at the stakeholder meetings. The pre-survey asked about the current system for collection services and facilities (trash, recycling and organics) in the area, expansion/contraction plans, prices and costs, material flows, economics of the system and opinions about how well the current systems were working. The pre-survey also solicited information on barriers, options best suited to the area and trends and drivers for change.

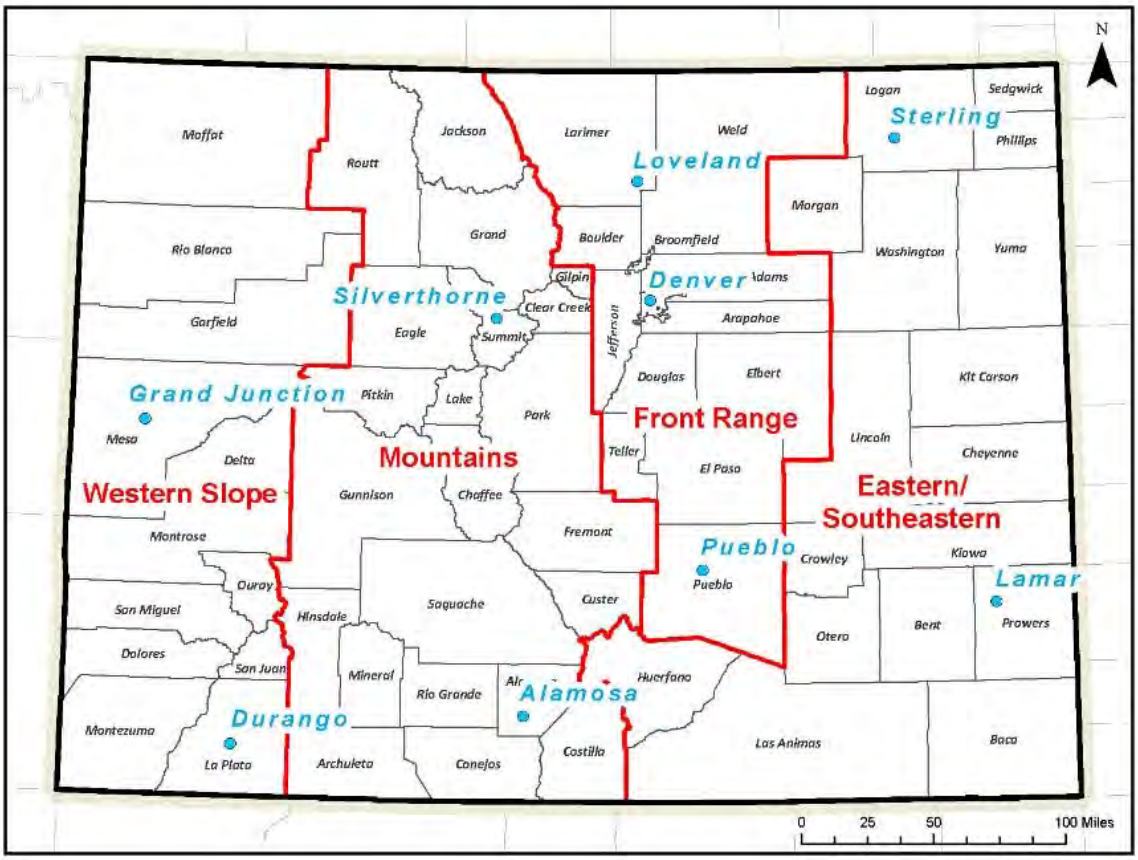

Figure 2-1: Stakeholder Meeting Locations

Maximizing feedback and discussion was the focus of each stakeholder meeting. The meetings included real-time voting using electronic "clickers" on 37 issues related to:

- sector and regions represented
- feedback on maps of regional facility and services
- information on current disposal and diversion systems and how well the systems were working
- regionalization and preferred options for landfills not meeting adequacy requirements
- barriers and opportunities for recycling and composting
- existing and potential funding and regulatory strategies in their area
- level of support for change from local elected officials and planners

As a third avenue for feedback and input, a group work session was conducted allowing participants to discuss needs and gaps, to share successful practices and to identify a potential diversion option that could potentially work in their region. Finally, maps identifying the availability of curbside and drop-off

services and locations of facilities for disposal, recycling and composting were posted at each table. Attendees were asked to review and annotate the maps with updates.

The information gathered from the pre-surveys, map corrections, voting results and group table discussions (Figure 2-2) were integrated to identify needs and gaps and potential strategies (as discussed in the subsequent sections of this Plan) reflecting each region's feedback.

Figure 2-2: Regional Stakeholder Meeting Group Work Sessions

The stakeholder groups were facilitated by Project Team staff with training in specialized stakeholder meeting methods, specifically Appreciative Inquiry. This approach focuses on leveraging successes rather than dwelling on barriers. All but one meeting was attended by one or more CDPHE staff. Table 2-1 provides the tally of meetings and attendees by type. The attendee types are listed in order of their relative attendance at each meeting.

The feedback from each meeting was extensive and covered a wide array of topics. Results were summarized in meeting-specific reports that were sent to attendees.[1] Rather than report comprehensive results of the stakeholder meetings in this section, key insight has been integrated into the disposal, collection and diversion sections that follow. To provide perspective on the level of detail addressed in the stakeholder meetings, the remainder of this section provides examples of the type of issues addressed during the meetings. The feedback and input provided by the many meeting attendees representing the variations in factors, situations, suitability and preferences were instrumental in informing the analyses and recommendations developed throughout this Plan.

[1] As of July 2016, these reports are available at: https://www.colorado.gov/pacific/cdphe/integrated-solid-waste-management-plan. If this link does not work in the future, please contact CDPHE at (303) 692-3330 for the updated location.

Table 2-1: Regional Stakeholder Meetings and Attendees

Location	Date	Pre-Survey	Attendees	Attendee Type (Listed in Order of Relative Attendance Numbers)
Alamosa	1/19/16	7	16	Disposal Facilities, City/County Solid Waste/Recycling Staff, Elected Officials, Recycling Businesses, Land Use Enforcement Officers, County Public Health Officials, County Regulators, Local Land Owner
Lamar	1/20/16	11	20	Disposal Facilities, City/County Solid Waste/Recycling Staff, Elected Officials, County Officials, Town Clerk
Pueblo	1/21/16	27	30	Disposal Facilities, City/County Solid Waste/Recycling Staff, Elected Officials, Recycling Businesses, Non-Profit Representatives, County Solid Waste Planner, Citizen Advisory Committee Representative, Haulers
Durango	1/25/16	12	15	Disposal Facilities, City/County Solid Waste/Recycling Staff, Elected Officials, Recycling Businesses, Non-Profit Representatives, County Solid Waste Planner, County Regulators, Regional Council of Government Representatives
Grand Junction	1/26/16	11	14	Disposal Facilities, Recycling/Composting Processing Facilities, City/County Solid Waste/Recycling Staff, Elected Officials, Recycling Businesses
Webinar	2/16/16	6	7	Disposal Facilities, Haulers, Recycling/Composting Processing Facilities, City/County Solid Waste/Recycling Staff, Consultants
Denver Metro	2/17/16	31	22	City Officials, City/County Solid Waste/Recycling Staff, Haulers, Non-Profit Representatives, Disposal Facilities, County Officials, Recycling/Composting Processing Facilities, Recycling Businesses/Brokers, Consultants, Research/Academics, End User Mill/Factory, State Agencies
Silverthorne	2/18/16	24	24	City Officials, City/County Solid Waste/Recycling Staff, Hauler, Non-Profit representatives, Disposal Facilities, County Officials Recycling/Composting Processing Facilities, Recycling Businesses, Consultants, State Agencies, Planning Agency/Regional Groups, Regulators, Restaurant Owners
Sterling	2/25/16	11	16	City Officials, City/County Solid Waste/Recycling Staff, Haulers, Disposal Facilities, County Officials, Recycling Facilities, Recycling Businesses, Planning Agency/Regional Groups
Loveland	3/2/16	39	27	City/County Solid Waste/Recycling Staff, Haulers, Recycling/Organics Processing Facilities, Disposal Facilities, Recycling Businesses, Households/Businesses, Recycling Non-Profit Representative, Elected Official, Broker, City Clerk, Consultant
Total		**179**	**191**	

Table 2-2 summarizes the feedback on the barriers to additional diversion from each meeting. The most commonly stated barrier to increased waste diversion was profitability issues followed by lack of local

municipal support. For the regions outside of the Front Range and the more rural areas, transportation and long distances to markets are a significant barrier. Lack of material supply, low program participation, low landfill tipping fees and illegal dumping issues were the next most frequently expressed barriers.

Table 2-2: Barriers to Diversion Programs by Stakeholder Meeting Area

Barriers by Stakeholder Meeting	Alamosa	Lamar	Pueblo	Durango	Grand Junction	Webinar	Denver Metro	Silverthorne	Sterling	Love land
Poor Enforcement of Regulations								RO		
Too Much Regulation		O								
Siting/Permitting Issues	O		O					O		O
Illegal Dumping Concerns	RO		RO		RO					
Contamination Concerns		RO						RO	RO	R
Lack of Municipal Support	RO	O	R				RO	RO	RO	RO
Weak Programs/Few Tons						RO	O			
Low Program Participation			RO	RO		RO				
Transient Tourist Population				RO				RO		
Low Program Profitability	RO	RO	RO	RO		RO	RO	RO		RO
Low Landfill Tipping Fees						O	R	RO		RO
Lack of Material Supply	O		O			RO	O		RO	
Lack of Market Demand		RO					O	R		R
Access to Markets	R		R	RO		R	R	R		R
Transportation Distance	R	RO	RO	RO	R					
Terrain - Winter Passes				RO						
Insufficient Understanding of Technology		O							RO	
Key: R = Recycling; O = Organics										

Another key topic was gathering feedback on the best ways by which CDPHE could improve solid waste management and recycling services that would be protective of human health and the environment. Table 2-3 provides a summary by region of the most common responses to that question. The responses provide suggestions in the areas of recycling, organics, landfills, regulations, education and other topics that move diversion forward and protect the environment.

Table 2-3: Common Responses to Solid Waste Suggestions Survey Question

Region	Common Responses
Front Range	**Recycling** - increase and improve recycling programs; mandate recycling; attract recycling businesses; standardize recycling programs; lead by example with recycling; develop recycling educational materials
	Education - increase public solid waste and recycling education; statewide recycling education; develop recycling educational materials; household hazardous waste education; education for regional recycling support
	Funding - develop fair funding model for solid waste; funding for solid waste plan, market and infrastructure development; funding for statewide solid waste initiative; closure and post-closure landfill fund
	Pay as You Throw (PAYT) - need PAYT programs; adopt statewide PAYT; mandate PAYT
	Goals - develop statewide plan with statewide goals; enforce goals
Mountains	**Recycling** - mandate recycling; free/subsidized/incentivized recycling; local/regional recycling; statewide recycling infrastructure; tax relief for recycling equipment; electronics recycling; commercial recycling
	Education - increase recycling education; focus on why recycling makes sense even if it costs more; pay for education; educate on proper methods of disposal to avoid hazards
	Compost - incentivize/subsidize composting; mandate food scrap/compost collection; commercial composting
	Facilities - regionalize recycling and solid waste facilities; foster cooperation between facilities; reduce regulations for composting facilities
	Transfer Stations/Landfills - have regional transfer stations; fund transfer stations for recycling and organics; oversight for landfills; funding for small closing landfills
Eastern/ Southeastern	**Recycling** - state assistance for recycling; incentivized/subsidized recycling or start-up costs; increase recycling awareness and education; takes time for recycling acceptance; fund recycling program through tax, landfill fee or purchase surcharges
	Help/Money - subsidize recycling programs; reduce fees; solid waste assistance; grant money for recycling programs; increase recycling and awareness
	Regulations - make "common sense" regulations; make reasonable regulations; additional regulations are not effective
	Producers - allow for producer input; meet with producers and make "common sense" diversion regulations with risk/reward analysis
Western Slope	**Diversion** - create policies to drive diversion; create diversion templates for easy adoption by local governments; increase funding for diversion programs; require diversion at landfills; landfill diversion should be addressed
	Landfills - have ready access to landfills in this area; landfill diversion should be addressed through a material recovery facility (MRF) or aggregation enterprise; enforce regulations at rural landfills; require diversion at landfills
	Commodities - need favorable market values for commodities; increase the desire for collected commodities; increase options to off-load collected materials
	Recycling - encourage recycling and composting; there is enough interest and willingness to further recycling operations and continue growth; a MRF is needed to address landfill diversion

3.0 TRANSFER AND DISPOSAL SYSTEM

3.1 Introduction

Having an adequate and cost effective transfer and disposal system in the State of Colorado is important to meet long-term disposal needs. This section evaluates the state's transfer and disposal system in an effort to identify the type and quantity of facilities that are necessary to meet the needs of local governments and citizens. This section begins with a review of the current transfer and disposal system, including analyses of the wastesheds, landfill adequacy and regional facility needs. Based on the review of the current system, this section includes an analysis of typical facility costs for transfer stations and landfills. This cost analysis has been included for the consideration of owners and operators of transfer and disposal facilities to improve the existing system. This current system and facility cost review yields multiple conceptual options that could be considered as alternatives to the current transfer and disposal system. The section concludes with a discussion of key findings and recommendations.

3.2 Current System Review

This section provides an analysis of the current transfer and disposal system. The analysis is organized geographically based on four regions of the state (Front Range, Mountains, Eastern/Southeastern and Western Slope) as shown in the Introduction Section (see Figure 1-1 in Section 1.3.3). Figure 3-1 is a map that displays key information regarding the wasteshed analysis and landfill adequacy.

3.2.1 Wasteshed Analysis

Understanding how solid waste moves from communities, via haulers and transfer stations, to landfills is meaningful in evaluating the current transfer and disposal system. Information on the communities and areas where waste is generated is not a requirement of the Engineering Design and Operations Plan (EDOP) for landfills. Correspondingly, there is not an existing data set of wastesheds for the state of Colorado. Based on input provided by stakeholders via written survey and during the stakeholder meetings, as well as insight from CDPHE and the Project Team (including multiple phone calls to facilities and internet research), Figure 3-1 portrays the disposal wastesheds in the state as they are currently understood.

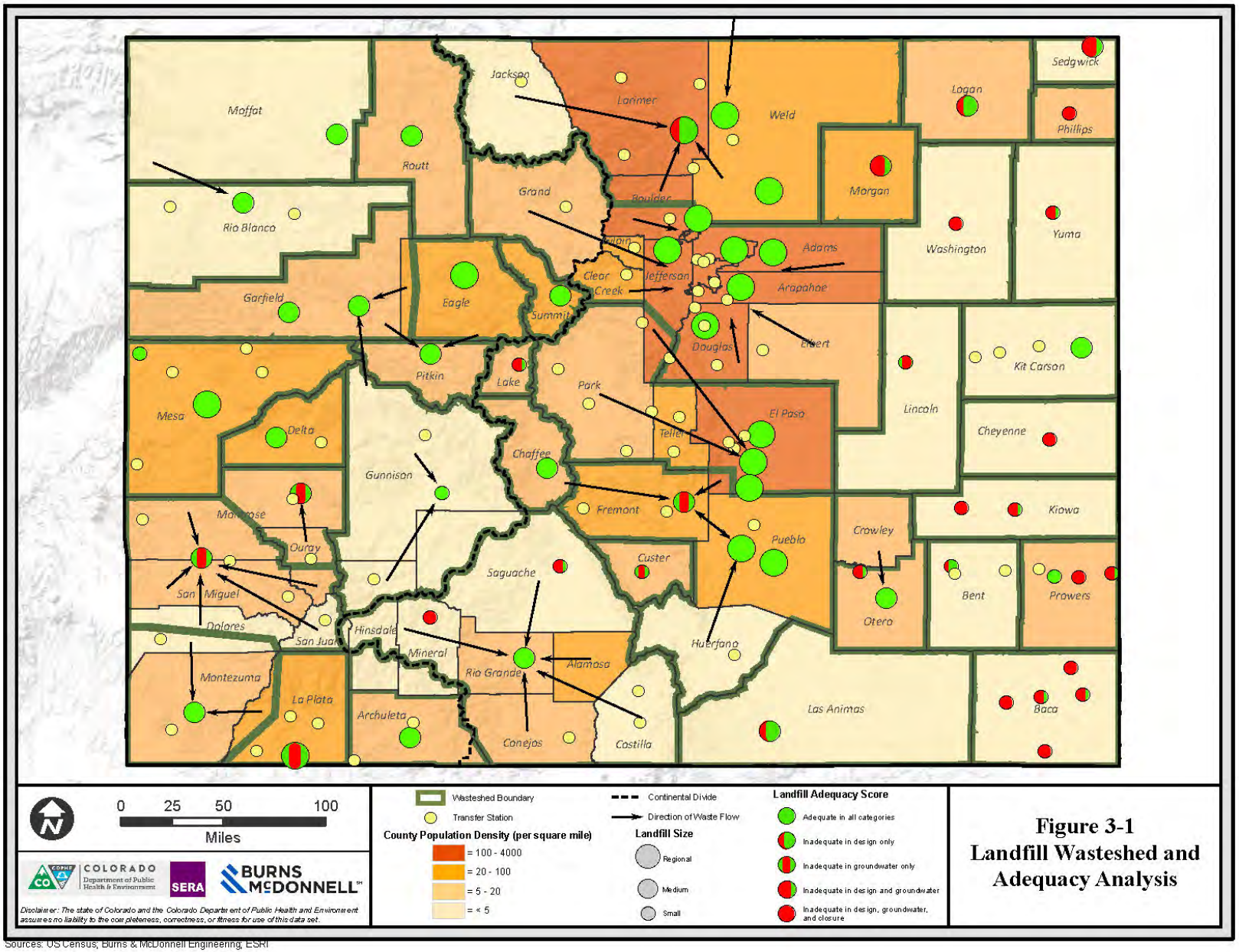

Figure 3-1
Landfill Wasteshed and Adequacy Analysis

Sources: US Census, Burns & McDonnell Engineering, ESRI

The following provides an overview of key information included on the wasteshed map:

- **Population density and landfill size**: The wasteshed map includes information on the population density and landfill size (based on annual quantities received). This detail is helpful to broadly understand the quantities of solid waste that may be generated and disposed on a county by county basis. Landfill size is based on ranges, as follows: small (less than 25,000 cubic yards annually), medium (25,000 to 200,000 cubic yards annually) and regional (greater than 200,000 cubic yards annually).
- **County defined wastesheds**: In many cases, the wasteshed limits were based on the county boundaries, meaning that the vast majority or all of the solid waste generated in the county is disposed at a landfill located within the county. Many of the county defined wastesheds are in the Eastern/Southeastern and Western Slope regions, with several located in the mountains.
- **Limited flows from one county to another county**: In some counties, defined as its own wasteshed, there may be some solid waste that is accepted from an adjacent county. These cases are represented by an arrow.
- **Multi-county wasteshed**: Some counties, typically with small populations, do not operate a landfill but collect solid waste at transfer stations before sending it to an adjoining or nearby county. In some cases, a hauler may directly transport the solid waste to a landfill in an adjacent county. These counties are outlined together with arrows representing the flow of waste.
- **Regional wastesheds**: Regional landfills along the Front Range accept solid waste from multiple areas, most of which overlap with other landfills. These areas are shown as one regional wasteshed with arrows showing the general flow of materials. These areas include multiple wastesheds on the Front Range and a few other areas of the state such as the San Luis Valley area and the Broad Canyon Landfill in San Miguel and Montrose counties.

3.2.1.1 Front Range

The Front Range region generally consists of cities and large towns with high population densities. As a result, the landfills in this region are regional in size. There is also a network of transfer stations where collected solid waste is collected for transport to the landfills. Most of the landfills in the Front Range are private and accept waste from various locations along the Front Range. Many towns and cities have open subscription for hauling where citizens can sign up for service with the company of their choosing (see Section 4.4.1 for further detail). The haulers that collect the solid waste then contract with a landfill for disposal, meaning waste collected from adjoining neighborhoods may be directed to different landfills.

For the purposes of this analysis the Front Range was divided into four regional wastesheds (Northern portion, Denver, Colorado Springs and Southern portion).

With landfills in Larimer and Weld counties, the most northern portion of the Front Range wasteshed accepts solid waste from within their own counties, as well as from Jackson and Boulder counties via transfer stations and direct haul. Additionally, solid waste from the city of Cheyenne, Wyoming is transported and disposed of at a landfill in Weld County.

The Denver wasteshed, which includes the city of Denver, as well as surrounding communities and several nearby counties (such as Adams, Arapahoe, Elbert, Douglas, Grand, Boulder, Gilpin and Clear Creek), has a large network of transfer stations and landfills. Due to the population densities and significant commercial solid waste generated here, waste flows throughout the area.

While not as large as the Denver wasteshed, the Colorado Springs wasteshed also consists of a network of transfer stations and landfills that includes Jefferson, Park, Teller and El Paso counties. The southern portion of the Front Range includes regional landfills in Pueblo County that accept solid waste primarily from Pueblo, Huerfano and Fremont counties.

3.2.1.2 Mountains

Counties in the Mountain region are generally remote with few towns and low population densities. This region is similar to the Eastern/Southeastern region in terms of generally having one landfill in each county. For the most part, solid waste generated in each county is disposed of at a landfill within the same county. Landfill sizes include small, medium and regional facilities. In some cases, solid waste is transported to adjacent counties due to the transportation network and the location of the Continental Divide.

Jackson, Grand, Gilpin, Clear Creek and Park counties do not have landfills but transport their solid waste to landfills on the Front Range. Routt County has one landfill and is assumed to service the entire county. Almost all of the population in Routt County is located along the Highway 40 corridor causing solid waste to be transported directly to the landfill without the need for transfer stations. Eagle and Summit counties are similar in that the majority of the population is along the I-70 corridor; therefore, solid waste can be hauled directly to these landfills from along the corridor.

The wasteshed for the Pitkin County Landfill was described by the operator as equal to the watershed for the Roaring Fork River between Aspen and Glenwood Springs. Assuming this wasteshed, solid waste

from parts of Eagle and Garfield County are transported to the Pitkin County Landfill. Figure 3-1 includes arrows showing the areas of other counties that are within the Pitkin County wasteshed.

Based on input from Garfield County landfills, solid waste from portions of Eagle and Gunnison are taken to the South Canyon Landfill located in Garfield County. Based on the topography this is the most feasible option for waste in northern Gunnison County. Lake County functions as a county wasteshed with solid waste staying within the county. Most of the solid waste in Chaffee County also stays within the borders of the county, with the exception that some solid waste from Salida is transported to Fremont County.

Phantom Landfill in eastern Fremont County accepts solid waste from the county, and waste from portions of El Paso and Pueblo counties. The Six Mile Landfill near Gunnison accepts solid waste from Gunnison County and the northern portions of Saguache and Hinsdale counties. The wasteshed for the Custer County Landfill is assumed to be the limits of Custer County.

The San Luis Valley Landfill in Rio Grande County has a large wasteshed that includes most of Saguache and Mineral counties and all of Rio Grande, Alamosa, Conejos and Costilla counties. The San Luis Valley has been organized as a wasteshed and includes transfer stations in Conejos and Costilla counties. Some solid waste is taken to the Mineral and Saguache County landfills, but most of the waste in the area goes to the San Luis Valley Regional Landfill. The wasteshed for the Archuleta County Landfill includes all of Archuleta County and the southern portions of Hinsdale and Mineral counties.

3.2.1.3 Eastern/Southeastern

Counties in the Eastern/Southeastern portion of the state have a relatively low population density and few towns. All of the landfills in this area are either small or medium sized. In all the counties in the northeast and east central portion of the state, the solid waste is hauled to each county's landfill. In the southeastern part of the state, Las Animas has a single Municipal Solid Waste (MSW) landfill servicing the entire county. Bent County and the city of Las Animas operate a Construction and Demolition (C&D) Landfill and haul MSW to the Otero County #2 Landfill.

Kiowa, Prowers, and Baca County all have multiple small landfills within their county boundaries, some owned by the county and some by individual towns. Otero County has one regional landfill and one small landfill. The wasteshed in these areas extends some distance away from the landfill and cannot be effectively shown on a statewide map; therefore, these counties are shown as one county-wide wasteshed.

Solid waste from Crowley County (which does not have a landfill) is typically transported to landfills in Otero and/or Pueblo County; however this was not confirmed. Huerfano County does not have a landfill, as solid waste is collected at a transfer station in Walsenburg and hauled to Pueblo County.

There are only a few counties utilizing transfer stations in this region. Most of the counties are either direct-hauling to landfills by collection trucks or by individual residents. The exceptions are Kit Carson County, which has transfer stations in Flagler, Seibert and Stratton that transfer solid waste to the landfill near Burlington; Bent County, which operates two small transfer stations; and the city of Lamar.

3.2.1.4 Western Slope

The counties on the Western Slope are large with relatively low population densities, with the exception of a few cities. Much of the area is remote and hard to access. Towns are located along highway corridors that cut through the expansive counties. Landfill sizes include small, medium and regional facilities.

In the northwest corner, Moffat County has one landfill that supports the relatively small population along Highway 40. Some of the solid waste in the southwest corner of the county may be transported to Rio Blanco County. Rio Blanco uses transfer stations in Rangely and Meeker to collect solid waste before transport to the Wray Gulch Landfill.

The solid waste in Garfield County is transported to one of two landfills within the county, all of which remains in the county. As stated in the Mountains section, the South Canyon Landfill in eastern Garfield County accepts solid waste from Gunnison and Eagle County. Mesa County has the largest population centered in Grand Junction which utilize transfer stations in the surrounding small towns. The small landfill near the Utah border accepts solid waste from the small towns at the western end of the county but no known delineation has been established, therefore Mesa County in its entirety is considered one wasteshed.

Delta County operates one landfill and accepts solid waste from a transfer station in the eastern portion of the county. Montrose County also operates one landfill, but accepts solid waste from one transfer station within the county and one transfer station in Ouray County, which receives solid waste from the northern portion of Ouray County.

The Broad Canyon Landfill near Naturita (bordering Montrose and San Miguel counties) supports a multi-county wasteshed including the western portion of Montrose County, the southern half of Ouray County, all of San Juan and San Miguel counties and the northern half of Dolores County. The wasteshed for the Montezuma County Landfill includes all of Montezuma County and the southern portion of

Dolores County around Dove Creek and western portion of La Plata County. A transfer station in Towaoc transports solid waste from the southwest corner of Montezuma County to the landfill. The Bondad Landfill in La Plata County accepts solid waste from La Plata County and uses transfer stations to collect solid waste in Marvel, Durango and Bayfield.

3.2.2 Landfill Adequacy Analysis

A key purpose of this plan is to identify current and future waste management needs and offer recommendations for improvements that can be made to Colorado's waste management system. Central to this objective is a candid assessment of the current solid waste landfill systems in Colorado. Without such assessment, the Plan would be unable to make cost-based recommendations for future improvements. Many small landfills initially received waivers from monitoring and design criteria. The state regulations require on-going demonstrations that the technical basis for these waivers remains adequate. However, a significant number of solid waste landfills lack not only the resources to complete the required demonstrations in support of their waivers, but also lack, more fundamentally, the resources to even comply with the reduced set of design, operational and closure requirements contemplated by the waivers. CDPHE believes these facilities will need to make upgrades to their landfill operations in order to achieve compliance with state and federal solid waste regulations. For purposes of estimating the costs associated with these upgrades, CDPHE provided the Project Team with the status of each operating landfill with respect to design and operation, monitoring and closure requirements in the federal and state solid waste regulations.

Toward this end, CDPHE assigned each site an adequacy score based on recent inspection information and review of the facility's approved design. At each stakeholder meeting, participants were provided a draft municipal solid waste landfill map prepared by the Project Team depicting each facility's adequacy score with respect to the above criteria. Some facilities that were rated inadequate in one or more categories had personnel express concern that the stigma attached to such a rating would cause them problems with their local elected officials, management, lessors or the public they serve. Some have interpreted the information on the maps as being pejorative or critical of the facilities or their operators.

Casting facilities in a bad light or reflecting negatively on their owners or operators was not the intent of the adequacy score, nor should the map be interpreted that way. Rather, the adequacy score is simply presented for the purpose of indicating specific costs facilities may need to incur in order to meet all regulatory design and monitoring requirements in the federal and state regulations. Just as CDPHE understands landfill operators are making good faith efforts to achieve compliance with the regulations, it is hoped that readers of the Plan will view the information presented in this section in light of its

constructive purpose - to foster dialogue between CDPHE and the owners and operators of these landfills aimed at taking advantage of the recommendations in the Plan. CDPHE looks forward to discussing with each site or region the results of the Plan, its recommendations for improvement and the requirements for achieving regulatory compliance.

In the Resource Conservation and Recovery Act (RCRA) 1984 Hazardous and Solid Waste Amendments, the U.S. Congress directed the U.S. Environmental Protection Agency (EPA) to develop regulatory authority over landfills and directed the preparation of landfill design and operating criteria that were protective of human health and the environment. The EPA responded with a complete set of regulations known as the RCRA Subtitle D. Subtitle D, Part 258 with an emphasis on landfill containment, was proposed in 1988 and became effective in 1991, although various implementation deadline extensions ran through 1997.

The rules established minimum landfill criteria for the location, operation, design, groundwater monitoring, closure and post-closure care and financial assurance. These minimum landfill management requirements had to be met by all landfills in each state. States were allowed to submit their statutes and regulations to EPA establishing that they had statutory and regulatory authority to require that landfills meet the minimum Part 258 requirements. In Colorado, the regulations meeting the minimum requirements in Subtitle D went into effect October 9, 1993 with some exceptions as outlined in 6 Colorado Code of Regulations (CCR) 1007.2 based on the authorities defined and established in the Solid Waste Act, 30- 20-100.5, et seq, Colorado Revised Statutes (C.R.S.). EPA approved Colorado's solid waste regulatory program as equivalent to Subtitle D and Part 258 requirements in October 1993.

Based on three criteria categories - design and operation, groundwater monitoring and closure requirements - this section summarizes the adequacy of landfills in the state. Each of the three criteria categories are comprised of requirements that are specifically included in Subtitle D and 6 Colorado Code of Regulations (CCR) 1007-2 Part 1. Table 3-1 provides an overview of the individual requirements included in each of the three categories.

Figure 3-1 identifies the levels of adequacy for landfills in the state based on the three categories. The figure also defines the landfills by size which was determined based on the quantity of solid waste disposed of at the landfill in 2014. Appendix B includes a table indicating the current adequacy for each item at every landfill, as well as the annual disposal quantities for the most recent three years.

CDPHE maintains records for each landfill including all design, operation, monitoring and closure components and the adequacy of the landfills for each item. The Project Team requested the adequacy

information from CDPHE during the initial document review task, and this information is presented in the following section. The Project Team relied on information provided by the CDPHE regarding the adequacy of each landfill in the state.

Table 3-1: Landfill Adequacy Criteria for Design and Operation, Ground Water Monitoring and Closure Requirements

Design and Operations	Ground Water	Closure Requirements
• Access controls – 6 CCR 1007-2 Part 1 Section 2.1.8 • Adequate hazardous waste screening procedures – 6 CCR 1007-2 Part 1 Section 2.1.2 • Stormwater quality permit - 5 CCR 1002-61 Section 61.3 • Air compliance with open burning permit – C.R.S 25-7-1 • Adequate daily cover – 6 CCR 1007-2 Part 1 Section 3.3.4 • Cover / compaction equipment - 6 CCR 1007-2 Part 1 Section 3.3.2 • Adequate liner - 6 CCR 1007-2 Part 1 Section 3.2.5 • Adequate leachate collection system - 6 CCR 1007-2 Part 1 Section 3.2.5 • Adequate methane monitoring - 6 CCR 1007-2 Part 1 Section 2.3	• Adequate system of ground water monitoring wells - 6 CCR 1007-2 Part 1 Section 2.2 • Adequate ground water sampling - 6 CCR 1007-2 Part 1 Section 2.2 • Ground water impacts from constituents • Ground water waiver granted/current - 6 CCR 1007-2 Part 1 Section 1.5	• Adequate closure cost estimate - 6 CCR 1007-2 Part 1 Section 1.8.2 • Adequate post closure cost estimate - 6 CCR 1007-2 Part 1 Section 1.8.2 • Adequate financial assurance funding mechanism - 6 CCR 1007-2 Part 1 Section 1.8.4

3.2.2.1 Front Range

All but one of the landfills in the Front Range region have been deemed adequate by CDPHE. The only landfill that is rated inadequate is the Larimer County Landfill, which is listed as inadequate due to the lack of a liner and leachate collection system. Similar to the Trinidad Landfill, the Larimer County Landfill operates within a footprint predating the promulgation of the Subtitle D regulations and so a liner and leachate collection system are not required.

3.2.2.2 Mountains

Most of the Mountain landfills have maintained a level of adequacy in regard to the regulations. However, there are several landfills in the region that do not meet adequacy in some or all categories. The Lake County Landfill, Phantom Landfill in Fremont County, Custer County Landfill, Saguache County Landfill and Mineral County Landfill have all been deemed inadequate in one or more categories by

CDPHE. Phantom and Custer County landfills lack adequate groundwater monitoring systems. Lake County and Saguache landfills have several operating and groundwater inadequacies. Mineral County Landfill is considered inadequate in all three categories.

3.2.2.3 Eastern/Southeastern

In the Eastern/Southeastern region there are a number of medium and small landfills. Five of the landfills – East Lamar Municipal, Kit Carson, LABC, Logan County and Otero County – are the only facilities operating in accordance with the regulations. All of the other facilities in the region are inadequate in at least one category with the majority of landfills being inadequate in all three categories. Landfills that are inadequate in all three categories include: Haswell Solid Waste Disposal Site (SWDS), Granada SWDS, Campo SWDS, Prichett SWDS, Two Buttes, Firstview Sanitary and Phillips County. The following landfills were inadequate in design and groundwater: Sedgwick County, Morgan County, Manzanola, Eads SWDS, Holly SWDLF, Yuma County SWDS, Walsh SWDS and Springfield SWDS. Trinidad Landfill was inadequate for design, primarily because it lies within a footprint established prior to the effective date of the current regulations. Washington County Landfill was inadequate for design and closure. The Lincoln County Landfill was inadequate for ground water and closure.

3.2.2.4 Western Slope

There are three landfills on the Western Slope that are in the groundwater monitoring category. These landfills are the Bondad Landfill, Broad Canyon Landfill and Montrose SWDS.

3.2.3 Regional Facility Gaps and Opportunities

For each of the four geographic regions, this section evaluates the gaps and opportunities associated with the transfer and disposal systems in the region, as well as identifies the general investment needs and next step recommendations. Figure 3-1 summarizes the wasteshed analysis and landfill adequacy review referenced in this section.

3.2.3.1 Front Range

All of the landfills in the Front Range have been categorized as regional landfills, which is to be expected based on the quantities of solid waste generated throughout this region. Most of these landfills are privately owned and operated as businesses that have a goal of generating profit. Other landfills owned by counties and municipalities also accept large quantities of solid waste, creating the ability to generate profit. The private landfills for the most part dominate the market and drive the progress through competition, and the public landfills keep pace.

The development of the solid waste transfer and disposal system on the Front Range has evolved over time as markets have changed. As population on the Front Range has increased, the landfills and haulers have adapted by building transfer stations, expanding landfills and/or changing engineering and operational practices to increase airspace. Based on responses from surveys and input at the stakeholder meetings, the current disposal system in the Front Range appears to be working well.

Moving forward it is expected that the haulers and regional landfills on the Front Range will continue to adapt to changing market conditions and provide services. There may be an opportunity for the Front Range regional landfills to expand their wastesheds beyond the highly populated areas of the Front Range. For counties and towns in the Eastern/Southeastern region bordering the Front Range region, challenged to maintain and operate an adequate landfill, construction of a transfer station and hauling to a regional landfill on the Front Range could allow for a viable option. There is also potential for the Front Range landfills to accept additional solid waste from adjacent counties and towns in the Mountain region.

3.2.3.2 Mountains

The Mountain region consists primarily of a mix of medium and small landfills, with one regional landfill in Eagle County. The population of the Mountain counties are much lower than the Front Range, which results in less solid waste generated and less revenue for the operation of the landfill. The transfer of solid waste in the mountains is largely dependent on the topography and road conditions. Most counties have a single county owned landfill that services the entire county, while some counties have only transfer stations. In the northern part of the Mountain region, Routt County operates a landfill, Jackson County does not have a landfill or transfer station and Grand County uses three transfer stations to collect solid waste before transporting it out of the county. The Milner Landfill in Routt County is operating adequately, serving the population around Steamboat Springs. Due to the size of the counties and lack of people living there, the current system seems to be sufficient for the current situation.

The central mountain counties of Gilpin, Clear Creek and Park all utilize transfer stations to collect their solid waste but do not have operating landfills within their respective counties. The rest of the central mountain counties have one landfill each and no transfer stations. These counties include Eagle, Summit, Pitkin, Lake, Gunnison, Chaffee and Fremont. Based on feedback during the stakeholder meetings the system in the central mountains is working well. Even with the small size of the landfills, regionalization is generally not a good fit for this area because of the difficulty associated with transporting solid waste between the counties. For these central mountain counties the emphasis will be to improve the few inadequate landfills to meet regulatory standards or consideration of transferring to a nearby adequate landfill.

In the southern portion of the Mountain region, which includes counties in and around the San Luis Valley, there is need for improvement in the transfer and disposal of solid waste. One clear issue in the region is illegal dumping. This occurs throughout the area and may be related to distance to transfer stations or landfills, but is most likely related to the cost of disposal. From information gathered at the stakeholder meeting in Alamosa, many of the areas in the southern Mountain region are considered impoverished and resort to dumping solid waste in ravines and ditches as opposed to driving to and paying the fees at the landfill. This keeps landfills from raising fees that will sustain operation and provide funding for future expansion or remediation. Voting during the Alamosa stakeholder meeting showed that small landfills not in full adequacy should be upgraded and allowed to continue operation. The responses collected during the meeting also indicate that regionalization of the landfills would not have community support. However, it is the Project Team's perspective that regionalization in the area is feasible with additional transfer stations at small existing landfills or other locations.

3.2.3.3 Eastern/Southeastern

The Eastern/Southeastern region has significant needs regarding the transport and disposal of solid waste. This region consists of large counties with small towns and a low population density. However, the region has a significant number of small landfills, owned by a combination of counties and towns. The vast majority of these landfills are inadequate with regard to the regulations (as discussed in Section 3.2.2.3). Another challenge presented with these landfills includes their extensive disposal capacity, which translates to long lifespans given relatively low incoming solid waste quantities.

Information from the stakeholder input process was insightful. Based on the questions asked during the stakeholder meetings, participants generally think the current solid waste and disposal system is working well. Furthermore, a high percentage of participants from the region said that regionalization of landfills would not make sense for the area. Many of the stakeholders in the Lamar meeting expressed dissatisfaction with the rules and wanted CDPHE to help revise the rules so small rural landfills could continue to operate. Attendees at the stakeholder meeting in Lamar indicated that regionalization would not be supported in the area. Several attendees also noted that closing existing facilities without other convenient and affordable options would likely increase illegal dumping.

Many stakeholder perspectives vary from the opinions of the Project Team relative to potential transfer and disposal solutions for the Eastern/Southeastern region. From the Project Team's perspective, continuing to operate many of the landfills in this region is a challenge due to the extensive number of facilities that are inadequate, as well as the relatively small solid waste quantities that are unlikely to generate sufficient revenue required to fund facility improvements. The lack of funding is a primary

reason the small landfills have not been upgraded to adequate regulation standards. This challenge is compounded for counties like Prowers and Baca that have multiple, small landfills. The closure of the small landfills, construction of a regional landfill and transfer stations may provide the optimal service in the area and eliminate the numerous inadequate landfills in this region.

Kit Carson County, located along the Kansas border, is operating an adequate landfill and has three transfer stations in towns along Highway 59. This system may be one that can be duplicated in other eastern counties that have similar size populations. This system would work with more transfer stations positioned throughout multiple counties, directing solid waste to one landfill.

3.2.3.4 Western Slope

Medium size landfills are predominantly on the Western Slope. The small S-Road Disposal Landfill in Mesa County, the regional sized Mesa County Landfill and Bondad Landfill in La Plata County are the only exceptions. Counties on the Western Slope are larger in area and generally have larger populations than the mountain counties, which generates more solid waste and in turn more revenue for the landfills helping to keep the landfills operating within the regulations.

Transfer and disposal of solid waste on the Western Slope are considered medium and regional size landfills supported by a number of transfer stations spread throughout the counties. Based on the wasteshed analysis and the response from the stakeholder meetings in Grand Junction and Durango, the system of having one county landfill accepting solid waste from transfer stations situated in the county is the working model for most of the counties. The number of transfer stations depends mostly on the number and size of towns within each county. Some counties with small populations and only a few towns have only transfer stations and tend to direct solid waste to other counties. Due to the large county sizes, regionalization has occurred to some extent within individual counties or amongst multiple counties.

The three landfills inadequate in the groundwater category will need to make adjustments to meet the regulatory requirements. Closure of these landfills would leave large areas unsupported.

3.3 Cost Modeling Overview

This section provides an overview of the landfill and transfer station financial models developed by the Project Team. These models were utilized to develop the financial comparison of the conceptual options discussed in Section 3.4. **The cost estimates for the landfills and transfer stations reflect the capital and operating costs associated with the facilities and do not include any excess revenue or profit. There are also no expenses for items such as program administration, franchise fees, operating**

reserve contributions and similar expenses. A capital reserve (or debt reserve depending on financing method) of 20% of the amortized capital expenses was included. Only for the purpose of developing the cost estimates, the Project Team also assumed that public sector entities would own and operate the transfer station and landfill facilities. See Section 1.4 related to limitations of the plan and probable cost estimates.

3.3.1 Baseline Landfill Model

The Project Team developed a baseline landfill financial model to which other solid waste disposal options could be compared. The baseline landfill model is based on operating a landfill compliant with state and federal regulations and is based on best management practices, the Project Team's experience in landfill design and operations and regulatory requirements.

Subtitle D defines a small landfill as one receiving less than 20 tons per day, which equates to roughly 25,000 CY per year. For the purposes of this plan, landfills are defined as small, medium or large based on the annual amount of cubic yards (CY) accepted at the landfill. A small landfill is defined as less than 25,000 CY per year, a medium landfill as greater than 25,000 CY but less than 200,000 CY and a large landfill as over 200,000 CY. However, for this analysis, it was necessary for the Project Team to develop additional size segments to adequately capture the cost differences for operating landfills of various sizes. Table 3-2 shows the size categories utilized for the baseline financial model. Table 3-2 also shows the airspace utility factor (AUF) and average vertical column of waste for each landfill size. The vertical column of waste is the sum of the depth of the landfill and the height of the landfill.

Table 3-2: Landfill Size Categories

	Micro	Small	Medium	Medium-Large	Large
Minimum Annual Tonnage	0	10,001	40,001	100,001	500,001
Maximum Annual Tonnage	10,000	40,000	100,000	500,000	1,000,000
Avg. Airspace Utilization (lbs/cy)	800	1,000	1,100	1,200	1,400
Avg. Vertical Column of Waste (ft)	30	60	80	90	110

By using the AUF, vertical column, annual tonnage information and desired site life information, an interested party can estimate the total site size required for the disposal operation. For example, assume a planned landfill has the following characteristics:

- Annual Tonnage: 150,000 tons per year (average)
- Desired Site Life: 50 years

- Airspace Utilization Factor: 1,200 pounds per cubic yard
- Average Vertical Column of Waste: 90 feet (30 yards)

Based on these assumptions, a landfill owner/operator would need to secure at least 86 acres for disposal capacity, as shown by the calculation below. Furthermore, additional land will be needed for buffer areas to the site boundary, entrance roads, site infrastructure, etc. At a minimum, the Project Team would suggest planning on a buffer of 200 feet around the perimeter of the waste footprint, plus an additional 5-30 acres for entrance roads, scale house and other site infrastructure. If there are residences or businesses nearby, the total size may increase to reduce the potential impact on neighbors.

$$Disposal\ Acres = 50\ years\ x\ \frac{150{,}000\ tons}{year} x \frac{2{,}000\ lbs}{ton} x \frac{yards^3}{1{,}200\ lbs} x \frac{1}{30\ yards} x \frac{1\ acre}{4{,}840\ yards^2} = 86.1\ acres$$

Based on this example and assuming a square waste disposal foot print (approximately 1,937 feet by 1,937 feet), plus an additional 20 acres for other site infrastructure, the landfill operator would need to plan on at least 145 acres (approximately 86 acres for disposal, 39 acres for buffer and 20 acres for other site infrastructure). This number ultimately is dependent on the location and site specific conditions.

3.3.1.1 Personnel

Table 3-3 shows the projected personnel needs for the landfill baseline analysis as well as the assumed base salary for each position. In addition to base salary, the Project Team included an additional 10% of base salary for overtime costs and an additional 35% of base salary for benefits-related costs. The Project Team understands that base salary and benefits will vary based on location, facility ownership (private versus public sector) and other factors. Based on the information presented in Table 3-3, any interested party can estimate the personnel costs based on their specific information.

Table 3-3: Landfill Personnel Requirements

Position	Base Annual Salary	Micro	Small	Medium	Medium-Large	Large
Manager	$75,000	0	0	1	1	1
Supervisor	$50,000	0	1	1	2	2
Heavy Equipment Operator	$40,000	1	1-2	2-3	5-6	7-8
Laborer	$25,000	0	0	1	2	3-4
Gate Attendant/Admin	$30,000	1	1	1-2	3-4	4-5
Total		**2**	**3-4**	**6-8**	**13-15**	**17-20**

In some cases, very small landfill operations may share staff with other non-landfill operations, thereby sharing the costs and lowering the costs allocated to landfill operations.

3.3.1.2 Equipment

Table 3-4 shows the projected equipment needs for the different landfill sizes, including both front-line and back-up units. At the low end of each landfill size, the equipment may not be fully utilized, whereas at the upper end of the range the equipment should be fully utilized. For micro landfills, equipment may be shared with other non-landfill operations. In cases where there is one piece of equipment that plays key role in the operations (e.g., the large dozer for a micro landfill), the landfill operator will need to rely on other non-landfill operations for back-up when there is unanticipated downtime for front-line units.

Table 3-4: Frontline and Back-up Equipment

	Micro	Small	Medium	Medium-Large	Large
Small Dozer	0	1	1 [1]	2 [1]	2 [1]
Large Dozer	1	0	1	1	3
Small Compactor	0	1	2 [1]	1 [1]	1 [1]
Large Compactor	0	0	0	2	3
Motor Grader	0	0	0	1	1
Water Truck	0	0	0	1	1
Excavator	0	0	1	1	1
Haul Truck	0	1	1	2	3
Small Loader	1	0	1 [1]	1 [1]	1 [1]
Large Loader	0	1	1	1	2
Pick-up	1	1	2	3	4
Total	**3**	**5**	**10**	**16**	**22**

1. Includes one back-up unit. In cases where there is one piece of equipment and a back-up is indicated, for the back-up could be a smaller piece of equipment that could be temporarily used for a larger front-line piece of equipment.

Table 3-5 shows typical purchase price and operating and maintenance expenses (including fuel) for the various types of equipment. For the baseline model, the Project Team assumed that the purchase price and annual operating and maintenance expenses of the back-up unit would equal 50% of the purchase price and annual operating and maintenance expenses of the front-line piece of equipment. In some cases, very small landfill operations may share equipment with other non-landfill operations, thereby sharing the costs and lowering the allocated landfill operation costs.

Table 3-5: Frontline and Back-up Equipment Cost

	Purchase Price	Annual Operating and Maintenance
Small Dozer	$300,000	$40,000 - $48,000
Large Dozer	$500,000	$40,000 - $80,000
Small Compactor	$600,000	$40,000 - $60,000
Large Compactor	$1,000,000	$80,000
Motor Grader	$250,000	$20,000
Water Truck	$150,000	$30,000
Excavator	$300,000	$24,000 - $32,000
Haul Truck	$400,000	$20,000 - $28,000
Small Loader	$150,000	$30,000 - $40,000
Large Loader	$350,000	$40,000
Pick-up	$35,000	$6,000

3.3.1.3 Other Operating and Non-Operating Expenses

The Project Team included additional operating and non-operating expenses to the baseline landfill model. Table 3-6 shows annual amounts for professional/engineering fees and environmental monitoring fees. Any one-time or upfront costs for a new landfill are captured in Table 3-7.

Table 3-6: Other Landfill Costs

	Micro	Small	Medium	Medium-Large	Large
Professional/Engineering Fees	$50,000	$75,000	$150,000	$200,000	$250,000
Environmental Monitoring	$15,000	$20,000	$30,000	$50,000	$60,000

Other costs were included as variables that are driven by operating expenses or tonnage. These additional costs are:

- Materials & Supplies: 10% of base salaries
- Insurance: 2.5% of operating and maintenance expenses
- Utilities: $0.05 per ton
- Other/Misc.: 5% of operating and maintenance expenses
- State Solid Waste User Fee: $0.84 per ton

For the purposes of this analysis, the Project Team assumed leachate management costs were minimal and therefore were not included in the model.

3.3.1.4 Capital Costs

The Project Team included non-equipment capital costs for developing landfill cells and closing cells once they reach capacity. Based on discussions with CDPHE staff, the Project Team included two options for both cell development and final cover. For cell development, there are cost options for both a three foot compacted clay liner and one that includes a synthetic liner. For the final cover, there are options for a compacted clay cover (two foot thick layer of protective soil cover over an 18 inch soil barrier layer) and a water balance cover. Water balance covers consist of soil, usually placed as a single loose lift, which provide storage capacity for infiltration from a prescribed annual precipitation. The precipitation is dependent on the ecozone in which the landfill falls and the cover depth is dependent on where the soil plots on the United States Department of Agriculture (USDA) soil texture triangle. For the purposes of this cost modeling, a thickness of 3 feet will be assumed for water balance covers. Water balance covers are generally less expensive as available soil on or near the facility can be used and no special construction labor or equipment is necessary.

In addition to these ongoing capital costs, the Project Team amortized the initial costs of opening a landfill, excluding the land cost, over 20 years. These costs include:

- Permitting
- Scale house
- Scales
- Improvements
- Maintenance
- Environmental monitoring infrastructure

The Project Team did not include the land cost for several reasons. The amount of land needed will vary based on the planned longevity of the landfill. The landfill owner may already own the land that may be utilized for the landfill. Also, land costs can vary greatly depending on location. Table 3-7 lists that initial capital costs and the cost per acre for landfill development and final cover.

Table 3-7: Landfill Capital Costs

	Micro	Small	Medium	Medium-Large	Large
Initial Landfill Costs	$645,000	$1,100,000	$2,000,000	$3,700,000	$5,850,000
Cell Development - Geomembrane (per acre)	$250,000	$225,000	$200,000	$180,000	$160,000
Cell Development - Compacted Clay (per acre)	$230,000	$205,000	$180,000	$160,000	$140,000
Final Cover - Compacted Clay (per acre)	$100,000	$95,000	$90,000	$85,000	$80,000
Final Cover - Water Balance (per acre)	$50,000	$45,000	$40,000	$35,000	$30,000

In addition, the Project Team included a capital reserve (or debt reserve, depending on financing method) contribution that equates to 20% of the annual amortized capital.

3.3.1.5 Total

Using the information presented throughout Section 3.3.1, Figure 3-2 graphically summarizes annual costs and cost per ton for landfills ranging from 5,000 to 750,000 tons per year. Figure 3-2 is based on operating five to six days per week with no sharing of equipment with other departments/entities. The costs for small landfills could be decreased if the number of operating days was reduced and equipment was shared with other departments/entities.

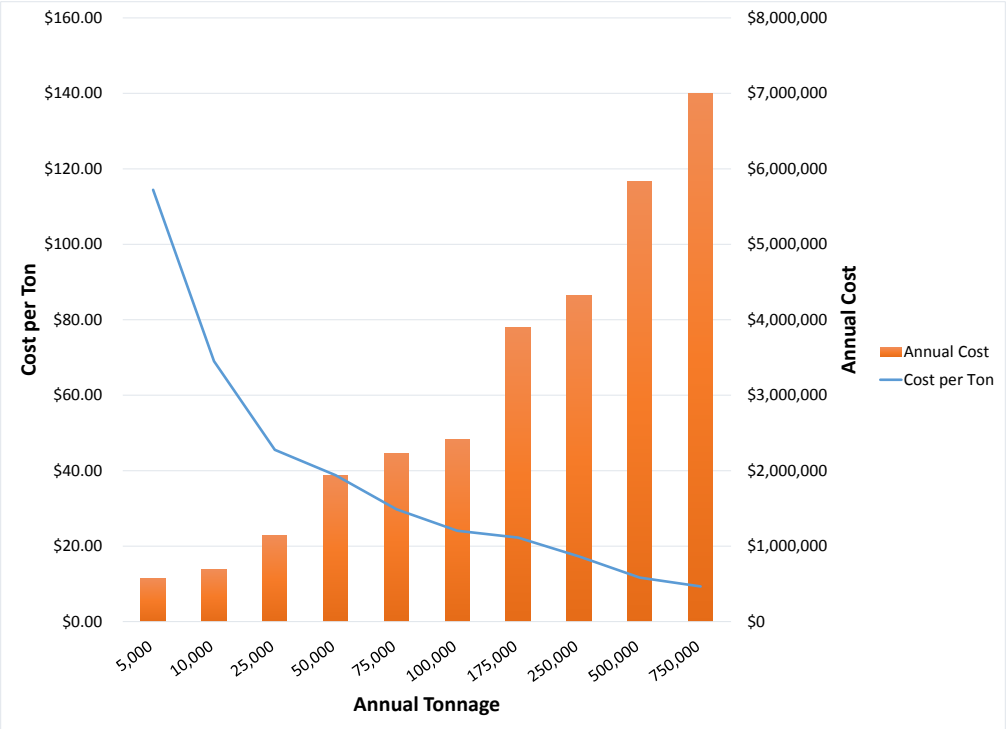

Figure 3-2: Landfill Cost Summary

3.3.2 Transfer Station Models

For the transfer station financial models, the Project Team developed three models based on different styles of transfer stations.

- **Drop-off transfer station:** Small fenced site with roll-off containers and/or front-load dumpster for self-haul customers (i.e., not for collection vehicles). The facility can be staffed or unstaffed.
- **Compactor transfer station:** Allows for use by both self-haulers and collection vehicles. Solid waste is compacted and hauled using roll-off vehicles. Could allow for both solid waste and recycling with the addition of second compactor (for collection vehicles) or roll-off (for recycling drop-off).
- **Top-load transfer station:** Larger transfer stations that allow collection vehicles to unload on a tipping floor before being loaded into transfer trailers for hauling to a disposal location.

Table 3-8 provides a summary of the three styles of transfer stations. While the capacity of a top-load facility could exceed 200,000 tons per year, the Project Team limited it to that amount for this analysis based on the review of the existing facilities and needs in the state.

Table 3-8: Transfer Station Overview

	Drop-off	Compactor	Top-Load
Minimum Annual Tonnage	25	2,500	25,000
Maximum Annual Tonnage	2,500	25,000	200,000
Primary Customer Type [1]	Self-haul	Collection vehicles	Collection vehicles
Site Size (acres)	0.25	0.75	1.5 - 10
Land Cost	$0	$0	$0
Site and Building Costs	$150,000	$300,000 - $350,000	$1.7 - $9.5 million
Hauling Vehicles Utilized	Roll-off and/or Dumpster	Roll-off	Open-top transfer trailer

1. Self-haul refers to individuals hauling waste and manually unloaded. Collection vehicles having compacting dump bodies that collect material from many residential or commercial customers.

3.3.2.1 Personnel

Table 3-9 shows the projected personnel needs for the transfer station models as well as the assumed base salary for each position. For the drop-off transfer station, the facility could be unattended or attended based on specified operating hours. If the drop-off transfer station is open two days per week, for example, it would only require part of one employee's time.

In addition to base salary, the Project Team included an additional 10% of base salary for overtime costs and an additional 35% of base salary for benefits-related costs. The Project Team understands that base salary and benefits will vary based on location, facility ownership (private versus public sector), and other factors. Based on the information presented in Table 3-9, any interested party can estimate the personnel costs based on their specific information.

Table 3-9: Transfer Station Personnel Requirements

Position	Annual Base Salary	Drop-off	Compactor	Top-Load
Manager	$75,000	0	0	0-1
Supervisor	$50,000	0	0-1	1
Heavy Equipment Operator	$40,000	0	1	2
Laborer	$25,000	0	1	2
Gate Attendant/Admin	$30,000	0-1	0-1	2
Total		**0-1**	**2-4**	**7-8**

Figure 3-3: Examples of Drop-off Centers (or Drop-off Transfer Stations)

Figure 3-4: Example of Compactor Transfer Station

Figure 3-5: Example of Exterior and Interior of Top-Load Transfer Station

3.3.2.1 On-Site Equipment

Table 3-10 shows the types of on-site equipment that are typically used at each type of transfer station. This table excludes the equipment utilized to haul the material from the transfer station to the disposal location. Hauling is addressed in Section 3.3.2.4.

Table 3-10: On-Site Transfer Station Equipment

Equipment Type	Purchase Price	Drop-off	Compactor	Top-Load
Open-top Roll-off Containers	$4,500	2	1-2	0
Compactors	$15,000	0	1-2	0
Compactor Receiving Containers	$7,500	0	2-4	0
On-Site Roll-off Vehicle	$125,000	0	0-1	0
Skid Steer	$60,000	0	0-1	0-1
Small Loader	$150,000	0	0	1
Large Loader	$350,000	0	0	0-1
Yard Tractor [1]	$85,000	0	0	1
Material Handler [2]	$200,000	0	0	1-2

1. Used for moving filled transfer trailers to a loading area so that transfer tractor can drop an empty trailer and pick up a loaded trailer without waiting to be loaded.
2. Used for compacting and distributing the material in the transfer trailer.

The Project Team included an annual amount equal to 20% of the purchase price to account for fuel and operating and maintenance expenses.

3.3.2.2 Other Operating Costs

Table 3-11 shows the other operating costs included in the transfer station model.

Table 3-11: Other Transfer Station Operating Costs

Equipment Type	Drop-off	Compactor	Top-Load
Utilities	$0	$7,500	$12,000 - $50,000
Miscellaneous Expenses	$2,500	$5,000	$15,000 - $25,000

3.3.2.3 Total Operating and Amortized Capital

Table 3-12 shows the typical range of operating and amortized capital for the range of transfer stations, including the costs discussed in Section 3.3.2.1 through 3.3.2.3. These costs do not include hauling or disposal.

Table 3-12: Transfer Station Operating and Capital Cost Summary

	Drop-off	Compactor	Top-Load
Minimum Annual Tonnage	25	2,500	25,000
Maximum Annual Tonnage	2,500	25,000	200,000
Typical Range of Total Annual Costs	$21,000 - $54,000	$140,000 - $305,000	$530,000 - $1,650,000
Typical Range of Cost per Ton	$21.60 - $840	$12.20 - $56.00	$8.25 - $21.20

3.3.2.4 Hauling

Hauling costs for the three types of transfer stations will vary and are described in this section.

Drop-off Transfer Station

Hauling for the drop-off transfer station is based on the collection costs discussed in Section 4 and will depend on the number of containers, the collection frequency, the haul distance and the landfill disposal rate.

Compactor and Top-Load Transfer Stations

For both the compactor transfer station and top-load transfer station, the Project Team developed a hauling model to capture the costs for hauling material from the transfer station to a disposal and/or recycling location. Hauling for these transfer stations is based on a number of variables, such as:

- Payload
- Haul distance
- Travel speed
- Time at landfill
- Price for fuel

For the compactor transfer stations, the receiving units or open-top roll-off are hauled by a roll-of vehicle. To increase the payload per trip, the roll-off vehicle can also tow a roll-off trailer so that two containers can be hauled to the landfill at one time. Typical costs for hauling from the compactor transfer stations are $0.25 to $0.40 per ton-mile, depending on the variables discussed and the number of containers (1 or 2 at a time). The Project Team included an example below Table 3-13 to show how a cost per ton-mile can be used to estimate a cost per ton or an annual hauling cost.

Figure 3-6: Example of Roll-off Truck with Roll-off Trailer

Figure 3-7 shows a common example of a transfer tractor and trailer used in top-load transfer station.

Figure 3-7: Example of Top-Load Transfer Tractor and Trailer

For hauling costs associated with top-load transfer stations, the Project Team developed a matrix based on different values for annual tonnage and haul distance. The matrix shows the output of the top-load hauling model based on these two variables. In addition, the following list shows several other key variables that were kept constant for Table 3-13:

- Fuel: $2.50 per gallon
- Payload: 20 tons
- Capital cost for transfer tractor/trailer: $180,000
- Minimum back-up ratio for haul vehicles: 20%
- Annual driver salary: $40,000 (plus 35% benefits)
- Average speed: 50 miles per hour
- Unloading time: 45 minutes

Table 3-13: Hauling Costs for Top-Load Transfer Station ($ per ton-mile)

Annual Tons	One-Way Haul Distance						
	30	40	50	60	70	80	90
40,000	$0.189	$0.186	$0.154	$0.157	$0.160	$0.143	$0.130
60,000	$0.201	$0.157	$0.151	$0.147	$0.144	$0.142	$0.129
80,000	$0.183	$0.162	$0.150	$0.142	$0.146	$0.141	$0.128
100,000	$0.171	$0.165	$0.149	$0.138	$0.139	$0.140	$0.127
120,000	$0.180	$0.154	$0.148	$0.136	$0.142	$0.140	$0.127
140,000	$0.173	$0.157	$0.148	$0.135	$0.138	$0.140	$0.127
160,000	$0.167	$0.160	$0.148	$0.134	$0.140	$0.140	$0.127
180,000	$0.173	$0.153	$0.148	$0.133	$0.141	$0.135	$0.123
200,000	$0.169	$0.155	$0.147	$0.132	$0.138	$0.136	$0.123

To estimate a cost per ton, multiply the cost per ton-mile by the round trip haul distance. For example, if a transfer station needs to haul 60,000 tons per year a one-way distance of 60 miles, multiply $0.147 by 120 miles (60 miles each way) to get $17.64 per ton. For the annual cost, multiply $17.64 per ton by 60,000 tons to get a total of $1.06 million per year, which takes into account operating and amortized capital costs for the hauling operation. As mentioned in the introduction to this section, this amount does not include program administration, franchise fees, operating reserve contributions and similar expenses.

3.3.3 Transfer Station Summary

Table 3-14 provides a general range of total transfer station costs based on constructing and operating the transfer station, hauling the material and disposing of it in a landfill. For this summary table, the assumed haul distance is 75 miles each way and the disposal fee is $30 per ton.

Table 3-14: Summary of Typical Transfer Station Costs

	Drop-off		Compactor		Top-Load	
Tons per Year	25	2,500	2,500	25,000	25,000	200,000
Transfer Station	$21,000	$54,000	$140,000	$305,000	$530,000	$1,650,000
Hauling	$18,000	$128,000	$150,000	$900,000	$615,000	$4,000,000
Disposal	Included in Hauling		$75,000	$750,000	$750,000	$6,000,000
Total Annual	$39,000	$182,000	$365,000	$1,955,000	$1,895,000	$11,650,000
Cost per Ton	$1,560	$73	$146	$78	$76	$58

3.4 Conceptual Options Analysis

The Project Team, with input from CDPHE staff, developed six conceptual options that reflect a mix of potential disposal scenarios for a range of community sizes. The purpose of these options is to provide a

broad understanding of how costs would compare between different options. The financial models discussed in Section 3.3 were utilized for the conceptual options as appropriate to determine the cost for each option. However, an interested party could utilize the information presented in this section to develop costs specific to their own situation. Table 3-15 summarizes the six conceptual options included in this section.

Table 3-15: Conceptual Options

Conceptual Option	Overview
Conceptual Option 1	Upgrade Existing Landfill to Current Standards
Conceptual Option 2	Single Drop-off Transfer Station
Conceptual Option 3	Single Compactor Transfer Station
Conceptual Option 4	Multiple Drop-off Transfer Stations Compared to Single Compactor Transfer Station
Conceptual Option 5	Moderate Size Top-Load Transfer Station
Conceptual Option 6	Large Top-Load Transfer Station with and without MRF

3.4.1 Conceptual Option 1

Conceptual Option 1 will evaluate the cost of improvements to two micro landfills (1,500 and 4,500 tons per year) that are currently inadequate in the three categories described in Section 3.2.2.

3.4.1.1 Overview and Key Assumptions

Costs for developing and operating a landfill include design and permitting, capital construction, groundwater monitoring, operations and closure. These costs can vary based on the location and size of the facility. The improvements assumed for this conceptual option will be sufficient to deem the landfill adequate in all categories including the installation of a groundwater monitoring system, completing the necessary sampling and analysis of groundwater, closure of the existing inadequate cell, construction of an appropriately lined cell with leachate collection, and maintaining adequate operations. The assumptions for this conceptual option are based on the lifespan of the new cell and construction materials of the cover and lined cell.

- Annual tons: 1,500 tons or 4,500 tons
- New cell area: one acre for 1,500 tons per year (TPY) and two acres for 4,500 TPY
- New cell lifespan: 13 years for 1,500 TPY and 8.5 years for 4,500 TPY
- Existing cell to be closed: 2.5 acres for 1,500 TPY and 5 acres for 4,500 TPY
- Existing cell will be closed using a water balance cover
- New cell will be completed using a geosynthetic liner and leachate collection system
- Groundwater monitoring system

3.4.1.2 Summary of Financial Model Results

Table 3-16 shows the up-front costs associated with closing an existing inadequate landfill cell and construct a new landfill cell that meets current regulations.

Table 3-16: Landfill Upgrade Costs

	1,500 Tons per Year	4,500 Tons per Year
Additional Permitting	$50,000	$50,000
New Cell Cost	$250,000	$500,000
Existing Cell Closure Cost	$125,000	$250,000
Groundwater Monitoring System Cost	$30,000	$30,000
Total	$455,000	$830,000
Amortization Period (Years)	13.0	8.5
Amortized Capital [1]	$48,437	$122,249

1. Based on funding up-front capital with debt for the amortization period at an annual interest rate of 5%.

Once the upgrades are made, the landfill should be operated based on best management practices and within current regulations. For this conceptual option, the Project Team assumed that all personnel and equipment would be allocated 50% of the time to landfill operations and 50% to non-landfill operations, which reduces the cost of operating the landfill. Table 3-17 summarizes the total projected operating and capital costs based on the landfill model and the amortized upgrade costs from Table 3-16.

