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DRAFT ENVIRONMENTAL IMPACT STATEMENT

PINE BEND SANITARY LANDFILL EXPANSION

INVER GROVE HEIGHTS, MINNESOTA

April 29, 1980

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DRAFT ENVIRONMENT IMPACT STATEMENT

PINE BEND SANITARY LANDFILL EXPANSION

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PINE BEND SANITARY LANDFILL EXPANSION

SECTION I

SUMMARY

IDENTIFICATION OF DOCUMENT

Preface

In 1979, Phoenix Inc., owner and operator of the Pine Bend Sanitary Landfill in Inver Grove Heights, Minnesota, filed an application with the Minnesota Pollution Control Agency (MPCA) for a permit to expand the disposal area of the landfill. The MPCA received an environmental assessment worksheet (EAW) on the proposal and, based upon information contained in the worksheet, determined that an Environmental Impact Statement (EIS) should be prepared. On January 29, 1980, the MPCA board recommended to the Environmental Quality Board (EQB) that an environmental impact statement be prepared, and that the Metropolitan Council prepare the EIS. The EQB concurred with the MPCA recommendations on February 21.

Organization of EIS

The Environmental Impact Statement has ten sections. Section Two briefly describes the existing landfill operations and the proposed action. Section Three describes the existing environment of the Pine Bend Landfill and the surrounding area. It covers air quality, water quality, ecology, socio-economics and human health aspects. Section Four covers the environmental impacts of the proposed expansion. This section of the EIS describes the primary impacts of the proposed action, direct effects that cannot be avoided, irreversible and irretrievable resource commitments, the relationship between local short-term uses of the environment and long-term productivity and any cumulative impacts. Section Five describes mitigating measures that might be undertaken to alleviate any significant environmental impacts. Section Six discusses alternatives to the proposal including a "no action" alternative, site design alternatives, waste reduction, and materials and energy recovery. Section Seven describes the impacts of any federal controls associated with the proposed action on state government. Section Eight describes multi-state responsibilities associated with the proposed action. Sections Nine and Ten discuss, respectively, impacts on county solid waste planning efforts and impacts on the Metropolitan Council's regional solid waste plan.

PROPOSED ACTION

The Pine Bend application is for a permit to the existing landfill which is in Section 33, T.27 N., R.22 W. in Inver Grove Heights, Dakota County, Minnesota. The Pine Bend Landfill is a 233-acre site which has been in continual operation since 1971. The proposed

expansion involves filling a 14.4-acre abandoned railroad right of way, which bisects the landfill, with general residential and commercial refuse, and constructing a 50-foot wide earthen berm on a 4.8-acre strip of land on the east side of the landfill. These actions would add 19.2 acres to the present permitted facility.

The proposed project does not extend the existing exterior boundaries of the Pine Bend landfill. The two newly-acquired parcels of land described above are located within the perimeter of the landfill. The proposed project does not increase the highest elevation (1,020 feet) previously approved (MPCA Permit SW-45) for the completed landfill. The applicant (Phoenix, Inc.) proposes to fill the railroad right of way up to the elevation of the final contours presently permitted. No changes in the operating procedures of the landfill are proposed.

MAJOR ENVIRONMENTAL IMPACTS

Air Quality and Noise

The construction, operation and closing of the proposed expansion area will result in a minimum amount of fugitive dust, odors and methane gas. In addition, the construction of the earthen berm will produce a minimum amount of fugitive dust. Current operational procedures at the landfill should be sufficient to handle most of the air emission problems associated with the proposed expansion area and the earthen berm. In addition, the surrounding topographic and land use features of the area should provide adequate protection from adverse impacts on local people and property. Finally, construction and proper operation of the proposed expansion area will improve surface runoff resulting in better methane gas control. Construction of the earthen berm will lessen noise and fugitive dust impacts from activities associated with the proposed expansion area and other permitted areas of the landfill.

The potential cumulative impacts resulting from fugitive dust and noise will increase temporarily because the construction and operation of the proposed expansion area and the construction of the berm are to be undertaken concurrently. A mitigative action would be to phase development and operation of the proposed expansion area with the completion of portions of the berm.

Water Quality

The primary impact on surface water quality from operations in the proposed expansion area would be an increased potential for minor leachate contamination and siltation of on-site and nearby off-site ponds. However, filling in the proposed expansion area will improve surface water runoff at the landfill and lessen infiltration into the fill areas. Construction of the earthen berm should also improve surface runoff and further protect nearby off-site water bodies. Adverse surface water quality effects, therefore, can be mitigated sufficiently by continued implementation of current operational procedures.

The application and grading of daily and final cover material at the landfill will serve to direct on-site drainage to catchment ponds. The catchment ponds will prevent sediment-laden runoff and minor leachate seepage from reaching off-site water bodies. Surface leachate should rarely occur with continued cover soil placement, grading and seeding practices. Continued seeding will promote natural vegetative growth which will subsequently stabilize fill surface areas, prevent erosion and enhance the appearance of the site.

There may be leachate contamination of the water supply wells within the area of influence of leachate identified at the landfill. The filling of the proposed expansion area may contribute additional leachate to the groundwater system. However, the daily rate of leachate discharge, its component strengths and movement through the groundwater system would not be affected by the additional leachate produced from the expansion area. Moreover, filling of the proposed expansion area will not add to the potential or risk from leachate contamination presently existing from the existing landfill operation.

An important part of Pine Bend's groundwater protection system consists of a recently implemented water quality monitoring program. This monitoring system appears adequate to detect existing or potential pollution caused by leachate. The system periodically measures the extent and rate of leachate migration from the landfill site and the degree and nature of leachate contamination. Periodic monitoring should aid in determining the need for and nature of future leachate controls, and in evaluating the effectiveness of present control procedures.

Terrestrial and Aquatic Ecology

Construction activities in the proposed expansion and berm areas, particularly the excavation and fill procedure, will unavoidably eliminate vegetation on the areas involved. Reduction of vegetation will, in turn, decrease the habitat of wildlife populations. This action will have minimal effect on areawide predator populations faced with a decrease in food supply. While considerable time will lapse between replanting and full restoration of a vegetative cover and subsequent reintroduction of associated wildlife species, impacts are generally not substantive.

Filling activity in the expansion area will have two additional indirect impacts. First, it will eliminate a wildlife path between the two large presently permitted areas. Mammal tracks found in this area indicate that this land is presently used for feeding and a pathway, although not specifically for nocturnal or diurnal dens. Second, the extreme variation in topography caused by the unfilled railroad bed in the expansion area contains various slope conditions for a wider variety of plant communities. Filling in this area will create a more uniform final topography which will result in less vegetative and wildlife diversity.

Operation activities in the proposed expansion area should have only negligible impacts on on-site and off-site ponds. Increased surface water runoff from the expansion may add sediment to the southeast

pond because of diverted runoff from the northeast pond. With daily cover and surface runoff controls (e.g., slope structure, seeding), potential impacts should be negligible.

Socio-Economics

The only significant impact of the proposed expansion on future public facilities would be a delay of Inver Grove Heights' plan for landfill property. If the expansion is granted, the city will have to delay park facility development for approximately four years, extending the date of land acquisition from 1988 to 1992. The landfill area has the potential to be the largest park in the city's system. There are, however, adequate available park facilities until the landfill area is developed, assuming the expansion is approved.

Human Health

Filling the proposed expansion area will raise the potential for adverse health impacts from methane gas after closure of the landfill, particularly if gas accumulates in new buildings. It may be necessary, prior to closure of the facility, to install a gas monitoring system to evaluate any future requirements for on-site and perimeter gas control measures.

The potential cumulative impacts resulting from noise will temporarily increase as the construction and operation of the proposed expansion area and construction of the earthen berm are undertaken concurrently. Although not expected, should the combination of these activities present noise problems for off-site people and buildings, a mitigative action might be to phase development and operation of the proposed expansion area with the completion of portions of the earthen berm. Employees at the landfill may also need to wear ear protectors.

REASONABLE ALTERNATIVES

The Pine Bend Sanitary Landfill, without expansion, may close as early as 1985. In this case, no resource recovery or new landfill facilities would likely be operating in time to represent reasonable alternatives to the proposed expansion. If, however, the Burnsville and Freeway landfills are both granted expansions, Pine Bend's existing capacity may not run out until 1987. Resource recovery and/or new landfills may represent alternatives to a portion of the Pine Bend expansion capacity in this case, but only a maximum resource recovery system (Hennepin County operating a 2,700 TPD (tons per day) facility and Ramsey County operating a 1,200 TPD facility) beginning in 1985 could totally replace the proposed expansion. But given the Region's need to maintain a safe margin of disposal capacity, it would not be reasonable to deny the expansion permit at this time based solely on future resource recovery projects or new landfill facilities which are only in initial stages of planning.

Existing alternatives to the proposed expansion include waste reduction and material recovery. Neither of these waste management methods could provide a reasonable alternative to the entire capacity

proposed for expansion. Source separation and materials reuse and recovery methods do, however, provide cost-effective alternatives for a portion of the waste materials presently landfilled. Additional support for existing programs and stepped-up efforts to implement new programs could be deemed as reasonable and prudent alternatives to a portion of the proposed expansion.

AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED

The Metropolitan Council staff prepared this Environmental Impact Statement. The Minnesota Pollution Control Agency's staff prepared Sections Seven and Eight and a portion of Section Six and reviewed the other sections.

The following agencies, organizations and individuals were consulted during preparation of this EIS.

University of Minnesota	C. McJilton, F. Thompson, H. Paulus, J. Mulhansen
Minnesota Department of Health	P. Gutkowski, T. Bosman, M. Convey, J. Washburn, D. Anderson, G. England, R. Koch
Minnesota Occupational Safety and Health Administration	D. Schilling, J. Berg, B. Bracht, W. Mergens
Minnesota State Planning Agency	P. Ashbrook
American Lung Association	B. Hughes
Dakota County	D. Gurney
City of Rosemount	D. Johnson
City of Inver Grove Heights	B. Schaffer, B. Meeker
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St. Paul Refuse Haulers Association	F. Rauschnot
Minnesota Historical Society	R. Fridley
Dakota County Historical Society	F. Miller
Minneapolis Refuse, Inc.	C. Kutter, C. Baker
Lake Sanitation, White Bear Lake	M. Ayde

City of St. Paul	F. Forsberg, R. Person
Pope-Reid Associates	R. Reid, S. Smith
U.S. Corp of Engineers	J. Esson
Peterson Forage Seed Co., Savage	S. Peterson
Minnesota Department of Natural Resources	T. Kucera, C. Henderson, J. Davidson
A. W. Martin Company King of Prussia, Pa.	W. Beck
U.S. Environmental Protection Agency	D. Sanning
City of Minneapolis	M. Enquist
Private hauler	L. Willman
U.S. Fish and Wildlife Service	K. Carr

PINE BEND SANITARY LANDFILL EXPANSION

SECTION II

DESCRIPTION OF EXISTING LANDFILL AND PROPOSED ACTION

DESCRIPTION OF EXISTING LANDFILL

SITE LOCATION

Legal Description

The Pine Bend permit application is for an expansion of the existing landfill located in Section 33, T.27N., R.22W. in the City of Inver Grove Heights, Dakota County, Minnesota. The location and limits of the existing landfill property and the proposed expansion area are shown in Figures II-1 and II-2. The legal descriptions of the existing landfill property and the proposed expansion area are included in Appendix I.

The Pine Bend Sanitary Landfill is an existing permitted landfill (MPCA Permit No. SW-45) which has been in continual operation since 1971. The landfill is operated under a conditional use permit with the City of Inver Grove Heights and a license with Dakota County. The landfill occupies 233 acres and is owned and operated by Phoenix, Inc., a Bloomington based solid waste management firm.

Major Access Routes

There are two major access routes to the Pine Bend Sanitary Landfill. U.S. Highway 55, a four lane divided bituminous surfaced highway (9-ton axle weight limit), is located just east of the Pine Bend site and extends north toward the urbanized portion of the Twin Cities Metropolitan Area. Along the south boundary of the site, 117th Street, a two lane bituminous surfaced highway having a 9-ton axle weight limit, extends east to U.S. Highway 55 and west to Rich Valley Road. The road locations are shown in Figures II-1 and II-2.

SOLID WASTE SERVICE CONDITIONS

Areawide

For a description of areawide solid waste collection and disposal conditions see Section III, Socio-Economics.

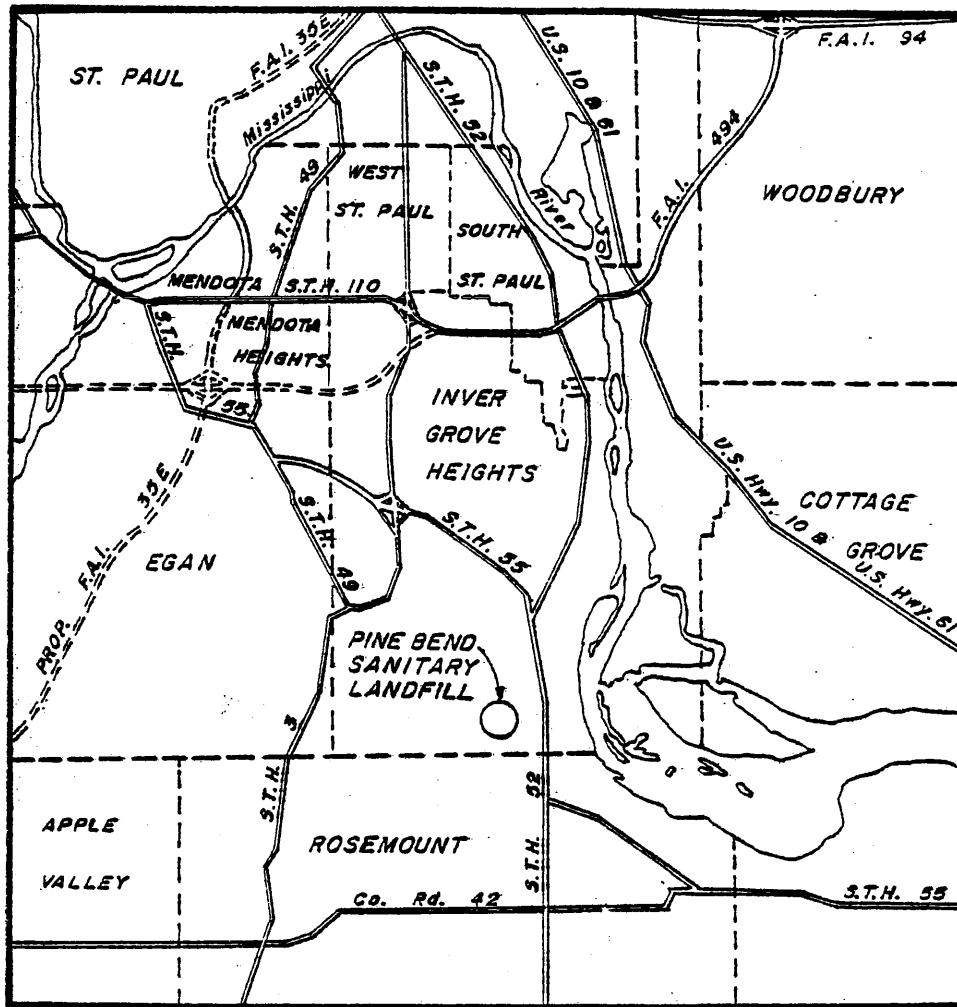
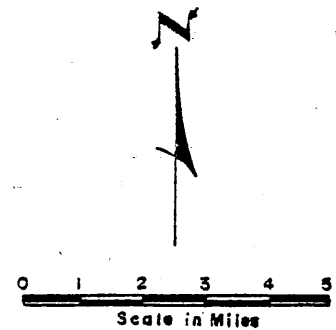


Figure II - 1
REGIONAL LOCATION MAP



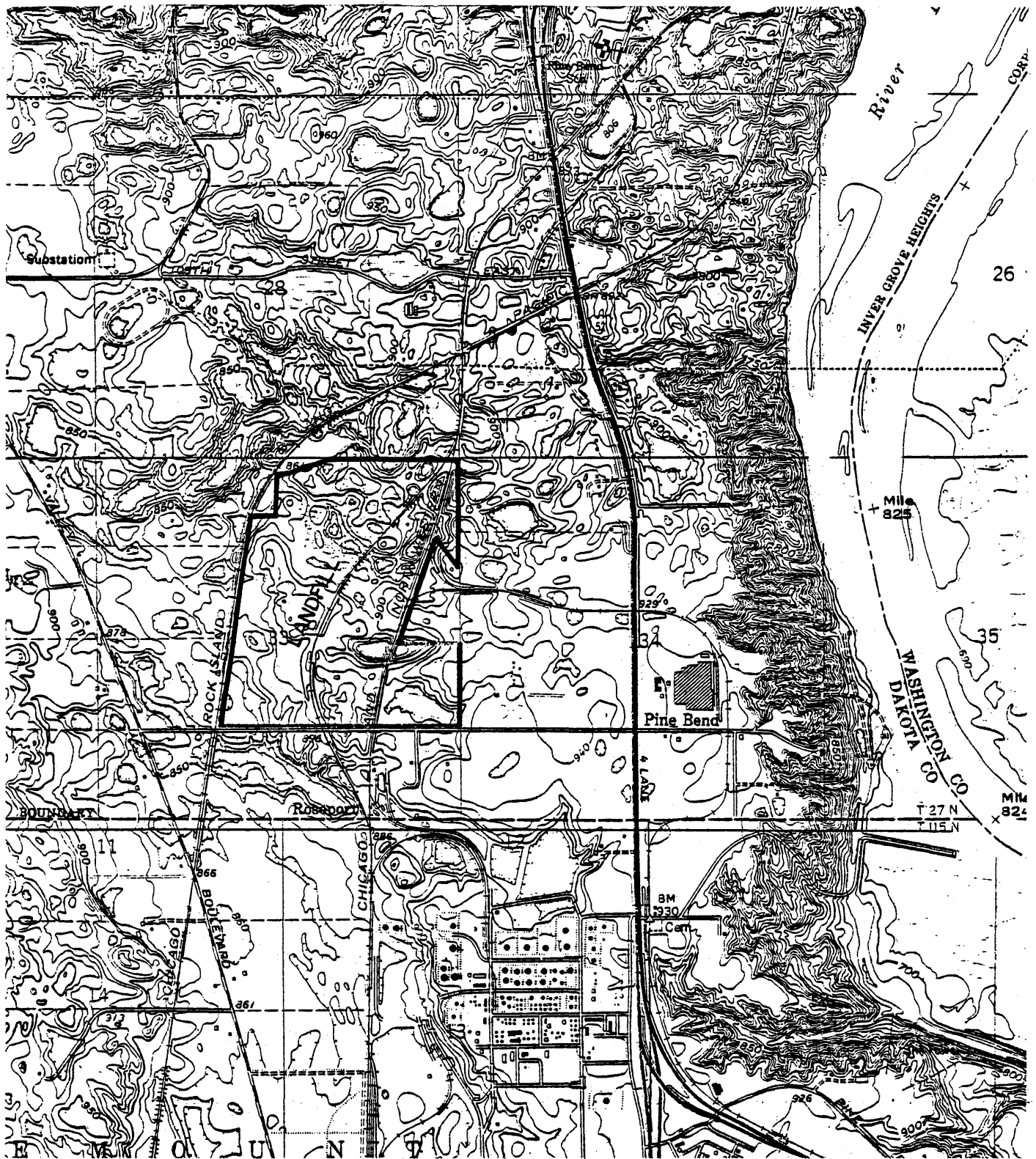


Figure II - 2

Quad Map Excerpt

Scale 1" = 2000'

From: U.S.G.S. Inver Grove Heights
Quadrangle

Solid Waste Quantities and Composition

Pine Bend Sanitary Landfill generally receives about 450,000 tons per year (1648 tons per day) of mixed municipal solid waste. Mixed municipal waste consists of solid waste that is collected from residential, commercial and industrial sources. No hazardous or liquid wastes are accepted at the landfill.

Recently the Burnsville and Freeway Landfills in Burnsville have raised their disposal charges. Because of this, there has been increased disposal at the Pine Bend Landfill. Presently, Pine Bend is receiving about 540,000 tons per year (1,735 tons per day).

Collection and Disposal Systems

The collection area served by the Pine Bend Sanitary Landfill includes St. Paul, Minneapolis, and their suburbs. All the residential solid waste collected from the City of Minneapolis is transferred from the Minneapolis Northside and Southside transfer stations to the Pine Bend Landfill. In addition, a great number of private and municipal refuse operations from other parts of the Metropolitan Area contribute to the refuse stream accepted at the landfill. A recent waste shed analysis by a consultant for the Metropolitan Inter-County Council shows the general service area boundaries for the Pine Bend Sanitary Landfill (see Figure II-3).

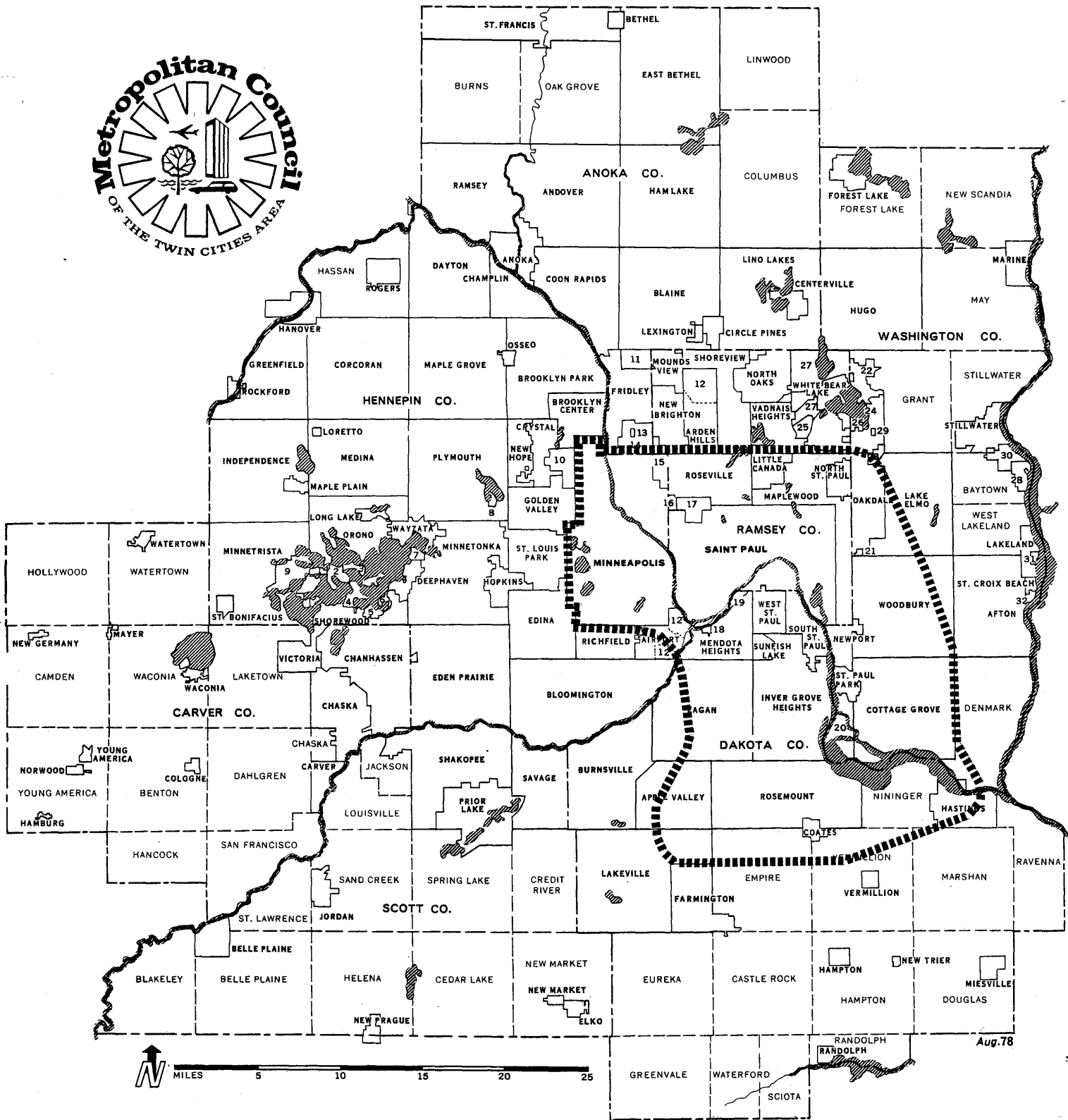
The Pine Bend Sanitary Landfill was originally permitted by MPCA at 6,918 acre-feet of capacity. In a normal year, it is estimated 600 to 700 acre-feet of capacity are used. It is further estimated that about 7 years of remaining life currently exists at the landfill given normal receiving rates.

SITE OPERATION

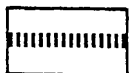
General Methods of Landfilling

Pine Bend Sanitary Landfill contains an on-site building near the site entrance which houses the landfill offices and equipment maintenance area. The landfill is operated from 6:00 a.m. to 8:00 p.m., Monday through Friday, and 6:00 a.m. to 4:00 p.m. on Saturday. The landfill operator accepts all solid waste offered for disposal during posted hours of operation which may legally and reasonably be disposed of.

The present equipment used at the site includes one Caterpillar 826B landfill compactor, one Rex 370 landfill compactor, one Caterpillar D-8K crawler dozer, one Michigan 110-HTB self-loading scraper, one Caterpillar 463 pull scraper, one Caterpillar 12 motor scraper and one light plant. Site personnel include 2 gatemen, 5 heavy machine operators, 1 mechanic, and 1 maintenance man and litter collector. In 1974, a



TWIN CITIES METROPOLITAN AREA



Pine Bend Wasteshed

Figure II - 3

4" diameter well extending to the Jordan Sandstone was installed at the landfill office for use as an on-site water supply. Electricity and telephone service is also available in the office.

The operating procedures currently used at the Pine Bend Sanitary Landfill were approved in 1973 by MPCA as an amendment to the permit on the site. The burning of refuse or any materials is not permitted at the site. No salvaging, scavenging nor animal feeding is permitted on the site. No resale of items disposed of at the landfill is allowed to take place on the site.

Refuse is unloaded at the bottom of the working face of the landfill under the direction of the operator who strives to maintain as small a working face as practical. This reduces work, improves compaction, minimizes the scattering of debris, and reduces the daily covering effort. The refuse is then spread out on the working face of the landfill so that its depth does not exceed two feet prior to compaction. Incoming trucks are emptied at the bottom of the working face and the refuse is spread up the open face and is then compacted by repeated travel by landfill compactors over the layers.

The slope of the compacted refuse on the working face does not exceed thirty degrees from the horizontal. The height of the cell does not exceed twenty feet as per county ordinance. At the completion of each day's refuse unloading activities, the exposed compacted refuse is covered with a six inch compacted layer of clean earthen material.

Daily cover material in winter is obtained from a trench which is excavated daily on-site and frost problems are thus minimized. When necessary, a ripper equipped tractor is used to loosen cover material.

A minimum separating distance of fifty feet is maintained between the disposal operation and adjacent property lines.

Bulky materials, such as refrigerators, stoves and other furniture items are accepted at the landfill and disposed of by traveling on them with a landfill compactor to compact them. The material is then pushed into the fill. Trees and branches are also accepted at the site, however, the disposal charges for these materials makes this option generally prohibitively expensive.

Auto wrecks are not accepted at the site for disposal. Tires are accepted for disposal at an additional charge to encourage alternative uses. An effort is made to distribute tire materials throughout the fill at the base. If possible, heavy objects such as concrete blocks, are placed upon tire materials at the base of the fill to hold them in place.

Putrescible materials which have reached a foul state of decay or decomposition, such as spoiled food or animal carcasses, are immediately covered and compacted.

Appendix II contains a chronology of significant events that have occurred at the Pine Bend Sanitary Landfill including MPCA site inspections.

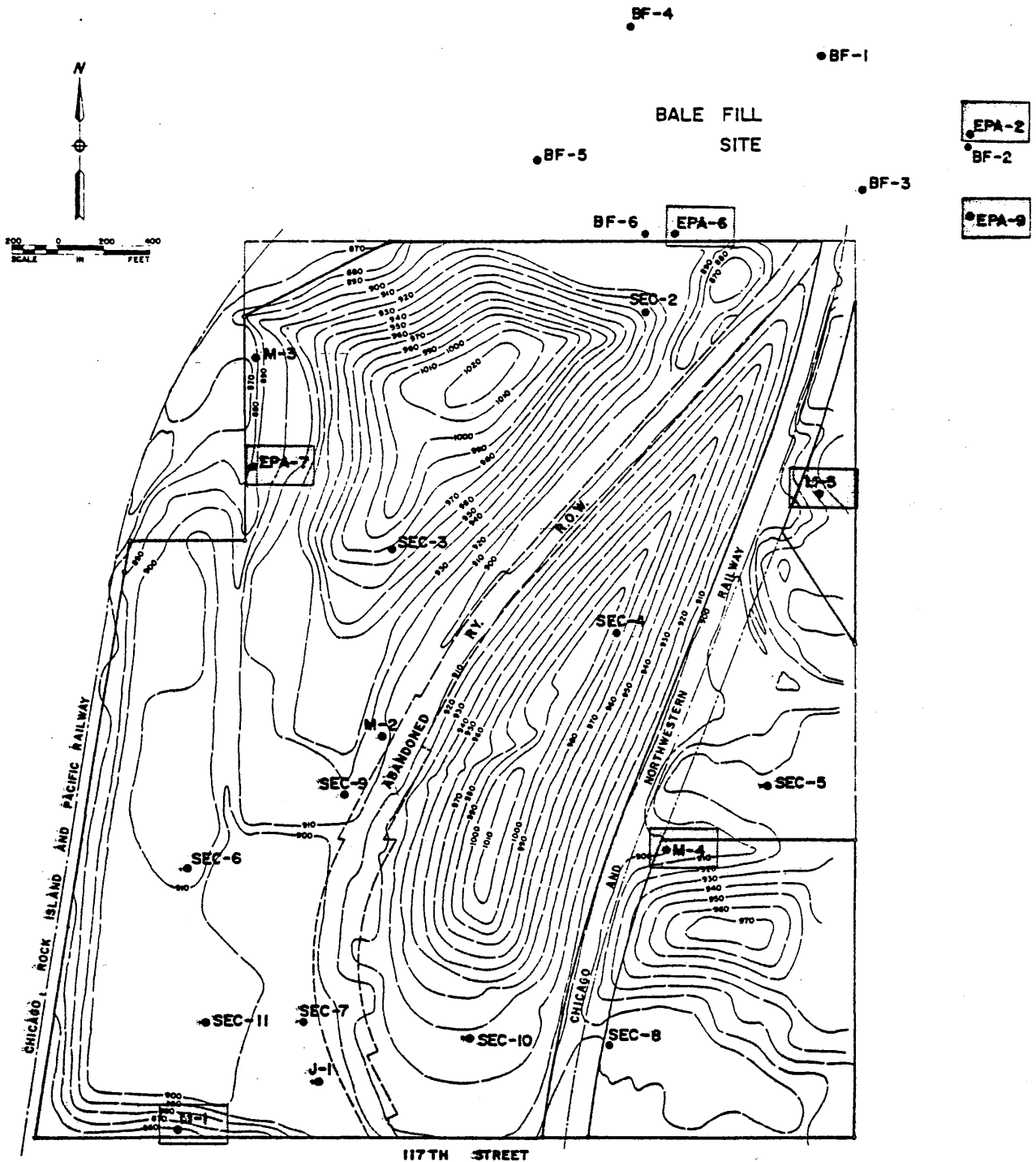
Environmental Controls

Leachate Control -- There is no leachate collection system under the landfill. Leachate is controlled by minimizing surface water infiltration at the site; this is accomplished by proper compaction of the refuse and proper application of daily and final cover materials.

Ground Water Monitoring System -- As a result of the recommendations in "Hydrogeologic Study of the Pine Bend Sanitary Landfill," dated December 1978, prepared by Gerald M. Sunde, and a subsequent letter, dated May 24, 1979, from the MPCA accepting those recommendations, the Pine Bend Sanitary Landfill has had installed and in operation since the summer of 1978 the ground water monitoring system outlined in the following table. See Figure II-4 for well locations.

TABLE II-1

<u>Well Number</u>	<u>Monitoring Function of Well</u>	<u>Sampling Frequency</u>
M-1	Background water quality and tie to previous water quality data.	Quarterly
M-4	Down-gradient well for south-east part of fill.	Quarterly
M-5	Down-gradient well for Pine Bend Sanitary Landfill. May be influenced by the balefill north of the landfill site boundary	Quarterly
EPA-6	Interior well located on the boundary between the Pine Bend landfill and the balefill	Quarterly
EPA-7	Possible background well. May be affected by southwest fill area	Quarterly
EPA-9	Down-gradient well for both Pine Bend Landfill and the Balefill	Quarterly



KEY TO MAP SYMBOLS

- SEC - 1971 PERMIT SOIL BORINGS
- BF - 1978 BALE FILL BORINGS
- M - M-1 THRU M-3 - 1971 MONITORING WELLS
M-4 & M-5 - 1978 SOIL BORINGS
- J - SHOP WELL
- EPA - 1978 EPA RESEARCH WELLS
FOR BALE FILL
- SHADED AREA DENOTES PROPOSED
MONITORING WELLS

Figure II - 4
AREA SOIL BORINGS AND WELLS
PINE BEND SANITARY LANDFILL

The monitoring system will remain in operation during and subsequent to the filling of the permitted site and the proposed expansion.

Directly to the north of the Pine Bend Sanitary Landfill and adjacent to the site is a demolition and construction waste landfill operated by Crosby American Properties, Inc. This demolition landfill was formerly a U.S. Environmental Protection Agency (EPA) demonstration project, owned and operated by American Hoist and Derrick Company, which received baled residential and commercial refuse. Monitoring wells EPA-6 and EPA-9 are located on the balefill property. Permission must be obtained from Crosby American Properties for use of these two wells. Monitoring wells EPA-6, EPA-7, and EPA-9 are part of EPA's study of the balefill; permission for use of these three wells must be obtained from EPA.

All monitoring wells are tested for pH, chemical oxygen demand, specific conductance, nitrates, and chlorides.

Surface Water Drainage -- The entire landfill, including the fill surface, is graded and/or provided with drainage facilities to minimize run-off onto and into the fill, to thus prevent erosion or washing of the cover material and to prevent the collection of standing water. The final contours for the completion of the landfill were prepared by William K. McKie and Associates, Inc. in 1973. The McKie report was approved by the MPCA on September 23, 1973, as an amendment to the landfill's permit (MPCA SW-45). The general plan is to develop hills of refuse with fairly steep uniform slopes. Surface runoff would be directed to landlocked depressions located outside of the fill areas such as the surface water retention area adjacent to the C & NW tracks in the northeast corner of the landfill and in the southeast corner (see Figure II-5).

Vector Control -- Periodically, or at the County Engineer's request, the operator has the landfill inspected by a licensed exterminator company, who sends a report of the inspection to the operator. This report is available to the MPCA and the Country Engineer's Office. To minimize scavenging by rodents and other animals, daily cover is applied at the end of the day's operation. Vectors are not a problem at the site.

