King County
Department of Natural Resources & Parks
Solid Waste Division

Summary Report of the 2001 Survey of Washington State's Recycling Industry

Results of the 2001 Survey of Recycled Material Collectors and Haulers, Transporters, Processors, and Re-Manufacturers

Final Report

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PREPARED BY:
Cascadia Consulting Group, Inc..

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1. Executive Summary

INTRODUCTION

The King County Department of Natural Resources, Solid Waste Division commissioned a survey of the Washington State recycling industry to characterize employment, capital investment, and other key features of the state's recycling industry. The survey, completed in the spring of 2002, focused on measuring and documenting the size and activities of the private recycling industry for calendar year 2001. Target companies included those that collect and haul, transport, process, or re-manufacture recyclable materials. Although commissioned by King County, the survey targeted recycling firms statewide because recyclable materials commonly flow from King County to other areas of the state, and vice versa.

In addition to preserving resources, recycling contributes to economic growth, as private-sector companies conduct nearly all handling of recyclable materials. The survey was intended to measure levels of employment, capital investment, and material handling in the year 2001 in order to assess trends, emerging markets, and possible opportunities in the recycling industry of King County and Washington State. Similar surveys were previously completed for the 1992 and 1995 calendar years. This report includes information from those surveys, when appropriate, to help describe industry trends. Data from 1992, 1995, and 2001 will be displayed together when a clear trend is present.

Results will be presented for both Washington State and King County. Please note that all Washington State results include King County. Similarly, all King County results are for the entire county, including Seattle and all other incorporated areas.

KEY FINDINGS

Based on the results presented in this report, the following key findings emerge:

- **Washington State's recycling industry is a significant component of the State's economy.** Washington State's recycling industry employs at least 3,620 people and has invested over $850 million in capital assets. The number of people employed by the recycling industry is comparable to other resource-producing industries. For example, employment in the recycling industry is larger than in the mining industry, and ranks just behind employment in primary aluminum production.
- **Washington's private recycling industry is responding to increased opportunities to recycle organic material and construction and demolition wastes.** The private sector has stepped up their processing and re-manufacturing of these materials. Most growth in organics processing has occurred in King County, while most growth in construction and demolition handling (especially concrete/asphalt) has occurred outside King County.

- **There is a possible opportunity for the establishment of local plastics and tires/rubber re-manufacturers.** Washington companies that re-manufacture these materials have gone out of business or scaled back their use of recycled feedstock. However, large quantities of plastics and tires/rubber continue to be collected, and are likely either stockpiled or sent out of state (or out of the country) for re-manufacture.
- **Capital investment in recycling has increased, but employment levels have remained constant or decreased slightly.** Increasingly automated collection, processing, and manufacturing equipment may be reducing the demand for workers. Additionally, the increased export of recyclable materials, especially plastics, may be reducing the local need for labor.

KEY DIFFERENCES FROM PREVIOUS SURVEYS

The 2001 survey was intended to replicate the general methodology of previous surveys (1992 and 1995) completed by the Clean Washington Center, a former State agency. In designing the 2001 survey, the Solid Waste Division and the consultant revised some aspects of the previous surveys in order to better address current goals. Most notably, the target population of previous surveys included firms that recycled used oil, solvents, and paint. Firms that recycle these materials were not included in 2001, because the materials are classified as hazardous and do not represent major components of the landfilled waste stream.

Another notable difference in this year's survey is the treatment of the manufacturing sector. This year's survey counts only the employees and capital investment that were required to use recycled feedstock instead of virgin feedstock. Previous surveys used slightly broader definitions of employment and capital investment in recycling for the manufacturing sector. Although the new definition introduces some uncertainty to comparisons of employment and capital investment between 2001 and previous years, it presents a more accurate representation of the manufacturing industry's role in recycling. Future surveys can continue the trend analysis by adopting this year's methodology, which is discussed in detail in Appendix C.

FUTURE DIRECTIONS

King County plans to conduct this survey again in 3 – 5 years in order to continue trend analyses. At that time, the conclusions and opportunities presented in this report can be revisited in light of public sector and industry goals and trends.

In this year's survey, capital investment was measured as the original cost of all equipment, vehicles, and property still in use in 2001, regardless of the time of purchase or present value. This definition was used in order to be consistent with previous surveys and to facilitate trend analysis, but it was not easily standardized to methods that are used to measure capital investment in other industries. Future administrators of this survey should consider investigating alternate methods for measuring new capital investment in recycling and standardizing the reporting methods to those of other industries' accounting practices.

2. Methodology

The 2001 Survey of Washington State's Recycling Industry was designed to measure the levels of employment, capital investment, and material use by Washington State recycling companies. Following is a discussion of the target survey population, survey process, and analyses presented in this report.

SURVEY POPULATION

This study focused on firms that transform non-hazardous materials from the waste stream into other products. Firms that recycle paper, plastic, glass, metal, construction/ demolition, organics, tires/rubber, and some other materials (such as industrial byproducts) were included. Firms that handle oil, paint, chemicals, car bodies, and biosolids were not included, because these materials are classified as hazardous materials or do not represent major components of the landfilled waste stream. Recovery of wood for energy production was also not included because energy production is not considered to be recycling for this survey.[1]

TARGET FIRM TYPES

Transforming recyclable materials into products involves a complete cycle of activities, from material collection to material transportation, processing, and re-manufacture. In order to acquire information about the full range of companies performing these activities, the following types of recycling companies were targeted:

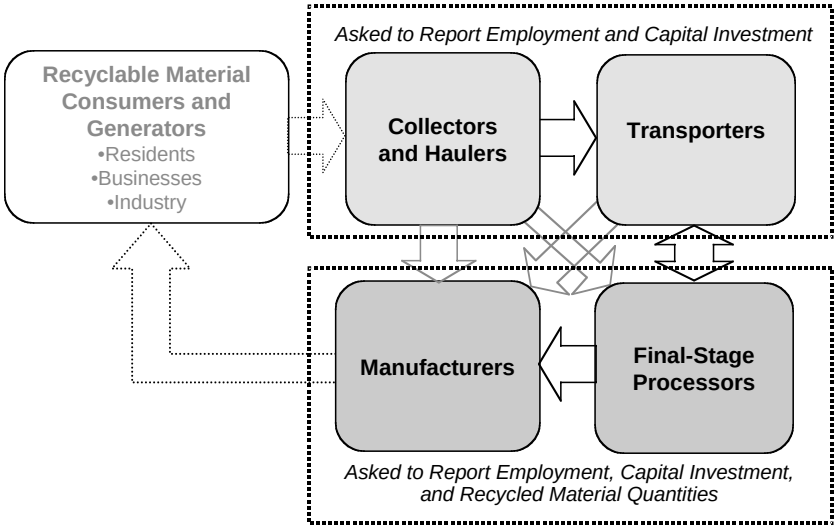
- **Collector/Hauler:** A firm that collects recyclable materials from the businesses, residents, or industries that generate them. Examples include companies that offer curbside recycling services or drop-off locations, and then may sort or bale the materials (such as at a material recovery facility). Activities performed by collector/haulers do not change the material's form.
- **Transporter:** A firm that transports recyclable materials after collection and takes them to a processor or manufacturer, mill, or port (for shipment within Washington or outside the state).
- **Final Stage Processor:** A firm that transforms recyclable materials into a feedstock for manufacturing. Such activities change the material's form. Examples of final-stage processing activities are flaking and/or shredding plastics, or chipping or grinding woodwaste. For this survey, processing does not include simply sorting or baling material.
- **Manufacturer:** A firm that uses post-consumer or post-industrial recycled materials as a feedstock in the production process. Examples of such firms include mills, reclaimers, and composters.

[1] For this survey, *recycling* is defined as "the process by which materials that would otherwise become solid waste are collected, separated, or processed and returned to the economic mainstream to be reused in the form of raw materials or finished products." Burning wood for energy production does not satisfy this definition.

Note that the survey did not include businesses or industries that simply consume recycled products (such as daily newspapers that print on rolls of recycled newsprint) or those that only sort recyclables from their own waste (such as a manufacturer that sells it's discarded metal to a recycler). Furthermore, the survey did not include public sector agencies that conduct recycling efforts, or those companies (such as some grocery stores) that occasionally collect recyclables only as a tangential function.

Figure 1 depicts the flow of recyclable materials through the state's economy, the types of companies surveyed, and the question topics relevant to each firm type. [2]

Figure 1: Flow of Recyclable Materials and Types of Companies Surveyed
(Target firm types are shaded in grey)



ASSEMBLING LISTS OF TARGET COMPANIES

Once the survey population was defined, lists of appropriate companies were assembled to construct a master list of all possible target companies. The starting point for this effort was reviewing the member lists of the Washington State Recycling Association (WSRA) and the Washington Refuse and Recycling Association (WRRA), two organizations that endorsed the survey and assisted with development. Companies were also added from other sources, such as the Washington Organic Recycling Council (WORC) and the Business and Industry Resource Venture (BIRV), among others. Although the initial survey list contained 714 companies, only 456 of these were determined, during the course of the survey, to meet the criteria for target firm types discussed above. These 456 firms became the target population for this survey.

[2] A number of state and local studies estimate the quantities of recyclable materials *collected*. At the state level, the Washington State Department of Ecology conducts an annual survey, the results of which are published in *Solid Waste in Washington State,* available on-line at www.ecy.wa.gov/biblio/swfa2001.html.

SURVEY PROCESS AND DATA MANAGEMENT

The survey instrument was based on those used in previous 1992 and 1995 surveys completed by the Clean Washington Center (CWC).[3] The 2001 form, which was sent directly to prospective firms, can be found in Appendix A. Surveys were mailed beginning in February 2002. Shortly thereafter, follow-up telephone calls were initiated to encourage participation and verify responses. These calls were completed by June 2002. The response rate for all Washington State firms was 84%. The response rate for firms in King County was 85%.

During the survey process and data analysis, all company responses and information were kept in secure databases. After analysis and before completion of this report, all physical and electronic records of company responses were destroyed, to preserve the privacy of respondents.

ANALYSIS AND REPORT

Results presented in this report reflect information from respondents only. No attempt was made to extrapolate findings to the entire target population. However, most firms that declined participation were thought to have relatively small recycling operations, as they were typically not members of either the WSRA or WRRA and were not mentioned by other companies as major players in the industry. Still, because not all recycling companies reported totals, all results should be considered minimum estimates.

In this report, results are presented first for Washington State, and then for King County. **Please note that all Washington State results include King County totals. Similarly, all King County results include totals from the entire county, including Seattle and all other incorporated areas.**

For a detailed discussion of survey methodology, including descriptions of the survey population, telephone call methodology, and data management, please see Appendix C.

[3] The 1992 survey was completed by the CWC, and the 1995 survey was completed by the CWC in conjunction with King County Solid Waste Division.

3. Results – Washington State

SURVEY RESPONSES

Of the 456 firms targeted in Washington State, 383 responded to the survey.[4] This represents an overall response rate of 84%. Of the 383 survey respondents, the majority of the firms (239) were collectors, haulers, or transporters of recyclable materials. Of the remaining 144 respondents, about half (70) were final-stage processors and half (74) were manufacturers.[5] Table 1 displays the number of respondents according to the type of firm, including comparisons to the 1995 survey. Note that the total number of respondents in 2001 is very similar to that in 1995.

Table 1: Survey Respondents by Firm Type – Washington State[6]

	Survey Respondents	
Firm Type	**1995**	**2001**
Collector/Hauler or Transporter[7]	216	239
Final-Stage Processor	63	70
Manufacturer	106	74
Total	**385**	**383**

MATERIAL PROCESSED AND RE-MANUFACTURED

The survey asked firms that conduct final-stage processing or re-manufacturing of recyclable materials to report the quantities of material handled in 2001.

REPORTED MATERIAL USE IN 2001

In 2001, over 4.4 million tons of recycled materials were used to make other products in Washington. Of this total, nearly 2.1 million tons were recycled concrete or asphalt made into roadbed or new concrete or asphalt. The remaining 2.3 million tons were materials such as paper, metal, plastic, glass, wood, and yard wastes that are commonly collected from residential and commercial locations. Table 2 presents the quantities used, by material type, and the primary products made with those materials.

[4] This total includes 118 respondents from King County. All results in this section include totals from King County.
[5] To maintain consistency with previous surveys, firms that grind or chip concrete and woodwaste (mostly from construction or demolition activities) are classified as final-stage processors, while firms that compost organic material (mostly from residential or commercial yard care or landscaping activities) are considered manufacturers.
[6] Data was not available for 1992.
[7] Collector/Hauler and Transporter are combined in this table because data for these firm types were aggregated in the 1995 report. In 2001, eight respondents were transporters and 231 were collector/haulers.

Table 2: Quantities of Materials Re-manufactured -- Washington State[8]

Material Group	Quantity (tons) Re-manufactured in Washington in 2001	Significant Products Made in Washington
Paper	1,040,805	Paper, paper packaging
Plastic	10,021	Plastic lumber, packaging (containers and bags)
Glass	33,327	Containers, concrete additive, abrasive grit
Metal	486,705	New metal
Wood	213,892	Mulch, paper, compost
Concrete/Asphalt	2,070,508	Roadbed, new concrete
Yard Waste	392,592	Compost
Food Waste	13,274	Compost
Tires/Rubber	1,100	Boat bumpers, flooring, outdoor surfaces
Other materials	203,354	Soil conditioners, cement, animal feed, and others
Total	**4,466,578**	

In addition to the recycled materials re-manufactured in Washington, large quantities of materials are final-stage processed but not necessarily re-manufactured in-state. Table 3 shows these quantities of materials final-stage processed in Washington. Respondent firms did not report where (or if) these quantities were re-manufactured. As a result, some quantities (especially metals) may be counted in both Table 2 and Table 3.[9]

Table 3: Quantities of Materials Final Stage Processed -- Washington State

Material Group	Quantity (tons) final-stage processed in Washington in 2001
Plastic	16,665
Glass	19,643
Metal	519,096
Wood	121,615
Tires/Rubber	4,500
Other materials	65,522
Total	**747,041**

[8] In many cases, the firm that re-manufactured the recycled material also performed the final-stage processing. In cases where the manufacturer and final-stage processor are distinct but both known, the quantity of material handled is reported only once (in Table 2, as re-manufacturing) to avoid double-counting it as both *final-stage processed* and *re-manufactured*.

