



**King County**

Department of Natural Resources & Parks

Solid Waste Division

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# Waste Monitoring Program

Market Assessment for Recyclable  
Materials in King County

Final Report

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# Chapter 1

## Introduction

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### 1.1 MARKET ASSESSMENT GOALS

The King County Solid Waste Division commissioned Cascadia Consulting Group to conduct this study of markets for recyclable materials generated in the county. This assessment is intended to help the County identify opportunities, establish priorities, and guide programs for market development and increased diversion of recyclable materials from the waste stream. This 2006 study will support King County and the cities' waste reduction and recycling efforts and will be used to help guide the 2007 Comprehensive Solid Waste Management Plan Update.

### 1.2 RECYCLABLE MATERIALS ADDRESSED

This study is an update to similar studies completed in 1998 and 2004, both of which were also completed by Cascadia Consulting Group. We include updated information on all materials studied in 2004, with the addition of gypsum wallboard. Following is a listing of the materials included in this report, with the corresponding chapter number in parentheses:

- **Electronics** (Chapter 4) – includes glass, metals, plastics, and flat-panel displays (a type of computer monitor) obtained from processing used electronic equipment;
- **Glass** (Chapter 5) – includes glass bottles and other containers;
- **Gypsum** (Chapter 6) – includes gypsum wallboard.
- **Metals** (Chapter 7) – includes scrap metal, aluminum cans, and steel food cans;
- **Organics** (Chapter 8) – includes food waste, yard waste, and compostable paper;
- **Paper** (Chapter 9) – includes newspaper, cardboard/kraft (OCC), and mixed paper;
- **Plastics** (Chapter 10) – includes PET bottles, HDPE bottles, other plastic containers, and plastic bags/film;
- **Textiles** (Chapter 11) – includes clothing and some other fabrics; and
- **Wood** (Chapter 12) – includes recyclable urban wood, such as dimensional lumber, engineered wood, manufacturing scrap, pallets, crates, and other wood materials; and

Each material-specific chapter addresses the market conditions for the material (including information about supply and demand), discusses barriers and opportunities concerning the recycling of each material, and recommends opportunities for public sector action.

In addition to each material-specific chapter, the report begins with two overview chapters (in addition to this introductory chapter) that look across these multiple materials to examine markets, assess needs and opportunities, and make recommendations. These next two chapters are:

- **Overview of King County Recyclables** (Chapter 2) provides an overall summary of King County markets for recyclables, including current and future supplies, value of recyclables, and key findings on market dynamics and trends.
- **Market Assessment Findings and Recommendations** (Chapter 3) examines by specific material, the needs and opportunities for market development as well as the public sector's ability to influence the recycling marketplace. This chapter summarizes the key results of the market assessment and presents both overall and material-specific recommendations for King County action.

## **1.3 STUDY METHODS**

Cascadia Consulting Group collected a range of data on supply and demand conditions for the various material classes and specific materials. Our research included a literature review of industry-focused journals as well as a review of previous studies related to recycling markets. Cascadia also conducted interviews with company leaders and other industry experts to obtain insights into market trends, needs, and opportunities for recycling of these materials.

The findings presented in this report are based on our interviews with recyclers, processors, and end markets; analysis of available supply data; King County projections of waste disposal; and a literature review. The findings provide the foundation for the analysis of barriers and opportunities as well as for the identification and assessment of opportunities for public sector action. Our overall priority assessment of materials, as detailed in Chapter 3, is based on considering each material's relative need or opportunity for market development and the relative ability of King County and its partners to influence each material's supply chain.

Unless otherwise noted, all quantity data pertains to King County excluding Seattle and Milton but including all other cities in the county.

## Chapter 2

# Overview of King County Recyclables

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This chapter provides an overview of the quantities and value of recyclable material generated in King County. It also describes key findings on market dynamics and trends for recyclables generated in King County.

### 2.1 LOCAL SUPPLY OF RECYCLABLE MATERIAL

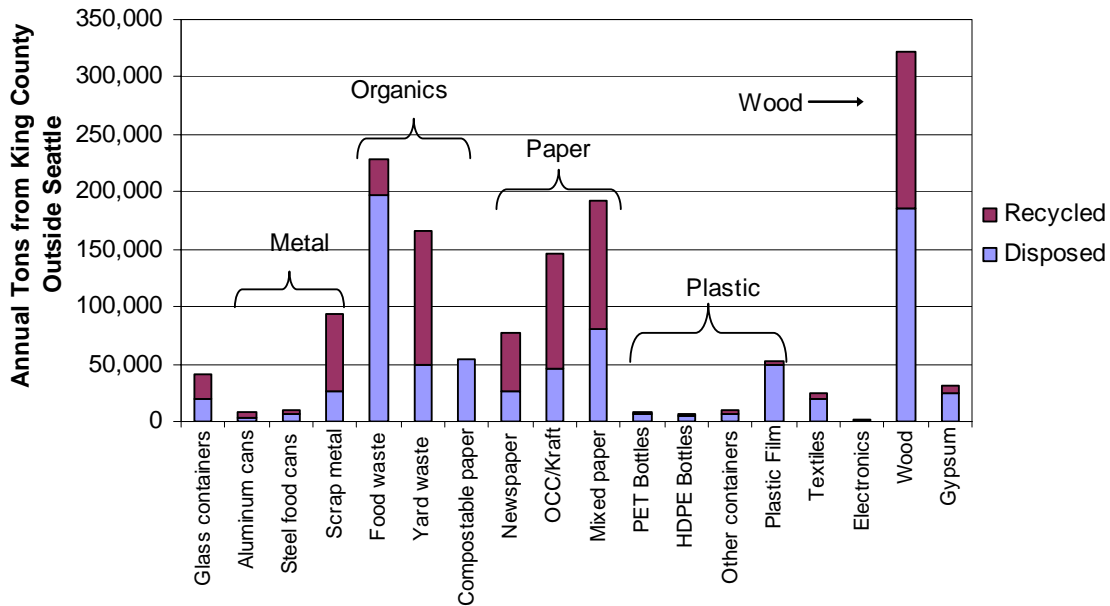
As shown in Figure 2-1, King County (outside Seattle) generates more than one million tons each year of the nine major materials covered in this study: electronics, glass, plastics, metals, organics, paper, wood, textiles, and gypsum. Of that total, over 500,000 tons are estimated to be recycled<sup>1</sup>, while more than 800,000 tons are estimated to be disposed. The quantities recycled and disposed vary considerably by material. As displayed in the following chart, the material with the single greatest quantity still disposed is food waste, with between nearly 200,000 tons estimated to be disposed in 2005.

Disposal figures in this chart were provided by King County Solid Waste Division and are calculated based on 2002 waste composition data applied to King County's waste disposal forecasts. Recycling estimates are from hauler data provided by King County, interviews conducted as part of this study, and projections made on estimates from 2003, the previous time this markets study was conducted.

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<sup>1</sup> For this chart, the term "recycled" includes wood diverted for use as hog fuel, a use that in some cases is not counted as "recycling."

**Figure 2-1. Recycling and Disposal of Major Materials Generated in King County<sup>2</sup> (excluding Seattle)**



## 2.2 VALUE OF RECYCLABLE MATERIAL FROM KING COUNTY

Recyclable materials have value in the marketplace – in fact, most are commodity materials with well-established markets. The value of each material depends in part on how much processing has occurred. As materials are sorted, cleaned (if necessary), and processed into feedstocks, the value continues to increase. Accordingly, identifying a single market value for each material can be difficult. Nevertheless, it is useful to estimate the total value of disposed recyclables because these materials represent lost opportunity to capture that value and support King County’s economy while also supporting King County’s waste reduction and recycling goals. Estimates conducted earlier this year by Sound Resource Management<sup>3</sup> place the value of disposed recyclables in King County between \$46.6 million and \$77.2 million, depending on routine price fluctuations in recyclable commodities. For that analysis, Sound Resource Management chose to use prices paid to Puget Sound area processors for recyclables that have been collected from households, businesses, or institutions and cleaned, processed, and packaged to recycling market specifications.

This *Market Assessment* study did not estimate the value of every disposed item like Sound Resource Management’s analysis did. Nevertheless, all of the more-valuable materials were covered in both analysis, and so estimates should be comparable. Based on current market prices, our estimates indicate that the current value of the disposed recyclables analyzed in this report is over \$40 million, consistent with Sound Resource Management’s estimates; further discussion of methods to estimate value are

<sup>2</sup> For this chart, the term “recycled” includes some end uses that may sometimes instead be considered “diversion” such as wood diverted for use as hog fuel or re-used textiles.

<sup>3</sup> Sound Resource Management submitted a memo to King County in January 2006 estimating the market value of King County’s disposed recyclables.



included in Appendix A. The individual material chapters in this report will further describe the prices received for individual commodities.

## 2.3 KEY FINDINGS ON MARKET TRENDS & DYNAMICS

King County's recycling industry has matured to the point where, in most cases, little or no market development assistance is needed from the public sector to find markets or keep materials moving. In general, King County and city efforts can focus on increasing supply, addressing quality concerns (especially if occurring at the point of generation), and helping to maximize the value of materials to increase the cost-effectiveness of the recycling supply chain relative to disposal.

Key findings about specific materials can be found in the material-specific chapters, while Chapter 3 presents our recommendations about priorities for King County. However, our analysis also reached the following broad conclusions regarding market trends and materials.

- **For nearly all materials studied, market demand is high enough to support any increase in material from King County.** King County need not worry about the market's ability to absorb material. In general, the recycling industry monitors growing supply and new emerging recyclables (such as e-waste) to expand or develop processing capacity and identify markets. The exception to this trend currently in King County is gypsum wallboard, for which demand is lower than supply.
- **Asia continues to grow as a major market destination.** Asia is the dominant market for paper and plastics, is a growing consumer of metal, and is sometimes a destination for e-scrap. Contacts interviewed for this study (and the literature reviewed) suggest that demand in Asia will continue to be strong for at least the next 5 to 10 years.
- **Heavy and bulky materials tend to stay local.** Glass and organics stay almost exclusively in King County, and all urban wood stays in western Washington. In addition, large quantities of scrap steel are marketed to Nucor Steel in Seattle.
- **Recyclables handlers (MRFs) could sometimes gain higher value for materials they market.** Many materials can be marketed as different grades for different prices. The question for MRFs, however, is whether the additional cost (primarily associated with labor) needed to produce higher-value materials can be recouped by the higher price obtained. Particularly for glass and paper, the answer has often been "no". For example, a large portion of King County's glass is going to construction applications for no cost, while paper is increasingly being marketed as Mixed Waste Paper instead of being sorted into higher grades. Also much of the region's newspaper is marketed as #6 or #7 instead of the higher-value #8.
- **Higher-value niche markets can be developed locally.** For many materials, higher-value niche markets can capture a portion of the local supply for recyclable materials and increase their value beyond what is offered in standard commodity markets. King County's LinkUp program has helped numerous companies make products out of recyclable materials. Accordingly, this assessment identifies niche market opportunities for organics (particularly food waste), urban wood, computers, and the paper backing from gypsum wallboard.

- **Increased recycling opportunities at transfer stations would help boost material supply to strong markets.** Yard waste and metal are disposed in significant quantities at King County transfer stations, yet both also have strong and stable markets. Transfer station upgrades to collect more of these and other recyclables with strong markets could benefit the recycling industry and support progress towards King County's waste reduction and recycling goals.

## Chapter 3

# Market Assessment Findings and Recommendations

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One of the primary goals of this project has been to help King County and the cities identify opportunities and establish priorities for market development and increased diversion of recyclable materials from the waste stream. In this chapter, we present our assessment of priority recyclables and opportunities for King County and the cities to pursue.

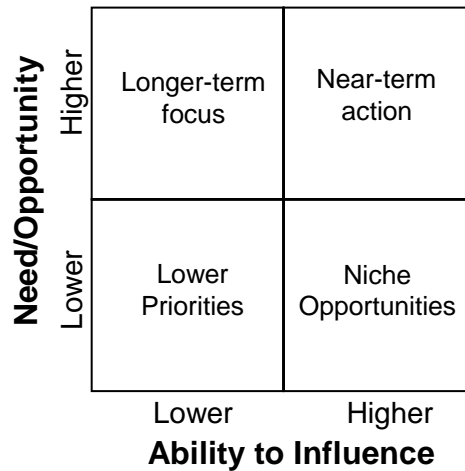
### Approach and Criteria

As in previous market assessments conducted for King County, we have assessed options and materials based on criteria concerning the need or opportunity for market intervention and the ability of King County to affect the marketplace. For this study, these criteria are defined as follows:

- **Need/opportunity** is a measure of the market development *needs* (such as large or toxic quantities of material being disposed or low market demand) and *opportunities* (such as the potential to create significant new value or substantially increase supply or demand). We have not assigned sub-criteria to this attribute nor attempted to rate each material quantitatively.
- **Ability to influence** is a measure of the degree to which King County and its partners can affect the markets or supply chain for a material in the near term.

Our current analysis focused on a qualitative assessment of each material against the *need/opportunity* and *ability to influence* criteria. In addition, as in past years, we use a quadrant chart to help categorize the materials into different priority groups. Materials that rate high on both the *need/opportunity* and *ability to influence* criteria are strong candidates for King County involvement, while materials that receive lower ratings may still provide niche or long-term opportunities. The following chart depicts this chart and displays the four categories (each represented by a quadrant) used in our analysis.

**Figure 3-1. Assessment Quadrant Used in Analysis**



Assignment of a material into each of the four categories was performed based on consideration of the *need/opportunity* and *ability to influence* criteria and was performed by the consultant team, including participation by all staff who conducted research on each material. In some cases, a material may fall into more than one quadrant if different strategies for that material affected the ratings it received. Following are definitions for the four quadrants.

- **Near-term action** are materials where there is a high need or opportunity (often because there are distinct, tangible possibilities not being fully utilized) and where the County and its partners have a high degree of ability to influence the marketplace (often because the markets are highly local). Our assessment concludes that these are materials where public sector action is likely to have an important impact on the supply chain for recyclable materials in King County.
- **Niche opportunities** are strategies that would have little marginal benefit to increase the quantity of recycling in the county but could create significant new, added value out of recycled material due to distinct, tangible opportunities available locally. Such opportunities could help with economic development and job creation.
- **Longer-term focus** are materials where a significant fraction of the supply is still disposed or for where global markets are lagging, but for which the County and its partners must take a longer-term, incremental approach to improving supply or end markets. Such materials have a high *need* or *opportunity* but a low *ability to influence* in the near term. Materials in this category are generally materials where markets are global and where there are fewer feasible, tangible opportunities.
- **Low priorities** are materials where there is relatively little need or opportunity to improve markets and where King County and its partners have little ability to affect any such changes. King County would benefit by continuing to monitor developments in the supply chain for these materials but the likely benefits relative to the cost and effort are low. Accordingly, we do not recommend any immediate agency action for these materials.

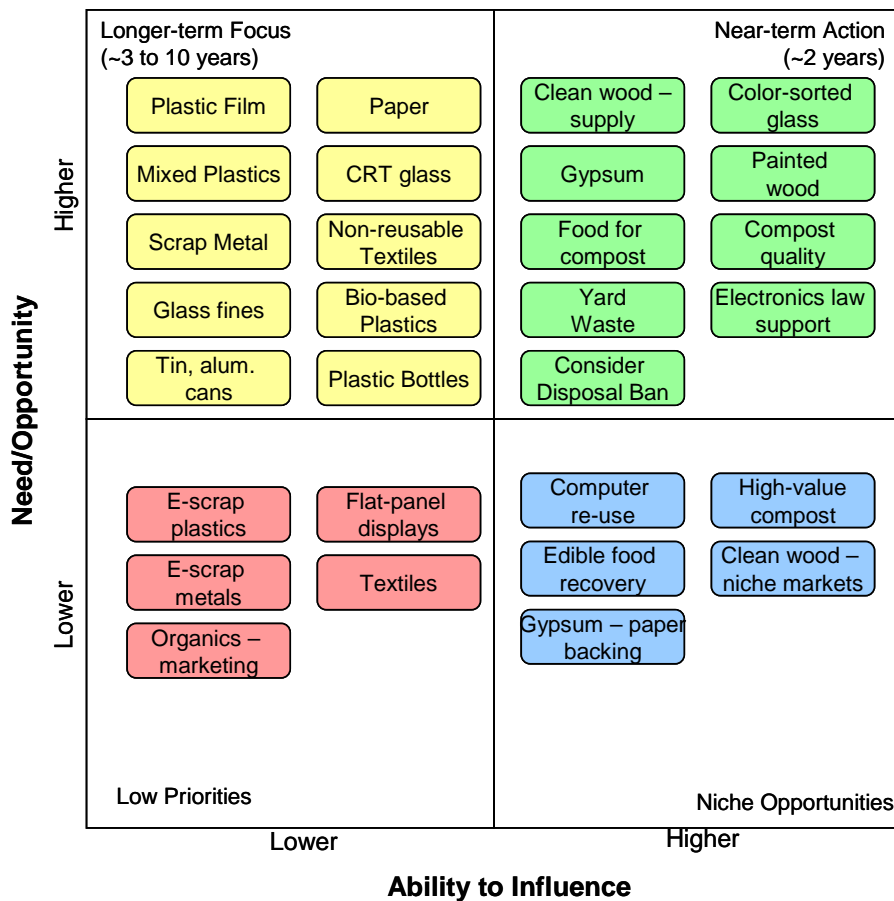
One potential policy that could have clear benefits for increasing recycling of many materials is a disposal ban or mandatory recycling ordinance. Such a policy could have

particular benefits for materials in the *longer-term focus* and *lower priority* categories, for which most other recent efforts to increase recycling have been only marginally successful. Although a full assessment of a disposal ban or mandatory recycling ordinance was beyond the scope of this study, they are important policies to consider and have the potential to override the low *ability to influence* rating of many materials.

## Market Assessment Results

Our assessment classified several materials into each of the four categories. The following chart summarizes our assessment of materials.<sup>4</sup>

**Figure 3-2. Summary of Market Assessment Results**



## Near-term Action

We have identified the following materials or options as strong candidates for action by King County and its partners, presented in no particular order:

- Maximize the potential for color-separated, bottle-to-bottle glass recycling:** Seattle bottle-maker Saint-Gobain Containers is unable to meet its demand for recycled cullet, despite the fact that plenty of material exists locally.

<sup>4</sup> The relative placement of materials in the chart is not intended to reflect relative priority.

Factors responsible include the relatively poor quality of glass produced through single-stream collection and processing; the limited and nearly outdated optical sorting equipment at Fibres, and apparent lack of cooperation between local parties. Although glass collected from King County is not disposed (much of it goes to construction applications), we conclude that there is an opportunity to increase the value of glass in the local economy and achieve other environmental benefits such as reduced energy use at Saint-Gobain Containers. Accordingly, there may be a strong opportunity for King County and its partners to convene a glass “summit” and invite all stakeholders (including haulers, processors, and end users) to create solutions that increase glass-to-glass recycling in the County. In particular, a shared-cost approach to capital upgrades in optical glass sorting technology (and perhaps also at MRFs) could benefit all parties.

- **Proceed with a residential and/or business disposal ban on paper, plastic bottles, and aluminum and steel cans.** The consultant’s analysis suggests that markets are strong, stable, and could support a ban for plastic bottles, aluminum and steel food cans, and recyclable paper. Markets for glass bottles and non-bottle plastic containers could also likely support increased quantities, although a ban may not be appropriate at this time due to uncertainties in the market supply chains for these materials. In addition, care should be taken to clearly define and communicate what materials are recyclable so that a ban does not lead to increased contamination.
- **Improve supply of clean urban wood.** Significant quantities of clean urban wood remain in the waste stream and markets for the material are strong. Options under discussion by King County’s Wood Markets Planning Team as of June 2006 include a disposal ban on clean urban wood, financial incentives for wood recycling, expanded space at transfer stations for recycling and reuse, and technology to neutralize CCA-treated wood.
- **Monitor and facilitate smooth implementation of RCW 70.95N, the Electronic Waste Recycling Act, in King County.** RCW 70.95N is likely to dramatically increase recycling of used electronic products in King County and throughout Washington State. Although responsibility for implementing RCW 70.95N has been assigned to manufacturers, King County can still take an active role to ensure smooth implementation for local recyclers and material generators. King County could monitor the emerging details of the law’s implementation to determine unintended consequences, provide assistance to local recyclers, support marketing efforts, as needed, and work with the Department of Ecology and other partners to ensure that recycling of electronic material under the bill meets environmental and health standards. King County can also assist in promoting the new recycling opportunities available under the bill to residents and businesses.
- **Increase food recycling for compost.** Markets for compost are strong in King County and the region, and providing increased feedstocks to the composting industry can both divert material from the waste stream and create value. Food is still a major component of the waste stream, and King County and several cities have been leaders in providing curbside food recycling options for residents as part of the already-offered yard waste collection. Despite this improved access to curbside food, few residents take full advantage of the

opportunity. King County could launch a regional outreach campaign to increase awareness and encourage residents to participate.

- **Monitor and promote compost quality.** Monitoring local compost products for consistency and quality and publicizing results could help expand the market for higher value, high quality compost products and help encourage healthy competition. Some landscapers and home gardeners express dissatisfaction with the texture, consistency, nutrient, and microbial life of locally made composts. While our assessment doesn't indicate this is a major concern, there is clearly an opportunity to offer these consumers a higher-quality product. Accordingly, all local compost products could be monitored for consistency and quality. Publicizing the results would create competition among processors to increase their product rankings. Data should be made available to the public on how the different brands score in terms of presence of microbial life, heavy metal content, and pesticide residue in compost products. Increased product quality could translate into higher value, potentially raising more revenue for local composters and allowing them to decrease tip fees, thus decreasing the cost of recycling and increasing cost-effectiveness relative to disposal.
- **Develop options for painted wood.** Few markets exist for painted and stained wood. With sufficient emissions controls, some painted wood can be used in hog fuel boilers, but the investments required to meet air quality standards while using painted wood as a feedstock may be cost-prohibitive. King County could explore the environmental implications of using painted wood as hog fuel and emissions technology as well as investigate any other potential markets for painted and stained wood.
- **Develop markets for gypsum.** Green building and a strong local construction industry are contributing to a significant supply of scrap gypsum that could be recycled. However, processors and manufacturers report that the local manufacturers of new gypsum wallboard cannot accept any more recycled gypsum. The supply-demand balance is so uneven that manufacturers do not pay for recycled gypsum, and depending on the customer often charge recyclers to drop it off. New markets for gypsum, particularly ones that will pay for the material, are needed before gypsum recycling can reach its potential in King County. Options include assisting processors with developing the cement and acoustical ceiling tile markets for recycled gypsum and the paper backing, respectively.

## Niche Opportunities

Our assessment indicates that the following opportunities (presented in no particular order) have a high potential to increase the value of recyclables in the County, even if they would not necessarily substantially increase the quantity of materials being recycled. Many of these opportunities could perhaps benefit from assistance through the King County LinkUp project.

- **High-value composts:** Most organic material collected for recycling in King County is processed by Cedar Grove into a moderate value compost that is in high demand by the public and, to a lesser extent, by the landscaping industry. However, certain segments of the agriculture industry (particularly nurseries and vineyards) as well as home gardeners often demand a higher-grade product with a more consistent and finer texture and higher nutrient and

microbial content, and these users have demonstrated that they will pay more for such a product. Vermicomposts (i.e., worm castings) and “vintner’s blend” composts are examples of higher-value composts. Producing such higher-value composts from recycled organics in King County may be viable, particularly given the growth in food waste recovery, a high-nutrient feedstock. King County could work with the private sector to identify and develop higher-value compost products out of local feedstocks, including food waste.

- **Computer re-use** by refurbishing and re-sale can be an additional revenue source for e-scrap recyclers and can help provide technology and learning opportunities to low-income and other communities in need. Existing King County companies such as RE-PC perform computer re-sale, but given the high volume of e-scrap generated there are likely additional opportunities to maximize the value of used computers for re-use rather than recycling. King County could help new or existing companies (including RE-PC) expand markets and opportunities for re-used computers, perhaps by identifying and networking with non-profits, schools, and other institutions in need of low-cost computers. One potential model that has successfully combined computer re-use, recycling, job training, and providing computers to disadvantaged populations is the non-profit Free Geek, based in Portland, Oregon.
- **Niche markets for clean urban wood:** Opportunities remain to explore niche and high-value markets for urban wood. Although most clean wood goes to the hog fuel market, local higher-value options include finger-jointed lumber manufacturing, landscaping wood chips, and erosion-control strands. The County could continue to work with manufacturers and consumers through the LinkUp program to develop these markets.
- **Edible food:** recover more edible food from the waste stream. King County could explore opportunities to better-connect grocery stores, food distributors, institutions, and even restaurants with donation opportunities for perishable food that would otherwise be disposed or composted. Possible partners include the Northwest Harvest and Food Lifeline organizations. A highly successful model is Metro’s Fork it Over program (Portland, Oregon) and the Oregon Food Bank’s Fresh Alliance program. Seattle has begun a similar program, the 2006 Food Systems Project, to increase donations of edible food from the commercial sector.
- **Gypsum’s paper backing:** Gypsum processors do not currently have reliable markets for gypsum’s paper backing, although several possible uses exist, including compost, acoustical ceiling tiles, and poultry bedding. King County’s LinkUp program could be a natural fit for this type of effort.

## Longer-term Focus

We have identified several materials where need or opportunity is relatively high, but for which there are few tangible options for King County to influence the market in the short term. These are generally materials for which recycling programs are well-established but for which either (1) capturing additional material would be difficult given current infrastructure, policies, and markets; or (2) markets are currently strong but may need monitoring to be prepared for possible long-term development needs. As a result, we recommend that King County efforts on these materials focus on long-term action to educate the public, gradually expanding service, and providing incentives. In addition,



the County and its partners may wish to further consider a disposal ban or mandatory recycling ordinance for most of these materials. Materials for which a longer-term focus is warranted are presented below, in no particular order.

- **Self-hauled yard waste.** Yard waste remains one of the biggest components of disposed self-haul waste. However, only two of King County's ten disposal sites, Cedar Falls Drop Box and Enumclaw Transfer Station, have yard waste recycling. King County could consider increasing the number of facilities with green waste drop-off, although capacity is highly limited and the investment required would be significant. In areas surrounding facilities without yard waste recycling, consider mailings to residents and targeted businesses on nearby yard waste drop-off sites. Another option would be to partner with private compost facilities to provide collection containers on a temporary basis during weekends or other days that the transfer stations receive particularly high volumes of yard waste.
- **Plastic bottles.** Recycling rates for plastic bottles in King County are low (as they are throughout the country) and organizations such as the Container Recycling Institute and the Beverage Packaging Environmental Council have been active on the issue nationally. Markets for both PET and HDPE bottles are strong, yet few promising strategies exist for King County to dramatically influence the market. The biggest concern is individual-serve plastic bottles that are consumed away from the home and from recycling services. Increased marketing and education, product stewardship, and expanded public place recycling could all be part of a longer-term strategy.
- **Plastic film:** Markets for plastic film from the commercial sector are strong, and numerous recyclers have capitalized on the high prices and large supply to increase recycling and make a profit. The Kent and Auburn valley has been a particular focus for recyclers given the high concentration of shrink wrap from warehouses in the area. Recovery of plastic film from other types of businesses and from residents still shows significant room for improvement. However, the material is quite disparate, and collecting plastic film in commingled programs does not generally produce a highly-marketable commodity. Strategies like bans, if coupled with expanded collection, could perhaps be effective, but in general there are not highly-viable opportunities for King County at this time, and so long-term action to educate the public, gradually expand service, and provide incentives may be the best approach.
- **Mixed plastics.** Markets for non-bottle containers (i.e., tubs) and #3-#7 containers do exist, but prices and demand, although at all-time highs, are still far short of those for PET and HDPE. Efforts in other parts of the country have focused on developing energy or building-material markets for these plastics, and King County could join with these efforts. However, few of these efforts have been successful to date, so it is unlikely that there is a near-term solution available other than to continue exporting the material for a penny or two per pound. Despite the low value of the material, King County could boost its recycling rate by promoting recycling of these materials without adversely impacting the market.
- **Bio-based plastics.** Current bio-based plastics are neither easily compostable nor recyclable, and all are viewed as a potential problem by plastics recyclers. For example, none of the current bio-based plastic tableware products have

met compostability standards at Cedar Grove. On the other hand, several bio-based bags have met standards and are being promoted for commercial handling of food scraps. If bags are used only for this purpose, they should not raise problems in traditional recycling streams. Overall, the market share of bio-based plastics is still very low, but we recommend that King County monitor the situation and industry literature on the topic and consider addressing bio-based plastics through a product stewardship approach via the Northwest Product Stewardship Council or even broader, regional approaches to ensure that the efforts of bio-based plastics manufacturers do not hamper local recycling programs. Recent dialogues in California involving manufacturers and recyclers succeeded in staving off some recycler concerns about bio-based bags, but with market share growing, the issue will surely arise again, perhaps on a national basis. Mandatory labeling of bio-based plastics may be one solution to keep bio-based plastics out of traditional recycling streams.

- **Paper.** Markets for paper have and will continue to be strong, and recycling rates of paper are generally high in King County. However, tens of thousands of tons still remain in the waste stream. Most paper recycling programs (and inclusion of the material in curbside recycling) are mature, however, so incremental improvements in the recycling rate will not come easily. The biggest opportunities are mixed paper from residents and office paper from businesses. Continued education and marketing efforts will help, as would technical assistance and further embedded recycling services offered to businesses, but great improvements are not likely without a significant new policy or incentive, such as a disposal ban. In the absence of a ban, we classify paper as a material for longer-term focus and continued persistence rather than a material with a great pressing need or significant new opportunities.
- **Scrap metal.** A fair amount of scrap metal is still disposed in King County, especially at transfer stations. While capacity at the current transfer stations is limited, the most cost-effective option in the longer term may be to add scrap metal recycling capacity to transfer stations as they are remodeled or as new facilities are built. In addition, publicizing the existing (largely private sector) options and providing on-call curbside metals collection would help increase recovery of scrap metal, particularly from the residential sector.
- **Cathode ray tube (CRT) glass.** The quantity of CRT glass available for recycling in King County is likely to increase in the short-term with the transition to flat-panel technology and the upcoming implementation of RCW 70.95N. CRTs contain several pounds of lead each, and for this reason King County and other governments are concerned about the safety of their disposal or handling through recycling programs. Domestic markets for both whole CRTs and the leaded glass cullet have largely dried up, and the most widely used market by King County recyclers is now in Brazil, where new CRTs are made using recycled cullet. This and other international markets are reportedly stable, as the demand for CRTs is increasing in the developing world, even as it is decreasing in the US and other developed countries due to the emergence of flat panel displays. There are, however, concerns about the legality of shipping US cullet into non-OECD countries that have ratified the Basel Convention, such as Brazil. King County could help ensure that exports of CRT glass to Brazil, or other countries, do not violate laws in those countries. Regardless,

markets for CRTs warrant further monitoring, however, because they will be a component of the waste stream for many years to come and so adequate and environmentally preferable recycling options must continue.

- **Glass fines.** Glass fines are marketed to the construction industry, primarily by a firm called Dr. Concrete. This firm reports that they are able to move material without significant challenges. In the past, however, recyclers such as Fibres have had a more challenging time doing their own marketing to the construction industry. If Dr. Concrete starts having difficulty, King County could help promote the use of glass fines to the construction industry by conducting focus groups with construction companies to find the barriers to using this material and targeting outreach based on those findings. However, if glass from Waste Management's Cascade MRF were to go into the bottle industry, significantly less glass would be available for construction and so less effort may be needed to market glass to construction.
- **Non-reusable textiles.** Several thousand tons of textiles are still disposed in King County, many of them not reusable as clothing but likely reusable for other uses, such as rags, insulation fiber, and upholstery fabric. King County could begin to expand options for recycling these items, but special care would need to be taken not to confuse resident or other donors or otherwise upset the supply chain for reusable textiles.

## Lower Priorities

We classify the following materials (presented in no particular order) as lower priority because the existing infrastructure and programs are generally working well (i.e., need is low), markets are strong, and there are few tangible opportunities for King County to add value or influence the market. As for materials in the "Longer Term Focus" category, materials classified as "lower priorities" would also benefit from education and marketing, expanded service, incentives, or bans, but they need not be the focus of County efforts in the short term because the likely benefits are low relative to expected cost and effort.

- **Textiles.** The existing (largely nonprofit) infrastructure for textile reuse and recycling is very well established, appears to be functioning efficiently, and is not currently in need of public sector assistance. Two possible areas for attention are further promotion of these existing opportunities or addition of collection options at King County transfer stations. In addition, the County could investigate means of recovering more non-reusable textiles that are recyclable to other uses, as described under "non-reusable textiles" in the Longer-term Focus section.
- **Tin and aluminum cans.** Both tin and aluminum cans have high recycling rates and strong markets, yet several thousand tons are still disposed. There are few tangible opportunities to increase recycling or influence end markets, other than to ban their disposal.
- **Flat-panel monitors, including those with liquid crystal diplays.** These items will steadily increase in the waste stream in coming years, but local recyclers report that recycling methods and markets are developing in step with increasing supply. King County need not get involved at this time but may wish to continue monitoring the situation.

## *Findings and Recommendations*

- **E-scrap plastics.** With the continued expansion of markets for plastics, e-scrap plastics have been readily marketed both domestically (two reclaimers are located in Oregon) and internationally. Recyclers don't report any major issues with PBDE content, but they would like to learn more about the possible health impacts of the chemicals on their workers.
- **E-scrap metals.** Markets for metals recovered from e-scrap are strong, no problems are anticipated, and so there is little need for public sector involvement.
- **Organics (general marketing).** Demand for compost, mulches, and soil blends is strong, thanks in part to long-term marketing, education, and policy support from public agencies that have helped mature the market. The greatest opportunity is for some market differentiation around quality, an initiative the County could advance by monitoring and promoting compost quality (see description under "Near-term action", above), but for which the private-sector processors should also bear significant responsibility.

