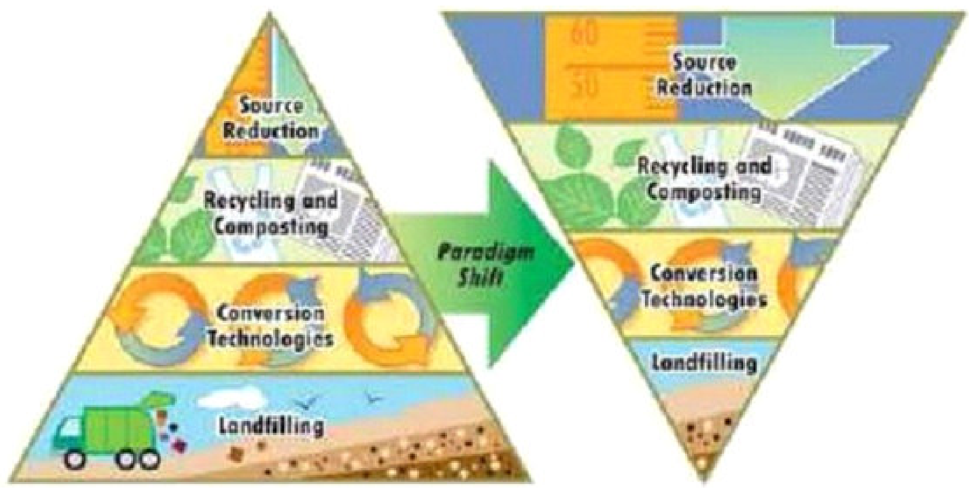
SECTION 7.0

WHAT OPTIONS ARE THERE TO MANAGE CITY'S WASTE/RESOURCES?

7.0 WHAT OPTIONS ARE THERE TO MANAGE THE CITY'S WASTE/RESOURCES?

7.1 INTRODUCTION

In Phase I options were researched that could potentially assist the City in meeting its projected solid waste disposal demands for the Strategic Plan study period. The new solid waste management hierarchy, as shown below, emphasizes the avoidance of waste generation and views waste as a resource rather than a waste to be landfilled. This hierarchy was followed as options were developed for the Strategic Plan.



This section discusses all of the options considered while Section 8.0 and Appendix G of this report discusses how they were screened and ranked. The categories used in this Phase I Report correspond to the solid waste hierarchy categories as follows:

Solid Waste Hierarchy Category	Strategic Plan Category
Source Reduction	Zero Waste Programs
Recycling and Composting	Zero Waste Infrastructure
Conversion Technologies	Conversion Technologies Waste-to-Energy
Landfilling	Landfill Optimization Landfill Disposal Options (In- and Out-of-County)

7.2 SOURCE REDUCTION

7.2.1 ZERO WASTE PROGRAMS AND POLICIES

7.2.1.1 WHAT IS ZERO WASTE?

The goal of zero waste is to reduce, reuse, recycle, or convert to beneficial use, resources that are now being disposed so as to divert waste from landfills. To reach higher diversion goals, zero waste strategies must consider the entire life-cycle of a product or material. By designing and managing materials with a "cradle to cradle" instead of "cradle to grave" mindset, zero waste eliminates the need for raw materials and waste disposal and instead holds producers responsible for their products and packaging, as well as consumers for their purchases.

Zero waste focuses on a "closed-loop" process where all products are designed to be cycled safely back into the economy or the environment. This closed-loop system not only heightens diversion levels but also helps communities achieve a local economy that operates efficiently, sustains jobs, and provides a measure of self-sufficiency. There are several programs and policies, as well as infrastructure, that need to be considered when planning for a city's or community's zero waste goals. When considering programs and policies to implement, there are *upstream* (pre-consumption) and *downstream* (post-consumption) options that need to be evaluated.

Upstream Options

Upstream options focus on "source reduction" which requires designing, manufacturing, purchasing, or using materials in ways that reduce the amount and/or toxicity of waste. Source reduction also conserves resources and reduces pollution, including greenhouse gases that contribute to global warming. Upstream strategies include more significant, society-level changes such as extending the lifespan of consumer products, reducing product packaging, and increasing recycled content in products.

The following are the main goals of upstream source reduction:

- Increase useful life of consumer products
- Reduce the amount of waste in products and packaging
- Increase recycled content of products and packaging
- Make products and packaging more recyclable

Some examples of programs and policies that can help reach these source reduction goals include: supporting a Green Building Initiative, creating or expanding a Junk Mail Reduction Campaign, bans on polystyrene food containers, plastic bags, and/or non-recyclable packaging.

Downstream Options

Downstream options focus on reuse, recycling, organics diversion, and education. Reusing a product extends its "life" which in turn reduces the amount of raw material needed to be extracted, as well as, reduces the amount of waste which eventually ends up in a landfill. Recycling involves taking a product or material at the end of its useful life and turning it into a usable raw material to make another product. Organics diversion refers to compostable organic material, including grass clippings, yard and food waste, wood, non-recyclable paper, etc., and diverting it from being landfilled. Some examples of programs to increase organics diversion would be increasing greenwaste pick-ups, developing supermarket produce collection and composting, banning organics from landfills, and allowing inclusion of residential food waste in the "green" can. Education involves informing the public of the importance of zero waste goals, inspiring them to become involved in the process, and then instructing through tools and resources (such as websites, seminars, courses, and advertisements), so that they can help make a difference.

7.2.1.2 WHAT IS THE CITY DOING?

The City of San Diego has had a long-standing commitment to achieving zero waste goals through programs, policies, and regulations. A complete discussion of what the City is doing is discussed in Section 2.2 of this report. The City's existing zero waste programs and policies are shown on Table 2-1.