Table 3-17: Financial Summary for Conceptual Option 1

	1,500 Tons per Year	4,500 Tons per Year
Personnel Costs	$23,625	$47,250
Equipment O&M	$76,000	$76,000
Other O&M [1]	$52,434	$83,123
Amortized Equipment	$34,132	$62,215
Other Capital Costs	$6,826	$12,443
Amortized Upgrade Costs [2]	$48,437	$122,249
Closure/Post-Closure Contributions	$10,748	$32,244
Solid Waste User Fee	$1,260	$3,780
Total	$253,462	$439,304
Annual Tons	1,500	4,500
Cost per Ton	$168.97	$97.62

1. Includes materials & supplies, professional/engineering fees, environmental monitoring, utilities, insurance, and miscellaneous expenses.
2. From Table 3-16.

Based on the cost estimates from Tables 3-16 and 3-17, the Project Team estimates an average cost of approximately $169 per ton for a 1,500 ton per year landfill and $98 per ton for a 4,500 ton per year landfill operated based on current regulations and best management practices.

3.4.2 Conceptual Option 2

Conceptual Option 2 is based on a drop-off transfer station for a community that has a small landfill that it may choose to close and convert to a transfer station.

3.4.2.1 Overview and Key Assumptions

The primary assumptions for this conceptual option is the amount of tons accepted and the operating hours based on having an attended drop-off transfer station.

- Annual tonnage: 1,500 tons
- Operating hours: 3 days per week, 8 hours per day
- Collection and disposal of roll-off containers and dumpsters provided by private contractor
- Site improvements and containers amortized over 15 years

Table 3-18 shows the number and type of containers and collection frequency for this option. The container mix and collection frequency could vary and still achieve an annual capacity of 1,500 tons per year.

Table 3-18: Containers and Collection Frequency

Container Type	Size (cy)	Number of Containers	Collections per Week	Total Weekly Capacity (cy)	Waste Density (lbs/cy)	Annual Tonnage Capacity
Roll-off	40	2	2	160	300	1,248
Front-Load	8	8	2	128	80	266
Total Annual Tons						1,514

3.4.2.2 Summary of Financial Model Results

Table 3-19 shows the financial summary based on the assumptions discussed, the financial model for drop-off transfer stations, and the collection costs from Section 4.

Table 3-19: Financial Summary for Conceptual Option 2

	Annual Expense
Personnel Costs	$24,300 [1]
On-Site Equipment O&M	$0
Other O&M [2]	$2,500
Collection Cost	$81,601
Disposal Cost	Included with Collection
Amortized Equipment	$0
Amortized Site/Facility Capital	$10,337 [3]
Total	$118,738
Annual Tons	1,500
Cost per Ton	$79.16

1. Based on 0.6 of a full-time equivalent gate attendant, plus 35% of base salary for benefits.
2. Includes miscellaneous supplies and expenses.
3. Includes $150,000 in site costs amortized over 15 years using a 5% cost of debt.

3.4.3 Conceptual Option 3

Conceptual Option 3 addresses a community with greater capacity needs than can be addressed with a drop-off transfer station. Conceptual Option 3 includes two sizes of a compactor transfer station, one that can manage 4,500 tons per year and one that can manage 15,000 tons per year. In addition, the Project Team included a version of the 15,000 tons per year transfer station with an additional compactor for accepting recyclables from collection vehicles.

3.4.3.1 Key Assumptions

The key assumptions for Conceptual Option 3 include:

- Annual tonnage: 4,500 tons or 15,000 tons
- Operating hours: 5 days per week, 8 hours per day
- One solid waste compactor plus one open-top container for bulk items or self-haul
- Option for recycling compactor at 15,000 ton per year transfer station (2,500 tons per year recycling and 12,500 tons per year refuse)
- Haul distance: 75 miles (one way) for refuse, 125 miles (one way) for recycling
- Disposal fee: $30 per ton
- Net processing fee: $0 per ton
- Site capital amortized over 15 years
- Equipment amortized over 7 years

3.4.3.2 Summary of Financial Model Results

Table 3-20 summarizes the results of the financial models for the scenarios discussed for Conceptual Option 3.

Table 3-20: Financial Summary for Conceptual Option 3

	4,500 Tons per Year	15,000 Tons per Year	15,000 Tons per Year with Recycling
Personnel Costs	$87,750	$166,750	$166,750
On-Site Equipment O&M	$7,800	$44,800	$50,800
Other O&M [1]	$12,500	$12,500	$12,500
Amortized Equipment	$6,740	$38,712	$43,896
Amortized Site/Facility Capital	$27,460	$27,460	$30,046
Hauling Cost	$213,447 [2]	$535,758	$543,571
Disposal Cost ($30 per ton)	$135,000	$450,000	$375,000 [3]
Processing Cost ($0 per ton)	$0	$0	$0 [3]
Total	$490,697	$1,275,980	$1,222,563
Annual Tons	4,500	15,000	15,000
Cost per Ton	$109.04	$85.07	$81.50

1. Includes utilities and miscellaneous supplies and expenses.
2. While one vehicle is sufficient to meet the hauling needs for this transfer station, the Project Team assumed the operator would purchase one used vehicle as back-up to the one front-line vehicle.
3. Based on collecting 12,500 for disposal and 2,500 tons for recycling.

As expected the larger transfer station (15,000 tons per year) benefits from some economies of scale and is less expensive on a per-ton basis than the small transfer station (4,500 tons per year). Adding the capability to accept recyclables to the 15,000 tons per year transfer station results in higher capital costs (additional compactor and larger building to accommodate the compactor), but by diverting material from the landfill, the operation as a whole was less expensive than hauling only solid waste.

3.4.4 Conceptual Option 4

Conceptual Option 4 utilizes the results of Conceptual Options 2 and 3 to compare the cost of operating three independent drop-off transfer stations (each accepting 1,500 tons per year) to one regional compactor transfer station accepting 4,500 tons per year.

3.4.4.1 Key Assumptions

The key assumptions are consistent with those listed in Section 3.4.2.1 and 3.4.2.1.

3.4.4.2 Summary of Financial Model Results

Table 3-21 summarizes the results of the financial models for the scenarios discussed for Conceptual Option 4.

Table 3-21: Financial Summary for Conceptual Option 4

	Three 1,500 Tons per Year Drop-off Transfer Stations	One 4,500 Tons per Year Compactor Transfer Station
Personnel Costs	$72,900	$87,750
On-Site Equipment O&M	$0	$7,800
Other O&M	$7,500	$12,500
Amortized Equipment	$0	$6,740
Amortized Site/Facility Capital	$31,010	$27,460
Hauling/Collection Cost	$244,804	$213,447
Disposal Cost ($30 per ton)	Included in Collection	$135,000
Processing Cost ($0 per ton)	$0	$0
Total	$356,213	$490,697
Annual Tons	4,500	4,500
Cost per Ton	$79.16	$109.04

Table 3-21 shows that the three smaller drop-off transfer stations could be operated less expensively than the one 4,500 ton compactor transfer station, the key difference is that the compactor transfer station can accept material from collection vehicles while the drop-off transfer stations allow for self-haulers that must manually unload the material.

3.4.5 Conceptual Option 5

Conceptual Option 5 includes a top-load transfer station with the capacity to accept 40,000 tons per year. This conceptual option may be applicable for a smaller-size landfill that may be reaching capacity in the future and the community or landfill operator may be interested in building a transfer station and hauling to a larger, regional landfill.

3.4.5.1 Key Assumptions

The key assumptions for Conceptual Option 5 include:

- Annual tonnage: 40,000 tons
- Operating hours: 5 days per week, 8 hours per day
- Building size: 8,000 square feet
- Site size: 1.8 acres

- Scale house: 1 scale, small scale house, scale management software
- Disposal fee: $30 per ton
- Net Processing fee: $0 per ton
- Site and building capital amortized over 20 years
- Equipment amortized over 7 years

3.4.5.2 Summary of Financial Model Results

Table 3-22 summarizes the results of the financial models for the scenarios discussed for Conceptual Option 5.

Table 3-22: Financial Summary for Conceptual Option 5

	Annual Cost
Personnel Costs	$210,250
On-Site Equipment O&M	$87,000
Other O&M [1]	$27,031
Amortized Equipment	$75,177
Amortized Site/Facility Capital	$193,073
Hauling Cost	$906,014
Disposal Cost ($30 per ton)	$1,200,000
Processing Cost ($0 per ton)	$0
Total	$2,698,545
Annual Tons	40,000
Cost per Ton	$67.46

1. Includes utilities and miscellaneous supplies and expenses.

The transfer station operating costs from Table 3-22 total approximately $15 per ton, while the hauling adds approximately $23 per ton and the disposal, $30 per ton. If the hauling distance were increased or decreased, the transfer station and disposal costs would remain the same and the hauling cost would increase or decrease.

The operator of a transfer station of this size could choose to dedicate a small portion of the tipping floor to recyclables and haul loads of recyclables to a Material Recovery Facility (MRF) in the region. Conceptual Option 6 includes a transfer station that accepts solid waste and recycling.

3.4.6 Conceptual Option 6

For Conceptual Option 6, the Project Team developed a comparison of two large scale transfer station operations. The first scenario is based on a transfer station that accepts a total of 200,000 tons per year,

with 175,000 tons being solid waste and the remaining 25,000 tons being recyclables. The solid waste is long-hauled to a landfill and the recyclables are long-hauled to a MRF.

For the second scenario, the transfer station takes 175,000 tons of solid waste and the 25,000 tons of recyclables are direct-hauled to a local single-stream MRF for processing. The cost for the local MRF is based on the analysis in Section 5.

3.4.6.1 Key Assumptions

The key assumptions for Conceptual Option 6 are summarized in Table 3-23. The model assumes processing costs of $70 per ton, which (similar to the other costs developed for this analysis) excludes program administration costs, overheads, excess revenue/profit and similar costs. The model also includes an average revenue of $90 per ton, meaning there is a net revenue of $20 per ton for the local MRF.

Table 3-23: Key Assumptions for Option 6

	Scenario 1	Scenario 2
Annual tonnage at transfer station	200,000	175,000
Annual tons of solid waste accepted at transfer station	175,000	175,000
Annual tons of recyclables accepted at transfer station	25,000	0
Annual tons diverted to local MRF	0	25,000
Operating hours	5 days per week, 8 hours per day	5 days per week, 8 hours per day
Building size	40,000 square feet	35,000 square feet
Site size	9.2 acres	8.0 acres
Scales	2	2
Haul distance (one way)	75 miles for refuse 125 miles for recycling	75 miles
Disposal fee	$30 per ton	$30 per ton
Net Processing fee	$0 per ton	($20 per ton) [1]
Site and building capital amortization	20 years	20 years
Equipment amortization	7 years	7 years

1. Based on a processing cost of $70 per ton and revenue of $90 per ton.

3.4.6.2 Summary of Financial Model Results

Table 3-24 summarizes the results of the financial models for the scenarios discussed for Conceptual Option 5.

Table 3-24: Financial Summary for Conceptual Option 6

	Scenario 1	Scenario 2
Personnel Costs	$456,750	$456,750
On-Site Equipment O&M	$209,000	$209,000
Other O&M [1]	$72,913	$67,306
Amortized Equipment	$180,597	$180,597
Amortized Site/Facility Capital	$768,931	$678,953
Hauling Cost	$4,350,188	$3,468,284
Disposal Cost ($30 per ton)	$5,250,000	$5,250,000
Processing Cost	$0	($500,000)
Total	$11,288,379	$9,810,890
Annual Tons	200,000	200,000
Cost per Ton	$56.44	$49.05

1. Includes utilities and miscellaneous supplies and expenses.

Based on this analysis, it would less expensive for an entity to process the recyclables locally rather than to long-haul recyclables to a third-party MRF. However, this scenario will depend on current market conditions for recyclable materials and the types of contracts that third-party MRF operators are willing to offer to outside customers.

3.4.7 Comparison of Conceptual Options

Table 3-25 provides a summary of the six conceptual options discussed.

Table 3-25: Comparison of Conceptual Options

Conceptual Option	Type	Annual Solid Waste Tonnage	Annual Recycling Tonnage	Total Annual Cost	Cost Per Ton
1	Landfill	1,500	0	$253,462	$168.97
1	Landfill	4,500	0	$439,304	$97.62
2	Drop-off Transfer Station	1,500	0	$118,738	$79.16
3	Compactor Transfer Station	4,500	0	$490,697	$109.04
3	Compactor Transfer Station	15,000	0	$1,275,980	$85.07
3	Compactor Transfer Station	12,500	2,500	$1,222,563	$81.50
4	Three Drop-off Transfer Stations	4,500	0	$356,213	$79.16
4	Compactor Transfer Station	4,500	0	$490,697	$109.04
5	Top-Load Transfer Station	40,000	0	$2,698,545	$67.46
6	Top-Load Transfer Station	175,000	25,000	$11,288,379	$56.44
6	Top-Load Transfer Station	175,000	25,000 [1]	$9,810,890	$49.05

1. Recycling tonnage processed at a local MRF rather than hauled from a transfer station to a third-party MRF.

3.5 Key Findings

The regional analysis of the transfer and disposal system in the state of Colorado presented in this section identified needs and opportunities for the regions. Below are the key findings for each of the regions and the costs associated with upgrading the landfills in each region to full adequacy.

3.5.1 Statewide Key Findings

The minimum landfill requirements established in Subtitle D of the federal regulations and 6 CCR 1007-2 of the state regulations were created for the protection of the human health and environment, with an emphasis on containment. The state of Colorado, as an EPA approved Subtitle D program, is required to maintain and enforce state regulations that meet the minimum criteria outlined in Subtitle D and the federal regulations. Operating landfills outside of the requirements established by the EPA and adopted by the state of Colorado increases the risk to the human health and environment. Bringing landfills in Colorado into compliance with these regulations will help reduce the potential risk to human health and the environment. By reducing the potential of contamination from landfills, owners can avoid remediation which involves expensive investigations and cleanups.

The state of Wyoming, in an effort to bring landfills into compliance, created a groundwater monitoring program to investigate the presence of contamination from landfills. The program was successful in determining the presence of contaminants in groundwater as a result of unlined landfills. However, this created the need for a remediation program to remediate impacted groundwater sites at a statewide cost of several hundred million dollars (as discussed in Appendix C). The absence of adequate groundwater monitoring systems and adequate sampling and analysis of the monitoring systems at landfills in Colorado has the potential to lead to contamination similar to Wyoming. Capital costs for groundwater monitoring systems and annual costs for sampling and analysis pale in comparison to the cost of remediation necessary to clean up the contamination.

In the past the enforcement of the groundwater system and sampling requirements by CDPHE has been inconsistent. Many groundwater waivers were granted without proper demonstration and were not properly renewed. Other issues with regard to the regulations were sometimes noted in landfill inspection reports and sometimes not. This inconsistency has left many owners frustrated with the inspection process and the approach of enforcement by CDPHE.

During the review of data provided by CDPHE, it was clear there was a lack of information collected from owners of landfills and transfer stations. Other than waste quantities derived from solid waste user fee amounts, there is not landfill capacity information available for any of the landfills. As planning for

future landfill development and potential partnerships moves forward, the access to total landfill capacity on a county, regional or state basis would benefit the planning process.

3.5.2 Regional Findings

The largest need identified for most of the regions is the inadequacy of landfills in one or more categories. Table 3-26 shows the number of landfills by size in each region that are currently considered inadequate by category.

Table 3-26: Count of Inadequate Landfills by Region

Region	Landfill Size	Adequacy Category		
		Design & Operations	Groundwater	Closure
Front Range	Small	N/A [1]	N/A	N/A
	Medium	N/A	N/A	N/A
	Regional	1	0	0
Mountains	Small	3	4	1
	Medium	0	1	0
	Regional	0	0	0
Eastern/Southeastern	Small	15	15	9
	Medium	4	2	0
	Regional	N/A	N/A	N/A
Western Slope	Small	0	0	0
	Medium	0	2	0
	Regional	0	1	0

1. N/A means not applicable and means that there were no landfills of that size in the region.

3.5.2.1 Front Range

With the landfills present in the region being regional in size, they accept large quantities of solid waste. Effectively, this creates enough revenue to maintain adequacy and make improvements as needed. The landfills in the Front Range are expected to continue to expand to meet the needs of the growing population in the region. The Larimer County Landfill is scheduled to reach capacity in the near future and will construct a new fully adequate landfill at that time.

3.5.2.2 Mountains

The small landfills in the Mountains, generally serving small seasonal populations, were initiated before the promulgation of Subtitle D. They receive waste quantities too small to generate the funds required, using current tipping fees, to operate adequately or upgrade the facilities. Significant increases to the tipping fee would likely result in illegal dumping. There is a need for adequate groundwater monitoring systems at a few of the landfills to aid in protecting human health and the environment. Some counties and municipalities in the Mountain region have closed landfills and switched to transfer stations to collect

waste before transporting it to other medium or regional sized landfills. The San Luis Valley uses a regional disposal system that services multiple counties surrounding the landfill located in Rio Grande County. Hinsdale County operates a transfer station in Lake City that collects and transports waste to the Six Mile landfill in Gunnison County.

3.5.2.3 Eastern/Southeastern

The Eastern/Southeastern region has large needs for their landfills that are currently inadequate. There is a necessity for these facilities to upgrade infrastructure and improve operations to be deemed adequate with regards to the current regulations. While many of the landfill owners in this region oppose regionalization and prefer to continue operating as is, continuing with the current system may pose a risk to the human health and environment. Based on the quantity of waste received at the inadequate landfills, generating the revenue necessary to upgrade and operate the landfills would require a significant increase in tipping fees. This would most likely cause hardship for residents and increase illegal dumping in the region. This region of the state would benefit from exploring options for regionalization.

3.5.2.4 Western Slope

Installing adequate groundwater monitoring networks and completing groundwater analysis is needed at three landfills in the Western Slope. Towns and counties in the Western Slope have provided a network of transfer stations to collect and transport waste to medium and regional landfills. This allows service to reach the small communities in the region while providing enough waste to landfills to generate funds necessary to maintain operations and expand as needed. Mesa County operates four transfer stations in small communities within the county to provide service to all residents.

3.5.2.5 Regional Costs

Funding for landfills in Colorado has been and will continue to be the responsibility of the owner. It is evident that inadequate funding exists in multiple communities across the state, resulting in landfills that are not financially able to maintain adequate operations or make plans for adequate expansion or closure. Landfills are expensive to build, operate and close in compliance with the regulations. As shown in this section, the expense of operating a compliant landfill can result in very large per ton costs when spread across a small amount of waste.

Based on the stakeholder meetings, there are different appetites for closing local landfills and creating regional facilities. Many of stakeholders opposed regionalization based on the convenience that would be lost by closing small local landfills. However, the small local landfill owners also stated that there was a lack of funding available to upgrade their landfills to an adequate rating. Table 3-27 shows the capital cost

range for each region to maintain the current number and upgrade the landfills. The cost ranges include closing existing disposal areas, constructing new disposal areas and constructing adequate groundwater monitoring systems. The Project Team estimated a statewide cost of $21 – 35 million to achieve adequacy for the landfills in the state. This estimated cost does not include sampling of the groundwater network. From Table 3-26, there are 23 landfills that are inadequate for design and operations. Correcting this inadequacy requires closure of the unlined areas of the landfill and construction of a new landfill cell. Based on the totals for cell closure and cell construction in Table 3-27, the average cost per landfill is between $875,000 and $1.46 million. For the 25 landfills that are inadequate for groundwater, the average cost per landfill is between $38,100 and $63,500.

Table 3-27: Total Estimated Planning Level Cost of Achieving Landfill Adequacy by Region

Region	Cell Closure [1]	Cell Construction [2]	Groundwater [3]	Total
Front Range	$900,000 - $1,500,000	$1,987,500 - $3,312,500	$0 - $0	$2,887,500 - $4,812,500
Mountains	$562,500 - $937,500	$1,237,500 - $2,062,500	$165,000 - $275,000	$1,965,000 - $3,275,000
Eastern/Southeastern	$4,612,500 - $7,687,500	$10,837,500 - $18,062,500	$487,500 - $812,500	$15,937,500 - $26,562,500
Western Slope	$0 - $0	$0 - $0	$300,000 - $500,000	$300,000 - $500,000
Cost Range[4]	$6,075,000 - $10,125,000	$14,062,500 - $23,437,500	$952,500 - $1,587,500	$21,090,000 - $35,150,000

1. Cell closure using water balance cover (Avg. costs: small - $250,000; medium - $600,000; regional - $1,200,000)
2. Cell construction using geosynthetic liner (Avg. costs: small - $550,000; medium - $1,550,000; regional - $2,650,000)
3. Groundwater wells to create adequate network (Avg. costs: small – $30,000; medium – $100,000; regional – $200,000)
4. Cost range is +/- 25% to account for variations in site conditions

Through the analysis provided in Section 3.3 (see Figure 3-2: Landfill Cost Summary), it is shown that the creation of regional landfills will reduce the per ton fees associated with operating landfills. Assuming landfills that are closed can be replaced by drop-off locations or transfer stations, there should minimal inconvenience to the public and may provide savings for the owner. With this in mind, some Colorado communities (refer to case studies for Bent and Hinsdale Counties in Appendix C) previously completed studies to determine costs of building and operating adequate landfills and elected to close landfills and transport waste to other landfills.

Regardless of whether a facility decides to close existing inadequate cells and build an adequate cell or transfer station, installation of groundwater monitoring networks or receptor analysis will be required for all facilities. By installing adequate groundwater monitoring systems or performing receptor analysis for closing facilities, the landfill owner and CDPHE will have the necessary information on the potential risk to the human health and environment. To this point, determination of adequacy is based on compliance

with the regulations and does not reflect an evaluation of individual sites. Consequentially, the capital costs shown above do not include potential remediation costs. However, the state of Wyoming has concluded in the past several years that many landfills set for closure were contaminating groundwater. Appendix C includes a case study of the Wyoming program.

3.6 Recommendations

The preceding portions of Section 3 have summarized the current state of the transfer and disposal systems in Colorado, as well as the financial costs for constructing, operating, upgrading and transitioning facilities. With this information, landfill owners can begin to make decisions regarding the future of the facilities under their care. The key objective is for facilities to begin working towards adequacy with regards to the regulations. The following provides recommendations and strategies for policies at the statewide level and considerations at the regional/local level to improve transfer and disposal of solid waste throughout Colorado. Several of these recommendations should be coordinated with the recommendations included in Section 6 of the Plan, which focuses on collection and diversion issues.

3.6.1 Statewide Recommendations

The following statewide recommendations are primarily focused on activities that can be implemented by CDPHE. Given the importance of addressing landfill adequacy issues, the expectation is that these recommendations will be implemented over the next five years.

3.6.1.1 Enforce Current Regulations

There is a need to clearly and consistently enforce landfill regulations to reduce risk to human health and the environment. As an EPA approved state program, Colorado is required to maintain and enforce regulations that meet the minimum criteria set forth in Subtitle D. In order to maintain the EPA approved program, CDPHE should enforce the regulations. Key strategies include:

1. CDPHE should provide written notices to each of the inadequate landfills in the state, specifically identifying the reason for an inadequate status.
2. CDPHE should conduct individual meetings with applicable landfills to discuss the timeline to achieve adequacy, as well as identifying available resource assistance.

3.6.1.2 Develop and Implement Policy for Compliance Timeline

Understanding that multiple landfills have been inadequate for a number of years, the CDPHE should outline the timing and requirements for landfills to improve operations, achieve adequacy or make decisions on future options (such as regionalization). Key strategies include:

1. Establish a one year period for landfill owners to review options and make decisions on future operations.
2. While decisions are being made by landfill owners, facility operations will need to improve and achieve operational-adequacy within one year. Adequate facility operations include maintaining access controls, completing hazardous waste screening, compacting waste, installing daily cover, removing litter and other nuisances and maintaining stormwater facilities.
3. If a landfill owner decides to close its facility within one year, CDPHE should streamline the closure process as allowed under state law and regulations. For example, the CDPHE could require only a receptor analysis for groundwater instead of a full monitoring network.
4. For landfills that decide to continue operating, CDPHE should provide three years for the landfill to plan and implement the needed changes to achieve full adequacy.
5. If a landfill has not agreed to a compliance or closure plan with CDPHE after four years, the CDPHE should take enforcement actions for inadequate landfills.

3.6.1.3 Provide Technical Assistance

A suggested key role for CDPHE is to provide technical assistance to cities and counties regarding landfill adequacy and related issues. Technical assistance can be provided through a combination of workshops, guidance documents, one-on-one meetings, etc. An initial list of technical assistance to be provided includes:

1. Assist landfill owners on interpretation of regulations and how best to comply.
2. Streamline approval process for owners that want to close inadequate landfills.
3. Guidance/workshops on regionalization opportunities and how to develop necessary facilities and arrangements.
4. Guidance/workshops on how local governments procure and contract for transfer and disposal services if a decision is made to close a landfill and the local government needs to contract for services.[1]
5. Develop statewide contract(s) for cooperative purchasing for landfill rates at transfer stations and landfills in the state in an effort to provide cities and counties with negotiated rates.

[1] For example, the Houston-Galveston Area Council conducted a Solid Waste and Recycling Procurement Workshop, which is available at: https://www.h-gac.com/community/recycling/workshops/documents/2015-08-19-SWandRecyclingProcurementPresentation.pdf

3.6.1.4 Support Sustainable Funding Strategies for Local Programs

Through understanding that there is a substantial financial requirement to achieve landfill adequacy or to consider regional options, there is a need to promote funding strategies and sources. Activities to be considered by CDPHE could include the following:

1. As another form of technical assistance, CDPHE could conduct workshops on how local governments can track costs and revenue on a full-cost accounting basis for their solid waste systems.
2. CDPHE should serve as a resource to identify and assist local governments with potential funding sources and strategies, such as the ones identified in Appendix D and Section 6.4.6 of this Plan.
3. Understanding that no state funding mechanism currently exists for closure or upgrading landfills, the state could evaluate the feasibility for a statewide funding source. If this option is considered, funding could be prioritized for facilities that are willing to close inadequate facilities and move toward regionalization. Including diversion capabilities (recycling and organics transfer or processing) within future disposal facilities could also be a basis for prioritizing the use of state funds.

3.6.1.5 Capture Disposal Facility Data

While there is an understanding of landfill adequacy in the state, there is a substantial level of additional information that could be tracked by CDPHE that would inform future solid waste planning in Colorado. This issue will become more important over time as additional landfills in the state begin to reach capacity. Specific activities include:

1. Continue to update the wastesheds for transfer stations and landfills (as shown in Figure 3.1).
2. Improve already-required landfill reporting requirements by having landfills report on annual waste quantities/types, origin of waste and remaining airspace.

3.6.2 Regional/Local Recommendations

Based on the regional analysis included in this section, there are a number of recommendations that local communities throughout the state can consider to meet the regulatory requirements for their landfills, as well as to operate in a manner of greater focus on costs and increasing diversion. While these recommendations are primarily focused on facilities that need to achieve adequacy status, there are other landfills in the state that will reach capacity. Over the long-term, these adequate landfills would benefit from starting to evaluate future disposal options.

3.6.2.1 Consider Regionalization Options

Given that there are a substantial number of relatively small landfills that are inadequate with regard to the regulations, there could be a substantial benefit for these communities to explore regionalization options. The intent of this Plan is not to prescribe which local governments should regionalize, but to provide an understanding of the benefits and costs associated with regionalization, as compared to continuing to operate existing facilities. While this is primarily an issue for communities located in the Eastern/Southeastern region, there are some landfills in other regions of the state that may also consider regionalization now or over time as their landfills reach capacity. Key activities can include the following:

1. Determine the full-cost for existing landfills to continue operating based on achieving adequacy status.
2. Coordinate with other local communities that may also have similar landfill adequacy issues and identify regionalization scenarios to evaluate.
3. Determine the costs for the regionalization scenarios and compare those costs to the current operation (based on achieving adequacy).
4. Utilize the cost analysis included in this section of the Plan to assist with the financial analysis.
5. Develop and implement the preferred scenario.

3.6.2.2 Evaluate Groundwater Monitoring

In accordance with state of Colorado and EPA regulations, facility owners need to install, maintain and regularly sample a groundwater monitoring system consisting of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer. Facilities considered inadequate in groundwater can become fully adequate by taking the following steps:

1. Consult with a geologist/hydrogeologist to develop a plan indicating location and depth of wells to be installed at the facility.
2. Coordinate with CDPHE to obtain approval of planned installation as adequate monitoring network.
3. Complete installation of groundwater monitoring wells and begin monitoring program.
4. Utilize results of monitoring program to identify additional areas where groundwater wells can be placed to provide a complete picture of groundwater on the site and help determine any risk to human health and the environment.

3.6.2.3 Implement Sustainable Funding Strategies

Facilities owners need to better understand and pay for the costs of their disposal programs. Specific activities can include the following:

1. Local governments should track costs and revenue on a full-cost accounting basis (with potential technical assistance from CDPHE).
2. Local governments should primarily utilize tipping fees and other local funding strategies (as discussed in Section 6.4.6) as the primary method for funding disposal systems.
3. While the Local Government Test is an allowable method for accounting for closure and post closure costs, local governments should establish and fund dedicated reserves each year based on the incoming tonnage.
4. Local governments should evaluate alternative funding strategies and sources (which are discussed in Appendix D).

4.0 SOLID WASTE COLLECTION

4.1 Introduction

The collection and hauling of solid waste is integral to ensuring that solid waste, recyclables and organics reach their intended destinations for proper management. Due to the variety of collection systems in Colorado, this section begins with a background discussion of existing solid waste collection services. The remainder of the section is organized geographically on the four regions of the state (Front Range, Mountains, Eastern/Southeastern and Western Slope) as shown in the Introduction Section (see Figure 1-1 in Section 1.3.3). For each geographic region, this section evaluates the current system, as well as needs, gaps, support and cooperation and funding opportunities. Due to the linkages between collection and diversion issues, solid waste collection recommendations are included in Section 6 of this Plan. This section also includes brief case studies in "text boxes." The detailed case studies are included in Appendix C.

4.1.1 Background on Existing Solid Waste Services in Colorado

Residential solid waste service: Colorado residential solid waste collection service consists of several main options.

Curbside collection: Curbside service is most commonly provided by a private hauler or by city staff. Billing methods for solid waste collection include a monthly fee for unlimited waste collection or the less common billing method which is based on the size of container collected (e.g. Boulder, Fort Collins).

- In most of the state, haulers are in a **free-market system**, with minimal municipal control or authority over solid waste collection. Contracts are established between a hauler operating in a community and the individual resident. The household is direct billed by the hauler for the collection service. In many communities, multiple haulers operate within a single area.

City of Longmont's Municipal Collection System

- The City of Longmont began providing residential solid waste and recycling collection in 1948.
- Funded through user fees, the service allows residents to select either a 48 or 96 gallon container with embedded single stream curbside recycling.
- A waste management fee charged to all participating residents funds the operation of the waste diversion center, special collection events, household hazardous waste and waste disposal at all city facilities and parks.
- The city collects 29,000 tons of solid waste and 12,000 tons of recyclables annually, maintaining a 30% diversion rate.
- Longmont is planning to launch a voluntary curbside organics collection program with enhanced pay-as-you throw rates. If approved, the new rates would include a reduced volume every-other-week solid waste collection option.

Refer to Appendix C for further details.

- A few communities in Colorado (e.g. Longmont, Thornton) use **municipal staff** for solid waste collection. The collection service is usually mandatory (or mandatory pay) and funded by community taxation, billed directly to the household or combined with other community utility service charges.
- Occasionally, communities establish **city-wide contracts for service** – issuing an Request for Proposal (RFP) where one hauler (or a limited number of haulers, with geographically distinct service areas) is selected to provide waste collection services community-wide (e.g. Louisville, Lafayette). Communities that select a city-wide contract for solid waste collection do so for the benefit of lower costs to residents, (assumed on economies of scale and geographic clustering) and for the decreased impact of having a single waste collection vehicle on the streets.

City of Lafayette's RFP and Collection Contract

- An audit of Lafayette's solid waste in 2013 determined that yard waste and food scraps made up 42% of the landfilled materials from the City.
- Lafayette posted a RFP for the addition of organics collection for single-family households that do not receive solid waste service from home owners associations (HOAs) in April of 2014.
- Single family residents already had recycling with a Pay-As-You-Throw (PAYT) program.
- A curbside organics program is now provided at no cost to residents and began in 2015. In the first four months of the program, with half the community outside HOA, the city collected 235 tons of organics.

Refer to Appendix C for further details.

Drop-off: In some small, rural communities, household solid waste collection services may primarily be provided via a drop-off option either at landfills or broadly distributed transfer stations. Drop-off collection is typically billed by the quantity of containers, by weight, or sometimes embedded in municipal utility rates or taxes. In many communities, households may have access to both curbside collection and drop-off services.[1]

Commercial solid waste collection in Colorado is almost universally provided by private haulers using carts or dumpsters, charging by the number, size and frequency of collection – a volume indicator. Some businesses "self-haul", transporting solid waste independently to transfer stations or landfills[2]. Local

[1] Hub and spoke: In a few areas of the state, a "hub and spoke" system is in place. While predominately a program for recycling, a few communities indicated their solid waste collection system might be considered hub and spoke, with households using distributed drop-off centers, where the material is accumulated and brought to a landfill. This is a kind of refinement to a transfer station system. This Plan generally defines hub and spoke for recycling operations.

[2] No community in the state of Colorado has opted to contract for commercial solid waste collection, a system that is in place in a limited number of communities nationwide.

governments in Colorado are almost never involved in providing waste hauling services for multifamily or commercial (or most mixed-use) buildings due to state law. To provide a statutory reference, CRS § 30-15-401 states: "The governing body may not compel industrial or commercial establishments or multifamily residences of eight or more units to use or pay user charges for waste services provided by the governmental body in preference to those services provided by a private person".

In Colorado, **solid waste collection for multifamily** establishments generally depend on container type. If the multifamily building is similar to single family dwellings (four-plexes, etc.), solid waste is collected via containers using rear load or automated trucks. Solid waste pick-up is arranged on an individual basis or on a pre-determined schedule. Small multifamily buildings are generally treated parallel to single family service. If the multifamily building is similar to an apartment complex, or mixed use, waste collection services are completed by detachable containers (dumpsters), and these multifamily locations are treated by haulers as a commercial customer[3].

Home Owner Associations (HOAs), most commonly found in the Front Range region of Colorado have commonly taken on the responsibility for arranging residential solid waste collection services. In these cases, the collection service for member households is contracted and the cost embedded in the HOA fees. This service tends to involve solid waste collection and single stream recycling in large containers.

City of Golden's Approach to Include HOAs in PAYT

- In 2014, the city of Golden passed an ordinance requiring all haulers to offer PAYT to HOA's with embedded recycling.
- Larger HOA's anticipate lower prices than the city program or wanted to maintain existing service and control their own options resulting in legal action against the city.
- Lessons learned include implementing Phase 2 within one year and allowing three years for compliance. Additional outreach would have improved acceptance within the community.
- The city of Golden should have had "star" resident examples and suggested the HOAs become leaders as "Green Adopters".

Refer to Appendix C for further details.

[3] University housing and building service is most commonly arranged as a contract by the university or by university staff and trucks. School collection service is commonly treated as a commercial account by haulers, as is government office service. Occasionally government account service is included as part of a municipal contract.

Pay As You Throw (PAYT): In Colorado, fees for solid waste collection have traditionally been charged as a fixed fee for unlimited collection. The PAYT system is based on the amount of solid waste being collected, where an additional charge is issued based on a higher volume of solid waste generated. Solid waste quantity measurements are completed based on the size of collection containers. There are certain elements associated with best practices in the design of these programs such as threshold levels of price increments between cans, embedded recycling and at least one smaller size container. Multiple studies suggest PAYT is one of the most cost-effective programs available, encouraging recycling, composting and source reduction. A growing number of communities in Colorado have initiated the residential[4] PAYT system in one of three ways:

PAYT Ordinances in Golden, Vail, and Fort Collins

- Golden, Fort Collins, and Vail are examples of communities in Colorado that have passed ordinances that resulted in implementation of PAYT services indirectly through hauler licensing.
- Curbside recycling must be offered and the cost embedded in the solid waste costs.
- Solid waste costs are based on container size.
- Haulers shall not collect recyclable materials co-mingled with solid waste.
- Golden's ordinance covers single and multi-family, HOA's and businesses.
  Fort Collins ordinances have changed over time and require unlimited recycling with carts provided by haulers. Vail's ordinance requires PAYT for the commercial sector.

Refer to Appendix C for further details.

- As an ordinance, requiring PAYT rate design by haulers operating in a community or unincorporated county (e.g. Vail, Boulder, Boulder County)
- As a practice by the municipal solid waste service (e.g. Longmont, Thornton)
- As a requirement of the selected contracted service provider (e.g. Lafayette)

Funding for solid waste collection services is provided by fees paid directly to haulers, or through community taxation paid to cities when the waste collection is a municipal or contracted service.

Table 4-1 provides the current system for solid waste services in the state; each geographical region is discussed individually throughout the following sections. Many of the regions may have curbside services available, however, curbside services are limited in rural areas.

[4] Commercial PAYT requires haulers to provide recycling service with the costs embedded in the trash charge. Rather than unlimited recycling, as the residential PAYT usually offers, commercial PAYT provides a "multiple" of the trash volume in recycling (e.g. 50%, 100%, 150%). This program is in place in Vail.

Table 4-1: Current System Solid Waste Collection Service by Region

Region	Stakeholder Meeting Location	Available Curbside		
		Residential	Commercial	Multifamily
Front Range	Denver	Abundant	Abundant	Abundant
	Loveland	Abundant	Abundant	Abundant
	Pueblo	Abundant	Abundant	Abundant
Mountains	Alamosa	Limited	Common	Limited
	Silverthorne	Abundant	Abundant	Common
Eastern/ Southeastern	Sterling	Common	Abundant	None
	Lamar	Uncommon (self-haul)	Common	None
Western Slope	Durango	Abundant	Abundant	Limited
	Grand Junction	Abundant	Abundant	Limited

The collection actors and situations around the state are quite varied. They include mostly private hauling, some municipal collection, and some contracting, and include service providers ranging from independent "man and a truck" firms and small haulers, medium-sized regional firms, and the largest firms in the nation. Solid waste and recycling progress has been made in areas with small firms and with large firms – but nearly always when licensing and service requirement ordinances, or contracts have been implemented by local jurisdictions, staff, and decision-makers that are interested in more organized collection or recycling progress. These strategies, when present, have moved the state's recycling performance forward. However, local requirements are less likely to be invoked in areas that lack at least minimal supporting infrastructure, or where distances cause clear barriers.

4.1.2 Consideration of Solid Waste Collection Gaps and Opportunities

Assessment of gaps are influenced by the requirements of the Plan authorization (see C.R.S. 30-20-100.5 (I) - (V)). The language requests a plan that addresses:

- safe service to Colorado residential and non-residential customers
- reduction and diversion of solid waste
- reduction of toxics
- education of the public
- other considerations

Gaps, as identified in this Plan, relate to realistic opportunities for change in solid waste-related **strategies** (services, incentives, policies, regulations, and supporting infrastructure) that relate to the elements requested in the Plan. Strategies also relate to services offered or expected in similar regions nationally.

Strategies List: There are a number of strategies related to solid waste collection that have been implemented within Colorado, and in other states, counties and communities. A list of strategies from SERA's "Comp Plan in a Box" program with potential suitability to different communities and counties in Colorado has been developed, identifying strategies, their pros and cons and their general suitability for rural verses urban communities. Further information is provided in Section 6.2.3.

4.2 Front Range

4.2.1 Current Solid Waste Collection System

The Front Range contains the largest population concentration in the state of Colorado and is centered along the I-25 corridor, from Fort Collins to south of Pueblo. Solid waste collection services for the Front Range are readily available along the western portion of the region and becomes limited in the southern and eastern portions. Results of survey data obtained from the stakeholder meetings in this region indicate that regional planning is supported along with hauler licensing and reporting for both residential and commercial haulers. PAYT type programs for residential solid waste service, while common in this region, are not universal.

4.2.2 Needs, Gaps, Support and Cooperation and Funding Opportunities

Table 4-2 summarizes current needs, gaps and opportunities identified for the Front Range.

Table 4-2: Needs, Gaps, Opportunities and Funding for Solid Waste Collection — Identified by Front Range Stakeholders

Issues	Findings	
Needs/Concerns	• The disposal system received a 3.5 on a scale from 1 to 5, where 5 is working well	• Low landfill tipping fees encourage unlimited disposal
Gaps	• PAYT requirements are in place in many, but not all, areas	• For some municipalities that provide or contract service, residents are not charged for solid waste collection
Want/Support	• There is general support in this region for hauler licensing and reporting for both residential and commercial haulers	• Majority would support mandatory PAYT type programs • Landfill and materials management plans/regulations/ funding
Cooperation	• Many facilities exist; expertise and passion in the disposal/diversion industries • Opportunity for sharing best management practices, coordinating, collaborating, • Use of equipment and staff	• Public events/publicity • Educational resources • Scheduling and transportation network
Funding in Place	• Collection fees are in place for roughly 25% of the region	• Commercial fees or taxes are established
Funding would Support	• Economic development	• Litter taxes • Landfill surcharges

The main considerations underlying the assessment of next steps in trash collection-related recommendations in this region include:

- The underlying trash collection and disposal infrastructure is quite mature.
- The region has two main areas – the I-25 corridor ("I-25 Front Range" or Metro Front Range) and the areas east and the areas at the north and south ends of the wasteshed area. The access to landfills and transfer stations – and the appetite for more requirements (including those that will move to higher recycling and diversion) is different between the areas – as are the population densities, which have implications for suitability of some strategies.
- For this region, aggressive requirements are potentially suitable, and given the population density, practices here have dramatic effects on the overall state performance.

4.3 Mountains

4.3.1 Current Solid Waste Collection System

This region runs north to south, the length of the state and includes communities situated in the major mountain ranges with the exception of the San Luis Valley. Mountain passes are especially difficult in winter for solid waste collection services. Populations tend to be spread out - along areas of high transient tourist populations. Waste collection services in this region range from non-existent to PAYT and other mandatory programs for both residential and commercial. Services are centered on the I-70 corridor and the southern section of the region. Each of these areas face unique challenges, besides long distances, illegal dumping is one of the main issues making it difficult for landfills to consider any price increase, especially in the southern part of the region.

4.3.2 Needs, Gaps, Support and Cooperation and Funding Opportunities

Table 4-3 summarizes current needs, gaps and opportunities identified for the Mountains.

Table 4-3: Needs, Gaps, Opportunities and Funding for Solid Waste Collection — Identified by Mountain Region Stakeholders

Issues	Findings	
Needs/Concerns	• On a scale of 1-5 (5= working well) the disposal system received a 3.6 • Education is lacking about effects of illegal dumping • Service needs can be inconsistent with large tourist population in northern mountains	• Some transfer stations/drop off sites do not have regular hours • Landfill rates stay low in part to avoid illegal dumping • People are resistant to paying landfill fees where some used to be free
Gaps	• In the southern area, there are fewer drop off sites and illegal dumping is a large problem; transfer stations and drop-off sites are more common in the northern part of the region • Transportation to the landfills are over large distances	• In some areas, regionalization opportunities are not being taken advantage of partly because of landfills being privately owned • State or regional help in identifying and facilitating progress or providing resources would be helpful
Want/Support	• Some support for hauler licensing and reporting	• Enforcement and measurement of landfill materials • Training and outreach
Cooperation	• San Luis Valley Ecosystem Council is a potential source for sharing information and coordinating programs	
Funding in Place	• User fees are the most common source of funding	• There are some landfill surcharges and litter taxes
Funding would Support	• User fees and Enterprise fund arrangements • Some support for generator fees up to $2/month /household • PAYT would be supported only in certain cases	• Trash tax if at a regional or state level • Planning areas • Requirements for plans with authorization for funding

The main considerations underlying the development of next steps in trash collection recommendations in this region include:

- This region has two main areas – the I-70 Mountain areas with a tourism and recreation focus (and some population density) and the Alamosa area. Landfill and transfer station access is greater in the I-70 Mountain corridor – and transfer stations are relatively far apart in the Southern part of the region. The southern area has some similarities to the mountain areas (some mountain-related barriers and transport distances). However, they differ significantly in that they are substantially more likely to transport materials to facilities across state lines (for example, New Mexico) than are communities in the northern part of this wasteshed. Illegal dumping and income issues are of greater concern in the southern part of this wasteshed. For these reasons, this part of the region has greater affinity with the Eastern/Southeastern or Western Slope regions than the Mountain region. However, the mountain barriers and some isolation issues argue for its inclusion in the Mountain grouping.
- It is important to have landfills and solid waste management up to regulations in this area because groundwater is an issue here and the water from this area ends up as a key water source for other areas of the state.
- For the southern part of the region, exemptions have been suggested because of the lower population density and low-income communities.

4.4 Eastern/Southeastern

4.4.1 Current Solid Waste Collection System

This region is located in the eastern plains in the south and southeastern sections of the state. Communities consist of smaller populations; however, most residents and businesses have access to adequate solid waste collection services. There are a few communities with PAYT programs, but they are less common. Tipping fees tend to be low.

4.4.2 Needs, Gaps, Support and Cooperation and Funding Opportunities

Table 4-4 summarizes current gaps and opportunities identified for the Eastern/Southeastern region.

Table 4-4: Needs, Gaps, Opportunities and Funding for Solid Waste Collection — Identified by Eastern/Southeastern Region Stakeholders

Issue	Findings	
Needs/Concerns	• Illegal dumping is common • The sparse rural population necessitates long hauls for collection	• The disposal system received a 3.4 on a scale from 1 to 5, where 5 is working well
Gaps	• Landfills are spread far apart and are often small	• Limited hauling services/options
Want/Support		• There was strong input against landfill regionalization in this region
Cooperation	• The region contains spread out communities which creates difficulty when sharing resources	• There is some interest in creating public/private facility partnerships
Funding in Place	• User fees	• Enterprise funds
Funding would Support	• Economic development assistance • Incentives/tax benefits for facilities and co-location of facilities	• Requirements for plans with authorization for funding • Landfill assistance

The main considerations underlying the assessment of next steps in trash collection recommendations in this region are:

- The area has just a few population concentrations. Beyond those areas, populations are sparse, distances are long, and there is a lack of transfer station distribution.
- No recommendations for required bundled recycling should be created in this region due to the typical distance to facilities and the rural and remote conditions present in this region.

4.5 Western Slope

4.5.1 Current Solid Waste Collection System

The Western Slope shares similar characteristics with the Mountain region. These include the spread out population densities and the difficulty involved in collecting materials due to mountain passes and winter conditions. Solid waste collection services are centered on the southern and central areas of this region. Facilities out of state may be closer to collection points in the northern area of this region, than those in state. The southern area of this region has a large tourist population, and local collection services support this area. Most of the residential curbside services are located in incorporated communities, and many counties have some form of volume based trash service (PAYT) available to residents. However, it is unclear how many select this option, and many of the available systems have small differentials in PAYT prices, which limits the diversion incentive provided.

4.5.2 Needs, Gaps, Support and Cooperation and Funding Opportunities

Table 4-5 summarizes current gaps and opportunities identified for the Western Slope.

Table 4-5: Needs, Gaps, Opportunities and Funding for Solid Waste Collection — Identified by Western Slope Stakeholders

Issue	Findings	
Needs/Concerns	• This area of the state has difficulty due to long driving distances • Mountain passes in winter make it difficult for waste collection	• Illegal dumping is an issue • The disposal system received a 4.0 on a scale from 1 to 5, where 5 is working well
Gaps	• Services tend to be in southern and East-Central part of region	
Want/Support	• PAYT with bundled recycling and organics services • For landfills, support for some facility closures and for the conversion of some to transfer stations should be based on location	• There is some support for waste-to-energy facilities
Cooperation	• There is potential for a regional education outlet where groups share education resources within the region	
Funding in Place	• User fees • Landfill surcharges	• Enterprise funds • Litter taxes
Funding would Support	• Economic assistance • Landfill surcharges	• Solid waste taxes at local level • Taxes on oil/gas

The main considerations underlying the assessment of next steps in trash collection recommendations in this region are:

- The area has relatively few population concentrations. Beyond those areas, populations are sparse, distances are long, and there is a lack of transfer station distribution.
- The mountains are a barrier to transport.
- Recommendations for required bundled recycling would probably be unsuitable in this region due to traveling distances to facilities and the rural and remote conditions present in this region.

5.0 DIVERSION MATERIALS MANAGEMENT

5.1 Introduction

A critical portion of this Plan is evaluating how the state can begin to transition away from disposal and toward materials management. Similar to Section 4 on solid waste collection services, Section 5 starts with a background discussion of the types of recycling and organics activities currently found in Colorado. Existing condition tables list the current situation of services available, but not necessarily how commonly they are used. The remainder of the section is organized geographically based on the four regions of the state (Front Range, Mountains, Eastern/Southeastern and Western Slope) as shown in the Introduction Section (see Figure 1-1 in Section 1.3.3). For each geographic region, this section evaluates the current system, as well as needs, gaps, support and cooperation and funding opportunities. Due to the linkages between collection and diversion issues, collection recommendations are included in Section 6 of the Plan. This section also includes brief case studies. Detailed case studies are included in Appendix C.

This section includes three maps relating to waste diversion, intended to provide context for the discussion of the current system, gaps and options moving forward. Figure 5-1 (on page 5-5) identifies the locations of recycling and composting facilities around the state. Two additional maps identify the extent to which recycling (Figure 5-2) and organics (Figure 5-3) collection and drop-off programs are available. The highly populated areas of the state reflect a higher concentration of facilities and services. Not surprisingly, the bulk of the facilities, in particular, are located along the I-70 and I-25 corridors.

5.1.1 Background on Existing Recycling Service and Processing

Residential recycling: Recycling service is available in most regions of the state. Residential recycling services are provided as curbside pick-up or via drop-off service.

Drop-off recycling: In most small, rural communities, recycling may primarily be available solely as a drop-off option, either at landfills or broadly distributed at transfer stations or convenience centers – usually unstaffed with no fee, but occasionally staffed, with or without a fee. In many communities, households may have access to both recycling collection service and drop-offs.

Fort Collins' Glass Recycling - Drop-off and Curbside

- Roughly 30% of glass from single-stream recycling is eligible for glass-to-glass recycling due to breakage.
- The city would like to move glass from its mixed recycling materials collection to clean glass drop-offs to increase its value, but does not wish to reduce recovered glass tonnage.
- Collection services in Fort Collins vary and allow choices; the city is educating residents about the nuances about glass recovery and the issues surrounding recycling.
- The city of Fort Collins offers two options, including curbside single stream programs or self-haul to facilities, and encourages use of the non-single stream alternative.

Refer to Appendix C for further details.

- **Hub and spoke:** A subset of drop-off recycling, this service consists of distributed drop-off or convenience centers for recycling, with some level of processing at a centralized "hub". Some of the hub and spoke facilities are established by non-profit organizations. In this service subset, trucks can circulate among the spokes collecting individual materials; at other spokes the material is single stream and is collected at one time. Usually, processing involves baling of separated materials. In other cases, processing involves light baling of the aggregated single stream materials with transport to a single stream Material Recovery Facility (MRF) located in the Front Range, New Mexico, or elsewhere, for processing and marketing.

Recycling Hub and Spoke - Clean Valley Recycling (CVR)

- Started in 2011, CVR is the "Hub" of the recycling system in the Arkansas Valley.
- The CVR baler was purchased through a grant.
- Collection sites are located in a 30-mile radius.
- At each drop-off site, recyclables go into large 40 gallon "potato sacks" sold for $3.
- Baled materials are stored at their site, located in an old sugar mill, to await a full load for transportation to Denver or elsewhere.
- CVR works with The Lamar Partnership which sells bags at the Chamber of Commerce and donated site containers.

Hub and Spoke - Angel of Shavano

- Located in Poncha Springs, Angel of Shavano took over recycling for Chaffee County in 2012.
- Angel of Shavano tripled the amount of material at the drop-off sites and created jobs for five employees. Waste Management's curbside recycling is processed by Angel of Shavano.
- Recycled material is sent directly to mills, manufacturers or exporters and 5% of the total material sales is reimbursed to the county and local government.

Refer to Appendix C for further details.

Multifamily recycling: In Colorado, recycling services for multifamily establishments are rare. When provided, the type of recycling service generally depends on the type of container. If the building is most like single family dwellings (four-plexes, etc.), collection is via containers (collected via rear loader or automated truck) and arranged on an individual basis or on a pre-determined schedule. If the multifamily building is similar to an apartment complex, or mixed use, recycling services are commonly delivered by detachable containers (dumpsters) and treated by haulers as a commercial customer.[1] Multifamily recycling is available in Boulder, however many communities in the state are not considering multifamily recycling until after they capture the residential and potentially commercial sectors. Some communities such as the Town of Superior have "space for recycling" ordinances in place for the commercial and multifamily sector. Historically, the multifamily sector has been complicated. This challenge is also seen

[1] University housing and building recycling services are most commonly arranged as a contract by the university or by university staff and truck owners.

in leading communities nationally (e.g., Seattle, San Jose, etc.). Challenges include limited space, "split incentives" between generators and bill payers, high resident turnover and contamination due to anonymity and lack of education.[2]

City of Boulder: Mandatory Commercial Recycling Ordinance

- The city of Boulder recently passed a new ordinance requiring all business owners (including multi-family residences) to provide recycling and organics service.
- Helping to ease the transition, a previous ordinance required all haulers to provide multifamily housing with free containers for recycling or composting with recycling costs embedded in the solid waste collection billing.
- This pre-existing ordinance creates an incentive for multi-family building owners to encourage their tenants to recycle.
- The city of Boulder will not begin issuing notices of violation until June 17, 2017.
- The penalties are $500 for a first offense, $1,000 for a second and $2,000 thereafter.

Refer to Appendix C for further details.

Home owner association (HOA) recycling: Generally, when recycling is included as part of the HOA services, it is contracted across member households and the cost is embedded in the HOA fees. Joint solid waste and recycling collection contracts for HOAs are most prolific along the Front Range and the collection tends to include solid waste and single stream recycling in separate containers. In some Colorado jurisdictions, HOAs are covered and called out by residential ordinances; in other areas, the coverage for HOAs is unclear.[3]

Commercial recycling: In Colorado, commercial recycling collection is almost universally provided by haulers using carts or dumpsters, charging by the number, size and frequency of recycling collection (parallel to commercial solid waste service). The service is a separately paid option service (with two exceptions – Vail and recently, Boulder). Some businesses "self-haul" their recycling to a MRF or other sites, or contract directly with brokers. A few large chains have separate arrangements (e.g. Walmart) for their own recycled commodities.

Commercial PAYT with Embedded Recycling

- A city wide ordinance was passed in Vail in 2014.
- As a resort/tourist community much of their waste came from businesses providing services to guests such as condos, restaurants and hotels.
- Owner(s)/occupant(s) of all premises and commercial establishments are responsible for ensuring that no recycling goes into their solid waste collection containers, contracting recycling services, ensuring delivery of recyclables to a MRF.
- To accommodate additional containers, the city of Vail waived building permit fees if a new solid waste structure had to be built and offered a rebate up to $750 for building and/or signage.

Refer to Appendix C for further details.

[2] Some strategies that have included bounties to haulers for building participation, "champions" for recycling in buildings (who encourage and educate residents and keep materials clean), provision of household containers and many other strategies. More recently, after 20-plus years of trying different approaches, San Jose elected to deliver its multifamily materials to a MRF. This controversial strategy boosted recovery of their multifamily sector.
[3] HOAs can require compliance at contract expiration or with some lead time to avoid interfering in contractual relationships.

Funding: Funding for recycling collection services is provided through fees paid directly to private haulers, or community taxation paid to cities when recycling collection is municipal. When contracted, the cost can also be embedded in the complete solid waste collection service fee.

Table 5-1 provides a summary of the currently offered recycling options in the state. Figure 5-2 provides a statewide map of recycling services. Each region is discussed individually in the following sections.

Table 5-1: Current Recycling Collection Services by Region

Region	Sector		
	Residential	**Commercial**	**Multifamily**
Front Range	Abundant	Abundant	Common
Mountains	Common	Common	Limited
Eastern/ Southeastern	Limited	Limited	None
Western Slope	Common	Common	None

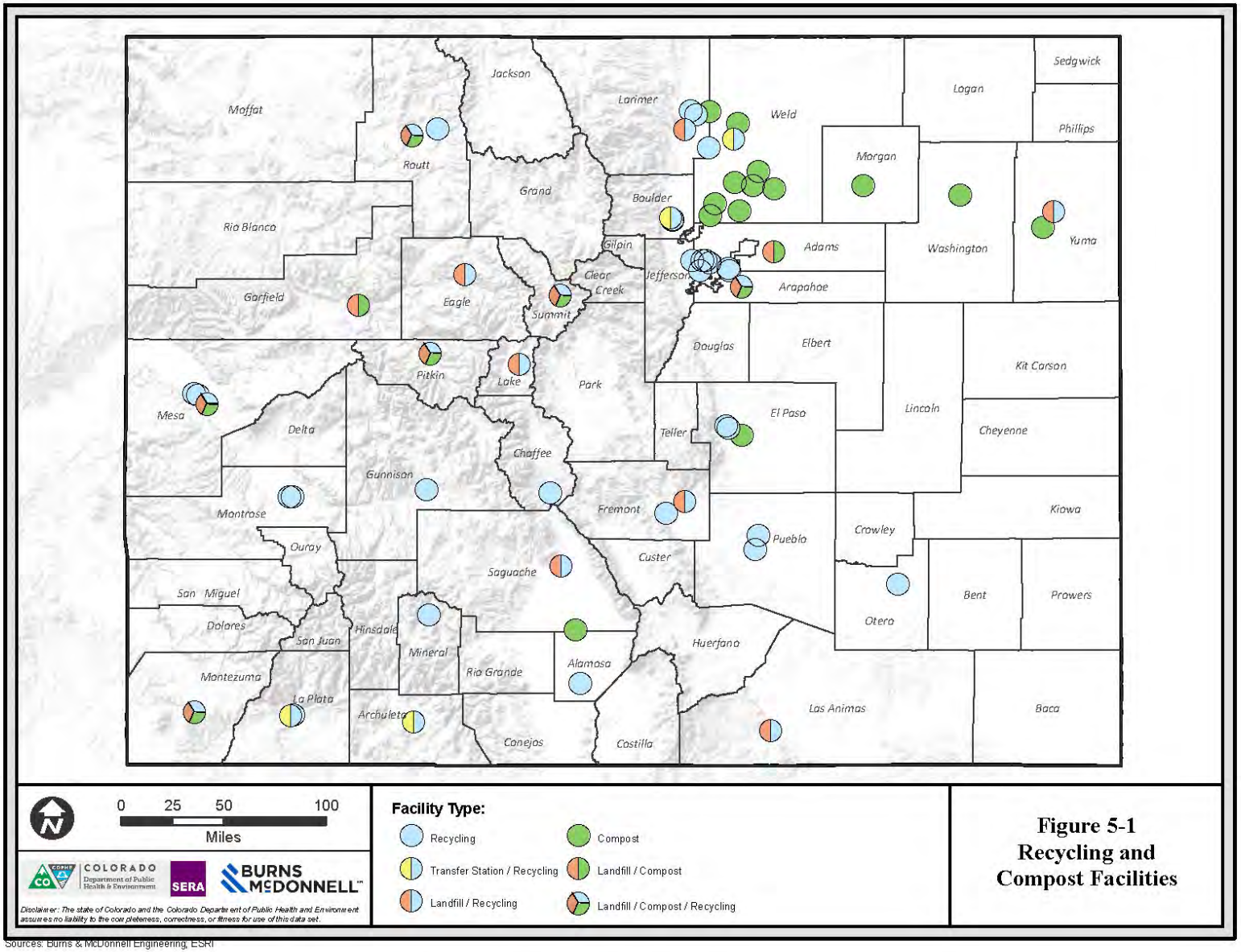

Figure 5-1
Recycling and Compost Facilities

Sources: Burns & McDonnell Engineering, ESRI

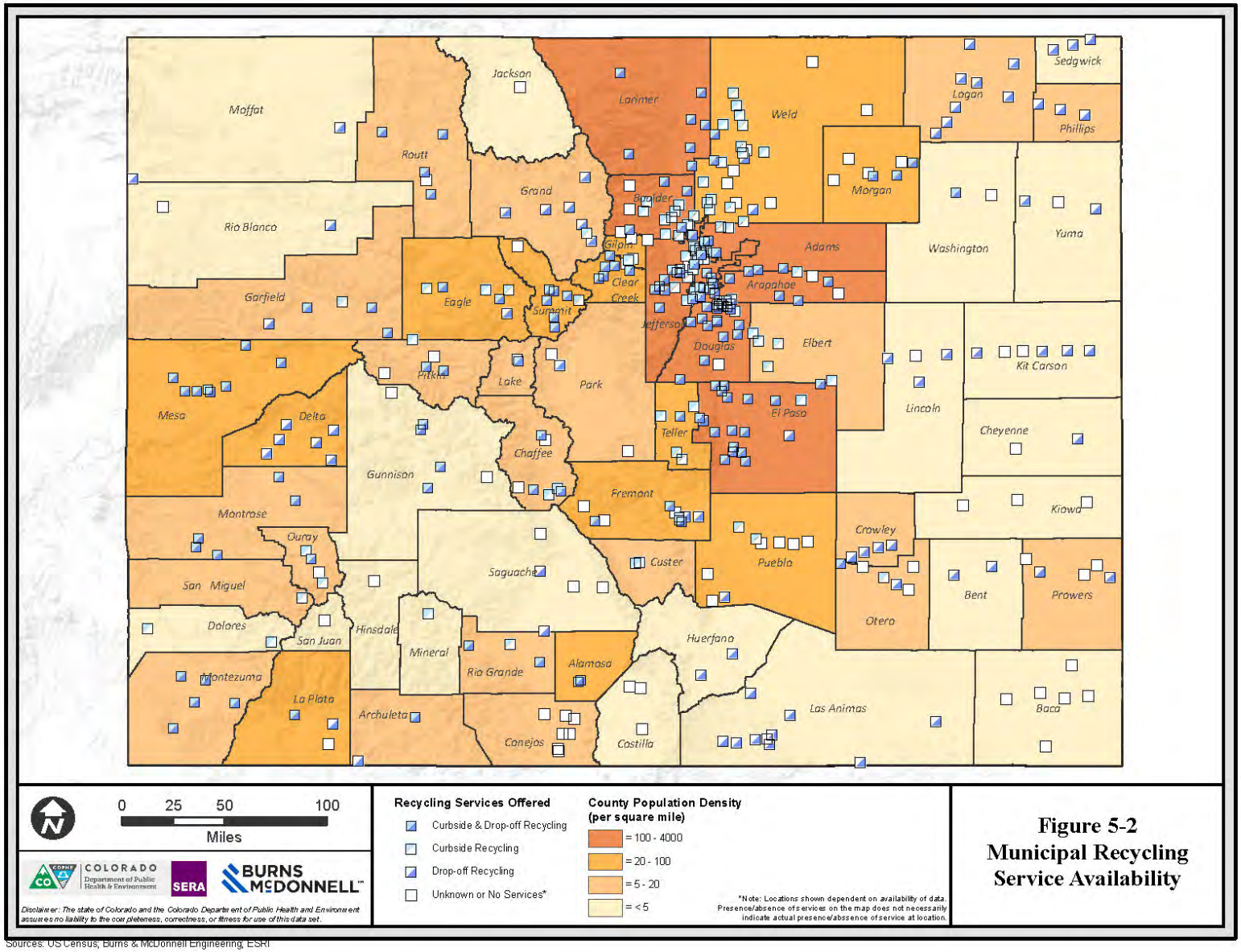

Figure 5-2
Municipal Recycling Service Availability

Sources: US Census; Burns & McDonnell Engineering; ESRI

Recycling processing: Recycling processing facilities (MRFs) are scattered throughout the state, with concentration in both number and size surrounding the densely populated areas of the state, predominately in the Front Range. Colorado has a mix of private and public MRF operations. Types of MRFs present in Colorado are described below.

- **Single stream MRFs**: Facilities in the Front Range tend to be more highly-automated single stream facilities that accept materials from both residential and commercial sources. Sorting equipment at these facilities can handle incoming recyclable materials that are commingled. Sorting at single stream MRFs is generally automated and not manual.
- **Dual stream MRFs:** Although single stream is the norm, some dual stream MRFs exist in Colorado, including the Eagle County MRF. These facilities do not include the extra equipment and labor needed to sort containers from paper. However, the focus is on reducing the chances for contamination by keeping glass and plastics from the paper stream to try to capture higher market prices.
- **Small scale manual operations**: Dump and Pick, baling only, or similar small manual operations: The state has numerous low-tech facilities, including hub and spoke or facilities that conduct basic sorting on a tipping floor followed by baling of separated materials. Facilities bale pre-sorted materials that are accepted from drop-off facilities. Low-tech facilities with a basic manual sorting line along a conveyer belt also exist. In some cases, haulers run informal operations to accomplish basic sorting which they then sell directly to brokers for higher revenues. They often accompany this process with specialized routes, running their recycling trucks to focus on offices and avoid restaurants, for example, to help provide cleaner, higher-saturation input materials.

Boulder County Publicly Owned and Privately Operated MRF

- The Boulder County Recycling Center (MRF), owned by the county and operated via county contract by Eco-Cycle, was built after a ballot initiative approved a recycling sales tax.
- The facility is roughly 50,000 square feet and processes an average of 48,000 single-stream tons per year (an estimated 38,880 tons residential, 5,280 tons commercial and 3,840 tons source-separated materials from drop-offs). The maximum capacity of the facility is 75,000 tons annually.
- The MRF originally accepted dual-stream materials, but in 2008 began accepting single-stream materials.
- The facility utilizes environmentally sustainable practices such as daylighting, use of recycled/sustainable materials, water reuse from roofs for irrigation and others.

Refer to Appendix C for further details.

Alpine Waste Privately Owned and Operated MRF

- Alpine Waste and Recycling is the largest privately held commercial solid waste collection company in Colorado.
- The recycling sorting facility is roughly 50,000 square feet and has the capacity to processes 30 tons/hour. The facility processes more than 6,000 tons per month and processed an average of 80,000 single-stream tons in 2015.
- Alpine was the first facility in Colorado to accept expanded polystyrene (EPS) and has a dedicated line with an EPS condenser to form “bricks” for recycling.