# Chapter 4

## Electronics

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### INTRODUCTION

Electronic waste has emerged as an important environmental issue in Washington State. More than 19 environmental groups in the state selected electronics recycling and the use of flame retardants – frequently used in the manufacture of electronic products – as top 2006 environmental priorities in Washington. Electronic waste is the result of a dynamic and ever-changing electronic consumers market driven by the continual development of new technologies to build smarter, faster, and cheaper products. The short lifespan of electronic products is just one of several factors contributing to the ongoing search for effective ways to handle electronic waste. Electronic products contain a variety of materials including plastics, metals, and glass, which pose challenges to efficiently getting the material commodities to the highest value markets. Furthermore, electronics often contain hazardous chemicals such as lead, mercury, and cadmium, which can pose serious environmental, health, and safety risks for workers and communities where the materials are stored, processed, or disposed.

There are several important changes from the last 2004 market assessment conducted for electronic waste, among them:

- **Collection options are increasing.** There are more options for consumers to recycle or reuse electronic products, including a growing number of manufacturer and retailer take-back programs, several curbside collection programs, regular special collection events, and increasing capacity of local recyclers and processors.
- **There is a growing commitment locally and nationally to keep electronic waste out of landfills and to ensure it is handled in environmentally sound ways.** Since October 2005, the disposal of electronic products, including computers, monitors, TVs, and cell phones, and mercury-containing devices has been banned in King County. In 2006, Washington State passed Engrossed Substitute Senate Bill (ESSB) 6428, later codified as Chapter 70.95N RCW, the most aggressive electronics recycling legislation in the country to date. While no one can predict how this bill will affect the current electronics supply chain, nearly everyone agrees it will dramatically change the way electronics are collected, reprocessed, and ultimately reused or recycled.

This chapter provides a summary of current market conditions for electronic waste, followed by action recommendations for King County to help businesses and organizations recover the highest value from electronic waste and ensure that environmental and health impacts are minimized. The focus of this chapter will be on commodity materials (as opposed to reuse) from computer monitors, televisions, and CPUs (all of which are covered in RCW 70.95N).

## MARKET CONDITIONS

### Trends & Key Variables Affecting Supply

**Washington State's new electronics recycling law.** The effect of the new electronics recycling law (RCW 70.95N), which took effect on July 1, 2006, is currently unknown, although it will significantly alter the supply of used electronics in the County.

- **Chapter 70.95N RCW Electronic Product Recycling.** In March, Washington State passed one of the most aggressive electronics recycling bills in the country. The Washington law goes further than many of the other state laws such as those in California, Maine, and Maryland in that it bans the use of prison labor and directs the state to establish rules for environmentally sound management of the materials. The goal of the bill is to establish a convenient, safe, and environmentally sound system for the collection, transportation, and recycling of computers, monitors, and TVs from consumers, small business, schools, small governments, and charities in the State (RCW 70.95N, 2006). Another objective is to encourage the design of electronic products that are less toxic and more recyclable through a system of shared responsibility by all stakeholders and financed by manufacturers. The idea is that by adopting a producer take-back model, manufacturers have a market-driven incentive to make recycling easier (and cheaper) and reduce toxics in their products. Manufacturers can either finance and set up an independent program, or participate in a standard plan if they don't want to set up their own. Regardless, each manufacturer will have to pay their "fair share" of the overall costs of the program based on their share of the products being brought to the collection facilities. The Department of Ecology will establish the performance standards that processors must meet, and provide general oversight and enforcement (RCW 70.95N, 2006).
- **Export of electronics.** Like all of the other state bills passed to date, it does not ban the export of hazardous waste to undeveloped countries. While there is much dialogue about the issue of exported materials – both from a market quantity standpoint and an environmental concern standpoint – our research did not uncover any state-led efforts to ban export of electronic waste. California's law goes the furthest towards regulating export by requiring the recycler to demonstrate that the waste will be managed only at facilities whose operations meet or exceed OECD guidelines for environmentally sound electronics waste management, regardless of whether the importing county is a member of the OECD (Section 42476.5(e) of the Public Resources Code). However, one contact at the EPA reported that California's law may be on shaky legal ground since states don't have the authority to regulate international trade (Tonnetti, 2006). On a federal level, the U.S. EPA has recently addressed the export issue in a new CRT recycling rule.
- **EPA establishes new rule governing CRT recycling.** In the new rule, EPA amended its hazardous waste regulations under the Resource Conservation and Recovery Act (RCRA) to exclude CRTs from hazardous waste regulations on the condition they are handled according to certain requirements. The law addresses proper handling, transport, and export of used, intact or broken CRT monitors or CRT glass. According to the EPA website, by streamlining the requirements for managing this material, the rule is intended to encourage

recycling and reuse of used CRTs and CRT glass. Export requirements are based on three scenarios: 1) CRTs exported for reuse require the exporting company to have documentation certifying that the units will be reused; 2) CRTs and CRT glass shipped for recycling requires that the company notify EPA, which, in turn, communicates with the importing country; and 3) sorted CRT glass does not require special notification for export (Tonnetti, 2006).

- **Impact of law on local processors is uncertain.** RCW 70.95n will drastically change electronics recycling in Washington State, although its specific impact won't be known until the rulemaking is finished and implementation begins. The following issues may change the field for local processors.
  - **Payment structure will be changed dramatically.** Most of our contacts were unsure how the new system will work and how they will get paid because they currently rely on fees charged to the consumer at the time of collection or delivery of the unwanted electronic device. While RCW 70.95N.030 allows manufacturers to pass disposal costs on to the consumer, it prohibits charging fees at the end-of-life, except for premium services. Instead, under the standard plan, the state will contract with collectors, transporters, and recyclers and pay them out of the regulating authority's account established for covered electronics. Even manufacturers with independent plans will be required to "fairly compensate" collectors and processors (RCW 70.95N.060).
  - **Possible loss of material from local area to national or overseas markets.** Total Reclaim, PC Salvage, PC Plastics, and Earth Protection Services, Inc. (EPSI) all felt that a manufacturer-led program – without rulemaking to support local recyclers – may send a lot of material to cheaper national or overseas markets. This has already happened to some degree with electronic waste. One contact reported that he is losing business to SML Metals in Tacoma (formally ECycle in the King County area), which is taking electronic waste for free and shipping it to China (Bracking, 2006). SML Metals does not have an environmentally reputable standing with the Basel Action Network (BAN). While RCW 70.95N.060 requires that the standard and each independent plan describe how they will "seek to use businesses within the state," there is no requirement that they do so and no explicit standards covering the export of waste.
  - **Effect on smaller operations will depend on a variety of factors.** Another concern is that a market shift towards fewer but larger processors (or exporters) may occur as manufacturers in independent plans seek economies of scale. Smaller operations are concerned that they will be unable to achieve the economies of scale necessary to compete with the overseas markets, which are not prohibited or limited in within RCW 70.95N. The contact at PC Salvage indicated that he is planning to end his recycling operations with a focus on sales and service as he is confident that manufacturers will choose national or international recyclers to handle their material (Bracking, 2006). Those firms who are able to scale their operations and certify their processes will be able to best take advantage of the changed marketplace. On the other hand, in-state recyclers are already competing with businesses that ship wastes overseas cheaply. In the new system, small recyclers may be better able

to compete with these exporters because they will not have to compete for customers on price. Instead, they can advertise their environmental stewardship and contribution to the local economy to encourage individuals to use their services.

- **The State's Standard Plan will include local collectors and processors.** While manufacturers may contract only with large recyclers in their independent plans, RCW 70.95N.280 requires that the state's standard plan accept any registered collectors and processors who meet Ecology's requirements and that the Authority will compensate collectors and processors for the "reasonable costs" of their services. This means that small recyclers will likely always have access to some part of the market and receive some standardized compensation. At this point, it is unclear what the eventual size of the independent plans will be in relation to the standard plans and what determines compensation for "reasonable costs."
- **Small recyclers may lose business if the independent plans are very large** and if manufacturers are able to steer their customers to their preferred recyclers (perhaps through convenient collection at the same time they sell a new computer). Also, just because manufacturers set up independent plans doesn't mean that consumers will choose to recycle through them. Recyclers cannot compete for customers based on price because collectors and recyclers are not allowed to charge except for curbside pick-up or premium services. Recyclers must therefore compete on convenience and other attributes, while keeping costs below the compensation rate. This is where the ability to ship waste overseas could harm small recyclers, depending on whether Ecology sets fees to be the same for in-state recycling as for shipping overseas. If Ecology sets a flat rate and considers the manufacturers' lower costs to recycle in bulk or overseas when determining compensation rates, the resulting compensation could be too small to cover the cost of recycling in state. On the other hand, Ecology may determine fair compensation rates only considering the cost to recycle within Washington, which would not automatically shut out small, local recyclers
- **The new legislation may create a system that favors recycling over reuse.** Several reuse operations and a number of the processors we spoke with felt that the bill failed to say anything meaningful about reuse as an important strategy for handling electronic waste. In fact, there were several complaints that the bill would hurt resellers as it will limit the resale of computers without labels or with labels of manufacturers who are not signed up with a plan. Starting on July 1, 2006, retailers are not able to sell equipment whose manufacturer has not registered with Ecology. One contact estimated that over 70% of the computers collected do not have manufacturer labels (Dabek, 2006). The new payment structure may also encourage materials that would have been reused to be recycled. While the current payment structure is based on consumer payments at the time of drop-off, reuse operations will no longer receive payment for accepting used electronics unless they recycle it. This will likely lead to the recycling (rather than reuse) of systems that are just outdated enough not to have a high resale value -- systems that have typically gone to charities (Powell, 2006). Similarly, California's recycling law has favored



recycling of CRTs since the price for recycling these is \$20, compared to the price paid for intact monitors for reuse (between \$2 and 20, at the high end) (Tonnetti, 2006).

**Changing technologies and sales.** While rapid changes in technology have always characterized the consumer electronics market, two technology changes frequently cited in the literature and mentioned by interviewees may affect the supply of used electronics in the near future.

- **Flat panel displays are rapidly replacing CRTs.** Flat panel displays (FPD) are used in a variety of electronic applications including televisions and computer monitors. Liquid crystal displays (LCDs) are the dominant FPD technology, followed by plasma displays. FPDs are predicted to replace cathode ray tubes (CRTs) in every application. Industry analysts now estimate that about one-half the televisions sold in the United States this year will be flat panel displays (E-Scrap May 2006). The sales of flat panel displays with LCD technology and the display size are expected to grow significantly over the next three years to reach 55 million units (from 9 million units in 2004) with an average display area of 480 square inches (doubled from 2004) (KCSWD, 2005). Similarly, the demand for plasma display televisions is expected to generate the fastest growth rate for any electronic product over this time span (KCSWD, 2005). However, according to one local newspaper, there has been some indication that with televisions, consumers have been slower than expected to invest in these new technologies due to cost and the challenge of making an informed choice among all the new technologies (Harrison, 2006).
- **Installation of Microsoft's new "Vista" operating system may increase supply of used electronics.** Vista is expected to have some new features that will require more computing power than many existing computers currently have – in particular, one gigabyte of RAM and a high-end video card (E-Scrap News, May 2006, p 2). However, most existing machines will still be able to run a standard interface (Spooner, 2005), and the Microsoft Vista website states that the new user experience has built-in capabilities to gracefully scale to the hardware capabilities of the computer on which it is installed (Microsoft, 2006). Nevertheless, some users will likely upgrade machines simply to take advantage of Vista's full capabilities, resulting in generation of used computers.

### **Current Supply**

The current supply of electronics is difficult to estimate with confidence due to the variety of dispositions used electronics can take. Used electronics may be disposed, recycled through numerous recyclers, given or sold to other users, or stored in homes or offices for unknown periods of time. Past efforts to estimate the supply of used electronics have often relied on estimates of sales combined with estimates of product lifespan. We take a similar approach here and provide a simple update to the estimates from the previous, 2004 *Market Assessment for Recyclable Materials*. We also provide estimates of the current electronics disposed, as provided by King County Solid Waste Division.

- **Over 2,000 tons of electronic waste are estimated to have been disposed in King County in 2005.** Estimates by King County Solid Waste Division (based on the 2002/2003 waste composition study) indicate that an estimated 181 tons of computer monitors, 1,705 tons of televisions, 48 tons of laptops and flat-panel monitors, and 185 tons of cell phones were disposed in 2005, for an

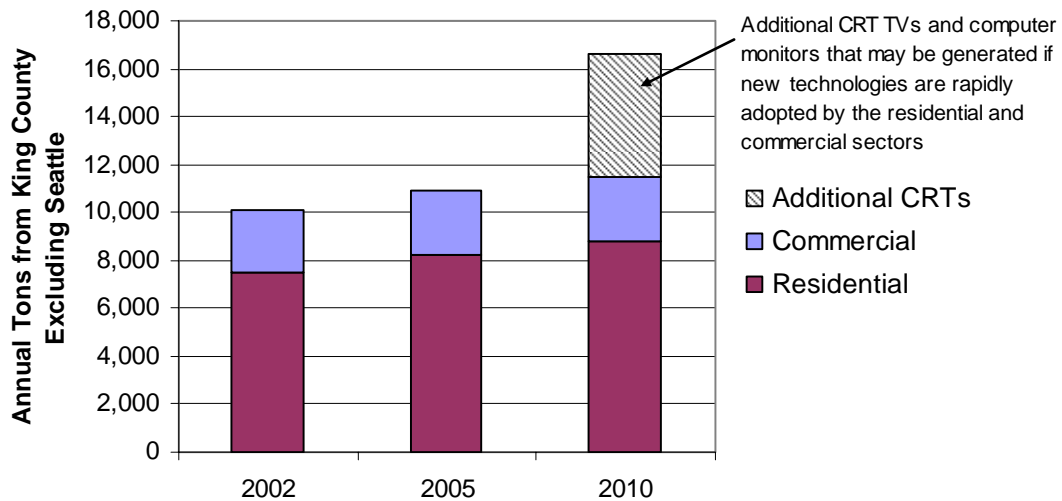
estimated total of 2,118 tons. Most of these items (an estimated 1,488 tons) were disposed at transfer stations. All of these figures, however, have a high degree of uncertainty due to the waste sampling method and the fact that they are each present in relatively small quantities compared to other items.

- **Over 10,000 tons of electronic waste are estimated to have been generated in 2005.** Modeling estimates performed by Cascadia Consulting indicate that at least 10,000 tons of computers and televisions were generated in King County in 2005. These items were disposed, recycled, given or sold to others, or stored.
  - **Disposal is the most commonly cited method for getting rid of old televisions and computers.** One-quarter (25%) of households reported disposing their unwanted computers and televisions in a 2005 survey of King County residents (King County Solid Waste Division, 2005). Other common management methods cited for computers included donating (20%), taking it to a store/collection center (14%), giving it to friends/family (11%), and researching recycling options (1%). Other common management methods for televisions include donating (23%), taking it to a store/collection center (11%), and recycling it or taking it to an event (11%). Note that this survey was conducted before the October, 2005 ban on disposal of these items.
- **An estimated 8,000 tons of electronic waste are currently being stored by King County households.** A 2005 survey of King County households found that 30% reported storing a computer they no longer use and 16% reported storing a television (King County Solid Waste Division, 2005). Computers and televisions that are stored may eventually be disposed, recycled, given or sold to others. Based on these figures, Cascadia Consulting estimates that over 500,000 computers, monitors, and televisions are being stored for a total weight of over 8,000 tons.

### ***Projected Supply***

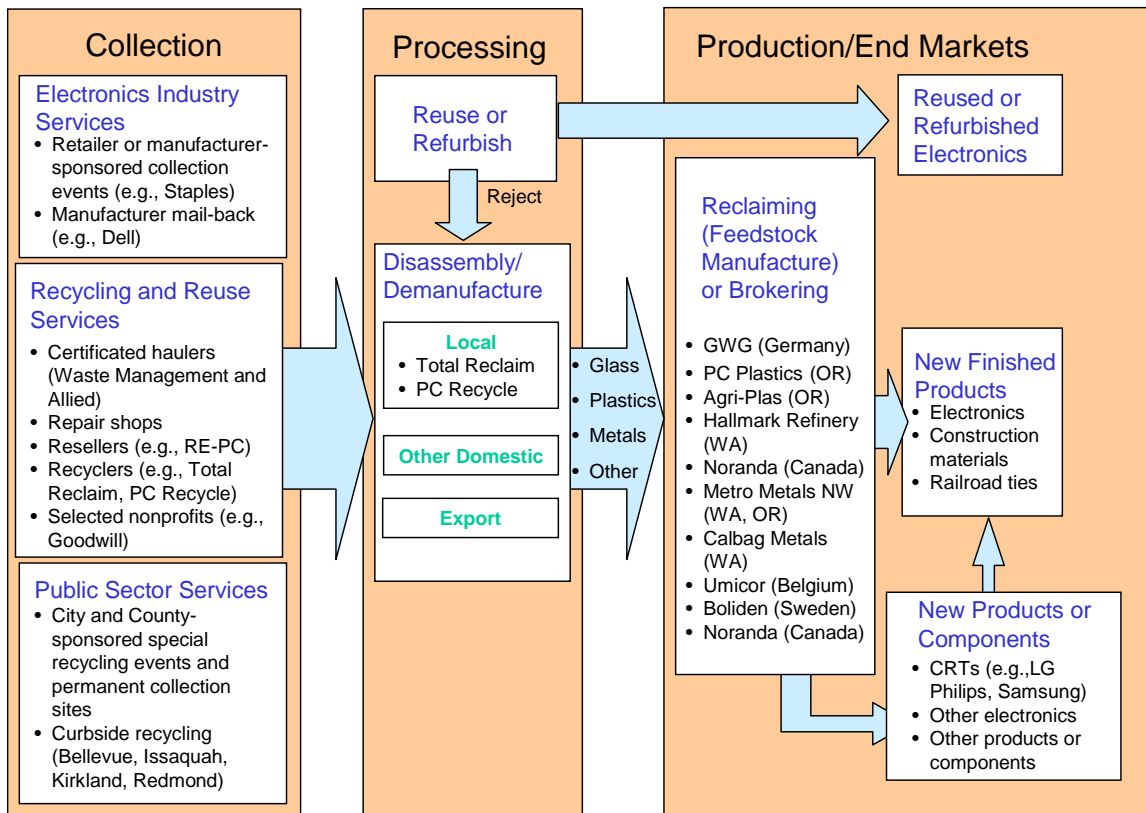
The following chart depicts estimates of the current and projected supply of used electronics in King County. These estimates were conducted by using a model developed in 2003 by Cascadia Consulting; the estimates are based on and assumptions of product ownership and obsolescence rates and product sales and growth trends identified at that time (Cascadia Consulting Group, 2003). Estimated 2005 residential generation estimates total 8,000 tons, with 6,000 tons of TVs, 1,000 tons of CRTs, and 1,000 tons of CPUs, Estimated 2005 commercial generation estimates total 2,700 tons, including 1,200 tons of CRTs, 1,400 tons of CPUs, and 100 tons of laptops (televisions were not estimated for the commercial sector). Note that uncertainty about how rapidly new television and monitor technologies will be adopted limits our ability to predict e-waste generation in 2010.

**Figure 4-1. Estimated Generation of Computers and Televisions in King County:  
Current and Projected  
(excludes Seattle)**



### Collection

Our research indicates expanded options for collection and recycling for many materials contained in e-scrap. CRTs are probably the only material where domestic markets are disappearing. Figure 4-2 below illustrates the current landscape – based on local interviews – for handling electronic waste. As seen below, local electronic waste handlers are primarily either *collectors*, companies that gather and/or transport material, or *processors*, companies that dismantle or otherwise physically transform material into commodities for further sale or processing by reclaimers. *Reclaimers* are companies that take materials from processors and transform them into feedstock for remanufacture.

**Figure 4-2. Current Flows of King County Electronic Waste**

**Manufacturer and retail take-back is increasing.** Interviews, press articles, and industry journals all indicate that there is a growing behavioral shift in many manufacturers to take more financial responsibility for products that they make and sell.

- Companies like Hewlett-Packard (HP), Apple, and Dell are all ramping up their own electronics take-back programs.** Dell wants to triple its recovery volumes by 2009. Dell's recovery volumes rose 72 percent in the past year and the company launched recycling systems in China and Latin America (E-Scrap News, 2006a). Dell recently announced that, beginning in September 2006, they will offer free recycling services for their computers even without the purchase of a new unit. HP recycled 70,000 tons of hardware and print cartridges in 2005, up 17 percent from the previous year. They also collected more than 2.5 million units for resale or donation (E-Scrap News, 2006c). Apple and Dell both recently announced customers purchasing new machines from them will be able to recycle another computer from any manufacturer. Retail stores like Staples and Best Buy have been offering computer recycling drop off at many of their locations through the country. Locally, Staples, a participant in the County's Take It Back Network (TIBN), collected over 8,000 monitors and CPUs during the last quarter of 2005 – more than any other participant and 40% of the total reported by the 21 members for that time period.

- **Firms such as Dell, Sony, and Panasonic are beginning to seriously consider redesign solutions for their products to be more ecological and make the materials easier to recycle** (Moran, 2006). Much of this interest is driven by necessity, as the European Union severely restricts the six most toxic materials used in most electronic equipment. While the law applies to products sold in the European Union, most firms believe that the trend is toward more regulation so it makes sense to design products that meet the most rigorous standards. As one manufacture put it, “if you’re a global company, you need to have global solutions” (Moran, 2006). An incentive towards green design may be the new Electronic Products Environmental Assessment Tool (EPEAT), which rates products that meet environmental criteria, including heavy metal content, energy efficiency, and ease of upgrading and recycling. Manufacturers must offer recycling options to have their products be EPEAT-registered.
- **Manufacturer-led recycling programs may lead to less reuse and greater export of used electronics.** While many of the processors contacted for this study indicated manufacturer-driven programs may be preferable in terms of product redesign and reengineering, some fear that manufacturer-driven efforts will favor recycling over reuse and potentially move recovered electronics overseas to benefit from less expensive labor, lower recycling costs, and less stringent environmental regulations. Our findings indicate that this shift to overseas markets is happening with CRTs and to some degree with metals and plastics as well.

**Local suburban collection programs are strong in King County.** There are currently four suburban cities in King County offering curbside collection of electronic waste: Bellevue, Kirkland, Issaquah, and Redmond. Contacts indicated that, for the most part, the electronic waste collection programs have been going well.

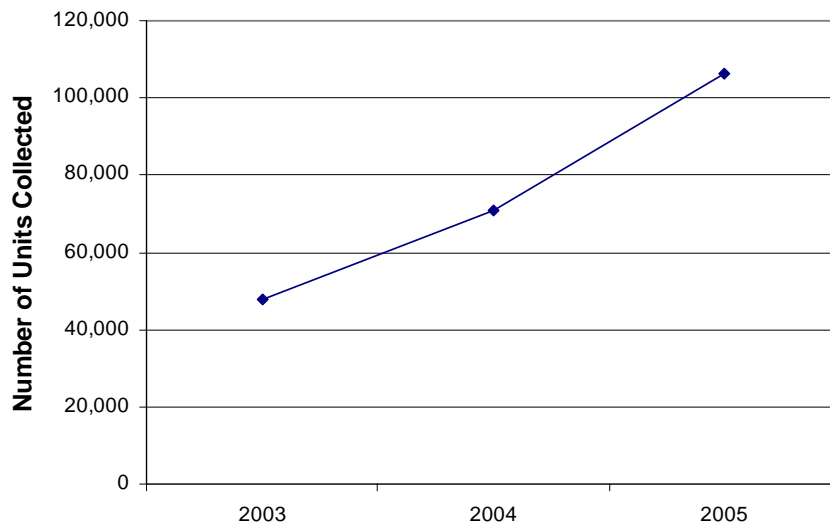
- **Bellevue.** While 2005 figures were not available at the time of our interview, Bellevue averaged six tons of electronic waste a month during the first year of its program. The City has targeted education to residents through postcards, newsletters, and bill stuffers.
- **Kirkland.** In 2005, Kirkland collected 17 tons of electronic waste through its curbside program. City staff felt the program was going fairly well, but that many residents were still not aware of this added service. They also noted that the tonnages collected through special collection events have not decreased. Kirkland plans to do more education and outreach messages in conjunction with communications about Washington’s new electronic waste law.
- **Issaquah.** Similar to Kirkland, Issaquah collected an average of 2800 pounds per month of electronic waste during the first eight months of 2005. Assuming a consistent collection rate, this equates to approximately 17 tons for the year. They also plan to do more active outreach and education of residents.
- **Redmond.** Redmond averaged 4100 pounds per month for the first eight months of 2005. Assuming a consistent collection rate, the city collected approximately 25 tons last year.

**Thrift store and other reuse opportunities remain strong.** Thrift stores, charities, and refurbish businesses collect computers for reuse and resale. Goodwill accepts computers made in 2000 or later. For those computers that are not resold, any electronics with over 50 percent scrap metal goes to Seattle Iron & Metals. While the

majority of computers collected by Goodwill are sold for reuse, the organization spent close to \$120,000 in FY2004/2005 on computer recycling. They recycled 174 tons with Total Reclaim in 2005. Our Goodwill contact believed that the electronic recycling bill would help them tremendously as consumers (and Goodwill) would no longer have to pay to recycle unusable computers. However, other processors we spoke to questioned whether donation of used electronics will be less common when collectors can compete for fees associated with recycling.

**Take It Back Network.** The County’s Take It Back Network (TIBN) is a group of retailers, repair shops, non-profit organizations, waste haulers and processors that accept used electronic equipment for reuse or recycling. Members pledge to ensure that discarded electronic equipment will be processed in full compliance with local, state, and federal regulations and international trade laws. They manage the hazardous materials domestically or in developed countries and pledge not to export hazardous materials to developing countries for repair, recycling or disposal. Over the last year, the network’s collection quantities and number of participants have been increasing. As Figure 4-3 illustrates, the number of electronic units collected by TIBN participants have more than doubled over the last three years (King County Solid Waste Division, 2006).

**Figure 4-3. Reported Electronic Units Collected by TIBN Participants**  
*(includes TVs, Monitors, CPUs, Cell Phones, Other)*



## Processing & Infrastructure

Markets for materials and commodities largely determine the processing and handling of electronic waste. In general, processors typically sort the electronic waste by type (CRT monitors, FPDs, televisions, CPUs, consumer electronics) and then dismantle to best balance the labor costs with end market prices. Hand disassembly generally produces the highest quality products, but is also time-consuming and thus expensive. Of the two local processing facilities visited, both combined hand disassembly with an automated system of shredding and separating metals from plastic and other materials.

**Total Reclaim and PC Recycle are the two large processors in King County.** They collect materials from general public drop-offs, special collection events, thrift stores, retail sites, and corporate clients, in addition to taking electronic waste from haulers and several curbside collection programs. Total Reclaim mentioned a particular niche they are building around asset-management – value-added services to protect confidentiality. Total Reclaim collected about 13 million lbs of electronic waste in 2005, and about 7 million from King County including Seattle. Seattle alone accounted for close to 4 million so a reasonable estimate from what they recycled from King County in 1995 is about 3 millions lbs. PC Recycle plans to double the material it is currently collecting (Molstad, 2006), while Earth Protection Services Inc (EPSI), a national processor with an office in Portland, OR, has several large accounts in the King County area including Swedish Hospital and The Seattle Times.

**Excess capacity exists for most local processors.** Most of the processors we spoke with indicated that they have capacity (and are adding capacity) and felt they would grow to accommodate additional electronic waste. The general feedback was that as markets grow, processors will expand to accommodate supply. Most were not concerned about predicted supply increases with the implementation of RCW 70.95N as long as there were viable markets for the material. For example, both Total Reclaim and PC Recycle, the two primary local processors, have plans to expand their operations. PC Recycle recently purchased special equipment from Germany to more efficiently handle CRTs and minimize health and safety risks to workers. This equipment meets International Organization for Standardization (ISO) 14000 environmental standards.

**The health and safety issues from handling electronic waste continue to be a challenge for processors.** The list of toxic components in computers includes lead and cadmium in computer circuit boards, lead oxide and barium in computer monitors' cathode ray tubes, mercury in switches and flat screens, and brominated flame retardants

#### **Computer Monitors with Cathode Ray Tubes (CRTs)**

Plastic monitor backs are removed and then the monitor is separated into the circuit board, degaussing cables, metals, and CRT. All non-glass material, including the copper wire yoke, is removed from the CRT prior to shredding. Some recyclers have experimented with separating the funnel glass (leaded) from the panel glass of the CRT before shredding. One local recycler cuts the funnel glass from the panel glass using specialized equipment designed to protect workers. A monitor weighs about 30 pounds, of which 50% is a cathode ray tube, 25% is plastic, 13% is circuit boards, 6% is metal, and 4% is wires (Townsend, 2002).

#### **Flat Panel Displays (FPDs)**

Flat-panel monitors and laptops are manually separated into fluorescent bulbs, liquid crystal screens, plastic, circuit boards, and metals. After the screen is removed, laptops can be shredded. The recycling procedure for LCD screens is under development, but it will likely involve removal of fluorescent tubes before further processing.

#### **CPUs**

CPUs are disassembled into hard drives, plastic or metal covers, batteries, and circuit boards. They can also be shredded after the circuit board is removed. CPUs weigh about 25 pounds on average. By weight, a CPU consists of a metal casing (45%), disk drives (17%), power transformer (15%), wiring boards (10%), plastic casing (8%), wiring (3%), and other miscellaneous parts (2%) (Townsend, 2002).

#### **Televisions**

Standard televisions are manually separated into CRTs, plastic covers, speakers, and wiring. TVs are frequently too large for shredding machines (if available) so are manually disassembled. A 15- to 21-inch screen television weighs an average of 42 pounds; larger televisions average 125 pounds.

on printed circuit boards, cables and plastic casing (SVTC, 2006). Probably the most difficult components to handle are CRTs, due to the glass itself, the lead within the glass, and phosphorous powder on the inside of the panel glass. Contacts at both Total Reclaim and PC Recycle stated that most safety concerns and worker injuries are associated with handling CRTs. Some of the precautions recently implemented at PC Recycle include installation of a new glass cutting machine to protect workers from broken glass due to smashing and ensuring that all employees wear respirators, gloves, and suits when handling CRTs. They also plan to begin routinely checking employees for lead levels.

## **End Markets and Prices**

On the whole, collectors and processors are sending electronic waste to local, regional, and international markets, depending on the commodity. The business is commodity driven, and thrives on large volume and low margins. Many of the contacts we spoke with expressed some concern with the transition of the current business model, which is heavily dependent on customer fees, to one where they will be paid through manufacturer accounts. For the most part, processors still rely on fees collected to support their operations, though some materials such as metals do generate revenue. Following is a specific discussion about the markets for each of the primary commodity materials found in electronic waste.



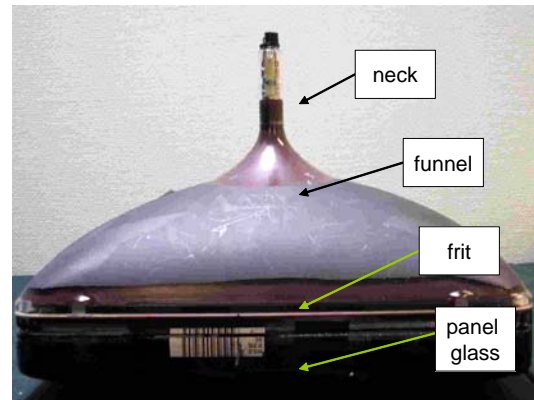
**Table 4-1. Summary of Commodity Prices, Markets, & End Use**

Item	Prices	Markets	End Use
CRT leaded glass/panel glass	-\$140/ton	LG Phillips (Brazil), Samsung (Malaysia), other CRT plants in India, China, Russia	New CRTs
CRT panel glass	No figures	Local quarry (some)	Fiberglass, Low-grade glass or concrete
Problem glass (sweepings)	-\$140/ton	Doe Run (not much goes there)	Fluxing agent
Whole monitor	No figures	GWG Ges Wiederverwertung (Germany)	Televisions
Flat Panel Displays (FPDs)	NA	Stockpiled – fluorescent tube is the primary problem	Disassemble or shred for various commodities
Circuit Boards (Precious Metals)	+\$0.80 - \$1/lb (depends on gold content; older boards bring higher value)	Hallmark Refinery (Mount Vernon) Metro Metals Northwest (Portland, Vancouver, Kelso) Calbag Metals (Tacoma) Umicor (Belgium) Boliden (Sweden) Noranda (Canada)	More metal products
Steel	+\$120/ton	Seattle Iron & Metals (Seattle) Schnitzer Steel Industries (Tacoma)	More metal products
Aluminum	+\$0.30/lb	Metro Metals Northwest (Portland, Vancouver, Kelso)	
Copper	+\$2-\$4/lb	Hallmark Refinery (Mount Vernon) Joseph Simon & Sons (Tacoma)	
Copper Yokes	+\$1/lbs	Bloch Steel Industries (Seattle)	
PCABS, HIPS, ABS	+\$0.10 - \$0.20/lbs	Agri-Plas (OR) PC Plastics (OR) (only PCABS and HIPS) Pellet price: \$0.55-0.70lbs	Lumber/picnic tables Railroad ties Construction parts
Mixed bales	\$0.06/lbs	China	Unknown

## Cathode Ray Tubes (CRT)

The CRT is the “picture tube” that is the primary component of a traditional monitor or television. CRTs are composed of three pieces of glass: neck glass, funnel glass, and panel glass. In addition, a lead-glass solder mixture called “frit” joins the funnel and panel. All three types of glass include some lead content: the funnel glass is approximately 25% lead; the neck glass is about 30% lead; and the panel glass is between 0% and 3% lead (Musson, 2000). Manufacturers include lead in the glass to shield the user (and others who may be nearby) from radiation. In fact, CRTs are estimated to account for 30% of all lead in municipal solid waste in the U.S. (EPA, 1989). Cuts from CRT glass as well as contact with lead and phosphorus powder also pose significant challenges in terms of worker health and safety to local processors.