7.2.1.3 ZERO WASTE – WHAT ARE OTHERS DOING?

In continuing to develop and implement comprehensive zero waste programs at the City, a review was conducted of other programs and policies developed in jurisdictions throughout California. Four types of zero waste activities were examined in each jurisdiction: Resource Conservation and Reuse, Transportation, Waste Reduction and Recycling, and Outreach and Education. Tables 7-1 through Table 7-6 summarizes the zero waste programs for the following California jurisdictions: Santa Monica (Table 7-1), Santa Cruz (Table 7-2), Oakland (Table 7-3), Berkeley (Table 7-4), Los Angeles (Table 7-5), and San Francisco (Table 7-6).

After reviewing these programs and comparing them to the City's existing programs, it was determined that the City's existing zero waste programs are already very robust. Potential new programs were recommended to the RMAC and ESD during the strategic planning process and 16 new zero waste options were recommended for Phase II which are presented in Section 8.3.

7.3 RECYCLING AND COMPOSTING

7.3.1 <u>ZERO WASTE INFRASTRUCTURE</u>

To "close-the-loop" and increase diversion of solid waste, strategic planning of a variety of infrastructure facilities is required. These facilities would accept, sort, process, transfer, and/or resell 'waste' materials, making them essential for the recovery of various resources currently being landfilled. Types of facilities include Household Hazardous Waste Collection Centers (HHWCC), Transfer Stations (TS), Curbside and Commercial Material Recovery Facilities (MRFs), Industrial and Community Resource Recovery Parks (RRPs), Construction and Demolition facilities (C&D), and Greenwaste/Composting Facilities (GCF).

All of these facilities can receive and process waste in one form or another. A curbside MRF receives single-stream recyclable material; a C&D facility receives wood, metal, and/or concrete; greenwaste facilities receive organics for composting; and a resource recovery facility which is a co-location of reuse, recycling, composting, manufacturing, and retail businesses in a central facility, receives material from partner companies to process and reuse their waste. They all are a vital part of the backbone infrastructure needed to achieve zero waste goals.

7.3.1.1 HOUSEHOLD HAZARDOUS WASTE

Currently, the City of San Diego Household Hazardous Waste Transfer Facility is located at the Miramar Landfill entrance on Convoy Street, just north of State Highway 52. The facility accepts household hazardous waste on Saturdays from 9 a.m. to 3 p.m., except holidays. The facility is open to the City of San Diego residents only.

HHWCC provide the community with a place to discard household waste not accepted at landfills due to hazardous constituents. Household hazardous waste is any hazardous waste generated incidental to owning or maintaining a residence, vehicle, or yard. Waste examples include paints, solvents, varnishes, acids, flammables, acrylics, resins, motor oil, and gasoline among others.

Electronic waste, or e-waste, includes household or office electronic devices in working or non-working condition that are no longer used. E-waste is known to contain heavy metals such as mercury and lead, which if placed in the landfill, can harm people and the environment. Universal waste, including consumer batteries, light bulbs, light tubes, and mercury containing items, are also received at a HHWCC, providing homeowners a consolidated location to dispose of such waste.

7.3.1.2 TRANSFER STATIONS

Transfer stations provide the capability of consolidating materials from smaller refuse trucks onto vehicles with higher capacities, thus conserving energy and minimizing vehicle trips. Once the materials are consolidated, they can be delivered to a MRF or to a distant landfill. Existing and planned facilities for San Diego County are listed on Table 3-6, Transfer/Processing Facilities.

7.3.1.3 MATERIAL RECOVERY FACILITIES

The use of a variety of automated equipment, as well as hand sorting, makes it possible for MRFs to separate recyclables by material type. After materials are separated, they can then be baled for transportation to recyclable processing facilities, where resources are reused. Materials have to be separated in order to be marketable; the following are current methods and equipment used for separation:

- Hand Sorting
- Screens
- Trommel Screens
- Disk Screens
- Air Classification
- Vertical Air Clarifiers
- Air Knives
- Eddy Currents
- Magnetism
- Conveyors

MRF's come in a variety of shapes and sizes, which process different materials. Source separated recyclables (curbside) is one of the ESD's most popular services. The City operates a comingled, automated curbside recycling program that currently serves 276,000 residents with every-other week collection service. Commercial waste recovery facilities recycle commercial waste, such as cardboard, plastic, and various packaging materials. There are also MRF's capable of recovering recyclables from mixed Municipal Solid Waste (MSW).

MRF/TS facilities are another option some jurisdictions choose to process and recover refuse material due to the type and amount of waste that requires processing. Existing and planned facilities in the County of San Diego are listed on Table 3-6 - Transfer/Processing Facilities, which show waste types accepted, type of facility, and material accepted. A study to determine the feasibility of building a TS and/or MRF at the Miramar Landfill has been conducted and is discussed in Section 2.3.2. The study found that City-leased property at Miramar would be able to accommodate a TS capable of processing 5,000 tpd of waste and a MRF capable of processing between 200 and 400 tpd of recyclables.

7.3.1.4 RESOURCE RECOVERY PARKS – INDUSTRIAL AND COMMUNITY

RRPs fall into two general categories: industrial and community parks. Large parks encourage relationships among industrial users to reuse and dispose of waste in one location. Community resource recovery parks encourage residents to dropoff and pick up free reused materials. Community RRPs are usually located near landfills or transfer stations.

The Cabazon Park (Park) in Mecca, California, is a good example of an industrial RRP. For this site, roughly one square mile of land was set aside and permitted via a programmatic EIR, for industries to be sited in close proximity. This allows them to share infrastructure (roads, utilities, security, stormwater control, etc.) as well as synergies between the suppliers and producers. The keystone of this park is the Colmac Biomass Power Plant that generates 30 megawatts of electricity from wood waste and other organics. This renewable energy is available for use by other industries at the Park. There have been other recycling industries developed in the park such as biosolids processing and heavy metal recovery and more are planned for the future. However, the remote location of the Park has been a deterrent and, to date, Colmac has been the only permanent tenant.

