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Past and present solid waste landfills in Bernalillo County, New Mexico

Terry Nelson

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CLOSING LANDFILLS

CLOSING LANDFILLS

LOS ANGELES LANDFILL

NAZARETH LANDFILL

NINE MILE HILL LANDFILL

RIVERSIDE LANDFILL

RUSS PITNEY LANDFILL

SACRAMENTO LANDFILL

SAN ANTONIO LANDFILL

SEAY BROTHERS LANDFILL

SOUTH BROADWAY (MESA DEL SOL) LANDFILL

SOUTH EUBANK LANDFILL

SOUTH YALE LANDFILL

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**ABBREVIATIONS:**

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>AEHD</td>
<td>Albuquerque Environmental Health Department</td>
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<td>AGIS</td>
<td>Albuquerque Geographic Information System</td>
</tr>
<tr>
<td>AMAFCA</td>
<td>Albuquerque Metropolitan Arroyo Flood Control Authority</td>
</tr>
<tr>
<td>BCEHD</td>
<td>Bernalillo County Environmental Health Department</td>
</tr>
<tr>
<td>bgs</td>
<td>Below Ground Surface</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response Compensation &amp; Liability Act</td>
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<tr>
<td>ED</td>
<td>Environment Department (post 1991 New Mexico)</td>
</tr>
<tr>
<td>EIB</td>
<td>Environmental Improvement Board (New Mexico)</td>
</tr>
<tr>
<td>EID</td>
<td>Environmental Improvement Division (pre 1991 New Mexico)</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency (Federal)</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GPPAP</td>
<td>Ground Water Protection Policy Action Plan</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HDPE</td>
<td>High Density Polyurethane</td>
</tr>
<tr>
<td>IRP</td>
<td>Installation Restoration Program @ KAFB</td>
</tr>
<tr>
<td>ITRI</td>
<td>Inhalation Toxicology Research Institute @ KAFB</td>
</tr>
<tr>
<td>KAFB</td>
<td>Kirtland Air Force Base</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower explosive limit (for gases)</td>
</tr>
<tr>
<td>mg/l</td>
<td>Milligrams per liter</td>
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<tr>
<td>MSWLF</td>
<td>Municipal Solid Waste Landfill Facility</td>
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<tr>
<td>NMAC</td>
<td>New Mexico Administrative Code</td>
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</table>
ABBREVIATIONS (CONTINUED):

PCB Polychlorinated Biphenyl
PCE Perchloroethylene (tetrachloroethene)
PDOP Position Dilution of Precision

ppb parts per billion
RCRA Resource Conservation and Recovery Act (Federal)
SV Ratio of the # of satellites being used to the total # available
SWL Solid Waste Landfill
SWMR Solid Waste Management Regulations (New Mexico)

TCE Trichloroethene
TCA 1,1,1-trichloroethane

ug/l Micrograms per liter

UTL Upper Threshold Limit
VOC Volatile Organic Compound
INTRODUCTION

In the geographic area of Bernalillo County, New Mexico there are over twenty known solid waste landfill (SWL) locations. Most were operated by the City of Albuquerque, but some were operated by Bernalillo County, Kirtland Air Force Base and some by private owners. There are three SWL’s currently operating in Bernalillo County. They include Cerro Colorado operated by the City of Albuquerque, Southwest Landfill operated by private owners and one operated by and on Kirtland Air Force Base. The remaining SWL’s have all been closed over the years. For many of these older sites there is no written record of the exact location, the time period of use, the amount of waste or the depth of the waste. There is potential for contamination of ground water and surface water from some of these SWL’s.

The purpose of this paper / project is to document the locations of all known SWL’s in Bernalillo County by using a Global Positioning System (GPS) or by plotting from aerial photos. This information will be placed in the Albuquerque Geographic Information System (AGIS) and a map showing the SWL locations will be produced. SWL map locations in some cases will be a best guess scenario of the actual waste boundaries. The paper will also provide a regulatory summary as well as background histories, hydrogeology and ground water monitoring status (where available) of these SWL’s. In discussions with Albuquerque Environmental Health Department (AEHD) and Bernalillo County Environmental Health Department (BCEHD) personnel, it was noted that a
centralized landfill document and AGIS map like this would be very helpful in planning for future well locations (monitoring or drinking water) or for decisions on zoning and building development in Bernalillo County. The paper will also look at the location of landfill sites in respect to current Albuquerque ground water production wells and discuss the potential scenarios for contamination.

For purposes of this paper, the term solid waste landfill (SWL) will be defined as a landfill location known to have been officially used by the City of Albuquerque, Bernalillo County, Kirtland Air Force Base or private owners for the disposal of municipal (commercial and household) solid waste including construction and demolition (c&d) waste material. The paper will discuss nineteen SWL's located outside Kirtland Air Force Base (KAFB) as well as several SWL's on KAFB. Please be aware that this paper deals only with SWL's. It does not deal with other sites which may be causing or have caused contamination of ground water but are not considered as SWL’s.

**GPS / GIS**

Global Positioning System (GPS) refers to a method of locating a place on the earth’s surface using orbiting satellites as reference points. Initially these satellites were placed in orbit by the U.S. Defense Department. GPS involves the use of trialatration. The location of a minimum of three satellites is used and the distance from your GPS instrument to each satellite is determined by the time it takes the signal from each satellite to reach your instrument. It is actually a much more complicated process than that, but simply speaking that is how it works. For the data gathered, I used a Trimble GPS Pathfinder portable logging system provided by the AEHD. Before using the GPS at each site it was necessary to check the number of satellites available and the PDOP
(position dilution of precision). The PDOP is basically a number showing your level of accuracy in gathering data points at certain times of the day (see Appendix A1). For best accuracy (within about five feet) on this GPS the PDOP level needs to be below 4. The PDOP level is dependent on the number of satellites available (SV) and their angle of position to you (Appendix A2). Notice the best PDOP reading in Appendix A1 is at about 11:30 AM (the light blue color). As long as the PDOP remains below 4 the accuracy of the GPS is very good. You must be aware when using a GPS that tall buildings, deep arroyos, tall trees, rock outcrops, steep slopes, hills or mountains can cause problems with reception and cause the PDOP reading to rise above acceptable levels. In some instances you may be able to bypass this problem by momentarily pausing your data logging in this particular area and then starting it again when you get around the obstacle and the PDOP level again becomes acceptable. I did run into this problem at several sites due to trees, hilly terrain and steep arroyo banks. Another point to remember when gathering GPS data is to be sure to get prior permission from property owners before going onto private property.

A GIS or Geographic Information System according to Dueker and Kjeme (1989) is: “A system of hardware, software, data, people, organizations, and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the Earth.” The Geographic part contains spatial data (x,y, and sometimes z coordinates) which can make up points, lines, arcs or polygons. This data may be gathered from a GPS instrument, map coordinates, latitude and longitude degrees, and other data sources. The Information part contains non-spatial data or attributes like precipitation, water levels, population, land use, vegetation, etc. The System part is a linkage of spatial and non-spatial data through a data management system. In essence a GIS
doesn't hold maps or pictures, it holds a database management system. Since GIS is a data driven system, the more accurate the data the better the system. Well researched and accurate data is a must for a good GIS.

There are five basic steps required to obtain a final output for a GIS:

Step 1: Data acquisition - obtaining the appropriate information for the anticipated end results. Requires about 40% of your time and budget.

Step 2: Preprocessing - conversion of raw data to a usable computer format. Requires about 40% of your time and budget.

Step 3: Data management - keeping track of processing steps and intermediate files to get a usable end product. Requires about 10% of your time and budget.

Step 4: Manipulation and analysis - getting the appropriate data and using it for the required result. Requires about 5% of your time and budget.

Step 5: Data output - the final product. Requires about 5% of your time and budget.

Gloria Cruz of AEHD handled most of steps two through five. I did step one.

The information system used by the City of Albuquerque is called the Albuquerque Geographic Information System (AGIS). The database system used by the AGIS is called ARC/INFO. The ARC handles where the features are, and the INFO component handles the feature descriptions and how each feature is related to others. Essentially, a GIS gives you the ability to associate information with a feature on a map and to create and compare new relationships. GIS mapping allows the use of multi-layered mapping or overlays. A perfect example is seen in Map 2 which is a map of all the SWL's overlaid by the city water supply wells and then printed out. Again the only
limit to layers is your data base information.

SOLID WASTE LANDFILLS-REGULATORY PERSPECTIVE

Solid waste landfills, previously and sometimes even currently called "dumps", have been a necessary part of man's way of life since creation. Man has always generated waste products and as a result has had to find a place to dispose of them. The culture patterns of many ancient societies have been theorized by artifacts found in their landfills. Unfortunately, as man began to use and develop waste products that in some cases were harmful to himself and his environment; these were also disposed of in the landfills or "dumps".

Hooker Chemicals buried over 21,000 tons of toxic chemicals in a place called Love Canal between 1942 and 1953. An elementary school and homes were later built on top of the Love Canal landfill. In 1976 after heavy rains caused the water table to rise, toxic chemicals began to rise along with it. On August 7, 1978 President Jimmy Carter declared a state of emergency in the Love Canal area (EPA, 1984). The Love Canal episode seemed to serve as a wake up call to the country that we must control what and how we bury our waste materials. Even today we continue to see pollution of our water, soil and air from many of these old landfills.

Old landfills in Bernalillo County as in most other parts of New Mexico and the United States have in many instances been placed in or next to watercourses (rivers or arroyos), in old sand/gravel pits or close to the ground water table (< 50 feet). New regulations no longer permit locating landfills in these locations but those that were placed there in the past have the potential to be sources of
ground water contamination.

Federal Solid Waste Regulations

To address the landfill pollution issue, especially that of ground water pollution, the Environmental Protection Agency (EPA) adopted 40CFR-Parts 257 & 258-Solid Waste Disposal Facility Criteria-Final Rule on October 9, 1991. Part 258 deals with municipal solid waste landfills (MSWLF’s) disposal criteria. Part 258 is also known as Subtitle D of the Resource and Recovery Conservation Act (RCRA). (Part 257 or Subtitle C deals only with hazardous waste facilities.) EPA developed this rule in response to the 1984 Hazardous and Solid Waste Amendments to RCRA. EPA studied the adequacy of the existing criteria to protect human health and the environment from all MSWLF’s. A municipal waste landfill is generally defined as one that takes nonhazardous or household type waste. The results of the study confirmed that the United States was in the midst of a municipal solid waste crisis. Data showed that in 1988 the nation generated nearly 180 million tons of municipal waste and it would probably grow to 216 million tons by the year 2000. This data coupled with the decreasing availability of disposal locations and capacity led EPA to set forth Subtitle D criteria including location restrictions, facility design and operating criteria, ground water monitoring requirements, corrective action requirements, financial assurance requirements and closure and post-closure care requirements. Any states with solid waste regulations that did not meet these minimum requirements as set forth by EPA and had not received approval from EPA were required to comply with the Federal Subtitle D Regulations until they developed their own regulations and were approved by EPA.
New Mexico Solid Waste Management Regulations

1974: In New Mexico the first set of solid waste regulations was adopted on April 19, 1974 by the Environmental Improvement Board (EIB). Compliance with the regulations was handled by the Environmental Improvement Division (EID) of the Health & Environment Department. These initial regulations were very vague in the area of landfill location and construction. In fact, the standard location for landfills in New Mexico during the 70's and 80's was in existing arroyos or old sand & gravel pits. Some highlights of these regulations were that they did require a landfill to register with the EID as a sanitary landfill and to be located at least twenty (20) feet above the ground water table. It also required the sanitary landfill to cover its waste with six (6) inches of dirt at the end of each day and to have a final cover of two (2) feet of compacted earth graded to facilitate runoff when it closed. Actual protection of ground water by these regulations was very minimal.