Refer to Appendix C for further details.

Additional case studies of MRFs are included in Appendix C, including Eagle County's Multi-material MRF and Altogether Recycling's large scale private MRF.

Table 5-2: Current Recycling Processing System by Region

Region	Stakeholder Meeting Location	Transfer Stations	Recycling Facilities	Recycling Facilities with On-Site Processing
Front Range Mountains	Denver	Common	Abundant	4
	Loveland	Common	Limited	2
	Pueblo	Common (most by Colorado Springs)	Common	3
	Alamosa	Limited (especially in rural areas)	Limited	2
	Silverthorne	Common	Common	4 to 5
Eastern/ Southeastern	Sterling	Common	Limited	1 (small scale)
	Lamar	Limited	Limited	1 (small scale)
Western Slope	Durango	Common	Common	2
	Grand Junction	Limited	Common	3

5.1.2 Background on Existing Organics Service and Processing

Residential organics service: Some communities along the Front Range offer combined yard waste and food scraps collection. Yard waste service is generally provided via drop-off service.

Curbside organics: Curbside organics service is most commonly provided by a private hauler or by city staff. The service is occasionally "embedded" and charged as part of a combined solid waste and recycling bill. In Colorado this service is not often available to residents. Yard waste service is the more common option for communities in the state, however a combined yard waste and food scraps service is becoming a more popular option in cities such as Boulder and Longmont. When provided, the material is usually collected in a lidded 96-gallon wheeled cart funded through a separate fee (e.g. Superior's Rock Creek HOA), or sometimes the fee is embedded in the solid waste collection bill (e.g. Lafayette, Boulder). A few communities, like Lafayette and Louisville, allow the generator to choose the size of organics container and charge based on the size. In most of the programs, service is year-round.

- **Drop-off organics**: In all sizes of communities in Colorado, yard waste drop-off sites are available. Facilities have year round and seasonal options, located at landfills, or more broadly, transfer stations or convenience centers. These centers are usually unstaffed with no fee. However, some are occasionally staffed, with or without a fee. Some facilities make the compost product available to residents for free or reduced fees. Drop-off programs in Colorado generally do not accept food waste. An additional case study of Summit County's drop-off organics program is included in Appendix C.
- **Seasonal/special and clean-ups**: It is common for communities to have special yard waste events, including holiday tree chipping events, a leaf drop-off or street side collection or "spring

Denver's Residential Curbside Organics Pilot Program

- A 2008 waste composition revealed that over 50% of the residential waste stream was compostable.
- Solid waste services are paid through property taxes and general funds.
- Through grant funding, the pilot program began in 2008 as a single route.
- With a funding shortfall in 2010, to continue program residents paid $9.75/HH/month.
- In 2012 Denver SWM was able to secure a $2 million inter-agency loan from the Denver Department of Environmental Health.
- The grant paid for the purchase of new carts and trucks, and collection and processing costs.

Refer to Appendix C for further details.

City of Louisville: Contracted Solid Waste, Recycling, and Organics Collection

- Through a contract with a private hauler, the city of Louisville provides solid waste, recycling and organics collection services to its residents.
- Solid waste is collected weekly, single stream recyclables and organics collection (food and yard waste) alternates every-other-week.
- The hauler provides the carts and customers can choose a 96-gallon, 64-gallon or 32-gallon cart for each separate service.
- A 64-gallon cart for solid waste, recycling and organics costs approximately $24.64 per month.
- The cost of recycling and the first 32-gallons of organics is covered in the fee for solid waste collection.

Refer to Appendix C for further details.

Superior's Drop-off Organics Program

- In 2005, the Town of Superior opened a 3,000 square foot seasonal yard waste drop-off site, open weekend days and one weekday evening, and staffed by a greeter (closed in winter).
- The facility has two concrete pads for 30 cubic yard roll-offs.
- In 2015, 101 tons of yard waste were collected.
- The largest challenge faced by the facility has been to balance increased usage and availability of service while minimizing contamination.

Refer to Appendix C for further details.

clean-up" programs that include significant yard/green materials. A few communities have included the costs in the structure of their hauling contracts, thought usually the costs of these services are embedded in taxation[4].

Commercial organics: Commercial organics consist of food scraps from restaurants, grocery stores and cafeterias (hospitals, long term care, universities, etc.). Service for food organics collection is not commonly provided in large dumpsters because the material can be too heavy for transportation. The service is provided frequently in smaller containers to also reduce common odor issues associated with this material. The service is billed by the number, size and frequency of collection, parallel to commercial solid waste collection service. The service is almost universally a separately-paid, optional service (with two exceptions: Boulder implemented a mandate for some business types and Fort Collins is considering a Universal Recycling Ordinance that may require the same for commercial organics). Some businesses "self-haul" their food scraps to the landfill; some businesses have invested in "Earth Tubs™" as part of a farm-to-table ethic to bring organic waste materials to their farm to be used as nutrient rich soil additives.

City of Boulder: Mandatory Commercial Recycling Ordinance & Food Mandates

- As part of Boulder's recently passed commercial ordinance - all business owners must separate recyclable and compostable material.
- They must also provide recycling and compost containers anywhere they have solid waste containers for employees or customers.
- This ordinance becomes effective on June 17, 2016.

Refer to Appendix C for further details.

Multifamily organics: Generally, there are not organic collection services provided for the multifamily sector in the state.

Home owner association (HOA) organics service: Unless required by local ordinance, HOAs rarely opt to include yard waste or food waste collection services. If the service is provided, it is generally contracted across member households and the cost is embedded in the HOA fees. There are a few HOAs that provide information to residents on how to separately contract for organics service (e.g. Superior's Rock Creek HOA). The service is generally expensive and in some cases may be separately collected and incorrectly delivered to the landfill and disposed of as solid waste rather than composted. If communities intend to include HOAs in their ordinances related to organics, they tend to call them out in ordinance text to ensure compliance.

[4] Communities that are considering PAYT programs often discontinue these "clean-ups" to avoid having people use it as garbage day.

Funding: Funding for organics service is provided through user fees paid directly to haulers, by user fees or community taxation paid to cities when collection is municipal, or contracted, or the cost is embedded in the solid waste collection fee (e.g. Boulder, Louisville, Lafayette). Table 5-3 provides the current availability of offered organics service in the state. Figure 5-3 provides a statewide map of organics services.

Table 5-3: Current Organics Collection Service by Region

Region	Sector		
	Residential	**Commercial**	**Multifamily**
Front Range	Limited	Common	Limited
Mountains	Limited	Limited	Limited
Eastern/ Southeastern	None	None/Limited	None
Western Slope	Limited	Limited	None

Table 5-4: Current Organics Processing System by Region

Region	Stakeholder Meeting Location	Compost Processing
Front Range	Denver	Limited
	Loveland	Common
	Pueblo	Limited
Mountains	Alamosa	Limited-None
	Silverthorne	Common
Eastern/ Southeastern	Sterling	Limited
	Lamar	None
Western Slope	Durango	Limited
	Grand Junction	Limited

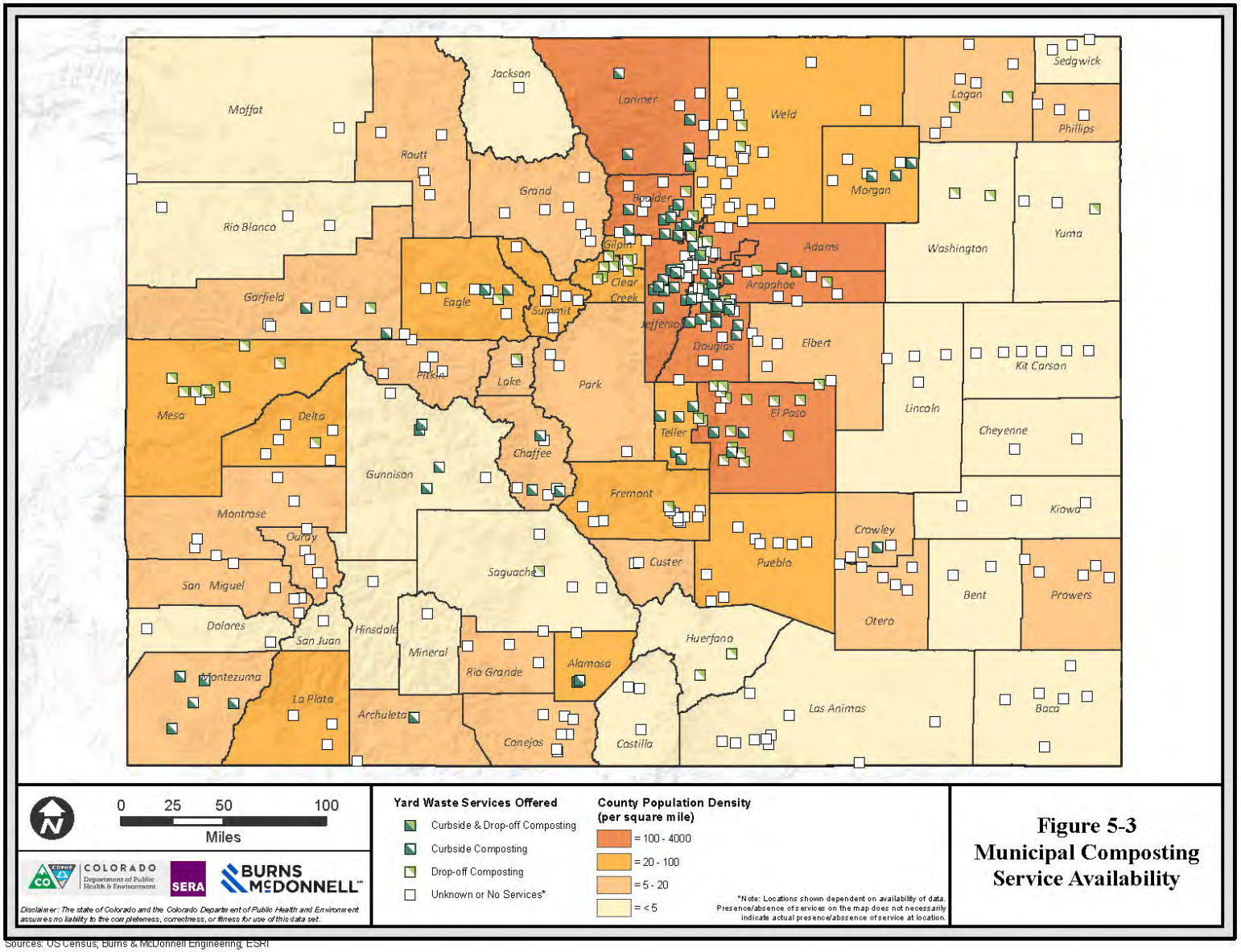

Figure 5-3
Municipal Composting Service Availability

Sources: US Census; Burns & McDonnell Engineering; ESRI

Organics processing: Organics processing facilities, or composting sites, are scattered throughout the state (see Figure 5-1), with concentration in both number and size in the more populated areas of the state. The organic processing facilities include both public and private operations. Windrow-based composting facilities are most common in Colorado. While compositing facilities are scarce in many rural areas of Colorado for residential and commercial organics, agricultural composting, where material is processed for use on agricultural land, is common.

Private Sector Organics Processing: A1 Organics

- A-1 Organics is Colorado's largest composter.
- Their facilities are located in rural areas to eliminate complaints about odor from neighbors.
- Curbside organics average $35.00 per ton.
- Remote locations require additional costs.
- A-1 Organics accept food and yard waste, manure, leaves and branches and more.

Private Sector Organics Processing-Western Disposal, Boulder

- Western Disposal is a privately owned collection company that services primarily Boulder County.
- Their Class II Compost facility processes source separated organic and food-waste materials, both residential and commercial.
- For over 10 years they have had a static pile compost facility on a nineteen-acre site within the City of Boulder without odor complaints.
- Western's Organics accept residential organics from other haulers at a price of $77.00 per ton.

Refer to Appendix C for further details.

On-Farm Composting/Farm Siting

- Under the National Organic Program Rule, organic producers have limited choices on what products can be used for crop production.
- Materials must be managed in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.
- Due to the heavy regulation and specific criteria involved in compost production, many facilities do not function as a public organics drop-off site for fear of a contaminated and unusable compost product.

Refer to Appendix C for further details.

Pitkin County: Compost Program and Processing

- Looking forward to the end of the landfill life in Pitkin County, a study revealed 40-60% of the landfill material was comprised of food waste and waste related paper.
- A yard waste ban was passed. Through a grant from the state, they purchased a compost mixer and began accepting food scraps.
- Pitkin County's compost site currently accepts roughly 781 tons of food waste and 6,442 of general compostables.

Refer to Appendix C for further details.

5.1.3 Consideration of Gaps, Opportunities, and Potential Strategies

Gaps are influenced by the requirements of the Solid Waste and Integrated Materials Management Plan empowering language (see (C.R.S. 30-20-100.5 (I) – (V)). The language requests a Plan that addresses:

- safe and cost effective services to Colorado residents
- maximizing waste reduction and recycling programs
- reduction of volume and toxicity of the waste stream
- education of the public
- other considerations

Gaps as identified in this Plan are related to realistic opportunities for changes in solid waste-related **strategies** (services, incentives, policies, regulations and supporting infrastructure) that relate to the elements requested in the Plan. Strategies also relate to services offered or expected in similar regions nationally.

5.2 Front Range

5.2.1 Current Diversion System

The Front Range is where many communities have high diversion rates and are moving beyond basic collection programs. Most residents have access to recycling either through curbside or drop-off programs (Table 5-5) and organics programs are becoming more available (Table 5-7). It is common for the cost of recycling to be embedded in the cost of waste collection services. Low landfill tipping fees are one of the most commonly cited barriers to increase diversion. For recycling, low market prices and contamination are also common issues (Table 5-9). While commercial recycling and organics programs are available, participation is often lacking. This region has the most recycling processing facilities (MRFs) and these facilities accept materials from the other regions (Table 5-8)[5]. Recycling processing in the southern portion of this region is limited. There are collection hubs, however materials are often transported north. Table 5-5 summarizes recycling programs available for the Front Range region based on the stakeholder meeting location.

[5] Source: Composting operations tables based on information from Eric Heyboer, Marjie Griek, and SERA

Table 5-5: Existing Recycling Availability – Front Range

Stakeholder Meeting Location	Residential		Commercial		Multifamily		Available Recycling Processing	Transfer Stations
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off		
Denver	Abundant	Common	Abundant	Limited	Common	Common	Abundant	Common
Loveland	Abundant	Abundant	Abundant	Limited	Common	Common	Common	Common
Pueblo	Common	Common	Common	Limited	Limited	Limited	Common	Common

Table 5-6: Recycling Processing Facilities – Front Range

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Denver Metro	Numerous throughout	Alpine W&R, Waste Management, Boulder County	Curbside, DOCs,[1] residential/commercial	Denver metro, north Front Range
Pueblo	Swink, Trinidad, others	Roots Recycling (formerly WE Recycle)	Curbside, DOCs, residential/commercial	South east central
Larimer	Throughout Larimer County	Larimer County	Curbside, DOCs, residential/commercial	Larimer, some Weld
Colorado Springs	El Paso, Pueblo and some Mountain counties	Bestway Recycling	Curbside, DOCs, residential/commercial	El Paso, Teller, Pueblo, Fremont

1. DOC = Drop off center

Most organics collection programs target yard waste only, but food waste programs are becoming more available. There are several large composting facilities in the eastern central portion of this region, but there is a scarcity of programs and facilities in the southern portion of the region. Table 5-7 summarizes current organics programs available for the Front Range region and each of the stakeholder meeting locations. Table 5-8 summarizes the known composting operations.

Table 5-7: Existing Organics Programs – Front Range

Stakeholder Meeting Location	Residential		Commercial		Multifamily	
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off
Denver	Common	Common	Common	Abundant	Common	Common
Loveland	Limited	Limited	Common	Limited	Limited	Limited
Pueblo	Limited	Limited	Limited	Limited	Common	Common

Table 5-8: Known Composting Operations – Front Range [1]

Location	Operator	Service Area/Type	Class
Bennet	Alpine East Regional Landfill	Front Range Residential and commercial drop off	2
Aurora	Waste Management (DADS)	Front Range Residential and commercial drop off	1
Colorado Springs	Don's Garden Shop	Southern Front Range Residential	3
Pueblo	Midway Organic	Southern Front Range Residential and commercial drop off	1
Erie	PermaGreen	Statewide Distribution through retailers	3
Eaton	A1 Organics	Eastern, Front Range Residential and commercial drop off	1
La Salle	Heartland BioDigester	Statewide Commercial only	None listed
Keenesburg	A1 Organics	Wholesale only	1

1. Does not include Class V agricultural or on-farm only facilities

5.2.2 Needs, Gaps, Support, Cooperation and Funding Opportunities

Table 5-9 summarizes current needs, gaps, support and funding opportunities identified for the Front Range.

Table 5-9: Needs, Gaps, Opportunities and Funding for Diversion – Front Range

Issues	Findings	
Needs/Concerns	• Weak municipal support • Market prices are low and access is difficult, creating unprofitable economics • Issues arise from contamination • Low landfill fees create an atmosphere where it is easy to discard rather than recycle • Siting and permitting issues for organic facilities	• Lack of local program demand and supply for organic facilities • Low landfill prices and unlimited solid waste collection services make it unprofitable to operate organic sites • The diversion system received a 4.0 on a scale from 1 to 5, where 5 is working well
Gaps	• Biggest gap is private industry profitability, which is currently being publicly subsidized • Diversion industry lacks participation as well as material market value and proximity needed to be independently profitable	• Siting guidelines for organics make it difficult to establish facilities
Want/Support	• Regional planning districts • Hauler licensing for residential and commercial services • State diversion goals- two tiers (lower goal for smaller population or rural areas) with measurement • Contamination control • Some support for landfill bans on cardboard, bottles and cans	• Producer responsibility • State level PAYT • Hub and spoke programs • Landfill surcharges • Mandates for diversion • State should do more measuring/ reporting of materials • More recycling education
Cooperation	• There is expertise and passion in the disposal/diversion industries • Opportunity for sharing best management practices, coordinating and collaborating resources is available. • Educational resources and environmental groups (CAFR, RMOC, RCAB, CML) can help share education and resources • Co-locating recycling remanufacturing at MRFs and transfer stations to improve synergy	• Bridging I-25 divide to help spread services and share resources • More sharing of systems, community gardens and reuse areas • Provide city models with strong programs • More directed meetings /communication • Marketing materials, coordinating transportation, scheduling and transportation network • Collaboration, with consideration of waste shed authority • Share public events and publicity
Funding in Place	• Advance Disposal Fees (ADFs) such as those for bags and paint • Litter taxes	• User fees • Landfill surcharges • A few areas do not have taxes on certain material streams
Funding would Support	• Economic development assistance • Tax incentives for facilities and programs • No taxes on some material streams	• Strong support for a solid waste tax, most common support is for between $0.10 - $2.00 per household/month • Producer responsibility programs

Feedback was also gathered on strategies that might be suitable and supported by the stakeholders. The strategies with wide support by stakeholders within this region include:

- State level goals, two-tiered
- Associated measurement and reporting
- Licensing for residential and commercial haulers, with reporting
- Establishing regional planning districts (with funding authority)
- Two of the three sub-areas strongly supported PAYT mandates, potentially at the state level
- Two of the three subareas supported landfill bans, mentioning OCC and bottles/cans
- User fees and solid waste taxes/fees (in the $0.10-$2.00 range/household/month)
- Landfill surcharges to modify recycling economics
- No taxes on recycling and organics streams (to modify recycling economics)
- Hub and spoke in outlying areas
- Producer responsibility initiatives/industry supported programs
- Economic development assistance
- CDPHE release the landfill and materials management plan soon
- CDPHE finish siting guidelines for organics
- CDPHE provide local planning assistance

The main driving forces underlying the recycling and organics collection/facility-related recommendations in this region are:

- There are substantial diversion programs in place within this region, but there remains additional regional appetite to divert more recycling from outside of the region.
- Programs and facility access are well established in the Metro/I-25 Front Range areas (e.g. Boulder's and Denver's access, densities and transportation distances are substantially less than rural/Northern Weld County, Elbert, Southern Pueblo County, etc.).
- There are hub and spoke programs in place in the outside of the I-25 Front Range Areas that fit well into the respective communities.

Stakeholder Insight -
Front Range Plastics Recycler

"Build programs that connect processors with their end-users in more of a partnership than a transactional way. At the moment, each individual business seems to either sink or swim based on how well they can sell their product. This is a short-term, not a long-term way, of dealing with fluctuating commodity prices, which often make it hard for these businesses to stay swimming. Partnerships with buyers (who aren't simply brokers) will permit less fluctuation in the prices, which will allow recycling/composting business to be more attractive to get into and to stay in."

Inappropriate Programs:

- For this region there are few programs that would be inappropriate. Aggressive requirements set by the state are suitable and given the population and facility densities, practices in this region have dramatic effects on the overall state performance.

5.3 Mountains

5.3.1 Current Diversion System

Several cities and counties in this region are committed to significantly increasing diversion and have dedicated resources to programs and facilities. Recycling is included in the cost of residential solid waste service for many areas along the I-70 corridor. There is also an active hub and spoke program throughout the region. High tourist populations bring in funding, but also cause consistency issues. Processing facilities are available; however, participation rates are low. There are limited recycling options in the southern portion of the region (Table 5-10), many drop off sites are run by volunteers and no major MRF or single stream processing facilities are present within the region, which cause higher transportation costs for collection systems. Insufficient demand and access to markets are reported as significant barriers. Table 5-10 summarizes recycling programs available for the Mountain region based on stakeholder meeting location.

Table 5-10: Existing Recycling Availability – Mountains

Stakeholder Meeting Location	Residential		Commercial		Multifamily		Available Recycling Processing	Transfer Stations
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off		
Alamosa	Limited	Limited	Limited	Common	Limited	Limited	Limited	Limited
Silverthorne	Abundant	Abundant	Abundant	Common	Common	Abundant	Multiple	Multiple

Table 5-11: Recycling Processing Facilities – Mountains

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Canon City	Fremont and Custer counties	Phantom LF (Twin Enviro), Howard Disposal	Curbside, DOCs[1], Residential/Commercial	Fremont and Custer
Salida	Buena Vista, Poncha Springs	Angel of Shavano	DOCs	Chaffee; also accepts from Park, Hinsdale
Archuleta	Pagosa Springs	Archuleta County	DOCs	Archuleta (takes to Durango)
Creede/Del Norte	Crestone, Monte Vista, South Fork	MDS Waste [2]	DOCs	Hinsdale, Mineral, Rio Grande, Alamosa
Gunnison	Crested Butte	Gunnison County	DOCs	Gunnison
Leadville	Leadville	Lake County	DOCs	Lake
Breckenridge	Summit County	Summit County, Waste Management	DOCs, some curbside by Waste Management, Residential/Commercial	Summit
Wolcott	Vail, Red Cliff, Eagle, Edwards, Gypsum	Eagle County	DOCs, some curbside by Waste Management	Eagle
Pitkin	Basalt, Carbondale, Snowmass	Pitkin County	DOCs, some curbside (by Waste Management)	Pitkin
Steamboat	Hayden, Oak Creek	Twin Enviro, Waste Management	DOCs, some curbside	Routt

1. DOC = Drop off center
2. Previously was Recycle Creede, now being serviced by a small local hauler

Table 5-12 summarizes organics programs available for the Mountain region based on the stakeholder meeting location.

Table 5-12: Existing Organics Programs – Mountains

Stakeholder Meeting Location	Residential		Commercial		Multifamily	
	Curbside	**Drop-off**	**Curbside**	**Drop-off**	**Curbside**	**Drop-off**
Alamosa	Limited	Limited	Limited	Limited	None	None
Silverthorne	Limited	Abundant	Limited	Limited	Limited	None

Table 5-13 summarizes the known composting operations.

Table 5-13: Known Public Composting Operations – Mountains

Location	Operator	Service Area/Type	Class
Milner	Milner Landfill (Twin Enviro)	Routt County Residential and commercial drop off	1
Snowmass Village	Pitkin County	Pitkin County Residential and commercial drop off	1
Saguache	Colorado Natural Compost		None listed
Center	Compost Technologies		None listed
Hooper	Soil Solutions	South central mountains (sell nationally)	5
Glenwood Springs	South Canyon Disposal Site (City of Glenwood Springs)	Glenwood Springs Residential and commercial drop off	1
Dillon	Summit County	Summit County Residential and commercial drop off	1

1. Does not include Class V agricultural or on-farm only facilities

5.3.2 Needs, Gaps, Support, Cooperation and Funding Opportunities

Table 5-14 summarizes current gaps and opportunities identified for the region. The northern area along the I-70 corridor has more services and facilities and a higher tourist population. In the southern portion of the region, the City of Alamosa has most collection services available, while there are few of the available services in the rural areas.

Table 5-14: Needs, Gaps, Opportunities and Funding for Diversion – Mountains

Issues	Findings	
Needs/Concerns	• Recycling is unprofitable due to market access and prices • Organics is unprofitable due to operating costs and permitting **Both** recycling and organics: • Lack municipal commitment • Economics hurt by low landfill prices	• Contamination issues are present in recycling and organics • Poor enforcement of regulations • Northern area is hampered by a large transient tourist population (education, convenience for them, etc.) • The diversion system received a 2.8 on a scale from 1 to 5, where 5 is working well
Gaps	• Transfer stations • Hub and spoke model • Education and outreach • Grants and subsidies for infrastructure • Regionalization/collaboration	• Funds/money/resources – including RREO/grants/subsidies • State level policy with goals • Bottle bill • Regional leadership and sharing of resources • Composting processing
Want/Support	• Some support for planning areas with funding • User fees • Enterprise funds • Training and outreach • Planning assistance • Landfill surcharge • Some support for generator fees or environmental fees up to $2/household/month	• Regional/state level solid waste tax • Waste to energy • Hauling licensing/reporting • Economic development assistance • Bottle Bills (traditional and Delaware-type) • Recycling goals • Planning districts • PAYT only in certain cases • Hub and spoke
Cooperation	• San Luis Valley Ecosystem Council • USDA Recycling Group • Waste tire inspection grant • Entities with solid waste grants work together • Safety First Fund Summit - shared resources/facilities.	• Recycling infrastructure is available with room for improvement • Share compost facility and related expertise as a hub • Those with PAYT share best practices with other cities • Recycling goals and planning districts
Funding in Place	• User fees • To a lesser extent, landfill surcharge	• Advanced disposal fees or litter fees • Enterprise funds
Funding would Support	• Bottle bill • Strong support for producer responsibility	• Landfill surcharge • Tax benefits for investments • Environmental fees

Feedback was gathered on strategies that might be suitable and supported by the community. The support for strategies has been split in this region by areas, as follows:

Alamosa and Silverthorne meetings stakeholders supported

- Planning areas (with funding authorization)
- Planning assistance

- Hub and spoke
- User fees and environmental or generator fees (up to $2/household/month)

In addition, Silverthorne meeting stakeholders supported

- Recycling goals
- Bottle bills
- Landfill surcharges

In addition, Alamosa meeting stakeholders supported

- Hauler licensing and reporting
- PAYT only in certain areas
- State level solid waste tax
- Waste to energy
- Enterprise funds

From CDPHE, Alamosa meeting stakeholders wanted:

- Training and outreach

The main driving forces underlying the recycling and organics collection/facility -related recommendations in this region are:

- There is a strong interest in sustainability along the I-70 Mountain corridor due to a high tourist population.
- The tourist and second-home nature of the I-70 Mountain communities complicates programs, especially in terms of education. Overall performance for the communities is hampered because if residents recycle, but tourists do not, the high percentage of tourists hurts the numbers.

Stakeholder Insight -
Recycling Processor and Collection Company

"In the future closer facilities need to pop up that accommodate smaller amounts of materials - this will reduce transportation costs and capital costs, while the material can ultimately go to a transfer station". (Recycling Processor)

"Compost is a work in progress so we are getting closer to a good system. Our local MRF has outdated technology that can only take duel stream but our residents and businesses are demanding single stream so we have to ship many recyclables to the Front Range. It's very cheap to bury everything in the landfill and that seems very short sighted". (Recycling Collection Company)

- Transportation distances between generators and facilities and getting materials across the mountains during the winter months makes collection services difficult.
- The southern portion of the Mountain region is substantially different from the rest of the region having lower population densities, lower incomes, fewer second homes and tourism and a greater likelihood to be transporting materials to neighboring states.

Inappropriate Programs:

- Provide reduced requirements for the rural areas of the region; very aggressive programs would not be appropriate.
- However, more aggressive options are suitable in the I-70 corridor because of facility access and strong interest in sustainability.

5.4 Eastern/Southeastern

5.4.1 Current Diversion System

Profitability and insufficient demand for products are the top barriers to recycling in this region. There are some successful hub and spoke programs, but full processing facilities are not present in this region (Table 5-16). Hub and spoke programs are limited by the distance between communities. Few areas within the region offer recycling as a subset cost to solid waste service. Table 5-15 summarizes current recycling programs available for the Eastern/Southeastern region based on stakeholder meeting location.

Table 5-15: Existing Recycling – Eastern/Southeastern

Stakeholder Meeting Location	Residential		Commercial		Multifamily		Available Recycling Processing	Transfer Stations
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off		
Sterling	Limited	Common	Common	Limited	None	None	None	Common
Lamar	Limited	Limited	Limited	Limited	None	None	Limited	Limited

Table 5-16: Recycling Processing Facilities – Eastern/Southeastern

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Denver	Sterling	Waste Management	Curbside (Sterling, other), DOC, Residential and Commercial	Julesburg, Sterling, other towns in NE (Northeast)
Yuma (new)	Keenesburg, Hillrose, Eckley	Quest Services	DOCs, Commercial Curbside	NE and East Central
Bent	Numerous	Southeast and East Central Recycling	DOCs	14 counties in east central and southeast, 1 in Kansas
Swink	La Junta, Rocky Ford, Manzanola, Fowler, Ordway, Ead	Clean Valley Recycling	DOCs	Southeast – 7 counties
Trinidad		TerraFirma	DOCs	Las Animas County

1. DOC = Drop off Center

Lack of financing and participation are cited as the main barrier to promoting growth in organics programs within the region. This is a high agricultural region and people compost on their own property. The composting sites listed by the state in this region were identified to no longer accept organics. Table 5-17 summarizes organics programs available for the Eastern/Southeastern region based on the stakeholder meeting location.

Table 5-17: Existing Organics Availability – Eastern/Southeastern

Stakeholder Meeting Location	Residential		Commercial		Multifamily	
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off
Sterling	None	Limited	None	None	None	None
Lamar	None	None	None	None	None	None

Table 5-18 summarizes the known composting operations.

Table 5-18: Known Composting Operations – Eastern/Southeastern [1]

Location	Operator	Service Area/Type	Class
Yuma	Ace Composting	Rendering	1
Ft. Lupton	BOSS Compost	Front Range for sales, unknown for intake (manure, definitely)	None listed
Akron	Colorado Compost	Unknown	3
Fort Morgan	Teague Enterprises	Not for public (commercial machinery)	2

1. Does not include Class V agricultural or on-farm only facilities

5.4.2 Needs, Gaps, Support, Cooperation and Funding Opportunities

Table 5-19 summarizes gaps and opportunities identified for the region. This region is fairly homogenous in types of facilities and the distances traveled for services.

Table 5-19: Needs, Gaps, Opportunities and Funding for Diversion – Eastern/Southeastern

Issues	Findings	
Needs/Concerns	Lack of the following for recycling and organics: • Material supply • Municipal commitment • Program participation • Finances/profitability • Market access and demand • High costs to operate	• Contamination issues • Insufficient understanding of some technologies • Too much regulation • Transportation distances • The diversion system received a 2.8 on a scale from 1 to 5, where 5 is working well
Gaps	• Better (more accessible) markets • Better/more accessible sources of funding • Improved education • Reasonable beneficial use permitting	• Reduced state regulation • More local control • Need more education • There are no public organic composting sites or full scale MRFs
Want/Support	• Hub and spoke • Waste to energy • Two-tier state recycling goals (lower goals for rural or certain regions) • Local planning assistance and training • Regional planning districts	• Bottle bill (traditional type and Delaware model) • Community members would like more burning to be allowed within the region • CDPHE technical assistance in lieu of fines
Cooperation	• Coordinated strategies among CDPHE divisions for overall benefit to public health, which might instigate some very innovative projects • Hub and spoke • volunteer-run facilities	• Public/private partnerships and collaboration • Some concerns that distances are too great out on the plains for effective sharing opportunities
Funding in Place	• User fees are by far the most commonly reported form of funding • Landfill surcharges	• Much less common: fees on hauler contracts
Funding would Support	• Economic development assistance • Environmental fee • Oil and gas tax • Incentives/tax benefits for facility co-location	• User fees • Fees on hauler contracts • Industry funded programs • No taxes on some streams

Feedback was gathered on strategies that might be suitable and supported by the community. The support for strategies has been communicated in this region by areas, as follows:

Sterling and Lamar meetings stakeholders supported:

- State level goals, two-tiered
- Possible waste to energy

In addition, Sterling meeting stakeholders supported:

- Hub and spoke
- Allotments from oil/gas tax
- No taxes on recycling and organics streams
- Environmental fees
- Facility co-location incentives

In addition, Lamar meeting stakeholders supported:

- Bottle bill
- Economic development assistance
- Fees on hauler contracts
- Industry-funded programs/producer responsibility

From CDPHE, Lamar and Sterling meeting stakeholders are looking for:

- Organics siting guidelines
- Local planning assistance
- Training

The main driving forces underlying the recycling and organics collection/facility-related recommendations in this region are:

- There is interest in hub and spoke and it is a suitable option for the area.
- On-site agricultural composting exists throughout the region.
- There are PAYT options; however, few have recycling options.
- Interest in economic development assistance and co-location of facilities was conveyed during stakeholder meetings.

Stakeholder Insight -
Town Administrator and Public Works Director

"One concern we do have for future budgeting concerns is the Town and surrounding area are seeing a declining population". (Town Administrator)

"The state needs to make composting more operator friendly, less regulation. Smaller communities don't have a lot of revenue for staff and permit or annual fees. Tax payers shoulder too much cost now". (Public Works Director)

Inappropriate Programs:

- For this region, mandates and bans will not be well-received and the lack of access to organics processing limits program initiatives in the near term.
- Low incomes and the anticipation of illegal dumping are a concern.
- Low population densities (along with mountain barriers) affects economics of diversion.

5.5 Western Slope

5.5.1 Current Diversion System

Curbside recycling is embedded in about half of the communities where curbside recycling is available. Processing is limited and is complicated by mountain passes. Much of the material is transported out of state to New Mexico or Utah. There is regional cooperation in the southern portion of the region and interest in improving the collection systems. Residents within the region are reluctant to contribute any additional monetary resources for recycling services. Table 5-20 summarizes recycling programs available for the Western Slope region and based on the stakeholder meeting location.

Table 5-20: Existing Recycling Availability – Western Slope

Stakeholder Meeting Location	Residential		Commercial		Multifamily		Available Recycling Processing	Transfer Stations
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off		
Durango	Common	Common	Abundant	Limited	Limited	Limited	Limited	Common
Grand Junction	Abundant	Abundant	Common	Common	Limited	Limited	Limited	Limited

Table 5-21: Recycling Processing Facilities – Western Slope

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Grand Junction	Locations in Mesa and Delta Counties	Mesa County, Grand Junction Curbside Recycling Indefinitely (with City), Waste Management	Curbside, DOCs[1]	Mesa and Delta
Montrose	Paradox, Gateway, Ouray, Nucla	Bruin Waste	DOCs	Montrose, Ouray and San Miguel (some Delta/San Juan)
Durango	La Plata, Montezuma, San Juan, Dolores	City of Durango, Phoenix Recycling	Curbside, DOCs	La Plata, Montezuma, San Juan, Dolores

1. DOC = Drop off Center

There are few areas that offer organics service and processing. It can be difficult in this region due to geography and climate. Some areas offer drop off yard waste areas, but the material, rather than being

composted, is sent to a landfill classified as solid waste. Table 5-22 summarizes current organics programs available for the Eastern/Southeastern region.

Table 5-22: Existing Organics Availability – Western Slope

Stakeholder Meeting Location	Residential		Commercial		Multifamily	
	Curbside	Drop-off	Curbside	Drop-off	Curbside	Drop-off
Durango	Limited (outside City)	Limited	Limited	Limited	Limited	Limited
Grand Junction	Limited (outside City)	Limited	Limited	Limited	Limited	Limited

Table 5-23 summarizes the known composting operations.

Table 5-23: Known Composting Operations – Western Slope [1]

Location	Operator	Service Area/Type	Class
Austin (Delta County)	CB Industries	Western Slope	1
Grand Junction	Mesa County Landfill	Mesa County Residential and commercial drop off	3
Cortez	Montezuma County Landfill	Montezuma County	1

1. Does not include Class V agricultural or on-farm only facilities

5.5.2 Needs, Gaps, Support, Cooperation and Funding Opportunities

Table 5-24 summarizes gaps and opportunities identified for the region. Montezuma County, in the southern portion of the region, has programs and facilities available for the services discussed and has five county's cooperating. There are few services and facilities between Durango and Grand Junction and in the northern area of this region.

Table 5-24: Needs, Gaps, Opportunities and Funding for Diversion – Western Slope

Issues	Findings	
Needs/Concerns	For recycling and organics: • Lack profitability • Lack market access • Have low participation • Other issues are a large tourist population	• Long distances to MRF (from 60-180 miles one way) and markets • Transportation especially difficult negotiating winter passes • Illegal dumping if costs increase • The diversion system received a 3.1 on a scale from 1 to 5, where 5 is working well.
Gaps	• Transfer stations • Hub and spoke • Local end use markets • Market development assistance	• Education (especially K-5) • Access to recycling for rural customers • Enhanced organics (especially food scraps) for commercial and multi-family
Want/support	• Some support for siting guidelines for organics • Regional planning districts • Local planning assistance • Small support for bans on cardboard • PAYT bundled with recycling and organics service (residential) • Strong support for hub and spoke • Waste to Energy	• Two-tier state recycling goal • More policy (not material bans which lead to illegal dumping of tires and electronics) • Require commercial recycling • More construction and demolition and household hazardous waste programs
Cooperation	• The Southwest Regional Council of Governments collaborates for increased diversion • Regional education outlet would be helpful Suggest landfill owners to provide space for composting	• Regional MRF and regional collaboration • Some facilities have 50/50 cost share with municipalities
Funding in Place	• User fees • Landfill surcharge	• Enterprise funds • Limited support for advanced disposal fees and litter fees
Funding would Support	• Local solid waste tax (between $1-5/household/month) • Economic (development) assistance • Allocation from the oil/gas tax • Landfill surcharge to improve economics of recycling/diversion • Producer responsibility programs • Implement stewardship bills to tire and electronic purchases to offset the cost for recycling	• Market development assistance • Local use requirements (require local use of locally-recovered recycled content products) • Local recycling and organics processing • Grant opportunities (to improve infrastructure in particular)

Feedback was gathered on strategies that might be suitable and supported by the community. The support for strategies has been split in this region by areas, as follows:

Grand Junction and Durango meeting stakeholders supported:

- Establishing regional planning districts (with funding authority)
- Hub and spoke
- Economic development assistance

In addition, Grand Junction meeting stakeholders supported:

- State level goals, two-tiered
- Associated measurement and reporting
- Solid waste taxes/fees (in the $1-$5 range/household/month)
- Producer responsibility/industry-supported programs
- Landfill surcharges to modify recycling economics
- Support from oil and gas funds
- Waste to Energy

In addition, Durango meeting stakeholders supported:

- PAYT mandates, potentially at the state level
- Cardboard bans

From CDPHE, Durango meeting stakeholders are looking for:

- Organics siting guidelines
- Local planning assistance

The main driving forces underlying the recycling and organics collection/facility-related recommendations in this region are:

- Limited areas with high population density
- Interest in collaboration
- Mountain passes pose significant issues for transportation of materials
- Hub and Spoke programs are a good fit for areas of this region

Stakeholder Insight - County Landfill Manager

"Curbside in the county involves very long hauls with very few stops because of low participation. We have long distances to end markets. Nothing is sustainable if it cannot be kept local, because you end up having to depend upon others. (i.e. when the ports were on strike last year). Composting on the other hand is great. When we keep organics out of the landfill we begin to eliminate problems like leachate and methane production. We can produce a product that people want and need locally. We can begin to fix our areas over tilled, nutrient depleted, over mono-cropped soil. The problem with local composting is that the super markets, casino, hospital, will have to get separate compactor style roll-offs and retrain their employees to source separate the materials."

Inappropriate Programs:

- For this region, mandates and bans will not be well-received and the lack of access to organics processing, limits program initiatives in the near term
- Low income communities and the anticipation of illegal dumping are a concern
- Low population densities (along with mountain barriers) effects the economics of diversion

5.6 Summary of Diversion and Materials Management Sector

This section discussed diversion and materials management as it currently exists in Colorado, and identifies needs, gaps, and opportunities in the four regions of the state.

5.6.1 Summary of Needs and Gaps and Challenges Commonly Found Statewide

The challenges and gaps for solid waste diversion in Colorado vary substantially between the regions. There are examples of extremely successful diversion programs, but many areas face significant difficulties due to logistics, cost, and lack of local volumes and interest. Recycling and organics processing facilities infrastructure is still needed, especially in the rural areas of the state. Common barriers are the low cost received for recycled materials, long hauling distances to recycling markets, and low tip fees at landfills making disposal more economically attractive. Although availability to recycling services is common through all but the most rural areas of the state, usage varies greatly. Rural areas tend to rely more on drop-off recycling and participation is generally lower than with curbside systems. Commercial recycling and organics services are becoming more available, but few communities have addressed the significant gains in diversion that could be made in this sector. Organics diversion

especially, with food waste included, is limited. Facility siting issues is one commonly stated barrier from stakeholders. Most of the existing programs are along the I-25 and I-70 corridors.

5.6.2 Summary of Programs Supported/Wanted by Stakeholders and Inappropriate Programs Statewide

Levels of diversion considered necessary, practical, and achievable differ between regions and even within regions. Generally, there is support for establishing a statewide diversion goal, especially if it is less stringent for areas with less access to recycling and organics. Landfill surcharges or environmental fees are also widely supported, though there is some concern that any additional charges to landfill fees may lead to illegal dumping. Local planning and economic assistance received statewide support and for the most part hub and spoke programs did as well. Hauler licensing or reporting Pay-As-You-Throw were frequently supported, and Waste to Energy also had support. More aggressive programs such as bans on certain materials would be more appropriate for the larger urban areas of the state, but not well received in most rural areas, where transporting materials to viable markets would be costly.

6.0 COLLECTION AND DIVERSION ANALYSIS AND RECOMMENDATIONS

6.1 Introduction

Sections 4 and 5 provided a summary of the status quo and gaps in the collection system and the diversion system (programs and facilities/infrastructure), respectively. Section 6 examines strategies for improving the system of collection and management of waste diversion in Colorado, identifying and assessing potential strategies and their costs toward providing recommendations for the near term and 20 year horizon. The two topics are jointly addressed because collection of solid waste and recyclables are often delivered simultaneously and the systems and recommendations are inevitably linked.

6.2 Considerations for this Section

6.2.1 Colorado's Unique Situation of Authorities and Implications for Diversion Elements of the Plan

Before appropriate strategies could be considered and crafted, it was necessary to review the authorities that could be used to make recommendations meaningful and enforceable. Strong limitations were noted, which dramatically affected the types of recommendations. However, it is also noted that progress can be made in the state because a majority of the state's population resides in areas with somewhat difficult, but not impossible, waste management economics.

State Level: The state of Colorado faces an unusual situation in regard to planning and recommendations related to diversion. **Under the Colorado Solid Waste Act, CDPHE has authorities almost exclusively in the realm of disposal at landfills. Generally, its enforceable authorities beyond disposal facilities do not exist.** There are assorted resolutions and proclamations that discuss the state's (and legislature's) interest in recognizing waste diversion and recycling. Furthermore, CDPHE is tasked with developing a Plan that provides recommendations on how to transition from disposal of waste to sustainable materials management. However, the lack of direct authority in the area of materials management, requires a Plan for collection and diversion options that:

- Speaks separately at the state level and the local level
- Develops strategies that can work because they are practical, suitable and beneficial for Colorado, and have the potential to improve waste management if the state or locality does not acquire additional authorities
- Recognizes that the recommended strategies work even better if the agencies are allowed additional authority

Local Level: Many local governments within Colorado have not asserted any of the authorities that are authorized to them in the waste management area. Counties and municipalities are generally assumed to have waste management authorities. However, as mentioned in Sections 4 and 5, the majority of jurisdictions in Colorado assert no authorities in this area. They do not register firms providing collection or programs, nor do they regulate service, rates or other elements regarding solid waste management.

Important exceptions exist – particularly the communities and counties along the Front Range and some in the Mountains that have initiated strong diversion services requirements, invested in diversion infrastructure, passed strong ordinances and fostered private business partnerships in diversion. Outside this area, few counties or local jurisdictions have gotten involved in waste management. There are exceptions. There are noteworthy individual communities along the Western Slope that have elected to initiate recycling service such as Grand Junction and Durango. Some other outstanding examples have sprung from the regional level – including pioneering hub and spoke efforts by the Upper Arkansas Area Council of Governments (UAACOG). However, most of the hub and spoke and other non-urban progress has been by non-profits or motivated individuals or groups (in a number of cases, aided by state grant funds) without strong local government/county mandates or drivers. Some jurisdictions have taken responsibility to the degree of municipally-provided service, and others have enacted ordinances or other authorities toward advancing recycling and diversion. However, by and large, in this state, the drivers have been interested councils, citizens and/or staff.

For the most part, without state authority to mandate change, and without a dramatic change in actual and relative costs between solid waste and recycling (see Section 3's recommendations that may change relative disposal costs at the local level) localities that have not undertaken change will not have specific motivation to do so. For that reason, this section's recommendations cannot have the force that they have in some other states. Until and unless the state acquires the authority to enforce change, the economics of waste management in this state are unlikely to result in widespread, meaningful movement toward improved materials' management. As a consequence, this Plan provides "best fit" strategies toward advancement, but until regulatory authority is authorized– at the state or local level – local activism and persuasion may be the main motivators of change, if any change is to happen.

This section identifies potential state and local strategies that leverage existing authorities. Suggestions are made for ways to leverage for authorities that may motivate some change. At the local level, locally-suitable programs are suggested that are as effective and cost-effective as possible. More advanced or aggressive suggestions are suitable in some areas (Front Range and possibly Mountains), but the waste management market economics of the state of Colorado make even basic programs a challenge in other

regions of the state. From the state perspective this is very important, because universal access to programs, and effective programs is certainly an attractive goal. However, from a practical standpoint, it can also be recognized that **truly remote economics, and the challenges they imply, affect about half of the land area of the state, but only about 10% of the state's population** (about 7-8% in the Western Slope and 3-4% in the Eastern/Southeastern). Further, these populations are scattered in communities with populations substantially smaller than 7,000-10,000 (about one or two efficient solid waste truck's worth of business). This provides further challenges to the economics.

Therefore, the recommendations for potentially-suitable strategies for the state regions are very divided in nature, with more advanced strategies in consideration for the Front Range and potentially Mountains, but substantially less aggressive recommendations for other areas. The Plan provides the state and CDPHE with real and positive recommendations on ways to help motivate implementation of these changes (RREO grant incentives, etc.). However, at least in the near term, the ability to drive change is limited in Colorado at the statewide level under CDPHE's current regulatory authority of the Colorado Solid Waste Act.

6.2.2 Organization of the Section

Because the state of Colorado's "authorities" situation regarding collection and diversion is unique, this section is organized differently than many solid waste and materials management plans, and differently than the preceding Transfer and Disposal Section. Section 6.3 addresses the state-level situation. It provides:

- assessment considerations for state-level recommendations for Colorado
- development of recommended state-level strategies for Colorado, with an accompanying assessment of the program and funding options available at the state level
- recommendations for strategies and an "action plan" for the state
- comparisons to recommendations from other states, and effective state-level strategies elsewhere
- statewide performance estimates (tons and costs) based on recommendations
- recommended set of goals and associated measurement methods, tailored to the local/regional level for three periods: 5 years, 10 years and 20 years from now
- resource lists for potential partner agencies for connecting at the local and planning area level

Section 6.4 examines the local/regional elements of the Plan. The results are presented jointly for comparison and analysis purposes, and then broken out into sections for each of the four regions of the state. Section 6.4 provides:

- Inventory and high level ranking assessment of higher – and lower – performing strategies available at the local level
- Local program recommendations for the four regions of the state
- Planning agencies in each area of the state that may be candidates for area-wide planning if counties prefer not to establish new agencies for integrated planning
- Potential funding sources for planning, service, and programmatic initiatives

Additional supporting tables and information are provided in Appendix G and Appendix H. Section 6.5 presents a summary and implications from the work in the Plan.

6.2.3 Recommendations and Resources

This Plan, and in particular this section, serves two main purposes:

- Develops recommendations and a Plan for the state guiding progress over the next 20 years in the areas of collection and diversion
- Serves as a resource document for the communities, counties, stakeholders and regional planning agencies considering change as a result of the state's adoption of the Plan and its collection and diversion goals and recommendations. The resources are designed for urban/ suburban and rural areas of the state

As a resource document for collection and diversion in communities, this section of the Plan includes:

- **Cost models**: This section refers to the results of cost models, to generate costs for the recommended strategies at the local levels (Sections 6.3 and 6.4). Template cost models, providing ranges of costs for collection and diversion in urban, suburban and rural areas of the state are provided in Appendix E
- **Tables of high impact/low cost initiatives and inventories of programs and funding options**: Tables of recommendations for effective and cost-effective collection and diversion programs and initiatives suitable for different state regions –illustrating programs that are high impact/low cost and identifying other strategies that are less effective and more costly (Section 6.4). The Plan also provides an inventory of "typical" recommendations in zero waste plans (Section 6.4), and next stage product stewardship and market development options for the state and for communities considering advanced options (Section 6.3). Funding strategies suitable for the local and state level area also described and assessed.

- **Access to "Comp Plan in a Box©"**: Opportunities for Colorado Community staff, county staff or planning agency staff to obtain a list of tailored community-specific strategies because CDPHE has contracted for one year's worth of results from SERA's "Comp Plan in a Box©" for community staff requesting the service.[1] This is accessed through the web link www.surveymonkey/r/SERAcompplaninabox.[2]
- **Collection and diversion case studies:** The Plan also contains many case studies in Appendix C of communities and programs that illustrate how various strategies work in real-world communities, with a focus on Colorado examples. These case studies are referenced throughout this Plan.

6.3 Introduction and Summary of State Level Recommendations

6.3.1 Overarching Considerations

In addition to the content for the Plan that is required on the collection and diversion side, several additional overarching considerations are being considered in the development of recommendations and program elements.

- **Opportunities to divert**: To achieve diversion, the opportunity to recycle must be available. Having some minimum access to at least drop-off options within some reasonable distance of population centers is a core principle in this Plan. This is consistent with 30-201-101.5 CRS, which suggests that reducing waste is a community ethic that CDPHE should promote. It is also a principle of state-level recycling legislation around the US since at least Oregon's "Opportunity to Recycle" legislation dating back to 1991.
- **Barriers**: The Plan recognizes barriers; in fact, a substantial effort on the project was to conduct 10 stakeholder meetings in very different areas of the state to identify the priority barriers for each region of the state – as well as for the CDPHE. The Plan addresses a number of key barriers, but also notes others that are not easily "addressable," and that must be recognized short or longer term, and that drive the expectations and recommendations at the local and state level.
- **Motivations**: Without motivations, status quo will prevail and virtually no change will occur. In the real world, actors act in their best interests, according to markets and to rules that are set out

[1] Up to two requests per agency, from July 1, 2016 through July 15, 2017. Agency staff respond to 25 questions on a Survey Monkey form, and the inputs are used in the model to generate a tailored list of residential and commercial program recommendations for that community using SERA's "Comp Plan in a Box" program. Contact SERA at 303/494-1178 or Skumatz@serainc.com to use this resource.
[2] No additional discussion of this topic is included in the Plan; the web link explains the resource.

(and enforced). The Plan works to integrate motivations into the recommendations where possible.

- **Diversification**: Work on previous plans has made it abundantly clear that the burden of responsibilities for solid waste strategies should be spread across many actors. Concentrating too much responsibility on one actor (e.g. haulers, etc.) does not recognize that changes need to occur at all levels, leads to resentment and lack of cooperation from affected actors and does not well-leverage the change. Spreading responsibility around recognizes the responsibility all had in the *status quo* and that all have in moving toward a solution.
- **Information**: Information alone is not motivational, but the right information can be leveraged with self-interest to effect change, and can provide foundational information (costs, impacts, program ideas) useful for communities and stakeholders to develop plans that are well-informed.
- **Enforcement**: For those strategies that need enforcement, enforcement should be the expectation. Without enforcement, changes and new rules are legally meaningless, are ineffective in motivating change in the market, and are unfair to those following the new rules. Enforced rules represent a "level playing field." If new rules are understood and reasonably enforced, stakeholders will generally follow the new rules. Without enforcement, those complying will face economic disadvantage, and their businesses will be hurt, which would not be the intent of any new initiatives.
- **Economics and tradeoffs:** There are economic issues at play. Stated landfill tipping fees do not, in many cases, fully cover the cost of compliance and closure, leading to understatement of costs. Very inexpensive diversion programs could help reduce costs, and extend lifetimes of landfills. Most areas of the state face unfavorable economics between landfilling, recycling and composting, with tipping fees and combined out-of-pocket collection/transport/management costs favoring disposal. However, near-term economics is not the entire picture. A tipping fee for an "almost full," or "about to close" or "out of adequacy" landfill is not truly the low tipping fee most sites charge in Colorado – it is much higher (as discussed in Section 3). This also extends to small landfills, where the costs of adequacy (and potentially coming into compliance) along with the highly fixed costs of running the landfill are spread over relatively few tons.[3] There are diversion options that are very inexpensive to implement; they can also substantially extend the lifetime of existing landfills, with potential savings, depending on the cost of running and replacing the landfill. Implementing some of these initiatives, and regionalizing landfills can be a cost effective set of strategies, and can lead to savings for communities and landfills.

[3] And the market is not perceived to be able to bear the landfill tipping rates that would result.

- **Economic development and wasted value**: There is potentially as much as $150 per ton in profit (and additional job creation benefits) to be realized by diverting and recovering more of Colorado's "single stream mix" recyclables from the waste stream – and more per-ton value from specific materials. A high percentage of materials disposed in Colorado have market value if they were recycled instead of disposed. A 2015 study[4] found that 27% of the disposal stream, or about 1.2 million tons per year was currently recyclable (not including "advanced" recyclables) and the buried value was between $145 and $170 million annually. The value (at 2015 prices) was about $120 per ton gross, and about $60 per ton net. Disposal costs range from about $15-$60 per ton in the state or about $30 per ton average. This leaves a considerable margin to work with - on the order of $150 net per ton gross revenue (and more for individual materials) to cover collection, transport, processing and marketing.

6.3.2 Level 1 and Level 2 State Level Collection and Diversion Recommendations

6.3.2.1 Level 1 Recommendations

In this section, the state-level recommendations for the collection and diversion sections of the Plan are summarized. **These Level 1 recommendations are almost universally items that CDPHE can introduce and act on, at least to some degree, immediately, with its existing authorities and funding sources**. These recommendations are presented in Table 6-1.

[4] Skumatz and D'Souza, "Colorado's Wasted Value: Recyclables Discarded in the Front Range and Rest of the State and their Dollar, Job, and GHG Impacts," Skumatz Economic Research Associates, Superior, Colorado, May 2015.

Table 6-1: Level 1 Collection and Diversion Recommendations

1. **Adopt Goals**: Adopt the recommended Two-Tier Diversion Goals – Short and Long Term – and Support/Conduct Activities to Achieve the Goals
2. **Improve Tracking**: Improve Performance Tracking and Reporting (to the Legislature)
3. **Training Focus**: Enhance CDPHE Diversion Training/Technical Assistance and Outreach on Collection and Diversion
4. **Inspections & Incentives**: Increase Inspection efforts on non-Adequate Landfills with an Emphasis on Providing Clear and Substantial Economic Incentives for Compliance and Diversion
5. **Regional Planning Initiative**: Establish Regionalized Solid Waste Planning Emphasizing Diversion Alternatives
6. **Supporting Funding**: Support/Fund Regionalized Solid Waste Planning emphasizing Diversion by use of revised RREO grant priorities
7. **Recycling Access Statewide**: Fill Gaps in Recycling Opportunities/Drop-off Networks in the State and Support Existing Infrastructure
8. **Materials Management in CDPHE Operations**: Implement Zero Waste (ZW), Extended Producer Responsibility (EPR), Life Cycle Cost Analysis (LCA), Materials Management (MM), Reduction, and other policies and principles in CDPHE operations
9. **Support MM**: Support ZW, MM and LCA where possible
10. **Supporting Authorities**: Seek additional Supporting Authorities and Identify Collaborative Working Arrangements with Other Agencies/Actors for near/longer term Diversion and Materials Management Progress in Colorado

For each of these 10 Level 1 diversion recommendations, Table F-1 in Appendix F provides a detailed discussion of:

- Specific **action elements** under each of these recommendations
- **Why** these strategies are high-level recommendations for CDPHE under this new 20-year plan
- Notes on **existing authorities/funding sources** that can support these activities

Given that there is always concern about the degree to which CDPHE (an agency with a primarily regulatory focus and very limited funding) can act on various recommendations, **notes are also provided identifying the source of the authority for these items, and the funding sources** – with a **strong emphasis on existing authorities and funding sources**.

Level 2 "Supporting" Recommendations. It is likely that CDPHE will find that substantial, on-going change in this state of the types envisioned by the Level 1 recommendations is hampered somewhat by CDPHE's current limited arsenal of available authorities. The Project Team examined additional authorities that CDPHE may find helpful in realizing the full intent of the Level 1 collection and diversion recommendations. These additional Level 2 recommendations are presented in Table 6-2; details are presented in Table F-2 in Appendix F. Note that as CDPHE adopts and begins to act on the 10 Level 1 recommendations, it may find some of the existing authorities or cooperative arrangements with other agencies are sufficient into the future, reducing the need for some Level 2 items. For example, a strong

network of regional COG planning agencies may adopt the regional solid waste planning responsibilities readily, with cooperation by the counties involved, reducing the need for Item 2 in Table 6-2. In addition, funding for additional CDPHE staff would be necessary to fully implement the Level 2 strategies, and to oversee implementation of the Plan, should the authority and funding be granted. Also, as it undertakes Level 1 efforts, CDPHE may also find this list is insufficient and add other items as priority barriers/needs for authority.

A review of Appendix F is important to gain an understanding of the elements and steps included in the recommendations in Levels 1 and 2, and the rationale for their priorization as recommendations. The details in Table F-2 include:

- Why the additional authority would be beneficial in assisting CDPHE in achieving the objectives of the Plan;
- The perceived and real barriers to flexing this type of authority; and
- Possible avenues to pursue for gaining or leveraging toward the desired authority.[5]

Table 6-2: Level 2 Collection and Diversion Recommendations[1]

1. **Enforce Goals**: Ability to Enforce Adopted Diversion Goals
2. **Hauler Licensing**: State Licensing of Haulers
3. **Require Regional Planning**: Authority to Require Regional Planning and Establish Planning Authorities
4. **Funding for Planning**: Authority to Provide Designated Funding Source for Regional Planning Activities
5. **Implement/Enforce State-Level Strategies**: Ability to Implement and Enforce Collection and Diversion Strategies Best Applied at the State Level
6. **Landfill Surcharges**: Authority to Increase Landfill Surcharges
7. **Supporting Legislation**: Pursue Legislation to Obtain Authorities
8. **If/as authorities are gathered, establish prescriptive and performance-based strategies:** Recommend flexible, well-suited options for two tiers of prescriptive options[1] for communities in addition to enforceable performance goals.

1. These minimum programmatic/opportunity to recycle standards are listed as Level 3 in Section 6.3

To support the last element of these recommendations, this section includes “minimum access standards” (designated Level 3 strategies) and more advanced standards (Level 4 options) later in this section. These recommendations provide a prescriptive approach for communities, which may be attractive to communities that feel a performance goal is not specific enough. The Level 3 options approach, adapted from the state of Oregon’s Legislation, recognizes that different requirements are suited to urban/metropolitan/central locations than for more distant and less densely populated areas. The number of recommendations for the two areas differ (fewer in more rural areas). The Level 4 options adapt the new standards instituted in Vermont. Level 4 recommendations differ from the previous

[5] Source: Based on analysis by the diversion project team, after discussions regarding existing legal authorities between diversion Project Team and legal counsel for CDPHE.

recommendations in that they are more aggressive, and ratchet up access, incentives and program minimums in recycling and organics over time. These strategies may be best suited as a guideline for the more densely populated areas of the state and those with better market access. All four "levels" of strategies are designed to prefer reuse, recycling, composting, and diversion over landfilling and disposal.

Other strategies stakeholders were interested in seeing the state work on included:

- Release streamlined compost siting standards, include options with food
- Break down silos/barriers in CDPHE/collaboration
- Statewide level market analysis study
- Bottle bill
- Work toward possibly transforming curbside recycling into an industry-supported programs. Examples include the Blue Box program in Canada, in which the municipal recycling programs are now funded by contributions from the paper/fiber and container industries whose products make up the materials collected.[6]

Longer Run Strategies. Finally, note that these strategies are not associated with a timeline. If the state does not acquire additional authorities, there is little it can do beyond the Level 1, or possibly some Level 2 recommendations. Acquiring additional strategies can be a very long process, but this is a 20-year plan. The state may be successful in gaining some (currently unknown) set of strategies beyond its current purview. To provide for this situation, the Plan provides Level 2, 3, and 4 recommendations, a list of potentially-appropriate strategies in the realm of product stewardship and materials management, and a list of zero waste strategies for consideration at the local level for advanced areas of the state (Section 6.4).

Support for the Strategies. The top three strategies receiving the highest votes by stakeholder meeting participants per question are included in Table 6-3 and Table 6-4. For example, in the question that included as one of the choices whether the state should adopt a 2-tier goal, in the Western Slope region that choice received the first and second highest scores out of approximately 10 choices. Not all the recommended strategies were voted on during the stakeholder's meetings.

[6] Industry contributes to a non-profit which distributes the funds, and/or contracts for service, depending on the location. One example is found at: http://stewardshipontario.ca/service-providers-municipalities-bluebox/the-blue-box-program-plan/. Other examples of industry-funded programs are paint care programs, e-waste takeback, and mercury thermostat collection programs.

Table 6-3: Top Ranking Regional Support for Level 1 State-Level Collection and Diversion Strategies

Level 1 Strategy	Front Range	Mountains	Eastern/ Southeastern	Western Slope
1. Adopt 2-tier Goals	1*	1~	1	1-2
2. Improve Tracking	1*	1~	2-3	2
3. Training Focus	1-3	1-3	1-2	1-3
4. Inspection/Incentives				
5. Regional Planning Initiative	2-3**	2-3	3~~	
6. Supporting Funding	2-3 **	2-3	3~~	
7. Recycling Access Statewide (hub/ spoke & drop-off)	2-3	2-3	1-2	
8. MM in CDPHE Operations				
9. Support MM				
10. Supporting Authorities				

***** Not including Pueblo; **Not including Denver; ~Not including Silverthorne; ~~Not including Sterling
This table shows the participant voting ranking results of the top three strategies per question

Table 6-4: Top Ranking Regional Support for Level 2 State-Level Collection and Diversion Strategies

Level 2 Strategy	Front Range	Mountains	Eastern/ Southeastern	Western Slope
1. Enforce Goals				
2. Hauler Licensing	1*	1~	2-3	2
3. Require Regional Planning	2-3**	2-3	3~~	
4. Funding for Planning	2-3 **	2-3	3~~	
5. Implement/Enforce State-Level Strategies				
6. Landfill Surcharges	2-3*		3	3
7. Supporting Legislation				
8.MM in CDPHE Operations				
9.Establish Performance & Prescriptive Strategies				

*Not including Pueblo; **Not including Denver; ~Not including Silverthorne; ~~Not including Sterling
This table shows the participant voting ranking results of the top three strategies per question

Funding Options at the State Level. State-level funding authority is a critical component of a Plan, both to fund state activities related to planning and oversight, and delivering the state-level Plan's elements. A review of the variety of funding options available in many states around the country is provided in Table 6-5[7], along with an assessment of their suitability for the state level[8] in Colorado.

[7] Adapted from Skumatz, "Footing the Bill for Diversion Programs: Funding Options", Skumatz Economic Research Associates, 2007.
[8] Local funding options are discussed later in the section.

Table 6-5 shows that current authorities for funds for CDPHE – and for passing funding to local efforts – is very limited. Disposal fee surcharges, which form a significant funding source for CDPHE, would take some change for the CDPHE to be able to take on substantial new activities. Other options, although limited, are also available, including supplementation environmental project (SEP) funds.[9] Industry funded programs are not in place in the US, and are most appropriate to the local level. Authorities that form the core of revenues for other states, disposal fee surcharges, newly authorized planning fees, fees on various products (not allowed), bottle bill escheats (not in place), and other sources, cannot be counted on to fund new efforts in the state. To the extent the state requests new authorities (from the legislature), it would need to request funding associated with the authorities. Barring that, appeals for greater efforts that are construed as under current authorities, will need to be made to the Solid Waste and Hazardous Waste Commission, in order to affect the funding situation both to CDPHE and the RREO – a critical near-term link in being able to motivate change in the state.

