August 23, 2019

Robert Peoples. Ph.D., Executive Director
Carpet America Recovery Effort (CARE)
100 South Hamilton Street
Dalton, Georgia 30722

Dear Dr. Peoples:

Crowe LLP (Crowe) is pleased to provide the enclosed CARE Cost Analysis Report, as well as the separate CARE Models Evaluation. These two reports represent an extensive independent research and analysis effort to survey post-consumer carpet (PCC) recyclers to determine costs to recycle PCC. Crowe also conducted a thorough evaluation of CARE’s Financial, Economic, Cost Conversion, and Subsidy Justification Models. This project represents the first time that such a survey of PCC recycling costs has been undertaken. This initial study of PCC recycling costs provides a baseline for future work and can inform and support the California Carpet Stewardship Program (CCSP) as it works to expand PCC recycling in the state.

Carpet recycling is still an immature industry with complex supply chain dynamics, few industry players, and a high degree of variability in processes and costs. Given the small number of recyclers in the population and the importance of maintaining confidentiality of participants’ financial information, Crowe is not able to provide numerical results for Collectors, Sorters, Entrepreneurs (CSEs), Processors, or Manufacturers.

Crowe understands the challenge that CARE faces in identifying the average costs of recycling PCC, and of interpreting this study without seeing numerical results. The implications of our cost study emphasize that costs are, in fact, dynamic and non-uniform, but also that costs reflect one of many factors that can potentially influence the recyclability of PCC and the success of the program. While ideally we would provide numerical results, our intent without them is to provide a robust analysis that informs PCC subsidy levels and provides insight into the factors that influence PCC recycling costs and incentives to help support PCC recycling and the goals of the CCSP.

Over the course of several months, Crowe worked collaboratively with CARE’s team to obtain necessary documentation and program data to perform this study of PCC recycling costs. CARE’s team provided invaluable insight about the economic and operational dynamics within the carpet recycling industry that helped inform our approach to this study. We greatly appreciate CARE’s sharing of knowledge and insights into PCC recycling.

Sincerely,

Wendy Pratt, Managing Director
Crowe LLP
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Sacramento, California 95814-4434
Direct 916.492.5173
Tel  916.441.1000
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Executive Summary
Executive Summary

Crowe LLP (Crowe) prepared this Independent Cost Analysis report under contract to Carpet America Recovery Effort (CARE). This CARE Cost Analysis Report provides weighted average cost per pound results for CARE’s Public Drop-Off locations. This report also provides relative weighted average cost per pound results for Collectors/Sorters/Entrepreneurs (CSEs), Processors, and Manufacturers. This report also summarizes tasks that Crowe conducted, and methodology used, in order to obtain these results. The results of Crowe’s evaluation of CARE’s models are provided in a separate report.

This executive summary is organized as follows:

A. CARE Cost Analysis Background
B. CARE Cost Analysis Methodology
C. CARE Cost Analysis Results and Findings
D. Material Flows and Policy Implications
E. Recommendations.

A. CARE Cost Analysis Background

Since 2011, CARE has operated the California Carpet Stewardship Program (CCSP) in partnership with the California Department of Resources Recycling and Recovery (CalRecycle). The CCSP’s primary function is to support California’s Carpet Stewardship Laws and recovery targets. In the 2018-2022 California Carpet Stewardship Plan (Plan), “Chapter 0” specifies CARE’s commitment to:

- “Conduct and provide to CalRecycle an independent detailed economic analysis to validate the Subsidy Justification and Conversion Cost Models that justifies the assessment based on actual costs of program participants… This must include a summary of the range of costs for collecting, processing, and recycling different materials, along with other programmatic expenditures that is sufficient to estimate how much overall funding and therefore what assessment level is needed to achieve the goal of a 24 percent recycling rate by January 1, 2020 and 26 percent by 2022.”
- “Demonstrate CARE’s Subsidy Justification and Conversion Cost Models use California-specific data and account for regional cost differences. A commitment to demonstrate to what extent its economic analysis accounts for regional differences in cost data.”

CARE contracted with Crowe to conduct the economic analysis. The Crowe team has over thirty years of experience working on recycling policies and programs in California, and 17 years of experience conducting cost of recycling surveys in support of California’s beverage container recycling program. Based on the requirements specified by CalRecycle, the key areas that Crowe sought to address were:

1. Validate the accuracy of the Subsidy Justification and Conversion Cost Models in determining subsidy levels based on actual costs of program participants.
2. Determine the range of costs for recycling different PCC materials.
3. Demonstrate that the SJM and CCM utilize California costs and evaluate regional cost differences.

In order to meet these objectives, Crowe conducted a broader evaluation of PCC recycling and factors that could potentially incentivize and/or increase the PCC recycling rate. A significant challenge of this study is providing study results while maintaining confidential business information (CBI) of the survey participants. We provide additional background and context on this CARE cost study in Section 1 of this report.
B. CARE Cost Analysis Methodology

Over the course of several months, Crowe worked collaboratively with CARE’s team to obtain necessary documentation and program data to perform this study of PCC recycling costs. CARE’s team provided invaluable insight about the economic and operational dynamics within the carpet recycling industry that helped inform our approach to this study.

CARE’s methodology is based on the methodology we have utilized since 2003 to conduct CalRecycle’s Processing Fee and Handling Fee cost surveys of beverage container recyclers and a similar Handling Fee Cost Study for the State of Hawaii. We provide Crowe’s review of the CARE models (Task 5) in a separate report. The project included eight tasks, as show in Exhibit ES-1.

Exhibit ES-1
Crowe Project Work Plan Tasks

<table>
<thead>
<tr>
<th>CARE 2019 Costs Analysis – Contractor Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conduct an “Environmental Scan” – Conduct interviews and research to help establish the methodological approach to detailed cost and labor analyses and to identify factors that are likely to impact the cost of post-consumer carpet (PCC) recycling.</td>
</tr>
<tr>
<td>2. Conduct Survey Preparation and Training – Develop the survey methodology in partnership with CARE. Conduct detailed training on survey methodology and prepare for survey logistics including communication with Collector/Sorter/Entrepreneurs (CSEs), Processors, and Manufacturers.</td>
</tr>
<tr>
<td>3. Conduct Drop-Off Site Cost Survey – Conduct a detailed study, by surveying at least 50 percent of CARE Public drop-off sites, to determine the actual cost, by weight, of recycling PCC by region (rural/urban).</td>
</tr>
<tr>
<td>4. Conduct Collector/Sorter/Entrepreneur (CSE)/Processor/Manufacturer Cost Survey – Conduct a detailed study, by surveying CSEs, Processors, and Manufacturers to determine the actual cost, by weight, of recycling PCC, where possible by region (rural/urban), and in and out of state.</td>
</tr>
<tr>
<td>6. Analyze Cost Data – Perform detailed analysis of CSE, Processor, and Manufacturer labor and financial data, including, where possible, specific costs associated with face fibers or PC4 material types; develop cost of PCC recycling, by weight, for CSEs, Processors, and Manufacturers to collect, process, and produce products across the U.S..</td>
</tr>
<tr>
<td>7. Prepare Study Reports – Prepare confidential Draft and Final reports summarizing study methodology, survey results, and cost results by applicable category. Prepare graphics to effectively summarize results, in addition to descriptive text. Prepare regular progress reports.</td>
</tr>
<tr>
<td>8. Present Study Methodology and Findings/Recommendations – Prepare and present study methodology and results to CARE Stewardship Planning Committee, CalRecycle Staff and Administration, and at Public Hearings, as requested by CARE.</td>
</tr>
</tbody>
</table>
Cost Analysis Surveys
The cost analysis surveys of drop-off sites, CSEs, Processors, and Manufacturers, involved five primary tasks: sample development, notification and scheduling, survey fieldwork, completing survey files, and quality control and review. Crowe approached the survey in two subsets, which took place in parallel. The first group consisted of CARE drop-off sites, and the second group consisted of CSEs, Processors, and Manufacturers. Exhibit ES-2 summarizes survey populations and participation.

Exhibit ES-2
Summary of Surveys

<table>
<thead>
<tr>
<th>Recycler Type</th>
<th>Survey Site Visits</th>
<th>Telephone Surveys</th>
<th>Incomplete Surveys*</th>
<th>Completed Surveys (Companies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop-Off Sites</td>
<td>44</td>
<td>2</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>CSEs/Processors/Manufacturers</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Totals</td>
<td>55</td>
<td>7</td>
<td>4</td>
<td>51</td>
</tr>
</tbody>
</table>

* Two companies did not participate in the survey; one company participated in site visit, but did not provide financial information. One drop-off site had negligible costs in 2018, and did not participate. We received partial information from six drop-off sites and one CSE, but obtained enough data to determine costs.

Cost Per Pound Analysis
Crowe calculated weighted average costs per pound for carpet recycling activities in 2018. The weighted average calculation sums total costs and total volumes (pounds) for the sample population, and then divides costs by volume (pounds) to determine costs per pound, as shown in Exhibit ES-3. Thus, small volume and/or low cost recyclers have less impact on the final result than larger or higher cost recyclers. However, a weighted average calculation better represents the costs per pound for the entire population, because higher volume recyclers are weighted more heavily.

Exhibit ES-3
Weighted Average Cost per Pound Calculation

\[
\text{Weighted Average Cost per Pound} = \frac{\text{Total PCC Recycling Costs}}{\text{Total PCC Recycling Pounds}}
\]

Crowe calculated weighted average costs per pound for all of the survey participants by recycler group (CSE/Processor/Manufacturer). In addition, we separated the 3 processors and 2 manufacturers that provided loaded transportation costs into a fourth group. The results are described in Section 4 of this report, using a relative scale. Crowe also determined the cost per pound ranges for each category, again displayed on a relative scale to maintain confidentiality.

Crowe calculated weighted average costs per pound for drop-off collection sites across several different categories. Because the population size was significantly larger (44 sites in total), we were able to provide numerical results for drop-off sites, as follows: statewide, rural versus non-rural, and small (11 or fewer pick-ups) versus large (12 or more pick-ups). Results of the drop-off site cost analysis are provided in Section 3.

For drop-off sites, there are four cost components. Crowe obtained and analyzed the following:

- Costs incurred by drop-off sites
- Freight costs incurred by CARE
- Recycling fees paid by CARE
- Administrative and management costs incurred by CARE.

We provide additional information on our methodology to perform this CARE cost study in Section 2 of this report.
C. CARE Cost Analysis Results and Findings

Drop-Off Cost Analysis Results

Over the 44 drop-sites, combined total costs for drop-off sites and CARE were $2 million for 8.6 million pounds of post-consumer carpet, an average of 23 cents per pound. Cost per pound ranges from $0.08 to $1.70 per pound, or a percent difference of about 2000%. This large difference between the lowest and highest emphasizes the high variability of cost per pound among drop-off sites. The weighted average cost per pound and the range is shown in Exhibit ES-4.

Exhibit ES-4
Weighted Average Cost per Pound

<table>
<thead>
<tr>
<th>Site</th>
<th>Total Pounds</th>
<th>Total Costs</th>
<th>Weighted Average Cost per Pound</th>
<th>Lowest Cost per Pound</th>
<th>Highest Cost per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Sites</td>
<td>8,594,750</td>
<td>$2,009,079</td>
<td>$0.234</td>
<td>$0.08</td>
<td>$1.70</td>
</tr>
</tbody>
</table>

Exhibit ES-5 shows that roughly half of drop-off sites’ total costs are incurred by the sites, while the other half are covered by CARE. “Site costs” consists of expenses, such as labor, rent, utilities, etc. CARE freight costs include coverage for storage. Sites that charge the full tipping fee (and provide more service) for carpet incur more costs than sites that offer a discount or do not charge to accept the material.

Exhibit ES-5
All Drop-off Sites, Cost Components

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CSE/Processor/Manufacturer Cost Analysis Results

Exhibit ES-6 displays the relative weighted average cost per pound for the four groups of PCC recyclers. As the exhibit illustrates, average CSE costs per pound are significantly lower than the other three groups. Processor average costs per pound are more than twice that of CSEs, and the semi-loaded processor/manufacturer costs are somewhat higher than processors. Manufacturers have significantly higher costs than the other three groups, which is reasonable given the more complex processes and higher-value output.

We provide additional cost analysis details in Sections 3 and 4 of this report.

Exhibit ES-6
Relative Weighted Average Costs per Pound for PCC Recycling Activities

D. Material Flow and Policy Implications

Crowe evaluated the flow of materials in the carpet recycling stream in order to inform the cost analysis, shown in Exhibit ES-7. We utilized the average percentages for whole fiber and carpet, in combination with the 2018 discard, collection, and recycled output numbers from CARE. We also created a scenario that illustrates the quantities necessary in order to achieve a 24 percent recycling rate based on the same proportion of recycled output as 2018. It is important to note that the quantities illustrated in Exhibit ES-7 may not flow from one stage to the next because there are differences in timing between when materials are collected, processed, and used in the manufacturing process. For example, several manufacturers have been purchasing California recycled fiber output, but have not yet manufactured that fiber into end-products and claimed the resulting subsidy. Thus, the Manufacturer recycled output volumes are lower than the Processor recycled fiber volumes.

The blue bar at the far left of Exhibit ES-7 illustrates total carpet discards, estimated at approximately 320 million pounds in 2018. The next bar, Recyclable Discards (Whole PCC) represents the potentially usable portion of discards consisting of face fiber, PC4, and PP backing. Approximately 20 percent of carpet discards are not currently recyclable.
Exhibit ES-7
PCC Material Flow from Discard to End-Use in 2018 and Theoretical 24 Percent Recycling Rate
The middle bar represents the pounds of whole PCC collected and reported by CSEs. The amount of whole carpet collected represents 21 percent of the recyclable discards.

The fourth bar represents processed recycled output (RO), as reported by Processors. RO is the figure used to calculate the recycling rate (~49 million pounds in 2018 divided by ~319 million = 15.4 percent). The 2018 mix of RO fiber types and PC4 reflect actual quantities. The Processed bar also includes a small amount of recycled and reused carpet tile.

RO used by manufacturers to create PCC products is illustrated in the bar on the far right, reflecting actual quantities of RO in products by fiber type. PC4 is not included in the manufacturing bar because it is sold by processors into various end uses. The Manufactured bar represents 26 million pounds, and is lower than the 36 million pounds of processed fiber due to timing differences between purchasing fiber and utilizing fiber in products. For some manufacturing processes, there is also a small amount of loss (typically 5%) that occurs due to moisture loss.

E. Recommendations

Carpet recycling is still an immature industry and understanding of supply chain dynamics and costs is complex and variable. Given the current dynamic status of the PCC recycling industry, there is no single subsidy level that will properly incentivize all materials and all recyclers. However, the work of the CARE modeling team, in combination with the results of this study, are providing new insights that will inform approaches to best support increased recycling and expansion of PCC recycling capacity. Based on our analysis, we believe that the current subsidy levels provide a solid foundation for further refinement, informed by the cost analysis and CARE’s ongoing modeling work. Exhibit ES-8 summarizes key takeaways and provides examples of how this study could be used to support future subsidy adjustments.

Taking a forward-thinking perspective, Crowe recommends the following in order to amplify CARE’s current approach to determine subsidy levels. Our recommendations are based on our research and observations while conducting the cost analysis, as well as over 25 years of experience in California recycling policies and programs. We recognize that several of these activities are in place or being planned:

1. Utilize Crowe’s cost category results to establish baseline cost breakdown percentages within the CCM to project for PCC costs at the CSE, Processor, and Manufacturer levels

2. Prepare and plan for likely increases to the minimum wage rate in California. CARE can leverage the cost category results to inform specific increases in subsidies. For example, with a ten percent increase in California minimum wage, this would be reflected in an increase in average CSE costs of 10% x 50% (the share of direct and indirect labor), equivalent to a 5 percent increase in CSE costs. This hypothetical example justifies a 5 percent subsidy in increase for California CSEs.

3. Develop a reporting dashboard that summarizes the results of CARE’s four primary models (Economic, Financial, Subsidy Justification, and CCM) in order to demonstrate traceability of financial results to external stakeholders, such as CalRecycle and the Mills.

