

## Markets (for recovered/recycled materials)

### Overview

The purpose of this document is to provide an overview and assessment of markets, current market prices and gaps in market for potentially recovered or diverted materials. The materials addressed are those, which are currently being recovered and those for which markets are available or may potentially be available in the future. The marketable energy from waste or landfill gas combustion, the diverted byproducts from construction and demolition activities, and materials diverted through source reduction programs are not addressed in this technical paper. The materials discussed in this technical include the following:

- Papers:
  - Old newspaper,
  - Old corrugated containers,
  - High grade office papers,
  - Mixed papers,
- Glass,
- Metals:
  - Ferrous metal,
  - Nonferrous,
- Plastics:
  - PET,
  - HDPE,
  - Other Plastics
- Compostables:
  - Yard waste compost,
  - Wood mulch, and
  - Food waste compost.

These materials have both a resource value and resale/market value. Additional market analysis information is contained in Appendix 1. This list is not intended to be exhaustive and it is acknowledged that based on market volatility, this technical paper should be treated as a snap shot in time of current market status. Pricing for various recyclables/recovered materials are tracked on a regional and national basis similar to other commodities that are bought and sold.

For a material to be considered 100 percent recyclable, it must be able to meet the requirements of the "closed loop" cycle. The closed loop cycle requires that the material can be completely utilized in a manufacturing process and that the material manufactured is also recyclable. Many materials that can be recovered or removed from the waste stream do not conform to the closed loop description. For example, HDPE bottles can be reprocessed into secondary products such as plastic lumber; however, these secondary products are not currently recoverable or recyclable and, therefore, may be ultimately disposed or used in a non-recoverable manner. This is generally considered delayed disposal or landfill diversion. Glass and aluminum containers for drink products can in theory be endlessly recycled into new

containers for the same use and, therefore would meet the requirements of a closed loop cycle. The closed loop cycle is the ideal system for recovery and reuse programs, because materials are truly and permanently diverted from final landfill disposal. Much of Lincoln's glass is sent to Owens Corning in Kansas City which uses it to make fiberglass insulation. This means that glass currently recycled in the City would not be part of a closed loop system.

Educating consumers to choose products that are recycled or are packaged in recycled containers, to purchase reusable items and refillable containers and to purchase bulk items will help promote markets.

Marketing recovered materials is affected by the volume of material recovered (fluctuating supply), market demand (consistent end markets) and consumer demand. This leads to volatile markets and price volatility. In addition, in the production of many products, raw materials are frequently more abundant, less expensive, of higher quality and available in more consistent quantities. Many of the recovered materials must be reprocessed to make them suitable for remanufacturing/end-markets.

Materials such as papers, glass, metals and plastics recovered in the Planning Area are sent to brokers, which aggregate and ship materials to regional, national or international end users. As a result, the revenue from these recycled materials is reduced by the costs for transportation and possibly by added processing and handling costs. The information on pricing in this technical paper is based on the delivery of a market grade material, excluding transportation/shipping costs.

### **Current Programs**

Appendix 1 provides information on existing markets, historic trends (including pricing) and gaps in markets for potentially recovered or diverted materials. Three private recycling processing centers operate in the City and accept recyclables from residential and business customers, and sort and process them to meet market specifications. There are eight buyback center locations in the City for metal cans and scrap metal; two of the centers only accept metal cans. Two firms have facilities located in the Planning Area, and handle large volumes of scrap, including automobile and demolition scrap metals. Their local facilities process and prepare material for shipment to markets.

Some businesses that generate large quantities of cardboard ship it directly to processors or markets outside the Planning Area.

There is a local firm that manufactures countertops and floor tiles that uses post-consumer crushed glass and porcelain from local businesses. This firm does not currently have the capacity to utilize a significant amount of the glass that might be recovered from the Planning Area. There is also a local foundry that uses recycled steel to produce steel building materials and manhole covers.

### **Generation and Diversion**

Since FY1990-1991, the recycling center drop-off facilities managed by the City have collected 114,163 tons of recyclables. The diversion rate through these facilities peaked at 7,437 tons per year in FY2007-2008 and has declined since that time. Table 1 – Tons of Materials

Recycled at Public Drop-off Sites shows the breakdown in material and overall tonnages of materials collected at drop-off sites over the past 11 years.