Air Quality -- The landfill's operational procedures provide protection against fugitive dust emissions and methane gas hazards. The approach to the landfill and the main site road for routing trucks to the active fill area are paved. In addition, a 2,000 gallon tank truck is kept on site. Water from this tank is sprayed on roads for dust control. If dust continues to be a problem, calcium chloride (CaCl_2) is spread on the unpaved roads to hold moisture.

No gas control system exists at the Pine Bend Sanitary Landfill. The amount of water in contact with the buried refuse is kept to a minimum through the application of daily cover material and final grading of completed portions of the



NOTES

MAP SYMBOLS DENOTE

- FINAL CONTOURS AS PROPOSED BY 1979 AMENDMENT
- FINAL CONTOURS PRESENTLY PERMITTED
- DIRECTION OF SURFACE DRAINAGE
- SURFACE WATER PONDING AREAS

Figure II - 5
FINAL GRADING AND DRAINAGE PLAN

PINE BEND SANITARY LANDFILL

fill. The rate of refuse decomposition is thus slow, and as a result methane gas is produced in small amounts over a long period of time. The low rate of methane production reduces the possibility of explosive concentrations from being reached.

Noise Control -- The land use features surrounding the landfill site and the topographic features of the working area of the landfill provide physical barriers and buffer areas from noise generated by the landfill operation.

Litter Control -- A 6-foot fence (2-inch mesh, chicken wire) is used around the perimeter of the active fill area to catch blowing litter. A 20-foot portable litter fence (2-inch mesh, chicken wire) is also used near the active fill area to catch blowing litter. This fence is moved depending on the wind direction. The entire south boundary of the landfill site will be fenced by a 6-foot high chain-link fence in order to catch blowing litter.

The landfill operator has a vacuum (6-inch, Stal-Vac) to sweep up litter on the site. The vacuum is mounted on a truck for portability.

If necessary, the landfill operator hires additional personnel for manual litter pick-up. Finally, under extremely windy conditions, the landfill operator will temporarily close the landfill until the conditions subside.

Security and Safety Practices

Fire Protection -- Fire protection is provided by maintaining a stockpile of earth reasonably close to the working face of the fill. The material is also used for daily cover purposes. All site vehicles are equipped with fire extinguishers and two-way radios for communication with the landfill office in the event of a fire or accident. Fire extinguishers are also located at the office on the site.

A 2,000 gallon water tank truck is kept on site for dust control and fire protection. In addition, the landfill operator has an agreement with the Inver Grove Heights fire department under which the operator pays the fire department \$1,500 annually as a stand-by charge. The operator has also agreed to pay \$300 per hour for fire call service with a one-hour minimum from the time the alarm is received.

Security -- The entrance road has a gate which is closed and locked when the landfill is not open. An attendant is on duty when the gate is unlocked. The landfill area, however, is not fenced and off-road access is possible.

Sanitary -- The office building on the landfill site has approved rest rooms with shower facilities for company personnel.

First Aid -- First aid equipment is provided and maintained at the office building for adequate treatment of injuries due to minor accidents. Telephone service is available should any emergencies occur which may require outside help. In addition, two-way radios are used in the day-to-day operations of the landfill and for any emergency situations.

Closure

Once an area reaches final fill elevation, two feet of earth is spread, graded and compacted. Figure II-5 shows the final grading plan including the proposed addition. The area is then revegetated with grass species as the final step in the closure.

Post-Closure

The City of Inver Grove Heights conditional use permit for the site requires the owner of the landfill to deliver a bond (of an amount to be determined by the city) to the city one year prior to the planned completion of the landfill. The purpose of this bond is to provide reasonable assurance that corrections or modifications will be made to any defects which may occur after closure of the site and final approval by the Dakota County Engineer and the MPCA.

The ultimate land use for the western portion of the landfill is to develop a community recreational park similar to that shown in Figure II-6. The land will be graded to accommodate the concept of the park according to the fill grading plan. When the landfill is completed, the property will be dedicated to the City of Inver Grove Heights as a park.

The future land use of the eastern portion of the site is private open space and industrial use of a type yet to be determined.

Energy

The following are the energy requirements for the existing facilities at the Pine Bend Sanitary Landfill.

Diesel Fuel -- The estimated annual requirement for diesel fuel is 84,000 gallons per year (7,000 gallons per month). There is a relatively steady demand with no significant peaks. The present supplier is Standard Oil Company on a contract basis.

Electricity and Natural Gas -- The amount of electricity and natural gas used at the landfill is not a significant energy requirement. Electricity is used only for lighting the 60 by 72 foot concrete building which serves as the landfill office and maintenance shop and for a small amount of air conditioning in the office (ten feet by twelve feet) alone. The maintenance shop is not air conditioned. Natural gas is used only for heating the office and maintenance shop. This building is already constructed and in use at the landfill.

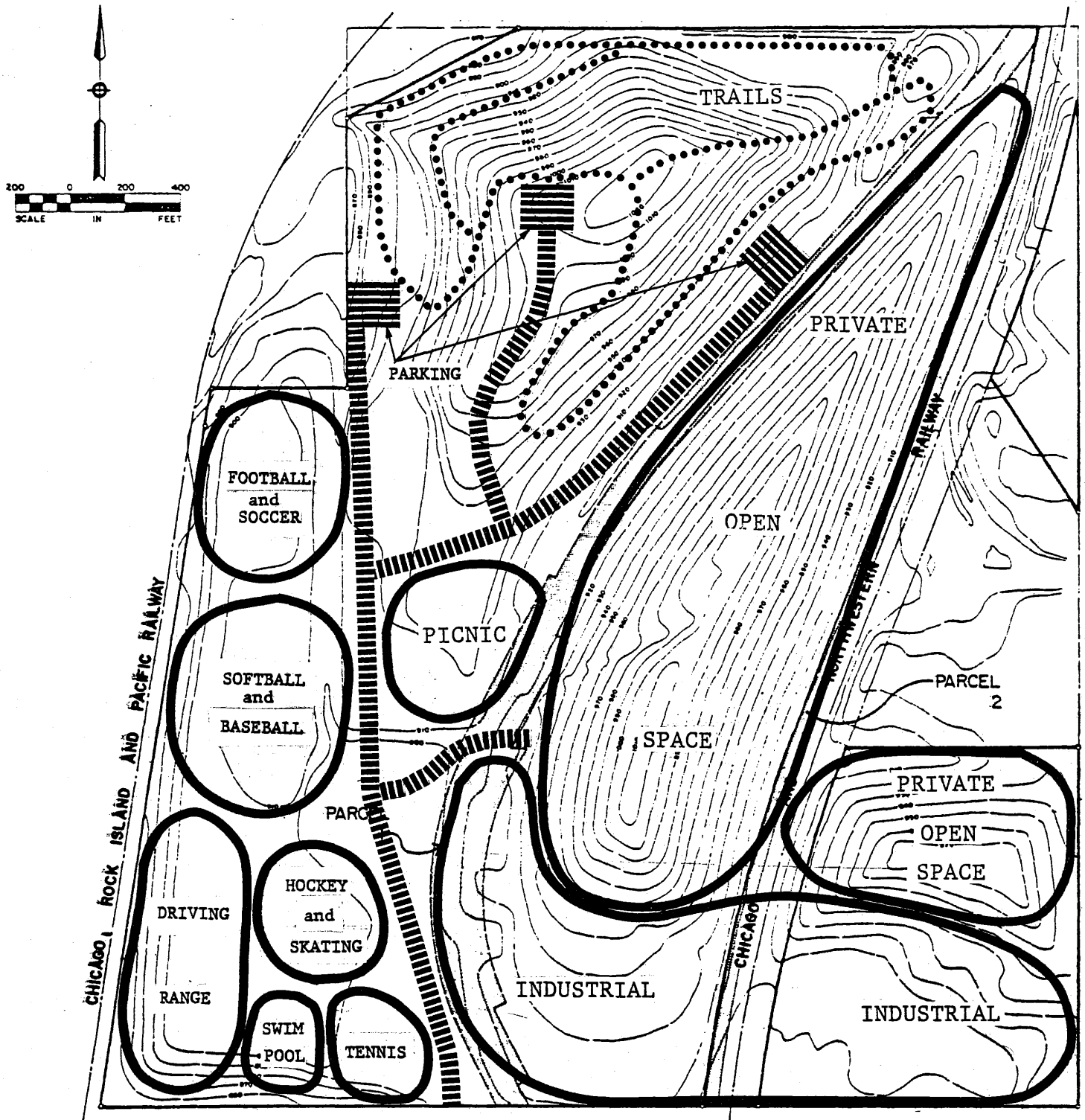


Figure II - 6

NOTE: CONTOURS SHOWN ARE
FINAL CONTOURS AS PRESENTLY
PERMITTED

FINAL LAND USE

PINE BEND SANITARY LANDFILL

On-site Fuel Storage -- The existing landfill has a 20,000 gallon underground diesel fuel storage tank.

DESCRIPTION OF PROPOSED ACTION

PRESENT APPLICATION

The existing Pine Bend Sanitary Landfill is crossed by an abandoned railroad track which was operated by the Chicago and Northwestern (C& NW) Railroad. The right of way for this track runs from the middle of the south boundary to the northeast corner of the landfill. A C& NW belt line also runs through the landfill site in a north-south direction to the east of the abandoned right of way.

The proposed activity involves filling the 14.4-acre abandoned right of way with general residential and commercial refuse and constructing a 50-foot wide earthen berm on the 4.8-acre strip along the west side of the belt right of way. This would add 19.2 acres to the present permitted facility (see Figure II-7).

The proposed project does not extend the existing exterior boundaries of the Pine Bend Sanitary Landfill. The two newly acquired parcels of land described above are located within the perimeter of the landfill. In addition, the proposed project does not change the final use of the landfill property.

The proposed project does not increase the highest elevation (1020 feet) previously approved (MPCA Permit SW-45) for the completed landfill. The applicant (Phoenix, Inc.) proposes to fill the railroad right of way with refuse until it is brought up to the elevation of the final contours of the completed fill areas on either side as shown in Figure II-5.

SITE LOCATION

The proposed action is located wholly within the existing, permitted boundaries of the Pine Bend Sanitary Landfill in Section 33, T.27N., R.22W, City of Inver Grove Heights, Dakota County, Minnesota. Figure 6 shows the location of the two land areas that are considered in the permit application for amendment.

Directly to the north and adjacent to the site is a demolition and construction waste landfill operated by Crosby American Properties, Inc. East of the existing landfill are presently developing industrial lands. South is the Koch Refining Company. West are undeveloped lands now being used for agriculture.

For a further description of the surrounding land uses refer to Section III, Socio-Economics.

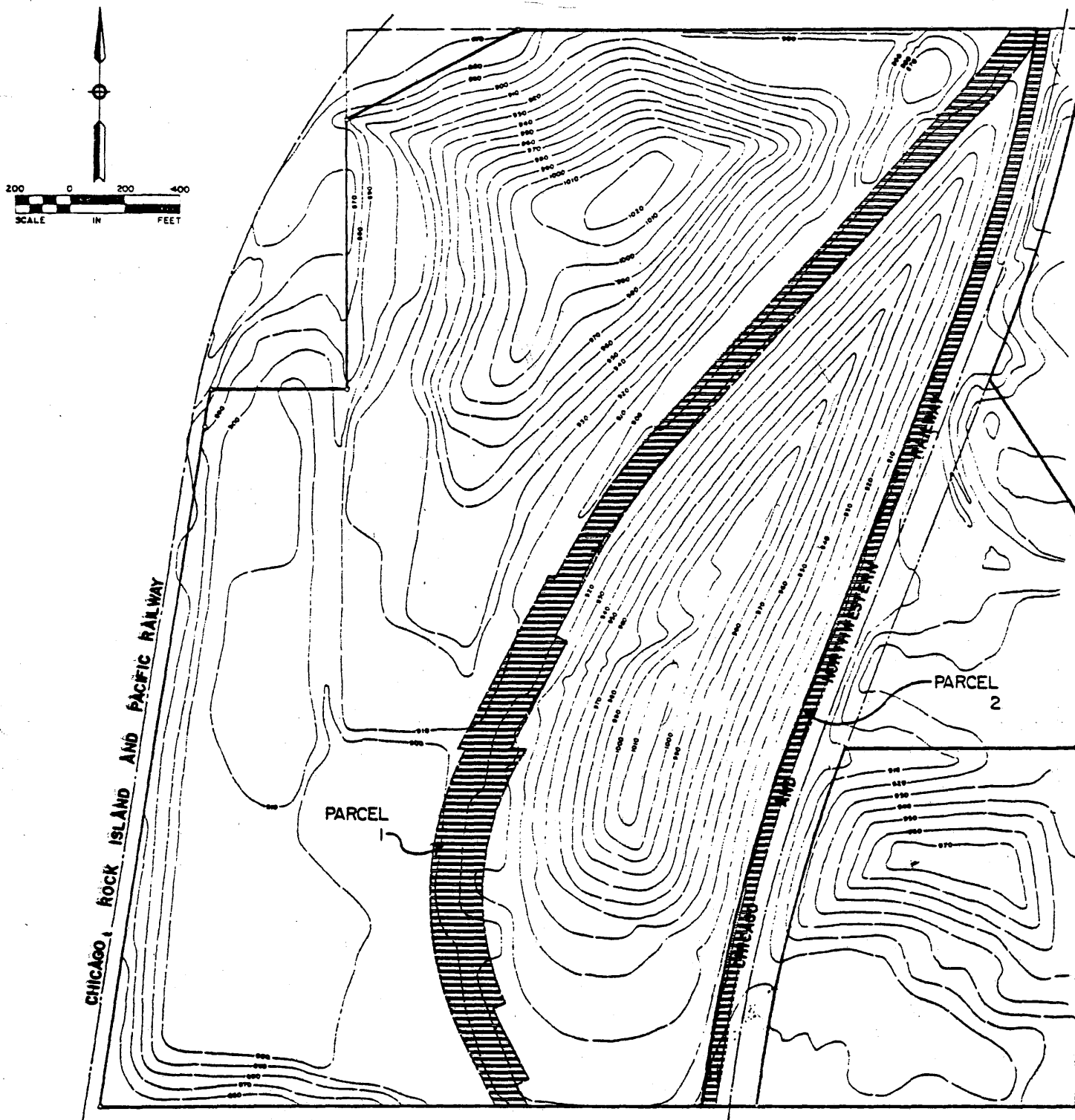


Figure II - 7

NOTE: CONTOURS SHOWN ARE
FINAL CONTOURS AS PRESENTLY
PERMITTED

LOCATION OF LAND AREAS
INCLUDED IN AMENDMENT

PINE BEND SANITARY LANDFILL

LEGAL DESCRIPTION

The legal description of the proposed expansion area is included in Appendix I.

ANTICIPATED LIFE, REFUSE SUPPLY, DESIGN CAPACITY

The 19.2 acre addition to the 233-acre permitted landfill site will hold approximately 1,780,000 tons of refuse and extend the life of the Pine Bend Sanitary Landfill by 3.9 years based on present projected generation rates. The 19.2 acres will fill at a rate of about 450,000 tons of refuse per year assuming normal receiving rates.

The type of refuse disposed and the collected area serviced for the proposed expansion area will remain the same as that of the present operation.

MAJOR ACCESS ROADS

The major access roads for the proposed expansion area are the same as that of the present operation (see Figure II-2).

PROPOSED OPERATION

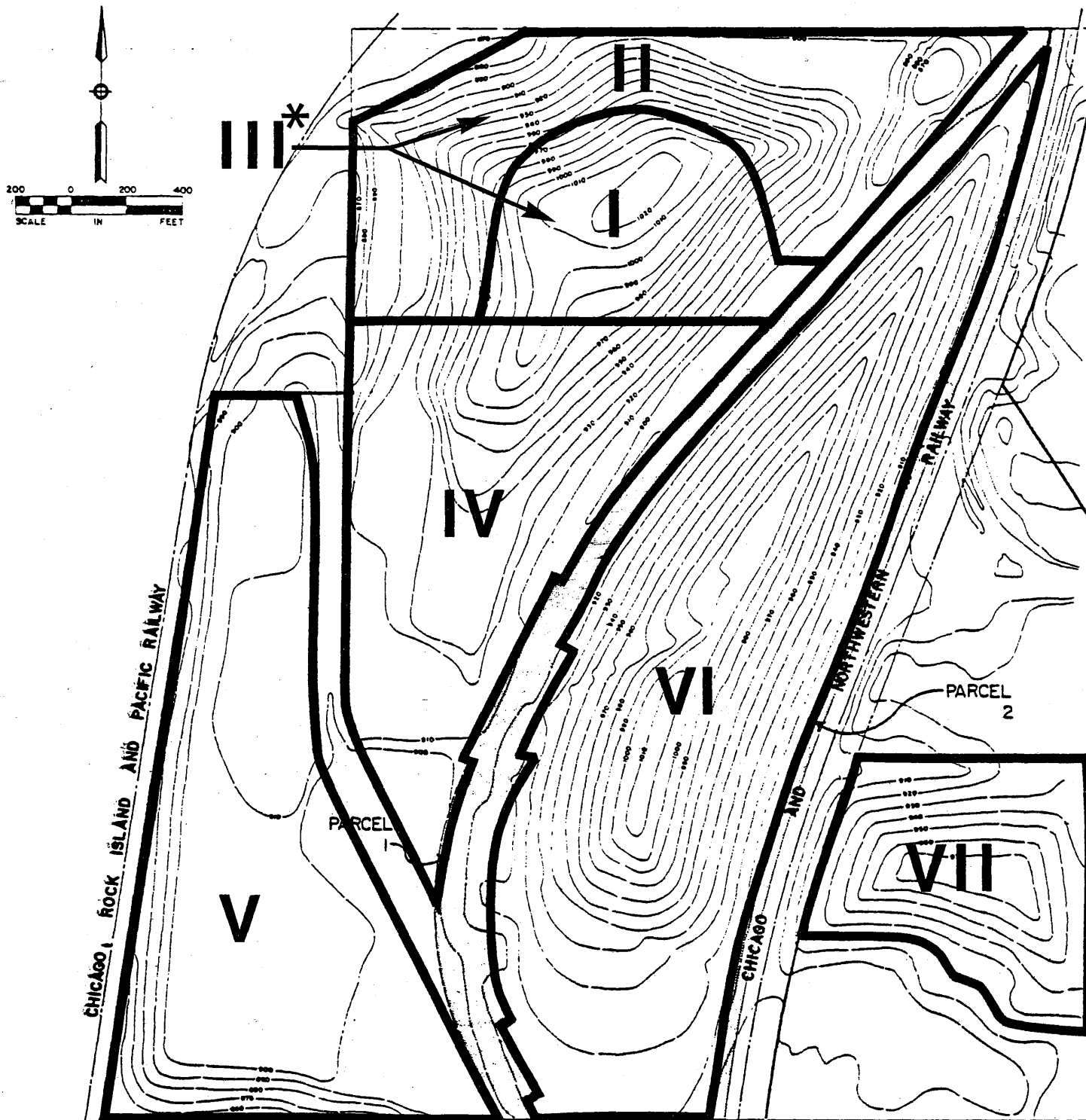
GENERAL METHOD OF LANDFILLING

The proposed project does not change the current methods of operation at the Pine Bend Sanitary Landfill.

The staging of development of the landfill with the proposed expansion area will be as follows. The present permit (MPCA SW-45) calls for seven phases of development. Phases I through V are west of the abandoned railroad right of way; Phase VI is immediately east of the abandoned right of way. Phases I, II, V, and part of Phases III and IV have been completed (see Figure II-8).

With the proposed amendments, Phases III, IV and VI will be combined. Filling operations will proceed from the north moving south, always maintaining previously filled berms on the north and west of the active fill areas to serve as protection from the prevailing winds from the northwest. Completion of the combined Phases III, IV, and VI, with the inclusion of the newly acquired 19.2 acres of former railroad property, should take 10.6 years.

Phase VII of the present landfill permit is in the southeast corner of the permitted landfill site, east of the C & NW belt line. Phase VII should take 0.4 years to fill.



* PHASE III is directly on top of I & II

Figure II - 8

NOTE: CONTOURS SHOWN ARE
FINAL CONTOURS AS PRESENTLY
PERMITTED

DEVELOPMENT PHASES

PINE BEND SANITARY LANDFILL

Instead of waiting until an entire phase is completed to add the two feet of final cover, grade and seed, subsections of each phase will receive final cover, topsoil, and be graded and seeded as soon as practical after reaching final fill elevation.

ENVIRONMENTAL CONTROLS

Environmental controls will remain the same as that of the present operation. In filling the abandoned railroad right of way, a minimum separation of 90 feet of unsaturated soils will be maintained between the refuse and the ground water.

The proposed operation should improve litter control and surface water drainage at the landfill. For a discussion of this, see Section IV, Surface Water Quality and Socio-Economics.

SECURITY AND SAFETY PRACTICES

Security and safety practices will remain the same as that of the present operation.

BUILDINGS

No change in the existing building on the landfill will be made. No new additional buildings will be constructed.

ENERGY

Current energy requirements to operate the landfill are expected to continue with the addition of the expansion area at the same level as the existing operation.

PROPOSED CONSTRUCTION

The landfill areas added by the amendment will be filled concurrently with that part of the landfill designated as Phase VI in the approved plans. Filling work in the railroad right of way will begin as soon as the necessary governmental approvals are obtained. All filling operations to the west of the C & NW belt line are expected to be completed in 1989 and the landfill completed in 1990.

Figure II- 5 shows the proposed final contours for the landfill site with the abandoned railroad right of way filled. The proposed project does not alter the proposed final use of the completed landfill.

The estimated preparation cost for the added landfill area is \$262,000. No federal, state, or local governmental funding is involved in the landfill project.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION III

DESCRIPTION OF EXISTING ENVIRONMENT

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

General

The most significant meteorological parameters associated with sanitary landfill design and operation are wind speed, wind direction, atmospheric stability, temperature and precipitation. Prevailing winds are important in consideration of problems relating to odor, dust, and blowing debris. The advection and diffusion of odorant gases and particulates from the landfill to receptors in the impact area is largely determined by the wind speed, wind direction and atmospheric stability.

Ambient temperature governs such factors as the types and quantities of odorant emissions and probable (indoor versus outdoor) activities of persons (sensitive receptors) in the area. Freezing temperatures may also cause problems. Cover material may be difficult to obtain when the frost line is more than six inches below the ground surface. The stockpiling, transport and placement of cover material may also be difficult during freezing conditions.

Precipitation (both rain and snow) is important in determining surface runoff, the design of an adequate drainage system for its control, the rate of waste decomposition, the generation and control of leachate, the feasibility of maintaining operations at all times at the site, the transport of equipment on the site, and access to and from the site. Loaded vehicles may experience difficulty on steep inclines and snow-covered roads. The combination of mild temperatures (thaw) and rainy conditions can make clayey soil conditions very muddy, thus limiting effective operations at the site. In certain areas, for example, it may be beneficial to construct a wet weather site where limited amounts of waste can be disposed of over short periods when weather conditions make access to the main site difficult.

The Pine Bend Sanitary Landfill, like the rest of the Metropolitan Area, is situated in the upper Mississippi River Valley on the borderline between the Humid Continental Warm Summer and Humid Continental Cool Summer Climates. The boundary between the milder and more severe cool-summer phase of the Continental Climates (Da and Db) is the 71.6°F. Isotherm for

the warmest month. The normal monthly temperature at the Minneapolis-St. Paul International Airport for the warmest month (July) is 71.9°F.

Due to the Metropolitan Area's closeness to the geographical center-line of North America, there exists a tendency for extremes in all climate features. For example, there are wide variations in temperature, plentiful summer rainfall and relatively little winter precipitation.

Temperature

Temperatures in the Metropolitan Area tend to range widely during the course of the year. The coldest month is January with mean daily maximum and minimum temperatures of 22.4 and 2.4°F., respectively. July is the warmest month with mean daily maximum and minimum temperatures of 83.9 and 60.7°F., respectively. The normal monthly temperature is 44.1°F. The lowest recorded temperature was -34°F. in January of 1970; the highest recorded temperature was 104°F. in July of 1941. The Annual Temperature Profile of the area is shown below:

TABLE III-1: ANNUAL TEMPERATURE PROFILE
TEMPERATURE DEGREES F

Maximum

Days annually 90°F and above	15 days
Days annually 32°F and above	83 days

Minimum

Days annually 32°F and above	153 days
Days annually 0°F and above	34 days

Source: Local Climatological Data, Annual Survey, 1974, Minneapolis, St. Paul, Minnesota, United States Department of Commerce.

The maximum temperature for almost one-quarter of the year does not exceed freezing (32°F.) and the minimum temperature for more than one-half of the year (193 days) is below 32°F. These temperatures translate into 8,159 heating degree-days and 585 cooling degree-days annually. Extremely low temperatures during the long winter frequently combine with moderate to high winds to create "wind chill factors" which make outside activity extremely uncomfortable. Winds during the winter months (November to March) consistently average above 10 miles per hour.

Humidity and Precipitation

The Metropolitan Area experiences only a relative brief (May to September) growing season, but precipitation is ample and well distributed during the five month growing cycle (average for the five month growing cycle is 16.78 inches). The average annual precipitation is 25.94 inches, including an average annual snowfall of 40.3 inches. Thunderstorms are the primary source of rainfall during the growing season. Rainfall can be heavy, but is usually brief in duration. Severe thunderstorms occur occasionally and may produce excessive rains, high winds, lightning and hail.

Table III-2 shows mean humidity (recordings over a fifteen year period) and mean precipitation (recordings over a thirty six year period) for the Minneapolis-St. Paul area.

TABLE III-2: MINNEAPOLIS-ST. PAUL MEAN
HUMIDITY AND PRECIPITATION

<u>Month</u>	<u>Humidity (%)</u>				<u>Precip. in.</u>
	<u>Midnight</u>	<u>6 am</u>	<u>Noon</u>	<u>6 pm</u>	
January	72	73	67	68	0.73
February	73	74	65	65	0.84
March	73	77	64	63	1.68
April	70	76	55	54	2.04
May	70	77	54	52	3.37
June	74	80	55	53	3.94
July	77	82	55	54	3.69
August	78	85	56	56	3.05
September	81	87	60	62	2.73
October	76	83	60	63	1.78
November	79	82	67	71	1.20
December	<u>77</u>	<u>79</u>	<u>72</u>	<u>74</u>	<u>0.89</u>
Year	75	80	61	61	25.94

Source: Local Climatological Data, Annual Survey, 1974,
Minneapolis, St. Paul, Minnesota, U.S. Department of
Commerce.

Table III-3 shows 14-year precipitation averages for the community of Rosemount, Minnesota. Rosemount is about two miles south of the Pine Bend Sanitary Landfill.

Table III-3: ROSEMOUNT 14-YEAR PRECIPITATION AVERAGES
January-December, 1959-1972

January	0.94	July	3.85
February	0.80	August	3.38
March	1.50	September	3.58
April	2.49	October	2.96
May	4.07	November	1.31
June	4.37	December	1.28

Annual 30.53

Source: University of Minnesota, Climate of Minnesota, Technical Bulletin 301, 1975.

As can be seen from Tables III-2 and III-3, precipitation amounts in the Metropolitan Area are small during winter and relatively high during the summer. The vast majority of precipitation during winter falls as snow. Annual precipitation for Rosemount averages about 30 inches.

The Metropolitan Area is subject to periods of severe weather during both the summer and winter months. The vast majority of the severe weather during the summer months derives from either convective or frontal thunderstorm activity. During the winter months, passage of cold fronts can produce very high winds associated with blizzard conditions. The highest recorded wind for the Twin Cities area in the 36 years ending in 1974 was 92 miles per hour.

The State of Minnesota is on the northern edge of the national region of maximum tornado frequency. The state ranks sixteenth among the fifty states and District of Columbia in frequency of tornadoes based on the forty-nine years ending in 1964.

Wind

Wind data at the Minneapolis-St. Paul Airport indicate that wind velocities are moderate with the annual wind speed averaging 10.5 mph (Table III-4). Prevailing winds are from the northwest during the winter, early spring and late fall. During the remainder of the year south or southeasterly winds predominate. Average wind speeds are highest during the cold portion of the year (12.3 mph in April), while the lowest values occur during the summer (9.1 mph in August). The advance of cold air after the passage of a strong storm system is responsible for most of the high winds which occur in winter. High winds experienced in summer often result from the gustiness produced by strong thunderstorms.

TABLE III-4: WIND SPEED AND DIRECTION SUMMARY FOR
MINNEAPOLIS-ST. PAUL, MINNESOTA
(1941-1970)

<u>Month</u>	<u>Mean Wind Speed-(mph)</u>	<u>Prevailing Direction</u>	<u>Fastest Mile*</u>		<u>Year</u>
			<u>Speed (mph)</u>	<u>Direction</u>	
Jan	10.4	NW	40	SE	1956
Feb	10.5	NW	52	NW	1952
Mar	11.2	NW	47	E	1951
Apr	12.3	NW	52	WSW	1964
May	11.3	SE	61	NW	1964
June	10.5	SE	63	NW	1939
July	9.3	S	92	W	1951
Aug	9.1	SE	63	N	1967
Sep	9.8	S	47	N	1951
Oct	10.4	SE	73	S	1949
Nov	11.0	NW	60	SW	1958
Dec	<u>10.4</u>	<u>NW</u>	<u>52</u>	<u>W</u>	<u>1946</u>
Annual	10.5	NW	92	W July	1951

*Fastest Mile Wind - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Source: J.T. McLaughlin, T.D. Van Epp and W.K. Tusa,
Environmental Impact Statement For Woodlake Sanitary
Landfill Expansion, Technical Work Paper No. 3,
Prepared for MPCA, Roseville, MN , 1980.

Dispersion Characteristics

The overall dispersion ability of the atmosphere in this area of the country is quite good. The frequent passage of weather systems minimizes periods of air stagnation. Consequently, atmospheric conditions are usually favorable for the dispersion of pollutants and the area seldom encounters "extended" periods of fog or high pollutant levels. The frequency of light winds (0-3 mph) at Minneapolis, which is indicative of the frequency of stagnation periods, is low ranging from 11 to 14 percent of the time (MPCA 1979). Pollutants are distributed through the

atmosphere by the action of horizontal wind and vertical air currents. At times, atmospheric inversions tend to "clamp a lid" over an area, reducing the volume of air into which the pollutants can defuse. Inversions are commonly associated with stagnating, high pressure systems and are characterized by fog, light winds and very stable conditions. When inversions exist for a long period of time, pollutants are trapped near the ground and can build up to potentially harmful levels. The frequent weather changes common to this section of the country inhibit prolonged inversion conditions so that adequate dispersion conditions generally prevail.

AIR QUALITY

Federal and State Regulations

Since the passage of the federal Clean Air Act of 1970, and the 1977 amendments, each state must revise its clean air strategy to attain the ambient air standards by December 31, 1982. Portions of the Minnesota State Implementation Plan (SIP) were approved by EPA in 1979. The plan defines how the state will reduce air pollution in areas where health standards are violated, and prevent deterioration of air quality elsewhere.

The Clean Air Act amendments require each state to identify all areas that meet healthy air standards and those that do not for five major pollutants: carbon monoxide (CO), ozone (O₃), particulates (dust and soot), sulfur dioxide (SO₂), and nitrogen oxides (NO_x). The Environmental Protection Agency promulgated two levels of standards for each pollutant (National Ambient Air Quality Standards). Primary air quality standards were developed to protect public health while secondary standards were developed to prevent other deleterious effects of air pollution, i.e. injury to crops, livestock, transportation and nuisance problems. The primary standards for particulates and sulfur dioxide are more stringent than the secondary standards for these pollutants.

Since the establishment of the national ambient air quality standards each state has been faced with the responsibility of meeting the standards. The national standards are minimum requirements that must be met within a specified time table, but the states may establish more stringent standards as Minnesota has done in the case of sulfur oxides, peak-hour carbon monoxide, and photo-chemical oxidants.

Table III-5 presents a comparison between federal and Minnesota state standards. Two units describe the standards: (1) ug/m³, micrograms/cubic meter, which refers to particulate matter; and (2) ppm, parts per million which quantifies gaseous pollutants. The standards specify exposure periods for each pollutant based on scientific studies concerning possible

TABLE III-5: COMPARISON BETWEEN NATIONAL AND MINNESOTA
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	WORDING OF STANDARD	PRIMARY ^a STANDARD		SECONDARY ^b STANDARD	
		National	State	National	State
SUSPENDED PARTICULATE MATTER	Annual geometric mean conc. Maximum 24-hour concentration Not to be exceeded more than once per year	75 $\mu\text{g}/\text{m}^3$ 260 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$ 260 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ 150 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ 150 $\mu\text{g}/\text{m}^3$
SULFUR OXIDES	Annual arithmetic avg. conc. *Maximum 24-hour concentration Not to be exceeded more than once per year *Maximum 3-hour concentration Not to be exceeded more than once per year	.03 ppm .14 ppm	.02 ppm .10 ppm .25 ppm	 .50 ppm	.02 ppm .10 ppm .25 ppm
CARBON MONOXIDE	*Maximum 8-hour concentration Not to be exceeded more than once per year *Maximum 1-hour concentration Not to be exceeded more than once per year	9 ppm 35 ppm	9 ppm 30 ppm	9 ppm 35 ppm	9 ppm 30 ppm
PHOTOCHEMICAL OXIDANTS	*Maximum 1-hour concentration Not to be exceeded more than once per year	.08 ppm	.07 ppm	.08 ppm	.07 ppm
HYDROCARBONS	*Maximum 3-hour concentration (6-9 a.m.) Not to be exceeded more than once per year	.24 ppm	.24 ppm	.24 ppm	.24 ppm
NITROGEN OXIDES	Annual arithmetic average concentration	.05 ppm	.05 ppm	.05 ppm	.05 ppm

FOOTNOTES: (a) Primary Standard: Protect Public Health
(b) Secondary Standard: Prevent all other adverse affects of air
pollutants

*Not to be exceeded more than once per year.

adverse health effects. With the exception of nonmethane hydrocarbons, all of the pollutants listed in Table III-5 affect the human physiological system. Nonmethane hydrocarbons, along with nitrogen oxides, are of primary concern due to their role in the formation of photochemical smog.

As can be seen from Table III-5, there are significant differences between the federal and Minnesota air quality standards for certain pollutants. For example, the Minnesota annual and 24-hour primary standards for sulfur oxides are approximately one-third less than the federal standard and the state's 3-hour secondary standard is only half of the national standard. It should also be noted that Minnesota has established standards for sulfur oxides where none currently exist at the federal level. Specifically, the state has established a 3-hour primary standard for sulfur oxides, along with annual and 24-hour secondary standards. In addition, Minnesota's 1-hour carbon monoxide standard (both primary and secondary) of 30 parts per million (ppm) is 5 ppm lower than the corresponding federal standards.

The National Ambient Air Quality Standards were to be met by June 1, 1975; although substantial improvements have been made in ambient air quality, the standards are not being met in all areas of Minnesota or the United States. Ambient air quality continues to be assessed by the primary and secondary standards.