Figure 4-4. Major Parts of a CRT



**Most glass-to-glass recycling takes place out of the U.S.** As CRTs are, for the most part, no longer manufactured in this country, most of the glass-to-glass recycling markets (turning used CRT glass into new CRTs) are overseas in India, China, Russia, and Brazil. Recycling is expensive and local processors must pay about \$140 a ton to have CRTs recycled into new CRTs. The dominant end market currently used by local processors is LG Philips in Brazil. However, LG Philips may be violating the Basel Convention, which Brazil joined by accession. Based on their legally binding obligations under the Basel Convention (Article 4, Paragraph 5), Basel Parties such as Brazil may not trade in hazardous wastes, as defined in the Basel Convention, with non-Parties, such as the US. However, because the US has not ratified the Convention, it is legal for businesses in this country to ship what are Basel wastes to almost any country, frequently in violation of the recipient country’s laws (Westervelt, 2006). A full legal analysis of this topic was beyond the scope of this study. It seems clear, though, that local processors are not breaking any laws in the U.S., but once shipments get outside of U.S. territory, they automatically fall under international laws and definitions, and could become illegal for other countries to accept. One processor (Earth Protection Services) has visited the LG Philips plant and reports it to be a responsible recycler (as described further below), but King County may wish to consider further research on this topic.. The new EPA CRT recycling rule requires that the business exporting CRTs or CRT glass must notify the EPA, who will communicate with the importing country prior to shipment of the material, unless the CRT glass has been sorted, in which case no notification is required (Tonnetti, 2006).

**Glass-to-lead recycling is limited.** Opportunities to recycle CRTs with smelters (glass-to-lead) are diminishing, as Doe Run (the only primary lead smelter in the U.S.) has limited demand for this material relative to the growing supply and secondary lead smelters, such as Exide, also have limited demand (Powell, 2006). As CRT manufacturing worldwide eventually decreases (15 years out), there will be few options for recycling CRTs other than glass-to-lead recycling. Several processors mentioned working with two Canadian smelters, Teck Cominco in Trail, B.C. and Noranda in Quebec, but these facilities have been less stable. For instance, Teck Cominco has

been struggling with issues stemming from a lawsuit alleging that it has been polluting the Columbia River for years with mining slag (Geranios, 2006).

**As more processors are using overseas markets, some are attempting to ensure that the operations are reputable and environmentally sound.** For example, several processors indicated that they are sending CRTs to LG Phillips in Brazil, where the material is used to manufacture new CRTs. The processors sending CRTs to Brazil all reported that the average cost to send CRTs there was \$140 per ton. Our contact from Earth Protection Services reported that their company president personally visited the LG Phillips plant to ensure that the material was handled in an environmentally sound way. As mentioned above, however, LG Phillips may be breaking with the Basel Convention by accepting this material. Locally, PC Recycle has implemented a CRT-processing method that they believe will minimize worker safety concerns by using an enclosed piece of equipment to separate funnel glass from panel glass of televisions. The piece of equipment they use has been certified for environmental performance under ISO 14000 to minimize contact with glass, phosphorous, lead, and other hazards.<sup>5</sup> PC Recycle sends whole computer monitors and the CRT glass to a broker in Germany, GWG Ges Wiederverwertung, who resells good monitors as televisions and sends glass to a Samsung CRT manufacturing facility in Malaysia that has been certified for environmental performance under ISO 14000<sup>5</sup>. PC Recycle and Earth Protection Services are two examples of processors making a concerted effort to research and investigate the safety practices of their offshore vendors. Most processors indicated they would like additional assistance with this time-consuming process.

### ***Flat Panel Displays (FPD)***

**There is no standard recycling method yet for recycling FPDs as they are still only trickling into the recycling market.** FPDs are not yet showing up in significant numbers, according to local contacts. Most processors reported that they were stockpiling these items until they achieved quantities great enough to justify disassembly and/or shipping costs. However, as these products are consumed in ever increasing quantities, reusing, disposing and recycling FPDs may soon pose its own set of challenges.

- **Some processors will likely remove the fluorescent bulb and dismantle and shred the rest.** Currently, PC Recycle reported collecting no more than two liquid crystal displays (LCDs), the most common flat panel display technology, per week, a high percentage of which are reusable. Total Reclaim is currently stockpiling LCDs until they have a significant quantity to justify setting up a process to remove fluorescent tubes and dismantle for recycling. Earth Protection Services says they are seeing some LCDs, but not many. To recycle the LCDs, they remove the fluorescent tube and circuit board, dismantle the unit, and shred for market like any other electronic unit. Earth Protection Services reported that the liquid crystals are landfilled or used for alternative daily cover. EPSI, like Total Reclaim, is well-positioned to handle increasing quantities of LCDs due to their fluorescent tube recycling program.

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<sup>5</sup> ISO (International Organization for Standardization) is a global network that identifies what International Standards are required by business, government and society. The ISO 14000 family is primarily concerned with environmental management to minimize harmful effects on the environment caused by its activities and to achieve continual improvement of its environmental performance ([www.iso.org](http://www.iso.org)).

- **Overseas markets are emerging with the capacity to recycle flat-panel displays.** PC Salvage, which is also stockpiling flat-panel displays, is currently negotiating with an overseas buyer who is working to trademark a process to remanufacture old liquid crystals into new liquid crystals. (they would not provide details about this relationship). There is also speculation that more LCDs will be going to Japan with the recent announcement by the country's federal environment minister that the country will be easing rules on the importation of e-scrap from developing countries. There is a likelihood that these reduced regulations will result in more LCDs heading to Japan, as that country has the world's only indium recycling system (E-Scrap News, 2006c).

**Health issues regarding materials unique to flat panel displays (FPDs) have not been well documented.** While FPDs contain many of the same hazardous materials found in other electronic products (lead, cadmium, chromium, antimony, beryllium, and brominated flame retardants), there are several substances unique to FPDs such as liquid crystals and mercury, which is in the fluorescent tube used to backlight the screen. While the health and environmental effects of mercury are well documented, there is currently little conclusive documentation about the short- or long-term effects of liquid crystals on human and environmental health (KCSWD, 2005). Getting more data and information on these issues out to the industry will be critical as LCDs increase in the consumer market and the waste stream.

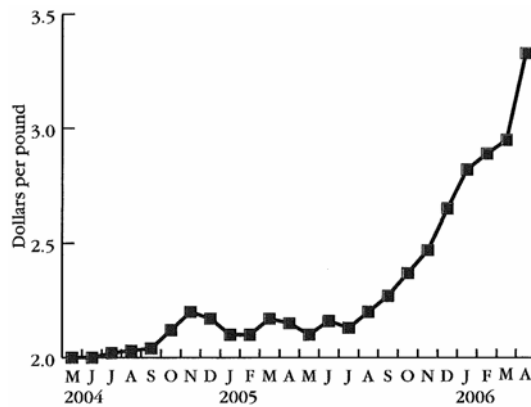
## Circuit Boards

Circuit boards are recovered from electronic waste and sold to refineries that recover precious metals. Due to the precious metal content, by weight they are the most valuable commodity from electronic waste.

**The intrinsic value of recyclable PC boards has been steadily increasing over the last several years.** As indicated in the chart to the right, the value of PC boards has increased steadily over the last two years, with a substantial increase during the last year. The data shown

represent the full metallic values of boards over time and are not the recycling values, as they do not include the cost involved in extracting the metals from the boards (E-Scrap News, 2006a).

**Figure 4-6. Intrinsic Value of PC Boards 2004-2006**



**Most of the local processors contacted for this study confirm that markets for circuit boards are fairly robust but that the value is dependent on the precious metal content.** PC boards are considered mid-value, with lower value scrap in monitor and television boards, and higher value scrap in network, video, IT cards, and mainframe boards. Processors noted that manufacturers have been improving their ability to produce boards with less precious metal content so many of the newer electronic products contain lower-value boards. The price reported for circuit boards ranged from \$0.80/lbs - \$1/lb. Some of the brokers and processors for circuit boards include Hallmark Refinery, Quality Materials Logistics, Metro Metals Northwest, and Calbag Metals Co. Noranda, Umicor, and Boliden were the primary smelters mentioned by local processors.

**Processing methods for circuit boards differ between processors.** Several local processors indicated that they had been exploring the cost-effectiveness of removing boards before shredding versus leaving boards intact and shredding the whole unit. Some processors shred the whole unit and use eddy currents and magnetic fields to separate certain metals. Others are manually removing boards before shredding the units.

## Plastics

Plastics recovered from electronic products may be remanufactured into new plastic products, burned as fuel, or landfilled. The most common plastics found in electronic waste include HIPS (high impact polystyrene), common in television housings, and ABS (acrylonitrile butadiene styrene) and PCABS (polycarbonate acrylonitrile butadiene styrene), common in CPU and monitor housings. Local and international markets for recycled plastics are improving.

**Because of access to cheap labor to hand-sort materials, China is the hot market for electronic waste and plastics.** Several of those interviewed commented that many plastics from the area were being shipped for free to China. At the same time, our research revealed the development of several regional markets for plastics, especially

HIPS and PCABS. One local collector sells plastic overseas to China for \$0.06 per pound.

**Acrylonitrile butadiene styrene (ABS), a common plastic used in computer housings, is more difficult to process, due to its lower melt point than many other plastics.** However, there are ongoing research activities around the country on ways to use recycled ABS in new applications. Professors at West Virginia University in Morgantown say they are close to commercializing a process of making wood-plastic composite deck boards from recycled ABS from computers. The lower melt point of ABS as compared to other plastics makes it well suited for a wood fiber mix product because the wood fiber does not burn off during processing. Other higher melt point polymers require temperatures too high to use the wood fiber mix (Griswold, 2006).

**Two regional processors accept electronics plastics for recycling.** PC Plastics and Agri-Plas, both located in Oregon, accept material from collectors and processors in King County and are looking to expand operations in order to supply domestic recycled plastic industries. Both reclaimers pay between \$0.10 to \$0.20 per pound, and typically get anywhere from \$0.55 to \$0.70 per pound for processed pellets.

- **PC Plastics is processing about 80,000 lbs per month and are not at full capacity.** They are currently hand-sorting material and would like to be able to invest in more automated technologies as product increases. They are currently experimenting with new technologies to blend of HIPS and PCABS together. Their approach to flame retardants has been to use respirators and dust collection systems, but they are concerned about the issue and would like further studies and assistance by government. PC Plastics currently sells all of its material within the United States to local manufacturers of construction parts such as concrete form pieces for housing. They process about 10,000 televisions annually from King County through Total Reclaim and could use more material.
- **Agri-Plas is also buying material from the King County area through contracts with Earth Protection Services, Inc. and other collectors.** As with PC Plastics, handling or marketing of plastics with flame retardants has not posed much of a problem for Agri-Plas. However, the contact did express a desire to obtain better information about the health risks and also best management practices in handling the material. Agri-Plas has a new U.S. buyer that can use a blend of plastics to make railroad ties and they are looking to dramatically increase supply of this material to supply this buyer. They are currently processing 500,000 lbs per month and eventually hope to reach five million lbs per month.

**Collectors and processors noted several challenges with collecting and selling plastics.** While it is easy to differentiate between HIPS (black) and ABS/PCABS (white), it can be difficult to tell the difference between the various white plastics. Furthermore, close to half of the plastics from electronic waste contain flame retardants and it can be difficult to identify which contain flame retardants (APC, 2000). These chemicals may pose health and safety risks for workers and can impact the recycling process. Some of the key concerns about flame retardants that were mentioned included:

- **Difficulty in identifying which materials contain flame retardants.** While “FR” is printed on many plastic casings, this symbol is not always used nor located in a standard place.

- **Worker safety and health issues in disassembly and processing activities.** Many of our contacts noted a lack of good information and science about the health and safety impacts of PBDEs on workers. Many asked for better information on the science and best management practices to protect workers. One strategy used by one contact was to shred plastics in larger pieces to avoid creating dust particles and powder. Additional strategies mentioned by public sector contacts (Ecology and Snohomish County) included providing uniforms and boots that stay on-site (to protect children and families at home) and using air purifiers (Carveth, 2006).
- **Concerns with proposed bans on using PBDEs in new products.** Processors and reclaimers expressed concern with banning PBDEs from new products. They worried that a ban would dramatically impact the end-use market for plastics from electronic products, as PBDEs are contained in much of the current and projected supply of electronic equipment for the near future. They would like to see a distinction between new products and those made with recycled content and would also like to see more research and development into end of life products for plastics with flame retardants.

### ***Scrap metal***

Overall, the markets for scrap metal are robust and strong. Local processors sell steel, copper, aluminum, and some mixed bales to local and regional dealers such as Seattle Iron & Metals, Schnitzer Steel Industries, Metro Metals Northwest, Hallmark Refinery, Joseph Simon & Sons, and Bloch Steel Industries. Depending on the material, metal prices range from \$0.30 per pound for aluminum to more than \$120/ton for steel. One contact said they send mixed metal to Bloch Steel Industries, as they have older and heavier processing equipment that can handle this material (old copier machines). The collector is not paid for the mixed metals and does have to pay for hauling.

## **OVERALL BARRIERS/OPPORTUNITIES**

As indicated in the discussions in this chapter, there are several barriers for the electronics recycling market in King County.

- **Toxics and safety issues pose challenges for processors.** Processors were concerned about worker safety issues associated with dismantling and shredding electronics. Many would like more studies done on the risks of working closely with toxics, specifically with flame retardants in plastics. In addition to flame retardants, there is a lack of data on the health effects of liquid crystals and the best ways to handle them.
- **The need for markets for CRT glass-to-glass recycling are expected to outlast CRT manufacturing.** Because most of this recycling is happening overseas and CRTs televisions and monitors are only expected to be manufactured for the next 10 to 15 years, there is a need for other options for this material. One option mentioned during the processor interviews (other than glass-to-lead via smelters) was the possibility of panel glass being used locally in construction applications.
- **The glass-to-lead market is currently limited and not extensively used by Northwest processors.** The only primary lead smelter in the country is Doe Run, with limited capacity. Other, secondary lead smelters (operated by Exide

technologies and others) are not currently a major destination and have not always been willing to accept CRT glass.<sup>6</sup> Therefore, in its present state glass-to-lead markets would likely not be able to absorb the current supply of old CRTs. If CRT manufacturing does come to an end and those recycling opportunities vanish, then further exploration of the glass-to-lead market will be necessary.

- **Although companies may want to make the right choices in terms of the environment, it is expensive to research the business practices of all their buyers.** EPSI, for instance, paid for the president of their company to visit the LG Phillips plant in Brazil. Many companies can't afford to conduct this extensive research.
- **Washington State's new electronics recycling bill raises new challenges and opportunities.** The law will undoubtedly increase recycling of electronics, but many of the details of implementation have yet to emerge. Local processors are concerned about losing market share; a smaller share of a bigger market may still result in increased volume, however.

## PUBLIC SECTOR ACTIONS OPTIONS

This research helped highlight several core areas and key actions that King County may wish to consider in its efforts to support links in the supply chain to help recover the most value from electronic waste and protect human and environmental health:

- **Provide information to residents, businesses, and organizations about the new bill and consumer recycling options.** This was one of the most common suggestions for King County mentioned by local processors. It will be critical to get accurate information to consumers about where to take electronic waste.
- **Help distribute current, accurate information on reclaimers and end-users with environmentally sound practices.** EPSI talked about an important role the Oregon Department of Environmental Quality has played in helping to identify and recommend plastic reclaimers in Oregon. Many of the processors we spoke with indicated that they would like access to information about buyers for their materials (local, regionally, and internationally). King County could serve an important role in documenting sound practices and making this information more widely available.
- **Provide technical assistance and funding to help support processors with reliable information and research on environmental, health, and safety standards.** Many processors contacted were interested in information on best management practices for handling PBDEs and other hazardous materials found in electronic products.
- **Continue to participate in public-private partnerships to support product stewardship and design for recycling strategies.** We recommend that King County continue to support this approach in partnership with other governments

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<sup>6</sup> As of 2000, national annual capacity at secondary lead smelters was 1.65 million CRTs (Musson, 2000). More recent figures were not available.



through the Northwest Product Stewardship Council or other avenues to help in publicizing successes and sharing knowledge.

- **Identify sources of financial assistance and provide technical assistance to help processors and end-users expand their operations and invest in safe and efficient equipment.** This effort may give local processors the advantage they need to remain competitive. For instance, Snohomish County assisted PC Recycle in the selection of new ISO 14000 equipment for their Bellevue facility.

Although the rule-making on the new electronics legislation will happen at the State level, there are several important ways King County could have an influence in order to strengthen, or maintain the stability of, local electronics markets.

- **Engage in rulemaking at the state level to ensure that material is not simply exported to the cheapest overseas market.** In the case of certain materials (CRTs and some plastics) overseas markets may be the only option. It will be important to establish rules to govern what steps need to be taken to ensure that environmental and health criteria are satisfied.
- **Work with Ecology or other governmental agencies to help establish a monitoring framework for exported electronic waste.** As with CRTs, some materials and commodity markets are primarily, if not entirely, overseas. King County could work in partnership with other governments and businesses to develop tools for monitoring and reporting on exported electronic waste to ensure that these materials are handled in environmentally sound ways.
- **If reuse is a priority for King County, investigate ways to encourage reuse through rule-making on new legislation.** King County and local collectors and processors could take a leadership role in prioritizing reuse during the rulemaking phase, and continuing to educate consumers about reuse opportunities.

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# Chapter 5

## Glass

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### 5.1 INTRODUCTION

Glass is unique among recyclables in that it can be recycled into the same products indefinitely without losing its essential qualities. Manufacturing bottles using recycled glass cullet also uses far less energy than using virgin materials.

In King County, glass has traditionally been collected at the curb with other recyclables. This trend has continued, except that in most municipalities (as well as in the unincorporated area), glass is now included with other recyclables in a single bin, a method termed “single-stream” recycling by the industry. In addition, due to economic and contamination concerns, some jurisdictions outside King County have stopped collecting glass at the curb. The changing methods of collecting glass have affected the entire supply chain for glass recycling, as well as the recycling markets for other materials, particularly paper, for which glass is a contaminant. King County will likely be faced with some difficult choices about glass recycling in the near future. The goal of this chapter is to give King County a perspective on the current situation in the glass recycling market, including how changes in collection have impacted this market and how these issues might be addressed.

### 5.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

Glass containers collected for recycling in King County come from both residential and commercial sources.

- **Residents recycle glass containers primarily through curbside recycling.** Single-stream recyclables collection, where all curbside recyclables are placed in one container, has continued as the favored curbside recycling practice in King County. King County estimates that over 16,000 tons of glass were recycled at the curb in 2005 (Reed, 2006). With an estimated 9,600 tons of glass containers still disposed in residential curbside waste, the estimated residential glass recycling rate is 63%. King County estimates that an additional 1,100 tons of glass containers are collected at transfer stations.
- **Glass in single-stream recycling is the subject of great debate.** The regional debate over the merits of single-stream has continued and even intensified. Glass processors, bottle manufacturers, paper mills, and some MRFs all complain about including glass in single-stream recycling and cite the merits of separate collection. So far, few changes have been made, but in 2005, Pierce County stopped collecting glass at the curb in favor of collecting it at drop sites. Initial results of the program indicate that less than half as much glass is now being collected (a 55% decrease), but that overall collection has increased by 64 percent due largely to the increased capacity and convenience of the 96-gallon cart that have enabled dramatically increased quantities of paper recycling (Pierce County, 2006).

- **Glass recycling is offered to businesses by the major haulers and other recyclers.** However, few data exist on glass recycling from businesses. We estimate that approximately 3,600 tons of glass containers were recycled by businesses in 2005, based on some limited data provided by King County and extrapolating from the 2004 markets report, when an estimated 3,500 tons of glass containers were recycled from businesses.
- **Bottle bill interest grows in Washington, then recedes.** The increasing prevalence of beverage containers in the waste stream has helped renew interest in a bottle bill in Washington. A session at the annual Washington State Recycling Association (WSRA) conference in 2005 was devoted to the topic, with representatives from the Northwest Product Stewardship Council (NWPSC), Container Recycling Institute, the Washington Food Industry, and the American Beverage Association debating the issue. The NWPSC and the City of Tacoma supported a consultant effort to analyze the issue (Morris, Smith, and Hlavka, 2005). The study concluded that a bottle bill would recover more containers at less cost than other recycling systems, but that any effort to pursue a bottle bill would need to include stakeholder input. Since that time, however, interest has cooled off as the recycling industry has largely turned to other issues – especially the recycling of electronics and the passage of a new bill in Washington. It appears as if there is little momentum currently for a bottle bill, but this remains an issue to watch.

### **Current Supply**

The following table summarizes our estimates of the quantities of glass containers (including bottles) generated in King County (excluding Seattle) in 2005. Disposal figures in this table were provided by King County Solid Waste Division and are calculated based on 2002 waste composition data applied to King County's waste disposal forecasts.<sup>7</sup> Recycling estimates are from hauler data provided by King County, interviews conducted as part of this study, and projections made based on estimates made in 2003, the previous time this markets study was conducted.

As the table indicates, the total supply of these items is approximately 40,000 tons.

**Table 5-1. King County Glass Container Generation, by Sector**  
(excludes Seattle)

	Disposed	Recycled	Total Generated	Estimated Recycling Rate
Residential	9,600	16,100	25,700	63%
Commercial	8,300	3,600	11,900	30%
Self-Haul	1,500	1,100	2,600	42%
<b>Total</b>	<b>19,400</b>	<b>20,800</b>	<b>40,200</b>	<b>52%</b>

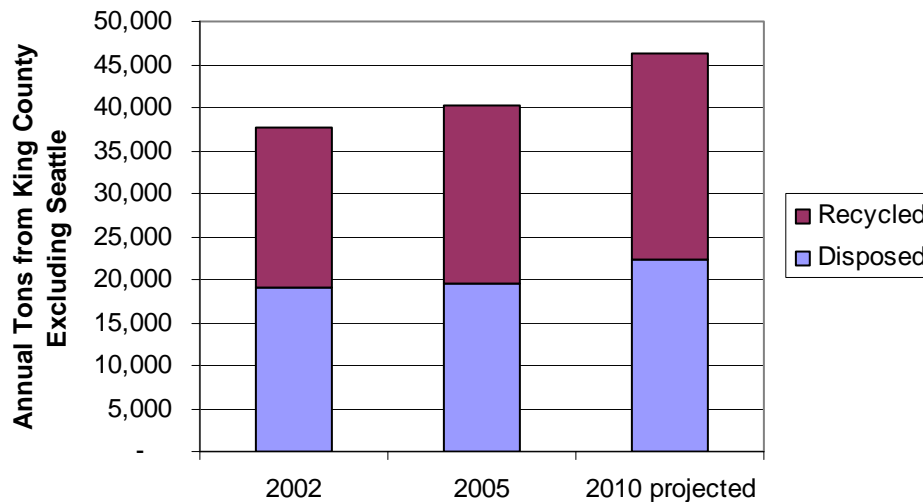
### **Projected Supply**

The King County Solid Waste Division projects that approximately 22,000 tons of glass containers will be disposed in 2010, assuming no major programmatic or policy changes.

<sup>7</sup> Note that the disposal figures in this table do not include items disposed in "mixed loads" of both residential and disposal waste. As a result, the estimate of total disposal is expected to be a slight underestimate.

The following chart projects a status quo future where the recycling rate remains constant and recycling and disposal increase at the same rate.

**Figure 5-1. King County Glass Container Generation:  
Current and Projected**  
*(excludes Seattle)*



## Processing & Infrastructure

Most glass collected for recycling from residents and businesses in King County is collected by the two major haulers. Glass collected by Waste Management in King County (outside Seattle) is generally handled at the Cascade facility in Woodinville, whereas glass collected by Allied and associated companies (and all that collected in the city of Seattle) is handled at Allied's Third and Lander facility in South Seattle.

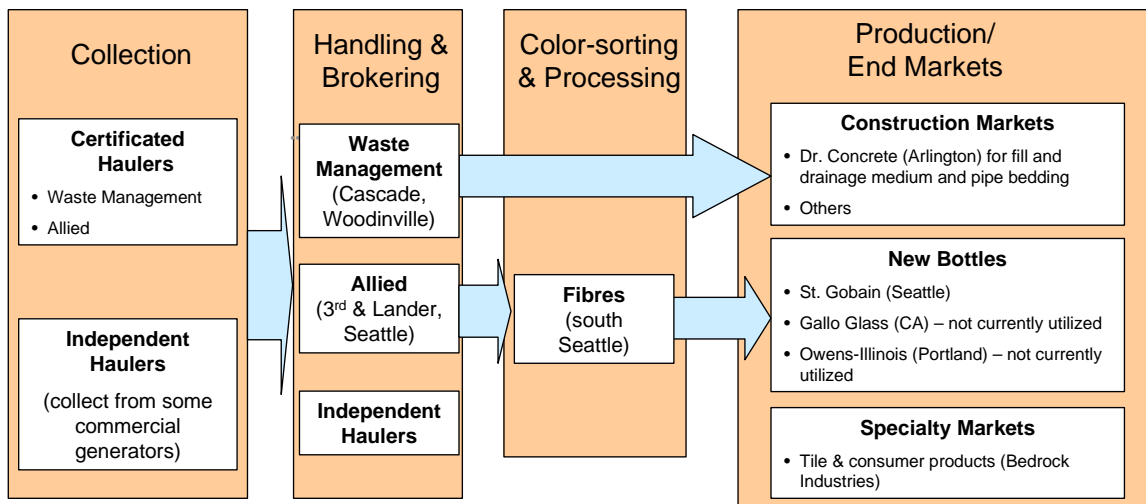
- Glass collected by Waste Management is handled at the company's Cascade MRF and marketed to construction applications.** Glass collected in King County by Waste Management is processed at their Cascade MRF in Woodinville. The Cascade facility is a single-stream MRF that uses a "fines separator" to sort glass out from other items and then a "cyclone", or air classifier, to clean small bits of paper out of the glass. Previously, most glass from the Cascade facility was shipped via rail car to Recycle America's sorting facility in the Bay Area. However, the high shipping costs have made it more economical for Waste Management to keep glass local and send it to Dr. Concrete, where it is handled free-of-charge. Waste Management and Fibres have also discussed sending glass to Fibres, but so far contamination concerns and economics have prevented this from happening. Glass from single-stream operations is more contaminated than glass collected separately, making it more challenging (and expensive) for Fibres to sort. For Fibres to sort glass, it must be clean, dry, and bigger than half an inch.
- Glass collected by Allied and its associated companies is handled at the company's Seattle facility and further processed by Fibres.** Allied's Third and Lander facility handles the glass collected in the City of Bellevue's

residential single-stream recycling program, as well as Allied’s other residential and commercial accounts in King County. The facility also handles Seattle’s residential recycling program, in which glass is collected in a separate bin. Seattle’s glass generally has fewer contamination problems than glass collected in local single-stream systems. Allied sends most glass to Fibres International, which operates a color separator in its facility in the South Park neighborhood of Seattle. Fibres has traditionally charged Allied to process glass from the 3<sup>rd</sup> and Lander MRF, although the current contract and price arrangement were confidential. Fibres then sells most of its glass to Seattle bottle-maker Saint-Gobain Containers.

In addition to container glass generated locally, a significant amount of industrial flat glass (primarily from windows) is scrapped every year. TriVidro estimates that 25,000 tons of flat glass is available in the local area from industrial sources including window manufacturers and glass plants. TriVidro is currently the only local company that uses this glass to make new products.

The following chart depicts the supply chain for recycled glass containers in King County.

**Figure 5-2. Current Supply Chain for Recycled Glass Containers Generated in King County**



## End Markets & Prices

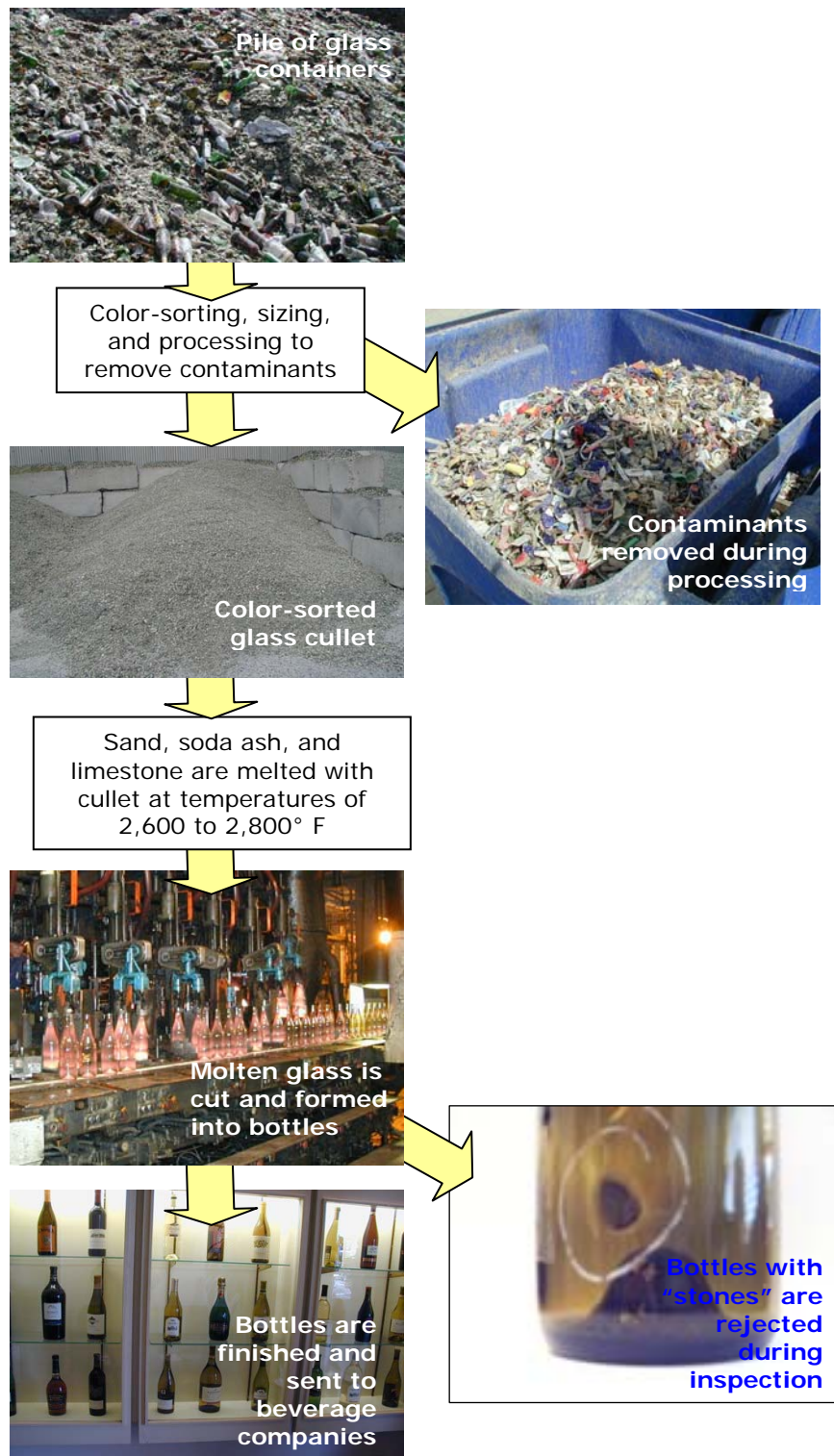
Currently, the construction market and the bottle market are both significant destinations for recycled glass collected in King County.

- **Saint-Gobain Containers is buying all the recycled cullet they can get.** Saint-Gobain has altered their process and is producing a bottle mix that has enabled them to use as much recycled cullet as they can obtain, including all three colors: green, amber (brown), and flint (clear). Recycled cullet is generally a cheaper feedstock than virgin, but the real benefit to Saint-Gobain is the dramatically reduced energy costs of using recycled cullet. Saint-Gobain’s

demand is so high that they have been buying cullet from as far away as Chicago and Los Angeles (at significant cost) to supplement their supply from Fibres.

- **Fibres isn't able to meet Saint-Gobain's demand.** In addition to sourcing material from Seattle's curbside program via Allied, Fibres has been acquiring a significant amount of material from other markets, including Vancouver, B.C.. Fibres would like to get material from Waste Management's Cascade facility to meet demand, but so far the two firms have not been able to work out the contamination and economic concerns. An additional challenge for Fibres is producing cullet that meets Saint-Gobain's quality standards. Saint-Gobain has been particularly vocal about the quantity of ceramics in the cullet, which can easily ruin bottles when they become "stones" contained within the wall of a glass bottle (see Figure 5-3).
- **In addition to Seattle's Saint-Gobain, other glass container manufacturers are located in Portland and California.** Owens-Illinois in Oregon produces beer bottles for the region's large micro-brew industry and is currently only buying amber cullet. Numerous bottle manufacturers, such as Gallo glass, exist in California to support the wine industry. Neither of these markets is currently being utilized by King County recyclers, due to the cost of transporting glass long distances and the strong local demand by Saint-Gobain and Dr. Concrete.

**Figure 5-3. Bottle-to-bottle Glass Recycling Process**



In addition to the bottle market, other markets exist for small, crushed glass, called "fines". Glass "fines" are those pieces that are too small to be sorted by color. These pieces are not suitable for bottle manufacturing.



- **Recycled glass is also used in construction applications.** Glass from King County recycling programs is also marketed to building contractors by Dr. Concrete and by Fibres. Fibres markets the glass that is too small to sort (the “fines” that make up approximately 25% of what they receive) to construction contractors. On the other hand, all of Waste Management’s glass is currently used in construction applications. Dr. Concrete processes the glass with a screen to remove contaminants (e.g., bottle caps and corks) and then runs the material through a crusher to create a product that is less than three-quarter inches in size. The construction industry uses the material in place of rock for road bedding, pipe bedding, backfill for drainage, and other structural fill. Some customers prefer it to rock because it reportedly compacts easier.

In addition to products made from recycled glass from curbside collection, TriVistro makes recycled glass products using flat glass from industrial sources such as window manufacturers and other glass plants. They create specialty products including aggregates, such as tiles, as well as abrasive sanding media and water filtration media. Another specialty market, Bedrock Industries, uses mixtures of container glass, industrial scrap, and art glass to create tiles, tumbled glass, and other novelty products. The container glass they receive is typically from bottle drives at local schools or children’s groups. They have also received rejected batches of wine and other bottles.

### **Prices**

Glass prices are lower than other curbside recyclables. Bottle-to-bottle glass recycling has a higher value than construction uses but is limited by contamination and, therefore, requires more processing.