[9] Due to the proprietary and valuable nature of metal handling, many companies did not report with what other companies they conducted transactions. This likely results in some double-counting of metal quantities in Table 2 and Table 3.

TRENDS IN MATERIAL USE, 1992-2001

The two previous surveys (conducted in 1992 and 1995) also inquired about quantities of recyclable materials that were final-stage processed or re-manufactured into new products in Washington. When compared to totals from those years, several notable trends emerge:

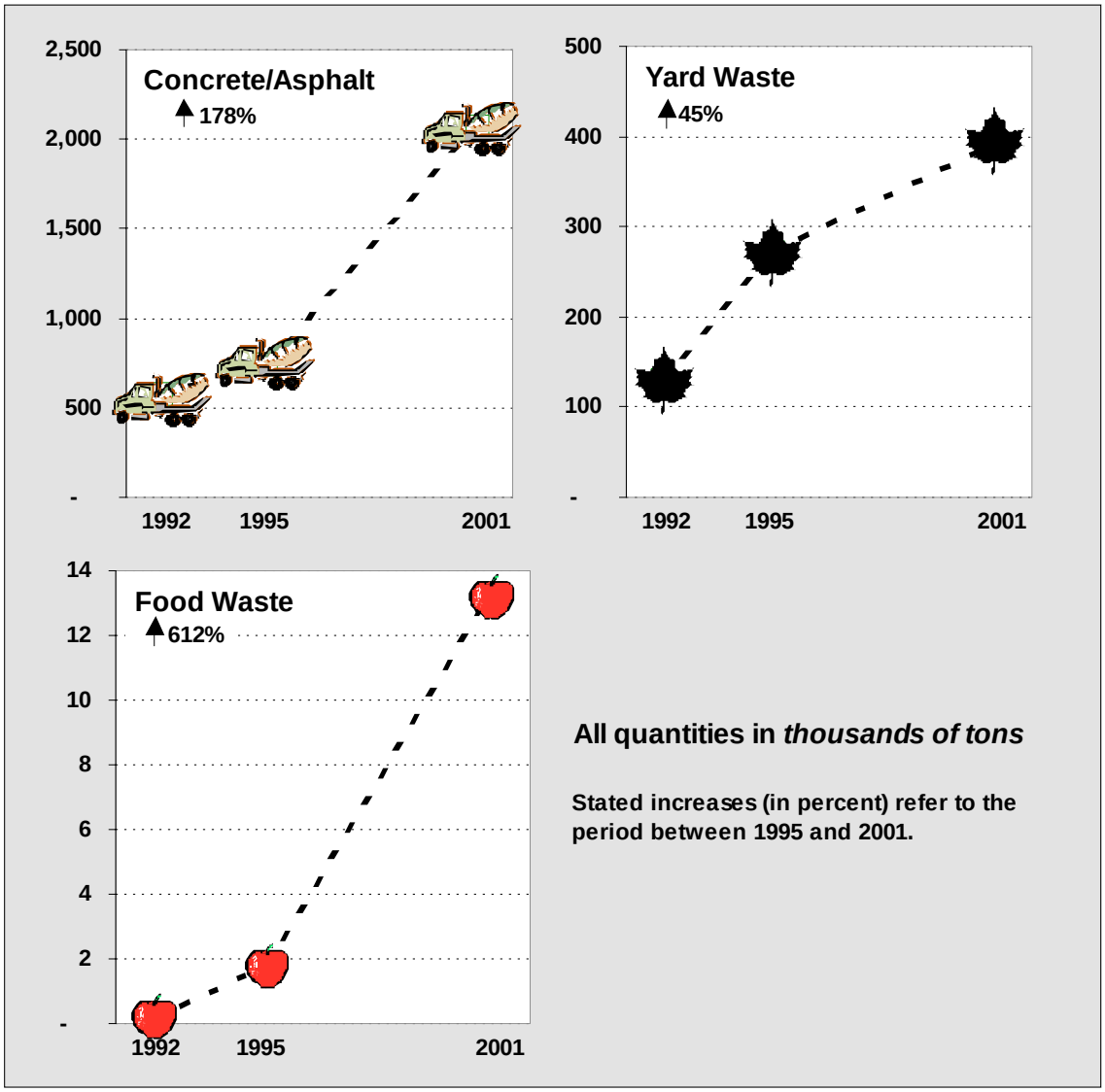
- **Use of concrete and asphalt has increased dramatically**, from less than 800,000 tons in 1995 to over 2 million tons in 2001, an increase of about 175%. This material is then turned back into concrete or used as roadbed fill.[10]
- **Composting of yard waste increased by more than 100,000 tons** since 1995. Yard waste composting increased from about 270,000 tons in 1995 to over 390,000 tons in 2001.
- **Composting of food waste may have a promising future,** as survey respondents reported composting over 13,000 tons of food waste in 2001, compared to less than 2,000 tons in 1995. Most food-waste composting is occurring in King County.[11] It remains to be seen whether food waste composting will take off in the next few years. Most food waste is still disposed.
- **Re-manufacturing of plastics has decreased by over 30% since 1995.** Several plastics re-manufacturers have closed and most plastics are now being sent out-of-state. However, local final-stage processing of plastics has reportedly increased.
- **Manufacturing using recycled tires/rubber has declined,** from over 27,000 tons in 1995 to less than 2,000 tons in 2001. Several tire recyclers have closed since 1995, and tires are increasingly being sent out-of-state for processing.
- **Use of recycled glass has apparently decreased** by more than 50% since 1995. Survey respondents report that although use of recycled glass to make containers has increased slightly, use of recycled glass in construction has declined.
- **Use of other major recyclable materials, including paper and metal, remains fairly consistent with totals reported in 1995.**

As noted above, concrete/asphalt, yard waste, and food waste all show clear positive trends since 1995. Figure 2 shows how these three material groups have increased, with concrete/asphalt experiencing the largest growth by weight, and food waste showing the largest growth as a percent of 1995 totals. These increases are likely indicative of the private industry responding to increased opportunities to recover these materials.

[10] About 90,000 tons of concrete were recycled from the demolition of the Kingdome in Seattle, which occurred in the spring of 2000. Some of this material was re-used on-site or re-manufactured in 2001. Although this total may be significant, it still represents only a small fraction of the increase in concrete recycling.

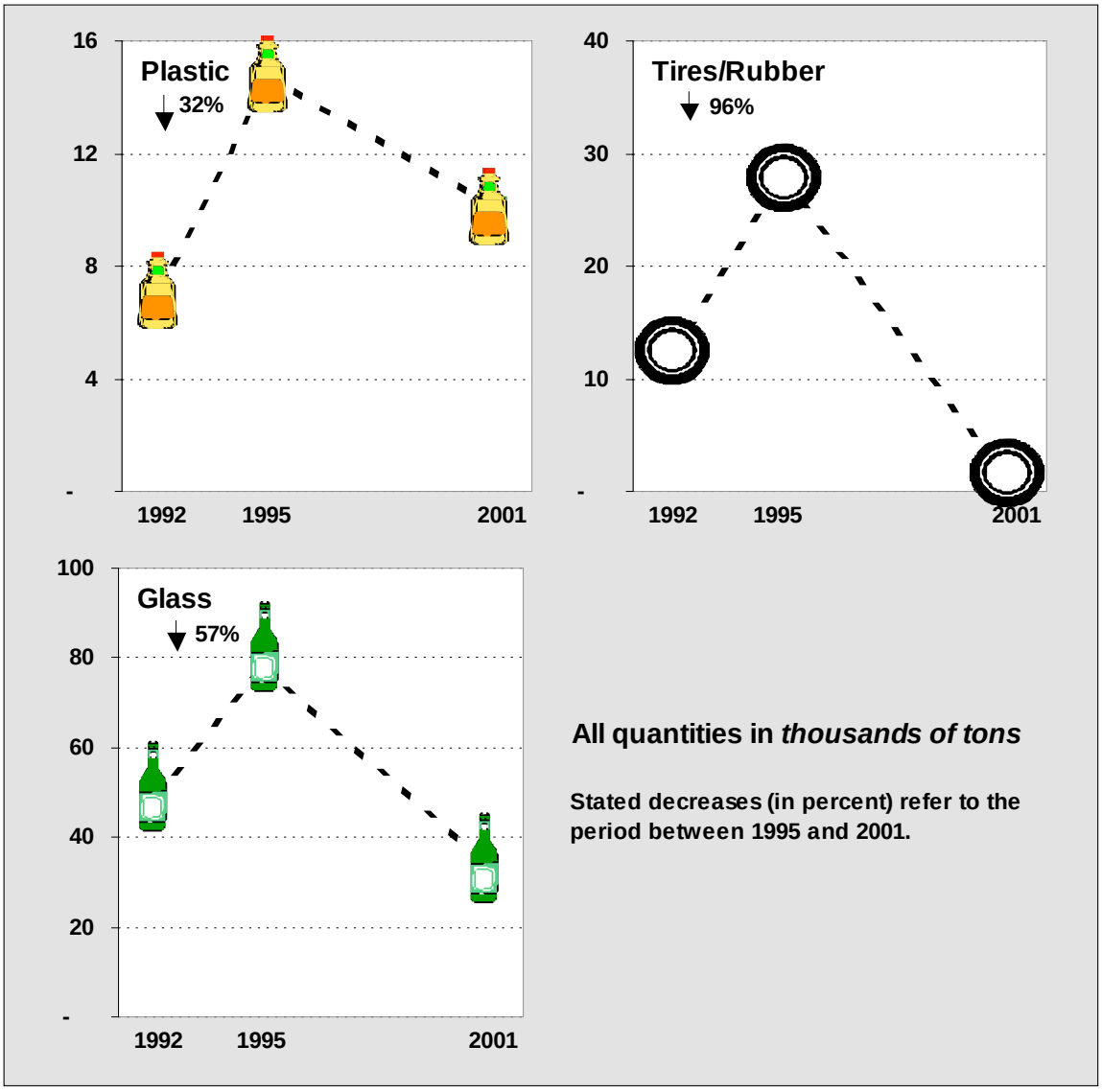
[11] A small amount of food waste from a King County-sponsored pilot program was actually composted outside King County.

Figure 2: Positive Trends in Re-Manufacturing – Washington State



While in-state re-manufacturing of recycled concrete/asphalt and compostable waste has increased, use of some other recycled materials has apparently declined since 1995. In particular, Figure 3 shows that although in-state re-manufacturing of plastics, tires/rubber, and glass increased from 1992 to 1995, they all declined substantially between 1995 and 2001.

Figure 3: Negative Trends in Re-Manufacturing – Washington State



The decrease in plastics re-manufacturing is due to the fact that at least three major post-consumer plastics re-manufacturers in Washington have gone out of business since 1995. Plastics may increasingly be sent to other domestic markets and to Asia. On the other hand, final-stage processing of plastics has reportedly increased. This trend, although not displayed in the charts above, is likely the results of increased collection of more types of plastics, largely from residential sources.

The decrease in recycling of tires and rubber is due to the closure of several tire recyclers since 1995, and tires are likely increasingly being sent out-of-state for processing.[12] Tires may also be stockpiled in-state. Additionally, tire-recycling totals for 1992 and 1995 may have been elevated as a result of focused tire cleanup efforts that took place in the early to mid-1990's. A state program to clean up and recycle large stockpiles of tires was funded by a surcharge on all new tires purchased between October 1, 1989 and September 30, 1994.[13] Tire cleanup continued through 1997, using funds generated by the surcharge.[14]

The decrease in re-manufacturing recyclable glass is possibly the result of several factors:

- One survey respondent reported that the use of recycled glass in construction aggregate has declined in the last 5 years.
- A 1997 minimum-content law in California required glass container manufacturers to use at least 35% recycled content. As a result, more recycled glass may be going to California. [15]
- In past years, recycled glass was likely used directly as fill material for construction projects.[15] However, during this survey, no survey respondents reported using glass directly as fill.

On the other hand, manufacturers and final-stage processors of glass report that re-manufacturing of glass into new containers in Washington has actually increased slightly since 1995.

CAPITAL INVESTMENT

As of December 31, 2001, Washington State firms had invested over $850 million in facilities, equipment, and vehicles necessary to carry out recycling activities. This figure, termed *capital investment in recycling,* includes the original cost (regardless of year-of-purchase or present value) of each of the following items that were still in use in 2001 for recycling activities:

- **Structures and land,** including the cost to construct (and, if necessary, convert) buildings and facilities for recycling activities.
- **Equipment and machinery,** including sorting or processing machinery, and other items required to collect, transport, process, or manufacture products from recyclable materials.
- **Vehicles,** including collection trucks, trailers, loaders, and other vehicles necessary to conduct recycling activities.

Original costs of the above items were pro-rated to reflect the portion of time that each item was devoted to recycling in 2001. For example, if a collection truck purchased for $160,000 was used 25% of the time to collect recyclables and 75% of the time to collect

[12] Source: Kip Eagles, Washington State Department of Ecology, who conducted their annual survey from 1996 through 2001.
[13] This surcharge was initiated by Washington RCW 70.95.510.
[14] Source: Randy Martin, Washington State Department of Ecology.
[15] This trend was reported in "Assessment of Markets for King County Recyclable Materials", prepared by Cascadia Consulting Group in 1998 for the King County Commission for Marketing Recyclable Materials.

solid waste, the truck would represent a $40,000 capital investment in recycling.[16] Leased items were included by estimating the total cumulative cost of that item, including pro-rating as appropriate.