4. Focus additional efforts and/or resources on the collection of whole carpet. Based on 2018 collections, yield, and RO, in order to achieve a 24 percent recycling rate; at a minimum, the amount of whole carpet collected must reach approximately 120 million pounds, a 29 percent increase over 2018 quantities.

5. As part of this effort, continue to educate and consider incentivizing installers to use collection networks.

6. Focus on assisting Processors and Manufacturers to expand their capacity.

7. Expand the definition of “highest recyclability” and incentivize recycling where it is most needed; this could potentially result in higher subsidies for CSEs to increase collection efforts and for Processors and Manufacturers to increase incentives to use non-nylon carpet. Building on the SJM, CCM, CARE’s ongoing work, and this cost analysis, consider where increases in subsidies (or shifting subsidies) will be most effective in supporting higher PCC recycling rates over time. Building on the assumptions in CARE’s Financial Model, the program could support a 10 percent increase in subsidies starting in 2020 and still maintain a $5+ million fund balance at the end of 2022. This indicates that the current 35-cent assessment is adequate to support the program over the next several years.
## Exhibit ES-8
### Key Takeaways from the Cost Analysis

<table>
<thead>
<tr>
<th>Finding</th>
<th>Implications</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative Costs</strong> – Costs for PCC recycling activities increase up the supply chain – CSEs have the lowest costs, Processors have mid-level costs, and Manufacturers are the highest cost; this progression also follows the complexity of each operation</td>
<td>• Subsidy levels may need to be higher at each level of the supply chain in order to provide similar levels of incentives</td>
<td>• The current subsidy structure follows this progression, with CSEs receiving the lowest per pound subsidy, then Processors, then Manufacturers. The exception is PC4 subsidies at the Processor level, which are the result of an entirely different market dynamic for this material</td>
</tr>
<tr>
<td><strong>Cost Variability</strong> – PCC Manufacturers, and to a lesser extent Processors, exhibit a wide range of costs per pound</td>
<td>• It is difficult to set subsidy levels that will equally incentivize all Manufacturers and Processors. Rather, CARE should utilize their models and market knowledge in combination with the results of this study to inform subsidy levels going forward</td>
<td>• For example, there is significant difference between a manufacturer making a PET or shoddy pad as compared to one using extrusion to produce recycled content pellets. This is one example of the range of products that ultimately drive differences in cost structure</td>
</tr>
<tr>
<td><strong>Subsidy Coverage</strong> – On average and compared to their costs, CSEs receive roughly equal subsidies; Processors receive more subsidies, and Manufacturers receive less. On average, subsidies cover less than 40 percent of costs</td>
<td>• The balance between costs and subsidies, in combination with information on other sources of revenues and market dynamics can help determine the level of subsidy necessary to incentivize PCC recycling at each level. Each group has a different cost-revenue structure</td>
<td>• Using the current proportions of costs and subsidies as a starting point can help inform where subsidies may need to be increased to support increased recycling. For example, an approach to further incentivize collection could be an increase in subsidies to CSEs</td>
</tr>
</tbody>
</table>
| **Regional Differences** – Given the variability in size and operations between recyclers, there were no clear differences in costs based on region. However, our research shows that there are differences in minimum wage, average warehouse rent, and average electric utility rates across different regions. California is higher in all three categories | • It is possible to leverage the cost category analysis with data on regional differences to inform adjustments to subsidy levels. Note that any changes in subsidies should be evaluated within the broader context of market dynamics to determine where subsidy dollars will be most effective | • Minimum wage in CA-San Jose is $15/hour while GA is $7.25/hour  
• Warehouse rent in CA-San Jose is $15/sqft/yr while GA is $5/sqft/yr  
• Electric utilities in CA-San Jose is $0.14/kWh while GA is $0.06/kWh |
### Exhibit ES-8
#### Key Takeaways from the Cost Analysis (continued)

<table>
<thead>
<tr>
<th>Finding</th>
<th>Implications</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Categories Provide a Basis for Subsidy Adjustments</strong></td>
<td>• Utilize cost categories and regional differences data to inform subsidy</td>
<td>• Focusing on a CSE, if the only regional difference is labor</td>
</tr>
<tr>
<td>• About half of CSE costs are labor related</td>
<td>adjustments in the future</td>
<td>between CA and GA with a 90% difference and labor represents 50% of</td>
</tr>
<tr>
<td>• Cost categories are similar for Processors and Manufacturers with</td>
<td></td>
<td>costs, the difference in costs could be calculated as: 90% * 50% =</td>
</tr>
<tr>
<td>non-labor cost inputs being more variable than labor</td>
<td></td>
<td>45% difference, which suggests a 45% increase to CA CSE subsidies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in relation to GA</td>
</tr>
<tr>
<td><strong>Cost Differences by Fiber Type</strong> – Given the small number of</td>
<td>• For CSEs and Processors, fiber type is not a cost differentiator</td>
<td>• Utilizing market price data, for example, as summarized in the Subsidy</td>
</tr>
<tr>
<td>market players, it was difficult to identify fiber type as a reason</td>
<td>• For Manufacturers, it may be more effective to use information on market</td>
<td>Justification Model, illustrates that PET generates lower prices than</td>
</tr>
<tr>
<td>for cost differences. Costs at CSEs are fiber agnostic; most costs</td>
<td>demand, fiber prices, and costs of technology to inform subsidies by</td>
<td>N6 or N66, and thus warrants a higher subsidy</td>
</tr>
<tr>
<td>at Processors are fiber agnostic; costs at manufacturers depend on</td>
<td>fiber type than trying to distinguish costs per pound by fiber type</td>
<td></td>
</tr>
<tr>
<td>the technologies employed and the end-products produced. Manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>costs for PET and Nylon 66 can be similar, but due to our small</td>
<td></td>
<td></td>
</tr>
<tr>
<td>population, we cannot confirm cost differences between fiber types</td>
<td></td>
<td></td>
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</tbody>
</table>
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Section 1
Introduction
1. Introduction

This report provides the results of the Crowe LLP’s (Crowe) independent Cost Analysis for the Carpet America Recovery Effort (CARE). This report provides the results of the Cost Analysis; the results of Crowe’s evaluation of CARE’s models are provided in a separate report. This introductory section is organized as follows:

A. Report Overview
B. Purpose of the CARE Cost Analysis
C. Background of CARE/California Carpet Stewardship Program
D. Carpet Recycling and Cost Analysis Context

A. Report Overview

Crowe’s Post-Consumer Carpet (PCC) Recycling Cost Analysis reflects the first time that a survey has been conducted to determine the costs of recycling PCC. The CARE Models Evaluation report is organized into the following five sections:

1. Introduction – Covers the purpose of the study, background on the California Carpet Stewardship Program (CCSP), and an overview of carpet recycling and context for the cost analysis.
2. Methodology – Provides an overview of Crowe’s methodology in conducting the cost analysis
3. Public Drop-Off Collection Center Costs to Recycle – Provides results and analysis of public drop-off site costs.
4. CSEs/Processors/Manufacturers Costs to Recycle – Provides results and analysis of CSE, processor, and manufacturer costs to recycle.
5. Implication of Results – Summarizes our analyses and the implications of study results on increasing carpet recycling and CARE subsidy levels.

B. Purpose of the CARE Cost Analysis

Carpet America Recovery Effort (CARE) operates the California Carpet Stewardship Program in partnership with and through the oversight of CalRecycle. CARE has prepared a five-year California Carpet Stewardship Plan (2018-2022) to support California’s Carpet Stewardship Laws and recovery targets. As part of the current Stewardship Plan, CARE contracted with Crowe to conduct an economic study to determine the weighted average costs to recycle for post-consumer carpet (PCC). CARE created a “Chapter 0” to the California Carpet Stewardship Plan 2018-2022 (Plan) at the request of CalRecycle. Chapter 0 includes a number of specific provisions and studies, including the commitment to:

• “Conduct and provide to CalRecycle an independent detailed economic analysis to validate the Subsidy Justification and Conversion Cost Models that justifies the assessment based on actual costs of program participants… This must include a summary of the range of costs for collecting, processing, and recycling different materials, along with other programmatic expenditures, that is sufficient to estimate how much overall funding, and therefore what assessment level is needed to achieve the goal of a 24 percent recycling rate by January 1, 2020 and 26 percent by 2022.”
• “Demonstrate CARE’s Subsidy Justification and Conversion Cost Models use California-specific data and account for regional cost differences. A commitment to demonstrate to what extent its economic analysis accounts for regional differences in cost data.”

In order to meet these requirements, Chapter 0 commits CARE to the following:

• CARE will hire an independent firm to conduct an analysis of CARE’s Conversion Cost Model (CCM) and Subsidy Justification Model (SJM) to validate accuracy including the costs of collecting/sorting, processing, and recycling post-consumer carpet (PCC). A statistical analysis will be included as part of the independent work. Finally, the independent firm will evaluate the sufficiency of the assessment to meet or exceed the 2020 24% recycling goal.
• CARE will work with CalRecycle during the analysis process to provide a sufficient level of detail while protecting the confidential business information (CBI) of the recycling community participants... CARE will work to include a description of the range of costs for collecting, sorting, processing and other program expenditure costs while balancing CBI considerations.

• During analysis of the SJM and CCM, CARE will look at California versus non-California costs along with regional costs within the state. This review will be sensitive to protection of confidential business information.

To fulfill the commitments to the required analyses, CARE released a Request for Proposal in February 2019 that included the following scope of work:

• Conduct an economic study to determine the U.S. and CA statewide weighted average and range of costs associated with collecting and processing post-consumer carpet along with costs to manufacture downstream products.

• Evaluate all data and assess the statistical error range associated with all estimates.

• Work with CARE to understand and offer recommendations for improvement of CARE’s Economic, Cost Conversion, Financial, and Subsidy Justification Models.

• In consultation with CARE, create a detailed survey methodology, logistics and analytical analysis manual used in surveys.

• Working with CARE, ensure recyclers that all individual data will be held strictly confidential and not shared with CARE unless expressly requested and approved by recycler(s).

CARE contracted with Crowe to conduct the cost analysis. The Crowe team has over thirty years of experience working on recycling policies and programs in California, and 17 years of experience conducting cost of recycling surveys in support of California’s beverage container recycling program. Based on the requirements specified by CalRecycle, the key tasks that Crowe sought to address were:

1. Validate the accuracy of the Subsidy Justification and Conversion Cost Models in determining subsidy levels based on actual costs of program participants.

2. Determine the range of costs for recycling different PCC materials.

3. Demonstrate that the SJM and CCM utilize California costs and evaluate regional cost differences.

In order to meet these objectives, Crowe conducted a broader evaluation of PCC recycling and factors that could potentially incentivize and/or increase the PCC recycling rate. A significant challenge of this study is providing study results while maintaining confidential business information of the survey participants.
C. California Carpet Stewardship Program Background

The CCSP was established in 2010 by AB2398 (Perez, Statutes of 2010) and further defined in 2017 with the passage of AB1158 (Chu, Statutes of 2017). Together, these statutes comprise the California carpet stewardship laws. AB2398 provides the foundation and the structure of the CCSP, while AB1158 provides additional program requirements.

The need for the CCSP, as outlined in AB2398, was based on the findings that identified:

- Discarded carpet was one of the ten most prevalent waste materials in landfills, at 3.2 percent of volume
- The weight and bulk of discarded carpet result in a significant solid waste management cost on local governments
- There are numerous products that can be manufactured from recycled carpets
- The vast majority of companies in the United States carpet industry have established a non-profit organization (CARE) to work with state governments to increase the recycling and reuse of carpet
- In 2008, 5.2 percent of carpet was diverted from landfills and 4.3 percent was recycled, nationwide.

As defined in statute, the purpose of AB2398 was to “increase the amount of postconsumer carpet that is diverted from landfills and recycled into secondary products or otherwise managed in a manner that is consistent with the state’s hierarchy for waste management practices pursuant to Section 40051.” AB2398 further specified that “it is in the interest of the state to establish a program, working to the extent feasible with the carpet industry and related reclamation entities, to increase landfill diversion and recycling of postconsumer carpet generated in California.”

AB1158 added specificity to the program and established the 24 percent recycling rate to be achieved by January 1, 2020. In addition, AB1158 included provisions such as:

- Requiring a carpet stewardship plan to achieve that goal, with quantifiable 5-year and annual goals
- Providing data for CalRecycle to evaluate the effectiveness of the program
- Prohibiting subsidies for engineered solid waste conversion (cement kilns and waste to energy)
- Creating an Advisory Committee
- Requiring the Department of General Services to recycle carpet and purchase carpet with PCC
- Specifying requirements for the assessment
- Specifying a subsidy/grant structure that incentivizes highest recyclability (although not defining the term).

The requirements of the carpet stewardship plan provide further insight into the legislative intent behind AB1158. The Carpet Stewardship Plan is to describe how CARE will:

- Increase PCC recycling and reduce PCC disposal
- Increase collection of PCC and improve convenience of collection
- Expand and incentivize markets for products made from PCC
- Increase processor capacity, including within California
- Increase the recyclability of carpet.

Ultimately, the carpet stewardship laws are intended to create an industry-driven effort to reduce landfill diversion of post-consumer carpet and increase the recycling rate to 24 percent by January 1, 2020, with further increases annually. The added specificity in the statutes are intended to further support those objectives.

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1 Section 40051 identifies the priority of waste management practices as: 1) source reduction; 2) recycling and composting; 3) environmentally safe transformation and environmentally safe disposal.
D. Carpet Recycling and Survey Context

Below, we provide an overview of carpet recycling. This overview is not meant to be a comprehensive discussion of the carpet recycling industry; there are other sources for that information. However, we include the discussion below to provide context to the cost analysis survey.

**Exhibit 1-1** provides a schematic of the carpet recycling process. There are four primary steps, all of which were included in the cost analysis. While we describe these steps separately, there are several entities that operate as CSE/Processor/Manufacturers, CSE/Processors, or Processor/Manufacturers.

**Exhibit 1-2** summarizes current CARE subsidies and other points of payment that support PCC recycling.

- **Collection** – The first step in the recycling process is to collect the material in order to divert carpet from landfill disposal. Most carpet is removed by carpet installers, although homeowners, contractors, and demolition companies may remove carpet as well. Carpet flows into the CCSP through two primary sources:
  - Private collection networks – Operated by CSEs, home goods or flooring distributors, carpet manufacturers, or other independent contractors. The majority of carpet is collected through private networks, which consists of approximately 200 private collection locations in California. While the cost of collection from private locations by CSEs was captured in this study as part of CSE costs, other independent collectors were not within the scope of this survey. There is a general understanding that carpet recycling handling and collection costs are similar to or less than that of traditional disposal methods.
  - CARE public drop-off sites – CARE currently supports over 62 public drop-off locations throughout California. Installers and the public can bring loads of carpet to these facilities. A few drop-off sites also sort carpet from mixed waste loads. Most of the drop-off sites are associated with permitted solid waste facilities such as county landfills, transfer stations, construction and demolition debris facilities, or material recovery facilities (MRFs). There were a few public access drop-off sites located at flooring stores in locations where a permitted solid waste facility was not otherwise available.

- **Collector/Sorter/Entrepreneurs (CSEs)** – CSEs receive truckloads of whole carpet from their private collection network locations, PCC delivered directly to their facility, and CARE drop-off sites. The CSE provides the first level of sorting and handling. CSEs sort carpet by fiber type and remove carpet padding and other waste from the load. A stand-alone CSE will typically bale the carpet for shipment to a processor, while a combined CSE/Processor may use some (or all) of the carpet in-house.

- **Processors** – Processors’ primary role is to mechanically or chemically separate the carpet face fiber from the backing, or in some cases to remove the calcium carbonate (PC4), but not separate the face fiber and backing fiber. Processors utilize several different mechanical processes (shredding, shearing, hammer mill, wet centrifuge) as well as chemical processes such as depolymerization. The outputs from this phase consist of face fiber (primarily nylon 6 (N6), nylon 6,6 (N66), PET, and some PTT, polypropylene (PP) backing fiber, and post-consumer calcium carbonate (PC4). These materials make up the recycled output (RO) used in calculating the PCC recycling rate.

