RAMSEY/WASHINGTON COUNTY
RESOURCE RECOVERY PROJECT
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# Environmental Analysis Report

## Introduction

The purpose of this report is to provide an environmental analysis of policy options related to system design under consideration by Ramsey and Washington Counties. This is one of several reports that provides information to the Resource Recovery Project Board as it approaches the May 2015 decision on Facility ownership.

The elements included in the analysis are:

1. Resource Conservation
    a. Materials
    b. Land
    c. Energy
2. Greenhouse Gas Analysis
3. Air Quality
4. Water Resources

**Resource Conservation: Materials, Land, Energy**

The goal of the Waste Management Act is protection of land, air, water and other natural resources and the public health, by improving waste management to serve a number of purposes. Protection of these valuable resources necessarily requires resource conservation - the practice of reducing the use of water, energy and raw materials. The analysis below provides information about conservation of materials, land and energy associated with the East Metro solid waste system.

Key Points:

- Over the past three decades the solid waste system in the East Metro, including reduction, recycling, composting, and resource recovery, has been successful in conserving resources. In 2014, for example, 86% of MSW was diverted from landfills into recycling or energy production.
- However much more can be done. Project Staff estimate that, in 2014, the East Metro region landfilled approximately $25 million worth of traditional recyclables such as cans, bottles, paper, plastic and glass.
- In addition, 25% of trash is organic material that could be recovered for anaerobic digestion or composting.

Conservation of Materials

Results:

Both Counties have worked hard to conserve resources through the Solid Waste Master Plans and county activities since the Waste Management Act was first adopted. Since 1980

there has been a substantial reduction in the land disposal of solid waste, and a significant increase in reduction, recycling, and energy recovery:

- Since 1980 to 2014 recycling increased from a small proportion to over 50% (53% - Ramsey; 52% Washington);
- Within the recycling performance, recovery of organics (mostly food waste) has increased from 0% to 7.4% in 2014.
- Since 1988 (the first full year of operations at the Newport Facility), the percentage of mixed municipal solid waste delivered for processing to energy grew from 0% to 40%;
- In sum, in 2014, 86% of mixed municipal solid waste from the two counties was recovered for recycling or energy – diverted from landfills, thereby conserving energy resources.

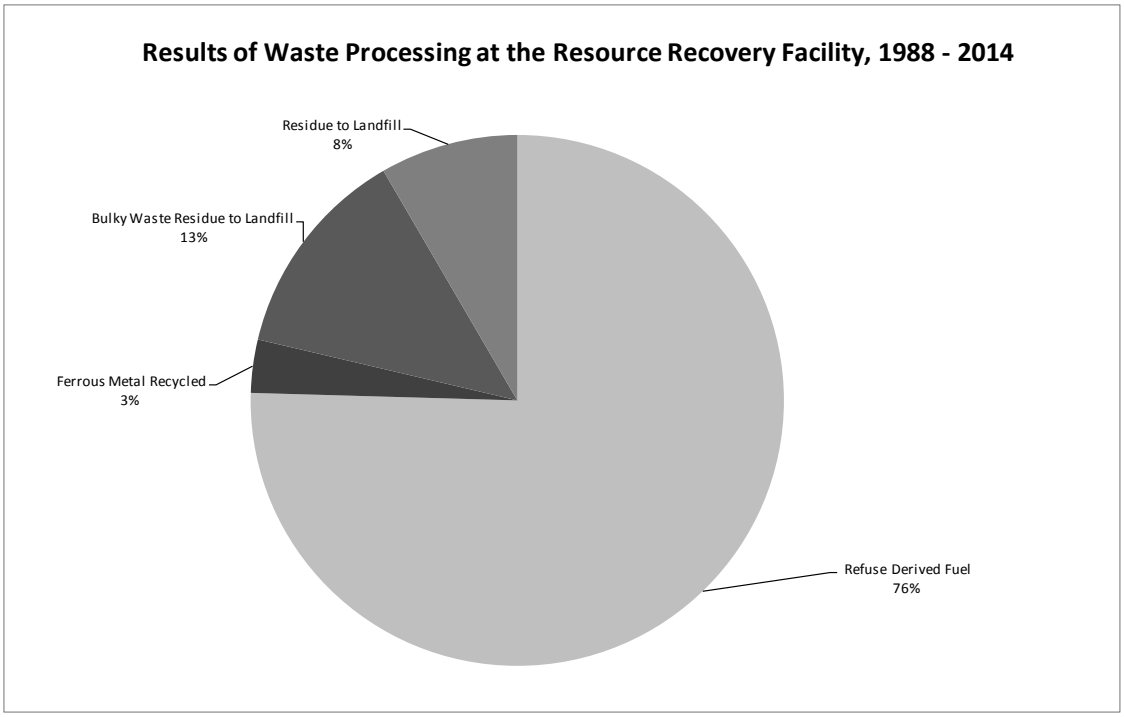
The table below shows the fate of mixed municipal solid waste from the two counties in 2014; following that is a table that compares those results with the MPCA's objectives for the metropolitan area. Through source separation programs at residences and businesses about ------ tons of material were recycled in 2014 - 112,923 tons in Washington, ---, --- tons in Ramsey.