REPORTED CAPITAL INVESTMENT, AS OF 2001

As stated above, over $850 million was invested in recycling as of December 31, 2001. This total includes the following investments, by firm type.[17]

- **$190 million was invested by firms that collect or haul recyclable materials.** Items used by these companies typically include collection trucks, sorting facilities (such as MRFs, material recovery facilities), baling equipment, loading vehicles, and warehouses.
- **$7 million was invested by firms that transport recycled materials.** Transporters most commonly use semi-trailers to transport recyclables to a port, final-stage processor, or manufacturer.
- **$189 million was invested by firms that final-stage process recyclable materials.** Items used by these companies typically include large pieces of machinery used to crush, grind, shred, pulp, or otherwise process recyclable materials into different feedstocks used in manufacturing.
- **$468 million was invested by firms that re-manufacture products using recycled feedstock.** Many manufacturers process their own feedstock, in which case items used are very similar to those of final-stage processors. Other items used by manufacturers include de-inking mills, composting equipment, or manufacturing lines (in cases where they are devoted specifically to recycled materials).[18]

The above totals demonstrate that in the recycling industry of Washington, re-manufacturing is more capital intensive than the other activities combined.

CAPITAL INVESTMENT TRENDS, 1992-2001

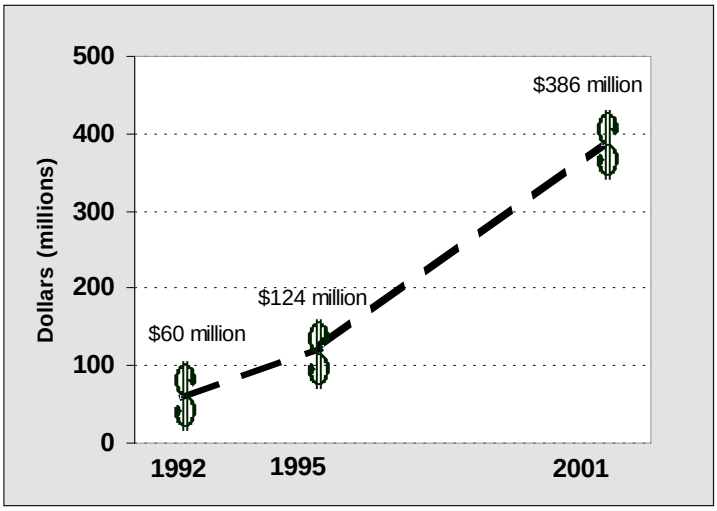
The 1995 survey found that capital investment in recycling was nearly $1.5 billion. Of this total, almost $1.4 billion was reported to be invested in the manufacturing sector. In contrast, the 2001 survey found, as stated in the previous section, that only about $468 million was invested in the manufacturing sector. We interpret this discrepancy not necessarily as a downward trend but rather as a change in survey methodology.

[16] See Appendix C for more details on the definition of *capital investment in recycling*.
[17] Firm types were assigned according to the primary activity of each firm.
[18] The costs of most manufacturing equipment and assembly lines were not included because recycled feedstock use was often incidental to the production process. However, some manufacturers are devoted to using feedstock that is almost exclusively recycled. In such cases, the entire cost of the facility was included.

The previous 1992 and 1995 surveys likely defined *capital investment in recycling* in a manner that counted manufacturing equipment that was used only incidentally for recycling. For 2001, we counted only that equipment required to use recycled instead of virgin feedstock, a more accurate measure of a company's true investment in recycling. Unfortunately, making appropriate adjustments to 1992 and 1995 capital investment totals to enable accurate comparisons was not possible, as any survey records kept by the Clean Washington Center (CWC) are no longer available. As a result, trends in capital investment in the manufacturing sector cannot be assessed. At present, the King County Solid Waste Division plans to conduct this survey again in 3 – 5 years, at which point capital investment trends in the manufacturing sector can be determined.

Despite the differences in methodologies in the manufacturing sector, comparisons can be made to capital investment levels for the other sectors, as the previous methodology is consistent with what was used in 2001. In 1992 and 1995, the CWC reported combined capital investment for the collector/hauler, transporter, and final-stage processor sectors. Aggregating the investment in these sectors for 2001 yields a total of $386 million invested. This total represents a substantial growth of about 200% over totals reported in 1992 and 1995, as displayed in Figure 4.

Figure 4: Trends in Capital Investment in Recycling (Excluding Manufacturers)– Washington State



EMPLOYMENT

REPORTED EMPLOYMENT IN 2001

As of December 31, 2001, Washington State firms employed at least 3,620 people to collect, haul, transport, final-stage process, or remanufacture recyclable materials.[19] The size of the recycling industry is therefore comparable to other resource-producing industries in Washington, as shown in Table 4. For example, Washington leads the

[19] Employees are reported as full-time equivalents (FTEs), where, for example, two half-time positions count as one full-time position.

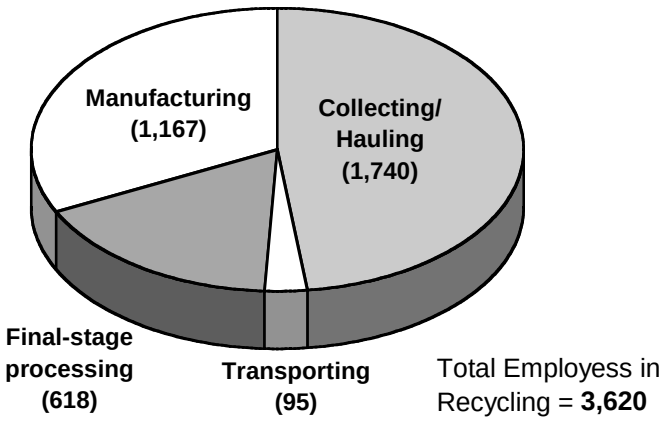
nation in both apple and cherry production: employment in recycling, although much less than in apple production, is significantly more than in cherry production. [20]

Table 4: Washington Employment Levels in Select Resource-Producing Industries

Resource-producing Industry	Average monthly employment[21]
Apple production	12,455
Logging	6,604
Primary aluminum	4,812
Recycling	**3,620**
Mining	3,473
Cherry production	2,779
Fishing	2,393

Of the 3,620 people employed in the recycling industry, almost half are employed by firms that collect and/or haul recyclable materials. Figure 5 shows the distribution of employees, by firm type.

Figure 5: Recycling Employment by Firm Type – Washington State



[20] Washington's ranks first in both the nation's apple and cherry production for 2000 according to the U.S. Department of Agriculture's Agricultural Statistics Service, available on-line at www.nass.usda.gov/wa/.
[21] Except for recycling, average industry employment for the year 2000 is estimated by the Washington State Employment Security Department. Figures include seasonal workers. Data are available at www.wa.gov/esd/lmea/. Data for 2001 were not yet available as of July 2002.

IMPACT OF 2001 RECESSION ON EMPLOYMENT

In 2001, an economic recession began in Washington State and the nation. Commodity prices for most readily-recyclable materials fell throughout the year.[22] However, the recession had little impact on recycling employment. According to survey respondents, total employment (3,620) at the end of the year was only 1% less than on Jan 1, 2001, when the industry employed 3,645 people.

RECYCLING EMPLOYMENT TRENDS, 1992 – 2001

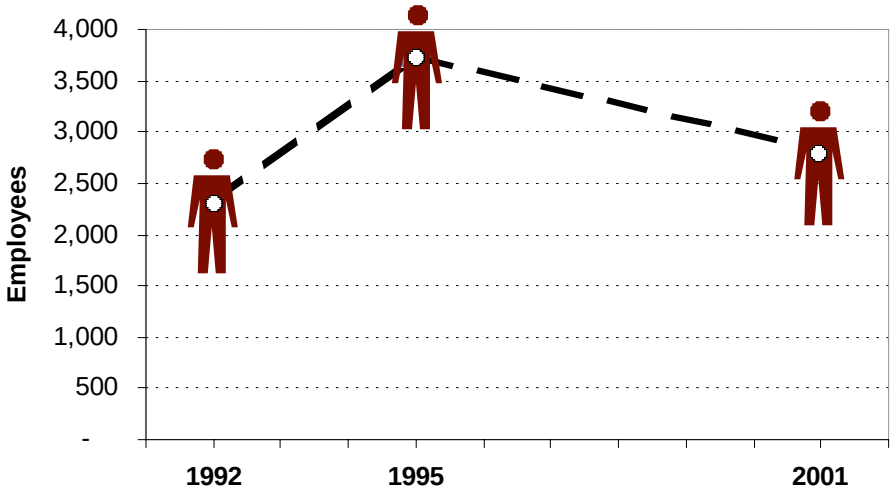
The 1995 survey found that the recycling industry employed at least 16,747 people in Washington State. Of this total, over 13,000 were reported to be employed manufacturing products out of recycled materials. In 2001, as stated above, the survey found that only about 1,167 people were employed in recycling in the manufacturing sector. As with capital investment, we interpret this discrepancy not as a downward trend but rather as a change in survey methodology.

The 1992 and 1995 surveys used a definition of employment in recycling that may have counted employees who manufactured products that included only minimal recycled content. For 2001, we counted only those employees required to use recycled instead of virgin feedstock, a more accurate measure of a company's true employment in recycling.[23] Unfortunately, as with capital investment, making appropriate adjustments to 1992 and 1995 employment totals to enable accurate comparisons was not possible, as any survey records kept by the Clean Washington Center (CWC) are no longer available. Future surveys will follow the methodology employed in 2001 and will be able to accurately assess employment trends in the manufacturing sector.

Despite the discrepancy in methodologies for manufacturing employees, comparisons can be made to employment levels for the other activity types. In 1992 and 1995, the CWC reported the number of employees that collect or haul, transport, and final-stage process recyclable materials. Employees of the collector/hauler, transporter, and final-stage processor firm types for 2001 total 2,456. However, an additional 365 people perform collecting, transporting, or final-stage processing activities at manufacturing firms. Therefore, the total number of people performing collecting, transporting, or final-stage processing of recyclable materials (regardless of firm type) as of Dec 31, 2001 is at least 2,821.[24] Figure 6 shows this total in the context of 1992 and 1995 employment in all activities other than re-manufacturing.

[22] Current and historical commodity prices for recyclables are published by *Waste News*, and available at www.wastenews.com.
[23] See Appendix C for a detailed description of how this survey counted capital investment.
[24] This adjustment is necessary to compare employment figures to previous surveys.

Figure 6: Trends in Recycling Employment (Excluding Manufacturing) – Washington State[25]



Note that reported employment in recycling has declined since 1995. This decline may represent increased mechanization (a possibility consistent with reported large increases in capital assets), as collecting vehicles and sorting machinery become more automated. Another factor may be that as more recyclable commodities are exported (especially plastic and tires), fewer workers could be needed in Washington to sort, process, or transport the materials.

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[25] As discussed on page 2, the 2001 survey (unlike the 1992 and 1995 surveys) did not target businesses that recycle oil, solvents, or latex paint. This could explain some (but probably not all) of the decline in employment displayed in Figure 6.

4. Results – King County

The primary focus of the 2001 Survey of the Washington State Recycling Industry was to measure recycling industry involvement statewide. However, a secondary purpose was to measure industry involvement in King County and make comparisons to statewide totals. The reader may therefore want to review the survey methodology (beginning on page 3) and the Washington State results (beginning on page 7) before proceeding with this King County section. Still, this section will incorporate some statewide results for comparison purposes.

Please note that all King County results are for the entire county, including Seattle and all other incorporated areas in the county.

SURVEY RESPONSES

Of the 139 firms targeted in King County, 118 responded to the survey. This represents an overall response rate of 85%. Of the 118 survey respondents, the majority of the firms (72) were collectors, haulers, or transporters of recyclable materials. Of the remaining 46 respondents, 20 were final-stage processors and 26 were manufacturers. Table 5 displays the number of respondents according to the type of firm, including comparisons to the 1995 survey. Note that the total number of respondents in 2001 is very similar to that in 1995.

Table 5: Survey Respondents by Firm Type – King County

	Survey Respondents	
Firm Type	**1995**	**2001**
Collector/Hauler or Transporter	59	72
Final-Stage Processor	19	20
Manufacturer	35	26
Total	**113**	**118**

The 118 firms responding from King County represent about 31% of the 383 respondents statewide.

MATERIAL PROCESSED AND RE-MANUFACTURED

The survey asked firms that conduct final-stage processing or re-manufacturing of recyclable materials to report the quantities of material handled in 2001.

REPORTED MATERIAL USE IN 2001

In 2001, over 1.2 million tons of recycled materials were used to make other products in King County. Table 6 presents the quantities used, by material type, and the primary products made with those materials.

Table 6: Quantities of Materials Re-manufactured – King County[26]

Material Group	Quantity (tons) Re-manufactured in King County in 2001	Significant Products Made in King County
Paper	138	Compost
Plastic	471	Packaging (containers and bags), insulation
Glass	28,827	Containers, abrasive grit, water filtration medium
Metal	455,000	New metal
Wood	32,937	Mulch, compost
Concrete/Asphalt	453,005	Roadbed, new concrete
Yard Waste	215,563	Compost
Food Waste	13,274	Compost
Tires/Rubber	1,050	Boat bumpers, flooring, outdoor surfaces
Other materials	35,152	Gypsum, compost
Total	**1,235,417**	

Note that the quantities of materials re-manufactured in King County represent 28% of the approximately 4.4 million tons re-manufactured statewide.