Table 6-5: Potential Funding Sources and Colorado "Fit"

Source	State/ Local	Available Now?	Priority	Discussion for Colorado
Disposal Fee Surcharge	Both	Yes	High	Increase existing surcharge to provide economic incentive and use funds for planning, grants, programs, enforcement
Differential Disposal Fee Surcharge	Both	No	High	Charge a higher surcharge for communities not meeting goals or without regional plan in place. Provides economic incentives to save money by meeting goals. Use funds for planning, grants, programs, enforcement
Hauler Registration or Licensing Fees	Both	No	High	Introduce a statewide (or local) fee for hauler registrations, related to oversight, data collection, enforcement, etc.
Fines	State	Yes	High	Fines for non-compliance or enforcement actions used to fund monitoring; difficult to reassign to recycling
SEP Funds	Local	Yes	High	SEP funding is available to recyclers/composters, but is not well known. Incentivizes diversion
Planning Fee Authorization	Local	No	High	State authorizes ongoing funding source for regional planning and/or programs. Often on per-ton basis or population based
Tax on first Sale of Toxics in the State	State	No	Medium	Incorporate a dedicated tax on wholesale sale of toxics in the state with funds used for proper management
Industry-funded Recycling and EPR Programs	Both	Not used	Medium	Industry contributes to e.g. going to EPR can reduce the revenue requirements at least at the local level

[9] Fines were mentioned in stakeholder meetings, but they are limited in level and use. However SEP funds could potentially be better advertised and used to support diversion. CDPHE could advertise SEP funding to recyclers/composters, as there is currently limited knowledge of these funds. https://www.colorado.gov/pacific/cdphe/supplemental-environmental

Table 6-5: Potential Funding Sources and Colorado "Fit"

Source	State/ Local	Available Now?	Priority	Discussion for Colorado
Severance, Lottery, Marijuana Tax, Hunter License	Both	No	Low	Allocations from specialized funds. Needs work at the legislative or other level. Easier links could potentially be drawn to severance, hauler license, or hunter license fees because of environmental or service links
Traditional Bottle Bills with Escheats	Both	No	Low	Collect small fees for container sales, rebated when returned through system. Funds not reclaimed (escheats) can be used for recycling/solid waste management at state level. Must be separately accounted to designate to specific purposes and the program designed to not impact TABOR revenues
Bottle Bills Revenues – without Rebates for Returns	Both	No	Low	One bottle bill system specifically did not rebate funds to returnees, and instead endowed a grant program to fund needed state infrastructure, with grants to cities or haulers
Litter Fees/Advanced Disposal Fees	Both	No	High	Product-based fees that are used toward the appropriate management of targeted waste streams. Examples include litter fees, single use bag fees, and others. Requires a nexus study to draw link and establish appropriate/justifiable fee. Rarely raise significant funds beyond the limited product management
Single Purpose Fees/Taxes for Recycling	Both	No	Low	With TABOR, this might be feasible to the extent a service is associated/rendered
Environmental Revenues	Both	No	Low	Carbon or emissions credits can be difficult to assign uniquely, and the State may not be first in line for the allocation, favoring local program deliverers. Air space guarantees are not very valuable in Colorado, not facing significant landfill space shortfalls

6.3.3 Operationalizing the Level 1/Level 2 Recommendations – a Near-Term Recommended State "Work Plan"

There are several steps that will help operationalize the recommendations in the short- to medium-term – without any changes to legislation.

- **RREO grant program revisions**: Revise the solicitation to communicate the target is regional planning; award higher points to regional planning efforts rather than small planning projects and non-regional plan projects; phase in revised eligibility criteria, making ineligible grant requests from any actors in those areas without completed (or in-progress) regional plans. Work with RREO to develop minimum content of the Plan, with guidance from the recommendations in this document.

- **RREO rebate program revisions**: Revise the criteria for the RREO rebate funds to allow application to broader diversion activities.
- **Meetings to revise/partner with Environmental Leadership Program (ELP)**: Meet with the ELP staff to explore the potential of adding "community is part of completed or in-progress regional plan" to their criteria for ELP status. The goal is to provide additional pressure to regional plan development. If this is not possible, develop a similar program, providing benefits of discounted or streamlined inspections or permitting, or similar benefits.
- **Meet and explore partnerships with regional planning agencies (e.g. COGs)**: Set up meetings with COGs around the state (or a series of group meetings) to explore their interest in expanding their scope of planning to include integrated solid waste and diversion/materials management planning. Mention RREO grant, ELP and other benefits to regional actors. Provide information on potential reduced waste management costs from regionalizing landfills, and from high impact/low cost diversion strategies. In short term (before new funding options arrive) mention funding source of RREO grant funds, and explore shared savings models to fund planning. Where possible, help organize/designate single or group planning agencies as appropriate. An initial list of candidate agencies is provided in Table 6-6.
- **Disseminate Plan information widely**: Disseminate Plan information widely across the state on the Plan, and on the economics of landfill operation, closure and disposal alternatives. Discuss and explain the goals, the recommendations, regionalization and planning, associated grants and incentives and the resource aspects of the document. Emphasize the 10 regional stakeholder meetings, and the regional design of the Plan. Focus on near term, but discuss longer-term directions as well.
- **Begin webinars, stakeholder meetings and outreach**: Prepare a series of training webinars open to state stakeholders, communities, counties, consultants, landfills, elected officials and others. Topics to consider: 1) outreach on the completed Plan and its recommendations and implications; 2) regional recommendations, program strategies and costs (for each of the four regions); 3) educational sessions on integrated planning, rural strategies, PAYT, cost-effective strategies, more effective citizen outreach programs; composting; EPP strategies; strategies for commercial and multi-family sectors; 4) the workings of the "Comp Plan in a Box" model to get participation; and 5) other topics requested by state communities or stakeholders. Position CDPHE staff as experts who use information from the Plan and available publications to work one-on-one with communities/counties/planning agencies. Continue the series of stakeholder meetings to periodically re-engage the regional stakeholders with CDPHE in this broader (non-enforcement) light.

- **Consider instituting periodic regional (and state-level) stakeholder meetings going forward**: At least two of the 10 Stakeholder meetings conducted as part of this project requested the meetings be held periodically – one suggested quarterly because they valued the networking and ability to learn about successful programs, market issues, collaboration opportunities and other issues in the region and state-wide. CDPHE staff should consider convening meetings at least annually (potentially every six months) to provide these opportunities – and to position CDPHE as an agency that provides information and training, addresses prevention and other issues and does more than enforce.
- **Meetings/informational sessions with Solid Waste & Hazardous Waste (SW&HW) Commission**: Prepare and deliver briefings for the SW&HW commission on the Plan, including industry stakeholders interested in revisions to the landfill tipping fee and making credible case for CDPHE and RREO allocation increases. Present information on successes in other states. The goal is to create an environment friendlier to increases in the tipping fee for CDPHE and RREO, and potentially to allow incentive-based differentials in the tipping fee's design based on progress toward goal.
- **Encourage development of regional 'eco-parks' located at or near landfills/transfer stations**: As landfills close or are converted into transfer stations, not only should recyclables and compostables be collected there, but also processed/reused/remanufactured/composted at these locations.[10] This creates local job development, reduced transportation costs and regional cooperation.
- **Improve compliance**: Work within the CDPHE to refine the rationale for non-compliance. In addition, prepare short documents on the costs of compliance, and the most cost-effective diversion options and policies, and the effect on landfill lifetimes.
- **Ramp up measurement efforts**: Ramp up measurement efforts and plan for the next round of improved measurement, introducing the new metric.
- **Waste composition study**: Identify cities or counties in the state that have conducted waste composition studies in the last one or two years, and compute Percent of Recoverable Remaining (PRR) for those areas. Use to refine the definition. Then identify cities or counties in the state planning waste compositions in the near future, and work with them to assure PRR can be computed from their results. Work with them to identify whether there are economies from adding simplified waste compositions (able to support PRR computations) for a few outlying areas of interest. Then identify (regional planning) areas of the state that need waste composition

[10] This strategy was suggested and supported by CAFR's 2015 Summit triumvirate work and is based on successful programs being piloted around the country.

studies that will provide a reasonable baseline for the PRR for the state and allocate funds for that work. Work with the regional planning agencies to develop a PRR monitoring protocol going forward, including periodicity of the measurements.

- **Pilot test draft hauler data collection form:** Find partners around the state (communities/counties or haulers) willing to pilot test a recommended reporting form and use the feedback to 1) solicit comments and work on improvements to the reporting form and procedures; and 2) use the new (partial state) information to prepare an improved next Legislative Tracking Report.
- **Backhauling**: CDPHE work with CDOT on relaxing fees/regulations to back haul recyclables to markets, especially from rural areas.[11]
- **Design/adopt/implement MM principles and practices at CDPHE**: Contact communities and counties with strong waste diversion and materials management practices to identify strategies suitable for integration into CDPHE operations. Examples include San Francisco, Boulder, Alameda StopWaste and others. Work toward incorporating Sustainable Materials Management (SMM) into policy and program development.
- **Meet with CDPHE attorneys and others to explore potential strategies for achieving authorities (or "authorities – light"):** Work with the attorneys and others (heads of other departments/agencies, etc.) to identify strategies for achieving additional capabilities related to the Plan's recommendations.

Of course, adding new authorities considerably expands CDPHE's ability to implement and enforce changes that encourage recycling and diversion in the state – and the progress toward recommended goals over time. The vast majority of the state already has regional bodies conducting planning work on issues of concern. Most of the agencies address transportation, housing and aging population, with other topics also addressed. Currently few of the COGs address solid waste in Colorado; however, Tri-County Health and Northeast County Health Department address solid waste to some degree and may also be considered as potential partners. Table 6-6 also lists the areas of the state without known COGs.

[11] A particularly good model is ALPAR in Anchorage, which established a non-profit to organize the efficient gathering and preparation/scheduling of recyclables, using backhaul space donated by major industries bringing materials into the state (beverage manufacturers, etc.)

Table 6-6: Potential CDPHE Planning Agency Partners for Regional Planning

Topic	Front Range	Mountains	Eastern/Southeastern	Western Slope
Presence of Potential Regional Planning Agencies	Pike Peak COG (PPCOG), Denver Regional (DRCOG), Pueblo Area (PCOG), North Front Range Transportation & Air Quality Planning Council; East Central Council of Local Governments (ECCOG, shared with Eastern/Southeastern)	Upper Arkansas Area (UAACOG), Northwest Colorado (NWCCOG) San Luis Valley Council of Governments/Development Group	Northeastern Colorado Association of Local Governments (NECALG); South Central Council of Governments (SCCOG); East Central Council of Local Governments (ECCOG, shared with Front Range)	Southwest Colorado (SWCCOG); Mesa County Regional Transportation Planning Organization; Associated Governments of Northwest Colorado (AGNC)
County Gaps in Potential Planning Agency Partners	No gaps	Gunnison, Hinsdale, Saguache, Mineral, Rio Grande, Alamos, Conejos, Costilla	Crowley, Kiowa, Otero, Bent, Prowers, Baca	Delta, Montrose, Ouray, San Miguel

6.3.4 Colorado's Recommendations in Context – Other States' Plans and Implications for Level 3/Level 4 "Next Generation" Recommendations

The recommendations summarized above can be put into context relative to the content and recommendations for plans in other states. Five selected examples are provided to show the range. Because Colorado is rather behind in the area of legislation on diversion, previous-generation/replaced legislation is provided (and in some cases, focused on) in some state cases. In short:

- Oregon's Original 1983 "Opportunity to Recycle" Plan had several attractive features that have been incorporated in the Diversion recommendations in this Colorado Plan. It established **two-tier goals** that recognized the differences between **urban/suburban and rural** conditions **(with performance and prescriptive elements)**. It established both a numeric goal (performance), and lower vs. higher numbers of prescriptive elements that were required for large/urban vs. small/rural communities. The law listed 12 fairly basic strategies or best management practices, and the 1997 update required cities with populations greater than 4,000 to provide at least three strategies from the list, and towns of 10,000 or more must provide "an additional one or two, depending on the activities chosen." The menu of strategies included:

    1. Weekly single family curbside recycling program, same day as trash, with container provided
    2. Enhanced education/outreach program

3. Multifamily recycling of at least four materials for buildings with five or more units with education
4. Effective yard waste collection (monthly or more frequent) or drop-off program (open at least once weekly) composting program, also promoting Back yard composting (BYC)
5. Commercial recycling program with weekly on-site collection for businesses with 10+ employees or 1,000 square feet or more, with associated education, and optionally, waste assessments and recognition programs. Commercial goal should be to strive for 55% diversion
6. Recycling depots for recycling the "principal recyclable materials" with regular/convenient hours, open on weekend days, and collect additional recyclables when convenient/possible
7. PAYT rates for households
8. Collection and composting program for commercial/institutional businesses that generate large volumes
9. Commercial recycling program that requires commercial generators of large amounts of recycling to recycle
10. Program for monthly or more frequent on-route collection of food and compostables from residential service customers, including an education component
11. Recovery program for construction and demolition (C&D) that requires C&D separated at generation site or sent to facility for separation; includes an education component
12. A food waste collection program requiring non-residential generators that generate large amounts of food to source separate food for recovery

- California's AB939 Legislation (1989) established a wide array of changes designed to motivate intensive recycling, diversion and waste reduction program development across the state. It authorized regional planning agencies, and gave them substantial new funding sources to support the planning. It required the regional planning agencies to conduct planning work/documents including SRREs (Source Reduction and Recycling Elements – a comprehensive planning document) and conduct detailed waste composition studies in their territory to inform the plans. They established a measuring method with rules – "landfill diversion" (selected because it also addressed source reduction). The state set goals for landfill diversion, relative to a 1990 baseline, of 25% by 1995 and 50% by 2000. Results were posted by area and community on a website for

comparison; plans were also posted. The state set substantial financial penalties for not reaching goals.[12]

- Iowa's original 1990s legislation established a 50% diversion goal. Communities not meeting goals must advertise the failure to meet goal to its residents; must put in a PAYT program; must pay higher landfill surcharges that achieving communities, along with other enforcement elements. The difference in surcharge is $3.75 per ton for communities with 25% diversion or more, and $4.75/ton for those not reaching the 25% goal. The state retained $0.95 per ton for implementation/planning, and $0.50 for environmental protection.
- New York's 2010 plan includes a number of recommendations and strategies. Most noteworthy is the recommendation of a numeric goal. The state's plan is a **generation** goal – not diversion. The state goals are phased-in reductions of generation per capita that began with the 2010 goal of 4.1 lbs. solid waste/day/capita, to 2016's 2.9 lbs. solid waste/day/capita, to 2030's 0.6 lbs. solid waste/day/capita. This is a reduction of 85% in generation over a 20 year period. Aggressive is not a strong-enough term for this goal.
- Vermont has a very straightforward prescriptive-approach plan (Act 148, passed 2012), which is being used as a model in several other states. It is based on three tenets for increasing recycling – convenience, incentives and mandates. It focuses on a phased implementation assuring access and eliminating (economic) barriers. The phase-in of program requirements includes (July 1 for all years):
    - 2014: Transfer stations and drop-offs must accept recyclables at no fee; Food scrap generators of 104 TPY must divert material to any certified facility within 20 miles
    - 2015: PAYT statewide (volume or weight); recyclables banned from landfill; Transfer stations/drop-offs must accept leaf and yard debris; haulers must offer residential recycling at no extra charge (embedded); public buildings must provide recycling containers adjacent to solid waste containers (except restrooms); food scrap generators of 52 TPY must divert material to any certified facility within 20 miles
    - 2016: Leaf, yard and clean wood waste banned from landfill; haulers must offer leaf and yard debris collection; food scrap generator threshold at 26 TPY
    - 2017: Transfer stations and drop-offs must accept food scraps; haulers must offer food scrap collection; food scrap generator threshold to 18 TPY

[12] The stated penalties were fines of $10,000 per day for not reaching goals (very substantial for large or small communities, dramatically changing the economics of recycling). Ultimately communities were not fined, with "best efforts" being recognized.

    - 2020: Food scraps banned from landfill
- New Oregon Legislation: Given that the state's original plan has led to substantial program development around the state, PAYT statewide (through hauler rate design requirements in regulations), and universal access, this new plan goes to the next step. It works to increase research and information, and works to integrate consideration of materials management more widely into waste management.

In crafting the collection and diversion recommendations for Colorado, lessons from other states' plans were considered.

- Oregon's **two-tier** goal-setting approach is extremely well-suited to Colorado; it has a "Front-range-like" area with denser populations and access corridors, and a "rest of state" that is more rural and has mountains and distance issues.
- Oregon and Iowa have elements of a **performance and prescriptive** approach – reach the goal using programs the town selects, but if goals are not achieved, some prescriptive elements come into play. This has attractive aspects, allowing creativity, but also ultimately forcing progress and change if it is not achieved without intervention.
- **Financial incentives** are important to gaining compliance. California's aggressive approach absolutely spurred market change and action, but this approach would not be acceptable in Colorado (and ultimately was not enforced in California). **Iowa's two-tier tip fee surcharge may be a more suitable approach in Colorado, but the dollar differences per ton must be large enough to incentivize action, or they are not worth the administrative and enforcement efforts**.
- **Funding the planning and programs** is important; avoiding unfunded mandates is critical. Each state had an array of funding sources; California and Iowa's are quite clear.
- New York's **goal is not practical or realistic**. Goals should be set that 1) are potentially achievable, 2) relate to the behaviors being sought, and 3) measurable. New York is highly unlikely to be able to reduce generation by such a huge percentage; regulating demand is extremely difficult in a world of Amazon.com, and considering supply/demand lessons like Prohibition and the War on Drugs. Given Colorado's situation – measurement and recycling maturity – two performance metrics are recommended. The first recommendation is the traditional diversion rate goal (including recycling and organics[13]); and secondly, introduction of another metric is recommended that directly reflects the behavior being requested, PRR. Major

[13] Tracked potentially through hauler reporting or a continuation of current facility-based efforts.

advantages of this metric include clear source of information, simplified waste characterization, and actionable results (indicates what is under-performing). Finally, the Project Team also recommends tracking additional information that can be easily calculated from these data, including generation per capita and other similar "normalized" metrics.

- California's landfill diversion measurement metric was fraught with **problems and too complex** and did not provide actionable information. Establishing a baseline requires identifying where all local haulers go with their waste in some base year, and then requires tracking over time – as haulers change and as they change where they bring materials.
- There is **clarity and enforceability** in Vermont's goal; either a program is in place or it is not. This is attractive – should CDPHE gain the authority to make similar requirements.

Each of these considerations is recognized and incorporated into the Level 1 and Level 2 statewide collection and diversion recommendations for Colorado, to the extent the current CDPHE authorities allow.

Note that in some states and communities, higher diversion is the goal, without strong regard for the cost of those diverted tons. The analyses in this report very strongly considered the near- and longer-term costs in developing the goals and strategies, and the cost-effectiveness of "upstream" initiatives (including reduction/prevention, EPP and other strategies). Given that it is a 20 year plan, the Project Team also tries to address marketplace changes that may occur or we may be able to help make happen with strategies in the Plan.[14]

Finally, the review of selected state legislation and plans also highlights strategies that would be suitable for Colorado, should greater authority be granted. These are identified as Level 3 and Level 4 strategies in the following section, and are provided as recommendations suited to the medium and longer term, as authorities allow.

[14] Sustainable programs are marked not just by their "green-ness" but by their ability to be sustainable in the market – or if you are lucky or deliberate or persistent enough to substantially transform the market, then in the transformed market. A no-longer-functioning or unfundable program is not sustainable.

6.3.5 Materials Management and Other State-Level Recommendation Options – Level 3 and Level 4 Strategies

6.3.5.1 Level 3 Strategies – Publish "Standards" on Minimum Program Recommendations for Communities

Given that the state may not acquire additional authorities, and that regional planning cannot, at this point, be guaranteed, one additional step the state can take is to widely publish a list of "expected" program access options for statewide communities. Taken from the Oregon legislation (although Oregon had enforcement powers), this approach will suggest a list of reasonable and flexible program/access options to decision makers and staff at the community and county level. This list could be considered the "minimum expected" for recycling access for communities around the state, and potentially guide governments with a concrete list of minimum expectations. In addition, the list in Table 6-7 recognizes that requirements can be made in some communities, but in others, the strategies are suitable for community or county implementation.

This list has the advantage of being relatively easily "counted," and the state could gather information on the number of communities/counties in the state conforming to the list. Should the communities in the state decide to move forward on these programs, progress would be realized in some areas of the state; presumably those communities that have adopted more aggressive options would not backslide because the drivers for their performance lie elsewhere. Finally, these Level 3 strategies allow communities and regions to increase access to diversion opportunities for residents, businesses, visitors, and others, and move toward goals with a set of strategies tailored to their region.

The recommendation is that:

- the Front Range area of the state should implement at least eight of the following strategies (Table 6-7),
- The Mountain areas should adopt five strategies
- Other areas of the state (more rural areas) should adopt at least four strategies

Additional state "heft" behind the goals may be implemented by coupling the list with access to RREO grants. Communities not adopting the minimum number are not eligible for RREO funds, and lose out on the other benefits noted in the state level recommendations (ELP, etc.). If the community or its county meet the area recycling goal (low or high), they are exempted from this "count."

Table 6-7: Level 3 Prescriptive Menu Strategies – Minimum State Recommendations for Publication (Near-Term and/or if State or Regional Authorities are not Achieved) [1]

1. Enhanced education program by communities or counties or designated actors, annually. 2. Recycling depots/drop-offs with regular, convenient hours, in each town of at least 4,000 population. 3. Curbside recycling offered, single family homes (at least bi-weekly, with minimum requirements for program elements). 4. Curbside recycling, fee embedded in solid waste bill (not separate or options), single family households (at least bi-weekly with minimum requirements for program elements). 5. PAYT rate structure required for single family households (with minimum program elements). 6. Multifamily recycling of at least four materials in buildings with 5+ units, with education provided (minimum program elements), in communities greater than 10,000 population.	7. Yard waste (or yard and food) collection program (single family), at least weekly, or drop-off site open weekends and at least one weekday. 8. Program available for monthly or more frequent on-route collection of yard waste (or food and yard waste) from single family customers, with an education component. 9. Commercial recycling program available for all businesses with 10+ employees or 1,000 square footage, or with 10 CY or greater service per week. 10. Collection and composting program for all businesses generating large quantities or targeted business types (designated by CDPHE Memo, updated). 11. Commercial recycling required for businesses generating large amounts of recyclables. 12. C&D recovery program requiring separate bins at generation or post-separation.

1. Communities in Front Range recommended to implement eight strategies; communities in Mountains recommended to implement five strategies, and the Eastern/Southeastern and Western Slope regions implement four strategies. Number of recommendations increases over time. Communities exempted if they demonstrate they have reached the numeric diversion goals

6.3.5.2 Level 4 and Advanced Materials Management Strategies – Considering More Aggressive Directions in the Medium- to Longer Run

Finally, this is a 20-year Plan. In the foreseeable future, there are few enforcement options available to the state -- and by the time authorities are available for a zero waste plan, the situation in each region of the state will likely have changed. However, if the state acquires real authority in materials management: beyond disposal, there are a number of suitable directions that can be studied, considered and pursued.

- The most direct, and first set of items the state can and should consider, is an adaption of the Vermont scheduled roll-out of direct program requirements for the Front Range. These recommendations are provided in Table 6-8.[15]
- The second set of recommendations that the state should consider and research is a set of product stewardship and market development suggestions that follow in Table 6-9.
- Note that, in addition, a list of typical recommendations from zero waste plans is provided in Section 6.4, as most of these recommendations are targeted more at the local program level.

[15] Note, of course, a different rollout time frame could be used.

Table 6-8: Level 4 Recommendations

Year 1 • Transfer stations/drop-offs must take recyclables at no fee • Food scrap generators of 104 TPY must divert material to any certified facility within 20 miles **Year 2** • PAYT statewide (volume or weight) • Recyclables banned from landfill • Transfer stations/drop-offs must accept leaf and yard debris • Haulers must offer residential recycling at no extra charge (embedded) • Public buildings must provide recycling containers adjacent to solid waste containers (except restrooms) • Food scrap generators of 52 TPY must divert material to any certified facility within 20 miles	**Year 3** • Leaf, yard and clean wood waste banned from landfill • Haulers must offer leaf and yard debris collection • Food scrap generator threshold at 26 TPY **Year 4** • Transfer stations and drop-offs must accept food scraps • Haulers must offer food scrap collection • Food scrap generator threshold to 18 TPY **Year 5** • Food scraps banned from landfill

Table 6-9 includes product stewardship and market development strategies. This list excludes traditional recycling and diversion program access, program mandates and material ban strategies that increase supply – and which are well-demonstrated by the strategies in the previous Vermont-inspired strategies. It is possible that, despite the statutory focus on disposal and disposal facilities, the CDPHE may be able to undertake action in a few of these stewardship or market development strategies, including, but not restricted to:

- Working to incorporate recycling and composting into the state's climate change report, especially given the existing work demonstrating the effectiveness and cost-effectiveness of recycling, composting, PAYT and other strategies in reducing GHG and in job-creation.[16] A strong case can be made in favor of considering SMM options in climate change plans. Using EPA's WARM Model, moving 100 tons of mixed recyclables from trash to recycling leads to greenhouse gas reductions of 86 metric tons of carbon equivalent (MTCE) or 315 metric tons of carbon dioxide equivalent (MTCO2E). The same model assigns 12 MTCE or 42 MTCO2E reductions from diverting mixed organics. The research also indicates SMM options are more

[16] McKinsey & Company, "Pathways to a Low Carbon Economy, Version 2 of the Global Greenhouse Gas Abatement Cost Curve, 2009. For comparisons of cost (cost per MTCE) and job-creation performances for US recycling, composting, PAYT waste management strategies compared to energy efficiency and generation strategies, see: Skumatz, Lisa A., "Biggest Bang for GHG Reduction", *Proceedings of the AESP Conference*, 2009; Skumatz, "Do Energy Efficiency Strategies Outperform Recycling in GHG Mitigation and Job Creation?", Proceedings of the IEPEC Conference, Portland, August 2009; Freeman and Skumatz, "A kWh Is Not Just a kWh: Comparing Various Energy Efficiency Programs in Terms of GHG, Job Impacts, and Policy Achievements (NEBs and Beyond)", Proceedings of the ACEEE Summer Study of Buildings", Asilomar, CA, August 2010 and others.

readily available to communities than are energy options, and many SMM options can be implemented quickly.

- Establishing procurement preferences, at least within CDPHE and publishing the standards for use by other state agencies and communities.
- Supporting tax benefit/exemption legislation proposal that may be brought by industry that provides incentives for expanded diversion and materials management infrastructure.
- Providing useful information and support to local and state economic development staff if they undertake efforts to work to attract recycling/waste management industries to communities, counties or the state.
- Keeping tabs on research at the national and international level to help inform interested communities, counties and stakeholders in the state as part of the CDPHE's revised "information and training" activities.

Table 6-9: Other Advanced Materials Management Strategies - State-Level Product Stewardship and Market Development Options[17]

Diversion Programs	• Have market development priorities • Statewide policies for funding • Local recycling market development zones	• Tying recycling and composting to climate change
Mandates	• Minimum content standards	• Procurement mandates/preferences
Sustainable Materials Management	• Including recycling and composting in climate change plan/tying to climate change	• Support for low carbon fuels and electricity generation
Funding Assistance	• Traditional (disposal surcharges, grants, product fees, product deposits, ADFs) • Bottle bills • State tax exemptions for major recycling facilities • Property tax exemption for specified criteria	• Sales tax exemptions/credits/tax incentives • Coordination with other government or private financing programs • Loan programs (RMDZ, GHG reduction loan programs) • GHG Grants
Extended Producer Responsibility	• Many products (packaging, paint, carpet, mattresses, fluorescents, pesticides, etc.)	• Industry –funded programs (full cost EPR, like British Columbia, etc.)
Market Assistance	• Local market development assistance staff • Technical support and research	• Dedicated recycling industry experts/networking
Other	• Research and development	• Regional cooperation

Again, zero waste strategies the state may consider – or consider requiring at the local level, should the authority become available – are listed in Section 6.4.

[17] Adapted/Selected from Skumatz and Boisson "State of Connecticut DEEP: Strategies for Modernization of the State's Solid Waste Management Infrastructure," 2015. Key chapter on this topic developed by Boisson.

6.3.6 Establishing a "Goal" – and the Role of the PRR Metric

The authorization language for the Plan states that it should establish a "Goal." In addition, the state Legislature also requires CDPHE to report on the state's performance in waste management and diversion, which the CDPHE has been providing for several years. Neither source requires a specific form for the goal or tracking, but tracking and monitoring is an important part of the Plan and monitoring progress toward improvement.

There has been extensive work, and formal work in many states, on the best form for tracking, metrics and goals. The main options have traditionally been variations on the following:

- Diversion rate, or percent of materials diverted (recycled or composted), calculated as recycling tons as a percent of tons "generated" (solid waste plus recycling plus organics tons), or organics tons as a percent of generation, or the combined diversion rate (recycling plus organics divided by generation). Also referred to as a program, recycling, or organics diversion rate.
- Landfill diversion rate, a calculation that compares the number of tons of MSW brought to any and all disposal facilities from a community today, compared to the total MSW tons brought to facilities in a designated "base year." Decreases reflect diversion from programs and source reduction in the community.
- Per-capita generation or diversion tonnages, computed as recycling, organics, or solid waste tonnages divided by population.

Each has pros and cons and vary in their data and reporting needs. The diversion rate attributes progress to recycling and organics, as illustrated in Table 6-10.

The difficulty of the traditional programmatic diversion rate figure is that it does not tell the state what to do next. It tracks progress relative to the previous year (assuming consistent definitions and measurements are used), and allows geographic comparisons, but it does not inform the state about which materials are recycled well or poorly (and which should be the focus of education and recovery efforts), does not allow separate computations of residential vs. commercial performance, and varies with economic conditions. The addition of a new metric PRR – provides the state with a new metric that addresses these concerns. PRR metric tracks the percent of recyclables and compostables still remaining in the disposal stream. The PRR metric uses simplified waste composition studies on the solid waste stream only to identify these percentages. The metric is computed using simplified waste composition sorts from tons at transfer stations or landfills, or from sorts from samples of individual residential and commercial collection trucks. The composition studies are substantially less expensive than traditional

waste composition studies (which commonly sort solid waste into 30+ categories) because the waste needs only to be sorted into "current recyclables," "current compostables" and "all else."

Table 6-10: Pros, Cons and Data Considerations for Measurement Metric Alternatives

	Major Pros	Major Cons	Data Needs
Diversion Rate	Traditional, easily understood, attributable to programs and sectors	Does not reflect source reduction, varies with economic conditions, variations in what is included in different communities	Current program or facility tonnages on solid waste, recycling and organics
Landfill Diversion Rate	Addresses source reduction	Does not attribute progress to specific programs or sectors, must track multiple haulers and facilities, varies with economy, requires ad hoc adjustments; data intensive	Landfill data covering materials attributable to community for current and base year
Per Capita Generation	Simple, normalized metric	No attribution to programs	Current program or facility tonnages on solid waste, recycling and organics and population
Percent Recoverables Remaining (PRR)	Limited data requirements, attribution to general program activities, measures customer behaviors requested, "actionable," relatively invariant to economic cycles	Requires waste compositions but only of the solid waste stream	Simplified solid waste composition study; in simplest form it does not require total tonnages

Some California communities have established goals of 10% (starting at 30% with an extensive list of "recoverables"). A recent publication[18] indicates the Front Range is currently at about 21% based on an intentionally very conservative (short) list of single stream recyclables, and rest of the state (ROS) is about 45%; statewide figures are about 27%. The metric directly tracks the desired behavior – diversion of materials from the disposal stream – without having to worry about variations in economic conditions and their effects on the overall generation stream. The PRR metric requires periodic waste sorting or waste composition studies of the solid waste stream, either at the landfill/transfer station streams, or from trucks or containers. However, again, the costs of the sorts are low because data on only three or four material streams are needed. The total solid waste remaining also needs to be weighed to compute the percent recyclables, and percent compostable (and the combined PRR) still left in the disposal stream.[19]

The recommendations to the state in regard to measurement and goals include:

[18] Skumatz and D'Souza, "Colorado's Wasted Value: Recyclables Discarded in the Front Range and Rest of the State and their Dollar, Job, and GHG Impacts", Skumatz Economic Research Associates, Superior, Colorado, May 2015. The only recyclables included were: cardboard, aluminum cans, HDPE, PET, high grade office paper, ONP, and mixed paper.

[19] A version of the PRR approach is in place in communities in California, with good success. PRR alone does not measure waste reduction. Tracking generation data and program data can help reflect these "upstream" effects.

- Continue **tracking the traditional "diversion rate**" and its constituents, the "recycling rate" and "organics rate" and the combined "diversion rate" as core metrics. These are calculated as percentages of these streams divided by "generation" (solid waste plus recycling plus organics tonnages). Current facility-centric data sources should continue to be used. When hauler reporting is instituted, the state should consider separately tracking results for the **residential and commercial** sectors, and improve regional tracking.
- Add tracking of the **Percent Recoverables Remaining** (PRR) for the state, potentially reporting information separately for residential and commercial streams, and for different regions of the state. In the short run, work with communities and counties conducting studies, and report out the implications of the information identified. If and when authorities are acquired, a periodic system of waste composition studies – or sampling of random trucks – should be implemented, at the state level or as a requirement of waste shed agencies.
- Add **tracking of additional information** that can be easily calculated from these data, including generation per capita and other similar "normalized" metrics.

Deriving the Goals for Colorado: The Plan's goals come from the derivation of practical and, in appropriate areas, more aggressive (stretch) diversion levels in the four designated regions in the state in the near, medium and longer term. These goals are calculated as diversion and PRR goals for consideration and benchmarking by state regions and communities.[20]
The Plan develops recommended goals, setting higher recommended goals for the Front Range than for the other regions to recognize the different levels of achievement that are feasible and reasonable to expect. The primary goal for the Plan should be the diversion goal; the PRR goal is secondary.

Setting goals that require legislation changes to be successful would be inappropriate; rather, the goals would be expected to be revised at that time to reflect the actual levels of authority granted. Therefore, the goals presented in Table 6-11 will appear very conservative. The main progress reflected in these goals is continued growth in access and use of organics programs, improved efficiencies in collection, and growth of infrastructure, making programs more feasible and cost-effective. Some of the growth may also occur as landfill compliance is enhanced, and diversion becomes an increasingly attractive alternative. Note that the goals are not intended to limit the achievement of motivated communities.

[20] CDPHE may elect to continue to report and track other metrics for its own uses and legislative purposes CDPHE tracks and reports on 'recycling' (2 numbers) and 'diversion'. 'Recycling' is generally more similar to EPA's method but usually includes scrap metal. Therefore CDPHE removes that and reports 'recycling' both with and without scrap metals. They also measure and report 'diversion' which includes both MSW and industrial/institutional/commercial.

The near term goals focus on achievements that are possible with continued improvement in access across the state, and a continuation of the trend in the Front Range and elsewhere for PAYT, added organics, contracting, universal recycling ordinances, and other programs. The figures represent a combination of residential and non-residential performance; residential figures would be expected to be higher, and non-residential would likely be lower than the goal presented. The figures assume that the current low market prices for recyclables would rebound somewhat over the period, or progress will likely stagnate. The calculations of the goal are based on computations in Section 6.4.1 (state tonnages and composition), and Section 6.4.2 (analysis of specific strategies). Note that the nationwide average for diversion is currently about 35%, based on EPA figures.

Table 6-11: Diversion Goals for Recycling in Colorado[1]

Diversion Goals (recycling and organics combined)	2016	2021	2026	2036
Front Range	NA	32%	39%	51%
Rest of State	NA	10%	13%	15%
Statewide	23% [2]	28%	35%	45%

1. Conservative Goals reflecting No New Legislative Authorities; includes recycling and organics
2. From CDPHE

Table 6-12: Secondary Goals for Recycling in Colorado – Percent Recoverables Remaining (PRR)

Diversion Goals (recycling and organics combined)	2016	2021	2026	2036
Front Range	21%	17%	14%	10%
Rest of State	45%	40%	34%	28%
Statewide	27%	21%	17%	13%

Should the full range of authorities envisioned in Levels 1-4 of the strategies list be adopted, the state could potentially expect to achieve goals of perhaps 30% by 2021, 35-40% by 2026, and 45%-50% or more by 2026, with higher levels achieved in the Front Range. This is because it is expected that many communities in the Front Range of Colorado can achieve long-term performance levels that come close to those included long-term plans for other major metropolitan areas of the nation. The rural areas will be expected to achieve lower goals, given their economic, density, and transportation challenges. The higher goals for the Front Range as a whole would not be expected to discourage some communities within the area from exceeding these performance levels. The Zero Waste goals in place in some Boulder County and Larimer County communities may be able to lead the Front Range to achievement beyond these goals.

Other metrics to consider tracking over time include generation per capita, important source reduction programs at state level, and indicators related to toxics, among others.

The Plan also estimated the value of the unrecovered recyclables being landfilled annually in Colorado. The calculations in Table 6-13 use five-year average market prices. Additional recovery of recyclables can have real value, and a tremendous share of this value is in the Front Range, where economics for recycling and diversion (at least at five-year average recycling market prices) are not unfavorable.

Table 6-13: Buried Value of Recyclables in Colorado[1]

Region	Front Range	Mountains	Eastern/ Southeastern	Western Slope	Statewide
Value of Recyclables Being Landfilled	$218 million	$12 million	$11 million	$26 million	$267 million

1. Using Five-Year Average Market Revenues

6.4 Diversion Potential at the Local/Wasteshed Level

Increasing diversion and recycling in the four regions of Colorado requires improved access, and regional planning, with the ability to enforce requirements and program initiatives. The economics of low landfill tipping fees, low population density and high transportation costs results in low existing and economic potential for diversion in the regions outside the Front Range. However, the previous section identified strategies designed to improve access to diversion, and suggested that fewer strategies could be "required" outside the Front Range, and additional elements could be required in the populated areas of the Front Range. To estimate the potential from these strategies, three analytical steps were taken:

- Estimate the tonnages available to be diverted in each region, including residential, commercial, and construction and demolition (C&D) and a proxy waste composition for the area.
- Develop regionally-appropriate assumptions about the tonnage totals that would be diverted from each of the 12 - Level 3 strategies in the four regions.
- Develop models and regionally-appropriate cost information for each of the strategies in the region.

6.4.1 Deriving Regional and Statewide Tonnage Estimates

Table 6-14 used assumptions about generation and disposal rates for the various regions of the state[21] and waste composition studies from Mesa County, Boulder County, Larimer County, Southwest Colorado

[21] 7 pounds per capita per day in the Front Range (from SERA Front Range research), 5.9 in the Eastern/Southeastern and Western Slope (from Gillow-Wiles and Trujillo, "Southwest Colorado Council of

Council of Governments, El Paso County and other sources to generate a proxy waste composition for the four areas of the state. Some of these studies provided data on the proportion of materials disposed by residential and commercial sources separately. Using data from each region on population and employment, ratios were developed on the estimated total tonnages of residential vs. commercial sector approximations. Finally, information from a study conducted in Larimer County[22] provided useful information to apportion elements from the residential and commercial sectors into a separate construction and demolition (C&D) sector stream.

Additional information was derived from the state, which provided forecasts of population and employment figures by county in five year increments, beyond 2035. The ratios developed as part of the projections and apportionments for 2016 were then extrapolated to provide projections for five-year increments for the next 20 years. The results at the state level are presented in Table 6-12. The results for each of the four regions are presented in Appendix G. The overall totals and results compared well with the last reports filed by the CDPHE. Table 6-15 presents the portions of the total disposal streams disaggregated into residential, commercial and C&D streams. Finally, Table 6-16 presents the breakdown by material type, summed up from the estimates for the four geographic regions of the state with their regional waste compositions.

Households and businesses within the state generate almost seven million tons of solid waste annually. Given growth rates projected by the state, this number is expected to grow to more than nine million tons in 20 years – unless major changes in upstream waste generation, underlying consumption trends, product stewardship or other structural changes occur in the market.

Governments Southwest Colorado Waste Study", 2015), and a blended rate of 75% Front Range and 25% non-Front Range for the Mountain area. EPA's national figures (of about 4.5 pounds per capita per day) are significantly exceeded by the tonnages in Colorado.

[22] Sloane Vasquez, 2012, "Waste Stream Analysis and Waste Conversion Technologies Review" provided useful ratios and translations to support separation of the C&D stream. Note that the C&D stream is assumed to be similar across the state, for lack of more refined information.

Table 6-14: Projections of Colorado MSW Disposal Tonnages

Region	2015	2016	2021	2026	2031	2036
Front Range	5,840,000	5,946,000	6,492,000	7,043,000	7,582,000	8,121,000
Mountains	296,000	301,000	328,000	363,000	396,000	431,000
Eastern/Southeastern	194,000	197,000	215,000	233,000	248,000	263,000
Western Slope	485,000	494,000	545,000	602,000	660,000	717,000
Statewide	6,815,000	6,938,000	7,580,000	8,241,000	8,886,000	9,532,000
Growth Rate	1.0%	1.8%	1.7%	1.6%	1.4%	1.4%

Table 6-15: Disaggregation of Disposed by Region and Sector (2016)

Region	% Tons Residential	% Tons Commercial	% Tons C&D	Total
Front Range	47%	26%	27%	100%
Mountains	39%	37%	23%	100%
Eastern/Southeastern	41%	38%	21%	100%
Western Slope	40%	38%	22%	100%
Statewide	46%	28%	26%	100%

Table 6-16: State-level Waste Composting Proxy and Associated Tonnages by Material Type, 2016

Material Type	Waste Composting 2016			Tons 2016			Total Tons 2016
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Paper	20.3%	28.2%	1.0%	648,900	542,400	18,300	1,209,600
Cardboard/bags	3.7%	12.4%	0.0%	118,900	238,900	-	357,800
Newspaper	3.9%	3.2%	0.0%	124,600	61,300	-	185,900
Office Paper	1.2%	2.5%	0.0%	37,100	48,900	-	86,000
Paperboard	2.5%	2.0%	0.0%	78,300	38,600	-	116,900
Junk Mail	2.3%	2.3%	0.0%	74,900	44,400	-	119,300
Magazines/Catalogues	1.9%	1.5%	0.0%	61,200	28,400	-	89,600
Dairy/Juice	0.3%	0.2%	0.0%	8,700	4,100	-	12,800
NonRecyclable Paper	4.6%	4.0%	0.0%	145,300	77,700	-	223,000
Plastic	12.4%	12.6%	0.0%	394,200	242,700	-	636,900
Plastics 1&2	7.2%	2.0%	0.0%	229,900	37,500	-	267,400
Rigid Plastics 3-7	0.5%	0.6%	0.0%	15,800	11,800	-	27,600
Polystyrene	0.3%	1.0%	0.0%	10,600	19,100	-	29,700
Other Rigid Plastics	1.8%	3.6%	0.0%	56,000	69,500	-	125,500
Plastic Bags/Film/Wrap	2.6%	5.5%	0.0%	81,800	104,800	-	186,600
Other Plastics	0.0%	0.0%	0.0%	-	-	-	-
Metal	3.9%	5.2%	2.0%	124,200	100,800	36,500	261,500
Aluminum Cans	0.6%	0.5%	0.0%	20,600	9,000	-	29,600
Tin Cans+AG19	1.2%	0.5%	0.0%	37,800	8,900	-	46,700
Other Ferrous	0.6%	1.0%	0.0%	19,200	19,200	-	38,400
Other Aluminum	0.4%	0.3%	0.0%	13,700	6,100	-	19,800

Table 6-16: State-level Waste Composting Proxy and Associated Tonnages by Material Type, 2016

Material Type	Waste Composting 2016			Tons 2016			Total Tons 2016
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Other Non-Ferrous	0.4%	0.6%	0.0%	13,700	11,100	-	24,800
Appliances	0.6%	0.4%	0.0%	19,200	8,100	-	27,300
Other Metal	0.0%	2.0%	0.0%	-	38,500	-	38,500
Glass	3.2%	3.5%	1.2%	101,200	66,600	21,600	189,400
Organics	40.1%	32.3%	5.1%	1,279,100	620,500	93,200	1,992,800
Yard Waste	8.4%	6.0%	5.1%	267,300	116,200	93,200	476,700
Food Scraps	17.6%	16.8%	0.0%	563,000	322,700	-	885,700
Textiles/rubber/Leather	3.7%	2.0%	0.0%	119,300	37,700	-	157,000
Wood	2.9%	5.4%	0.0%	91,000	104,400	-	195,400
Diapers	4.8%	0.6%	0.0%	153,800	12,000	-	165,800
Other Organics	2.7%	1.4%	0.0%	84,700	27,400	-	112,100
E-waste	2.1%	0.6%	0.0%	67,700	11,500	-	79,200
Problem Wastes	17.1%	13.9%	4.7%	545,400	266,800	85,900	898,100
HHW	0.1%	0.1%	0.0%	3,000	2,100	-	5,100
C&D	0.4%	1.1%	78.6%	13,800	22,100	1,436,200	1,472,100
Rock/Concrete/Brick	0.0%	0.0%	31.2%	-	-	570,000	570,000
Asphalt Shingles	0.0%	0.0%	18.0%	-	-	328,900	328,900
Wood (treated)	0.0%	0.0%	11.1%	-	-	202,800	202,800
Wood Dimensional	0.0%	0.0%	10.0%	-	-	182,700	182,700
Drywall – Clean	0.0%	0.0%	5.1%	-	-	93,200	93,200
Drywall – Paint	0.0%	0.0%	10.3%	-	-	188,200	188,200
Other	0.8%	3.5%	1.3%	26,100	67,800	24,100	118,000
Total 2016	100.0%	100.0%	101.0%	3,189,700	1,921,200	1,827,000	6,937,900
Total 2021	-	-	-	3,484,900	2,099,000	1,996,100	7,580,000
Total 2026	-	-	-	3,788,800	2,282,000	2,170,200	8,241,000
Total 2036	-	-	-	4,382,300	2,639,500	2,510,100	9,532,000

6.4.2 Achieving Minimum Progress - Estimated Impact of Basic "Access-Oriented" Strategies

The state Level 1 and Level 2 goals are very state-focused, and are crafted in a way that works around the lack of current authorities. The first level of achievement for state progress should be regional planning. Short of that, substantial progress is made if access to recycling and diversion in the state is improved. This section provided an analysis (in Section 6.3) that assessed goals and recommendations collaborated from other states. Leveraging off the approach taken in Oregon, this section suggested a two-level approach to minimum recycling access strategies (Level 3 recommendations). These recommendations represent minimum requirements that allow flexibility for communities and are easily quantifiable.

Access to recycling is a core principle of this Plan, and strategies geared toward greater access are the underpinnings of the strategies summarized in Table 6-7.

This Plan recommends that the Front Range implement no fewer than eight of the Level 3 strategies identified in Table 6-6 (abbreviated below in Table 6-17), where the Mountains should adopt five, and four in the remaining regions. Communities not adopting the minimum number recommended are not eligible for RREO funds, and lose out on the other benefits noted in the state level recommendations (ELP, etc.). If the community or its county meet the area recycling goal (low or high), they are exempt from this recommendation.

Table 6-17: Level 3 Prescriptive Approach - State Recommendations for Publication (Near-Term, and/or if State or Regional Authorities are not Achieved)

Number of recommendations increases over time. Communities exempt if they demonstrate they have reached these Numeric Diversion Goals.	
1. Enhanced education program 2. Recycling depots/drop-offs in towns with population of at least 4,000. 3. Curbside recycling offered to single family homes (at least bi-weekly) 4. Curbside recycling for single family households (at least bi-weekly), cost fully embedded in solid waste bill 5. PAYT rate structure for single family trash service 6. Multifamily (MF) recycling of at least four materials in 5+ unit buildings in communities with a population greater than 10,000.	7. Yard waste (or yard and food) drop-off site 8. Organics (yard waste with or without food scraps) collection program for single-family customers 9. Commercial recycling program available for larger businesses 10. Commercial composting collection program for targeted businesses 11. Commercial recycling required for businesses generating large amounts of recyclables. 12. C&D recovery program requiring separate bins at generation or post-separation.
Recommendation: Front Range – Adopt 8 strategies; Mountains – 5 strategies, Rest of State - 4 strategies.	

The 12 - Level 3 strategies, designed to increase access to diversion in the regions are modeled in the tables below. The results are used to estimate the diversion potential that can be realized at the state level from basic access-related strategies implemented at the local level. The revised diversion quantities, presented in Table 6-17, show that diversion can be increased to 31% if the Front Range implements eight strategies, and the Mountains, Eastern/Southeastern and Western Slope implement four to five strategies.

To estimate the quantity of potentially recovered waste, the Project Team reviewed the presence of various programs and the relevant available waste by tons for each region and the likely involvement in the program (where voluntary). An estimate of the quantities that could be recovered if each program were implemented in each region is summarized in Figure 6-1. Individually selected programs and the quantity of waste collected if implemented in each region are summarized in Figure 6-2. The program

assumptions are included in the table heading. To estimate the costs, a variety of assumptions were used, derived from the cost modeling in Appendix E:

- For drop-off programs, the cost of the operation of the drop-off center was incorporated, tipping fees were included and the relevant hauling distances were added for each region.
- For residential and commercial collection service strategies, the cost per ton for the service was developed and included.
- For education, a simplistic approach of expenditures of $2 per household per year was assumed.

Given that most programs were service-oriented, most of the costs accrued are charged to the generators. The cost to agencies or the state are minimal, covering only the drop-off centers, where relevant, and education initiatives. The assumption during this exercise is that households and businesses would absorb the cost of collection services in user fees. Further, because profit figures vary substantially based on local conditions (competition included), per the convention of this report, profit is excluded from the cost computations.

Table 6-18 presents planning level costs for key collection and diversion options. The ranges reflect difference in assumptions about elements comprising the costs.

Table 6-18: Planning Level Estimates: Cost per Ton Options by Region[1]

Total Costs	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Voluntary Residential Collection				
Trash	$70-$80	$80-$100	$90-$110	$90-$110
Recycling	$10-$30	$140-$190	$200-$290	$280-$410
Organics	$90-$110	$100-$110	$110-$130	$110-$130
Mandatory Residential Collection				
Trash	$60-$70	$70-$80	$80-$90	$80-$90
Recycling	$-10-$10	$120-$170	$180-$270	$260-$380
Organics	$80-$90	$80-$90	$90-$100	$90-$100
Every Other Week Residential Collection				
Trash	$50-$50	$60-$70	$60-$70	$60-$70
Recycling	$-20-$-10	$100-$140	$160-$240	$230-$350
Organics	$60-$70	$60-$70	$60-$70	$60-$70
Commercial Collection				
Trash	$60-$70	$70-$90	$80-$100	$80-$100
Recycling	$0-$20	$120-$180	$190-$280	$260-$390
Organics	$80-$90	$80-$90	$90-$100	$90-$100
Drop-off Recycling				
Range	$140-200	$230-$360	$600-$800	$300-$600

1. Includes collection, transport, processing, and tip fees; does not include avoided cost per ton

If the recommended number of strategies in the Front Range, Mountains, Eastern/Southeastern and Western Slope are implemented, the state achieves 722,000 additional diverted tons (71% of the potential from implementing all options). These tons are achieved at about 65% of the per-ton costs to generators (customers) or governments/non-profits that would have arisen if all of the strategies had been implemented in all four regions. Table 6-19 shows that diversion statewide from improving access, with sensitivity to regional situations, is expected to increase to approximately 31%. Note that these strategies include both residential and commercial sector outreach and programmatic initiatives, in recycling and organics.

Table 6-19: State Recycling Performance with Basic Minimum Access Strategies (Tons)

2014 Total Diversion (per CDPHE)	2,018,264
2014 MSW Generation	8,765,610
2014 Diversion Rate	23%
Additional Generation (1% growth per year)	175,312
Additional Base Diversion (1% growth per year)	40,365
Additional Tons from Level 3 "Access" Strategies	722,000
Diversion Rate including basic access improvements (Level 3)	31%

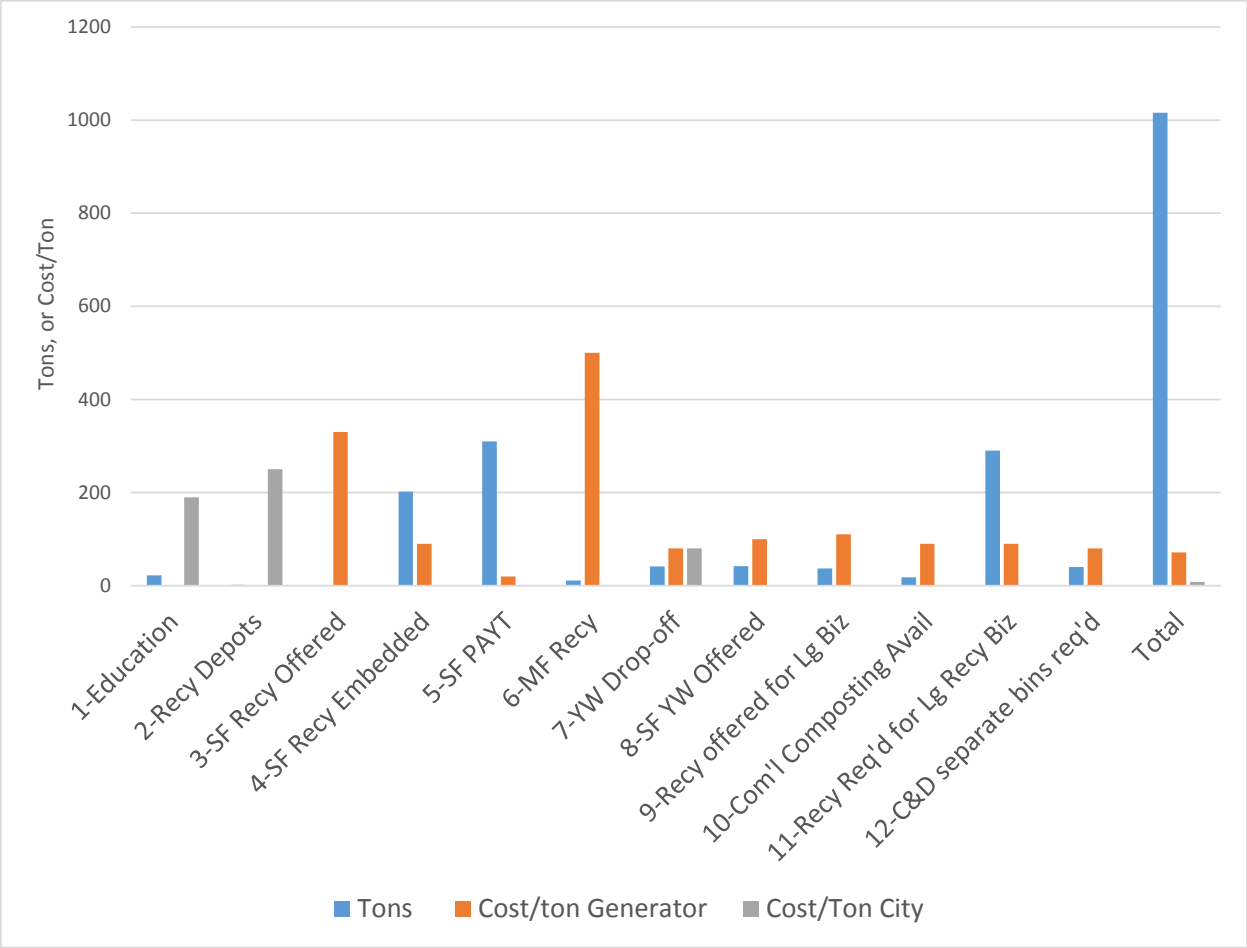

Figure 6-1: State Level Summary Diversion Performance – If All 12 Strategies Invoked in Each Region

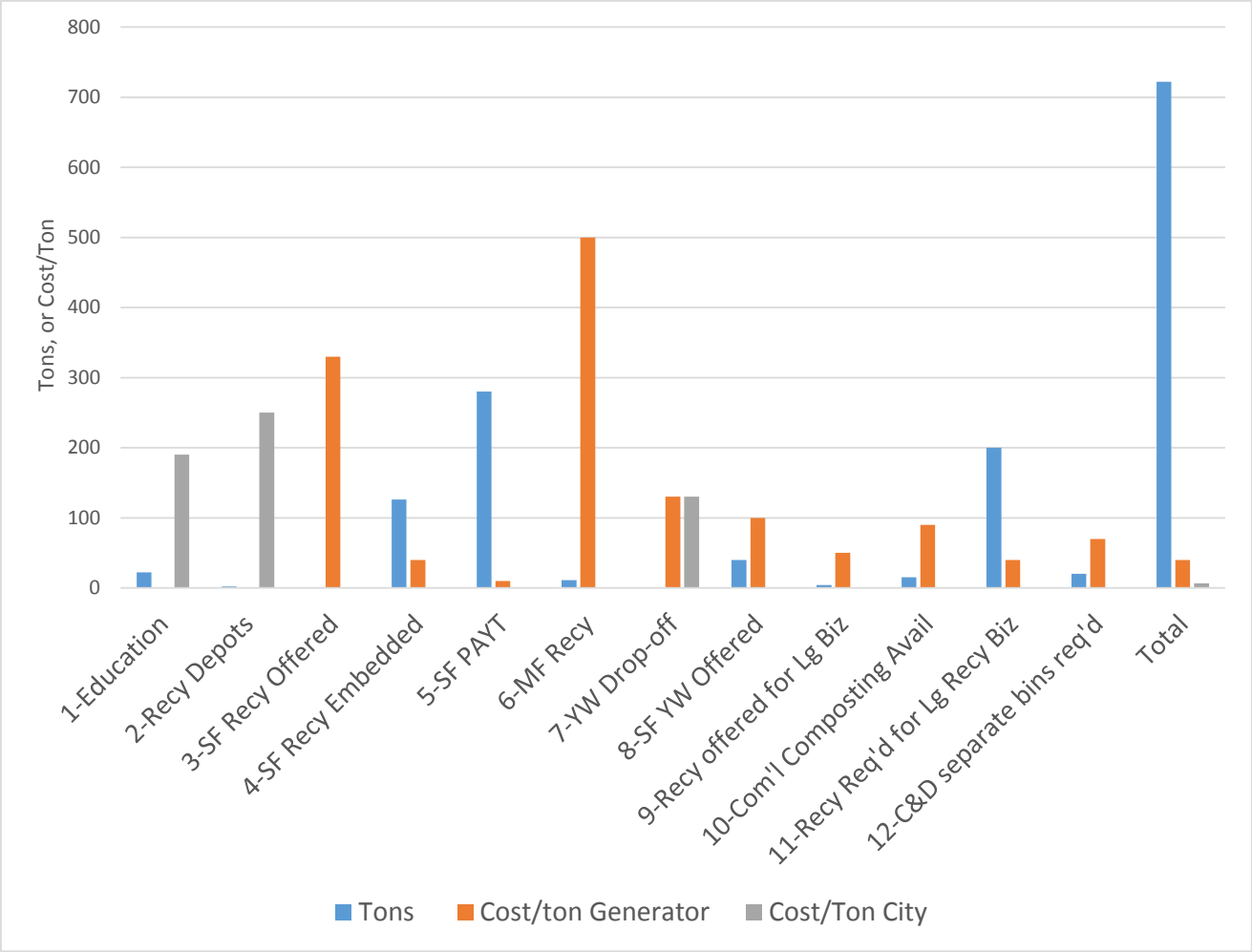

Figure 6-2: State Recovery with Selected Programs for Each Region[23]

These figures show that:

- Education is relatively costly per ton to the community, but delivers more tons that some of the voluntary service options modeled
- Embedded recycling and PAYT are strong performers; optional recycling for a separate fee delivers few tons
- Multifamily recycling is expensive and not very effective
- Offering households organics service is relatively expensive, but would deliver substantially more tons if the program was mandatory or "embedded" rather than optional as modeled
- Requiring recycling in the commercial sector is effective at diverting tons

[23] Assumes Front Range implements: 1,4,5,6,8,10,11,12 (8 programs); Mountains implement: 1,4,5,6,9 (5 programs); Western Slope and Eastern/Southeastern implements: 1,2,3,7,(4 programs)

- Even simple C&D recycling strategies have the potential to deliver noticeable tons

Similar figures for the selected Level 3 programs in each of the regions are provided in Appendix H.

The results from Figure 6-2 can also be summarized in tabular form, including the results from each of the regions. Table 6-18 details the tons (in thousands) and the costs (in cost per ton) associated with the implementation of between four and eight strategies in each region. The costs are derived from the program design assumptions and detailed cost modeling in Appendix E. The results show:

- An additional 722,000 tons per year can be diverted statewide if the "access to recycling" recommendations (Level 3) are implemented in the regions. The weighted average cost of achieving this diversion is about $46-$53 per ton
- Most of the tons are generated in the Front Range, which is also reflected in the low statewide costs for the set of programs
- The costs in the Eastern/Southeastern and in the Western Slope are 2.5-3.7 times the cost per ton found in the Front Range, identifying the influence that travel distance and low densities have on the affordability of diversion in those regions
- The cost to implement programs from the community perspective are quite low in the Front Range and Mountains; they consist of the education and drop-off programs. The drop-off option (with the associated transportation) is more expensive in the Eastern/Southeastern and Western Slope regions. The remainder of the programs are assumed to be directed by the communities or counties through ordinance or other method, with the cost borne by the generator
- These costs assume a five-year average of $140 per ton in single stream mix revenues, and zero revenues for organics. To the extent the market prices differ from those values, these weighted average costs would need to be adjusted

Table 6-20: Weighted Average Cost per Ton of Level 3 Options by Region[1]

For Selected Subsets of Level 3 Options	Front Range	Mountains	Eastern/ Southeastern	Western Slope	Statewide
Diverted Tons (in thousands)	675	41	2	4	722
Weighted Cost per Ton – Generator	$38	$58	$38	$75	$39
Weighted Cost per Ton - Community	$5	$5	$154	$167	$7
Weighted Cost per Ton - Total	$43	$62	$192	$242	$46

1. Selected subset of strategies for each region

6.4.3 Beyond the Minimum in Colorado – Strategy Options Inventory

There are a number of strategies that are well-suited to the various regions of the state and should be considered for implementation if and when planning agencies and funding are achieved. The first section lists traditional strategies (programs, mandates/bans, incentives, etc.). A list of zero waste and market development options is also included in this section.

Programs and Strategies List Ranked by Relative Cost-Effectiveness: The Project Team considered the array of effective and cost-effective diversion strategies available. These options are presented in Table 6-21. The table provides a relative ranking of a variety of diversion program alternatives available for the residential and commercial sectors.

- The first row reflects the best performance ─ high impact/low city cost strategies
- The second row represents the alternatives related to medium cost and low to high impact; and the medium impact with low to high cost
- The third row reflects low impact/higher cost strategies
- The last row reflects strategies that do not have direct tonnage quantities assigned

Note that some important strategies (toxicity reduction, etc.) may be ranked low in this table because the criteria is based on quantity in tons and cost to city. In other cases, the cost to city may be low, although the cost to the generator may be high (higher bills for recycling), because the cost to the city is simply an ordinance or similar. The list is a general guide on the most effective and cost-effective strategies for communities to consider.

Table 6-21: Major Diversion Strategies Ranked by General Performance Category[24]

Single Family	Multifamily (MF)	Commercial
High Impact/Low (City) Cost		
• PAYT with cost for organics and recycling embedded; better with small solid waste cans, aggressive rates, every other week (EOW) solid waste • PAYT with recycling embedded • Organics – Mandatory or embedded in solid waste rate • Recycling – Mandatory or embedded in solid waste rate • Add food waste to organics • Add materials to recycling • Reduce recycling frequency to EOW and introduce organics	• All new or improved properties must have generator fee to fund recycling • PAYT bag program for MF and small businesses • City-wide ordinance requiring all large	• Recycling and organics embedded in solid waste rate a la PAYT for residential • Recycling embedded in solid waste • Material disposal bans • Mandatory recycling for all or targeted businesses • Mandatory organics for specific business types • Education on bidding for service and right-sizing; require clear invoicing and incentives on bills

[24] Program list developed/subsetted from SERA's "Comp Plan in a Box" and supporting publications.

Table 6-21: Major Diversion Strategies Ranked by General Performance Category[24]

Single Family	Multifamily (MF)	Commercial
• Material disposal bans – organics, recyclables, individual materials • EOW solid waste collection with organics • Larger recycling bins required • ADF legislation/fees on certain products (depends on product)	MF to provide recycling	• Differential taxes or tipping fees on some material streams (if substantial) • Add small businesses to residential curbside program • Require incentive rates for recycling and/ or organics
Middling Impact/Middling Cost		
• Drop-off recycling program, hub and spoke • Drop-off organics program • Offer curbside organics • Offer curbside recycling EOW • Offer curbside recycling weekly • Contract incentive to haulers to meet goals • Enhanced drop-off recycling stations • Taxes on some material streams • Require incentive rates for composting service • Recycling rebate program • Enforcement of non-compliance in programs, incentives	• Clear bags for recycling • ADF legislation on products • Enforcement of noncompliance	• Differential tip fee or contract incentives for haulers meeting goals • Technical assistance for businesses • Encourage cooperative agreements to share recycling service in neighborhoods or for small businesses • Require recycling (and composting) containers next to solid waste containers at businesses • Enforcement of non-compliance • Neighborhood sweeps – advising businesses door to door in a neighborhood
Low Performance (high cost/low impact)		
• E-waste events; HHW events • Reuse events promotion • Social Marketing education/outreach • Education/outreach • Backyard composting education	• Promote reuse programs • Education/outreach • Social marketing	
Unclear tonnage impact		
• Reporting required as part of hauler license • Contracting for collection (reduces cost) • Lobby for better organics permitting • Zero waste branding	• Space for recycling/organics ordinance (new or remodel)	• Space for recycling/organics ordinance (new or remodel) • Business recognition program • Require business recycling plans • Procurement guidelines • Require leases with recycling clauses • Work with industry groups to promote sustainable/green business practices

Note: Ranking within groups is not meaningful

Zero Waste, Extended Producer Responsibility, and Market Development Options: Finally, as communities and regions of the state consider options as part of regional planning work, zero waste options, environmentally-preferred packaging strategies (EPP) and market development approaches should be included in the mix. SMM encompasses integrated management of materials, considering a

systemic approach to using and reusing materials more productively over their entire lifecycles. Zero waste, product stewardship, and traditional reduction/reuse/recycling strategies are all parts of an SMM strategy. SMM leads to greater consideration of "upstream" management of materials; rather than focusing on recycling what the market generates, SMM informed by life cycle assessment (LCA) studies[25] may argue for changes in material usage in the products to facilitate recycling.

Table 6-22 presents a list of sustainable materials management options that are frequently considered in more aggressive plans, and which should be seriously considered, at least by the agencies that may be ultimately tasked with developing the waste shed comprehensive plans in the Front Range. The optimal plan would encourage diversion, protect the environment, but also support industry growth and innovation. The large majority of these options are elements of traditional integrated, or comprehensive Plans as well (PAYT, education, program expansions/service options, facility recommendations); however, as a resource, the list of zero waste, SMM, and market development program recommendations beyond those often included in traditional comprehensive solid waste management plans are italicized and are also included in Table 6-22. The strategies include economic development, packaging strategies, product stewardship, and other initiatives. Note that the state has already introduced some other programs from this list, including strategic bans (tires, E-waste), and individual communities have undertaken many other elements.