Community RRPs, often coupled with Reuse Stores, are more numerous in California and are exemplified by facilities in San Luis Obispo and other communities. Often, these facilities are popular in rural areas where other modes of recycling are sparse or non-existent. These parks are typically open air compounds in which bunkers or roll-off containers are positioned around the periphery. Users drive to the facility with their materials and place them in the proper bunkers or bins. These materials may include:

- Furniture
- White goods (large appliances)
- Greenwaste
- Lumber
- Inerts (concrete, asphalt)
- Cardboard
- Bulk metals

If combined with a chipping and grinding operation, users can also pick up mulch or compost for their landscaping needs. These facilities provide a valuable public service; however, they are only a small contributor in terms of the amount of material diverted as compared to other diversion programs and facilities that can divert hundreds or even thousands of tons per day. Table 3-8 provides a list of Recyclable Processing Centers available to City residents. In addition, Habitat for Humanity manages a store in Mission Valley, California, where contractors donate and buy used construction materials. Table 7-7 has a listing of existing RRPs in California and Table 7-8 lists RRPs outside California and the United States (U.S.).

7.3.1.5 CONSTRUCTION AND DEMOLITION FACILITIES

Construction and Demolition facilities sort and recycle wood, concrete, green waste, drywall, metals, inerts, and other recyclables generated by the construction industry. With the use of automated equipment and manual labor, materials are separated into commodity piles providing clean materials for re-use.

Studies show that approximately 35 percent of the waste generated in the City of San Diego delivered for disposal is construction and demolition debris, which could be diverted from landfill disposal through recycling, repurposing, and reprocessing. On July 1, 2008, the Construction and Demolition (C&D) Debris Deposit Ordinance took effect. Section 5.3.6 and Appendix A-4 contain a discussion of this ordinance which was to establish the Construction and Demolition Debris Diversion Deposit Program within the City of San Diego as a city-wide approach to preserving local landfill capacity. Existing and planned C&D facilities and their permitted capacities are shown on Table 3-6.

7.3.1.6 GREENWASTE/COMPOSTING FACILITIES

The ESD Curbside Yard Waste Recycling Program currently serves 202,000 City of San Diego households. Currently, more than 14 percent of the residential waste in the Miramar Landfill is recyclable yard material. Recycling greens is a key to lengthening the life of the landfill. The ESD plans to expand greenery collection where yard waste generation and participation rates make it economically efficient to operate the service. Greenwaste/composting facilities process organic materials by chipping, grinding, and composting. Table 3-17 lists existing and proposed composting facilities and their capacities.

7.4 CONVERSION TECHNOLOGIES

7.4.1 INTRODUCTION

The City is considering conversion technologies as part of its Strategic Plan. Conversion technologies could offer the City many potential benefits including: enhanced recycling and beneficial use of waste; diversion of waste from landfill disposal; environmental benefits, including reduction in greenhouse gases and other emissions; and production of needed renewable products with strong, year-round markets (electricity, gas, fuels).

Conversion technologies include a wide array of thermal, biological, chemical, and mechanical technologies capable of converting MSW into energy such as steam and electricity; fuels such as hydrogen, natural gas, ethanol, and biodiesel; and other useful products and chemicals. Conversion technologies are successfully used to manage solid waste in Europe, Israel, Japan, and other countries in Asia, but are not currently in commercial operation in the U.S. as of this date. There have been pilot demonstrations of conversion technologies in the U.S., but the absence of larger-scale demonstration facilities and commercial facilities in this country has been an obstacle to demonstrating the capabilities and benefits of these technologies for processing MSW.

- **Thermal Processing.** Includes technologies such as gasification, plasma gasification, and pyrolysis, which use or produce heat, under controlled conditions, to convert MSW into a synthesis gas (that can be used to produce a fuel, or cleaned and combusted to generate electricity) and other usable products (e.g., vitrified aggregate, carbon-based char, metal).
- **Biological Processing (Anaerobic Digestion and Composting).** Anaerobic digestion is a biological process that reduces the biodegradable, organic fraction of MSW through controlled decomposition by microbes. Anaerobic digestion, which occurs in the absence of oxygen, produces a biogas that can be combusted to generate electricity as well as compost. Biological

technologies such as anaerobic digestion are often combined with mechanical pre-processing systems, which allow for the recovery of traditional recyclables.

MSW can also be aerobically ("with oxygen") digested through various types of vessels and systems to produce either a soil amendment (compost) or a solid fuel. These systems are enclosed (at least for the active portion of the composting term) and include controlled air, moisture, and oxygen, as well as the ability to capture and treat air emissions.

- **Hydrolysis.** Hydrolysis is a chemical reaction in which water, typically with an acid, reacts with the cellulose fraction of MSW (e.g., paper, food waste, yard waste) to produce sugars, with additional processing to convert the sugars to ethanol or other products.
- **Mechanical Processing**. Mechanical processing technologies employ physical processing, such as steam classification (autoclaving), primarily to recover recyclables and separate the organic and inorganic fractions of MSW. Mechanical processing technologies are typically followed by other conversion processes.
- **Chemical Processing**. Chemical processing technologies use one or a combination of various chemical means to convert MSW into usable products, often uniquely encompassing other conversion processes (e.g., biological, thermal). Hydrolysis, separately identified above, is a subset of chemical processing technologies.

Appendix C contains a complete report on solid waste management conversion technologies evaluated for the Strategic Plan. The information used in this report is based on available, published information from other recent studies, including those for New York City, Los Angeles County, and the City of Los Angeles. Table 7-9 has a list of the screening criteria definitions that were used to screen conversion technologies for the City.

The different categories of conversion technologies are at various stages of development as summarized as follows:

STATUS OF CONVERSION TECHNOLOGIES FOR MSW IN THE U.S.			
Technology Category	Commercial Use Outside U.S. for MSW	Pilot Testing with MSW	Additional Research and Testing Required for MSW
Anaerobic Digestion	✓	✓	
Thermal Processing	✓	✓	
Hydrolysis		✓	
Aerobic Digestion/composting		✓	
Chemical Processing			✓
Mechanical Processing		✓	

7.4.2 CHALLENGES TO DEVELOPMENT OF CONVERSION TECHNOLOGIES

Challenges to development of conversion technologies in the U.S. include the following:

- Lack of commercial demonstration in the U.S.;
- Lack of development/acceptance for certain product markets in the U.S. or regulatory hurdles for product use;
- Availability of Renewable Energy Credits;
- Permitting;
- Loss of Potential Diversion Credits; and
- Public Education.