In addition to the recycled materials re-manufactured in King County, large quantities of materials are final-stage processed but not necessarily re-manufactured within the county or the state. Table 7 shows these quantities of materials final-stage processed in King County. Respondent firms did not report where (or if) these quantities were re-manufactured. As a result, some quantities (especially metals) may be counted in both Table 6 and Table 7.[27]

[26] In many cases, the firm that re-manufactured the recycled material also performed the final-stage processing. In cases where the manufacturer and final-stage processor are distinct but both known, the quantity of material handled is reported only as being re-manufactured (in Table 2 and/or in Table 6, depending on whether the company was located in King County or in another part of Washington) to avoid double-counting it as both *final-stage processed* and *re-manufactured*.

[27] Due to the proprietary and valuable nature of metal handling, many companies did not report with what other companies they conducted transactions. This likely results in some double-counting of metal quantities in Table 6 and Table 7.

Table 7: Quantities of Materials Final Stage Processed – King County[28]

Material Group	Quantity (tons) final-stage processed in King County in 2001
Plastic	1,900
Glass	9,900
Metal	360,000
Wood	9,375
Other	63,625
Total	**444,440**

TRENDS IN MATERIAL USE, 1992-2001

Previous surveys (in 1992 and 1995) also inquired about quantities of recyclable materials that were final-stage processed or re-manufactured into new products in King County. When compared to totals from those years, several notable trends emerge:

- **Composting of yard waste in King County increased by more than 60,000 tons** since 1995. Yard waste composting increased from about 150,000 tons in 1995 to almost 220,000 tons in 2001. The quantity of yard waste composted in King County in 2001 represents over half of that composted in the state.
- **Composting of food waste may have a promising future in King County**, as survey respondents reported composting over 13,000 tons of food waste in 2001, compared to less than 2,000 tons in 1995. It remains to be seen whether food waste composting will take off in the next few years. Most food waste is still disposed, and it represents 17% of King County's residential disposed waste stream.[29]
- **Manufacturing using recycled tires/rubber has declined in King County,** from about 3,000 tons in 1995 to about 1,000 tons in 2001. A major retailer and collector of used tires is now sending most of them out-of-state for processing. The manufacturing of recycled tires that does still take place in Washington occurs mostly in King County.
- **Manufacturing using recycled plastic has decreased dramatically in King County.** There are now only three firms in King County that use recycled plastics, and none of them use more than 250 tons of recycled feedstock.

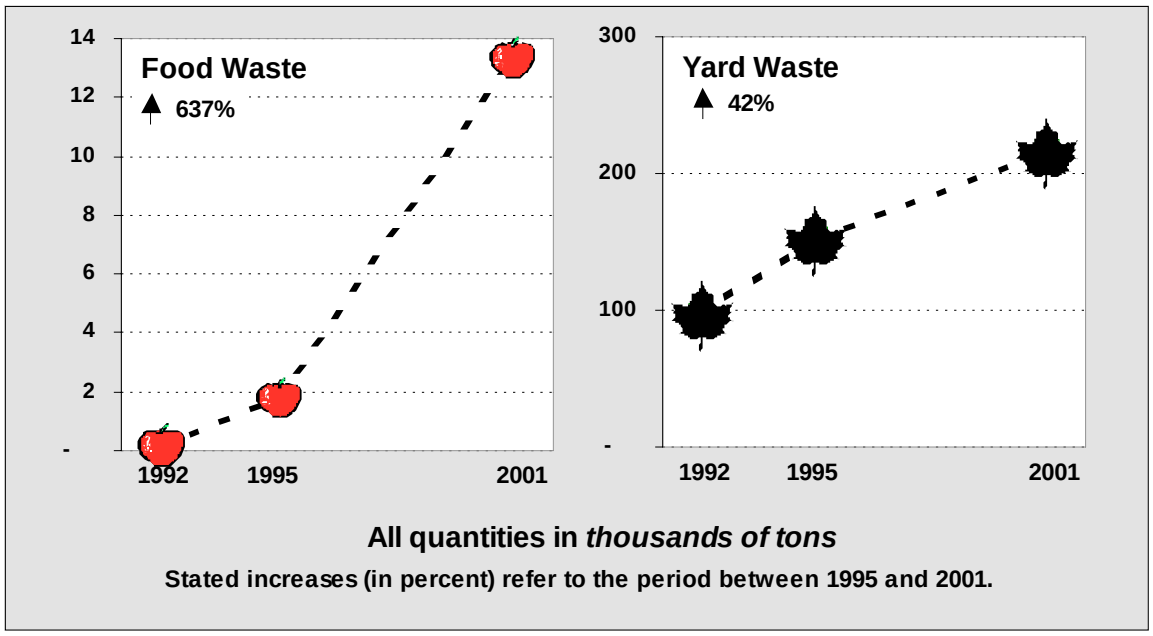
[28] Additional quantities of materials may be final-stage processed in King County but not reported in Table 7. If a material was final-stage processed in King County and then sent to another (known) firm in Washington for re-manufacture, the quantity was reported only as re-manufactured, and would be counted in Table 2 on page 8. See footnote 26 for more information on this issue.

[29] King County Solid Waste Division Waste Monitoring Program, "1999/2000 Comprehensive Waste Stream Characterization and Transfer Station Customer Surveys", prepared by Cascadia Consulting Group.

- **As in Washington State, re-manufacturing of recyclable glass in King County has declined** by more than 50% since 1995. This is possibly due to decreased use of recycled glass in construction aggregate. The processing and re-manufacturing that does take place in Washington happens mostly in King County.
- **Re-manufacture of concrete/asphalt and metal in King County remains fairly consistent with totals reported in 1995.**

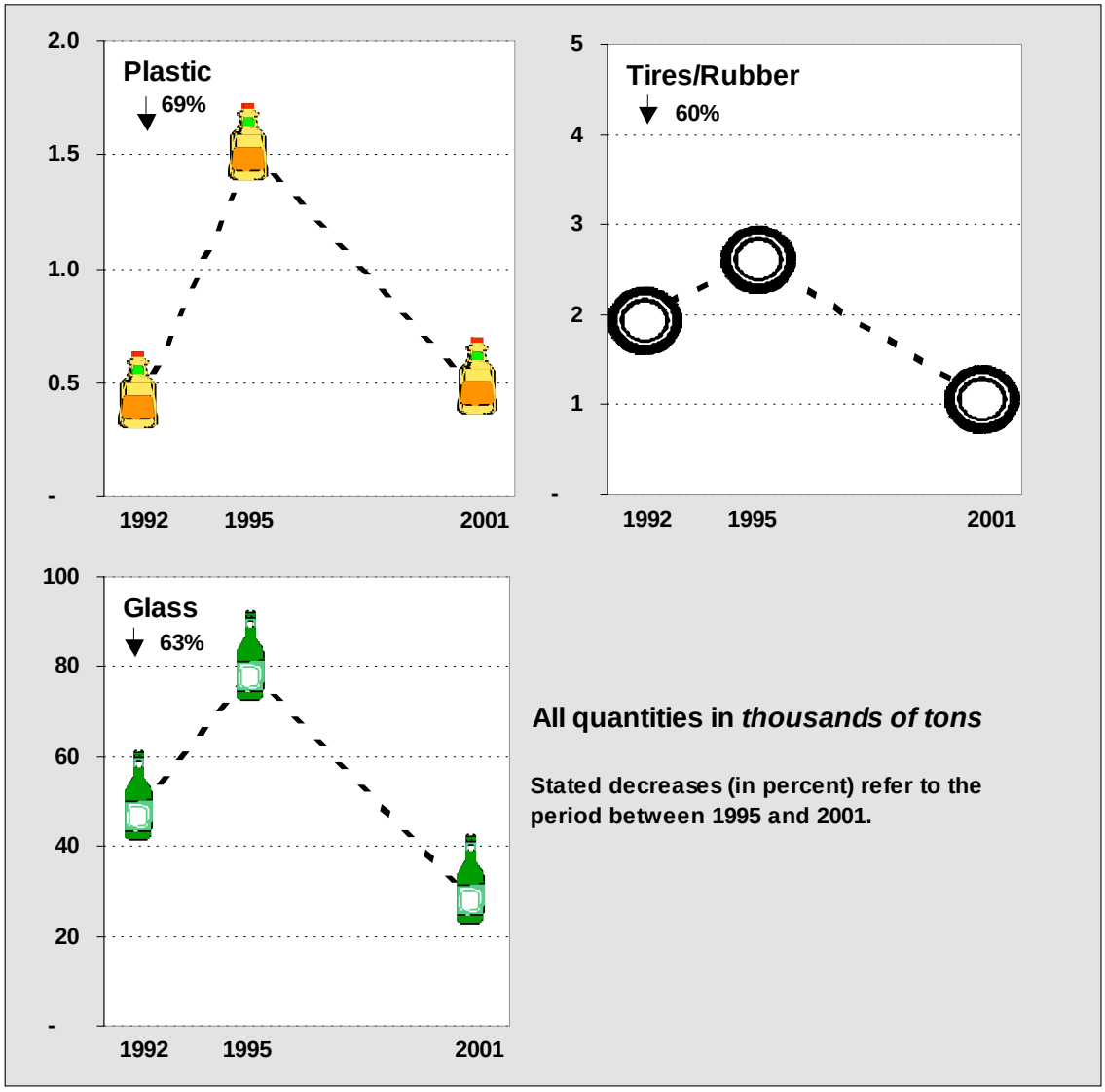
Figure 7 displays the positive trends noted above. Increases in yard waste and food waste composting are likely the results of residents and businesses responding to increased opportunities to recycle these materials.

Figure 7: Positive Trends in Re-Manufacturing – King County



While re-manufacturing of recycled yard waste and food has increased in King County, use of some other recycled materials has apparently declined since 1995. Figure 8 shows that although re-manufacturing of glass, tires/rubber, and plastics in King County increased from 1992 to 1995, they all declined sharply between 1995 and 2001.

Figure 8: Negative Trends in Re-Manufacturing – King County



The downward trends in plastics, tires/rubber, and glass re-manufacturing evident in King County are also present in Washington State as a whole, as presented in Section 3. The mid-to-late 1990's saw a number of re-manufacturers using recycled tires and plastics close in Washington. At least one of the manufacturers using tires and one using plastics were located in King County. Many tires and plastics destined for re-manufacture are likely shipped out of state or even internationally.[30] Glass re-

[30] For more information on market trends relating to re-manufacturing using tires, plastics, and glass, see Section 3: Results – Washington, page 10 and 11.

manufacturing has likely declined due to a variety of factors, including the probable decreased use of glass in construction aggregate.

CAPITAL INVESTMENT

As of December 31, 2001, King County firms had invested over $400 million in facilities, equipment, and vehicles necessary to carry out recycling activities. This figure, termed *capital investment in recycling,* includes the original cost (regardless of year-of-purchase or present value) of each of the following items that were still in use in 2001 for recycling activities:

- **Structures and land,** including the cost to construct (and, if necessary, convert) buildings and facilities for recycling activities.
- **Equipment and machinery,** including sorting or processing machinery, and other items required to collect, transport, process, or manufacture products from recyclable materials.
- **Vehicles,** including collection trucks, loaders, and other vehicles necessary to conduct recycling activities.

Original costs of the above items were pro-rated to reflect the proportion of time that each item was devoted to recycling in 2001.[31] Leased items were included by estimating the total cost spent on that item, including pro-rating as appropriate.

REPORTED CAPITAL INVESTMENT, AS OF 2001

As stated above, over $400 million was invested in recycling as of December 31, 2001. This total includes the following investments, by firm type.[32]

- **$101 million was invested by firms that collect or haul recyclable materials.** Items used by these companies typically include collection trucks, sorting facilities (such as MRFs, material recovery facilities), baling equipment, loading vehicles, and warehouses.
- **$1.6 million was invested by firms that transport recycled materials.** Transporters most commonly use semi-trailers to transport recyclables to a port, final-stage processor, or manufacturer.
- **$137 million was invested by firms that final-stage process recyclable materials.** Items used by these companies typically include large pieces of machinery used to crush, grind, shred, pulp, or otherwise process recyclable materials into feedstock used in manufacturing.

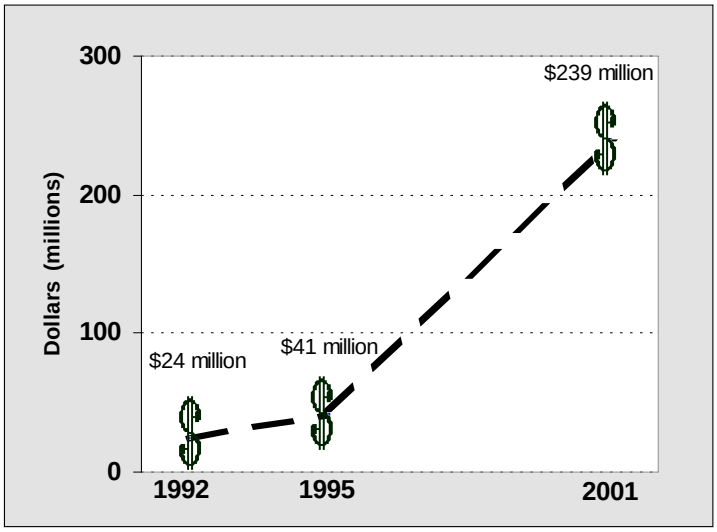
[31] For example, if a collection truck purchased for $160,000 was used 25% of the time to collect recyclables and 75% of the time to collect solid waste, the truck would represent a $40,000 capital investment in recycling. See Appendix C for more details on the definition of *capital investment in recycling*.
[32] Firm types were assigned according to the primary activity of each firm.

- **$188 million was invested by firms that re-manufacture products using recycled feedstock.** Many manufacturers process their own feedstock, in which case items used are very similar to those of final-stage processors. Other items used by manufacturers include de-inking mills, composting equipment, or manufacturing lines (in cases where they are devoted specifically to recycled materials).[33]

CAPITAL INVESTMENT TRENDS, 1992-2001

As discussed in the Executive Summary (page 2), the previous 1992 and 1995 surveys were likely less precise in their treatment of capital investment in re-manufacturing recycled materials. As a result, trends in capital investment in the manufacturing sector cannot be assessed. However, comparisons can be made across years for capital investment for the other firm types. In particular, capital investment in recycling by King County firms that collect or haul, transport, and final-stage process recyclable materials totals $239 million as of 2001, representing a substantial growth since 1995. Figure 4 displays this nearly 500% increase in capital investment in collecting and processing recyclable materials since 1995.