With regard to the SIP for Minnesota, areas that violate standards are classified non-attainment for each pollutant exceeding the standard. Areas that do meet health standards are classified attainment. The MPCA is presently identifying the exact sources of pollutants in each area.

In nonattainment areas, industrial growth could occur until July 1, 1979, if: the firm's potential pollutant emissions are less than 100 tons per year or the amount of pollution added by the new facility is offset somewhere else in the area and the firm attains the lowest achievable emission rate for its type of operation. After July 1, 1979, new sources must be permitted in accordance with the revised SIP.

In addition to regulations for primary and secondary emissions, Minnesota has established a number of regulations and rules pertaining to the emission of odorous substances. Specifically, Minnesota Air Pollution Control (APC) Rule 9 regulates odorous air pollution from various sources including sanitary landfills. APC 9 sets odor emission limits based on the specific type of source and the nature of the potential odor impact area (residential, industrial, etc.).

Areawide Compliance

The Twin Cities Metropolitan Area has been designated as a nonattainment area for particulates, sulfur dioxide, carbon monoxide and oxidants. It is important to note that nonattainment designations are on an areawide basis. Attainment

areas (or pockets of clean air) can exist within a nonattainment area. It is probable that air quality, particularly in the rural portions of the Region, are in compliance with ambient air quality standards. For a further description of areawide compliance with federal and state air quality standards see Environmental Impact Statement For Woodlake Sanitary Landfill Expansion, Technical Work Paper No. 3, Minnesota Pollution Control Agency, 1980.

Pine Bend Area

The Pine Bend area is an industrial area comprised of an oil refinery, ammonia products plant, alum plant, power plant peaking station, petroleum pipeline product terminal, and the Pine Bend Sanitary Landfill. It covers an area of approximately ten square miles.

The MPCA has established an ambient air monitoring station (MPCA No. 0420) in the Pine Bend area near the intersection of Highways 55 and 52. Table III-6 shows the results of monitoring at this station for particulates, sulfur dioxides and nitrogen oxides. The station recorded violations of standards for particulates and sulfur dioxide. There were no violations of the nitrogen oxide standards.

Suspended Particulate Matter -- For total suspended particulate concentrations, the station recorded (out of 56 observations) in 1978 no episodes in violation of federal and state primary standards for maximum 24-hour concentrations and one episode in violation of secondary standards for maximum 24-hour concentrations. In 1979, the station recorded (out of 56 observations) two episodes of particulate concentrations in violation of secondary standards and no violations of primary standards. Over the 2-year period of observations recorded at the station, the geometric mean concentration for particulates exceeded secondary standards only.

A list of the major point sources of particulates in the Metropolitan Area are shown in Table III-7 with the location of these sources shown in Figure III-1. Figure III-2 shows the areas in the Region impacted by particulate concentrations from these sources. As can be seen, the Koch Refining Company, St. Paul Ammonia Company, Minnesota Valley Surfacing Company and the Northern States Power Blackdog power generating facility are the main contributors of particulate concentrations in or near the Pine Bend area. These four sources accounted for approximately 13,000 tons of particulates being emitted in 1977.

TABLE III-6

1978 Particulate Summary (Micrograms/Cubic Meter)

Location	State	No.	Geom	Std	Max	2nd	No.	No.
<u>MPCA No.</u>	<u>Rank</u>	<u>Obs</u>	<u>Mean</u>	<u>Dev</u>	<u>Obs</u>	<u>High</u>	<u>260u/m³</u>	<u>150u/m³</u>
0420								
Annual	59	56	63.7	1.7	319	162	1	2

1979 Particulate Summary (Micrograms/Cubic Meter)

Location	No.	Geom	Std	Max	2nd	No.	No.
<u>MPCA No.</u>	<u>Obs</u>	<u>Mean</u>	<u>Dev</u>	<u>Obs</u>	<u>High</u>	<u>260u/m³</u>	<u>150u/m³</u>
0420							
Annual	56	64	1.7	239	173	0	3

1978 Sulfur Dioxide Summary (ppm)

Location	No.	Ari	Std	3-Hour Average			24-Hour Average		
				Max	2nd	No.	Max	2nd	No.
<u>MPCA No.</u>	<u>Obs.</u>	<u>Mean</u>	<u>Dev</u>	<u>Obs</u>	<u>High</u>	<u>Vio</u>	<u>Obs</u>	<u>High</u>	<u>Vio</u>
0420									
Annual	8555	.027	.063	.790	.778	134	.393	.387	349
0420*									
Annual	58	.015	.037				.246	.116	2

1977 Nitrogen Summary (ppm)

<u>Site No.</u>	<u>No. Obs.</u>	<u>Arith Mean</u>	<u>Std Dev</u>	<u>Max Obs.</u>
0420*				
Annual	57	.0211	.0108	.066

*Indicates method is bubbler.

Source: Minnesota Pollution Control Agency, 1979.

Interestingly enough, point sources are not always the major contributors to violations of particulate standards especially in rural areas. In areas, such as Pine Bend, where there are agricultural lands, a number of unpaved roads, etc., particulate concentrations can be higher than those in urban areas due to wind erosion and dust entrainment. Emissions from these large area sources are nearly impossible to control and difficult to quantify. They will, however, contribute significantly to recorded observations of particulate concentrations.

Table III-7

TWIN CITIES METRO AREA

MAJOR POINT SOURCE EMISSIONS INVENTORY, 1977

Site	PARTICULATES		HYDROCARBONS	
	Tons/Year	Effective Stack Hgt.	Tons/Year	Effective Stack Hgt.
1. H&S Asphalt	n/a	n/a	-	-
2. NSP-Blackdog	5,866	289'	-	-
3. Koch Refining Co.	234	50'	11,593	60'
4. St. Paul Ammonia	105	45'	-	-
5. Williams Pipe Line Co.	-	-	105	48'
6. Minnesota Valley Surfacing	7,040	n/a	11,826	n/a
7. Agg Sinter, Coke	1,260	30'	-	-
8. Champion Packages Co.	-	-	358	40'
9. NSP-Riverside	503	335'	-	-
10. Fleischmann Malting	252	30'	-	-
11. Tonka Toys	-	-	181	25
12. University of Minnesota	299	n/a	-	-
13. A D M nokomis Mill	178	60'	-	-
14. General Electric Service	-	-	175	25'
15. Honeymead Products	157	150'	-	-
16. Commutator Foundry	292	40'	-	-
17. Honeywell Inc.	-	-	119	n/a
18. Onan Div. of Onan Corp.	-	-	112	36'
19. Howe Incorporated	103	25'	-	-
20. 3M Company	-	-	42,919	n/a
21. Webb Publishing	-	-	17,273	43'
22. Mobil Oil Corporation	-	-	1,772	n/a
23. Ford Motor Company	-	-	1,008	50'
24. William Pipe Line	-	-	1,100	72'
25. American Can Co.	-	-	611	200'
26. Union Oil Co. of California	-	-	1,052	10'
27. Metro. Waste Control Commission	2,050	n/a	-	-
28. Hoerner Waldorf Corp.	-	-	463	58'
29. Koppers Co.	180	20'	300	20'
30. Whiripool Corp.	-	-	266	68'
31. Total-Asphalt	257	36'	-	-
32. Fugta	355	n/a	-	-
33. Standard Oil	-	-	392	24'
34. Shell Oil Co.	-	-	604	48'
35. Texaco Inc.	-	-	194	n/a
36. Olympia Brewing Co.	184	n/a	-	-
37. NSP-Highbridge	290	570'	-	-
38. NSP-3rd Street Stream	136	258'	-	-
39. National Can	-	-	132	41'
40. Bryan Rock Products	1,439	20'	-	-
41. Bunge Corporation	1,292	n/a	-	-
42. Rahr Malting Co.	554	n/a	-	-

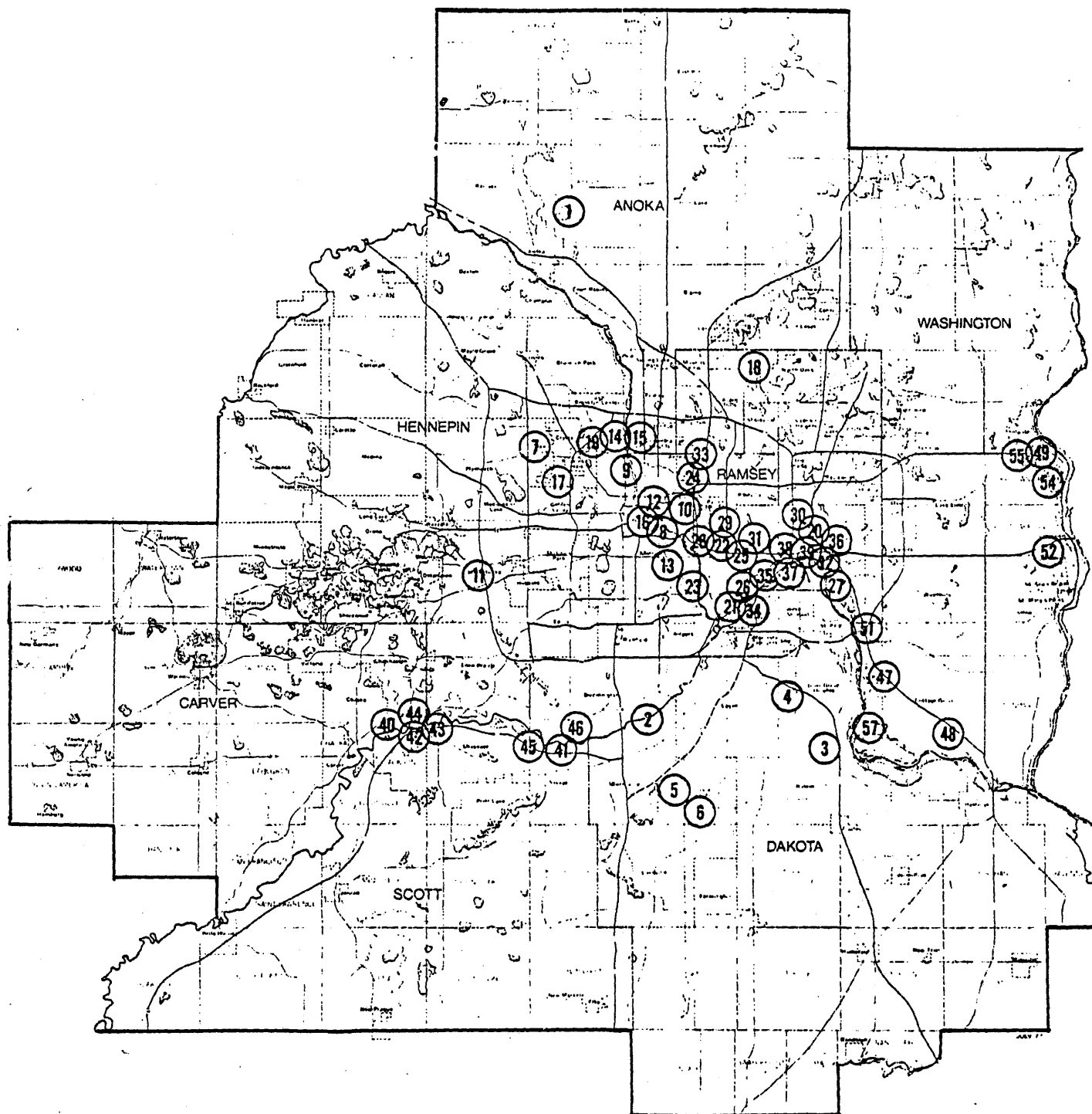
Table III-7 cont'd.

43.	J.L. Shiely Compan -Shakopee	500	n/a	-	-
44.	Continental Grain Co.	448	20'	-	-
46.	Cargill, Elev. C	147	n/a	-	-
47.	Northwestern Refining Co.	-	-	7,720	53'
48.	3M Company-Cottage Grove	-	-	2,999	31'
49.	NSP-King	659	785'	-	-
51.	Erickson Petroleum Corp.	-	-	1,329	48'
52.	Tower Asphalt Inc.	465	n/a	-	-
54.	Anderson Corp.	-	-	511	25'
55.	Minn. State Prison	397	110'	-	-
57.	J.L. Shiely-Grey Cloud	325	10'	-	-

Source: Metropolitan Waste Control Commission, 1977.

Figure III-1

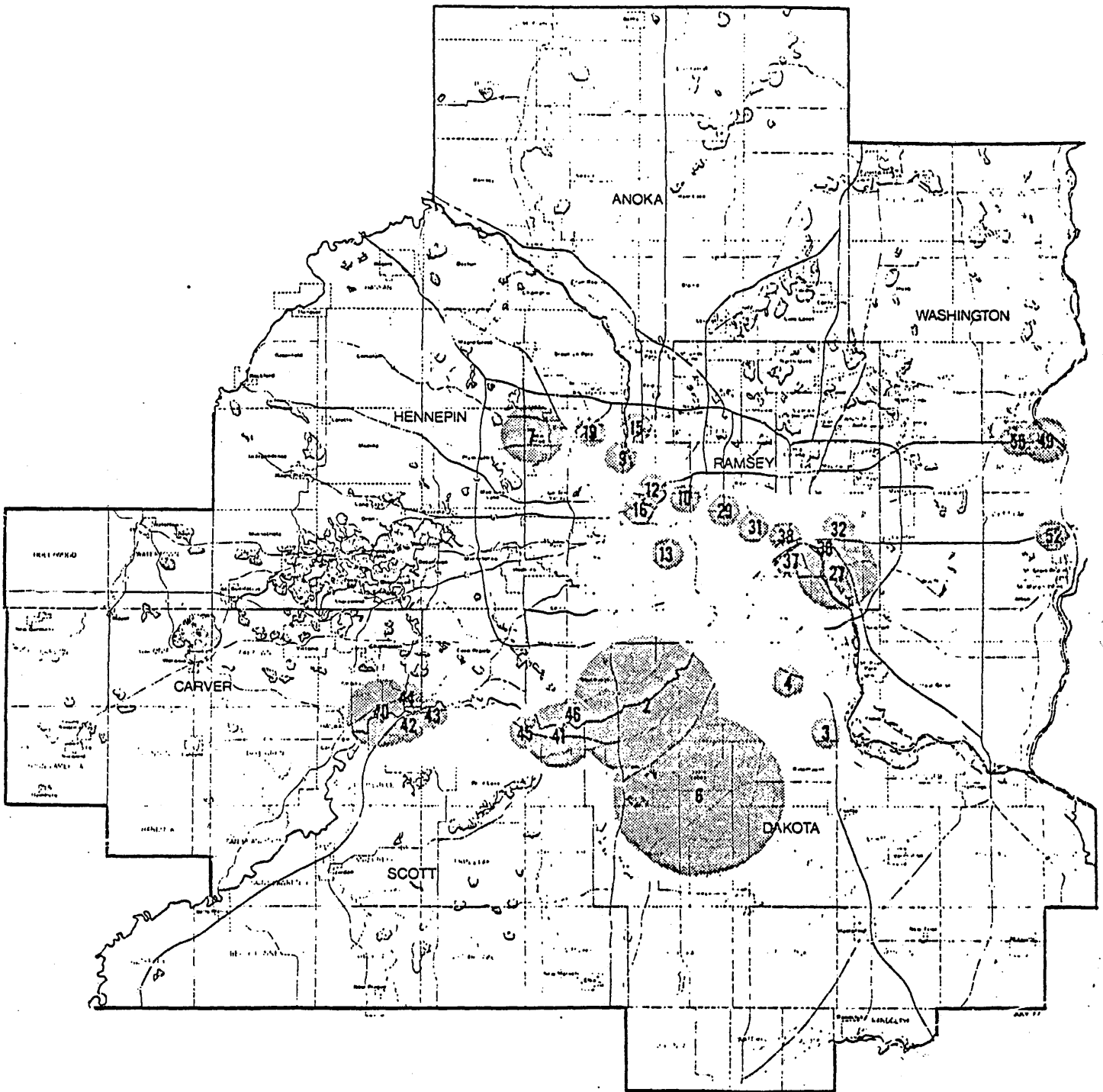
LOCATION OF MAJOR EMISSION SOURCES



SOURCE: Metropolitan Waste Control Commission, 1977

Figure III-2

METROPOLITAN AREAS IMPACTED BY PARTICULATES



SOURCE: Metropolitan Waste Control Commission, 1977

It is difficult to say whether the recorded observations for particulate concentrations in the Pine Bend area can be attributed mainly to either point or area sources. The monthly and daily recordings of the particulate concentrations do not indicate any discernible trends correlating with agricultural practices and the operations of industry in the area.

Sulfur Oxides -- In 1978, the Pine Bend area monitoring station recorded sulfur oxide concentrations (out of 8555 observations) in violations of both federal and state primary and secondary standards for maximum 3-hour and 24-hour concentrations. The annual arithmetic average concentrations for sulfur oxides recorded at the station exceeded state primary and secondary standards. The federal primary standard, however, was not exceeded.

In 1979, four episodes were noted where the area exceeded federal standards for the 24-hour average; also there were eight episodes noted where the state 24-hour average was violated. Regarding the three-hour average, no episodes were noted which violated federal standards and twenty episodes were noted in violation of state standards. Sulfur dioxide sources in the area are primarily from stack emissions from industries within the industrial complex.

Regulatory Compliance

The Pine Bend area is in violation of standards for suspended particulates and sulfur oxides. Koch Refining Company, the largest contributor of sulfur oxides in the area and a contributor of particulates, has recently entered into a stipulation agreement with the MPCA to reduce emissions of these pollutants. In addition, as part of the SIP revision for the Pine Bend area, three of the area's industries have agreed to install equipment or make operational changes which will ultimately reduce emissions of particulates and sulfur oxide.

It is likely that the Pine Bend area is actually an attainment area (within a non-attainment area) for carbon monoxide. Carbon monoxide levels in the Pine Bend area should approach typical rural background concentrations.

Existing Landfill Site

The Pine Bend Sanitary Landfill is located in the northwest corner of the Pine Bend area industrial complex. Given that geographic relationship to other industries and the prevailing wind (from the southeast in the summer and the northwest in the winter), the air quality at the landfill site does change considerably from winter to summer.

Suspended Particulate Matter -- The particulate problem at the landfill site is caused, for the most part, by fugitive dust emissions. The engineering method of sanitary landfilling is by nature a construction activity, and as such, it produces fugitive emissions. Fugitive dust emissions are caused by

activities such as the movement of refuse trucks to and from the working area of the landfill, the excavation, stockpiling and grading of cover material, the movement of heavy equipment and vehicles over unpaved areas, and the land clearing of future disposal areas on the site.

Fugitive dust impacts have not been a significant problem with the existing operation. Potential fugitive dust impacts have been minimized by final covering and seeding, the use of a paved road to the active fill area and the use of a water spray truck and calcium chloride when conditions warrant. It should also be noted that fugitive emissions are usually at a minimum in the winter since the ground is frozen and usually snow-covered.

The primary carriers of refuse traffic to the Pine Bend Sanitary Landfill are State Highways 55 and 52, and 117th Street. These are bituminous surfaced roads extending through unpopulated areas of the county, and as such, transportation related fugitive emissions and impacts will be negligible.

The impact of suspended particulate matter from the existing landfill is negligible compared to the overall particulate problem in the highly industrialized Pine Bend area.

Sulfur Oxides -- Concentrations of sulfur dioxide exceeding ambient air quality standards will occur at the landfill during the summer months. This is due to the prevailing southeastern wind during the summer which affects emission plumes from the Pine Bend area industrial complex transporting them to the northwest. Sulfur oxide emissions from the operations of the landfill itself are negligible.

Methane Gas -- Methane gas (CH_4) is a colorless, odorless gas produced by the anaerobic decomposition of refuse. Methane generation in a sanitary landfill depends on the waste composition, internal moisture content, temperature, and other environmental factors. In general, a mature landfill that has reached its maximum generation rate, estimated to occur between one to five years after completion, will produce gas at a high rate for about six to ten years and will continue to produce gas at lesser rates for up to 100 years.

The composition of landfill gas based on field samples ranges from 45 to 65 percent methane with the most common values lying between 45 and 55 percent. The balance of the gas is carbon dioxide with smaller amounts of hydrogen, oxygen, nitrogen, and traces of other gases.

From a safety aspect, methane is only considered a problem when it is mixed with oxygen at concentrations greater than 15 percent. At such concentrations methane is explosive.

Generally, there is no danger of a methane explosion. Methane, being lighter than air, will naturally vent upwards through the cover material into the atmosphere, where the methane will be at concentrations much lower than 15 percent. If methane is

prevented from venting upwards into the atmosphere, possibly by an impermeable cover over the refuse, the gas will migrate laterally beneath the surface until it reaches a permeable surface where it can escape into the atmosphere. If there are buildings with basements near the landfill and if the methane is prevented from venting upward through the cover material and therefore is forced to migrate laterally below the surface, there is a possibility that some methane may concentrate in a basement and be an explosion hazard.

The operational procedures at the Pine Bend Sanitary Landfill should provide adequate protection against any methane hazard. The rate of methane production in a landfill is increased according to the amount of moisture coming in contact with the refuse. Covering and grading practices by the landfill operator and subsequent surface water drainage pattern development should keep water in contact with the buried refuse at a minimum. The rate of refuse decomposition will, therefore, be slow, and as a result methane gas will be produced in small amounts over a long period of time. This low rate of methane production reduces the possibility of explosive concentrations being reached. In addition, the small amount of methane gas that is produced within the landfill should vent through the cover material and at the landfill perimeter, ultimately dissipating at harmless concentrations into the atmosphere.

Phoenix, Inc. owner of the Pine Bend Sanitary Landfill, recently began an investigation of the feasibility of recovering and processing methane gas produced at the landfill. Phoenix is still in the feasibility stage of this proposal.

Odor -- Odorous emissions may result from the operation of sanitary landfills. In general, there are a number of primary sources of odor at sanitary landfills. The most common is that which emanates directly from the incoming refuse. Odorous compounds can also result from the degradation of previously buried refuse. As previously discussed, gas is produced naturally when solid wastes decompose. The quantity generated in a landfill and its composition depend on the types of solid waste and on environmental factors such as temperature, and moisture content.

Some of the chemical compounds that are released during the decomposition process may include odorant gases. While methane and carbon dioxide are the major constituents of landfill decomposition gas, other gases produced may cause a repugnant odor. For example, hydrogen sulfide may be generated at a landfill, particularly if it contains a large amount of sulfate containing wastes or if brackish water infiltrates the solid waste. Other odorant gases which may be produced by the decomposition process include ammonia and trace mercaptans.

Another potential source of odor is leachate which reaches the surface from either seeps or from a collection system. Groundwater and infiltrating percolation in conjunction with landfill liquid wastes can result in leachate, a term denoting a

solution consisting of dissolved and suspended solid matter and microbial waste products which results when water comes in contact with landfilled solid waste.

The specific nature and concentration of substances contained in the leachate depend on the composition of the refuse as well as its degradation stage. Odorants may be released into the air as a result of leachate formation, collection or treatment.

Special wastes being received at the landfill may also generate strong odors. Typical examples include manures, fermented grains, and food processing wastes. In general however, properly operated sanitary landfills do not have substantive odor problems. Prompt waste processing, application of daily cover, leachate and gas control measures and exclusion of special wastes, as necessary, generally result in a relatively odor free operation.

The Pine Bend Sanitary Landfill, as operated by Phoenix, Inc. has not resulted in odor impacts to date. Odor generation and impacts have been minimized by operation of the site as a sanitary landfill and by the lack of sensitive receptors adjacent to the site.

Regulatory Compliance -- Based on available information, the existing Pine Bend Sanitary Landfill appears to be in compliance with regulations concerning potential air emissions from the landfill. There is no record of significant adverse odor impacts from the landfill. Furthermore, no significant adverse impacts from fugitive dust emissions and methane gas emissions have been reported.

NOISE

Federal and State Regulations

MPCA regulations NPC-1 and NPC-2 govern acceptable noise levels throughout the state. NPC-1 contains relevant definitions and specifies provisions for obtaining a variance from MPCA noise pollution control regulations. Variances may be granted in certain cases involving practicality and feasibility of compliance with the standards. MPCA regulation NPC-2 instituted a three-tier noise area classification (NAC) scheme which limits L_{50} and L_{10} (hourly) exterior noise levels during both the daytime and nighttime periods. The L_{50} parameter is defined as the noise level that is exceeded 50 percent of the time and the L_{10} parameter is the noise level that is exceeded 10 percent of the time. Noise area classification 1, which contains the most restrictive noise standards, pertains to various types of human habitations ranging from single dwellings to camping areas and hotels. Nonresidential public area activity spaces (e.g., commercial establishments) are represented by NAC-2. Manufacturing, industrial, and agricultural land uses are represented by NAC-3. Underdeveloped

land is represented by NAC-4; however, no standards have been promulgated for this category. The MPCA noise standards are shown in Table III-8.

The Occupational Safety and Health Act (OSHA) of 1970 established maximum permissible noise exposures for persons working in noise environments. These noise standards are shown in Table III-9 and are intended to protect the hearing of people exposed on a daily basis to elevated noise levels over a lifetime of employment. Violations of the OSHA standards are not common in most work environments.

Existing Landfill Site

Noise monitoring has not been conducted at or near the vicinity of the Pine Bend Sanitary Landfill. It is, therefore, difficult to assess compliance with the above regulations.

During the operation of the landfill, the primary generators of noise are equipment for earth moving and compaction and vehicular traffic entering and leaving the facility. Table III-10 shows a range of dBA levels for typical equipment used at the landfill site.

Table III-10

<u>Machine</u>	<u>dBA Range</u> (measured at 50 ft.)
Scraper	89-95
Dozer	87-89
Motor Grader	77-87
Refuse Trucks	85-95

Noise generated by the above equipment and vehicles is mitigated at the existing landfill by the following considerations. The major haul road to the site is 117th Street. All land adjacent to 117th Street is zoned industrial and no private homes are located in that area. The Phase VI working area of the landfill (see Figure II-8) is located at least 2100 feet from the nearest private dwelling. At that distance, dBA levels should be reduced by about 32.5 dBA (no obstructions).

Topographic features buffer the present working area of the landfill. Phases I through V (see Figure II-8) to the west and high ground to the east will provide physical barriers between the work areas and residences for much of the life of the landfill.

Operating hours at the site are from 6:00 a.m. to 8:00 p.m., Monday through Fridays and 6:00 a.m. to 4:00 p.m. on Saturday. After those hours, no heavy equipment is in operation.

Table III-8

MINNESOTA POLLUTION CONTROL AGENCY NOISE STANDARDS (dBA)

NA C	Day (7:00 A.M. to 10:00 P.M.)		Night (10:00 P.M. to 7:00 A.M.)	
	<u>L</u> <u>50</u>	<u>L</u> <u>10</u>	<u>L</u> <u>50</u>	<u>L</u> <u>10</u>
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Table III-9

OCCUPATIONAL SAFETY AND HEALTH ACT
MAXIMUM PERMISSABLE NOISE EXPOSURE
IN NOISE ENVIRONMENTS

<u>Duration per day, hours</u>	<u>Sound level (dBA)</u>
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

WATER QUALITY

CONTAMINATION FROM LANDFILLS

Leachate

The principal source of surface and ground water contamination from landfills is leachate. Leachate may be defined as liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it. In most landfills the liquid portion of the leachate is composed of the liquid produced from the decomposition of the wastes and liquid that has entered the landfill from external sources, such as surface drainage, rainfall, ground water, and water from underground springs.

When leachate percolates through solid wastes that are undergoing decomposition, both biological materials and chemical constituents are picked up. Representative data on the chemical characteristics of leachate, reported in Table III-11, indicate that the range of concentration values for the various constituents is rather extreme. For this reason, no average value can be given for leachate. The typical values reported in Table III-11 are intended to be used only as a guide.

In general, it has been found that the quantity of leachate is a direct function of the amount of external water entering the landfill. In fact, if a landfill is constructed properly, the production of measurable quantities of leachate can be eliminated. In some cases leachate treatment may be required.

Leachate Movement

Under ideal conditions, leachate should either be contained within the landfill or removed for treatment. Unfortunately, these conditions are found only in a few modern landfills, and so the movement of leachate from landfills is an important aspect of solid waste disposal.

Under normal conditions, leachate is found in the bottom of landfills. From there its movement is through the underlying strata, although some lateral movement may also occur, depending on the characteristics of the surrounding material. As leachate percolates through the underlying strata, many of the chemical and biological constituents originally contained in it will be removed by the filtering and adsorptive action of the material composing the strata.

Control of Leachate Movement

Because of the potential risk involved in allowing leachate to percolate to the ground water, best practice calls for its elimination or containment. To date, the use of clay has been the favored method of reducing or eliminating the percolation of

Table III - 11

DATA ON THE COMPOSITION OF LEACHATE FROM LANDFILLS

<u>Constituent</u>	<u>Value+ mg/l</u>	
	<u>Range ++</u>	<u>Typical</u>
BOD ₅ (5-day biochemical oxygen demand)	2,000-30,000	10,000
TOC (total organic carbon)	1,500-20,000	6,000
COD (chemical oxygen demand)	3,000-45,000	18,000
Total suspended solids	200- 1,000	500
Organic nitrogen	10- 600	200
Ammonia nitrogen	10- 800	200
Nitrate	5- 40	25
Total phosphorus	1- 70	30
Ortho phosphorus	1- 50	20
Alkalinity as CaCO ₃	1,000-10,000	3,000
pH	5.3- 8.5	6
Total hardness as CaCO ₃	300-10,000	3,500
Calcium	200-3,000	1,000
Magnesium	50-1,500	250
Potassium	200-2,000	300
Sodium	200-2,000	500
Chloride	100-3,000	500
Sulfate	100-1,500	300
Total iron	50- 600	60

+ Except pH

++Representative range of values. Higher maximum values have been reported in the literature for some of the constituents.

leachate. Membrane liners have also been used, but they are expensive and require care so that they will not be damaged during the filling operation.

Surface Water Runoff

Equally important in controlling the movement of leachate is the elimination of surface water infiltration, which is the major contributor to the total volume of leachate. With the use of a relatively impermeable cover material, an appropriate surface slope, and adequate drainage, surface infiltration can be controlled effectively.

Improper surface runoff from a landfill can also result in erosion of the cover material. Erosion may lead to the discharge of suspended solids to streams and possible siltation of adjacent water bodies. Surface runoff diversion may be necessary including channeling and the construction of berms and dikes.

GEOLOGY AND HYDROLOGY OF THE PINE BEND LANDFILL AND SURROUNDING AREA

Geologic and hydrologic conditions are major considerations in determining the environmental acceptability and impacts on an area from a landfill operation. Data on these factors are necessary to assess the pollution potential of a landfill and to establish what must be done to ensure that the movement of leachate and surface water runoff from a landfill will not impair the quality of local ground and surface waters.

The following discussion is presented for background purposes for the later assessment of water quality impacts from the existing operation and proposed expansion of the Pine Bend Sanitary Landfill.

Previous Studies

In recent years, the Pine Bend area has been the subject of extensive geologic and hydrologic study. This has been due, at least in part, to suspected ground water problems in the industrial area of Pine Bend. The area was also considered for siting of a hazardous waste facility in 1977. Finally, the Pine Bend Landfill itself was the subject of a hydrogeologic study in 1978.

These studies provide the major source of information for this section of the environmental impact statement.

Reeder and Norvitch (1974) -- The Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDOH) conducted field reconnaissance efforts consisting of the sampling and analysis of the quality of domestic, municipal and industrial ground water wells in the Pine Bend area. The results of these water quality sampling programs indicated that the ground water in the Pine Bend area displayed chemical characteristics atypical of similar ground waters in the area.

Subsequently, the MPCA entered into a cooperative agreement with the United States Geological Survey (USGS) to further study the ground water in the Pine Bend area. The purpose of the USGS study was to delineate the approximate area showing atypical characteristics, define the basic ground water flow system and recommend future studies to predict the future spread of the atypical characteristics. The USGS used specific conductivities greater than 700 umhos/cm at 25 °C as an indicator that the quality of the ground water was atypical. The resulting report by Reeder and Novitch (1974) entitled "Hydrogeologic Reconnaissance of Ground Water Pollution in the Pine Bend Area, Dakota County, Minnesota" identified an area of approximately 2.2 square miles in which the ground water exhibited high conductivity levels. The report concluded that this area has reached a steady-state condition with regard to areal spread. The study also defined the basic geology and horizontal ground water flow system existing in the Pine Bend area.

Gebhard (1975) --The studies by the MPCA, MDOH and Reeder and Norvitch (1974) did not result in sufficient data to define in detail the vertical seepage of ground water in the Pine Bend area nor to ascertain whether the vertical spread of ground - water with high conductivity levels had reached steady-state conditions. Gebhard (1975) developed a hypothesis regarding the vertical seepage of ground water with high conductivity levels. Gebhard's analysis showed that the seepage of ground water with high conductivity to deeper aquifer formations is unlikely. Gebhard further concluded that subsequent studies should be carried out to design a monitoring system to obtain data to test the hypothesis.

Metropolitan Council (1978) -- A 1978 report by the Metropolitan Council summarized the potential leachate pollution from sanitary landfills in the Metropolitan Area. The study was carried out by the Council under the federal "208" program to investigate non-point pollution sources. Hydrogeologic conditions in the Pine Bend area were investigated in order to use the water balance method to determine the potential for leachate generation from the Pine Bend Sanitary Landfill.

Sunde (1978) -- A report by Sunde (1978) investigated soil and ground water conditions at the Pine Bend Sanitary Landfill and adjacent areas. The report analyzed previous studies of the area and soil borings and water quality tests both on-site and adjacent to the landfill. The report concluded with recommendations for a ground water monitoring system at the landfill and the implementation of certain operational procedures to improve surface water runoff from the facility.