- **Manufacturers** – Manufacturers are the most diverse of the four types of entities. They purchase the separated face fiber or PP backing and utilize the material to produce a range of end-products. One subset of manufacturers produces pellets (typically N6 or N66) that are then sold for use in products, including automotive parts, yarns, and shelving. PCC pellets are often a substitute for post-industrial pellets. Another subset of manufacturers produces carpet padding, cushions, landscape materials, and insulation.

As Exhibit 1-2 illustrates, at each stage of the PCC recycling process, participants may charge or pay for material inputs, and receive payments for material outputs. **Exhibit 1-3** summarizes the charges and payments for the four recycler types in the cost analysis. At each level, participants also incur costs; these costs were the focus of this study, as shown in the center boxes. It is important to note that the amount of subsidy that is “necessary” to incentivize recycling at each level depends not only on the costs to recycle, but on the entire array of payments and charges that a particular recycler faces. As shown in Exhibit 1-3, there are numerous moving parts in the cost/revenue equation at each level. Furthermore, given the wide range of processing and manufacturing activities in the PCC industry, there is also significant variability within the cost of recycling. The Crowe team further explored these issues as part of the cost analysis study.
Exhibit 1-1
PCC Recycling Participants and Flow of Material
<table>
<thead>
<tr>
<th>Recycler</th>
<th>CARE Subsidy</th>
<th>Other Revenue/Fees</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private collectors</td>
<td>• None</td>
<td>• Fee for collection service</td>
<td></td>
</tr>
<tr>
<td>CARE Public Drop-offs</td>
<td>• Storage container rental fee</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Transportation and recycling fee to CSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Many charge a fee to accept the material</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fee typically less than landfill charge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSEs</td>
<td>• 2 cents per pound of whole carpet shipped to a Processor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• $1,000/period reporting incentive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 5 cents per pound for carpet tile</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 10 cents per pound for tile or broadloom reuse (not eligible for 2 cents)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Many charge a fee to accept the material</td>
<td></td>
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<tr>
<td></td>
<td>• CARE provides a variable recycling fee for carpet from drop-off sites</td>
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</tr>
<tr>
<td></td>
<td>• CSEs sell baled whole carpet to Processors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processors</td>
<td>• 10 cents per pound for tile recycling and tile or broadloom reuse</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 10 cents per pound for recycled fiber output with less than 25% ash (Type 1)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• 3 cents per pound for recycled fiber output with more than 25% ash</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Additional 5 cents per pound for N6 and N66 with less than 25% ash</td>
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<tr>
<td></td>
<td>• 17 cents per pound for PC4 (specified uses)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Processors purchase whole baled carpet from CSEs</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Processors sell separated fiber to Manufacturers</td>
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<tr>
<td></td>
<td>• Processors sell PC4 to end-users, but currently pay PC4 end-users a portion of the subsidy in order for the end-user to “purchase” the PC4</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Tile manufacturers process carpet tile, separating the face fiber and backing, typically using the backing as an input into new carpet tile (in addition to PI tile)</td>
<td></td>
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<tr>
<td></td>
<td>• Manufacturers pay CSEs for whole carpet and typically cover shipping costs to their facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manufacturers pay Processors for recycled fiber; prices vary based on fiber markets, quality, and demand</td>
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<tr>
<td></td>
<td>• Carpet tile manufacturers may provide collection and processing of used carpet tile as a service to customers</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Costs of shipping to Manufacturers typically absorbed by Manufacturers</td>
<td></td>
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</tr>
<tr>
<td>Manufacturers</td>
<td>• 25 cents per pound for products made with PET and PTT Type 1 fiber</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 25 cents per pound for products made with Type 1 PP fiber from backing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 10 cents per pound for products made with N6 and N66 Type 1 fiber</td>
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<tr>
<td></td>
<td>• Manufacturers pay Processors for PCC fiber, based on plastic fiber market prices (which generally follow oil prices)</td>
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</tr>
<tr>
<td></td>
<td>• Manufacturers that produce pellets sell to end-users that typically use the recycled pellets along with post-industrial and/or virgin plastics</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Manufacturers that produce PCC end-products sell those products into the marketplace</td>
<td></td>
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<tr>
<td></td>
<td>• Subsidies are paid on the weight of recycled output used in products</td>
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<tr>
<td></td>
<td>• Recycled pellet typically has a 10 cent discount as compared to the same post-industrial (PI) polymer fiber</td>
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</tr>
</tbody>
</table>
Exhibit 1-3
Summary of Charges, Costs, and Payments for Drop-Off Sites, CSEs, Processors, and Manufacturers

Inputs | Process/Activity | Outputs
--- | --- | ---
| Charge for receiving carpet $ | CARE drop-off sites | CARE transportation, storage, and recycling fee ($) |
| | Costs at collection sites | |
| | CARE drop-off sites | |
| | | |
| | CARE subsidy and reporting incentive | |
| | | |
| Charge for collection $ | CSEs | Payment for whole carpet $ |
| | Cost of sorting and handling | |
| CARE recycling fee for drop-off site carpet $ | | |
| | CARE subsidy and reporting incentive | |
| | | |
| Payment for whole carpet and shipping $ | Processor | Payment for separated fiber $ |
| | Cost of separating and handling | |
| | Payments to PC4 end-users, Manufacturers $ | |
| | CARE subsidies for RO and PC4 | |
| | | |
| Payment for fiber and shipping $ | Manufacturer | Payment for end-products $ |
| | Cost of production using RO | |
| | Payment to end-users to use PCC $ | |
| | CARE subsidies for RO in end-products | |
Section 2
Cost Analysis Methodology
2. Cost Analysis Methodology

This Section describes Crowe’s methodology for the independent Cost Analysis of PCC recycling. Crowe’s methodology is based on the methodology we have utilized since 2003 to conduct CalRecycle’s Processing Fee and Handling Fee cost surveys of beverage container recyclers and a similar Handling Fee Cost Study for the State of Hawaii. The current study, as well as the Processing Fee and Handling Fee cost surveys, focus only on the cost side of a recycler’s financial data. We provide Crowe’s review of the CARE models (Task 5) in a separate report. The project included eight tasks, as show in Exhibit 2-1. In the remainder of this section, we describe the study methodology for the following four major activities:

A. Environmental Scan
B. Survey Preparation and Training
C. Surveys
D. Data Compilation and Analysis.

Exhibit 2-1
Crowe Project Work Plan Tasks

CARE 2019 Costs Analysis – Contractor Tasks

1. Conduct an “Environmental Scan” – Conduct interviews and research to help establish the methodological approach to detailed cost and labor analyses and to identify factors that are likely to impact the cost of post-consumer carpet (PCC) recycling.

2. Conduct Survey Preparation and Training – Develop the survey methodology in partnership with CARE. Conduct detailed training on survey methodology and prepare for survey logistics including communication with Collector/Sorter/Entrepreneurs (CSEs), Processors, and Manufacturers.

3. Conduct Drop-Off Site Cost Survey – Conduct a detailed study, by surveying at least 50 percent of CARE Public drop-off sites, to determine the actual cost, by weight, of recycling PCC by region (rural/urban).

4. Conduct Collector/Sorter/Entrepreneur (CSE)/Processor/Manufacturer Cost Survey – Conduct a detailed study, by surveying CSEs, Processors, and Manufacturers to determine the actual cost, by weight, of recycling PCC, where possible by region (rural/urban), and in and out of state.


6. Analyze Cost Data – Perform detailed analysis of CSE, Processor, and Manufacturer labor and financial data, including, where possible, specific costs associated with face fibers or PC4 material types; develop cost of PCC recycling, by weight, for CSEs, Processors, and Manufacturers to collect, process, and produce products across the U.S..

7. Prepare Study Reports – Prepare confidential Draft and Final reports summarizing study methodology, survey results, and cost results by applicable category. Prepare graphics to effectively summarize results, in addition to descriptive text. Prepare regular progress reports.

8. Present Study Methodology and Findings/Recommendations – Prepare and present study methodology and results to CARE Stewardship Planning Committee, CalRecycle Staff and Administration, and at Public Hearings, as requested by CARE.

A. Environmental Scan

The environmental scan provided the foundation for the remaining tasks of this study of PCC recycling costs. Crowe cast a wide net to understand the technologies, markets, regulations, and history of carpet recycling and the California Carpet Stewardship Program (CCSP). This phase of the project helped the team evaluate and understand the range of factors that influence costs associated with PCC recycling. We began by conducting an extensive review of PCC recycling legislation, publications, and reports, including:

- PCC recycling legislation (including but not limited to: Assembly Bills 2398 and 1158)
• CARE publications (including but not limited to: CARE California Stewardship Plan (2018-2022) and Annual Reports)
• Relevant PCC webpages (Carpet companies, CalRecycle, CARE, etc.)

Once our team conducted this external portion of the environmental scan, we worked with CARE to identify key stakeholders to interview. Crowe conducted telephone, in-person, and site visit interviews with leadership staff of CSEs, Processors, and Manufacturers. We incorporated the information we obtained during our research and interviews into the survey methodology and training.

B. Survey Preparation and Training

Following the research and interviews, Crowe immediately began preparing for the cost surveys. The short timeframe of the project necessitated that many of these activities took place in parallel.

1. Preparation of Training Materials

Crowe prepared a comprehensive training manual to be used by the survey team as a resource. The training manual included ten chapters:

• Program Overview
• Cost Survey Fundamentals
• Site Tour and Interviews
• Site Memo
• Financial Statements
• Allowable and Actual Costs
• Direct and Indirect Costs
• Labor Costs
• Site File Assembly Workpapers
• Site Visit Logistics.

2. Customization of Crowe’s Cost Model and Cost Build-Up Form

The foundation of Crowe’s cost analysis methodology is an Excel cost model that brings together labor costs and financial/operational costs of a recycler. The model, first utilized for beverage container cost of recycling studies, is based on a labor allocation approach to split costs between various recycling and non-recycling activities of an organization. Within the recycling activities, the model can further divide costs between material types, when such a split is applicable.

Crowe conducted an extensive revision of the beverage container cost model to make it applicable to the carpet cost analysis. The initial versions of the model were designed to split costs by carpet fiber type. During our research, we learned that many PCC recyclers handle only whole carpet or single carpet fiber types. Many other carpet recycling activities are fiber agnostic. To address this universe of survey participants, we also developed a version of the cost model that allocated costs to PCC activities and non-PCC activities. During the survey, we utilized the appropriate model based on the activities of the recycler.

Crowe also prepared two Excel cost build-up templates to provide to survey participants to facilitate collection of financial and labor data. We prepared one version for drop-off sites and one version for CSEs/Processors/Manufacturers. We prepared these models based on feedback from survey participants that for many entities, California carpet recycling made up only a small fraction of their overall operations. In cases such as this, it is more accurate to utilize carpet recycling-specific costs than to allocate a few percent of an organization’s total operating costs. Exhibit 2-2 provides a screenshot of the drop-off site cost build-up template.

3. Surveyor Training

Crowe conducted a one-week in-person training session for the cost survey team. During this training session, participants participated in presentations, activities, and class discussions, read the training manual, and conducted research on Collector/Sorter/Entrepreneurs (CSEs), Processors, and Manufacturers. Participants prepared background documents on each CSE/Processor/Manufacturer to use as references prior to our site visits.

On the final day of training, the survey team conducted site visits to local drop-off sites. These visits allowed the survey team to view drop-off sites and discuss site activities and expenses with on-site managers.
Exhibit 2-2  
Cost Build-Up Template for CARE Public Drop-off Sites

CARE Drop Off Cost Build-Up Form

Overview: The objective of this form is to identify applicable costs associated with collecting California post-consumer carpet (CA-PCC). There are two sections within the form: (1) labor cost build-up, and (2) operations cost build-up. Please identify applicable labor and operational cost inputs within the light blue shaded cells in each section. Refer to the "Example" tab for an example of a completed form.

Section 1: Labor Cost Build-Up

Instructions: Use this section to identify wages and hours by role for employees involved in the collection of CA-PCC. Estimate the number of hours per week in both low and high seasons that an employee handles CA-PCC. Include that employee’s hourly wage in 2018. For example, if a yard employee spends approximately 10% of his time collecting CA-PCC, we would want to identify 10% of the 2018 hours and wages for that representative employee. Add additional rows to include additional employees, if needed.

<table>
<thead>
<tr>
<th>Role</th>
<th>Estimated Hours/Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role</td>
<td>Low</td>
</tr>
<tr>
<td>Scale Operator</td>
<td></td>
</tr>
<tr>
<td>Yard Employee #1</td>
<td></td>
</tr>
<tr>
<td>Yard Employee #2</td>
<td></td>
</tr>
<tr>
<td>Yard Employee #3</td>
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<tr>
<td>Yard Employee #4</td>
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<tr>
<td>Equipment Operator</td>
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</tr>
<tr>
<td>Driver</td>
<td></td>
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<tr>
<td>Supervisor</td>
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<tr>
<td>Office/Admin</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Section 2: Operations Cost Build-Up

Instructions: Use this section to identify the share of expenses involved in the collection of CA-PCC. This could be done by prioritizing applicable cost categories based on share of input/recycling output (RO), labor, or by load. For example, transportation costs related to the collection of CA-PCC can be estimated based on costs per load to transport materials to another recycler or processor. Add additional rows to include cost categories, if needed.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Estimated Costs for 2018</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Insurance</td>
<td></td>
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<tr>
<td>Worker’s Compensation</td>
<td></td>
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<tr>
<td>Payroll Tax</td>
<td></td>
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<tr>
<td>Transportation</td>
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<td></td>
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<tr>
<td>Hauling fees</td>
<td></td>
<td></td>
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<tr>
<td>Truck insurance</td>
<td></td>
<td></td>
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<tr>
<td>Fuel</td>
<td></td>
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<tr>
<td>Truck maintenance</td>
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</tr>
<tr>
<td>Rent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility</td>
<td></td>
<td></td>
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<tr>
<td>Equipment</td>
<td></td>
<td></td>
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<tr>
<td>Property tax</td>
<td></td>
<td></td>
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<tr>
<td>Depreciation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
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<tr>
<td>Trucks</td>
<td></td>
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<tr>
<td>Facility</td>
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<tr>
<td>Utilities</td>
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<td>Gas/electric/Internet</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td>Equipment</td>
<td></td>
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<tr>
<td>Facility</td>
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<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
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<tr>
<td>Safety/Training</td>
<td></td>
<td></td>
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<tr>
<td>Supplies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
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</tr>
</tbody>
</table>
4. Maintaining Recycler Confidentiality

Maintaining the confidentiality of PCC recyclers’ financial information was critical for this cost analysis study. The cost analysis involved obtaining, reviewing, and analyzing proprietary business information. While it is necessary to securely handle confidential business information (CBI) in all cases, the fact that the PCC industry is relatively new and has few players makes maintaining CBI even more critical.

In order to garner the participation of PCC recyclers, Crowe provided a third-party non-disclosure agreement (NDA). The NDA is a legal document, signed by both parties, that outlines the handling of confidential information obtained for the study. Exhibit 2-3 provides an excerpt from the NDA related to defining confidentiality and handling of material. Exhibit 2-4 provides the excerpt regarding confidentiality from the survey notification letter. As described in the results section, Crowe’s legal requirement to ensure that individual data cannot be identified has necessitated that the report does not include numerical results for CSEs, Processors, and Manufacturers. As a further precaution, upon completion of the project, Crowe will destroy all of the financial, labor, and recycling volume information obtained during the survey.

Exhibit 2-3
Excerpt from Non-Disclosure Agreement

“Confidential Information” is any information, written or oral, which relates to the disclosing party’s policies, business, or processes, including, but not limited to, information related to concepts, ideas, financial, accounting, computer programs, techniques, proposals, business plans, Client information, requirements, forecasts, marketing, selling, and the documentation thereof, with the following exceptions: (a) information which was already known to or in the possession of the receiving party prior to disclosure; (b) information ascertainable or obtainable from public or published information; (c) information received from a third party not under an obligation of confidentiality; (d) information which is or becomes known to the public other than through a breach of this Agreement; or (e) information that is independently developed by the receiving party without use of or reference to Confidential Information.