**Table 1 –Tons of Materials Recycled at Public Drop-off Sites**

F.Y.	Newsprint	Containers				Paperboard & OCC	Mixed Paper	Total Tons
		Aluminum	PET & HDPE	Glass	Metals			
00-01	3,317	27	178	577	117	732	1,239	6,187
01-02	3,222	25	176	569	118	696	1,236	6,042
02-03	3,219	32	190	594	133	738	1,349	6,255
03-04	3,154	35	200	613	123	739	1,436	6,300
04-05	3,161	36	230	628	126	865	1,511	6,557
05-06	3,162	39	228	675	129	875	1,573	6,681
06-07	3,210	43	281	726	122	966	1,727	7,075
07-08	3,101	51	336	853	127	1,138	1,831	7,437
08-09	2,474	64	396	928	125	1,180	1,641	6,808
09-10	2,155	68	413	978	128	1,210	1,449	6,401
10-11	1,932	59	392	940	120	1,209	1,370	6,022

The City also provides Christmas tree grinding and mulching for approximately 3 weeks following the Christmas holiday. Christmas trees can be dropped off at drop-off sites located throughout the City. In the last 25 years, the City has recycled approximately 205,000 trees (approximately 2,950 tons), with an annual average of approximately 118 tons.

As mentioned above, there are also three local material recovery facilities. All the facilities have warehouses, which are used for sorting and baling recyclables. As presented in the Need Assessment (2012), an annual City survey of recyclers provides some data on the quantity of residential and commercial recyclables handled by private-sector recyclers. Table 2 summarizes the reported data since 2000 for various recycled materials. The quantities originally reported include metals associated with auto scrap, as well as salvage and demolition activities; quantities of metals in Table 2 were adjusted in an effort to reflect only metals from commercial and residential recycling operations. The totals in Table 2 exclude recycled concrete and asphalt materials (construction and demolition waste recycling).

**Table 2 – Tons of Materials Recycled (Reported by Private-Sector)**

Calendar Year	Metals <sup>(1)</sup>	Papers	Cardboard	Glass	Plastics	Totals
2000	5,967	10,095	12,412	1,899	92	30,465
2001	3,205	9,891	11,260	2,931	74	27,361
2002	5,623	11,343	13,690	2,665	281	33,603
2003	5,188	18,937	11,495	1,633	513	37,766
2004	7,962	14,108	14,464	1,702	276	38,512
2005	9,505	20,277	13,098	1,183	342	44,405
2006	7,434	12,262	20,931	1,696	461	42,784
2007	7,777	16,962	21,673	1,542	399	48,353
2008	9,716	9,227	14,317	316	449	34,025
2009	7,247	9,638	16,017	327	618	33,847
2010	9,815	14,252	16,750	1,874	1,308	43,999
2011	9,710	14,020	17,298	834	1,249	43,111

**Notes:**

(1) Actual quantities of reported ferrous metals have been adjusted to reflect 3 percent of the waste stream to correspond to the percentages of metals in NDEQ statewide waste composition study. Adjustments were made because the values reported to the City include items such as scrap automobiles and metals from salvage and demolition operations.

The average amount of materials reported to be recycled by these private sector activities since 2000 has been approximately 38,000 tons per year. These quantities have not been verified and it is not known what amounts come from subscription recycling service, buybacks, or other internal corporate recycling programs. Quantities of recyclables imported and exported are also unknown.

**Program (Facility/System) Options**

Currently most recovered/recycled materials are marketed by private processing facilities and scrap metal dealers. In their business they understand that marketing recovered materials is affected by the volume of material recovered (fluctuating supply), market demand (consistent end markets) and consumer demand. They also understand that these factors can lead to volatile markets and price volatility. In addition, in the production of many products, raw materials are frequently more abundant, less expensive, of higher quality and available in more consistent quantities. Many of the recovered materials must be reprocessed to make them suitable for remanufacturing.

From the above discussion of recovered material types, the current need and options for markets, which could be developed for local demand, may include:

- Papers: where an end product such as cellulose insulation could be cost competitive.
- Glass: while current supplies and market prices are a major limitation the development of a local market could provide a significant incentive to glass recovery.
- Plastics: where a local product could be developed for one or more types of plastic. This is complex because it may need to compete with larger national markets. A niche

opportunity might exist if products could be economically developed for the currently tough to market plastic types (Types 3 through 7).

- Compostables: Currently markets exist for yard waste compost and wood mulch, although demand, pricing and local/regional competition may inhibit significant growth. If food waste composting were to be undertaken it would probably be for a local market.

The first issue that must be addressed is what if any role government may wish to play in the support and development of markets. The major opportunities associated with new markets generally fall within two broad but closely related categories:

- Market Incentives
- Market Development

Incentives related to recycling were discussed in detail in the technical paper on Recycling Incentives. Additional discussions of incentives and market development are also included in the following technical papers:

- Residential Recycling and Diversion
- Commercial Recycling and Diversion
- Organic Waste Diversion (Composting)
- Construction and Demolition Material Recycling
- Conversion Technologies

This technical paper will not repeat all of the content in these various papers.