- **The bottling industry has been paying \$58 per ton for glass cullet.** Saint-Gobain’s price paid to Fibres has remained about \$58/ton. The company reports that using all virgin feedstock (sand, soda ash, and limestone) costs about \$65 per ton. Shipping cullet from elsewhere in the country can cost \$100 per ton or more, but can still be cost-effective due to the energy savings realized by using recycled cullet instead of virgin feedstock.
- **The construction industry pays \$0 to \$7 per ton.** Depending on the quantity of material, construction contractors are charged anywhere from \$7 per ton (generally for small quantities) to \$2 per ton (generally larger quantities). In some cases, Fibres may not charge anything if they have a large supply and Dr. Concrete or a contractor will take a large quantity of fines off their hands. Dr. Concrete charges construction contractors between \$3.50 and \$7/ton for products of glass mixed with gravel or sand and \$6.50 per ton for crushed glass.
- **Fibres has paid for color-separated glass delivered to its facility, but this is a rare occurrence.** This glass becomes more rare as few glass recycling programs color-separate glass at the point of collection.

## **5.3 BARRIERS & OPPORTUNITIES**

The following were identified as barriers to glass recycling.

- **Contamination limits bottle-to-bottle glass recycling.** The biggest single barrier for recycling glass bottles and containers back into bottles and containers is contamination from ceramics. The presence of even a small

amount of ceramic in glass cullet causes weaknesses in the final product that is unacceptable and can lead to breakage, particularly in carbonated beverages such as champagne. Ceramics are a major concern in glass from both single-stream and source-separated programs. Saint-Gobain reports that about 2% to 3% of bottles, and as high as 5%, contain pieces of ceramic termed “stones”. One or two loads per month are rejected at Saint-Gobain as having too much contamination. An additional concern specific to single-stream programs is contamination from paper (and, to a lesser extent, plastics), which can render the material unsortable by the types of optical sorters used by Fibres and therefore prevent its use in bottle manufacturing.

- **Newer sorting equipment could benefit Fibres.** Fibres has three optical sorters: two for sorting colors and one for removing contaminants, including ceramics. However, the machinery is about 15 years old and doesn't perform as well as newer models, many of which have built-in capacity to remove ceramics, the most problematic contaminant. Each optical sorting machine costs approximately \$250,000, an investment Fibres is hesitant to make without the guarantee of supply from local haulers.
- **Freight costs inhibit access to other markets.** When glass is used in construction markets it must compete with rock and gravel that, in some cases, can be sourced more locally than recycled glass. This is particularly true in some areas of rural King County where gravel is accessible from local quarries but glass would need to be procured from Fibres in Seattle. In addition, when demand for local end markets is low, local recyclers have had difficulty accessing markets in Oregon and California due to the high cost of shipping glass by truck or rail. Alternately, it is hard to make a competitive bid for glass in Oregon, eastern Washington, and British Columbia because of freight costs.
- **Increased awareness in the construction industry could help grow markets for “fines”.** Use of recycled glass in construction applications has picked up in the last couple years, but further efforts may be needed to ensure that demand is there for the “fines” and other glass that cannot be recycled back in to bottles.
- **Current supply of glass is insufficient to meet demand by the local bottle manufacturer.** Saint-Gobain receives about half as much material from Fibres as they could use. For this reason, they are using less cullet in their feedstocks than is optimal as well as paying more to supplement their feedstocks with recycled cullet from other areas. While Saint-Gobain would prefer about 30% recycled cullet, they are now using a mix of about 20%. As a result of using less cullet, they need to buy more sand and oxygen. They are now reaching limitations from the sand and oxygen suppliers who can't meet their increased demand. Those pressures along with increased energy costs for the higher temperatures needed to melt sand drive Saint-Gobain to seek more recycled cullet.

## 5.4 PUBLIC SECTOR OPTIONS

The biggest need and opportunity is to clean up the supply of recovered glass to address contamination issues.

- **Facilitate discussions between haulers, processors, and end users to maximize the potential of glass recycling in the area.** Saint-Gobain Containers is unable to meet its demand for recycled cullet, despite the fact that plenty of material exists locally. Factors responsible include the relatively poor quality of glass produced through single-stream collection and processing; the limited and nearly outdated optical sorting equipment at Fibres, and apparent lack of cooperation between local parties. Although glass collected from King County is not disposed (much of it goes to construction applications), we conclude that there is an opportunity to increase the value of glass in the local economy and achieve other environmental benefits such as reduced energy use at Saint-Gobain Containers. Accordingly, we think there is a strong opportunity for King County and its partners to convene a glass “summit” and invite all stakeholders to create solutions that increase glass-to-glass recycling in the County. In particular, MRFs, Fibres, Saint Gobain, and local governments could all benefit by sharing the costs of capital upgrades in sorting technology at MRFs and Fibres to cost-effectively process glass for use in the high-value and high-demand bottle market.
- **Assist with education and marketing concerning construction use of glass.** Even if more glass goes to the bottle-to-bottle market, a significant fraction (at least 25%) of glass will likely remain as “fines” that are too small to sort. The construction market can continue to be a local market for this material, and King County efforts could focus on educating contractors and cities about the use of this material for construction purposes.
- **Continue and expand outreach and education.** Ceramics are a highly problematic contaminant in recycled glass cullet, and continued education is needed to ensure residents do not place ceramic items in their recycling bins.
- **Consider a disposal ban on glass containers, if local processing and marketing challenges can be resolved.** Current single-stream collection and processing methods used in King County have not been able to cost-effectively return glass to the bottle market. A disposal ban would help increase supply, but the material would only be marketable to the construction market, which may not be able to accept increased quantities.

*Glass*

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# Chapter 6

## Gypsum

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### 6.1 INTRODUCTION

Gypsum is the hydrated form of calcium sulfate. Naturally occurring gypsum is mined, but synthetic gypsum<sup>8</sup> made from the byproducts of scrubbing sulfate out of the smoke of coal-fired power plants. Chemically, these two types of gypsum are identical, so processors and markets do not distinguish between the two. Therefore, the definition of gypsum used for this report includes both natural and synthetic gypsum.

Its primary use in the United States is to make drywall, or wallboard, which is used to build interior walls. Commonly heard names for drywall, such as Sheetrock® or Gyproc®, are registered trademarks. Construction, remodeling, and demolition activities generate the preponderance of scrap gypsum in King County.

### 6.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

In 2005, Recovery 1 stopped accepting gypsum because of the company's concerns over the potential health effects of breathing gypsum dust on its workers. These concerns arose after the promulgation of a new EPA rule regulating mercury emissions, due to take effect in 2007 (please see the wood chapter for additional information). Even though many contractors brought their gypsum to New West Gypsum instead, recycling tonnages still declined in 2005. Recovery 1 has reassured itself that the worker-safety hazards from gypsum dust are not significant, and is proactively working through the issues arising from the new regulation with EPA. The company began accepting gypsum again in late 2005.

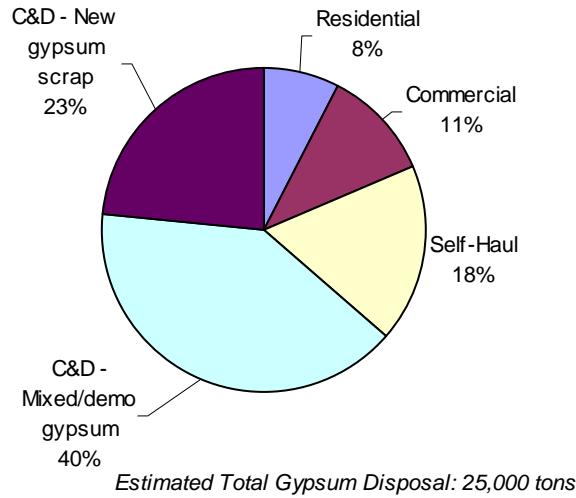
#### ***Current Supply***

An estimated 25,000 tons of gypsum were disposed from King County 2005: most as construction and demolition waste at the five private transfer stations in King County. The following pie chart displays the sources of gypsum disposal in King County. An estimated 1,900 tons were disposed in residential waste, 2,700 tons in commercial waste, 4,300 tons in self-hauled MSW loads, and 15,700 tons in C&D loads (9,900 tons of which were mixed/demo gypsum and 5,700 tons of which were new gypsum scrap.)

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<sup>8</sup> Synthetic gypsum is also known as industrial gypsum, flue gas desulphurized gypsum (FGD) and desulphurized gypsum (DSG).

**Figure 6-1. Estimated King County Sources of Gypsum Disposal<sup>9</sup>**



In addition, at least 6,000 tons of gypsum generated in King County were recycled in 2005 at two processing facilities: Recovery 1, which accepts commingled loads, and New West Gypsum, which accepts only source-separated gypsum. One processor recycled an additional 140 tons of the paper backing.

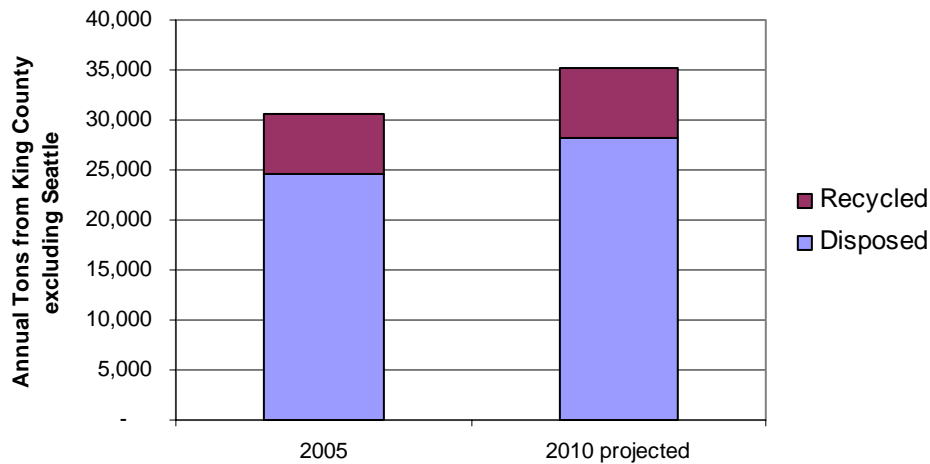
In total, at least 31,000 tons of waste gypsum were generated in King County in 2005. With at least 6,000 tons being recycled, the recycling rate for gypsum is therefore at least 19%.

### **Projected Supply**

The King County Solid Waste Division projects that approximately 28,000 tons of gypsum will be disposed in 2010. Recycling tonnages should remain steady or increase somewhat now that Recovery 1 is accepting gypsum again and new C&D processing capacity is coming online in Seattle. The following chart projects a status quo future where the recycling rate remains constant and recycling and disposal increase at the same rate.

<sup>9</sup> New gypsum scrap is generally off-cuts from new installation. Mixed/demo gypsum is generally from demolition of existing gypsum.

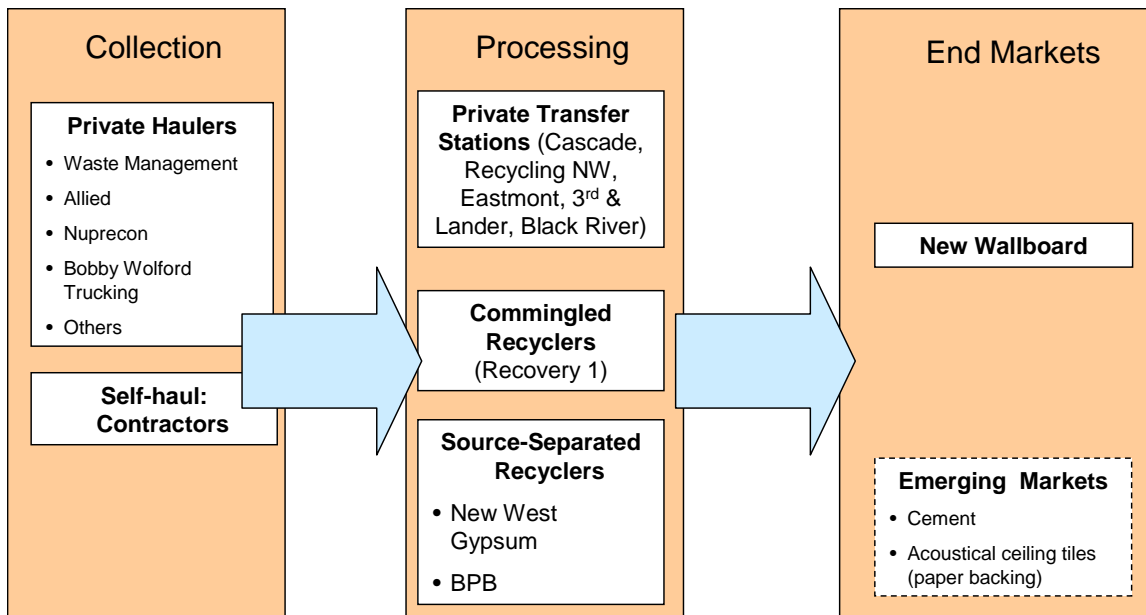
**Figure 6-2. King County Gypsum Generation:  
Current and Projected**  
*(excludes Seattle)*



## Processing & Infrastructure

Two major processors accept gypsum generated in King County: Recovery 1 and New West Gypsum. However, both of these processors are located in Pierce County. New processing capacity is coming online in Seattle.

- Recovery 1, in Tacoma, accepts commingled loads for recycling.
- New West Gypsum, in Fife, recycles post-industrial scrap from Georgia-Pacific and also accepts source-separated, post-consumer scrap from about 35 contractors. The company accepts new gypsum scrap and scrap from demolition projects, provided the scrap is free of studs, lead paint, and asbestos.
- In June 2006, CDL Recycle, LLC, opened a processing facility in south Seattle that accepts commingled loads for recycling from haulers. This facility plans to deliver its new gypsum scrap to New West Gypsum, and its demolition gypsum scrap to the Weyerhaeuser Materials Recovery Facility, where it is mixed with other materials to become structural fill.
- All processors report that they have excess processing capacity.

**Figure 6-3. Current Supply Chain for Recycled Gypsum Generated in King County**

## End Markets & Prices

Currently, end markets for gypsum are limited. In fact, one processor reports that weak end markets limit his ability to recycle more gypsum: although his company could accept hundreds of tons more gypsum each month, it doesn't because the company can't sell the recovered product.

- **The primary end market for recycled gypsum in King County is new gypsum wallboard.** Both major processors currently sell their recycled gypsum to manufacturers of new wallboard. There are two local end users for recycled gypsum: BPB and Georgia-Pacific.
- **Some gypsum scrap from demolition projects ends up as structural fill or ADC.** As noted above, CDL Recycle plans to send its demolition scrap gypsum to the Weyerhaeuser MRF, where it will be turned into structural fill. However, New West Gypsum reports that it mixes ground gypsum from demolition projects together with ground gypsum from new gypsum scrap and sells it to a local wallboard manufacturer, with no deleterious effects.
- **One processor is developing a new local market for recycled gypsum: concrete.** This processor has developed a process that grinds the gypsum to a particle size that is small enough for use in Portland cement. A local cement manufacturer has indicated interest in purchasing this feedstock, which can be made of either new or demolition scrap gypsum.

Because end markets for recycled gypsum are weak nationally, not just locally, other entities are experimenting with new uses for gypsum, including the following:

- **Soil amendment:** in California, new construction drywall is being recycled into soil amendment that can be marketed to mushroom growers, nurseries, golf courses, composters, general agriculture, and other markets. This use is controversial due to various additives in drywall, and the California Integrated Waste



Management Board does not recommend that demolition drywall scraps be used for agriculture.

- Stucco additive: in New Jersey, one company is adding gypsum to stucco.
- Sludge drying: The State of New York is funding a study to determine the efficacy of mixing recycled gypsum with sludge for bulking and drying.
- Water treatment: The State of New York is funding a study to determine whether recycled gypsum could help settle dirt and clay particles out of turbid water.
- Salty soil treatment: recycled gypsum could help leach sodium out of soils along roads where salt is spread in winter to melt ice.
- Manure treatment: although several studies in Washington show mixed results, recycled gypsum can be mixed with animal wastes to combine with ammonia and reduce odor.
- Animal bedding: recycled gypsum can be a substitute for sawdust or sand to absorb moisture in animal bedding, when mixed with wood shavings.
- Flea powder: gypsum makes up over 90% of the inert material in some flea powders.
- Grease absorption: mechanics could sprinkle recycled gypsum on the floors of their shops to absorb grease.
- Athletic field marker: groundskeepers use gypsum to mark lines on athletic fields.
- Moulds: researchers in the UK are investigating the potential to use recycled gypsum in ceramic and metal casting moulds.

Processing scrap drywall yields two products: gypsum rock and pieces of the paper backing. Markets for the paper backing are limited but growing:

- One processor tried to **compost** this paper backing, but because the paper emits hydrogen sulfide gas when composted, composting operations can take only limited amounts of the paper backing. Because the processor generates more paper than the composting operations can handle, the processor disposes the paper backing.
- However, the other processor has developed a process to remove the paper backing from scrap drywall in large enough pieces that it can be sold on to another market – **acoustical ceiling tiles**. The processor has sent trial shipments of the paper backing to major ceiling tile manufacturers, who have indicated interest in receiving the material on an on-going basis.
- Nationally, the California Integrated Waste Management Board notes that one processor separates the paper backing and sells it for use in **poultry bedding**.

## **Prices**

Processors report that prices for gypsum remain steady, although markets are not as robust as they would like.

- **Tip fees for scrap gypsum range from about \$60/ton to over \$90/ton.** Recovery 1 charges \$56/ton, and CDL Recycle charges about \$85/ton, for commingled construction debris for recycling. New West Gypsum charges

\$60/ton for source-separated gypsum. Allied's published price is \$85/ton for commingled loads and Waste Management's is \$93.50.

- **Wallboard manufacturers do not pay for recycled gypsum.** One manufacturer reported that depending on the customer, they charge anywhere from nothing to \$60/ton for recyclers to bring them ground gypsum.

The processor that is developing new markets for gypsum and the paper backing is not willing to divulge anticipated prices until the markets have solidified.

### 6.3 BARRIERS & OPPORTUNITIES

Contacts reported the following barriers to gypsum recycling in King County:

- **Collection options for small generators are limited.** CDL Recycle, Recovery 1, and New West Gypsum accept loads only from contractors or haulers that have accounts with their facilities. Therefore, small generators have little choice but to dispose their gypsum scrap.
- **Markets for gypsum currently are limited.** The vast majority of recycled gypsum is made into new wallboard. Nationally and internationally, different industry players report widely ranging limits on the amount of recycled gypsum that can go into new wallboard. For example, Gypsum Recycling International, a European firm that markets gypsum recycling technology, reports that new wallboard can contain up to 25% recycled content. In contrast, wallboard manufacturer USG produces panels with over 95% recycled content. However, most gypsum produced in King County is sold to local manufacturers BPB and Georgia-Pacific, who report that new wallboard can contain only 17- 20% recycled gypsum without sacrificing quality. One processor reports that his company limits the amount of gypsum it accepts because it can't find markets for additional material.
- **End markets currently do not pay for recycled gypsum.** Therefore, tip fees must stay high enough for recyclers to recover the costs of processing and transporting it to end markets.

Fortunately, promising opportunities appear to be arising for gypsum recycling in King County:

- **The opening of CDL Recycling in Seattle bodes well for recycling of new gypsum scrap in King County.** The lack of processing capacity for commingled construction and demolition debris in King County has long been a major barrier to increasing recycling of many materials, including gypsum.
- **Processors are actively working to diversify markets for gypsum.** As reported above, one processor has developed promising new markets for both gypsum rock and gypsum paper.

### 6.4 PUBLIC SECTOR OPTIONS

King County already provides extensive programs designed to increase recycling and recovery of construction and demolition materials, including gypsum. Contacts interviewed for this study suggested the following ways that King County could build on its efforts to expand markets for gypsum:

- **Assist with development of new end markets.** Recovery 1 and New West Gypsum both expressed a desire for more assistance with developing and testing new end markets for gypsum rock and the paper backing. In particular, finding new end markets that are willing to pay for recycled gypsum would be helpful. King County could work through its LinkUp program to provide these processors with technical assistance, development of specifications, and testing of new markets.
- **Work with local wallboard manufacturers to encourage them to accept a higher percentage of recycled gypsum in their new products.** Given that other manufacturers use up to 95% recycled content in new wallboard, it is possible that these companies could absorb much higher quantities of recycled gypsum.
- **Continue to encourage the adoption of green building practices in King County.** The King County Solid Waste Division is nationally recognized for its efforts to transform the building industry to one that builds green. One processor noted the importance of these efforts, stating that because contractors building green projects often purchase recycled-content wallboard, these practices help build markets for recycled gypsum.
- **Consider a ban on landfilling gypsum.** This practice has been effective in British Columbia. However, end markets need to be more robust before a landfill ban takes effect.

Gypsum

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# Chapter 7

## Metals

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### 7.1 INTRODUCTION

Curbside collection programs collect aluminum cans, steel cans, and small pieces of scrap metal. Previous iterations of this markets study (i.e., 1998 and 2004) have focused largely on steel and aluminum cans. This study includes information about cans, but places most emphasis on scrap metal. These metals include appliances, automobiles, aluminum siding, industrial scrap, construction materials, and other sources of residential, commercial, or industrial scrap metal.

The goal of this chapter is to look at the state of metal recycling in King County and examine barriers and opportunities to collecting scrap metal that is still being disposed. The information summarized below is largely based on interviews with 13 of the local metal processors and recyclers.

Recycling scrap metal is driven by the prices and strength of the current metals markets. Because generators can often get paid for scrap metal, these materials typically have very high capture rates. As the research indicates below, prices for scrap metal are at record high levels. This is largely driven by the demand abroad for scrap metal (Taylor, 2004).

### 7.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

Little has changed in collection programs for aluminum and steel cans in King County in recent years, but in 2004 some cities began accepting small pieces of scrap metal in their curbside recycling programs. Several private scrap metal recyclers accept larger pieces of scrap metal, as do the transfer stations in Seattle. Several King County transfer stations accept appliances for recycling, and Recycling Events operated by King County or suburban cities also accept metal.

- **Most metal is being recycled.** Prices are so high for metals right now that some report they believe most of it is being recycled. The exception is some larger scrap metal from individual consumers that don't have convenient access to recycling facilities or scrap yards and the item is too big for the curbside collection program. Most scrap yards feel that most of the appliances generated in King County are being recycled. There are some that complain about metal – mainly appliances – being thrown on the side of the road.
- **Scrap metal collectors prefer to work with large industrial customers** and prefer that type of material to individual customers. Most scrap yards do accept drop-off material from individual consumers, but report that these quantities make up only 10 to 20% of their supply.
- **Few convenient opportunities exist for residents to take large scrap metal.** There are few convenient opportunities for individual consumers to recycle their metal. None of the King County transfer stations offer scrap metal recycling other than appliances with refrigerants, Recycling Collection Events are

relatively infrequent. Information about the location of metal scrap yards is not widely known amongst consumers and these yards are not always in convenient locations for them.

- **Quantities of steel cans recycled remain fairly constant**, according to contacts interviewed.
- **Quantities of metal recycled are stable after some increase.** When prices start going up there is a general increase in quantities recycled associated with higher prices. Higher prices are also associated with an initially spike in metal quantities recycled, because people are cleaning out their yards and selling whatever they have lying around. A number of interviewees mentioned the construction boom as a big source of material.
- **Most metal recycled locally is generated within the region.** Of the 11 recyclers interviewed, there was great variance in where they got their metals. Most that are located in King County get the majority of their materials from the region, whereas those located in neighboring counties get materials from a wider range of locations.

**Current Supply**

Estimating the quantities of scrap metal recycled in King County is challenging because scrap metal recyclers often trade metal amongst themselves, making it difficult to accurately count (and not double or triple-count) the quantities of scrap metal handled. Cascadia recently completed an analysis of the Department of Ecology’s recycling survey data for King County and estimated that a total of about 52,000 tons of ferrous scrap and 14,000 tons of nonferrous scrap were recycled from King County in 2004.

King County Solid Waste Division has estimated that over 26,000 tons of scrap metal are still disposed in the MSW stream, with an additional 24,000 tons disposed as C&D, as detailed in the following table.

**Table 7-1. King County Scrap Metal Disposal, by Sector, 2005 tons**  
(excludes Seattle)

	Aluminum Scrap	Ferrous Scrap	Nonferrous Scrap (ex. Alum.)	Total
Residential	1,041	5,618	379	7,038
Commercial	677	11,292	184	12,153
Self-Haul	288	7,040	163	7,492
C&D	N/A	22,218	1,863	24,081
<b>Total</b>	<b>2,006</b>	<b>46,168</b>	<b>2,589</b>	<b>50,763</b>

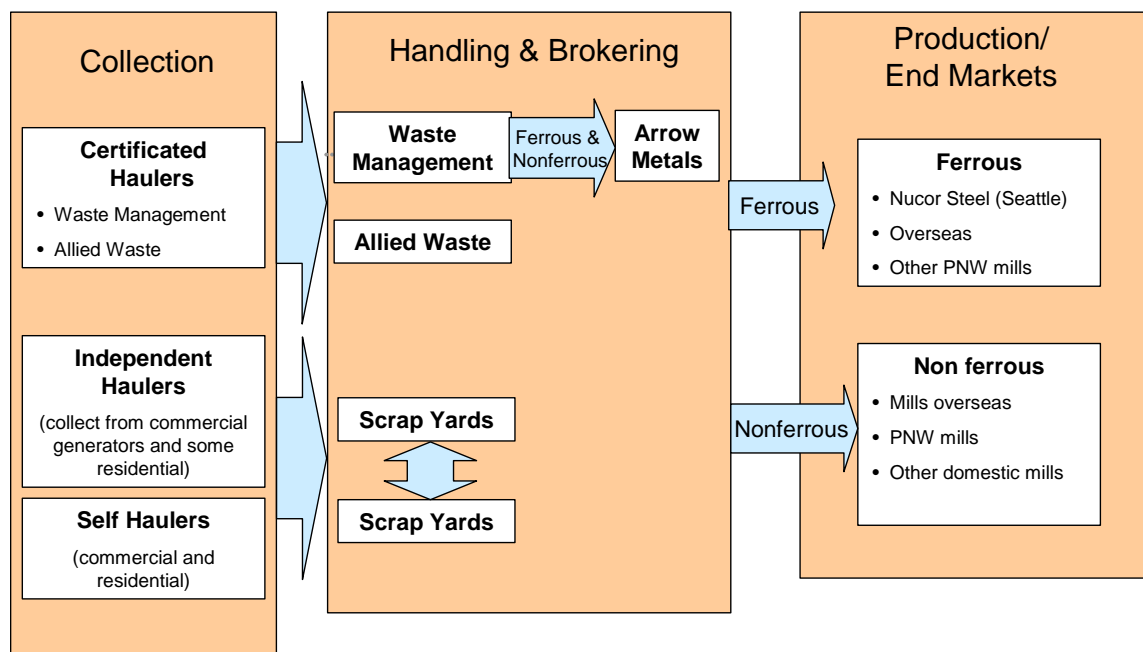
**Projected Supply**

According to projections by King County Solid Waste Division, the estimated disposal of ferrous scrap metal is projected to increase from over 50,000 tons in 2005 to approximately 58,000 tons in 2010, assuming no major changes in markets or local policies or programs.

## Processing & Infrastructure

King County has a strong scrap metal industry because of the high value of the material and the large quantities that it is often generated in from sources such as automobiles, appliances, industrial sources, and construction. The diagram below displays the supply chain for them many buyers and sellers of scrap metal.

**Figure 7-1. Current Supply Chain for Recycled Metal in King County**



Our research determined the following findings regarding metals processing in King County.

- **Scrap metal from curbside programs can cause equipment damage during sorting.** Metals that do not get caught early in the sorting line at a recycling MRF can jam or break the equipment and put a hold on the sorting process. While both companies have ways to try to avoid the problem, an increase in scrap metal in the recycling stream could increase equipment problems.
- **King County's infrastructure for metals is well developed and handles hundreds of thousands of tons of metal every year.** King County's 2001 survey of local metal processors found that an estimated 360,000 tons of metal were processed in King County in 2001. This total includes metal that was brought here from other areas.
- **Contacts interviewed for this study reported handling a total of 240,000 to 275,000 tons of scrap metal in 2005,** including both ferrous and nonferrous quantities. This figure includes some double-counting that is difficult to extract as well as material from Seattle and outside King County. The figure includes estimates from 8 of the 11 local metals processors identified (three companies would not respond).

## End Markets & Prices

The steel market has made a strong turn around from the slump at the beginning of the decade, bringing the rest of the scrap metal markets up as well. The improvement in the ferrous and nonferrous metals markets is largely due to increased demand in Asia for all types of metals.

- **Markets are strong for all metals.** Prices for all metals have been steadily increasing for the past couple of years. Copper alone has increased approximately 60% since January 2006. The table below lists current average prices for common metal commodities.

Metal Type	Price Paid
# 2 Bundles (Steel)	\$145 - \$190 per ton
Auto Scrap	\$130 - \$190 per ton
White Goods	\$0 - \$80 per ton
Aluminum cans	\$0.60 - \$0.70 per pound
Copper	\$3.15 - \$3.40 per pound
Steel Cans	\$70 per ton

- **Prices are high for all metals, but recyclers are uncertain about future trends.** Record high prices were reported for all types of metals, largely due to the demand from Asia, Russia, and India. There are strong concerns about what will happen to the metals market if prices drop dramatically. Many said that prices have been high too long and they must drop sometime. Some dealers are being cautious about what they accept and sell to keep from having a large quantity of low price or more volatile metals. When prices do go down, quantities of scrap metal collected will likely decrease as well.
- **Most scrap yards are selling at least some of their metals overseas.** Of all those interviewed there was a range of 40% to 80% of their material being sold overseas. This is due to the demand from foreign markets for scrap metal, but also the increased energy costs for ground transportation, making it often more costly for local metal processors to ship domestically than by boat internationally.
- **Nucor Steel increased processing capacity.** In 2005, Nucor Steel's permit was approved to increase their process capacity by an additional 55,000 tons per year. They are the only steel mill in the region and are already processing at or near the new capacity (Kale, 2006).

## 7.3 BARRIERS & OPPORTUNITIES

Due to the mature state of the metals market and the currently high prices paid for metals the majority of metal scrap is being processed through recycling instead of disposal. However, there are limited opportunities for collecting the remaining scrap metal that is still being disposed.

- **Rising energy costs make collection and processing more expensive.** The cost to collect and transport metal, especially for smaller generators and companies, makes it more difficult to provide cost effective service to all



customers. The cost of transporting material to processors or end markets keeps most material in the Pacific Northwest or overseas (Asia, Russia, India). Nucor steel, the largest energy user on Seattle City Light's grid, reported that energy is one of their top operating costs. They have taken advantage of energy incentives to reduce their energy costs by 17% in last year (Kale, 2006).

- **Few convenient locations exist for individuals to take larger scrap metal.** Other than curbside recycling, which limits the size of scrap metal that is accepted, there are few convenient opportunities for residents and small businesses to take scrap metal.
- **Prices are high and collection opportunities exist.** Given strong metals markets, recyclers are interested in capturing more of what is currently disposed. These strong markets present the opportunity to use extra current revenues to develop increased capacity for smaller generators – investments that if made now could also help in times of down markets.

## 7.4 PUBLIC SECTOR OPTIONS

While scrap metal recycling is a well established market, with a strong recycling rate there is still room to collect more metals, especially from the smaller generators. Through the interviews with local metal recyclers and processors a number of opportunities for increasing metals collection were mentioned. These are described below.

- **Provide more drop-off locations and better promotion of existing recycling opportunities.** Make it more convenient for residents to recycle their scrap metal by providing more locations for the public to drop-off scrap metal and appliances, specifically at King County transfer stations. Also, increase the education and promotion of the recycling opportunities for metals, including, locations and acceptance policies of transfer stations, Recycling Collection Events, and scrap metal yards that accept metal from the public.
- **Offer on-call curbside metals collection.** Work with haulers to offer curbside collection of larger scrap metal items on an on-call basis. This would give those customers without the capacity to transport larger scrap metal an opportunity to recycle it.
- **Investigate subsidies and incentives to improve metal recycling.** A number of metal recyclers mentioned opportunities for King County to provide financial or regulatory assistance to metal recyclers. These include subsidies for transportation costs to collect the scrap metal from smaller residential customers, subsidies for smaller firms to purchase capital equipment to improve their processing capacity and ability, and implement changes in the tax code to incentivize companies to use recycled materials.
- **Ban metal from disposal.** King County could enact a disposal ban on scrap metal, tin food cans, and/or aluminum cans.

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# Chapter 8

## Organics

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### 8.1 INTRODUCTION

This chapter outlines the current state of collection, processing, and end markets for organic material in King County. It is intended as an update to the previous King County Markets Study, published in 2004. The key changes in the organics market over the past two to three years are examined. The study focused primarily on food, yard waste, and compostable/soiled paper, as defined below.

- **Food waste** – food wastes and scraps, including meat and bone, vegetable peelings, fruit rinds, and similar materials;
- **Yard waste** – leaves, grass clippings, garden wastes, as well as brush and branches under four inches in diameter;
- **Compostable/food-soiled paper** – paper towels, paper plates, waxed paper, tissues, and other papers that were soiled with food during use, such as pizza box inserts.

Other organic waste, such as animal waste and biosolids, were not included for the purposes of research although the products were compared to compost. This chapter focuses on the following products:

- **Compost** – decomposed organic material produced when microorganisms break down organic residue, such as recycled plant waste or other organic matter; compost can be used as a soil amendment to add nutrients and improve soil health.
- **Topsoil/Soil blends** – topsoil is the nutrient-rich top layer of soil, composed of a mixture of organic and mineral content; soil blends sold by landscapers often are designed to replicate this composition and may use compost to provide organic matter.

In order to develop the assessment presented in this chapter, Cascadia interviewed all four local organics processors as well as industry experts from a landscaping company, local cities, and other government agencies. Additionally, a literature survey was conducted to gather further information.

### 8.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

- **Food waste can now be included in yard waste recycling in 47% of single family households.** Estimated participation ranges from about 12% in Bellevue (Skony, 2006) to 25% in Kirkland (Borjeson, 2006).
- **However, curbside food waste collection has decreased home composting.** Recent survey data indicates that the availability of curbside food waste composting has decreased the practice of home composting. A survey of King County residents in 2005 found that 17% of residents reported composting food at home, down from 20% in 2003. 27% of respondents said they were permitted to put food waste in their

yard waste bin, and 38% of those reported typically doing so. These statistics suggest that only about 10% (27% multiplied by 38%) of King County households have participated in food waste collection at the curb, and that about 3% of households have stopped composting at home, possibly because of the availability of curbside food waste composting (King County Solid Waste Division, 2005). Further data are available from Seattle, where a more detailed survey was conducted. Seattle Public Utilities conducted a Home Composting Survey in 2005 and found that there was a decrease in home composting associated with food waste collection (Seattle Public Utilities, 2006). According to the survey, about 8% of all residents either decreased the amount or stopped home food waste composting entirely after curbside service began. A large portion (156 of 600 residents surveyed) reported that they compost some food waste at home (Seattle Public Utilities, 2006).