Each party’s Confidential Information shall remain its personal property. Each party will maintain all Confidential Information of the other party in confidence and will protect such Confidential Information of the other party with the same degree of care as it exercises in protecting its own Confidential Information, but shall at all times use a commercially reasonable degree of care. Neither party will disclose, divulge, disseminate, publish or otherwise distribute any Confidential Information of the other party to any third party, without the written consent of the disclosing party. ..

Exhibit 2-4
Excerpt from Survey Notification Letter

Confidentiality of Information

Crowe and CARE recognize that protecting your confidential business information (CBI) is essential. Crowe will not provide individual company cost data and survey results to CARE or CalRecycle. In the presentation of results, we will work to provide a sufficient level of detail while protecting CBI. Our standard requires sufficient participation such that an individual firm’s data cannot be identified. We recognize the challenge of meeting this confidentiality requirement in the relatively small PCC industry; however, we are committed to safeguarding confidentiality of information. A copy of Crowe’s third party non-disclosure agreement, signed by Lisa Voeller, Partner-Principal, is attached. Please complete this form prior to our visit. As a public accounting firm, Crowe abides by strict security and confidentiality guidelines. All Crowe employees must follow IT security and records management policies to safeguard client and third party confidentiality. The eight Crowe employees working on this CARE cost survey have also signed a project-specific confidentiality agreement and are receiving additional security training specific to this project.
C. Surveys

The cost analysis surveys of drop-off sites, CSEs, Processors, and Manufacturers, involved five primary tasks: sample development, notification and scheduling, survey fieldwork, completing survey files, and quality control and review. Crowe approached the survey in two subsets, which took place in parallel. The first group consisted of CARE drop-off sites, and the second group consisted of CSEs, Processors, and Manufacturers. We briefly describe each task below.

1. Sample Development

The overall sample size for the cost analysis was between 50 and 75 sites, based on the Request for Proposal (RFP) Scope of Work. The RFP requested a survey of at least 50 percent of the drop-off sites, and all CSEs, Processors, and Manufacturers. Crowe designed the survey to meet these two objectives. Because of the small population size, Crowe did not conduct random sampling of any of the four categories of PCC recyclers. Rather, we sought to survey all possible recyclers in each group, essentially a census rather than a sample. Because a census (or near census) provides costs for essentially the full population, a statistical analysis of the sample was not applicable.

CSEs, Processors, and Manufacturers

Crowe received a list of CSEs, Processors, and Manufacturers from CARE. The list identified each company and the recycling activities they conducted. Some companies only operate at one level, while others operate at all three. There were 21 companies on the list that encompassed 26 recycling activities once the activities were narrowed to those receiving subsidies in 2018. Only five companies were located in California, encompassing nine recycling activities. The initial list included 6 CSEs, 8 Processors, and 12 Manufacturers (one did not receive subsidies but purchased CA materials in 2018). Our initial intent was to survey all 26 of these entities/recycling activities. However, two companies did not participate, so the final survey census included 19 companies and 23 recycling activities.

CARE Drop-Off Sites

Crowe determined the number of drop-off sites to survey based, in part, on the number of CSEs, Processors, and Manufacturers in the population. Our approach was to complete drop-off surveys to reach as close to the maximum sample size of 75 sites. Thus, our target was up to 52 drop-off sites. The CARE drop-off list included 55 drop-off locations. However, eleven of these sites started operations during the second half of 2018 and/or did not ship carpet in 2018. These sites did not incur a sufficient level of PCC collection costs to warrant including them in the survey. This resulted in a census of all 44 of the drop-off sites that had been operating at least six months in 2018.

2. Notification and Scheduling

Crowe prepared two separate notification letters, one for CSEs/Processors/Manufacturers and one for CARE Drop-Off sites. After obtaining approval from CARE, Crowe mailed and emailed notification letters, along with non-disclosure agreements (NDAs) to all participants. The letters identified the purpose of the survey, requested payroll and financial information, and described confidentiality procedures. Because PCC recyclers have never participated in a cost analysis study, several recyclers reached out to CARE and/or Crowe for additional information about the surveys. CARE and Crowe worked with recyclers to describe the survey process and alleviate concerns about sharing confidential data. Crowe participated in the CARE Drop-Off Site quarterly meeting in May 2019 to provide additional information on the survey to drop-off participants. In response to recycler concerns, Crowe developed the cost build-up templates (described above) to assist recyclers in determining costs specific to carpet recycling.

Crowe contacted recycling centers starting in late April to schedule survey site visits. Given the short time-frame of the project, we worked with recyclers to schedule site visits during May and June. As discussed below, this meant that we often had to follow-up with recyclers after the site visits to obtain the requested cost information.
3. **Survey Field Work**

The survey team conducted field work starting in late April, and finishing in early July. Survey teams consisted of two trained Crowe team members. Teams typically conducted a series of recycler site visits over a one-week period, covering all sites within a particular region. The team conducted surveys throughout California, Arizona, Florida, South Carolina, Nevada, and Nebraska. We also conducted telephone interviews with several recyclers in Georgia.

During the site visits (or telephone interviews), survey team members toured the site (if on site), discussed PCC recycling activities conducted by site employees, and reviewed financial and labor information (when available). Crowe obtained similar information during telephone interviews. Many recyclers did not have their financial information ready for the survey team at the time of the site visit. Crowe spent a significant amount of time following up with recyclers to discuss the data needed for the survey. All but a few recyclers were ultimately able to provide the labor and financial information Crowe requested. **Exhibit 2-5** summarizes survey populations and participation.

**Exhibit 2-5**

Summary of Surveys

<table>
<thead>
<tr>
<th>Recycler Type (Number of Companies)</th>
<th>Survey Site Visits</th>
<th>Telephone Surveys</th>
<th>Incomplete Surveys*</th>
<th>Completed Surveys (Companies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop-Off Sites</td>
<td>44</td>
<td>2</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>CSEs/Processors/Manufacturers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>55</td>
<td>7</td>
<td>4</td>
<td>51</td>
</tr>
</tbody>
</table>

* Two companies did not participate in the survey; one company participated in the site visit, but did not provide financial information. One drop-off site had negligible costs in 2018, and did not participate. We received partial information from six drop-off sites and one CSE, but obtained enough data to determine costs.

4. **Completing Survey Site Files**

Following the site visits, survey teams prepared site files for each recycler. All files and project documentation was maintained on a secure SharePoint site accessible only to the eight Crowe project staff and a site administrator. The site files included a Site Memorandum that summarized activities at the site, an affidavit signed by the recycler, and list of equipment. The Crowe team prepared a separate file for each recycler and recycler activity (i.e. for a company that operated as a CSE, Processor, and/or Manufacturer, we created one file for each activity). We prepared a cost model for each recycler/recycler activity that summarized the financial and labor information provided by the recycler. The models summarized total costs, total pounds, cost per pound, and when applicable, operating costs by category. Cost categories included: labor, all other labor (AOL – benefits, worker’s compensation), transportation, rent, property tax, depreciation, supplies, fuel, utilities, interest, insurance, and maintenance.

5. **Quality Control and Review**

Once the survey team completed the file, we began the three-step quality control review process. First, one of the project team members that did not conduct the site visit conducted a thorough review of the site file documentation and cost model. When the initial reviewer had questions about the site file, they submitted review comments back to the survey team members. Once the initial reviewer approved the site file, Crowe’s Certified Public Accountant (CPA) Partner on the project team conducted a review of the site. When the CPA Partner had review questions, she submitted the file back to the survey team for their response. Once the file passed through the CPA Review, the Project Director and/or a project team member conducted an additional review in order to finalize the files for data compilation and analysis.
D. Data Compilation and Analysis

Crowe conducted four steps within the analysis phase of the project, as described below. The primary limiting factor in the cost analysis was the small population size for CSEs, Processors, and Manufacturers.

1. Data Compilation

Once the survey files were submitted and reviewed, Crowe began the data analysis phase of the project. We compiled total PCC costs, volumes, wage data, and costs by category (labor, rent, transportation, etc.) into separate worksheets for drop-off sites, CSEs, Processors, and Manufacturers. Compiling each dataset into a stand-alone format facilitated further analysis.

2. Cost per Pound Analysis

Crowe calculated weighted average costs per pound for carpet recycling activities in 2018. The weighted average calculation sums total costs and total volumes (pounds) for the sample population, and then divides costs by volume (pounds) to determine costs per pound, as shown in Exhibit 2-6. Thus, small volume and/or low cost recyclers have less impact on the final result than larger or higher cost recyclers. However, a weighted average calculation better represents the costs per pound for the entire population, because higher volume recyclers are weighted more heavily.

Exhibit 2-6
Weighted Average Cost per Pound Calculation

\[
\text{Weighted Average Cost per Pound} = \frac{\text{Total PCC Recycling Costs}}{\text{Total PCC Recycling Pounds}}
\]

CSEs/Processors/Manufacturers

Crowe calculated weighted average costs per pound for all of the survey participants by recycler group (CSE/Processor/Manufacturer). In addition, we separated the 3 processors and 2 manufacturers that provided loaded transportation costs into a fourth group. The results are described in Section 4 of this report, using a relative scale. Crowe also determined the cost per pound ranges for each category, again displayed on a relative scale to maintain confidentiality.

Drop-off Collection Sites

Crowe calculated weighted average costs per pound for drop-off collection sites across several different categories. Because the population size was significantly larger (44 sites in total), we were able to provide numerical results for drop-off sites, as follows: statewide, rural versus non-rural, and small (11 or fewer pick-ups) versus large (12 or more pick-ups). Results of the drop-off site cost analysis are provided in Section 3.

For drop-off sites, there are four cost components. Crowe obtained and analyzed the following:

- Costs incurred by drop-off sites
- Freight costs incurred by CARE
- Recycling fees paid by CARE
- Administrative and management costs incurred by CARE.
3. Cost Category Analysis
Crowe conducted additional analysis of CSE/Processor/Manufacturer costs by cost category. For this analysis, we summarized total costs by category and determined the percent of total costs for each category. We did not include a similar analysis for drop-off sites because the vast majority of costs were related to labor. Crowe also summarized and analyzed labor hours and hourly wages related to PCC recycling for drop-off sites and CSEs/Processors/Manufacturers.

4. Subsidy Coverage Analysis
Crowe performed subsidy coverage analysis of PCC recycling costs for CSEs, Processors, and Manufacturers. We utilized three key data elements to perform this analysis, including: 1) actual PCC recycling costs obtained through our study, 2) actual PCC subsidy volumes reported to CARE, and 3) actual subsidy revenues that the CSEs, Processors, and Manufacturers received in 2018. This analysis is presented in Section 5.
Section 3
CARE Public Drop-Off Collection Center Costs to Recycle
3. CARE Public Drop-Off Collection Center Costs to Recycle

This section provides the results of Crowe’s cost survey of CARE public drop-off collection sites. CARE began establishing a network of collection sites in 2012 with six sites growing to 55 sites by early 2019 with the goal of increasing access to drop-off sites, focusing on installers. The main objective of this program is to maintain and expand sites to achieve a minimum number drop-off sites per population or geographic area. This section is organized as follows:

A. Survey Overview and Participation
B. Results
C. PCC Recycling Costs by Components
D. Findings

A. Survey Overview and Participation

1. Population and Sites Surveyed

Of the 55 existing drop-off sites, Crowe surveyed the 44 sites that were operational for at least six months in 2018. Among the sites surveyed, four of the 44 sites did not have reported volume in 2018. Crowe understands that there is a timing issue between actual collection versus what is reported; a load must go out in 2018 to be reported as 2018. However, to better represent the pounds for this analysis, we made two modifications:

1. The first load in 2019 was allocated 2018 for the two sites that did not have pounds in 2018
2. The first loads in 2019 for all sites were prorated based on date of the last load in 2018 to the date of the first load in 2019.

These modifications increased total volume used in this analysis by 0.9%. The first modification was necessary for those two sites, as generating a cost per pound would not be possible otherwise. Of the 44 sites, two sites did not have any reported weight in 2018 or 2019, and two other sites provided negligible costs. The planned versus actual surveyed sites are summarized by rural and non-rural sites in Exhibit 3-1. We utilized CalRecycle’s definition of rural counties. For this drop-off cost analysis, the survey population was large enough to allow Crowe to provide numerical results.

Of the approximately 66 million pounds collected by CSEs in 2018, 13% or 8.6 million pounds across 433 loads were collected by drop-off sites in 2018; a summary is shown in Exhibit 3-2. It is important to note that container sizes vary to meet the demands and capacities of each site, which is one explanation as to why rural and non-rural sites’ average weight per load varies.

Exhibit 3-1
Number of Sites Surveyed

<table>
<thead>
<tr>
<th>Site Type</th>
<th># of Sites Planned</th>
<th>Actual % of Sites Surveyed</th>
<th># of Sites with Volume</th>
<th>% of Sites with Volume</th>
<th># of Counties</th>
<th>Site to County</th>
<th>% of Counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>16</td>
<td>100%</td>
<td>15</td>
<td>94%</td>
<td>16</td>
<td>1:1</td>
<td>28%</td>
</tr>
<tr>
<td>Non-Rural</td>
<td>28</td>
<td>100%</td>
<td>27</td>
<td>96%</td>
<td>20</td>
<td>7:5</td>
<td>34%</td>
</tr>
<tr>
<td>Total/Average</td>
<td>44</td>
<td>100%</td>
<td>42</td>
<td>95%</td>
<td>36</td>
<td>62%</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 3-2
Number of Pounds and Loads

<table>
<thead>
<tr>
<th>Site Type</th>
<th># of Pounds</th>
<th>% of Total Whole Carpet Collected</th>
<th>Average Pounds per Site</th>
<th># of Loads</th>
<th>Average Pounds per Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>1,359,590</td>
<td>2%</td>
<td>84,974</td>
<td>92</td>
<td>14,778</td>
</tr>
<tr>
<td>Non-Rural</td>
<td>7,235,160</td>
<td>11%</td>
<td>258,399</td>
<td>341</td>
<td>21,217</td>
</tr>
<tr>
<td>Total/Average</td>
<td>8,594,750</td>
<td>13%</td>
<td>195,355</td>
<td>433</td>
<td>19,849</td>
</tr>
</tbody>
</table>
2. Drop-Off Site Costs

Costs for PCC collection for each drop-off are broken into four primary cost components, making up the total costs used to generate cost per pound:

1. **Site Costs** – Costs incurred by the drop-off site for initial collection include the following cost categories: salary and wages, employee benefits, transportation (self-haul), rent/property tax, depreciation, utilities, maintenance, and miscellaneous (safety training, supplies, etc.).

2. **CARE Freight Costs** – Costs incurred by CARE, paid to a third-party hauling company, for transporting material from a drop-off to CSE.

3. **CARE Recycling Fee Costs** – Costs incurred by CARE for a recycling/tipping fee at the CSE.

4. **CARE Administrative Costs** – Specific costs incurred by CARE to administer and manage the drop-off collection program, including coordinating load pick-ups, and communication and coordination with drop-off sites.

B. Results

This subsection presents the results of the cost survey for the public drop-off sites, reflecting combined costs for the four cost categories identified above. We examine costs for each of the four categories in the next subsection. The results are represented in three ways, listed below:

1. Overall (all sites together)
2. Large versus Small Sites
3. Rural versus Non-rural Sites

1. Overall

Over the 44 drop-sites, combined total costs for drop-off sites and CARE were $2 million for 8.6 million pounds of post-consumer carpet, an average of 23 cents per pound, of which 11 cents per pound is the share of costs incurred by drop-off sites and the remainder is incurred by CARE. Crowe analyzed individual sites to assess the level of variability among sites. The weighted average cost per pound and the range is shown in Exhibit 3-3.