**Incentive** options can take many forms; some are very program specific, most are based in some measure on economic incentives/disincentives and will involve changes in laws, regulations, or ordinances to implement. Options for market incentives generally fall within the following categories:

- Bans, Restrictions and Mandates
- Grants or Subsidies

As discussed in the technical paper on Recycling Incentives, bans, restrictions and mandates can be used to create a demand for certain products and as such serve as an incentive (generally to private industry) to create markets or provide alternate management options. Bans and restrictions are generally more appropriate on a state-wide basis but can be used at the local level for select materials. As illustrated by the traditional recycling logo, using the collected material, in whole or in part, in new products is also necessary to complete the “recycling” cycle. Examples of programs to create a demand through mandates can include:

- **Building Specifications:** where new construction is encouraged or required to use of a certain amount of recycled materials, thus helping to support markets and create market demand for certain materials. This concept is a significant cornerstone of the Green Building Council and their Leadership in Energy and Environmental Design (LEED) certification program.
- **Utilization of Recycled Materials:** where mandates on the inclusion of a “buy-recycled” provision in purchasing policies and government construction specification. As a simple example, the City and County standard specification could be modified to include provisions to require use of recycled materials (such as local compost) in construction projects. This would create added markets for the City’s LinGro compost.

New grant or subsidy programs could be developed by the City or in conjunction with specific funding sources to further encourage/promote the development of markets or new products from recycled materials, or to help businesses (e.g., through economic development grants or subsidies) implement/establish and maintain systems, facilities and programs. A key consideration will be the identification of funding sources and mechanisms for grants and subsidies. Long-term grants and subsidies may or may not represent sustainable funding approaches for market development.

**Market Development** is a complex topic as it entails a strategy that must address a wide range of topics including but not limited to:

- Market demand (consistent end markets) and consumer/buyer demand for either the raw product or re-manufacturer product. This may include increasing demand beyond current levels or new products with sustained demands. This may also involve creating a compelling reason to purchase the material. A further decision is whether the markets will be local, national or international.
- Adequate supply of raw product - volume of material recovered. This needs to address changes in consumer habits and product manufacturing, as well as potentially fluctuating supply.
- Diversity – Is the target market for a single product or will it require a diverse product line to compete with established programs, especially if it is not a new product.
- Distribution and sales (marketing) of the product or recovered materials. As part of distribution and sales it will be important to establish the markets position in the supply chain (e.g., as a middle man supplier or an end product supplier) and the extent to which the market is dependent upon others for product distribution.
- Pricing
- Competition/Competitors

From a very broad perspective market development could include integration with other businesses and industries in what is sometimes referred to as an eco-park or eco-industrial park. Under this concept the City would work with (co-operate with) businesses or developers to create a campus-type area where resources, products and energy needs could be shared with an emphasis on public health, economic and environmental benefits. The Eco-industrial Park Handbook<sup>1</sup> states that "An Eco-Industrial Park is a community of manufacturing and service businesses located together on a common property. Members seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues." The Innovation Campus on the site of the former Nebraska State Fair contains elements of these principles.

## Options Evaluation

The general issues associated with markets, and market development/implementation are:

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1. Lowe, Ernest A. 2001. Eco-industrial Park Handbook for Asian Developing Countries. A Report to Asian Development Bank, Environment Department, Indigo Development, Oakland, CA

- Most markets for materials diverted from disposal are national/international markets.
- Local markets for compost made from yard wastes and wood waste are not large revenue generators and compete with other local or regional markets.
- Markets for compost from food waste are not established.
- Markets for clear [flint] and brown [amber] glass have been the relatively consistent; the market for green glass has been more volatile. Prices for cullet have been quite low in comparison to the cost of recovery, processing and transportation making it difficult to justify on an economic basis. The absence of a container redemption program in Nebraska is a limiting factor on the volume and supply of cullet and which might justify construction of a commercial processing unit.
- Prices for almost all recovered/recyclable materials experience volatility.
- Local market development options may only exist for certain materials; market longevity/sustainability is a key issue in facility construction but may also be viewed as an economic development opportunity.

There is a wide array of issues and options associated with markets for materials currently being recovered and those for which markets are available or may potentially be available in the future. It is not always possible to compare them to each other. Consistent with the guiding evaluation criteria developed for use in the Solid Waste Plan 2040, the topic of markets have been further evaluated based on the following considerations:

**Waste Reduction/Diversion:** The availability of markets is critical to any source reduction and/or recycling goals established as a result of the Solid Waste Plan 2040 and necessary to prevent recovered materials from going to landfills for disposal. The availability of a market would also be essential for recovered energy.

**Technical Requirements:** Markets currently exist for materials currently being recovered in the Planning Area and general national trends suggest market capacity is increasing for these materials. The capacity of current processing facilities, with the exception of composting, is not known, but these and buy-back centers are generally only viewed as intermediate markets. Existing, large national and international markets represent risks to the local community from the standpoint of price, price volatility and demand; establishing local markets can represent some level of risk due to complexities associated with almost any new business. The establishment of viable local markets for certain recyclables could provide redundancy and flexibility in contrast to reliance on national and international markets.