- **Residential yard waste recycling continues to be highly successful.** An estimated 89% of yard waste generated by residents is recovered through yard waste collection. Big opportunities still remain in self-hauled yard waste, however, where an estimated 24,000 tons are still disposed.
- **Businesses remain a strong target for food waste recovery.** An estimated 77,000 tons of food waste were disposed by businesses in King County in 2005. Collection of commercial sector food waste has increased dramatically in the past few years, but many opportunities still remain. Processors and haulers are targeting large food waste generators. Cities reportedly are interested in established commercial food waste collection routes, which may be less lucrative for haulers if they include many small generators. King County has recently concluded 2 years of commercial food waste collection pilots with Bellevue, Redmond, and Kirkland (Science Applications, 2005b). The pilot project highlighted several challenges to collecting food waste from small commercial generators: although popular with program participants, providing biodegradable bags free of charge to program participants was very expensive; taking into account containers, bags, and staff time, food waste collection may cost a business more than can be realized from disposal cost savings; and collection systems, especially those in smaller cities, are probably more efficient and result in cleaner loads when food waste is co-collected with residential yard waste. Produce waste is the primary type of food waste collected from commercial customers.

### ***Current Supply***

Due to the relatively rapid increase in collection of food waste for composting, it is difficult to estimate how much food waste is still disposed in King County. The following table displays the estimates of disposal for 2005 provided by King County Solid Waste Division. Disposal figures in this table were provided by King County Solid Waste Division and are calculated based on 2002 waste composition data applied to King County's waste disposal forecasts. Accordingly, the figures below may be overestimates if food waste recycling has succeeded in diverting food from disposal. Recycling estimates are from hauler data provided by King County, interviews conducted as part of this study, and projections made based on estimates made in 2003, the previous time this markets study was conducted.<sup>10</sup>

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<sup>10</sup> Note that the disposal figures in this table do not include items disposed in "mixed loads" of both residential and disposal waste. As a result, the estimate of total disposal is expected to be a slight underestimate.

**Figure 8-1. Estimated King County Organics Disposal, by Sector, 2005 tons**  
(excludes Seattle)

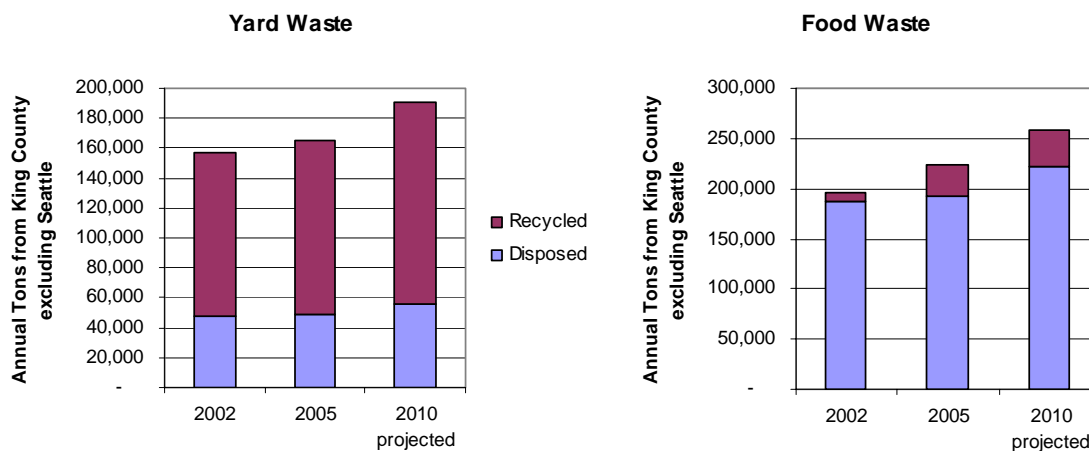
	Food Waste	Yard Waste	Compostable Paper	Total
Residential	106,165	15,020	24,431	145,617
Commercial	77,214	9,834	26,679	113,728
Self-Haul	9,727	24,081	2,571	36,380
<b>Total</b>	<b>193,107</b>	<b>48,935</b>	<b>53,682</b>	<b>295,724</b>

Based on an analysis of the Department of Ecology's survey data for food waste recycling in King County, Cascadia estimated that 32,900 tons of food waste were recycled from King County in 2004. This total was estimated by using data reported to the Department of Ecology (31,000 tons) adjusted upward to account for known omissions.<sup>11</sup> Assuming a similar level in 2005, the recycling rate for food waste in the County would be at least 14%, calculated as  $31,000 / (193,107 + 31,000)$ .

### Projected Supply

As population and economic activity in King County grow, organics generation is expected to increase as well. The following charts depict "status quo" projections according to econometric modeling estimates for future waste growth by King County Solid Waste Division.

**Figure 8-2. King County Food & Yard Waste Generation: Estimated Current and Projected**  
(excludes Seattle)



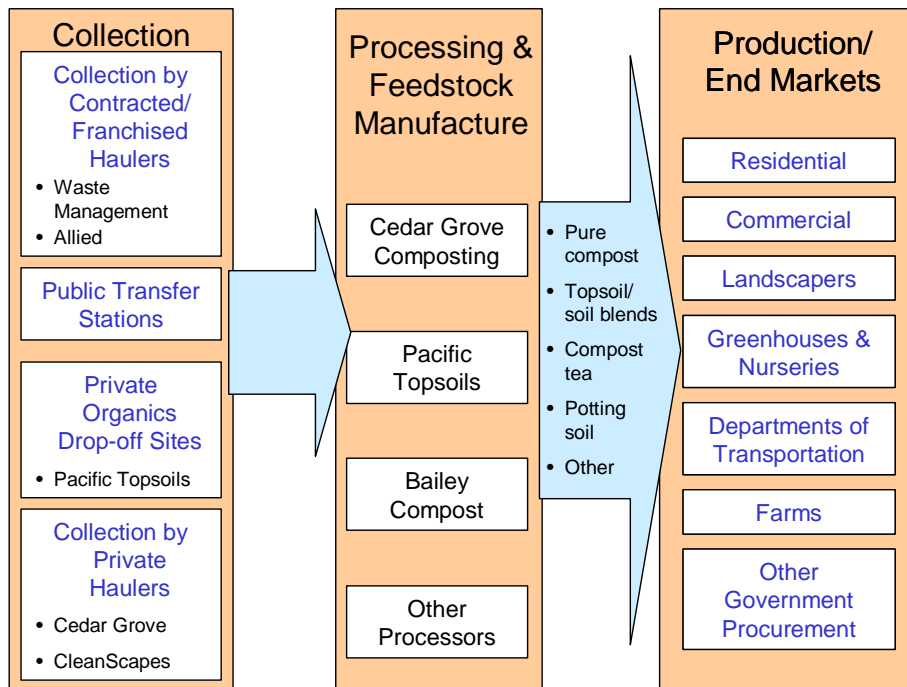
### Supply Chain for Organics

Figure 8-3 depicts how food and yard waste flows from generator to the end markets in King County. Most organics collected in King County follow this path.

<sup>11</sup> Task 5 of the 2006 King County Monitoring Project was devoted to such estimates.

- **Franchised haulers and private haulers collect organic material, or generators self-hauled them to public and private facilities.** Contracted or franchised haulers, such as Waste Management and Allied, collect food and yard waste from residents and businesses throughout the County. Recently, Cedar Grove (2005) and CleanScapes (2006), a waste hauler based in Seattle, have also received permits to haul food waste from commercial generators. Cedar Grove hauls the material to their facility while CleanScapes consolidates material in dumpsters in their yard where it is picked up by one of the Seattle’s contracted haulers and transported to Cedar Grove. Generators also self-hauled organics to transfer stations or private drop-off sites.
- **Processors convert organics into soil amendments.** The majority of organics collected in King County are processed by Cedar Grove at their Maple Valley or Everett facilities. Bailey Compost and Pacific Topsoils also handle large amounts of material, while smaller sites, such as those operated by landscapers, also process organics. Products include compost, potting soil, soil mixes, mulches, and compost tea.
- **Landscapers, residents, businesses, and government agencies purchase the finished products.** The products are primarily sold in King County and surrounding areas, although Cedar Grove is able to sell bagged product in Alaska, Oregon, and Idaho.

**Figure 8-3. Current Flows of Organic Waste Generated in King County**



## Processing & Infrastructure

**There are three main processors serving King County.** Cedar Grove Composting, Pacific Topsoils and Bailey Compost handle all the curbside collected material and most of the self-hauled material organic material from King County. Cedar Grove’s Maple Valley facility receives most of the material from King County. They also have a major

presence in Snohomish County with their new facility located in Everett. LRI, the only major organics processor based in neighboring Pierce County, does not receive much material from King County.

As shown in Table 8-1, most of the organics processors are operating below capacity. The total capacity in the region is about 554,000 tons, with about 104,000 tons of remaining capacity. In King and Snohomish Counties, Cedar Grove represents about 84% share of the 2005 market throughput, while Pacific Topsoils processes approximately 14%, and Bailey Compost handles about 2%.

**Table 8-1. Reported Capacities at Local Organics Processing Facilities**

Company	Facility	Permitted Capacity (tons)	Yard and Food Waste Processing 2005 (tons)	Expected Near-term Excess Capacity
Pacific Topsoils	Maltby	54,000	52,000	2,000
Cedar Grove	Maple Valley*/Everett*	359,000	302,000	57,000
Bailey Farms	Snohomish	16,000	8,000	8,000
<i>Subtotal: King and Snohomish Counties</i>		<i>429,000</i>	<i>362,000</i>	<i>67,000</i>
LRI	Puyallup, "Purdy Facility"	93,000	60,000	33,000
LRI	"Compost Factory" (Pierce County Facility)*	32,000	26,000	6,000
<i>Subtotal: Pierce County</i>		<i>125,000</i>	<i>86,000</i>	<i>39,000</i>
<b>Totals</b>		<b>554,000</b>	<b>448,000</b>	<b>106,000</b>

\*Permitted to handle food waste.

**With their new facility completed and operational, Cedar Grove has further solidified its position as the dominant player in the market.** Already the largest player in the region, Cedar Grove's share of the market has been expanded further through the opening of their new Everett facility. That facility opened in February 2005 and, like the Maple Valley facility, is permitted to handle food waste. Despite this advance for Cedar Grove, other composters feel they are able to maintain a strong customer base.

- **Food waste handling has been key to Cedar Grove's recent success.** In 2005, they handled an estimated 50,000 tons of food waste (Bartlett, 2006). This represents about 16% of their total input while they could reportedly accommodate food waste up to 75% of their total feedstock (Bartlett, 2006). Because they are permitted to handle food waste, they receive material from businesses and the new residential food waste collection programs in several King County cities and Seattle. Cedar Grove was also able to bid and win the contract to handle Portland's commercial food waste in December 2004 (Erickson, 2005).
- **Pacific Topsoils reports that they can maintain a separate market from Cedar Grove's market hold.** This processor sells bulk product mainly in King and Snohomish County and doesn't compete in the bagged compost market.

Representatives contacted report that they are not concerned about Cedar Grove's expansion.

- **In terms of the supply of available organics, Bailey Compost has felt the squeeze from Cedar Grove's new facility in Snohomish County.** Bailey typically land applies yard waste on their farm as well as uses yard waste to produce compost (Bailey, 2006). With limited yard waste input though, they now contribute all their yard waste for compost production, and the quantities are limited. They produce a mix of 10% manure and 90% yard waste compost. Bailey reported that they could sell much more compost than they produce and are limited by the supply of yard waste. Like Pacific Topsoil, Bailey Compost sells bulk, rather than bagged material. They are not concerned about competition with Cedar Grove for this market. Their focus is on high-end gardeners.

**Contamination with food waste collection is not a major problem.** Cedar Grove reports that contamination with food waste collection hasn't been a problem although they have rejected some loads. Loads are rejected that have more than 20% contamination. About 2 or 3 loads per month are rejected, which equates to about 20 or 30 tons of a total of 30,000 tons total, or about 1% of incoming material. LRI, the only other processor with a food waste permit, did not report any problems with contamination associated with food waste collection, although food waste is a fairly small portion (about 1 to 2%) of their total feedstock at this point (Gregory, 2006).

One processor in 2003 hypothesized that the new minimal functional standards for organics processing that were instituted in February of 2003 by WAC 173-350-220 would put some processors out of business. That hasn't been the case though and the same processor suggests there is little enforcement of those rules.

**Pacific Topsoils is operating out of their Maltby location near Woodinville.** The Maltby facility began accepting material in 2004. The Mill Creek facility closed the same year. The first product at the new facility was produced in February, 2005. Much of 2005 was spent ramping up the new operation.

**LRI in Pierce County is close to capacity and may expand their facilities.** Their input has increased since they were awarded the City of Tacoma curbside contract. If they expanded their Purdy facility, they would likely try to obtain a food waste handling permit there. Their other location, the "Compost Factory", has a food waste handling permit, although it is only receiving a small quantity of food waste. Their only commercial customers, currently, are a handful of businesses, including florists and some other small businesses, that the City of Tacoma recruited. The City of Tacoma is currently discussing a pilot for commercial food waste recycling that they hope to conduct beginning in spring 2007 (Dave Frutiger, personal communication, August 1, 2006). Material collected in this program could either be processed at LRI or at the City's wastewater utility.

**Clopyralid is no longer a concern but other problems arise that may be resistant to the compost process.** All of the processors interviewed expressed the view that Clopyralid is no longer a concern and that they believe the ban on the herbicide was effective. There have not been similar problems since the Clopyralid scare. The disease sudden oak death (SOD) has arrived in California and Oregon (WORC, 2006). The detection of the pathogen that causes SOD in Washington State could lead to quarantines limiting the sale of soil and compost products (WORC, 2006). When asked if they were concerned about SOD, local processors were either not concerned or were slightly concerned but believed the compost process would kill the pathogen. LRI stated



that their facilities are set up to prevent cross-contamination between new and finished feedstock (Gregory, 2006). After material crosses the “pathogen line”, different equipment is used to handle this “clean” material. The possibility of the public responding poorly to negative media about SOD was a larger issue for one processor. None of the facilities interviewed were preparing for SOD. The Washington Organics Recycling Council (WORC) is preparing best management practices guidelines for pathogen control at organic material processing facilities that addresses SOD.

**Energy prices are not high enough to support biomass/energy generation from food waste, yard waste, or compostable paper.** Processors have not looked into this or they report that energy prices would have to increase substantially to make this a viable option. One processor reports that anaerobic digestion may be an option if fuel prices were to double over current levels.

**King County’s Clearing and Grading Ordinance and low impact development standards have not produced any quantifiable increase in demand.** Although these regulations may have increased demand, the processors interviewed had not seen or could not quantify an increase in demand as a direct result.

- **The soil standard provision in the County Clearing and Grading Ordinance has not affected the market significantly at this point.** The Critical Areas Ordinance, updated in January 2005, includes an update to the clearing and grading regulations. For all site development activities, disturbed soils must be restored to a native condition through amending with compost or replacing with original soil. One processor suggests that this ordinance is still in the education rather than the enforcement stage and that upcoming enforcement should affect demand (Bartlett, 2006). In addition, the current standard applies only to unincorporated King County, whereas most construction activity occurs in incorporated cities. As the cities update their stormwater manuals over the next two years, there will be opportunity for them to implement post-construction soil standards (Beatty, 2006).
- **The results on the organics market of low-impact development standards are not conclusive.** Processors did not report seeing an impact from these new standards. Cedar Grove does not track material in a way that would allow them to evaluate how much product is sold for this purpose although they believe it will have a large impact on sales.

**New processors are not likely to enter market due to several barriers.** New processors would have to overcome a lack of readily available organics supply, permitting challenges in siting new facilities, and challenges in find space for facilities.

- **None of the facilities interviewed are operating at capacity and all are seeking more organic material.** Any new entrants to the market would have trouble competing for material particularly without established relationships with landscapers, haulers, and other suppliers. For instance, Pacific Topsoils ran out of yard waste to mix with landclearing debris, and therefore sold 6,000 tons of landclearing debris as hog fuel.
- **It is difficult to site and permit a new facility.** Land in King County and surrounding areas is very expensive; less is available as development increases. Finding land that is zoned appropriately and that will not encounter significant neighbor complaints on noise and odor is difficult. The process to permit and set up Pacific Topsoil’s new Maltby facility took about 10 years.
- **Food waste permits may become more vital as new jurisdictions add food waste to yard waste collection.** Bailey is interested in making the necessary

changes so that they can qualify for a food waste permit and Pacific Topsoils will likely obtain one at their Purdy Facility if they decide to expand that site.

## End Markets & Prices

Organics collected in King County is transformed into a variety of products including compost, soil mixes, and compost tea, and sold, predominantly, to landscapers, residents, and government agencies. This section discusses the types of buyers and prices paid for these products.

Yard and food waste compost competes with other products in the local market, such as bark, biosolids compost, and manures. Table 8-2 presents the prices charged for soil amendments and some similar products at Cedar Grove, Pacific Topsoils, and Sawdust Supply. As in 1999, prices for pure compost are generally less than soil mixes and bark products. Prices have increased at similar annual rates to the previous period (1999-2004). Cedar Grove's increases have remained near that of the rise in the Consumer Price Index, which has averaged 2.0% per year from 2004 to 2006. Pacific Topsoils and Sawdust Supply prices for soil mixes have experienced larger increases, while prices for some products have decreased over the same period.

**Table 8-2. Local Organics Product Prices by Company**

<b>Cedar Grove</b>	<i>cu. yd.</i>	<i>cu. yd.</i>	<i>cu. yd.</i>	<i>Annualized Cost Increase</i>	
<i>Retail</i>	1999	2004	2006	1999-2004	2004-2006
Pure Compost	\$13.95	\$16.00	\$16.95	2.8%	2.9%
Two-way Topsoil	\$15.95	\$18.00	\$18.95	2.4%	2.6%
Potting Soil	\$28.00	\$30.00	\$30.95	1.4%	1.6%
Medium Fine Bark	\$15.00	\$17.00	\$17.95	2.5%	2.8%
Fine Bark	\$17.00	\$19.00	\$19.95	2.2%	2.5%
<i>Wholesale</i>					
Pure Compost	\$11.50	\$13.00	\$13.75	2.5%	2.8%
Two-way Topsoil	\$13.50	\$15.00	\$15.75	2.1%	2.5%
Potting Soil	\$26.00	\$28.00	\$28.75	1.5%	1.3%
Medium Fine Bark	\$13.00	\$15.00	\$15.75	2.9%	2.5%
<b>Pacific Topsoils</b>				<i>Annualized Cost Increase</i>	
<i>Retail</i>	1999	2004	2006	1999-2004	2004-2006
5-Way Mix Topsoil	\$13.50	\$16.50	\$19.25	4.1%	8.0%
3-Way Mix Topsoil	\$14.50	\$17.50	\$19.75	3.8%	6.2%
Enviro Mix	\$16.50	\$20.50	\$24.00	4.4%	8.2%
Special Garden Mix	\$14.50	\$20.00	\$23.00	6.6%	7.2%
Fine Bark	\$16.50	\$21.50	\$20.25	5.4%	-3.0%
Medium Fine Bark	\$13.50	\$18.75	\$17.75	6.8%	-2.7%
Cedar Playchips	\$17.75	\$25.75	\$28.75	7.7%	5.7%
Pacific Garden Mulch & Screened Comp Mulch	\$15.50	\$20.50	\$23.50	5.8%	7.1%

<b>Sawdust Supply</b> <i>Retail</i>	<i>cu. yd.</i>	<i>cu. yd.</i>	<i>cu. yd.</i>	<i>Annualized Cost Increase</i>	
	1999	2004	2006	1999-2004	2004-2006
Bark	\$15.20	\$18.95	\$21.95	4.5%	7.6%
Nuggett	\$24.95	\$29.20	\$32.95	3.2%	6.2%
GroCo	\$13.95	\$18.45	\$29.95	5.8%	27.4%
SteerCo	\$16.45	\$19.70	\$22.95	3.7%	7.9%
Cedar Grove	\$20.95	\$27.45	\$35.95	5.6%	14.4%
Planting Mix	\$18.95	\$22.45	\$25.95	3.4%	7.5%
Topsoil	\$18.95	\$22.45	\$25.95	3.4%	7.5%
Playchips	\$19.95	\$24.70	\$27.95	4.4%	6.4%
Sawdust/Fir	\$7.00	\$10.00	\$10.00	7.4%	0.0%
Sawdust/Alder	\$16.45	\$19.70	\$22.95	3.7%	7.9%
Shavings/Fir (sold by the bale)	\$7.00	\$7.50	\$14.00 (for large bale)	1.4%	N/A (no longer sell small bale)
Shavings/Cedar (sold by the bale)	\$7.00	\$7.50	\$14.00 (for large bale)	1.4%	N/A (no longer sell small bale)

Although this study did not focus on interviewing end users, processors reported the same major markets as in the previous study. Landscapers, government agencies, residents, and smaller markets are the primary end markets for compost and compost-related products. This section explores reported usage and expected demand from these common end-users.

All processors interviewed stated that demand was sufficient or surpassed their production levels. One processor conjectured that demand would meet increased supply as long as the supply increased by only 5% to 10% annually (Bartlett, 2006b). Weather fluctuations, such as the timing of the growing season, were a large concern mentioned by two processors.

## Landscapers

**Landscapers continue to be a major buyer of compost products.** All King County processors interviewed mentioned landscapers as a significant part of their customer base.

- Pacific Topsoils mentioned the largest share of their sales, about 75%, going to landscapers. Cedar Grove and Bailey sell significant amounts to this group as well.
- **Some landscapers are concerned about the quality of compost products.** Only three landscapers were consulted for this study, but all reported concerns about the major King County compost producers. One reported that the products were not consistent (Bloom, 2006). The others thought that Cedar Grove's product did not have enough microbial activity (Morrison, 2006 and Henry, 2006). This market, more than any other, may be most responsive to quality concerns because they buy in large quantities and are discerning about product performance.

## Government Agencies

Government agencies, and transportation departments in particular, are major compost users.

- **The Washington State Department of Transportation (WSDOT) is a significant user although their use varies significantly from year to year.** WSDOT primarily uses compost for a water quality treatment, in the form of erosion control blankets, berms, and socks, and as a growing medium (Salisbury, 2006). Since 2000, annual use has fluctuated from a low of about 14,000 cubic yards in 2000 to peaks of over 200,000 cubic yards in 2001 and 2004 (Salisbury, 2006). Cedar Grove estimates that 25% of their sales in 2006 will be to the WSDOT. This is an increase over 2005 but represents a smaller portion compared to previous years. Pacific Topsoils sells about 2% to 3% of their product to WSDOT. The WSDOT budget for roadwork and potential for development of compost applications, such as for erosion control, make it the biggest potential increase in demand. The agency could likely see a significantly increase their demand if they finalize their current research on the ability of compost to absorb stormwater and find that the results are favorable (Salisbury, 2006). Compost use by WSDOT, though budgets are limited, represents a significant opportunity in increase market demand.
- **Demand by King County Department of Transportation (KCDOT) fluctuates with road projects.** King County's use of compost peaked in 2004 at almost 11,000 cubic yards, and decreased to an amount in 2005 consistent with previous years (about 3,700 cubic yards) (Nelson, 2006).
- **Cities and counties could likely use more compost than they purchase.** Cedar Grove reports that Cities and Counties could likely purchase more compost and are not closing the recycling loop. Pacific Topsoils estimates about 5% of their sales are to cities and parks departments.

## Residential

Households are a consistent market for compost products. All three King County processors interviewed mention selling a large portion of their products to residents. Bailey Compost reports increased residential sales. Approximately 80% of their sales are to residents (Bailey, 2006b). Cedar Grove estimates that residents purchase 95% of bagged and 40% of bulk compost. The remaining 60% of bulk compost is sold wholesale to nurseries where it is also mostly purchased by residents. Approximately 10% of Cedar Grove product is sold bagged compared to 90% sold in bulk. Nearly 20% of Pacific Topsoils sales are to homeowners.

## Other End Markets

- **Commercial sector.** Commercial users were not mentioned by interviewees as large purchasers except in the case of one processor trying to target commercial office parks. This market is frequently served by professional landscapers, and, therefore, is included in that market.
- **Agricultural sector.** Although many farms (especially organic and other bio-intensive farms) use significant quantities of organic material, finished compost is not usually the material of choice. Farmers need significant quantities of organic material to amend many acres of soil, and purchasing compost (even at bulk rates) is not seen to be cost-effective compared to other, free sources of organic material such as manure. In addition, other farms may be using chemical fertilizers in place

of organic materials. Likely as a result of these factors, none of the processors mentioned farms as large customers. Nevertheless, the increased demand for organic food, and subsequent increase in organic farming, has translated to greater demand for compost from this group (Bartlett, 2006). No farms were interviewed for this study.

### 8.3 BARRIERS & OPPORTUNITIES

- **Local governments are relying on a processor monopoly and may lose pricing power and control over time.** Cedar Grove has been a long-term and consistent partner to local governments interested in expanding organics composting. While every indication is that Cedar Grove will continue to operate effectively, its monopoly standing means that they will have less inherent incentive to compete on quality and price. The possible risk for local governments is that the price of composting may remain at current levels or increase, making it hard for food waste collection to be cost-effective and sustainable on its own relative to disposal and maintaining the necessity for continued public-sector programs to promote food waste composting and assist in recruiting business participants.
- **Cedar Grove is seeking to increase commercial food waste collection.** Cedar Grove is concentrating on large businesses and institutions. Now that Cedar Grove is permitted to haul food waste, they can target food waste generators directly. The entry of Cedar Grove into collection service will likely increase food waste diversion, as Cedar Grove will establish accounts with food waste generators that were previously disposing their food waste. In addition, having a new collector will increase competition, potentially decreasing costs and making the service more attractive to business generators.
- **A large amount of edible food remains in the commercial waste stream.** As a means of addressing food waste in the waste stream, and demand by food banks and other service agencies for fresh food (including fruits, vegetables, dairy, and meat items), Seattle has begun a 2006 Food Systems Project to increase donations of edible food from the commercial sector (Musick, 2006). The project is modeled on Portland's "Fork it Over!" food diversion project which targets edible food diversion, first, and composting, second.
- **Participation in residential food waste collection is low.** In Bellevue, a phone survey showed that only 12% are participating in food waste collection (Skony, 2006). Participation is about twice as much, 25%, in Kirkland (Borjeson, 2006).

### 8.4 PUBLIC SECTOR OPTIONS

- **Increase collection at transfer stations of yard waste and/or promote nearby organics drop-off locations.** Only two of King County's ten disposal sites, Cedar Falls Drop Box and Enumclaw Transfer Station, have yard waste recycling options, currently, and yard waste collection will soon be available at a third facility, 1<sup>st</sup> NE Transfer Station. Given that significant quantities of yard waste are disposed at transfer stations, this limited service inhibits further recycling of yard waste and progress towards waste reduction and recycling goals. As it plans for transfer station upgrades, King County may wish to consider increasing capacity for yard waste recycling and other recyclers. In the meantime, in areas surrounding facilities without yard waste recycling at transfer stations, consider mailings to residents and targeted businesses on nearby yard waste drop-off sites operated by the private

sector. Another option would be to partner with private facilities to provide collection containers on a temporary basis during weekends or other days that the transfer stations receive particularly high volumes of yard waste.

- **Maintain procurement policies and encourage use of compost on new projects.** As in the 2004 study, procurement policies are suggested as the best way for government agencies to increase their demand and aid in market development. Procurement departments can set specifications for environmentally-preferable products such as compost and suggest products that meet those specifications (Nelson, 2006). In addition, King County can also adopt policies, such as low-impact development standards, that encourage compost use in various applications, such as for stormwater management or erosion control.
- **Encourage standards and monitor products.** Some landscapers and home gardeners express dissatisfaction with the texture, consistency, nutrient, and microbial life of locally made composts. While our assessment doesn't indicate this is a major concern, there is clearly an opportunity to offer these consumers a higher-quality product. Accordingly, all local compost products could be monitored for consistency and quality (including nutrient content and microbial life) and the results could be publicized to inform the community. King County could create sample gardens at local parks to monitor performance of different products. According to landscapers, testing should provide data concerning the level of microbial life, heavy metal content, and pesticide residue in compost products. This information is reportedly not readily available from all producers.
- **Resolve question of whether to promote plastic biodegradable bag use with organics collection.** The County should consider whether they would like to promote the use of plastic biodegradable bags in compost collection programs, and, if so, whether they can provide them or assist users by offering discounts. Biodegradable bags are expensive but are preferred by users because they are convenient. One third of participants in a recent compostable bag survey of King County residents, indicated they would not have participated in food waste collection without compostable bags (Science Applications, 2005). Cedar Grove has approved four brands of biodegradable bags for use in commercial collection (Cedar Grove, 2006). Use of biodegradable bags in residential collection has so far been discouraged because of: 1) the challenge involved in educating residents to distinguish between acceptable and unacceptable bags, and 2) the unknown impact of a large amount of compostable bags in the compost process (Science Applications, 2005b). To test the viability of the use of bio-based, compostable bags for residential organics collection, a pilot project is being conducted in Issaquah, where residents have been encouraged to use one of the four bags approved by Cedar Grove.
- **Expand promotion of residential curbside food composting,** given low participation rates.
- **Facilitate the research and development of higher-value applications.** Most organic material collected for recycling in King County is processed by Cedar Grove into a moderate value compost that is in high demand by the public and, to a lesser extent, by the landscaping industry. However, certain segments of the agriculture industry (particularly nurseries and vineyards) as well as home gardeners often demand a higher-grade product with a more consistent and finer texture and higher nutrient content, and these users have demonstrated that they will pay more for such a product. Vermicomposts (i.e., worm castings) and "vintner's blend" composts are examples of higher-value composts. Producing such higher-value composts from

recycled organics in King County may be viable, particularly given the growth in food waste recovery, a high-nutrient feedstock. King County could partner with other organizations (such as Cedar Grove and Washington State University) to research and perhaps develop higher-value, specialty composts.

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# Chapter 9

## Paper

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### 9.1 INTRODUCTION

Due to high prices and high volumes, paper is the most valuable material collected in most curbside and business recycling programs. Many successful businesses have been built around paper recycling, and the Pacific Northwest paper industry has been willing to purchase and use recycled paper in its mills. Paper is also the commodity (along with plastics) where the highest fraction of material is being marketed offshore. In fact, the Chinese company Yao-Yang is a major investor in recycling in King County (Waste Management's Cascade MRF), and so most paper processed through that facility is sent directly to Yao-Yang's Asian mills.

Markets for paper are strong, and no marketing challenges are foreseen in the next five to ten years. However, our research indicates – as it did in 2004 – that continued growth in export of paper from the Northwest may threaten the viability of recycling at regional paper mills. If Northwest mills downsize or halt their use of recycled fiber because they can't compete for it, then future competition and marketing options may be limited, potentially having adverse consequences for the economic viability of local paper recycling and manufacturing.

### 9.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

In general, recycling rates for paper are high, making it difficult to increase future supplies significantly, as much of the more readily recoverable material has already been captured. However, the commercial waste stream and mixed waste paper both offer opportunities for increasing future supplies of recyclable paper. Following are key conditions affecting supply of recycled paper from King County.

- **Single-stream recycling has continued in King County.** Single-stream recyclables collection, where all curbside recyclables are placed in one container, has continued as the favored curbside recycling practice in King County. The regional debate over the merits of single-stream has also continued. For example, in 2005, Pierce County stopped collecting glass at the curb. In 2004, Seattle Public Utilities (SPU) conducted stakeholder research into single-stream recycling to provide input into a possible switch to single-stream in Seattle (Cascadia Consulting Group, 2004). The study found that single-stream as a concept is here to stay, that Allied is not likely to add glass to their commingled service in the near future, and that local governments could exert influence over collection, processing, and material marketing practices through their contracts with haulers and processors. Northwest paper mills often cite MRF practices and single-stream collection as a major contributor to quality problems in secondary paper supplies.
- **Recycling rates are high, and businesses outperform households.** King County currently enjoys high recycling rates for the principal grades of

recoverable paper, with recycling rate estimates as follows: old corrugated cardboard (OCC) at 70%; old newspapers (ONP) at 62%; and mixed waste paper (MWP), including high-grade and office papers, at 53%. Interestingly, King County’s business sector is estimated to be doing a better job overall than households: the business paper recycling rate is estimated at 70% compared to 58% in the residential sector.

- **Mixed waste paper remains the greatest opportunity for increased supply.** Both residents and businesses could increase recycling of paper grades other than cardboard and newspaper.
- **Embedded recycling for commercial collection customers has increased paper recycling.** Several King County suburban communities have begun offering recycling services to businesses at no additional charge, with the cost of recycling “embedded” in the garbage charges. This embedding has been estimated to result in additional diversion of 6,000 to 16,000 tons of recyclable paper, as more businesses participate in recycling, although actual program results were not available.

### **Current Supply**

The following table summarizes the quantities of recyclable paper generated by King County’s residential, commercial, and self-hauled waste streams in 2005. Disposal figures in this table were provided by King County Solid Waste Division and are calculated based on 2002 waste composition data applied to King County’s waste disposal forecasts.<sup>12</sup> Recycling estimates are from hauler data provided by King County, interviews conducted as part of this study, and projections made based on estimates made in 2003, the previous time this markets study was conducted. As the table indicates, the total supply of recyclable paper in King County (excluding Seattle) is roughly 426,000 tons. Note this total includes nearly 12,000 tons of cardboard and kraft paper generated by the C&D sector.

**Table 9-1. King County Recyclable Paper Generation, by Sector**  
(excludes Seattle)

	Disposed	Recycled	Total Generated	Recycling Rate
Residential	61,207	92,836	154,044	60%
Commercial	73,544	168,250	241,794	70%
Self-Haul	14,331	4,317	18,647	23%
C&D	7,739	3,835	11,574	33%
<b>Total</b>	<b>156,821</b>	<b>269,238</b>	<b>426,060</b>	<b>63%</b>

### **Projected Supply**

The King County Solid Waste Division projects that over 150,000 tons of recyclable paper will be disposed in 2010, assuming no major programmatic or policy changes. The following chart projects a status quo future where the recycling rate remains

<sup>12</sup> Note that the disposal figures in this table do not include items disposed in “mixed loads” of both residential and disposal waste. As a result, the estimate of total disposal is expected to be a slight underestimate.

constant and recycling and disposal increase at the same rate. Note this chart does not include totals from the C&D stream to be consistent with the available data for 2002.