1989: On April 14, 1989, long overdue solid waste management regulations (SWMR) were adopted by the Environmental Improvement Board (EIB) as EIB/SWMR-2. Compliance with these regulations was handled by the Environmental Improvement Division (EID) - Special Waste Bureau. These regulations began to address most of the criteria listed in the then draft EPA Subtitle D regulations. These new regulations did not permit landfills to be located in wetlands, watercourses or flood plains; within fifty (50) feet of ground water; near subsurface mines or within 200 feet of a fault within Holocene time. Bulk liquids including septage, petroleum wastes and sludge were prohibited. Ground water monitor wells could be required by EID upon closure of a landfill. Landfill liners were not required. Closure and post-closure care for a landfill was set
at twenty-five years and had to be backed by financial assurance. All new landfills were required to have a permit issued by EID before they could operate. Public notice of all landfill permits was required and a public hearing held if there was significant public interest. On May 12, 1989, a lawsuit was filed by 64 municipalities and 22 county governments against the state of New Mexico stating the 1989 regulations violated the New Mexico Constitution because no financing was provided by the state to cover the cost of complying with the new regulations. The Plaintiffs were granted a Temporary Restraining Order by the District Court and a Stay of the implementation of the regulations by the Court of Appeals. In essence they were temporarily exempted from the 1989 regulations. Ground water protection by these regulations was improved but still lacked several important elements like requiring liners and ground water monitoring.

1990: In March of 1990 the legislature passed the New Mexico Solid Waste Act. Its purpose was to authorize and direct the establishment of a comprehensive state-wide solid waste management program to include a waste characterization element, a source reduction element, a recycling element (including a goal to recycle 25% of all solid waste by 1995 and 50% by the year 2000), a composting element, a solid waste facility capacity element, an education and public information element, a funding element, a special waste and household hazardous waste element. It also required the EIB to adopt new solid waste regulations by December 31, 1991 and to adopt regulations establishing financial responsibility for SWL operators. On September 14, 1990 the Plaintiffs in the 1989 lawsuit agreed to a settlement which basically extended the time they had to comply with the new regulations until March 31, 1991 and even then compliance would be on a public health/environment priority basis.
1991: On December 31, 1991, new regulations, EIB/SWMR-3, were adopted to comply with the Solid Waste Act. Compliance with these regulations was handled by the newly formed (January, 1991) New Mexico Environment Department - Solid Waste Bureau. Highlights of these regulations were that landfill liners and leachate collection systems might be required to protect ground water; landfills now had to be located at least one hundred (100) feet from ground water, at least one thousand (1000) feet from large volume wells (>100 gallons per minute), and at least three hundred fifty (350) feet from small volume wells (<100 gpm). These new regulations also required each new landfill to have a minimum of four ground water monitor wells. These regulations still did not make liners or their equivalent mandatory so maximum protection measures for ground water were still not in place.

1994: Once again on July 18, 1994, a new set of regulations, EIB/SWMR-4 was adopted. These regulations were redone to try and put New Mexico regulations in line with the Federal Subtitle D regulations so New Mexico could become an approved state under EPA. These regulations now required a thirty (30) year post-closure monitoring period, a leachate collection system, a Subtitle D liner or equivalent and a final cover to prevent precipitation from reaching the waste. Additional limitations on location now included alluvial fans and seismic impact zones. The number of ground water monitor wells now required depended on the individual site needs as determined by the Environment Department. Ground water sampling was now more specifically addressed by detection, assessment and corrective action monitoring. In December of 1994, New Mexico became an approved state by EPA as having regulations equivalent to Subtitle D, meaning New Mexico regulations have precedence over all solid waste facilities. These regulations now provide
substantial protection of ground water by requiring location restrictions as well as liners and final covers.

1995: On October 27, 1995 the EIB/SWMR-4 regulations were redesignated for legal and administrative purposes as 20 NMAC (New Mexico Administrative Code) 9.1.

1997: The EIB in conjunction with the ED-Solid Waste Bureau is currently in the process of once again revising the solid waste management regulations.

**Ground Water Protection Policy and Action Plan**

In 1988 the Albuquerque City Council and Bernalillo County Commission passed Resolution 143 calling for a comprehensive Ground Water Protection Policy and Action Plan (GPPAP). They decided that since ground water was currently the sole source for public drinking water for Bernalillo County that it was a precious resource and needed to be protected. They were aware that contamination of ground water had already occurred at numerous locations in the county. Its main goals and objectives were to protect the ground water resource, find and clean up the contaminated ground water and promote the coordinated protection and prudent use of the ground water resources throughout the region. The plan was officially adopted by Bernalillo County in 1993 and by the City of Albuquerque in 1994. GPPAP specifically addresses landfills under Protection Measures. It designates crucial areas and wellhead protection areas where landfills will be prohibited and develops a landfill monitoring program for existing and closed landfills. The current weak point in GPPAP is that currently it is only a policy plan. The policy plan can not be
implemented and has no regulatory authority until detailed regulations and ordinances are
developed and put into law (GPPAP, 1995).

METHODOLOGY

SWL location information was obtained by direct knowledge of the author from six years
employment with the Environment Department Solid Waste Bureau, old aerial photos, consultant
reports, closure plans from the Environment Department, interviews from employees who
remembered some of the old sites, data from AEHD as well as just walking the sites and observing
surface debris and topography (obvious settling of surface areas). In most cases the GPS (Global
Positioning System) locations are best guess scenarios and are not to be used as exact boundaries
of waste material (Map 1, 2 &3 in Appendix).

I first used information gained from employment as an Environmental Specialist with the
Environment Department Solid Waste Bureau from May of 1990 until December of 1996. During
this time I was required to inspect all existing and recently closed landfills in Bernalillo County as
well as in Torrance, Valencia, Sandoval, Cibola, McKinley, San Juan and Socorro counties. This
provided me with direct knowledge of many of the locations and background histories of SWL’s in
Bernalillo County.

Old aerial photos were also used to try and determine dates as well as locations. Aerial photos may
be found at the UNM map room although currently there are from five to ten year intervals
between photos. Koogle & Pouls also has aerial photos for a fee as does the Earth Data Analysis
Center with UNM. In many cases it was obvious from some of the aerial photos that some kind of excavation was going on but the final boundaries of the waste disposal were often hard to determine. As a result most of the waste boundaries on the map are best available information and observation and are by no means the exact waste perimeters of the SWL's.

Several of the old landfills had environmental consultant reports in which data for waste depth and limits was obtained from actual bore holes on the site. Some even included monitor wells, soil vapor analyses, background histories and a site specific hydrogeologic summary. Sites with consultant reports included: Cerro Colorado, Coronado, Los Angeles, Sacramento, South Broadway, South Eubank, and South Yale.

Interviews with former SWL employees provided some general information, but in many cases the areas around the closed SWL's had been built up and changed so much that they were unable to remember exact locations or perimeter boundaries.

SWL permit applications or closure plans from the ED-SWB were valuable for information on landfills that have either opened or closed within the past five to six years such as Cerro Colorado, South Broadway, Riverside and Seay Brothers.

I also used information gathered by the AEHD around 1988-89 on old solid waste landfill locations including dates of operation and location some of which were found to be incorrect. A valuable SWL resource person at AEHD is Doug Earp, a hydrogeologist, who is in the process of
drilling monitor wells at many of the old city SWL sites.

Finally, just walking the old sites revealed many distinguishable perimeter boundaries through observation of exposed surface waste, subsidence due to waste decomposition, difference in vegetative growth or difference in natural topography.

From all of this source information I was able to locate 26 landfill locations in Bernalillo County which includes 7 locations within the boundary of Kirtland Air Force Base (KAFB). Appendix E is a table of each of the SWL sites that will be discussed in this paper and Map 1 shows locations.

**GENERAL HYDROGEOLOGY OF BERNALILLO COUNTY**

Most of Bernalillo County is located within the Albuquerque Basin, which is one of a series of basins along the north-south aligned Rio Grande Graben or rift which formed in response to middle - late Tertiary tectonics. The basin has been the catchment area for the surrounding highlands resulting in extensive valley fill deposits. The basin is bordered by high angle normal faults and related uplifted fault blocks, the Sandia, Manzanita and Manzano Mountains to the east and the Lucero and Jemez Mountains to the west. These uplifted fault blocks as well as the bedrock underneath the valley fill at depth are igneous, metamorphic and sedimentary rocks (see Appendix C). The valley fill in the basin includes the Santa Fe Group overlain by various alluvial deposits. The depth of the fill has been measured on the order of 14,000 feet deep. The Santa Fe Group, a sequence of unconsolidated to consolidated sediments locally interbedded with volcanic rocks, was derived from erosion and local volcanic activity from the surrounding highlands. A
series of alluvial fan sediments overlie the Santa Fe Group from the base of the mountains to the bluffs on the east side of the inner Rio Grande valley. Discontinuous terrace deposits overlie the Santa Fe Group adjacent to the inner valley of the Rio Grande. Unconsolidated valley alluvium of recent age overlies the Santa Fe Group along the flood plain of the Rio Grande and its tributaries (Fox Consultants, 1983).

The Santa Fe Group, alluvial fan deposits, and valley alluvium are all hydrologically interconnected and consist of the principle aquifer in the Albuquerque Basin. It has been noted though that in much of the inner valley, layers of clay as thick as about 15 feet in the alluvium limit the flow of water between the surface-water system and the alluvium and thus the underlying Santa Fe Group. The most productive part of the Santa Fe Group aquifer system is the upper and to some extent the middle part of the Santa Fe Group. The most productive part of the aquifer system is 2 to 6 miles wide and has a remaining saturated thickness of about 600 feet. Water levels in the east Albuquerque area declined 140 feet from 1960 to 1992. Water levels declined 40 feet from 1989 to 1992 in eastern, northwestern and south-central Albuquerque. Ground water withdrawn from the Santa Fe Group in the Albuquerque area comes from three sources: depletion of aquifer storage, capture of mountain-front and tributary recharge and induced recharge from the surface-water system through or across the recent flood-plain alluvium (USGS, 1993). Recent USGS water model studies have indicated that Bernalillo County is using water much faster than it is being recharged back into the system. It is this increasing drop in the aquifer level which has caused the City of Albuquerque and Bernalillo County to look at other water supply sources, begin a water conservation program and develop a policy to protect the ground water.
A method used to determine the potential for precipitation infiltration into soils and thus potential leachate generation for landfills as well as potential recharge to ground water is the water balance analysis. It basically compares local precipitation (an average of 8-9 inches/year in Albuquerque), evapotranspiration (the evaporation of moisture from soils and vegetation) and storage capacity (the maximum moisture content a soil can retain by gravity without producing a downward flow). On all SWL’s where a water balance analysis was run, it always revealed that evapotranspiration and storage capacity were always greater than the available precipitation except during prolonged or very heavy precipitation events. This in essence means that most precipitation in Bernalillo County rarely makes its way much below the soil surface.

LANDFILLS-SITE HISTORIES

CERRO COLORADO LANDFILL

Location: This site is located approximately 17 miles west of Albuquerque and about 2.5 miles south of Interstate 40. It is about two miles east of the Rio Puerco River.

Background: Cerro Colorado is owned and operated by the Albuquerque Solid Waste Management Department. It was permitted as a municipal landfill by the ED and opened in May of 1990. Current total acreage for the property is 1025 acres of which 192 acres are currently permitted for waste disposal. The permitted acres consist of nine-twenty acre cells, each interconnected to the other. The bottom and sides of each cell have a plastic high density polyurethane (HDPE) liner to contain the waste along with a leachate collection system to capture any liquids. The original life expectancy for these nine cells was about twenty-six years. As of this
writing about three and one half cells have been filled with approximately three million tons of waste. Currently the SWL takes in around 40,000 tons of waste a month and is open seven days a week. The site also has a petroleum contaminated soils remediation site consisting of five cells about one acre each in size. It also has a separate intermediate processing (recycling) facility located in the northwest portion of the property. In 1996 the site received approximately 9 inches of precipitation mostly in the form of summer thunderstorms of short duration but large volume.