**Environmental Impacts:** The availability of local markets could conserve resources by eliminating transportation costs and associated air emissions.

**Economic Impacts:** Establishing markets will require careful consideration of capital and operating costs. Establishing new, local markets may be beyond the role of government, except to help facilitate such markets through economic incentives. New, local markets represent an economic development potential, but careful economic analysis will be necessary to ensure the market is economically sustainable. Residents and businesses may benefit if an economically viable local market can be established for select materials.

**Implementation Viability:** Implementation viability is closely tied to economic viability. Because of the “green” nature of markets for recycled/recovered materials it would generally be anticipated to be socially/politically acceptable. Whether legislative and regulatory changes would be necessary for market development is not known and would likely be material specific. It is generally assumed the market development would be the responsibilities of private entities (with the exception of yard waste compost and wood mulch); these entities would generally provide the land and undertake any required siting and permitting.

### **Relationship to Guiding Principles and Goals**

The current outlet for recovered/recycled materials relies on private service providers and private markets (excluding yard waste and wood mulch). As it relates to the Guiding Principles and Goals of the Solid Waste Plan 2040, the possibility of expanding markets is directly applicable, as further noted below.

- **Emphasize the waste management hierarchy:** Markets are essential to a successful waste reduction and recycling program. Recycling is one of the most preferred waste management methods in the hierarchy in that it places maximum emphasis on options to recover materials and convert them into new products. Current programs are compatible with this hierarchy.
- **Encourage public/private partnerships:** The current markets for recycled materials involves both public and private efforts including private recycling processing centers and private buy-back centers and City provided education and promotional outreach. Private companies also serve as retail outlets for the City’s LinGro compost. If an expanded recycling program is selected for implementation it is expected to be developed with private parties providing processing and recovered materials marketing services. Services by non-profits, private companies, and public/private partnerships such as buyback centers, special materials take-backs, and thrift stores are expected to continue and complement any market needs created as a result of the planning process.
- **Ensure sufficient system capacity:** There are eight buyback center locations in the City for metal cans and scrap metal; two of the centers only accept metal cans. Two firms have facilities located in the Planning Area, and handle large volumes of scrap, including automobile and demolition scrap metals. Their local facilities also accept and recycle materials from other recyclers in the region. In conjunction with three private recycling processing centers, these firms serve to market most of the recyclable materials collected in the Planning Area. The need for local markets may require further evaluation as part of any program that significantly expands recycling diversion rates or attempts to recycle materials for which there is only limited current demand or for which the purchase price of the commodity is much lower than the cost of collection, processing and transportation. Incentives and program funding for markets development do not necessarily ensure sufficient system capacity, but can be used to encourage or support expanded capacity and markets for diverted materials.
- **Engage the community:** Any expanded recycling program would need to engage the residents and businesses to encourage them to divert more recyclables from disposal. Community engagement may have limited applicability to new markets unless the city is taking a role in funding, building, owning or operating such facilities/programs.

- **Embrace sustainable principles:** Maximizing recovery of materials through recycling into new products recognizes that waste is not inevitable and discarded materials are potentially valuable resources. Careful evaluation of economic and environmental aspects of new local markets will need to be undertaken to ensure the benefits are sustainable.

## Summary

Markets and prices for recovered materials can be volatile and are influenced by supply and demand, as well as other factors such as material quantity and quality. Of the various materials targeted for recycling, only glass and metals currently have the potential to meet the criteria for a closed loop cycle.

Papers, metals and plastics (and possibly glass) generally targeted for diversion are often sorted locally and shipped to manufacturer's or secondary processors outside the Planning Area. For over a decade markets have existed for:

- Paper
- PET and HDPE Plastics
- Ferrous and Non-Ferrous Metals
- Yard Waste Compost
- Wood Mulch

While free market efforts tend to find markets, where opportunities exist, it is possible that the combined efforts of the public and private entities may be necessary to create markets or increase market opportunities.

Limited cost effective markets exist for glass and certain plastics; even when properly sorted and processed, the revenue stream for glass and certain plastics has been small in comparison to the costs associated with collection, processing and transporting. Since glass is inert, it does not pose a toxicity risk in landfills. Glass is sometimes viewed as a potential contaminant in single stream recycling operations. Therefore glass recycling has been a low priority target in some recycling programs. Of the other plastic streams film plastics may have the greatest near term market potential, assuming they can be made suitable for the end market.

Compost and wood mulch material markets are also well established, but again rely upon a high quality product to generate a commercial demand and revenues. If plan implementation activities pursue food waste composting on a commercial scale it will be very important to focus on product purity and to have established markets/outlets before investing in collection infrastructure, processing and distribution facilities.