### Exhibit 3-3

<table>
<thead>
<tr>
<th>Site</th>
<th>Total Pounds</th>
<th>Total Costs</th>
<th>Weighted Average Cost per Pound</th>
<th>Lowest Cost per Pound</th>
<th>Highest Cost per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Sites</td>
<td>8,594,750</td>
<td>$2,009,079</td>
<td>$0.234</td>
<td>$0.08</td>
<td>$1.70</td>
</tr>
</tbody>
</table>

Cost per pound ranges from $0.08 to $1.70 per pound, or a percent difference of about 2000%. The large difference between the lowest and highest emphasizes the high variability of cost per pound among drop-off sites.

Individual sites are compared to the weighted average in the form of percent difference in Exhibit 3-4. When comparing the weighted average to the cost per pound for each site, it can serve as a benchmark to show the number of sites that are either above or below the weighted average. Under this comparison, 15 sites have a cost per pound lower than the average, while 29 sites have a cost per pound greater than the average. In the end, these results show that if there was a subsidy based solely on weighted average for drop-offs, 66% of sites would be under subsidized, while 34% would be over subsidized. This would be relevant if drop-off sites were given a subsidy based on pounds. This example highlights one challenge of using a weighted-average cost to determine payments of any kind – there are always “winners” and “losers”.
2. Large versus Small Sites

It is expected that sites with more volume would generally have a lower cost per pound than sites with less volume. To test this expectation, Crowe tested the cost per pound differences between large and small sites. For the purpose of this comparison, Crowe defined large and small drop-off sites as described below:

1. Large sites: 12 or more loads in 2018
2. Small sites: 11 or less loads in 2018.

We defined large and small sites, with the sites with more loads as large sites and sites with less loads as small sites. The number of sites and loads for small and large sites are as shown in Exhibit 3-5.
There are 36 small sites to eight large sites, while small sites make up 44% of loads and large sites make up 56% of loads. A summary of total pounds and cost differences between small and large sites is presented in Exhibit 3-6.

This comparison shows that large sites have more volume with roughly the same total costs as small sites. More importantly, this shows that large sites reflect a greater share of overall volume and costs. This implies that large sites would have a lower cost per pound primarily due to their volume. The weighted average cost per pound is compared in Exhibit 3-7 illustrates an 8-cent per pound differential between large and small sites, with large sites having a 30% lower weighted average cost per pound than small sites. Exhibit 3-7 also illustrates that small drop-off sites have a higher cost per pound when comparing costs incurred by drop-off sites. The combination of the results from Exhibit 3-6 and 3-7 indicate that large sites experience a level of economies of scale as higher volume resulted in lower cost per pound. Additionally based on this evidence, as sites gain more volume, cost per pound decreases.

Exhibit 3-6
Total Pounds and Costs

<table>
<thead>
<tr>
<th>Site Size</th>
<th>Total Pounds</th>
<th>% of Pounds</th>
<th>Total Costs</th>
<th>% of Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>4,951,018</td>
<td>58%</td>
<td>$979,610</td>
<td>49%</td>
</tr>
<tr>
<td>Small</td>
<td>3,643,732</td>
<td>42%</td>
<td>$1,029,468</td>
<td>51%</td>
</tr>
<tr>
<td>Total</td>
<td>8,594,750</td>
<td>100%</td>
<td>$2,009,079</td>
<td>100%</td>
</tr>
</tbody>
</table>

Exhibit 3-7
Weighted Average Cost per Pound

$0.00 \rightarrow $0.10 \rightarrow $0.20 \rightarrow $0.28

<table>
<thead>
<tr>
<th>$0.00</th>
<th>$0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large sites</td>
<td>Drop-off costs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$0.10</th>
<th>$0.13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small sites</td>
<td>CARE costs</td>
</tr>
</tbody>
</table>
3. Rural versus Non-Rural Sites

Drop-off locations have been sited in rural areas of the state as part of CCSP’s support of convenient collection. The goal is to have at least one drop-off site per county in order to provide carpet recycling opportunities to residents and businesses in all parts of the state. However, there is a cost premium for this service. There are obvious differences in distances to a CSE that we would expect to increase costs. To address rural versus non-rural differences, Crowe performed a cost analysis between rural and non-rural sites.

As shown in Exhibit 3-2, non-rural sites collected 5.5 times more total pounds and 3 times more pounds per site than rural sites. To compare the ratio of total costs between rural and non-rural sites, Exhibit 3-8 presents a comparison.

Exhibit 3-8
Total Pounds versus Total Costs

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Total Pounds</th>
<th>% of Pounds</th>
<th>Total Costs</th>
<th>% of Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>1,359,590</td>
<td>16%</td>
<td>$468,510</td>
<td>23%</td>
</tr>
<tr>
<td>Non-Rural</td>
<td>7,235,160</td>
<td>84%</td>
<td>$1,540,568</td>
<td>77%</td>
</tr>
<tr>
<td>Total</td>
<td>8,594,750</td>
<td>100%</td>
<td>$2,009,079</td>
<td>100%</td>
</tr>
</tbody>
</table>

The results show that the ratio of total costs between non-rural and rural sites are fairly consistent between total pounds and costs with pounds with a ratio of 84:16 while costs show a ratio of 77:23, respectively. However, rural sites had a higher percentage of costs compared to pounds, indicating that rural sites incur a higher cost per pound than non-rural sites.

Regarding transportation/freight costs, all but a few sites used the freight service that CARE provides. The most noteworthy difference between rural and non-rural sites is the freight costs funded by CARE to transport material to a CSE. It is expected that rural sites will require loads hauled for longer distances, which would result in a higher average freight cost per pound. To show these differences, we provide a comparison of weighted average freight (and storage) cost per pound in Exhibit 3-9. Because of the wider geographical distribution of rural sites compared to non-rural sites, we also expect that the range in freight cost per pound would be greater with rural sites; the results are presented in Exhibit 3-10.

The results in Exhibit 3-9 show that rural sites incur freight costs at $0.10 more per pound, or 220%, greater than non-rural sites. In Exhibit 3-10, rural sites have a freight cost per pound range from $0.04 to $0.77, while non-rural sites have a range from $0.02 to $0.28. Additionally, the range for rural sites varies about 1.6 times more than non-rural sites, based on percent difference between the lowest and highest. These results support the claim that on average rural sites incur more freight costs per pound and vary more.

A comparison between overall cost per pound whether freight costs are the most substantial differentiator between rural and non-rural costs. The weighted average cost per pound is compared in Exhibit 3-11. This exhibit also illustrates that the drop-off site’s share of costs is the same for rural and non-rural drop-off sites. To further test the effect of freight on cost per pound differences, a comparison of the ranges in cost per pound is provided in Exhibit 3-12.

As illustrated in Exhibit 3-9, there is an average of a $0.10 per pound differential for rural compared to non-rural freight costs. The overall weighted average cost per pound results show a $0.13 per pound differential, which indicates that differences in freight costs contributes to about 75% of the difference. The remaining $0.03 difference is likely because rural sites have lower volumes. In summary, the combination of lower volume and higher per pound freight costs at rural sites compared to non-rural sites are the primary reasons for the cost per pound differences.

Rural sites have a range in cost per pound from $0.17 to $1.70, or a percent difference of about 900%. Non-rural sites have a range in cost per pound between $0.08 to $1.14, or a percent difference of about 1400%.
Exhibit 3-9  
Weighted Average Freight Cost per Pound

Exhibit 3-10  
Freight Cost per Pound, Ranges
Exhibit 3-11
Weighted Average Cost per Pound

Exhibit 3-12
Cost per Pound, Ranges
C. PCC Recycling Costs by Component

In this subsection, Crowe breaks down each drop-off site cost component to analyze costs incurred by drop-off sites and by CARE. All sites are broken down into the four main cost components in Exhibit 3-13.

Exhibit 3-13
All Sites, Cost Components

This shows that roughly half of the costs are incurred by the sites, while the other half are CARE-funded. This may help facilitate discussions on the percent of total costs that sites should reasonably pay for. We generally observed that sites that charge the full tipping fee for carpet (and provide more service to drop-off customers) incur more costs than sites that offer a discount or accept the material for free. This is because handling carpet is labor-intensive and without an adequate source of revenue to support it, there is little to no incentive to assign employees to handle carpet to incur costs.

Exhibit 3-14 compares cost components for large and small sites. The biggest differences in share of cost in this exhibit are the recycling fee and administrative/management costs. The differences are likely due to large sites having more volume than small sites, resulting in higher recycling fee costs, as recycling fee costs rely on the number of pounds. Since the majority of administrative costs are fixed based on the total number of sites, this cost component is expected to decrease in percent of total as total costs increase.

Exhibit 3-15 provides a comparison of cost components for rural and non-rural sites. Freight costs are the largest cost component for rural sites representing approximately 40 percent of rural sites’ total costs, which is nearly twice as much as non-rural sites. Site costs (i.e. – labor, utilities, rent, etc.) are the largest cost component for non-rural sites, representing about half of non-rural sites’ total costs, which is generally consistent with the overall breakdown in Exhibit 3-13.
Exhibit 3-14
Large and Small Sites, Cost Components

Exhibit 3-15
Rural and Non-Rural Sites, Cost Components
D. Findings

In this last subsection, survey findings are summarized as follows:

1. Cost Survey
2. Price Variability
3. Other Survey Observations

Our results indicate that CARE covers approximately half of drop-off sites’ total costs. Continued (and possibly increased) investment in the collection of carpet at drop-off sites can be critical to reaching recycling targets as other collection methods may reach capacity. While currently carpet collected by public drop-offs represents 13 percent of whole carpet reported by CSEs, the majority of drop-off sites have the capacity to collect more carpet.

1. Cost Survey

The collection, review, and analysis of drop-off site cost data provide validation of expectations regarding differences in costs between different types of sites. Exhibit 3-16 summarizes our findings of the drop-off survey. The findings presented in Exhibit 3-16 provide CARE with a basis for making future decisions on additional support for drop-off sites, if needed.

Exhibit 3-16
Cost Survey Findings

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Finding</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural versus Non-Rural Sites</td>
<td>Freight costs are the biggest cost driver for rural sites.</td>
<td>When expanding to all counties, CARE must account for the high freight cost.</td>
</tr>
<tr>
<td>Large versus Small Sites</td>
<td>Higher volume sites have a lower and less variable cost per pound.</td>
<td>Economies of scale occur with sites with more volume, therefore, as sites gain more volume, cost per pound will decrease.</td>
</tr>
<tr>
<td>Overall Sites</td>
<td>Weighted average cost per pound favors a few, high volume sites.</td>
<td>If a subsidy per pound is implemented for drop-offs, it should be based on other factors than weighted average cost per pound (such as rural versus non-rural).</td>
</tr>
<tr>
<td>Cost Components</td>
<td>On average, costs are funded 50/50 by sites and CARE.</td>
<td>Drop-off sites are investing time and resources in carpet collection; depending on the tipping fees they charge, some could use additional coverage/support in order to expand their role in the program.</td>
</tr>
</tbody>
</table>

2. Price Variability

Beyond volume and distances to a CSE, there is still a high level of variation among sites with similar volume and geographic location. Understanding the various factors influencing price is key to identify areas of improvement at the operational level. By addressing factors contributing to lower volume, volumes would increase at existing sites, which is critical to maximizing the funding provided by drop-off sites and CARE. Price variability at drop-off sites can be categorized in two ways:

1. Site-specific differences to include CARE costs

Factors influencing site costs:

- Volumes of PCC
• Charging full tipping fee versus discounted rate for PCC loads (higher costs when PCC loads are charged at the full tipping price)
• Manual labor versus equipment-assisted labor
• Number of steps between customer drop-off and the CARE collection trailer
• Distance from scale house to the CARE collection trailer (some trailers are in far corners of the site)
• Sorting padding
• C&D and/or public waste sorting
• Overall level of environmental stewardship (more effort, more costs)
• Overall efficiency.

Primary factors influencing freight costs:
• Number of loads
• Pounds per load (% of trailer containing carpet)
• Distance to CSE
• Number of stops to CSE.

Primary factor influencing recycling fee costs:
• Number of pounds received at the CSE.

Primary factors influencing administrative costs:
• Number of loads
• Total number of drop-off sites in the program.

3. Other Survey Observations
While Crowe focused on costs, we had additional observations on drop-off site activities. The observations, impacts, and recommendations are listed below:

1. Tipping Fee Differences – Through all site visits, this seems to be the most significant difference influencing both volume and costs. Sites that charge the full tipping fee (i.e. the same as the landfill tip fee) provide more service for carpet and incur more costs than sites that offer a discount or accept the material for free. This is because handling carpet is labor-intensive and without an adequate source of revenue to support, there is little to no incentive to assign employees to handle carpet to incur costs.
   a. Sites would need to implement a pricing structure that supports both providing service and incentivizing the customer to recycle versus landfill. This is likely a discounted rate, but not free of charge. According a study performed by CalRecycle in 2015, tipping fees at municipal solid waste landfills vary from $0 to $125 per ton, with the median being $45 per ton. Other drop-off facilities such as transfer stations and materials recovery facilities also have different price structures. Additionally, sites with below average tipping fees are likely sites that rely more on self-service. Therefore, each site would need a different strategy to strike the perfect fee level to maximize carpet diversion.

2. Carpet is Hard-to-Handle – Because carpet is bulky, heavy, and contains extra material (padding and trash), many sites have a difficult time handling carpet and sometimes even cut the carpet to a smaller size to reduce strain.

3. Type of CARE/Carpet Trailer – There are a variety of trailers used to collect carpet, ranging from trailers on wheels to trailers that lay flat on the ground. The latter makes it easier, quicker, safer, and more efficient to load carpet as both employees and customers can simply walk (or drive machinery) to load the trailer; CARE provides a number of different trailer types designed to accommodate the various conditions at drop-off sites.
4. **Location of Trailer** – The physical location of the carpet trailer at each site plays an important role as it relates to both convenience and plain visibility of where the carpet should go. Some sites have containers at the front (or for one site, before the scale house) and some have containers towards the very back of the site, past the landfill. There are also sites with designated recycling areas that are extremely visible. Sites vary in signage and availability of traffic directors to guide customers to the proper location. Lastly, some sites actively ensure any recyclable material, including carpet, is diverted, with a load inspector checking and pulling out any recyclables prior to sending the customer to the landfill.

5. **Padding/Stacking Differences** – Sites vary in the amount of padding that goes into the carpet trailer as well as the level of rolling and stacking of carpet, as stack height ranges from 50 to 90% of the trailer.

6. **Wet/Dry Seasonality Differences** – Wetter areas of the state will have a smaller window of time to collect carpet. Additionally, during wet season, carpet is either brought in wet (and is landfilled), or not brought in at all. In especially wet years, the total pounds collected by drop-offs is likely significantly less than drier years.
   
   a. Covered storage in the form of covered bins and/or awnings would help protect carpet from getting wet (and landfilled) and would increase overall volume; CARE currently assists drop-off sites with obtaining covered storage through micro-grants.

7. **Carpet Installation Seasonality** – Depending on the location, construction/carpet installation activity may be very minimal during the wet season. In addition to carpet getting wet, this further reduces the volume during wet season.
Section 4
CSEs/Processors/Manufacturers
Costs to Recycle
4. CSEs/Processor/Manufacturer Costs to Recycle

This section of the report provides the cost analysis results for seventeen CSEs, Processors, and Manufacturers. We present relative average costs per pound and ranges for each recycler type, as well as a discussion of cost categories and factors that influence costs. This section is organized as follows:

A. Survey Overview and Participation
B. Results
C. PCC Recycling Costs by Category
D. Average Regional Cost Differentials
E. Findings

A. Survey Overview and Participation

Exhibit 4-1 provides a summary of the CSE/Processor/Manufacturer population and survey participants. Crowe and CARE conducted extensive outreach to the population of CSEs/Processors/Manufacturers during the course of the survey. However, we were not able to garner 100 percent participation. In addition, there were a few recyclers that participated in the survey site visit, but were not able to provide cost data during the short survey time window. There were also a few companies that were not willing to share their confidential data, despite the NDA and precautions in place to protect CBI. There was no legal requirement to participate in the survey, particularly for the out-of-state recyclers. Although there were challenges in obtaining data, Crowe was able to obtain costs for the majority of CSE and processor volume, and one-third of manufacturer volume.