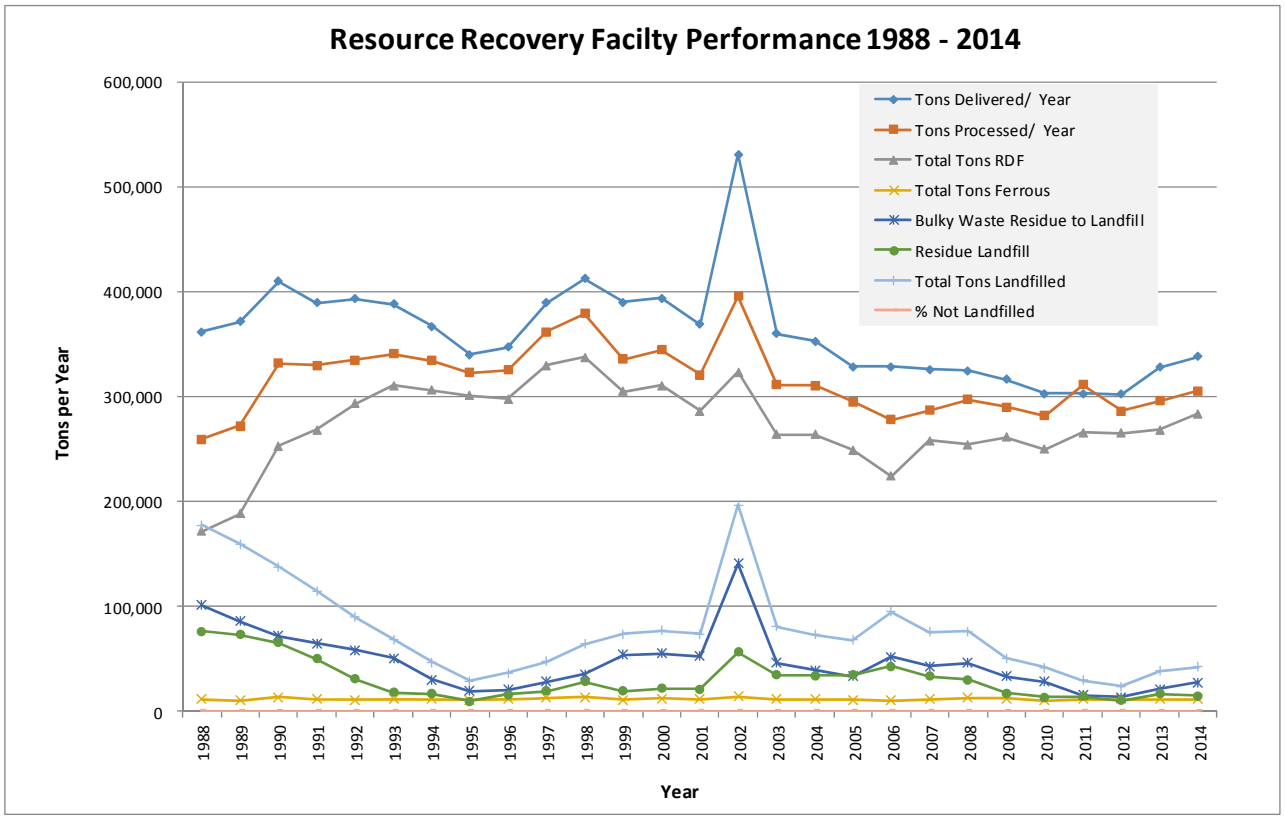
| 2014 | Ramsey | Washington | R/W | | |
|---|---|---|---|---|---|
| | | | Tons | % of Total | % of Total w/o dbl-counting recy |
| **RECYCLING (inc. yard waste composting)** | | | | | **51.2%** |
| *Residential* | *99,680* | *37,232* | *136,912* | | |
| *Commercial/industrial -- documented* | *58,308* | *25,633* | *83,941* | | |
| *Commercial/industrial - estimated* | *202,684* | *46,700* | *249,384* | | |
| *Mechanical/hand-sort* | *9,519* | *3,357* | *12,876* | | |
| **Total recycled** | **370,191** | **112,923** | **483,114** | **52.6%** | |
| *Organics* | 50,710 | 16,977 | 67,687 | 7.4% | |
| *Recycling without organics* | 310,405 | 92,589 | 402,994 | 43.9% | |
| *Recycling at Newport* | *9,076* | *3,357* | *12,433* | *1.4%* | |
| Excluding recycling at Newport | **361,115** | **109,566** | **470,681** | | |
| **PROCESSING** | | | | | **36.9%** |
| **Delivered for processing** | **247,591** | **91,503** | **339,094** | **36.9%** | |
| Actual MSW processed | 227,474 | 84,062 | 311,536 | | |
| **LANDFILLING** | | | | | **9.7%** |
| *Unprocessed MSW to MN landfills* | 47,096 | 9,031 | 56,127 | | |
| *Unprocessed MSW to out-of-state landfills* | 31,078 | 1,897 | 32,975 | | |
| **Total unprocessed waste to landfill** | **78,174** | **10,928** | **89,102** | **9.7%** | |
| *Process residuals* | 11,014 | 4,074 | 15,088 | | |
| *Non-processibles/excess* | 20,117 | 7,441 | 27,558 | | |
| Total landfilled from RRT-Newport | 31,131 | 11,515 | 42,646 | *4.6%* | |
| State estimate of problem materials not recycl | 13,244 | 6,358 | 19,602 | 2.1% | **2.1%** |
| TOTAL of MSW managed | **700,122** | **218,355** | **918,477** | | |
| **Total %** | | | | 101.4% | |
| **Total % w/o double-counting recycling** | | | | | **100%** |