Figure 9: Trends in Capital Investment in Recycling (Excluding Manufacturers)– King County



EMPLOYMENT

REPORTED EMPLOYMENT IN 2001

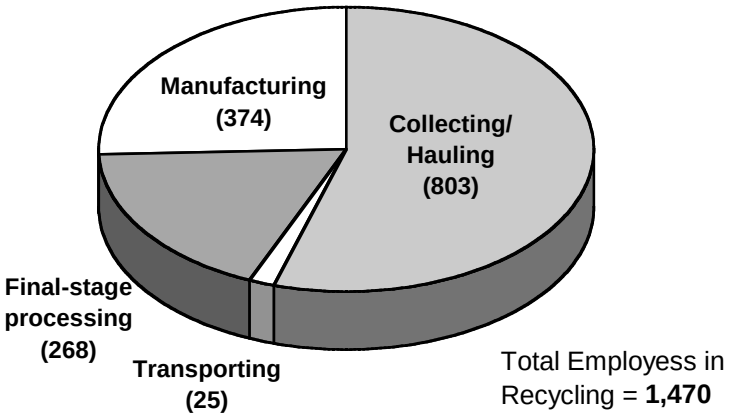
As of December 31, 2001, King County firms employed at least 1,470 people to collect, haul, transport, final-stage process, or remanufacture recyclable materials.[34]

[33] The costs of most actual manufacturing equipment and assembly lines were not included, as recycled feedstock use was often incidental. However, some manufacturers are devoted to using feedstock that is almost exclusively recycled. In such cases, the entire cost of the facility was included.

[34] Employees are reported as full-time equivalents (FTEs), where two half-time positions count as one full-time position.

Of the 1,470 people employed in King County's recycling industry, over half are employed by firms that collect and/or haul recyclable materials. Figure 5 shows the distribution of employees, by firm type.

Figure 10: Recycling Employment by Firm Type – King County



IMPACT OF 2001 RECESSION ON EMPLOYMENT

In 2001, an economic recession began in Washington State and the nation. Commodity prices for most recyclable materials fell throughout the year.[35] However, in King County, the recession had only a small impact on recycling employment. According to survey respondents, total employment (1,470) at the end of the year was only about 20 employees less than on Jan 1, when the industry employed 1,494 people. This represents a decrease of less than 2%.

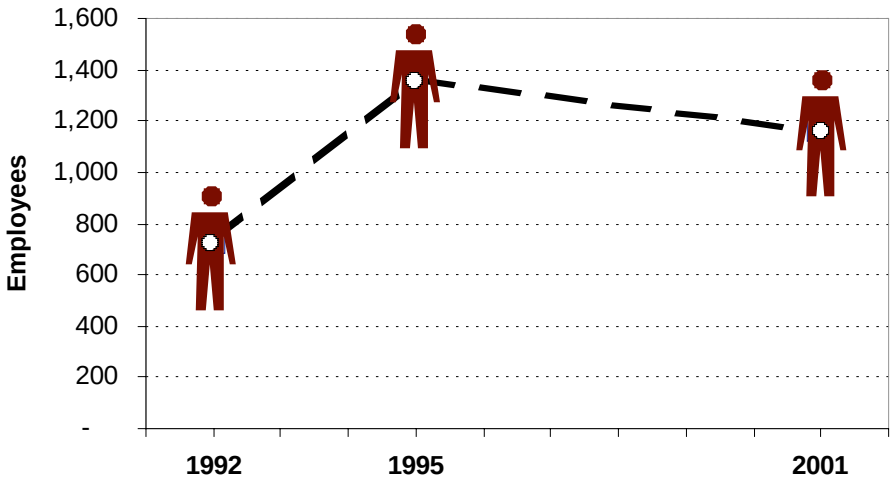
RECYCLING EMPLOYMENT TRENDS, 1992 – 2001

As discussed in Section 3, Results – Washington State (page 15), previous surveys may have overstated recycling employment levels in manufacturing using recyclable materials. Although this survey counts only those employees required to use recycled instead of virgin feedstock, the previous surveys likely used a broader definition. As a result, accurate comparisons across years cannot be made. However, comparisons can be made to employment levels in other activities.

Previously, the CWC reported the number of employees that collect or haul, transport, and final-stage process recyclable materials to be at least 723 in 1992 and 1,369 in 1995. Reported employees in the collector/hauler, transporter, and final-stage processor firm types for 2001 total 1,096. However, an additional 65 people perform collecting, transporting, or final-stage processing activities at manufacturing firms. Therefore, the total number of people performing collecting, transporting, or final-stage processing of recyclable materials (regardless of firm type) as of Dec 31,2001 is at least 1,161.[36] Figure 11 shows this total in the context of 1992 and 1995 employment.

[35] Current and historical commodity prices for recyclables are published by *Waste News*, and available at www.wastenews.com.
[36] This adjustment is necessary to compare employment figures to previous surveys.

Figure 11: Trends in Recycling Employment (Excluding Manufacturing) –King County[37]



Recycling employment reported in King County has declined somewhat since 1995. This decline may represent increased mechanization (a possibility consistent with reported large increases in capital assets), as collecting vehicles and sorting machinery become more automated. Another factor may be that as more recyclable commodities are exported (especially plastic and tires), fewer workers could be needed in King County to sort, process, or transport the materials.

ROLE OF KING COUNTY IN THE STATE'S RECYCLING INDUSTRY

This section has presented employment, capital investment, and material use results for King County. When comparing these results to those reported for all of Washington State (as discussed in Section 3, Results – Washington State), it is clear that a substantial portion of Washington State's recycling industry is located in King County. In particular, half of the capital investment in recycling in the state is located in King County.[38] Table 8 shows the fraction of Washington's employment, capital investment, and material use located in King County.

[37] As discussed on page 2, the 2001 survey (unlike the 1992 and 1995 surveys) did not target businesses that recycle oil, solvents, or latex paint. This could explain some (but probably not all) of the decline in employment displayed in Figure 6.

[38] This finding is influenced in some degree by heightened real estate costs in King County as compared to the rest of Washington State.

Table 8: Fraction of Washington's Employment, Capital Investment, and Material Use located in King County

	Fraction in King County	Fraction in Rest of Washington
Respondent Firms	**31%**	**69%**
Collector/Hauler	29%	71%
Transporter	63%	38%
Final-stage processor	29%	71%
Manufacturer	35%	65%
Employment (FTE's)	**41%**	**59%**
Collector/Hauler	46%	54%
Transporter	26%	74%
Final-stage processor	43%	57%
Manufacturer	32%	68%
Capital Investment ($)	**50%**	**50%**
Collector/Hauler	53%	47%
Transporter	24%	76%
Final-stage processor	73%	27%
Manufacturer	40%	60%
Material Re-manufactured (tons)	**28%**	**72%**
Population (2001 est.)	**29%**	**71%**

The above table also demonstrates that King County's industry involvement in recycling is particularly significant for businesses that collect and haul recyclable materials. Nearly half of the statewide employees of collector/hauler firms and over half of the capital investment by collector/hauler firms are located in King County. On the other hand, most re-manufacturing activity is located outside of King County, as 68% of the employees, 60% of the capital investment, and 72% of the material use by manufacturers occur outside of King County.

5. Conclusions

FINDINGS

Based on the results presented in Section 3 and Section 4, the following conclusions emerge:

- **Washington State's private recycling industry is a significant component of the State's economy.** Washington State's recycling industry employs at least 3,620 people and has invested over $850 million in capital assets. The number of people employed by the recycling industry is comparable to other resource-producing industries. For example, employment in the recycling industry is larger than in the mining industry, and ranks just behind employment in primary aluminum production.
- **As of December 31, 2001, the economic recession had not significantly impacted Washington's private recycling industry.** Employment in December was only about 1% lower than in January 2001.
- **The private recycling industry is responding to increased opportunities to recycle organic material such as yard waste and food waste.** The private sector has stepped up their processing and re-manufacturing of these materials. Most growth in organics processing since 1995 has occurred in King County.
- **The private recycling industry is growing to accommodate the need for recycling of construction and demolition debris.** Increasing disposal costs have led contractors to seek other options for managing heavy waste materials such as concrete. At least eleven new companies have started since 1995 to process construction and demolition debris, and concrete recycling has grown by approximately 175%. Most of this growth since 1995 has occurred outside King County, which already had well-established concrete recycling firms in 1995.
- **Recyclable plastics and tires/rubber may increasingly be sent out of state (or out of the country) for re-manufacture.** Washington companies that re-manufacture these materials have gone out of business or scaled back their recycling activities. However, large quantities of plastics and tires/rubber continue to be collected.
- **While recycling firms have invested heavily in capital assets since 1995, employment levels have declined somewhat.** Increasingly automated collection, processing, and manufacturing equipment may be reducing the demand for workers. Additionally, it could be that as more recyclable commodities are exported (especially plastic and tires), fewer workers could be needed in Washington to sort, process, or transport the materials.

- **About half of Washington's recyclables collection infrastructure and employees are located in King County.** The combination of dense population and increased opportunities for material collection has created a viable network of recycling businesses.
- **Most remanufacturing of recyclable materials that occurs in Washington happens outside of King County.** About two-thirds of re-manufacturing employees and nearly three-quarters of materials re-manufactured (by weight) are located outside King County.

KEY OPPORTUNITIES

Given the above findings, the following opportunities may exist in Washington State:

- **Potential exists for local re-manufacturing of plastics and tires.** Supply of these materials is strong, but most are likely either stockpiled or shipped out of state for re-manufacture.
- **There may be an opportunity to develop collection infrastructure outside of King County.** Results of this survey suggest that collection infrastructure is less developed outside of King County. Although 71% of the State's residents live outside King County, only about half of the capital investment and collection employment in recycling is located there.
- **If food waste recycling continues to emerge in King County (and possibly in other areas of Washington), local composting capacity will be essential.** Food-waste composting is increasingly being seen as a waste reduction and diversion strategy. Results of this survey suggest that although most food waste is still disposed, food-waste composting has increased dramatically since 1995. If this trend continues, there will be increasing opportunities to develop composting infrastructure in Washington.

FUTURE DIRECTIONS AND RESEARCH

At present, King County plans to conduct this survey again in 3 – 5 years in order to continue trend analyses. At that time, the above conclusions and opportunities should be revisited in light of public sector and industry goals and trends. Future administrators of this survey are encouraged to use Appendix C of this report to help make all facets of future surveys comparable to the results of this survey.

In this year's survey, capital investment was measured as the original cost of all equipment, vehicles, and property that were in use in 2001, regardless of time of purchase or present value. This definition was used in order to be consistent with previous surveys and to facilitate trend analysis, but it was not easily standardized to methods that are used to measure capital investment in other industries. Future administrators of this survey should consider investigating alternate methods for measuring new capital investment in recycling and standardizing the reporting methods to those of other industries' accounting practices. One possible approach could be to ask for new capital investment for each year since 2001.

Appendix A – Survey Form

Following is the survey form sent to all prospective recycling firms in Washington.

2001 Survey of Washington State Recycling Industry

CONFIDENTIAL
For Calendar Year 2001 Operations

Please enter or update the following contact information:

Contact Name and Title: _____
Firm: _____
Address: _____
City, State, and Zip: _____

Facility Name/Location: _____
Phone Number: ( ) _____
Fax Number: ( ) _____
E-Mail: _____

(i.) **Please tell us the name, title, and phone number of the person completing this report, if different than the contact name above.**

Person Completing this Report	Title	Phone Number	E-mail address
		( )	

(ii.) **In this report, your answers should pertain to all of your company's facilities in Washington. Please list these other facilities and include them in this report. If there are more than two other facilities, please attach an additional sheet and list them there.**

	Other Location A	Other Location B
Facility Name:		
Contact Name and Title:		
Address:		
City, State, and Zip:		
Phone Number:	( )	( )
Fax Number:	( )	( )

(iii.) **Does your firm collect, transport, or process recyclable materials, or use them as a feedstock in manufacturing?**

☐ **Yes** *Please complete this survey and return to Cascadia Consulting Group, Inc.*

☐ **No** *Check this box and fax this page to Cascadia Consulting at (206) 343-9819.*

Survey questions follow. All information supplied will be kept strictly confidential. If you have any questions while completing this survey, or if you need any assistance, please call Peter Erickson at (206) 343-9759 x118.
Please fax completed surveys to (206) 343-9819, e-mail to peter@cascadiaconsulting.com, or mail to:

Cascadia Consulting Group
ATTN: WA State Recycling Survey
1109 First Ave, Suite 400
Seattle, WA 98101

1. Firm Type (*Select all that apply)*

Please choose the definitions that best describe your company.

☐ **Collector/Hauler/Primary Processor:** A firm that performs activities that do not change the material's form, such as: collecting from residential or commercial locations (such as curbside recycling); operating a drop-off site or buy-back center; or sorting and baling recyclable materials (such as at a MRF, a material recovery facility).

☐ **Transporter:** A firm that transports recyclable materials after collection and takes them to a processor or manufacturer, mill, or port (for shipment within Washington or to outside the state).

☐ **Final Stage Processor:** A firm that transforms recyclable materials into feedstocks for manufacturing. Such activities change the material's form, such as flaking and/or shredding plastics, or chipping or grinding woodwaste. For this survey processing does not include simply sorting or baling material.

☐ **Manufacturer:** A firm that utilizes post-consumer or post-industrial recycled materials as a feedstock in the production process. Examples of such firms include mills, reclaimers, and composters.