**GPS:** The GPS for Cerro Colorado was run on the property boundaries, on the waste boundaries for the first six cells, on the roads into and on site, on the ground water monitor wells and on the petroleum contaminated soils site. Currently only the first four cells have waste in them. It was plotted with the GPS on 2/12/97 by Corey Fouser and Gloria Cruz with AEHD.

**Hydrogeology:** The surface topography for Cerro Colorado is of the badlands type which form fairly steeply eroded slopes. Surface soil and bedrock exposures are comprised of alluvium and Upper Santa Fe Group bedrock, respectively. The alluvium is composed of mostly silty fine sand and gravelly sand and is fairly shallow. The Santa Fe Group is composed of lightly cemented sands, silty sands and occasional thin layers of sandy clay. The Santa Fe Group was deposited as a basin fill into the developing Rio Grande rift. Sediments are alternating to thinly interbedded mixtures of sand, silty sand, gravels, silty clays and sandy clays. These beds are capped by a caliche horizon (Vineyard & Associates, 1990). Three phases of faulting have occurred in the site vicinity (Rio Puerco Fault Belt). The first was the late Laramide compression faulting causing the uplift of the Sierra Nacimiento and inducing the Rio Puerco Fault Zone predominantly down to the west. The second was the Miocene in which the two crustal plates pulled apart causing the Rio Grande rift with down to the east movement. The third phase was the collapse of the Rio Grande
rift with down to the east faulting. Three exposed faults were found on the surface, but all were in a zone on the eastern portion of the site away from the waste disposal cells.

Ground water well logs showed clayey units at a depth of around 300 feet. Comparison of well logs showed well #1 to be 300 feet lower than well #2 or #3 suggesting one or more down to the west faults between these wells at a depth of around 600 feet. Flow direction is shown to be to the south with water depth around 500 to 600 feet below the bottom of the waste cells.

The site is about 1.5 miles southeast of an exposed complex latite plug dome (volcanic) which intruded the Santa Fe beds. This volcanic dome is named Cerro Colorado and was the name used for the landfill.

**Ground Water Monitoring:** Currently Cerro Colorado has three ground water monitor wells. Well #1-B is located southwest of the SWL. Well #2 is located southeast of the site and well #3 is located north of the site. Wells #1 and #2 were drilled in 1988 and well #3 in 1989 by Rodgers and Co. Well #1 was abandoned in 1991 when an inoperative pump was not able to be removed. Well #1-B was installed in its place. These wells have been sampled for various chemical parameters on an average of twice a year since 1990. Specific parameters analyzed for may be found in the annual monitoring reports submitted to the ED each year. To date no contaminants have been noted other than naturally occurring substances such as arsenic, boron, iron, managanese and thallium. Background levels for most of these have been established and all parameters are within acceptable statistical limits (IT Corporation, 1997). Another downgradient monitor well will probably be installed within the next year due south of the waste cells.
Potential for Contamination: Since Cerro Colorado is lined with an equivalent clay layer and HDPE and since the depth to ground water is around 600 feet or greater, the ground water protection factor is very high. There is potential for faulting at a depth of around 600 feet or less. If such faults are under the waste cells, that could potentially lower the protection factor if any contaminant leaked out of the liner. Otherwise this SWL seems well located and engineered to protect groundwater. Monitor wells have not noted any contaminants to date above background levels. Methane is being generated but is remaining within cell boundaries.

SOUTHWEST LANDFILL

Location: This site is located west off South Coors Rd on Parajito Rd. It is near the eastern edge of Ceja Mesa.

Background: Southwest landfill was opened in 1987 under private ownership, and was registered with the ED as a sanitary or municipal landfill. Due to Bernalillo County zoning restrictions, they were only allowed to accept construction and demolition (c&d) waste material. The original site contained about 40 acres. To date approximately 25.2 acres of that have waste in them. The current cells do not have any protective liner in place. According to testimony in the public hearing held for the current landfill permit, in 1988 Southwest disposed of about 400,000 cubic yards of waste from the old South Yale landfill into cells #1 and #2. On May 8, 1997 after public hearings, Southwest Landfill received a Solid Waste Facility permit as a municipal waste landfill from the ED. The permit expanded the existing size by another 40 acres to the north with another 40 acres in reserve. The permit requires all future waste cells to have an approved liner installed. The site has taken only c&d waste in the past but plans to start taking municipal waste with the issuance of
this new permit when the new lined cells are installed. A local citizens group is fighting this permit and has filed a lawsuit against the landfill. The expected life of the permitted 80 acres is from 10-18 years. Waste depth in the current 25 acres is about 120 feet bgs and in the new 40 acres will be 100 feet bgs (Daniel B. Stephens & Associates, 1996).

**GPS:** The property boundaries of the original 40 acre site for Southwest landfill were used as the GPS waste boundary. Only the south 25 acres of the recorded GPS boundary site actually contain waste at this time. Plotted with GPS on 2/17/97 from 10-10:30 AM. PDOP = 3.2 and SV = 8/8. Also plotted road to SWL and ground water monitor wells.

**Hydrogeology:** Southwest landfill is located in the Albuquerque Basin about 4.25 miles west of the Rio Grande River. It is on the Ceja mesa between the Rio Grande and Rio Puerco valleys. The Ceja Mesa is part of a pediment, is bounded by dissected slopes of basin fill and bears alluvial slopes on its eastern flank (Kelly, 1977). Southwest landfill sits in the Santa Fe Group alluvial deposits. From borehole samples and geophysical logs the deposits down to 560 feet bgs consist mainly of sand, along with subordinate silty sand and minor silt and gravel. The flow direction for ground water is west-southwest according to monitor well measurements. The closest Holocene fault to this site is about 2 miles to the southwest (D. B. Stephens, 1996). Depth to ground water is about 500 feet bgs meaning the distance from the bottom of the waste to ground water is about 380 feet.

**Ground Water Monitoring:** Southwest landfill currently has three ground water monitor wells. Two more will be drilled within six months. To date no contaminants have been found during monitor well sampling.
**Potential for Contamination:** Because Southwest landfill has taken in only c&d waste the theoretical prospect for contamination should be minimal. Since about 1991 this SWL has had a waste screening program to check loads for hazardous waste. Prior to that waste screening was not routinely done. It is always a possibility for loads to contain hazardous materials unknown to the landfill operator. This site has been graded to prevent ponding of water over the waste. It has always contained a large and deep (~100 feet) excavated cell area, so any heavy precipitation would end up collecting at the bottom and be a possible source of leachate. In general this site should have minimal impact on ground water. The closest municipal supply well is the Leavitt #3 well about 3.5 miles northeast of the site. This site is also located in the GPPAP crucial area, meaning it is in an area that landfill construction is not recommended. GPPAP is currently only a policy, so actual enforceable regulations have not yet been implemented. Methane gas has not been detected outside the site boundaries.

**KIRTLAND AIR FORCE BASE (KAFB) LANDFILL**

**Location:** This SWL is located on the north central portion of KAFB and is bounded by Tijeras Arroyo on the north and is south across Tijeras Arroyo from the South Eubank landfill. It is noted as LF-08 and LF-12 on the KAFB-IRP map (Appendix B).

**Background:** The current active KAFB disposal area was started in 1989 and is operated by KAFB. It is actually part of a larger area that encompasses what is noted as LF-08 (Landfills 4,5,6) in the KAFB Management Action Plan - Environmental Restoration Plan (April, 1995). The original landfill area (adjacent but west of the current site) was started in about 1964 and was operated as a combination c&d and municipal waste landfill with a separate asbestos monofill.
trench added in the early 1990's. The Plan indicates that the City of Albuquerque also used this site for some waste disposal between 1964 and 1967. This seems questionable since the city was also using the South Eubank landfill at this time and it is just across the arroyo. Previous interviews indicated that chemical drums containing unknown materials were deposited in this site. In July, 1994 the Air Force decided to prohibit any further disposal of municipal waste on base and to accept only construction and demolition (c&d) waste which was generated on the base. In December, 1994 the asbestos monofil landfill was closed. Currently all municipal waste and asbestos are disposed of at approved landfills off the base. Maximum depth of waste at this SWL is around 40 feet. Total surface area is around 30 acres. To date this SWL has no protective liner nor has it received a permit by the ED.

**GPS**: GPS data for KAFB landfill was provided by Denise Blakely of Sandia National Labs to the AGIS through the 1994 Brac Commission Report on Installation Restoration Program (IRP) sites. Neal Weinberg with AGIS graciously provided the information to Gloria Cruz at AEHD for the map.

**Hydrogeology**: A borehole drilled to 100 feet on the west side of the site showed mixtures of silty sand, sandy silt, clay and gravel located in the alluvial fan deposits and the upper Santa Fe Group. The site is west of the Hubbell Springs fault. It is located in the Santa Fe Group containing alluvium made up of poorly consolidated coarse sediments (sand and gravel) with lesser amounts of fines (silt and clays). Ground water flow direction is to the northwest with ground water depth 364 feet bgs at the southeast corner of the site.

**Ground Water Monitoring**: Currently there are five ground water monitor wells in the vicinity of the KAFB landfill. Monitor wells downgradient (northwest) of the SWL run between 429 and 493
feet bgs. Mark Holmes with the KAFB-Environmental Restoration Program deals with most of the ground water sampling analysis of this site as well as the other closed SWL's on base.

**Potential for Contamination:** Since this site has been used since 1964 (when it was acceptable to dispose of hazardous chemicals in landfills), there is a high probability that hazardous materials were placed in this site although total quantity is unknown. This is also a fairly large site (around 30 acres) and has been in use for over 30 years. It is an unlined site so the potential for contamination of ground water is very high. To date levels of selenium and cadmium above state ground water standards have been noted. It is possible that natural background levels of these elements may run high in this area. Testing is being done in an attempt to gather base wide background levels.

**KIRTLAND AIR FORCE BASE (OLD LANDFILLS)**

According to the KAFB-IRP Sites map (Appendix B), six other significant SWL's have been located on the base. I will attempt to highlight pertinent information for each site. More in depth site specific descriptions and information may be found in the KAFB-Management Action Plan (April, 1995). I have not listed LF-09, LF-44, LF-22 or LF-56 in this report since they are no longer considered as landfill sites of any significance. The list of potentially significant sites is as follows:

- LF-01 (Landfill 1)
- LF-02 (Landfill 2)
- LF-07 (Landfill 3)
- LF-15 (Landfill 15)
- LF-18 (Landfill A)
- LF-20 (Manzano Landfill)

**Location:** These sites are located throughout the KAFB property. See Appendix B. General location on KAFB property per the Management Action Plan is as follows:
LF-01 is located on the northwest corner of KAFB and is about 400 south of the east-west runway of the Albuquerque International airport.

LF-02 is located between the Trestle facility on the north and Tijeras Arroyo on the south.

LF-07 is northwest of LF-02 with its southern boundary being the Tijeras Arroyo floodplain.

LF-15 is east of Lake Christian in the south-central region of the base.

LF-18 is in the northwest corner of KAFB and is about 550 yards south of the east-west runway.

LF-20 is located in the southwest corner of the Manzano area in the central region of KAFB.

**Background:**

None of these six sites has a protective liner.

LF-01 (Landfill1) was operated between 1965 and 1975 for general use. Depth of waste ranged from 10-30 feet over a 55 acre area. Photographs taken in 1971 show numerous 55-gallon drums at this site. Informal and undocumented interviews indicated that hazardous waste drums may have been disposed of here. A naturally occurring drainage channel running north to south ran right through this landfill site causing some erosion exposure of the waste material. KAFB water production well #2 is located about 150 feet northeast of the site.