7.5 WASTE-TO-ENERGY

7.5.1 INTRODUCTION

Conventional Waste-to-Energy (WTE) is the most widely used volume reduction technology for MSW in the U.S. Nationwide, there are 87 WTE facilities operating in 25 states, disposing of nearly 29 million tons per year of MSW. These facilities generate over 2,700 megawatts of electricity, which is enough power to meet the needs of more than 2.4 million homes. These facilities are commonly constructed with two or three combustion trains, with the majority of facilities (greater than 70 percent) having design capacities of 500 tpd or greater. More than a dozen existing WTE facilities in the U.S. have design capacities of 2,000 tpd or greater, with several of the largest facilities designed to process 3,000 tpd of MSW (Miami, Florida; Pinellas, Florida; Fairfax, Virginia) (IWSA, 2007 Directory of Waste-to-Energy Plants).

Worldwide, there are 776 WTE facilities operating commercially, processing approximately 140 million tons per year of waste. WTE is common in overseas locations (Western Europe with 388 plants and Asia with 301 plants) that have high population densities, limited available landfill space, and high energy demands (IWSA, 2007 Directory of Waste-to-Energy Plants).

WTE technology has a strong track record in the U.S. with several decades of operating experience. Most of the WTE facilities in the U.S. began operating in the late 1980's and early 1990's and have reached or are approaching a 20-year operating period. One of the oldest WTE facilities in the U.S. is the 1,500-tpd facility in Saugus, Massachusetts, which began operation in 1975 and continues to operate today. The industry remains active, with contract extensions, facility retrofits (e.g., the 800-tpd facility in Harrisburg, Pennsylvania, in 2006) and facility expansions (e.g., the addition of a third 636-tpd unit in Lee County, Florida, in 2007).

In California, there are three existing WTE facilities:

- **Commerce Refuse-to-Energy Facility, Commerce, California.** This facility consists of one unit, with a capacity to process 350 tpd of MSW. It began operation in 1987 and generates approximately 10 megawatts of electricity. The facility is owned by the Commerce Refuse-to-Energy Authority and is operated by the Sanitation Districts of Los Angeles County.
- **Southeast Resource Recovery Facility (SERRF), Long Beach, California.** This facility consists of three units with individual capacity of 460 tpd, for a combined facility processing capacity of 1,380 tpd of MSW. It began operation in 1988 and generates approximately 37.5 megawatts of electricity.

The facility is owned by the City of Long Beach and operated by Montenay Pacific Power Corporation.

- **Stanislaus County Resource Recovery Facility, Crow's Landing, California.** This facility consists of two units with individual capacity of 400 tpd, for a combined facility processing capacity of 800 tpd of MSW. It began operation in 1989 and generates approximately 22 megawatts of electricity. The facility is owned and operated by Covanta Stanislaus, Inc.

There are currently four prominent WTE providers in the U.S.:

- Covanta Energy Company
- Energy Answers Corporation
- Veolia ES Waste-to-Energy, Inc. (Montenay)
- Wheelabrator Technologies, Inc.

7.5.2 WHAT TECHNOLOGY IS USED IN WTE?

Conventional WTE facilities include two basic types of technology: mass burn and refuse-derived fuel (RDF). Units can be field-erected or modular. Mass burn plants combust unprocessed, mixed municipal waste in furnaces dedicated to converting the waste into energy. Mass burn is the most common technology for existing waste-to-energy facilities in the U.S., and is in use at more than 70 percent of the operating facilities. RDF facilities pre-process the waste by removing non-combustible materials and shredding the remaining waste to create a more uniform fuel. The resulting RDF can be burned on-site or transported for use as fuel in off-site boilers.

Conventional WTE technologies use MSW as a fuel, recovering the heat value of the combusted waste in the form of steam. The steam may be sold or subsequently converted into electricity in a turbine generator. Conventional WTE facilities have a net electricity generation rate (i.e., electricity available for sale) on the order of 500 kilowatt hour per ton or higher.

During the combustion process, approximately 25 to 30 percent by weight of the incoming MSW becomes ash residue. This ash residue can often be used as landfill cover material and other applications for beneficial reuses are continuing to be researched in the U.S. (e.g., as aggregate, fill material, and for asphalt manufacture). Predominantly, however, ash residue is disposed in a landfill.

Conventional WTE facilities frequently recover and recycle ferrous metal from the ash residue. A reasonable estimate is recovery of approximately 3 percent by weight of the incoming waste in the form of post-combustion ferrous metal. Nationwide, the existing WTE facilities recover and recycle more than 700,000 tons of ferrous metal annually from the ash (IWSA, 2007 Directory of Waste-to-Energy Plants). WTE facilities can also incorporate front-end recycling, recovering materials such as glass, metal, and cardboard for sale to secondary markets. Front-end recycling has been successfully installed at several small-scale WTE facilities in Minnesota. For example, the 80-tpd Polk County Resource Recovery Plant in Fosston, Minnesota, installed a front-end MRF in 1996. The Fosston MRF supplements curbside recycling and achieves the objectives of removing non-burnables from the waste stream and reducing ash residue disposal rates (*Materials Recovery Facilities and Waste-to-Energy Plants, Do They Go Together*, Willard Wilson, 2003).

7.5.3 IS WTE ECONOMICAL?

Conventional WTE facilities are expected to have a unit-price cost for development, design, and construction ranging from approximately $150,000 to $200,000 per tpd of design capacity. Typically, economies of scale can be demonstrated with WTE technology, with larger facilities having a lower unit-price cost than smaller facilities. Unit-price operating costs (which are *not* the same as tipping fees) are expected to be on the order of $50 to $70 per ton of waste processed or higher, depending on the size of the facility. These costs are partially offset with the revenues from sale of steam and/or electricity and, if applicable, the revenues associated with the sale of secondary products (e.g., recovered ferrous metal). Considering development, design, and construction costs together with operation and maintenance costs, net of project revenues, tipping fees for conventional WTE facilities at a size of 500 tpd or larger, are typically in the range of $60 to $85 per ton. Costs can be much higher ($85 to greater than $100 per ton) for smaller facilities.