2. Employment

Please list or estimate the number of your firm's employees directly involved in each of the categories below at both the beginning and end of 2001. Please record your responses as number of full-time employees, but include part-time employees by adding them up to arrive at full-time equivalents. In doing so, full-time employees should count as 1 and half-time employees should count as 0.5. For example, a firm with 8 full-time employees and 4 half-time employees should enter "10". Please include only employees who spend a majority of their time (whether full-time or part-time) in the activities listed.

In addition, if your firm's only function is recycling activities, then also include administrative and managerial positions that support the activities below. If your firm has functions other than recycling activities, don't include administrative and managerial positions.

	Employees	
	Jan. '01	**Dec. '01**
Collecting, Hauling, and/or Primary Processing……. *Number of employees **who collect, haul, sort, bale, and/or perform primary processing of recyclable materials.***	_____	_____
Transporting……. *Number of employees **who transport recyclable materials after collection.***	_____	_____
Final-Stage Processing……. *Employees **who final-stage process recyclable materials.***	_____	_____
Manufacturing…….. *Employees **who manufacture products using recycled materials**.*	_____	_____

3. Capital Investment in Recycling

Please list or estimate the amount of capital your firm has invested as of December 31, 2001 in order to collect, transport, or process recyclable materials or to manufacture products using recycled feedstock. Please include the original cost of each item in use in 2001. Note: If your firm's only function is recycling activities, then all your capital investment in use in 2001 is Capital Investment in Recycling.

Capital Investment in Recycling is defined as:

- **Structures and Land,** including the cost to construct or convert buildings and facilities for collecting, transporting, processing, or manufacturing products from recyclable materials. (If converted facilities, please include the cost of conversion plus the original value of the facilities.)
- **Equipment and machinery,** including sorting, processing or manufacturing machinery, and other items required to collect, transport, process, or manufacture products from recyclable materials.
- **Vehicles,** including collection trucks, loaders, and other vehicles required to collect, transport, or process recyclable materials or to manufacture products using recycled feedstock.

Capital Investment in Recycling as of December 31, 2001……$_____

Collectors, Haulers, Primary Processors, and Transporters have now completed the survey. Final-Stage Processors and Manufacturers, please continue.

This Section -- Manufacturers ONLY

(Final-Stage Processors skip to question 5.)

4. Manufacturing Operations. (*For Manufacturers Only*)

Is your facility one which: (*Select only one)*

☐ **Was built/constructed** to utilize recycled materials/feedstock;

☐ **Was converted** from use of virgin feedstock or from another use to incorporate some or all recycled feedstock; or

☐ **Now incorporates** some or all recycled materials/feedstock without the need for facility conversion.

Please estimate the following percentages regarding recycled content:

- Percent of total utilized **raw-material/feedstock** that is recycled material……___%
- Percent of all the **products** you manufacture that include recycled content…… ___%

All information supplied will be kept strictly confidential

This Page -- Final Stage Processors and Manufacturers ONLY

5. Recycled Feedstock Processed or Utilized

(*For Final Stage Processors and Manufacturers Only*)

For each material your firm processed or used in the manufacturing of recycled-content products, please list the source, major supplier(s), major customer(s), and amount utilized in 2001 (including units). Note that your suppliers and customers may also report the quantities you list here; therefore we ask you to identify suppliers and customers only to help us avoid counting the same materials more than once and to make sure that we survey all applicable firms in Washington. All information will be kept strictly confidential.

Note: *Please list Source as Post-Consumer (PC), Post-Industrial (PI), or Both (B).*

Material	Source	Major Supplier(s)	Major Customer(s)	Amount Utilized, 2001 *(include units)*
EXAMPLE: Mixed Paper	*PC*	*John Doe Recycling*	*Jane Rowe Paper Products*	*2,540 tons*

6. Product Marketing (*For Final Stage Processors and Manufacturers Only*)

Does your company incorporate recycling or recycled-content messages into your marketing efforts?

☐ **Yes** ☐ **No**

If Yes, what type of marketing is undertaken?

Thank you for completing this survey! Please return to Cascadia Consulting Group, Inc. at the address, fax, e-mail, or telephone number listed on page 1.

Appendix B – Detailed Results

This appendix is organized according to survey topic. It includes detailed survey results for both King County and Washington State for the following topics:

- Survey response;
- Materials processed and re-manufactured;
- Capital investment;
- Employment;
- Manufacturing facility type; and
- Product marketing

SURVEY RESPONSE

RESPONSE RATE BY QUESTION TOPIC AND FIRM TYPE

Overall survey response rate was 84%.[1] Not all respondents answered every question, however. In particular, companies occasionally would not report their capital investment in recycling, as this information was considered proprietary. In addition, some final-stage processors and manufacturers would not report the quantities of materials utilized. Table B-1 and Table B-2, for Washington and King County, respectively, present the fraction of survey respondents that answered each question.

Table B-1: Survey Responses by Question Topic – Washington State

Topic	Survey Responses	Respondent Population	Response Rate
Employment	379	383	99%
Capital Investment	346	383	90%
Material Use[2]	131	142	92%

Table B-2: Survey Responses by Question Topic – King County

Topic	Survey Responses	Respondent Population	Response Rate
Employment	117	118	99%
Capital Investment	101	118	86%
Material Use[3]	40	46	87%

The following two tables represent number of responses by firm type. The target population includes all the companies considered to be active recycling companies. The non-respondents in these tables include companies that refused the survey or that the interviewers were not able to contact but are believed to be recycling companies. We were able to categorize most of these companies according to firm type.

[1] Firms were considered respondents if they answered any of the three primary questions.
[2] The survey only asked final-stage processors and manufacturers to report material use, so the target population for these companies is smaller.
[3] The survey only asked final-stage processors and manufacturers to report material use, so the target population for these companies is smaller.

Table B-3: Target Population and Response Rate by Firm Type – Washington State

Firm Type	Survey Respondents	Target Population	Response Rate
Collector/Hauler or Transporter	239	274	87%
Final-Stage Processor	70	80	88%
Manufacturer	74	96	77%
Unknown	0	6	N/A
Overall	**383**	**456**	**84%**

Table B-4: Target Population and Response Rate by Firm Type – King County

Firm Type	Survey Respondents	Target Population	Response Rate
Collector/Hauler or Transporter	72	85	85%
Final-Stage Processor	20	21	95%
Manufacturer	26	32	81%
Unknown	0	1	N/A
Overall	**118**	**139**	**85%**

RESPONSES FIRMS OWNED BY THE SAME CORPORATE ENTITIES

Each survey respondent was asked if they were associated with other recycling firms in Washington. If possible, the contact was asked to answer for any other firms owned by the same corporate entity. If that was not possible, the other firms were contacted and surveyed separately. In some cases, one corporate entity was able to provide responses for a number of individual firms. As shown in Table B-5, the 383 respondent firms in Washington were owned by 287 separate corporate entities. In other words, almost 100 respondent firms were associated with other firms in Washington.

Table B-5: Comparison of Respondent Firms to Individual Corporate Entities – Washington

Activity Type	Total Respondent Firms	Corporate Entities Represented
Collector/Hauler	231	167
Transporter	8	7
Final-Stage Processor	70	58
Manufacturer	74	55
Totals	**383**	**287**

Table B-6: Comparison of Respondent Firms to Individual Corporate Entities – King County

Activity Type	Total Respondent Firms	Corporate Entities Represented
Collector/Hauler	67	51
Transporter	5	5
Final-Stage Processor	20	16
Manufacturer	26	18
Totals	**118**	**90**

MATERIALS PROCESSED AND RE-MANUFACTURED

REPORTED MATERIAL USE

The following two tables detail the quantities of recyclable materials final-stage processed and re-manufactured in King County and Washington. Table B-7 shows the quantities of materials final-stage processed but not necessarily re-manufactured in the State. Respondent firms did not report where (or if) these quantities were re-manufactured. Table B-8 details the quantities used to manufacture new products.

Table B-7: Detailed Results of Reported Material Use – Final-Stage Processing

Material Description	Material Type	Tons of Material Used	
		King County	*Washington State*
CDL	Ceramic/Porcelain	0	50
	Drywall (Gypsum)	0	2,207
	Stumps & Logs	0	90,990
	Woodwaste	9,375	30,625
	Subtotal, CDL	**9,375**	**123,872**
Glass	Colored	4,800	4,800
	Mixed	5,100	14,843
	Subtotal, Glass	**9,900**	**19,643**
Metal	Electronics	0	250
	Ferrous	360,000	510,125
	Mixed	0	1,000
	Non-Ferrous	0	2,009
	Aluminum	0	5,687
	Silver	0	25
	Subtotal, Metal	**360,000**	**519,096**
Plastic	HDPE	0	275
	Other & Mixed	1,900	16,275
	PET	0	115
	Subtotal, Plastic	**1,900**	**16,665**
Rendering	Fat & Bone	820	820
	Used Cooking Oil	62,445	62,445
	Subtotal, Rendering	**63,265**	**63,265**
Textiles	Textiles	**0**	**0**
Tires/Rubber	Tires/Rubber	**0**	**4,500**
Totals		**444,440**	**747,041**

Table B-8: Detailed Results of Reported Material Use – Manufacturing

Material Description	Material Type	Tons of Material Used	
		King County	*Washington State*
CDL	Concrete and Asphalt	453,005	2,070,508
	Drywall (Gypsum)	26,516	49,816
	Stumps & Logs	0	46,821
	Roofing, Composite Shingles	0	10,042
	Roofing, Wood shakes	0	4,000
	Woodwaste	32,937	167,071
	Subtotal, CDL	**512,458**	**2,348,258**
Glass	Brown	5,850	5,850
	Clear	13,162	13,162
	Green	5,850	5,850
	Mixed	1,045	1,045
	Non Container	2,920	2,920
	Shot	0	4,500
	Subtotal, Glass	**28,827**	**33,327**
Metal	Ferrous	455,000	457,330
	Aluminum	0	29,375
	Subtotal, Metal	**455,000**	**486,705**
Organics	Biosolids	6,338	6,818
	Foodwaste	13,274	13,274
	Manure	2,297	12,424
	Yardwaste	215,563	392,592
	Subtotal, Organics	**237,472**	**425,108**
Paper	Coated	0	10,000
	Computer Printout (CPO) and ONP	0	16,700
	Double Lined Kraft (clippings)	0	7,168
	Mixed/Other Paper	138	6,695
	Office Paper	0	25,000
	Old Corrugated Containers (OCC)	0	454,535
	Old Magazines (MAG)	0	53,000
	Old Newspaper (ONP)	0	460,590
	Recycled Market Pulp	0	4,297
	Sorted White Ledger (SWL)	0	2,820
	Subtotal, Paper	**138**	**1,040,805**
Plastic	HDPE	250	250
	Other & Mixed	0	750
	PET	0	750
	Polypropylene	0	3,050
	Polystyrene	221	721
	UHMW Polyethylene	0	4,500
	Subtotal, Plastic	**471**	**10,021**
Rendering	Rendering -- Used Cooking Oil	0	20,758
	Rendering -- Fat & Bone	0	78,630
		0	**99,388**
Textiles	Textiles	**1**	**1**
Tires/Rubber	Tires/Rubber	**1,050**	**1,100**
Other	Alumina	0	1,571
	Calcium Carbonate	0	6,591
	Catch Basin & Vactor Solids	0	4,772
	Diatomaceous Earth	0	148
	Mullite	0	984
	Slag	0	7,800
	Subtotal, Other	**0**	**21,865**
Totals		**1,235,417**	**4,466,578**

MATERIAL TRENDS, 1992 – 2001

The tables in this section show material use trends for 1992, 1995, and 2001. (Please refer to Section 3 of the main report for a discussion of key material use trends in Washington.)

Table B-9: Trends in Final-Stage Processing, Washington

Material Type	Tons of Material Used		
	1992	***1995***	***2001***
CDL	409,665	636,601	123,872
Glass	48,115	53,685	19,643
Metal	29,285	30,604	519,096
Plastic	0	450	16,665
Rendering	N/A	N/A	63,265
Textiles	0	40,000	0
Tires/Rubber	N/A	N/A	4,500

Table B-10: Trends in Final-Stage Processing, King County

Material Type	Tons of Material Used		
	1992	***1995***	***2001***
CDL	59,500	264,693	9,375
Glass	48,000	53,500	9,900
Metal	29,285	32,104	360,000
Plastic	0	0	1,900
Rendering	N/A	N/A	63,265
Textiles	0	0	0
Tires/Rubber	N/A	N/A	0

Table B-11: Trends in Re-manufacturing, Washington[4]

Material Type	Tons of Material Used		
	1992	***1995***	***2001***
CDL	619,640	864,977	2,348,258
Glass	49,097	78,138	33,327
Metal	687,155	686,500	486,955
Organics	340,280	386,499	425,108
Paper	616,609	1,089,167	1,040,805
Plastic	7,106	14,732	10,021
Rendering	N/A	N/A	99,388
Textiles	0	0	1
Tires/Rubber	12,300	27,756	1,100
Other	N/A	N/A	21,865

Table B-12: Trends in Re-manufacturing, King County[4]

Material Type	Tons of Material Used		
	1992	***1995***	***2001***
CDL	406,100	521,540	512,458
Glass	49,035	78,068	28,827
Metal	600,000	600,000	455,000
Organics	106,500	165,892	237,472
Paper	0	0	138
Plastic	419	1,503	471
Rendering	N/A	N/A	0
Textiles	0	0	1
Tires/Rubber	1,980	2,640	1,050
Other	N/A	N/A	0

[4] In 2001, quantities of auto bodies were excluded form the *Metal* totals. Previous surveys likely included auto bodies in their reported material *Metal* totals.