Regional Setting

Figure III-3 is a west-to-east geologic cross-section through the center of the Metropolitan Area and Table III-12 lists the important geologic units in the Region and describes their water bearing characteristics. Some of the strata are highly permeable and yield water to wells; some of the strata are

GENERALIZED GEOLOGIC CROSS SECTION OF THE METROPOLITAN AREA

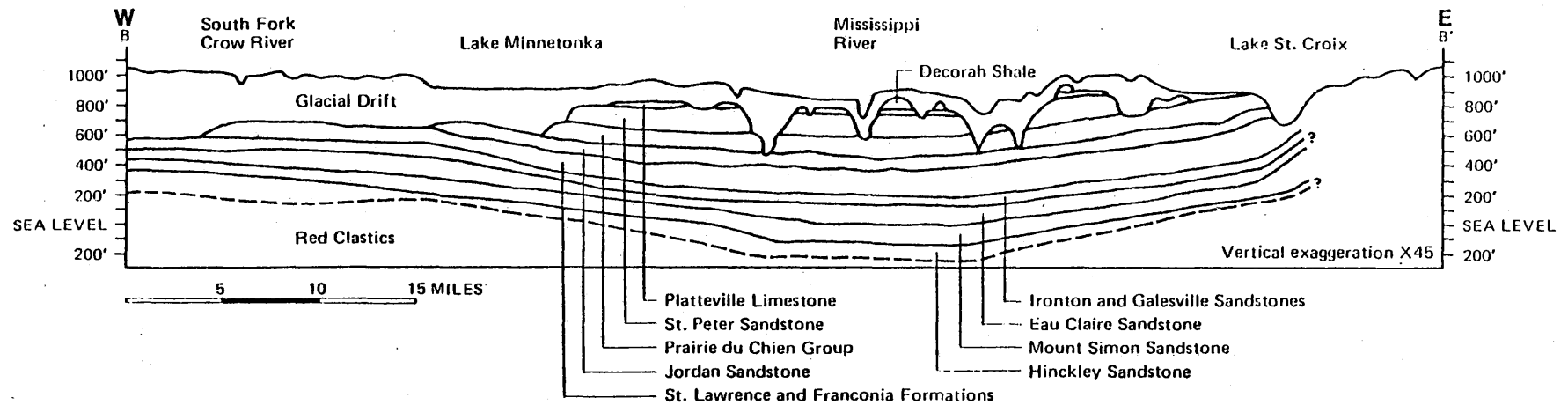


Figure III - 3

GEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS IN THE METROPOLITAN AREA

System	Geologic Unit	Approx. Range in Thickness (in feet)	Description	Water-Bearing Characteristics
Quaternary	Undifferentiated glacial drift	0-400+	Glacial till, outwash sand and gravel, valley-train sand and gravel, lake deposits, and alluvium of several ages and several provenances. Vertical and horizontal distribution of units is complex.	Distribution of aquifers and relatively impermeable confining beds is poorly known, especially in subsurface. Where saturated, stratified well-sorted deposits of sand and gravel (alluvium, valley train, outwash, some lake and ice-contact deposits) yield moderate to large supplies of water to wells. Records of 24 large diameter wells completed in sand and gravel show yields ranging from 240 to 2,000 gpm (gallons per minute) with from 2 to 69 feet of drawdown. Des Moines Lobe till is non-water bearing; Superior Lobe till is sandy and may yield small supplies suitable for domestic or farm use.
			Unconformity	
Ordovician	Decorah Shale	0-95	Shale, bluish-green to bluish gray; blocky; thin, discontinuous beds of fossiliferous limestone throughout formation.	Only about 25 square miles in extent in area of study. Confining bed.
	Platteville Limestone	0-35	Dolomitic limestone and dolomite, dark gray, hard, thin-bedded to medium-bedded; some shale partings; can be divided into five members.	Only about 200 square miles in extent in area of study. Where saturated, fractures and solution cavities in rock generally yield small supplies to wells. Records of 23 wells show an average yield of 23 gpm. Water is generally under artesian pressure where overlain by Decorah Shale. Not considered to be an important source of water in area of study.
	Glenwood Shale	0-18	Shale, bluish-gray to bluish green; generally soft but becomes dolomitic and harder to the east.	Confining bed, locally, some springs issue from the Glenwood-Platteville contact in the river bluffs.
	St. Peter Sandstone	0-150+	Sandstone, white, fine- to medium grained, well sorted, quartzose; locally iron-stained and well cemented; rounding and frosting of grains is common; 5-50 feet of siltstone and shale near bottom of formation.	About 650 square miles in extent in Minnesota part of study area; not fully saturated throughout area. Most wells completed in the sandstone are of small diameter and used for domestic supply. They yield 9 to 100 gpm with 1 to 21 feet of drawdown. Two wells known to be used for public supply have been pumped at 600 and 1,250 gpm. Water occurs under both confined and unconfined conditions. Confining bed near bottom of formation seems extensive and hydraulically separates sandstone from underlying Prairie du Chien-Jordan aquifer. Not considered to be an important source for public supplies in area of study, but is suitable source for domestic supplies.
	Prairie du Chien Group	0-250+	Shakopee Dolomite	About 2,000 square miles in extent in Minnesota part of study area. Together, the Prairie du Chien dolomite and Jordan Sandstone constitute the major aquifer unit in the area. The two are hydraulically connected throughout most of the area, but locally some small head differences may exist owing to intervening low-permeable confining beds of limited extent. Prairie du Chien. Permeability is due to fractures, joints and solution cavities in the rock. Yields small to large supplies of water to wells. Pumping rates of up to 1,800 gpm have been obtained. Jordan. Permeability is mostly intergranular but may be due to joint partings in cemented parts. Main source of water for public supply in metropolitan area. Almost all wells completed in the sandstone are of large diameter. Recorded yields are from 16 to over 2,400 gpm with 2 to 155 feet of drawdown.
			New Richmond Sandstone	
			Oncota Dolomite	
Cambrian	Jordan Sandstone	0-100+	Sandstone, white to yellowish, fine- to coarse grained, massive to bedded, cross-bedded in places, quartzose; commonly iron-stained; loosely to well cemented.	
	St. Lawrence Formation	0-45	Dolomitic siltstone and fine grained dolomitic sandstone; glauconitic, in part.	Confining bed. No wells are known to obtain water from this formation.
	Franconia Sandstone	0-200+	Sandstone, very fine grained; moderately to highly glauconitic, worm-bored in places. Interbedded very fine grained sandstone and shale; mica flakes common. Glauconitic fine-grained sandstone and orange to buff silty fine-grained sandstone (often worm-bored).	Small amounts of water may be obtainable from the medium- to coarse-grained members of the formation, very little water from the fine-grained members. Not considered to be an important water source in the area of study. Records of wells completed only in the Franconia Formation are lacking.
	Hutton Sandstone	0-60+	Sandstone, white, medium- to fine grained, poorly sorted and silty	About 3,000 square miles in extent in area of study. An important aquifer beyond the limits of the Prairie du Chien-Jordan aquifer. Yields of wells range from 40 to 400 gpm with 4 to 110 feet of drawdown.
	Galesville Sandstone		Sandstone, yellow to white, medium- to coarse grained, poorly cemented.	
	Eau Claire Sandstone	0-150	Sandstone, siltstone, and shale, gray to reddish-brown, fossiliferous.	Confining bed. Sandstone beds may yield small quantities of water to wells for domestic use. Shale of very low permeability and apparent large areal extent constitutes the main confining bed for water in the underlying aquifer.
	Mt. Simon Sandstone	As much as 100	Sandstone, gray to pink, medium- to coarse-grained. Some pebblic lenses and thin, shaly beds.	Secondary major aquifer in the area of study. Supplies about 15 percent of ground water pumped in the metropolitan area. Recorded yields of 27 municipal and industrial wells range from 125 to 2,000 gpm with 20 to 209 feet of drawdown. Major source of artesian water in northern half of study area.
Precambrian	Thinley Sandstone	As much as 200	Sandstone, buff to red, medium- to coarse-grained, well sorted and cemented.	Aquifer of local interest in Chicago County, T. 35 N., R. 21 W. Wells have yields from 15 to 120 gpm with 41 to 150 feet of drawdown. Data are lacking in metropolitan and other parts of area. Rock is at and near the surface at Taylor Falls and north of boundary of study area. Weathered or fractured zones provide small quantities of water for domestic needs. Deeply buried in metropolitan area and no data available.
	Red clastics	As much as 4,000	Silty siltstone, sandstone and lithic sandstone, fine-grained; probably included red shale.	
	Volcanic rocks	As much as 20,000	Mostly mafic lava flows, but includes thin interlayers of tuff and breccia.	

Table III - 12

highly impermeable forming confining beds for the aquifers. Bedrock formations in the Metropolitan Area are in a general bowl shape, with formations subcropping beneath glacial drift in the periphery of the Region. The underlying bedrock is Cambrian or Ordovician in age and primarily limestone, dolomite, sandstone, and shales.

The Metropolitan Area has been glaciated several times. On each occasion, as the glaciers advanced and retreated, they deposited a highly complex mantle of glacial drift, ranging from highly permeable sands and gravels of outwash to highly impermeable clays of glacial lakes and tills. In addition, each period of glaciation altered the course of the rivers in the Region. The various rivers cut through the glacial drifts down into the bedrock in several areas (see Figure III-3) and were subsequently filled in by drift from a later period of glaciation.

Area Topography

Topographic relief in the Pine Bend area is more than 350 feet. Land surface altitudes range from more than 1,040 feet above mean sea level on the morainal hills west of Pine Bend to less than 690 feet on the flood plain of the Mississippi River. Despite the appreciable relief, the area is poorly drained, containing numerous lakes and swamps on the morainal surfaces and being largely dry on the outwash surfaces. There are no natural perennial streams in the area other than the Mississippi River, thus precipitation on the land surface either seeps into the subsurface or is lost to evapotranspiration. At the Pine Bend Landfill, the hilly moraine topography results in many land locked depressions or ponds to which surface water flows.

Site Geology

Bedrock -- In terms of bedrock structure, the Pine Bend Sanitary Landfill is located in the southeastern part of a broad relatively shallow basin, the Twin Cities Basin. This basin is centered beneath the cities of Minneapolis and St. Paul with the various strata of Paleozoic rocks dipping gently towards the basin center. The Twin Cities Basin is a part of the larger structural basin, the Hollandale Embayment, which extends to the south and southeast. The limits of the Twin Cities Basin near the landfill are the Hudson-Afton Anticline to the east and a relatively gradual divide to the south in southern Dakota County. Beyond the divide to the south is the main Hollandale Embayment.

The Ordovician and Cambrian rock formations within the Twin Cities Basin are relatively flat, have reasonably constant thickness, and have lateral continuity. However, considerable erosion has occurred at the bedrock surface. Throughout the Metropolitan Area, bedrock valleys are cut into the rock surface exposing the underlying bedrock formations filled with morainal debris.

One of these valleys passes in an east-west direction beneath the landfill. The uppermost bedrock formation in the general area of the landfill is likely the Prairie du Chien Group dolomites.

Figure III-4 shows a stratigraphic column for the Pine Bend area through the Ordovician and Cambrian formations and to the pre-Cambrian Hinckley Sandstone. Formations that may be exposed as the bedrock subcrop or are of importance are described as follows.

Prairie du Chien Group -- There are usually assumed to be two formations comprising the group, the upper Shakopee Formation and the lower Oneota Dolomite. The Shakopee Formation is described as consisting of two members. The upper member is dolomite with some interbedded sandstone and shale. The lower member is the New Richmond Sandstone, a relatively thin layer of quartzose sandstone. The Oneota Dolomite is a fine- to medium-grained dolomite with possible beds of siltstone. This material is exposed at the surface in many locations in the Pine Bend area including a large quarrying operation just to the east across the Mississippi River on Grey Cloud Island. Of interest in terms of hydrogeology is the relative permeability of the Group. The presence of joints and fractures along with solution channels results in permeabilities equivalent to that of the underlying Jordan Sandstone. In terms of bedrock aquifers, the Prairie du Chien Group is assumed generally to act as a unit with the Jordan Sandstone.

Jordan Sandstone -- The Jordan Sandstone is a white to yellow coarse to medium grained quartzose sandstone. Although it is only on the order of 90 to 100 feet in thickness, it is considered to be an extremely valuable ground water aquifer. It is at present the most heavily used ground water aquifer in the Twin Cities Basin.

St. Lawrence Formation -- This formation lies at the base of the Jordan Sandstone and includes mainly silty and sandy dolomitic rocks. Because it has relatively low permeability, the formation acts as an aquitard restricting flow downward from the Jordan Sandstone.

Franconia Formation -- This formation is primarily sandstone with some layers of silt and dolomite and silty sandstone. It is not normally used for water supply due to the availability of more productive layers. It is likely that the Franconia Formation is the oldest bedrock formation to subcrop in the buried valley that crosses the landfill area.

Beneath the above formations and above the basal red clastic series are two other usable aquifers. These are the Iron-ton-Galesville and the Mt. Simon-Hinckley. The first is used only to a limited degree in the Twin Cities Basin due to the presence of more productive aquifers. The Mt. Simon-Hinckley Aquifer is the second most heavily used aquifer in the basin and has been

STRATIGRAPHIC COLUMN NEAR PINE BEND SANITARY LANDFILL

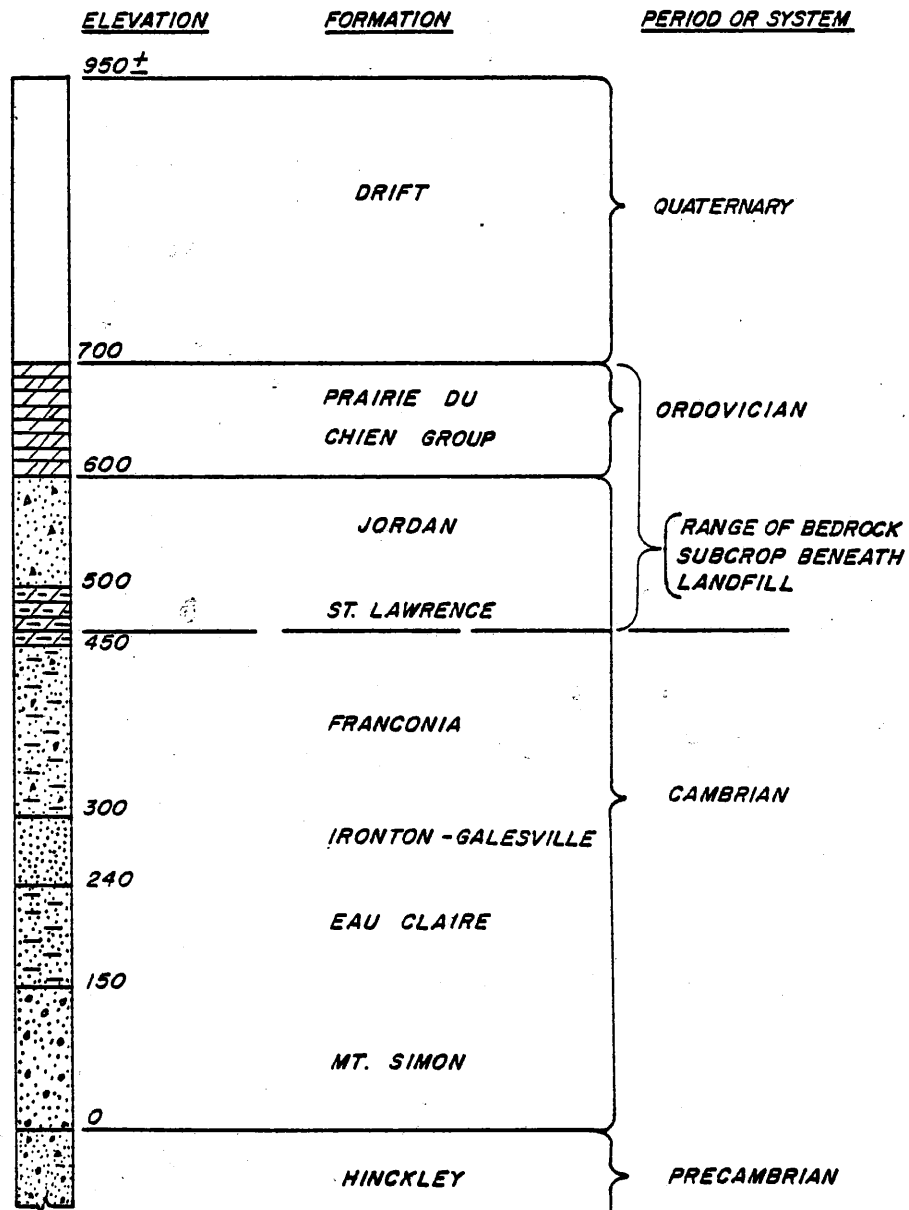


Figure III - 4

extensively developed in recent years.

Not shown in Figure III-4 is the St. Peter Sandstone which is located stratigraphically above the Prairie du Chien Group dolomites. Reeder and Norvitch (1974) indicate that outliers of the sandstone may remain above the dolomite group at some places in the general area.

Figure III-5 shows the probable bedrock subcrop formations beneath the general area of the landfill. This drawing is developed from data in Norvitch (1973) and Reeder and Norvitch (1974). Most references indicate that the buried bedrock valley beneath the landfill and the other similar valleys of the Metropolitan Area are either pre-quaternary or interglacial in origin. The particular valley beneath the landfill extends to the west to approximately the valley of the Minnesota River in the City of Eagan. From there it extends west-southwest along the Minnesota River towards Chaska. Another branch of the valley runs north generally through Lake Minnetonka from about Eden Prairie. The valley is eroded deeply into the nearly horizontal bedrock formations. At Pine Bend, the buried valley extends through the Prairie du Chien Group and Jordan Sandstone and into or through the St. Lawrence Formation. The valley has a bottom altitude of less than 500 feet and contains some 450 to 500 feet of drift and outwash (see Figure III-6).

Glacial Geology and Soils -- The unconsolidated soils above bedrock at the landfill reflect the effects of glaciation of the area particularly the latest Wisconsin glacial period. This particular area was covered by at least one ice lobe during the Wisconsin period, the Superior Lobe. This lobe moved into the area from the north-northeast. The area was also affected by the Des Moines Lobe, a later retreat that did not reach the landfill area but covered nearby areas to the north and west.

Figure III-7 shows the general area where the surface soils are either moraine or alluvial in origin. Almost without exception, soil borings taken in undisturbed areas on the landfill and at the bale fill identify at least some glacial till at the surface. This till is Superior Lobe in origin and in all cases is underlain at depths of from 0 to 40 feet by alluvial sands and gravels with minor amounts of silt and clay.

The mechanics of deposition of the unconsolidated soils are most likely as follows. The buried bedrock valley running beneath the site was operational as a main channel of the Mississippi-Minnesota River drainage system during pre-Wisconsin times. Because it drained a large area and likely carried a significant amount of sediment (particularly during the time of glacial ice advance), the stream valley aggraded and filled with the presently in-place alluvial soils. The aggradation may have been caused by downstream blockage of the deeper channel or possibly an increased sediment loading. In any event, the valley filling took place prior to covering the area by the Superior Lake ice.

BEDROCK SUBCROP



Figure III - 5

MAP SHOWING CONTOURS ON BEDROCK SURFACE

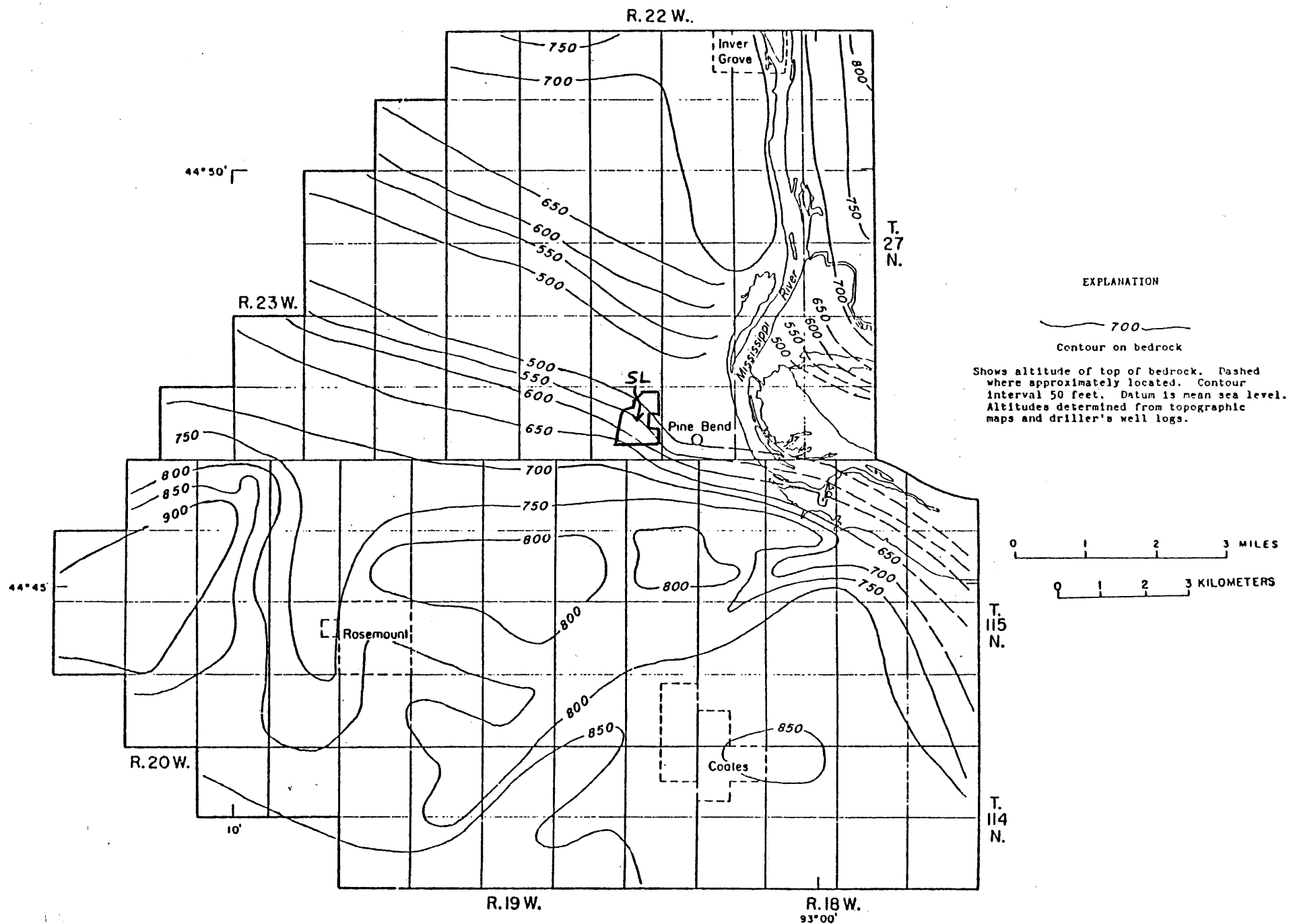


Figure I - 6

SURFICIAL SOILS

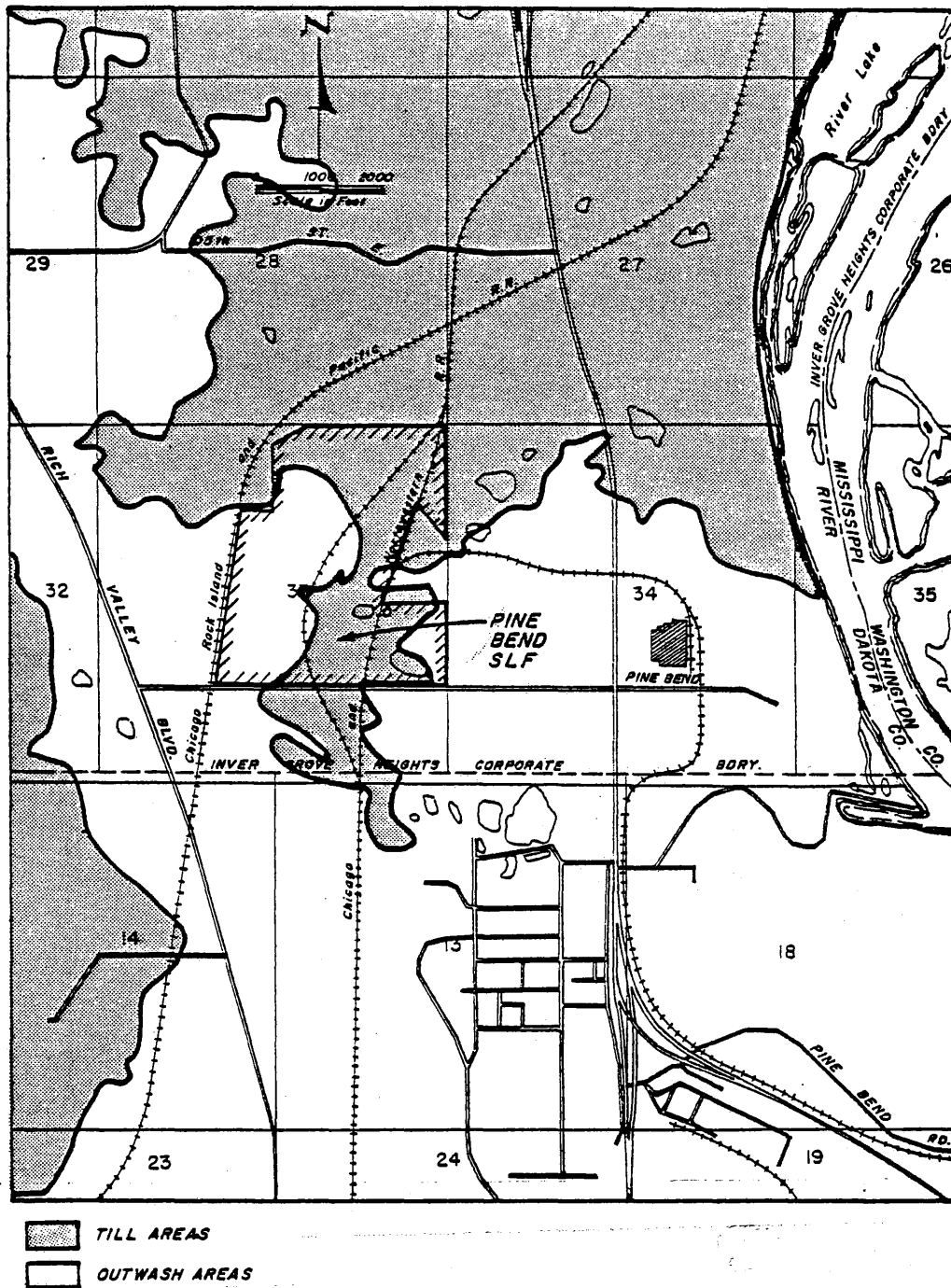


Figure III - 7

When the Superior Lobe moved into the Twin Cities area, it advanced to a limit approximately at the Pine Bend Landfill site which is actually located in the terminal moraine. The terminal moraine extends northeast towards Stillwater and to the west into Burnsville. Any trace of this moraine to the southwest and west of Minneapolis has been buried by a later ice advance. As the moraine overrode the in-place alluvial valley fill soils of the area, there apparently was considerable reworking of that material resulting in the very sandy nature of the tills present in the area of the landfill.

Wasting of the Superior Lobe resulted in formation of the broad alluvial plains that exist in Rosemount, Empire Township, and Apple Valley. Such deposits extend to the west and southwest parts of the landfill site as is shown in Figure III-7.

Arneman (1960) classified the surface soils of the site prior to landfill development as being:

Till Areas:	Burnsville, Hayden, Kingsley and Scandia loam and sand loam.
Outwash Areas:	Burnsville-Lakeville sandy loams and loamy sands Waukegan silt loams Estherville loam and sandy loam Dakota and Waukegan loam

These site soil classifications are the basis for the division between till and outwash areas shown in Figure III-7.

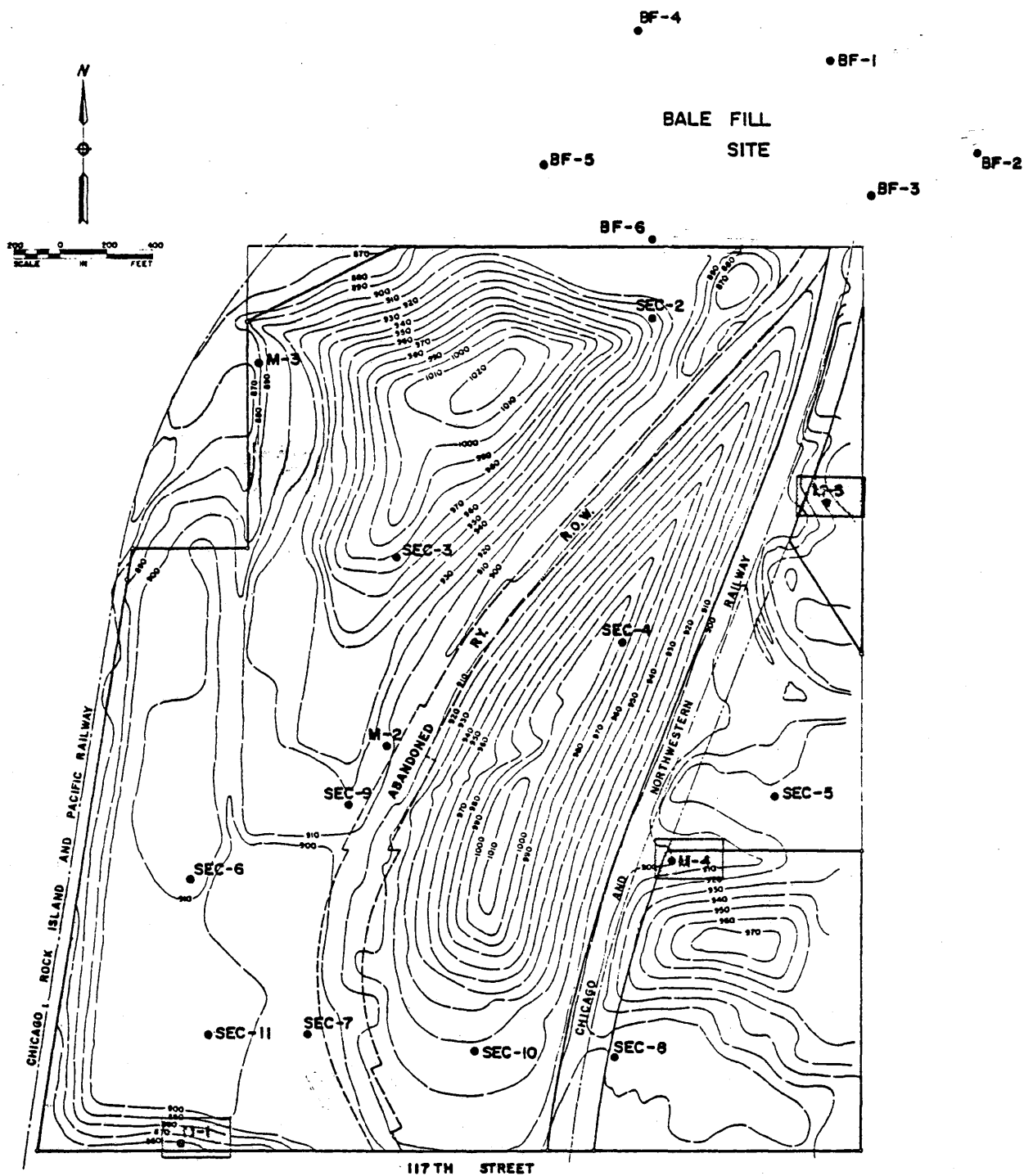
To summarize, the landfill site is characterized by alluvial soils overlain by Superior Lobe glacial tills except possibly at the southwest part of the landfill. The alluvial soils extend to the ground water table and likely reach the bedrock subcrop at depths of from 250 to 450 feet.

Soil Borings -- As part of the initial permitting process at the Pine Bend Sanitary Landfill and the bale fill to the north, several soil borings were taken in the general area. These were followed by supplemental boring work done as part of further studies or construction activities. Figure III-8 shows the location of the several borings in the area for which data has been available. The sequence of boring work in the area and the reasons for drilling is as follows:

1. April 9, 1971: A series of 10 borings (marked SEC-1 through SEC-10) were taken by Soil Exploration Company to provide baseline data for design of the original landfill. These borings varied in depth from 25 to 51 feet. Ground water was not encountered in any of the boring holes.

PINE BEND SANITARY LANDFILL

AREA SOIL BORINGS



KEY TO MAP SYMBOLS

SEC - 1971 PERMIT SOIL BORINGS

BF - 1978 BALE FILL BORINGS

M - M-1 THRU M-3 - 1971 MONITORING WELLS.
M-4 & M-5 - 1978 SOL BORINGS

Figure III - 8

2. May 13, 1971: One boring by Soil Exploration Company (marked SEC-11) was drilled specifically to locate the ground water table beneath the site. The boring extended to a depth of about 106 feet and located ground water at a depth of 99 feet (approximately elevation 781).
3. September 1974; October 28, 1974; and November 3, 1975: At these times, six shallow borings (25 feet or less) were taken to provide foundation information for design of the Phoenix building and truck scale. Locations are not shown in Figure III-8.
4. January 17, 1978: Six borings were taken by Soil Exploration Company as a part of a ground water study at the adjacent bale fill (marked BF-1 through BF-6). This data is applicable to the landfill site to the extent that area soil conditions can be inferred.
5. July 7, 1978: Two soil borings were taken and piezometers installed along the east limits of the site by Soil Exploration Company. This work, which was done as part of the Sunde's hydrogeologic study, required that the borings reach the ground water table. The holes are marked M-4 and M-5.

Three on-site borings show in detail the soil profile beneath the landfill site. These are M-4, M-5, and SEC-11. These borings indicate the presence of surface glacial tills to depths of up to 25 feet. Below this, the materials are mainly dense sands with minor amounts of silty sand.

Ground Water Hydrology

In other studies of the Pine Bend area, there have been various opinions forwarded as to depths to ground water and direction of ground water flow. For example, the initial ground water study for the Crosby American Properties, Inc., bale fill encountered water at shallow depths in some but not all borings on the site. From this data, it was inferred that the ground water gradient in the area was possibly to the west.

Reeder and Norvitch (1974) also showed a probable ground water gradient to the west in the landfill area. They theorized the existence of a ground water divide between Rich Valley and the Mississippi River valley. They stated that the altitude of the water table shown in their report is based on hydrographic features and test holes. It appears that the assumption was made that surface water exposures in the moraine area between the two valleys represent ground water levels.

Sunde (1978) has shown that this is not the case. Comparison of surface water levels with nearby monitoring wells indicated that water in the landlocked ponds on and near the landfill and in the shallow bale fill wells were representative of perched water

conditions. As described below, Sunde found that the ground water gradient dips to the east towards the deep Mississippi River valley as one would expect.

As previously mentioned, as a part of the hydrogeological study of the Pine Bend Sanitary Landfill (Sunde, 1978) and the EPA water quality investigation at the adjacent bale fill, several borings were specifically taken to locate the water table and monitor water quality. Figure III-8 shows the locations of these borings. Figure III-9 shows the approximate ground water contours in the surficial drift below the site. The ground water levels vary from approximately 780+ in the southwest corner to approximately 730 in the northeast corner. It appears that the ground water gradient is generally to the northeast except near the north limits of the landfill where the gradient is more directly to the east.