| Metropolitan Area MSW Management Objectives: 2010-2030 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Management Method | Ramsey County 2014 | Washington County 2014 | Combined Ramsey/ Washington 2014 | 2015 | 2020 | 2025 | 2030 |
| Source Reduction | -- | -- | -- | 1-2% | 2-4% | 3-5% | 4-6% |
| Recycling | 44.3% | 42.4% | 43.9% | 45-48% | 47-51% | 49-54% | 54-60% |
| Organics Recovery | 7.2% | 7.8% | 7.4% | 3-6% | 4-8% | 6-12% | 9-15% |
| Resource Recovery | 35.4% | 41.9% | 36.9% | 32-34% | 32-33% | 30-31% | 24-28% |
| Landfill | 11.2% | 5.0% | 9.7% | 20% | 17% | 15% | 9% |

In addition to source separation, the Newport Facility has played a valuable role in conservation of resources. At the facility, ferrous and non-ferrous metals have been pulled from the RDF and recycled. The graphs below show the history of resource recovery at the Newport Facility.

- From 1988 to 2014, 329,000 tons of metals have been recycled. This equates to approximately $52 million in revenues from the sale of these metals over this time.
- The environmental impact of recycling 329,000 tons of metals is equivalent to:
  - Energy savings equivalent to 8 million MMBTUs or 1.4 million barrels of oil; or
  - Carbon dioxide release savings of 664,000 tons






Material Conservation Potential

The waste sort conducted at the facility (see two tables, below) shows opportunity for further recovery, with a significant amount of organic material that could be recovered for anaerobic digestion or composting. As explained in previous reports, the volume of recyclable glass, paper, metals and plastics is not in the top ten prevalent materials in trash delivered to Newport, indicating that there is significant source separation occurring in the two counties. The exception was corrugated cardboard/kraft paper in commercial waste, at 5.3%.

**Top Ten Most Prevalent Materials in Residential Waste**

| Rank | Material | Percent |
|---|---|---|
| 1 | Food Waste | 20.0% |
| 2 | Yard Waste | 7.6% |
| 3 | Textiles & Leather | 7.1% |
| 4 | Compostable Paper | 6.3% |
| 5 | Film: Other | 4.5% |
| 6 | C&D Material | 4.3% |
| 7 | Carpet & Padding | 3.5% |
| 8 | Diapers | 3.0% |
| 9 | Bulky Material | 2.6% |
| 10 | Non-Recyclable Plastic | 2.5% |
| **Cumulative** | | **61.4%** |

**Top Ten Most Prevalent Materials in in Commercial Waste**

| Rank | Material | Percent |
|---|---|---|
| 1 | Food Waste | 22.4% |
| 2 | Bulky Material | 8.4% |
| 3 | Treated Wood/ Plywood | 8.1% |
| 4 | Compostable Paper | 6.3% |
| 5 | Non-Recyclable Plastic | 5.4% |
| 6 | Cardboard/Kraft paper | 5.3% |
| 7 | Clean Lumber Pallets/Crates | 5.2% |
| 8 | Film plastic: Other | 3.3% |
| 9 | C&D Material | 2.4% |
| 10 | Other Organics | 2.0% |
| **Cumulative** | | **68.7%** |

There are recyclables that have value in the trash: Based upon the MPCA's 2013 statewide analysis of the market value of recyclable material in MSW, and the 2014 waste composition study, Project Staff estimate that in 2013 MSW that was delivered to Newport and landfills contained approximately $25 million worth of traditional recyclables such as cans, bottles, paper and glass: $20 million from Ramsey County and $5 million from Washington County. These materials have existing recycling markets and represent a lost potential for resource conversation.

In terms of trash that was landfilled - in the five-year period from 2010 to 2014 waste haulers delivered 479,000 tons of unprocessed MSW from Ramsey and Washington Counties directly to landfills instead of the Newport Facility. This volume equates to approximately $32.3 million worth of recyclables directly sent to landfills. The volume also includes a loss of 2.5 MMBTUs in the remaining waste that could have been produced through RDF combustion.

Land Conservation

Through processing of waste in the East Metro since 1987, the Project has prevented the need for 100 acres of 40 foot deep landfill volume. The prevention of this amount of waste going to a landfill has several environmental benefits including protection of groundwater and prevention of landfill gas emissions. Additional social benefits include reducing long-term legal liability, avoiding siting a landfill in Ramsey or Washington County, and preserving available land for higher and better uses.

If the Project Board successfully implements the Scope for Resource Management by 2030, the Project will prevent the need for an additional 16 acres of 40 foot deep MSW landfill volume.

For reference, SW-1, also known as the Lake Jane landfill in Lake Elmo was 60 acres, 40 feet deep. And, the Burnsville Landfill expansion in 2005 was to add 42 acres of landfill volume at 6.5 foot depth to the existing 145 acres landfill.