As a part of the overall plan implementation strategy, Planning Area members should continue to look for local market opportunities to provide sustainable revenue streams, to help off-set collection and management costs associated with diverted/recycled materials. Where national or regional markets are utilized, local efforts should also support the consolidation, processing and transport of recovered materials to enhance their marketability. Additional attention may also need to be given to development of new local markets to reduce reliance on national markets or markets outside the Planning Area. As such Planning Area members may wish to pursue opportunities for local markets for items such as glass and certain plastics.

Marketing of recovered materials may be managed by private entities, individual communities or may be coordinated as a multi-jurisdictional effort; however, existing marketing practices, principally by private entities, are anticipated to be maintained to the extent that they are adequate to meet the needs of the Planning Area and effectively support the goals and objectives of the Solid Waste Plan 2040. In looking at local market development opportunities, Planning Area members may also need to consider the added potential to attract businesses and create green jobs in the Planning Area.

Further evaluation and adoption of changes to current purchasing policies, building codes and material purchase specifications used in Planning Area governmental procurement programs represent options to encourage waste reduction and recycling. Such changes would also enhance the markets for recycled and compost products/materials, thus completing the “recycling” cycle.

# Appendix 1

## Paper and Paper Products

Papers are referred to in the recycling market industry as “fiber”, to more accurately describe the quality and component being recycled. The paper/fiber recycling industry has matured considerably since the 1994 Lincoln-Lancaster County Solid Waste Plan was prepared and markets now exist for essentially all types of recovered paper. Since 1994, the quantities of recycled paper in the US have nearly doubled and large numbers of processing mills, which de-ink and remove contaminants, have developed new or modified existing mills in the US. Such mills have generally located in proximity to large paper manufacturing or specialty products manufacturing markets to most efficiently deliver their fiber products to paper product manufacturers/markets.

The American Forest & Paper Association (AF&PA) reports that in 2011 66.8 percent of the paper consumed in the U.S. was recovered for recycling. According to the November 2012 Recovered Fiber Monthly Statistics Report (published 12-19-2012) by the AF&PA, year-to-date total consumption in 2012 was 4 percent lower than during the same period last year and year-to-date exports of recovered paper in 2012 are 6 percent lower than during the same period in 2011. In recent years, one of the most significant markets for recycled paper has been exports to China and other nations. These exports accounts for nearly 40 percent of the market for recycled paper collected in the U.S. in 2010. Additionally, while prices are more favorable than two decades ago, the material pricing is still somewhat volatile and generally fluctuates with the economic conditions.

### *Paper Markets*

Local processing facility for residential and commercial waste paper is currently available at three facilities in the Planning Area. These include the following:

- Firststar Fiber
- Midland Recycling
- Recycling Enterprises of Nebraska

These facilities sort paper by grades/types, remove contaminants and generally bale the material for shipment to mills or markets. Regionally, there is one firm in Nebraska (Green Fiber) that processes old news paper into cellulose insulation.

### *Old Newspapers (ONP)*

The AF&PA reported that total (national) recovery of news/mechanical papers declined 3.2 percent in 2010, but generation of these papers in the waste stream declined by an even larger rate of 5.4 percent. In 2011, ONP tonnage generated continued to fall, but most of these declines were the result of a reduction in hard-copy newspaper readership.

Currently ONP is being utilized in the production of the following types of products: tissue products, packaging and industrial papers, paper board, kraft (the flat board used in corrugated paper board), corrugated medium, roofing felt, gypsum wallboard liner, cellulose insulation, animal bedding, hydro-mulch, molded pulp products (egg

cartons, trays, and flower pots), packaging cushion material, kitty litter, and single-ply cardboard containers.

#### *ONP Pricing*

Mid-2011 prices for recovered ONP averaged \$145 per ton.

#### *Old Corrugated Containers (OCC)*

The AF&PA reported that after declining in 2009, U.S. purchases of containerboard rebounded 7.2 percent in 2010. However, recovery of OCC, driven by both increased domestic demand and exports, rose 11.2 percent. As a result, the recovery rate for OCC increased to 85.1 percent in 2010, up from 82.0 percent in 2009.

Currently OCC is being used in the production of the following types of products: tissue products, packaging and industrial papers, chip board, kraft, corrugated medium, paper pulp, roofing felt, gypsum wallboard liner, cellulose insulation and hydro-mulch.

#### *OCC Pricing*

Mid-2011 prices for recovered OCC averaged \$165 per ton.

#### *High-Grade/Office Papers*

The AF&PA estimated that the nationally, recovery rate for high grade papers (printing-writing) was at 54.6 percent in 2010 versus 61.3 percent in 2009 and 54.7 percent in 2008. An increase in the 2009 rate suggests a drawdown of inventories – a result of the global recession.

Because of their quality, the market demands for high-grade papers have remained fairly constant. These papers have a wide range of potential for reuse that include newsprint, toweling, wrapping, writing paper, card stock, and paper board, as well as many of those listed above for lower grades of fiber.