LF-02 (Landfill2) was operated between 1943 and 1967. Depth of waste is between 9 and 20 feet over a 35 acre area. Informal and undocumented interviews indicated that hazardous waste drums may have been disposed of here. The northernmost portion of the site was excavated and relocated to LF-07 (Landfill3) in 1972 to accommodate the Trestle facility. Two buried sewer pipes cross this site. One on the northeast portion and one on the southeast corner. The southeast line is known to have failed in the past. The Tijeras Arroyo 100 year floodplain cover 80% of this site with its
southern portion actually abutting the arroyo. Because of erosion by the arroyo this portion has been stabilized with riprap and wire mesh.

LF-07 (Landfill 3) was created to receive the waste removed from LF-02. It was operated from 1972 until 1977. Waste depth is about 10 feet over the 7 acre site. According to interviews this site was mostly filled with burned aircraft parts. It lays on the side of a hill above the arroyo floodplain.

LF-15 (Landfill B) covers about 3 acres and was operated from the 1960's until 1994. It reportedly received c&d, general refuse and Inhalation Toxicology Research Institute (ITRI) laboratory wastes (animal carcasses). Undocumented interviews reported the landfill waste was removed in 1984 to other sites and only the ITRI test animal carcasses continued to be disposed of in trenches on the northeast portion of the site.

LF-18 (Landfill A) covers about 10 acres with a waste depth of about 10 feet. It was used from about 1941-1946, but was never officially closed until the 1980's. It reportedly received burned hospital (non-biomedical) and mess hall waste.

LF-20 (Manzano Landfill) according to old aerial photos was used and covered prior to 1959. It was a general disposal site for the Manzano base housing and was used for open burning. There is a possibility that hazardous waste was disposed of here.
GPS: GPS data for the AGIS was provided through Denise Blakely of Sandia Labs and Neal Weinberg of AGIS and put in the AEHD landfill file by Gloria Cruz. This data had previously been gathered in the Brac Commission Report in 1994 from Sandia National Labs.

Hydrogeology: LF-01 overlies the Santa Fe Group west of the Hubbell Springs fault, an area characterized by deep unconsolidated sedimentary soil. The water table ranges from 405 to 450 feet bgs and is moving to the northeast.

LF-02 rests on recent alluvium of Tijeras Arroyo which overlies the Santa Fe Group and lies west of the Hubbell Springs fault. Depth of the alluvium is estimated to be around 50 feet. The water table was 395 feet in 1990 but is falling at a rate of about 2.4 feet per year. Ground water flow direction is to the northwest. Current water levels range from 366 to 395 feet bgs.

LF-07 is located in the Santa Fe Group and is west of the Hubbell Springs fault. Ground water depth is about 420 feet with a flow to the north.

LF-15 is in terrace and sediment sands and gravels. It is east of the Hubbell Springs fault. Ground water depth is about 140 feet with flow to the southwest.

LF-18 overlies the Santa Fe Group and is west of the Hubbell Springs fault. Depth to water is about 420 feet with regional flow to the northeast.

LF-20 is west of the Sandia fault zone and has fractured granite overlain by the Santa Fe
Formation. Depth to water is unknown but believed to be greater than 100 feet with flow to the west.

**Ground Water Monitoring:**

LF-01 currently has 7 monitor wells. Four of these are sampled routinely (#111, #113, #114 and #115). #111, #114 and #115 are all downgradient wells with #113 as the upgradient. Initially well DM-01 was drilled at this site along with the installation of two lysimeters. Results from the well were inconclusive with respect to background sampling. Beryllium and managanses were the contaminants found above action levels and base-wide upper threshold limits (UTL's). Current sampling has not noted any contaminants above regulatory levels.

LF-02 currently has 6 monitor wells. Four are sampled regularly (#214, #215, #216 and #218). #214 and #218 are downgradient wells with #215 upgradient and #216 off gradient. Initially monitor well DM-02 was installed. Samples contained .1 mg/L of an organic chloride, .004 mg/L of an organic bromide and 4 mg/L of nitrates. Current sampling indicates there are no contaminants above regulatory levels.

The remaining SWL's do not have ground water monitor wells.

**Potential for Contamination:** With most of these KAFB landfill sites being over twenty years old, it is highly probable that unknown quantities of hazardous materials were disposed of in most of them. Twenty years ago it was standard practice to dispose of unwanted chemicals in SWL's. As a result there is a high probability that any of these sites could potentially contaminate ground water and in the case of LF-02 even surface water if there was a 100 year flood. To date no definitive evidence of contamination by any of these sites has been noted. Monitoring of these site is
continuing by KAFB.

**ATRISCO LANDFILL.**

**Location:** This SWL is located south of Central Ave, and east of Coors Rd. It is bounded on the north by Sunset Gardens Rd, on the east by Corregidor Rd and on the south by Salvador Rd. The old Santa Clara Cemetery is east of the site.

**Background:** Undocumented sources indicate that the Atrisco landfill was used around 1968-1969 by the City of Albuquerque. It was named the Atrisco landfill because it is just west of the area of Albuquerque known as Atrisco. One undocumented account indicated that the waste was buried due west and adjacent to the Santa Clara cemetery. After observing aerial photos from 1969 and 1974, it appears that the eastern half to two thirds of the current mobile home park use to be a sand and gravel pit operation and was therefore the site of the waste disposal. According to Everett Naranjo, who was an equipment operator at this site, only residential garbage trucks from the City of Albuquerque dumped there. The site covers about six acres and is unlined. It is estimated that about 1.5 million cubic feet of residential waste were disposed of there. Depth of waste is estimated to be around 8 feet. The site is currently a mobile home park.

**GPS:** The boundaries of the current mobile home park on the north, east and south were used as the GPS data points for the Atrisco landfill and the western boundary points were decided from aerial photos. It was plotted with the GPS on 6/5/97 from 2-2:30 PM. PDOP = 2.6-3.2 and SV = 6/8. It is unclear exactly where the waste boundaries are, so since the sand/gravel pit on old aerial photos is where most of the current mobile home park is, the eastern two thirds of the park are used as the waste boundaries.
Hydrogeology: The Atrisco landfill appears to be mostly sand and gravel valley alluvium overlaying the Upper Santa Fe Group. Depth to ground water is between 60 and 90 feet. Ground water gradient is probably due west because of the influence of the Rio Grande River as well as the two municipal water supply wells less than ½ mile west of the SWL. The Rio Grande River is approximately 1.5 miles to the west.

Ground Water Monitoring: Currently there are no monitor wells at Atrisco but AEHD is planning to install one or more in the near future.

Potential for Contamination: Since the Atrisco site was used only for residential waste for only a year, the potential for any large quantities of hazardous materials should be minimal. Depth to ground water is considered fairly shallow (<100 feet) so if there is any contamination it could show up in the ground water fairly soon. City water production wells, Atrisco #1 & #2 are less than half a mile east of this site and could potentially be impacted by it. Methane monitoring has not been done on this site but could potentially be a problem.

CITY RIVER LANDFILL

Location: This landfill was located on the east side of the Rio Grande River actually along the river bank. The smaller south portion of the landfill is west of Woodward Rd (off 2nd St SW) underneath the power lines between the river and the flood dike. The main portion is about 1/4 mile north of this area and is much larger.

Background: The City River landfill was operated by the City of Albuquerque in the 1920's, 1930's and 1940's. If you walk the site you see a lot of exposed waste mainly in the form of glass bottles and broken glass. It appears that the waste was dumped or pushed with equipment to the
edge of the tree lined bosque area which during high water would be the edge of the river. It must be assumed that a lot of the original waste has been washed on downstream. Depth of the waste is believed to be about 15 feet. Obviously at the time, this location seemed a prime location for waste disposal. Just let the river wash it all downstream was probably the philosophy. Unfortunately, we now know that was a very poor location for a landfill since any contaminants would go directly into the Rio Grande River.

**GPS:** The City River landfill was walked to observe the waste boundaries but the GPS was unavailable for use at the time. Waste boundaries were very defined as it appeared the waste had been pushed up to the bosque tree line in the dumping areas. I assisted Gloria Cruz in drawing in this site (actually two sites) using the AGIS aerial photo.

**Hydrogeology:** The City River landfill is on top of recent valley alluvium sand deposited by the Rio Grande River. This is underlain by the basin fill from the river. The water table is immediately beneath the waste material anywhere from 5 to 15 feet bgs.

**Ground Water Monitoring:** The City River Landfill has five monitor wells, all on the east side of the site. They are between the landfill and the irrigation canal. No contaminants have been detected so far in any of these wells.

**Potential for Contamination:** It is obvious the City River landfill has major potential for contamination since the waste is actually next or in the water table at all times. A point to remember though is that with over 30 years of water running underneath and at times over this waste, most of any contaminants that would have been found have probably washed away downstream.
CORONADO LANDFILL

Location: The Coronado landfill is believed to be located west and south of the current Philips Semiconductors complex (formerly called Signetics) and may extend north across San Diego Ave. It is east of San Mateo Blvd. and north of Modesto Ave. Aerial photos seem to indicate that it was actually three separate fairly large arroyos that were used as disposal sites.

Background: The Coronado landfill was used between 1963 and 1966 by the City of Albuquerque for residential and commercial waste disposal. It got its name from the fact that it was just across the interstate from the Coronado airport. In reviewing old aerial photos it appears the original site was L-shaped with the top of the L north of San Diego and just east of San Mateo Blvd and the bottom of the L extending from San Mateo east along Modesto Ave. almost to the frontage road. Aerial photos seem to indicate that waste disposal began in the southern most arroyo and worked its way north to the other two arroyos. It is believed from the soil borings done by Fox Consultants (1980) for Philips that the first two old arroyos traversed the Philips site in an east-west direction (one on the north side and one on the south side) and that these were filled in with trash. All waste directly underneath the Philips plant was excavated when Signetics (Philips) built the original building in 1980. Depth of waste in this section was shown to have been 30-35 feet bgs and was described as typical household material. According to the Energy Resources Co. Report (1981) approximately 77,500 tons of waste were removed for the building excavation and from under San Mateo Blvd and hauled to the Los Angeles landfill. Depth of waste in the northwest section of the Philips property was around 20-30 feet. The Philips property is bounded on both the north and south by AMAFCA concrete lined flood control channels.
During my GPS data collection in the area north of San Diego, I observed numerous holes approximately 10-15 feet deep excavated by backhoe. There did appear to be several thin (less than a foot thick) layers of waste showing in these holes, indicating this area must also have been used for disposal. Aerial photos from 1966 seem to confirm this. It is very questionable as to how much and how deep the waste is in this area but it is probably deeper than 15 feet bgs. The aerial photos from 1966 show this northern section was another arroyo that appears to have been filled in with waste.

**GPS:** After reviewing aerial photos and the Fox Consultant soil boring report as well as some backhoe excavation holes, the decision was made to divide the GPS mapping of Coronado landfill into three areas. Area 1 was the arroyo on the southern portion of the current Philips property. Area 2 is on the northwest portion of the Philips property. Area 3 is on the property north of San Diego Rd. Coronado was plotted with the GPS on 6/11/97 from 3 - 5 PM. PDOP = 2.6 - 3.4 and SV = 6/7.

**Hydrogeology:** There are three different formations beneath Coronado landfill. The upper 65 feet consist of alluvial fan type sand and gravel. Below this lies a more permeable material containing 50% gravel and 50% silts and is part of the Edith Formation (20-50 feet thick). Below the Edith is the Upper Buff Formation containing alluvial clays and silts. This extends about 55 feet until the water table is reached at about 200-240 feet bgs (Energy Resources, 1981).

**Ground Water Monitoring:** There are four ground water monitor wells drilled by Philips in 1988 and three wells drilled by the City of Albuquerque for the Coronado landfill site. Depth to ground water is around 200 to 240 feet bgs. Levels of PCE have been found in most of the monitor wells. Ground water flow seems to be south-southeast except at the east side of the Philips property.
where it seems to turn due east.