7.5.4 HURDLES TO WTE IN CALIFORNIA AND SAN DIEGO

There are several hurdles to development of new WTE facilities, generally applicable to California as a whole and specifically in San Diego. State-wide, new WTE facilities are not currently eligible for renewable energy credits or for diversion credits since under current State laws and regulations, WTE facilities are categorized as "combustion" facilities and not "conversion facilities" and any credits that are allowed are for existing facilities only. Locally, Proposition H places specific demands on the development of WTE facilities of 500 tpd or larger in the City of San Diego. Specifically, Proposition H imposes the following standards on solid waste facilities burning more than 500 tpd of solid waste:

1. No such facility shall be built that will:
    a. increase existing levels of toxic air pollutants within the City as those levels are determined by Federal, State, or San Diego public agencies; or
    b. be located within a 3-mile radius of a hospital, elementary school, child care center, or nursing home for the elderly licensed by a governmental entity; or
    c. make additional demands on the treated water distribution system within the City.
2. Any such facility built shall include recycling and separation methods whereby major sources of toxic air pollutants including, but not limited to plastics, metals, industrial wastes, and coatings, are removed from the solid waste prior to incineration.

Proposition H restrictions in the City of San Diego may not be applicable to a facility on Federal lands. Therefore, a WTE facility at the Miramar Landfill is a potential option to be considered as part of the City's Strategic Plan.

7.5.5 ADVANCEMENTS IN WTE TECHNOLOGY

Advancements are occurring in the WTE industry, particularly in overseas applications. As an example, Green Conversion Systems, LLC (GCS) is the license holder in the U.S. for the Mull Verwertung Rugenberger (MVR) advanced thermal recycling technology. This technology has been in operation since 1999 in Hamburg, Germany (1,100 tpd facility). The technology differs from traditional

WTE facilities in the U.S. in several ways, including the use of more extensive air pollution control technology (two scrubbers, one for HCl, and one for SO_2, sandwiched between two baghouses), hydrochloric acid and gypsum recovery and a bottom ash processing system for high recovery of ferrous and non-ferrous metals and generation of a marketable aggregate to replace natural aggregate. The technology is currently being considered by the City of Los Angeles as it evaluates proposals for future solid waste management.

7.6 LANDFILL OPTIMIZATION TECHNIQUES

7.6.1 INTRODUCTION

The BAS Consultant Team evaluated six landfill optimization techniques to optimize capacity and preserve the life of the West Miramar Landfill:

1. Compaction
2. Alternative Daily Cover
3. Leachate Recirculation
4. Steam Injection
5. Bio-cell (Bio-Reactor)
6. Landfill Reclamation

The West Miramar Landfill is a valuable asset to the City because it is an active, permitted landfill and, therefore, any options that extend the life of the landfill need to be carefully evaluated during the Strategic Plan process. Evaluation and ranking of these options based on the screening criteria is discussed in Section 8, *Screening The Options In Phase I*, and Appendix G, *How the Options Were Evaluated and Screened*, of this report.

7.6.2 ISO 14001 CERTIFICATION

On July 31, 2002, the West Miramar Landfill was the first municipally owned-and-operated landfill in the U.S. to successfully attain ISO 14001 Certification. The ISO (International Standards Organization) 14000 Environmental Management Standards help organizations minimize how their operations might negatively affect the environment.

The Disposal Division of the ESD developed an Environmental Management System in order to qualify for ISO 14001 Certification. ESD subsequently reviews its operational procedures on an annual basis and is continually refining its procedures and looking for ways to improve their operations.

7.6.3 COMPACTION TECHNIQUES

7.6.3.1 SOIL SURCHARGING

One of the first landfill optimization techniques BAS analyzed was compaction. Primarily, the use of soil stockpiles to surcharge the refuse. Large soil stockpiles can be used much like paperweights over the existing refuse cells to compress the soil.

7.6.3.2 COMPUTER-AIDED EARTHMOVING SYSTEM

There is a computerized system manufactured by Caterpillar that can be added to the City's leased heavy earth moving compaction equipment called the Computer Aided Earthmoving System (CAES), an innovative tool that helps users maximize compaction and improve the capacity of their landfill.

The CAES allows machine operators to achieve:

- Maximum landfill compaction,
- Desired grade/slope, and
- Conserve and ensure even distribution of valuable cover soil with increased accuracy without the use of traditional survey stakes and crews.

Using global positioning system (GPS) technology, machine-mounted components, a radio network, and office management software this state-of-the-art machine control system delivers real-time elevation, compaction, and grade control information to machine operators on an in-cab display. By monitoring grade and compaction progress, operators have the information they need to maximize the efficiency of the machine, resulting in proper drainage and optimum airspace utilization.

7.6.4 ALTERNATIVE DAILY COVER

ESD uses a Tarp-o-Matic machine to place a tarp as daily cover instead of using daily soil cover. The tarp machine requires constant attention to ensure that the tarpaulins are not torn. If they are torn, then the site staff must mend the tarps. The purpose of ensuring that there are no holes in the tarps is to ensure that vectors do not enter the refuse mass when the landfill closes for the day. During high wind conditions, it is sometimes difficult to place the tarps and in these situations soil is used.

ESD reports the following in their ISO 14001 2007 Annual Report: "The tarp machine has been in operation for almost the entire year. The use of the tarp machine has allowed for a wider tip face, thereby, increasing vehicle spacing and reducing the potential for accidents and traffic congestion. In addition, it has allowed for the saving of nearly 89,000 cubic yards of landfill capacity with a cost savings of approximately $2.3 million dollars annually. The total cost of the machine was recovered in 17 days. In addition, the dirt saved by using the tarp will now be available for top deck cover as we extend the height of the landfill."