#### *High Grade Paper Pricing*

Mid-2011 prices for recovered high grade paper averaged \$ 271 per ton.

#### *Mixed Papers*

This category of paper is a mixture of varying grades of papers such as colored papers, magazines, telephone directories and envelopes. Mixed papers may include high-grade papers that are not easily separable from the remainder of the mixed paper stream.

The current uses of mixed papers include, but are not limited to, the following: newsprint, tissue products, recycled paper board, recycled corrugated medium, roofing felt, and gypsum wallboard liner. In addition, mixed papers are also being combined with other paper, shredded, baled and used as animal bedding.

### *Mixed Paper Pricing*

Mid-2011 prices for recovered mixed papers averaged \$109 per ton.

### **Glass**

The Glass Packaging Institute estimates that 80 percent of the recovered glass containers are recycled into glass bottles. They also report that nationally in 2010 over 41 percent of glass beer and soft drink bottles and 25 percent of the wine and liquor bottles were recycled. These rates of diversion are in part attributed to states with bottle deposit legislation. Although glass is considered a 100 percent recyclable material, because it meets the closed loop definition, the principal reason for the lower rates of recovery include: (i) it requires specialized optical sorting equipment to separate glass by color, and (ii) the cost of processing and transporting the glass to remote manufacturing markets is significantly higher than the revenue it generates. Glass processors have tended to locate in states where bottle refund laws exist, because such states provide a steady supply of high quality cullet and can provide a sustainable supply of recovered glass. The closest glass processing facilities are in Des Moines, IA and St. Paul, MN.

### *Glass Markets*

Recovered and processed glass is referred to as "cullet". The primary end markets for recovered glass have been manufacturers of glass containers. Other uses for recovered glass, though not as lucrative as the glass container industry, include fiberglass insulation, fiberglass swimming pools, masonry block and glass wool. Owens-Corning in Kansas City does accept recovered glass from Lincoln recyclers to produce fiberglass insulation. Additional potential uses for mixed glass which are currently being researched include use of cullet as an aggregate material in roadway construction and in concrete drainage pipes.

The Glass Packaging Institute reports that there are 48 glass manufacturing plants operating in 22 states. Approximately 76 cullet, or recycled glass, processors are in 31 states.

Manufacturers are most interested in glass that is furnace-ready. Furnace-ready cullet is glass that has been separated by color (clear [flint], brown [amber], and green), is free of contaminants and can be fed directly into the furnace melting pot without further processing. Depending on the manufacturer, furnace ready cullet in the form of whole or broken bottles is preferred for inspection for contamination. Cullet can also be crushed and cleaned by a commercial processing unit ("CPU") for delivery.

The CPU processes glass by color sorting, crushing, washing, removing and separating out the contaminants and grinding the glass to a specific particular size. The final product from a CPU facility is furnace ready cullet that can be used by glass container manufacturers. Presently manufacturers are incorporating approximately 30 percent recovered glass into newly manufactured glass containers. In 2008 glass container manufacturers set a goal to achieve 50 percent recycled content in the

manufacture of new glass bottles by 2013. Presently there are two CPUs in the region that produces furnace ready cullet:

- Greenstar Recycling in Des Moines, IA
- e-Cullet in Saint Paul, MN

The demand for clear [flint] glass has been the most consistent. However, markets have also been consistent for brown [amber] glass. The market for green glass has been more volatile. The markets for recovered glass have increased steadily since 1994 as manufacturers of glass containers have increased their percentage use of recovered glass and as other uses have developed. Absent the establishment of a container redemption program in Nebraska (which would provide a large volume, steady supply of cullet and which might justify construction of a CPU), there may be opportunities for niche markets that would improve the overall economics associated with glass recovery and recycling.

### *Glass Pricing*

eCullet buys glass cullet from material recovery facilities (MRFs) and small volume recycling facilities for between \$5 to \$30 per ton depending on the color and level of contamination.

## **Metals**

In the recycling industry, metals are normally classified as either ferrous or non-ferrous metals. Ferrous scrap, which is metal waste product containing iron, has been a recoverable material for many decades and has established markets. Nonferrous metals are those that contain very little or no iron. The most common nonferrous metal targeted for recovery in the solid waste stream is aluminum. Other nonferrous metals which are often targets for diversion or recovery include copper, lead, zinc, nickel, gold, silver, brass, bronze, mercury and platinum. While there are scrap yards in and adjacent to the Planning Area, regionally there is one firm in Nebraska (Nucor Steel) that serves as an end market and processes large volumes of recycled ferrous metals into new building products; no other significant end product manufacturers/markets are located in proximity of the Planning Area. No significant non-ferrous manufacturers/markets are located in proximity to the Planning Area.