Energy Conservation

In 2014, the RDF produced at Newport resulted in 198,000 MWh of energy generated at the two Xcel power plants. This is equivalent to electrical need of 20,000 homes in Minnesota per year. For reference, the City of Woodbury has 24,000 homes.

**Greenhouse Gas Analysis**

Greenhouse gas (GHG) emissions are one measure of environmental performance. Many chemical compounds present in the atmosphere behave as 'greenhouse gases'. As the sunlight's energy heats the earth's surface, energy in the form of heat is radiated to the atmosphere. Molecules of greenhouse gases absorb this energy instead of letting the heat radiate into space. This traps the heat in the lower atmosphere, and warms it – similar to the way glass in a greenhouse warms the air. Many greenhouse gases occur naturally in the atmosphere, such as carbon dioxide, methane, water vapor, and nitrous oxide, while others, such as fluorocarbons, are made by humans. Human activities that release these gases into the atmosphere increase the concentration of these gases particularly because many persist for hundreds of years or more in the atmosphere. The greenhouse gases of greatest concern from an emissions perspective are carbon dioxide $CO_2$, methane ($CH_4$), nitrous oxide ($N_2O$), and fluorinated chemicals.

<u>Historical Results</u>

There are two broad ways that the resource recovery facility has reduced GHG emissions over time. The first is through the recycling of metals recovered at the facility. Recycling metals reduces the need for mining and processing ore, uses less energy, and therefore has lower GHG emissions. Second, the use of refuse derived fuel (RDF) as a fuel source to generate electricity has reduced the emissions of GHG associated with fossil fuels that would have been used to generate that electricity.

On a relative basis, waste management accounts for about 3% of GHG emissions in Minnesota. The MPCA reports the following sources based on 2012 data:

| | |
|---|---|
| Electric Utility | 31% |
| Transportation | 25% |
| Agriculture | 19% |
| Industrial | 14% |
| Residential | 6% |
| Commercial | 4% |
| Waste Management | 3% |

In 2012 total GHG emissions were reported at 154.5 Million $CO_2$-e tons. The waste sector (associated with landfilling, recycling, waste-to-energy, etc.) amount of the total is 2.2 Million $CO_2$-e tons. The two Xcel facilities generated an estimated 149,000 CO2-e tons, or 0.1% of the State total, or 7% of the waste sector total.

As shown in the following section (Future System Analysis), the Scope for Resource Management changes the direction of the GHG emissions associated with waste from

Ramsey and Washington Counties, and further reduces GHG emissions. Importantly, should these technologies be developed, the production of biofuels (compressed natural gas from anaerobic digestion, and ethanol from gasification) also contribute to reduced GHG from other sectors.

Attachment 1 includes estimates of GHG emissions from the Xcel RDF combustion facilities since 1988. Two primary factors affect GHG emissions in this analysis. The first is waste composition, the second is Xcel Energy's sources of electricity. This analysis considers the composition of waste over time, because GHG emissions from combusting materials that are derived from petroleum (such as plastic) "don't count" toward savings, but those from "biogenic" sources, such as paper and wood, do count. The analysis compares the GHG associated with RDF combustion against the CHG production by the NSP/Xcel Energy grid; over time the Xcel grid has proportionally reduced its dependence on fossil fuels, which shows in the results.

Since 1988 a total of 481,060 metric tons of $CO_2$ equivalent GHG have been saved over using NSP/Xcel to generate that electricity. That is equal to the $CO_2$ emissions from

- Over 54 million gallons of gasoline;
- Over 2,500 rail cars filled with coal; or
- Over 1.14 billion passenger car miles.

Figure 1 shows the history of GHG saving on an annual basis compared to the Xcel system. Some things to note:

- Xcel has decreased its GHG emissions by purchasing wind and solar power, using nuclear power, and shifting at least some plants' reliance on coal to natural gas.
- The composition of the waste stream has changed, and there is a higher proportion of plastic relative to metals and paper than 25 years ago.
- Over time, the use of RDF has been an important, but unrecognized, fuel choice that helped to reduce GHG emissions from the power sector.
- While the Xcel electric power system has become  less GHG-intensive over time largely due to advances in technology,, advances in waste conversion technologies that promise waste-derived transportation fuels and chemicals can help further reduce GHG emissions.