According to Table B-13, manufacturers that used *other materials*, such as industrial by-products, were more likely to use a greater portion of new materials with those. The manufacturers using the highest percentage, on average, of recycled materials to manufacture a product are those that utilize organics. These finished products frequently were compost or mulch, which do not require new products to be added in order to manufacture them. Manufacturers using metals or organics had the greatest percentages of products with recycled content.

Table B-13: Percentages of Recycled Feedstock Used in Manufacturing Areas

Material Re-manufactured	Number of Respondents	Average % of Recycled Feedstock Used	Average % of Products Containing Feedstock
Traditional Recyclables	29	56%	76%
Metals	3	68%	90%
CDL Materials	22	57%	71%
Organics	16	90%	93%
Other Materials	5	50%	77%

CAPITAL INVESTMENT

Below is the capital investment by activity and commodity type for King County and Washington. Please refer to Appendix C for an explanation of this matrix and description of each cell.

Table B-14: Capital Investment by Activity and Commodity Type

<table>
<tr><th></th><th>Traditional Recyclables</th><th>Organics</th><th>CDL</th><th>Metal</th><th>Other</th></tr>
<tr><td rowspan="2">Collecting</td><td colspan="3">KC: $54,484,440
WA: $90,502,903</td><td rowspan="2">KC: $0
WA: $0</td></tr>
<tr><td colspan="2">KC: $38,580,829
WA: $72,243,243</td><td>KC: $980,000
WA: $5,629,750</td><td>KC: $6,459,084
WA: $22,051,370</td></tr>
<tr><td>Transporting</td><td colspan="5">KC: $1,616,000
WA: $6,616,000</td></tr>
<tr><td>Processing</td><td>KC: $5,500,000
WA: $8,268,000</td><td rowspan="2">KC: $14,030,000
WA: $41,822,200</td><td rowspan="2">KC: $10,529,000
WA: $43,412,999</td><td>KC: $114,000,000
WA: $130,210,000</td><td>KC: $7,000,000
WA: $7,000,000</td></tr>
<tr><td>Manufacturing</td><td>KC: $5,235,370
WA: $245,150,370</td><td>KC: $163,765,000
WA: $166,805,300</td><td>KC: $5,292,050
WA: $14,272,350</td></tr>
</table>

EMPLOYMENT

Employment for both King County and Washington by activity and commodity type is shown in the following table. Again, please refer to Appendix C for an explanation of this matrix and description of each cell.

Table B-15: Employment by Activity and Commodity Type[5]

<table>
<tr><th></th><th>Traditional Recyclables</th><th>Organics</th><th>CDL</th><th>Metal</th><th>Other</th></tr>
<tr><td rowspan="2">Collecting</td><td colspan="3">KC: 359
WA: 669</td><td rowspan="2">KC: 4
WA: 4</td></tr>
<tr><td colspan="2">KC: 334
WA: 777</td><td>KC: 10
WA: 33</td><td>KC: 97
WA: 257</td></tr>
<tr><td>Transporting</td><td colspan="5">KC: 25
WA: 95</td></tr>
<tr><td>Processing</td><td>KC: 37
WA: 105</td><td rowspan="2">KC: 73
WA: 261</td><td rowspan="2">KC: 72
WA: 257</td><td>KC: 150
WA: 247</td><td>KC: 9
WA: 9</td></tr>
<tr><td>Manufacturing</td><td>KC: 61
WA: 525</td><td>KC: 186
WA: 215</td><td>KC: 54
WA: 166</td></tr>
</table>

OVERVIEW OF EMPLOYMENT AND CAPITAL INVESTMENT

Table B-16 provides a comparison of survey results between King County and Washington. For reference, 2001 population estimates (as reported by the Washington State Office of Financial Management) are also included. According to this table, recycling companies in King County tend to have more employees and capital investment than firms outside of the County (the 31% of the firms that are in King County

[5] Individual cells may not add to the exact totals cited in the text due to rounding.

represent 41% of the employees and over 50% of the capital investment in recycling in the State). Transporters seem to have a disproportionate number of companies in King County, about 63%, compared to the portion of employment and capital investment, 26% and 24%, respectively.

Table B-16: Comparison of Employment and Capital Investment Between King County and Washington

	King County	Outside King County	Total in Washington	Fraction in King County	Fraction in Rest of Washington
Respondent Firms	**118**	**265**	**383**	**31%**	**69%**
Collector/Hauler	67	164	231	29%	71%
Transporter	5	3	8	63%	38%
Final-stage processor	20	50	70	29%	71%
Manufacturer	26	48	74	35%	65%
Employment (FTE's)	**1,470**	**2,150**	**3,620**	**41%**	**59%**
Collector/Hauler	803	937	1,740	46%	54%
Transporter	25	70	95	26%	74%
Final-stage processor	268	350	618	43%	57%
Manufacturer	374	793	1,167	32%	68%
Capital Investment ($)	**$427,471,773**	**$426,512,712**	**$853,984,485**	**50%**	**50%**
Collector/Hauler	$100,504,353	$89,922,913	$190,427,266	53%	47%
Transporter	$1,616,000	$5,000,000	$6,616,000	24%	76%
Final-stage processor	$137,029,000	$51,861,999	$188,890,999	73%	27%
Manufacturer	$188,322,420	$279,727,800	$468,050,220	40%	60%
Material Re-manufactured (tons)	**1,235,417**	**3,231,161**	**4,466,578**	**28%**	**72%**
Population (2001 est.)	**1,758,000**	**4,217,000**	**5,975,000**	**29%**	**71%**

MANUFACTURING FACILITY TYPE

Manufacturing companies were asked to report whether their facility was built to use recycled feedstock, was converted to use it, or uses it without the need for any conversion. The following table shows how many companies gave each response.

Table B-17: Manufacturing Operations and Facility Conversion

	Survey Responses	
Facility type	**King County**	**Washington State**
Facility was built or constructed to use recycled feedstock	6	32
Facility was converted from use of virgin feedstock or from another use to incorporate some or all recycled feedstock	3	21
Facility now incorporates some or all recycled feedstock without the need for facility conversion	12	24

PRODUCT MARKETING

Sixty-four companies replied that they did use recycled-content messages in their advertising.

- 9 companies had the recycling symbol or recycled content information on the product label
- 8 had recycling information on their website
- 8 included a recycling message with their phone book advertisement
- 5 advertised themselves as recycling companies in journals or directories
- 6 used direct sales
- 4 had a recycling symbol on business card or invoices
- 8 mention recycling in their brochure
- 6 didn't answer how they advertised
- 18 used other means including television and print advertisements or recycling was in their name or inherent to their product, such as steel or worm castings.

Of the companies that responded that they did not use recycling for marketing, comments included "(product) markets itself" and "no, but end-users do."

Appendix C – Detailed Methodology

This appendix is divided into two sections: *survey process* and *treatment of specific topics or questions*. The first section discusses the mechanics of conducting the survey and analyzing results. The second section discusses exactly how we counted capital investment, employment, and material use during the survey.

SURVEY PROCESS

Conducting the 2001 Survey of Washington State's Recycling Industry involved the following components:

- **Identifying companies to survey**. The King County Solid Waste Division and Cascadia Consulting Group defined the target population. Company lists were assembled to develop a survey list.
- **Contacting and surveying companies**. Cascadia, with assistance from the WSRA and WRRA, sent surveys to companies on the survey list. Cascadia then conducted follow-up phone calls to encourage participation and verify responses.
- **Storing, tracking, and managing information**. Cascadia developed secure databases to contain survey responses and company information. Strict measures were taken to preserve the security of the information and company privacy. The databases enabled tracking of survey progress for each individual company as well as for the survey as a whole.
- **Analyzing results**. Cascadia developed database queries to compile company responses. Results were tabulated in aggregate form to preserve company privacy.
- **Developing final report**. Cascadia assembled a final report summarizing results with input from the King County Solid Waste Division.

Following is a detailed discussion of each survey component.

IDENTIFY COMPANIES TO SURVEY

The survey targeted companies located in Washington that perform recycling activities.

For this survey, ***recycling*** is defined as "the process by which materials that would otherwise become solid waste are collected, separated, or processed and returned to the economic mainstream to be reused in the form of raw materials or finished products."[1]

This definition guided our efforts to identify appropriate companies.

Define Target Population

This survey targeted companies that collect and haul, transport, process, or re-manufacture recyclable materials. The activities conducted by target companies must be considered recycling, as defined above. Company types that were included in the survey pool and the reasons they were included are described below in Table C-1. Many companies perform activities that are similar to recycling (in that they divert materials from the waste stream to other uses) but do not meet the criteria for this

[1] This definition is the same as that used in the 1992 and 1995 surveys.

survey. Company types that were excluded from the survey are outlined in Table C-2. Also excluded from the survey were public sector agencies.

Table C-1: Company Types Included in Survey Population

Type of Company	Reason for Inclusion
Collectors and Haulers	These companies collect recyclable materials from residential, commercial, or industrial services.
Transporters	These companies are typically hired by another company specifically to transport recyclable materials.
Final-stage processors	These companies transform recyclable materials into feedstock for manufacturing.
Manufacturers	These firms utilize recycled materials as a feedstock in manufacturing products.
Material Brokers	These (typically small) companies are vital to the recycling industry, and are performing a material procuring service that would otherwise be provided by a processor or manufacturer. They have created a market niche where they can actually advocate for recycling. These companies typically have very low capital investment (no trucks, equipment, etc.). We have classified them as collector/haulers in most cases.
On-site chippers or grinders of woodwaste or concrete	These companies are providing services that keep material out of landfills. They are classified in this survey as processors. However, smaller landscaping companies that may haul material for composting but primarily do landscaping/pruning are excluded.
Appliance Recyclers	Appliance refurbishing or resale is not a recycling activity. However, a small number of companies specialize in collecting appliances of any quality for recycling. Although some may be refurbished or used for parts, many are sold for scrap metal.
Tire Re-treaders	Tire re-treading is not itself a recycling activity, but these companies often serve as collectors of tires for recycling. If they collect tires, sort them according to best use, and sell many to final-stage processors or re-manufacturers, the companies are considered recycling companies, and classified as collector/haulers.

Table C-2: Company Types Excluded from Survey Population

Type of Company	Reason for Exclusion
Hazardous Waste "Recyclers"	The survey focuses on materials that would otherwise become solid waste. Hazardous wastes are banned from the solid waste stream.
Material Generators	These companies are only tangentially involved in recycling, as they do not handle the materials as a business activity.
Retailers	Many retailers (such as auto parts stores, mailbox centers, etc.) take items from the public to be recycled. However, they do this as a convenience rather than as a primary business activity.
Re-users or Refurbishers	Many companies re-use items without transforming them. Some examples are re-filling toner cartridges or re-treading tires.
Re-sellers	Items are re-sold without any processing or transformation. Examples include thrift stores; used appliance stores; used computer stores; used building material stores.
Salvagers	Similar to re-users and re-sellers, salvage yards may yield metal for recycling, but their primary business activities involve re-sale and re-use. Auto salvagers are also excluded because vehicles are not part of the solid waste stream.
Landscaping companies & tree pruners	Their primary service is yard work. Although they do haul wood and yard waste away to be composted, 1) they are actually hauling waste generated from their own activities, and 2) hauling it is secondary to their main business activity. Possible exceptions include (usually larger) companies for which shredding or chipping woodwaste for mulch is a primary business activity.
Recycling equipment manufacturers	Although equipment manufacturers may make equipment to perform recycling activities, they do not themselves perform recycling activities.
Recycling industry consultants	Do not perform recycling activities.
Users of recycled products	Such companies may cut, stamp, reassemble, etc. the recycled products into another product, but rather than transforming a feedstock, they are manipulating a product. Some definitive examples include: • Daily newspapers buy rolls of recycled paper, but do not themselves make paper. • Furniture makers may buy wheatboard or recycled lumber to use in their products, but those items are already considered products for the purpose of this survey.
Demolition Contractors	Firms that are contracted to demolish buildings are hauling a waste that they themselves generated. These firms are not included unless they also provide specific hauling services to other contractors.

Develop Survey List

Once the survey population was defined, Cascadia began assembling lists of appropriate companies located in Washington. The following process was used to develop a working list of recycling companies in Washington.

1. We started with membership lists from the WSRA and WRRA that were believed to take part in recycling. This list of WSRA and WRRA members contained 344 companies.
2. From NameFinders, a list provider, we received a list of all companies described by the following SIC code categories. This list included 409 companies.

SIC Code	Description
26110302	Pulp manufactured from waste or recycled paper
30690606	Reclaimed rubber (reworked by manufacturing
42129906	Garbage collection and transport, no disposal
49530201	Garbage: collecting, destroying, and processing
49530203	Rubbish collection and disposal
49539905	Recycling, waste materials
50930000	Scrap and waste materials
50930100	Waste paper and cloth materials
50930105	Waste paper
50930200	Metal scrap and waste materials
50930201	Ferrous metal scrap and waste
50930202	Nonferrous metals scrap
50939903	Bottles, waste
50939904	Junk and scrap
50939906	Plastics scrap
50939907	Rubber scrap

3. We obtained the Clean Washington Center survey list from a 1993 survey they did as a follow-up to the King County 1992 survey. This list included 130 companies.
4. The Department of Ecology's 1-800-RECYCLE database of recycling collectors throughout the state was aquired. This list included 525 companies.
5. We compiled the above lists to create a master list. We eliminated any duplicates. We also eliminated companies that belonged to one of the company types listed in Table C-2.
6. To supplement the resulting list, we consulted a number of other sources, including the Washington Department of Ecology's annual survey list of recyclers, the King County Construction Recycling Directory; recycling businesses listed by the Business and Industry Resource Venture; a list of plastics processors compiled by the American Plastics Council; the member list of the Washington Organic Recycling Council; and listings of paper, steel, and aluminum mills available through Reference USA, an on-line database of businesses.

7. After adding companies from these other sources, in Step 6, and eliminating duplicates and other companies clearly not compatible with our target population, 714 companies remained.