**Potential for Contamination:** The Coronado (Philips) site already has some contamination in the form of PCE. Recent sampling indicates that the PCE levels are falling. This site is being closely monitored by the New Mexico ED. The nearest city well is about 6500 feet to the southeast of the site and potential contamination here is a major concern. If PCE levels are falling does that mean it is actually dissipating or is the plume simply moving off the site. This site also poses a dilemma in that it is not clear if the contamination is coming from the landfill or the Philips plant. Philips put in subsurface methane venting wells around the building to prevent methane gas buildup. These are monitored routinely but no levels above LEL have been noted recently.

**CRAWFORD LANDFILL (Dead Mans Curve)**

**Location:** This landfill is located between Carnue and Deadman's Curve in Tijeras Canyon off old Hwy 66. It is on the north side of I-40 and directly north of Tijeras Creek.

**Background:** Crawford Landfill covers about 5.2 acres. The landfill was operated by Thomas Crawford from 1983-1985. The property was leased from James Musser and Ester Key. The site reportedly received only c&d waste. The site was unsupervised and unfenced until late 1984 when a fence was erected. This SWL did not have a protective liner. Tijeras Creek was rechanneled to the south around the site so the old meander loop could be filled with c&d waste. Waste depth is at least 27 feet bgs. There is still a lot of exposed c&d waste on the south slope of this site. During the operation of this SWL depth to ground water was less than 20 feet (Doremus, 1988). Prior to being used as a landfill, the northern part of the property (adjacent to Hwy 66) was used as a gasoline station and an auto storage yard from 1965-1968. Sandia Die & Cartridge, a small arms
manufacturing facility, was located north across Hwy 66 from the SWL. The site was investigated as a Superfund site due to contamination in some domestic wells in the area.

**GPS:** The Crawford landfill was plotted with the GPS on 4/4/97 from 2:15 - 3 PM. PDOP = 2.5 and $SV = 6/6$. The locations of the waste boundaries were provided on site by Baird Swanson of the ED.

**Hydrogeology:** The Crawford landfill is located within Tijeras Canyon which forms the geographic boundary between the Sandia Mountains to the north and the Manzano Mountains to the south. Tijeras Creek runs through the canyon and runs due south and adjacent to the landfill site. Tijeras Canyon is cut into Precambrian igneous and metamorphic rocks. Quaternary alluvial sediments overlay Precambrian bedrock along the floor and side slopes of the canyon. Alluvial sediments at the SWL consist of fine to coarse sands and gravels. The Precambrian Cibola Gneiss, a medium grained granitic gneiss, forms the bedrock in the vicinity of the site. Both the alluvium and Precambrian rocks are hydrogeologically connected and serve as aquifers in this area. Aquifer flow in this area is south down the slopes toward Tijeras Creek and then west when it hits the creek at the canyon floor. (Doremus, 1988).

**Ground Water Monitoring:** There were five monitor wells installed by the ED as well as two private wells that were have been used as monitor wells for the Crawford landfill site. Investigations by the ED (EID) in 1987 and 1988 documented moderate to high levels of gasoline constituents, explosives and solvents in the ground water.

**Potential for Contamination:** All domestic wells in the immediate vicinity of Crawford landfill were either abandoned or recommended for discontinued use because of contamination. With this SWL basically right in the water table (within 20 feet) any contaminants are going to quickly
become a part of the ground water. It appears that some and possibly all of the contaminants may have come from other sources than the SWL.

**LOS ANGELES LANDFILL:**

**Location:** Los Angeles landfill is generally located two miles east of the Rio Grande River and one mile west of I-25, between Alameda Blvd on the north and Paseo del Norte Blvd. on the south. The actual west boundary is the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), the south boundary is the Domingo Baca Channel, and the east boundary is commercial/industrial properties and the north is Alameda Blvd. The Alameda Cemetery is located near the northwest corner of the site. (Earp, 1992).

**Background:** The 77 acre Los Angeles landfill was previously a commercial sand & gravel quarry excavated to a depth of about 50 feet and operated by Springer Corporation. The City of Albuquerque purchased the site and operated it as a landfill between June, 1978 and 1983. It was the only city landfill operated during that time and does not have a protective liner. The northern 42 acres were filled first. Waste depth varies from less than 25 feet to up to 47 feet. There is from one to 11 feet of native cover material over the waste. The SWL received residential, commercial and c&d waste. The site was fenced, but there was no official waste screening plan implemented to keep hazardous materials out of the landfill. Methane gas migration to the east has been documented at this site. Currently (June & July of 1997) a methane gas extraction system is being constructed by International Technologies Corp. via a contract with the City. It will consist of 22 methane wells along the east boundary which will capture the methane gas and vent it off via a flare before it reaches the commercial businesses to the east. Success of this project still remains to
be seen. The name Los Angeles came from the fact that the road now known as Paseo del Norte south of the site used to be called Los Angeles Ave.

**GPS:** AEHD personnel ran a GPS on the Los Angeles landfill prior to this project so the data was already available in the AGIS.

**Hydrogeology:** The Los Angeles landfill is located over a thick sequence of unconsolidated terrace deposits and interbedded floodplain and alluvial fan of Quaternary sediments. Sand and gravel deposits are extensive. Silt and clay beds are generally thin and discontinuous. The valley fill alluvium is underlain by the basin fill deposits of the Santa Fe Group. Depth to groundwater presently varies from 97 feet in the northwest corner to 128 feet in the southeast corner. With waste buried 47 feet deep the separation between waste and the water table is less than 50 feet. The horizontal hydraulic gradient (aquifer flow direction) is .004 to the south-southeast. The vertical gradient is .02 down (Earp, 1992).

**Ground Water Monitoring:** Currently there are fifteen ground water monitor wells dedicated specifically for the Los Angeles landfill. Three initial wells were installed in 1985. See Appendix D for well locations. Water levels have shown a decline of about one foot per year since installation. Elevated concentrations of total dissolved solids, sulfate, nitrate, manganese and other inorganic constituents as well as several halogenated volatile organic compounds have been found in sampling from the wells. Trichloroethene (TCE) is one of the organics found in wells 3, 4, 6 and 8 along the south and southeast portion of the site. Area and depth of ground water affected has increased over the monitoring period.

**Potential for Contamination:** It appears that Los Angeles landfill has contributed to the contamination of the ground water under it. In addition the methane gas from the site has migrated
off site causing concern over potential combustion in nearby businesses. Measured nitrate concentrations have exceeded applicable state ground water standards and measured TCE have exceeded maximum federal contaminant levels for drinking water supplies although the levels are below state ground water standards. Recommendations by Fox Consultants (1983) in the closure plan were to final grade the site on a 2% slope and seed it to minimize erosion, ponding and surface water infiltration. This was never completed and as a result there is ponding and surface water run on onto the site. This may have contributed to the leaching of any contaminants into the ground water.

**NAZARETH LANDFILL**

**Location:** This SWL was located north of San Diego Ave. and Honeywell (formerly Sperry Corp.), due west of the Sumitomo plant and east of the current Balloon Fiesta site.

**Background:** The Nazareth landfill was operated by the City of Albuquerque as a landfill for residential and commercial waste between 1971 and 1972. It received its name from the Nazareth Hospital located west of the site. It is believed to have been about 8 acres in size with waste depth up to thirty feet. This site had no protective liner. Some older investigative location drawings show the site to be farther west than what appears on aerial photos and what is observed on site. I used the aerial photos and on site observations to determine waste boundaries. The site is currently vacant property, although the western extent may lie underneath a recreational hook-up site for the balloon fiesta park.

**GPS:** The Nazareth landfill was plotted using the GPS on 5/29/97 from 3:30 - 4 PM. PDOP = 2.7 and SV = 6/7. During the site investigation while GPS mapping, a fairly defined waste boundary
on the north and east part of the site was noted and used but the southern and western boundaries were not well defined had to be estimated from old aerial photos in the file.

**Hydrogeology:** The geology of the Nazareth landfill is in general the same as that for the Coronado Landfill. It is made up of alluvial fan sand and gravel for the first 65 or so feet. Under this lies the Edith Formation made up of 50% gravel and 50% silts and then the silts and clays of the Upper Buff Formation. Depth to ground water is 140 feet bgs.

**Ground Water Monitoring:** This site currently has one monitor well located southwest of the site. It currently appears this well is off gradient to the site. In the future another well may be located due south (more downgradient) of the site.

**Potential for Contamination:** The Nazareth landfill appears to be upgradient of the Coronado Landfill and could potentially be a contributor to any contamination picked up at that site. Further monitor well placements should determine the extent of any contamination.

**NINE MILE HILL LANDFILL**

**Location:** This SWL is located at the top of what is known as nine-mile hill going west out of Albuquerque. It is north of I-40 and east of Paseo de Volcan Rd. Take Exit #149 off I-40 west and then take the first road to the right (adjacent to and parallels the north side of I-40) which leads to the locked gate to the site. It is plainly visible from I-40 as it is only about 100 yards north of it as you approach the top of nine-mile hill.

**Background:** The Nine Mile Hill landfill was operated by Bernalillo County from 1962 to 1978. It got its name from the fact that it is located at the top of what is known as “nine mile hill” since it is
approximately nine miles from downtown Albuquerque. It received residential and commercial waste from county residents outside the Albuquerque city limits and did not have a protective liner. Depth of waste appears to range from several feet to about 40 feet. In checking with Bernalillo County Environmental Health there is very little written documentation or records in the files for this SWL. The SWL appears to be a large area fill divided into two sections. A very large section on the west end toward the top of the mesa and a smaller section to the east of that. The smaller eastern section not only contains solid waste but was also the location for the disposal of petroleum contaminated soils prior to the opening of Cerro Colorado. The SWL was used for a short while in the late 1980's solely for the purpose of disposal of petroleum contaminated soils. The SWL is readily observed directly to the north of I-40 as you approach the top of nine mile hill. The remains of the dilapidated scalehouse are still visible as is the entrance gate.

**GPS:** The Nine Mile Hill landfill was plotted with the GPS on 3/14/97 from 10 - 11 AM. PDOP = 2.3 - 3.2 and SV = 6/8. Most boundaries were fairly obvious because of fill height or exposed waste material. Plotted road leading to entrance of SWL.

**Hydrogeology:** There were no site specific reports on the Nine Mile Hill landfill but it is in the same general hydrogeologic area as Cerro Colorado landfill. Surface soil and bedrock exposures are comprised of alluvium and Upper Santa Fe Group bedrock, respectively. The alluvium is composed of mostly of silty fine sand and gravelly sand, and is fairly shallow. The Santa Fe Group is composed of lightly cemented sands, silty sands and occasional thin layers of sandy clay. The Santa Fe Group was deposited as a basin fill into the developing Rio Grande rift. Sediments are alternating to thinly interbedded mixtures of sand, silty sand, gravels, silty clays and sandy clays. Fault maps show that a fault lies right in the SWL as it has been named the County Dump fault.
Ground water depth is probably more than 600 feet.

**Ground Water Monitoring:** To date the Nine Mile Hill landfill has no monitor wells. BCEH indicated that some monitor wells will probably be installed in the near future.

**Potential for Contamination:** Because of the fault that runs through the Nine Mile Hill landfill site there is definite potential for contamination of ground water. The SWL has some ponding problems in that there is a large pit due west of the smaller waste cell which collects much of the runoff from the large waste cell and infiltrates into the base of the small waste cell allowing for potential leachate generation. Waste is becoming exposed on the side slopes of the large cell due to erosion and allowing for surface water contamination. Ground water monitor wells at this SWL are highly recommended.

**RIVERSIDE CONSTRUCTION LANDFILL**

**Location:** This site is generally located west of South Coors Rd and north of Blake Rd. It is approximately three miles west of the Rio Grande River. It is due north of the closed Seay Brothers landfill. Riverside Mobile Home Park is next to the site.

**Background:** Riverside was registered as a private construction and demolition (c&d) landfill in June of 1987 and was operated by Riverside Construction. The site was started as a sand and gravel operation in 1972. Riverside Construction is owned by Mr. George Sena. It was closed in October of 1992. It covers about two acres and waste is as deep as forty feet. Past inspections by ED indicated that on occasion there were fires at the landfill. There is also a documented incident by ED-SWB of an equipment operator becoming ill on site while pushing a load of waste. The exact cause of the illness was never determined and no evidence of any large quantities of
hazardous materials were ever found. This SWL had no protective liner. Riverside Mobile Home Park has recently been built just to the southeast of the landfill site and may in the future be expanded over the site.