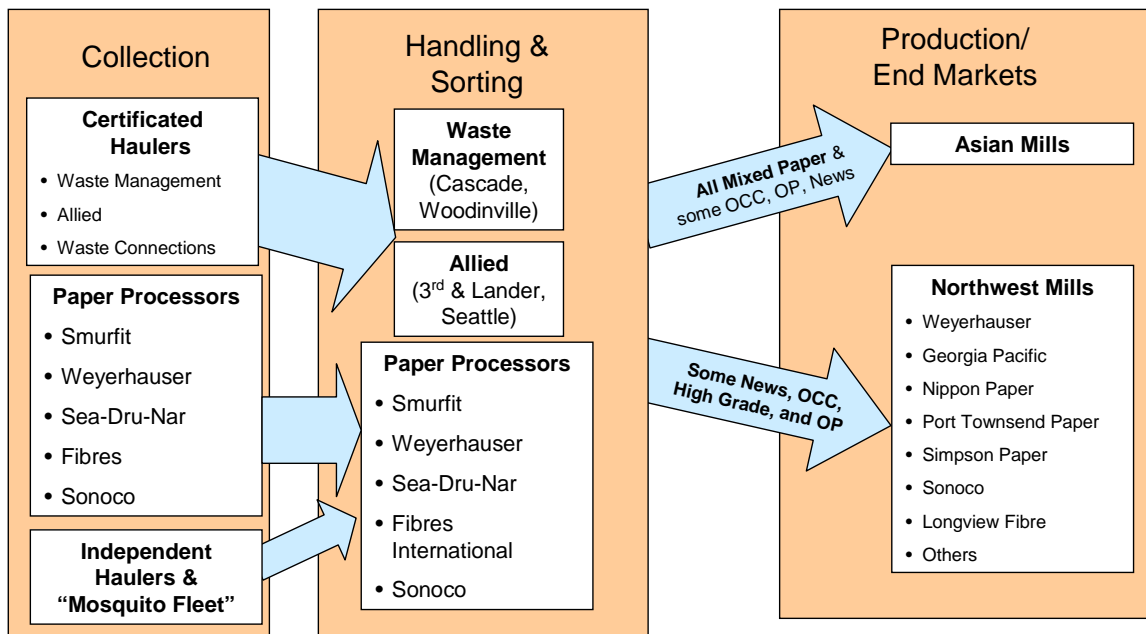
**Figure 9-1. King County Recyclable Paper Generation: Current and Projected Status Quo**  
(excludes Seattle)



## Processing & Infrastructure

King County’s infrastructure for collecting and processing recovered paper is well-developed, with the large waste haulers and four larger independent recyclers (Weyerhaeuser, Smurfit, Sea-Dru-Nar, and Fibres) all sorting and marketing recycled paper. The following chart depicts the flow of recovered paper collected in King County.

**Figure 9-2. Current Supply Chain for Recycled Paper Generated in King County**



Following are some key points and additional trends concerning processing of recovered paper in King County.

- **Rising prices for mixed waste paper (MWP) have tempted recyclers to sort less and export more.** The rise in Asian demand and prices for mixed paper have lessened the marginal benefit of sorting out higher paper grades. In other words, the increased value obtained by sorting out white ledger or newspaper have not always been sufficient to cover sorting costs. As a result, recyclers are marketing more bales of mixed paper – in a sense, exporting the sorting function to Asia. This trend has also occurred nationally (Mills, 2005). For example, U.S. collection and marketing of high grade (“deinking grade”) paper has declined considerably from its high in 2000 (AF&PA, 2006). The trend is not unique to paper. Many also marketed bales of mixed plastics rather than pull out PET and HDPE from their supply of plastic bottles and containers.
- **Processors that specialize in business recycling still market “office pack.”** Despite the growth in mixed waste paper (MWP), office pack (OP) fetches at least \$40 per ton more than mixed waste paper, making it economically viable to sort paper procured from businesses to meet the office pack requirements. Office pack is marketed both domestically (including to Georgia Pacific’s Halsey mill) and to Asia.
- **Single-stream MRFs have a hard time getting the glass out and glass grit wears out their equipment.** Northwest paper mills have been very vocal in recent years about the presence of glass grit in paper bales (particularly newspaper, as cardboard is generally cleaner and mixed waste paper is marketed overseas). Haulers, however, favor single-stream collection for route efficiency and worker safety reasons. Paper mills have gained an ally in their quest to keep glass separate, however, as MRFs have seen increased wear and tear on their equipment (particularly belts) from glass grit and are therefore receptive to alternative means of collecting glass.

## End Markets & Prices

End markets are widely expected to stay strong for at least a decade. However, most contacts felt that prices were currently near a peak and upward growth in price is unlikely.

## General Findings and Trends

- **Global recycled fiber demand is reported to increase by 8 million tons per year.** Part of this is being driven by increased demand for recycled copy and office papers. On the other hand, one contact reports that decreased newspaper readership (in favor of online news sources) will likely decrease domestic newspaper production and therefore demand for recovered newspaper.
- **Feedstock quality and competition continue to hinder domestic paper mills, including those in the Northwest.** Domestic mills cite poor fiber quality and global competition as the two major barriers inhibiting their ability to meet their needs. Mills continue to describe quality issues related to inadequate sorting (mostly at MRFs) that result in plastics and other contaminants in bales as well as continued challenges with glass grit from single-stream collection systems. Asian mills tend to be more lenient with material quality and can offer

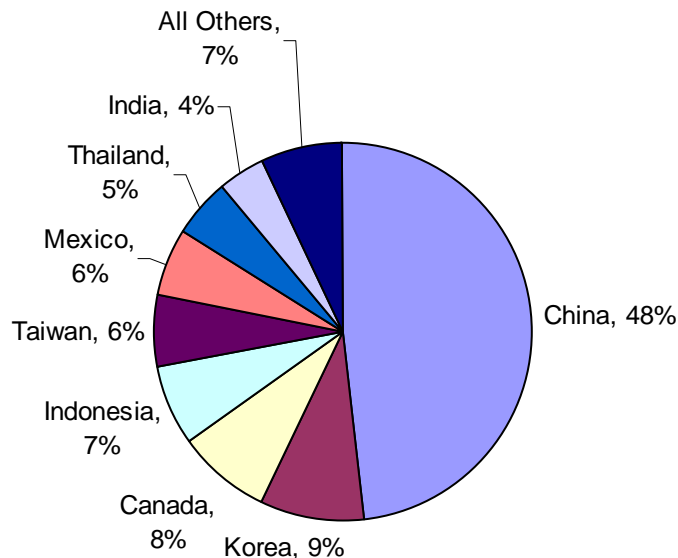
better prices (due to cheaper labor), resulting in stiff competition for domestic mills. Many mills have shut in the last few years in the U.S. One bright spot is that 10 to 12 new tissue mills are in the planning stages around the country and will demand significant quantities of recovered office paper (Grogan, personal communication, 2006).

- **Domestic mills have an easier time sourcing paper from Vancouver, B.C. or Portland than from the Seattle area.** Domestic mills report that the major Seattle-area processors are too invested in the export market. In addition, one domestic mill reported that export prices offered through the Portland and Vancouver ports may not be as great as those offered in Seattle, making it easier for domestic mills to compete with the international mills in those markets. Major Northwest destinations of recycled fiber include Weyerhaeuser's Norpak mill, Georgia Pacific, Simpson, Port Townsend Paper, and Longview Fibre.

### ***Findings and Trends for specific grades***

- **By volume, most newspaper (ONP) is marketed to Asia.** All (or nearly all) newspaper collected in residential curbside programs in King County is marketed overseas. Newspaper collected from business generators (less overall than what is collected from residential) is often collected by the independent haulers, which utilize both domestic and Asian markets. Domestic pricing of #8 ONP is on par with export prices, about \$110 per ton, but the two biggest local MRFs choose to market #6 or #7 abroad instead of spend the extra effort to meet #8 specs.
- **Much OCC is also marketed to Asia.** In past years most OCC collected in King County was sold to Northwest mills, but this situation has been changing. Most haulers report sending at least some of their OCC to Asian mills, which have been offering \$10 to \$15 per ton more than Northwest mills. Asian demand for recovered OCC is growing rapidly. Asia, and particularly China, has been rapidly building paperboard mills, and OCC is a primary feedstock. The new demand from these mills will more than offset the continued decline in paperboard capacity in North America, leading to a continued trend towards export of OCC to Asia (currently at least 19% of U.S. OCC is being exported, but this figure is expected to rise.) Even as recovery of OCC within Asia is expected to grow, the huge demand of the existing and new mills that use OCC will result in continued purchasing of large (and increasing) quantities of OCC from the U.S. (Moore, 2006). The following chart shows U.S. export destinations for OCC. Domestic destinations for OCC include Simpson, Longview Fiber, Weyerhaeuser, and Port Townsend Paper.

**Figure 9-3. U.S. OCC Export Destinations in 2004**  
(Moore, 2006)



- **Nearly all mixed waste paper goes to Asia.** All of our contacts reported marketing all or nearly all of their mixed waste paper (MWP) to Asian mills. Furthermore, Asian prices for mixed waste paper are near an all-time high – as high as \$90 per ton. Asian demand for recovered mixed paper is growing, and the economics of processing are changing. In particular, the price differential between MWP and both ONP and OCC has narrowed – meaning that the marginal benefit of sorting these grades out has declined. If this trend continues, local processors may consider ceasing their sorting operations and marketing all paper as mixed. Some recyclers express concern that if recovery of paper within Asia grows that the mills may be less interested in off-spec mixed paper from the U.S.. Others, however, claim that current recycling Asian recycling rates are under-reported and that any growth in recycling of paper within Asia is not likely to happen on a scale large enough to affect mixed waste paper imports from the U.S.
- **Office pack is marketed both domestically and overseas.** Georgia Pacific is the largest Northwest consumer of office pack (OP) in their Halsey, Oregon mill. The mill is also a major consumer of paper from mobile document destruction companies throughout the Northwest.
- **High-grade paper, when sorted, is often marketed domestically.** However, the rise in demand and prices for mixed paper have eroded the marginal benefit of sorting out a higher grade, and so high grade paper is increasingly left in mixed paper bales. On the other hand, an increasing demand for recycled-content copy paper has resulted in an increased domestic consumption of de-inked pulp. For example, in the Northwest, Grays Harbor paper (Hoquiam, WA) has been expanding its production of recycled-content office papers (including a 100% recycled product) and is interested in sourcing more material locally. The company currently buys recycled de-inked pulp from the Midwest but in the

longer-term would like to establish de-inking capacity at its mill and source more material locally.

- **Milk cartons are included in mixed paper bales.** All recyclers reported that milk cartons (including those received from school cafeteria recycling programs) are included in mixed paper bales and that they have received no negative feedback about the presence of them. Recyclers presume that the milk cartons are placed into the same pulper as the rest of the mixed paper, but do not know for sure whether the mills do any further sorting. Tetra Pak, a prominent milk carton manufacturer, has been active with school recycling programs and is supportive of cartons being included in mixed paper bales as long as the cartons are clean and dry (Debbie Dodson, personal communication, July 26, 2006). Composting has been another possible use for milk cartons. Although small numbers of milk cartons can be included in food waste collection programs (where they are currently promoted as a means of transporting food from kitchen to collection bin), Cedar Grove does not want large quantities (including entire loads) of cartons from schools or other institutional generators.

### Prices

The following table shows recent price ranges offered by domestic and international mills for the various grades. Note that the domestic price for newspaper is higher than the export price, but it must meet a higher spec (ONP #8) than the Asian market (\$6 or #7).

Grade	Domestic Price	Asia Price
Newspaper	\$110 (#8)	\$90-\$100 (#6, #7)
OCC	\$95	\$110
Mixed Waste Paper	N/A	\$85
Office Pack	\$110-\$120	\$115-\$150
White Ledger	\$190	\$190

## 9.3 BARRIERS & OPPORTUNITIES

In the short term (next 3 to 5 years), recycling of paper in King County is not likely to see any major barriers. Markets are strong, nearly all industry players expect markets to stay strong, and the collection infrastructure is very well-established. Accordingly, the barriers and opportunities we've identified are longer term, but would still benefit from attention.

- **Northwest mills are having increasing difficulty procuring the fiber they need.** The last few years have seen a rapid increase in recycled fiber demand from Asia and prices at or near record levels. In addition, supplies of recycled paper out of King County have reportedly been declining in quality due to both changes in collection (i.e., single-stream) and Asia's more flexible quality standards that remove the incentive for local processors to meet a higher spec. As a result, Northwest mills report that their biggest barrier is being able to

procure the quantities of quality fiber they need. Mills often procure fiber from outside the Northwest. In addition to providing jobs and tax revenue for Northwest communities, the presence of local paper mills that use recycled fiber helps maintain competition with Asia and may help keep prices high, which helps support local collection and processing efforts.

- **Recyclable paper is still being disposed in King County's waste stream.** An estimated 172,000 tons of recyclable paper is still being disposed. Markets would have no problem absorbing these additional quantities.

## 9.4 PUBLIC SECTOR OPTIONS

Although markets are strong and the recycling infrastructure is well-established, we have identified the following options for increasing paper recycling or increasing the durability and robustness of the supply chain for paper collected in King County.

- **Further explore or implement mandatory recycling or a disposal ban** to increase paper recycling (particularly mixed paper) from the residential and business sectors. King County has conducted analysis of both mandatory recycling and disposal bans as a means of increasing recovery of paper from both the commercial and residential sectors, including some consultant analysis (Sound Resource Management Group and Cascadia Consulting Group, 2004). The analyses have indicated that the options would likely increase paper recycling by several thousand tons, although neither option is particularly palatable to haulers. King County could move forward with a paper ban or mandatory recycling.
- **Develop a position on preferred end markets for paper generated in King County.** Northwest paper mills cite lack of quality supply as the biggest barrier they face to expanding their recycling operations and, in some cases, to their survival as companies. The export market is offering higher prices and more flexible quality standards, leading local processors to export paper that previously would have been marketed domestically. This in itself is not a problem, but Northwest paper mills have raised some possibly legitimate concerns about the long-term health of the industry if the trend continues. In particular, one hypothesis supposes that continued growth in paper exports will drive Northwest mills out of business. According to this hypothesis, without the competition offered by Northwest mills, export prices will fall, undermining the local paper and recycling industries. We recommend that King County decide if it wants to get involved in this debate or whether it wants market forces to dictate the outcome. Factors to be assessed include if, and to what extent, King County wants to favor (1) certain end markets or end uses over others; and (2) local end markets for economic development reasons. One option for King County involvement could be to research options for supporting local mills, either through increasing material supply or offering financial subsidies. Few existing precedents exist for King County to build upon, but some possible models have been discussed in emerging dialogues concerning electronic waste. For example, the Washington State Department of Ecology will be setting performance standards for electronic waste processing under the new recycling law. King County could explore use of quality standards for recycled fiber as a means of ensuring that paper is clean enough to be marketed to domestic mills.



- **Partner with local governments, Northwest paper mills, and paper processors to assess options for increasing supply of recovered paper to Northwest mills.** Depending on King County's position on export of paper and other recyclable materials, the agency could launch a study and stakeholder involvement exercise to assess options for keeping recovered paper in the Northwest. Seattle Public Utilities may be a natural partner, as they are evaluating their recycling systems from an "asset management" perspective that considers economic, environmental, and social criteria. Since using local mills may have environmental benefits (shorter shipping distances and potential for reduced pollution) and social benefits (maintaining or increasing local jobs), using these criteria in recycling processor contracts could have benefits for local mills.
- **Implement options and incentives to increase paper recycling at transfer stations.** Over 6,000 tons of cardboard and kraft paper are estimated to be disposed at King County transfer stations in 2005, with an additional 7,000 tons of mixed recyclable paper. King County could work to expand recycling services at transfer stations that don't offer recycling and implement other policies or incentives (possibly including disposal bans) to capture more of this material.

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# Chapter 10

## Plastics

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### 10.1 INTRODUCTION

Prices for recycled plastics have been on the upswing since 2002, driven largely by strong overseas demand and rising oil prices. This relatively long period of market strength appears to be encouraging recyclers to add new resins and products to their portfolios, and raising awareness among business generators that plastics are a valuable commodity. Recyclers report adding a variety of new products, including e-waste plastics, durable goods, plastic toys, media (CDs, DVDs, VHS tapes, etc.), and even barrels and crates to their list of accepted materials, often at the request of business and industrial generators. Because prices are strong, they are willing to put in the effort to find an end market for these materials.

Strong end demand and prices, however, have little effect on residential recycling of plastics. The emergence in popularity of single-serve beverage containers on other on-the-go plastic packaging has led to a growth in packaging in the waste stream that has not been matched with increased recycling.

Furthermore, the market may be “overheated” and prices may not be sustainable. While now is a great time to develop relationships and expand plastics recycling, the real test will come when markets drop off again.

### 10.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

Plastics recycling is well-established in King County, and opportunities for recycling different grades and types of plastics have grown steadily over the past several years. Particular findings include the following.

- **Collection of plastic tubs is now standard in King County.** In 1998, no curbside programs in King County accepted any plastics other than PET (#1 resin code) and HDPE (#2) bottles. Now in 2006, collection of plastic tubs (e.g., dairy tubs) is now standard as well, with only a few smaller communities not accepting tubs (e.g., Pacific, Snoqualmie). This trend has largely been driven by communities’ desire to increase recycling rates by collecting more plastics. Up through 2004 there were very few markets for these materials; recyclers now report that they are able to sell the material for \$0.02 per pound to Asia, a great improvement.
- **Curbside collection of plastic bags from residences has grown slowly.** Bellevue and nearby Beaux Arts are the only King County communities other than Seattle to collect plastic bags at the curb. Most plastic bag recycling in King County by residents occurs at grocery stores (such as Albertson’s, Safeway, and QFC) that offer this service.
- **Single-serve bottles still recycled in low numbers.** The last several years have seen a great expansion in the number of single-serve juice, soda, and

water bottles in the marketplace. Consumer recycling behaviors have not kept pace with the increased supply of these items in the marketplace, however, a trend partially explained by the tendency for consumers to consume single-serve beverages away from the home where recycling services are less convenient.

- **Bio-based plastics are on the rise.** Plastics made from corn, sugar cane, and other plant materials are all gaining in popularity for certain applications. In particular, an industry leader is NatureWorks LLC, a division of Cargill, who makes a corn-based polyester called polylactic acid (PLA). NatureWorks' PLA is now used by both Wal-Mart and Del Monte in food packaging (Greer, 2006). Soy-based resins are also being used to make plastics. For example, John Deere has begun using some soy-based plastics in its machinery. Cedar Grove has been active in conducting tests on the biological degradation of bio-based plastics, and some bio-based bags (but no tableware products) have met Cedar Grove's composting standards. A bigger unknown, however, may be what happens when and if bio-based plastics gain significant market share. Will labeling or other methods develop to assist consumers in accurately handling these items, or will bio-based items get into traditional recyclable streams? No local processors reported any problems at this time, but the trend certainly warrants monitoring.
- **Bottle bill interest grows in Washington, then recedes.** The increasing prevalence of beverage containers in the waste stream has helped renew interest in a bottle bill in Washington. A session at the annual Washington State Recycling Association (WSRA) conference in 2005 was devoted to the topic, with representatives from the Northwest Product Stewardship Council (NWPSC), Container Recycling Institute, the Washington Food Industry, and the American Beverage Association debating the issue. The NWPSC and the City of Tacoma supported a consultant effort to analyze the issue (Morris, Smith, and Hlavka, 2005). The study concluded that a bottle bill would recover more containers at less cost than other recycling systems, but that any effort to pursue a bottle bill would need to include stakeholder input. Since that time, however, interest has cooled off as the recycling industry has largely turned to other issues – especially the recycling of electronics and the passage of a new bill in Washington. It appears as if there is little momentum currently for a bottle bill, but this remains an issue to watch.

### **Current Supply**

- The following table summarizes our estimates of the quantities of plastic bottles, jugs, jars, and tubs (PET, HDPE, and other resins) generated in King County (excluding Seattle) in 2005. Disposal figures in this table were provided by King County Solid Waste Division and are calculated based on 2002 waste composition data applied to King County's waste disposal forecasts. Recycling estimates are from hauler data provided by King County, interviews conducted as part of this study, and projections made based on estimates made in 2003, the previous time this markets study was conducted.<sup>13</sup> As the table indicates, the total supply of these items is nearly 30,000

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<sup>13</sup> Note that the disposal figures in this table do not include items disposed in "mixed loads" of both residential and disposal waste. As a result, the estimate of total disposal is expected to be a slight underestimate.

tons, but only about five to six thousand tons are recycled. Residential recycling rates for PET are estimated at 25%, HDPE at 38%, and other containers at 24%. In addition to the plastics included in this table, residents disposed an estimated 19,000 tons of plastic film and bags in curbside garbage, businesses disposed an estimated 26,000 tons, and self-haulers disposed an estimated 3,000 tons. It is not included in the following table because these significant quantities would skew the totals.

**Table 10-1. King County Recyclable Plastics Generation, by Sector, 2005 tons**  
*Includes bottles, containers, and other plastic packaging, but not film<sup>14</sup>*  
*(excludes Seattle)*

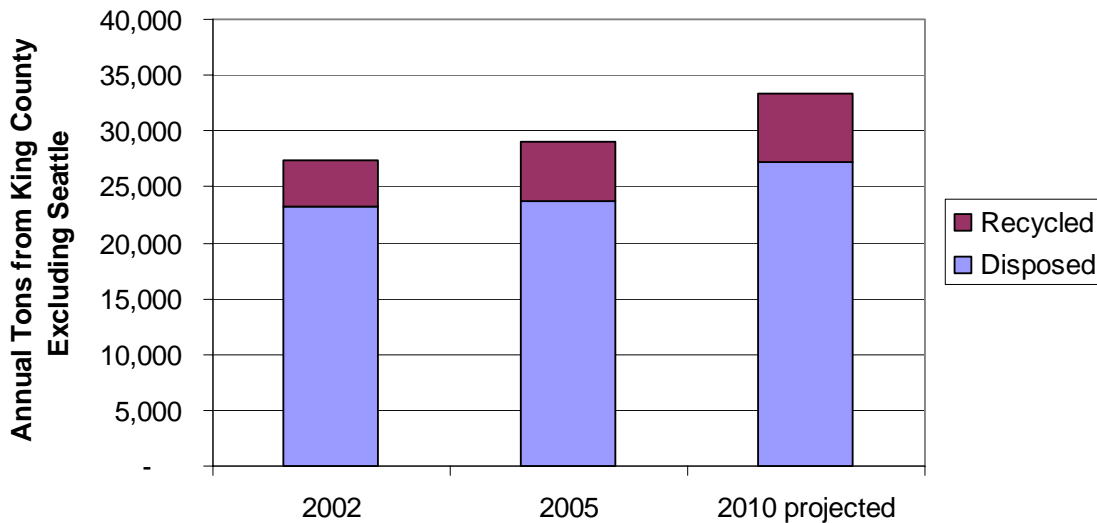
	Disposed	Recycled	Total Generated	Recycling Rate
Residential	11,346	4,369	15,714	28%
Commercial	9,851	996	10,847	9%
Self-Haul	2,491	168	2,660	6%
Total	23,688	5,533	29,221	19%

<sup>14</sup> Polystyrene foam, plastic products, foam rubber/padding, and plastics mixed with other materials are also not included.

### Projected Supply

The King County Solid Waste Division projects that approximately 22,000 tons of plastic containers and packaging will be disposed in 2010, assuming no major programmatic or policy changes. The following chart projects a status quo future where the recycling rate remains constant and recycling and disposal increase at the same rate.

**Figure 10-1. King County Recyclable Plastic Generation: Current and Projected** (excludes plastic film and bags) (excludes Seattle)



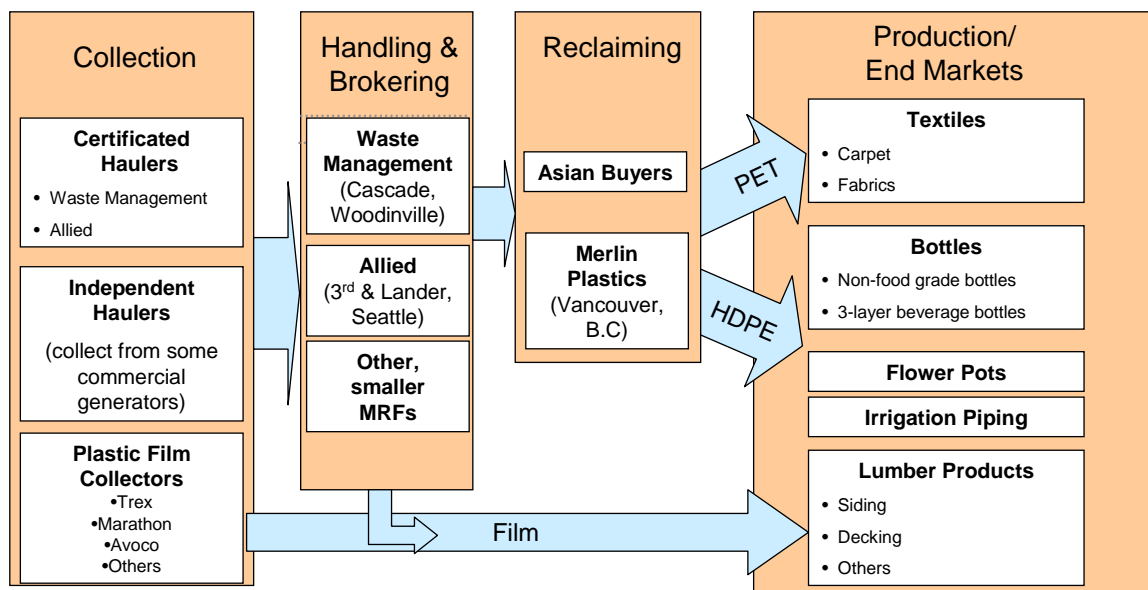
### Processing & Infrastructure

- Most plastic containers are handled by Allied and Waste Management.**  
 Most plastic bottles and tubs recycled come from residences, where recycling is controlled by the certificated haulers, who process recyclables primarily at Waste Management’s Cascade facility and Allied’s Third and Lander facility. Independent recyclers also collect containers from business generators, but these quantities don’t match those collected from residents.
- Bulky, non-container plastics are handled by a wider variety of recyclers.**  
 Recyclers are increasingly focusing on specialty types of plastics from business generators. Almost any plastic can now be recycled if present in sufficient quantity – and sufficient quantity now can mean a few bales rather than a whole shipping container.
- Curbside film is a processing challenge for MRFs, but markets exist.**  
 Quality problems have not hampered recyclers’ ability to market the material because demand is so strong – but the price obtained doesn’t come close to covering the cost of sorting it out, as very few bags come in ‘bag-in-a-bag’ as desired.

- **Biodegradable plastic bags or other bio-based plastics haven't yet caused a stir.** Many manufacturers are interested in bringing bio-based plastics to consumer applications. Plastics recyclers do not want this material, however, and are concerned about how to effectively sort it out. A recent state-level discussion in California steered the state away from biodegradable bags, but the debate will surely come up again.
- **A new web-based resource aims to facilitate plastic recycling.** 2005 saw the launch of NWplasticmarkets.com, a web site intended to help West Coast processors with domestic and international buyers. The site includes a database of buyers and sellers, as well as procedures for handling and bailing plastics and exporting them. Most established plastics recyclers have existing contacts, but the site may still provide benefit to start-ups, researchers, and established companies looking to re-assess their supply chain.

The following chart depicts the supply chain for recycled plastic containers and film in King County.

**Figure 10-2. Current Supply Chain for Recycled Plastics Generated in King County**



## End Markets & Prices

Plastics prices have remained high, with only slight dips since last autumn. Markets continue to be very strong, although a few contacts reported that new virgin capacity in Asia (which has been expected for about a year now) is now online and has contributed to a slight softening in overseas demand for recycled resins. Demand for PET and HDPE from the dominant domestic reclaimer (Merlin) is still strong, and strong markets for film from Trex and Marathon continue as well.

- **The only major plastics reclaimer in the region is Merlin Plastics in Vancouver, B.C.** But increasingly, smaller recyclers are investigating or using

processing technology. For example, Agriplas and PC Plastics, both in Oregon, have begun doing some limited reclaiming, especially of e-scrap plastics and other non-container-grade plastics.

- **China's appetite for recycled resins has continued, but may wane somewhat in the future.** China's imports of recycled plastics increased by as much as 35 percent in 2004 and 70 percent in 2005 (Esposito, 2006), although not all analysts estimate growth quite that high. China is the world's largest importer of recycled plastics, followed by Hong Kong (Holmes, 2006).<sup>15</sup> However, China has recently made significant investment in virgin polyethylene capacity, making growth in its demand for recycled resins uncertain.
- **Chinese import standards are being enforced, but local recyclers have reported few problems.** China bans unprocessed post-consumer plastic, and customs agents are enforcing this ban (e.g., no smelly food containers, no polystyrene foam plastic) (Moore Recycling Associates, 2005). In addition, China has reportedly restricted bank lending of credit to importers of recycled plastics (PET in particular) as a means of preserving the country's new virgin capacity and clamping down on contamination in imports (Phil Coughlan, personal communication, June 5, 2006). As a result, some Chinese reclaimers stop buying recycled PET when the government intervenes. However, local recyclers have reported few problems.

### **PET Bottles (#1)**

- **Most King County PET is marketed to Asia.** Prices have hovered around \$0.20 per pound for the last year, following a steady climb dating back to 2002, when prices dropped to a low of about \$0.07 per pound.
- **Merlin has also been a regional destination of PET, but little King County material is marketed there.** Merlin is more commonly a destination for rural or eastern Washington recyclers without port access or without shipping-container quantities.
- **MicroGreen Polymers may become a local end-market for recycled PET.** Microgreen, founded in 2002, is testing a technology to make food packaging products (including microwaveable dishes and coffee cups) out of recycled PET. The technology was developed at the University of Washington and the company is conducting the tests in Arlington, Washington. However, the feedstock the company is using is currently recycled PET rollstock – not flake, pellet, or baled material (Jim Sutton, VP of Business Development, personal communication, June 20, 2006). In the long term, the company may investigate using pellet or flake. However, since the only reclaimer in the region is Merlin in British Columbia, the likelihood that MicroGreen would be a major end destination of King County PET in the near future is not high.
- **Recycled PET is used primarily in fabrics and carpets,** with a small percentage going to other applications such as dishwashing liquid containers (APC, 2006).

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<sup>15</sup> Since 1997, Hong Kong has been a special administrative region of the People's Republic of China. However, it still retains its own legal system, currency, and customs policy, and recyclers consider it a separate market from China.



## HDPE Bottles (#2)

- **Prices for natural-colored HDPE have increased dramatically since 2004.** Prices in recent months have topped \$0.30 per pound, more than double the \$0.12-\$0.14 price range seen in 2003 and early 2004. Increased Asian demand has been a dominant driver, but Hurricane Katrina has been a large factor in the price surges since late summer, 2005. The storm knocked out a sizable fraction of the nation's petroleum-refining capacity, causing a decrease in virgin supply of polyethylene and dramatic increases in virgin prices of \$0.12 per pound. As a result, many manufacturers purchased more recycled HDPE, causing prices to rise (Holmes, 2006). This trend has led to a surge in the domestic market, with reclaimers such as Merlin capturing a larger share of the local supply.
- **Prices for colored HDPE are at all-time highs.** Prices for colored HDPE bottles had a huge run in 2005 to levels several times those seen in recent years. Prices have held at between \$0.15 and \$0.20 per pound in the last few months. Most colored HDPE has been going to export.
- **Recycled HDPE is used primarily in piping, flower pots, edging, and non-food bottles.** Natural-colored HDPE is used to make non-food bottles such as detergent and motor oil bottles, as well as plastic lumber (Holmes, 2006). Colored HDPE is used in corrugated irrigation piping, and flowerpots, both of which generally have a high percentage of recycled content.

## Other Rigid Plastics

- **Markets for other rigid plastics have expanded greatly in the last two years.** This finding is especially true of bulky HDPE items and larger quantities of specific-resin containers. As recyclers expand the types of plastics they accept, their arrangements with end markets have become more specific and unique such that it's difficult to compare prices or specifications across recyclers. For example, one recycler in the region reported marketing dozens of different grades of plastics, whereas many market only a small handful.
- **The value of mixed, non-bottle containers is still low.** Bales of container plastics with the PET and HDPE bottles removed (leaving 3 through 7s and non-bottle PET and HDPE) sell for about \$0.02 per pound in the export market. This price, although low relative to other resins, is great news, as prices had been half a cent per pound (\$0.005) as recent as 2004. Recyclers who leave HDPE colored bottles in the mixed plastic bales have received \$0.04-\$0.07 per pound, due to the presence of the higher-value colored HDPE resin.
- **Recyclers do not know the end uses of the mixed, non-bottle containers they market.** Recyclers don't know the specific end uses employed by their buyers, but most were confident that given the price and demand the material is being recycled. Even Pralumex, who specializes in marketing 3-7s for West Coast recyclers, didn't know specific end uses. A few contacts questioned whether some of the mixed, non-bottle container resins might actually be burned for energy, but none had confirmed reports of this taking place. The following table reports common end uses of 3-7 plastics according to the American Plastics Council (APC, 2006).