Future System Analysis

Foth, with the assistance of the Great Plains Institute (GPI) conducted a "Greenhouse Gas System Analysis" that estimates and compares the GHG emissions of options for various waste management scenarios that could occur in Ramsey and Washington Counties. The Executive Summary is attached to this report (Attachment 2). The full analysis is available online at http://www.co.ramsey.mn.us/recovery/index.htm .

The purpose of the Greenhouse Gas Systems Analysis is to develop, analyze, and compare the estimated greenhouse gas (GHG) emissions from several different potential municipal solid waste (MSW) management scenarios under consideration by the Ramsey/Washington Counties Resource Recovery Project Board (Project Board). The Project Board conducted this analysis to evaluate and compare the potential environmental impacts of each of the

scenarios using GHG emissions as an indicator, recognizing that GHG emissions are just one component in the overall system analysis.

This analysis was conducted as a comparative view of the different waste management systems that could occur. It is indented to be a comparison of alternatives and *not* an all-inclusive life cycle GHG analysis. The GHS model includes: collection and hauling, transportation, materials management, RDF combustion, ethanol offsets and electrical offsets. Each system was modeled for GHG emissions based on 400,000 tons per year of MSW in the system.

Figure 1 on page 10 shows the results of the analysis for the various scenarios. These scenarios are the same as those modeled in the financial analysis prepared earlier in 2015.

Key Findings

The key finding of the GHG analysis is that strategies that convert waste to resources, such as increased recycling and organics diversion, or using new technologies to convert waste to other resources, result in the greatest GHG impacts.

1) Collection and transportation have the least GHG emissions impact.
   Collection and transportation, while the most visible component of the waste management system to the households and businesses, are a small component of GHG emissions in the overall waste management scenarios. Any increase in GHG from collection and transportation are more than offset by the GHG savings from recycling and materials management.

2) Conversion of waste to recyclables including organics has significant reduction impact on GHG emissions
   The addition of various recycling (mixed waste processing -MWP, source separated organics and recycling - SSO/SSR) and anaerobic digestion (AD) to the system has considerable GHG reductions.
   - Adding SSO/SSR to the processing only system would result in a 52% GHG reduction.
   - Adding MWP and AD would result in 79% GHG reduction.
   - By adding SSO/SSR with MWP and AD results in an 89% GHG reduction.

3) Gasification changes "waste" management to "resource" management.
   Adding gasification results in a net negative GHG emissions scenario or a 225% reduction from the existing system. By adding SSO/SSR/AD/MWP with gasification, the study estimates the largest GHG reduction, at 282%. Converting to gasification changes the "waste" management system to a "resource" management system. Gasification of RDF rather than combustion was compared in two of the systems. By adding gasification to the Processing Only (Base Case) system, GHG emissions become negative (or a GHG credit). Importantly, the waste-derived- ethanol

replaces the use of petroleum-based gasoline, significantly reducing GHG emissions in the transportation sector.

**Air Quality**

Air emissions are an often cited concern related to resource recovery facilities. Attachment 3 includes a memo from Foth that provides and overview of waste-to-energy (WTE) permitting, and compares various facilities in Minnesota. Key points:

- WTE facilities are permitted by the Minnesota Pollution Control Agency (MPCA). The permits impose strict air emissions limits, outline monitoring and testing requirements, and requires training.
- Standards are established for these pollutants at the two Xcel facilities:
    - Particulate Matter,
    - Sulfur dioxide
    - Carbon monoxide
    - Nitrous oxides
    - Lead
    - Cadmium
    - Hydrochloric acid
    - Mercury
    - Organics
- Each facility permit is unique, and the standards that are set for each facility depends on the technology. At the Red Wing and Wilmarth facilities, emissions standards for some pollutants are more stringent than other WTE facilities, and for others are less stringent.
- Some pollutants are continually monitored, others are tested on a recurring basis. If a facility exceeds a standard for a pollutant in a performance test, they have 60 days to retest and comply with the limit.
- Since 2011 the Wilmarth Facility has had no emission exceedances. In the same time period, the Red Wing Facility had one exceedance for particulate matter, which resulted in Xcel making operational changes to prevent future occurrences. Red Wing also had a performance exceedance for lead, which did not recur upon retesting.
- WTE facilities, when compared generally on a national scale for various emissions, rank lower in emissions than landfill related emissions, and coal and oil fired electrical generation facilities. Nuclear energy ranks better, and natural gas about the same.
- Compared to other permitted facilities in Minnesota, WTE is not a significant emitter. The MPCA lists facility rankings in the State of some constituents of air emissions. These include all permitted facilities of a variety of types. For particulate matter, small particulate matter (10ug), and volatile organic compounds (VOCs), WTE facilities were not in the top 100. For other pollutants, the two Xcel facilities ranked in to top quartile in one category, and in the second or third quartile for others.

Figure 1

**GHG Emissions Summary ($MtCO_2e$)**

| | Processing Only (Base Case) | Phase 1 - SSO/SSR | Alternative 1 - Processing, AD, and MWP | Phase 2 - SSO/SSR/ MWP/AD | Alternative 2 - Processing and Gasification Only | Phase 3 - Gasification/SSO /SSR/MWP/AD | Existing System - Extended |
|---|---|---|---|---|---|---|---|
| **Collection** | 13,502 | 14,684 | 13,502 | 14,684 | 13,502 | 14,684 | 13,502 |
| **Transportation** | 9,384 | 8,770 | 8,771 | 8,419 | 5,414 | 5,114 | 11,342 |
| **RDF Processing** | 5,393 | 4,969 | 9,048 | 8,957 | 5,393 | 8,957 | 4,341 |
| **Material Management** | | | | | | | |
| ♦ Recycling | (32,190) | (58,813) | (71,550) | (76,937) | (32,190) | (76,937) | (25,910) |
| ♦ Anaerobic Digestion (AD) | 0 | (4,934) | (10,060) | (11,044) | 0 | (11,044) | 0 |
| ♦ RDF Combustion | 72,198 | 65,860 | 60,714 | 58,909 | 0 | 0 | 58,119 |
| ♦ Gasification | 0 | 0 | 0 | 0 | 61,075 | 48,343 | 0 |
| ♦ Landfill | 5,372 | 5,057 | 4,871 | 4,828 | 5,372 | 4,828 | 15,244 |
| **Material Management Subtotal** | **45,380** | **7,170** | **(16,024)** | **(24,244)** | **34,257** | **(34,810)** | **47,454** |
| **RDF Combustion Plant Shut-down** | 0 | 0 | 0 | 0 | (170,538) | (141,967) | 0 |
| **Ethanol Offset** | 0 | 0 | 0 | 0 | (80,523) | (69,987) | 0 |
| **Electrical Offset** | 0 | 0 | 0 | 0 | 100,641 | 83,780 | 0 |
| **Total GHG** | **73,659** | **35,592** | **15,296** | **7,816** | **(91,855)** | **(134,229)** | **76,636** |

**Water Resources**

Surface water and groundwater supplies are susceptible both to chronic and acute contamination from waste management activities. An acute release – sudden release of a contaminant such as a chemical spill, is most commonly a problem with surface water, but can also affect groundwater. A chronic release – such as ongoing dumping of a chemical, or release over time from a landfill or dump, typically has a greater effect on groundwater.

Homeowners with private wells, and public water suppliers who depend on groundwater face a challenge with chronic contamination. Once groundwater is contaminated, it is often very difficult to remove the contamination or predict its movement.