[25] LCA Studies are generally fairly expensive, but can lead to important and unexpected suggestions for changes in the hierarchy for treatment of materials. Work by Allaway at Oregon's Department of Environmental Quality found shipping in plastic bags led to lower impacts than cardboard boxes. Recent work by Franklin Associates found that overall environmental impacts were lower from ground coffee purchased in bags than in plastic or metal cans.

Table 6-22: Options for Sustainable Materials Management - ZW, EPP, Market Development and Traditional Strategies – Typical Zero Waste Plan Options[26]

Topic	Options for ZW, EPP, and Market Development Strategies	
Outreach/Education (mostly traditional strategies)	Social marketing Sustained Public relations outreach Focus on source reduction Technical assistance & awards/recognition Media, regional, and retailer partnerships City staff education Train the trainer	*Develop and communicate to residents the highest priority materials for recovery*, and where to recycle/drop-off Publicize take back locations Reuse/repair directories on websites, etc. Research
Programs/Services (mostly traditional strategies)	Universal recycling ordinances (residential, commercial, recycling, organics) PAYT incentives; more aggressive incentives, smaller solid waste container options Embedded recycling – no extra fee Embedded organics – no extra fee Every other week solid waste to drive use of organics Highest use hierarchy (and research on topic) Maintain one or more recycling drop-offs in the community; potentially work with local non-profits as appropriate Bottle bill/collection sites Single stream recycling Schools programs Multifamily sector gets access to, or required recycling Reduce garbage volume exemptions for commercial or multifamily buildings Support multifamily compost programs/collection system Business technical assistance, waste audits, recognition programs	Develop/expand materials to recycling programs as markets develop Improve efficiencies in recycling collection Develop/expand organics materials to food, compostable paper; drop-offs or curbside as appropriate; increase curbside collection frequency *Encouraging use of in-sink garbage disposers in areas with appropriate waste water treatment and other conditions* Expand materials at drop-offs (e.g. metals) Expanded access to programs Mandatory/embedded programs for some sectors/targeted materials Material bans for high value materials/landfill bans Increase electronics collection Work with independent recyclers to help the community recycle their waste Support at-home composting programs Opportunities for tree limb management Outreach program and work with individual firms on expanding food waste reuse/composting/diversion (technical assistance, etc.); similar for recycling

[26] Source: Skumatz, "Zero Waste Planning: Unlocking the Next 30% - Tips for Balancing Near and Long Term Strategies for Fundamental Change" Skumatz Economic Research Associates, 2013. Note that some recommendations "cross" classification lines and are listed multiple times in the table.

Table 6-22: Options for Sustainable Materials Management - ZW, EPP, Market Development and Traditional Strategies – Typical Zero Waste Plan Options[26]

Topic	Options for ZW, EPP, and Market Development Strategies	
Collection//Haulers (mostly traditional strategies)	Provide financial incentives for diversion and against landfilling Considerations of contracting, franchising, regulations, requirements for economies and authorities Diversion requirements in contracts/agreements	Reporting and measurement Require haulers to offer or provide diversion services (recycling and/or organics) *Ensure that recyclable materials collected at curbside or drop-offs are actually recycled and that operations are effective*
Requirements/Ordinances (mostly traditional strategies)	Recycling plans, space for recycling in commercial/multifamily Support/establish material bans (food, yard waste, separated recyclables, etc.) Required services, embedded, mandates Require embedded recycling for commercial sector (commercial PAYT) Require city recycling and composting ordinance compliance as part of city leases, zoning, building permits, etc. for commercial and multifamily	Incentives (PAYT, surcharges, avoided taxes on some diversion streams) *ZW Events*, internal environmental preferred purchasing Reporting Require trees/slash to be diverted from landfill
Facilities (mostly traditional strategies)	New or expansions of facilities for Organics with food C&D facilities; support capacity for transfer, sorting, possible processing Appropriate MRFs, including mini-MRFs Ecosites, grinders, drop-offs, signage *Minimize long term landfill liabilities*	Regional cooperation, incentives for clustering or regionalization, cooperative siting; support capacity for additional diversion; tax benefits for co-location Anaerobic digesters, methane collection, conversion technologies Include clean damaged dimensional lumber in slash management programs Investigate new technologies
C&D (mostly traditional strategies) (traditional plans)	C&D plans Increase recycling of C&D debris Separate dumpsters required with service C&D deposit programs, incentives	Required deconstruction or reuse, recycling Green building codes, training, resources
Upstream activities (*mostly ZW/Stewardship strategies*)	*Support Product stewardship initiatives/policies/ordinances; advocacy, EPR* ADFs for target materials (plastic bag fees, etc.) Materials use/important bans *Strategic partnerships with states, agencies, associations, industry*	*Bottle bills, minimum content standards, takeback requirements* Education, outreach, social marketing *Work with State/Federal legislators to encourage ZW* *Promote markets/market development for recyclables and compost at local, state, and national levels*

Table 6-22: Options for Sustainable Materials Management - ZW, EPP, Market Development and Traditional Strategies – Typical Zero Waste Plan Options[26]

Topic	Options for ZW, EPP, and Market Development Strategies	
Other (*mostly ZW/Stewardship strategies*)	Other specific strategies for small tonnage/high "cost" materials (plastic bag bans, etc.) *City leads by example in ZW; advocates ZW, develops promotional materials and case studies/web links* *Require ZW for community events* Track/monitor/publish progress *Promote re-use policies, reusable bags, use of reusable water bottles, flatware, etc.* *Encourage non-profits and private sector to provide innovative services* *Green building codes/ZW elements/ZW building planning assistance*	Household hazardous waste programs/strategies *Work with industry groups to promote Sustainable Business and Green Business programs* *Implement ZW task force* *Adopt policies for identifying full avoided disposal costs to be basis for evaluating economics of programs/policies* *Promote and incentivize businesses to create and market products/services that reduce toxicity and disposal tonnages* *Conduct/support Life Cycle Cost studies for optimal material management*

ZW/Product Stewardship Strategies beyond those included in traditional Integrated SWM Plans in italics

In crafting the appropriate mix for each of the state regions, the regional planning agency should avoid some of the pitfalls of many zero waste plans:

- Avoid generalities (e.g. "optimize the existing system," "encourage cooperation," "increase awareness of…") and include tangible, enforceable, trackable recommendations
- Be specific and local, and recognize that what already exists affects the next steps and recommendations
- Estimate the impacts and costs – and therefore, cost effectiveness. Put the recommendations in context, and rank by criteria including impact, toxics reduction, and do not forget cost-effectiveness
- Do not overwhelm with dozens of recommendations. Focusing the most important and biggest bang recommendations so activities can be focused and progress might be realized. Recognize that the most effective strategies are unlikely to be the most popular – because they mean change
- Remember a detailed implementation plan, with responsibilities and timeline, and a funding plan

6.4.4 Tailored Strategies for Consideration in Plan's Region

The wide variety of strategies were considered as options that planning agencies may want to consider when regional planning and the authority to initiate programs becomes available in the state. This study analyzed opportunities and gaps in the four designated regions of the state (discussed in Sections 4 and 5,

and summarized in Appendix H). Table 6-23 presents a list of program options that should be considered seriously as potentially-suitable in each of the regions:

- when appropriate for the regions if the state gains authorities to require programs
- if regional planning authorities are approved. These programs and infrastructure initiatives should be strongly considered in future regional modeling work

The costs and diversion quantities in tons would be developed as part of the wasteshed's comprehensive Plan.

Table 6-23: Local Program Recommendations for Four Colorado Sub-Regions

Recommendation/Strategy	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Statewide Strategies				
Statewide Recommended Strategies – 2 tier goal, regional planning with grant preferences, tracking; Release streamlined compost siting standards with food; Break down silos/barriers in CDPHE/collaboration	Yes, higher goal	Yes, lower goal; possibly higher for I70 corridor	Yes, lower goal	Yes, lower goal
Statewide level study: Bottle bill; industry-supported programs	Study	Study	Study	Study
Hauler Licensing and reporting, possible state level	Yes, IF auth.	Yes, IF auth.	Yes, IF auth.	Yes, IF auth.
PAYT requirements, possible state level	Yes, unless diversion rate >30%, IF auth.	In I-70 corridor	For communities >4000 pop.	For communities >4000 pop.
All landfills and large transfer stations install recycling drop-off and transfer recyclables to MRF – unless H&S already available within 20 miles, possible state level. Landfills have scales; consider balers and cullet machines in some locations for long hauling savings.	Yes, but exempt areas with embedded SF recycling IF auth.	Yes, but exempt areas with embedded SF recycling	Yes	Yes
All landfills and large transfer stations install organics drop-off if composting facility within 20 miles and no drop-off within the area.	Yes, exempt areas with curbside	Yes, in longer run.	Multiple compost sites avail.; mid-longer term	Multiple compost sites avail.; mid-longer term
IF state gains authorities, recommend these; if not, encourage regional planning agency to consider. Potential provide grant points for every one of recommended list they have, etc.				
Cross-sector strategies				
Increased education on recycling, costs of contamination, awareness of recycling opportunity for all	Yes	Yes	Yes	Yes
Yard waste ban (county level)	I-25 Front Range	I-70 corridor		
Cardboard ban (county level)	I-25 Front Range	I-70 corridor		

Table 6-23: Local Program Recommendations for Four Colorado Sub-Regions

Recommendation/Strategy	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Develop procurement standards for use of compost for soil amendment in developments and CDOT	Yes	Yes	Yes	Yes
Purchase compost spreaders to facilitate use of local compost	Yes	Yes	Yes	Yes
Work with farmers on on-farm composting	Yes	Yes	Yes	Yes
Work to arrange for back-hauls from empty retail deliveries donated for rural recycling		Yes, rural areas	Yes, rural areas	Yes, rural areas
Single Family				
Require recycling to be offered for SF				
Require embedded recycling for SF	Yes, populations >4000	Yes, I-70, populations >4000	Consider, mid- to longer run	Consider, mid- to longer run
PAYT by ordinance or other means	Metro Front Range	I-70, populations >4000		
Make EOW solid waste collection possible	Yes	Yes, I-70		
Require 3-bin program (composting included) if goal not met	Yes, metro Front Range			
Explore pros and cons of contracting for service, especially if economies of scale can be significantly improved	Yes	Yes	Yes	Yes
Multifamily				
Assure convenient drop-offs, provide education (in-sink, other programs)	Yes			
Require recycling bins & education in all rental units		Yes		
Require space for recycling (and potentially composting) for new construction and substantial remodels	Yes	Yes	Yes	Yes
Commercial				
Require space for recycling (and potentially composting) for new construction and substantial remodels	Yes	Yes	Yes	Yes
Targeted recycling program requirements for certain sectors, large commercial generators (e.g. ABC law example for bars/restaurants)	Yes, Metro Front Range	I-70	Yes in towns with pop>4000	Yes in towns with pop>4000
Targeted food program requirements for all businesses in food-related sectors, large generators if compost site within 20 miles	Yes, Metro Front Range	I-70		
Encourage downtown business districts to consider contracting for solid waste/recycling for access and waste management for savings	Yes	I-70	Yes, encourage, pop >4000	Yes, encourage, population >4000
Require hotels to have in-room recycling containers	Yes	Yes		
Business recognition programs and technical assistance; business plans for businesses over 50 employees, filed with the county	Yes	Yes	Yes	Yes
Construction and Demolition				
Require recycling bins with any solid waste bins delivered to sites for collection	Yes	Maybe	No	No
Require C&D deposit program; developers may recover their financial deposit if they demonstrate	Yes	Maybe	No	No

Table 6-23: Local Program Recommendations for Four Colorado Sub-Regions

Recommendation/Strategy	Front Range	Mountains	Eastern/ Southeastern	Western Slope
they recycled/reused sufficient materials; low recover requirements until C&D facility available				
Processing				
Siting of additional compost facilities		Yes	Yes	Yes
Use landfill or transfer station as hub or spoke (if a hub is feasible distance) for recycling if there is no Hub or drop-off within 20 miles. Site open as long as host site. For some areas, consider co-location at grocery stores, if preferable. Develop and support H&S in rural areas where possible	Yes non-Metro Front Range, rural	Yes, rural	Yes, rural	Yes, rural
C&D sorting/processing facility	Yes	No	No	No
Longer Term Programs				
Long Term Programs, Sustainable Materials Management and ZW strategies (inventory in Table 6-19)	Consider the Level 4 roll-out region-wide, and the wide-ranging list of ZW & EPP strategies provided in Table 6-19 including upstream options and lobbying; other. Explore industry-funded curbside recycling like Canadian "Blue Box"	Elements of Level 4 strategies (along I-70); Wide range of traditional options including C&D; ZW options including ADFs, ski industry partnerships, ZW Task force, Business incentives; other	Regional planning; move toward shared hauling and infrastructure where practical; increase access; enhanced hub & spoke; economic development assistance; differential surcharges by stream (MSW, recy, organics); industry-sponsored programs; green building codes; other	Regional planning; move toward shared hauling and infrastructure where practical; increase access; enhanced hub & spoke; economic development; differential surcharges; industry-sponsored programs; green building codes, other
Other Program Considerations				
	None – aggressive programs suitable, except in a few rural areas	Aggressive In I-70 with ski industry, less in rural	Mandates & bans unacceptable, unclear if much organics tonnage available, illegal dumping concerns, mountains impede hauls	Mandates and bans unacceptable, unclear if much organics tonnage available, low population density

A number of these programs are already in place in Colorado, and certainly in communities outside the state. Appendix C includes dozens of case studies of these and other strategies, included to assist Colorado communities in understanding the options, and follow-up for more information. Case studies beyond those previously mentioned in Sections 4 and 5 include:

- Recycling and organics options: Fort Collins PAYT ordinance, rural recycling innovations in Virginia, food donation strategies; recycling and composting strategies in Loveland and Fort Collins; Bans; unique composting options
- Commercial issues: Better invoicing
- Schools/Education: University of Colorado – Boulder; K-12 example
- Funding issues: Moving from tax base to user fee; tip fee surcharges
- Other: Aspen's Sustainability Plan; regional planning leadership in Vermont; circular local economies/lifecycle plans; outreach on contamination in Massachusetts; state legislation details for other states

6.4.5 Available Regional Planning Agencies – Operationalizing Planning Work

As mentioned, there is a network of existing regional planning agencies around the state. Local planning in solid waste may be a natural addition to their responsibilities. The list of known agencies, and the areas with apparent gaps in coverage, is provided in Table 6-6.

6.4.6 Strategies for Funding Local Initiatives – Operationalizing Progress

A number of options are available for funding collection and diversion initiatives at the local level (state strategies were provided elsewhere). A number of options are listed in Table 6-24, along with their suitability in Colorado. The table includes strategies suitable for local funding – or for cost savings – to help fund planning and programmatic initiatives.

While new responsibilities and mandates are disliked by communities, unfunded mandates are despised. Any additional responsibilities for local jurisdictions must be packaged with a funding mechanism. Where the authority for the source does not exist, the state may need to consider empowering it. Unfortunately, many communities are not anxious to charge their residents and businesses additional taxes and fees to meet state recycling goals. These mechanisms can address the potential sources for these funds, but not the political will to implement them.

Table 6-24: Potential Funding Sources for Local Communities in Solid Waste Planning/Management/Programs

Assistance	Currently Available	Priority	Considerations	Funding Source	Notes
Revenue Sources					
State-funded Grants	Yes	High	The state makes a grant program available to help fund the specific responsibilities that the state chooses to rely on local authorities to perform. It may also provide a reward or incentive for taking on additional programs and responsibilities	Disposal surcharge revenues	Some states have offered grants that are almost "earned" or guaranteed if the community develops Plans or puts in preferred programs. Here that might include PAYT, contracts for collection
New Direct Funding Authority	No	High	State grants new funding authority to communities	New fees at the local level	California introduced AB939 planning fees. Could be based part on tons, part on participation
User Fees	Yes	High	Funding for direct costs of recycling and composting collection programs are generally recovered through user fees. Cities can assess user fees surcharges on the top of solid waste bills to help pay for new responsibilities; they could be on solid waste or recycling	User fees; potential surcharges through contracts or municipal service delivery	Under contracting arrangements, cities can pay haulers on a basis that differs from the way in which they charge service

Table 6-24: Potential Funding Sources for Local Communities in Solid Waste Planning/Management/Programs

Assistance	Currently Available	Priority	Considerations	Funding Source	Notes
New Taxes	With nexus	Medium	Some cities have implemented specialized commercial taxes (e.g. business and occupation or other taxes) to provide a way to access adequate funding for the system from the commercial sector	Direct assessment on businesses	New fee to fund new responsibilities, and gather funds from the business sector, which benefits but doesn't always pay cities for the direct and indirect solid waste services it receives from communities (litter, road wear and tear, etc.)
Generator Fees/Environmental Fees	Yes	High	Communities invoke a generator fee on households and businesses to help pay for the programs and planning responsibilities	Households and businesses	Some cities have in place already in the state, or may be a new fee to fund new responsibilities
Lower Surcharges/Lower Tip Fees	No	High	Some states have offered lower disposal tipping fees (or reduced surcharges) for communities meeting goals or implementing programs. This is a de facto grant or funding source, depending on who pays tip fees	Savings to the community if it has municipal or contracted service	May be able to structure reimbursement to city even for cities that do not collect or have contracts, based on tons
Direct Surcharge Authority	No	Unlikely	Cities could be authorized to charge surcharges on facilities in their area	New fee on local solid waste tons	Not available in state currently
Shared Disposal Surcharges	Yes	General	State reimburses some share of surcharges to cities with planning responsibilities	From state collected revenues	From increased fees on higher level fee plus potentially from fees raised from out of state tones

Table 6-24: Potential Funding Sources for Local Communities in Solid Waste Planning/Management/Programs

Assistance	Currently Available	Priority	Considerations	Funding Source	Notes
Hauler Registration Fees	No	Medium	Cities can collect fees to cover administration/oversight/ enforcement, etc. related to haulers	From haulers	Expanded responsibilities could mean higher local fees; sharing arrangements could be worked out with the state
Contractor Fees - fees on hauler contracts or operations, or similar	Yes	High	Communities can assess fees to contractors if they establish contracts or districts—for oversight and management, etc.	From haulers	Can be assessed to the level required for oversight. However, under contract arrangements, the city can assess generator fees or similar and add to the bill
Litter Fees, ADFs	No	Med-High	Communities or counties can assess product fees to help fund proper disposal of problematic products (short duty cycle relative to life, hazardous, clean-ups, etc.)	Product fees	In place elsewhere, successful; may require vote; usually linked closely to one product/not "general"
Savings					
Education/Training/ Assistance (avoided cost /savings)	Yes	High	The state can assist cities by putting together webinars on topics, template RFPs and educational materials, etc. to save cities money in designing/researching their own. Some states have hired technical experts on staff to work with cities to help plan strategies	From state revenues/econ omies in expertise	Use website and webinar series and local meetings to disseminate materials. CDPHE provides expert assistance to communities/re gions
Market Development Assistance	Yes	Med-High	Would require considerable staff time		Much desired by stakeholders

Table 6-24: Potential Funding Sources for Local Communities in Solid Waste Planning/Management/Programs

Assistance	Currently Available	Priority	Considerations	Funding Source	Notes
Efficiencies and other BMPs	Yes	High	As listed in the program strategies and discussed in Appendix E; examples include optimizing collection frequencies (reducing to biweekly recycling to add organics), participation incentives, embedded service for economies of scale, etc.	Reduced cost	Very effective; local control issues if no authority over haulers
Industry-Funded Programs	Yes, in some areas	Med-High	Canadian Blue Box program shifted costs of municipal recycling programs to the paper and container industries whose materials are in the curbside recycling bin. Other industry-funded programs include Paint, Mercury Thermostat recycling, etc.	Reduced cost	Major change, successful elsewhere, will require significant lobbying or negotiation
Shared Savings	Yes	Uncertain	Requires agreements	Share of reduced cost	Not demonstrated in solid waste; in place widely for energy

Other Desired Assistance: In addition to direct funding assistance from the state, most of the regional stakeholder meetings were very interested in the state providing direct market development assistance, presumably at the state and local level. Similarly, there was strong interest in training and outreach, including webinars, websites, and other information helpful to devising effective local strategies.

6.5 Summary Recommendations

The detailed cost, program, and facility analyses imply that things are unlikely to change substantially in sustainable materials management in Colorado unless the state interjects policies, incentives, and mandates that force change in the solid waste system. Given the state's authorities, this can be challenging. However, the state can influence change if it links diversion policy to disposal and diversion funding. If CDPHE is committed to finding ways to advance diversion in the state of Colorado, the Project Team recommends:

- **Link the availability of state funds to assist in closing landfills to a requirement that those counties must first pass ordinances or use other means to divert materials from landfills:** PAYT[27] is identified as the priority strategy because this program is already directly within the authorities of Colorado communities, does not require substantial expenditure of county or community funds, and is the single most cost-effective strategy available for diverting materials. The only supporting infrastructure necessary for the program is access to recycling. This may be a curbside program or a reasonably-convenient drop-off recycling program. Grant fund preferences (see below) or landfill compliance savings may help fund these programs where they do not currently exist or where they need expansion. The increase in recycling tons generated from the PAYT incentive should help the economics of these programs. Adoption of PAYT in these areas may also spur adoption of PAYT beyond these counties and communities.
- **Work to increase funding for the RREO grant program and support diversion access, infrastructure, programs, and planning:** Continue to prioritize grant funds to increase access to recycling across the state (including the current focus on hub and spoke, etc.); however, also allocate funds to regional comprehensive planning efforts, but if and only if they 1) cover multiple counties; 2) have the active participation[28] of the local County governments; and 3) if there is a stated commitment to implementing strategies. RREO funds are limited, and planning projects in themselves do not increase diversion. CDPHE should time the requests for increases in RREO funds to maximize chances of success.
- **Provide education, training, and facilitation to improve diversion effectiveness, access, and performance:** CDPHE is empowered to provide training and technical assistance, and should substantially increase its efforts in strategies designed to decrease disposal. CDPHE should use all available channels to provide education, including web pages[29], webinars, stakeholder meetings, conferences, articles, memoranda, manuals and other methods, especially, direct assistance by phone or other means. Initially, the education should be focused on practical information and technical assistance on diversion strategies, best practices, efficiency/effectiveness tips, and feasible "next" strategies to enhance diversion in the residential and commercial sector. The state

[27] The PAYT programs implemented must meet minimum best practices design standards outlined elsewhere in this document. For curbside PAYT, there must be a container available that is no larger than 32 gallons, with other options available. The price incentives for double the service should be 50%-80% extra. There should be access to recycling options that include the basic single stream materials, in a single stream or separated program. If trash containers are provided, recycling containers must also be provided, and embedded in the trash price. The PAYT program may be drop-off in design, with Grand Lake or others as example programs. Education should be provided at least annually.
[28] Demonstrated with a signed commitment of participation as part of the Grant application.
[29] Including potentially a library of links to in-state (and national) comprehensive plans, case studies, program reports, waste compositions, etc.

can also be a source of information on advanced materials management strategies for communities, counties, and stakeholders.

- **Work to get more from existing programs, and leverage existing successes:** Access to at least minimal recycling statewide should be pursued. However, Colorado's overall diversion performance will be best and most sustainably improved by improving recycling in the Front Range, where performance is already stronger than in the rest of the state and conditions are relatively conducive to diversion, and where 83% of the state's waste is generated. Densities are favorable, and the infrastructure exists for many streams. There is an appetite for taking on authority in solid waste. Available waste composition studies clearly demonstrate there remain high percentages of current recyclables still being disposed. One percent improvement in the Front Range translates to four times as much diverted tonnage as one percent improvement in the entire rest of the state – and similarly, one percent improvement in the Western Slope, the second most populous region identified (8%), increases statewide diversion performance by only one-twelfth of one percent. Improving performance in areas with good economics should also improve the chances of sustainable change. The Front Range buries more than $200 million market values in recyclables,[30] including high value plastics (8-12% of landfilled tons in the residential sector), recyclable paper (15% or more, including at least 4% each cardboard and news) and metals. Organics should also be a key focus. At least 25% of the tonnage landfilled in the Front Range is compostable organics, at least two-thirds of which is food. The state should educate on best practices for programs that encourage more diversion, and encourage adoption of programs and strategies that improve effectiveness of capture of existing materials. The focus areas should include: 1) in areas with existing collection programs, encourage adoption of cost-effective strategies that make it affordable to expand diversion to organics, and to collection of "next" recyclables. For example, every-other-week recycling collection may make new organics collection affordable; every other week collection of trash drives diversion of food waste; PAYT and small cans drives diversion; embedded recycling (and consider organics) is highly effective; universal recycling ordinances; and in some cases, contracting for collection may improve economies enough that collection of recycling and organics can be added a little cost beyond the previous cost of trash alone.[31] Local ordinances related to solid waste are powerful and inexpensive local tools. 2) There are significant areas of the Front Range with programs that are weaker than other areas (lacking embedded recycling, PAYT, organics collection, single stream

[30] Using 5-year average market prices for the region.
[31] Case studies of Colorado communities using most of these strategies are provided in Appendix C: Case Studies on Collection and Diversion in this report.

in large containers, performance tracking by haulers, etc.). 3) Lesson-learning opportunities between Front Range communities and between advanced communities nationally and the Front Range (regional meetings, webinars, toolkits, white papers, etc.) may spur further innovation, adoption, and progress. 4) Take a cue from communities that have begun progress in the commercial sector (Fort Collins, Boulder, Vail, etc.). Finally, improved tracking and adopting Percent Recoverables Remaining (PRR) metrics and the associated waste composition studies would help focus Front Range communities on the eligible (and "next") items still remaining in the disposal stream. Focusing attention in these four to five achievable areas is, frankly, the key strategy to significant, affordable, and near-term improvement in state diversion.

- **Regional strategy priorities should vary:** Beyond the Front Range economics (addressed above), organics is likely to be a higher priority in the Front Range than in more rural areas of the state. Rural landfills tend to have a different experience with organics than Metro-area landfills with lower amounts of landscaping trimmings, and similar materials coming into the facility, and the materials tend to come in separate truckloads that can be redirected to compost facilities. In addition, commercial strategies should be a high priority in the Front Range; the number of businesses in the rest of the state is considerably smaller. Similarly, attention in the C&D sector will be difficult in the areas outside the Front Range, as sufficient densities are lacking to support any infrastructure needed. A C&D facility in the Front Range would address a barrier to recycling a significant waste stream. Areas with substantial university presence should focus on successful strategies that have been implemented by successful university programs elsewhere.[32]
- **Encourage innovation to address barriers:** The state should actively encourage development of innovative strategies that address collection and diversion barriers. Collection of trash and recycling separately drives the expense of diversion. Experimentation has already occurred in the state on co-collection of trash in colored bags or containers and (different colored) bagged or loose recyclables, which would reduce recycling collection costs and affordability substantially. This strategy can apply to the commercial sector as well as the residential sector. There ae other innovations – some of which may already be in place but not well known – that may help address Colorado barriers.
- **CDPHE should work to gain the authorities to implement the additional strategies that lead to diversion, and should assure that diversion is part of the state's Climate Plan and**

[32] Leading university programs include the University of Colorado – Boulder, and the winners of the National Recycling Coalition, and now KAB's "RecycleMania" college and university competition. Information on these initiatives are available on the web. Schools programs are also a potential strategy, but the relative costs of collection for this sector (and the institutional sector) follows the pattern for the commercial sector. Appendix C includes a case study for the University of Colorado – Boulder.

environmental agendas: Conduct meetings with stakeholders with a natural affinity to recycling (CAFR, SWANA, environmental groups, non-profits) to find supporting coalitions that can help enhance CDPHE's toolkit for achieving progress in disposal alternatives, linking to improved health and safety in the waste management system. Continue to highlight the job and greenhouse gas abatement advantages, including the literature demonstrating diversion's outstanding cost-effectiveness and speed in achieving progress in GHG.[33] Priority strategies should include: 1) enforce or prioritize progress in access to recycling (Level 3 strategies) and enforcement of goals; 2) PAYT because it is effective, available, demonstrated, and affordable (not an unfunded mandate; and other priorities; 3) consideration of landfill surcharge increases, which have increased diversion in other states and to help fund SMM strategies; and 4) regional planning, tracking, and other strategies listed elsewhere. Consider establishing a long-term standing committee of advisors on the topic. The state should also work on longer-term materials management strategies at the local and state level – including support for research, accumulation of research and case studies, outreach on feasible strategies, support for legislation or opportunities, in-house adoption, and other support. The state can encourage economic development to grow local markets for recyclables in the state and implement in-house strategies related to sustainability, procurement, prevention, and diversion. CDPHE should actively insert itself in state initiatives (committees, projects, etc.) related to climate change, sustainability, and materials management.

- **Progress needs a policy leader:** The literature indicates that progress beyond the *status quo* in recycling is driven by policy leadership[34], and specifically by industry associations, councils, and states. Boulder, Vail, Fort Collins, Lafayette, Longmont, and other examples exist at the local level in Colorado. Progress in Oregon, California, Minnesota, and most recently and notably, Vermont, resulted from state-level policy leadership and well-crafted legislation. Involving CDPHE in an increasing role in technical advice on recycling will be a very helpful role, and continuing and growing a collaborative process (with stakeholders, local governments) will advance materials management in the state. Progress in Colorado would benefit greatly from CDPHE becoming more directly involved in waste diversion if and when authorized by statute.

[33] McKinsey & Company 2009 op.cit., Skumatz 2007 op.cit..
[34] A statistical analysis of this question is included in City of Denver and Skumatz Economic Research Associates, "Toolkit for Commercial Programs", Skumatz Economic Research Associates, 2013.

APPENDIX A: TERMS AND DEFINITIONS

APPENDIX A: TERMS AND DEFINITIONS

"CAFR" is the Colorado Association for Recycling

"CDPHE" is the Colorado Department of Public Health and Environment.

"C.R.S" is the Colorado Revised Statutes.

"Compostables" in this report means organic material that are commonly included in a composting program, including yard wastes, small branches and trimmings, and when allowed, food scraps and food-soiled paper.

"Composting" means the biological process of degrading organic materials that is facilitated and controlled through intentional and active manipulation of piles and windrows. These manipulations may include but are not limited to grinding, mixing of feed stocks and bulking materials, addition of liquids, turning of piles, or mechanical manipulation.

"Composting facility" means a site where compost is produced.

"Composting rate" in means the percent of tons of compostable materials diverted and processed as a fraction of the total "generation" commonly comprised of MSW, recycling, and organics.

"Contracted collection" is the organized collection of residential trash and potentially recyclables and/or organics for all households in a community with the service provided by one (or sometimes more geographically districted) authorized private haulers that earned the right through a competitive bidding process organized by the Community. The city manages the contract, and the city or hauler may provide the billing.

"Daily cover" means using a product as a cover placed upon exposed solid waste in a permitted solid waste facility to control disease vectors, fires, odors, blowing litter and scavenging, without presenting a threat to human health or the environment.

"Department" means the Colorado Department of Public Health and Environment or CDPHE.

"Diversion rate" means the percent of tons of recyclable and compostable materials diverted and processed as a fraction of the total "generation" commonly comprised of MSW, recycling, and organics.

It is the sum of the recycling rate and the composting rate. Diverted materials may also include source reduction.

“Dual stream” is collection of recyclables in two separate containers and streams, keeping separate the fiber streams (paper) from container streams (plastic, glass). Dual stream processing facilities (MRFs) do not include the extra steps necessary to separate single stream materials into individual marketable materials.

“Financial assurance” means the requirements of Section 1.8 of the solid waste regulations and include a detailed written estimate of the cost of hiring a third party to close the largest area of a site and facility that may require closure and shall be the basis for the closure estimate. The closure cost estimate must equal the cost of closing the largest area requiring closure during the active life of the site and facility when the extent and manner of its operation would make closure the most expensive, as indicated by its closure plan through the use of one or more of the financial mechanisms to financially assure full payment of all closure, post-closure, and if applicable, corrective action estimated costs.

“Ground water” means any water below the land surface in a zone of saturation.

“Groundwater monitoring” means those standards established by the methodology and standards established by this Department (5 CCR 1002-8) in the Solid Waste Regulations, Section 2.

“Ground water protection standard” means those standards established by following 40 CFR 258.55(H) and (I) methodology or standards established by this Department (5 CCR 1002-8).

“Hub-and-Spoke” is a model used to increase transportation efficiencies and reduce infrastructure and service redundancies in a regional service area. The model consists of a centralized processing center for recyclables, or “hub,” where material is sorted, baled and/or sold to market. The “spokes” are the surrounding communities that feed the recyclables they collect to the main hub. Typically the hub and spoke communities have a formal agreement that ensures the recyclables collected in the region flow from the spokes to the hub for processing.

“Integrated Solid Waste Management (ISWM)” is a comprehensive waste prevention, recycling, composting and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions.

"Landfill liner" means a continuous layer of natural or man-made materials beneath and on the sides of a landfill which restricts or prevents the downward or lateral escape of solid waste, its constituents, or leachate. A liner is also used in cap construction to prevent and control vertical movement of fluids.

"Leachate" means liquid that has passed through or had contact with solid wastes and may contain soluble, miscible, or suspended constituents removed from the wastes.

"Material Recovery Facility (MRF)" means a facility consisting of structures, machinery, devices, or persons to sort, bale, or otherwise manage or process source separated recyclable materials prior to conveyance to end markets.

"Medium size MSW landfills" means a landfill that accepts between 25,000 to 200,000 cubic yards of municipal solid waste per year.

"Municipal Solid Waste (MSW)" means solid waste from household, community, commercial sources that does not contain hazardous wastes as defined in the Colorado Hazardous Waste Act.

"Municipal solid waste landfills" means a sanitary landfill where one of the main waste streams accepted is municipal waste.

"Municipal collection" is the organized collection of residential trash and potentially recyclables and/or organics for all households in a community using city staff, billed by the city or embedded in taxes.

"Pay As You Throw" (PAYT) means a solid waste collection and billing system by which households or customers are charged in relation to the quantity of solid waste being collected. These systems use "per can" or "per bag" service increments. The systems most commonly refer to residential service, but programs can also be applied to the commercial sector.

"Plan" means the Colorado Integrated Solid Waste and Materials Management Plan.

"Recycling facility" (see material recovery facility) means a separate facility, or a part of a solid waste disposal facility, where recycling operations are conducted.

"Recycling" is a series of activities by which material that has reached the end of its current use is processed into material utilized in the production of new products.

"Recyclables" are materials recovered from the solid waste stream and transported to a processor or end user for recycling.

"Recycling rate" means the percent of tons of recyclable materials diverted and processed as a fraction of the total "generation" commonly comprised of MSW, recycling, and organics.

"Regional" is multi-jurisdictional, encompassing multiple counties or cities as well as the service providers who operate within those borders.

"Regional MSW landfill" means a landfill that accepts more than 200,000 cubic yards of municipal waste per year.

"Recycling Resource Economic Opportunity (RREO)" means the grant and rebate opportunity fund created by HB 07-1288 with the intent to fund implementation projects that promote economic development though productive management of recyclable materials that would otherwise be treated as discards.

"Request for Proposal (RFP)" means a solicitation which is often made through a bidding process, by an agency or company interested in procurement of a commodity, service or valuable asset, to potential suppliers to submit business proposals.

"SERA" is Skumatz Economic Research Associates.

"Single stream" is collection of recyclables in one (usually large) container or rolling cart combining fiber streams (paper) with container streams (plastic, glass). Single stream processing facilities (MRFs) include sorting and processing equipment capable of separating the streams into individual marketable materials.

"Small size MSW landfill" means a landfill that accepts less than 25,000 cubic yards of waste municipal solid per year.

"Solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, air pollution control facility, or other discarded material; including solid, liquid, semisolid, or contained gaseous material resulting from industrial operations, commercial operations or community activities.

"Solid (Waste) and Hazardous Waste Commission" (SW&HW or S&HW Commission) is the Governor-appointed commission responsible for setting the disposal tipping fee surcharge level that is used to fund CDPHE activities.

"Subscribed or open market collection" is the collection of residential trash and potentially recyclables and/or organics for all households by private haulers contracting one-on-one directly with households, potentially in a competitive market place with multiple haulers covering the same territory. Haulers bill the customers directly for service.

"SWANA" is the Solid Waste Association of North America.

"Solid waste disposal" means the storage, treatment, utilization, processing, or final disposal of solid wastes.

"Solid waste disposal site and facility" means the location and/or facility at which the deposit and final treatment of solid wastes occur.

"Solid waste regulations" means the regulations pertaining to solid waste sites and facilities 6 CCR 1007-2, Part 1 as authorized by the Colorado Solid Waste Act, 30-20-1 C.R.S..

"Stakeholders" means local officials, government employees, private businesses, nongovernmental organizations and interested citizens that are involved in or have an interest at stake within the solid waste and recycling sector.

"Sustainable materials management (SMM)" is an approach to serving human needs by using/reusing resources most productively and sustainably throughout their life cycles, from the point of resource extraction through material disposal. This approach seeks to minimize the amount of materials involved and all the associated environmental impacts, as well as account for economic efficiency and social considerations.

"TPY" means tons per year.

"Tipping fee" is the user fee charged at a landfill or transfer station for deposit of materials for management, and may be charged on a per ton basis or may be charged per cubic yard.

"Transfer station" means a facility at which refuse, awaiting transportation to a disposal site, is transferred from one type of containerized collection receptacle and placed into another or is processed for compaction.

"Waiver" for the purposes of these regulations shall mean a formalized process whereby an applicant may request to be excused from specific portions of these regulations. In general a defensible technical argument must be presented and verified before a waiver may be granted.

"Waste division" is the prevention and reduction of generated waste through source reduction, recycling, reuse, or composting. These actions generate a host of environmental, financial, and social benefits, including conserving energy, reducing disposal costs, and reducing the burden on landfills and other waste disposal methods. (U.S. EPA, 2012)

"Wasteshed" means a regional area of the state usually composed of multiple counties that share a common solid waste disposal and recycling system by use of the same infrastructure including landfills and recycling facilities.

APPENDIX B: LANDFILL ADEQUACY SUMMARY

Colorado Lanfill Evaluations

Integrated Solid Waste and Materials Management Plan

Name	County	Facility Size	2012 Tons	2013 Tons	2014 Tons	Design & Operating Requirements									Ground Water Monitoring					Closure Requirements		
						Access Controls	Adequate Haz Waste Screening Procedures	Stormwater-Water Quality Permit	Air-In Compliance with Open Burning Permit	Adequate Daily Cover	Cover/ Compaction Equipment	Adequate Liner	Adequate Leachate Collection System	Adequate Methane Monitoring	Adequate System of Groundwater Monitoring Wells	Groundwater Sampling	Groundwater Impact from Constituents	Groundwater Waiver Granted	Current Groundwater Waiver	Adequate Closure Cost Estimate (Y/N)	Adequate Post Closure Cost Estimate (Y/N)	Adequate Financial Assurance $ Mech (Y/N)
Front Range																						
Broadacre Landfill	Pueblo			-	-	Y	n/a	Y	n/a	n/a	n/a	Y	Y	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
Buffalo Ridge LF	Weld	L	103,303	131,505	104,457	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
CO Springs LF	El Paso	L	276,051	273,670	263,302	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
Conservation Services, Inc	Adams	L	36,236	40,362	49,229	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
DADS	Arapahoe	L	1,631,439	1,727,586	1,720,197																	
Denver Regional LF South	Weld	M	797	68,331	9,665	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
East Regional Landfill	Adams	L	209,242	246,181	196,816	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Foothills LF	Jefferson	L	283,152	261,272	267,823	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Fountain LF	El Paso	L	217,593	234,886	272,929	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Front Range LF	Weld	L	591,919	1,021,554	1,126,550	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Larimer County LF	Larmier	L	201,126	220,446	264,097	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
Midway LF	El Paso	L	244,100	257,983	265,167	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
North Weld Sanitary LF	Weld	L	408,733	460,792	469,886	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
Sedalia Recycling Center	Douglas	L	74,436	66,268	74,142	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Southside SW Disposal	Pueblo	L	140,833	137,520	141,680	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	N
Tower Landfill, Inc	Adams	L	804,834	544,723	701,807	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Mountain																						
Archuleta County LF	Archuleta	M	12,083	12,131	10,814	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Chaffee County LF	Chaffee	L	13,932	20,463	33,098	Y	Y	Y	Y	Y	Y	N-old, Y-NEW	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Custer County LF	Custer	M	2,573	3,520	3,400	Y	Y		Y	Y	Y	WAIVED	N - WAIVED	Y	N	N		n/a	n/a	Y	Y	Y
Eagle County LF	Eagle	L	63,363	66,082	74,568	Y	Y	Y	Y	Y	Y	Y	Y	?	Y	Y		n/a	n/a	Y	Y	Y
Lake County LF	Lake	M	5,367	4,264	5,543	Y	N	Y	N	N	Y	N-WAIVED	N-WAIVED	Y	Y	Y		Y	N	Y	Y	Y
Milner LF	Routt	L	40,871	38,516	31,020	Y	Y	Y	Y	Y	Y	Y-old, Y-new	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Mineral County SWDLF	Mineral	S	511	472	555	Y	N	N	Y	Y	N	N-WAIVED	N-WAIVED	N	N	N		Y	N	N	N	N
Phantom LF	Fremont	L	28,861	18,237	31,833	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	DETECT	n/a	n/a	Y	Y	Y
Pitkin County SW	Pitkin	L	47,760	53,063	49,680	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	DETECT	n/a	n/a	Y	Y	Y
Saguache County LF	Saguache	S	5,322	1,647	622	Y	N	N	N	Y	Y	NATURAL Y	N	N-W/D	N	Y	DETECT	Y	N	Y	Y	Y
San Luis Valley LF	Rio Grande	L	29,667	30,008	30,692	Y	Y	Y	Y	Y	Y	Y-old, N-new	Y-old, N-new	Y	Y	Y		n/a	n/a	Y	Y	Y
Six Mile LF	Gunnison	M	17,051	16,446	3,762	Y	Y	Y	Y	Y	Y	N-old Y-new	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Summit County SWDS	Summit	L	27,005	40,995	43,147	Y	Y	Y	Y	Y	Y	Y-new	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Eastern/Southeastern																						
Campo SWDS	Baca	S		20	30	Y	N	N	N	N	N	N	N-WAIVED	N-W/D	N-W/D	N		Y	N	N	N	N
Prichett SWDS	Baca	S	50	55	48	Y	N	N	N	N	N	N	N-WAIVED	N-W/D	N-W/D	N		Y	N	N	N	N
Springfield SWDS	Baca	M	2,151	3,179	3,076	Y	Y	N	Y	Y	Y	N	N	Y	N	Y	DETECT	n/a	n/a	Y	Y	Y
Two Buttes	Baca	S			35	N	N	N	N	N	N	N	N	N-W/D	N-W/D	N		Y	N	N	N	N
Walsh SWDS	Baca		539	449		Y	Y	N	N	Y	Y/N	N	N	N	N-W/D	N		Y	N	Y?	Y	Y
Eads SWDS LF	Kiowa	S	1,055	1,669	-	Y	Y	N	Y	Y	Y	N	N-WAIVED	N	N	Y		n/a	n/a	Y	Y	Y
Haswell SWDS LF	Kiowa	S	95	150	1,112	N	N	N	N	N	N	N	N-WAIVED	N-W/D	N-W/D	N		Y	N	N	N	N
East Lamar Municipal LF	Prowers	S	11,218	11,124	2,393	Y	Y	Y	Y	Y	Y	N-old, Y-NEW	Y	Y	Y	Y	?	n/a	n/a	Y	Y	Y
Granada SWDS LF	Prowers	S	249	489	390	Y	N	N	N	N	N	N	N	N-W/D	N-W/D	N		Y	N	N	N	N
Holly SWDLF	Prowers	S	1,147	3,982	1,345	Y	Y	N	Y	Y	Y/N	N	N	Y	N	Y	DETECT	Y	N	Y	Y	Y
Firstview Sanitary LF	Cheyenne	S	1,304	1,259	1,320	Y	N	N	N			Y	N	Y	N	N		n/a	n/a	N	N	N
Kit Carson SWDS LF	Kit Carson	M	8,781	9,049	10,804	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
LABC Landfill	Bent	S	729	260	2,998	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Lincoln County LF	Logan	M	2,623	3,542	3,814	Y	Y	Y	Y	Y	Y	Y	Y	Y	N-Piezo	N		Y	N	N	N	N
Logan County LF	Logan		34,141	8,440		Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a			
Manzanola LF	Otero	S	1,156	1,091	1,022	Y	Y	N	Y	Y	N	N	N	N-W/D	N	N		n/a	n/a	Y	Y	Y
Otero County LF	Otero	M	18,360	18,658	14,028	Y	Y	N	Y	Y	Y	Y	Y	Y+W/D	Y	Y		n/a	n/a	Y	Y	Y
Morgan County LF	Morgan	M	24,231	25,573	25,217	Y	Y	Y	Y	?	Y	N	N-WAIVED	Y	N	Y	DETECT	n/a	n/a	Y	Y	Y
Phillips County LF	Phillips	S	2,204	2,197	2,318	Y	N	N	Y	Y	Y	N	N-WAIVED	Y	N-3W/D	N		n/a	n/a			
Sedgwick County LF	Sedgwick		5,095	5,382				N			Y	Y?	N-WAIVED	Y	N	Y		Y	N	Y	Y	Y
Trinidad LF	Las Animas	M	10,956	11,053	11,667	Y	Y	N	N	N	Y	N	N-WAIVED	Y	Y	Y		n/a	n/a	Y	Y	Y
Washington County LF	Washington	M	3,189	4,309	4,899	Y	N	N	N	N	Y	N	N	Y	N	Y		n/a	n/a	N	N	N
Yuma County SWDS LF	Yuma	M	6,755	6,719	6,259	Y	Y	Y	Y	Y	Y	N-WAIVED	N	N-W/D	N-3W/D	N		Y	N	Y	Y	Y
Western Slope																						
Adobe Buttes LF	Delta	M	15,708	35,903	28,799	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Bondad LF	La Plata	L	53,579	79,668	78,341	Y	Y	Y	Y	Y	Y	Y NATURAL	Y	Y	N	Y		n/a	n/a	Y	Y	Y
Broad Canyon LF	Montrose	L	23,408	29,830	32,397	Y	Y	Y	Y	Y	Y	Y	Y	N-W/D	N	N		n/a	n/a	Y	Y	N
Mesa County LF	Mesa	L	157,182	159,670	163,975	Y	Y	Y	Y	Y	Y	Y	N-WAIVED	Y	Y	Y		n/a	n/a	Y	Y	Y
Moffatt County LF	Moffatt	M	13,163	13,647	12,073	Y	Y	Y	Y	Y	y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	Y
Montezuma County LF	Montezuma	M	23,053	32,081	29,401	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		n/a	n/a	Y	Y	N
Montrose SWDS	Montrose	M	26,709	25,547	25,528	Y	Y	Y	Y	Y	Y	Y NATURAL	N-WAIVED	N-W/D	N-W/D	n/a		Y	N	Y	Y	Y
South Canyon SWDS	Garfield	L	68,011	58,554	47,656	Y	Y	Y	Y	Y	Y	Y NATURAL	Y	N-W/D	Y	Y		n/a	n/a	Y	Y	Y
S-road Disposal	Mesa	S	533	2,332	1,817	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y		n/a	n/a	Y	Y	
West Garfield SWDS LF	Garfield	M	19,231	22,848	25,547	Y	Y	Y	Y	Y	Y	Y RECOMP	N	Y	Y	Y		n/a	n/a	Y	Y	Y
Wray Gulch LF	Rio Blanco	M	19,930	18,729	10,630	Y	Y	Y	Y	Y	Y	Y RECOMP	N	Y	N-W/D	n/a		Y	N	Y	Y	Y

Notes:
n/a = not applicable
LF = Landfill
N-W/D = not in compliance, using a inadequate system of a wet dry well(s)
DETECT = ground water contamination detected
N-WAIVED = not in compliance but was previously waived by the Dept. with no demonstation for approval
Y = In compliance
SWDF = Solid Waste Disposal Facility
? = additional information needed
SWDS = Solid Waste Disposal Service
N = Not in compliance

APPENDIX C: CASE STUDIES

APPENDIX C – CASE STUDIES

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SECTION 3: TRANSFER AND DISPOSAL SYSTEM CASE STUDIES

Mesa County Transfer and Disposal System

Mesa County Solid Waste Management operates four transfer stations within the county. The transfer stations are located in Fruita, Gateway, De Beque and Molina.

The transfer stations were planned based on the solid waste plan for Mesa County written in the late 1990s. Most of the transfer stations were built based on promises from commissioners to provide service in small towns that were not serviced or underserved. The Molina and De Beque transfer stations are on private property that is leased to the county.

The transfer stations do not meet the current definition of a transfer station since they are 20 years old. They are mostly drop off locations that are open and staffed a couple days a week for some and twice a month (Mo) for others. The tipping fee at each transfer station is $15 per load for up to regular sized pickups. The transfer stations also accept recyclables that are taken to the Waste Management MRF in Grand Junction.

The transfer stations see little traffic, sometimes only a handful of loads per day. Fruita is the most visited with 30 – 60 loads each day it is open depending on the season. Fruita is also the only transfer station that is not subsidized by the landfill. Gateway now has solid waste collection service that transports waste south to the Broad Canyon Landfill.

Bent County Transfer and Disposal System

Bent County in Southeastern Colorado does not operate a municipal solid waste landfill. The county made the choice in the 1990s to avoid the costs of constructing and operating a landfill that would comply with Subtitle D regulations. The county instead decided to transport waste collected in the county approximately 23 miles one way to the landfill in neighboring Otero County. The county transports approximately 460 tons of solid waste per month and pays approximately $13/ton in tipping fees at the Otero County Landfill. Bent County does operate a construction and demolition landfill that is located north of Las Animas.

The disposal system, which was started by a private company around 2000, was taken over by Bent County around 2006 or 2007. The disposal system consists of 60 – 70 three cubic yard dumpsters spread around the county. Most of the dumpsters are located in turnouts along county roads. Some larger farming enterprises in the county have dumpsters on their property because of the larger waste quantities

generated. The county has also established transfer stations in Las Animas and McClave for city residents to drop off waste.

To provide collection, Bent County and the city of Las Animas created a partnership and share the cost of collection equipment. Residents of the county voted on a fee of $80 annually for every household in the county to fund the disposal and collection system. Larger farm enterprises that have dumpsters located on their property are charged $65 per month. The county acknowledges the transportation costs are high especially for waste that is transported from McClave to Otero County, but the system is solvent and is working well for county residents.

Hinsdale County Transfer and Disposal System

Hinsdale County operates a transfer station in Lake City that collects and routes waste to the Six Mile Landfill in Gunnison County. Hinsdale County had operated a “dump” style landfill that opened in the 1950s, and closed in 1990. Prior to the closure of the landfill, a study was conducted to outline options for future waste management in the county. Based on the study, the county decided that a transfer station would provide the best option and result in a cost savings for the county.

The transfer station does not have scales, but charges customers by container or volume. Rates are posted at the facility entrance, and customers are generally used to the measurement of material, whether it is in a bag, truck bed or trailer. The transfer station operates as an enterprise fund and requires no support from county tax revenue. The rate charged at the transfer station is set to provide an approximately $2/ton surplus over the tipping fee the county is charged at the Six Mile Landfill. This surplus is used within the enterprise fund to operate the transfer station.

Materials brought to the transfer station are loaded into compactors for solid waste and recycling that are transported to other facilities. There is a burn pit for tree limbs and clean wood. The burn pit is used annually under a burn permit to reduce that waste to ash, which is then combined with solid waste for transport to the Six Mile Landfill, which is approximately 70 miles away.

In 2015, the county hauled 604 tons of material from the transfer station to the Six Mile Landfill. This total does not include recycling, which is hauled to another facility. Overall, the facility is working well and the facility is financially self-sufficient which benefits the county.

State of Wyoming Disposal Program

The Wyoming Department of Environmental Quality (WDEQ) formed a Citizen's Advisory Group in 2003, at the direction of the Governor, after the need to address groundwater contamination and plan for the rising cost of providing safe solid waste services became apparent. At that point, groundwater monitoring required under the Subtitle D regulations had been indicating some landfills had groundwater contamination, indicating landfills were generating enough leachate to migrate into groundwater.

In 2006, the state of Wyoming began a groundwater monitoring program, led by the WDEQ, to determine if contaminants were present at any of the unlined landfills in the state. The Wyoming Legislature set aside $7,970,000 to help local governmental entities fund the installation of monitoring networks, and in some cases pay for monitoring. Until this program began, it was believed that the climate in the arid west would limit the generation of landfill leachate (liquid that has passed through or emerged from solid) and the migration of leachate to groundwater. Because of this thinking, landfills in Wyoming and other arid states were designed and operated without liners for almost 20 years after the promulgation of regulations under Subtitle D. Results of the ground water monitoring program indicate that 96% of Wyoming landfills have measurable levels of ground water contamination and 91% have contamination above water protection standards.

During the implementation of the groundwater monitoring program, an Integrated Solid Waste Planning report was completed in 2009 to address the groundwater contamination from unlined landfills and the rising costs of operating safe landfills beyond the financial capabilities of many local governments in Wyoming. The report determined that shared landfills can help control the rising costs. Based on the report, many small landfill operators plan to transfer waste to more cost-effective regional landfills and then close their local landfills. The closure of a landfill and transfer of waste cannot happen until the waste transfer infrastructure is constructed, which can require years to determine need, arrange funding and complete permitting, design and construction. In 2013, an evaluation of local landfills by WDEQ led to the creation of a prioritization list. In 2015, the Wyoming Legislature passed Enrolled Act No. 17 which finalized the priority list and the funding for each community.

The results of all of the available monitoring data submitted from the groundwater monitoring program was evaluated by WDEQ and summarized in a report in June of 2010, indicating the extent to which facilities are contaminating groundwater. The finding of the report estimated the groundwater remediation cost faced by local governments state-wide was about $226 million. Wyoming Statute § 35-11-524 was passed by the Legislature in 2011 and required additional investigations and the preparation of an initial report by December 2012, describing an assessment of the clean-up costs at the highest priority landfills.

In 2013, the Legislature passed Enrolled Act No. 43, which created the Landfill Remediation Program (LRP), which enabled WDEQ to oversee and fund up to 75% of the cost of investigating and remediating contamination at municipal solid waste landfills for up to 10 years. Legislation passed in 2014, required the Legislature to approve a prioritized list of qualified projects prior to the expenditure of funds to conduct remediation activities at high priority landfills. The Priority list was approved in Enrolled Act 2 in the 2015 session clearing the way for remediation activities to begin.

SECTION 4: SOLID WASTE COLLECTION SYSTEM CASE STUDIES

City of Longmont's Municipal Collection System

Longmont Sanitation

The city of Longmont has been providing solid waste and recycling collection services to its residents since it was codified in 1948. The services are delivered by the city sanitation division and funded through monthly subscription fees charged to residents in their utility bills. The city offers a modest pay-as-you throw (PAYT) program that allows residents to select from two container sizes, either 48 gallon (gal) or 96 gallon, which includes an embedded rate for curbside recycling. The city also charges a waste management fee to all residential units that pay for the operation of the waste diversion center, special collection events, household hazardous waste and waste disposal at all city facilities and parks.

In the late 1980s, Longmont began its journey to introduce waste diversion practices for the city. Curbside recycling was introduced when a non-profit organization began a grass-roots recycling effort offered to residents. Soon after that effort began, the city initiated a curbside recycling program.

Over the last 10 years, Longmont has focused on a few key programs to increase recycling opportunities to its residents such as: introducing single stream recycling, having a waste diversion center and providing a limited number of special collection events. The city collects 29,000 tons of solid waste and 12,000 tons of recyclable materials annually, currently maintaining a 30% diversion rate.

Waste Diversion Center

Longmont operates a waste diversion center, an enhanced recycling center that accepts a variety of recyclable materials. When it was opened in 2005, the center only accepted a few commodities: tree branches, cardboard/paperboard, mixed recyclables and bulky metals. Today, that facility has grown to offer enhanced recycling opportunities to the community and accepts single stream recyclables, bulky metals, cardboard, shredded paper, rechargeable batteries, cooking/motor oils, food waste organics,

plastic bags and styrofoam. The waste diversion center is visited by over 40,000 customers annually and collects about 5,000 tons of material each year.

Special Collection Events

The city provides two special curbside collection programs that help divert material from the landfill and keep storm drains free and clean of debris: a spring-time curbside branch collection and a fall leaf collection. The purpose of these programs is not only to provide a convenience service to residents, but to divert the woody and leafy debris from the curbside solid waste containers and landfills.

Household Hazardous Waste Management

The city also provides its residents with household hazardous waste services. Longmont provides an annual collection event at the public works facility collecting unused paints and chemicals from residents. This annual collection event is augmented with an intergovernmental agreement with the Boulder County hazardous material collection facility so residents can have a year round opportunity to properly dispose of household chemicals.

Longmont's Future

Longmont is currently planning to launch a voluntary curbside organics collection program along with enhanced pay-as-you throw (PAYT) subscription rates. The new subscription rates, if approved, would include a reduced volume solid waste collection service option that is provided as an every-other-week solid waste collection. These two programs are intended to create a convenient organics curbside collection opportunity for residents and increase Longmont's solid waste diversion quantities.

City of Lafayette's Organic's Collection Request for Proposals (RFP) and Collection Contract

An audit of Lafayette's solid waste in 2013 determined that yard waste and food scraps made up 42% of the landfilled materials from the city. Seeing an opportunity for increased diversion and because the city already had a two-cart PAYT solid waste and recycling system, "the next logical step was a three-cart system." Therefore, Lafayette posted a Request for Proposal (RFP) for the addition of organics collection for single-family households that did not receive solid waste service from home owners associations (HOA) in April of 2014, with notices placed in two local papers in July.

The desired program would include a seven-year contract for a single-hauler with a three-cart PAYT system for collection of solid waste, recycling and organic materials (the city already had a PAYT solid waste and recycling system at the time).

The city collected bids for service, discussed the advantages and disadvantages of each and brought their recommendations to city council. The three bids considered contained the details that follow for monthly collection of a 64-gallon solid waste cart and 32 gallon organics cart respectively: Waste Connections - $5.14 and $3.67, Republic Services - $8.25 and $4.45 and Western Disposal - $10.20 and $3.62. The most inexpensive bid was from Waste Connections, but seemed to lack details and the city did not feel that it was "sustainable." The bid from their current hauler Western Disposal, whom the city had been happy with, was detailed but included a 45% increase in rates compared to their current system which was the highest increase of the three bids. The bid from Republic Services lacked a few details, but included a rate that was reasonable. The representative from Republic Services who attended the meeting was able to immediately supply the missing details. As a result, the Lafayette city council voted to "authorize negotiations" for organics collection with Republic Services on July 15, 2014.

The current details of Lafayette's single-family non-HOA solid waste services are included below.

- PAYT solid waste
- Recycling cost is not embedded in solid waste cost
- Organics cost not embedded, but payment for minimum organics service is mandatory
- Provided solid waste, recycling and organics to 5,759 households (HH) for 4 months 2015
- Solid waste: 1,309 tons or 113.6 lbs/HH/Mo in 2015 for 4 months only
- Recycling: 584.3 tons or 50.7 lbs/HH/Mo in 2015 for 4 months only
- Organics: 235 tons or 20.4 lbs/HH/Mo in 2015 for 4 months only
- In 2015 there were still 70 HHs that asked to have their organics cart taken away, even though they had to pay for service
- In 2015, only about half the town had this city solid waste service – the rest were HOAs that have their own solid waste service
- Organics program started Feb 2015
- Pricing solid waste: 32 gallon $8.33/Mo, 64 gallon $16.66/Mo, 96 gallon $25.00/Mo
- Pricing recycling: $1.00/Mo
- Pricing organics: 32 gallon $4.49/Mo, 64 gallon $7.87/Mo, 96 gallon $11.24/Mo; mandatory pay for 32 gallon
- Extra $0.15/Mo administration fee for solid waste service
- Extra $7/Mo for additional 96 gallon solid waste cart up to two carts; extra solid waste bag stickers for 32 gallon bag $4 each; extra $3/Mo for additional 96 gallon compost cart up to two

- Collection frequency is organics every other week, recycling every other week, solid waste weekly

The following "value-added" services began in 2015:

- Every April a supply of finished compostable material is available to residents free of charge
- A fall curbside pick-up of yard waste
- In the fall, one free curbside pick-up of unlimited bulky items in addition to the quarterly one item pick-up that was already available

City of Golden's Approach to Include HOAs in PAYT

On November 13, 2014, an ordinance was approved to expand the city of Golden's PAYT program. All solid waste haulers in the city of Golden were required to offer PAYT to single-family residents, multi-family complexes, HOAs and commercial entities by January of 2016. The minimum size offered for collection must be 32 gallons with additional sizes increasing by 32 gallon increments. Recycling must be provided and the costs must be embedded in the solid waste costs. The hauler can choose to offer carts, bags, and/or tags that meet the previously stated sizing requirements.

There are 61 HOAs and four other housing associations in Golden that include more than 1,600 housing units. Because these account for a large percentage of Golden's households and therefore have strong effects on recycling and solid waste, the city included requirements for HOAs in the PAYT ordinance. Therefore, all HOAs indirectly have PAYT through hauler licensing requirements. HOAs are not automatically included in the city PAYT solid waste program. If HOAs provide waste collection through a hauler for their residents, then they are not included in the program, but if waste collection is not provided by the HOAs for their residents, then the households are included in the city program. HOAs can opt-in to the city PAYT program at any time. HOAs that do not have the city PAYT service had to meet with their haulers by January 1, 2016 to change their contracts to fulfill the requirements in the PAYT ordinance if necessary. The resulting solid waste costs may be slightly different from those of the city PAYT program depending on negotiated pricing.

Implementation amongst the HOAs was met with opposition and was delayed two times for six months at a time with an original implementation deadline of January 1, 2015 and actual implementation deadline January 1, 2016. Haulers are responsible for ordinance enforcement. Some of the smaller HOAs with less than 100 households chose to opt-in to the city PAYT program, but many of the larger ones thought they could get better rates due to economies of scale on their own. Other reasons that the larger HOAs were resistant were that their boards wanted to retain control over their solid waste and some had bylaws that

did not allow for changes to solid waste service, one hauler charged "liquidation damages due to early termination" when some tried to make changes to their service, some claimed their residents did not want PAYT programs, some didn't want to give up the large solid waste cans and some HOAs claimed they already recycle more than the city does. The city of Golden was threatened with lawsuits by three HOAs. The Council then decided to allow compliance exemptions if HOAs can provide data to prove they have a 25% diversion rate by August 1, 2016. If they do this, then they will receive a one-year exemption extension with renewals possible on a yearly basis. If they do not, then they must comply by January 1, 2017. Three HOAs are exempted from the ordinance at this time, but the city hopes they will eventually be brought into compliance. There was initial confusion amongst many HOA residents over whom to call for solid waste service questions/concerns because many thought their HOA was enrolled in the city PAYT program when they were not.

While the initial PAYT single-hauler ordinance passed in 2010 and received substantial outreach and education, it did not require compliance from HOAs. The plan was that HOAs were going to be brought in during the 2014 "Phase 2" with compliance required by January 1, 2015. As a result of this time gap, HOAs were caught by surprise and were unprepared for making service changes. The city believes acceptance could have been improved by implementing Phase 2 within one year and allowing three years for complete compliance. An additional round of outreach in 2014 would have helped the process as well. Another timing circumstance that affected the process was that the city was re-bidding services for their existing single-hauler PAYT program in 2015 when HOAs began inquiring about city PAYT rates. Because those rates had not been determined, HOAs were not able to make decisions about participation in the city's PAYT program. The city of Golden should also have had "star" resident examples chosen from the few HOA residents who called the city and said they thought PAYT would be great in their neighborhood. The city should have done direct outreach to those residents, given them PAYT service, and made them "test cases" that they could use as examples when the HOAs said their residents did not support PAYT programs. A final lesson learned was that the city should have suggested that the HOAs become leaders in the city as "Green Adopters."

The City's PAYT Program

Residential solid waste is collected weekly by a contracted hauler, who provides the carts. It is PAYT and the monthly cost rates are:

- Super Saver 32 gallon: $6.20
- 32 gallon: $7.50
- 64 gallon: $12.60

- 96 gallon: $19.25
- Additional 96 gallon available for $10.85 and solid waste stickers for $2.00 each for up to a 32 gallon bag

Solid waste is billed on residents' quarterly water utility bill, with optional organics, large item pick-up, carryout/carry-in service or drive-in service billed separately by the hauler. Cart size can be changed free of charge within the first 90 days of service. Residents can choose to use any solid waste hauler that is licensed to operate in the city for their waste collection, but if their household is included in the city program, they will be billed for the minimum service.

Single stream residential recycling is collected every other week by the contracted hauler. The hauler provides a 96 gallon recycling cart, but residents have the option for a 64 gallon cart. The cost is embedded in the solid waste rate. Drop-off recycling is also available. Recyclable materials collected curbside include: newspaper, office paper, mixed paper, junk mail, phone books, magazines, brown paper bags, cardboard cereal/tissue boxes, empty aerosol cans, aluminum cans, tin cans, plastic milk jugs, rigid plastics, plastic (#1 - #7), milk/juice cartons, expanded polystyrene (EPS) and glass bottles.

Curbside residential yard waste and food scraps co-mingled collection are available year-round by subscription from Alpine Waste and Recycling. They are collected every other week in 96 gallon carts. The hauler provides the cart as well as a kitchen waste container. Residents who participate in the PAYT program are eligible for the semi-annual curbside collection of yard waste provided by Alpine Waste and Recycling for one week in the fall and spring. During this collection, residents can place the materials in reusable containers or compostable 30 gallon bags on their solid waste collection day.

Multi-family complexes that are less than eight units are included in the city PAYT program and can choose from the cart sizes and prices above, use a dumpster for solid waste and recycling carts or use one dumpster for solid waste and one for recycling. Dumpster prices are volume based. Solid waste prices are equivalent to the three main service levels and adjusted accordingly with dumpster pricing remaining the same. Commercial and industrial entities are excluded from the city PAYT program.