In summary, the initial population of 714 companies was developed from the following sources:

- Washington State Recycling Association (WSRA)
- Washington Recycling and Refuse Association (WRRA)
- King County Construction Recycling Directory
- Washington Organic Recycling Council (WORC)
- Business and Industry Resource Venture (BIRV)
- American Plastics Council (APC)
- Clean Washington Center (CWC)
- ReferenceUSA (an on-line database of businesses, organized by SIC code)
- NameFinders (a provider of SIC-based lists)
- Washington State Department of Ecology (1-800-RECYCLE list and annual recycling survey list)

CONTACT AND SURVEY COMPANIES

Develop Survey Instrument

The survey instrument was developed based on those used in the 1995 survey. For that survey, two separate survey forms were used: one primarily for collector/haulers and transporters, and another primarily for final-stage processors and manufacturers. For 2001, the two were integrated into a single form, included as Appendix A. Use of a single form eliminated the need to know, before sending the survey, what activities a company performed.

As part of the design process, a draft of the survey instrument was circulated to three members of the WSRA and three members of the WRRA. These members provided valuable input and suggestions for making the survey clear and increasing company participation.

Sending Surveys

Surveys were sent in three waves, beginning in February 2002. The first wave of surveys went to Washington State Recycling Association and Washington Refuse and Recycling Association members. Surveys were sent by U.S. mail to members of the WRRA. Surveys were sent mostly by e-mail to members of the WSRA.

The second wave of surveys was sent to all known recyclers in the 206, 425, and 253 area codes that were not members of the WSRA or WRRA. This mailing was sent to 287 firms.

The third wave of surveys was sent to all other recycling companies in the State. Most of these companies were located in the 360 and 509 area codes, but surveys were also

sent to several companies that did not receive them in the second wave because we did not yet know of their existence. In this wave, 274 surveys were sent by U.S. mail.

Finally, a relatively small number of surveys were sent out via e-mail, fax, and U.S. mail between the large mailing waves. Such surveys were sent as the interviewers conducted the follow-up phone survey and needed to resend surveys that did not reach the correct person at each company. Additionally, we sent some surveys to individual companies as we learned of them from other companies.

Follow-up Phone Survey

Beginning about one week after the first wave of surveys was sent, staff interviewers began calling businesses to make sure the survey reached the correct person. Once the interviewers reached the correct person, they first made sure that the business handled recyclable materials or manufactured products using recycled feedstock. Businesses that were not involved in recycling were omitted from the survey list.

If possible (and the company contact was willing), the interviewer completed the survey over the phone. Otherwise, the interviewer asked if the contact had any questions, and encouraged him or her to return the survey as soon as possible. The interviewer sent a new copy of the survey when necessary.

Data from paper or emailed surveys were entered into the database extension. The interviewer reviewed the surveys for any inconsistencies or omissions. All companies received a follow-up call to verify responses and, if necessary, explain definitions. If any answers were blank or questionable (for instance, if capital investment was not reasonable given the reported number of employees), these concerns were addressed in the follow-up telephone call. After this verification, the survey was considered complete.

Interviewers logged their calls with brief notes in the database. This process enabled them to make timely follow-up calls to company contacts that were still completing their surveys. Companies were considered non-respondents if no survey was returned and the interviewer had made at least three reminder calls to the contact.

Frequently, in the process of interviewing a company, the interviewer learned of other recycling companies not already in the survey list. New companies were added to the list and sent a survey. This was particularly common when discussing material flows between processors and manufacturers.

STORE, TRACK, AND MANAGE INFORMATION

Cascadia developed a data management system in Microsoft Access to store, track, and manage information.

Before the survey began, Cascadia developed a database to house all company contact information. A separate database extension was developed to contain company responses. This database extension did not contain any information to identify the company respondent. The two databases were kept on separate servers, and both were secure and accessible only by the Cascadia staff directly responsible for the survey. Company contact information in one database was only linked to confidential responses in the database extension via a random, unique ID number. This method ensured that company responses stored in the database extension were secure and anonymous.

As the survey progressed, the database and extension allowed for constant tracking of survey progress. Database queries allowed monitoring of progress on each individual record as well as on the number of companies completed and still remaining to survey.

The database extension, containing all survey responses, was destroyed after analysis was complete.

ANALYZE RESULTS

Classify Companies

Companies were classified according to firm type and commodity type. Firm types included collector/hauler, transporter, processor, and manufacturer. Commodity types included the following:

- **Traditional Recyclables** – Materials such as paper, plastic, glass, and tires. Metals, another traditionally recyclable material, is considered as its own category.
- **Organics** – Materials generated mostly by residential and commercial sources used to make mulch or compost.
- **Construction, Demolition, and Landclearing (CDL)** – Materials generated by construction, demolition, and landclearing activities. These materials commonly include concrete and asphalt, gypsum, and woodwaste.
- **Metals** – Ferrous or non-ferrous metals, including steel, iron, aluminum, and some others, in small amounts.
- **Other** – Other materials not easily classified, especially industrial byproducts.

Classifying companies into the following matrix was an effective way to analyze results for different types of companies. The matrix originally consisted of 20 cells since it includes 5 commodity types and 4 activity types. To accommodate different types of companies, some cells were merged, and others divided, to create the resulting matrix of 14 cells. Companies were assigned to a cell according to the combination of activity and commodity types their recycling operations involved. All analyses were conducted by adding up totals from the appropriate cells.

Matrix of Activity and Commodity Types

<table>
<tr><th></th><th>Traditional Recyclables</th><th>Organics</th><th>CDL</th><th>Metal</th><th>Other</th></tr>
<tr><td rowspan="2">Collecting</td><td colspan="3">Collect/haul and/or sort some combination of traditional recyclables, organics, CDL, and metal. General haulers and materials recovery facilities.</td><td rowspan="2">Collect or broker industrial by-products or other materials.</td></tr>
<tr><td colspan="2">Collect and haul traditional recyclables and organics, such as yardwaste.</td><td>Collect, haul or sort CDL waste (not from their own projects).</td><td>Scrap metal dealers that collect and sort recyclable metals.</td></tr>
<tr><td>Transporting</td><td colspan="5">Transport recyclable materials between recycling collectors, processors, and manufacturers as a primary business activity.</td></tr>
<tr><td>Processing</td><td>Process materials such as glass, tires, or plastic to create manufactur-ing feedstock.</td><td rowspan="2">Make compost or mulch from food waste, yardwaste, and/or manure.</td><td rowspan="2">Process materials and create new products from concrete/ asphalt, roofing materials, or gypsum.</td><td>Shred or grind metals to prepare for manufactur-ing.</td><td>Process industrial byproducts or other materials.</td></tr>
<tr><td>Manufacturing</td><td>Create products using glass, tires, plastic, or other traditional recyclables feedstock.</td><td>Melt down steel, aluminum, and other metals to create products.</td><td>Use industrial byproducts (not their own) or other materials to create new products.</td></tr>
</table>

In particular, the above matrix was an effective way of organizing companies that were both processors and manufacturers. For instance, processing and manufacturing for organics and CDL materials were frequently accomplished by the same companies, and even the same processes. Results from organics processors and manufacturers were included in the manufacturing sector since compost is a finished product. Alternately, results from CDL processors and manufacturers were included in the processing sector to maintain consistency with the previous surveys. However, the output of most CDL processing is also a finished product (crushed concrete for roadbed, ground wood for mulch) so material use is reported as material re-manufactured.

For survey results corresponding to each cell in the above matrix, see Appendix B.

Convert Results to Tons

When companies reported volume rather than weight for material quantities, those were converted to pounds, then tons, using the following conversion factors.

Volume-to-Weight Conversion Factors[2]

Material Type	lbs/cubic yard	Source
Asphalt	1,215	FEECO
Composition Shingles	419	CIWMB
Concrete	2,700	FEECO
Dirt	1,890	FEECO
Manure	1,628	FEECO
Sawdust	375	Tellus
Stumps & Logs	1,080	SD
Woodwaste	330	SD
Yardwaste	400	SD

PREPARE FINAL REPORT

The report was prepared by Cascadia Consulting Group. As previously mentioned, the database extension, which contained all company responses, and the surveys, physical and electronic, were destroyed before publication of the final report.

TREATMENT OF SPECIFIC TOPICS OR QUESTIONS

CAPITAL INVESTMENT

Capital investment in recycling is defined as the original cost of all structures, land, equipment, machinery, and vehicles required to collect, transport, or process recyclable materials or to manufacture products using recycled feedstock in 2001.

More specifically, *capital investment in recycling* includes the cost of each item that satisfies both of the following conditions:

1. Without the item, the surveyed companies would not be able to collect, transport, or process recyclable materials. In the case of manufacturers, without the item the company would not be able to use recycled feedstocks.
2. The item is devoted to recycled materials or feedstocks at least part of the time.

[2] **Data Source Abbreviations**

FEECO refers to "FEECO International Complete Systems and Equipment Handbook," 9th printing.

CIWMB refers to "Conducting a Diversion Study - A Guide for California Jurisdictions," March 2001, California Integrated Solid Waste Management Board.

Tellus refers to Tellus Institute, Boston, Massachusetts
SD refers to conversion factors developed by Cascadia Consulting Group for a waste composition study in San Diego, California in 2000.

The second condition is intended to exclude manufacturing processes that are never devoted to using recycled feedstocks, even though they may always use some (usually small) percentage of recycled feedstock.

Some manufacturers may use recycled feedstock as a matter of convenience, cost, or image, but their facilities are not devoted to using recycled feedstock. In this case the company's investment in recycling is only the cost of the equipment necessary for using the recycled material as a feedstock, not the factory as a whole (likewise with employees.) Such companies are product-focused, and would keep making their product, possibly out of 100% virgin material, regardless of the availability of recycled feedstock. However, some companies are more resource-focused. They are in business to make things out of recycled materials. What the products are doesn't matter as much as what feedstock they are using to make them. One company, for example, is in business to make things out of recycled plastic. They have decided to make certain products, but the specific products aren't the focus as much as recycled plastics are. So we counted all of their investment as capital investment in recycling and count all their employees. On the other hand, suppose another company is in the business of making a very similar product, and when economical, they use recycled feedstock. Their capital investment in recycling is very small - only the equipment (and employees) they use to prepare recycled feedstock for use in their manufacturing line would be counted.

Leased Structures, Land, Equipment, Machinery, or Vehicles

Many surveyed recycling companies lease some or all of the items used in their recycling operations. Although not strictly capital investment, these items are contributions to the State's economy much like purchased items. For leased items, we asked the monthly or annual cost and inquired as to how long they had leased each item. For example, suppose that John Doe's Recycling leases a truck for $20,000 a year, and has been doing so for 6 years. The capital investment in this item was recorded as $120,000.

Items that are Also Used for Activities Other Than Recycling

For all firm types, if an item is also used for activities that do not count as recycling, then the cost of the investment is pro-rated to reflect the fraction of the time it is used for recycling. If only part of an item (such as a building) is used for recycling, then only that fraction of the item is counted. Note that this does not apply to manufacturing lines that failed the second condition, above, because they are never devoted to recycling.

For example, a company for which recycling is a relatively small component might have a large building to house all of its activities. However, only a fraction of the building is necessary for the company to carry out its recycling activities. For this reason, we inquired about what fraction of the building is used for recycling, and recorded a proportional cost. If a company has a $1 million building, but only 25% of it is used for recycling, we considered their recycling capital investment in this building to be $250,000. Similarly, if a piece of rolling stock costs $50,000 and is used 75% of the time to prepare waste products for hog fuel (a non-recycling activity) and is used 25% of the time to prepare waste products for recycling markets - then only 25% of the capital investment was counted as an investment in recycling.

EMPLOYMENT

Employment in recycling is defined as the number of positions directly involved in recycling at the company. Using full-time equivalents (FTE), positions were scaled down according to what portion of their time was spent dealing with recyclables or supporting recycling. For instance, if a forklift driver spent half of his/her time moving recyclable materials and the other half dealing with new materials (or conducting non-recycling activities such as preparing wood for hog fuel), they were included as 0.5 units.

For manufacturing companies that used some portion of virgin materials, employees were only included if they worked directly sorting or processing the recyclable materials. Employees working on a production line where recyclable feedstock and new materials are mixed were generally not included. However, if the company was devoted almost entirely to recycled materials, than all production employees were counted.[3]

If the company's only activity was recycling, all the employees, even administrative and managerial, were included. The companies were asked to report employment at the beginning and end of 2001. If the company used seasonal labor, those jobs were averaged out over the year. Likewise, if recycling operations only occurred for a portion of the year, those positions were averaged across the entire year.

MATERIAL USE

Final-stage processing and manufacturing companies were asked for quantities of materials processed for recycling or recyclable feedstocks used to manufacture new products. [4] If, in addition to processing recyclables, a processing company collected and sorted other materials, only the processed recyclable material quantities were included. Quantities of wood processed for hog fuel were not counted, as this is not considered a recycling activity.

In order to avoid counting the same quantities more than once, and also to verify that we included all appropriate companies in our database, processors were asked what to which manufacturing companies they sold feedstock and manufacturing companies were asked from which company they bought their recycled feedstock. Frequently, companies would not give the names of their suppliers or buyers, and so were encouraged to at least give quantities of materials recycled.

Several materials commonly hauled by recyclers were not considered recycling in this survey. Final-stage processing or re-manufacturing of the following materials were not recorded. Furthermore, capital investment and employment levels were scaled down according to the fraction of time each was devoted to any of the following:

- Wood for hogged fuel;
- Auto bodies;
- Hazardous materials; or
- Any other material that was handled in a way that did not meet our definition of *recycling*, as defined on page C-1.

[3] For further discussion of the intricacies in counting employees and capital investment in the manufacturing sector, see the *Capital Investment* section above.
[4] Material scraps generated by the manufacturing process and re-used or recycled internally (within a company) were not included.