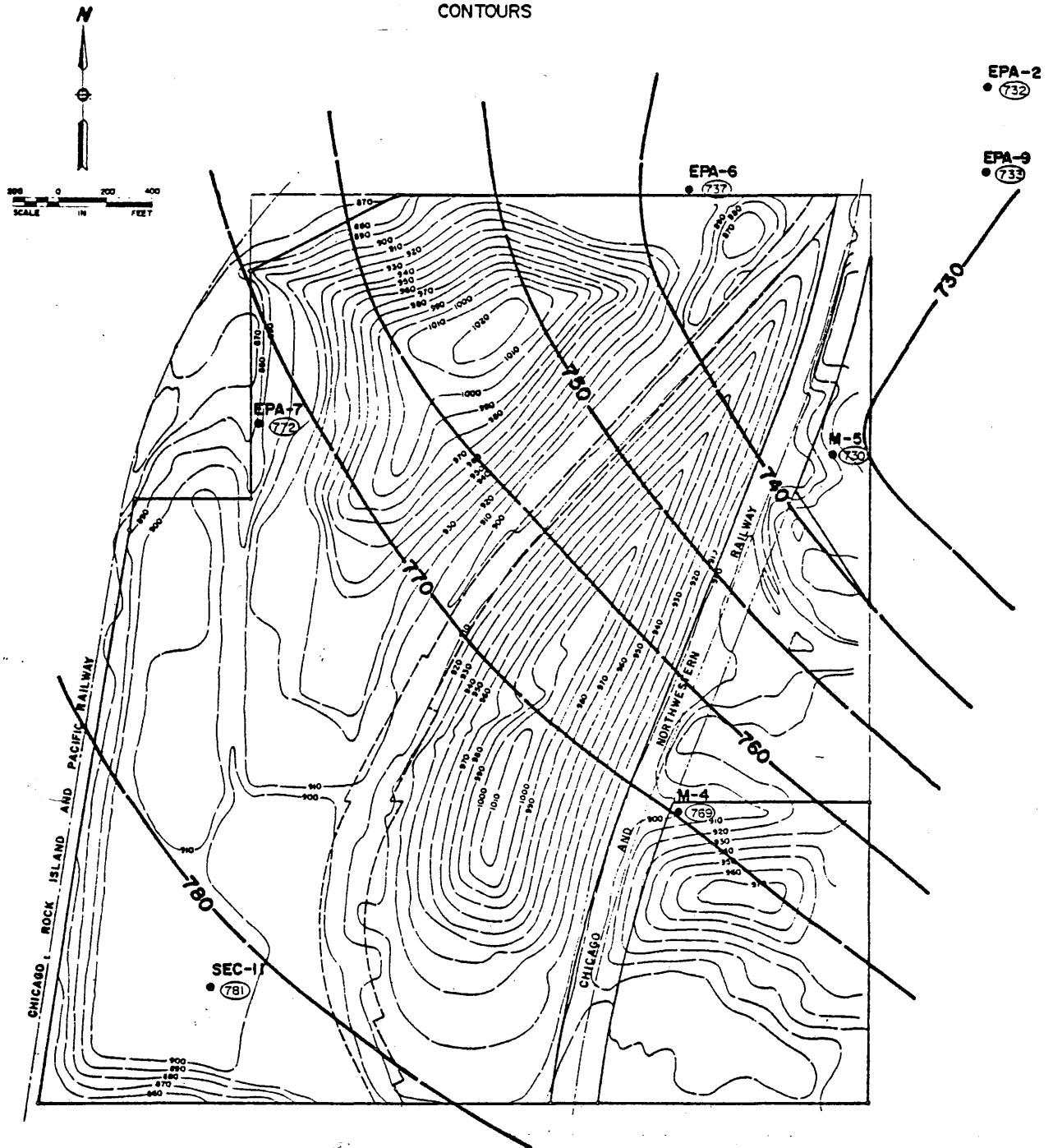
As shown in Figures III-5 and III-6, the landfill property is located along the south slope of the buried glacial valley. Near the southwest limits of the landfill, the bedrock subcrop appears to be Prairie du Chien Group dolomite whereas near the north limits of the property, the valley is eroded through the Jordan Sandstone and into the St. Lawrence and Franconia Formation. It should be noted that the bedrock valley location is approximate and is not closely identified by borings. The direction of ground water flow shown in Figure III-9 is at approximately right angles to the axis of the buried valley. If the buried valley is filled with unconsolidated alluvial materials that have lateral continuity to the Mississippi River valley and these materials have generally a higher hydraulic conductivity (permeability) than that of the Prairie du Chien-Jordan Aquifer, then one would expect ground water levels to be lower in the valley. This is because less gradient would be required to convey water through the granular soils than through an equivalent length of the bedrock aquifer.

It appears, ground water flows from the Prairie du Chien-Jordan Aquifer to the alluvial soils in the bedrock valley due to potentiometric surface of the bedrock aquifer being higher than the surface in the buried valley (near the north limits of the landfill). Reeder and Norvitch (1974) showed the potentiometric levels in the Prairie du Chien-Jordan Aquifer near the south limits of the landfill as being approximately at elevation 780 to 760. These are about the levels recorded in the surficial drift wells SEC-11 and M-4. An on-site well located at the shop near the south limits of the landfill is finished into the Jordan Sandstone and has a static water level of about 750. Because the valley in the bedrock has apparently completely eroded through the Jordan Sandstone near the north property line and the surficial drift ground water table elevations are at about 730 in that area, there must be a gradient from the Jordan Sandstone to the valley granular soils.

The Prairie de Chien-Jordan Aquifer which is partially or completely eroded away beneath the landfill is generally continuous to the south and southwest of the landfill. The

PINE BEND SANITARY LANDFILL

SITE GROUND WATER CONTOURS



KEY TO SYMBOLS

- GROUNDWATER LEVEL MEASUREMENT POINT

- (772) ELEVATION OF GROUNDWATER IN WELL OR BORING

- ESTIMATED GROUNDWATER CONTOUR

Figure III - 9

potentiometric gradient of the aquifer is towards the valley of the Mississippi River. In the general area of the Pine Bend refinery to the south of the landfill, the gradient is approximately 30 feet per mile according to Norvitch (1973)

Little data is available on the Iron-ton-Galesville Aquifer in the landfill area primarily because there is no real use of the strata. Barr (1975) indicates that it is likely that the aquifer does not discharge to the Mississippi River in the immediate area. The aquifer is separated from the Prairie du Chien-Jordan and the surficial drift aquifers by formations having relatively low vertical permeabilities including the St. Lawrence and Franconia Formations.

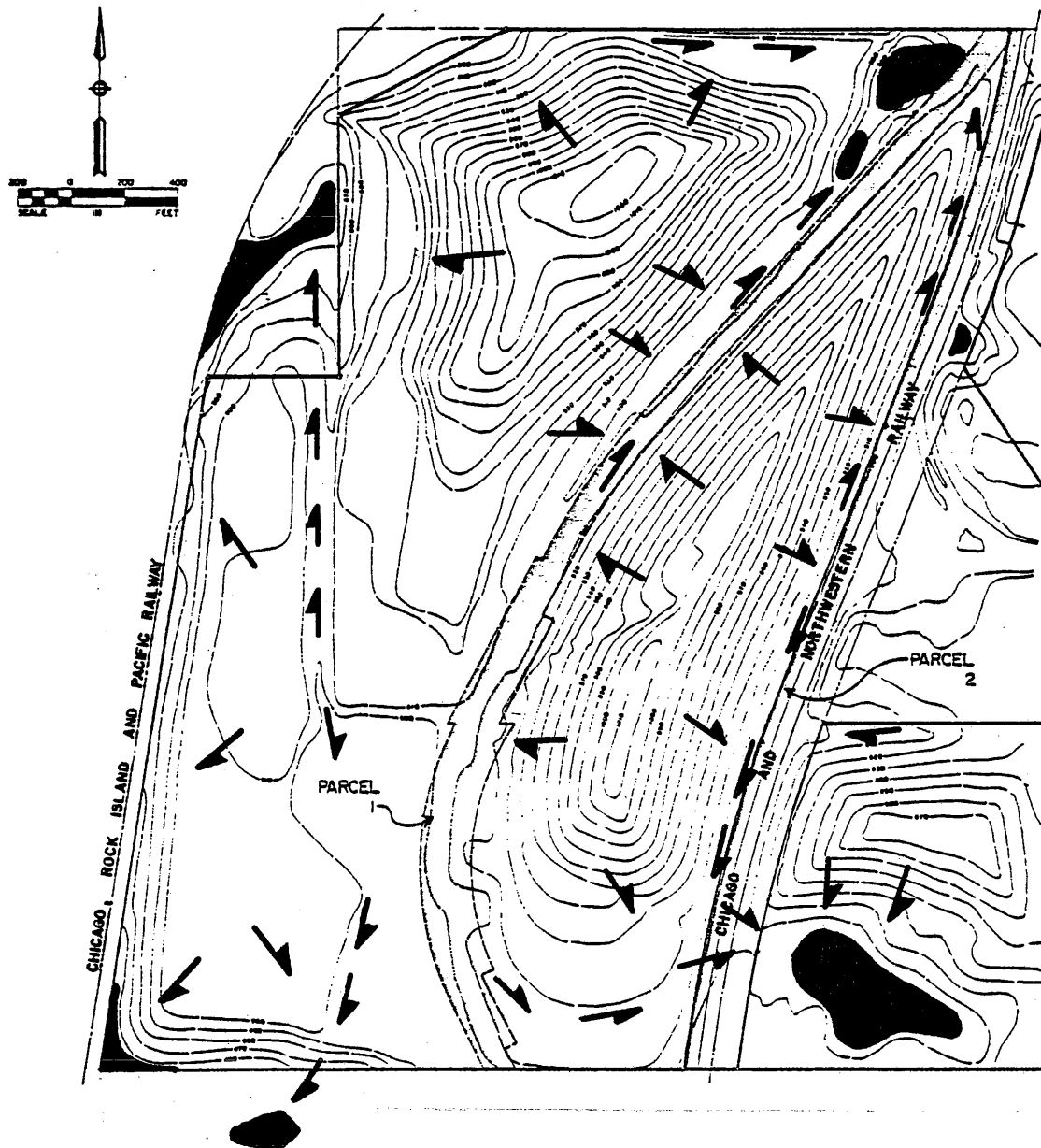
To summarize ground water conditions beneath the landfill site, both the ground water in the surficial drift and the Prairie du Chien-Jordan aquifers are moving towards the valley of the Mississippi River. The buried valley in the bedrock beneath the landfill area has a local effect on the direction of groundwater flow. It is probable that water from the Jordan Sandstone is moving to the buried valley soils and then to the river valley. The underlying bedrock aquifers, Iron-ton-Galesville and Mt. Simon-Hinckley, do not discharge to the Mississippi River valley in the landfill area.

Surface Water Hydrology

Prior to construction of the Pine Bend Sanitary Landfill, surface drainage in the area was very poorly defined. The pre-development topography shown in the plans prepared by William K. McKie is characterized by knoblike hills, ridges, and landlocked depressions. Essentially all of the surface water runoff generated on the site flowed to depressions either on or just adjacent to the landfill property. Even the ditches along the three railroad lines on or adjacent to the site simply drain to the depressions. When the water ponded in the landlocked low areas following runoff events, it either evaporated or percolated into the ground and entered the ground water system. It is likely that those depressions having either large drainage areas or fairly impermeable soils lining their bottoms are the ones that maintain water during non-rainfall periods.

The presently approved landfill plan calls for diversion of surface runoff to landlocked ponding areas located on or just adjacent to the landfill property (see Figure III-10). The northeast quarter of the site including much of the abandoned railroad right-of-way drains to the landlocked pond at the northeast corner of the Phoenix site. The remainder of the east side of the landfill drains to a large pond in the southeast corner of the site. The northwesterly quarter of the landfill drains to a pond located adjacent to the Chicago, Rock Island and Pacific Railway (CRI&P) railroad on the west side of the site. The southwest quarter of the site drains to the south across 117th Street to a landlocked area near the CRI&P railroad. The culvert beneath 117th Street was in place prior to starting the landfill and conveyed runoff from the area at that time.

PINE BEND SANITARY LANDFILL
FINAL GRADING AND DRAINAGE PLAN



NOTE: CONTOURS SHOWN ARE
FINAL CONTOURS AS PRESENTLY
PERMITTED

—> DIRECTION OF SURFACE DRAINAGE

● SURFACE WATER PONDING AREAS

Figure III - 10

When comparing the surface runoff conditions for the approved landfill plan with the conditions prior to development, it can be seen that the runoff drainage pattern will not change significantly. The land surface will in general be in grass or pasture type vegetation, the slopes will not exceed 4 to 1, 25 percent, and the drainage will be directed to landlocked ponding areas.

Local Water Supply

The prevailing land use in the area adjacent to the Pine Bend Sanitary Landfill is either agricultural or industrial. The site is considerable distance from public sewer and water services. Therefore, all adjacent properties use individual wells for water supply.

Records indicate that there are about 53 known nonpublic water supply wells within a one mile radius of the landfill site (see Figure III-11). Sunde (1978) indicated that as many as 18 private wells could be located downgradient from the site (in the path of ground water flow from the landfill to the Mississippi River). This number was based on the number of single family homes and commercial operations in the area (see Local Water Supply Quality).

Phoenix Inc. and Minnesota Department of Health records indicate that the depths of these wells vary considerably, with the majority in the range of from 200 to 400 feet (data was not available for all wells). One down-gradient well at the Cenex facility is a Mt. Simon-Hinckley well and is 810 feet in depth.

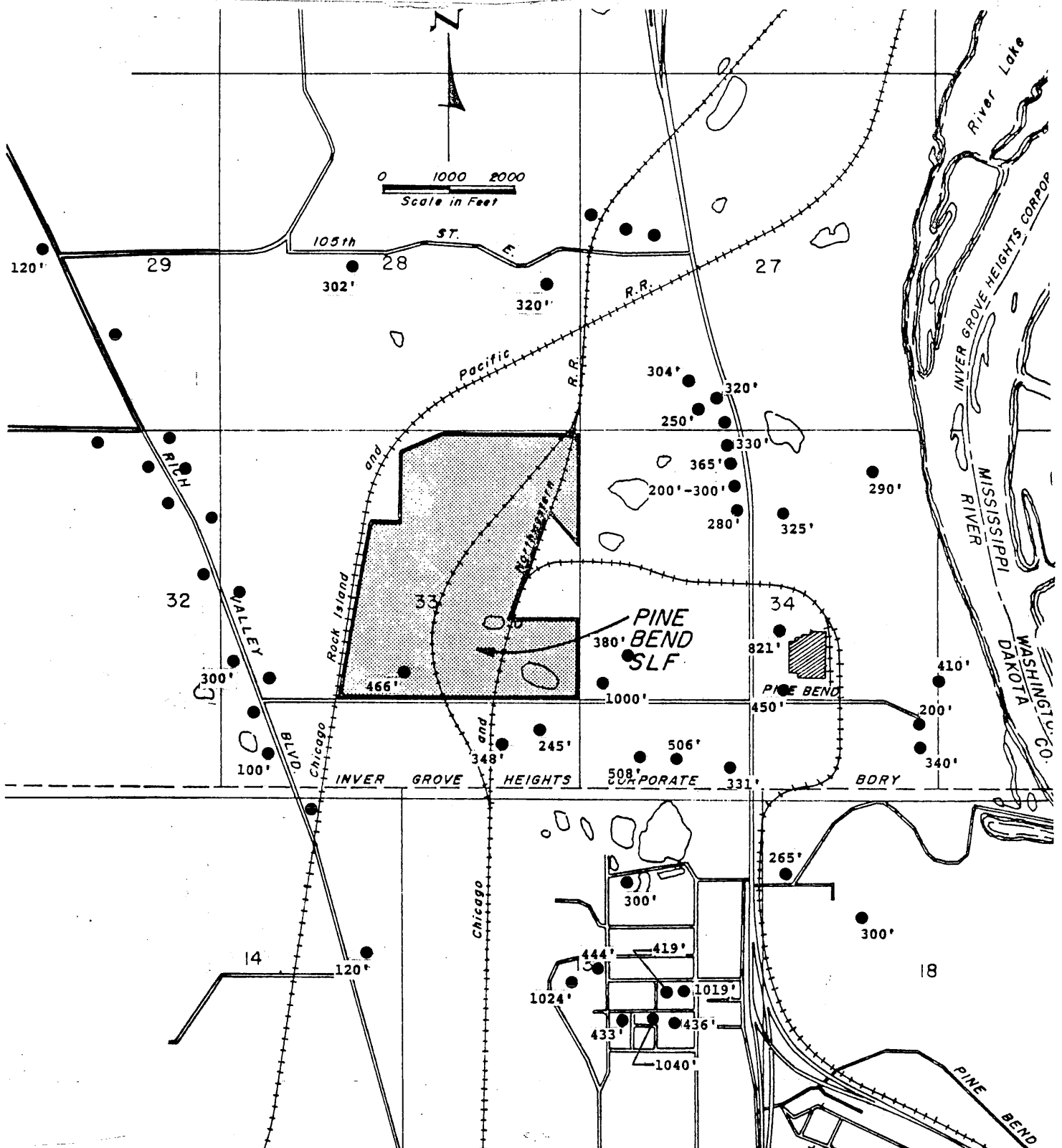
From available information, it appears that domestic and commercial wells in the buried valley area downgradient from the site are finished in the alluvial sands and gravels that comprise the valley backfill.

Site-Specific Water Budget

Rather than being a very complex system, the movement of water from the Pine Bend Landfill is relatively straight-forward. Precipitation falls directly on the landfill site and either evaporates, runs off, or infiltrates into the landfill. There is essentially no surface water from off-site that runs onto the landfill, although some surface water runoff will enter ponding areas from off-site sources. Therefore, in terms of water budget, the main consideration is the amount of water that can infiltrate into and through the landfill and into the ground water system.

The Pine Bend Sanitary Landfill is located near the limits of a ground water recharge area just adjacent to a major discharge area for the surficial drift and upper bedrock aquifers.

NON-PUBLIC WATER SUPPLY WELLS IN PINE BEND AREA



●— Well locations

300'—Known well depth

Figure III - 11

In the previous ground water hydrology section, it was shown that the ground water gradient in the surficial drift and the Prairie du Chien-Jordan Aquifer beneath the site is to the northeast and east towards the valley of the Mississippi River. The general aspects of water flow to, through, and from the landfill will be as follows. Water will infiltrate into the landfill surface and percolate downward through the refuse until such time as the holding capacity of the refuse is exceeded. At that time, leachate in some quantity will migrate downward through from 80 to 130 feet of unsaturated soils to the water table. From that point, it will enter the ground water flow system moving to the river. Each part of the sequence of flow is discussed in the following paragraphs.

A relatively detailed assessment of the relationship between precipitation, evaporation, transpiration, and runoff in the Pine Bend area was performed by Barr (1975). From information in that report and from Gebhard (1975), Sunde (1978) estimated infiltration on an annual basis to be in the range of from 1 to 12 inches per year depending on the conditions at the ground surface. Variables that will affect the amount of infiltration on an average annual basis are ground slope, soil type at the ground surface, and turf or vegetation cover at the surface. At a typical landfill, infiltration is likely near a maximum end of the range during the fill construction period. However, when sections of a landfill are completed, amounts can be greatly reduced. The Pine Bend Landfill at final development will have steep slopes with much of the site at the maximum allowed by the MPCA, 4 horizontal to 1 vertical. Present plans are to use on-site glacial tills and topsoil for the final cover. The entire site will be seeded at termination to promote growth. Sunde estimates that, based on the present design, the average annual infiltration rates into the refuse will be on the order of three inches per year. The Metropolitan Council (1978) estimated an annual percolation rate into the Pine Bend Landfill of 3.38 inches per year.

When water infiltrating into the landfill enters the refuse, the net effect is to begin to raise the moisture content of the refuse. The normal term applied to describing the holding capacity of the refuse is field capacity. A landfill is said to be at field capacity when the bulk of the refuse is at a moisture content beyond which it can hold no more water. At that time, a relatively steady flow of leachate should be produced from the site equivalent to the rate of infiltration at the landfill surface. The Pine Bend Landfill has thicknesses that range from 40 to 160 feet. Sunde estimates that the theoretical field capacity would not be reached for more than 20 years.

Some leachate could be generated prior to reaching field capacity since water will move downward through voids in the refuse, particularly during the period prior to placement of the final cover. However, the steady state long-term release of leachate that equals the amount of infiltration should not occur for a considerable time.

Leachate leaving the site will migrate downward through from 80 to 130 feet of horizontally bedded alluvial soils to the ground water table. From that point, it will enter the surficial drift ground water table that is moving laterally to the valley of the Mississippi River. The travel distance to the river is approximately one mile. Based on average factors for hydraulic conductivity of the surficial drift soils and the ground water gradients indicated from borings, Sunde estimated the time required for ground water to move from the landfill to the Mississippi River would be on the order of four to five years. The ground water would move about 1,200 feet per year.

At the Pine Bend industrial area to the south, there has been concern about whether ground water contaminants that could enter the flow system in the area could reach bedrock aquifers lower than the Prairie du Chien-Jordan. Even through the Prairie du Chien-Jordan Aquifer has a strong gradient towards the river and large quantities of ground water are discharged to the river in the area, the probability of some downward flow to the Iron-ton-Galesville and Mt. Simon-Hinckley Aquifers does exist. As previously discussed, the potentiometric head in the Mt. Simon-Hinckley Aquifer near the landfill is approximately elevation 665 as compared to Prairie du Chien-Jordan and surficial drift water levels in the area of 730 to 780. Gebhard (1975) studied the potential for locally generated contaminants to move downward to the lower aquifers. Gebhard concluded that any contaminants entering the system in the Pine Bend industrial area would move to the river and not reach the underlying aquifers.

SURFACE WATER QUALITY

State Regulations

The MPCA has established surface water quality standards based on water use classifications for all interstate and intrastate waters in Minnesota. Table III-13 shows the water use classifications as described and defined in WPC 14 and WPC 15.

All rivers of the state have been assigned one or more water use classifications as listed in WPC 24 and WPC 25. That portion of the Mississippi River of concern with respect to the Pine Bend area, from the outfall of the Metropolitan Waste Control Commission's (MWCC) treatment plant at Pig's Eye to Lock and Dam Number 2 near Hastings, has been assigned WPC use classifications 2C and 3B. Table III-14 shows limiting concentrations or ranges of substances for these two classifications.

All other surface waters in the Pine Bend area are included under WPC use classifications 2B, 2C, 3B, 3C, 4A, 4B, 5 and 6 for intrastate waters. The ponds within the permitted area of the Pine Bend Sanitary Landfill would not be subject to standards under these use classifications.

Table III - 13

MPCA WATER USE CLASSIFICATION
WPC 14 and WPC 15

- (1) Domestic Consumption. (To include all waters which are or may be used as a source of supply for drinking, culinary or food processing use or other domestic purposes, and for which quality control is or may be necessary to protect the public health, safety, or welfare.)
- (2) Fisheries and Recreation. (To include all waters which are or may be used for fishing, fish culture, bathing or any other recreational purposes, and for which quality control is or may be necessary to protect aquatic or terrestrial life, or the public health, safety, or welfare.)
- (3) Industrial Consumption. (To include all waters which are or may be used as a source of supply for industrial process or cooling water, or any other industrial or commercial purposes, and for which quality control is or may be necessary to protect the public health, safety or welfare.)
- (4) Agricultural and Wildlife. (To include all waters which are or may be used for any agriculture purposes, including stock watering and irrigation, or by waterfowl or other wildlife, and for which quality control is or may be necessary to protect terrestrial life or the public health, safety, or welfare.)
- (5) Navigation and Waste Disposal. (To include all waters which are or may be used for any form of water transportation or navigation, disposal of sewage, industrial waste or other waste effluents, or fire prevention, and for which quality control is or may be necessary to protect the public health, safety, or welfare.)
- (6) Other Uses. (To include waters which are or may serve the above listed uses not listed herein, including without limitation any such uses in this or any other state, province, or nation of any interstate waters flowing through or originating in this state, and for which quality control is or may be necessary for the above declared purposes, or to conform with the requirements of the legally constituted state or national agencies having jurisdiction over such interstate waters, or any other considerations the Agency may deem proper.)

Table III - 14

WATER QUALITY STANDARDS IN REGULATIONS WPC 15
OF THE MINNESOTA POLLUTION CONTROL AGENCY

Mississippi River from Metropolitan Wastewater
Treatment Plant Outfall to
Lock and Dam No. 2 near Hastings

WPC Classification 2C

<u>Dissolved Oxygen Min(mg/l)</u>	<u>Temperature Maximum</u>	<u>pH Min/Max</u>	<u>Turbidity JTU Max</u>	<u>Ammonia- N mg/l</u>	<u>Fecal Coliform MPN/100ml Max</u>
5.0 Apr- Nov 4.0 all other times	See Footnote 1	6.5/9.0	25	1.5	200 as monthly mean; not to exceed 2,000 in more than 10% of all monthly samples.
<u>Chromium Max (mg/l)</u>	<u>Copper Max (mg/l)</u>	<u>Cyanides Max (mg/l)</u>	<u>Oil Max (mg/l)</u>	<u>Phenols Max (mg/l)</u>	<u>Radioactive Materials</u>
0.05	0.01 or not gr. than 1/10 the 96 hr TLM value	0.02	See Footnote 2	0.1 and none that impart odor or taste to fresh- water edible products	Not to exceed lowest concen- trations permitted

WPC Classification 3B

<u>Arsenic Max (mg/l)</u>	<u>Barium Max (mg/l)</u>	<u>Cadmium Max (mg/l)</u>	<u>Chlorides Max (mg/l)</u>	<u>Chromium Max (mg/l)</u>	<u>Cyanide Max (mg/l)</u>	
0.05	1	0.01	100	0.05	0.2	
<u>Flouride Max (mg/l)</u>	<u>Lead Max (mg/l)</u>	<u>Selenium Max (mg/l)</u>	<u>Silver Max (mg/l)</u>	<u>Hardness Max (mg/l)</u>	<u>pH Max Min/Max</u>	<u>Radio- active Material</u>
1.5	0.05	0.01	0.05	250	6.0/9.0	Not to exceed lowest concentra- tions permitted

¹ MPCA standards establish the following limits: "5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperature, except in no case shall it exceed the daily average temperature of 90°F.

² 10 Mg/l, and none in such quantities as to (1) produce a visible color film on the surface, (2) impart an oil odor to water or an oil taste to fish and edible invertebrates, (3) coat the banks and bottom of the watercourse or taint any of the associated biota, or (4) become effective toxicants according to the criteria recommended.

The state solid waste regulations require that the fill and trench areas of a sanitary landfill be at least 1,000 feet from the normal high water mark of a lake, pond, or flowage and at least 300 feet from a stream (SW 6(1)). There are four small ponds northeast of the landfill and one southeast of the site, each about one acre in size, that would be subject to this regulation. The Mississippi River is located about one mile east of the eastern boundary of the landfill and, thus, would not be subject to this regulation.

State solid waste regulations also require that sanitary landfills be constructed and cover material graded so as to promote surface water runoff without excessive erosion and that surface water drainage be diverted around and away from the landfill operating area (SW 6(2)). Finally, the solid waste regulations require that a water monitoring program be constructed and operated to determine leachate impacts on surface water and that a leachate collection and treatment system be installed where required to protect surface waters (SW 6(2)).

Regulatory Compliance

Mississippi River -- That segment of the Mississippi River of concern with respect to the Pind Bend area, from the MWCC's Treatment Plant at Pig's Eye to Lock and Dam Number 2 near Hastings, has been closely monitored for water quality violations. In cooperation with the United States Geological Survey (USGS), the MWCC has established six sampling locations within this segment of the river (see Figure III-12). The MWCC sampling program consists of weekly and monthly grab sampling and analyses of the samples collected from a depth of one meter and within the main channel of the river. The MWCC-USGS cooperative program consists of automatic monitoring of routine quality parameters such as dissolved oxygen and temperature and grab sampling for inorganic and organic parameters such as sulfates, hardness, phenols, cyanides, and heavy metals and for biological organisms.

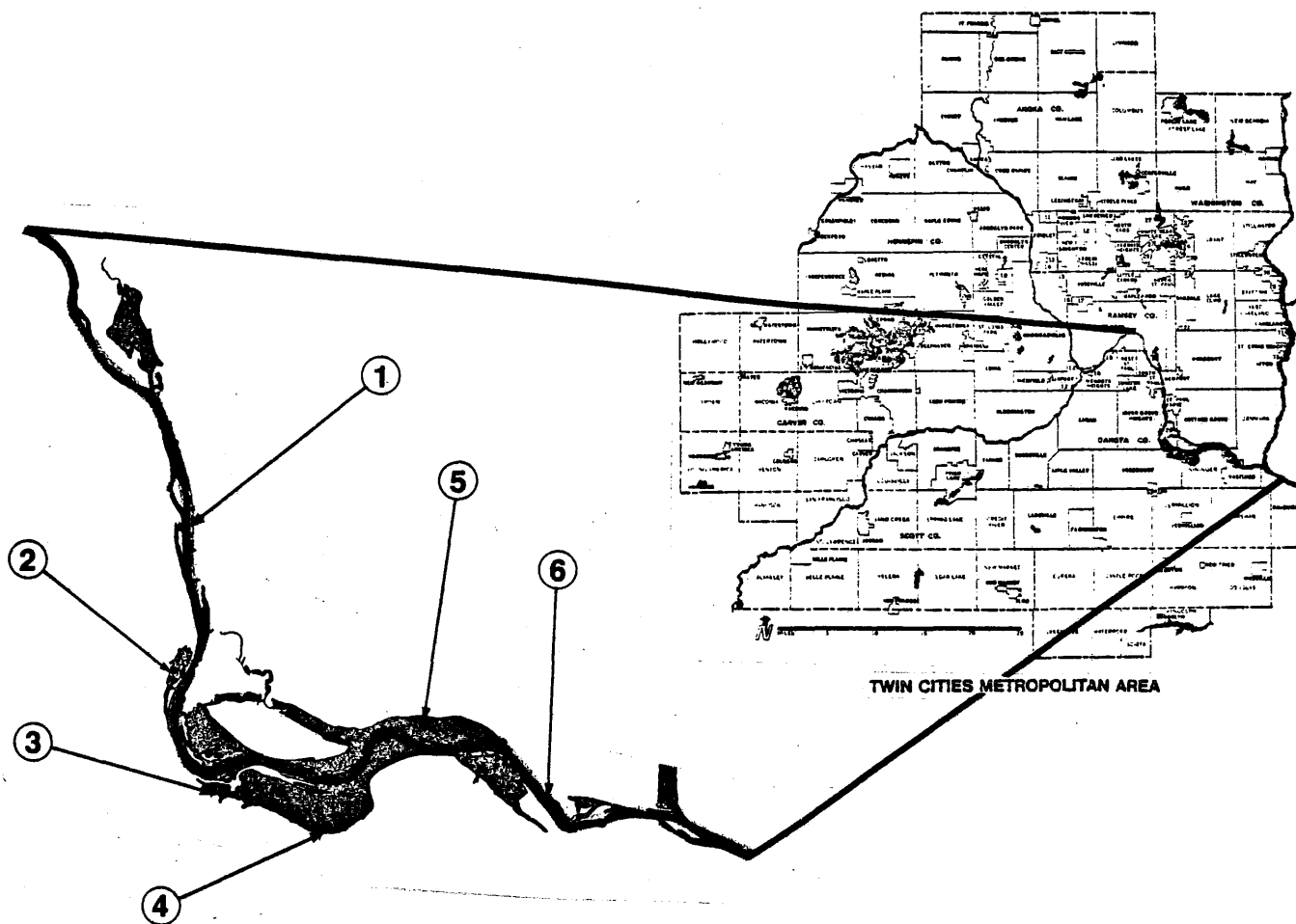
Table III-15 shows the results for 1978 from automatic monitoring of dissolved oxygen, temperature and pH for the Pig's Eye to Lock and Dam Number 2 segment of the river. DO concentrations were generally above the river standard of 5 mg/l for April through November and 4.0 mg/l for all other months. (It should be pointed out that 1978 was a year of high river flow, as compared to historical average flows and DO concentrations would subsequently be higher.) The station at Grey Cloud (UM 826.6), however, did fall below the minimum standard from June through September. Values for temperature and pH showed compliance for most of the days reporting.

Table III-16 shows the percent compliance with water quality standards for turbidity, ammonia and fecal coliforms for the Pig's Eye to Lock and Dam Number 2 segment of the river. Results of sampling for turbidity and ammonia show compliance 90

Figure III - 12

Metropolitan Waste Control Commission
1978 Water Quality Monitoring Locations
Mississippi River - Outfall Metro Plant

Plant at Pig's Eye to Lock and Dam Number 2
near Hastings



Station Designation	Name	Description of Location	Sampling* Program
1 UM 830.3	Inver Grove	Co. 22 Railroad-Highway Swing Bridge	1
2 UM 826.6	Gray Cloud Island	Upper Gray Cloud Island, Shielys Dock	1, 2, 3
3 UM 822.8	Daymark	Off Farm at Gov't Daymark	1
4 UM 820.5	Gov't Light	Government Light Marker	1
5 UM 817.8	Nininger	Nininger Landing	1, 3
6 UM 815.3	Lock and Dam No. 2	Hastings	1, 2, 3

* Sampling program key:
1. MWCC grab sampling station
2. MWCC - USGS automatic monitoring station
3. MWCC - USGS grab sampling station

Table III - 15

1978 ANNUAL SUMMARY OF PERFORMANCE OF AUTOMATIC
MONITORS AND PERCENT COMPLIANCE WITH WATER QUALITY
STANDARDS FOR DISSOLVED OXYGEN, TEMPERATURE AND PH

Monitor	Para- meter	Days Reporting		Compliance with Standards	
		No. Days Reporting	% Days of Year	Days in Compliance	% of Days Reporting
UM 826.6	DO	315	86	236	75
	Temp	302	83	288	95
	pH	309	85	308	99
	Cond	273	75	NA	NA
UM 815.3	DO	217	59	215	99
	Temp	222	61	217	98
	pH	215	59	215	100
	Cond	212	58	NA	NA

Table III - 16

COMPLIANCE WITH WATER QUALITY STANDARDS FOR TURBIDITY,
AMMONIA, AND FECAL COLIFORMS FROM MWCC'S TREATMENT PLANT
AT PIG'S EYE TO LOCK AND DAM NUMBER 2 NEAR HASTINGS, 1978

Monitor	Turbidity		Ammonia		Fecal Coliform ³	
	N ¹	%C ²	N	%C	N	%C
830	43	93	41	98	12	33
827	42	90	41	95	12	33
817	41	95	39	97	12	42

¹N = Number times sampled

²%C = Percent compliance (No. days in compliance/no. times sampled) x 100

³N = Number times sampled or number of months sampled, depending on criteria specified in Water Quality Standards

percent or more the number of times sampled. Fecal coliform levels exceeded the standard consistently from April through October.

Concentrations of selected metals for the river segment are shown in Table III-17. Generally, most metals were found at concentrations less than the maximum standards. Exceptions, include boron (maximum value only), copper (maximum and mean values), iron (maximum and mean values), lead (maximum and mean values), and manganese (minimum, maximum and mean values).

The Pig's Eye to Hastings segment of the Mississippi River has the most severe water quality problem in the Metropolitan Area. The primary contributors to poor water quality in this segment are several point source dischargers, large volumes of urban stormwater, combined sanitary and stormwater overflows, and agriculture- and construction-related nonpoint runoff. The largest single discharger in the segment is the MWCC's Treatment Plant at Pig's Eye.

The Pine Bend Sanitary Landfill is approximately one mile east of this segment of the Mississippi River. Leachate leaving the landfill site will migrate downward through from 80 to 130 feet of horizontally bedded alluvial soils to the ground water table. From that point, it will enter the surficial drift ground water table that is moving laterally to the valley of the Mississippi River. Based on average information for permeability of the soils in the area, Sunde (1978) estimated that the flow time for ground water flow from the landfill area to the river would be on the order of four to five years.