Resin	Common Recycled Uses
PVC (#3)	Air bubble cushioning, frisbees, decking, paneling, piping
LDPE (#4)	Shipping envelopes, bags, decking, furniture, trash cans
PP (#5)	Auto battery cases, signal lights, brooms and brushes, oil funnels
PS (#6)	Thermometers, light switch plates, insulation, egg cartons, rulers, license plate frames
Other (#7)	Custom products, lumber

- **Prices for large quantities of single-resin bulky items are variable, but strong.** For example, one recycler reported marketing recovered vinyl siding, window profile, and fencing to a domestic recycled decking manufacturer for prices over \$0.35 per pound.
- **Markets for non-traditional plastics such as e-waste scrap are growing.** One e-waste scrap recycler reports that the number of end-users of e-waste scrap is growing, and therefore the market is becoming competitive and more robust. However, the specter of a ban on PBDEs, which would complicate or prevent recycling of e-scrap that contains PBDE, looms over this stream. Please see the electronics chapter for more information about e-waste plastics.
- **Environmental groups express concerns over PVC.** A coalition of environmental groups organized as the Center for Health, Environment and Justice (CHEJ) has launched a campaign to pressure companies to stop using PVC as a packaging material. The group began with Johnson and Johnson and Microsoft in December 2004. CHEJ reports that vinyl is hazardous at all phases of its life cycle, from carcinogens like vinyl chloride monomer used in manufacturing, to dioxins and toxins released when vinyl is landfilled or incinerated, and that vinyl can cause problems when recycled with other plastics, and it said PVC often needs hazardous metals such as lead and cadmium as stabilizers (Toloken, 2004).

### **Film**

Plastic film markets remain strong – both domestic and overseas. Markets for clear stretch are \$0.20-\$0.25 per pound, with post industrial film in the \$0.28-\$0.30 per pound range. Northwest MRF operators who handle plastic film for curbside recycling programs continue to report that handling the material is a challenge – but Trex and Marathon are both buying for prices in the \$0.03-\$0.05/lb range. Following are additional market findings that pertain to film.

- **Demand for plastic bags and film continues to be strong.** End markets and prices are strong and are expected to stay that way. But Marathon and Trex are no longer the only game in town: as more and more companies have begun collecting film from businesses in the region, prices have increased and

recyclers' margins have eroded (Phil Coughlan, personal communication, June 5, 2006). As an example of the strong demand, Trex expects its demand for film to more than double in the next few years (Moore Recycling Associates, 2005).

- **OfficeMax looking to sell former Boise-Cascade Home Plate facility.** Both the former Home Plate facility in Elma, WA and the pilot-scale facility in Idaho have been mothballed and for sale for nearly two years. Boise had serious technical problems in their production process that the company was not able to remedy. In addition, corporate changes within Boise helped keep the project in limbo. In the fall of 2004, Boise Cascade Corporation sold its paper, timberland, and forest products assets to a private equity group, Madison Dearborn Partners LLC, who created Boise Cascade, LLC. What remained of the Boise Cascade Corporation became OfficeMax Incorporated as of November 1, 2004. The Home Plate facility, however, was not purchased by the Madison Dearborn Partners and so it remained with OfficeMax. OfficeMax is looking to sell the facility. As of June 2006, OfficeMax was reportedly in negotiations with a Midwestern producer of wood and rubber composite products to buy the Elma facility.
- **Recycling of agricultural film becoming a reality.** At least three recyclers are looking for agricultural film from the Northwest – AgriPlas, Weyerhaeuser, and Trex. AgriPlas (based in Oregon) recently launched a satellite facility in Lynden, Washington, in Whatcom County to collect film and other agricultural plastics from that area's numerous dairies, vegetable farms, greenhouse businesses, and other agricultural operations. Markets are both overseas and domestic. Contacts were aware of the development of a wash-line for agricultural film (especially ground mulch and fumigation film) in Ventura County, CA, but none expected it to impact their business as it is reportedly still months away and will be sourcing material locally rather than from the Northwest. Trex, which has a wash line on the East Coast, is not moving forward with a wash line in the West Coast at this time. Agricultural film sought in the Northwest includes greenhouse film (plastic sheeting used to construct temporary greenhouses or "hoop houses") and hay-bale wrap. Besides film, the agricultural plastics sought include bailer twine, nursery pots and trays, and seed bags. Given the relative scarcity of agriculture in King County relative to other Western Washington counties, however, recyclers did not plan to focus as much effort here.

### 10.3 BARRIERS & OPPORTUNITIES

- **Opportunities remain to increase supply, as recycling rates are low.** Recycling rates for plastics bottles and containers are near 30% in the residential sector but around 10% in the commercial sector. Clearly there are opportunities to increase recycling of these items. A significant challenge, however, is how to do so cost-effectively given the trend towards single-serve beverage containers that are consumed "on the go." A disposal ban may be a possible solution – King County could monitor results of Seattle's ban, which for plastics applied only to residents.

- **Bio-based plastics loom on the horizon.** Bio-based plastics represent both a barrier and an opportunity. They are a barrier in that they could be a nearly indistinguishable contaminant in the traditional supply chain of recyclable plastics. However, many feel the appeal of bio-based plastics are the environmental benefits of not producing them from petroleum, as well as the benefit that they may be able to be composted.
- **Demand for non-bottle and #3 through #7 containers is variable.** Current demand is strong, and prices are at all time highs. However, this may not be the case for long, and so the need for market development for these materials may return.

## 10.4 PUBLIC SECTOR OPTIONS

- **Increase beverage-container recycling.** Many PET and HDPE beverage containers remain in the waste stream, and recycling rates nationally have declined in recent years, in part due to the dramatic growth in single-serve containers consumed away from home. King County could work to increase public place recycling and partner with others to explore product stewardship approaches.
- **Monitor bio-based plastics in the marketplace.** Bio-based plastic bags are currently being promoted for handling of food waste (and eventual composting) in curbside organics collection programs. The prevalence of bio-based plastics is also growing in the larger economy, however, with companies such as Wal-Mart and Del Monte using them as food packaging. King County could monitor the prevalence of bio-based plastics in consumer goods, keep in contact with recyclers about any concerns, and join with other governments to keep abreast of an issue likely be of interest throughout the country.
- **Develop a pro-active approach to #3-#7 plastics.** Despite the fact that current markets are relatively strong, markets for #3 through #7 plastics have historically been poor. King County could team with other governments to study the feasibility of new uses for these mixed rigid plastics.
- **Assist with plastic bag recycling options for residents.** The current infrastructure for collection of plastic bags is largely drop-off services offered at grocery stores. King County could promote these services or consider expanding curbside recyclables collection to include plastic bags. However, adding plastic bags to curbside recycling is not necessarily advisable, as it is difficult and costly to sort out and results in a product that is of much lower value than that currently collected at the grocery stores. Another option currently used in San Francisco is to develop a formal agreement with grocery stores to offer more recycling containers and reduce the number of bags used through bagger retraining and providing low-cost reusable bags. San Francisco also attempted a per-bag tax to provide a disincentive for their use and to fund recycling programs – a proposal that was ultimately dropped due to both logistical and political concerns. British Columbia is now considering a bag tax, with some council members proposing a 25-cent tax.

# Chapter 11

## Textiles

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### 11.1 INTRODUCTION

For the purposes of this study, textiles include clothing, linens, draperies, rags, and other fabrics. Shoes, belts, and handbags were not included, although some industry contacts did provide limited information about these items which is included here.

Residents generate the bulk of the unwanted textiles disposed and recycled in King County. Charities and for-profit groups resell usable clothing locally or ship it to overseas brokers. Textiles that are not reusable are shipped to overseas brokers that sell them into a variety of markets. The chart below depicts the flow of used textiles in King County.

### 11.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

As mentioned above, the supply of used textiles comes almost entirely from residents' donations. Therefore, the key variable that affects supply tends to be residents' desire or willingness to make charitable donations. The unprecedented scale of natural disasters over the last two years, including the aftermath of Hurricane Katrina, led to a nationwide outpouring of charitable donations. However, industry contacts did not report an unusual spurt of textile donations in 2005. In contrast, nearly all of them reported that donations in the first half of 2006 have been unusually slow, leading them to suspect that "donation fatigue" has set in among their donors.

#### **Current Supply**

Key findings about the current supply chain for used textiles include the following:

- **Government-sponsored curbside collection of used textiles has not been fruitful.** In 2002, several suburban cities began offering curbside collection of textiles through their certificated haulers. Residents in Bellevue, Issaquah, Kirkland, and Redmond can set out unwanted textiles with their other recycling and the haulers will collect it. The haulers store the textiles until they collect a significant amount, and then the Northwest Centers will come and pick them up. City representatives report that the volume of textiles collected through these programs has been negligible, and at least one city may not include it in their next solid waste contract. City representatives believe that although the programs work well logistically, residents don't use them for one or more of the following reasons:
  - They prefer to receive a tax receipt for their donations, which is not available through this program.
  - People are "passionate about their clothes" and are hesitant to set them out with their recyclables. Often, they have selected a particular charity where they donate their clothes. Although textiles donated through the

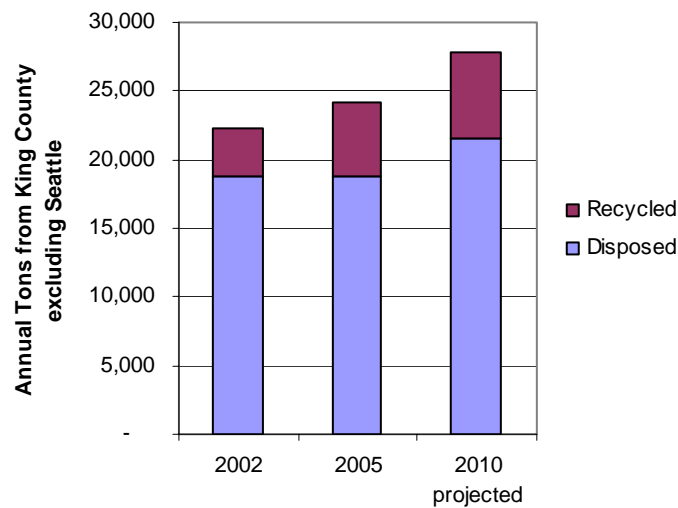
curbside program go to charity, city representatives suspect that residents may not realize that fact or prefer to take the clothes to their favorite charity.

- City representatives acknowledge that they have not publicized the programs much, if at all. Residents simply may not know the programs are available.
- Residents have a plethora of options for recycling their clothing, unlike their paper, plastic, and other traditional curbside materials. The curbside clothing donation programs must compete with these other options, which are very well established and marketed.
- **The supply of textiles follows a seasonal pattern.** Donations are high between June and October, when the weather is sunny and people are cleaning out closets and garages. They drop off again during the rainy months.
- **Charities and for-profit groups provide curbside collection and donation stations to collect used textiles.** Non-profits such as the Northwest Centers and Community Services for the Blind offer pick-up services, while other charities such as Goodwill rely on residents' willingness to drop off their unwanted items. For-profit groups such as Retex Northwest place bins in parking lots and other public spaces where people can place clothes and shoes.
- **Approximately 11,000 tons of textiles were recycled or resold in 2005.** Brokers reported selling approximately 5,500 tons of textiles to overseas processors. Assuming that about 50 percent of donated textiles are resold locally (as estimated by one contact), doubling the amount sold to processors yields a very approximate total of 11,000 tons recycled.
- **An estimated 551 tons of shoes, soft toys, and backpacks were recycled in 2005.** These items are generally handled separately from clothing.
- **Over 18,000 tons of textiles are still disposed in King County:** 7,700 tons in residential garbage, 8,600 tons in commercial garbage, and 2,500 tons in self-hauled garbage. These textiles include clothing, rags, curtains, and other fabrics, according to the definition of textiles used in the waste composition study. An additional 26,000 tons of carpets, upholstery, shoes, and other nonrecyclable textile products are estimated to have been disposed in 2005.

### ***Projected Supply***

Industry contacts did not foresee any major changes in the supply of textiles, but were concerned about the low rate of donations during the first half of 2006. All were hoping that donations will pick up again in the summer months. The following chart depicts estimates of the total supply of reusable or recyclable textiles in King County in 2005 and 2010, assuming a constant recycling rate between now and 2010.

**Figure 11-1. King County Textiles Generation: Current and Projected Status Quo**  
(excludes Seattle)



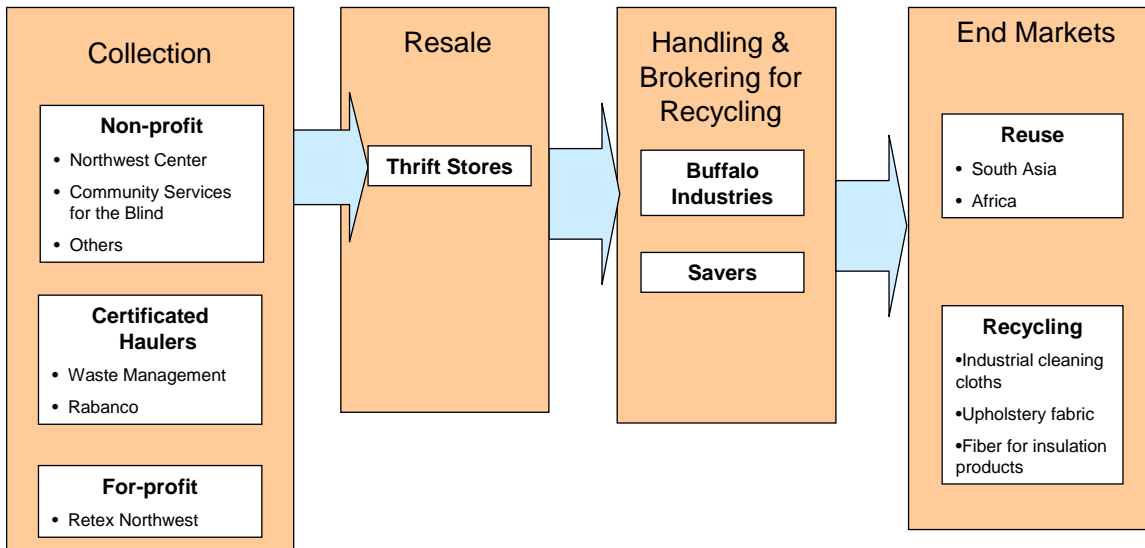
## Processing & Infrastructure

The infrastructure to collect and process textiles in King County is very well developed.

- **Charities sort clothing and resell as much as possible locally to support their programs.** Some charities, such as Goodwill and Salvation Army, operate their own thrift stores. Others, such as Northwest Centers and Community Services for the Blind, sell to thrift store chains such as Value Village. Charities use the proceeds from these sales to fund programs such as job training for low-income or unemployed people.
- **Charities and thrift stores sell the remaining items to brokers.** Textiles that are not reusable locally, or remain on thrift store racks too long, are sold to brokers such as Savers (the parent company of Value Village) or Buffalo Industries.
- **The infrastructure to collect and process textiles locally is more than adequate.** One charity describes the market as over-saturated with charities, thrift stores, for-profit collectors, government-sponsored curbside collection, and other options for consumers to recycle their unwanted textiles.

The following chart depicts the supply chain for recovered textiles in King County.

**Figure 11-2. Current Supply Chain for Recovered Textiles Generated in King County**



## End Markets & Prices

Industry contacts report that textile markets have held fairly steady over the last two to three years. Because textiles are a global commodity, global politics, including corruption and import quotas, have the greatest effect on textile markets. For example, local brokers won't sell to countries such as Nigeria and Bangladesh in which bribery is considered a cost of doing business. Local brokers develop and rely upon long-standing relationships with buyers in other countries, and are very careful about where they sell their materials because they can't afford to pursue a buyer that defaults. Import quotas also affect markets. For example, in 2004 Tanzania briefly banned imports of textiles. Brokers are watching India, Pakistan, and Afghanistan carefully in the hopes that those markets will open up.

Other findings about textile markets include the following:

- **Reuse is still the favored market for textiles.** Charities and thrift store chains resell as many textiles as they can locally. Thrift store chains will pay charities \$0.40 to \$0.50 per pound for reusable clothing.
- **Brokers bale the textiles that are not reusable locally and sell them overseas for \$0.07 to \$0.09 per pound.** The biggest overseas buyers are India, Canada, and Dubai, in descending order of importance. The buyers take the bales apart, sort the textiles into many categories, and sell them in Canada, Asia, and Africa. Especially in Asia and Africa, American-made clothing carries a certain cachet, and used clothing is much more affordable than new. Local contacts speculate that any textiles that are unusable are disposed in these other countries. The exception to this rule is Retex Northwest, described below.
- **Retex Northwest, a for-profit company, has found markets for non-reusable textiles.** Retex Northwest sells all of its textiles to a grading plant overseas. Like other overseas processors, this plant sorts the textiles and resells the usable clothing. However, the grading plant also sells the non-reusable textiles into other markets, such as industrial cleaning cloths, fiber for insulation products,



and upholstery fabric. Buttons and zippers are removed and reused. Retex estimates that 50 percent of the textiles it collects is reusable clothing and 45 percent is sold into these other markets. The remaining 5 percent is composted.

### 11.3 BARRIERS & OPPORTUNITIES

The recycling infrastructure for textiles operates quite smoothly in King County. However, the following barriers and opportunities do exist:

- **Despite the array of recycling options, over 18,000 tons of textiles were disposed in King County in 2005.** Industry contacts speculate that despite their best efforts to market their services, residents and businesses still are unsure where to take their reusable clothing and other textiles. Many of the disposed textiles may not be reusable, however. Further analysis of the textiles portion of King County's waste stream may help illuminate the situation. In King County's waste composition study, for example, the textiles category includes clothing, rags, curtains, and other fabrics, but does not distinguish between textiles that are reusable and those that are not. Future waste composition studies might differentiate between reusable and non-reusable textiles to determine the extent to which consumers are throwing reusable items away.
- **There are few options for recycling non-reusable textiles.** Charities such as Northwest Center and Community Services for the Blind do not accept non-reusable textiles. Retex Northwest's bins seem to be the only place that residents and businesses can donate non-reusable textiles.
- **One charity reported that donations of textiles are down because the charity no longer accepts e-waste.** Now that e-waste is banned from landfill disposal in King County, the charity no longer accepts it and reports that it has heard many complaints from donors who would prefer to donate all of their unwanted items at once.
- **Charities that offer curbside collection services are worried about the rising cost of gasoline.** Increasing fuel costs cut into their margins, and therefore into the services they can provide to needy people. If fuel costs continue to rise, it is possible that these charities may cease to offer pick-up services, which may have a negative effect on textile recycling tonnages.

### 11.4 PUBLIC SECTOR OPTIONS

Although textiles are a global market, there are some ways that the County could act to improve textile recycling locally:

- **Advertise the existing infrastructure.** Industry contacts agreed that the best way the County could help keep reusable textiles out of the landfill is to direct residents into the existing reuse and recycling infrastructure.
- **Distinguish between reusable and non-reusable textiles in future waste composition studies.** This information would allow the County to determine whether consumers are still throwing reusable textiles in the garbage.
- **Investigate ways to move non-reusable textiles out of the landfill.** Most residents know that they should donate their reusable textiles, but they also know

## *Textiles*

that charities don't want their ripped and stained items. Given that markets for non-reusable textiles do exist, the County could look into ways to collect these items. Options for collection may include adding non-reusable textiles to special collection events or curbside recycling, or placing containers for non-reusable textiles at transfer stations. However, the County would need to be extremely careful not to compete with the organizations that collect reusable clothing, because this competition would have the unintended consequence of reducing funding for much-needed social services that the charities provide. To avoid collecting reusable textiles, the County likely would need to invest in an extensive education program.

# Chapter 12

## Wood

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### 12.1 INTRODUCTION

This chapter focuses on “urban wood,” including wood generated during construction and demolition activities. This definition includes dimensional lumber, pallets, crates, manufacturing scrap, engineered wood, roofing and siding, finished and unfinished furnishings, and painted or stained wood. It excludes landclearing debris, because landclearing debris typically has different characteristics and markets than most urban wood.<sup>16</sup> For the purposes of this report, use of wood as hog fuel is considered recycling.

### 12.2 MARKET CONDITIONS

#### Trends & Key Variables Affecting Supply

The major change in supply in 2005 occurred as a result of EPA’s promulgation of new National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters.<sup>17</sup> This standard, which takes effect in September 2007, limits mercury emissions from pulp and paper mills to 9 pounds per trillion BTU annually. Recovery 1’s major hog fuel customer decided to get ahead of the standard and imposed a limit of 4.5 pounds per trillion BTU on its hog fuel, a standard that was impossible to meet with painted or stained wood because latex paint formulated before 1991 contains mercury. Because this customer would no longer take hog fuel made from painted and stained wood, Recovery 1 had no market for this wood, which can be a major component of demolition debris. As a result, Recovery 1 stopped accepting demolition debris in May 2005.

Recovery 1’s tonnages fell by 70% and the company laid off more than a third of its workforce. The company did some research and discovered that, according to EPA, mercury that is disposed in a landfill will ultimately be released from that landfill. In contrast, when mercury-containing hog fuel is burned, some of the mercury gets trapped in the fly ash and clinker, resulting in less mercury being released into the air than if the same mercury-containing hog fuel had been disposed in a landfill. This information was enough to convince Recovery 1’s major customer to start using their hog fuel again and Recovery 1 is once again accepting demolition debris.<sup>18</sup> The company is still working with the EPA.

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<sup>16</sup> This definition for urban wood is the same one used for the Market Assessment of Construction and Demolition Waste Materials (2004).

<sup>17</sup> For more information about this standard, please see <http://www.epa.gov/ttn/atw/boiler/boilerpg.html>.

<sup>18</sup> The standard allows for two methods of determining compliance: companies can measure the amount of mercury in their fuel, or they can monitor emissions from their stacks. Recovery 1’s major customer chooses to measure the amount of mercury in its fuel, but the company’s other two hog fuel customers monitor their stacks. Both companies report that their emissions easily meet the compliance standard.

A secondary change that may affect supply is the shift toward commingled recycling. Because commingled recycling is more convenient, contractors are less likely to source-separate their wood for recycling. At least one processor of source-separated wood plans to start accepting mixed debris from new construction in the near future to adapt to this trend.

### ***Current Supply***

By definition, construction and demolition activities generate most urban wood. According to projections developed by the King County Solid Waste Division, approximately 186,000 tons of urban wood were disposed in King County in 2005, 100,000 tons as C&D and 86,000 tons as MSW. An estimated 53,000 tons of the C&D portion was recyclable, and an estimated 41,000 tons of the MSW portion was recyclable, for a total of 94,000 tons of recyclable wood disposed.<sup>19</sup>

Interviews with processors revealed that at an estimated 38,000 tons of post-consumer urban wood were recycled in 2005; furthermore, 2002 data suggests that other processors recycled approximately another 98,000 tons. Combining these figures indicates that about 322,000 tons of urban wood were generated in King County in 2005.

The reported recycling tonnages are less than those reported in 2002, for at least two reasons. As described above, Recovery 1's tonnages fell by 70% in 2005 when it stopped accepting demolition debris. A secondary cause of the apparent drop in recycling tonnages is that this survey was of more limited scope than in 2002, and therefore fewer processors were interviewed. As a result, some recycling data may have been omitted.

In addition, some processors reported using post-industrial scrap, rather than post-consumer wood waste. One processor used about 30 tons of post-industrial veneer scrap in 2005, and another used about 8500 tons of post-industrial scrap generated by mills, truss manufacturers, and other sources.

### ***Projected Supply***

Assuming the same growth rates as used for other commodities (and developed by King County Solid Waste Division), the quantity of urban wood generated will increase from an estimated 283,000 tons in 2005 to approximately 325,000 tons in 2010. Given the strong hog fuel market for clean urban wood, new processing capacity in Seattle, and the shift toward green building practices, recycling tonnages should increase over current levels.

## **Processing & Infrastructure**

A variety of options exist for recycling urban wood in King County.

- **A number of processors accept source-separated clean wood for recycling.** Rainier Wood Recyclers is the largest of these by volume. The company is

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<sup>19</sup> For the purposes of this study, "recyclable" wood is dimensional lumber, new/clean used lumber, new/clean engineered wood, remanufacturing scrap, pallets and crates, unfinished furnishings, and 50% of wood roofing and siding. This definition for urban wood is the same one used for the Market Assessment of Construction and Demolition Waste Materials (2004). It is an expanded definition from the one used for the Construction and Demolition Waste Characterization and Recycling Industry Profile (2002), which excluded roofing and siding; painted or stained wood from new construction; and finished and unfinished furnishings.

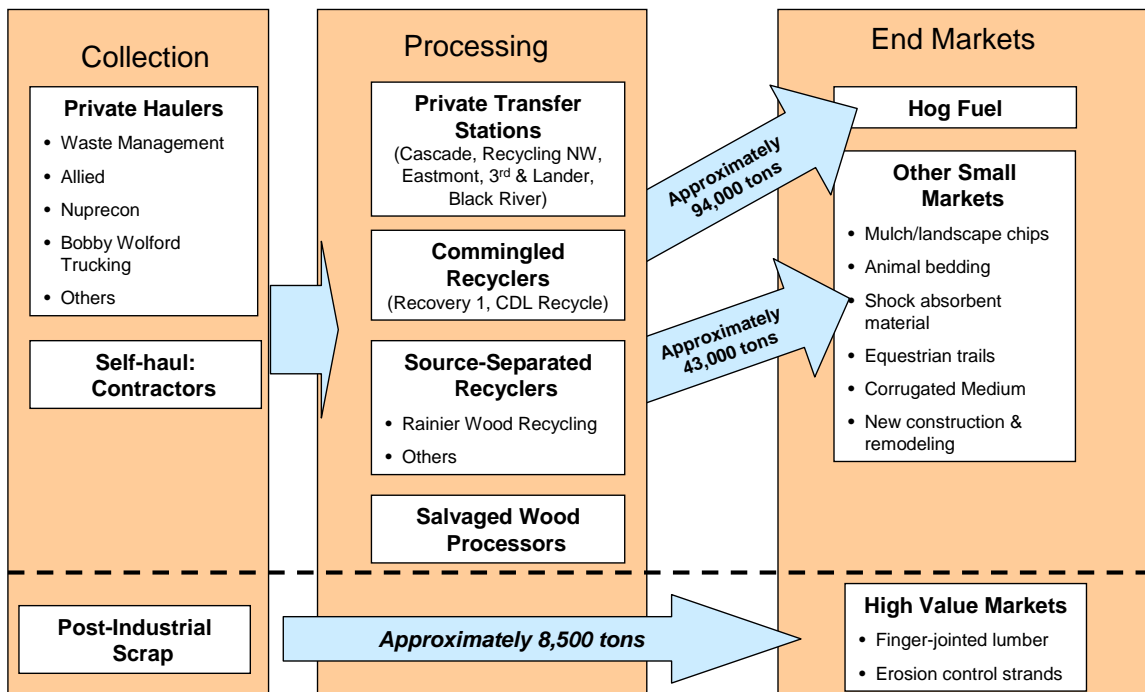
- working with the Health District to broaden its permit so that it can take more mixed debris from new construction, which should increase its throughput.
- **A number of companies accept salvaged lumber for reuse.** The lumber is processed and sold for use in timber frame homes, flooring, paneling, and other applications.
  - **Recovery 1, located in Tacoma, accepts commingled debris** and separates out the wood for recycling.
  - **CDL Recycle, a new commingled processing facility, began accepting loads from haulers for recycling in June 2006.** This facility should improve the cost-effectiveness of recycling wood generated in King County: for many job-sites it will be far closer than Recovery 1, thus decreasing the cost of transporting wood for recycling. This facility is open only to haulers that have accounts with CDL Recycle; for safety reasons the facility does not accept materials from the public.
  - **King County's Enumclaw Transfer Station accepts clean wood for recycling.** However, transfer station staff report high rates of contamination in this wood stream.
  - **Waste Management diverts pure loads of clean wood to a small facility near their Cascade Recycling Center.** The wood is loaded into large containers and sent for recycling.
  - **Other privately operated transfer stations dedicated to construction and demolition debris<sup>20</sup> accept commingled loads and separate out some clean wood for recycling.** However, these transfer stations are not full-scale commingled recycling operations like Recovery 1 or CDL Recycle.

The following chart depicts the supply chain for recycling wood in King County.

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<sup>20</sup> These transfer stations include Cascade, Recycling NW, Eastmont, 3<sup>rd</sup> & Lander, and Black River.

**Figure 12-1. Current Supply Chain for Urban Wood in King County**



## End Markets & Prices

As in previous years, hog fuel is the major market for recycled wood. However, processors are working to develop new markets for urban wood, particularly as colored mulch or landscape chips, and some manufacturers are creating other value-added products such as finger-jointed lumber and erosion-control strands out of post-industrial scrap. The following section provides additional detail on these markets.

- **Hog fuel remains the dominant market for recycled wood.** Processors report that they sell anywhere from 60% to 100% of their wood to the hog fuel market. Interest in hog fuel is growing; with the mounting emphasis on biofuels as a means to reduce greenhouse gas emissions and create local energy sources, this trend is likely to continue. For example, Seattle Steam recently announced that it plans to convert its boilers from natural gas to hog fuel, citing the rising cost of natural gas and the environmental benefits of burning wood rather than fossil fuels for energy.
- **Hog fuel is one of the few markets for painted and stained wood.** It can provide an outlet for painted wood generated during demolition activities if air quality regulations can be met.
- **A variety of smaller markets for recycled clean urban wood exist.** One processor has developed and is selling three colors of colorized mulch made of recycled clean urban wood<sup>21</sup> to consumers.<sup>22</sup> Another is researching the market

<sup>21</sup> For the purposes of this report, clean urban wood includes clean dimensional lumber, clean engineered wood, pallets and crates, scrap from production of prefabricated wood products such as furniture or cabinets that have not been treated with paint, stain, or other chemical finish.

for colorized mulch with assistance from the LinkUp program. Other processors report selling small amounts of wood chips for other uses, such as for compost bulking agent, shock absorbent material, and animal bedding. One processor sells some clean wood for use as corrugated medium (used to make the interior layer of corrugated cardboard) to a mill in eastern Washington. However, these are all relatively small, niche markets.

- **The Home Plate siding product remains in limbo.** OfficeMax, Inc. (formerly Boise Cascade Corporation) discontinued its pilot production of the Home Plate siding product in 2004. The company is reportedly in negotiations to sell the plant to a Midwestern manufacturer of wood and rubber composite products.
- **Local manufacturers are developing high value uses for post-industrial scrap.** Forest Concepts, LLC, manufacturers WoodStraw erosion control strands out of post-industrial scrap from veneer mills. The company is interested in using post-consumer scrap, but must be assured that the scrap is completely clean. West Coast Forest Products manufactures finger-jointed lumber out of trim ends from mills and truss manufacturers. The company is interested in increasing its supply of clean wood, but like Forest Concepts, it requires clean wood free of nails, screws, and other contaminants.
- **Demand for finger-jointed studs outstrips current supply.** In fact, West Coast Forest Products cannot fill the demand due to supply and labor constraints and hopes that other companies will start producing finger-jointed lumber to meet it. The company produces about one million board feet of finger-jointed lumber annually.
- **The highest life-cycle use of urban wood is direct re-use in the construction industry.** Increasingly more buildings in King County are being partially or entirely deconstructed (taken down to maintain the reuse value of the materials in the building to the greatest extent feasible). High-quality salvaged beams, rafters, joists, flooring, decking, paneling, and other wood products are all readily marketable in the Seattle area. Demand for salvaged wood is increasing as more architects and builders learn how to acquire and work with these materials.

## Prices

- **Salvaged wood processors report selling salvaged beams for \$1.00 to \$2.50 per lineal board foot.**
- **Processors report selling hog fuel for \$0-\$40 per bone dry ton, delivered,** depending on the particle size and the stringency of the specifications. The average price range, however, is \$10-\$20 per bone dry ton.
- **Niche products sell for more than hog fuel.** Aside from that statement, however, processors did not divulge the prices they receive for products such as animal bedding, shock absorbent material, and compost bulking agent.

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<sup>22</sup> This processor excludes CCA-treated wood from the mulch using visual inspection of incoming loads. If there is a question about whether wood is treated, the processor uses XRF analysis. The EPA prohibits the use of CCA-treated wood in mulch.

- **Colorized mulch sells for \$19 per cubic yard.** Using a conversion factor of 500 pounds per cubic yard, this translates to \$76 per ton.
- **Other markets command higher prices.** Forest Concepts sells its WoodStraw erosion control strands for \$283 to \$370 per ton, depending on the size of the bale. West Coast Forest Products sells finger-jointed lumber for \$330 to \$410 per thousand board feet, or up to approximately \$158 per ton, with buyers all over the country.

## 12.3 BARRIERS & OPPORTUNITIES

Reuse markets are currently in their infancy, but opportunities exist to expand them. Wood recycling is well established in King County, but barriers such as the strength of the hog fuel market, contamination, and transportation costs currently limit its further expansion. Fortunately, opportunities to overcome these barriers exist as well.

- **Reuse markets for salvaged wood are still niche markets.** Better marketing of salvaged lumber to the public and the building community, revision of building codes to encourage reuse, and a better developed marketplace for salvaged lumber could help foster reuse.
- **The hog fuel market is a barrier to increased recycling of clean wood.** The market for hog fuel is quite strong right now, especially with the price of oil and natural gas so high, since many boilers burn both wood and petroleum products. As a result, most recyclable urban wood ends up as hog fuel, which the King County Solid Waste Division considers a beneficial use, rather than recycling. Therefore, the strength of this market represents a barrier to increased recycling of urban wood into higher value uses.
- **The hog fuel market may represent an opportunity for beneficially using painted and stained wood, and other mixed demolition wood.**<sup>23</sup> As mentioned above, hog fuel is one of the few markets for painted and stained wood. It may be possible to shift painted and stained wood and mixed demolition wood into the hog fuel market, thus beneficially using what is now often disposed. The clean wood it replaces could be used to increase supply to higher value markets, such as mulch or wood-plastic composites. However, further research is required to determine whether this shift is feasible or desirable. For example, it is likely that many boilers would need additional pollution-control measures to burn painted and stained wood,<sup>24</sup> possibly making the cost of this shift prohibitive.
- **Manufacturers need guaranteed supplies of very clean wood and additional investment to switch to recyclable urban wood as feedstock.** Both

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<sup>23</sup> For the purposes of this report, mixed demolition wood includes a variety of wood types – clean lumber, painted and stained lumber, and engineered wood, for example – that typically result from a demolition project.