In Washington County, groundwater provides 100% of the water supply in the county available for drinking, commercial, industrial, and irrigation needs. In Ramsey County, 15-20% of county residents use groundwater as the sole source of drinking water – a majority of County residents use surface water, primarily from the Mississippi River.

Both counties have experienced issues with water quality and quantity. The recent issue with falling lake levels in northeastern Ramsey County and western Washington County, in which there are clear interactions between surface water and groundwater levels have generated significant public policy movement.

Contamination of groundwater with chemicals disposed in old dumps, or in SW-1 (the "Lake Jane" landfill) have required significant investigation and remediation and been the source of great public concern.

The Ramsey/Washington County Resource Recovery Project (originally the "Waste-to-Energy" project) was created on the heels of county involvement in spending significant local dollars to provide alternative water supplies and commence remediation of SW-1. Both counties have developed extensive programs to prevent water contamination, including comprehensive hazardous waste regulatory programs, household hazardous waste collection programs, and education about proper disposal of chemical waste.

This prevention approach has resulted in:

- Ramsey County licenses 1,854 hazardous waste generators and 14 hazardous waste facilities. Washington County licenses over 540 hazardous waste generators and 5 hazardous waste facilities. These are routinely inspected to assure that hazardous wastes are properly managed.
- The two counties hold continuous household hazardous waste services, and in 2014 served over 66,000 households, who delivered over 2.7 million pounds of chemical waste to the facilities.
- Both counties collect old medicines, and since they started their programs over 23,800 pounds of pharmaceutical waste has been kept from surface and groundwater.

Landfilling has the potential to affect groundwater. Old dumps and early landfills built up to the early 1980's had no protective liners between the garbage and ground; in some cases they were

sited in low areas and waste was in contact with the wastes. For MSW landfills designed now, composite liners, (a natural clay component and a plastic membrane), are now required at the base of the landfill cells. Landfill owners and engineers design and build newer landfills to reduce the risk of leaks and groundwater contamination. Most new landfills are guaranteed not to "leak" for at least 30 years, and landfills are required to have funding set aside to pay for any remediation for 30 years. After that, the perpetual care for the landfill is uncertain.

Should groundwater become contaminated, it may remain contaminated for decades and add financial and social costs to manage and treat affected water supply. Washington County has a greater level of groundwater contamination compared to counties with similar land use and industrial practices. One reason is that in Washington County, groundwater resources are moderately to highly susceptible to pollution introduced from the surface environment. The county's geology, especially in the southern part, does not have sufficient overlying till to ensure protection of bedrock aquifers. Bedrock is fractured and there are areas of karst. All of these characteristics create a situation with great potential for contaminating groundwater.

Examples of known groundwater contamination with Perfluorochemicals (PFC) include:

- PFC containing wastes disposed of by the 3M Company at the 3M disposal sites
- 9 communities impacted by PFCs in the groundwater
- Sites of PFC
    - Washington County Landfill *
    - 3M Oakdale Site
    - 3M Woodbury Site
    - 3M Cottage Grove Site Facility

It is difficult to estimate the cost of groundwater impacts. For example, it has cost $25 million since 2007 for the MPCA to manage PFC groundwater issue from the SW-1 Landfill. Note: This includes only contractual construction and operating/maintenance costs from the State's Closed Landfill Program. Reconstruction of the landfill began in 2007 and was completed in 2012. Operation and maintenance costs include past and ongoing monitoring of landfill, sampling, analytics, leachate collection, and residential well treatment system maintenance, and so on.

In Ramsey County, the MPCA has identified at least 80 unpermitted former dumps. The Public Health Department maintains a list of 264 closed dump sites, has verified field locations, and maintains files on them. A number of ongoing redial actions to deal with groundwater contamination associated with former dumping of wastes continues, including treatment of water for the City of New Brighton, and remediation of water at TCAAP.

Attachments

1. Memo from Foth – GHG History for RDF and Xcel Facilities
2. Executive Summary: Greenhouse Gas Systems Analysis, Foth Report
3. Air Quality Comparison of Minnesota WTE Facilities