It is highly doubtful that leachate presently produced by the landfill is reaching the river. Sunde (1978) has estimated that the theoretical field capacity of the site would not be reached for more than 20 years, that is, when the bulk of the refuse is at a moisture content beyond which it can hold no more water and a relatively steady flow of leachate is produced equivalent to the rate of infiltration at the landfill surface. A small quantity of leachate may presently be generated at the landfill because of water moving downward through voids in the refuse particularly before the placement of final cover material. However, leachate should be reduced in strength by the subsurface attenuation processes of dilution, ion exchange, filtration, dispersion and complexing prior to reaching the ground water. Any leachate that is presently reaching the river is further reduced in strength by several orders of magnitude by dilution in the river. Based on available data, therefore, there is presently no measurable impact of leachate from the landfill on the water quality of the river.

Theoretically, once field capacity is reached at the landfill, a relatively steady flow of leachate should be produced from the site equivalent to the rate of infiltration at the landfill surface. Sunde (1978) estimates an approximate average infiltration into the refuse at the completed site of three inches per year. Using the assumption that leachate generation

Table III - 17

CONCENTRATIONS OF SELECTED METALS (TOTAL, UG/L) FROM
MWCC'S TREATMENT PLANT AT PIG'S EYE TO
LOCK AND DAM NUMBER 2 NEAR HASTINGS
1978

Location	Parameter	Hardness (CaCO ₃)	Arsenic	Boron	Barium	Cadmium	Chromium	Copper	Iron	Lead	Mercury	Manganese	Nickel	Selenium	Silver	Zinc
Guideline (ug/l)			50	750	1000	10	50	10/LC50	1000	50	.05	50	100	10	50	100
UM 827 (Grey Cloud)	Minimum		1	70	0	2	10	3	330	3	.5	110	6	0	0	20
	Maximum		4	130	100	17	30	8	6000	150	.5	300	22	1	2	50
	Mean		2	95	50	8	18	6	1763	60	.5	153	15	1	1	33
UM 817 (Nininger)	Minimum	160	1	50	0	0	10	4	340	0	.5	60	0	0	0	10
	Maximum	290	4	130	100	12	20	60	3300	100	.5	200	28	1	4	30
	Mean	229	2	95	50	4	13	12	1038	30	.5	131	15	1	1	22
UM 816 (Lock No. 2)	Minimum	170	1	80	0	3	10	0	290	40	.5	90	8	0	0	10
	Maximum	280	3	1000	100	13	10	13	1200	83	.5	180	24	1	2	20
	Mean	228	2	270	50	8	10	6	755	65	.5	134	17	1	1	18

will equal infiltration, the estimated average daily leachate discharge, after the landfill reaches field capacity, will be 6,265 cubic feet. (A similar analysis by the Metropolitan Council in 1978 showed a potential for 8,789 cubic feet of leachate daily from the Pine Bend Sanitary Landfill. Higher infiltration was assumed.) Table III-18 shows various daily leachate discharges based on varying infiltration, average daily river flow, and the ratio of the two values. As can be seen, leachate strength would be reduced by five to six orders of magnitude by dilution only. This assumes, however, that all of the leachate generated eventually reaches the river. It can be expected, as previously discussed, that attenuation of the leachate would occur before reaching the ground water and as the pollutant moves toward the river.

It should be pointed out that there are no readily available water quality test results that would give an indication of the effectiveness of the underlying soils in the landfill area to attenuate leachate strengths. The U.S. Environmental Protection Agency is presently monitoring ground water quality at wells located on the former bale fill north of the landfill. The results of their tests may provide a better indication of soil treatment in the area.

Other Surface Waters In The Pine Bend Area -- There are a number of small ponds in the Pine Bend area ranging in size from 0.5 to 7 acres (see Figure III-13). These water bodies would be subject to WPC 14 standards for intrastate waters for use classifications 2B, 2C, 3B, 3C, 4A, 4B, 5 and 6 (see Table III-19).

As previously discussed, the ground water gradient in this area dips to the east towards the deep Mississippi River valley. If the buried valley is filled with unconsolidated alluvial materials that have lateral continuity to the Mississippi River valley and these materials have generally a higher hydraulic conductivity (permeability) than that of the Prairie du Chien-Jordan Aquifer, then one would expect ground water levels to be lower in the valley. This is because less gradient would be required to convey water through the granular soils than through an equivalent length of the bedrock aquifer.

Figure III-14 shows the probable area where ground water passing beneath the landfill site would flow on its way to the river. As can be seen, there are off-site ponds in the path of this ground water system. However, the area shown follows the axis of the buried valley and one would expect these ponds, as other ponds in the Pine Bend area, to be perched water bodies that would not be affected by leachate generated by the landfill. There has been no sampling of these ponds to determine compliance with WPC 14 standards.

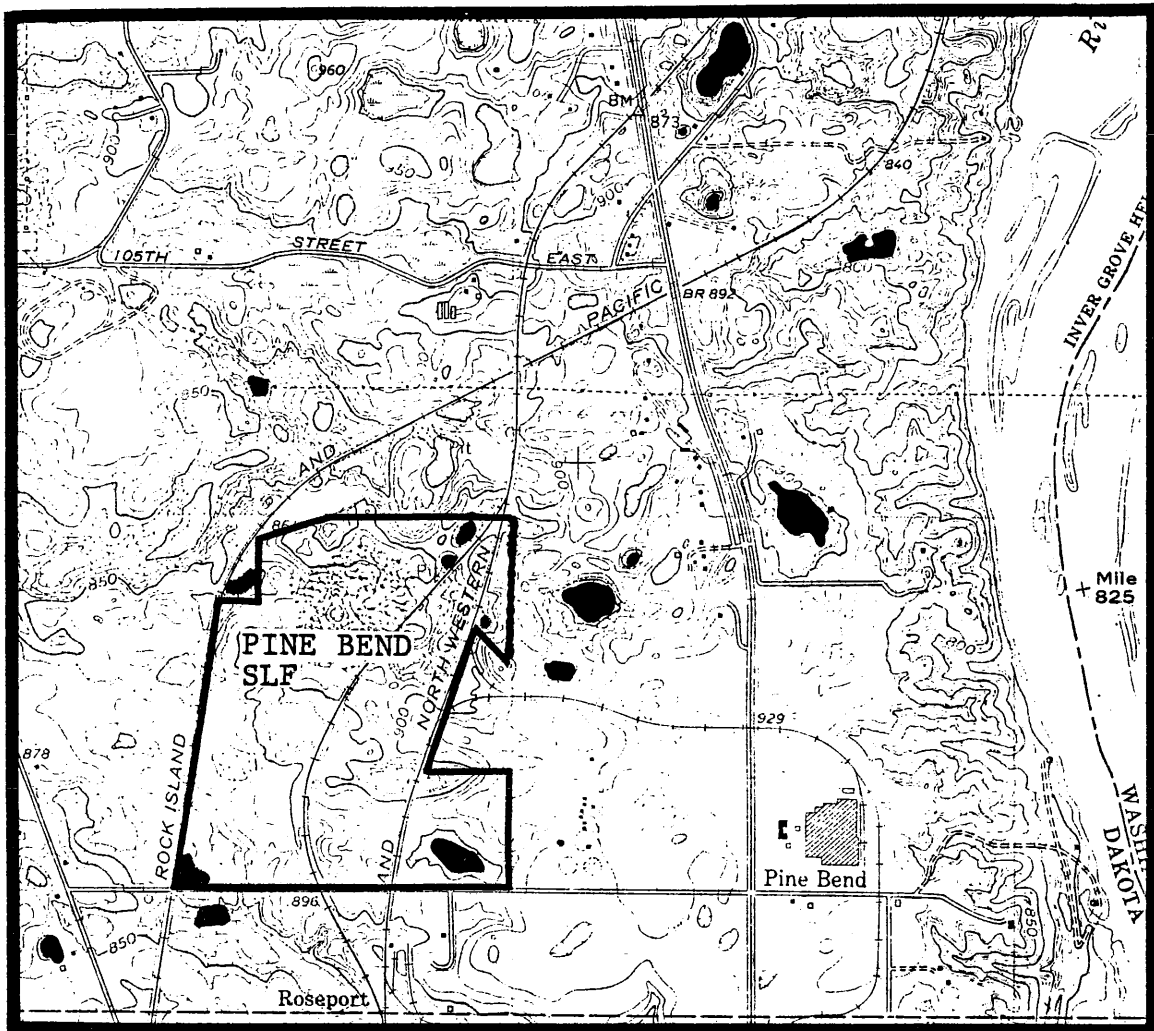
There are two off-site ponds, east of the landfill, and one pond south and one pond west of the landfill that are within 1,000 feet of the site and would thus be in violation of SW6. SW6, however, was passed in 1973 after the landfill had been permitted.

Table III - 18

<u>Infiltration inches/year</u>	<u>Leachate Discharge cubic feet/ day (2)</u>	<u>River Discharge cubic feet/ day (3)</u>	<u>Ratio of (2)/(3)</u>
1	2,088	9.05×10^8	2.31×10^{-6}
3	6.265	9.05×10^8	6.93×10^{-6}
6	12,530	9.05×10^8	13.86×10^{-6}

Note: average daily discharge of 10,470 cfs from USGS (1973)
for St. Paul gage.

SURFACE WATER PONDS in PINE BEND AREA



— Surface water pond sites

Figure III - 13

Table III - 19

WPC
ClassificationWATER QUALITY STANDARDS IN REGULATIONS WPC 14
OF THE MINNESOTA POLLUTION CONTROL AGENCY

Parameter	Fisheries and Recreation		Industrial Consumption		Agricultural and Wildlife		Navigation and Waste Disposal	Other Uses
	2B	2C	3B	3C	4A	4B	5	6
Dissolved Oxygen	Not less than 6 milligrams per liter from April thru May 31, and not less than 5 milligrams per liter at other times.	Not less than 5 milligrams per liter from April 1 thru Nov 30, and not less than 4 milligrams per liter at other times.						
Temperature	5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperature, except in no case shall it exceed the daily average temperature of 86°F.	5°F above natural in streams and 3°F above natural in lakes, based on monthly average of the maximum daily temperature except in no case shall it exceed the daily average temperature of 90°F.						
Ammonia (N)	1 milligram per liter	1.5 milligrams per liter						
Arsenic (As)			0.05 milligram per liter					
Barium (Ba)			1 milligram per liter					
Bicarbonates (HCO ₃)					5 milliequivalents per liter			
Boron (B)					0.5 milligram per liter			
Cadmium (Cd)			0.01 milligram per liter					
Chlorides (Cl)			100 milligrams per liter	250 milligrams per liter				
Chromium (Cr)	0.05 milligram per liter	0.05 milligram per liter	0.05 milligram per liter					

Table III - 19 (continued)

WPC Classification	<u>Fisheries and Recreation</u>		<u>Industrial Consumption</u>		<u>Agricultural and Wildlife</u>		<u>Navigation and Waste Disposal</u>	<u>Other Uses</u>
	<u>2B</u>	<u>2C</u>	<u>3B</u>	<u>3C</u>	<u>4A</u>	<u>4B</u>	<u>5</u>	<u>6</u>
Copper (Cu)	0.01 milligram per liter or not greater than 1/10 the 96 hr. TLM value.	0.01 milligram per liter or not greater than 1/10 the 96 hr. TLM value.	0.2 milligram per liter					
Cyanides (CN)	0.02 milligram per liter	0.02 milligram per liter						
Fluoride (F)			1.5 milligrams per liter					
Lead (Pb)			0.05 milligram per liter					
Oil	0.5 milligram per liter	10 milligrams per liter and none in such quantities as to (1) produce a visible color film on the sur- face (2) impart an oil odor to water or an oil taste to fish and edible inverte- brates (3) coat the banks and bottom of the watercourse or taint any of the associated biota or (4) become effective tox- icants according to the criteria recommended.						
Hardness			250 milligrams per liter	500 milligrams per liter				
pH value	6.5-9.0	6.5-9.0	6.0-9.0	6.0-9.0	6.0-8.5	6.0-9.0	6.0-9.0	
Phenols	0.01 milligram per liter and none that could impart odor or taste to fish flesh or other freshwater edible product such as cray- fish, clams, prawns and like creatures where it seems probable that a discharge may result in taint- ing of edible	0.1 milligram per liter and none that could impart odor or taste to fish flesh or other freshwater edible products such as crayfish, clams, prawns and like creatures. Where it seems probable that a discharge may result in tainting of edible aquatic products, bioassays and						

Table III - 19 (continued)

WPC
Classification

Parameter	Fisheries and Recreation		Industrial Consumption		Agricultural and Wildlife		Navigation and Waste Disposal	Other Uses
	2B	2C	3B	3C	4A	4B	5	6
	bioassays and taste panels will be required to determine whether tainting is likely or present.	be required to determine whether tainting is likely or present.						
Turbidity value	25	25						
Fecal coliform organisms	200 most probable number per 100 milliliters as a monthly geometric mean based on not less than 5 samples per month, nor equal or exceed 2000 most probable number per 100 milliliters in more than 10% of all samples during any month.	200 most probable number per 100 milliliters as a geometric mean nor equal or exceed 2000 most probable number per 100 milliliters in more than 10% of the samples.	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters	
Radioactive materials	Not to exceed the lowest concentration permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.	Not to exceed the lowest concentration permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.		Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.		
Hydrogen sulfide							0.02 milligrams per liter	
Selenium (Se)			0.01 milligram per liter					
Silver (Ag)			0.05 milligram per liter					
Sodium (Na)					60% of total cations as milliequivalents per liter			
Specific conductance					1,000 micromhos per centimeter			

Table III - 19 (continued)

WPC
Classification

	<u>Fisheries and Recreation</u>		<u>Industrial Consumption</u>		<u>Agricultural and Wildlife</u>		<u>Navigation and Waste Disposal</u>	<u>Other Uses</u>
<u>Parameter</u>	<u>2B</u>	<u>2C</u>	<u>3B</u>	<u>3C</u>	<u>4A</u>	<u>4B</u>	<u>5</u>	<u>6</u>
Sulfates (SO ₄)						10 milligrams per liter applicable to waters used for production of wild rice dur- ing periods when the rice may be suscep- tible to damage by high sulfate levels.		
Total dissolved salts						700 milligrams per liter		
Total salinity							1,000 milligrams per liter	
Unspecified toxic substances						None at levels harmful either directly or indirectly.		

*The uses to be protected in this class may be under other jurisdictions and in other areas to which the intrastate waters of the state are tributary, and may include any or all of the uses listed in the other categories, plus any other beneficial use. The MPCA reserves the right to impose any standards necessary for protection of this class, consistent with legal limitations.

PROBABLE AREA OF INFLUENCE OF LANDFILLS

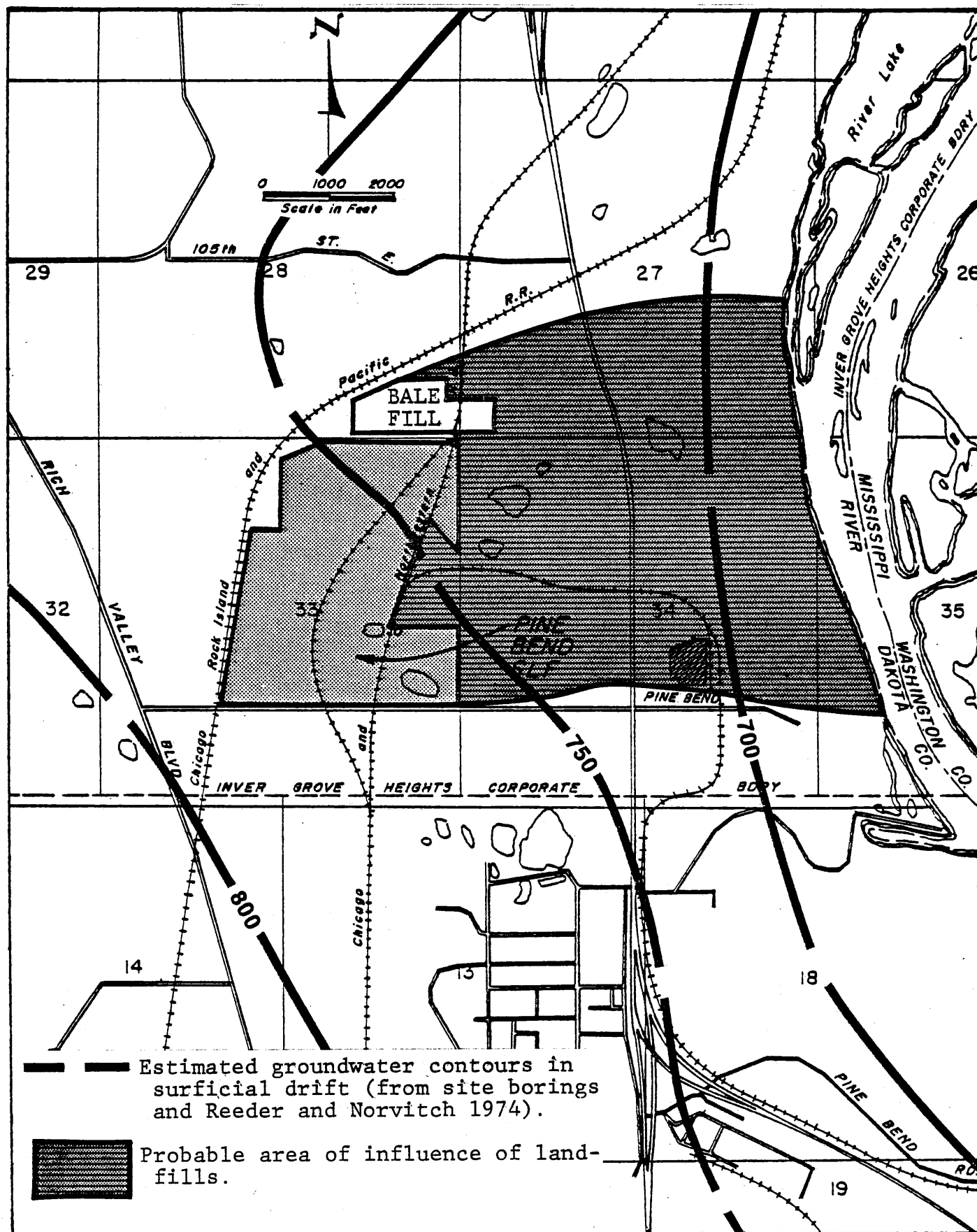


Figure III - 14

Leachate seeps have occurred at the landfill. Some of the closer off-site ponds could be affected by such seepage, particularly those ponds receiving surface water runoff.

On-Site Surface Waters -- Three ponds are located within the permitted area of the landfill (see Figure III-13). These ponds, however, would not be subject to the standards under WPC 14. From an interpretation of WPC 14 (a) (3) and Minnesota Statute Chapter 115.01 subdivision 7, water quality standards cannot be applied to surface waters wholly within permitted landfill areas. Notwithstanding, the two northeastern ponds of the landfill have been sampled recently and it is interesting to compare the parameters tested with compliance under WPC 14 standards.

Table III-20 shows the results of sampling by MPCA for heavy metals at the northeastern ponds. As can be seen, concentrations exceeded standards for copper, iron and manganese. Of those standards applicable to ponds (use classifications 2B, 2C, 3B, 3C, 4A, 4B, 5 and 6), only copper exceeded standards. There is no standard for nickel.

As with the off-site ponds, the on-site ponds are also perched water bodies and would not be affected by ground water. The southeast and northeast ponds have surface water elevations of about 890 and 870 respectively. Soil borings and monitoring wells have shown ground water levels to run generally from about 780 in the southwest corner of the landfill to about 730 in the northeast corner (see Figure III-9). The surface water level of the ponds appear, therefore, to be about 110 to 130 feet above the ground water table.

The on-site ponds act as catchment areas for surface runoff from which water can either evaporate or seep to recharge the ground water system. Degraded conditions at the northeast ponds appear to have resulted from leachate seeps that occurred at the landfill. (A September 7, 1979 inspection of the landfill by the MPCA staff noted two leachate seeps coming out of the fill slope and draining to the northeast ponds.) If seepage occurs while filling the southern portion of the landfill, the southeastern pond may become as equally degraded. The northeast and southeast ponds most likely have increased suspended sediment as a result of receiving surface drainage and minor erosion of the fill surface that may have occurred.

Surface Water Runoff -- Figure III-10 shows present surface water drainage patterns at the Pine Bend Landfill. The northeast quarter of the landfill including much of the abandoned railroad right-of-way drains to the landlocked ponds at the northeast corner of the site. The remainder of the east side of the landfill drains to the pond in the southeast corner of the site. The northwesterly quarter of the landfill drains to a pond located adjacent to the CRI&P railroad on the west side of the site. The southwest quarter of the site drains across 117th street (through a culvert) to a landlocked depression near the CRI&P Railroad.

Table III - 20

CONCENTRATIONS OF SELECTED METALS (TOTAL, UG/L)
FROM NORTHEASTERN PONDS AT THE
PINE BEND SANITARY LANDFILL

Sampling September 7, 1979

<u>Location</u>	<u>Arsenic</u>	<u>Cadmium</u>	<u>Chromium</u>	<u>Copper</u>	<u>Iron</u>	<u>Lead</u>	<u>Manganese</u>	<u>Nickel</u>	<u>Zinc</u>
Guideline WPC 14* (ug/l)	50	10	50	10**	300	50	50		5000
Little Pond	8.3	<10	1.8	<50	12,000	<50	990	57	16
Large Pond	7.6	<10	3.3	<50	2,600	<50	260	50	19

* Includes all use classifications under WPC 14. Concentrations for iron, manganese, and zinc are for use classification 1a, domestic consumption.

There is no standard for nickel.

** Or not greater than 1/10 the 96 hr. TLM value

Surface water received by these catchment ponds either evaporates or percolates into the ground and enters the ground water system. Because these ponds maintain water during non-rainfall periods, seepage is probably slow indicating fairly impermeable soils lining their bottoms.

As previously mentioned, MPCA solid waste regulations require that sanitary landfills be constructed and cover material graded so as to promote surface water runoff without excessive erosion and that surface water drainage be diverted around and away from the landfill operating area (SW 6 (2)). Presently, the landfill drains surface runoff fairly good, particularly completed areas of the fill. Completed portions of the landfill are at higher elevations than surrounding areas. Surface runoff from these areas of the fill drains quickly into natural topographic depressions until it reaches the catchment ponds described above.

Surface runoff problems, however, may occur in the working area of the landfill and those areas of the fill that have not reached final elevation and subsequently covered with two feet of cover material. Some surface water infiltration of these areas of the landfill can be expected to occur. Daily cover generally prevents most runoff from seeping into these areas, particularly during heavy runoff periods; however, until final cover has been applied and properly graded, some infiltration will occur. The best measure is to keep the working area small, reach final fill elevation quickly, properly grade and seed. Should infiltration of these areas of the landfill present a problem, surface runoff diversion at elevations above these areas, such as channeling or diking, may be necessary.

Under existing operations, a large portion of the surface runoff that occurs at the landfill drains by way of the abandoned railroad right-of-way. This has presented problems. The grade of the abandoned railroad right-of-way is very flat. The total drop of the track is less than 10 feet over the total length of about 4,700 feet across the landfill property resulting in a slope of less than 0.3 percent. Surface water runoff has had a tendency to collect in this area of the landfill. Furthermore, under present permitted conditions, once the landfill is completed, the railroad right-of-way will remain as a long narrow valley between the east and west portions of the landfill. The side slopes of this valley will exceed 12 percent. Surface water runoff will continue to collect in the valley, perhaps in even greater quantities, and not readily be diverted to the ponding areas which are not in contact with the buried refuse.

It is important to point out that no major runoff problems or erosion problems have been reported to have occurred at the landfill. As described above, some infiltration of incompleated portions of the fill will occur and standing water will occur from time to time in the abandoned railroad right-of-way.

Water Monitoring Program -- As previously discussed, regulations require that a water monitoring program be constructed and operated to determine leachate impacts on surface water and that a leachate collection and treatment system be installed where required to protect surface water (SW6 (2)). As a result of the recommendations in "Hydrogeologic Study of the Pine Bend Sanitary Landfill," dated December 1978, prepared by Gerald M. Sunde, and a subsequent letter, dated May 24, 1979, from the MPCA accepting those recommendations, Phoenix Inc. has had installed at the landfill a ground water monitoring system consisting of six wells. These wells are sampled quarterly and tested for pH, chemical oxygen demand, specific conductance, nitrates, and chlorides. The wells are located up-gradient and down-gradient of the ground water movement and this system appears adequate to properly determine potential leachate impacts on surface waters, particularly contaminated water moving toward the Mississippi River. As previously discussed, ground water contaminated by leachate from the landfill should not adversely impact on-site or nearby off-site ponds because these are perched water bodies.

There is no leachate collection and treatment system at the landfill to protect nearby surface waters. The subsurface attenuation of any contaminated ground water resulting from leachate produced by the landfill should be adequate to protect surface waters in the vicinity. However, any leachate that moves laterally through the landfill and seeps to the surface could present a problem to nearby ponds. Seepage does not appear to be a major problem presently at the landfill. Seepage that has been known to occur drained to the on-site catchment ponds. Should off-site ponds become threatened by such seepage further controls through surface runoff diversion can be implemented. The installation of a leachate collection and treatment system to protect off-site surface waters does not appear to be necessary at this time.

For a further discussion of water quality monitoring refer to "Ground Water Monitoring Program" below.

GROUND WATER QUALITY

State Regulations

The MPCA has established ground water standards that would be applicable to operation of the Pine Bend Sanitary Landfill. Perhaps the most stringent standard is WPC 22. This standard states that wastes shall be controlled as may be necessary to ensure that to the maximum practicable extent the underground waters of the state are maintained at their natural quality. This standard, then, is essentially a non-degradation standard.

WPC 14 also applies to ground waters. Where differences exist between WPC 14 and WPC 22 the more stringent conditions are applied.

Other standards that would apply include those under SW6. SW6 states that solid wastes shall not be deposited in such a manner that material or leachings therefrom may cause pollution of underground or surface water. SW6 also states that the proposed separation between the lowest portion of the landfill and the high water table elevation shall be a minimum of five feet. Finally, SW6 provides that a water monitoring program shall be constructed and operated to determine whether or not solid waste or leachate therefrom is causing pollution of underground or surface water and that an approved leachate collection and treatment system shall be used where required.

Ground Water Monitoring Program

Ground water monitoring has been in effect at the Pine Bend Landfill since 1971. As part of the original landfill permit, three wells were installed and sampled. The location of these wells are shown in Figure III-15 and designated as M-1, M-2 and M-3. During the life of the landfill, these wells have been used for water quality sampling. However, the well points are finished well below the water table surface and the MPCA has questioned the validity of data from these wells as accurately reflecting ground water quality as related to the landfill activity. It was felt that the deep wells would not detect leachate entering the ground water system.

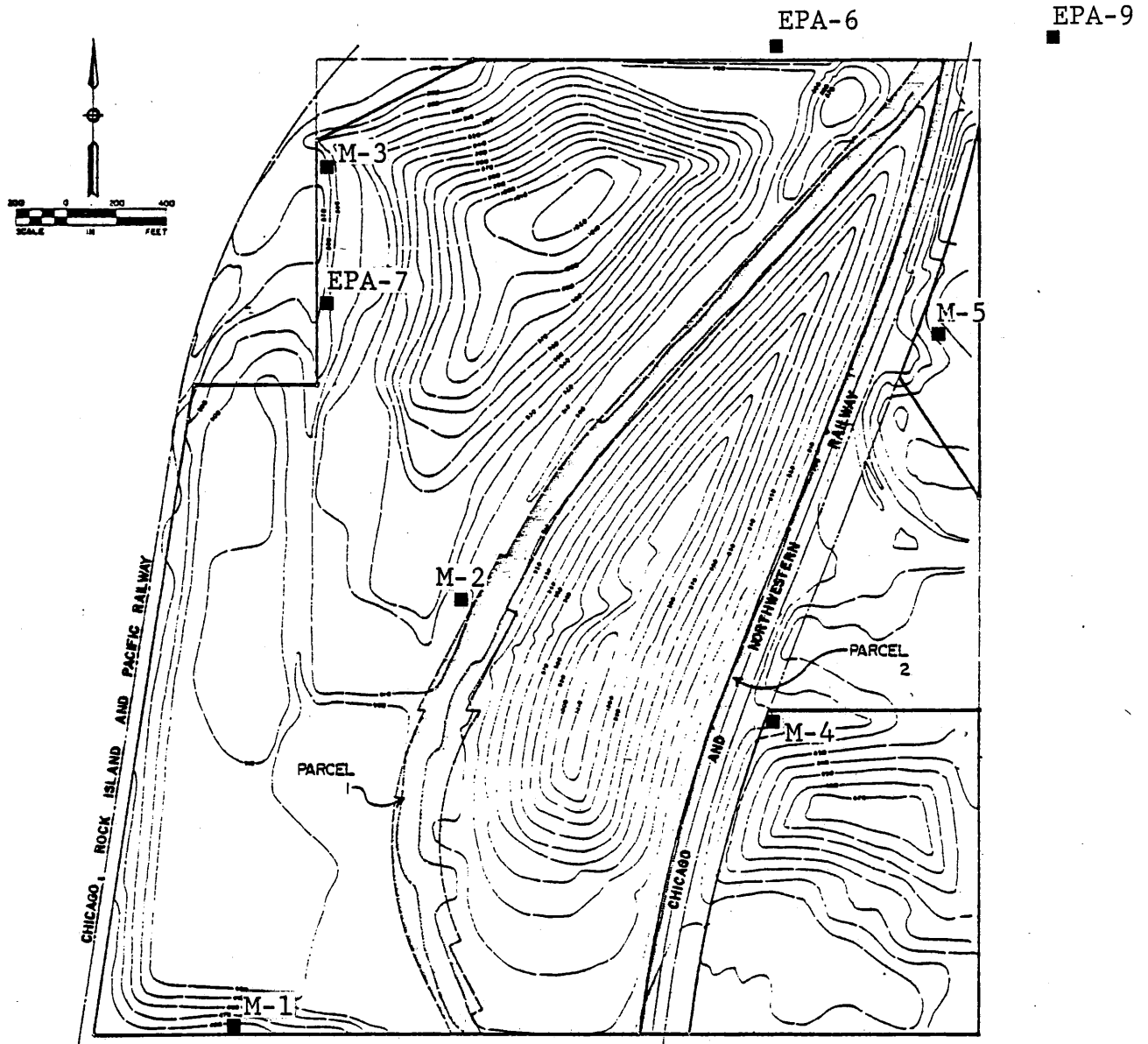
In the hydrogeologic study of the landfill, Sunde (1978) recommended the revision of the landfill monitoring program to add several downgradient monitoring wells that would be finished just into the ground water table. These wells are designated as M-4, M-5, EPA-6, EPA-7, and EPA-9 (see Figure III-15). By letter of May 24, 1979, the MPCA gave interim approval to the proposed monitoring system and the program has since been implemented. Well J-1 is a potable water well at the landfill office. It was installed in 1974 and extends to the Jordan Sandstone.

Monitoring wells EPA-6 and EPA-9 are located on the balefill property, which is owned by Crosby American Properties, Inc. Permission must be obtained from Crosby American Properties for use of these two wells. Monitoring wells EPA-6, EPA-7 and EPA-9 are part of a U.S. Environmental Protection Agency (EPA) study of the balefill; permission for use of these three wells must be obtained from EPA. It should be pointed out that the direction of ground water flow and the close proximity of the balefill will make it difficult to separate water quality data from ground water samples for the two landfills. In actuality, the two sites should be considered as one landfill in terms of ground water impact.

Well M-1 has been retained as a background well. Well M-1 is up-gradient from refuse that is or will be placed in the landfill. It provides a measure of ground water quality upstream from the site and provides testing continuity with the data that has been collected during the life of the landfill. EPA-7 is also being

PINE BEND SANITARY LANDFILL

WATER QUALITY MONITORING WELLS



M - M-1 Thru M-3 = 1971 MONITORING WELLS
M-4 & M-5 = 1979 MONITORING WELLS

EPA - 1978 EPA RESEARCH WELLS
FOR BALE FILL

Figure III - 15

maintained as a background well. This well may be affected by leachate originating from the southwest portion of the landfill. Well M-3 has also been retained as a background well. Well M-2 was abandoned as suggested by the recommendations of Sunde. This well is not downgradient from the landfill and is finished well into the ground water table.

The monitoring wells are sampled quarterly and tested for pH, chemical oxygen demand, specific conductance, nitrates, and chlorides.

Regulatory Compliance

Two problems are immediately evident when ground water quality at the Pine Bend Sanitary Landfill is discussed. First, even though the landfill has been in operation for eight years, the monitoring wells have never shown evidence of leachate in measurable quantities in the underlying ground water system. This may be due to the fact that significant quantities of leachate have yet to be produced at the landfill or leachate that is being generated is effectively attenuated by the site's underlying soils.

The second problem concerns other land uses nearby that could have an effect on both background and down-gradient water quality. The land areas to the southwest, west and northwest of the site are presently used primarily for agricultural purposes. However, portions of this area are urbanizing and homes that are constructed normally used on-site sewage disposal systems. To the south of the landfill is the Pine Bend industrial complex. As previously discussed, water quality in the ground water system near the industrial area has been the subject of several studies in the past. Reeder and Norvitch (1974) studied the increased levels of specific conductance in the ground water in order to identify degraded ground waters. Figure III-16 shows the area they designated as having specific conductance values in excess of 700 micromhos/cm at 25°C. This level of specific conductance was used by Reeder and Norvitch as a minimum value measure of ground water pollution. Immediately to the north of the Pine Bend Landfill is the Crosby American Properties, Inc. landfill. This site accepted municipal solid waste from September 1970 until June 1974. The waste accepted at the site was highly compressed into bales, and the baled solid waste was placed in the site by stacking in tiers with a forklift. Presently, the site only receives demolition wastes. Based on the ground water gradients previously discussed and shown in Figure III-9, it is apparent that leachate input to the ground water system down-gradient of the Pine Bend Landfill might be due to the Pine Bend Landfill itself or the Crosby American fill.