PAYT Ordinances in Golden and Fort Collins

Two cities in Colorado passed ordinances that were very similar and resulted in implementation of PAYT services indirectly through hauler licensing requirements. In 1996, Fort Collins first approved ordinances with the goal of implementing PAYT (these have been updated several times since). The PAYT ordinances adopted in Golden on November 13, 2014 were approved to expand recycling. These

ordinances from the two cities have similar requirements and key verbatim language. The major elements that are identical are the following:

- All solid waste haulers in the city were required to be licensed and to offer PAYT to single-family residents, multi-family complexes, HOAs and commercial entities with pricing for 32 gallons carts/bags/ tags with additional sizes increasing by 32 gallon increments.
- Charges are based on container sizes rather than the actual volume of solid waste within the container. Haulers determine the types of containers they will collect and the rates for service of the different sized containers with those for additional containers being equal to or greater than the charge for the first container of equal size.
- Haulers supply the carts, and/or bags and/or labels for carts.
- Solid waste containers may not be overloaded. Charges for bags or excess solid waste volumes need to be proportional by volume to the subscription cost per 32-gallon bag/container.
- Haulers must educate new customers when starting service, and existing customers annually about all of the available solid waste options they offer.
- Haulers that offer bag/tag services only may charge a fixed fee in addition to the PAYT fees for solid waste service only to cover operational costs of routing, fuel and other surcharges.
- Curbside recycling must be offered and the cost is embedded in the solid waste costs.
- Exceptions to the recycling requirements will be made if the hauler provides documentation to the city that verifies there is not sufficient space for the recycling containers.
- Recycling collection from multi-family and/or commercial entities must be frequent enough to prevent recycling container overflow.
- Recyclables may not be commingled with solid waste, must include all the materials designated by the city and must be disposed of at a qualified recycling facility.
- A hauler shall not collect recyclable materials that are required to be recycled.
- Any subcontractors must provide service that is compliant with the code and rules.
- Vehicles used for recycling must be clearly marked.
- Haulers are required to report to the city the rate schedules, number and type of accounts (residential, multi-family, and commercial), number of accounts on each level of service and solid waste tonnages collected from each type of account on at least a quarterly basis based on the weight of a representative sample.
- Hauler licenses must be renewed annually by November 30th for the following year.

There are some differences in the PAYT ordinances. One difference is that many of Fort Collin's requirements are only for single-family residents and HOAs, but Golden's requirements are for single-family residents, HOAs and multi-family complexes and commercial entities. Some additional differences are as follows:

Golden

- Haulers must provide the recycling carts/containers/bags free of charge in at least 64 gallon and 96 gallon sizes.
- Since dumpsters used by multi-family complexes are already volume-based, these complexes can retain their dumpsters or switch to smaller cart service for solid waste and recycling with associated PAYT rates if desired.
- Documentation that illustrates compliance had to be submitted by the haulers to the city by January 1, 2016.

Fort Collins

- Unlimited curbside recycling must be offered in hauler-provided 64 gallon or 96 gallon carts, with some haulers allowed to offer an 18-gallon tub.
- No additional service fees can be charged on residential solid waste bills.
- A hauler may collect any container that has no more than 25%, by volume, of recyclable cardboard.

Vail's 2014 PAYT Ordinance

On July 1, 2014, Vail Town Council members approved an ordinance that made PAYT in Vail mandatory for single-family residents, multi-family residents and businesses with penalties for non-compliance. The language in the document also includes HOAs. The ordinance states that all haulers of solid waste and recycling that operate in the Town of Vail must be registered. The haulers are required to provide new customers with written details of the available variable rate solid waste prices for different container sizes and available sizes for recycling. A list of current materials that can be recycled must be included. The haulers are required to submit a copy of each unique notice to the community development department by January 31st annually.

In 2010, Vail was interested in exploring ways to reduce solid waste and increase recycling. They determined substantial solid waste came from the 120 – 140 commercial entities, especially hotels, condos and restaurants. Therefore, they decided to try to include the commercial sector in their solid

waste reduction plans. Specifics to the commercial sector are discussed in the case study that follows called "Vail, CO Commercial PAYT Program with Embedded Recycling." The town created a local recycling advisory committee that included businesses, haulers, town council members and residents; and hired consultants to aid in the process. They had already tried educating the public and determined that it resulted in only about a 3% increase in recycling. They then prioritized goals/recommendations and voted on many options. Finally, after four years of effort, the town council voted four to three to approve the ordinance with the PAYT and embedded recycling. After the ordinance was approved, the town provided education about the requirements and options to residents. The town put hangers on solid waste and recycling cans, ran ads, and had a website that offered education.

There were concerns about the requirements of this ordinance. One of these was about the cost for servicing an additional container for recycling. This was addressed by embedding the recycling cost in the PAYT solid waste costs. People were also worried about having to pay more for solid waste than they had previously. Since bear proof containers were now required, there were additional costs incurred to either lease them from the haulers or to purchase them. Since the 18-gallon recycling bin would no longer be allowed, residents had to obtain new recycling containers. The town suggested that some of the old solid waste cans could be re-purposed for recycling. There were also concerns over having space for the recycling containers.

As of June 2016, recycling in Vail is "in limbo" and there is a need for police department enforcement of the recycling mandates through fines. It also remains unclear whether all haulers are following the PAYT mandates.

Some lessons learned through implementation and maintenance of the ordinance were that changes should be made to residential services at the same time as commercial services to limit confusion and to ease the education and compliance. The town also determined that it was easier to get businesses to cooperate than residents because many employees supported and wanted to recycle more, whereas many residents did not care. Pairing requirements for mandatory embedded recycling with those for PAYT service was a natural fit and worked very well. The cost of the required bear-proof containers to residents and small businesses were a huge barrier to the program. There needed to be lots of education about the program to improve compliance. Initially haulers were charging too much (and continue to do so), there was confusion about whether recycling was dual stream or single stream since different haulers accepted one but not the other and haulers didn't help educate to decrease the confusion. However, it is beneficial to have the haulers working with the town as partners to make the transition, as well as continuation of the

program a success. And finally, even though hauler reporting is required, it is very challenging to obtain the data.

SECTION 5: DIVERSION MATERIALS MANAGEMENT

Fort Collins' Glass Recycling – Drop-off and Curbside

Glass recycling with single-stream recycling is challenging due to glass breakage into small pieces which are not easily sorted mechanically or manually which causes contamination of other recyclable materials. As a result, only about 30% of glass from single-stream recycling is eligible for glass-to-glass recycling. Fort Collins therefore offers two options for recycling glass to their residential and commercial entities. The first is to self-haul to the city's recycling drop-off center, the Larimer County Recycling Center, or other drop-offs and deposit into designated glass-only bins. Glass from these sites are used to make new glass bottles at a plant based in Wheat Ridge. The second option is for residential and commercial entities to recycle their glass curbside mixed in with their single-stream recycling. The glass is then separated out at a recycling facility, crushed, and then used as alternative daily cover and/or for drainage at landfills. Fort Collins is slowly moving towards eliminating glass in their single-stream recycling and have been "heavily messaging" to residents and businesses to source separate and self-haul their glass to the town drop-off sites set up by Clear Intentions.

Recycling Hub and Spoke - Clean Valley Recycling

Started in 2011 with little money and a lot of passion for recycling, Clean Valley Recycling (CVR) in Swink is the "Hub" of the recycling system in the Arkansas Valley Region. Deanna Hostetler, manager of the non-profit, said, "we started in La Junta as a spoke of Pueblo, but that was just too far." CVR was able to find the "Old Sugar Factory" in Swink and move into its huge warehouse and purchase a baler. This was aided by a CDPHE RREO grant. Recycling goes into large 40-gallon, "potato sack" bags. Residents can drop these off in Swink or at one of the many drop-off sites around the region. Most of the sites are manned with volunteers who receive some of the proceeds received from the materials. Here is a snapshot of their operation:

- Spokes are located within a 30-mile radius to keep down transportation costs
- Recycling bins are only picked up when full
- Recycling bags are sold for $3 per 40-gallon sack
- They currently have two full time equivalents, five part-time equivalents, volunteers, and one driver
- They rely on donations and grants and host a barn dance fundraiser annually in June

- They have recently started curbside recycling pickup for a few communities for approximately $6.50 a month

CVR has partnered with communities such as Lamar. The Lamar Partnership, Inc. manages the drop off site, open two Saturdays a month in the North Thriftway parking lot. When the large, donated container fills up, they haul the material to Swink and it is recycled by CVR. Residents can purchase the recycling bags at the Lamar Chamber of Commerce.

Recycling Hub and Spoke - Angel of Shavano

Angel of Shavano Recycling operates a hub and spoke recycling program in Chaffee County, taking over operations for the county in 2012. Owner Mickey Barry installed better roll-off containers at the three drop off sites where residents place material in separate bins. Once full, they are collected by the company and brought back to their "hub" facility in Poncha Springs for processing. They have three trucks and trailers that they use, picking up the full containers and leaving an empty one behind. That is normally twice per week collection for cardboard and plastics and once per week for everything else, though during the Christmas holidays it can be as often as every day. They process the recycling collected from Waste Management's curbside pickup, tripled the amount of material coming to the drop off sites and created jobs for five employees. This material means space is somewhat tight with the 40-foot sort lines and horizontal baler. Angel of Shavano sends the material direct to mills, manufacturers or exporters, and reimburses 5% of the total sales of the material to the county and local governments. In 2014 that amounted to $8,285.69. Mickey said "this type of program works especially well in rural areas. Just make sure you start simple with materials like cardboard, #1-2 plastics and paper."

Commercial PAYT Program with Embedded Recycling

On July 1, 2014, Vail town council members approved an ordinance that made PAYT and recycling in Vail mandatory for single-family residents, multi-family residents and businesses with penalties for non-compliance. Vail was the first town in the "valley" to mandate recycling. The costs for recycling must be embedded in the solid waste rates for residents, multi-family residents and businesses. The owner(s)/occupant(s) of all premises and commercial establishments are responsible for ensuring that no recycling goes into their solid waste, as well as for contracting for recycling service/ensuring delivery of recyclables to a MRF. The way the ordinance is written also includes HOAs. All haulers of solid waste and recycling must be registered.

In 2010, Vail was interested in exploring ways to reduce solid waste and increase recycling. They determined that substantial solid waste came from the 120 – 140 commercial entities, especially hotels,

condos and restaurants. Therefore, they decided to try to include the commercial sector in their reduction plans. They created a local recycling advisory committee that included businesses, haulers, town council members and residents; and hired consultants to aid in the process. They had already tried educating the public and determined that it resulted in only about a 3% increase in recycling. They therefore determined that they needed "to do more." They prioritized goals/recommendations and voted on many options. Finally, after four years of effort, the town council voted four to three to approve the ordinance with the PAYT and embedded recycling which included commercial entities.

There were concerns about implementation of this ordinance – more for mandatory recycling than PAYT since business solid waste was already PAYT due to the way it was serviced. One concern was about how commercial entities would be able to adapt current solid waste policies to be able to comply with the new requirements. Some businesses had their own "structure" that had specific requirements to house their dumpsters or carts, and others shared the "structure." Most of these structures housed six yard dumpsters that were used for solid waste. There was concern over how they could accommodate a dumpster for recycling as well as the added expense to do so. To help with this, the Town suggested using two three-yard dumpsters instead of one six-yard dumpster, waived building permit fees if a new solid waste structure had to be built, and offered a rebate up to $750 for building and/or signage. There was also concern about the cost of adding and servicing an additional container for recycling. This was addressed by embedding the recycling cost in the PAYT solid waste costs.

Initially one strategy to aid in implementation was to allow for up to two-year recycling exemptions granted by the Vail Planning and Environmental Commission, giving businesses more time to "figure things out." The town also provided a lot of education about the requirements and options to businesses. They even hired an intern to go door-to-door to speak with them directly, and put informative hangers on their doors. The town put hangers on solid waste and recycling cans, ran ads and had a website that offered education. This extra attention to businesses greatly eased the transition and increased compliance.

As of June 2016, recycling in Vail is "in limbo." While there are not any complaints noted from the commercial sector, there is a need for police department enforcement of the recycling mandates through fines since many commercial entities seem to believe that the town will not notice recycling non-compliance. However, Vail is planning to use "gentle" enforcement and to use tag hangers to remind and show that they are paying attention. They are also considering re-instating the building/signage rebates.

Some lessons learned through implementation and maintenance of the ordinance were that changes should be made to residential services at the same time as commercial to limit confusion and to ease the education and compliance. The town also determined that it was easier to get businesses to cooperate than residents because many employees supported and wanted to recycle more. And finally that pairing requirements for mandatory embedded recycling with those for PAYT service was a natural fit and worked very well.

City of Boulder: Mandatory Commercial Recycling Ordinance & Food Mandates

The city of Boulder recently passed a new ordinance requiring that all business owners (including multi-family housing owners) must provide recycling and organics service within their buildings. The ordinance, in part, reads as follows:

"All business owners must separate recyclable and compostable material from the solid waste and wherever business owners provide solid waste containers to employees or customers, they must also provide recyclables and compostables containers for employees and customers' use. Containers must be at least as conveniently located as solid waste and be of adequate size and number to prevent recyclables and compostables from being mixed with solid waste."

The ordinance goes on to require that all property owners must be able to demonstrate that they have not only solid waste collection service, but also recyclables and organics collection services for their properties.

The ordinance, city of Boulder Revised Code 6-3-14, becomes effective on June 17, 2016. The city recognized that it would take a considerable period of time for all of the businesses and multi-family landlords to comply with the ordinance and will not begin issuing notices of violation until June 17, 2017.

The penalties for not complying with the ordinance are $500 for a first offense, $1,000 for a second offense and $2,000 for all offenses thereafter. Commercial landlords can pass the responsibility for complying with the ordinance on to their tenants by addressing the responsibility for compliance in their leases. The ordinance is unique in that it is sweeping in scope, encompassing all buildings in Boulder (including single family homes) and that it required not only recycling at businesses, but also separation of organics.

A separate pre-existing ordinance, city ordinance 6-12-5 - Containers for Recycling or Composting Collection, required that haulers provide a certain level of recycling service to multi-family buildings. The ordinance, in part, reads as follows:

"Haulers providing solid waste collection service to multifamily customers through centralized collection areas shall provide containers for recyclable materials at no additional charge. Containers shall be of a sufficient size to accommodate the regular accumulation of recyclables from that customer, but, at a minimum, such container shall be of a volume equal to one-half of the volume of the solid waste collection service. If the city manager requires the collection of compostables, haulers shall provide containers for that service of a sufficient size to accommodate the regular accumulation of compostables from that customer."

This pre-existing ordinance creates an incentive for multi-family building owners to encourage their tenants to recycle in that they can save money on their combined solid waste and recycling service if the tenants recycle effectively.

Boulder County Publicly Owned and Privately Operated MRF

The Boulder County Recycling Center (MRF) was built after a ballot initiative that approved a recycling sales tax was passed, with the ultimate goal of diverting more materials from the landfill. It is owned by Boulder County, operated by Eco-Cycle and began operation in 2001. It includes a materials processing center, drop-off area, tipping floor, offices and a rail spur. It accepts single stream materials from local haulers, residents and small businesses from Boulder County and from any hauler and municipality that has a contracts with the MRF. It does charge a tip fee for single-stream residential materials. The facility uses both mechanized and manual sorting techniques and the initial sorting line splits into a fiber line and container line. It has a baler, several sorting platforms, a corrugated cardboard screen, a fines screen, a double deck paper screen, a French Screen, a cross-belt magnet, an air classifier, an Eddy current separator, an optical system for removal of stones, ceramics and porcelain from glass and an organics separator. Materials accepted are paper, paperboards, plastic containers #1 – 7, aseptic cartons/boxes, steel/tin containers, aluminum beverage containers and foil, all colors of glass containers, office paper and mail products and textiles (in drop-off boxes only). Scrap metal is no longer accepted at this facility.

The facility is about 50,000 square feet, processes an average of 48,000 single-stream tons per year (about 38,880 tons residential, 5,280 tons commercial, and 3,840 tons source-separated materials from drop-offs), and has a capacity of 75,000 tons. The MRF originally only accepted dual-stream materials, but in 2008 began accepting single-stream materials to make recycling more convenient for the community and to increase the recycling rate. While this has been better overall, accepting glass into the system wears down the equipment more quickly and it is challenging to get all of it out of the resulting products. Some of the average per ton prices that the facility sold their materials for in 2014 are: OMP $87, OCC $100,

tin/steel $200, aluminum $1500, PET $300, and HDPE $790. The facility also includes a drop-off center. Prepared materials are shipped to recycling mills.

The facility utilizes the following practices when possible to maximize environmental sustainability: daylighting, use of recycled/sustainable materials, water reuse from roofs for irrigation, "innovative water polishing techniques" for wetland protection, xeriscaping and landscaping with native plants, reduction of truck traffic through use of a rail spur and reduction of costs and increases in revenues by having an area where only clean papers from drop-offs are unloaded and put directly into balers.

A best practice to follow when setting up a MRF is to invest in the latest technologies like optical sorters to keep the costs down. A lesson learned in the process was to remove glass to the best of your ability at the beginning of the system to produce cleaner products.

Local Level "Green" Advocates: Eco-Cycle, Boulder CO

Community recycling champions or advocates can be an effective tool for a community to kick-start and continue momentum and interest in diversion programs. Eco-Cycle is a non-profit established in 1976 by a group of residents who were strong advocates for recycling, helping make Boulder one of the first communities in country to have a curbside recycling program.

In 2001, through a contract, they began operating Boulder County's Recycling Center and remain strong advocates for programs throughout the county. With over 750 volunteers they are able to persuade opinions and effect change. They organize representatives to show up at council meetings and ensure there is public support for environmentally friendly programs. Eco-Cycle advocates participate on local recycling boards and are active in state and national recycling associations. Their Network volunteers distribute hundreds of copies of The Eco-Cycle Guide and help educate and encourage neighbors to be more active. The have also helped establish many programs through the Recycling Center and strive to help the community move towards Zero Waste.

As part of that effort, Eco-Cycle opened the CHaRM facility (also in 2001), to give the community a place to recycle unusual items such as electronics, yoga matts, and mattresses. For mattress recycling they partner with Spring Back Colorado which disassembles and reuses the materials, employing many former drug and alcohol related felons.

Eco-Cycle works with businesses, schools and event organizers to educate on Zero Waste best practices. Although they have worked to facilitate large scale Zero Waste events, they saw demand increasing for small scale events as well. They now have Zero Waste Kits for smaller events.

Education is a large part of their advocacy for Zero Waste and they have won many awards for their efforts to promote diversion. For schools, they provide tours to the recycling facility and educational programs. Their website provides free information and downloadable material.

Alpine Waste Privately Owned and Operated MRF

Alpine Waste and Recycling is the largest privately held commercial solid waste collection company in the Colorado collecting over 300,000 tons of materials per year. In 2007 when Alpine Waste and Recycling's Altogether Recycling Facility (MRF) opened, it was Colorado's second largest single-stream processing facility. Since then, their collection of recyclable materials has gone from 200 tons per month to over 2,600 tons per month eight years later. After expansions in 2011 and 2015, it gained the ability to process more than two times the original capacity of recyclable materials, and now has the highest capacity in the state. The facility accepts single stream materials from 35,000 households, commercial and industrial sources, and processes source-separated materials like post-industrial plastics and scrap paper from commercial printers. The facility uses both mechanized and manual sorting techniques. After the 2011 addition of a commercial single-stream processing line (there was already an existing residential one), the facility currently has three lines. In 2015 at a cost of $5 million, more updates were completed with the old residential line replaced with a Machinex processing system. This system is capable of handling both residential and commercial materials, and had improved material sorting technology and two times the number of transfer belts as before. It has an MACH OCC screen for separating OCC on its commercial line. The facility has a two balers, one of which is the first two ram machine in the US, a MACH Hyspec optical sorter for plastics, a ballistic separator for containers and paper, live-floor material bunkers emptying directly onto conveyors, multiple bin-fed return conveyors, a sorting conveyor for plastics, a debris roll screen for glass, split paper screens, a triple-deck cardboard screen, an Eddy current/ vacuum system for aluminum and a cross-belt magnet for steel. It is also the first facility in Colorado to accept expanded polystyrene (EPS) and has a dedicated line with the first EPS condenser to form "bricks" in the state as well. Materials accepted are paper, paperboards, plastic containers #1 – 7, aseptic cartons/boxes, steel/tin containers, aluminum beverage containers and foil, all colors of glass containers, office paper and mail products and EPS.

The facility is about 50,000 square feet, has the capacity to processes 30 tons/hour, processes more than 6,000 tons per month, and processed an average of 80,000 single-stream tons in 2015 (about 56,000 tons of fiber and 17,000 tons of containers). The facility operates five days per week, and has one full shift and one small shift used to bale materials.

The entire Machinex system design allows for flexibility to meet future needs and market changes. Improvements can still be made to existing operations to increase efficiencies. The ability to switch from one baler to the other by pushing a button decreases facility down time. Alpine continues to educate customers about the damage and problems that contaminants like plastic bags, steel and construction debris can cause in the machines.

Dump and Pick-up: Commercial Brokers: Small Operations around Colorado

There are several small baling operations around Colorado where solid waste haulers have established routes to collect clean cardboard and/or office paper mixes from their customers and then bale them for shipment to market.

These operations are generally built around the hauler's customer base and are dependent upon having one or two customers who produce a sizeable amount of clean materials. The hauler can then add smaller amounts of materials from other smaller generators to construct a route(s) that produces enough material(s) to economically justify the purchase of a baler and the procurement of enough space to store materials before baling and after baling to accumulate a full truck load of materials before shipment to market.

Often these operations are started with a small used baler that the hauler procures through the network of used equipment dealers or from a bankruptcy case. Often they are initially operated in a corner of a haulers existing facility until the volume and economics allow for a dedicated space. Baling costs in these small operations generally are $25.00 to $30.00 per ton.

These operations are often the stepping stone to bigger processing operations as the community and the hauler grow and as the demand for recycling services among the customer base expands.

Denver Residential Curbside Organics Pilot Program

While the economics of diversion in Denver are challenging when compared to the low price of landfilling, a 2008 waste composition revealed that over 50% of the city's residential waste stream was compostable. This program, designed by the city and county of Denver Solid Waste Management Board (SWM), was implemented to improve diversion, provide a valuable service to residents and prevent organics from being landfilled.

Since solid waste services in the city of Denver are paid through a combination of property taxes and general funds, residents are never directly billed for solid waste or recycling services. The city provides unlimited weekly solid waste collection. Residents can enroll in the city's "opt-in" every other week

recycling service and receive a 96 gallon cart. Solid waste, recycling and organics are collected on the same day.

After receiving the initial grant funding, the pilot program began in 2008 as a single route through all sectors of the city to gauge interest among a diversity of households and demographics. By the end of the first year, the service had 3,200 satisfied participants and had only experienced minor setbacks like squirrels chewing through some of the carts. In 2010 the city of Denver had an unusually lean budget and could not afford to continue the $15-$17 million program so they told the participants that if they wanted the service to continue, then they would have to pay for it ($9.75/HH/MO or prepay a whole year for $107.25 (which provided a one-month discount). This strategy kept the program running, but did not provide the level of funding necessary for growth and expansion.

In 2012, after a bit of creative thinking, Denver SWM was able to secure a $2 million inter-agency loan from the Denver Department of Environmental Health to help fund a program expansion. However, before SWM could accept the money, staff had to work with elected officials to set-up a special revenue fund (SRF). The loan, coupled with the creation of the SRF, allowed SWM to accept the compost payments, place them in the fund, and subsequently use the fund to service the loan, purchase new carts and trucks and pay for collection and processing. The loan and SRF was approved in the fall of 2013 along with an expansion plan to make service available to over 75% of the city within 10 years, fully pay back the loan in 13 years and provide an on-going funding source for composting into the future. The city is discussing potential options to speed the growth of the program.

City of Louisville: Contracted Solid Waste, Recycling and Organics Collection

The city of Louisville has provided solid waste, recyclables and organics collection service to its residents for over seven years. The city contracted with a private hauler, Western Disposal Services, Inc. to provide the collection service to its residents.

Solid waste is collected weekly and single stream recyclables and organics are collected every-other-week on an alternative schedule. The organics program collects not only yard waste but also food waste including meat and dairy waste.

Under the program, the hauler provides the carts to the customers and customers can choose a 96 gallon, 64 gallon or 32 gallon cart independently for each service. Rates are based upon the cart sizes selected. Following is the current price list for Louisville residents:

Refuse Cart Size	Compost Cart Size	Monthly Cost for Refuse/Compost Service (effective 9/1/14) includes 60¢ service fee	Cost for Recycling any size cart (32, 64 or 96)
32 Gallon	32 gallon	$14.67	$0.00
32 Gallon	64 gallon	$18.29	$0.00
32 Gallon	96 gallon	$21.91	$0.00
64 Gallon	32 gallon	$23.02	$0.00
64 Gallon	64 gallon	$26.64	$0.00
64 Gallon	96 gallon	$30.26	$0.00
96 Gallon	32 gallon	$31.37	$0.00
96 Gallon	64 gallon	$34.99	$0.00
96 Gallon	96 gallon	$38.61	$0.00

Additional carts for solid waste and compostables are $2.50 per month if at 96 gallon service. Prepaid stickers for a 32 gallon bag are $3.35.

In this PAYT pricing model, the cost of recycling is covered in the fee for solid waste collection and the first 32 gallons of organics collection is also covered in the fee for solid waste collection. Additional 32 gallon units of organics collection cost approximately $3.62 each.

Superior's Drop-Off Organics Program

The town of Superior's Waste Diversion Advisory Committee (WDAC) (now the Resource Conservation Advisory Committee) saw the need for some kind of diversion of yard waste in their town. They had gathered survey information about materials that took up space in residents' solid waste carts and determined that yard waste was a huge contributor. Yard waste also made up a large portion of material set-out during the town's bulky item pick-up events. As a result, the WDAC recommended construction of the yard waste drop-off site within the already existing fenced area that the landscaping contractors used for staging. In 2005, the town board approved the plan and the drop-off yard waste organics facility was developed and opened in the same year. It currently consists of a 3,000 square foot outdoor fenced area with two concrete pads to station the roll-offs, and is open seasonally from April through November, and again for a month following Christmas for tree drop-offs. It is open on Saturdays and Sundays from 8:00 AM to 4:00 PM with a lunch closure from 12:00 PM to 1:00 PM and Wednesdays from 4:00PM to 7:00 PM. One part-time employee oversees the open hours. In 2015, 100.8 tons of yard waste were collected from the two 30 cubic yard dumpsters. It costs the town around $49,000 annually to operate the site – hauling and employee costs for management. The town has seen savings from not having to collect yard waste at their bulky events and has been able to compost increasing amounts of yard waste. A limited amount of free compost is also made available for residents to pick-up at the site annually.

The biggest challenge since the site opened has been to achieve a balance between increased usage/availability while minimizing contamination. This problem continues today but has improved with education and site staffing. Also, because only one side of the fenced-in site is open, access and egress

for the site exit both occur on the one side. As a result, there are often lines and congestion from residents waiting to get into the site. Therefore, one future plan/improvement for the site is to possibly make it a drive-through for drop-off of yard waste and pick-up of compost.

Private Sector Organics Processing: A-1 Organics

A-1 Organics is Colorado's largest composter with operations in Eaton, Keenesberg and Commerce City. The company also has operations in Las Vegas, Nevada. The company accepts all types of organic materials including green waste, animal manures, clean wood waste, and yard waste, food waste for composting, tree limbs, logs, clean wood (untreated, unpainted), brush, grass, leaves, sod and soil. Products manufactured include compost, compost mixes, soil mixes and mulches.

A-1's composting producing facilities total nearly 600 acres and are located in very rural areas, Eaton and Keenesberg, to eliminate complaints about odor from neighbors. Because manures are included in many of the compost feedstocks, neighbors sometimes "think they smell something."

The company has a wide variety of tipping fees depending upon the material being delivered. Tipping fees for curbside organic materials average $35.00 per ton, but transportation costs to their more remote locations need to be factored into the total cost of disposal.

Private Sector Organics Processing: Western Disposal, Boulder

Western Disposal is a privately owned collection company that services primarily Boulder County collecting solid waste, recyclables and organics. Western Disposal permitted and operates a Class II Compost facility for the processing of the source separated organic and food-waste materials it collects on its residential and commercial routes. In addition to manufacturing compost, Western Disposal also grinds woody material to manufacture wood chips and wood mulch.

Western Disposal developed a yard-waste and food-waste only windrow compost facility on a nineteen acre site within the city of Boulder and has been operating there for over 10 years without any odor complaints from the public.

The Western Disposal site is unique in that it is operated in an industrial part of Boulder and is not located in some remote part of the county. Because Western Disposal does not use any bio-solids in its process it has been able to operate with no odor complaints from its neighbors. The site is used predominantly by Western Disposal but they also accept residential organics from other haulers at a price of $77.00 per ton.

Pitkin County: Compost Program and Processing

Although this program is in Pitkin County, it gathers material and affects diversion throughout the Roaring Fork Valley. This is an example of an effective program created by necessity and aided through RREO grants and rebates from CDPHE. As with many communities in the mountains, Pitkin County has limited options for landfilling sites. As the end of life for the landfill began approaching, and with no alternative site, the county needed an immediate way to reduce materials. A yard waste ban was one of the first steps taken. When a study revealed 40-60% of the landfill material was comprised of food waste and waste related paper, Pitkin County began looking into adding food scraps to the program. Through a grant from the state, they were able to purchase a compost mixer and with a rebate check from the CDPHE, the county was able to purchase much needed bear proof containers which they loan out to businesses and HOA's. They also provide small covered kitchen containers free of charge for single family residents. Though it requires active participation by residents, the program seems to be growing in popularity and currently takes in about 781 tons of food waste and 6,442 of general compostables. Evergreen, the local hauler, has around 200 mostly residential accounts and large businesses (like Whole Foods and the local ski operators) also send their material to the facility. There is a local and very active company in the region that provides curbside pickup of food scraps and education to participants, or residents can drop the material off free of charge at the compost facility at the landfill.

One of the problems composting processors face with residential food waste programs is contamination. The city of Aspen's bag ban program has greatly reduced the plastic in the food waste stream as well as outreach, education and screening at the compost facility. Pitkin County has a large transient population with tourists and second home residents. Although outreach can be difficult regarding food scraps, most residents pay for landscaping service and have the material collected for them. Even without the yard waste ban, the lower price for this material at the landfill ($45 for yard waste vs. $64 for landfill) provides economic incentives for landscapers. The Pitkin County site is Class 5 facility that uses static, non-aerated windrows to process yard trimmings, food waste and biosolids. Adding foods scraps to the mix provides a better quality of compost which is Seal of Testing Assurance certified by the US Composting Council. It is in turn purchased by the landscapers and community members for $35/ton, bringing in a sales revenue of $296,582. They contract with a private company for operations which cost $291,335. Revenue from the incoming materials brings in $614,137.

Residential yard waste and food scraps are a continuous source of material for the county and this program helps fund other diversion programs. Through another grant for outreach and education, Pitkin County, and their largest community of Aspen, have been able to get the word out through mailers, PSAs, newspaper advertisements, half hour weekly television/video spots and website links.

On-Farm Composting/Farm Siting

Organic Producers have limited choices on what products can be used to meet fertility needs for crop production under the National Organic Program rule. The rule states that a producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil or water by plant nutrients, pathogenic organisms, heavy metals or residues of prohibited substances. The national policy then goes on to explain the highly specific criteria for compost production relative to maintained temperature, time of soil incorporation and final carbon-to-nitrogen ratio. The state of Colorado also has regulations for organics processing.

Due to the protective regulations that require monitoring and specific criteria involved in compost production, many facilities do not function as a public organics drop-off site for fear of a contaminated and unusable final product. However, most, if not all, farms compost organic agricultural material generated on-site. Residents/businesses in rural areas either perform backyard composting (BYC), landfill their material or arrange a private drop-off with a local farm. Farm owners are typically open to receiving material, but due to more stringent regulations on solid waste compost facilities, they are unlikely to operate as commercial drop-off locations for non-agricultural organics in the near future.

Eagle County: Multi-Stream MRF

The Eagle County (material recovery facility) MRF is owned and operated by Eagle County and began operation in 2010. It accepts three streams of materials, from residents, multi-family, and businesses in Eagle County and the surrounding areas, doesn't charge any tip fees, and does not have any profit sharing incentives. The facility uses both mechanized and manual sorting techniques by inmates on one line for co-mingled materials. The paper stream is dumped onto the shop floor and hand sorted before being fed into the baler. The cardboard stream is very clean and is fed directly into the baler. The MRF has an optical sorter, a tin magnet, an Eddy current separator, a glass breaker screen and a dual RAM baler. Materials accepted are newspaper, office paper, magazines, corrugated cardboard, plastic containers #1 – 7, steel/tin containers, aluminum beverage containers and all colors of glass beverage containers. Co-mingled materials are plastics, aluminum cans, steel/tin cans, and glass in one container, newspaper in another and cardboard in a third.

The facility encompasses 14,000 square feet and processes over 5,000 tons per year. Although it does not include a drop-off center, dual stream materials are accepted from six Eagle County managed drop-off sites in Vail, Red Cliff, Avon, Edwards, Eagle and Gypsum. Prepared materials are shipped to recycling end-users. No revenue is produced from glass which is crushed and hauled to a facility in the Denver area that does not charge for disposal.

The pre-MRF separation of the recyclable materials result in very clean products that get "the highest" prices. Some of the prices that the facility sold their materials for in 2016 are the following: OMP $49.96, OCC $78.52, tin/steel $25.49, aluminum $1,020.00 (2015 price), PET $133.24, HDPE colored $362.13 and HDPE natural $504.40. All of the aforementioned prices include transportation costs. The facility processing is under capacity because of the requirements of the source separated incoming materials. Since the facility opened, all three haulers in the area have switched to single-stream recycling. One hauler sorts the recyclable materials into the three streams curbside and continues to bring them to the Eagle County MRF, but the other two now bring their materials to the Denver area. As a result, the tonnages of incoming materials have steadily declined over the last few years with the tonnages from curbside and drop-offs (not including glass) being as follows: 2010 5,834.93 tons; 2011 6,239 tons; 2012 6,179 tons; 2013 5,989 tons; 2014 4888 tons; and 2015 4260 tons. The feeling is that even though multi-stream recycling results in cleaner products that get higher prices in the market, it is more difficult for residents, and haulers prefer to offer single-stream to their customers even if it increases the hauling distance. There are still problems with profitability, material supply and insufficient demand/pricing for products. Conversion to accept single-stream recyclables would be very expensive and there currently are not any plans to do so, but will depend on the hauler's willingness to continue pre-sorting, and whether there are any changes to resident's desire for curbside single-stream service and their willingness to use the drop-offs.

Better Invoicing – Residential and Commercial

Many residential and commercial customers who are billed for their solid waste services by their municipality or hauler(s) often find the invoices to be very confusing. Because these invoices lack clarity, it is difficult to determine the exact services they are paying for and receiving. Many invoices are unclear about service frequency, number and size of containers for solid waste, recycling and organics that are collected, the total number of pickups they are billing for and pricing. There are often vague undefined "codes" on the invoices that appear to correspond to the particular service, but actually are not even consistent within invoices. Or they may just state "Basic Service" without adequate explanation. Many invoices do not show clarity in costs for solid waste versus recycling versus organics, in tax incentives, or in other fees like gas charges, sustainability/environmental fees and solid waste taxes that are included in the total solid waste bill. And finally, the physical location of and absence of information about specific charges can lead to confusion about which solid waste stream the charges actually apply to. For example, locating solid waste taxes and fees immediately after the recycling section of the bill rather than in the earlier solid waste section, makes it seem like recycling costs more than it actually does. Quite often tax

percentages and what they are assessed on are not listed clearly. Many of the aforementioned invoicing issues are illustrated in the following figure.

Current Invoice Charges

Administrative Fee $1.92

[redacted]

1 - Front Load (2 Yd) Scheduled Service (S3)

Date	Description	Reference	Quantity	Unit Price	Amount
01/25	Rate Adjustment 01/15/13-02/28/13		1.0000	$106.56	$38.98
01/25	Basic Service 02/01/13-02/28/13			$81.56	$81.56

1 - Front Load Recycling (2 Yd) Scheduled Service (S4) Single Stream Recycling

Date	Description	Reference	Quantity	Unit Price	Amount
01/25	Recycling Service 02/01/13-02/28/13			$52.14	$52.14
	Total Fuel/Environmental Recovery Fee				$52.61
	Total County Environmental Charge				$83.35
	Total Solid Waste Management Tax				$26.75
	Current Invoice Charges				**$337.31**

This lack of clarity makes it difficult for both residents and businesses to see any potential savings from favoring one solid waste stream over the other, and therefore may actually end up having negative effects on recycling and organics collection. It also makes it extremely difficult to comparison shop for services so residents and businesses may not end up with the best combination of price and service possible. Therefore, invoice clarity that includes solid waste stream-separated information about service frequency, volumes of solid waste, number of pick-ups, pricing, taxes and additional fees can be extremely beneficial to both residential and commercial customers.

Aspen Sustainability Plan

In recognition of Aspen's dependence on climate and natural resources for a thriving economy, healthy ecosystems and exceptional quality of life, Aspen's city council adopted the city of Aspen's Canary Action Plan in 2007, which commits to reducing community greenhouse gas emissions 30% by 2020 and 80% by 2050, below 2004 levels.

The plan contains background information on climate change, results from the city's baseline greenhouse gas inventory and action steps to address greenhouse gases from various sectors. It also includes goals for renewable energy for the city's municipal utility, goals for community deployment of renewable energy systems and calls for increasing Colorado's renewable electricity standard and the renewable energy portfolio of the rural electric cooperative that also serves the city.

This Climate Action Plan is a widely cited example of a community that was an early adopter for greenhouse gas reduction strategies and commitments. The reductions goals were set to comply with levels that the International Panel on Climate Change (IPCC) called for to avert climate catastrophe at the time the plan was adopted by city council. The plan showcases actions that the city's municipal utility and other internal departments can take to affect community wide emissions. The report also outlines actions that can be taken by various sectors.

The plan calls for the creation of a "low carbon footprint" guideline for city events which has resulted in the green events checklist and event report cards available at: http://aspenpitkin.com/Living-in-the-Valley/Green-Initiatives/Aspen-ZGreen/Events/. The Canary Initiative has also developed an energy tracker for business and citizens to track their energy use (http://aspenpitkin.com/Living-in-the-Valley/Green-Initiatives/Aspen-ZGreen/) and a carbon calculator and offset program for offsetting emissions (www.canarytags.com).

Unique Considerations for Composting in Eastern Colorado

After nearly 30 years of monitoring nitrogen levels in Rocky Mountain National Park (RMNP), the Colorado Air Quality Control Commission, the Colorado Department of Public Health and Environment (CDPHE), the National Park Service (NPS) and the U.S. Environmental Protection Agency (EPA) determined that changes were occurring in the types of organisms and biochemistry of the park's soil and forest ecosystems from the increased nitrogen. As a result, in 2010, they endorsed an agreement called the Rocky Mountain National Park Initiative Nitrogen Deposition Reduction Contingency Plan. The latter three agencies worked together and determined that 1.5 kg of nitrogen per hectare per year (kg N/ha/yr) wet deposition was the "critical load" threshold above which negative environmental changes would occur. They then used a glidepath approach to set the following goals for the reduction of nitrogen levels in RMNP to: 2.7 kg N/ha/yr by 2012; 2.4 kg N/ha/yr by 2017; 2.1 kg N/ha/yr by 2022; 1.8 kg N/ha/yr by 2027; and 1.5 kg N/ha/yr by 2032.

One source of nitrogen that was studied came from ammonia. The agencies determined that there was a "sharply decreasing east-to-west gradient" of ammonia concentrations from field measurements in Colorado, and that the highest concentrations were in the northeastern part of the state where there were many livestock operations and farms. Livestock and farms produce large volumes of ammonia emissions that combine with nitrogen oxides from vehicles, as well as other combustible sources, to create nitrogen particles. It was shown using tracers that upslope winds from the east (common in the spring and summer) then blow this nitrogen into RMNP. Therefore, weather conditions and time of year are

important regarding this source of nitrogen and could be an important part of the overall reduction in the park.

To aid in this reduction of ammonia, the agencies recommended some best management practices that farmers could follow. Nitrogen level tracking has been used to provide "alerts" on a daily basis so activities that might cause nitrogen increases can be avoided when the levels are already high. Some of the current voluntary practices to reduce the amount of ammonia produced specifically by livestock manure that are being evaluated through use within Colorado are the following:

- Scraping pens/alleys when wind/temperature/nitrogen conditions are favorable or using water to rinse rather that scraping them
- Changing methods for handling manure after removal from pens
    - Composting – aerate/turn compost on non-windy/low temperature/nitrogen favorable days, add biodegradable carbon sources, manage pile moisture, manage pile temperature and decrease pile pH
    - Stockpiling – aerate/turn on non-windy/low temperature/nitrogen favorable days, may be favorable to mounding (being evaluated)
- Incorporate manure into the soil as quickly as possible, even at a shallow depth, during cool, dry, and calm weather
- Irrigate immediately after application of manure to land

The reduction of nitrogen in RMNP as a result of most of the aforementioned practices is still being evaluated. Hopefully a decrease to the next nitrogen-level goal in 2017 will be achieved in the park and levels will continue to decrease steadily in the future.

Successful K-12 Program: Delta School District (Non-Front Range)

Delta County School District 50J has created an environmental education coordinator position though their newly formed educational foundation, The Nature Connection. Their part time coordinator is connecting resources throughout Colorado (including multiple state and federal agencies) to enhance student's education with hands on in class opportunities as well as field applications for students K-12 throughout the district. Colorado Parks and Wildlife trained 24 Teaching Environments Naturally (TEN) teachers in site based field applications in the district resulting in helping 982 students from second to eighth grade experience field studies this fall in TEN related activities.

While The Nature Connection teaches *Leave No Trace*, a set of wilderness etiquette and proper waste disposal guidelines, they mainly provide education for students on how and where to get outside. The primary idea being that deeper connections between individuals and nature will lead to a heightened sense of environmental stewardship within the community. Their biggest accomplishment has been collaboration and connecting local resources to student learning. Networking and team work have been the most important aspect of this project. Crucial elements of a successful education program:

- Strong support from the local school district, which offered a building and a funded Environmental Education Coordinator position. This position is currently part-time, but with funding from the anticipated GOCO Grant it will become a full-time job.
- Teach children to engage older residents and interview them on ways to improve their local community. Strong emphasis on community building.
- A partnership with Western Colorado Community Foundation has given The Nature Connection non-profit status and subsequent financial benefits.
- Do research via stakeholder feedback. Provide an online survey where data is collected and sorted out by area so it is possible to focus on the specific needs of each community.
- Lots of grant writing to ensure consistent levels of funding.

CU Boulder - An Education in Sustainability

Colorado is home to over 30 colleges and universities, creating the opportunity to educate and innovate in diversion and material management. CU Boulder is one of those universities leading the way through their on campus efforts, and working to collaborate with other state institutions. As a participant in AASHE's Sustainability Tracking, Assessment & Rating System™ (STARS)) - the university voluntarily reports their programs and diversion statistics to the group for national ranking. They currently have a gold ranking and received four out of four points for innovation.

Though not required, CU has a long history of sustainability through student lead interest. Recognized as one of the oldest and largest environmental centers in the country, and the first university to start a recycling program, CU Boulder received the National Recycling Coalitions "Outstanding School Program" award in 1995. In the 1970's, students voted to fund the Eco/Environmental Center with student fees, which also help fund the Recycling Program. With Jack DeBell leading the way since 1984 as the first profession Director of Recycling, CU's programs now reach far beyond a simple campus recycling program.

Sustainability reaches throughout the campus and community with LEED's building standards, student "Eco" bus passes, The Blueprint for a Green Campus and Campus Master Plan with formal guidelines for recycling, recycled content purchasing policy, a green energy campaign, on site composting facility and bag ban for student dining services, zero waste events and football games, public/private partnerships including student run outreach in the local community, and in 2015, a new on campus Recycling Operations Center opened, designed to increase landfill diversion rate and reach 90% diversion goal.

An institute of higher learning is an excellent place to introduce and engage future generations in sustainability practices. CU Boulder offers an undergraduate and graduate degree in environmental studies. They also have over 118 sustainability courses that over 300 include some form of sustainability education. Sustainability research involving students and faculty is also on going. This information and practices are hopefully something that will be carried and dispersed wherever these students go. CU Boulder has been host to many waste diversion and environmental conferences. In 2016, Jack DeBell helped organize the first of its kind Colorado Campuses Recycling Forum.

Although CU Boulder is working hard to achieve great progress, there is no state directive requiring them to do so, or connecting the universities to pool their combined potential. Without that state level influence on policy, there is a missed opportunity for things like purchasing policies and construction contract C&D diversion clauses. Without these higher level policies, Colorado cannot "fully nurture the opportunities of over 30 universities. The chain of command could be mobilized to meet those challenges" commented Jack DeBell.

Regional Leadership Example – Chittenden, Vermont

Authorized by Act 78, Vermont's first solid waste law, solid waste districts are government entities that design regional solutions to the solid waste challenges faced by their member towns and cities. The Chittenden Solid Waste District (CSWD) is a union municipal district chartered by the state of Vermont in 1987. Its mission is to reduce and manage the solid waste generated within Chittenden County in an environmentally sound, efficient, effective and economical manner.

Each of the 18 member municipality's governing board appoints a representative and an alternate to serve on the Board of Commissioners. The Board meets monthly to set policy and make major decisions. Commissioners' votes are weighted by population. The district's annual budget proposal is approved by the governing bodies of the member municipalities. The votes on the budget are not weighted, and a simple majority is required to approve the budget. Like other municipalities, CSWD has its own

ordinance. It governs how solid waste is managed in the county. CSWD must comply with the state's solid waste laws and meet the performance standards in the Vermont Materials Management Plan.

CSWD's programs and facilities are intended to affect the production, consumption and disposal decisions made by residents, businesses, and institutions, resulting in less waste produced and proper disposal. Ordinance highlights:

- Mandatory separation requirements for special wastes, yard trimmings, mandatory recyclables, and unregulated hazardous waste.
    - **Special wastes** are defined as "discarded major appliances (such as refrigerators, stoves and washers), tires, untreated wood, state-banned electronic devices, untreated regulated medical waste, waste oil, lead-acid batteries, nickel-cadmium and other rechargeable batteries, mercury-containing batteries, paint [excluding solidified water-based paint in quantities of less than one (1) gallon], scrap metal, and, commencing July 1, 2016 and thereafter, asbestos-free asphalt shingles, unpainted/unstained plywood, and unpainted/unstained oriented strand board."
- Mandatory education requirements for haulers, multi-unit residential and commercial property owners/managers, and special event venue owners/managers regarding separation requirements.
- Requirement that providers of solid waste containers for use by the general public must also provide an equal number of recycling containers.
- Requirement for haulers to offer collection of recyclables (and soon yard debris and food scraps under state law).
- Labeling requirements for solid waste, recycling, and food scrap collection containers.
- Banned Materials Fee: $20 ($60 minimum per load) fee charged on full loads delivered to disposal facilities (landfill-bound) containing 10% or more by volume of special wastes, yard trimmings, mandatory recyclables, or food scraps (phased in), or any amount of hazardous waste.

Tips for Other Regions

Be transparent with activities, policies, and finances. Keep member municipalities informed. You cannot manage what you do not measure. Education and enforcement are key. Boots on the ground to assist businesses, institutions and multi-unit properties are critical. Partnerships with businesses, institutions, non-profits and trade groups are an excellent way to spread your messages and good will. Involve stakeholders in planning and policy development.

Innovations in Rural Recycling: Amelia County, Virginia

Amelia County, Virginia received the Virginia award for Outstanding Rural Innovation in 2015. There are six convenience centers owned publicly, operated by Waste Management. Details on the centers include:

- One facility is open 24/7
- Other five have reasonable hours (40/week)
- No charge to residents
- 5% profit share with WM (county receives 25%)

Program Strategies

- First focus on local economic strengths and weaknesses and any comparative advantage.
- Regionalization (collaboration with other municipalities, regions, and businesses).
- It is the policy of the Virginia Waste Management Board to require each region to develop comprehensive and integrated solid waste management plans that, at a minimum, consider and address all components of the hierarchy (Source Reduction, Reuse, Recycle, Resource Recovery/WTE, Incineration, Landfilling):
    - Establish requirements for public and environmental health
    - Rules for designation of regional boundaries and waste shed boundaries for solid waste management plans
    - Provide reasonable variance and exceptions (for different economics/demographics)
- Spread out industry responsibility as well as reduce transportation costs by providing convenient colocation facilities and subsequently boost the economics of area diversion via reduced costs, increased participation and decreased contamination. For example, Food Lion accepts plastic bags, NAPA (auto parts) accepts car batteries, and a local towing company pickups and delivers many inoperable vehicles all for recycling.
- Regional Policy: “It is the Policy of the Board of Supervisors that the citizens of the county should be encouraged to recycle with the goal to meet or exceed the recycling requirements mandated”.
- Diversion (Recycling/Organics) not required, but strongly encouraged through this policy, infrastructure development, consistent education and community engagement (including annual and semi-annual events), strong data tracking and reporting, and many public/private partnerships and collaboration to spread the responsibility throughout the industry.

Other Ideas

- Use of converted farm equipment for sorting and initial processing of materials like newspaper and glass. (Glass can be ground and used in paving. Shredded newspaper can be used in soil preparation, and animal bedding).
- Appropriate container size based off of completed waste composition.
- Routing efficiency studies.
- Cooperative marketing (to share resources and save money).

Drop-off Organics in Summit County, CO

The Summit County Resource Allocation Park (SCRAP), owned and operated by Summit County, was an upgrade made to the Summit County Landfill in order to offer a drop-off location for organic waste material, as well as create a circular local economy by providing on-site processing and resale of High Country, Class 1 high-quality compost. This operation was designed primarily as food waste pilot program with Whole Foods separating and providing any leftover organic materials. However, the program quickly evolved as a solution to dealing with the large amounts of beetle kill (dead trees left standing from the pine beetle) in the Summit County area.

The largest challenge for the development of this program has been the transient population of Summit County (tourists and seasonal residents) that possesses a “throw-away” mentality and is generally unfamiliar with local services, programs and acceptable forms of waste diversion. Nevertheless, the program continues to grow successfully because the economics work. SCRAP is profitable, saves the community money on landfill disposal costs, provides a high quality usable product for the residents and has therefore created a circular local economy. Their main advice to other communities attempting to start on-site organics processing is to introduce accepted items slowly. It is easier to gradually accept more waste streams than try to sort out contamination. Programs which go slowly and gather consistent feedback on what is working and what is not save money.

Circular Local Economies: Lifecycle Plastics and Recycle Projects

Laura Brower is the founder of Lifecycle Plastics, the postconsumer food-grade plastics processor based in Commerce City, and run by Recycle Projects, a Colorado-based nonprofit organization. The process technology research and development conducted by Recycle Projects paved the way for the Lifecycle solution. Lifecycle is ‘closing the loop’ on the Colorado plastics market by processing locally disposed of food-grade plastic and plans to sell the finished product to manufacturers in the Front Range.

Process

Lifecycle's technology uses water to separate plastic regrind by density. First, they grind all the food grade plastic together, then the plastic gets washed and the labels removed. Afterwards, the plastic is sent through our automated sorting technology where the separated polymers streams are dried and shipped as regrind. Lifecycle takes all the food grade plastic they can handle and makes sure it gets converted back into a usable product.

Mission

The mission of Lifecycle Plastics is to provide a national solution for recycling single-use, food grade plastic. This not only saves 50% more energy than producing new plastic, it reduces the amount of natural resources extracted to produce virgin plastic, and it extends the lifetime of plastic as it gets recycled over and over again.

Elements Crucial to Success

- Capita: Received a grant for start-up funding.
- Partnership with Boulder County/Eco-Cycle MRF: Collaborated on an employee training program to help pre-sort out food-grade plastics.
- Close working relationship with manufacturers in the Front Range and out-of-state (Colorado markets are not yet developed enough to absorb the quantity of material produced by Lifecycle).
- Research and development: Lifecycle is currently evolving and the improvement of the process and equipment is an on-going operation.

Obstacles

- Still learning and gathering information on industry legislation and Food and Drug Administration regulation. Have a legal team for support, but will not really start working with them until the plastics recycling process has been totally ironed out.
- Lack of industry network: Due to the young and underdeveloped nature of this industry in Colorado, there is not a readily available group to seek out with questions or requests for assistance.

Tips

- Follow your head and your heart: Research the end markets really well so you do not attempt to jump into one that does not exist. People will say no end markets or potential sources of revenue exist, but do not get discouraged.
- Develop strong relationships with industry stakeholders to create a support network.

- Economic/industry development takes a long time: Do not expect immediate success.
- Put pressure on the state to have goals/planning, structured support (mentorship, business support, logistic support), easy connections to legislators, and opportunities for direct funding or at least assistance procuring direct funding.

Contamination Education Program - Springfield, MA

Contamination is a problem in that it clogs recycling systems or ruins what were otherwise salvageable materials. That cuts into the commodity stream at the back end of recycling systems, which ultimately impacts revenues and profitability. The bullet points from Springfield's education program follow:

- The third largest city in Massachusetts.
- An urban, economically challenged city with a lot of language barriers with the residents.
- 2008-2009 rolled out a single stream recycling program with huge success. Increased diversion and doubled recycling rates. Grew from 4,000 tons to 8,000 tons in one year.
- A contamination problem developed. There is some question to how much contamination since the metrics for measuring contamination are subjective. They were being told by the processor that they were not comfortable with the amount of contamination they were being given.
- In May, a program was launched to address the contamination problems.
- Within two weeks, contamination dropped from nine trucks being flagged to no trucks being flagged.
- Barrels were left behind.
- Proactive steps are being taken to make sure that Springfield was not one of the communities that were bringing contaminated recycling to the MRF. The markets have sort of stagnated because of the drop in oil prices, having less paper, the Chinese green fence – all those factors have contributed to the drop in revenue which makes the processors more carefully scrutinize loads.
- Education and effectively communication with residents are critical components of managing contamination.
- Leaving the barrels behind is key but when the barrel is left behind, a tag must be put on the barrel explaining the reason it was not picked up.
- Flyers were distributed to neighborhood groups and senior centers to help educate on recycling and contamination.

Collaboration: Southwest Colorado Council of Governments (SWCCOG)

Established in 2009 the council consists of five counties in the southwestern corner of Colorado and includes 14 local governments. They cover a sparsely populated area of approximately 6,500 square miles. SWCCOG member work to share resources and reduce redundancies among the members. Collectively they were able to conduct a waste study in late 2014 as a State of Colorado Recycling Resource Economic Opportunities (RREO) grant project. As part of this, they developed a Recycling Task Force with both public and private members. They concluded that "improving the economics of recycling was an important goal, and that regionalizing diversion activities, expanding public outreach, creating diversion incentives and providing better access to recycling collection were important components." Members were able to discover obstacles and opportunities for greater waste diversion.

A representative of SWCCOG participated in one of the CDPHE stakeholder's meetings and shared their insight to regional issues with nearby communities and the state. They are collaborating to look at issues in a way many other communities in other meetings have suggested as a way to move forward in their region's diversion goals. SWCCOG efforts help identify lacking programs and facilities and share best practices. They are currently looking for actionable goals and further partnering opportunities, recognizing that each member community has a different level of solid waste facilities and programs.

The State of Colorado: Implications for Food Donations

Food waste in Colorado has implications beyond making up about 15-25% of the materials filling up landfills. Take into consideration the amount of water used for agriculture and that "more than one quarter of total fresh water goes to food waste." There are also the effects of deforestation, and methane gas pollution and the sad fact that one in seven Coloradans struggle with hunger at that food insecure households are on the rise.

Many restaurants, grocery stores and large venue events and are still reluctant to donate extra food, paying instead to have someone to haul it to the landfill. One of the biggest reasons they do this is fear of lawsuits, that it may be illegal. But since 1996, the federal government has had the Bill Emerson Good Samarian Food Donation Act that states that "a person is not subject to civil or criminal liability arising from the nature, age, packaging, or condition of "apparently wholesome food" that the person donates in good faith to a nonprofit organization for ultimate distribution to needy individuals (e.g., a food bank)." Colorado has its own version of the law, C.R.S. §§ 13-21-113 with similar wording, and most recently in 2015, the Colorado Charitable Crop Donation Act passed where local producers can receive a 25% tax credit for the wholesale value of the food that they produce and donate to Colorado food banks and pantries. To date, there have been no lawsuits regarding these laws.

In Colorado, there are about 95 cities with food pantries from Durango and Edwards to Greeley and Lamar and multiple ones in the larger metropolitan areas. For those that cannot take food to the pantries, there are nonprofits like Food Bank of the Rockies, Denver/Boulder Food Rescue, and We Don't Waste Food that will come and collect the food for you. The Executive Director of We Don't Waste Food said he started in 2009, "picking up donations in his station wagon." The donations quickly outgrew that and he now has three refrigerated trucks, three full time employees and three part time employees and last year provided 6.8 million servings of food for the needy. They now collect food from all the main sporting arenas in Denver and the convention center. All this is done on grants and donations. "Everything is picked up and dropped off on the same day, free of charge, and there is very little waste."

Changing from Solid Waste Included in Tax Base to User Fees

One of the benefits in charging user fees instead of a general tax is that it is specific to those using the service. For solid waste service it has the added benefit of reminding residents that there is an actual cost for services provided, especially as more communities struggle to balance their budgets. In Colorado there are still many communities that offer unlimited amounts of solid waste disposal combined in property taxes, making it solid waste seem "free" when it is buried in a larger budget. This gives residents an "indiscriminate dependence on disposal of waste" and makes it harder to encourage diversion. There are many versions of user based fees in Colorado from: complete volume based fees, where users pay according to the amount they individually dispose of, and reap the benefits of reducing solid waste through recycling; to a combination of a base tax for everyone and an additional fee based on individual usage.

There are pros and cons to changing to user fees instead of taxes. The most important item to keep in mind when establishing user fees is that the fee must be used for the service provided. The National Conference of State Legislatures warned about this more than a decade ago when it stated, "If user charges exceed the cost of providing services, or if separate accounting is not used, governments are vulnerable to court rulings that such charges are taxes." Some of the reasons user fees for solid waste are becoming more common:

- It puts control of the payment for service in the hand of the users
- Increases public's awareness of the cost of providing a service
- Avoids having to raise taxes for increase cost of service
- More flexible than taxes for price adjustments and can respond to demand
- Can provide direct financial incentives for diversion

A few things to consider when changing to user fees is to provide plenty out information about where the funds are going and what services will be provided. Administration cost of collecting fees needs to be considered though it is often combined with other utilities such as water service. Compared to taxes, user fees may have increased impacts to low income and senior members of the community and exceptions or discounts may need to be included

Tip Fee Surcharges/Environmental Fees

Funding mechanisms such as environmental/solid waste fees or higher or lower tip fees can be used for paying for solid waste and diversion programs or used to encourage participation by making one alternative cheaper than another. The following example highlights one regions various approaches.

The six county Solid Waste Management Coordinating Board (SWMCB) is located in the twin cities area of Minnesota. Solid waste surcharges and taxes are used by both the state and some of the counties in the region. These fees, taxes, and other mechanisms incentivize alternative management options by increasing the cost of solid waste and generate revenue for landfill closures, groundwater monitoring, recycling grants, household hazardous waste facilities and other solid waste services.

The state solid waste management tax was implemented in 1997 and imposes a sales tax on waste hauling customers that is collected by haulers. The residential tax is 9.75% on solid waste services and commercial and institutional customers are charged a 17% sales tax on their solid waste services (there is a different mechanism used for non-solid waste). Three of the six counties in the SWMCB region also impose their own hauler-collected service charges on solid waste, including Hennepin, Ramsey and Washington counties.

Hauler billing for recycling services, including source separated organics, is exempt from the state tax and county charges, which helps make recycling a more attractive alternative.

Anoka County: The county has a solid waste management charge on all properties that is charged through the property taxes. The current fee is from $23 to $36 for residential properties and $80 to over $2,000 per year for commercial properties. The residential fees are based on the type of dwelling and the commercial fees are based on the value of the property improvement. County staff reports that they are planning on lowering fees by 33%.

Carver County: County ordinances say the county shall impose a solid waste management fee on property taxes and the county has the authority to impose a service fee on solid waste services in the county.

Hennepin County: The county imposes a solid waste management fee of 14.5% on commercial generators and 9% on residential generators. The fee is assessed on solid waste bills by the haulers as a condition of their operating license and remitted monthly to the county. The county also imposes, by ordinance, a fee of $2.00 per cubic yard of solid waste accepted and disposed at a facility for mixed solid waste (landfills). The fee is reduced for waste-to-energy facilities and there is no fee for recycling. The county also has a county collected solid waste management fee that is added to property taxes, the rate for this fee is currently set at zero.

Ramsey County: The county imposes a solid waste management charge on the sales price of solid waste services on the generator. The residential charge rate is 28% and the commercial charge rate is 53%.

Washington County: Similar to Ramsey County, Washington County imposes a charge on all MSW generators. One rate of 37.5% is assessed to both residential and non-residential generators.

Large Scale Private Sector Material Recovery Facility: Altogether Recycling

The Denver area is served by two large scale Material Recovery Facilities. One owned by Waste Management, Inc., the country's largest recyclables processor and a second one owned by Alpine Waste Solution's Altogether Recycling.

Altogether Recycling's facility, located in Denver, was built in 2007 was the first facility in the state to accept #3-7 plastics and aseptic (milk) cartons; it is currently the only company in the market to accept rigid plastics. Altogether Recycling is currently the second largest recycling facility in the state, processing in excess of 6,000 tons of recycling per month.

The existence of two large MRF facilities in the Denver area promotes competitive pricing for materials and competition to take more and more materials so that haulers can expand the list of materials that they will collect in their curbside recyclables collection programs.

State Legislation from Oregon, Vermont and New York

Older Oregon Legislation

Oregon has passed several series of solid waste legislation over the years. Their first, the Opportunity to Recycle Act, was passed in 1983. It established the following hierarchical solid waste strategies – reduce waste generation, reuse, recycle, compost, recover energy from materials that cannot be composted, recycled, reused or reduced, and finally dispose of all others that are remaining. Drop-off recycling

centers were required for all "wastesheds", and monthly curbside recycling had to be provided in communities with more than 4,000 residents.

The next piece of legislation, the 1991 Oregon Recycling Act (Senate Bill 66), required a statewide solid waste management plan and set a 50% statewide "recovery" goal by 2000. Other requirements were annual calculation of material recovery rates, every other year waste composition studies, additional recyclable materials/opportunities, establishment of a statewide household hazardous waste program, product procurement and recycled content requirements, funding for school recycling/reduction education, and providing grants. Counties/cities/metro districts were given three - eight choices in solid waste/recycling service options. Community size and location determined how many items they had to comply with.

Newer Oregon Legislation

Two programs to increase resource recovery were developed by the coalition of recycling and solid waste management members in 1997. One was providing a 2% recovery rate credit to local governments for additional solid waste programs, and the other was providing up to 6% total credits for additional solid waste programs toward individual wasteshed goals. Additional clarifications to existing requirements and program changes were made in 1997 including the addition of curbside collection of food scraps and compostable paper for commercial and industrial entities. By 2000, the 50% statewide recovery goal had not been achieved, so two new goals - 45% recovery by 2005, and 50% recovery by 2009 were established for the state with House Bill 3744 in 2001. New/amended solid waste management plans with voluntary individual recovery goals were submitted by the wastesheds and updated in 2006 and 2010. Technical reviews of solid waste management plans were conducted if these goals were not met and suggestions for improvements were offered. Some additional goals of HB3744 were that there would not be any annual increase in: a) per capita solid waste generation after 2005 and b) total solid waste generation after 2009. It also increased how wastesheds could receive the 2% recovery rate credit, and provided recovery rate credit for waste-to-energy participants. The state met its 50% recovery goal in 2010.

In 2012, "Materials Management in Oregon, 2050 Vision and Framework for Action" was adopted. In order to fund this action and vision, Senate Bill 245, which allows for the following increases in fees: tipping fees from the current $0.81 to $1.18; permit fees from $0.30 to $0.58; and with orphan site fees remaining at $0.13 was initiated in 2015. The bill included other revisions/additions as well. In 2015, Senate Bill 263 added four new recycling strategies to the already existing ones that dealt with residential food waste, commercial recycling, construction and demolition and commercial food waste. It also

increased the required numbers that had to be provided by certain communities/cities/counties based on population and location. Along with some other refinements and revisions, it set the following new recovery goals: increased the statewide goal to 52% by 2020 and 55% by 2025; set a 25% food and plastics goal by 2020; and set a 25% carpet goal by 2025. SB 263 also set the solid waste generation goals to be 15% below 2012 levels by 2025 and be 40% below by 2050.

Vermont Legislation

Vermont passed its Universal Recycling Law (Act 148) in 2012. This law includes phased-in landfill bans of food scraps from commercial entities generating 104 or more tons per year by 2014, 52 or more tons per year by 2015, 26 or more tons per year by 2016, 18 or more tons per year by 2017 and from all businesses and residents by 2020; from mandatory recyclables by 2015; of yard waste by 2016; and of clean wood in 2016. The following hierarchical diversion practices for yard waste and food scraps are encouraged: reduction, smart acquisition/use/reuse, diversion of consumables to people, diversion of consumables to agriculture/composting/energy recovery. All facilities permitted to accept solid waste (including transfer stations and drop-off centers) must accept and divert from the landfill the following materials: mandatory recyclables by 2014 at no extra charge, yard waste by 2015, and food scraps by 2017. Haulers that collect solid waste in the State must also provide collection for the following materials: mandatory recyclables by 2015 at no extra charge, yard waste by 2015, and food scraps by 2017. Solid waste haulers must provide PAYT statewide for residents by 2015, yard waste collection by 2016, and food scraps collection by 2017. Public buildings must provide recycling containers with solid waste cans by 2015 except in restrooms.

New York Legislation

New York has a Beyond Waste Plan that was written in 2010 and was scheduled for updates in 2013. Section 360 deals with solid waste. To be more effective and provide legal authority, the statutory structure of the Plan would need to be changed. As it currently is, it can only provide “direction and goals.” The state goals are phased-in reductions of generation per capita that began with the 2010 goal of 4.1 lbs. solid waste/day/capita, to 2016’s 2.9 lbs. solid waste/day/capita, to 2030’s 0.6 lbs. solid waste/day/capita. The state planning units will set their own individual goals that are in line with the state’s. Some of the additional goals within this plan are to increase the following: reuse, recycling, composting of organics, product stewardship, “green jobs” and to minimize the following: solid waste disposal, climate impacts, waste export.