7.6.5 LEACHATE RECIRCULATION

Leachate is the liquid that drains or 'leaches' from a landfill; it varies widely in composition depending on the age of the landfill and the types of waste that it contains. In addition, as the infiltration component of precipitation percolates through the waste, it reacts with the products of decomposition, chemicals, and other materials in the waste to produce the leachate.

Leachate recirculation has been accomplished at landfills by a variety of methods, including pre-wetting of the waste, direct discharge into the working face, spraying, infiltration ponds, vertical injection wells, horizontal gravity distribution systems, and pressure distribution systems. The success of the various recirculation systems has depended on a variety of factors that include the type of waste, permeability of cover material, homogeneity of the waste, and understanding how to operate the system. See Appendix D for a detailed discussion of leachate recirculation.

7.6.6 BIO-REACTOR

The operation of a landfill as a bio-reactor is a technology that enhances biological activity, thus accelerating waste decomposition. The goals of a landfill bio-reactor are to reclaim landfill volume through accelerated decomposition and to stabilize the waste in a much shorter time period, which reduces post-closure maintenance costs. Bioreactor landfills are the next step beyond leachate recirculation (the biological activity in the landfill is enhanced through recirculation of leachate and the control of other factors – temperature, pH – to encourage activity), so in some respects many landfills have been operating as sub-optimal bio-reactors. Both recirculation and bio-reactor operations result in more cost-effective landfill operations. Bioreactors are designed and implemented prior to filling of waste. It is not feasible to create a bioreactor at the existing West Miramar Landfill site since it is already an operating landfill.

Yolo County initiated a full-scale operation of a bio-reactor landfill upon successful completion of their demonstration project in 2002 (Yolo County Planning and Public Works Department, Final Technical Report, 2006). While early bio-reactor landfills used only leachate recycling, Yolo County realized accelerated biodegradation of organic matter with further addition of liquid to allow completion of the anaerobic microbial process. Settlement resulting from this accelerated anaerobic composting technology during the pilot project was more than four times higher in the biocell than in the control cell with the majority of settlement occurring within the first four years.

The focus of this technology for the City of San Diego's Strategic Plan is the accelerated settlement of the refuse prism, insofar as this conserves airspace in the landfill. Bioreactor landfilling has other potential benefits, such as:

- Rapid stabilization of organic waste and consequent reduction of environmental hazard,
- Optimization of landfill gas yield,
- Reduced greenhouse gas emissions,
- Interim leachate storage,
- Rapid reduction in the strength of leachate,

- Reduction of leachate treatment costs, and
- Reduction of post-closure maintenance costs.

For the West Miramar Landfill, the availability of necessary volumes of leachate, gas condensate, or other liquid sources (i.e., reclaimed water) to affect measurable accelerated decomposition and airspace savings within the short-time period before closure of the site would need to be assessed. If technically feasible, regulatory approval requirements would then need to be considered.

7.6.7 STEAM INJECTION

Another emerging bio-reactor technology is the use of steam injection in landfills. Cool liquids injected into a landfill cell slow biodegradation until the temperature recovers and liquids primarily move downward. Steam flow, however, preheats the refuse to enhance biodegradation immediately and moves in all directions resulting in even distribution throughout the cell ((STI Engineering, Inc. (STI)). Further, using a combination of low- and high-temperature steam injection could produce additional benefits. Low-temperature steam increases organic biodegradation while high-temperature steam could be used to shrink and open plastic garbage bags, allowing the steam into this refuse. While current estimations of increased landfill airspace using traditional bio-reactor technology range between 15 to 30 percent, as much as 50 percent of the airspace could be recovered using the combination low/high-temperature steam injection process depending on the amount of plastic in the refuse**.**

A pilot steam injection project was conducted by STI at the West Miramar Landfill from May of 2005 to March 2006 with limited results. See Appendix E for a detailed discussion of the "Miramar Landfill Steam Injection Pilot Study."

7.6.8 LANDFILL RECLAMATION

As part of the LRMOSP, the potential for reclamation of the inactive North Miramar Landfill was assessed. The *Reclamation Options Study Report for the North Miramar Landfill,* prepared in July 2008 by BAS included a review of site specific data, reclamation-related technologies, and another reclamation project that has been implemented at Clovis, California. Because the North Miramar

Landfill was not an engineered, lined landfill, it was determined that there is a potential to remove in-place waste, excavate the subgrade, and line the landfill area to provide substantial additional landfill capacity at the site. This feasibility study will be further developed in Phase II of the Strategic Plan. See Appendix F for a summary discussion of the "North Miramar Landfill Reclamation Study."

7.7 LANDFILL DISPOSAL OPTIONS

Every potential landfill in and out of San Diego County was evaluated to determine which, if any, landfills could potentially be used to dispose of the City's waste. Initially 25 landfills were evaluated. Detailed screening and ranking information for these landfill disposal options can be found in Appendix G – How the Options Were Evaluated and Screened. At the end of Phase I, only six landfills were recommended for consideration in Phase II and one landfill (Gregory Canyon) is recommended for the watch list. This section of the report documents all of the landfills and their associated data that was used in reviewing landfill disposal options for the Strategic Plan.

7.7.1 IN-COUNTY DISPOSAL

7.7.1.1 EXISTING LANDFILLS

San Diego County currently has eight permitted landfills (see Figure 7.1). Seven landfills are in operation and the Gregory Canyon Landfill is in the planning and permitting stages. The site capacities and closure dates of the County's landfills are listed below.