Exhibit 4-1
Summary of CSE/Processor/Manufacturer Population and Survey Participation

<table>
<thead>
<tr>
<th>Applicable Recycler Type</th>
<th>Number Receiving Subsidies in 2018</th>
<th>Number Surveyed</th>
<th>Number Surveyed in California</th>
<th>Percent of Volume Surveyed</th>
<th>Percent of Subsidy Recipients Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>76%</td>
<td>67%</td>
</tr>
<tr>
<td>Processor</td>
<td>8</td>
<td>6**</td>
<td>1</td>
<td>58%</td>
<td>75%</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>12</td>
<td>7**</td>
<td>1</td>
<td>33%</td>
<td>64%</td>
</tr>
</tbody>
</table>

* There were a three additional surveyed companies that received CSE and Processor subsidies; however, based on the recyclers’ activities, Crowe categorized these recycler costs under Processor. There were also three entities that were classified as processors and manufacturers, but only received subsidies in 2018 as one or the other. We obtained costs for the classification that received subsidies. Crowe obtained cost data from one manufacturer that has not yet received subsidies.

** Three of the six processors handle only carpet tile; Crowe obtained loaded shipping costs for these companies. Crowe also obtained loaded shipping costs for two manufacturers. For all of these entities, California PCC represents a small fraction of the total inputs of a large-scale manufacturing process and the cost to ship California PCC to the eastern U.S. are most relevant to the CARE subsidy. We analyzed the loaded shipping costs for these five entities separately from the costs of the other processors and manufacturers. One of the surveyed manufacturers purchased, but has not yet claimed CA PCC.

Due to the small numbers in the total population and surveyed recyclers in each category, and even smaller number of entities in California, Crowe is not able to provide numerical cost per pound results. The fact that there are few participants is also compounded by the fact that some recyclers handle large percentages of the total amount of PCC, while others are small players in the market. There is not sufficient participation to ensure that an individual company’s costs could not be re-engineered from average cost per pound results. Thus, providing numerical results would violate the conditions of Crowe’s NDAs with recyclers, which were necessary in order to obtain their participation in the cost analysis. While ideally we would provide numerical results, our intent without them is to provide a robust analysis that informs PCC subsidy levels and provides insight into the factors that influence PCC recycling costs and the incentives to help support PCC recycling and the goals of the CCSP.
B. Results

Crowe calculated weighted average costs per pound and cost per pound ranges for CSEs, Processors, Manufacturers, and a subset of Processors and Manufacturers that provided loaded shipping costs. We refer to these costs as loaded shipping costs because in some cases shipping included purchase cost of the material and some loading/handling costs. As described previously, these five entities (all out of state) did not provide manufacturing or processing costs because California PCC is no more than a few percent of their overall operations, and often less than one percent. For these companies, the relevant costs of using California PCC is the shipping cost to get the material from California to the eastern U.S. In general, the recycling activities covered in operating costs included the following:

- **CSEs** – Transporting, unloading, identifying, sorting, disposing of waste, baling, selling
- **Processors** – Transporting, unloading, testing, separating, baling, selling
- **Manufacturers** – Transporting, unloading, testing, producing output (extruding and blending/production activities), packaging, selling, shipping
- **Processor/Manufacturer Semi-Loaded Shipping** – Transporting, purchasing, unloading.

Exhibit 4-2 displays the relative weighted average cost per pound for the four groups of PCC recyclers. As the exhibit illustrates, average CSE costs per pound are significantly lower than the other three groups. Processor average costs per pound are more than twice that of CSEs, and the semi-loaded processor/manufacturer costs are somewhat higher than processors. Manufacturers have significantly higher costs than the other three groups, which is reasonable given the more complex processes and higher-value output.

Exhibit 4-3 illustrates the range of costs per pound for each recycler group, again on a relative scale. This exhibit shows the relative spread between highest and lowest cost per pound results for all companies surveyed in each category. The cost per pound range for manufacturers is significantly greater than the other three recycler groups, reflecting the variety of end-products and many-fold difference in volume of recycled output. The numbers demonstrate the challenge of determining an average cost per pound with such a small and diverse population.
Exhibit 4-3
Relative Cost per Pound Range for PCC Recycling Activities (Full Range)

Exhibit 4-4
Relative Cost per Pound Range for PCC Recycling Activities ("Outliers" Removed)

Exhibit 4-4 also provides the range of costs, but we have eliminated some of the apparent outliers in the dataset. The vertical axis scale is the same in both exhibits. Eliminating apparent outliers from the relative range calculation dramatically reduces the spread between high and low costs. However, with so few recyclers in the population, we cannot be certain that these high cost recyclers are actually outliers.
As Exhibits 4-3 and 4-4 illustrate, there are a wide range of costs within each recycler group. Factors that contribute to the cost variation include, but are not limited to:

- **CSEs** – Collection volumes, whether they ship carpet or use the material on-site as a processor, quantity of unusable carpet and other waste, whether they operate a collection network and if so use their own haulers or contract
- **Processors** – Throughput volumes, yield, method of separation, level of PC4 extraction, quality of separated fiber, mix of fiber types, whether they ship carpet or using on-site as a manufacturer, number of shifts, condition of equipment, cost of new equipment
- **Manufacturers** – Throughput volumes, yield, recycled fiber prices, production processes, end-product characteristics (pellets, flake, products), extent of PCC use in product, number of shifts, condition of equipment, cost of new equipment
- **Processor/Manufacturer Semi-Loaded Shipping** – Size of loads, inclusion of purchase price, inclusion of some handling costs, distance shipped, fuel prices.

C. PCC Recycling Costs by Category

As part our analysis of PCC recycling costs, Crowe identified and categorized costs, direct and indirect costs, and direct costs to fiber type(s) when applicable. We classified costs into one of the following categories:

- Direct Labor (wages, owner’s income)
- Indirect (all other) (AOL) Labor (worker’s compensation, health insurance, retirement, other benefits)
- General Business Overhead (GBO) (administrative costs, accounting, office expenses)
- Transportation
- Rent
- Depreciation
- Property Tax
- Utilities (telephone, water, waste disposal, electricity)
- Supplies (office supplies, uniforms, bale wire, etc.)
- Fuel (propane, gasoline)
- Insurance (general liability, auto insurance)
- Interest
- Maintenance.

Our category analysis provides the overall results of PCC recycling costs, as a percentage of total costs for the sixteen CSEs, Processors, and Manufacturers. Within this section, we also identify and discuss specific costs (i.e. – labor, transportation, rent, etc.) to highlight categories where the results indicate variability and similarity in costs between the CSEs, Processors, and Manufacturers.
1. Overall Category Analysis

Exhibit 4-5 provides a breakdown of total PCC recycling costs as a percentage, by category, for CSEs in 2018. The top four categories were:

- Direct labor (40%)
- Indirect labor (12%)
- Utilities (11%)
- Transportation (8%).

Each of the remaining categories accounted for between 0.004 percent and 7.3 percent of allowable costs.

Exhibit 4-5
CSE Costs by Category
Exhibit 4-6 provides a breakdown of total costs as a percentage, by category, for Processors in 2018. The top four categories were:

- Direct labor (29%)
- Transportation (16%)
- Rent (12%)
- Utilities (10%).

Each of the remaining categories accounted for between 0.2 percent and 9.4 percent of allowable costs.
Exhibit 4-7 provides a breakdown of total costs as a percentage, by category, for Manufacturers in 2018. The top four categories were:

- Direct labor (29%)
- Supplies (18%)
- Transportation (15%)
- Utilities (9%).

Each of the remaining categories accounted for between 0.2 percent and 6.2 percent of allowable costs.
Exhibit 4-8 provides a comparison of total PCC costs as a percentage, by category, for CSEs, Processors, and Manufacturers in 2018. Labor (direct and indirect) accounts for approximately half of CSE costs, whereas, labor accounts for roughly 30 percent of Processor and Manufacturer costs. Transportation costs as a percentage of total costs are relatively similar for Processors and Manufacturers. Supplies account for nearly 20 percent of Manufacturers’ total costs, which is significantly higher in comparison to the other two groups.

Exhibit 4-8
Comparison of Categories as a Percentage of Total Costs
2. Labor

Exhibit 4-9 provides a comparison of total PCC labor costs (direct and indirect) as a percentage for CSEs, Processors, and Manufacturers in 2018. Direct and indirect labor costs are closely related. CSEs rely on laborers to collect, sort, and prepare PCC materials for Processors. In comparison to Processors and Manufacturers, CSEs rely less on equipment, machinery, and supplies. This explains why labor as a percentage of total PCC costs are approximately half of CSEs total costs. Processors and Manufacturers have relatively similar labor costs as a percentage of total PCC costs; both groups have higher costs in other categories, such as transportation and supplies. On average, labor is roughly 40 percent of total PCC costs for CSEs, Processors, and Manufacturers.

Crowe also evaluated total labor hours and wages to determine average wages per hour for “yard” workers and administrative employees. Average hourly wages for yard workers (essentially on the warehouse floor) were $15.24. Average hourly wages for administrative and managerial workers were $28.65. These wage rates are consistent with those from the 2016 beverage container recycler survey, with average hourly wages for yard workers of approximately $14 per hour and $24 per hour for administrative and managerial workers.

Exhibit 4-9
Comparison of Labor (Direct and Indirect) as a Percentage of Total Costs
3. Transportation

Exhibit 4-10 provides a comparison of total PCC transportation costs as a percentage for CSEs, Processors, and Manufacturers in 2018. The results indicate relatively little variability in transportation costs as a percentage of total PCC costs between CSEs, Processors, and Manufacturers. On average, transportation is roughly 13 percent of total PCC costs.
4. Utilities

Exhibit 4-11 provides a comparison of total PCC utility costs as a percentage for CSEs, Processors, and Manufacturers in 2018. The results indicate little to no variability in utility costs as a percentage of total PCC costs between CSEs, Processors, and Manufacturers. On average, utilities are roughly 10 percent of total PCC costs for CSEs, Processors, and Manufacturers.

Exhibit 4-11
Comparison of Utilities as a Percentage of Total Costs
5. Depreciation

Exhibit 4-12 provides a comparison of total PCC depreciation costs as a percentage for CSEs, Processors, and Manufacturers in 2018. The results indicate substantial variability in depreciation costs between CSEs, Processors, and Manufacturers. At the high end, Manufacturers have higher depreciation costs as a percentage of total PCC costs because of the equipment, machinery, and infrastructure needed to granulate fibers and to produce products. CSEs have the lowest depreciation costs as a percentage of total PCC costs because of their reliance on labor to collect, sort, and prepare PCC materials for Processors. On average, depreciation is roughly 3 percent of total PCC costs for CSEs, Processors, and Manufacturers.
6. Maintenance

Exhibit 4-13 provides a comparison of total PCC maintenance costs as a percentage for CSEs, Processors, and Manufacturers in 2018. The results indicate some variability in maintenance costs as a percentage of total PCC costs between CSEs, Processors, and Manufacturers. On average, maintenance is roughly 8 percent of total PCC costs for CSEs, Processors, and Manufacturers.

Exhibit 4-13
Comparison of Maintenance as a Percentage of Total Costs
7. Rent

Exhibit 4-14 provides a comparison of total PCC rent costs as a percentage for CSEs, Processors, and Manufacturers in 2018. The results indicate variability in rent costs as a percentage of total PCC costs between CSEs, Processors, and Manufacturers. On average, rent is roughly 7 percent of total PCC costs for CSEs, Processors, and Manufacturers.

D. Average Regional Cost Differentials

Given the limited number of participants in the study, Crowe could not confirm or validate regional differences (in state versus out-of-state costs) as a major factor influencing recycling costs at the CSE, Processor, and Manufacturer levels. Other factors, such as throughput, processing methods, and manufactured end-products outweighed any potential regional differences. However, we evaluated current differences in minimum wage, warehouse rent, and electric utilities between three California locations (San Jose, Los Angeles, and Sacramento), Nevada, Arizona, and Georgia to help understand the implications of recycler location on costs, summarized in Exhibit 4-15.

This summary shows a range in rates across the different regions. All three California jurisdictions have higher minimum wages, higher rents, and higher utility rates than the three other states. We should note that while the average hourly wage rates for PCC recyclers was above minimum wage, changes in minimum wage impact employers that pay above minimum wage because they must stay higher than the lowest wage rate in order to compete for workers. This is even more critical when the unemployment rate is low, as it is currently.

The average percent difference for each category of the three California locations compared to Georgia is shown in Exhibit 4-16. This shows that, on average, minimum wage, warehouse rent, and electric utilities in California are substantially more expensive than Georgia, ranging from a +90% difference in minimum wage to a +132% difference in warehouse rent. Overall, these results indicate that regional differences could be considered when adjusting subsidy levels. The category analyses, in combination with the data in Exhibits 4-15
and 4-16 could be used to set differential subsidy rates for California recyclers versus those out-of-state, based on the percent of total costs and the percent difference between California and the other jurisdictions. For example, California’s minimum wage is, on average, 90 percent higher than Georgia’s, and labor and benefits account for 35.3 percent of Processor costs (see Exhibit 4-6). Processors currently receive 10-cents per pound for Type 1 recycled fiber output. A hypothetical California supplemental subsidy to account for higher wages could be calculated by multiplying $0.10 × 35.3% x 90% = $0.03.

While these differentials are notable, we are not recommending such an increase with this example, as any increases in subsidy would need to be evaluated within the scope of the overall program. There may be other subsidy increases that would be more effective in supporting program goals. More importantly, the significant variability between PCC recyclers based on throughput, fiber type, processing technology platform, and end-product are more critical than geographical differentials despite the large deltas.

Exhibit 4-15
Regional Differences in Labor, Rent, and Electricity Costs

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Unit</th>
<th>CA-SJ</th>
<th>CA-LA</th>
<th>CA-Sac</th>
<th>NV</th>
<th>AZ</th>
<th>GA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>Min. Wage6</td>
<td>$/hr</td>
<td>15.00</td>
<td>14.25</td>
<td>12.001</td>
<td>8.25</td>
<td>11.00</td>
<td>7.252</td>
</tr>
<tr>
<td>Rent</td>
<td>Warehouse7</td>
<td>$/sqft/yr</td>
<td>15.48</td>
<td>10.72</td>
<td>8.01</td>
<td>5.403</td>
<td>7.254</td>
<td>4.925</td>
</tr>
<tr>
<td>Utilities</td>
<td>Electricity8</td>
<td>$/kWh</td>
<td>0.138</td>
<td>0.129</td>
<td>0.080</td>
<td>0.053</td>
<td>0.064</td>
<td>0.058</td>
</tr>
</tbody>
</table>

1 Based on 26 or more employees
2 For limited exceptions, minimum wage is $5.15/hour when not covered by the Federal Fair Labor Standards Act
3 Las Vegas
4 Phoenix
5 Atlanta
6 Based on each individual city or state government websites.
7 Based on the Q4 2018 U.S. MarketBeat Report (Cushman & Wakefield) on industrial rental rates for selected U.S. cities.
8 Statewide averages taken from the May 2019 U.S. Energy Information Administration electric power report besides CA regions. For CA-SJ and CA-LA, information was collected from a Bureau of Labor Statistics regional study of residential rates. In order to represent industrial rates, these residential rates were adjusted by the ratio between residential and industrial statewide averages. For CA-Sac, we used an average calculation of Sacramento Municipal Utility District residential rates across the different times of year and peak hours. In order to represent industrial rates, these CA-Sac residential rates were adjusted using the same method as CA-SJ and CA-LA.

Exhibit 4-16
California Compared to Georgia by Category, Percent Difference

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
<th>Average % Difference to GA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>Min. Wage</td>
<td>+90%</td>
</tr>
<tr>
<td>Rent</td>
<td>Warehouse (Industrial)</td>
<td>+132%</td>
</tr>
<tr>
<td>Utilities</td>
<td>Electricity</td>
<td>+99%</td>
</tr>
</tbody>
</table>
E. Findings

Recognizing the challenge of identifying the “true” cost of recycling PCC, the results presented in this section provide a baseline for CARE to plan for uncertain economic, recycling, and regulatory conditions. Our results, in general, indicate the following trends:

- CSEs have the lowest weighted average costs per pound and the lowest relative cost per pound range
- Processors have higher weighted average costs per pound than CSEs, but lower weighted average costs per pound than Manufacturers; and, have a slightly higher cost per pound range than CSEs, but a lower cost per pound range than Manufacturers
- Manufacturers have the highest weighted average costs per pound and the highest relative cost per pound range.