**GPS:** Due to the location of mobile homes now on site, it was decided to use 1995 AGIS aerial photos to locate the waste boundary for Riverside landfill, so an actual GPS was not run. Waste location was determined by recollection during actual site inspections when the landfill was in use and closure plan information. I assisted Gloria Cruz in plotting this site on the AGIS aerial photo.

**Hydrogeology:** The Riverside landfill is within the Quaternary Terrace gravels and alluvial deposits consisting of alternating beds of sand, clay and gravel; overlying the Tertiary, Upper Santa Fe Group. Depth to water from the bottom of the waste trench is around 35 to 40 feet. Regional ground water flow in this area is to the southwest but contoured well data in the area showed flow being split to the northwest and southeast.

**Ground water monitoring:** Because of the small size and type of waste disposed of by Riverside landfill the ED allowed the owners to use the north monitor well on the Seay Brothers site as the down gradient well for Riverside. To date this is the only monitor well for this site and no contaminants have been noted in the Seay Brothers north well. It is possible that this is not really a downgradient well for this SWL.

**Potential for contamination:** With the water table only 35 to 40 feet from the bottom of the waste trench and the geology being made up of mostly sand and gravel, there is potential for fairly rapid leaching of any contaminants into the ground water at Riverside landfill. In general, c&d waste material should not contain any large quantities of contaminants. Inspections of the facility indicated that waste loads were not routinely inspected prior to disposal, so it would be possible for
contaminants to have been in the waste material. This is a fairly small site (2 acres) so the potential is fairly low that any major contaminants would be located at this site. The possible location of another properly located down gradient monitor well might be advisable at this site. Methane production did not seem to be a problem at this site. All methane samples were well below any explosive levels. With mobile homes currently being placed near the SWL, methane monitoring should routinely be done by the property owner to insure safety.

**RUSS PITNEY LANDFILL**

**Location:** This site is located south of Tramway Rd and east of Coronado Airport on the north side of Albuquerque.

**Background:** Russ Pitney landfill was a c&d landfill operated by Russ Pitney, a private contractor, between 1974 and 1984. The site is only about 2 acres. There is very little information on this site. Visual inspections in the early 1990's indicated that mostly clean fill dirt was disposed of at this site, at least in the latter stages. Depth of waste is unknown but estimated to be about 20 feet. Since the SWL was closed before 1989 it was not required to submit a closure plan or provide post-closure care.

**GPS:** The Russ Pitney site was plotted with the GPS on 2/15/97 from 2:15 - 2:30 PM. PDOP = 2.1. SV = 7/8.

**Hydrogeology:** There was no site specific geology for the Russ Pitney site. This area appears to contain alluvial fan material underlain by the Santa Fe Group. Depth to ground water in this area is probably more than 400 feet. Ground water flow will probably be to the south due to the influence of the city water supply wells located south of the site.
**Ground water monitoring:** Since the Russ Pitney site was closed before 1989 it was not required to have any ground water monitor wells.

**Potential for contamination:** Since the Russ Pitney site is small and appeared to have only c&d waste with a lot of that possibly clean fill, the potential for ground water contamination is probably minimal.

**SACRAMENTO LANDFILL**

**Location:** The Sacramento site is located at the northeast intersection of Paseo del Norte Blvd and Interstate 25. It is bounded on the north by Holly Ave.

**Background:** The Sacramento landfill was operated during the year of 1962 by the City of Albuquerque as a landfill accepting residential and commercial waste. It had no protective liner. The site was a former borrow pit around 25 feet deep and covered about 5 acres in size.

Maximum waste depth and thickness noted in Agra Environmental soil borings was 26 feet bgs (Terracon, 1995). Waste is deepest on the western 2/3 of the site. The SWL surface drains to the west through a drainage culvert (on the west central portion of the property) that runs under I-25. This drains into the Arroyo de Domingo Baca drainage channel which in turn drains into the Northern Diversion Channel and then into the Rio Grande River. There is currently a vacant warehouse building on the east side of the property constructed in 1980. The SWL site is currently vacant land.

**GPS:** Sacramento landfill was plotted with the GPS on 2/15/97 from 1:45 - 2:05 PM. PDOP = 2.4 - 2.6. SV = 6/6. Used waste location data from the Terracon Environmental report (Terracon, 1995).
**Hydrogeology:** The Sacramento landfill is in the alluvial sediments of the Rio Grande. These terrace deposits consist of medium to fine grain sand. This is underlain by a thick sequence of river sediments that grade from fine grain sand to gravel and boulders. Ground water is probably between 250 and 300 feet deep. These sediments are loosely consolidated and are extremely porous and permeable. Because of the influence of the two city production wells close by, the flow direction is probably east to southeast.

**Ground Water Monitoring:** To date the Sacramento landfill has no monitor wells. The nearest municipal wells are the Albuquerque Coronado well #1 about .5 mile east-southeast of the site and Coronado #2 about .5 mile southeast. There is a private well about 1000 feet west of the site at the Coronado Village Trailer Park.

**Potential for Contamination:** Results of the EPA soil sampling for the Sacramento landfill showed soils have been impacted by low levels of lead, pesticides and PCB's. Low levels of lead were found in the well samples from the Coronado Village Trailer Park (4.1 and 3.6 ug/l) and at the Coronado municipal well #1 (5.6 ug/l). These values are well below the EPA drinking water action level standard of .015 mg/l or 15 ug/l. Subsurface sampling by Agra indicated that subsurface soils have been impacted by the VOC acetone; the pesticides methoxychlor, 4,4DDE, Dieldrin and Chlordane and PCB’s. Even though contaminant levels were below any regulatory levels, there is certainly a possibility this site may be a source of contamination to surface and ground water. No lead levels were found in soil samples taken in the drainage ditch west across I-25 from the site. The Coronado #1 city well is about .5 mile east southeast of the SWL and the Coronado #2 is about .5 mile southeast of the SWL. The Coronado #2 is probably the most
downgradient well and should be closely watched for contamination. Recent construction due south across Paseo del Norte from the SWL has uncovered a large amount of buried municipal and c&d type waste. This site also has several low subsidence areas that pond water. These should be filled in to prevent ponding and potential leachate generation.

In June of 1981 Region VI of the EPA received a “Notification of hazardous Waste” form from the City of Albuquerque for the Sacramento SWL. A Preliminary Assessment was conducted in July of 1983. At that time EPA determined that no further response action was needed. Subsequently in February of 1991, EPA reopened the site to conduct a Site Inspection which was completed by Fluor Daniels in August of 1993. At that time EPA’s Final Strategy Determination was “No action needed” and it is listed under CERCLA as an inactive site.

SAN ANTONIO LANDFILL

Location: This site is generally located east of I-25, just south of San Antonio Blvd., west of Louisiana Blvd. and north of Bear Canyon Arroyo. It is about one mile due south of the Sacramento Landfill.

Background: The San Antonio landfill was operated by the City of Albuquerque between 1968 and 1970. During construction of San Antonio Blvd in the early 1990's to four lanes, the portion over the old SWL was compacted with heavy weight instead of being excavated. It will be interesting to see if any major subsidence occurs over time in this area. Construction of the Cracker Barrel Restaurant at the west end of the site in 1995 required excavation of waste under the building and part of the parking lot on the south side. Observations during this excavation
showed it to be a mixture of residential and c&d waste. It was hauled to the Sandoval County landfill. Depth of waste is estimated to be 10-20 feet bgs.

GPS: The San Antonio landfill was plotted with GPS on 3/8/97 from 12:15 - 1:00 PM. PDOP = 2.4 and SV = 6/8.

Hydrogeology: There are no specific site hydrogeologic reports for the San Antonio landfill. It should be very similar to the Sacramento landfill. It is alluvial fill from the Rio Grande consisting of medium to fine grain sands underlain by a thick sequence of river sediments that grade from fine grain sand to coarse gravel and boulders. Depth to ground water runs from 300 feet bgs at the west well to 350 feet at the east well. Regional flow direction is believed to be east-southeast.

Ground Water Monitoring: The City of Albuquerque has installed two monitor wells in 1997 at the San Antonio site. Both wells are located on the south boundary of the SWL. To date no contaminants have been detected in these wells. The closest downgradient city well is Leyendecker #3 about 1.5 miles south although Coronado #2 is just over .5 mile to the northeast upgradient.

Potential for Contamination: The San Antonio landfill has potential for contamination but with ground water being at least 280 feet below the waste it will take some time to leach down even with the permeable soils. The surface of the SWL drains fairly well and should not be allowing much infiltration of water into the existing waste except maybe at the far east end near Louisiana. It is believed that this portion of the SWL has a very minimal amount of waste. No contaminants have been detected in monitor wells to date.
SEAY BROTHERS LANDFILL

Location: This site is generally located west of South Coors Rd and north of Blake Rd (see AGIS map). It is approximately three miles west of the Rio Grande River. This site is due south of the closed Riverside Construction landfill, another c&d landfill.

Background: Seay Brothers landfill was registered with the ED in September of 1983 as a private construction and demolition landfill operated by Seay Brothers solely for the disposal of waste from Seay Brothers contracts. It was closed in March of 1995. Waste was placed in the excavation left from the sand and gravel operation and is roughly 20 to 30 feet deep. The SWL covers roughly about 7-10 acres. The waste is located on approximately the southern two thirds of the property. It had no protective liner. Current usage on the northern portion of the property is for individual storage units (Valley Vista Storage). These are located just north of the northern edge of the waste disposal area. The actual waste disposal area is currently undeveloped.

GPS: I was unable to actually run the GPS at Seay Brothers landfill as I was unable to contact the property owner to get permission to enter the property. Waste locations were established using closure plan information, direct knowledge from earlier site visits when the landfill was in operation and aerial photos. I assisted Gloria Cruz in drawing the site in on the AGIS aerial photo.

Hydrogeology: Soil borings done in 1987 to a depth of 30 feet indicate medium to fine grain sands and gravel interspersed with some clay layers at the Seay Brothers site. It is within Quaternary Terrace gravels and alluvial deposits overlying the Tertiary, Upper Santa Fe Group. Ground water flow is in a southwest direction. During the soil borings in 1987, water was hit at the 29 foot depth. There seems to be quite a difference (40 to 50 feet) between the water depth in 1987 and that seen in 1990 (75-90 feet) when the wells were drilled. This issue may need to be
researched further. Waste depths probably average about 20 to 30 feet and separation of waste from ground water is around 50 to 60 feet.

**Ground water monitoring:** The Seay Brothers landfill has three ground water monitor wells located north, west and south of the site. Depths to ground water are 74, 90 and 80 feet respectively. The north well is used as an upgradient well for the site as well as a down gradient well for the Riverside landfill located due north of it. The water table in this area is very shallow, but to date no contaminants have been found in the ground water sampling analysis.

**Potential for contamination:** With the water table only 50 to 60 feet from the waste material and the geological layer being made up of fairly permeable sand and gravel there is potential for contamination of ground water at the Seay Brothers site. In general, c&d waste material should not contain any hazardous or toxic materials, but unless each load is screened 100% there is always the possibility of hazardous materials being disposed of. To date, the ground water sampling has not shown evidence of any contaminants which is a good sign. Monitoring must continue to detect any contaminants that might leach into the ground water. To date methane production has not been seen to be a problem at this site.

**SOUTH BROADWAY (MESA DEL SOL) LANDFILL**

**Location:** This SWL is generally located about 8 miles south of the intersection of I-25 and I-40. It is on the east side of I-25 about two miles south of the Rio Bravo exit off I-25. The old entrance is just south of Los Picos Rd as it crosses east over I-25.