### *Metal Markets*

Metals have the most established recyclable markets. Metals can generally be recycled without losing their important properties and thus meet the requirements of the "closed loop" cycle. Although all metals are recyclable the most prominent metals found in the municipal waste stream are ferrous and aluminum.

### *Ferrous Metal*

Ferrous scrap has become the steel industry's single largest source of raw material, because it is economically advantageous to recycle old steel into new steel. There is a well-established network of more than 2,000 ferrous scrap processors and more than 70 end markets across the United States. The steel recycling infrastructure has

grown and matured over the years in its efforts to meet the steel industry's demand for steel scrap. The Steel Recycling Institute estimates that 67 percent of steel cans, 90 percent of steel appliances, 98 percent of structural steel and 70 percent of the reinforcing steel sold in the United States is ultimately being recycled.

### *Ferrous Pricing*

Prices for ferrous metal were depressed as a result of the 2008 recession to a level of approximately \$100 per ton, rose to a high of \$400 per ton in 2009, then dropped back to around \$300 per ton in 2010 and were at \$400 per ton in mid-2011. Ferrous is classified into several grades based on the level of contamination and prices vary according to grade.

### *Aluminum*

Aluminum is one of the most marketable metals that can be diverted or recovered from the solid waste stream. As with ferrous and glass, aluminum meets the closed loop definition as a 100 percent recyclable product. In addition, reprocessing of aluminum requires approximately 95 percent less energy than making aluminum from raw materials.

### *Aluminum Pricing*

Aluminum recycling markets have ranged from \$2,240/ton in 2009 to \$1,800 per ton in 2010, to 2,300 to \$2,500 per ton in 2011.

### **Plastics**

The components used to make plastics come largely from refinement of crude oil and natural gas. For purposes of distinguishing the different resin applications, plastics are assigned a recycling symbol and a number; the most common are listed as follows:

- Type 1 - Polyethylene Terephthalate (PET)
- Type 2 - High-Density Polyethylene (HDPE)
- Type 3 - Polyvinyl Chloride (PVC)
- Type 4 - Low-Density Polyethylene (LDPE)
- Type 5 - Polypropylene (PP)
- Type 6 - Polystyrene (PS)
- Type 7 - Acrylonitrile Copolymers

Regionally, there are no identified large volume manufacturers that are directly processing plastics into usable resins. Some local small businesses in the region may be using resins derived from recovered/recycled plastics, but no significant resin processors are located in proximity of the Planning Area. An opportunity for local market may exist for recycling Type 3 through 7 plastic because there are not currently good markets for this material. However, technology and supply infrastructure would be critical issues in attempting to develop local markets, especially since national markets are limited to non-existent for several of these plastics.

### *Plastic Markets*

A major issues associated with plastics recycling is that in order for them to be recycled, different types of plastics cannot be mixed, yet to a typical consumer it is virtually impossible to distinguish one type from another merely by looking at them or even by touching them. Types 1 through 5 plastics are collected at the City's recycling drop-off sites. Private recyclers collect Types 1 through 7 plastics in their residential curbside recycling programs. While efforts are underway in various locations and by various companies to develop and expand markets for plastics, there are not strong markets for types 3 through 7 plastics. The absence of such markets may also represent opportunities within the Planning Area, but the development of such markets may be complex and is beyond the scope of this technical paper.

### *PET*

The National Association for PET Container Resources (NAPCOR) reports that approximately 29 percent of the PET containers sold in the United States in 2011 were recovered. PET container recovery is also reported to have been gradually increasing over the last five years. Several new PET plants were opened in early 2011; these new plants have created new demand for recycled PET. PepsiCo Beverages of Canada has recently developed a process that it says will allow it to increase the use of PET in its bottles from 10 percent to 100 percent; this could significantly increase the demand for recycled PET.

### *PET Pricing*

The average of price for PET has ranged from \$400/ton in mid-2010 to approximately \$840 per ton in early-2011.

### *HDPE*

The market information on HDPE is much more difficult to quantify. Demand and pricing is higher for natural HDPE than for mixed colored HDPE materials. Recycled HDPE is generally used to produce non-food bottles, drainage pipe, plastic lumber and other plastic products.

### *HDPE Pricing*

Over the last two years the prices per ton for natural HDPE have ranged from \$580 to \$800 with mixed colored selling for approximately \$440 to \$580 per ton.

### *Mixed Plastic Containers (Types 1 through 7)*

Some communities accept/collect mixed plastic containers (Types 1 through 7) to encourage recycling, because residents do not have to concern themselves with identifying and sorting their plastics. This generally increases the amount of plastics diverted; however, from a revenue perspective the market value for mixed plastics is much less than for a single type (e.g., type 1 or Type 2) plastics, because end markets must ultimately sort the materials. No end market or plastic processing centers exist in the region.