These results confirm that weighted average costs per pound and relative cost per pound ranges vary between CSEs, Processors, and Manufacturers because they are ultimately performing different PCC recycling activities – collecting/sorting, processing, and manufacturing. In essence, these activities require distinct cost inputs. Our cost category analysis results further emphasize the distinct cost inputs required to perform collecting/sorting, processing, and manufacturing activities, as follows:

- Approximately half of CSE costs are labor related because collecting and sorting activities require human labor to prepare PCC materials for Processors; whereas, labor accounts for approximately a third of Processor and Manufacturer costs because processing and manufacturing activities require more non-labor cost inputs
- In comparison to CSEs, Processors and Manufacturers require similar cost inputs because processing and manufacturing activities generally require more supplies, equipment, and technology
- Processing and manufacturing cost inputs (supplies, depreciation, etc.) are typically more variable than labor, which explains why Processors and Manufacturers have higher weighted average costs per pound and wider relative cost per pound range in comparison to CSEs.

Identifying the costs associated with recycling PCC is one of many approaches to consider when establishing assessment and subsidy levels. In Section 5, we discuss the implications of these findings and other considerations to provide CARE with guidance on validating its current assessment and subsidy levels and to make future adjustments, if needed.
Section 5
Implications of Results
5. Implications of Results

Our cost analysis results presented in Sections 3 and 4 confirm that PCC recycling costs are non-uniform and dynamic. In this last section, we expand on the implications of our results to help guide CARE’s decision-making on future subsidy and assessment setting. This section is organized as follows:

A. Post-Consumer Carpet Recycling Operations and Challenges
B. Validating Subsidy Levels
C. Material Flows and Policy
D. Assessment, Subsidies, and Fund Balance
E. Summary and Recommendations.

A. Post-Consumer Carpet Recycling Operations and Challenges

Crowe’s cost analysis results are indicative of the operational challenges that CARE faces in the immediate future. Below is a summary of challenges that Crowe has observed throughout the course of our study of PCC recycling costs:

- There are a wide range of PCC recycling operations and activities that influence costs at each level: Drop-off, CSE, Processor, and Manufacturer
- As new players enter the program, equipment, infrastructure, and consequently depreciation costs, will most likely continue to be a relatively large portion of Processor and Manufacturer costs
- Uncertainty and volatility within global markets further complicate fiber pricing; macroeconomic factors include, but are not limited to, the price of oil, global supply versus demand of virgin polymers and their building blocks
- Demand for specific fiber types influence PCC availability and pricing
- Large players within the program can strongly influence prices
- PCC recycling is immature as compared to beverage containers, paper, scrap metal, and many other commodities; the small number of companies, many in early in the investment cycle, leads to highly variable PCC recycling costs
- Recyclability of carpet that contains a mixture of fiber types is unknown, but expected to be more expensive
- AB1158’s highest recyclability requirement – and the interpretation of that requirement – does not necessarily incentivize the level of increased recycling that the law requires and is contrary to “normal” market-based incentives for hard to recycle materials

Understanding these challenges, we provide additional context within this section in order to explain the complexities involved in determining the “true” costs of recycling PCC.

1. Status of the PCC Recycling Industry

Carpet recycling in California is relatively new. At the inception of the California Carpet Stewardship Program (CCSP) in 2011, the recycling rate for PCC was 6.5 percent. In 2012, the first full year of the program, there were 9 million pounds of recycled output (RO). In 2018, the recycling rate was 15.3 percent, representing 48.9 million pounds of recycled output, a five-fold increase in seven years.

Comparing Carpet Recycling to Beverage Container Recycling

The model for the CARE Cost Analysis was CalRecycle’s Processing Fee and Handling Fee Cost Survey (Cost Survey) of beverage container recyclers for the Beverage Container Recycling Program. While the Cost Survey provides a methodological foundation for the CARE Cost Analysis, there are significant differences between the populations, cost structures, and maturity of these recycling industries. That said, there are some similarities between the current status of PCC recycling and the status of plastic beverage container recycling that may potentially inform the PCC carpet analysis results.
### Exhibit 5-1
Comparison of PCC and Beverage Container Recycling

<table>
<thead>
<tr>
<th>Factor</th>
<th>PCC Recycling</th>
<th>Beverage Container Recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Participants</strong></td>
<td>• Few – 25 CSEs, Processors, Manufacturers and ~55 drop-offs</td>
<td>• Many – 1,200 to &gt;2,000 certified recyclers operating at any one time</td>
</tr>
<tr>
<td><strong>Size of Companies</strong></td>
<td>• Wide variation</td>
<td>• Wide variation, although less than PCC recyclers</td>
</tr>
<tr>
<td><strong>Types of Recyclers</strong></td>
<td>• Diverse – CSEs, Processors, and Manufacturers have extremely different operations</td>
<td>• Relatively few; mix of CRV-only recyclers of various sizes and larger scrap yards that accept more materials</td>
</tr>
<tr>
<td><strong>Recycling Processes</strong></td>
<td>• Wide range of technologies at Processor and Manufacture level</td>
<td>• High degree of consistency across all participants</td>
</tr>
<tr>
<td></td>
<td>• Mix of new and established technologies</td>
<td>• Primarily established processes and technologies</td>
</tr>
<tr>
<td><strong>Recyclability</strong></td>
<td>• Carpet is made up of multiple components; only a portion of whole carpet can be recycled</td>
<td>• Individual beverage containers (in the Beverage Container Program) are made up of a single material type</td>
</tr>
<tr>
<td></td>
<td>• Some carpet fiber is more costly to recycle</td>
<td>• Essentially 100% of beverage container materials is recyclable</td>
</tr>
<tr>
<td><strong>End-Use Markets</strong></td>
<td>• Wide variation within and between material types</td>
<td>• Relatively few markets for each material type</td>
</tr>
<tr>
<td></td>
<td>• Developing markets</td>
<td>• Mature markets</td>
</tr>
<tr>
<td><strong>Pricing</strong></td>
<td>• Dependent on global economic factors (oil and natural gas) and plastic pricing</td>
<td>• Plastics are dependent on global economic factors and plastic pricing</td>
</tr>
<tr>
<td></td>
<td>• PC4 has relatively low (to no) market value</td>
<td>• Aluminum is dependent on global metals markets</td>
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<td></td>
<td></td>
<td>• Glass has relatively low (to no) market value</td>
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</table>

Exhibit 5-1 provides a comparison of PCC carpet and beverage container recycling across several factors. A key point for this exhibit is the difference in the number of recyclers in the population, and the significantly more diverse array of PCC recyclers as compared to beverage container recyclers. The activities that beverage container recyclers undertake, and that are analyzed in the Cost Survey, are relatively straightforward, including: sorting, weighing, moving to bins, baling (for aluminum and plastic at some recycling centers), and shipping. PCC recyclers undertake similar activities; however, at the processor and manufacturer levels, there are a wide range of physical and chemical processes involved in separating whole carpet into its components and producing recycled content products. The cost of these processes are also highly variable, and depend heavily on throughput and yield. As Crowe found in conducting the CARE Cost Analysis, these differences made this analysis significantly more challenging, and the results significantly more varied.

**Plastic Beverage Container Recycling Historical Context**

The history of plastic beverage container recycling in California provides context that may potentially inform current and future cost trends for recycling PCC. During the early years of the beverage container-recycling program, PET recycling was non-existent. In 1990, PET beverage containers (at that time only 2-liter soda bottles) made up only 3 percent of containers recycled. The cost per ton calculations from the first few Cost Surveys showed dramatically different results, reflecting the immaturity of PET recycling. In 1987, the PET cost per ton was $270.29, while in 1989 it was $930.42. PET recycling is now an established activity, and since 2002, the cost to recycle PET has been less than $500 per ton. During the same time, the volume of PET in the recycling stream has increased, and now represents 50 percent of all containers recycled.

Exhibit 5-2 illustrates the costs per ton for PET, aluminum, and glass beverage containers from 1987 to 2016. The exhibit provides a visualization of the significant variability in PET cost per ton during the first several years of the program, and the relative stability of PET costs per ton over the last ten years.
A second comparison to plastic beverage container recycling provides additional insight to the challenges resulting when there are few recyclers in the population. After the addition of new plastic beverage containers to the recycling program in 2000, CalRecycle added containers made with plastic resins #2 to #7 to the Cost Survey. Between 2002 and 2010, the Crowe team (contracting to CalRecycle) conducted census surveys of recyclers handling plastics #3 to #7 because there were so few recyclers handling these materials. For example, in some years, as few as 11 recyclers accepted PVC #3 beverage containers. The cost per ton results for these materials varied widely between survey years. The wide swings in costs occurred because costs for these materials depended more on the broader operations of the recyclers than the specific cost of handling a very small volume beverage containers. In addition, with only 11 recyclers included in a cost per ton calculation, the impact of an outlier (with either high or low cost) was significant. Both the number of recyclers and volume of containers were too low to obtain consistent cost per ton results year over year. CalRecycle resolved this issue by indexing the cost of plastics #3 to #7 and bi-metal to the costs of HDPE #2 plastic, which has much higher recycling volumes.

Crowe’s observation during the course of this study is that PCC recycling is still relatively new and faces similar systemic barriers as plastic beverage recycling experienced during the inception of the Beverage Container Recycling Program. We contend that the status of the PCC recycling industry is similar to that of PET beverage container recycling in the early 1990s. With the continued focus of the CCSP and CARE, we expect that PCC recycling will have more participants and become more “mainstream” over the next several years. As this occurs, the results of a PCC cost analysis could be an improved predictor of costs incurred by a larger range of PCC recyclers.
Diversity of PCC Recycling

As discussed previously, there are a wide range of PCC recycling technologies and activities that influence PCC costs at the Processor and Manufacturer levels. At the Processor level, the primary activity is separating the carpet face fiber from the backing. This can be done through a number of physical and chemical processes. The costs of these activities and the resulting quality and prices of the recycled fiber output also vary.

At the Manufacturer level, the primary activity is making a product from the recycled fiber output generated by processors. The range of activities and resulting costs are even more variable at the manufacturer level. For example, several manufacturers produce recycled nylon pellets using traditional extrusion technologies. The resulting plastic pellets can be sold for production into automotive parts, nylon yarn, or other plastic products. Other manufacturers produce cushion and padding products using PCC fiber, which require less sophisticated infrastructure and more than likely less costly manufacturing operations. In both cases, these products are sold into the marketplace, with the selling prices generally reflective of the cost of production. The diversity of PCC Recycling activities results in a wide range of recycling costs, as seen in the cost analysis results, influenced not only by volume (throughput), but by the processes themselves.

For both Processors and Manufacturers, throughput is a key factor in determining efficiency and costs. There are more than 80-fold differences in volumes of recycled output. An entity moving 80 times more material through their facility is going to have a radically different set of costs (and revenues) than the smaller company.

Recyclability of PCC

The recyclability and markets for each fiber type vary. Whole carpet consists of several different components. While carpet is plainly recyclable, the degree of recyclability depends on the components of the carpet. Exhibit 5-3 illustrates the typical percentages of face fiber, backing (primarily polypropylene (PP)), PC4, and latex in whole carpet. Exhibit 5-4 illustrates the typical mix of fibers in face fibers and the backing. Note that there are other types of face fiber that enter the recycling stream, including PTT, wool, and blended fibers. Blended face fiber (for example PET and PTT) can create challenges to recycling because of the difficulty in separating the two polymers.

The recyclability and markets for each fiber type vary between each other, and over time. Currently, markets for N66, and to a lesser extent N6, are strong and N66/N6 pellets have high value in the marketplace for use in engineered plastics. PET typically is used in blended fiber products. There is technology available to chemically separate PET, but unlike nylon, recycled PET prices are not currently high enough for this approach. Based simply on the proportion of materials in whole carpet and face fiber, it seems reasonable to focus on the higher volume materials – PET face fiber and PC4. Markets for these materials may be more difficult to find, and generate lower revenue, than N6 and N66.

AB1158 specifies that the CCSP should incentivize “highest recyclability”, although the law does not specifically define the term. Traditionally, highest recyclability refers to the highest value use of a recyclable material. For example, recycling paper into new paper is higher recyclability use as compared to composting paper products. Thus far, the interpretation of AB1158 has resulted in additional 5 cent per pound subsidies for N6 and N66. These fibers generate higher market prices, can be extruded into pellets, and used in high-value products such as automotive parts.

Clearly, within this definition of highest recyclability, adding additional incentives to N6 and N66 makes sense. However, within the broader context of increasing overall PCC recycling, this may not be the best use of subsidy dollars. Both of these fiber types, but particularly N66, are in high demand. Based on the Subsidy Justification Model (using March 2019 pricing), N66 recycled pellets do not “need” subsidies, while the model indicates that the PET pellet subsidy should be higher. In addition, blended fiber carpets, which are reportedly becoming more common in the marketplace, have lower recyclability. However, these carpets will require more subsidies to support the additional cost of separating mixed-fiber carpet. This trend also highlights the need to focus on design for recyclability.
Exhibit 5-3
Components of Whole Carpet

Exhibit 5-4
Typical Mix of Fibers in Carpet
2. Factors Influencing Recycling and Recycling Costs

Through the course of our cost study, Crowe identified many factors that incentivize or dis-incentivize PCC recycling. These approaches and factors vary at different stages of the PCC recycling process. **Exhibit 5-5** describes factors influencing recycling for CSEs, Processors, and Manufacturers, and the influence these factors have on costs to recycle.

**Exhibit 5-5**
Factors Impacting Recycling and Costs to Recycle at CSEs, Processors, and Manufacturers

<table>
<thead>
<tr>
<th>Factors Influencing Recycling</th>
<th>Impact on Costs to Recycle</th>
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<tr>
<td><strong>Quality</strong> – The PCC must be of adequate quality to be used in the recycling process.</td>
<td>• Low quality inputs reduce yield and increase production and disposal costs</td>
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<td><strong>Supply of PCC</strong> – There must be an adequate supply of PCC from the prior stage of recycling to generate enough throughput to support the operation.</td>
<td>• Following basic supply and demand, if there is an oversupply of PCC, prices will drop, and vice versa</td>
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<td><strong>Throughput capacity</strong> – The facility must have adequate throughput capacity to handle the PCC coming into the facility.</td>
<td>• Major factor on PCC recycling costs; higher throughput operations are less costly; recyclers incur costs and do not generate revenue when there is unused capacity</td>
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<td><strong>Economics</strong> – The labor and operating costs to recycle or utilize PCC must be less than the revenue generated by the sale of PCC recycled output.</td>
<td>• If the costs to recycle PCC are greater than the revenue, there must be other sources of revenue, such as subsidies, to incentivize recycling</td>
</tr>
<tr>
<td><strong>Technological capability</strong> – The recycler must have the technological capability to process PCC into recycled output products.</td>
<td>• PCC recycling is relatively early in the investment cycle, particularly for chemical processing; investing in new equipment increases costs, as does maintaining old equipment</td>
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<tr>
<td>• If there is uncertainty in the market, recyclers will be unwilling to invest in new technologies</td>
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<tr>
<td><strong>End-user demand</strong> – There must be markets for PCC fiber, pellets, products, PC4 (calcium carbonate), and backing at each phase of the recycling process.</td>
<td>• Demand influences the revenue side of equation; if there are willing buyers, recyclers will be better able to invest in new capacity</td>
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</table>

Given the limited number of participants in the study, Crowe could not confirm or validate regional differences (in state versus out-of-state costs) as a major factor influencing recycling costs at the CSE, Processor, and Manufacturer levels. While we have documented significant differences in average wages, rents, and utility costs between regions, within the current population of recyclers, other factors, such as throughput, processing methods, and manufactured end-products outweighed any potential regional differences. The results presented in Section 4 provide CARE with a baseline for understanding CSE, Processor, and Manufacturer cost variations and distinct cost inputs to collect/sort, process, and manufacture PCC. Crowe anticipates that regional differences may be more apparent as more players, both in and out of the state, enter the program.
B. Validating Subsidy Levels

In an effort to assist CARE validate its current subsidy levels, Crowe performed subsidy coverage analysis of PCC recycling costs for CSEs, Processors, and Manufacturers. We utilized three key data elements to perform this analysis, including: 1) actual PCC recycling costs obtained through our study, 2) actual PCC subsidy volumes reported to CARE, and 3) actual subsidy revenues that the CSEs, Processors, and Manufacturers received in 2018. We excluded the five sites that were surveyed for loaded transportation costs from this analysis. We did not include sales revenues to perform our analysis because we did not obtain revenue data from the CSEs, Processors, and Manufacturers. It important to note that by excluding sales revenue from our analysis the results are indicative of coverage solely based on existing subsidy levels. Crowe calculated subsidy coverage for selected participants based on the following formula:

\[
\text{Subsidy Coverage} = \frac{\text{Subsidy Revenue (Reported PCC Volumes} \times \text{Applicable Subsidy)}}{\text{Actual PCC Recycling Costs}}
\]

For example, consider a CSE that reported 400,000 pounds of collected PCC to CARE, and would have received $0.02/pound (the applicable subsidy), resulting in $8,000 in subsidy revenue. If the CSE’s actual PCC recycling costs were $45,000 in 2018, then coverage is determined by dividing the $8,000 in subsidy revenue by the $45,000 in costs, which would result in approximately 18 percent in subsidy coverage.