**Background:** The total property area for the South Broadway site is about 700 acres but the actual landfill waste boundaries cover about 150 acres. The property is currently owned by the
New Mexico State Land Office. Beside being used as a landfill other areas of this property were previously used as experimental sludge application areas. There are actually two separate landfill sites on the property. The northern site was called the South Broadway landfill and the southern site the Mesa del Sol landfill. Currently for closure purposes both sites have been combined as one and are called the South Broadway landfill. In 1963 the City of Albuquerque leased the property from the State Land Office and began dumping at the eastern and upper portion of the original South Broadway site and moved in a slightly northeast direction across the area until 1968 when the lease expired. The lease was again renewed by the city between 1972 and 1977. In 1978 Bernalillo County began using the lower northeast section (called the county hole) of the site. The county dumped there until around 1982. In 1982 the City moved back (from the Los Angeles landfill) and began disposing in the separate Mesa del Sol (south portion) area of the site which was also on State Land. It was also at this time that Bernalillo County quit operating at the SWL. From February of 1989 until about September of 1989 approximately 293,000 cubic yards of waste were disposed of by the city in the old county hole in the northern site to finish filling in the existing depression left by the county in 1982. The City used Mesa del Sol until May of 1990 when the entire SWL was closed down and the City moved to Cerro Colorado landfill. None of the sections of the South Broadway SWL had a protective liner. Waste depth was up to 40 feet bgs in some areas.

GPS: The South Broadway site was plotted with the GPS on 3/22/97. North section was plotted from 9:25 - 10:30 AM with PDOP = 2.4 and SV = 6/8. PDOP went above 4 at 10:30 AM so waited until 11:10 AM to plot the south section. PDOP = 2.7 and SV = 6/8. Finished south section at 11:35 AM. Also plotted all ground water monitor wells and the entrance road; finished at 12:30 AM.
PM. Tim Callahan of the State Land Office gave valuable on-site guidance as to the waste boundary perimeters.

**Hydrogeology:** The South Broadway landfill is located on the broad alluvial slope between the Manzano Mountains approximately 10 miles to the east and the Rio Grande River about 2.5 miles to the west. The Santa Fe Group underlies this SWL. It consists of poorly consolidated coarse sediments (sand and gravel) with lesser amounts of fines (silts and clays). What is interesting is that in 1960 the horizontal hydraulic gradient was said to have been .0017 to the southwest (Scanlon & Associates, 1989). Scanlon said in a verbal conversation with AEHD in November, 1988 that the gradient had reversed to north-northwest. Current monitor well information indicates that it is in a northeast direction. It is believed that withdrawals from municipal supply wells northeast of the site have caused this flow direction change. Seventeen methane monitor wells were installed in 1992.

**Ground Water Monitoring:** In 1989 the first four monitor wells for South Broadway were drilled. In 1991 four additional monitor wells were installed. Depth to ground water varies from 254 feet bgs to 437 feet depending on well elevation. Approximate distance from the bottom of the waste to ground water is about 320 feet. Wells are sampled annually and to date no hazardous contaminants above ground water standard levels have been detected.

**Potential for Contamination:** Because of the amount of waste in the South Broadway landfill and the extended period of use (1960's to 1990) there is a slight potential for contamination of ground water in the years ahead. Depth to water is over 300 feet and generally the site has been graded and contoured to avoid ponding problems. It is interesting to note that some ponding does occur on the east side of the Mesa del Sol site which is where methane readings are the highest. This area may need to be graded to address this ponding problem. Unless there are some unknown
rapid migration pathways to ground water under the site, it will probably take many years before any contamination may be detected, if at all.

SOUTH EUBANK LANDFILL:

Location: This SWL is generally located at the south end of Eubank Blvd., north as well as west of Tijeras Arroyo, east of Sandia Laboratories, and south of Shaw Mobile Home park and south of the PNM generating station at the end of Eubank.

Background: The South Eubank landfill actually has two area sections as was seen with the South Broadway landfill. The first or northern section was operated between 1963 and 1973 by the City of Albuquerque on property leased from and owned by the State Land Office. The entire leased plot was about 40 acres but only about half of that was actually used as a landfill. This 40 acre plot was due south of the Shaw Mobile Home Park. It had no protective liner and received residential and commercial waste from the City of Albuquerque. GTE opened a telecommunications plant in Albuquerque in 1972 and operated it until 1986 (when it was sold to Siemens) and was operating during a portion of the time the SWL was open. Interviews by the ED-Ground Water Bureau with undocumented sources indicated that numerous chemical drums from the GTE (Siemens) manufacturing plant were dumped in this SWL. It was unclear as to which section it was dumped in or whether it was both sections of the SWL. TCE contamination and other VOC's have been found at the GTE/Siemens site. The toe of the waste slope from the South Eubank landfill was placed all the way into the bottom of Tijeras Arroyo on the east and south side. In 1968, Shaw Mobile Home, Inc. leased 5 acres on the northern portion of the site away from the fill area on which a septic tank and sewage lagoon were installed. When the City's
lease expired in 1973, Reco Corp. leased the site for trailer park predevelopment, drainage and sewer services until 1984. During this lease there were complaints that waste was continuing to be dumped by private haulers and sewer lines as well as the sewage lagoons were leaking. Eventually the mobile home park was connected to City sewer services and the sewage lagoons were drained. Surface runoff from Shaw Mobile Home Park continues to flow across the west side of the site and has contributed to erosion of the bank on the southwest corner. This SWL was never properly closed to prevent surface ponding of water and as a result has numerous areas of depression that continue to collect water which serves as a leachate source. This portion of the SWL also has quite a bit of exposed waste on the surface as well as the south and east slopes. Most of it is c&d type waste. Depth of waste in this section is unknown but is believed to be around 30-40 feet bgs. It was observed in 1994 that heavy flows in Tijeras Arroyo were beginning to uncover a section of buried waste along the west bank of the arroyo (east side of the SWL) and were washing it downstream. In 1996 a soil cement stabilization project was completed by Leedshill-Herkenhoff, Inc. and Pioneer Industries on the east and southeast portion of the SWL along the arroyo to keep the waste from washing away (CH2M Hill, 1996).

The second or southern section of the South Eubank landfill was located due southwest of the first section. This property was leased by the City of Albuquerque for use as a sanitary landfill in 1974 from the Cathedral Church of St. John and Margaret Glasebrook who were the property owners. The lease agreement extended until July 31, 1986 but according to records this portion of the SWL was only used for waste disposal from the City between 1974 and 1984. It was located south of the PNM generator station, and was bounded on the south and east by Tijeras Arroyo.
Maximum depth of waste in this section is around 36 to 40 feet bgs. This section had no protective liner. This section of the SWL was graded fairly well to prevent ponding but still has several areas of depression that collect water. It received residential and commercial waste.

**GPS:** The South Eubank landfill was plotted with the GPS on 4/17/97 from 3-4 PM. PDOP = 2.4 - 2.8. SV = 6/8. Aerial photos, interviews with Tim Callahan of the State Land Office and soil boring information were used to determine the approximate waste boundaries to use. The lower edge of Tijeras Arroyo was used as the waste boundary on the north section and the top edge of the arroyo was used as the boundary for the south section.

**Hydrogeology:** The South Eubank landfill is located on the broad alluvial slope between the Sandia/Manzano Mountains approximately 3 miles to the east and the Rio Grande River about 7.5 miles to the west. Alluvial fan deposits from the Sandia/Manzano mountains and the Santa Fe Group underlie this SWL. It consists of poorly consolidated coarse sediments (sand and gravel) with lesser amounts of fines (silts and clays). Soil borings by Agra Earth & Environmental (1994) in the southern section down to 40 feet showed fine to medium silty sand with some gravel. Depth to water in the south section is around 575 feet bgs, in the north section about 600 feet bgs.

Ground water flow is shown to be generally north to north-northwest in this area. This is most probably due to the proximity of six municipal water supply wells. Lomas wells # 1, #5 and #6 are located approximately 1-3/4 miles northeast of the SWL. Ridgecrest wells # 1, #2 and #3 are located approximately 2 miles to the west and slightly north (CH2M Hill, 1996).

**Ground Water Monitoring:** The South Eubank site currently has 4 ground water monitor wells. Depth to water averages 560-600 feet bgs. The first monitor well #1 was drilled in 1988 on the west side of the south section. Monitor wells #2,3 and 4 were drilled in the first quarter of 1997 by
AEHD and sampling results should be available very soon. Wells are sampled for inorganic, volatile and semi-volatile compounds on an annual basis.

**Potential for Contamination:** A preliminary soil gas survey was performed by CH2M Hill in January, 1996 on the northern section of the South Eubank site (CH2M Hill, 1996). The presence of TCE and tetrachloroethene (PCE) were detected in the survey, indicating that some media at or in the vicinity of the site is a source of these compounds. The specific source has yet to be determined. It must also be noted that levels of TCE have been detected in shallow ground water wells west of the site on Sandia National Labs and KAFB property. Methane gas was also detected in the soil gas survey, indicating the presence of some moisture within the waste. This could be a result of the combination of surface water ponding on site, surface water run-off from Shaw Mobile Home Park, seepage from the old septic lagoons, infiltration from Tijeras Arroyo and potential leakage from storm and sanitary sewer lines on site. Small amounts of 1,1,1-trichloroethane (TCA) have been found in monitor well #1. Levels are well below New Mexico ground water standards but are an indication that there is potential for contamination.

**SOUTH YALE LANDFILL**

**Location:** The main portion of this SWL was located on the west side of Albuquerque International Airport with University Blvd. as the approximate east boundary. The north boundary was several hundred yards south of Randolph Rd and the south boundary is just south of the west end of the main east-west runway at the airport. A smaller second section was located east of Yale Blvd., northwest of the terminal building and just south and east of the present Best Western hotel (the old AMFAC hotel).
**Background:** The South Yale landfill was operated by the City of Albuquerque between 1948 and 1965. It received residential and commercial waste and did not have a protective liner. It is about 1.7 miles east of the Rio Grande River. It was divided into two sections as noted in the **Location.** The smaller section covered about 20 acres and the larger section about 80 acres. The site contained scattered gravel pits prior to use as a SWL. Historically, at least three underground fires have occurred which burned for undetermined periods of time. It is believed these areas were flooded with water to extinguish them. These areas were located on the west-central portion of the SWL near University Blvd. Depth of fill in the 80 acre area runs from 4.5 feet to 23 feet. It is unclear how much, if any, waste was removed for the construction of the original airport terminal entrance road, the old AMFAC parking lot to the south and east and the western portion of the airport parking lot. It is believed that these areas all still have some if not most of the original waste under them. Exploration holes showed waste in this area to be around 10 feet deep (Fox consultants, 1986). In about 1988 approximately 400,000 cubic yards of waste were removed for construction of the new Post Office complex which was located on the east portion of the SWL. This waste was hauled to Southwest landfill. From the end of 1995 until the beginning of 1997 approximately 285,000 tons of waste were removed from this SWL for completion of the new Sunport Blvd terminal access off I-25. Phase I (the major phase) contractor for this project was Albuquerque Underground and Phase II contractor was Twin Mountain Contractors. Chava Trucking did most of the hauling. During this project both George Rd (formerly Viewpoint Rd) and a portion of University Blvd were relocated and all waste removed from underneath them. All waste was hauled to Cerro Colorado Landfill. The site has been fairly well graded so no major ponding of water occurs.
**GPS:** The boundaries for the large section of the South Yale site were walked using the GPS. The smaller section was located using the AGIS aerial photo in conjunction with the Fox Consultants Report (1986). The large section was plotted with the GPS on 5/24/97 from 12:15 - 1:15 PM. PDOP = 2.6. SV = 6/7. When comparing old aerial photos (specifically road locations) of this SWL to photos taken since 1995, it must be remembered that the locations for George Rd. and University Blvd. were rerouted quite a bit during the Sunport Blvd. construction project.