Fort Collins PAYT Ordinance

In 1996, Fort Collins adopted its PAYT ordinance. This legislation requires that solid waste haulers operating in the city must by licensed and has the following requirements for all single-family residents including those in HOAs: solid waste rates must be volume-based and cannot include supplemental service fees, and recycling must be offered in 18 gallon bins or 64/96 gallon carts free of charge. The PAYT ordinance has been updated over the years to close loopholes that solid waste haulers were using to avoid PAYT especially when it came to HOAs, to adapt to changing options for service /markets like moving to wheeled carts and adding single-stream recycling, and to "fine-tune" the system in general.

Some suggestions that the city has for program implementation are to get base-line solid waste data before implementation if possible since it will provide credible measurements of program impacts. Also, it is a good idea to add PAYT requirements for commercial and multi-family customers at the same time as single-family ones, since it's easier and less overall effort to make all of the changes at once. The interviewee believes that PAYT has been the "cornerstone" of waste reduction and recycling progress in Fort Collins especially since they have privatized solid waste haulers. Another detail that has been helpful in Fort Collins from regulatory standpoint is that their definition of a single-family home is a residence that has its own solid waste bin, and a multi-family home is a residence with a shared solid waste bin. This demarcation makes it much easier for solid waste haulers and others (unless communities adopt PAYT system-wide) since the 8-unit or other definitions often leave many locations in grey areas or do not make sense on the ground. This way, if the haulers are providing one cart per unit/house, they know the PAYT rules apply.

Fort Collins Cardboard Ban

As of March 2013, corrugated cardboard generated by residents and commercial/industrial entities in Fort Collins is banned from the solid waste and must be recycled or composted (or reused). The city, which was the first in Colorado to initiate this type of ban, expected to recover around 12,000 tons as a result. Residents can still include cardboard in their curbside single-stream recycling, or bring it to drop-off centers. Businesses can either include it in their single-stream recycling, arrange to have it collected separately depending on hauler contracts or bring it to drop-off centers.

Five months before adopting this ordinance, the city council solicited input from both residents and commercial entities about the advantages and disadvantages of the ban. Banning cardboard from landfill disposal in Fort Collins was driven by the community goals of 50% waste diversion and the climate action goal of preventing 42,000 tons of CO_2 from being released. Cardboard was targeted since it is ubiquitous and easily-identified and has strong recycling markets. Enacting the ban on cardboard disposal

resulted in an increase in single-stream recycling in town (the manner in which most the cardboard is recycled), as well as increases in cardboard collected separately from businesses and cardboard brought to the city's recycling drop-off center. However, for maximum effectiveness, it would be helpful to pair the landfill ban with a requirement for service provision (including all sectors in the community in PAYT or requiring recycling collection or other mechanism to ensure all locations covered by the ban also have recycling collection service).

Recycling/Composting Strategies with Potential in the Loveland/Fort Collins Area

The ten stakeholder meetings throughout Colorado for this Plan provided a lot of information about existing area programs, what is currently working well, program gaps/barriers, successes/resources, neighbor sharing opportunities, near and long-term ideas, types of assistance/funding needed and roles of the entities involved. Here is a summary of what a group based in the Loveland/Fort Collins area came up with. The following are solid waste strategies that have potential:

- Require diversion tracking in every jurisdiction/region: Gathering information is the basis for understanding the status of a community's programs, identifying opportunities, and tracking the impact of programs or changes in the community. This ties well with a licensing requirement for haulers operating in the community. It is important to coordinate tracking forms/fields with other nearby jurisdictions to make it as simple as possible for haulers to report. Be sure to gather information for all sectors: residential, multi-family, commercial and industrial.
- Regional plans: Much of the infrastructure needed for waste management or diversion operates on a regional scale. Working with regional partners to identify opportunities and work together toward solutions and needed infrastructure.
- Funding mechanisms: Acknowledging the importance of funding mechanisms and the difficulty of creating them.
- Scale requirements by population density: The idea here was to have fewer requirements from the state for smaller communities/rural counties than for population centers.
- Regional resource recovery parks: Efficiencies can be gained by siting multiple waste/resource recovery locations at the same site, and funding them from the entire region/"wasteshed."
- Statewide requirement to license haulers: This was in recognition that licensing haulers is an important entry into waste management and diversion programs in communities. Licensing haulers to operate in the community/jurisdiction and requiring insurance and reporting of tonnage information are an important foundational step.

- Commercial sector recycling or composting requirements: Including in PAYT or requiring recycling/composting service creates an equal playing field in the community in that every business participates in recycling

The following strategies/systems have been working well in the area:

- Sustainability/carbon action/waste diversion goals (local): Having a diversion goal has been an important part of the development of programs in Fort Collins. Once the city council has set a clear direction, it provides a framework for further policy and program development. Highlighting the nexus between waste diversion and sustainability or climate action goals has also been important in garnering support for advancing programs and policy.
- Curbside yard waste/trimmings/organics/recycling with PAYT
- Local champions.
- Local volunteers/advocates/non-profits are invaluable to building a successful diversion program.

The following is a list of “what’ missing” from the area programs/systems:

- Local champions: If recycling or composting advocates are not participating in the process of creating programs or policy, the conversation quickly becomes one-sided.
- Depending on town, same list as above (maybe the "working well" group above).
- Equitable funding mechanisms for diversion.
- In some areas, motivation/reason/political will to divert.
- Proximity to compost facility or transfer station.
- Regulations allowing partnerships for small-scale composting with local farmers.

And finally, opportunities that were noted for sharing resources and other items with neighbors included a construction and demolition sort facility, a regional planning approach and regional resource recovery parks.

CASE STUDY SOURCES

Section 3: Transfer and Disposal System

Mesa County

- Phone conversation with Cameron Garcia, Solid Waste & Sustainability Division Director

Bent County

- Phone conversation with Bill Long, County Commissioner

Hinsdale County

- Phone conversation with Robert Hurd, Hindsdale County Road and Bridge Supervisor

State of Wyoming

- Phone conversation with Craig McOmie, Remediation and Cease & Transfer Program Manager
- Citizens' Advisory Group on Solid Waste and Department of Environmental Quality Report: Improving Solid Waste Management in Wyoming by The Citizens Advisory Group on Solid Wastes dated October 28, 2004

Section 4: Solid Waste Collection System

City of Longmont's Municipal Collection System

- Written by Charles Kamenides- City of Longmont as response to request from SERA

City of Lafayette's Organic's Collection Request for Proposals (RFP) and Collection Contract

- http://www.cityoflafayette.com/219/Residential-Waste-Collection-Services
- http://www.dailycamera.com/lafayette-news/ci_26156570/lafayette-moves-add-curbside-composting
- SERA Staff Interviews and research (DB) 2016

City of Golden's Approach to Include HOAs in PAYT

- http://www.cityofgolden.net/live/additional-resources/trash-recycling/
- SERA Staff Interviews and research (DB) 2016

PAYT Ordinances in Golden and Fort Collins

- http://www.cityofgolden.net/media/Ord%201868%20PAYT%20code%20amendments.pdf
- http://www.fcgov.com/recycling/pdf/trash_ordinance_20090519.pdf
- SERA Staff Interviews (DB) and research 2016

Vail's 2014 PAYT Ordinance

- http://www.vaildaily.com/news/10671655-113/ordinance-recycling-vail-council
- SERA Staff Interviews and research (DB) 2016

Section 5: Diversion Materials Management

Fort Collins' Glass Recycling – Drop-off and Curbside

- http://www.fcgov.com/recycling/glass.php
- http://www.fcgov.com/recycling/pdf/20080826_glass_study_final_report.pdf
- SERA Staff Interviews and research (DB) 2016

Recycling Hub and Spoke - Clean Valley Recycling

- Phone conversations and onsite visit, SERA Staff with Deanna Hostetler, and SERA Presurvey for CDPHE Stakeholder meetings
- SERA Staff Interviews and research (MS) 2016

Recycling Hub and Spoke - Angel of Shavano

- Phone conversation SERA Staff and Mickey Barry January 2016
- angelofshavanorecycling.com
- salidachamber.org/angel-of-shavano-recycling/

Commercial PAYT Program with Embedded Recycling

- http://www.vaildaily.com/news/10671655-113/ordinance-recycling-vail-council
- SERA Staff Interviews and research (DB) 2016

City of Boulder: Mandatory Commercial Recycling Ordinance & Food Mandates

- SERA Staff Interviews and research (GH) 2016

Boulder County Publicly Owned and Privately Operated MRF

- http://www.bouldercounty.org/env/recycle/pages/recyclingcenterfacts.aspx
- SERA Staff Interviews and research (DB) 2016

Local Level "Green" Advocates: Eco-Cycle, Boulder CO

- SERA Staff research (DD) 2016
- http://www.ecocycle.org/zero-waste-events
- https://www.ecocycle.org/files/pdfs/press-releases/Eco-Cycle-Spring_Back_CO_Press_Release-Mattresses-12-01-15.pdf

Alpine Waste Privately Owned and Operated MRF

- http://www.recyclingtoday.com/article/alpine-waste-recycling-mrf-expansion/
- http://waste360.com/mrfs/alpine-waste-upgrading-denver-recycling-plant
- SERA Staff Interviews and research (DB) 2016

Dump and Pick-up: Commercial Brokers: Small Operations around Colorado

- SERA Staff Interviews and research (GH) 2016

Denver Residential Curbside Organics Pilot Program

- "Growing a Compost Program in the Mile High City," Juri Freeman, City and County of Denver, Resource Recycling
- SERA Staff Interviews and research (MS) 2016

City of Louisville: Contracted Solid Waste, Recycling and Organics Collection

- SERA Staff Interviews and research (GH) 2016

Superior's Drop-Off Organics Program

- http://superiorcolorado.gov/services/trash-recycling
- SERA Staff Interviews and research (DB) 2016

Private Sector Organics Processing: A-1 Organics

- SERA Staff Interviews and research (GH) 2016

Private Sector Organics Processing: Western Disposal, Boulder

- SERA Staff Interviews and research (GH) 2016

Pitkin County: Compost Program and Processing

- Phone conversation SERA Staff and Jack Johnson, Pitkin County 3/29/16
- http://www.landfillrules.com/
- www.cityofaspen.com/recycling
- SERA Staff Interviews and research (DD) 2016

On-Farm Composting/Farm Siting

- SERA Staff Interviews and research (MS) 2016

Eagle County: Multi - Stream MRF

- http://www.eaglecounty.us/RecyclingWaste/Recycling/Materials_Recovery_Facility_(MRF)/
- http://www.eaglecounty.us/RecyclingWaste/Recycling/Where_to_Recycle/
- SERA Staff Interviews and research (DB) 2016

Better Invoicing – Residential and Commercial

- "Commercial Contracts and Billing – Big Barriers to More Recycling", Dawn BeMent, SERA, CAFR Meeting October 2014
- SERA Staff Interviews and research (DB) 2016

Aspen Sustainability Plan

- SERA Staff Interviews and research (MS) 2016

Unique Considerations for Composting In Eastern Colorado

- https://www.colorado.gov/pacific/sites/default/files/AP_PO_Nitrogen-Deposition-Reduction-Plan-NDRP-Contingency-Plan-Final-Version.pdf
- https://www.colorado.gov/pacific/sites/default/files/AP_PO_Agricultural-Producer-Nitrogen-Fact-Sheet.pdf
- Other sources:
- https://www.colorado.gov/pacific/sites/default/files/AP_PO_Nitrogen-Deposition-Reduction-Plan-NDRP-Contingency-Plan-Final-Version.pdf
- http://articles.extension.org/pages/22686/ammonia-deposition-in-rocky-mountain-national-park:-what-is-the-role-of-animal-agriculture
- https://www.colorado.gov/pacific/sites/default/files/AP_PO_Agricultural-Producer-Nitrogen-Fact-Sheet.pdf
- http://climatechangeconnection.org/solutions/agriculture-solutions/livestock-production/manure-management/
- http://extension.colostate.edu/topic-areas/agriculture/best-management-practices-for-reducing-ammonia-emissions-manure-application-1-631d/
- http://ammoniabmp.colostate.edu/link%20pages/feedlot%20compost%20stockpile.html
- SERA Staff Interviews (DB) and research 2016

Successful K-12 Program: Delta School District (Non-Front Range)

- SERA Staff Interviews and research (MS) 2016

CU Boulder- An Education in Sustainability

- http://www.colorado.edu/ecenter/recycling; https://stars.aashe.org/institutions/university-of-colorado-at-boulder-co/report
- Interview Jack DeBell & SERA Staff (DD) June 2016

Regional Leadership Example – Chittenden, Vermont

- SERA Staff Interviews and research (MS) 2016

Innovations in Rural Recycling: Amelia County, Virginia

- SERA Staff Interviews and research (MS) 2016

Drop-Off Organics in Summit County, Colorado

- SERA Staff Interviews and research (MS) 2016

Circular Local Economies: Lifecycle Plastics and Recycle Projects

- SERA Staff Interviews and research (MS) 2016

Contamination Education Program - Springfield, Massachusetts

- SERA Staff Interviews and research (MS) 2016

Collaboration: Southwest Colorado Council of Governments (SWCCOG)

- Staff Interviews and research (DD) 2016

The State Of Colorado: Implications for Food Donations

- http://www.hungerfreecolorado.org/policy-and-advocacy/the-colorado-charitable-crop-donation-act/
- http://www.foodliabilitylaw.com/2009/11/articles/legislation-and-regulation/donate-food-generously-and-with-immunity/
- http://www.hungerfreecolorado.org/hungerfacts/
- http://www.foodpantries.org/st/colorado
  Hall KD, Guo J, Dore M, Chow CC (2009) The Progressive Increase of Food Waste in America and Its Environmental Impact. PLoS ONE 4(11): e7940. doi:10.1371/journal.pone.0007940
- Phone conversation 3/30/16 SERA Staff and Arlan Preblud Executive Director We Don't Waste www.wedontwaste.org
- SERA Staff Interviews and research (DD) 2016

Changing From Solid Waste Included In Tax Base to User Fees

- http://www.governing.com/columns/smart-mgmt/col-risks-of-raising-non-tax-revenue.html
- Maine Townsman, January 1994 by Michael L. Starn, Editor
- MN Pollutions Control Agency 2015 Solid Waste Policy Report www.pca.state.mn.us/sites/default/files/lrw-sw-1sy15.pdf
- SERA Staff Interviews and research (DD) 2016

Tip Fee Surcharges/Environmental Fees

- SERA Report "Diversion Research Studies: Commercial and Organics Recycling -Final Report-
- Submitted to: Solid Waste Management Coordinating Board, 2011

Large Scale Private Sector Material Recovery Facility: Altogether Recycling

- SERA Staff Interviews and research (GH) 2016

State Legislation from Oregon, Vermont and New York

- https://www.oregonlegislature.gov/bills_laws/ors/ors459.html
- http://www.vtsolidwastedistrict.org/portal/index.php?option=com_content&view=article&id=198&Itemid=62
- http://www.nyenvlaw.com/wp-content/uploads/2015/05/Chapter-6-Solid-Waste-Regulation.pdf
- SERA Staff Interviews and research (DB) 2016

Fort Collins PAYT Ordinance

- Sources: http://www.fcgov.com/recycling/ordinances.php
- SERA Staff Interviews and research (DB) 2016

Fort Collins Cardboard Ban

- http://www.fcgov.com/recycling/ordinances.php
- http://www.fcgov.com/recycling/cardboard.php
- SERA Staff Interviews and research (DB) 2016

Recycling/Composting Strategies with Potential in the Loveland/Fort Collins Area

- Table exercises from 2016 CDPHE Loveland Stakeholder Meeting
- SERA Staff Interviews and research (DB) 2016

APPENDIX D: FUNDING SOURCES

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Government incentives – whether at the federal, state or local levels – can potentially provide financial benefits for a variety of solid waste and recycling projects. These funding sources are often provided on a competitive basis, and are not specific to the solid waste and recycling industry. If a project can secure additional funding, it will typically allow for a reduction in the capital and/or operating costs. This section provides an overview of potential governmental incentives that public and/or private solid waste and recycling entities could utilize or have historically been for solid waste management or recycling projects.

State Grant/Funding Programs

The Recycling Resources Economic Opportunity (RREO) Act (HB 07-1288) created the RREO Grant Program with the intent to fund implementation projects that promote economic development through the productive management of recyclable materials that would otherwise be treated as discards. Projects that meet this goal are designed to implement recycling, composting, anaerobic digestion, source reduction, and beneficial use/reuse for a wide variety of materials.

Since its inception, the grant program has awarded more than $7.1 million to businesses, local governments, nonprofit groups, schools and universities throughout Colorado to help develop recycling infrastructure. A few grant recipients are highlighted below:

- Lake County was awarded $165,498 to triple the amount of recycling accomplished in the County and create a sustainable revenue stream for recycling services in the future by (a) providing increased access to recycling at two drop-sites; (b) increasing Lake County's ability to store and process material; and (c) providing the institutional and educational support needed to make increased access a long-term economic success.
- Clean Valley Recycling was awarded $29,790 to expand its hub and spoke recycling model by bringing services into additional communities (Crowley, McClave and Eads) and by accepting greater quantities of recyclable materials (specifically, cardboard, plastics and glass). Equipment and supplies purchased with grant funds will increase Clean Valley's processing capacity.
- Terra Firma Recycling was awarded $99,333 to develop a hub and spoke recycling network that can potentially serve 16,000 people within a 75 mile radius of Trinidad. Grant funds will purchase equipment and supplies to increase storage capacity, improve processing capabilities, and develop an education and outreach campaign.

Website: https://www.colorado.gov/pacific/cdphe/recycling-grants-and-rebates

US Department of Agriculture (USDA)

Community Facilities Direct Loan and Grant Program

Through the Community Facilities Direct Loan and Grant Program, the USDA provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community, such as solid waste or recycling services, for the orderly development of the community in a primarily rural area. Private, commercial or business undertakings are excluded. Public bodies, community-based nonprofits, and federally-recognized Tribes serving rural areas including cities, villages, townships and towns as well as Federally Recognized Tribal Lands with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program.

Example: Encore Life, a non-profit in Wray, Colorado that offers a variety of programs and services in eastern Yuma County, was able to purchase security equipment and pallet jack with scale through funding from the Community Facilities Loan and Grant Program for its electronics recycling program.

Rural Utilities Services Program

Through Rural Utilities Service Water and Environmental Programs (WEP), rural communities can obtain the technical assistance and financing, typically through long-term, low-interest loans, necessary to develop drinking water and waste disposal systems. WEP provides funding for the construction of waste facilities in rural communities and is the only Federal program exclusively focused on rural waste infrastructure needs of rural communities with populations of 10,000 or less. The funds may also be used for collections and landfill closure. Grants within WEP include:

- Solid Waste Management Grant
- Water & Waste Disposal Grants to Alleviate Health Risks on Tribal Lands and Colonias
- Water & Waste Disposal Loans and Grants
- Water & Waste Disposal Loan Guarantees
- Water & Waste Disposal Predevelopment Planning Grants
- Water & Waste Disposal Revolving Loan Funds
- Water & Waste Disposal Technical Assistance and Training Grants

Example: The San Luis Valley Ecosystem Council received $75,000 in funding from the FY 2015 Solid Waste Management Grant to enhance the capacity and efficiency of current local landfill operations in Saguache County and integrate illegal dumping into currently landfill operations.

Websites: http://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program; and http://www.rd.usda.gov/programs-services/all-programs/water-environmental-programs

Private Funding Sources

While there are various potential private funding sources, this section describes the Recycling Partnership, Closed Loop Fund and Bloomberg Philanthropies.

The Recycling Partnership

The Recycling Partnership (Partnership), formerly the Curbside Value Partnership, is an industry-funded national recycling nonprofit with the goal to improve curbside residential recycling in the United States. The Partnership provides resources for communities (4,000 or more households) starting programs with recycling carts or switching from bins to carts. To accelerate the local level adoption of recycling best management practices, the Partnership uses highly leveraged grants coupled with technical assistance.

For 2016, the Partnership grants offered were for:

- Cart procurement: $7.00 per cart delivered up to $500,000
- Education and outreach implementation: $1.00 per household up to $50,000
- Access to technical assistance and the CARTs campaign materials valued at $139,000

Example: In 2015, the Recycling Partnership awarded a grant for residential recycling carts to the City of Santa Fe. The grant dollars will assist Santa Fe with purchasing new recycling carts. Additionally, the City will receive assistance with a customized public education campaign and with technical planning to support the cart deliveries to its 29,000 households. Santa Fe anticipates that cart distribution will take place in the late fall of 2016.

The Closed Loop Fund

The Closed Loop Fund (CLF) was created to increase recycling rates and is funded by consumer goods companies and retailers. The CLF provides zero interest loans to municipalities and low interest loans to private companies. The goal for CLF is to invest $100 million in recycling infrastructure from 2015 to 2019.

Example: The Closed Loop Fund is investing in conversion from dual to single stream recycling collection systems in Quad Cities, Iowa**,** and Portage County, Ohio**,** both important Midwest markets for recycling. The loan will aid in the purchasing of new recycling carts and trucks, making it easier for citizens to recycle and significantly increasing recycling rates.

Bloomberg Philanthropies

Bloomberg Philanthropies focuses on environment, public health, education, government innovation and the arts. Bloomberg also has an initiative dubbed the "Mayors Challenge" where cities submit innovative ideas to improve city life and have a chance at winning a $5 million grand prize or one of four additional $1 million grants.

Example: During the 2012-2013 Mayors Challenge, the City of Houston won a Bloomberg Philanthropies grant of $1 million for their "One Bin for All" initiative. The city is currently in the process of evaluating proposals to design, construct and operate a facility to reach the 75% diversion rate goal.

Websites: http://recyclingpartnership.org/; http://www.closedloopfund.com/; http://www.bloomberg.org/

New Market Tax Credit

The New Market Tax Credit (NMTC) Program is a federal program operated by the Department of Treasury that provides investors with federal tax credits for qualified development in low income communities. The tax credit is provided to a specialized financial institution called a Community Development Entity who invests in the NMTC applicant. The tax credit provided to the investor is claimed over a seven-year credit period. In each of the first three years, the investor receives a tax credit equal to five percent of the total amount paid for the stock or capital interest at the time of purchase. For the next four years, the value of the tax credit is six percent annually. The tax credit can be applied for multiple times in a row for the same project.

Example: The City of Albuquerque (through a public-private partnership with Friedman Recycling) utilized new market tax credits as a part of its efforts to build and operate a new single-stream material recovery facility in the city.

Website: http://www.cdfifund.gov/what_we_do/programs_id.asp?programID=5

Tax-Exempt Private Activity Bonds

Private activity bonds provide tax-exempt financing for the furtherance of governmental and qualified purposes, which may include the construction of solid waste disposal (which could include various types of recycling activities) facilities. Qualified private activity bonds are issued by a state or local government, the proceeds of which are used for a defined qualified purpose by an entity other than the government issuing the bonds.

Qualified private activity bonds must be approved by the governmental entity issuing the bonds and, in some cases, each governmental entity having jurisdiction over the area in which the bond-financed facility is to be located. Public approval can be accomplished by either voter referendum or by an applicable elected representative of the governmental entity (e.g. Pueblo City Council) after a public hearing following reasonable notice to the public.

Example: The City of Dallas City Council approved the issuance of private activity bonds for the landfill gas to energy project at the McCommas Bluff Landfill as required by IRS regulations. The contractor, Dallas Clean Energy, used a conduit issuer, Mission Economic Development Corporation, as the issuer of the private activity bonds.

Website: http://www.irs.gov/pub/irs-pdf/p4078.pdf

APPENDIX E: COST MODELS FOR COLLECTION AND DIVERSION

APPENDIX E: COST MODELS FOR COLLECTION AND DIVERSION

E.1 Diversion Collection and Processing Cost Modeling by Regions and Typologies

This appendix presents overall cost models estimating the per-ton costs for:

- Collection of trash, recycling, and organics (residential and commercial)
- Diversion processing (recycling and organics)
- Drop-off sites
- Hauling and dead-head collection of materials from drop-offs and distant landfill and other sites

The common unit in the models is cost per ton,[1] which allows the "building up" of costs and comparisons between sectors, materials and regions. Section E.7 uses the results from each of these elements of collection and diversion, and presents the costs for scenarios for each region, based largely on the travel distances to and between service, processing and market locations.

These costs are used to assess the costs and feasibility of programmatic and policy options for diversion in regions of the state, with consideration of urban/suburban vs. rural conditions. The cost models for a state-level Plan cannot represent any one community, nor will they directly represent the costs for any specific area. Detailed modeling assumptions are overwhelmed by the wide array of diversity in labor, equipment, land purchase, local competition, market fluctuations and dozens of other variables. The planning level models are designed to avoid providing depth in some areas when other areas have wide variability. The section focuses on providing the information necessary to understand the opportunities and challenges in the four regions. The cost models are designed to serve as an aid to communities and counties that may be considering programs and policies in their area. The figures may be used as "look-up" tables for approximate cost elements in the planning work for new diversion service and program initiatives around the state.

E.2 Profit Discussion

Note that, per the convention in the rest of the report, the costs in this appendix **do not include profit** for either municipal (return on investment) or private haulers (profit). It should be noted that this leads to estimates that are under full cost-of-service for haulers, because haulers pay their overhead costs out of these markups. Governments already have people on staff to cover the clerical, payroll and personnel,

[1] Although a few models present additional units, including cost per household for collection, and hauling costs per cubic yard and ton-mile.

routing costs, etc. that the hauler would cover from a mark-up, so government can presumably charge a lower markup.

Municipal service may need to add anywhere from 3% (for a low return on investment) to 5% to perhaps as much as 15% for "contingencies." Private hauler figures for profit vary. Some haulers wish for 100% profit; for collection, we more commonly see figures in the 20-30% range[2], and depending on competitiveness in the area, figures for facilities, hauling, or collection could be anywhere in the range (20%-100%) – based on "what the market will bear." Therefore, figures in this appendix can and should be multiplied by relevant profit assumptions, based on the local conditions.

E.3 Cost Models of Collection of Residential and Commercial Trash, Recycling and Organics

E.3.1 Residential Collection

Tables E-1, E-2 and E-3 model the costs for residential collection for:

- Collection service for trash, recyclables, and organics (with and without food scraps) offered to all households on a weekly basis, and on a voluntary basis. It is assumed that about 15% of households sign up (particularly relevant assumption for organics and recycling). Collection is more expensive because of the skipped homes that do not participate
- Collection service for trash, recyclables and organics provided to all households on a weekly basis, with all households participating
- Collection of each service on an alternate-week basis, with collection of slightly less materials resulting savings
- Economies of scale reduce costs in collection. These models assume the economies from one service provider, not because that is the norm in Colorado, but because any other assumption would be arbitrary, and every town is different. Using one service provider, rather than many, tends to reduce costs because equipment is used more intensively, homes are not passed by without collection, etc.

The results are provided on a per-ton basis (the main performance indicator for this section). Recall that the costs presented do not include any profit. The cost per ton figures also do not include tipping fees or

[2] Some suggest 10%; haulers report higher figures.

hauling (from a transfer station), but this component represents the cost of collection alone. The estimates for each region of the state that are presented in Section E.7 provide all-inclusive comparisons.

Table E-1: Residential Collection Cost per Ton: Voluntary Curbside[1]

Assumptions	Urban / Suburban				Rural			
	Trash	Recycling	Organics	Organics with Food	Trash	Recycling	Organics	Organics with Food
Assumed Participation Rate	15%	15%	15%	15%	15%	15%	15%	15%
Cost per Hour Truck & Driver	$60	$60	$60	$60	$60	$60	$60	$60
Tons Collected per day	20	14	14	16	20	14	14	16
Collection Efficiency Relative to Urban	100%	100%	100%	100%	75%	75%	75%	75%
Revised Cost per Hour[2]	$81	$81	$81	$81	$81	$81	$81	$81
Assumed lbs./HH/week (per participant)	48	25	25	30	48	25	25	30
Assumed Tons/HH/year (per participant)	1.25	0.65	0.65	0.78	1.25	0.65	0.65	0.78
Collection Cost/Ton[3]	$35	$50	$50	$44	$46	$66	$66	$58

1. SERA National Model, run with Colorado Assumptions
2. Truck and Driver - adjusted for collection efficiencies and participation rate
3. No profit, no tip fee, no haul, no revenue, no processing

Table E-2: Residential Collection Cost per Ton: Mandatory Curbside[1]

Assumptions	Urban / Suburban				Rural			
	Trash	Recycling	Organics	Organics with Food	Trash	Recycling	Organics	Organics with Food
Assumed Participation Rate	100%	100%	100%	100%	100%	100%	100%	100%
Cost per Hour Truck & Driver	$60	$60	$60	$60	$60	$60	$60	$60
Tons Collected per day	20	14	14	16	20	14	14	16
Collection Efficiency Relative to Urban	100%	100%	100%	100%	75%	75%	75%	75%
Revised Cost per Hour (Truck & Driver)	$60	$60	$60	$60	$80	$80	$80	$80
Assumed lbs./HH/week (per participant)	48	25	25	30	48	25	25	30
Assumed Tons/HH/year (per participant)	1.25	0.65	0.65	0.78	1.25	0.65	0.65	0.78
Collection Cost/Ton[2]	$24	$34	$34	$30	$32	$46	$46	$40

1. SERA National Model, run with Colorado Assumptions
2. No profit, no tip fee, no haul, no revenue, no processing

Table E-3: Residential Collection Cost per Ton: Every-Other-Week[1]

Assumptions	Urban / Suburban				Rural			
	Trash	Recycling	Organics	Organics with Food	Trash	Recycling	Organics	Organics with Food
Assumed Participation Rate	100%	100%	100%	100%	100%	100%	100%	100%
Cost per Hour Truck & Driver	$60	$60	$60	$60	$60	$60	$60	$60
Collections per Week	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tons Collected per day	20	14	14	16	20	14	14	16
Reduction in Collection, Less Frequent Collection	2%	2%	8%	8%	2%	2%	8%	8%
Collection Efficiency Relative to Urban	100%	100%	100%	100%	75%	75%	75%	75%
Revised Cost per Hour (Truck & Driver)	$30	$30	$30	$30	$40	$40	$40	$40
Assumed Lbs./HH/week (per participant)	47	25	23	28	47	25	23	28
Assumed Tons/HH/year[2]	1.22	0.15	0.14	0.17	1.22	0.15	0.14	0.17
Collection Cost/Ton[3]	$12	$17	$17	$15	$16	$23	$23	$20

1. SERA National Model, run with Colorado Assumptions
2. Per participant, corrected for collection frequency
3. No profit, no tip fee, no haul, no revenue, no processing

The main observations from these models include:

- Costs per ton are higher in rural areas because collection stops are farther apart – and collections per hour are lower
- Universal mandatory service is cheaper than optional service (obviously, the economies relate to the percent of households signed up for collection)
- Every other week service is substantially cheaper than weekly service for all materials

Commercial collection costs are presented in Table E-4. Again, the data focus on comparisons of cost per ton for collection. Tipping fees and hauling costs for the various streams are not included here, but are included in Section E.7. The major findings are:

- Collection costs are lower in urban/suburban areas because of greater densities, and it is assumed that trucks will need to cross to multiple communities to obtain a full load (with travel time between communities)
- Recycling is the least expensive service – assuming both trash and recycling are provided to all businesses. However, at the generator level, adding recycling collection for businesses may almost double solid waste management bills to businesses, largely because, like for the residential

sector, the major portion of the cost of collection is getting the truck to the container – regardless of which material, or how much of it, is collected

- Organics is more expensive because universal service to all businesses is not suitable. Since uptake and distances are difficult to model, the estimated costs are higher; including tip fee, it is more expensive per ton than trash, even though the material is substantially heavier per cubic yard. If organics collection was provided to all businesses, costs would not be that different than trash, because the major cost is collection, and there are similar tipping fees (although volumes for organics would be substantially smaller)
- If recycling is not provided for all businesses, costs will also increase per ton, with arguments similar to the discussion of organics collection costs

These findings are used in developing the program recommendations discussed in the following section.

Table E-4: Commercial Collection Costs per Ton[1]

Assumptions	Urban / Suburban			Rural		
	Trash	Recycling	Organics with Food	Trash	Recycling	Organics with Food
Cost per Hour Truck & Driver	$55	$55	$55	$55	$55	$55
Efficiency Multiplier Compared to Urban Trash	100%	100%	100%	75%	75%	75%
Adjusted Cost/hr.	$55	$55	$55	$73	$73	$73
Tons per day	20	14	16	20	14	16
Pounds per CY	85	75	300	85	75	300
Percent Full	100%	100%	100%	100%	100%	100%
Collection Cost/Ton	$28	$39	$34	$37	$52	$46

1. SERA National Model, run with Colorado Assumptions; collection cost only, no profit, no tip fee, no revenues, no processing

Note that the table includes no tip fee for recyclables. Five-year average revenues have been about $140 for mixed single stream recyclables for the Colorado market, and the facilities paid small payments to hauler and communities for those tons. However, markets have decreased during the past couple of years such that some facilities are charging $35 per ton for delivered single-stream materials, and that figure is more than landfill tipping fees in some areas. Given that the study is a 20-year plan, current prices (at one point in time) were not considered appropriate for developing long-term options, and instead, the Project Team used five-year average market prices to better represent markets.

E.4 Recycling and Organics Processing Costs

E.4.1 Recycling Processing Costs

Table E-5 summarizes the estimated costs per ton for four types of recycling processing facilities that have possible roles in the state of Colorado – near or longer term. They range in size from very small dump and pick operations, to medium-sized automated single stream facilities managing up to 42,000 tons per year (TPY). For areas outside the Front Range, where there is already substantial coverage for recycling processing, larger plants are not generally justified because population densities do not support them.

Certainly, there are myriad assumptions affecting these figures. However, the costs of processing are in the range expected for automated plants – and different real-world plants make different business decisions. Specific plants are run with various degrees of management efficiency, face a wide range of processing effectiveness and cleanliness of input streams, and experience layout and equipment differences, and so on. The results are being used as planning assumptions. These costs are used – along with transport costs – in modeling the effects of new program recommendations in later sections.

Table E-5: Recycling Material Recovery Facility (MRF) Cost: Net Revenues per Ton[1,2]

MRF Type	Tons Per year	Site, Improvement and Building Costs	Equipment Cost	Annualized Building[3]	Annualized Equipment[3]	Annual Operating Expenses	Annual Total Costs	Cost Per Ton	5-Year Average Single Stream Per Ton Revenue[4]
Dump and Pick	4,800	$350,000	$500,000	$28,000	$77,000	$461,000	$566,000	$118	$120-170
Small Manual	6,000	$900,000	$1,000,000	$72,000	$155,000	$715,000	$942,000	$157	$120-170
Small Automated	20,000	$2,400,000	$2,000,000	$193,000	$309,000	$1,091,000	$1,593,000	$80	$120-170
Medium Automated	42,000	$5,500,000	$5,000,000	$441,000	$774,000	$1,494,000	$2,709,000	$65	$120-170

1. Not including hub and spoke
2. SERA National Model, run with Colorado Assumptions; no profit
3. Based on 20 years and 5% cost of capital for the building and eight years and 5% cost of capital for the equipment
4. Range provided; revenues vary with composition of materials collected single stream

E.4.2 Composting Facility Costs

Windrow is the most common processing option in Colorado.[3] Table E-6 summarizes the cost for various refinements of a windrow operation – including consideration of a standalone facility vs. one co-located

[3] The analysis focused on windrow based composting and did not include other technologies such as anaerobic digestion.

at a landfill. The figure provides information on major cost elements, and the resulting cost per ton – excluding profits. Table E-6 shows:

- Composting costs per ton model are about $41-46 per ton when operating at the high end of tons.
- Co-location of the facility with a landfill results in savings from equipment and personnel sharing. The savings reduction is about $5-10 per ton.

These costs, along with collection and hauling costs, are used in discussing diversion options in Section 6.

Table E-6: Compost Facility Cost per Ton[1,2]

Assumptions	Stand-Alone Facility	Co-Located at Landfill or other Facilities
Tons Inbound or Cubic Yards Outbound	10,000-20,000	10,000-20,000
Equipment Capital Cost	$1,355,000	$1,230,000
Equipment Cost Recapture	$143,300	$135,000
Equipment Operating Cost	$506,800	$506,800
Personnel	$263,200	$172,300
Total Annual Costs	$913,300	$814,000
Assumed Tonnage Processed	10,000-20,000	10,000-20,000
Cost per Ton Processed	$46-91	$41-81
Cost per Finished Yard of Compost	$46-91	$41-81

1. Reduction assumption: 1 ton of material inbound = 1CY of material outbound
2. SERA National Model, run with Colorado Assumptions; no profit

E.5 Drop-off and Hub & Spoke Facilities

E.5.1 Trash, Recycling and Organics Drop-offs Using Dumpsters

Table E-7 and Table E-8 provides information on the cost per ton for delivery of drop-off service (likely unstaffed) using multiple eight-cubic yard dumpsters at a potentially-remote site. The results are presented in cost per ton and cost per ton-mile terms. The data shows that:

- Costs increase substantially the longer the haul
- The costs per-ton decrease as greater volumes are collected
- The costs for recycling are lowest because the tip fee is assumed to be zero in this Plan
- Organics service is the most expensive of the three services; it has the highest tip fee in the modeling assumption

E.5.2 Recycling Drop-Offs and Hub and Spoke

Drop-off facilities are an important part of the services and "opportunity-to-recycle" picture in Colorado. Table E-7 presents results for recycling drop-off facilities of various sizes and configurations. These include simple moveable trailers, hub and spoke, and convenience center configurations. Because the range of costs is so broad, costs from a number of sites were assembled and statistical analysis performed to identify the planning level estimates of the basic site administration and operations and maintenance (O&M) costs as a function of site size. The results show that small facilities (including trailer-based options) are substantially more expensive (per ton) than larger sites, partly because of the fixed costs of operation, which is spread across fewer tons. The cost of adding the basic baler and sorting needs of a hub are also shown. The total hub "adder" costs relate to processing costs including a baler and sorting capabilities. Typical costs from the RREO grant applications for hub and spoke follow. Balers cost about $15,000-$55,000 (and about $90,000 and much more for facilities larger than these). New or upgraded electrical may be needed for a baler. Additional 15-40 cubic yard roll-offs cost about $4,000-$9,000 each. One site described a simple sort line for plastics that cost $4,500 to set up; machine-based sort lines would be more expensive.

Table E-7: Drop-off Facility Costs per Ton

Assumptions	Towable Diversion Drop Site[1]	Community Convenience Center, Rural, Recycling (no processing)[2]	Added Costs for Hub[3]	Community Convenience Center, Rural, Refuse[2]
Annual Total Tons Processed	13-38	50-750		500-3,500
Capital Cost	$28,000	n.a.		n.a.
Annualized Capital (8 yrs., 5%)	$7,264	n.a.		n.a.
Annual Administration and O&M	n.a.	$40,000+$50/ton throughput		$90,000+$60/ton throughput
Basic Processing (baling/year)	n.a.	n.a.	$7,250	n.a.
Hauling		Table E-9	Table E-9	Table E-9
Tipping Fee or Revenue		Revenue $0-$140/Ton		
Cost per Ton Excluding Hauling and Tip fee or Revenues	$191-559/ton	$100-$850/ton	Add $10-$30/ton[4]	$85-$240

1. Described in LBA Associates, "Southwestern Colorado Waste Study", 2015. The cost computations in that report were presented differently, so some elements are "n.a." in Table E.7.
2. Estimated by SERA using regression using eight recycling convenience center sites in New Mexico over a range of sizes, administration and O&M costs, excluding hauling and tipping fee. From Table 1-6, "Solid Waste Assessment & Management Study, Santa Fe County," by Leidos, March 2014. Planning Level estimates. Note the study recommended adding compactors for larger sites taking cardboard.
3. Assembled from Hub and Spoke RREO Grant applications provided by CDPHE. Typical costs from the RREO grant applications for hub and spoke follow. Balers cost about $15,000-$55,000 (and about $90,000 and much more for facilities larger than these). New or upgraded electrical may be needed for a baler ($6,000-$10,000 or more). Additional 15-40 cubic yard roll-offs cost about $4,000-$9,000 each (used cost about $4,000). One site described a simple sort line for plastics that cost $4,500 to set up; machine-based sort lines would be more expensive. Storage or baler covers are quite expensive; a storage building for one application was $216,000, and baler cover building was $63,000, and paving ranged from $20,000-$65,000. The costs in the Table E-7 focus on a baler and mid-range electrical, spread over eight years.
4. No baler was included for a site smaller than 250 tons per year; the costs per year truncated at $30/ton.

Table E-8: Cost per Ton by Cubic Yards and Distance[1]

Cost Per Ton[2]	Distance[3]									
	5	10	25	50	75	100	125	150	175	200
8	$70	$111	$232	$434	$637	$839	$1,041	$1,243	$1,445	$1,648
16	$50	$70	$131	$232	$333	$434	$536	$637	$738	$839
24	$43	$57	$97	$165	$232	$300	$367	$434	$502	$569
32	$40	$50	$81	$131	$182	$232	$283	$333	$384	$434
40	$38	$46	$70	$111	$151	$192	$232	$273	$313	$354
48	$37	$43	$64	$97	$131	$165	$199	$232	$266	$300
56	$36	$42	$59	$88	$117	$146	$174	$203	$232	$261
64	$35	$40	$55	$81	$106	$131	$156	$182	$207	$232
72	$34	$39	$52	$75	$97	$120	$142	$165	$187	$210
80	$34	$38	$50	$70	$91	$111	$131	$151	$172	$192
88	$34	$37	$48	$67	$85	$104	$122	$140	$159	$177
96	$33	$37	$47	$64	$81	$97	$114	$131	$148	$165
104	$33	$36	$46	$61	$77	$92	$108	$123	$139	$154

1. SERA National Model, run with Colorado Assumptions and long distance dedicated collection assumptions; No profit, no tip fee, no haul, no revenue, no processing
2. Trash based on a tip fee of $30 per ton and 85 lbs. per cubic yard
3. Distances are one way using eight cubic yard dumpsters

E.6 Hauling and Transporting Materials

E.6.1 Collection of Roll-offs

Table E-9 presents the costs for collection, hauling and disposal of 40 CY roll-offs containing loose residential trash, recycling, yard waste, yard waste and food scraps. The results are presented as “per ton” costs, with assumptions about hauling distances ranging from 0-300 miles. Of course, some of the distances are not cost-effective, and that is part of the important picture to show what is and what is not practical in various areas of Colorado.

Table E-10 presents similar results using a tractor/trailer arrangement. Tables E-11 and E-12 present the figures assuming no collection truck compaction.

Table E-9: Hauling Costs per Ton- Roll-off, with Collection Compaction[1,2,3]

Assumptions[4]	Haul Trash	Haul Recycling	Haul Organics – Yard Waste	Haul Organics including Food
Staff and Truck / Hour	$55	$55	$55	$55
Speed	50	50	50	50
CY per Roll-off	40	40	40	40
Pounds/CY	85	75	200	300
Collection Truck Compaction Ratio	2.5	2	2.5	2.5
Max Tons/Load	10	10	10	10
Calculated Tons per Load	4.25	3	10	10
Cost Per Ton				
<10 miles	$1.81	$2.57	$0.77	$0.77
25 miles	$6.47	$9.17	$2.75	$2.75
50 miles	$12.94	$18.33	$5.50	$5.50
75 miles	$19.41	$27.50	$8.25	$8.25
100 miles	$25.88	$36.67	$11.00	$11.00
150 miles	$38.82	$55.00	$16.50	$16.50
200 miles	$51.76	$73.33	$22.00	$22.00
300 miles	$77.65	$110.00	$33.00	$33.00
Adder: Per-Ton Tip Fee	$30.00	$0.00	$35.00	$36.00

1. Hauling costs per ton if 25-ton payload basic modeling assumption drivers for roll-off costs; equipment capital costs are spread over 5-8 years, depending on equipment, with 5% cost of capital
2. Tip fees and payload assumptions for all materials follow the table. Lower driver labor costs and benefits assumed for rural areas
3. SERA National Model, run with Colorado Assumptions
4. Based on using a 40-cubic yard roll-off; distances are based from facility and exclude tip fees

Table E-10: Hauling Costs per Ton Transfer Trailer, with Collection Compaction[1]

Assumptions[2]	Trash	Recycling	Organics	Organics with Food
Staff and Truck / Hour	$55	$55	$55	$55
Speed	50	50	50	50
CY per Trailer	153	153	153	153
Pounds/CY, Loose	85	75	200	300
Collection Truck Compaction Ratio	2.5	2	2.5	2.5
Max Tons / Load	25	25	25	25
Calculated Tons / Load	16.3	11.5	25.0	25.0
Cost Per Ton				
<10 miles	$0.47	$0.67	$0.31	$0.31
25 miles	$1.69	$2.40	$1.10	$1.10
50 miles	$3.38	$4.79	$2.20	$2.20
75 miles	$5.07	$7.19	$3.30	$3.30
100 miles	$6.77	$9.59	$4.40	$4.40
150 miles	$10.15	$14.38	$6.60	$6.60
200 miles	$13.53	$19.17	$8.80	$8.80
300 miles	$20.30	$28.76	$13.20	$13.20
Adder: Per-Ton Tip Fee	$30.00	$0.00	$35.00	$36.00

1. SERA National Model, run with Colorado Assumptions: No profit
2. Distances based from Facility, exclude tip fee

Table E-11: Hauling Costs per Ton - Roll-off, Loose (not compacted)[1,2,3]

Assumptions[4]	Haul Trash	Haul Recycling	Haul Orgs (YW)	Haul Organics including Food
Staff and Truck / Hour	$55	$55	$55	$55
Speed	50	50	50	50
CY per Roll-off	40	40	40	40
Pounds/CY Assumed	85	75	200	300
Collection Truck compaction ratio	1	1	1	1
Max Tons / Load	10	10	10	10
Calculated Tons per Load	1.7	1.5	4.0	6.0
Cost Per Ton				
<10 miles	$6.18	$7.00	$2.63	$1.75
25 miles	$22.06	$25.00	$9.38	$6.25
50 miles	$44.12	$50.00	$18.75	$12.50
75 miles	$66.18	$75.00	$28.13	$18.75
100 miles	$88.24	$100.00	$37.50	$25.00
150 miles	$132.35	$150.00	$56.25	$37.50
200 miles	$176.47	$200.00	$75.00	$50.00
300 miles	$264.71	$300.00	$112.50	$75.00
Adder: Per-Ton Tip Fee	$30.00	$0.00	$35.00	$36.00

1. Hauling costs per ton if 25-ton payload basic modeling assumption drivers for roll-off costs; equipment capital costs are spread over 5-8 years, depending on equipment, with 5% cost of capital
2. Tip fees and payload assumptions for all materials follow the table. Lower driver labor costs and benefits assumed for rural areas
3. SERA National Model, run with Colorado Assumptions
4. Based on using a 40-cubic yard roll-off; distances are based from facility and exclude tip fee

Table E-12: Hauling Costs per Ton - Transfer Trailer, Loose (not compacted)[1]

Assumptions2	Trash	Recycling	Organics	Organics with Food
Staff and Truck / Hour	$55	$55	$55	$55
Speed	50	50	50	50
CY per Trailer	153	153	153	153
Pounds/CY, Loose	85	75	200	300
Collection Truck Compaction Ratio	1	1	1	1
Max Tons / Load	25	25	25	25
Calculated Tons / Load	6.5	5.7	15.3	23.0
Cost Per Ton				
<10 miles	$1.61	$1.83	$0.69	$0.46
25 miles	$5.77	$6.54	$2.45	$1.63
50 miles	$11.53	$13.07	$4.90	$3.27
75 miles	$17.30	$19.61	$7.35	$4.90
100 miles	$23.07	$26.14	$9.80	$6.54
150 miles	$34.60	$39.22	$14.71	$9.80
200 miles	$46.14	$52.29	$19.61	$13.07
300 miles	$69.20	$78.43	$29.41	$19.61
Adder: Per-Ton Tip Fee	*$30.00*	*$0.00*	*$35.00*	*$36.00*

1. SERA National Model, run with Colorado Assumptions; no profit
2. Distances are based from facility and exclude tip fees

E.7 Summary Cost Results by Region

E.7.1 Introduction to the Regional Cost Results

The cost models from the previous sections were used as inputs to construct planning level regional cost models for the key services and programs. The key to the definition of the scenarios is the distance grid, presented as Table E-13. Distances, densities and the associated transportation costs are the major factors affecting the feasibility of collection and diversion in various regions of the state. For this reason, the scenarios are defined based on distance and "urban/rural" categorization. Each column in Table E-8 provides a "typical" distance to landfills, recycling sites, and compositing sites within the regions, and these values are used to calculate costs for collection and diversion options in each region.

Table E-13 also defines the regional scenarios in terms of the distance of major MRFs in the region from the markets. End-user markets for individual materials recovered in Colorado are located around the country (and internationally), but the locations of the "optimal" markets at any one time vary; brokers work continually to find the best price for a facility's recovered materials. The Project Team used simpler approaches to understand the relative feasibility of recycling diversion options in the four regions of the state. Review of the stakeholder pre-surveys and interviews with brokers and MRF managers makes it

clear that sales in the Western region sometimes go to Albuquerque or Salt Lake City, and Eastern MRF sales sometimes go to Oklahoma. Some materials have local end-user markets, particularly some of the high-value plastics, and looking forward, potentially glass. Beyond market price, driving distance is not the only factor affecting choice of market destination. The quality of roads, the greater the number of carriers and availability of backhauls also affect freight rates and influence where materials go. Denver is advantageous in these characteristics. To corral the scope of the scenario analysis, the Project Team determined to use distance to Denver markets as the best proxy distance to market. While Denver is not directly a "market" for all materials, using Denver as the common destination allows the scenarios to measure the difference in costs for the other regions relative to the Front Range's costs. Finally, the specific destination for the materials may not be Denver, but the distance to Grand Junction to Denver is fairly similar to the distance to Salt Lake City. The end points for the various regions that were used were Grand Junction (Western Slope), Sterling and Alamosa (Eastern/Southeastern), Denver Metro (Front Range), and Eagle County (Mountains).

Note that distances to the compost sites were not given much additional treatment beyond the 40-50 mile distances noted in the table. Given its weight and low value, it is not feasible to transport the material much beyond a fairly small area.

Table E-13: Scenario Definitions: Distance Assumptions (Miles)

Round Trip	Trash Facility	Recycling Facility	Composting Site	Recycling Markets
Front Range	20	20	40	40
Mountains	40	60	40	250
Western Slope	50	80	40	500
Eastern/Southeastern	50	100	40	350

These scenarios do not consider material by material distances (e.g. glass and plastic are the only local markets; paper mills can be 700 or more miles away). Centroid distances to Denver were used as proxies.

E.7.2 Regional Cost Results

Using the cost figures presented in the previous section, the cost for each service and region can be built up. Table E-14 provides the summary results, reflecting the fully vertically integrated costs. The ranges reflect differences in assumptions about costs, profits, and other inputs. To compute the costs at zero recycling revenues, subtract $140 from the recycling entries in Table E-14. Table E-15 provides the costs for just collection and tipping fees, to indicate the collection portion is not "free."

Table E-14: Regional Cost per Ton Results including Collection, Transport, Processing, Tip Fees and 5-year Average Recycling Revenues – Fully Vertically Integrated [1]

Total Costs	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Voluntary Residential Collection				
Trash	$70-$80	$80-$100	$90-$110	$90-$110
Recycling	$10-$30	$140-$190	$200-$290	$280-$410
Organics	$90-$110	$100-$110	$110-$130	$110-$130
Mandatory Residential Collection				
Trash	$60-$70	$70-$80	$80-$90	$80-$90
Recycling	$-10-$10	$120-$170	$180-$270	$260-$380
Organics	$80-$90	$80-$90	$90-$100	$90-$100
Every Other Week Residential Collection				
Trash	$50-$50	$60-$70	$60-$70	$60-$70
Recycling	$-20-$-10	$100-$140	$160-$240	$230-$350
Organics	$60-$70	$60-$70	$60-$70	$60-$70
Commercial Collection				
Trash	$60-$70	$70-$90	$80-$100	$80-$100
Recycling	$0-$20	$120-$180	$190-$280	$260-$390
Organics	$80-$90	$80-$90	$90-$100	$90-$100

1. Excluding avoided tip fee

Table E-15: Regional Cost per Ton Results including Only Collection and Tipping Fees

Collection plus Tip Fee	Front Range	Mountains	Eastern/ Southeastern	Western Slope
Voluntary Residential Collection				
Trash	$65	$69	$76	$76
Recycling	$50	$55	$66	$66
Organics	$85	$90	$101	$101
Mandatory Residential Collection				
Trash	$54	$57	$62	$62
Recycling	$34	$38	$46	$46
Organics	$69	$73	$81	$81
Every Other Week Residential Collection				
Trash	$42	$43	$46	$46
Recycling	$17	$19	$23	$23
Organics	$52	$54	$58	$58
Commercial Collection				
Trash	$58	$61	$67	$67
Recycling	$39	$44	$52	$52
Organics	$69	$73	$81	$81

E.7.3 Residential Collection of Trash, Recycling, and Organics

Review of the residential results for Table E-14 shows the following conclusions:

- Every other week service is substantially cheaper – largely because the vast majority of the cost of collection is getting the truck to the door (the "stops"), not the material collected. Because the costs are mostly about collections, optimizing service is about minimizing collections – or collecting more material types (trash, recycling, and organics) with the same number of stops. For example, organics can be added fairly cost-effectively if recycling collection frequency is reduced.
- Recycling is considerably more expensive outside of the Front Range/Mountain regions. Although collection cost differences are part of the cause, the largest difference is because the materials must be shipped further to facilities and markets.
- Organics is more expensive per-ton than trash or recycling. However, collection of food scraps with the yard waste is more cost-effective than yard waste alone, and diverts more tons (shown in earlier tables in this appendix). Per-ton costs for organics are not estimated to be substantially lower in the Front Range areas than in the rest of the state because it is assumed materials would only be processed within the region, and we assumed similar distances in each region. The value of the materials and the bulkiness makes it difficult to have markets outside the nearby surrounds.
- Collecting recycling every other week costs less than weekly service, and, as noted elsewhere in the Plan (Section 6), reduces diverted tonnages only marginally. Taken as a whole, the extra recycling tons collected from weekly collection vs. every other week collection are about four times as costly per ton as the recycling collected from an every-other-week program. Most importantly, because costs are largely about getting the truck to the door (regardless of amount collected), eliminating one recycling collection (and/or one trash collection) can open the door to addition of organics collection at minimal extra cost, losing one-to-three percentage points of recycling diversion, but adding 18% to more than 20% of organics collection. This has a strong positive effect on overall diversion rates.
- Universal service (providing service to all households in the community) is more economical than voluntary trash service. Universal (or mandated or embedded) recycling or universal organics is cheaper per household (and per ton) than optional or voluntary programs – and of course, diverts more tons than programs with only 15% participation (a common result for voluntary recycling programs).
- Economies of scale reduce costs in collection. These models assume the economies from one service provider, not because that is the norm in Colorado, but because any other assumption would be arbitrary, and every town is different. Using one service provider, rather than many, tends to reduce costs because equipment is used more intensively, homes are not passed by without collection, etc. Towns using these results should realize that service provided with

multiple haulers in the same geographic area is almost certainly going to cost more than the figures provided in this Plan. Beyond consolidating collection for one service, research indicates using one service provider for *multiple* materials – trash, recycling, and organics – also leads to lower costs.

E.7.4 Commercial Collection of Trash, Recycling and Food Scraps

Review of Table E-14 shows the following:

- Costs per ton for collection for recycling are lower than trash and organics – assuming traditional ranges of tons per collection. However, trash will presumably always be some part of the solid waste stream, and state law requires proper disposal of these materials. Adding recycling, or adding organics will be just that, an addition to the trash bill. If tons were traded on a one-for-one basis between trash and recycling streams, the per-ton figures would imply savings for businesses. However, per-ton figures mask the fact that the rates to businesses are constructed in two parts: the fixed portion covering getting the truck to the door, and the variable portion related to the management of collected materials. Few businesses can reduce trash volumes enough to make up for the fixed cost of getting the recycling truck to the door even once per week. Small businesses have particular difficulties.[4]
- Trash and recycling cost more in the more rural areas. This is because trucks are more likely to have to collect in multiple small towns to fill the truck, increasing distances to fill trucks.
- Recycling costs considerably more outside the Front Range. This is partly because trucks are assumed to need to visit multiple towns to fill the truck, and because it is assumed that recycled materials must be transported longer distances outside the Front Range.

E.7.5 Hauling Options and Impacts on Costs

Table E-9 and E-10 have important implications for the results in Table E-14. The results show:

- Shipping to market via transfer trailer is substantially cheaper per ton (in dollar and percentage terms) compared to hauling via 40 cubic yard boxes. This becomes pronounced as distances increase, like those seen in the Western Slope and Eastern/Southeastern areas. The more loads shipped, the greater the expense for a site.

[4] Strategies to address small businesses include adding them to the residential program, using 96-gallon recycling containers so the containers fit in small "screened" areas, and other approaches. However, the economic issue is difficult to address without requiring embedded recycling in the commercial sector, akin to the practice in the residential sector.

- The barrier to using transfer trailers is the loading facility. It is expensive to construct a facility that allows the transfer of materials from boxes, trucks, etc. into to transfer trailer, requiring two-level facilities, or other capital expenses. Further, going out of the way to accomplish this transfer can be a barrier, so the determination of optimal location of sites would be complicated, even if they could be afforded (or were funded by grants or state funds or other). This is discussed in more detail in Section 3.
- There is a significant effect on the effective (or "net") market price for recyclables, based on the region (higher transfer costs regardless of method for Western Slope and Eastern/Southeastern), and for the difference between transfer trailer vs. roll-off.

E.7.6 Drop-offs and Hub and Spoke

Table E-7 provides cost data for these facilities. The results show:

- Interviews with operators around the state, literature review on drop-offs on other states and cost model calculations showed wide variations in operating costs, based on site setup and many other conditions. Drop-offs will have difficulty operating profitably in today's markets, but fare better at five-year market prices.
- Very small facilities are high cost, and are not showing a profit. Note that the costs exclude land purchase, and note also that the costs for these facilities are affected by a wide array of assumptions. Some facilities are staffed by avid volunteers, reducing costs. Others are co-located in ways to reduce costs. Creativity appears to be a hallmark of these small, local options.

E.7.7 Recycling Processing Facilities

Table E-5 relates to the costs for recycling processing facilities. The results show:

- Table E-5 shows that small manual MRFs have a hard time making a profit. Dump and pick facilities are marginally profitable in the regions excluding the Western Slope. Automated processing – although a substantial capital investment – is profitable in most of the scenarios. However, these facilities must have a large enough population base to provide the higher annual tonnages associated with the plant.
- Profitability is higher in the rural areas when hauling is achieved by transfer trailer.

E.7.8 Composting Processing Facilities

Table E-6 shows the costs for compost facility processing. The results show:

- Costs per ton for processing range from $41 or $46 per ton when processing 20,000 tons, and higher figures if the facility processes less material. This is higher than the assumptions made in this report ($35/ton). The assumptions in the Plan are based on reported tipping fees from the pre-survey, and from existing facilities.
- These figures are not out of the range of costs for new facilities located in other areas.
- The fully loaded costs for the facilities would not show a substantial difference by region of the state. This is because it was assumed that compost plants would not be shipping product far afield (bulky and relatively low-value product). The distance that materials would be transported both to the facility (and presumably away) were assumed to be quite local, and the same distance assumptions were used for each region of the State.
- Note that the composition of the materials delivered to Front Range vs. non-Front Range sites will probably differ. Grass, yard waste, and food scraps are most common in the Front Range; other areas may divert branches and land clearing, but perhaps less lawn care materials.

E.7.9 Summary and Implications

In summary, Table E-14 presents planning level costs for key collection and diversion options. The ranges reflect differences in assumptions about costs, profits, and other inputs. The figures show that:

- Recycling in the Front Range is generally profitable, and the challenges to diversion in the Eastern/Southeastern and Western Slope areas are substantial.
- Organics collection does not appear profitable, especially with zero market value as assumed in this report. Adding in a $30 avoided tipping fee improves the situation relative to trash.
- Every other week collection can help make collection of recyclables more cost-effective, and studies indicate that the loss in tons is relatively minor.

What is not shown in the table is that the costs for distant locations could improve on the order of $20-$40 per ton if the transport was made via trailer instead of roll-off. This is relevant in the Eastern/Southeastern and the Western Slope regions, and might bear attention from the RREO grant program.

APPENDIX F: LEVEL 1 AND LEVEL 2 COLLECTION AND DIVERSION RECOMMENDATIONS – SUPPORTING RATIONALES AND POTENTIAL CDPHE AUTHORITY OPPORTUNITIES

APPENDIX F: LEVEL 1 AND LEVEL 2 COLLECTION AND DIVERSION RECOMMENDATIONS – SUPPORTING RATIONALES AND POTENTIAL CDPHE AUTHORITY OPPORTUNITIES

As discussed in Section 6 and elsewhere within the Plan, CDPHE's primary existing authorities focus on landfill and facility permitting, inspection and monitoring. These are statutory responsibilities that have substantial associated enforcement authorities. CDPHE's authorities related to collection and diversion are more commonly addressed via resolutions or general statements in the CRS, but lack the crucial enforcement (and funding) authorities that would significantly enhance Colorado's opportunities to move diversion and sustainable materials management in the state. Given that this is a 20-year Plan, the document considers and develops recommendations under the authorities in place in the near-term. However, it also develops priorities for strategies that would support strong sustainable materials management in future situations under which CDPHE may have access to broader authorities. This appendix explores the Level 1 and Level 2 collection and diversion recommendations and discusses:

- Explanation of key elements of the recommendation
- The rationale for the recommendation and why it is important in moving diversion and sustainable materials management forward in the state
- The statutory or other underpinnings supporting the authority or for those recommendations that are not currently supported by existing authority, suggestions are provided about opportunities for funding or authorities that may be indirectly or directly pursued [1]

Some aspects of these authorities may also be relevant, helpful or necessary for implementing one or more of the more advanced elements of the transfer and disposal recommendations identified in Section 3. Note that the authorities necessary for the Level 3 and Level 4 recommendations included in Section 6 are new authorities (similar to those discussed in this appendix) and are acquired by CDPHE.

Garnering stakeholder and industry support toward these strategies would be helpful if the CDPHE is to approach the Legislature, the Solid Waste and Hazardous Waste Committee or other entities that could help the state acquire additional capabilities and funding for moving sustainable materials management forward.

[1] The "potential authority" notes were developed by SERA after several detailed (and extremely helpful) discussions with David Kreutzer, an attorney for CDPHE, about CDPHE's existing statutory authorities in this topic area. Note that the potential authority concepts were developed by SERA and are not the responsibility of or attributable to Mr. Kreutzer. The discussions were held in April and May 2016.