It is also important to point out that there is no available water quality test results that would give an indication of the effectiveness of the underlying soils in the area to attenuate leachate strengths. Attenuation occurs as leachate moves through unsaturated soil toward the ground water. Soil has the

AREA OF HIGH CONDUCTIVITY IN GROUNDWATER

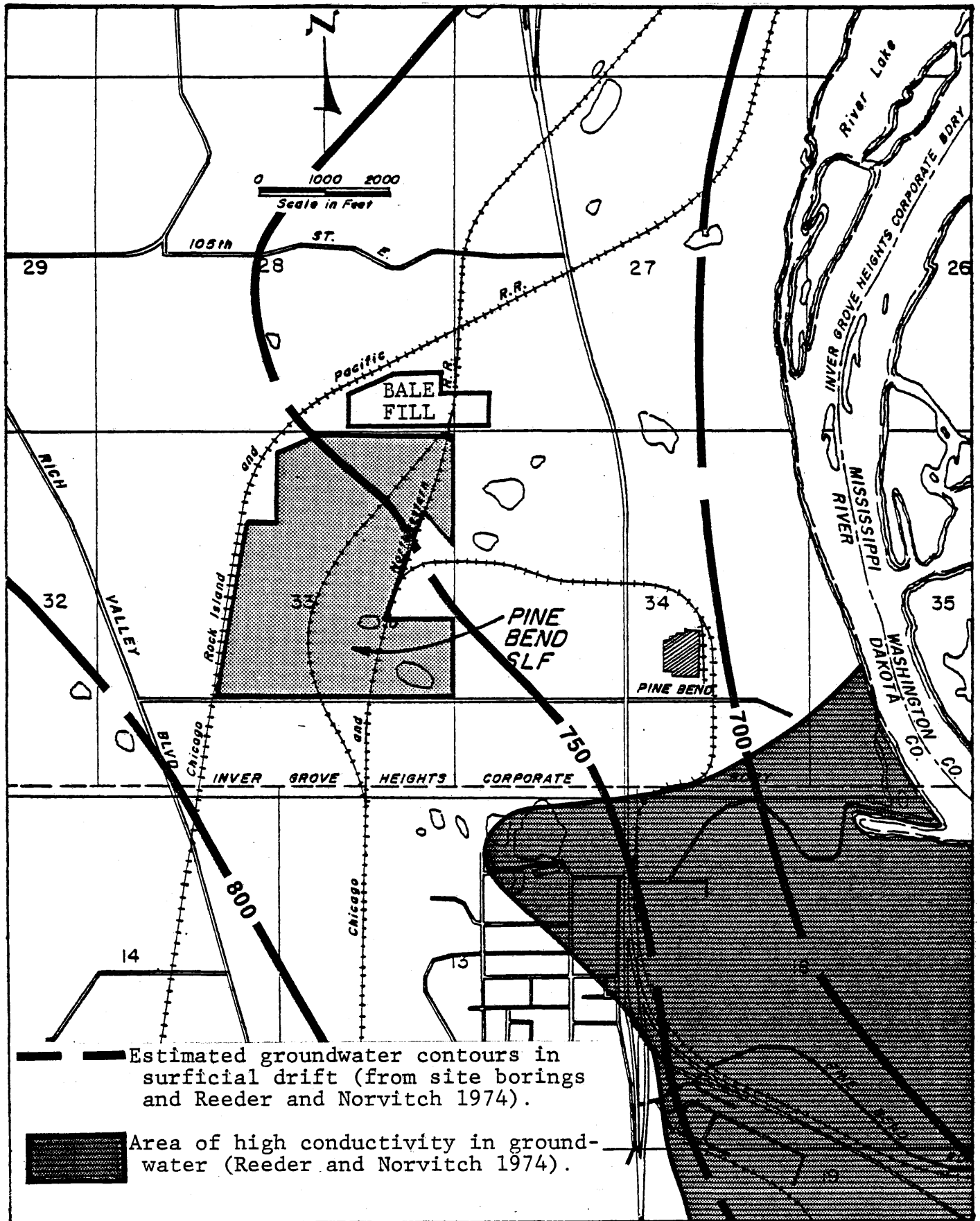


Figure III - 16

ability to change the composition and decrease the strength of leachate. Attenuating mechanisms in the unsaturated soil zone include adsorption, ion exchange, chemical precipitation, oxidation-reduction reactions, biological activity and filtration. As previously discussed, leachate produced at the Pine Bend Landfill will migrate downward through 80 to 130 feet of unsaturated alluvial soils prior to reaching the ground water. Some degree of treatment of the leachate will, therefore, occur before it enters the ground water. Any leachate that reaches the ground water must travel one mile before discharge to the Mississippi River. Sunde estimates that this travel will take 4 to 5 years. Further attenuation of the leachate will occur during this time period.

Table III-21 shows the results of ground water monitoring at the Pine Bend Landfill to date. Well J-1 for which test results are shown is the potable water well at the landfill office. A comparison of these test results with WPC 14 (see Table III-19) shows that in practically all cases the parameters tested are within standards.

Presently, the production of leachate at the landfill is minimized by the following considerations. A minimum of 90 feet of unsaturated soil is maintained between the refuse and the ground water. Refuse is compacted tightly and surface water is diverted away from the fill areas. Areas are covered with two feet of compacted earth, graded and seeded as soon as practical after reaching final fill elevation, instead of waiting until an entire phase of the landfill is completed before adding final cover. This practice minimized infiltration into the refuse. Completed areas are graded to the maximum slope allowed by the MPCA in order to maximize runoff and minimize infiltration.

The strength and composition of any leachate that is produced at the landfill is presently minimized by attenuation. It has also been found that leachate strength diminishes with age. For example, for individual parameters the strength of 17 year old leachate may be 0.01 percent to 8 percent of the composition of 2 year old leachate. By the proper application of daily and final cover material the amount of moisture in the landfill can be kept to a minimum and the time required for the fill to reach field capacity will be maximized. Sunde estimates that given such practices it will take 20 years for the site to reach field capacity and, therefore, before significant amounts of leachate begin to flow from the site. At this steady state, most of the leachate generated from the landfill will be more than 20 years old.

It is theorized that leachate from the landfill will, in time, reach the underlying surficial drift aquifer. As previously discussed, an approximate average infiltration at the completed site has been estimated at about three inches per year. Using the assumption that leachate generation will equal infiltration, Sunde estimated an average daily leachate discharge, after the landfill reaches field capacity of approximately 6,265 cubic feet per day.

Table III - 21
SUMMARY OF WATER QUALITY TEST RESULTS AT PINE BEND LANDFILL FOR THE PERIOD
FROM 1974 THROUGH 1979

Date	pH	COD mg/l	Nitrate (N), mg/l	Chloride mg/l	Spec. Cond. umhos/cm
<u>Well M-1</u>					
5-15-74	7.6	19	*1	*1	314
9-18-74	7.9	0	*1	2	209
10-16-74	7.6	10	*1	2	290
7-11-75	7.9	*1	*1	2	125
8-25-75	8.5	9	*1	2	157
5-19-76	7.4	-	3	1	-
8-24-76	7.0	18	*1	*1	330
12-14-76	7.3	*1	1	2	380
2-23-77	7.5	26	*1	1	310
6-07-77	8.1	24	*1	1	330
8-11-77	7.5	*1	*1	1	310
11-21-77	7.6	11	*1	3	250
2-09-78	7.5	*1	*1	1	290
5-11-78	7.9	9	*1	1	250
8-18-78	8.0	*1	*1	*1	290
12-14-78	7.7	24	7.2	6	479
<u>Well M-2</u>					
5-15-74	7.9	10	*1	*1	334
9-18-74	7.8	0	*1	1	334
10-16-74	8.4	48	*1	1	150
7-11-75	7.9	41	*1	1	146
8-25-75	7.7	140	*1	3	397
5-19-76	7.5	-	*1	*1	-
8-24-76	7.3	*1	*1	1	290
12-14-76	8.0	*1	*1	*1	310
2-23-77	7.7	*1	*1	*1	310
6-07-77	7.9	*1	*1	*1	330
8-11-77	7.7	*1	*1	1	290
11-21-77	7.9	11	*11	*1	230
2-09-78	7.9	23	*1	1	290
5-11-78	8.0	9	*1	1	270
8-18-78	8.0	*1	*1	*1	270
12-14-78	9.4	45	0.2	1	171
2-09-79	8.9	12	*0.1	3	242
5-16-79	8.9	20	*0.1	3	1,000
8-21-79	9.0	16	4.4	4	185
<u>Well M-3</u>					
5-15-74	7.7	0	*1	2	355
9-18-74	8.0	18	*1	1	355
10-16-74	7.5	97	*1	3	290
7-11-75	8.0	*1	*1	9	146
8-25-75	7.8	149	*1	4	345
5-19-76	7.4	-	*1	1	-
8-24-76	7.3	18	*1	2	400
12-14-76	7.9	*1	*1	1	360
2-23-77	7.6	21	*1	*1	360
6-07-77	7.7	14	*1	2	380
8-11-77	7.5	*1	*1	2	330
11-21-77	7.6	11	*1	1	230
2-09-78	7.8	*1	*1	1	310
5-11-78	8.1	14	*1	2	310
8-18-78	8.0	*1	*1	*1	290
12-14-78	8.4	8	*0.1	3	259
2-09-79	8.1	4	*0.1	5	333
5-16-79	8.6	8	*0.1	3	282
<u>Well J-1 (Shop Well)</u>					
8-24-76	7.4	*1	*1	2	330
12-14-76	8.0	*1	*1	1	360
2-23-77	7.0	10	*1	1	330
6-07-77	8.0	9	*1	1	360
8-11-77	7.6	*1	*1	1	330
11-21-77	7.7	16	*1	1	270
2-09-78	7.8	*1	*1	2	310
5-11-78	8.0	*1	*1	1	290
8-18-78	8.0	*1	*1	1	290
<u>Well M-4</u>					
12-14-78	8.4	82	1.0	13	458
2-09-79	8.2	350	0.6	9	529
5-16-79	8.2	43	2.9	6	546
8-21-79	8.0	580	3.2	5	531
<u>Well M-5</u>					
12-14-78	8.2	173	0.1	5	468
2-09-79	8.1	1270	*0.1	8	552
5-16-79	8.0	63	0.1	4	577
8-21-79	7.8	76	0.3	10	561
<u>Well EPA-7</u>					
5-16-79	8.2	24	6.4	8	462
8-21-79	8.1	16	4.4	4	441

Figure III-14 shows the probable area of influence of leachate generated from the Pine Bend and Crosby American landfills. This is an area of potential effect of leachate on wells (see Figure III-11). The area shown follows the axis of the buried valley as previously discussed. In the ground water hydrology section, it was shown that potentiometric levels in the Prairie du Chien-Jordan Aquifer adjacent to the valley were higher than the ground water levels in the buried valley area. Ground water should, therefore, flow to the valley. Ground water carrying leachate within the valley area will not spread beyond the limits of the valley.

LOCAL WATER SUPPLY QUALITY

State Regulations

As previously discussed, all adjacent properties to the Pine Bend Landfill use individual wells for water supply. The MPCA standards in WPC 14 apply to individual water supply wells. Table III-22 shows WPC 14 standards that apply to domestic consumption. Class A standards apply to drinking water without treatment of any kind while the other classes require various degrees of treatment. Other uses of water from individual supply wells would be covered by the WPC 14 standards shown in Table III-19.

The Minnesota Department of Health (MDOH) has also promulgated standards for drinking water, however, for public water supplies only. There are no MDOH standards for drinking water from individual wells. Table III-23 shows the MDOH maximum contaminant levels for inorganic and organic chemicals contained in public water supplies.

Regulatory Compliance

Figure III-11 shows 53 known nonpublic water supply wells within a one mile radius of the Pine Bend and Crosby American landfills. Eighteen of these wells are within the zone of influence of leachate from the two landfills identified in Figure III-14. As previously mentioned, ground water movement in this area should not spread beyond the limits of the buried valley; therefore, it is highly unlikely that leachate from the landfills would reach wells beyond the zone identified in Figure III-14.

In 1979 the MDOH sampled a number of individual water supply wells in the Pine Bend area. Figure III-17 shows the approximate location of those wells sampled within or nearby the leachate zone of influence. Table III-24 shows the test results for these wells. As can be seen, the parameters tested met most of the applicable standards contained in Table III-22 and all of the applicable standards contained in Table III-23. All of the wells exceeded Class A standards for total coliform organisms

Table III - 22

WATER QUALITY STANDARDS IN REGULATIONS WPC 14
OF THE MINNESOTA POLLUTION CONTROL AGENCY
WPC CLASSIFICATION - DOMESTIC CONSUMPTION

Substance or Characteristic	Class A Limit or Range	Class B Limit or Range	Class C Limit or Range	Class D Limit or Range
Total coliform organisms	1 most probable number per 100 milliliters	10 most probable number per 100 milliliters	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters
Turbidity value	5		25	
Color value	15			
Threshold odor number	3			
Methylene blue active substance (MBAS)	0.5 milligram per liter			
Arsenic (As)	0.01 milligrams per liter			0.05 milligram per liter
Chlorides (Cl)	250 milligrams per liter			
Copper (Cu)	1 milligram per liter			
Carbon Chloroform extract	0.2 milligrams per liter			
Cyanides (CN)	0.01 milligrams per liter			0.2 milligrams per liter
Fluorides (F)	1.5 milligrams per liter			1.5 milligrams per liter
Iron (Fe)	0.3 milligrams per liter			
Manganese (Mn)	0.05 milligrams per liter			
Nitrates (NO ₃)	45 milligrams per liter			
Phenol	0.001 milligram per liter			
Sulfates (SO ₄)	250 milligrams per liter			
Total dissolved solids	500 milligrams per liter			
Zinc (Zn)	5 milligrams per liter			
Barium (Ba)	1 milligram per liter			1 milligram per liter
Cadmium (Cd)	0.01 milligram per liter			0.01 milligram per liter
Chromium (Hexavalent, Cr)	0.05 milligram per liter			0.05 milligram per liter
Lead (Pb)	0.05 milligram per liter			0.05 milligram per liter
Selenium (Se)	0.01 milligram per liter			0.01 milligram per liter
Silver (Ag)	0.05 milligram per liter			0.05 milligram per liter
Radioactive material	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.			Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.

Table III - 23

1978 Public Water Supply Standards
Minnesota Department of Health

Maximum Contaminant Levels for Inorganic and Organic Chemicals

<u>Inorganic Chemicals</u>	<u>mg/l</u>
Arsenic	0.05
Barium	1.0
Cadmium	1.010
Chromium	0.05
Fluoride	2.4
Lead	0.05
Mercury	0.002
Nitrate	10
Selenium	0.01
Silver	0.05

Organic Chemicals

Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys	0.1
Silvex	0.01

**WATER SUPPLY WELLS IN THE PINE BEND LANDFILL AREA
TESTED BY MINNESOTA DEPARTMENT OF HEALTH
SEPTEMBER 1979**

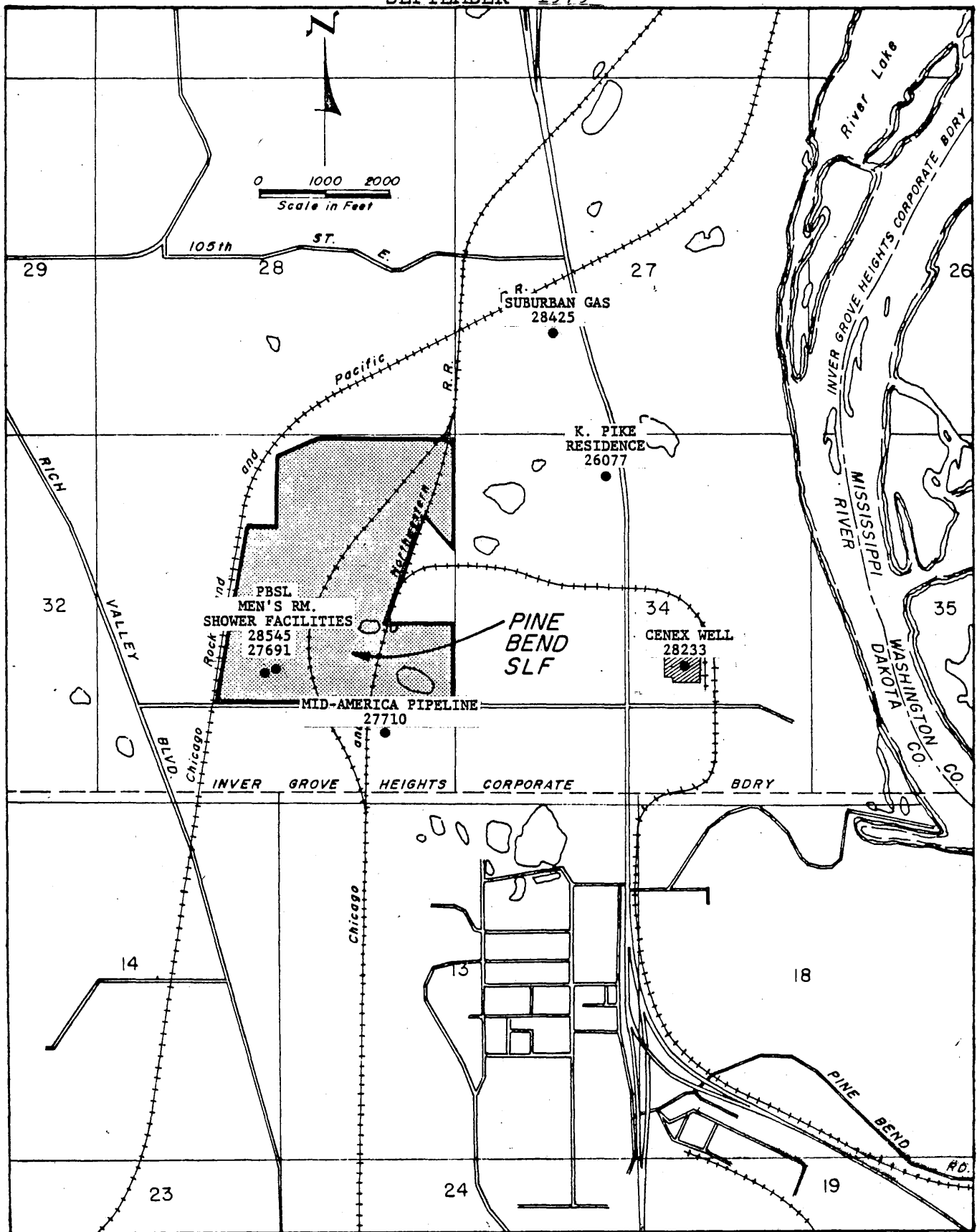


Figure III - 17

Table III - 24
Analytical Data - Various Water Supply Wells, Pine Bend Area
September 1979

	Cenex Well ¹ Inver Grove Heights	Suburban Gas Co., ² Pressure Tank, ³ Inver Grove Heights	Pine Bend Landfill H.B. Men's Room Inver Grove Heights	Mid-America Pipeline ² Rosemount	Pine Bend Landfill Shower, Rosemount	Kenneth Pike 11025 Courthouse Blvd Inver Grove Heights
Sample Number	28233	28425	28545	27710	27691	26077
Coliform Group Organisms						
MPN/100 ml.	2.2	2.2	-	2.2	2.2	2.2
Total Solids mg/L	330	320	-	-	260	280
Total Hardness as CaCO ₃ mg/L	280	280	-	230	260	260
Alkalinity as CaCO ₃ mg/L	270	270	-	260	270	250
pH	7.7	7.7	-	7.8	8.0	8.2
Iron mg/L	0.05	5.2	-	2.1	3.2	2.8
Manganese mg/L	0.02	0.40	-	0.37	0.34	0.25
Chloride mg/L	3.4	2.0	-	1.2	1.9	18
Sulfate mg/L	25	18	-	16	16	18
Flouride	0.16	0.15	-	0.15	0.12	-
Total Phosphorous mg/L	0.077	0.110	-	-	-	-
Nitrate Nitrogen NO ₂ mg/L	2.9	0.4	-	0.4	0.4	0.4
Calcium as CaCO ₂ mg/L	180	180	-	160	160	170
Sodium mg/L	3.2	3.2	-	2.9	3.2	3.0
Potassium mg/L	1.6	1.7	-	1.6	1.6	2.5
Spec. Cond. umhos/cm@25	520	500	-	490	490	460
Phenols ug/L	3.6	4.0	7.5	2.0	41	2.0
Total Organic Carbon mg/L	2.4	8.1	-	1.5	1.5	1.0
Total Kjeldahl Nitrogen mg/L	0.12	0.10	-	-	-	-
Magnesium as CaCO ₃ mg/L	100	100	-	94	100	94
Arsenic ug/L	50	50	-	50	50	50
Barium ug/L	1000	1000	-	1000	1000	1000
Chromium ug/L	50	50	-	50	50	50
Cadmium ug/L	10	10	-	10	10	10
Lead ug/L	50	50	-	50	50	50
Mercury ug/L	0.1	0.1	-	-	-	-
Selenium ug/L	10	10	-	10	10	10
Silver ug/L	50	50	-	50	50	50
Ammonia Nitrogen mg/L,						
Methylene Blue Active	0.02	-	-	0.03	-	0.2
Sub. as ABS mg/L	-	-	-	-	-	0.1
Ammonia mg/L	-	0.02	-	-	0.02	-
Nitrate Nitrogen mg/L	-	-	-	0.01	-	-

¹sample tap

²outside faucet

³public water supply

and phenols; however, other use standards for these parameters were met (see Table III-19). With the exception of the Cenex well, all of the wells exceeded Class A standards for iron and manganese; there are no other use standards for these parameters.

None of the parameters measured, including those exceeding standards, would indicate the presence of leachate in the ground water system. Practically all of the parameters measured were considerably below or below typical low value ranges for leachate (see Table III-11). Notwithstanding, these wells should be periodically tested in the future. There will continue to be the potential for leachate contamination of these wells for a number of years; particularly after the landfills (Pine Bend and Crosby American) reach field capacity.

TERRESTRIAL AND AQUATIC ECOLOGY

VEGETATION

The Pine Bend Sanitary Landfill and surrounding area is located in a northern mixed hardwoods woodland which was once characterized by an oak woods/savanna plant community prior to settlement. The dominant species of the remnant hardwood stands in the area are red maple (Acer rubrum), northern red oak (Quercus rubra), northern pine oak (Quercus ellipsoidalis), and various poplars such as quaking aspen (Populus tremulaides), and eastern cottonwood (Populus deltoides).

The undeveloped area to the southwest of the landfill is generally rural agricultural with occasional large stands of mixed hardwoods. Immediately west of the landfill is private farmland presently producing corn. To the north of the site is located a demolition and construction waste landfill operated by Crosby-American Properties, Inc., which is presently partially overgrown with pioneer grasses and intermediate cottonwood shrubs. Within one mile to the east of the landfill is the Mississippi River basin characterized by bottomland and steep slope plant communities.

A vegetation survey by Metropolitan Council staff of the landfill and adjacent land was conducted on February 24, 1980. The objective of this survey was to identify the major plant communities as characterized by dominant or conspicuous species found along the proposed expansion and earthen berm areas in order to determine vegetation and habitat impacts. The plant species found on the proposed expansion area and earthen berm are listed in Table III-25. Those species indicated by an asterisk were actually found on the expansion and berm areas, the remainder were identified on the existing permitted area of the landfill.

Four general cover types are present on the proposed expansion and earthen berm areas: sparse-mixed hardwood stands, intermediate shrubs, grassland, and barren-graded soil. Two additional cover types are found immediately adjacent to the expansion and berm areas: lowland forest and wetlands. The location of these cover types are depicted in Figure III-18 which was developed from a recent aerial photo and the vegetation field survey.

TABLE III-25

VEGETATION IDENTIFIED ON THE
PINE BEND SANITARY LANDFILLField Survey Conducted
February 24, 1980(*indicates species on proposed expansion parcels)
Scientific CommonTrees and Shrubs

*Acer rubrum	red Maple
Acer negundo	box elder
*Alnus sp.	alder
*Betula papyrifera	paper birch
Corylus americana	hazel
*Juniperus sp.	juniper
Ostrya virginiana	ironwood
*Populus tremuloides	trembling aspen
Populus deltoides	eastern cottonwood
*Quercus rubra	northern red oak
*Quercus ellipsoidalis	northern pin oak
Quercus macrocarpa	bur oak
*Rosa sp.	wild rose
*Rhus typhina	staghorn sumac
*Salix amygdaloides	peachleaved willow
Tilia americana	basswood

Herbs and Grasses

*Agropyron spicatum	wheat grass
*Alopecurus sp.	foxtail barley
*Asclepias sp.	milkweed
*Bromus sp.	brome-grass
*Compositae family	thistle
*Elaeagnus angustifolia	russian olive
*Rosaceae family	blackberry
*Solidago spp.	goldenrod
Typha latifolia	common cattail
*Verbascum sp.	mullein

Sparse-mixed Hardwoods

Infrequent stands of mixed hardwood are found on the proposed expansion areas, dominated by red maple (Acer rubrum), northern red oak (Quercus rubra), and poplars (Populus sp.). Substantial stands of these species surround the surface water holding pond in the northeast corner of the landfill and the wetland adjacent to the proposed earthen berm. The wetland stand contains other dominant species such as bur oak (Quercus macrocarpa) and box elder (Acer negundo) as this stand descends into a low lying area. Only the outer fringes of these stands are contained within the expansion and berm areas. No part of the wetland itself is within the proposed expansion area.

Intermediate Shrubs

Several small stands of intermediate shrubs are scattered through the expansion and berm areas, dominated by staghorn sumac (Rhus typhina), alder (Alnus sp.), mullein (Verbascum sp.), and young poplars (Populus sp.). These shrubs, especially along the abandoned right-of-way of the expansion area, are indicative of disturbed areas. Several small thickets are located in the southern third of the expansion area (see Figure III-18).

Grassland

Grassland areas which exist on the landfill with vegetative cover are dominated by a variety of grasses and a number of herbaceous species such as goldenrod (Solidago sp.), milkweed (Asclepias sp.), brome grass (Bromus sp.), and wheat grass (Agrophron spicatum). Some areas on the existing permitted unused portions of the landfill are covered by pioneer grasses, while planted grasses are contained on completed portions of the landfill. Phoenix Inc. has used several types of commercial seed mixes in order to vegetate completed surfaces of the existing landfill. Near the northeast pond straight alfalfa was used, while "Highway Mix No. 5", "Kentucky 31", and hay-pasture types of seed mixes were used on other areas (see Table III-26 for seed mix content analysis). It is likely that some of these seeded grasses have located on portions of the proposed expansion area.

Baren-Graded Soil

The remainder of the proposed expansion area has no vegetation cover due to its present use as a roadway for large vehicles. The northernmost portion of both the expansion and berm areas presently borders excavation operations where the soil is scraped for daily cover material.

TABLE III-26

TYPES OF SEED MIX USED TO REVEGETATE
COMPLETED PORTIONS OF THE LANDFILL

<u>Common Name</u>	<u>Scientific Name</u>
<u>Highway Mix No. 5</u>	
40% park kentucky blue grass	Poa pratensis
14% smooth brome grass	Bromus sp.
6% red top seed	Agrostis alba
8% timothy	Phleum sp.
20% perennial rye grass	Lolium perenne
6% white dutch clover	Trifolium sp.
6% birds foot trefoil	Lotus sp.
<u>Typical Hay-Pasture Mix (Alfalfa Predominant)</u>	
70% alfalfa	Medicago sp.
15% red clover	Trifolium pratense
10% timothy	Phleum sp.
5% alfike	(unidentified)
<u>Kentucky 31</u>	
100% tall fescue	Festuca elatior

Wetland (entirely within presently permitted area)

Two wetland areas exist on the presently permitted landfill. A small peat-based wetland is located approximately 100 feet west of the proposed earthen berm and approximately 1000 feet north of the landfill's southern boundary (see Figure III-18). It is characterized by typical regional wetland species. Shrub-carr, wet meadow, and emergent aquatic vegetation are found in this type of area, including such species as dogwood (Cornus spp.), willow (Salix spp.), cattail (Typha latifolia), reed grass (Phragmites sp.), and sedge (Carex sp.). The landfill manager states that this wetland has only occasionally had standing water over the past nine years. Another wetland surrounds the settling pond in the southeast corner of the landfill.

Lowland Forest (entirely within presently permitted area)

Surrounding the wetland area, and directly adjacent to the proposed earthen berm is a lowland forest type of plant community (see Figure III-18). This area is a transition zone from the wetland to the mixed hardwood stands on the earthen berm area. Species typically found in lowland forests include willow (Salix sp.), American elm (Ulmus americana), box elder (Acer negundo), ironwood (Ostrya virginiana), bur oak (Quercus macrocarpa), basswood (Tilia americana), hazel (Corylus americana), and dogwood (Cornus spp.).

WILDLIFE

Wildlife species which are likely to be found within the Pine Bend Sanitary Landfill area would include those species commonly associated with the previously described plant communities. Figure III-18 shows the location of the general plant communities on and near the proposed expansion and berm areas. Species listed in Table III-27 are those animals which could be expected to use the various habitats found at Pine Bend for at least a portion of the year. This list is not intended to be exhaustive, but rather indicative of the families and genera of animals that could potentially be found on or near the expansion and berm areas. While not specifically identified, insects at the Pine Bend Sanitary Landfill are a primary unit in the site's ecosystem as a basic link in the food web.

AQUATIC ECOLOGY

The only bodies of water on the Pine Bend Sanitary Landfill are two surface water retention areas in the northeast and southeast corners of the property (see Figure III-19 and Table III-28). Occasionally, the low wetland area previously discussed, is submerged with water during the rainy season. The only other water bodies in the immediate area are five smaller ponds west and south of the landfill (see Figure III-19 and Table III-28).

Table III-27

Animals Which Commonly Utilize Plant Communities
Identified at Pine Bend Sanitary Landfill

(*indicates species identified on expansion parcels,
February 24, 1980)

KEY: MH - Mixed Hardwood
IS/G - Intermediate shrubsgrassland
LF - Lowland forest
W- Wetlands

MAMMALS

Plant Communities
Utilized by
Species

<u>Species</u>	<u>Scientific Name</u>	<u>Common Name</u>
MH, IS/G, LF	<i>Citellus tridecemlineatus</i>	thirteen-lined ground squirrel
MH, IS/G	<i>Geomys</i> sp.	gopher
MH, IS/G	<i>Marmota monax</i>	woodchuck
MH, LF	<i>Microtus</i> sp.	Vole
MH, IS/G	<i>Mephitis mephitis</i>	• striped skunk
Mh, IS/G, LF *	<i>Mustela</i> sp.	weasel
LF, W	<i>Mustela vison</i>	mink
MH, LF *	<i>Odocoileus virginianus</i>	white tailed deer
IS/G, LF	<i>Peromyscus maniculatus</i>	deer mouse
MH, LF	<i>Procyon lotor</i>	raccoon
MH, IS/G	<i>Sacalopus aquaticus</i>	eastern mole
MH, LF *	<i>Sciurus carolinensis</i>	eastern gray squirrel
MH, IS/G, LF	Soricidae	shrews
IS/G, LF *	<i>Sylvilagus floridanus</i>	cotton tail rabbit
MH, LF	<i>Tamias striatus</i>	eastern chipmunk
MH, IS/G, LF *	<i>Vulpes fulva</i>	red fox

Table III-27
(continued)

BIRDS

Plant Communities

Utilized by

Species

Scientific Name

Common Name

MH, W		Aix sponsa	wood duck
W		Agelaius phoeniceus	red-wing
			blackbird
W		Anas platyrhynchos	mallard
W		Anas carolinensis	green-wing teal
W		Anas discors	blue-winged teal
MH, LF		Bonasa umbellus	ruffed grouse
MH, LF		Bubo virginianus	great horned owl
MH, LF		Buteo jamaicensis	red-tailed hawk
IS/G, W		Charadrius vociferus	killdeer
IS/G		Chondestes grammacus	lark sparrow
IS/G, W		Circus cyaneus	marsh hawk
MH, LF		Colaptes auratus	yellow-shafted flicker
MH, LF	*	Corvus brachyrhynchos	common crow
MH, LF	*	Cyanocitta cristata	blue jay
MH, LF		Dendrocopos pubescens	downy woodpecker
IS/G		Dendroica petechia	yellow warbler
IS/G, W		Dendroica palmarum	palm warbler
IS/G		Dolichonyx oryzivorus	bobolink
MH		Empidonax minimus	least flycatcher
IS/G		Eremophila alpestris	horned lark
IS/G		Falco sparverius	sparrow hawk
IS/G, W		Geothlypis trichas	yellowthroat
W		Ixobrychus exilis	least bittern
IS/G		Junco hyemalis	slate-colored junco
LF, W		Nycticorax nycticorax	black crowned night heron
LF		Melanerpes erythrocephalus	red headed woodpecker
MH		Otus asio	screech owl
MH, IS/G, LF	*	Parus atricapillus	black capped chickadee
IS/G	*	Passer domesticus	house sparrow
IS/G		Passerculus sandwichensis	savannah sparrow
IS/G	*	Phasianus colchicus	ring-necked pheasant
MH, LF		Piranga olivacea	scarlet tanager

Table III-27
(continued)

IS/G		Poocetes gramineus	vesper sparrow
IS/G		Richmondia cardinalis	cardinal
W		Scolopacidae	sandpipers
IS/G		Sialia sialis	eastern bluebird
LF		Sitta carolinensis	white breasted nuthatch
MH, IS/G, LF		Spinus tristis	american goldfinch
IS/G	*	Spizella arborea	tree sparrow
IS/G		Sturnella magna	eastern meadowlark
IS/G		Sturnella neglecta	western meadowlark
LF		Troglodytes aedon	house wren
MH, LF		Turdus migratus	robin
IS/G, LF		Zenaidura macroura	mourning dove

REPTILES AND AMPHIBIANS

Plant Communities

Utilized by

Species

Scientific Name

Common Name

MH, LF, W	Hyla versicolor	gray treefrog
LF, W	Notophthalmus viridescens	central newt
	louisianensis	
W	Rana sp.	leopard frog
MH, LF	Rana sylvatica	wood frog
LF	Storeria occipitomaculata	red-bellied snake
MH, IS/G, LF	Thamnophis sirtalis sirtalis	eastern garter snake

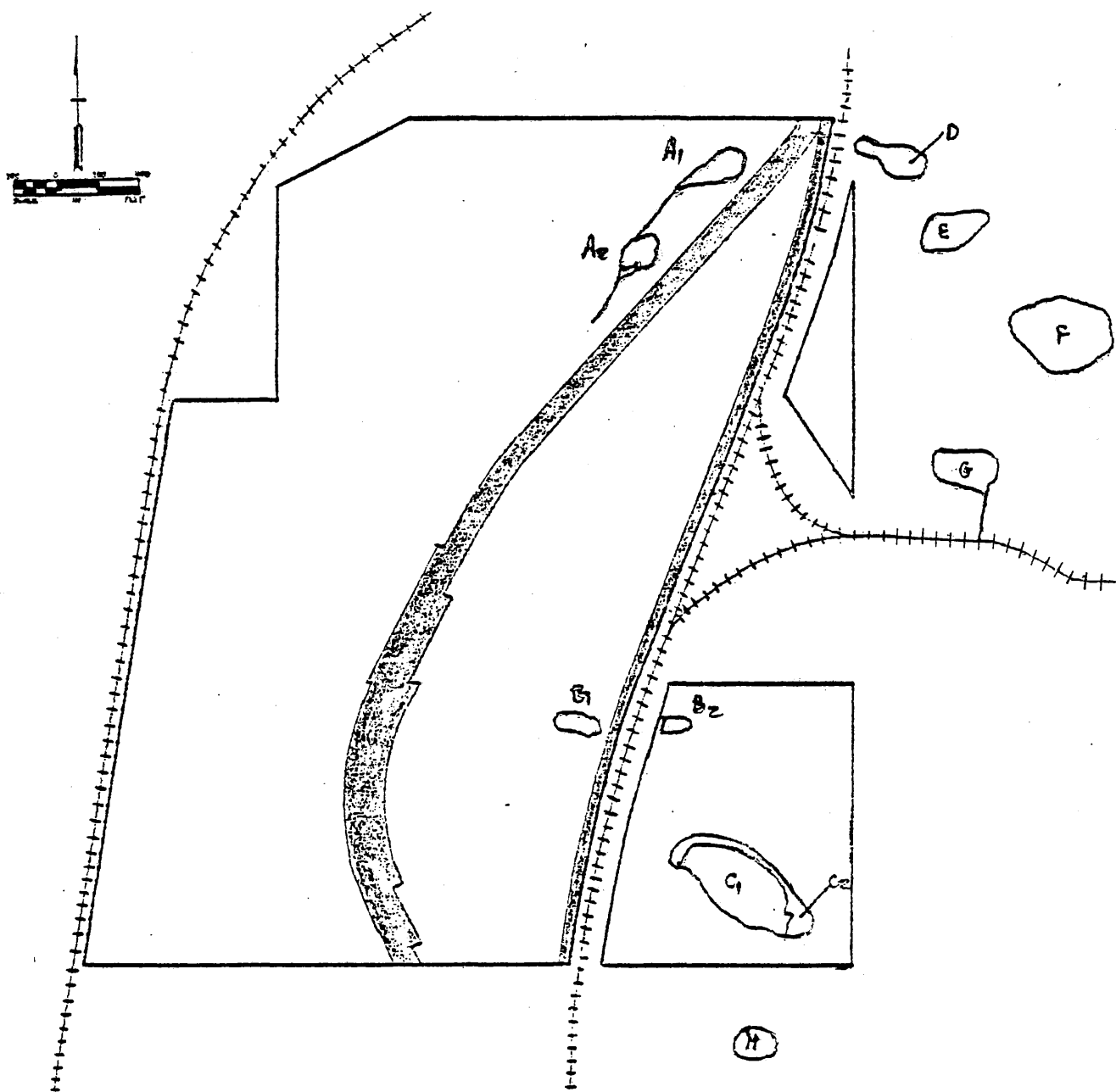


Figure III - 19
Ponds and Wetlands on and near
Pine Bend Sanitary Landfill
(See Table III-4)

Table III-28

PONDS AND WETLANDS ON PINE BEND SANITARY LANDFILL
AND IMMEDIATE SURROUNDING AREA

(See Figure III-19 for Location)

ON-SITE

<u>Label</u>	<u>Description</u>	<u>Aquatic Vegetation</u>	<u>Acres</u>
A ₁	NE Settling Pond	none visible	0.15
A ₂	"Upper NE Settling Pond	none visible	0.10
B ₁	Wetland West of Parcel 2	Type 2 and 3	1.04
B ₂	Wetland East of Parcel 2	Type 2 and 3	0.67
C ₁	SE Settling Pond	Water lily	2.84
C ₂	SE Wetland	Type 2, 3, 4, and 6	0.59

OFF-SITE

D	Pond	NA	1.0
E	Pond	Water lily, reed canary	1.0
F	Pond	NA approx.	1.0
G	Pond North of RR Tracks	NA	1.0
H	Pond South of Road	NA	1.0

It is doubtful, however, because of their location, that any present or future operations at the landfill will affect these ponds in any manner.