<sup>24</sup> The new EPA air quality standard for hog fuel boilers, discussed earlier in this chapter, sets strict limits for emissions of mercury, lead, arsenic, cadmium, chromium, hydrogen chloride, hydrogen fluoride, manganese, and nickel. However, performance requirements differ according to a boiler's rated heat input, fuel type, and utilization. It is beyond the scope of this study to identify the characteristics of each boiler in the Puget Sound Region and determine which would need additional pollution-control equipment to meet these standards if they burned hog fuel that contained painted, stained, or treated wood.



manufacturers that use post-industrial scrap expressed interest in urban wood; but, because their specifications are strict, they were concerned with the quality of recycled urban wood. One processor mentioned that converting equipment to use urban wood can be expensive. Increased supplies of clean wood would benefit West Coast Forest Products in particular: it has excess capacity and plans to expand, but cannot do so until it secures additional supplies of very clean wood.

- **CCA-treated wood is difficult to recycle.** The EPA bans its use in most consumer applications. Local processors typically reject loads that contain CCA-treated wood, so as a result it is typically disposed.
- **Rising transportation costs may adversely affect wood recycling.** The high price of gas raises the cost of transporting debris from a construction site to a processor. Therefore, if transfer stations are closer than recyclers, contractors may find it cheaper to dispose than recycle even with the difference in tip fees. West Coast Forest Products also reported that trucking companies won't haul their products to distant markets without a guaranteed back haul.
- **Processors report that the green building movement is bolstering wood recycling.** Their perception is that public demand for green buildings and environmentally friendly building products is increasing.

## 12.4 PUBLIC SECTOR OPTIONS

The King County Solid Waste Division has been actively encouraging wood recycling for years. Currently, its internal Wood Markets Planning Team is developing a strategy to guide its efforts to move more reusable and recyclable urban wood into higher value markets. The options below are drawn from that effort.

- **Increase the supply of recyclable urban wood from both the construction and demolition (CDL) waste stream and the municipal solid waste (MSW) stream.** A number of approaches in the Wood Markets Strategy address this option:
  - Evaluate the costs and benefits of a disposal ban on clean urban wood. The County could analyze the costs of a disposal ban, including the costs to the County and its stakeholders, and the benefits to the environment, the public, and the County.
  - Research, develop, and implement a model ordinance for construction and demolition recycling, such as a CDL deposit program, that provides incentives for wood salvage and recycling.
  - Design new transfer stations to include space for wood recycling and for staff to divert reusable/recyclable urban wood (as well as other items).
  - Monitor technology development for neutralizing CCA-treated wood.
- **Continue to lead by example.** The County could serve as a model for other public agencies in the way it conducts its capital projects:
  - Develop and implement best management practices for King County capital projects. Ideally, these practices would include a policy that requires wood recycling and salvage on King County projects.

## Wood

- Develop specifications for locally salvaged and recycled-content wood products for King County projects. These specifications should strengthen markets for recycled-content wood products.
- Streamline permitting and wood handling policies and requirements. Provided additional processing capacity is needed, the County could review its current policies to find places where streamlining them could smooth the path toward establishing more recycling options in the county.
- **Assist with market expansion.** The County could continue its efforts, such as the LinkUp program, to provide recyclers with market data and enhance the public's awareness of recycled-content wood products:
  - Investigate ways to connect finger-jointed lumber manufacturers, such as West Coast Forest Products, with supplies of clean urban wood.
  - Conduct trials to demonstrate the characteristics of other markets for recycled urban wood, such as wood chips. Currently, little data exists on the benefits of using recycled wood chips as mulch or on playgrounds, for example. The County could conduct trials and publish this data.
  - Investigate manufacturing and milling opportunities. The County could identify manufacturers and millers that might be willing to expand their operations, and entice them to locate in King County. As part of this option, the County could monitor developments in the sale of the Home Plate siding plant in Elma.
  - Identify markets for clean wood pulp feedstock, such as paper.

The King County Green Building Program also is pursuing the following options to foster deconstruction:

- Develop incentives for individual contractors to salvage and reuse building materials, and to deconstruct unwanted buildings.
- Develop and implement a policy to require wood salvage for King County projects.
- Encourage the use of contracting methods and specifications to make public property salvage feasible.
- Encourage online resources for salvaged wood.
- Promote the use of salvaged wood use in green building projects.
- Provide technical assistance to the deconstruction industry.
- Conduct an education campaign about wood salvage targeted at residents and businesses.
- Educate contractors and/or the public about salvage and deconstruction.
- Encourage demolition companies to adopt deconstruction techniques.

Contacts interviewed for this study offered the following ideas for ways the public sector could improve markets for urban wood:

- **Work with mills and other end users to shift painted and stained wood and mixed demolition wood into, and clean wood out of, the hog fuel market.** Interest in using biomass to create energy is strong, and momentum is growing. Rather than trying to buck the trend, the County could attempt to harness it and encourage companies that burn hog fuel to convert their equipment so that it can handle painted and stained wood and mixed demolition wood. Currently, the Tacoma Simpson Kraft and Kimberly-Clark plants accept hog fuel made from painted and stained wood. However, much additional research is required to determine whether this shift is desirable or even feasible.
- **Encourage networking and communication.** Host workshops for industry players to create a network, communicate amongst themselves, and perhaps learn about topics of interest. Networking and communication might help connect raw materials with markets, and publicize trade specifications for different end markets.
- **Create an enterprise area for LinkUp partners.** This enterprise area could be a physical location somewhere in the county where permits for recycling are streamlined. This streamlining of permits might increase the number of recycling options for wood and other materials. In addition, the enterprise area would encourage companies that generate materials such as wood to locate there and create an industrial ecology.

*Wood*

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# Chapter 13

## References

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### CHAPTER 4 ELECTRONICS

- American Plastics Council (APC), 2003. "An Industry Full of Potential: Ten Facts to Know about Plastics from Consumer Electronics – 2003 Update." American Plastics Council, 2003.
- Borjeson, Elaine, 2006. The City of Kirkland. Personal communication, 5/9/06.
- Bracking, Mark, 2006. PC Salvage. Personal communication, 6/5/06.
- Cascadia Consulting Group, 2003. "E-Waste Generation in Northwest Washington." Prepared by Cascadia and Sound Resolutions for Seattle Public Utilities, November 21, 2003.
- Carveth, Deanna, 2006. Snohomish County. Personal communication, 6/6/06.
- Computer Takeback, 2006. Computer TakeBack Campaign  
<http://www.computertakeback.com/>
- Dabek, Marc, 2006. Re-PC. Personal communication, 6/7/06.
- E-Scrap News, 2006a. *E-Scrap News*, Volume 6 No. 5, May, 2006.
- E-Scrap News, 2006b. *E-Scrap News*, Volume 6 No. 4, April, 2006.
- E-Scrap News, 2006c. *E-Scrap News*, Volume 6 No. 3, March, 2006.
- EPA, 1989. U.S. EPA, Characterization of Products Containing Lead and Cadmium in Municipal in the United States, 1970 to 2000, EPA/530-SW-89-015B, U.S. Environmental Protection Agency Office of Solid Waste, Washington D.C., 1989.
- Geranios, Nicholas K., 2006. "Early findings of Lake Roosevelt samples show beaches are safe." *Seattle Times*, June 13, 2006.
- Gogel, John, 2006a. PC Plastics. Personal communication, 5/5/06.
- Gogel, John, 2006b. PC Plastics. Personal communication, 6/2/06.
- Griswold, Matt, 2006. "Old Computers to be recycled into decking." *Waste News*, March 27, 2006.
- Grossman, Elizabeth, 2006. "High Tech Trash." *Weekday, KUOW Radio (94.9)*, June 5, 2006.
- Harrison, Crayton, 2006. "Overwhelmed consumers shying away from HDTV." *The Seattle Times*, January 16, 2006.
- Hatch, Tiffany, 2006. Seattle Goodwill. Personal communication, 4/25/06.
- Jongsma, Allen, 2006. Agri-Plas, Inc. Personal communication, 6/7/06.
- King County Solid Waste Division (KCSWD) and Science Applications International Corporation, 2005. *Literature Review End of Life Management: Flat Panel Display Devices*, December, 2005 (draft).

## References

- Lorch, Craig, 2006a. Total Reclaim. Tour of facility, 5/1/06.
- Lorch, Craig, 2006b. Total Reclaim. Personal communication, 5/5/06.
- Lorch, Craig, 2006c. Total Reclaim. Personal communication, 6/8/06.
- Microsoft, 2006. "Windows Vista Capable and Premium Ready PCs." <http://www.microsoft.com/windowsvista/getready/capable.mspx>, June 29, 2006.
- Molstad, Steve, 2006a. PC Recycle. Tour of facility, 5/4/06.
- Molstad, Steve, 2006b. PC Recycle. Personal communication, 6/2/06.
- Moran, Susan, 2006. "Panning E-Waste for Gold." *New York Times*, May, 17, 2006.
- Musson, 2000. "Management of Discarded Cathode Ray Tubes: Electronic Hazardous Waste", *Electronic Science and Technology*, 2000.
- Peters, Anne, 2006. "Certifying e-scrap processors: the controversy continues." *Resource Recycling*, March, 2006.
- Powell, Jerry, 2006. E-Scrap Magazine. July 31, 2006.
- Recycling Today Magazine, 2006. Apple Launches Free Computer Take-Back Program." *Recycling Today Magazine*, May 31, 2006. [www.recyclingtoday.com](http://www.recyclingtoday.com).
- RCW 70.95N, 2006. Electronic Product Recycling law Chapter 70.95N RCW. Available on Washington Legislature web page, <http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95N>
- Sampson, Greg, 2006. Earth Protection Services Inc (EPSI). Personal communication, 8/1/06.
- Shepard, Jay, 2006. Washington Department of Ecology. Personal communication, 6/6/06.
- Skony, Wendy, 2006. The City of Bellevue. Personal communication, 5/1/06.
- Spooner, John G. and Mary Jo Foley, 2006. "Will Your PC Run Windows Vista?" *Eweek.com*, August 5, 2005.
- Streight, Ken, 2006. Earth Protection Services Inc (EPSI). Personal communication, 5/5/06.
- SVTC, 2006. "Why Focus on Computers?" Silicon Valley Toxics Coalition website, June 29, 2006. <http://www.svtc.org/cleancc/focus.htm>
- Takamiya, Yuka, 2006. Basel Action Network (BAN). Personal communication, 6/8/06.
- Tonetti, Robert, 2006. U.S. Environmental Protection Agency. Personal communication, 8/1/06.
- Walton, Warren, 2006. Washington Department of Ecology. Personal communication, 5/25/06.
- Westervelt, Sarah, 2006. Basel Action Network (BAN). Personal communications, 7/26/06.
- Woellert, Lorraine, 2006. "HP Wants Your Old PCs Back." *BusinessWeek online*, April 10, 2006. [www.businessweek.com/print/magazine/content/06\\_15/b3979109.htm?chan=gl](http://www.businessweek.com/print/magazine/content/06_15/b3979109.htm?chan=gl)

## CHAPTER 5 GLASS

- Coburn, Doug and Ken Wagner, 2006. Saint-Gobain Containers. Tour of facility. 4/10/06.
- Frease, Don, 2006. TriVitro Corporation. Personal communication. 4/17/06.
- Lloyd, Dan, 2006. Dr. Concrete. Personal communication. 6/7/06.
- McCuiston, Jay, 2006. Oregon Recycling Systems. 3/22/06.
- Munford, Chris, 2006. Bedrock Industries. Personal communication. 9/7/06.
- Pierce County, 2006. Seven-months evaluation: Single cart curbside recycling. Pierce County Department of Public Works and Utilities Environmental Services, Solid Waste Division, February 2006.
- Rounds, Steve and Tony. Fibres International. Tour of facility. 4/18/06.
- Reed, Bill. 2006. Waste forecast projections supplied to Cascadia Consulting. June 2006.
- Vaught, Todd. Waste Management Cascade Recycling Facility. Personal communication. 5/2/06.

## CHAPTER 6 GYPSUM

- AEA Technology Plc, 2006. *Review of Plasterboard Material Flows and Barriers to Greater Use of Recycled Plasterboard*. Produced for the Waste and Resource Action Programme. Project code: PBD0004.
- California Integrated Waste Management Board, 2004. Wallboard (Drywall) Recycling. <http://www.ciwmb.ca.gov/ConDemo/Wallboard/>. Accessed June 4, 2006.
- Construction & Demolition Recycling, 2006. "WRAP Explores Applications for Recycled Plasterboard." *Construction & Demolition Recycler E-Newsletter for Thursday, June 1, 2006*. <http://www.cdrecycler.com/news/news.asp?ID=2628>
- Futral, Jim, 2006. BPB. Personal communication, June 13, 2006.
- Gillis, Terry, 2006. Recovery 1. Personal communication, April 26 and July 27, 2006.
- Martin, Chris, 2006. CDL Recycle, LLC. Personal communication, June 22 and July 27, 2006.
- Perry, Quentin, 2006. New West Gypsum. Personal communication, May 1 and July 28, 2006.

## CHAPTER 7 METALS

- Coia, Anthony, 2004. "Old into new: a healthy scrap climate and a brisk new appliance market keep white goods flowing." *Recycling Today*. December 2004.
- Kale, Bart, 2006. Environmental Manager at Nucor Steel, Seattle. Personal communication, May 3, 2006.
- Taylor, Brian, 2004. "Level best: the abrupt ending of Section 201 tariffs has put steelmakers in the U.S. back into a competitive but possibly healthier global market." *Recycling Today*. January 2004.

## References

American Metal Market's Pricing. (May 22, 2006). Retrieved May 23, 2006, from <http://www.amm.com/pricing/default.asp>

## CHAPTER 8 ORGANICS

- Bailey, Barbara, 2006. Bailey Compost. Personal communication, 5/3/06.
- Bailey, Barbara, 2006b. Bailey Compost. Personal communication, 6/8/06.
- Bartlett, Jerry, 2006. Cedar Grove Compost. Personal communication, 5/3/06.
- Bartlett, Jerry, 2006b. Cedar Grove Compost. Personal communication, 6/8/06.
- Beatty, Kris, 2006. King County. Personal communication. July 2006.
- Bloom, Jessie, 2006. N.W. Bloom Ecological Landscaping. Personal communication, 5/22/06.
- Borjeson, Elaine, 2006. City of Kirkland. Personal communication, May 9, 2006.
- CAO User's Manual Part Four – Clearing and Grading, January 2005.  
<http://www.metrokc.gov/des/cao/#manual>
- Cedar Grove, 2006. <http://www.cedar-grove.com/customers/buy/whatwerecoycle.htm>, 6/27/06.
- Erickson, Jennifer, 2005. "10 Lessons from 10 Years of Food Residuals Diversion Planning." *BioCycle*, July 2005.
- Gregory, Carrie. LRI. Personal communication, 6/1/06.
- Henry, Cheryl, 2006. Cheryl Henry Gardening & Design. Personal communication, 7/6/06.
- King County Solid Waste Division, 2005. *Residential Waste Reduction and Recycling Survey 2005: Final Report*. Prepared by Cascadia Consulting Group. April, 2005.
- Morrison, Nancy, 2006. Garden of Weedin'. Personal communication, 6/28/06.
- Musick, Mark, 2006. "Seattle Public Utilities 2006 Food Systems Project." 2006.
- Nelson, Eric. King County Procurement. Personal communication, 5/4/06.
- Salisbury, Sandy, 2006. Washington State Department of Transportation. Personal communication, 5/5/06.
- Science Applications International Corporation, 2005. "Compostable Bag Survey Summary of Results", September 25, 2005.
- Science Applications International Corporation, 2005b. "Compostable Bags for Food Waste Recycling in King County Background Research and Recommendations", October 31, 2005.
- Seattle Public Utilities, 2006. *2005 Home Organics Waste Management Survey*. City of Seattle, July 2006.
- Skony, Wendy, 2006. City of Bellevue. Personal communication, May 1, 2006.
- WORC, 2006. Washington Organic Recycling Council Newsletter, May/June 2006.



## CHAPTER 9 PAPER

Several contacts from paper processors and mills were interviewed for this study. In addition, the following published resources were consulted.

- American Forest and Paper Association (AF&PA), 2006. Statistics published on [paperrecyclers.org](http://paperrecyclers.org). Accessed April, 2006.
- Cascadia Consulting Group, 2004. *On the path to sustainability: Research into single-stream recycling*. November 2004.
- Friberg, Tom, Terry Gerhardt and Conni Kunzler. "The future of fiber." *Resource Recycling*, February 2005, pp 25-27.
- Mills, Victoria. "The Status of Domestic Recovered Paper Supplies." *Resource Recycling*, November 2005, pp. 13-18.
- Moore, William P. "The world OCC market." *Resource Recycling*, February 2006, pp 26-28.
- Sound Resource Management Group and Cascadia Consulting Group, 2004. *Options to Increase Commercial Paper Recycling in King County*. March 2004.
- Truini, 2005. "Paper recovery: the good, the bad." *Waste News* August 15, 2005.

## CHAPTER 10 PLASTICS

Numerous contacts were interviewed for this chapter. In addition, the following published sources were consulted.

- American Plastics Council (APC), 2006. "Plastic Recycling Codes." *PlasticsResource.com*. Accessed June, 2006.
- Antosiewicz, Frank. 2006. "Microgreen testing thermoformed eco-cup." *Plastics News*, March 6, 2006: page 24.
- Esposito, Frank. 2006. "China has not sated its demand for resin." *Plastics News*, March 13, 2006.
- Greer, Diane. "Plastic from plants, not petroleum." *BioCycle*, May 2006.
- Holmes, Kim. 2006. "Riding the HDPE rollercoaster." *Resource Recycling*, June, 2006.
- Moore Recycling Associates. 2005. *Feasibility of Adding Plastic Containers and Film to Curbside Recycling*. Metro (Portland), November 2005.
- Morris, Jeff, Bill Smith, and Rick Hlavka. 2005. "Economic and Environmental Benefits of a Deposit System for Beverage Containers in the State of Washington." City of Tacoma Solid Waste Management, April 2005.
- Toloken, Steve. 2004. "Coalition pushes to ban PVC from packaging." *Plastics News*, December 13, 2004.
- Toloken, Steve. 2005. "Eno to open California facility to reprocess agricultural film." *Plastics News*, December 12, 2005.

## CHAPTER 11 TEXTILES

- Benezra, Anthony, 2006. Buffalo Industries. Personal communication, April 25, 2006.

## References

- Borjeson, Elaine, 2006. City of Kirkland. Personal communication, May 9, 2006.
- Hatch, Tiffany, 2006. Goodwill Industries International. Personal communication, April 25, 2006.
- Johnson, Les, 2006. Community Services for the Blind and Partially Sighted. Personal communication, April 10, 2006.
- Kantu, Jean, 2006. Northwest Center. Personal communication, May 4, 2006.
- Levinson, Dave, 2006. Savers, Inc. Personal communication, May 4, 2006.
- Retex Northwest, 2006. Company website. <http://www.retexnorthwest.com/default.htm>. Accessed June 6, 2006.
- Skony, Wendy, 2006. City of Bellevue. Personal communication, May 1, 2006.

## CHAPTER 12 WOOD REFERENCES

- Bennink, Dave, 2006. Re-Use Consulting. Personal communication, July 28, 2006.
- Dooley, Jim, 2006. Forest Concepts, LLC. Personal communication, May 8, 2006.
- Gillis, Terry, 2006. Recovery 1. Personal communication, April 26, June 6, and July 27, 2006.
- Larson, Ken, 2006. West Coast Forest Products. Personal communication, May 9, 2006.
- Martin, Chris, 2006. CDL Recycle, LLC. Personal communication, June 22 and July 27, 2006.
- Moore, Jeff, 2006. Montana Originals. Personal communication, July 28, 2006.
- Sargent, Bob, 2006. Rainier Wood Recyclers. Personal communication, June 6, 2006.
- Tapas, Das, 2003. *Hog Fuel Boiler RACT Determination*. Washington State Department of Ecology publication number 03-02-009. Available at <http://www.ecy.wa.gov/biblio/0302009.html>.
- U.S. Environmental Protection Agency, 2006. Technology Transfer Network Air Toxics Website. *Rule and Implementation Information for the Industrial/Commercial/Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants*. <http://www.epa.gov/ttn/atw/boiler/boilerpg.html>. Accessed June 6, 2006. Updated March 8<sup>th</sup>, 2006.
- Virgin, Bill, 2006. "Seattle Steam switching from gas to wood fuel." *Seattle Post-Intelligencer*, Friday, March 31, 2006.
- Yeasting, John, 2006. Rainier Wood Recyclers. Personal communication, April 3, 2006.

## Appendix A: Estimated Value of Disposed Recyclables

The following table provides estimates of the disposed value of the materials addressed in this report.

	Disposed 2005	Price	Estimated Value
<b>King County Outside Seattle</b>			
<b>Glass</b>	<b>19,400</b>		<b>\$ (291,000)</b>
mixed containers	19,400	\$ (15)	\$ (291,000)
<b>Metal</b>	<b>37,396</b>		<b>\$ 9,200,243</b>
aluminum cans	3,616	\$ 1,300	\$ 4,701,054
steel food cans	7,098	\$ 70	\$ 496,871
scrap metal	26,682	\$ 150	\$ 4,002,318
<b>Organics</b>	<b>295,724</b>		<b>\$ 5,027,308</b>
food waste	193,107	\$ 17	\$ 3,282,814
yard waste	48,935	\$ 17	\$ 831,903
compostable paper	53,682	\$ 17	\$ 912,591
<b>Paper</b>	<b>149,082</b>		<b>\$ 13,896,153</b>
newspaper	25,237	\$ 95	\$ 2,397,525
cardboard & kraft	44,817	\$ 110	\$ 4,929,860
mixed paper	77,280	\$ 85	\$ 6,568,768
<b>Plastic containers and film</b>	<b>71,728</b>		<b>\$ 10,635,028</b>
PET (#1)	6,107	\$ 400	\$ 2,442,766
HDPE (#2)	4,795	\$ 600	\$ 2,876,821
other rigids (#3-#7)	12,786	\$ 40	\$ 511,458
film	48,040	\$ 100	\$ 4,803,983
<b>Textiles</b>	<b>18,716</b>	\$ 160	\$ 2,994,572
<b>Electronics</b>	<b>2,118</b>	\$ (25)	<b>\$ (53,294)</b>
<b>Wood</b>	<b>185,503</b>	\$ 16	\$ 2,968,049
<b>Gypsum</b>	<b>24,584</b>	\$ -	\$ -
<b>Total</b>			<b>\$ 44,377,059</b>

Price assumptions are as follows, and are generally based on prices paid to Seattle-area MRFs or other processors who are the first handlers of the material after the consumer:

- Glass: price used is the approximate fee Fibres charges MRFs to process glass collected in curbside programs;
- Metal: prices are midpoints of market prices in the metals chapter of this report, which are prices paid to metal recyclers;
- Organics: price is the retail bulk price of compost assuming one ton of feedstock makes one cubic yard of compost;
- Paper: prices are best estimate prices paid to MRFs as reported in the paper chapter of this report; export prices were used.
- Plastics: prices for PET, HDPE, and other rigids were from the plastics chapter of this report and are based on prices paid to MRFs. The price used for film was \$0.05, the upper end of a curbside program, assuming that most disposed film is not of a high enough quality (and is highly dispersed) to warrant the much higher prices offered to commercial generators with large quantities.

- Textiles: price used was the midpoint of the export price, assuming that most disposed textiles are not of high-enough quality to warrant the local re-sale price.
- Electronics: this is an approximate weighted average of the price for recycled electronics paid to electronics processors; note that the high weight and cost to recycle CRTs drives this negative value, even though some items (such as circuit boards) have very high per-pound value.
- Wood: A price of \$16 was used, assuming a bone-dry price of \$20 in the hog fuel market and a 20% moisture content.
- Gypsum: gypsum manufacturers do not pay for this material, as documented in the gypsum chapter.

Note that Sound Resource Management completed a similar analysis of value in January, 2006, which placed the value of disposed recyclables in King County between \$46.6 million and \$77.2 million, depending on routine price fluctuations in recyclable commodities. Their analysis included estimates for every category in King County's waste composition study, a distinction that helps account for the difference in estimates. In addition, some of the price assumptions made differed between the two methods. In particular, Sound Resource Management used higher prices for wood (especially dimensional lumber, for which they assumed 10% was reusable at \$1 per board foot), glass (they used Fibres' published prices for source-separated glass delivered to their door), plastic film, and electronics, assumptions that also contribute to a higher estimated value.

Sound Resource Management's estimates are included on the next two pages as submitted to King County in January 2006.

Value of Disposed Recyclables

Estimated Market Value (FOB processing plant - cleaned, processed & packaged to market specifications) for King County Disposal Stream

DISPOSED MATERIAL	TONS	MEAN COMP%	\$/TON	\$ VALUE	DISPOSED MATERIAL	TONS	MEAN COMP%	\$/TON	\$ VALUE
<b>Paper</b>	<b>232,389</b>	<b>23.2%</b>		<b>\$15,407,943</b>	<b>Metal</b>	<b>69,436</b>	<b>6.9%</b>		<b>\$9,150,434</b>
Newspaper (1)	26,979	2.7%	\$102.83	\$2,774,300	Aluminum cans (1)	3,757	0.4%	\$1,086.06	\$4,080,655
OCC/Kraft paper (1)	46,103	4.6%	111.74	5,151,541	Other aluminum (3)	2,122	0.2%	760.24	1,613,603
Low-grade recyclable paper (1)	62,345	6.2%	79.73	4,970,783	Tinned food cans (1)	7,418	0.7%	49.90	370,157
High-grade printing paper* (1)	16,252	1.6%	79.73	1,295,744	Other ferrous metal (5)	23,794	2.4%	83.58	1,988,760
Bleached polycoat paper* (1)	3,172	0.3%	79.73	252,868	Other nonferrous metal (4)	734	0.1%	1,429.25	1,049,780
Paper/other materials	16,253	1.6%	0	0	Mixed metals/materials	31,042	3.1%	0	0
Compostable paper (10)	55,375	5.5%	16.75	927,531	Gas metal cylinders (5)	568	0.1%	83.58	47,479
Gift wrap paper* (1)	441	0.0%	79.73	35,176	<b>Other Wastes</b>	<b>106,760</b>	<b>10.7%</b>		<b>\$458,286</b>
Other paper	5,469	0.5%	0	0	Construction/demolition wastes	41,303	4.1%	0	\$0
<b>Plastic</b>	<b>107,939</b>	<b>10.8%</b>		<b>\$22,087,599</b>	Ashes	1,520	0.2%	0	0
PET #1 plastic bottles (1)	6,362	0.6%	\$394.67	\$2,511,079	Nondistinct fines	11,260	1.1%	0	0
HDPE #2 plastic bottles (1)	5,042	0.5%	376.76	1,899,551	Gypsum wallboard (18)	9,024	0.9%	\$0.70	6,317
Other plastic containers (2)	7,100	0.7%	286.34	2,032,920	Furniture/mattresses (19)	27,203	2.7%	0	0
Polystyrene foam	4,227	0.4%	0	0	Small appliances (6)	8,260	0.8%	24.95	206,085
Plastic film and bags (2)	50,027	5.0%	312.71	15,644,049	Printers/copiers/faxes (7)	1,174	0.1%	100.00	117,382
Other plastic packaging	6,183	0.6%	0	0	Office electronics (7)	1,285	0.1%	100.00	128,501
Plastic products	14,807	1.5%	0	0	Miscellaneous inorganics	5,732	0.6%	0	0
Foam rubber/padding	3,168	0.3%	0	0	<b>Household Hazardous</b>	<b>5,965</b>	<b>0.6%</b>		<b>\$498,220</b>
Plastic/other materials	11,022	1.1%	0	0	Used oil (20)	438	0.0%	\$500.00	\$218,754
<b>Organics (wood/yard/food)</b>	<b>340,659</b>	<b>34.1%</b>		<b>\$8,465,648</b>	Vehicle batteries	0	0.0%	0	0
Dimensional lumber (13)	38,021	3.8%	\$114.07	\$4,337,061	Household batteries	253	0.0%	0	0
Treated wood (14)	9,419	0.9%	5.00	47,096	Alkaline/button cell batteries	505	0.1%	0	0
Contaminated wood (14)	18,828	1.9%	0.00	0	Latex paint	332	0.0%	0	0
Roofing/siding (14)	6,430	0.6%	3.75	24,113	Oil-based paint	112	0.0%	0	0
Stumps (15)	1,832	0.2%	16.60	30,408	Solvents/thinners	47	0.0%	0	0
Large prunings (10)	1,965	0.2%	16.75	32,914	Adhesives/glues	509	0.1%	0	0
Yard wastes (10)	50,134	5.0%	16.75	839,738	Cleaners and corrosives	196	0.0%	0	0
Other wood (14)	14,224	1.4%	10.00	142,236	Pesticides/herbicides	213	0.0%	0	0
Food wastes (10)	199,806	20.0%	15.08	3,012,081	Gas/fuel oil	70	0.0%	0	0
<b>Other Organics</b>	<b>106,742</b>	<b>10.7%</b>		<b>\$716,948</b>	Antifreeze	38	0.0%	0	0
Textiles/clothes (16)	19,944	2.0%	\$35.00	\$698,049	Medical waste	512	0.1%	0	0
Carpet/upholstery/other textiles (17)	26,800	2.7%	0	0	Computer monitors (8)	183	0.0%	(40.00)	(7,313)
Disposable diapers	27,397	2.7%	0	0	Televisions (8)	1,724	0.2%	(50.00)	(86,212)
Rubber products	2,530	0.3%	0	0	Cell phones (21)	187	0.0%	1,850.00	345,932
Tires	3,780	0.4%	5.00	18,899	Laptops/LCD monitors (9)	90	0.0%	300.00	27,059
Animal carcasses	56	0.0%	0	0	Other hazardous	556	0.1%	0	0
Animal feces	19,619	2.0%	0	0	<b>Total</b>	<b>1,000,000</b>	<b>100.0%</b>		<b>\$57,112,503</b>
Miscellaneous organics	6,616	0.7%	0	0	Expected variation about average prices over next 5 - 7 years:			<b>LOW</b>	<b>\$46,640,614</b>
<b>Glass</b>	<b>30,110</b>	<b>3.0%</b>		<b>\$327,426</b>				<b>HIGH</b>	<b>\$77,240,641</b>
Clear glass containers (11)	10,291	1.0%	\$23.00	\$236,695	<b>Annual King County Disposal</b>	<b>1,000,000</b>			<b>1/23/2006</b>
Green glass containers (11)	4,554	0.5%	0.00	0					
Brown glass containers (11)	5,380	0.5%	17.00	91,452					
Other colored glass containers (12)	48	0.0%	(15.00)	(721)					
Other glass	9,837	1.0%	0	0					

Notes: \* Grades of paper assumed to be recycled with other mixed paper.

- (1) Seattle metropolitan area average end-user prices (FOB MRF) for October 2004 through September 2005.
- (2) Other containers are 76% of Seattle area HDPE bottle price and film/bags are 83% of HDPE price based on Plastic News recycled post-consumer mixed plastic containers and HDPE/LDPE film prices averaging, respectively, 76% and 83% of post-consumer mixed color HDPE bottle prices over the past 12 months.
- (3) 70% of Seattle area recycled aluminum can price based on ratio of recent old mixed aluminum spot prices to used beverage can spot prices on Recycler's World at <www.recycle.net>.
- (4) 188% of other aluminum price based on ratio of recent copper, brass, bronze and zinc spot prices to old mixed aluminum spot prices on Recycler's World at <www.recycle.net>.
- (5) Based on 50/50 mix of sheet tin and scarp iron/steel with sheet tin at 67% of tinned food cans price and mixed scrap iron/steel at 268% of tinned food cans price according to recent spot prices on Recycler's World at <www.recycle.net>.
- (6) 50% of tinned food cans price according to recent spot prices on Recycler's World at <www.recycle.net>.
- (7) Based on incoming charges/spot prices for printers, faxes, and other computer peripherals at local recyclers and Recyclers' World at <www.recycle.net>, as well as processed material composition and end-user market values for the three main processed material streams -- circuit boards, shredded metals and shredded plastics.
- (8) Based on incoming charges/spot prices for Class M mixed WEEE at local recyclers and Recyclers' World at <www.recycle.net>, as well as processed material composition and end-user market values/charges for the four main processed material streams from CRT monitors and TVs -- leaded glass, shredded metals, shredded plastics and circuit boards. Class M is all WEEE equipment with a CRT (cathode ray tube) monitor. WEEE is waste electronic and electrical equipment.
- (9) Based on incoming charges/spot prices for Class F mixed WEEE at local recyclers and Recyclers' World at <www.recycle.net>, as well as processed material composition and end-user market values for the three main processed material streams -- shredded plastics, shredded metals, and circuit boards. Class F is all WEEE equipment with a flat screen monitor.
- (10) Based on picked up bulk price of \$16.75 per yard for compost at Cedar Grove, and assumption that one ton of input compostable material yields one yard of finished compost. 10% of food waste assumed to be in containers and non-recoverable.
- (11) Based on recent City of Seattle market survey prices from Fibres International
- (12) Based on recent prices reported to City of Seattle by Rabanco for mixed color broken glass.
- (13) Based on recent minimum spot prices of \$1 per board foot for usable recycled dimensional lumber on Recyclers' World, and 1005.69 board feet per ton at 33.2 pounds per actual (not nominal) cubic foot. Assumes 10/90 mix of reusable lumber and hogged fuel, and long term price of \$15 for clean wood fuel.
- (14) Assumes long run \$10 price on fuel markets for creosote treated wood chips and chipped non-treated wood; no market for lead or arsenic treated wood which is assumed to be 50% of treated wood. Assumes 25% of roofing/siding can be sold for mulch at \$15 per yard; remainder has near zero price on fuel markets.
- (15) Assumes \$10 long run price on fuel markets for chips from stumps and \$30 for landscaping chips; 2/3 for fuel, 1/3 for landscaping.
- (16) Estimated price for used textiles sold to developing countries, recoverable for buttons/zippers/rug cloth, or usable for rags with less than 10% trash and non salable domestically as clothing.
- (17) Waste carpet in the Northwest has less than zero value both because certain polymers are not recycled and because end-user markets are in the Southeast.
- (18) Estimated average worth of recycled gypsum on recycling markets .
- (19) Some used furniture is recoverable for reuse; lack of data on recoverable proportion and specific types of items prevented estimating its market value.
- (20) Estimated minimum end-use market value for used oil from cars and light trucks based on re-refining into lubricating oils or marine diesel oil.
- (21) Based on cell phone weight of about 5 ounces, \$0.25 average payment for used cell phones, and estimated margin between costs and revenues.

1/23/2006