### *Other Plastics*

Plastic film, which is typically defined as any plastic less than 10 mm thick, is principally made from polyethylene resin and is readily recyclable if the material is clean, dry, and not pigmented black. There are no markets (firms paying for collected materials) in the Planning Area for film plastic; however there are a number of local grocery and department stores that will accept plastic bags for recycling purposes.

### *Compostable Materials*

The decomposition of organic materials under controlled conditions produces a humus-like material referred to as compost. Compost can be produced from either the entire solid waste stream, or, as is more typically the case, from single components diverted from the waste stream such as yard and wood wastes. Certain materials can also be combined to produce compost, such as papers and foods. Most markets for compost and wood mulch type materials are local/regional. At home composting is a viable, multi-material composting/diversion opportunity (for organic material generated at a residence) but is not considered a viable processing option or market for the potential large volumes of materials from other generators. National market competition for compost and mulch would require large volume supplies and an extensive marketing initiative. The City of Lincoln has had success locally marketing its yard waste compost product (LinGro) and it appears that wood mulch produced locally by public and private efforts is being successfully marketed and consumed locally. While opportunities are believed to exist to use compost type products for local land restoration and to reduce urban run-off, the revenues generated from compost sales is not expected to exceed the costs of collection, composting facility construction, and operating and maintenance costs for composting facilities.

### *Markets*

Most markets for materials diverted from disposal are local/regional markets. Within the Planning Area markets have been established for compost made from yard wastes and wood waste. Two private companies also market manure compost in the Planning Area.

Local, commercial-scale, revenue generating markets have not been established for compost from items such as food waste and solid waste. Markets, as used in the following discussions, refer to post processing (following composting operations). Additional market development opportunities may also exist to expand the use of compost and wood mulch products to improve storm water run-off quality, increase infiltration (reduce run-off), and improve soil conditions in the Planning Areas urban environment.

### *Yard Waste Compost*

A large scale yard-waste composting program is currently operated by the City of Lincoln adjacent to the Bluff Road Landfill site. This site currently accepts only yard waste collected from within Lancaster County. The resulting composting material is marketed locally under the trade name LinGro.

Yard waste is also accepted the City's North 48<sup>th</sup> Street and then hauled by the City to the Bluff Road site for further processing/composting.

LinGro Compost is utilized by both the public and private sectors. Over the last 4 years, roughly 40 percent of compost produced has been used by the public sector for various projects ranging from rain gardens, landscape areas, and infrastructure improvements and to help establish a healthy vegetative cover in the closed areas of the City's landfills. The remaining 60 percent was sold to local landscapers, garden centers and homeowners.

#### ***Yard Waste Compost Pricing***

Each spring the City of Lincoln sets aside a certain quantity of LinGro compost for distribution to the public at no cost. The material is available at the North 48th Street Transfer Station, 5101 North 48th Street. The material is available on a first come, first served basis and individual must self-load the compost.

Individuals and businesses may order a minimum of 10 cubic yards of LinGro Compost directly through the City. There is a \$6.00 per cubic yard charge for the compost plus a delivery fee of \$50 per dump truck load. Individuals may also arrange their own transportation of the material.

#### ***Wood Mulch***

There are established local/regional markets for processed wood waste in the form of wood mulch. These wood wastes are generally processed by the private sector firms although City of Lincoln also accepts and grinds tree waste. Private firms, including landscapers and tree trimming services, generally grind brush, branches, tree trunks and pallets to produce mulch that they can use or sell in a natural or stained color for landscaping purposes. Mulch produced by the City is used by Solid Waste Operations.

#### ***Wood Mulch Pricing***

Various grades and colors of this material sell in bulk for prices ranging from \$18 to \$35 per cubic yard. Prices also vary by volume with small bagged quantities generally selling for \$3 to \$4 per two cubic foot bag (equivalent of \$40 to \$55 per cubic yard).

#### ***Food Waste and Paper Compost***

The composting of food waste (and other organic materials) must be conducted in a controlled environment as further discussed in the technical paper on Organic Waste Diversion (Composting), to prevent the spread of disease, to avoid attracting vermin and to avoid odor problems. While the quantities composted at individual residences in unknown, there are no facilities in the Planning Area that are currently undertaking commercial scale food waste composting operations. Compost operations are currently allowed to take up to 1,000 cubic yards (approximately 1,000 tons) per year in food waste without a permit from NDEQ.

If a commercial scale food waste (or food and papers) collection program were to be initiated and a commercial scale composting facility were to be operated, care would have to be taken to make sure the compost product was free of other contaminants to be marketable. Where food and mixed organic waste composting has been done in other communities, one of the largest challenges is identifying/establishing sustainable market outlets.

#### *Food and Paper Waste Compost Pricing*

No readily useable information is available to characterize the price that might be assigned to compost produced from food and paper wastes. While the nutrient levels may be higher than compost associated with yard waste, marketing such materials may also be constrained by contaminant levels.