Table F-1: Level 1/State-Level Recommendations for CDPHE

Recommendation		Why	Authority/Funding Notes
Overview	**Detailed**		
1. Adopt the recommended Two-Tier Diversion goal and support/conduct activities to achieve the goals	• Adopt the recommended Two-Tier Goal (Front Range/Rest of state) for near term and longer term Specific goals are included in the Plan • Goals are set as "Diversion Rate" (combining recycling and organics) and "Percent Recoverables Remaining" for 2021, 2026 and 2036 (5, 10 and 20 year horizons) • Publicize and provide information to help cities/counties move toward the goal • Post regional results on CDPHE website	• Required content element of 20-year plan • Goal set to encourage compliance with "reduce waste, cost-effective… protect environment," etc. aspects of 30-20-101.5 CRS • Posting regional results encourages comparisons and competition among regions/communities/ counties and encourages progress	• Consistent with requirements of 20-year Plan contents • Authority not needed to adopt and publicize a goal and measurement results • Consistent with 30-20-101.5 CRS • No new authority or funding needed • No existing authority to enforce
2. Improve performance tracking and reporting on diversion	• Improve already-required reporting/tracking by adding statistics on residential vs. commercial, regional information as possible • Introduce a second metric "Percent Recoverables Remaining" (PRR) that measures the amount of recyclables and compostables still being disposed to track improvements, be less susceptible to economic cycles and best inform next steps priorities • Track performance on both metrics; publicize to encourage competition • Post-performance statistics/updates on the web and otherwise publicize the information to encourage regional/community/county competitions and improvement • CDPHE's work on this recommendation should be coordinated with the transfer and disposal recommendations to capture disposal facility data	• Must currently report to Legislature on tracking results • If not measured, status and progress toward goal will not be known, nor will it likely improve substantially without the feedback • Tracking by sub-area and by sector (residential/commercial) provides information on progress, and opportunities to identify/target local and state programs and activities • Can lead to economic development opportunities locally when quantities and types of materials available as feedstock are known • New tracking method better shows where progress is needed and better identifies effective strategies	• Legislation already requires CDPHE to report on tracking. Does not stipulate exact content. CDPHE presumably can adjust what it considers adequate • No additional authority required • Some additional funding likely needed, including periodic medium-level waste composition studies and possibly waste tracking software

Table F-1: Level 1/State-Level Recommendations for CDPHE

Recommendation		Why	Authority/Funding Notes
Overview	**Detailed**		
3. Enhance diversion training/technical assistance and outreach on diversion	• Increase training and technical assistance with a focus on diversion strategies (in addition to landfill issues) • Conduct regional training sessions as a method to continue the stakeholder engagement/sharing/ discussion process from the Plan's 10 regional stakeholder meetings • Conduct regular and frequent webinars and other cost-effective outreach approaches to offer training to cities/counties/regional planning agencies on suitable diversion options and best management practices. • Post useful documents on the website (fact sheets, case studies, best practices, template ordinance language, etc.) • Encourage CDPHE staff to function as technical assistance ambassadors. Encourage communities/counties/planning agencies to contact CDPHE for technical assistance, advice and information on diversion • Publicize this capability/service • Maintain a ready list of high-performing strategies and best practices for the various state regions for potential introduction at key points if progress is not achieved, and for interested communities • CDPHE's work on this recommendation should be coordinated with the transfer and disposal recommendations to provide technical assistance	• Advice and training resources would support the goal and progress in reducing waste and increasing compliance assistance and cost-effectiveness in waste management per 30-20-101.5, CRS • CDPHE already provides technical advice, but focuses on disposal and compliance. Agencies need advice, and CDPHE is well-positioned, with relationships/contacts • Can help improve strategies and prevent poor waste management strategies being implemented/continued • Can get CDPHE staff involved before problems arise • Prevention is cost-effective	• No new Authority required; CDPHE has a history of providing outreach • Using webinars, websites, etc. is inexpensive, but some additional funding likely/may be needed • Consistent with "prevention" focus for CDPHE direction and action • No change in authority, just a change in focus and additional funding, because hosting outreach meetings and training requires additional funding and official function approval
4. Increase inspection efforts on non-adequate landfills, providing economic signals for compliance and diversion	• Get tougher on inspection of inadequate landfills and re-check progress toward hard timeline regularly • Become more consistent regarding economic incentives to comply and provide incentives that underline the potential cost-effectiveness of diversion activities (as well as regionalized disposal where appropriate)	• Addressing inadequate landfills is a core part of the Plan • Providing economic incentives improves relative cost-effectiveness of diversion alternatives to localities and encourages diversion	• Authority already available and directly consistent with existing CDPHE activities

Table F-1: Level 1/State-Level Recommendations for CDPHE

Recommendation		Why	Authority/Funding Notes
Overview	**Detailed**		
	• CDPHE's work on this recommendation should be coordinated with the transfer and disposal recommendations to enforce current regulations		
5. Establish regionalized solid waste planning emphasizing diversion	• Recommend regional/wasteshed planning for management of solid waste • Explore relationships with groups of counties, COGs and similar entities for regional comprehensive integrated solid waste and materials management planning focusing on the hierarchy of reduction, diversion, disposal and wise long-term waste management • CDPHE's work on this recommendation should be coordinated with the transfer and disposal recommendations to consider regionalization options	• Encourages more cost-effective, compliant disposal facilities • Encourages consideration of more cost-effective, regionalized diversion and disposal options – and supporting infrastructure becomes more feasible • Increases diversion and progress toward goal	• Cooperation/exploration of cooperative agreements does not require authority or substantial new funding • No authority necessary, but authority would substantially strengthen coverage, compliance, planning
6. Support/fund/ incentivize regionalized solid waste planning	• Provide economic support and incentives for regional integrated comprehensive solid waste/materials management plans • In short term, use RREO grants to support this activity and provide funding • In near and longer term, work to identify other funding sources • Provide incentives for conducting planning through RREO grant, modifying the award criteria to favor regional planning • Given there are no direct funding sources for CDPHE, identify other incentives that can be provided besides direct funding. Consider the following options. After a certain date, areas with completed plans are eligible apply for RREO grants (but not other areas); areas with completed plans receive a streamlined process or higher priority for permitting for facilities and enforcement regulations, etc. similar to the current Environmental Leadership Program (ELP or incorporate into ELP	• Provide support needed to accomplish cost-effective waste management and higher diversion; removes key barriers from preparation of plans • Provides tangible incentives/encouragement to prepare plans; lack of eligibility for grants encourages pressure from regional stakeholders and ELP advantages encourages pressure from regional agencies/stakeholders	• May not need additional authority in order to provide some immediate support – either via RREO or prioritization/ streamlining of other CDPHE services • Priorities/scoring for RREO grants easily accomplished • Longer term may want to investigate additional funding sources

Table F-1: Level 1/State-Level Recommendations for CDPHE

Recommendation		Why	Authority/Funding Notes
Overview	**Detailed**		
	• CDPHE's work on this recommendation should be coordinated with the transfer and disposal recommendations to support sustainable funding strategies for local programs		
7. Fill gaps in recycling opportunities/drop-offs network and support existing infrastructure	• Require recycling drop-offs at landfills or transfer stations in areas identified as "gaps" for recycling to provide "opportunity to recycle" statewide. Gaps should be identified as areas without a drop-off site within 25 miles of a population center with at least 4,000 population or within the county • Update the list periodically to account for new and closing drop-off facilities • Recognize to agencies they may be able to recover costs through the landfill tipping fee • Require compliance with minimum design standards	• Assures reasonably-convenient minimal recycling access across the entire state • Serves residential, commercial, and multi-family generators • Much more cost-effective if co-located • Does not undermine existing drop-off or hub and spoke operations/network • Compliance inspections of the sites can be conducted with disposal site inspections • Requiring recovery through landfill fees encourages cost-effective design	• No specific authority available • May be consistent with prevention authority and landfill inspection activities • Consistent with 30-20-101.5 CRS • Inspecting the sites co-located at disposal facilities would be easily verified as part of inspection process. Inspections may be warranted if solid waste facility, rather than solid waste disposal facility language prevails
8. Implement ZW, LCA, MM, reduction and other polices and principles in CDPHE operations	• Identify appropriate zero waste (ZW), life cycle cost analysis (LCA), materials management (MM) and reduction strategies for implementation in CDPHE offices, contracts, procurement, enforcement, and other operations • Track/assess results • Disseminate information on successful initiatives. • Continually evaluate progress and implement additional strategies as the field progresses	• Agency walks the talk for prevention, cost-effectiveness, and environmental protection • Agency demonstrates effective practices and provides information on practical initiatives suitable in the state	• No additional authority needed – operational policy choices/direction from management. • Authority for CDPHE and all state agencies to implement Department wide waste reduction plan with goals under the Greening Government Executive Order

Table F-1: Level 1/State-Level Recommendations for CDPHE

Recommendation		Why	Authority/Funding Notes
Overview	**Detailed**		
9. Support ZW/MM/LCA where possible	• Encourage and support state/regional/local agencies to implement ZW, LCA, MM, reduction and other polices and principles into their plans and operations. • Provide information about potential strategies, policies and best practices • Support and disseminate research and projects on these topics • Consider providing incentives, including possible grant preferences for agencies incorporating/studying these initiatives in the medium and longer run	• Meets elements of the guidelines for content for the 20-year Plan • Keeps CDPHE informed about best practices that may be suitable within the state • Provides information to communities, on strategies consistent with goals of prevention and (short- and longer-term) environmental protection	• No additional authority needed/consistent with agency's mandate to educate, work toward prevention, and protect the environment
10. Seek additional supporting authorities for near/longer term diversion and materials management progress	• Seek additional authority to set/require and enforce goals and regional planning • Seek additional authority to provide stronger support to require planning, enhance diversion, support development of diversion infrastructure and increase funding for planning and diversion • Seek additional authority to require/enforce high-impact, suitable, reduction/ZW/MM initiative statewide or for areas of the state (e.g. market development, bans, PAYT, and other high-impact options) • Acquire additional funding authority to support diversion and MM projects, programs, research. • Acquire more direct authority to improve financial/economic incentives in the market for diversion and materials management. • If strategies discussed in Section 6.3.2 are not available from minor changes in rules, etc., work to obtain key authorities directly through legislation	• CDPHE lacks all authorities needed for efficient and successful implementation and enforcement of goals related to the Plan's requested content, and this Plan's recommendations and suggested local initiatives • CDPHE lacks all authorities needed to provide (paraphrased) '… improved policies and procedures for … promoting the community ethic to reduce waste… and promote innovative and cost-effective protection of the environment and quality of life…' in the state of Colorado	• CDPHE lacks all authorities needed for efficient and successful implementation and enforcement of goals related to the Plan's requested content and for meeting statements in 30-20-101.5, CRS, 30-20-100.5, CRS and other legislative declarations, resolutions, etc

Table F-2: Authorities and Recommendations that will Assist in Achieving Recommendations in Table F-1

Issue/Desired Authority	Why	Perceived/Real Barriers	Possible Approaches
1. Enforcement of adopted diversion goals	• To drive implementation of diversion strategies at the local and regional level • Require cities/counties/ regions or haulers to report tonnages collected trash, recycled, and composted tonnage regularly • Facility tonnages (recycling, composted, transfer station and disposal facilities) should also be tracked • Recommend posting of the performance at the city, county, and regional planning agency level on the web annually by May 1	• CDPHE lacks statutory authority to enforce a goal • Unambiguous and consistent definitions and reporting methods will be required • Best sources of data are haulers; they may be concerned about sector- or community-level data as their routes cross lines, but workable reporting guidelines are in place in multiple communities (using customer counts, and other proxies to apportion tons)	• CDPHE may be able to argue that reporting requirements extend to the data needed to provide the data for tracking • If cities/counties/regions are required to report tonnages, they may prefer to request the state to acquire the authority and gather the data for them, or support legislative changes for the authority
2. State licensing of haulers	• To support higher quality of tracking and more useful tracking – for residential vs. commercial and local (city/county/wasteshed) tonnage and performance data. Haulers are among the only sources for	• CDPHE lacks this authority, and only has authority to regulate disposal sites and facilities • Reporting when haulers cross community lines or collect residential on the same route	• CDPHE must file reports to Legislature on tonnages. Certain information (city, wasteshed, residential vs. commercial, etc.) is impossible to collect through current facility data approach. CDPHE could argue a need for greater reporting authority/access to file reports that better meet the legislative requirements/expectations • CDOT licenses/has limited authorities on large trucks including haulers. Work with CDOT to potentially expand to help regulate materials management trucks

	tonnage data – at least by sector or community • To identify who is operating in the state, to support enforcement of safe waste disposal, that firms are managing waste as they advertise and customers are paying for • There is licensing of haulers for waste tires, and waste grease; should be expanded for these relatively parallel materials • To provide access for enforcement of other strategies that may arise	is a perceived barrier; however multiple towns in Colorado and elsewhere require reporting, and have established easy guidelines that address the issues of separating community tonnages and tonnages by sector that are workable by haulers • Can consider omitting haulers below a certain size for administrative ease	• Possible relationship to FCC regulations. CDPHE responsibilities (or other environmental agencies) might be interpreted to be the agency responsible for enforcing that trucks hauling solid waste are bringing materials to disposal sites, those hauling recyclables are actually taking them to a recycling/processing facility, etc. Similar cases have been brought in Colorado, but as crimes of "theft by deception," Must be brought by District Attorney • There may be a possibility of reinterpretation of existing licensing of waste tire and waste grease haulers to more materials • Per steps taken to license trucks hauling waste tires and waste grease, explore industry support for acquiring similar authorities • Haulers are among the best sources for tonnage data because they are the first step, avoid double-counting (an issue with some types of facility reporting), and know the source. If cities are requested/required to report tonnages, they may request the state to acquire the authority and gather the data for them, or support legislative changes for the authority
3. Authority to require (regional/wasteshed) planning and establish regional planning authorities	• Integrated plans, diversion progress, better landfill management/ operations • Opportunity to illustrate to counties that operating more regionalized facilities and system – perhaps with increased diversion – may be cheaper and more efficient. In addition, may illustrate that operating fewer, more regionalized landfills may reduce budgets • Facilitate growth/expansion of reuse and	• CDPHE has no authority except regulating disposal sites/facilities • Counties have apparent solid waste authority in Colorado, but have no particular motivation to plan or cooperate in planning because it incurs extra cost and takes on more responsibility than they have elected to take on previously	• Non-attainment of air quality may be a strategic approach. Making a scientific link between non-attainment and methane generation from landfills may argue that waste planning to reduce/divert compostables (including paper, etc.) from the landfill can help achieve attainment, providing design and enforcement authorities through CDPHE or through air agencies/department. However, the current definition of attainment may not include methane from any facilities except oil and gas. Unless these definitions change, this may not be a strong option • Water quality may provide a link, making the case that better landfill and diversion planning lessens risk to water tables, runoff, etc • Continue to encourage planning projects under the existing RREO grant program, prioritizing them for funds, and prioritizing regional plans. Explore options for increasing RREO funds for these projects. Set deadlines for period in which the plans need to be completed, after which the area becomes ineligible for any RREO grants in order to provide an

	remanufacturing businesses regionally to take advantage of economies of scale • CDPHE should coordinate these efforts with transfer and disposal recommendation to consider regionalization options		incentive to complete regional plans. Another incentive would be provided by allowing areas with plans to receive streamlined processes, or priorities in permitting and inspections • Explore whether the inconsistency of language in various legislation (solid waste disposal facilities vs. solid waste facilities) provides any opportunity for a wedge for requiring plans • The Department might have authority to request additional funds of the SW&HW Commission and greater on authorities based on the declaration for planning and funding 30-20-101.5, CRS
4. Authority to provide funds for (regional/wasteshed) planning activities	• Funding planning, assistance, strategies, enforcement • Providing incentives for agencies to consider taking on authority/planning tasks • Encouragement for agencies to work together/plan and implement cooperatively • CDPHE should coordinate these efforts with the transfer and disposal recommendation to consider regionalization options	• CDPHE has no funding beyond what the SW & HW Commission provides through landfill surcharge they set; no specific inclination to change	• Air quality non-attainment link (described above) may provide access to funds • Instituting a possible bottle bill (new legislation) could provide access to funding to support the recommendations. A nexus study likely would be needed to provide the link to broader system expenditures. CDPHE should be sure to address issues of strictly separate accounting and application of unclaimed escheats to recycling/diversion during the development of any bottle bill legislation and program • CDPHE might have authority to request additional funds of the SW&HW Commission and greater on authorities based on the declaration for planning and funding 30-20-101.5 CRS • Revise the criteria for the RREO rebate funds to allow application to broader diversion activities. • There is support for illegal dumping strategies at the SW&HW Commission and from landfills. Perhaps advanced disposal fees can be introduced on key litter/illegal dumping components as a funding source. This strategy would require introducing logic that some of the costs are associated with a larger, integrated system, not purely litter (nexus-plus). Additionally, note there is not current authority at CDPHE for product-based fees, only waste material authorities • Leveraging off the illegal dumping nexus, consider a similar strategy –introducing a “convenience fee” (a la Nebraska), which imposes a surcharge on convenience stores and fast food on the rationale that their takeaway waste constitutes a large component of litter. Again, nexus-plus study needed, and there

			is not authority at CDPHE for product-based fees, only waste material authorities. • Consider introduction of a possible fee on first wholesale sale on toxics (a la Washington state), to help fund a system for their proper management/disposal. Again, a nexus-plus study is likely necessary to expand beyond toxics to broader system funding support (if appropriate), and recall that product-based fees are not currently in CDPHE's authority
5. Ability to implement and enforce collection & diversion strategies best applied at state level	• Some effective, high-impact, cost-effective, market, incentive, and programmatic strategies are best implemented at the state level (some education, PAYT, bans, surcharges, source reduction and/or recycling rate goals, etc.)	• CDPHE lacks this authority and has authority only over solid waste disposal facilities only	• Non-attainment of air quality standards may be a rationale for implementing diversion strategies. Certain solid waste diversion strategies may be fast, cheap, and effective at reducing methane and reaching air attainment. Note the caveats associated with methane's limited inclusion in the attainment accounting mentioned above • Explore whether the inconsistency of language in various legislation (solid waste disposal facilities vs. solid waste facilities) provides a wedge for allowing implementation of effective statewide strategies
6. Authority to increase landfill surcharge	• To provide economic incentive for recycling, funding planning, assistance, strategies, enforcement • Recommend two-tier landfill surcharges, with a higher surcharge for waste from communities that have not met recycling goals or implemented plans. Recommend substantial dollar differential per ton to provide meaningful incentive (as large as justifiable from study)	• CDPHE has no funding sources beyond what the SW & HW Commission provides through landfill surcharge (they set CDPHE's allocation) Commission has no specific inclination to change. • A few other states have established surcharges as high as $4-$9/ton; the range across states is wide	• Work with Governor's office to revise priorities for criteria for appointment to the SW&HW Commission toward candidates with diversion experience and not primarily landfill or industry focus; increase/diversify recruitment efforts; and provide recycling industry testimony/education to the SW&HW Commission. • Revise the criteria for the RREO rebate funds to allow application to broader diversion activities (if these are funded through decisions of SW&HW Commission). • Consider using the litter/illegal dumping nexus as justification for increased funds through this or other funding mechanisms (described above) • Justified as funds for non-attainment strategies (described above)
7. Pursue legislation to obtain authorities	• To acquire priority authorities needed to help	• CDPHE lacks these authorities	• Directly pursue legislation to acquire priority elements of these authorities and others the CDPHE identifies to help implement

	implement and enforce the 20 year Plan		and enforce the 20 year Plan. Work with industry, CAFR, and stakeholder for them to support/implement this objective
8. If authorities are gathered, establish two-pronged prescriptive/performance goal options	• Strong progress not possible to guaranteed without enforcement authority • Gain authority to enforce performance goals as listed in Level 1 • Gain authority to enforce recommended prescriptive elements for Collection and Diversion (See Level 3 Strategies) • These requirements are invoked if performance goals are not reached • Provides opportunity for strong additional progress by reviewing Level 4 state-level options	• CDPHE lacks authorities currently	• Directly pursue legislation to acquire priority elements of these authorities and others the CDPHE identifies to help implement and enforce the 20-year Plan. Work with industry, CAFR, stakeholders for them to support/implement this objective

APPENDIX G: ESTIMATED 2016 TONNAGES BY REGION

APPENDIX G: ESTIMATED 2016 TONNAGES BY REGION

The calculations in Section 6 include tonnages and values for each of the four planning regions. These figures are presented in this appendix.

Table G-1: Estimated 2016 Tonnages – Front Range

	Waste Composition		Tons				
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Paper	20.4%	26.7%	1.0%	570,100	412,800	16,100	999,000
Cardboard/Bags	3.9%	11.5%	0.0%	109,300	178,200	-	287,500
Newspaper	4.2%	3.5%	0.0%	118,400	53,700	-	172,100
Office Paper	1.0%	3.0%	0.0%	27,300	45,900	-	73,200
Paperboard	2.2%	1.5%	0.0%	60,100	23,600	-	83,700
Junk Mail	2.2%	1.5%	0.0%	60,100	23,600	-	83,700
Magazines/Catalogues	1.8%	0.8%	0.0%	51,000	11,800	-	62,800
Dairy/Juice	0.1%	0.3%	0.0%	3,600	3,900	-	7,500
Non-Recyclable Paper	5.0%	4.7%	0.0%	140,200	72,100	-	212,300
Plastic	12.3%	12.3%	0.0%	343,700	190,200	-	533,900
Plastics 1&2	7.7%	1.4%	0.0%	213,900	20,900	-	234,800
Rigid Plastics 3-7	0.4%	0.4%	0.0%	11,400	5,700	-	17,100
Polystyrene	0.3%	1.1%	0.0%	8,600	17,100	-	25,700
Other Rigid Plastics	1.6%	3.9%	0.0%	45,600	60,800	-	106,400
Plastic Bags/Film/Wrap	2.3%	5.5%	0.0%	64,200	85,600	-	149,800
Other Plastics	0.0%	0.0%	0.0%	-	-	-	-
Metal	3.5%	5.2%	2.0%	97,800	80,400	32,100	210,300
Aluminum Cans	0.5%	0.2%	0.0%	15,200	2,400	-	17,600
Tin Cans+AG19	1.1%	0.4%	0.0%	30,400	6,500	-	36,900
Other Ferrous	0.5%	1.0%	0.0%	15,200	15,400	-	30,600

Table G-1: Estimated 2016 Tonnages – Front Range

	Waste Composition		Tons				
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Other Aluminum	0.4%	0.3%	0.0%	10,900	4,900	-	15,800
Other Non-Ferrous	0.4%	0.6%	0.0%	10,900	8,900	-	19,800
Appliances	0.5%	0.4%	0.0%	15,200	6,500	-	21,700
Other Metal	0.0%	2.3%	0.0%	-	35,700	-	35,700
Glass	2.3%	2.8%	1.2%	64,300	43,300	18,900	126,500
Organics	40.1%	33.4%	5.1%	1,120,600	516,400	81,900	1,718,900
Yard Waste	8.4%	6.4%	5.1%	234,700	99,200	81,900	415,800
Food Scraps	17.4%	16.2%	0.0%	486,300	250,300	-	736,600
Textiles/Rubber/Leather	3.8%	2.2%	0.0%	106,200	34,600	-	140,800
Wood	2.9%	6.2%	0.0%	81,000	96,000	-	177,000
Diapers	4.9%	0.7%	0.0%	136,900	11,000	-	147,900
Other Organics	2.7%	1.6%	0.0%	75,500	25,200	-	100,700
E-waste	2.2%	0.6%	0.0%	61,500	9,300	-	70,800
Problem Wastes	18.8%	15.9%	4.7%	525,400	245,800	75,500	846,700
HHW	0.1%	0.1%	0.0%	1,700	2,000	-	3,700
C&D	0.0%	0.0%	85.7%	-	-	1,375,800	1,375,800
Rock/Concrete/Brick	0.0%	0.0%	31.2%	-	-	500,900	500,900
Asphalt Shingles	0.0%	0.0%	18.0%	-	-	289,000	289,000
Wood (treated)	0.0%	0.0%	11.1%	-	-	178,200	178,200
Wood Dimensional	0.0%	0.0%	10.0%	-	-	160,500	160,500
Drywall - Clean	0.0%	0.0%	5.1%	-	-	81,900	81,900
Drywall - Paint	0.0%	0.0%	10.3%	-	-	165,400	165,400
Other	0.3%	3.0%	0.3%	9,500	45,900	5,100	60,500

Table G-1: Estimated 2016 Tonnages – Front Range

	Waste Composition		Tons				
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Total 2016	100.0%	100.0%	100.0%	2,794,600	1,546,000	1,605,400	5,946,000
Total 2021	-	-	-	3,051,200	1,688,000	1,752,800	6,492,000
Total 2026	-	-	-	3,310,200	1,831,200	1,901,600	7,043,000
Total 2036	-	-	-	3,816,800	2,111,500	2,192,600	8,121,000

Table G-2: Estimated 2016 Tonnages – Mountains

	Waste Composition		Tons				
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Paper	20.3%	29.2%	1.0%	23,900	32,800	700	57,400
Cardboard/Bags	3.4%	13.0%	0.0%	4,100	14,600	-	18,700
Newspaper	3.4%	3.0%	0.0%	4,000	3,400	-	7,400
Office Paper	1.5%	2.3%	0.0%	1,700	2,600	-	4,300
Paperboard	2.9%	2.3%	0.0%	3,500	2,600	-	6,100
Junk Mail	2.7%	2.8%	0.0%	3,100	3,200	-	6,300
Magazines/Catalogues	2.1%	1.9%	0.0%	2,400	2,200	-	4,600
Dairy/Juice	0.5%	0.2%	0.0%	600	200	-	800
Non-Recyclable Paper	3.8%	3.6%	0.0%	4,500	4,100	-	8,600
Plastic	12.5%	12.9%	0.0%	14,700	14,400	-	29,100
Plastics 1&2	6.5%	2.3%	0.0%	7,700	2,600	-	10,300
Rigid Plastics 3-7	0.6%	0.8%	0.0%	700	900	-	1,600
Polystyrene	0.4%	0.9%	0.0%	400	1,000	-	1,400
Other Rigid Plastics	2.0%	3.4%	0.0%	2,300	3,800	-	6,100
Plastic Bags/Film/Wrap	3.0%	5.4%	0.0%	3,500	6,100	-	9,600

Table G-2: Estimated 2016 Tonnages – Mountains

	Waste Composition		Tons				
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Other Plastics	0.0%	0.0%	0.0%	-	-	-	-
Metal	4.5%	5.3%	2.0%	5,300	5,900	1,400	12,600
Aluminum Cans	0.8%	0.7%	0.0%	1,000	800	-	1,800
Tin Cans+AG19	1.3%	0.5%	0.0%	1,600	600	-	2,200
Other Ferrous	0.7%	1.0%	0.0%	800	1,100	-	1,900
Other Aluminum	0.5%	0.3%	0.0%	600	400	-	1,000
Other Non-Ferrous	0.5%	0.6%	0.0%	600	700	-	1,300
Appliances	0.7%	0.4%	0.0%	800	500	-	1,300
Other Metal	0.0%	1.8%	0.0%	-	2,000	-	2,000
Glass	4.6%	3.9%	1.2%	5,400	4,400	800	10,600
Organics	40.1%	31.6%	5.1%	47,400	35,500	3,600	86,500
Yard Waste	8.4%	5.8%	5.1%	9,900	6,500	3,600	20,000
Food Scraps	18.1%	17.2%	0.0%	21,300	19,300	-	40,600
Textiles/Rubber/Leather	3.6%	1.8%	0.0%	4,300	2,000	-	6,300
Wood	2.8%	4.9%	0.0%	3,300	5,500	-	8,800
Diapers	4.7%	0.6%	0.0%	5,600	600	-	6,200
Other Organics	2.6%	1.3%	0.0%	3,100	1,500	-	4,600
E-waste	2.0%	0.6%	0.0%	2,400	700	-	3,100
Problem Wastes	14.4%	12.6%	4.7%	17,000	14,100	3,300	34,400
HHW	0.1%	0.1%	0.0%	200	100	-	300
C&D	0.0%	0.0%	85.7%	-	-	60,400	60,400
Rock/Concrete/Brick	0.0%	0.0%	31.2%	-	-	22,000	22,000
Asphalt Shingles	0.0%	0.0%	18.0%	-	-	12,700	12,700
Wood (treated)	0.0%	0.0%	11.1%	-	-	7,800	7,800

Table G-2: Estimated 2016 Tonnages – Mountains

	Waste Composition			Tons			
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Wood Dimensional	0.0%	0.0%	10.0%	-	-	7,000	7,000
Drywall - Clean	0.0%	0.0%	5.1%	-	-	3,600	3,600
Drywall - Paint	0.0%	0.0%	10.3%	-	-	7,300	7,300
Other	1.6%	3.9%	0.3%	1,900	4,400	200	6,500
Total 2016	100.0%	100.0%	100.0%	118,200	112,300	70,400	300,900
Total 2021	-	-	-	128,800	122,400	76,700	328,000
Total 2026	-	-	-	142,600	135,500	84,900	363,000
Total 2036	-	-	-	169,300	160,900	100,800	431,000

Table G-3: Estimated 2016 Tonnages – Eastern/Southeastern

	Waste Composition			Tons			
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Paper	19.8%	36.8%	1.0%	15,800	27,900	400	44,100
Cardboard/Bags	2.0%	17.5%	0.0%	1,600	13,300	-	14,900
Newspaper	0.8%	1.6%	0.0%	600	1,200	-	1,800
Office Paper	2.9%	0.2%	0.0%	2,300	200	-	2,500
Paperboard	5.3%	4.7%	0.0%	4,200	3,600	-	7,800
Junk Mail	4.2%	6.7%	0.0%	3,400	5,100	-	8,500
Magazines/Catalogues	2.8%	5.5%	0.0%	2,200	4,200	-	6,400
Dairy/Juice	1.6%	0.0%	0.0%	1,300	-	-	1,300
Non-Recyclable Paper	0.2%	0.6%	0.0%	200	500	-	700
Plastic	12.9%	14.5%	0.0%	10,300	11,000	-	21,300
Plastics 1&2	3.0%	5.3%	0.0%	2,400	4,000	-	6,400
Rigid Plastics 3-7	1.3%	2.0%	0.0%	1,000	1,500	-	2,500
Polystyrene	0.6%	0.4%	0.0%	500	300	-	800
Other Rigid Plastics	2.9%	1.8%	0.0%	2,300	1,400	-	3,700

Table G-3: Estimated 2016 Tonnages – Eastern/Southeastern

	Waste Composition			Tons			
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Plastic Bags/Film/Wrap	5.1%	5.0%	0.0%	4,100	3,800	-	7,900
Other Plastics	0.0%	0.0%	0.0%	-	-	-	-
Metal	7.6%	5.5%	2.0%	6,100	4,200	800	11,100
Aluminum Cans	1.6%	2.2%	0.0%	1,300	1,700	-	3,000
Tin Cans+AG19	2.1%	0.7%	0.0%	1,700	500	-	2,200
Other Ferrous	1.1%	1.0%	0.0%	900	800	-	1,700
Other Aluminum	0.8%	0.3%	0.0%	600	200	-	800
Other Non-Ferrous	0.8%	0.6%	0.0%	600	400	-	1,000
Appliances	1.1%	0.4%	0.0%	900	300	-	1,200
Other Metal	0.0%	0.3%	0.0%	-	200	-	200
Glass	11.4%	7.2%	1.2%	9,100	5,500	500	15,100
Organics	40.1%	26.1%	5.1%	32,000	19,800	2,100	53,900
Yard Waste	8.2%	4.0%	5.1%	6,500	3,000	2,100	11,600
Food Scraps	20.0%	20.2%	0.0%	16,000	15,300	-	31,300
Textiles/Rubber/Leather	3.2%	0.4%	0.0%	2,500	300	-	2,800
Wood	2.4%	1.1%	0.0%	1,900	800	-	2,700
Diapers	4.1%	0.1%	0.0%	3,300	100	-	3,400
Other Organics	2.2%	0.3%	0.0%	1,800	200	-	2,000
E-waste	1.4%	0.6%	0.0%	1,100	500	-	1,600
Problem Wastes	1.1%	2.6%	4.7%	900	2,000	1,900	4,800
HHW	0.4%	0.0%	0.0%	300	-	-	300
C&D	5.0%	8.4%	0.0%	4,000	6,400	-	10,400
Rock/Concrete/Brick	0.0%	0.0%	31.2%	-	-	12,900	12,900
Asphalt Shingles	0.0%	0.0%	18.0%	-	-	7,400	7,400
Wood (treated)	0.0%	0.0%	11.1%	-	-	4,600	4,600
Wood Dimensional	0.0%	0.0%	10.0%	-	-	4,100	4,100
Drywall - Clean	0.0%	0.0%	5.1%	-	-	2,100	2,100
Drywall - Paint	0.0%	0.0%	10.3%	-	-	4,300	4,300
Other	5.3%	6.7%	0.3%	4,200	5,000	100	9,300

Table G-3: Estimated 2016 Tonnages – Eastern/Southeastern

	Waste Composition			Tons			
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Total 2016	100.0%	100.0%	100.0%	79,800	75,800	41,400	197,000
Total 2021	-	-	-	87,100	82,700	45,200	215,000
Total 2026	-	-	-	94,400	89,700	49,000	233,000
Total 2036	-	-	-	106,500	101,200	55,300	263,000

Table G-4: Estimated 2016 Tonnages- Western Slope

	Waste Composition			Total			
	Residential	Commercial	C&D	Residential	Commercial	C&D	Total
Paper	19.8%	36.8%	1.0%	39,000	68,900	1,100	109,000
Cardboard/Bags	2.0%	17.5%	0.0%	3,900	32,800	-	36,700
Newspaper	0.8%	1.6%	0.0%	1,600	3,000	-	4,600
Office Paper	2.9%	0.2%	0.0%	5,700	400	-	6,100
Paperboard	5.3%	4.7%	0.0%	10,400	8,800	-	19,200
Junk Mail	4.2%	6.7%	0.0%	8,300	12,500	-	20,800
Magazines/Catalogues	2.8%	5.5%	0.0%	5,500	10,300	-	15,800
Dairy/Juice	1.6%	0.0%	0.0%	3,200	-	-	3,200
Non-Recyclable Paper	0.2%	0.6%	0.0%	400	1,100	-	1,500
Plastic	12.9%	14.5%	0.0%	25,400	27,100	-	52,500
Plastics 1&2	3.0%	5.3%	0.0%	5,900	9,900	-	15,800
Rigid Plastics 3-7	1.3%	2.0%	0.0%	2,600	3,700	-	6,300
Polystyrene	0.6%	0.4%	0.0%	1,100	700	-	1,800
Other Rigid Plastics	2.9%	1.8%	0.0%	5,700	3,400	-	9,100
Plastic Bags/Film/Wrap	5.1%	5.0%	0.0%	10,000	9,400	-	19,400
Other Plastics	0.0%	0.0%	0.0%	-	-	-	-

Table G-4: Estimated 2016 Tonnages- Western Slope

	Waste Composition			Total			
	Residential	**Commercial**	**C&D**	**Residential**	**Commercial**	**C&D**	**Total**
Metal	7.6%	5.5%	2.0%	15,000	10,300	2,200	27,500
Aluminum Cans	1.6%	2.2%	0.0%	3,200	4,100	-	7,300
Tin Cans+AG19	2.1%	0.7%	0.0%	4,100	1,300	-	5,400
Other Ferrous	1.1%	1.0%	0.0%	2,200	1,900	-	4,100
Other Aluminum	0.8%	0.3%	0.0%	1,600	600	-	2,200
Other Non-Ferrous	0.8%	0.6%	0.0%	1,600	1,100	-	2,700
Appliances	1.1%	0.4%	0.0%	2,200	800	-	3,000
Other Metal	0.0%	0.3%	0.0%	-	600	-	600
Glass	11.4%	7.2%	1.2%	22,500	13,500	1,300	37,300
Organics	40.1%	26.1%	5.1%	79,000	48,800	5,600	133,400
Yard Waste	8.2%	4.0%	5.1%	16,200	7,500	5,600	29,300
Food Scraps	20.0%	20.2%	0.0%	39,400	37,800	-	77,200
Textiles/Rubber/Leather	3.2%	0.4%	0.0%	6,200	700	-	6,900
Wood	2.4%	1.1%	0.0%	4,800	2,000	-	6,800
Diapers	4.1%	0.1%	0.0%	8,000	200	-	8,200
Other Organics	2.2%	0.3%	0.0%	4,400	500	-	4,900
E-waste	1.4%	0.6%	0.0%	2,800	1,100	-	3,900
Problem Wastes	1.1%	2.6%	4.7%	2,200	4,900	5,200	12,300
HHW	0.4%	0.0%	0.0%	800	-	-	800
C&D	5.0%	8.4%	0.0%	9,900	15,700	-	25,600
Rock/Concrete/Brick	0.0%	0.0%	31.2%	-	-	34,300	34,300
Asphalt Shingles	0.0%	0.0%	18.0%	-	-	19,800	19,800
Wood (treated)	0.0%	0.0%	11.1%	-	-	12,200	12,200
Wood Dimensional	0.0%	0.0%	10.0%	-	-	11,000	11,000

Table G-4: Estimated 2016 Tonnages- Western Slope

	Waste Composition			Total			
	Residential	**Commercial**	**C&D**	**Residential**	**Commercial**	**C&D**	**Total**
Drywall - Clean	0.0%	0.0%	5.1%	-	-	5,600	5,600
Drywall - Paint	0.0%	0.0%	10.3%	-	-	11,300	11,300
Other	5.3%	6.7%	0.3%	10,500	12,500	400	23,400
Total 2016	100.0%	100.0%	100.0%	197,000	187,200	109,800	494,000
Total 2021	-	-	-	217,300	206,500	121,100	545,000
Total 2026	-	-	-	240,100	228,100	133,800	602,000
Total 2036	-	-	-	285,900	271,700	159,400	717,000

APPENDIX H: OPPORTUNITIES AND GAPS BY REGION

APPENDIX H: OPPORTUNITIES AND GAPS BY REGION

H.1 Introduction

The calculations of program suitability and opportunities presented in Section 6 are based on the presence and gaps in facilities and access in recycling, hub and spoke, composting sites and geographic considerations. The tables in this section summarize those factors for each of the four planning regions of the state. The information in these tables was used in developing programmatic recommendations and calculations included in Section 6.

The figures in each of the four sections represent the tonnages, and cost per ton associated with each region assuming the recommended number of programs are implemented in each region (eight in Front Range, five in Mountains, and four in Eastern/Southeastern and Western Slope). The total of the results for these regional graphs make up the totals presented in the figures in Section 6. Each figure presents the estimated tonnage recovery from the selected programs, and the cost per ton for the community (if the program is delivered by the community) or cost per ton for the generator (if the program is largely a requirement imposed by the community).

Note that the tonnage estimates by material and by region are included in Appendix G. A high level summary comparing services, gaps and opportunities across all regions is provided in Table H-1.

Table H-1: Services, Gaps, Barriers, and Opportunities Summary by Colorado Sub-Region

	Front Range	**Mountains**	**Eastern/Southeastern**	**Western Slope**
Population (and % of State) (5.2 M)	4,332,041 (83.5%)	319,969 (6%)	157,455 (3%)	388,115 (7.5%)
Gaps in recycling access including hub and spoke/drop-off recycling	Pueblo area; Colorado Springs Area; Western reaches of Larimer, Boulder, & Jefferson Counties; Weld County (except Greeley); Parts of Douglas, Adams, Elbert Counties. *Gaps (Colorado Springs 439K; Pueblo 108K; proxy estimate missing 13%)*	Grand County; Jackson County; Clear Creek County; Gilpin County *Gaps (Grand 15K, Jackson 1K, Clear Creek and Gilpin 15K)*	Plains, in general; Morgan County; Huerfano County. *Gaps (Plains Generally 155K, specifics - Morgan 28K, Huerfano 6K)*	Moffat County (one drop-off); Rio Blanco County; Garfield County; Western Slope, in General. *Gaps (Moffat and Rio Blanco 19.5K, Garfield 58K, Western Slope most; preliminary estimate missing 100K+)*

H.1.1 Front Range

This section includes tables supporting the development of the recommendations and computations listed in Section 6.4.

- Table H-2 outlines the collection and diversion gaps and opportunities
- Table H-3 and Table H-4 present known hub and spoke operations and gaps
- Table H-5 presents the organics opportunities

Table H-2: Gaps and Opportunities – Front Range

Population (and % of State) (5.2 M)	4,332,041 (83.5%)
Gaps in recycling access including hub and spoke/drop-off recycling	Pueblo area; Colorado Springs Area; Western reaches of Larimer, Boulder, & Jefferson Counties; Weld County (except Greeley); parts of Douglas, Adams, Elbert Counties *Gaps (Colorado Springs 439K; Pueblo 108K; proxy estimate missing 13%)*
Estimated percent of population with coverage	87% of area population (preliminary estimate); 3.8 million.
Active organics options	Bennet, Aurora, Colorado Springs, Pueblo, Boulder
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Organics siting guidelines
Special Opportunities	Density, facilities, organized collection fairly common, appetite for green and zero waste in areas
Potentially-acceptable strategies	Regional planning, Hauler licensing, Goals, some support for bans, EPR, PAYT, H&S, Surcharges, Mandated diversion, Education

Table H-3: Locations and Gaps in Hub and Spoke – Front Range

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Denver metro	Numerous throughout	Alpine W&R, WMI, BCRCD	curbside, drop-off centers, res/commercial	Denver metro, north Front Range
Pueblo	Swink, Trinidad, others	WE Recycle	curbside, drop-off centers, res/commercial	South east central
Larimer	Throughout Larimer County	Larimer County	curbside, drop-off centers, res/commercial	Larimer, some Weld
Colorado Springs	Throughout El Paso, Pueblo, and some Mountain Counties	Bestway Recycling	curbside, drop-off centers. Res/commercial	El Paso, Teller, Pueblo, Fremont

Table H-4: Gaps in Hub and Spoke – Front Range

Location	Notes
Pueblo area	Minimal resources available for a large and dense population center
Colorado Springs area	Minimal resources available for a large and dense population center – includes Castle Rock, Teller County
Western reaches of Larimer, Boulder and Jefferson counties	Some drop-off centers available but curbside pretty much non-existent, lower population densities, mountainous terrain makes transportation more difficult
Weld County	Only access near Greeley
Parts of Douglas, Adams, Elbert Counties	Lone Tree, Parker Centennial, Elizabeth, Aurora etc. have practically no access yet populations are growing immensely in those locations

Table H-5: Public Composting Operations[1] – Front Range

Location	Operator	Service Area/Type	Class
Bennet	Alpine East Regional Landfill	Front Range/residential and commercial drop off	2
Aurora	Waste Management (DADS)	Front Range/residential and commercial drop off	1
Colorado Springs	Don's Garden Shop	Southern Front Range/residential	3
Pueblo	Midway Organic	Unknown but guessing southern Front Range/ commercial and residential drop off	1
Boulder	Western Disposal	North Front Range/residential and commercial drop off	2

1. Does not include Class V agricultural on-farm only facilities

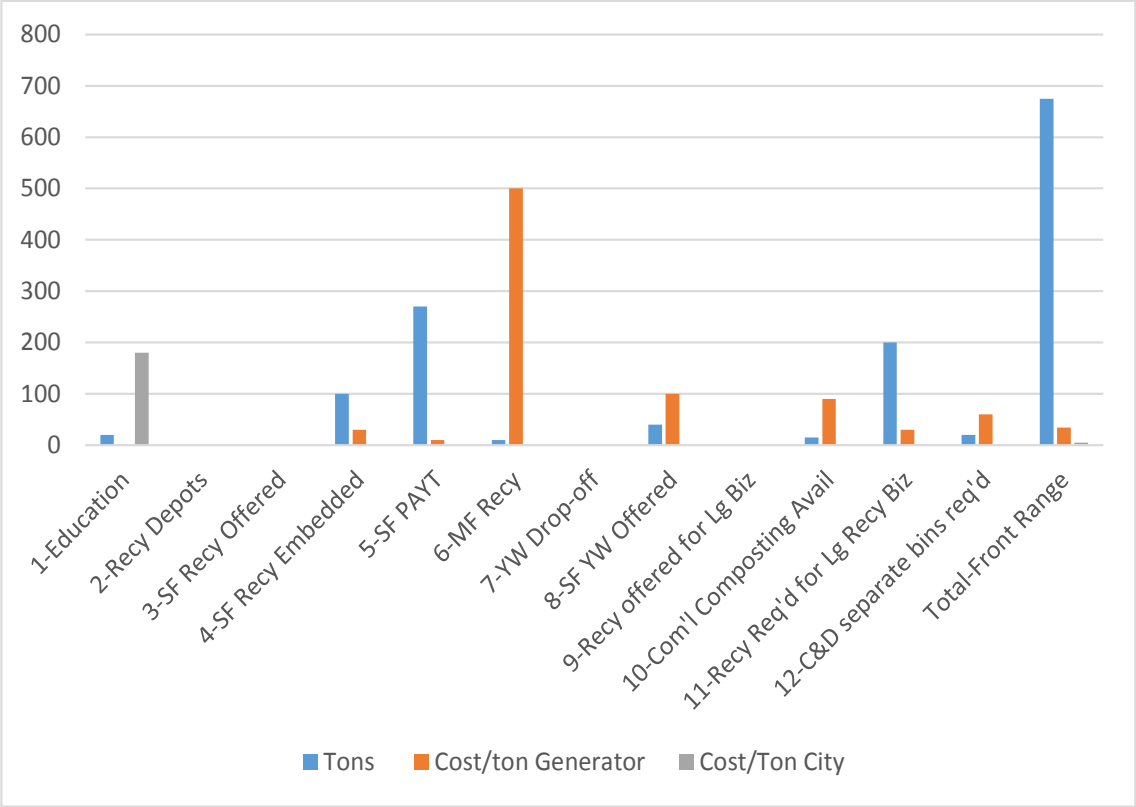

Figure H-1: Diverted Tons and Cost / Ton from Selected Level 3 Strategies in Front Range[1,2]

1. Assumes Front Range implements: 1, 4, 5, 6, 8, 10, 11, 12 (8 programs)
2. Note that these Level 3 programs are more fully described in Section 6.

H.1.2 Mountains

This section includes tables supporting the development of the recommendations and computations listed in Section 6.4

- Table H-6 outlines the collection and diversion gaps and opportunities
- Table H-7 and Table H-8 present known hub and spoke operations and gaps
- Table H-9 presents the organics opportunities

Table H-6: Gaps and Opportunities – Mountains

Population (and % of State) (5.2 M)	319,969 (6%)
Gaps in recycling access including hub and spoke/drop-off recycling	Grand County; Jackson County; Clear Creek County; Gilpin County *Gaps (Grand 15K, Jackson 1K, Clear Creek and Gilpin 15K)*
Estimated percent of population with coverage	90% of area population, 290K population covered
Active organics options	Milner Landfill, Snowmass Village, Saguache, Center, Hooper, Glenwood Springs, Dillon
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Transient populations/2nd home owners; Lack transfer stations/no regionalization, compost processing missing
Special Opportunities	Have MRF; green ethic with interested industry
Potentially-acceptable strategies	Planning areas, hub and spoke, recycling goals (2-tiered), landfill surcharges, possibly PAYT, solid waste tax, consideration of WTE

Table H-7: Locations and Gaps in Hub and Spoke – Mountains

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Canon City	Fremont & Custer counties	Phantom LF (Twin Enviro), Howard Disposal	curbside, drop-off centers, res/commercial	Fremont & Custer
Salida	Buena Vista, Poncha Springs	Angel of Shavano	drop-off centers	Chaffee; also accepts from Park, Hinsdale
Archuleta	Pagosa Springs	Archuleta County	drop-off centers	Archuleta (takes to Durango)
Creede/Del Norte	Crestone, Monte Vista, South Fork	MDS – was Recycle Creede, now being serviced by a small local hauler	drop-off centers	Hinsdale, Mineral, Rio Grande, Alamosa
Gunnison	Crested Butte	Gunnison County	drop-off centers	Gunnison
Leadville	Around Leadville	Lake County	drop-off centers	Lake
Breckenridge	Summit County	Summit County, Waste Management	drop-off centers, some curbside by Waste Management, residential/commercial	Summit
Wolcott	Vail, Red Cliff, Eagle, Edwards, Gypsum	Eagle County	drop-off centers, some curbside by Waste Management	Eagle
Pitkin	Basalt, Carbondale, Snowmass	Pitkin County	drop-off centers, some curbside	Pitkin
Steamboat	Hayden, Oak Creek	Twin Enviro, WM	drop-off centers, some curbside	Routt

Table H-8: Gaps in Hub and Spoke – Mountains

Location	Notes
Grand County	LF closed, currently studying options for solid waste/recycling solutions for entire valley (Winter Park, Tabernash, Kremmling, Hot Sulphur Springs, etc.) and Rocky Mountain National Park
Jackson County	Nothing seems to be available
Clear Creek and Gilpin counties	Minimal drop-off centers in Idaho Springs, Golden State Park.

Table H-9: Public Composting Operations[1]– Mountains

Location	Operator	Service Area/Type	Class	Notes
Milner	Milner Landfill (Twin Enviro	Routt County/residential and commercial drop off	1	
Snowmass Village	Pitkin County	Pitkin County/residential and commercial drop off	5	Surprised to see them listed as a Class 5
Center	Compost Technologies		None listed	No information found
Hooper	Soil Solutions	South Central Mountains (sell nationally)	5	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be
Glenwood Springs	South Canyon Disposal Site (City of Glenwood Springs)	Glenwood Springs/residential and commercial drop off	1	
Dillon	Summit County	Summit County/residential and commercial drop off	1	

1. Does not include Class V agricultural on-farm only facilities

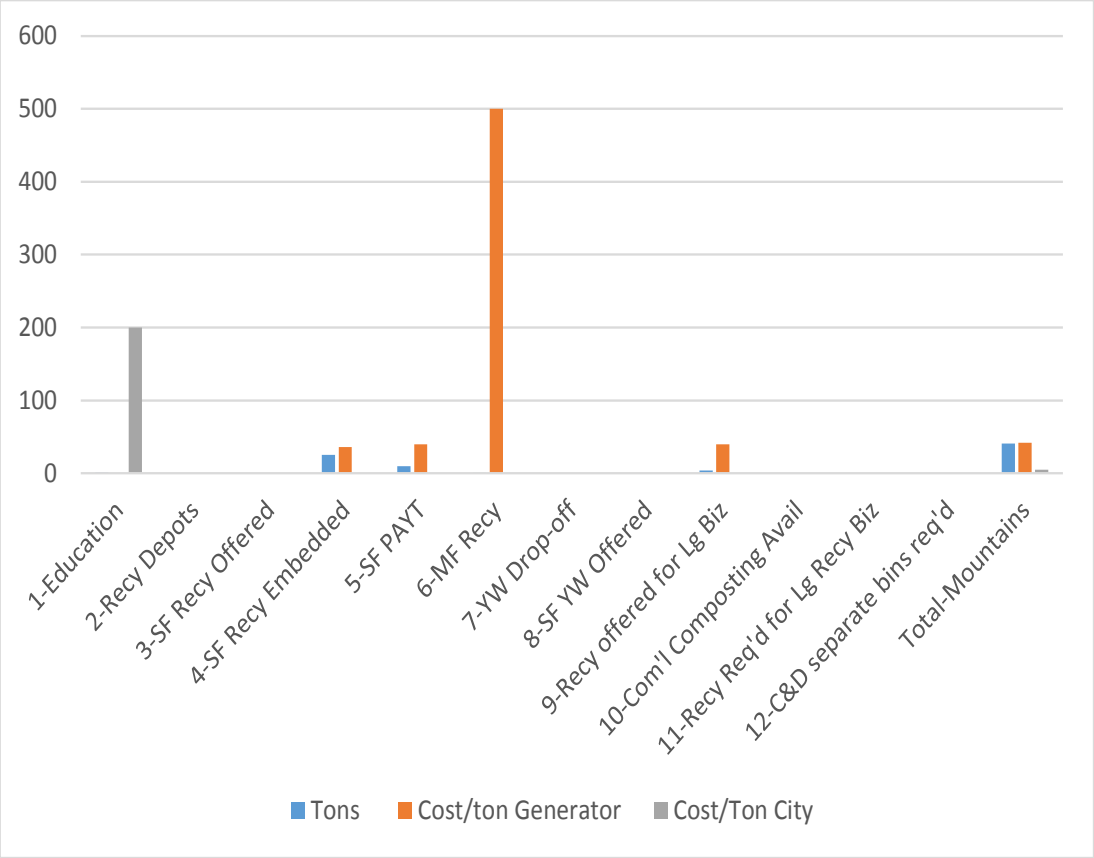

Figure H-2: Diverted Tons and Cost / Ton from Selected Level 3 Strategies in Mountain Region[1,2]

1. Assumes Mountains implement: 1, 4, 5, 6, 9 (5 programs)
2. Note that these Level 3 programs are more fully described in Section 6.

H.1.3 Eastern/Southeastern

This section includes tables supporting the development of the recommendations and computations listed in Section 6.4

- Table H-10 outlines the collection and diversion gaps and opportunities
- Table H-11 and Table H-12 present known hub and spoke operations and gaps
- Table H-13 presents the organics opportunities

Table H-10: Gaps and Opportunities – Eastern/Southeastern

Population (and % of State) (5.2 M)	157,455 (3%)
Gaps in recycling access including hub and spoke/drop-off recycling	Plains, in general; Morgan County; Huerfano County *Gaps (Plains 155K, Morgan 28K, Huerfano 6K)*
Estimated percent of population with coverage	60% of area population (preliminary estimate; 94K
Active organics options	Yuma, Ft. Lupton, Akron, Eaton, LaSalle, Erie, Keenesburg, Hudson, Fort Morgan
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Market access/transportation, want local control and want fewer landfill inspections/enforcement, lack MRFs; low incomes, illegal dumping concerns
Special Opportunities	
Potentially-acceptable strategies	2 tier goals, WTE; some support for Hub and Spoke, severance funding, differential taxes by stream; environmental/generator fees; facility co-location incentives; bottle bill; economic development assistance, hauler contract fees; industry funded programs

Table H-11: Locations and Gaps in Hub and Spoke – Eastern/Southeastern

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Denver	Sterling	Waste Management	Curbside (Sterling, other), drop-off center, res/commercial	Julesburg, Sterling, other towns in NE (NorthEast)
Yuma (new)	Keenesburg, Hillrose, Eckley	Quest Services	drop-off centers, commercial CS, ag	NE and EastCentral
Denver	Numerous	South-east and EastCentral Recycling	drop-off centers	14 counties in east central and southeast, 1 in KS
Swink	La Junta, Rocky Ford, Manzanola, Fowler, Ordway, Ead	Clean Valley Recycling	drop-off centers	Southeast – 7 counties
Trinidad		TerraFirma	drop-off centers	Las Animas County

Table H-12: Gaps in Hub and Spoke – Eastern/Southeastern

Location	Notes
Plains, in general	Despite the variety of hub and spoke operators, the eastern plains cover a vast amount of territory with a low population density limiting the effectiveness of individual programs. Some material may go out of state
Morgan County	Area is becoming more populated but no specific service (besides one drop-off center) is available in the county
Huerfano	Minimally serviced

Table H-13: Public Composting Operations[1] – Eastern/Southeastern

Location	Operator	Service Area/Type	Class	Notes
Yuma	Ace Composting	Unknown	1	Listed as 'fertilizer mixer' company
Ft. Lupton	BOSS Compost	Front Range for sales, unknown for intake (manure, definitely)	None listed	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be
Akron	Colorado Compost	Unknown	3	No online info
Eaton	A1 Organics	Eastern, Front Range/Residential & commercial drop off	3	
La Salle	Heartland BioDigester	Statewide/Commercial only	None listed	AD & Compost
Erie	PermaGreen	Statewide distribution through retailers	3	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be
Keenesburg	A1 Organics	Wholesale only	1	
Hudson	Stromo/Renewable Fiber	Eastern/Front Range	None listed	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be
Fort Morgan	Teague Enterprises	No info online	2	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be

1. Does not include Class V agricultural on-farm only facilities

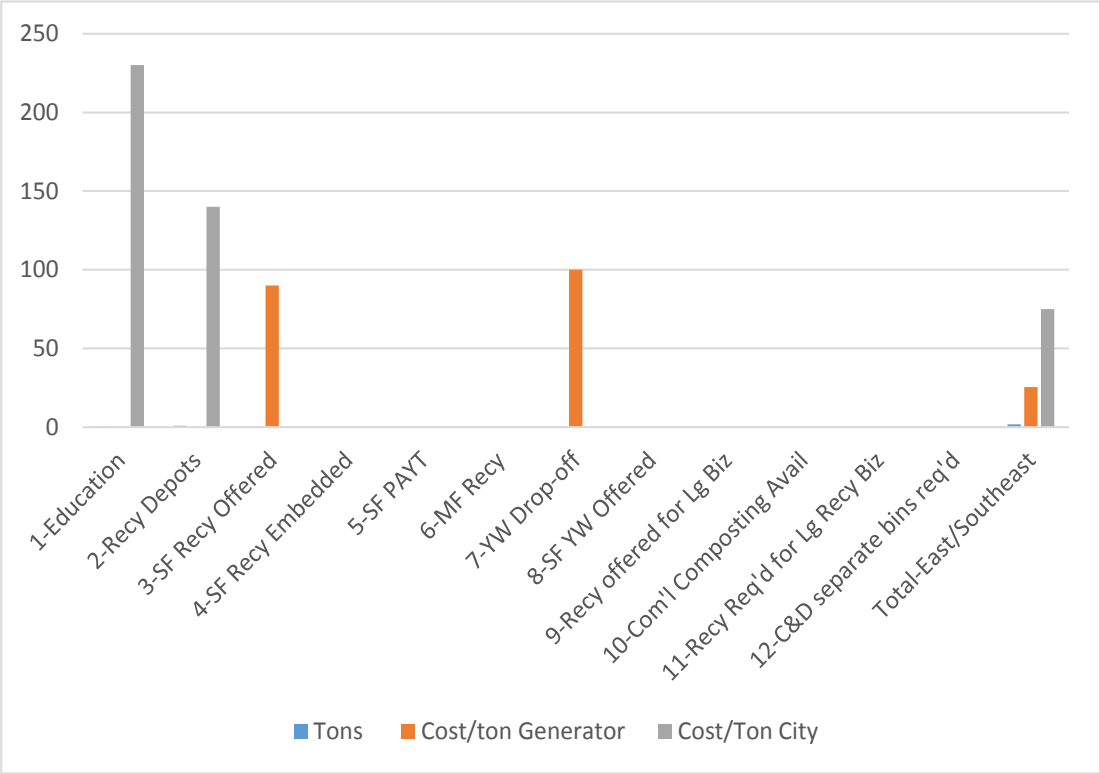

Figure H-3: Diverted Tons and Cost / Ton from Selected Level 3 Strategies in Eastern/Southeastern Region[1,2]

1. Assumes Eastern/Southeastern implements: 1, 2, 3, 7 (4 programs)
2. Note that these Level 3 programs are more fully described in Section 6.

H.1.4 Western Slope

This section includes tables supporting the development of the recommendations and computations listed in Section 6.4

- Table H-14 outlines the collection and diversion gaps and opportunities
- Table H-15 and Table H-16 present known hub and spoke operations and gaps
- Table H-17 presents the organics opportunities

Table H-14: Gaps and Opportunities – Western Slope

Population (and % of State) (5.2 M)	388,115 (7.5%)
Gaps in recycling access including hub and spoke/drop-off recycling	Moffat County (one drop-off); Rio Blanco County; Garfield County; Western Slope, in General *Gaps (Moffat and Rio Blanco 19.5K, Garfield 58K, Western Slope most; preliminary estimate missing 100K+)*
Estimated percent of population with coverage	75% of area; 288K population covered
Active organics options	Austin/Delta County, Grand Junction
Barriers/Special Concerns – beyond markets/profitability, low landfill fees	Lack transfer stations, hub and spoke in some areas, lack end markets, significant rural population
Special Opportunities	
Potentially-acceptable strategies	Partial support for Regional planning, hub and spoke, two-tiered state goals, reporting, solid waste taxes, LF surcharges, economic development assistance, industry-supported programs, severance funding, possible WTE, possible PAYT, OCC bans

Table H-15: Locations and Gaps in Hub and Spoke – Western Slope

Hub Location	Spoke Locations	Operator(s)	Types	Service Area
Grand Junction	Locations in Mesa & Delta Counties	Mesa County, Grand Junction Curbside Recycling Indefinitely (with City)	curbside, drop-off centers	Mesa and Delta
Montrose	Paradox, Gateway, Ouray, Nucla	Bruin Waste	drop-off centers	Montrose, Ouray & San Miguel (some Delta/San Juan)
Durango	La Plata, Montezuma, San Juan, Dolores	City of Durango, Phoenix Recycling	curbside, drop-off centers	La Plata, Montezuma, San Juan, Dolores

Table H-16: Gaps in Hub and Spoke – Western Slope

Location	Notes
Moffat and Rio Blanco counties	One drop-off center in Meeker
Garfield	Limited availability drop-off centers along I-70 in Glenwood, Rifle and others; some curbside in larger towns
Western Slope, in general	Have some programs but many have failed. Distances, coupled with difficult terrain, weather and sparser population impact transportation/cost to market. Some material may flow to Utah or New Mexico

Table H-17: Public Composting Operations[1] – Western Slope

Location	Operator	Service Area/Type	Class	Notes
Austin (Delta County)	CB Industries	Western Slope	1	Difficult to tell whether or not they take organics from the public or who commercial suppliers might be
Grand Junction	Mesa County	Mesa County/ residential and commercial drop off	1	

1. Does not include Class V agricultural on-farm only facilities

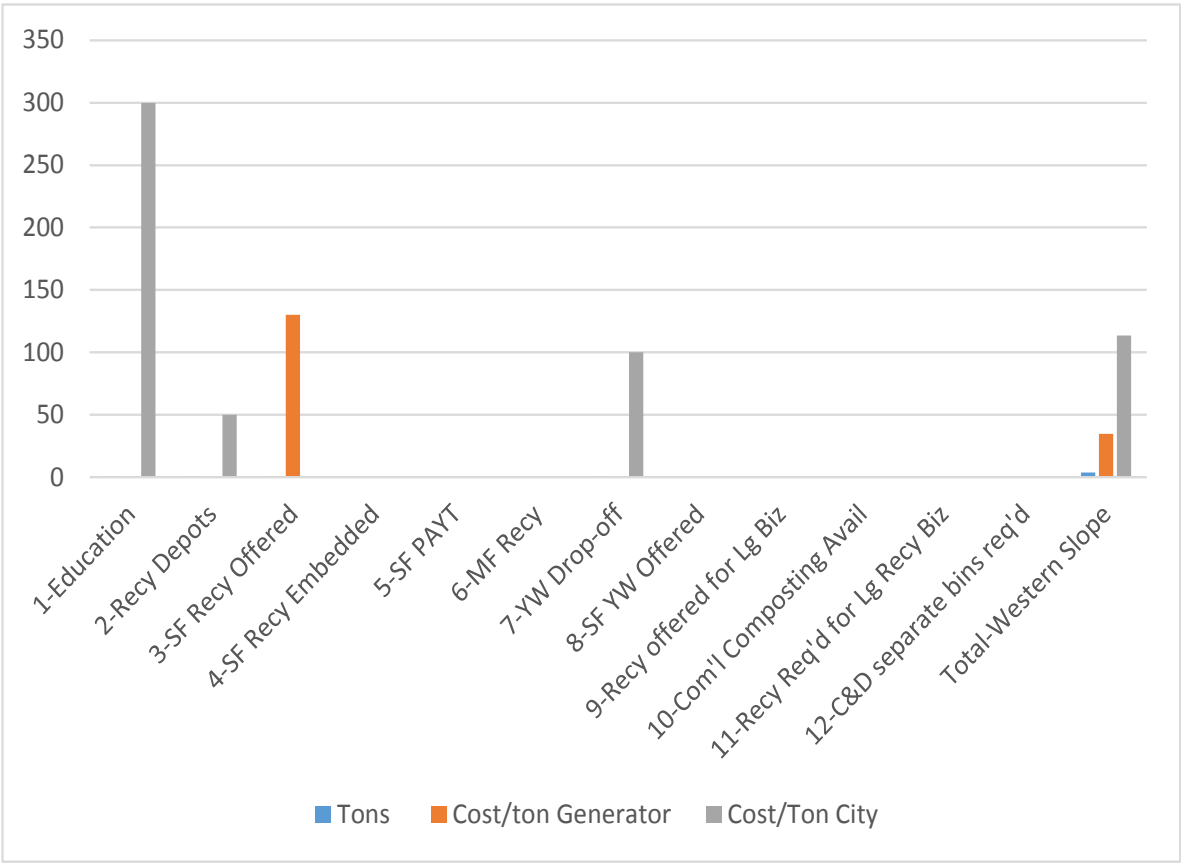

Figure H-4: Diverted Tons and Cost / Ton from Selected Level 3 Strategies in Western Slope[1,2]

1. Assumes Western Slope implements: 1, 2, 3, 7 (4 programs)
2. Note that these Level 3 programs are more fully described in Section 6.

H.2 Summary Results

Table H-18 provides a high-level summary of the results of the implementation of selected Level 3 strategies in each region. The results show:

- Most of the tons are generated in the Front Range, which is also reflected in the low statewide costs for the set of programs
- The costs in the Eastern/Southeastern and in the Western Slope are 2.5-3.7 times the cost per ton found in the Front Range, identifying the influence that travel distance and low densities have on the affordability of diversion in those regions
- The cost to implement programs from the community perspective are quite low in the Front Range and Mountains; they consist of the education and drop-off programs. The drop-off option (with the associated transportation) is more expensive in the Eastern/Southeastern and Western Slope regions. The remainder of the programs are assumed to be directed by the communities or counties through ordinance or other method, with the cost borne by the generator
- These costs assume a five-year average of $140 per ton in single stream mix revenues, and zero revenues for organics. To the extent the market prices differ from those values, these weighted average costs would need to be adjusted.

Table H-18: Weighted Average Cost per Ton of Level 3 Options by Region[1,2]

For Selected Subsets of Level 3 Options	Front Range	Mountains	Eastern/ Southeastern	Western Slope	Statewide
Diverted Tons (in thousands)	675	41	2	4	722
Weighted Cost per Ton – Generator	$34	$42	$26	$35	$35
Weighted Cost per Ton - Community	$5	$5	$75	$113	$6
Weighted Cost per Ton - Total	$40	$47	$101	$148	$41

1. Selected subset of strategies for each region
2. Assumes Front Range implements: 1, 4, 5, 6, 8, 10, 11, 12 (8 programs); Mountains implement: 1, 4, 5, 6, 9 (5 programs); Western Slope and Eastern/Southeastern implements: 1, 2, 3, 7 (4 programs)

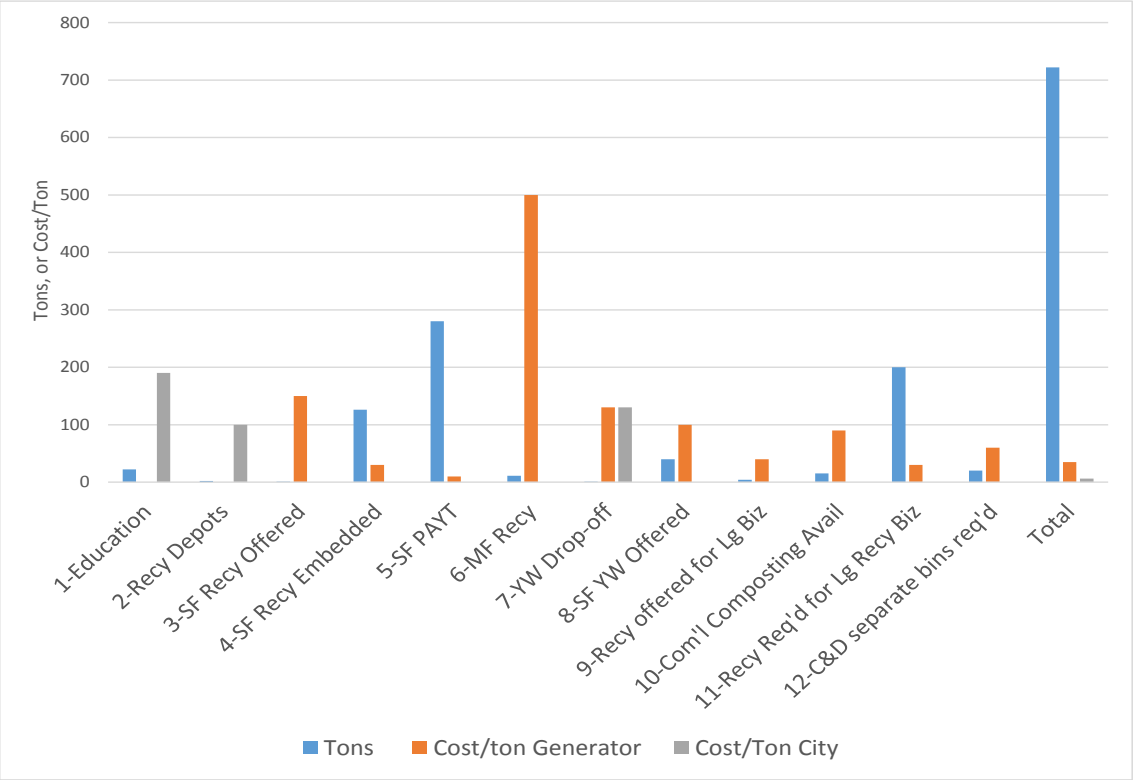

Figure H-5: Diverted Tons and Cost / Ton from Selected Level 3 Strategies Statewide[1,2]

1. Assumes Front Range implements: 1, 4, 5, 6, 8, 10, 11, 12 (8 programs); Mountains implement: 1, 4, 5, 6, 9 (5 programs); Western Slope and Eastern/Southeastern implements: 1, 2, 3, 7 (4 programs)
2. Note that these Level 3 programs are more fully described in Section 6.

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