SAN DIEGO COUNTY LANDFILLS					
Landfill Name	**Total Capacity (TONS)**	**Permitted Daily Throughput (TONS)**	**Remaining Capacity (TONS)**		**Permitted Closure Date**
Borrego	416,980	50	271,315	as of 3/31/2005	12/31/2021
San Onofre	1,132,800	50	830,130	as of 6/21/2001	11/30/2257
Las Pulgas	6,301,200	270	5,398,500	as of 6/21/2001	12/31/2184
Otay	36,803,005	5,830	19,511,819	as of 11/30/2006	4/30/2021
Ramona	1,298,000	295	407,100	as of 6/11/2001	12/31/2006
Sycamore	28,393,433	3,965	27,959,173	as of 10/30/2006	12/31/2031
West Miramar	33,315,353	8,000	8,075,598	as of 3/31/2006	12/31/(2011)

7.7.1.2 VERTICAL EXPANSION OF WEST MIRAMAR LANDFILL

The proposed Miramar Landfill Service Life Extension/Height Increase project is a maximum 20-foot increase in permitted height on an active portion of the Miramar Landfill with no horizontal expansions, change in daily throughput, change in operations, or change in land use proposed. A detailed discussion of this option is included in Section 3.2.3.1 of this report.

7.7.1.3 SYCAMORE LANDFILL EXPANSION

Sycamore Landfill provides solid waste disposal capacity for the City of San Diego, as well as the rest of San Diego County. Remaining capacity at the Sycamore site, under the revised 2006 Solid Waste Facility Permit (SWFP), is approximately 28 million tons, which is approximately 42 percent of the total existing landfill capacity (excluding military landfill capacity) within the County.

7.7.1.4 GREGORY CANYON

The proposed Gregory Canyon Landfill is to be located in northern San Diego County, approximately three miles east of Interstate 15, to the south of Highway 76, in northern San Diego County. The proposed project is designed as a Class III MSW landfill, which could accept municipal solid waste, inert waste, and dewatered sewage sludge. The proposed Class III MSW landfill would not be allowed to accept hazardous wastes for disposal. The proposed project would cover approximately 1,770 acres located adjacent to the San Luis Rey River. The proposed landfill footprint is approximately 183 acres with a design capacity of approximately 46 million cubic yards (or 31 million tons) of waste and an expected service life of approximately 30 years. The Gregory Canyon Landfill was issued a solid waste facility permit in 2004 and the other regulatory permits are currently still being processed.

7.7.2 OUT-OF-COUNTY DISPOSAL

Out-of-County disposal sites in nearby counties were also considered as potential disposal options. A discussion regarding these sites by County follows and a map showing these sites is included as Figure 7-2.

7.7.2.1 IMPERIAL COUNTY

There are currently ten permitted landfills in Imperial County. Nine are in operation and the Mesquite Regional Landfill (MRL) is under construction. It is anticipated that Mesquite and will be ready for disposal operations in 2009. The MRL has 600 million tons of capacity for disposal, with a projected site life of about 100 years. The MRL is permitted to receive 20,000 tons per day of MSW from Southern California by rail, including 1,000 tpd from Imperial County by truck. The distance from West Miramar Landfill to Imperial County's closet landfill (Imperial Solid Waste Site) is 116 miles. The next closest site to West Miramar is Allied Imperial Landfill with a distance of 124 miles. The capacities and closure dates of Imperial County's landfills are listed below.

IMPERIAL COUNTY LANDFILLS

Site Name	Total Capacity (TONS)	Permitted Daily Throughput (TONS)	Remaining Capacity (TONS)		Permitted Closure Date
Allied Imperial Landfill	2,537,000	1,135	1,239,000	as of 1/31/2006	1/1/2013
Calexico Solid Waste Site	1,180,000	150	885,000	as of 5/22/2005	1/1/2022
Imperial Solid Waste Site	1,121,000	207	108,484	as of 5/22/2006	9/1/2015
Holtville Solid Waste Site	386,332	20	10,034	as of 5/22/2005	4/1/2007
Niland Solid Waste Site	77,290	55	25,991	as of 5/1/2006	4/1/2020
Hot Spa Solid Waste Site	304,597	10	33,923	as of 5/22/2005	4/1/2036
Salton City Solid Waste Site	1,475,000	50	5,356	as of 4/27/2006	9/1/2011
Picacho Cut And Fill Site	380,746	15	45,442	as of 5/22/2005	1/1/2000
Monofill Facility	1,003,000	750	767,000	as of 4/6/2005	3/1/2012
Mesquite Landfill	600,000,000	20,000 (1,000 tons from Imperial County)	600 million	as of 01/01/2009	12/31/2097

The County of Imperial is currently under an agreement with the CIWMB to close all of its unlined landfills and locate bin type transfer stations at centrally located landfills, such as the closed Palo Verde Solid Waste Site. Only the Allied Imperial Landfill is to remain open in the central part of the county as an operating landfill. Additionally, the County has given and awarded a contract to Burtec to redevelop and expand the Salton City Landfill. This expansion is primarily aimed at taking waste from the Palm Springs cities rather than hauling it to the Lamb Canyon Landfill in Riverside County. The Imperial County sites are, in general, too distant and have insufficient daily permitted tonnage capacity to serve as alternative disposal sites for the City. Currently, the Imperial sites do not provide a feasible alternative for disposal of City refuse.

7.7.2.2 RIVERSIDE COUNTY

There are currently seven permitted landfills in Riverside County. Six are in operation and Eagle Mountain is fully permitted to receive residual solid waste by rail from Southern California. However, the purchase of Eagle Mountain Landfill by the Los Angeles County Sanitation Districts and its eventual operation are contingent upon successful resolution of pending federal litigation. The distance from West Miramar Landfill to Riverside County's closest landfill (El Sobrante Landfill) is 82 miles. The next site closest to West Miramar Landfill is the Lamb Canyon Landfill with a distance of 85 miles. The capacities and closure dates of Riverside County's landfills are listed below.