After calculating subsidy coverage for each participant, we then rolled up individual results in to an average. Give the small number of recyclers in the sample population; we cannot specify the percentage of coverage. However, on average subsidies cover less than 40 percent of CSE, Processor, and Manufacturer costs. Subsidies cover a smaller percentage of CSE costs as compared to Processors and Manufacturers.

Exhibit 5-6 provides a comparison of the relative subsidy coverage of PCC costs for CSEs, Processors, and Manufacturers. The results indicate a wide range of variability in subsidy coverage between the CSEs, Processors, and Manufacturers. CSEs have the least variability in coverage. Processors have more variability in coverage in comparison to the CSEs, but less variability in coverage in comparison to the Manufacturers. Variability in subsidy coverage between the CSEs, Processors, and Manufacturers is primarily due to the wide range of PCC recycling costs and volumes reported to CARE.

Exhibit 5-6
Relative Subsidy Coverage of PCC Costs
Exhibit 5-7 provides a comparison between the percentage of total subsidies and the percentage of total PCC costs of CSEs, Processors, and Manufacturers. The results indicate that the percentages of total subsidies are relatively proportional to the percentages of total PCC costs for CSEs, and less so for Processors, and Manufacturers. Processors receive relatively more subsidy than they incur costs due to the fact that they receive subsidies for recycled fiber output and PC4. However, the subsidy for PC4 is offset by its lack of market value and the fact that Processors often must pay a portion of the subsidy to end-users. Manufacturers incur more costs than they receive subsidy, but also sell a higher-value product as an output.

As discussed in prior sections of the report, there are a wide range of factors influencing PCC recycling costs at the CSE, Processor, and Manufacturer levels. The results identified in Exhibit 5-6 and Exhibit 5-7 provide CARE with performance metrics to make future decisions on subsidy levels. Based on our analysis, subsidies and costs are roughly equivalent for CSEs, and shifted high and low, respectively, for Processors, and Manufacturers. This can inform policy decisions to increase the level of subsidies for a given group. If, for example, there was interest in increasing PCC collection efforts, CARE may want to consider increasing subsidies at the CSE level in order to increase coverage of CSE costs.
C. Material Flows and Policy

Crowe evaluated the flow of materials in the carpet recycling stream in order to inform the cost analysis, shown in Exhibit 5-8. We utilized the average percentages shown in Exhibits 5-2 and 5-3 for whole fiber and carpet, in combination with the 2018 discard, collection, and recycled output numbers from CARE. We also created a scenario that illustrates the quantities necessary in order to achieve a 24 percent recycling rate based on the same proportion of recycled output as 2018. It is important to note that the quantities illustrated in Exhibit 5-8 may not flow from one stage to the next because there are differences in timing between when materials are collected, processed, and used in the manufacturing process. For example, several manufacturers have been purchasing California recycled fiber output, but have not yet manufactured that fiber into end-products and claimed the resulting subsidy. Thus, the Manufacturer recycled output volumes are lower than the Processor recycled fiber volumes.

The blue bar at the far left of Exhibit 5-8 illustrates total carpet discards, estimated at approximately 320 million pounds in 2018. The next bar, Recyclable Discards (Whole PCC) represents the potentially usable portion of discards consisting of face fiber, PC4, and PP backing. Approximately 20 percent of carpet discards (latex, waste, etc.) are not currently recyclable.

The middle bar represents the pounds of whole PCC collected and reported by CSEs. The amount of whole carpet reported by CSEs represents 21 percent of the recyclable discards.

The fourth bar represents processed recycled output (RO), as reported by Processors. RO is the figure used to calculate the recycling rate (~49 million pounds in 2018 divided by ~319 million = 15.4 percent). The 2018 mix of RO fiber types and PC4 reflect actual quantities. The Processed bar also includes a small amount of recycled and reused carpet tile.

RO used by manufacturers to create PCC products is illustrated in the bar on the far right, reflecting actual quantities of RO in products by fiber type. PC4 is not included in the manufacturing bar because it is sold by processors into various end uses. The Manufactured bar represents 26 million pounds, and is lower than the 36 million pounds of processed fiber due to timing differences between purchasing fiber and utilizing fiber in products. For some manufacturing processes, there is also a small amount of loss (typically 5%) that occurs due to moisture loss.
Exhibit 5-8
PCC Material Flow from Discard to End-Use in 2018 and Theoretical 24 Percent Recycling Rate
D. Assessment, Subsidies, and Fund Balance

Crowe conducted a sensitivity analysis of projected revenues, subsidy payments, and the impact on the program’s fund balance. This analysis provides one approach to evaluate whether, and how long, the program can support increased subsidies at the current assessment level of $0.35 per square yard. The analysis is based on the assumptions below. We recognize that many of these variables are in flux and depend on future economic conditions that are also highly variable.

- 2018 actual revenue, expenditures, and end of year fund balance
- 2019 end of year fund balance of $17.9 million, which is likely conservative
- Sales of approximately 87 million square yards in 2019 and 2020, decreasing slightly in 2021, 2022, and 2023 (note, we used a lower sales projection than CARE’s financial model to be more conservative on revenue)
- Baseline subsidy payouts reflecting a 21.9 percent recycling rate in 2019, increasing to 25 percent, 25.9 percent, and 26.4 percent in following years
- CARE administrative costs and interest based on CARE’s Financial Model; using 2022 costs for 2023 estimates.

Crowe evaluated the ability of the program to absorb a 10 percent or 15 percent increase in subsidies. Such an increase in subsidies could be the result of higher subsidies, higher recycling rates, or a combination of the two; our focus was on whether the program could support higher subsidies at the current assessment level. The existing fund balance provides a substantial cushion to allow for increasing subsidy payments over the next several years. Even under the current subsidy scenario, total annual expenditures exceed annual revenue starting in 2019. However, the fund balance will allow the program to operate at an annual deficit and maintain a reserve for the next several years.

Our analysis shows that at the current assessment of $0.35 per square yard and a 10 percent increase in subsidies, the fund balance will be almost $7 million in 2022. At a 15 percent increase in subsidies, the fund balance would be over $3 million in 2022. This indicates that the current assessment is sufficient to support the program through the remainder of the Plan.

E. Summary and Recommendations

Crowe understands the challenge that CARE faces in identifying the average costs of recycling PCC, and of interpreting this study without seeing numerical results. The implications of our cost study emphasize that costs are, in fact, dynamic and non-uniform, but also that costs reflect one of many factors that can potentially influence the recyclability of PCC and the success of the program.

Given the dynamic status of the PCC recycling industry, there is no single subsidy level for CSEs, Processors, Manufacturers, or for fiber types, that will provide exactly the incentive needed to use recycled PCC. As we have described, there are many variables that influence costs; all of these variables are in play among the recyclers that we surveyed during this study. Even within the beverage recycling program, the statewide weighted average costs that are used to determine processing payments are too low for half of the volume of containers recycled and too high for the other half. This challenge is amplified for the CCSP because there are so few recyclers in the population. Given these dynamics, the program should use the information available, evaluating current markets, market players, material flows, cost structures, and variable components of recycling costs within the context of overall policy goals and identify the mix of subsidies that will maximize opportunities for success.

Based on our study of the costs associated with recycling PCC, we can confirm that CARE’s current approach in determining subsidy levels is reasonable. CARE’s Subsidy Justification Model and Cost Conversion Model (CCM), in particular, adequately consider the variability of costs to project for subsidy coverage at the CSE, Processor, and Manufacturer levels. The current subsidy levels provide a solid foundation for further refinement, informed by the cost analysis and CARE’s ongoing modeling work. Exhibit 5-9 summarizes key takeaways and provides examples of how this study could be used to support future subsidy adjustments.
Carpet recycling is still an immature industry and understanding of supply chain dynamics and costs is complex and variable. Given the current dynamic status of the PCC recycling industry, there is no single subsidy level that will properly incentivize all materials and all recyclers. However, the work of the CARE modeling team, in combination with the results of this study, are providing new insights that will inform approaches to best support increased recycling and expansion of PCC recycling capacity.

Taking a forward-thinking perspective, Crowe recommends the following in order to amplify CARE’s current approach to determine subsidy levels. Our recommendations are based on our research and observations while conducting the cost analysis, as well as over 25 years of experience in California recycling policies and programs. We recognize that several of these activities are in place or being planned:

1. Utilize Crowe’s cost category results to establish baseline cost breakdown percentages within the CCM to project for PCC costs at the CSE, Processor, and Manufacturer levels
2. Prepare and plan for likely increases to the minimum wage rate in California and regional minimum wage differences within the state. CARE can leverage the cost category results to inform specific increases in subsidies. For example, with a ten percent increase in California minimum wage, this would be reflected in an increase in average CSE costs of 10% x 50% (the share of direct and indirect labor), equivalent to a 5 percent increase in CSE costs. This example justifies a 5 percent subsidy increase for California CSEs
3. Develop a reporting dashboard that summarizes the results of CARE’s four primary models (Economic, Financial, Subsidy Justification, and CCM) in order to demonstrate traceability of financial results to external stakeholders, such as CalRecycle and the Mills
4. Focus additional efforts and/or resources on the collection of whole carpet. Based on 2018 collections, yield, and RO, in order to achieve a 24 percent recycling rate, at a minimum the amount of whole carpet collected must reach approximately 120 million pounds, a 29 percent increase over 2018 quantities
5. Educate and incentivize installers to use collection networks
6. Focus on assisting Processors and Manufacturers to expand their capacity
7. Expand the definition of “highest recyclability” and incentivize recycling where it is most needed; this could potentially result in higher subsidies for CSEs to increase collection efforts and for Processors and Manufacturers to increase incentives to use and non-nylon carpet. Building on the SJM, CCM, CARE’s ongoing work, and this cost analysis, consider where increases in subsidies (or shifting subsidies) will be most effective in supporting higher PCC recycling rates over time. Building on the assumptions in CARE’s Financial Model, the program could support a 10 percent increase in subsidies starting in 2020 and still maintain a $5+ million fund balance at the end of 2022. This indicates that the current 35-cent assessment is adequate to support the program over the next several years.
### Exhibit 5-9

#### Key Takeaways from the Cost Analysis

<table>
<thead>
<tr>
<th>Finding</th>
<th>Implications</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative Costs</strong> –</td>
<td>- Subsidy levels may need to be higher at each level of the supply chain in order to provide similar levels of incentives</td>
<td>- The current subsidy structure follows this progression, with CSEs receiving the lowest per pound subsidy, then Processors, then Manufacturers. The exception is PC4 subsidies at the Processor level, which are the result of an entirely different market dynamic for this material</td>
</tr>
<tr>
<td>Costs for PCC recycling activities increase up the supply chain – CSEs have the lowest costs, Processors have mid-level costs, and Manufacturers are the highest cost; this progression also follows the complexity of each operation</td>
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<td><strong>Cost Variability</strong> –</td>
<td>- It is difficult to set subsidy levels that will equally incentivize all Manufacturers and Processors. Rather, CARE should utilize their models and market knowledge in combination with the results of this study to inform subsidy levels going forward</td>
<td>- For example, there is significant difference between a manufacturer making a PET or shoddy pad as compared to one using extrusion to produce recycled content pellets. This is one example of the range of products that ultimately drive differences in cost structure</td>
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<tr>
<td>PCC Manufacturers, and to a lesser extent Processors, exhibit a wide range of costs per pound</td>
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<td><strong>Subsidy Coverage</strong> –</td>
<td>- The balance between costs and subsidies, in combination with information on other sources of revenues and market dynamics can help determine the level of subsidy necessary to incentivize PCC recycling at each level. Each group has a different cost-revenue structure</td>
<td>- Using the current proportions of costs and subsidies as a starting point can help inform where subsidies may need to be increased to support increased recycling. For example, an approach to further incentivize collection could be an increase in subsidies to CSEs</td>
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<tr>
<td>On average and compared to their costs, CSEs receive roughly equal subsidies; Processors receive more subsidies, and Manufacturers receive less. On average, subsidies cover less than 40 percent of costs</td>
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<td><strong>Regional Differences</strong> –</td>
<td>- It is possible to leverage the cost category analysis with data on regional differences to inform adjustments to subsidy levels. Note that any changes in subsidies should be evaluated within the broader context of market dynamics to determine where subsidy dollars will be most effective</td>
<td>- Minimum wage in CA-San Jose is $15/hour while GA is $7.25/hour</td>
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<tr>
<td>Given the variability in size and operations between recyclers, there were no clear differences in costs based on region. However, our research shows that there are differences in minimum wage, average warehouse rent, and average electric utility rates across different regions. California is higher in all three categories</td>
<td></td>
<td>- Warehouse rent in CA-San Jose is $15/sqft/yr while GA is $5/sqft/yr</td>
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<td></td>
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<td>- Electric utilities in CA-San Jose is $0.14/kWh while GA is $0.06/kWh</td>
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</table>
### Exhibit 5-9
**Key Takeaways from the Cost Analysis (continued)**

<table>
<thead>
<tr>
<th>Finding</th>
<th>Implications</th>
<th>Examples</th>
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<tbody>
<tr>
<td><strong>Cost Categories Provide a Basis for Subsidy Adjustments</strong></td>
<td>• Utilize cost categories and regional differences data to inform subsidy adjustments in the future</td>
<td>• Focusing on a CSE, if the only regional difference is labor between CA and GA with a 90% difference and labor represents 50% of costs, the difference in costs could be calculated as: 90% * 50% = 45% difference, which suggests a 45% increase to CA CSE subsidies in relation to GA</td>
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<tr>
<td>• About half of CSE costs are labor related</td>
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<tr>
<td>• Cost categories are similar for Processors and Manufacturers with non-labor cost inputs being more variable than labor</td>
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<td><strong>Cost Differences by Fiber Type</strong> – Given the small number of market players, it was difficult to identify fiber type as a reason for cost differences. Costs at CSEs are fiber agnostic; most costs at Processors are fiber agnostic; costs at manufacturers depend on the technologies employed and the end-products produced. Manufacturing costs for PET and Nylon 66 can be similar, but due to our small population, we cannot confirm cost differences between fiber types</td>
<td>• For CSEs and Processors, fiber type is not a cost differentiator</td>
<td>• Utilizing market price data, for example, as summarized in the Subsidy Justification Model, illustrates that PET generates lower prices than N6 or N66, and thus warrants a higher subsidy</td>
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<tr>
<td>• For Manufacturers, it may be more effective to use information on market demand, fiber prices, and costs of technology to inform subsidies by fiber type than trying to distinguish costs per pound by fiber type</td>
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