**Hydrogeology:** The South Yale site is located at the western edge of the broad alluvial slope or east mesa between the Manzano Mountains approximately 10 miles to the east and the Rio Grande River about 1.5 miles to the west. The Rio Grande valley floor is adjacent to the east mesa and the two features are separated by a bluff which was formed by a higher level of an ancestral Rio Grande. It is the bluff area where the SWL is located. The alluvial fan deposits and river terrace deposits in this area are underlain by the Santa Fe Group. It consists of poorly consolidated coarse sediments (sand and gravel) with lesser amounts of fines (sилts and clays). Depth to ground water in the SWL varies from 186 feet bgs to 423 feet bgs depending on well location (elevation). The Miles #1 supply well is located about one hundred yards northwest of the SWL. Ground water flow direction as measured in 1983 (Fox, 1986) was to the north-northeast.

**Ground Water Monitoring:** The South Yale landfill currently has 8 monitor wells. Exact locations may be obtained from the AEHD. Wells are sampled semi-annually by AEHD. Some contaminants have been detected but all are below regulatory levels.

**Potential for Contamination:** Ground water sampling from the South Yale site has not shown any contaminants except for some small quantities (ppb) of PCE found in monitor well #4 and some 1,1 dichloroethane and 1,1 dichloroethylene in monitor well #5. Levels are below current New
Mexico Ground Water Standards but are an indication of potential contamination to watch. Because a lot of the waste has been removed for construction and the site slopes drain fairly rapidly, surface water infiltration is not a major problem at this site although in the past methane gas readings above LEL have been detected.

TIJERAS LANDFILL (Chamisoso Canyon)

**Location:** This site is located in the Cibola National Forest southeast of the village of Tijeras and the Sandia Mountain Ranger Station. It is about 1.5 miles east on Chamisoso Canyon Rd off Hwy 337 (old Hwy 14 south) and north of Chamisoso Canyon and Cedro Peak.

**Background:** The Cibola National Forest office was not able to provide any documentation on the Tijeras Canyon landfill. It is known to have been operated by Bernalillo County and aerial photos from 1974 appear to show it in use. ED records indicated that it closed in 1981. It covered about 10 acres total. It served as a disposal site for residential type waste from the east mountain area of Bernalillo County. Depth of waste is estimated to be about 10 to 20 feet. The surface of the site has revegetated fairly well and has very few erosion problems. Contact was made with the Cibola National Forest office but they were not able to find any documentation showing when the site had been used. They did remember it being used as a landfill but did not have much other information.

**GPS:** Tijeras Canyon landfill boundaries were fairly evident from topography and exposed waste. It was plotted with the GPS on 3/15/97 from 9:45 - 10:40 AM. PDOP = 2.3 - 2.6 and SV = 6/8. The road leading to the SWL was also plotted.

**Hydrogeology:** The Tijeras Canyon site is located on the east side of the Manzanita Mountains in the canyon area south of the town of Tijeras. Its elevation is about 6400 feet. It is in the vicinity of
the Tijeras fault zone and according to the geologic map by Myers (1976) the landfill is situated in a Quaternary alluvium area surrounded and underlain by the Pine Shadow Member of the Madera Limestone. The average thickness of the Madera Limestone is 200-360 feet. The Madera Limestone is the most significant aquifer east of the Sandia and Manzanita Mountains (American Ground Water Consultants, 1990). The Madera contains fractures, joints and solution cavities which can all act as conduits directly to ground water. Ground water flow direction is to the east in this area. Depth to ground water is unknown for this SWL but probably less than 100 feet.

**Potential for Contamination:** The Tijeras Canyon landfill has revegetated fairly well and is sloped to prevent any major ponding problems. This should minimize any leachate generated by the SWL. With the Madera Limestone formation under this SWL there is potential for quick contamination of ground water if any contaminated leachate hits a fracture or solution cavity. Because of the type waste (residential) reportedly disposed of, this SWL probably poses only a minor threat to ground water or surface water.

**W.W. COX LANDFILL**

**Location:** This site is located about \( \frac{1}{2} \) mile south of the frontage road off I-40 at the top of nine-mile hill. It is in the vicinity of the Cerro Colorado Landfill.

**Background:** There is not much information on the W.W. Cox site. It was registered as a construction and demolition landfill with the ED sometime in the mid 1980's. It was closed in 1989. The property size is about 10-15 acres but the waste disposal area is probably about half that (5-7 acres). This was a very small site and large amounts of waste were never noted being disposed of during routine inspections by ED. Depth of waste is probably less than 10 feet.
GPS: The perimeter fence (property) line was walked as the GPS points for the W.W.Cox site. The actual waste location probably only takes up half that area but there is no documentation as to exactly where burial trenches are located. It was plotted with the GPS on 4/18/97 from 10:30 - 10:45 AM.

PDOP = 3.8. SV = 6.8.

Hydrogeology: No site specific geological information has been done for the W.W.Cox site. It is in the same basic formation as Cerro Landfill and Nine Mile Hill Landfill. It is made up of the sand and gravel of the Santa Fe Group. Depth to ground water is probably around 600-700 feet.

Ground Water Monitoring: The W.W.Cox landfill has no monitor wells, nor are there any wells within ½ a mile. The closest wells are the two RV parks-one is north across I-40 and the other due east.

Potential for Contamination: Because only c&d waste went into this small landfill, and depth to ground water is over 600 feet there is minimal potential for ground water contamination at the W.W.Cox landfill site.

CONCLUSIONS
In an arid but fast growing metropolitan area like the City of Albuquerque including Bernalillo County, the need to plan for the future is critical, especially in the area of ground water use.

A very necessary tool to aid in current as well as future planning is the implementation of a GIS. Cities and counties going into the future without GIS programs are going to be lost in the area of planning. By using the SWL location data gathered by the GPS and converting it into the AGIS, Maps 1,2 &3 in the Appendix were able to be generated. Each map shows a little different location.
parameter for the SWL’s. This multi-facet use of the AGIS is what makes it invaluable in the planning process. You are only limited by your data base.

Albuquerque and Bernalillo County have come to realize what a precious resource we have in our underground water supply. In the recent past some have believed that we had an unlimited aquifer supply but recent studies, especially by USGS, have shown that we are using it up faster than it is being replenished. Since the ground water supply is currently our sole source of drinking water the City and County decided it needed to be conserved and protected from contamination. As a result they developed GPPAP (future planning!). GPPAP specifically restricts the location of SWL’s in the “crucial areas” as defined in GPPAP in Bernalillo County. When you observe Map 3 (Appendix) you will note that except for Cerro Colorado, Nine Mile Hill and W.W.Cox landfills, the rest are in the “crucial area”. This means that there is potential for the SWL’s in the “crucial areas” to contaminate ground water. In Map 2 (Appendix) the proximity of SWL’s to city production wells is noted. Over 8 of the SWL’s are less than a mile from city production wells. By using this AGIS map location information along with the site histories and monitoring well data, each of these SWL’s can be looked at more closely if or as contamination of ground water occurs in their area. As was noted earlier in the paper, Los Angeles, South Eubank, Coronado, Crawford, KAFB and South Yale have noted small amounts of different contaminants in their monitor wells and they are continuing to be monitored. To date, it does not appear that any SWL’s are responsible for contaminating any of the city production wells but it still may be too early to tell.

One of the difficulties in gathering information for this report was the fact that for many of the old
landfill sites there were no written records. I would recommend to any metropolitan centers anywhere in the U.S. to gather all the information available on any old SWL’s as soon as possible. There did not appear to be a need to document waste dumping in the past at least in the Bernalillo County and I would surmise probably not anywhere else either. Many of the employees who may have worked these sites have already retired or are close to it so glean what information you can from them and document it. If you wait too long any critical information may be lost. Any location information should be gathered and placed in a GIS data base for current or future reference. As more and more accurate data is entered into the GIS the more useful the system will become. Another point to remember in gathering information on SWL’s is to look everywhere. I found information with the Environment Department Solid Waste Bureau, Ground Water Bureau and District Office as well as from consultant reports located with the Albuquerque Solid Waste Management Department, AEHD and State Land Office. Other sources were also used as is noted in the Acknowledgements and Methodology. The point is don’t leave any stone unturned.

GIS is the wave of the future. As it continues to be updated and and its capabilities made known to all city and county departments, it will aid the city and county in making current and future decisions on the ground water supply as well as other areas of planning.
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AGRA Earth & Environmental. (September, 1996). *Geotechnical investigation South Eubank storm drain, Eubank landfill section, Albuquerque, NM*. Job# 6-517-68. Submitted to Smith Engineering.

American Groundwater Consultants. (October 1990). *The geology and hydrology of eastern Bernalillo and southern Santa Fe counties, New Mexico*.


Energy Resources Co./CA. (September, 1991). *Detailed evaluation of the waste fill at the Signetics (Philips) construction site, Albuquerque, NM*.


REFERENCES (continued)


APPENDIX
Number SVs and PDOP

Point: Albuquerque
Lat 35:03:0 N  Lon 106:36:0 W
Almanac: 970211.SSF 2/11/97
Date: Monday, February 10, 1997
Threshold Elevation 15 (deg)
Time Zone 'Mountain Std USA' -7
24 Satellites considered: 1 2 3 4 5 6 7 9 10 14 15 17 18 19 21 22 23 24 25 26 27 29 30 31

Date: Monday, February 10, 1997
Threshold Elevation 15 (deg)
Time Zone 'Mountain Std USA' -7
24 Satellites considered: 1 2 3 4 5 6 7 9 10 14 15 17 18 19 21 22 23 24 25 26 27 29 30 31

Time: Major tick marks = 60 Minutes. (Sampling 2 Minutes)
SkyPlot

Point: Albuquerque
Date: Monday, February 10, 1997
24 Satellites considered: 1 2 3 4 5 6 7 9 10 14 15 17 18 19 21 22 23 24 25 26 27 29 30 31

Time: Major tick marks = 60 Minutes. (Sampling 2 Minutes)

APPENDIX A2
From KAFB Management Action Plan

1 December 1991
APPENDIX C

GEOLOGIC CROSS-SECTION OF THE ALBUQUERQUE BASIN AREA

FROM BJORKLAND & MAXWELL, 1961
From IT Site Investigation report-Los Angeles landfill (1997)

General Site Plan
Los Angeles Landfill

LEGEND

Groundwater Monitoring Well

Methane Well Cluster Probes for Monitoring or Extraction Wells (approximate location)

A - A' Line of Cross Section

Limit of Landfill

SCALE

0 350 M

0 700 FT
# APPENDIX E

**SOLID WASTE LANDFILLS IN BERNALILLO COUNTY - 1997**

<table>
<thead>
<tr>
<th>LANDFILL</th>
<th>OPERATOR</th>
<th>WASTE TYPE</th>
<th>STATUS</th>
<th>DATES</th>
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<td>MUNICIPAL</td>
<td>OPEN</td>
<td>1990-PRESENT</td>
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<td>SOUTHWEST</td>
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<td>CONSTRUCTION</td>
<td>OPEN</td>
<td>1987-PRESENT</td>
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<td>KAFB</td>
<td>KAFB</td>
<td>CONSTRUCTION</td>
<td>OPEN</td>
<td>1964-PRESENT</td>
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<td>KAFB (OLD LANDFILLS)</td>
<td>KAFB</td>
<td>MUNICIPAL &amp; CONSTRUCTION</td>
<td>CLOSED</td>
<td>1940'S-1990'S</td>
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<td>ATRISCO</td>
<td>CITY OF ALBUQUERQUE</td>
<td>MUNICIPAL</td>
<td>CLOSED</td>
<td>1968-1969</td>
</tr>
<tr>
<td>CITY RIVER</td>
<td>CITY OF ALBUQUERQUE</td>
<td>MUNICIPAL</td>
<td>CLOSED</td>
<td>1920's, 30's &amp; 40's</td>
</tr>
<tr>
<td>CORONADO</td>
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<td>CLOSED</td>
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