RIVERSIDE COUNTY LANDFILLS

Landfill Name	Total Capacity (TONS)	Permitted Daily Throughput (TONS)	Remaining Capacity (TONS)		Permitted Closure Date
Badlands	17,700,000	4,000	12,980,000	as of 4/21/2005	1/1/2016
Lamb Canyon	20,060,000	3,000	12,390,000	as of 7/31/2005	1/1/2023
Desert Center	69,049	60	13,715	as of 7/31/2006	1/1/2011
Blythe	2,714,000	400	1,298,000	as of 7/31/2006	5/31/2034
Mecca II	219,763	400	20,524	as of 7/31/2006	1/1/2007
El Sobrante	109,150,000	10,000	93,220,000	as of 4/30/2006	1/1/2030

The only landfill in Riverside County with sufficient daily tonnage capacity and ability to receive out-of-County imported waste is the El Sobrante Landfill.

7.7.2.3 ORANGE COUNTY

There are currently three permitted landfills in Orange County. All three are in operation. The distance from West Miramar Landfill to Orange County's closest landfill (Prima Deshecha Sanitary Landfill) is 62 miles. The next site closest to West Miramar is Frank R. Bowerman Sanitary Facility with a distance of 78 miles. The capacities and closure dates of the Orange County's landfills are listed as follows:

ORANGE COUNTY LANDFILLS					
Landfill Name	**Total Capacity (TONS)**	**Permitted Daily Throughput (TONS)**	**Remaining Capacity (TONS)**		**Permitted Closure Date**
Frank R. Bowerman	74,930,000	8,500	34,810,000	as of 12/1/2006	12/31/2022
Olinda Alpha	44,191,000	8,000	22,420,000	as of 10/1/2005	12/31/2013
Prima Deshecha	102,070,000	4,000	51,330,000	as of 8/1/2005	12/31/2067

Expansion plans are being permitted for the Frank R. Bowerman (FRB) Landfill to provide additional capacity to year 2053 and at the Olinda Alpha Landfill to 2021. A revised SWFP was issued for the FRB Landfill in July 2008 and revised Waste Discharge Requirements are pending. Importation of out-of-County waste is permitted at each Orange County Landfill until 2015 when existing importation agreements expire.

7.7.3 <u>OUT-OF-COUNTY WASTE-BY-RAIL DISPOSAL</u>

7.7.3.1 WASTE-BY-RAIL REQUIRED INFRASTRUCTURE

A waste-by-rail system for San Diego would require using existing and/or future MRFs and construction of an intermodal facility to load the waste into railcars. Waste arriving at the MRFs would be processed and recyclables, hazardous waste, or other unacceptable materials are removed from the waste stream. The residual MSW remaining would then need to be loaded onto rail-compatible containers at an intermodal facility and sent onto a "main line" railroad.

There are currently two waste-by-rail landfills in different stages of development in Southern California: the Mesquite Regional Landfill located in Imperial County and the Eagle Mountain Landfill located in Riverside County. Information on the waste-by-rail landfills is provided in the following sections of this report.

7.7.3.2 MESQUITE REGIONAL LANDFILL (MRL)

The MRL is a planned and fully-permitted Class III, non-hazardous solid waste landfill on approximately 4,250 acres in Imperial County, with the landfill itself occupying approximately 2,290 acres. The anticipated capacity of this landfill is 600 million tons. The anticipated maximum daily permitted capacity is 20,000 tpd. The anticipated life of this landfill is 100 years.

The landfill project includes an approximately five-mile long railroad spur from the former Southern Pacific Transportation Company (SPTC) main line track to the landfill site. The containers on rail cars would be approximately 40 feet long, have capacity for 25 tons of waste, and would be sealed to control litter, vectors, and odor. At the maximum disposal rate of 20,000 tpd, five 40-car trains would serve the landfill each day. Truck delivery of solid waste to the landfill would only occur from Imperial County and in the event the rail line is closed temporarily as a result of an accident or damage to the tracks.

A new 8,000 tpd Intermodal Facility in the City of Industry is proposed to begin construction in 2009 with a projected completion date of December 2011. This facility will be located adjacent to the Puente Hills Landfill (scheduled for closure in 2013) and will be the first Intermodal Facility to serve the Mesquite Regional Landfill.

Currently, waste-by-rail from San Diego would need to be transported from an intermodal facility and then the waste would be transported in railcars using existing rail lines from San Diego to the Atwood (Placentia) station in Orange County, California. These rail lines are currently owned by the North County Transit District and the Orange County Transit Authority (formerly owned by the Santa Fe Railroad).

At the Atwood station, California the line joins the Burlington Northern Santa Fe (BSNF) railway's transcontinental line running between Los Angeles and Chicago. Between Atwood and San Diego, the BNSF Railway has the right to use the rails for freight leaving the area and thus an agreement with the BSNF Railway would be needed for freight access rights. The waste-loaded containers would then travel to Colton and would switch to the Union Pacific Railroad (UPRR) tracks, travel easterly around the Salton Sea, then to Glamis with the final destination to the Mesquite Landfill. The five-mile railroad track from Glamis to the Mesquite Landfill is currently under design by the Los Angeles County Sanitation Districts.

7.7.3.3 EAGLE MOUNTAIN LANDFILL

The Eagle Mountain Landfill is a planned and fully-permitted Class III, non-hazardous solid waste landfill in an unused, open pit mine on approximately 4,654 acres in Riverside County. Landfilling would be permitted on approximately 2,164 acres. The anticipated capacity of this landfill is 700 million tons. The anticipated maximum permitted capacity is up to 20,000 tpd with approximately 16,000 tpd delivered by rail and approximately 4,000 tpd by truck.

The anticipated life of this landfill is 117 years. This description of the Eagle Mountain Landfill was taken from the Eagle Mountain Landfill Project, Riverside County, California, Draft Environmental Impact Statement/Impact Report (July 1996). Currently, the Eagle Mountain Landfill and its eventual operation are contingent upon successful resolution of pending Federal litigation; therefore, it is not yet a viable option.

If the eventual destination for the San Diego waste is Eagle Mountain, then the containers would travel the same approximate route as to the Mesquite Landfill (San Diego to Colton, switch to the UPRR line, continue around the Salton Sea) and then use the old Kaiser Steel railroad line to the Eagle Mountain Landfill.