There is no aquatic ecology information on the two settling ponds or the surrounding area of the landfill based on conversations with the landfill manager and the Minnesota Department of Natural Resources (DNR). However, a site inspection was made by MPCA staff on September 7, 1979, when water samples were collected from the northeast pond and analyzed for heavy metals by the Minnesota Department of Health. Table III-29 shows the results of the MPCA sampling. It should be noted that MPCA's sampling was a random one-time sampling, and may not be necessarily indicative of long-term conditions at the on-site ponds.

Table III-29 indicates that the iron concentration in the northeast settling pond appears to be elevated. It is unknown whether or not the southeast settling pond has similar contamination since no samples have been taken. It was further noted by MPCA that there was a complete lack of vegetation or wildlife in or near the edge of the ponds. This observation was verified by the Council's field survey, except that several small mammal tracks were noted near the edge of the northeast pond.

The wetland area, described in the preceding section on vegetation, is approximately 100 feet in diameter. As reported by the landfill manager, this wetland has rarely been observed with standing water. Therefore, the ecological significance of this area as an aquatic community is probably minimal due to its small size and the short periods of flood conditions.

WETLANDS

Wetlands, in general, play a vital role in the retention and release of water. During periods of flooding, wetlands act as storage basins by impounding water in open ponds and storing water in their organic soils. Wetlands have many valuable ecological functions, including wildlife inhabitation, water storage and water recharge potential, and pollutant filtration capability.

The three wetland areas located on the landfill property are all less than one acre (see Figure III-19 and Table III-28). These wetlands would probably be classified as Type 2 and 3 labeled (B1 and B2) and Type 2, 3, 4, and 6 (labeled C2) according to USDI Fish and Wildlife Service definitions. The soil in these wetlands is usually without standing water during most of the growing season but is probably waterlogged within at least a few

Table III-29

HEAVY METAL ANALYSIS FROM NORTHEAST POND

Samples Collected September 7, 1979
(parts per billion)

<u>Parameter</u>	<u>"Upper" NE Settling Pond (A₂)</u>	<u>NE Settling Pond (A₁)</u>
Arsenic	8.3	7.6
Cadmium	10	10
Chromium	1.8	3.3
Copper	50	50
Iron	12,000	2,600
Lead	50	50
Manganese	990	260
Nickel	57	50
Zinc	16	19

inches of its surface. Representative plants of inland fresh meadow include corex, rushes, redtop, reedgrasses, mannagrasses, prairie cordgrass, and mints.

RARE AND ENDANGERED SPECIES

Minnesota has enacted a law for the protection of threatened and endangered species (M.S.A. 97.488), and state listings of regulated species are presently being compiled. According to DNR records, there are no rare or endangered species in the landfill area. Moreover, there are no species listed in Tables III-25 or III-27 which are plants and animals which merit special consideration and management according to the DNR publication "...the Uncommon Ones" (Moyle, J. B., 1975).

CH743A

SOCIO ECONOMICS

LAND USE, ZONING

Land Use

The Pine Bend Sanitary Landfill is located in the City of Inver Grove Heights in the northern part of the Pine Bend industrial area. The landfill is located almost adjacent to the northern boundary of the City of Rosemount. Directly east, approximately one mile, is the Mississippi River.

The Pine Bend area is the prime industrial area for both the community's of Inver Grove Heights and Rosemount. The area is very suited to industrial development because of its proximity to railroads and major arterials and the soil stability and level terrain of the area easily accommodates industrial structures.

Figure III-20 shows the land use surrounding the landfill area. To the north and adjacent to the landfill is a demolition and construction waste landfill operated by Crosby American Properties, Inc. This landfill was formerly a U.S. Environmental Protection Agency (EPA) demonstration site, owned and operated by the American Hoist and Derrick Company of St. Paul. This site accepted baled residential and commercial refuse from 1970 to 1974.

Directly east of the landfill is Northern States Power Company's electrical generating plant. This is a 375-MW oil-fired peaking station, providing additional electricity to area customers only during high demand periods. Bordering NSP on the east is Union Carbide, a manufacturer of industrial gases (oxygen, nitrogen and argon) in liquid form. Further east are presently developing lands and the Cenex Company. Cenex is a farmer's cooperative supplying area farming needs.

Directly south of the landfill is the Mid-America Pipeline Company. Mid-American is a pipeline terminal where propane gas is temporarily stored before it is transported to area customers. Immediately south of Mid-America is Koch Refinery, a major petroleum refinery. Southeast of Koch is the N-REN Corporation comprising its North Star Chemical Division (an alum manufacturer) and St. Paul Ammonia Products.

Land areas southwest, west, northwest and north of the landfill are primarily used for agricultural purposes. Located west of the site is Bituminous Roadways, a sand and

GENERALIZED LAND USE

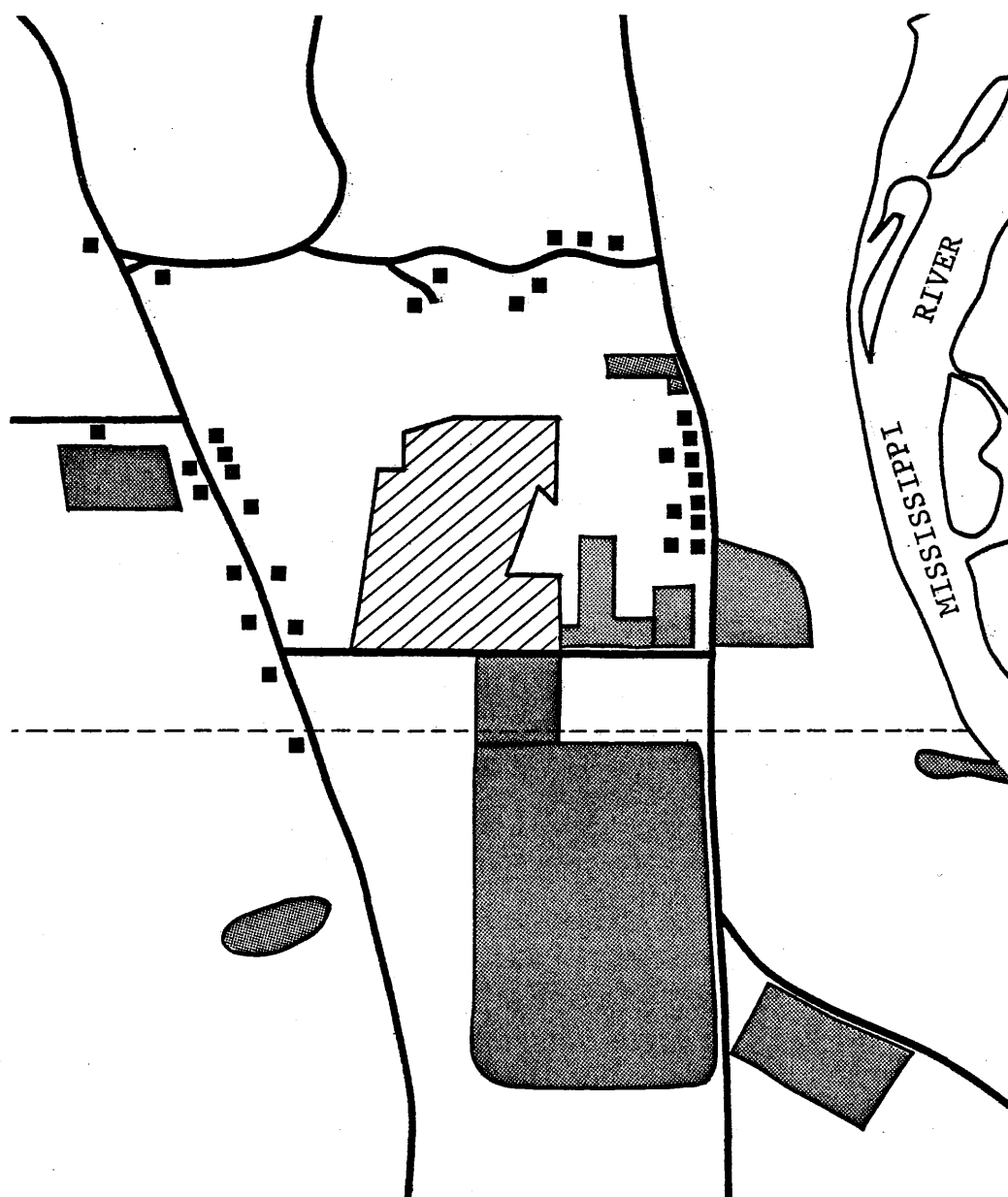
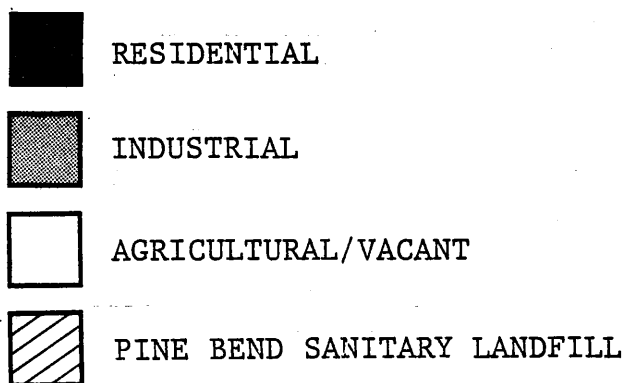


Figure III - 20



gravel operation. Northeast of the site is the Suburban Gas Company, a retailer of liquid-propane gas and gas appliances. Located throughout the surrounding area are a number of single-family homes.

Zoning

Figure III-21 shows zoning for the areas adjacent to and in the general area of the Pine Bend Sanitary Landfill. As can be seen, land parcels north, northeast, east, southeast and south of the landfill are zoned for general industry use or industrial park use. Land parcels northwest, west and southwest of the landfill are primarily zoned for agricultural use. Other zoning in the Pine Bend Landfill area include small areas designated for such uses as public or quasi-public, general business, institutional, sand and gravel, and residential.

Regional Development Framework Plan

The Metropolitan Council has adopted a Development Framework Plan to guide present and future decision-making in the seven-county Region (see Figure III-22). This plan designates general areas for future urban and rural services and provides standards for making decisions with respect to these services. Appendix III describes the various urban and rural use classifications contained in the plan.

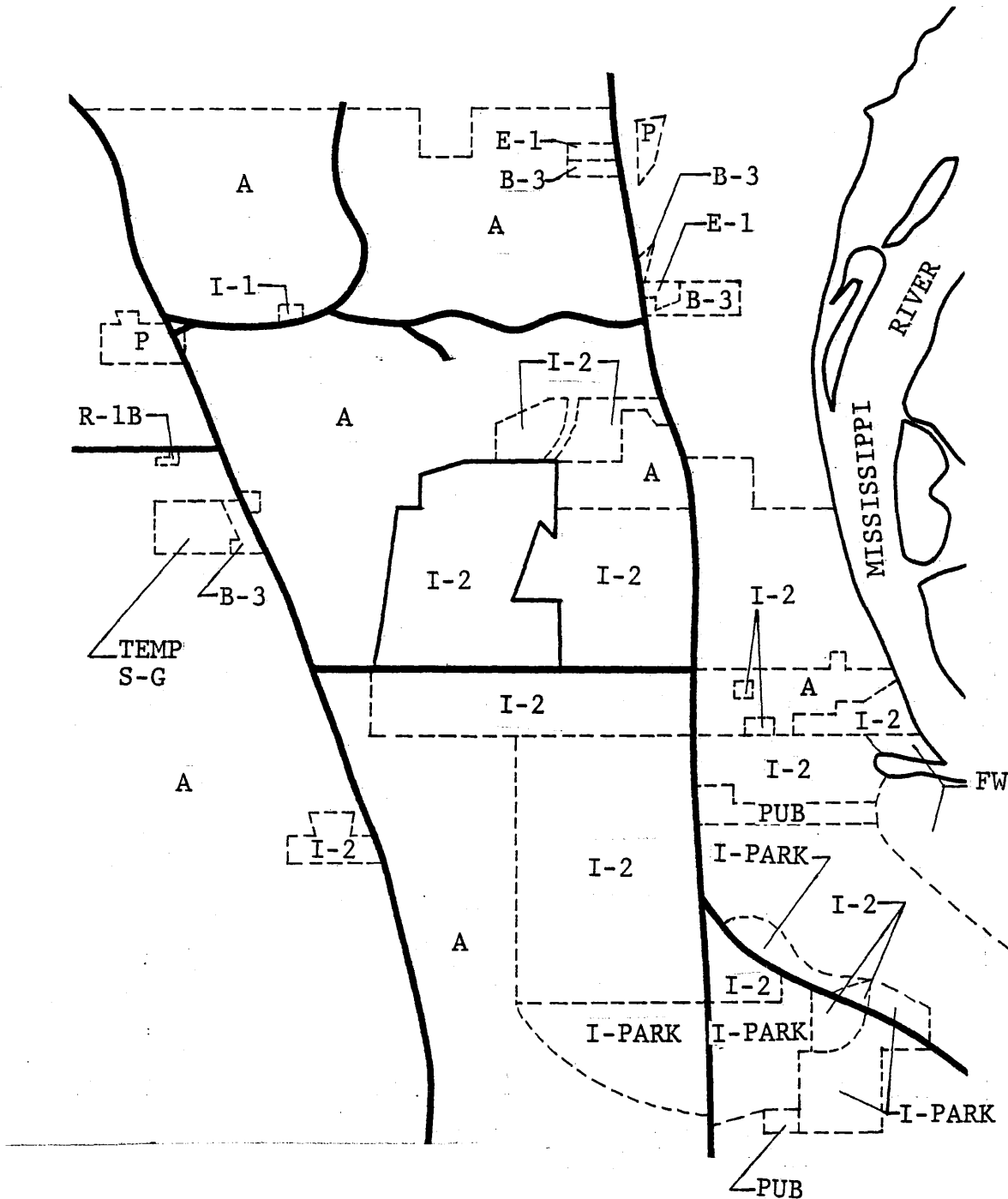
The Pine Bend industrial area, including the Pine Bend Sanitary Landfill, is located in a general rural use region. Within this region, the Metropolitan Council gives first priority to agricultural uses, however, quasi-urban uses are also recognized as occurring in this region. No new urban services will be provided in this region before 1990, but the Urban Service Area may be expanded into this area after that. The Council Development Framework states that low density residential land use may be suitable in general rural use regions if local governments, including school districts, certify that the development will not require additional public services or harm natural resources.

Critical Areas

On November 23, 1976, the Governor of Minnesota signed Executive Order Nos. 130 and 130A designating the Mississippi River Corridor as a Critical Area. Such designation set in motion a planning process that allowed local, regional and state agencies to work together to prepare a coordinated plan for managing an 80 mile stretch of river. The City of Inver Grove Heights adopted such a plan in 1979. Figure III-23 shows existing and proposed land use features and projects as described in the city's plan, of interest with respect to the Pine Bend Landfill area.

The city's Critical Area plan provides for future adoption of a "Critical Area Overlay District Ordinance" which would provide

ZONING MAP



- A - Agricultural District
- B-3 - General Business
- E-1 - 2½ Acre Estate
- P - Institutional District
- I-1 - Limited Industry
- I-2 - General Industry
- I-PARK - Industrial Park
- PUB - Public or Quasi-Public
- R-1B - One Family Residential
- TEMP S-G - Temporary Sand and Gravel Operation
- FW - Flood Way

Figure III - 21

REGIONAL LOCATION

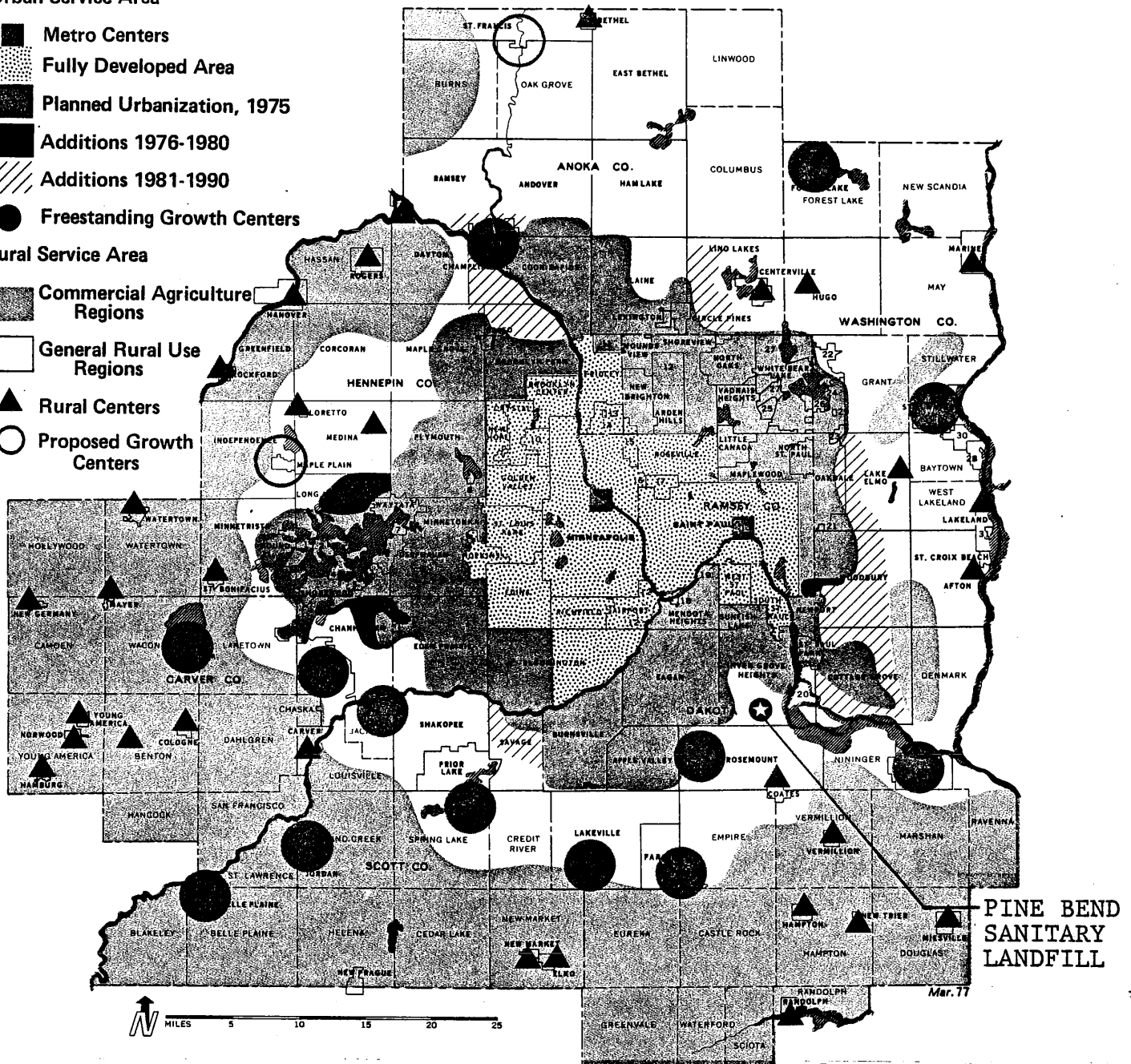
DEVELOPMENT FRAMEWORK PLAN

Urban Service Area

- Metro Centers
- ▨ Fully Developed Area
- Planned Urbanization, 1975
- Additions 1976-1980
- ▨ Additions 1981-1990
- Freestanding Growth Centers

Rural Service Area

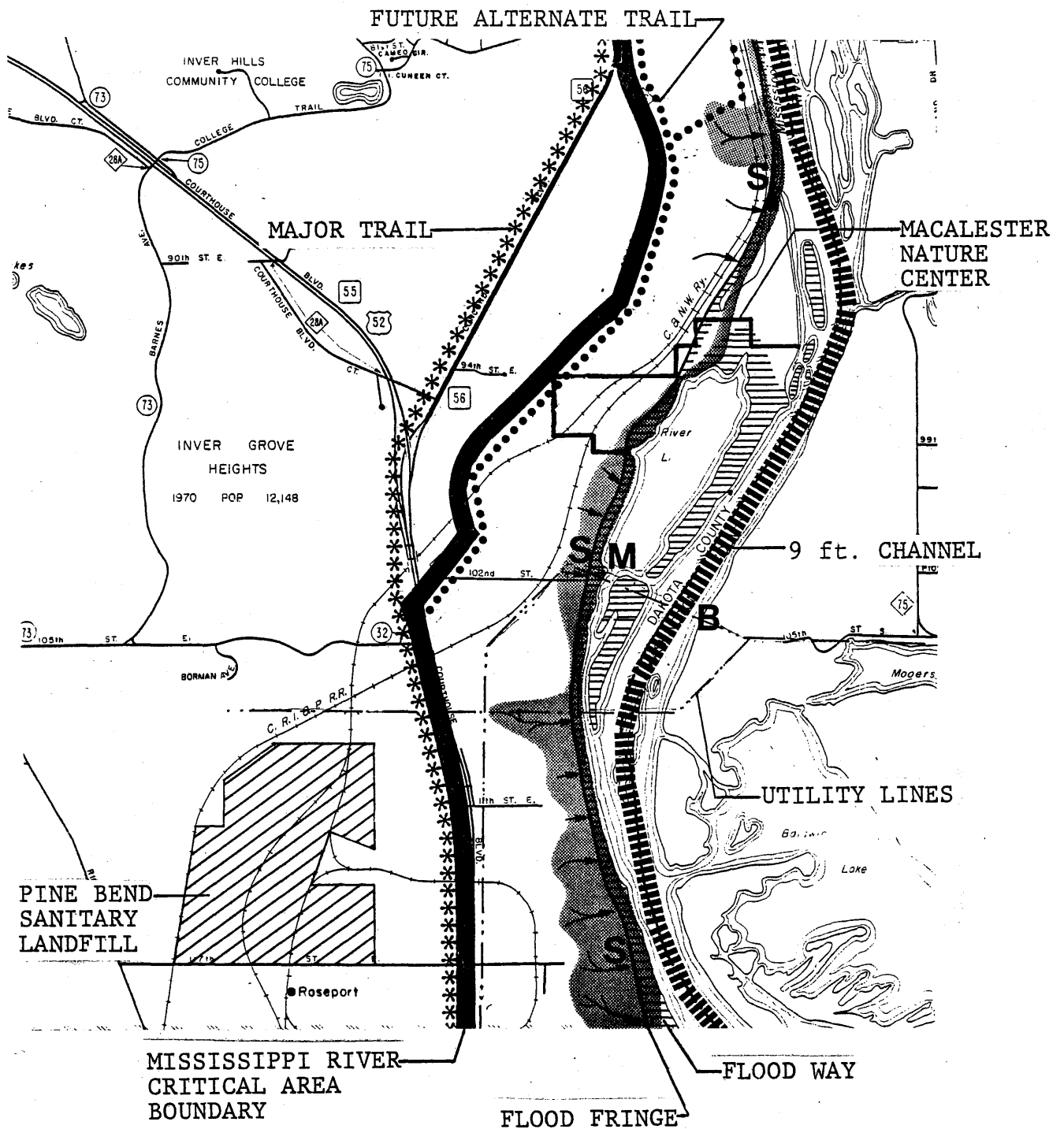
- ▨ Commercial Agriculture Regions
- General Rural Use Regions
- ▲ Rural Centers
- Proposed Growth Centers



TWIN CITIES METROPOLITAN AREA

Figure III - 22

CRITICAL AREAS MAP



M-MARINA

B-BARGE TERMINAL

S-SCENIC OVERLOOK

→ DRAINAGE ROUTES

■ SLOPES OVER 18%

Figure III - 23

for specific regulations protecting natural features within the designated area. The plan restricts development within the flood fringe, floodway and floodplain of the designated area. The area immediately east of the landfill within the designated area has been assigned a limited industrial use, consistent with zoning for the area. The area north of the Cenex industrial complex has been designated both a limited industrial use area and a rural open space district. Finally, the plan protects and promotes existing marina facilities, provides for new scenic overlooks, vistas and trails, and provides for barge slips and fleeting facilities.

See Appendix IV for a further discussion on the Critical Area planning process.

POPULATION CHARACTERISTICS

Population

Table III-30 shows Metropolitan Council population, housing and employment forecasts for Rosemount and Inver Grove Heights. The combined population for these two communities is presently about 23,000. Over the next ten years, the population is projected to grow 75 percent for Rosemount and 35 percent for Inver Grove Heights resulting in a combined population of about 33,200. After this time period, the population for the two communities is projected to grow much slower resulting in a combined population of about 35,500 for the year 2000, a 7 percent growth rate for the decade.

Housing and Employment

Presently, there are about 6750 occupied housing units in the combined area of Rosemount and Inver Grove Heights. Over the next decade housing is projected to increase 97 percent in Rosemount and 52 percent in Inver Grove Heights resulting in a combined total of about 10,900 housing units. Projections for housing in the year 2000 show a total of 14,000 units for the two communities, representing about a 28 percent increase for the decade.

Employment in the two communities will grow considerably over the next decade. Projections for Rosemount show a 56 percent increase and for Inver Grove Heights an employment increase of close to 300 percent, resulting in a 1990 total employment of about 12,500. Figures for the year 2000 show a total employment of about 17,000, representing a 40 percent increase for Rosemount and a 33 percent increase for Inver Grove Heights for the decade.

Table III - 30

POPULATION, HOUSING AND EMPLOYMENT

	Rosemount			Inver Grove Heights		
	<u>Pop.</u>	<u>Housing</u>	<u>Employment</u>	<u>Pop.</u>	<u>Housing</u>	<u>Employment</u>
1970	4,043	1,025	2,500	12,148	2,845	2,100
1979 (78)	5,260	1,472	3,200	17,750	5,278	1,900
1990	9,200	2,900	5,000	24,000	8,000	7,500
2000	11,500	4,000	7,000	24,000	10,000	10,000

Population - 1970 census (revised to allow for boundary changes)
 1979 estimate for April 1, 1979
 1990 & 2000 forecasts based on current city boundaries

Housing - Estimated number of occupied housing units

Employment - 1970 employment securities data, assembled by
 Dept. of Transportation (State of Minnesota)
 1979 spring 1978 estimate by Minn. Dept. of
 Economic Security
 1990 & 2000 forecast for current city boundaries

PUBLIC FACILITIES AND SERVICES

Community Offices

The City of Inver Grove Heights administrative offices, including the public works and police departments, are located at County Road 73 and MN Highway 55. The City Council chambers are located in a converted school house south of 66th Street along Doane Trail in the northeastern section of the city.

Rosemount city offices are located at 1367 145th Street East (County Road 42). These offices currently house the police department, all administrative offices and a deputy registrar post for vehicle registration and licensing.

Fire Services

Three fire stations exist in the City of Inver Grove Heights, the newest of which is a facility located along County Road 18 near the Babcock Trail intersection (see Figure III-24). Other facilities are located along Concord Boulevard north of 66th Street and along 70th Street between Concord boulevard and Cahill Avenue.

The Rosemount fire station is located at 14425 Brazil Avenue, just north of 145th Street and east of the downtown business district. (see Figure III-24) The Rosemount volunteer fire department is staffed by 35 men.

Schools

Inver Grove Heights -- Figure III-25 shows school district boundaries and the location of schools serving the Inver Grove Heights-Rosemount areas. As can be seen, School District No. 199 serves the vast majority of the population of Inver Grove Heights and a small portion of Rosemount. Seven schools serve the Inver Grove Heights area.

Rosemount -- The City of Rosemount is served primarily by one school district, School District No. 196. This district encompasses 110 square miles and takes in part of Inver Grove Heights including the Pine Bend Landfill area population. As can be seen in Figure III-25, three schools are located just east of Rosemount's downtown area.

Sanitary Sewer Services

The northern two-thirds of Inver Grove Heights is serviced by a gravity flow interceptor sewer which flows northward to the South St. Paul Wastewater Treatment Plant (see Figure III-26). The Inver Grove Heights interceptor also provides sewer service for Newport and St. Paul Park. After initial treatment, the South St. Paul Plant discharges north to the Metropolitan Wastewater Treatment Plant where final effluent treatment is

FIRE STATION LOCATIONS IN INVER GROVE HEIGHTS AND ROSEMOUNT

★—FIRE STATIONS

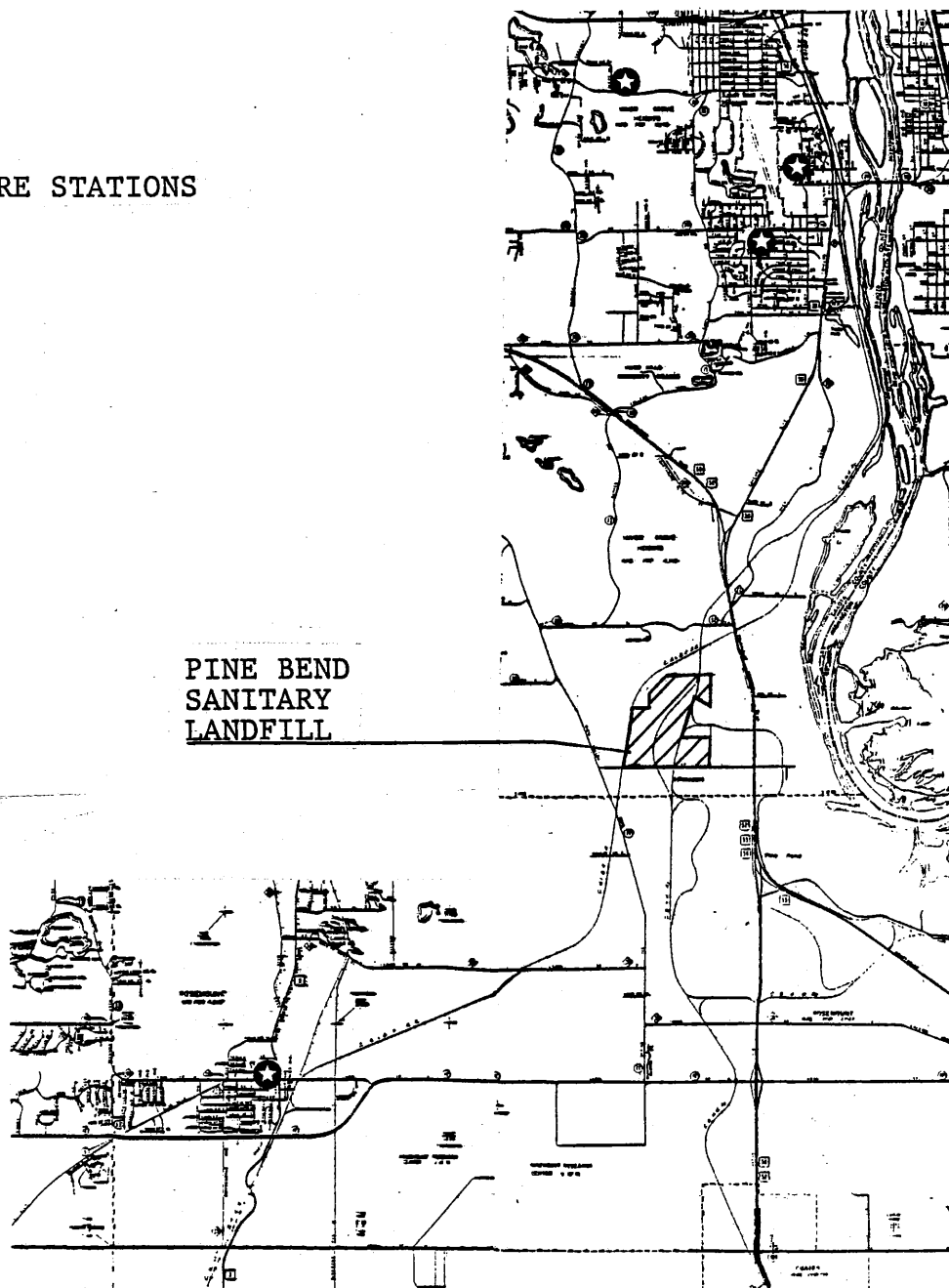


Figure III - 24

LOCATION OF SCHOOLS AND SCHOOL DISTRICT BOUNDARIES
IN INVER GROVE HEIGHTS AND ROSEMOUNT

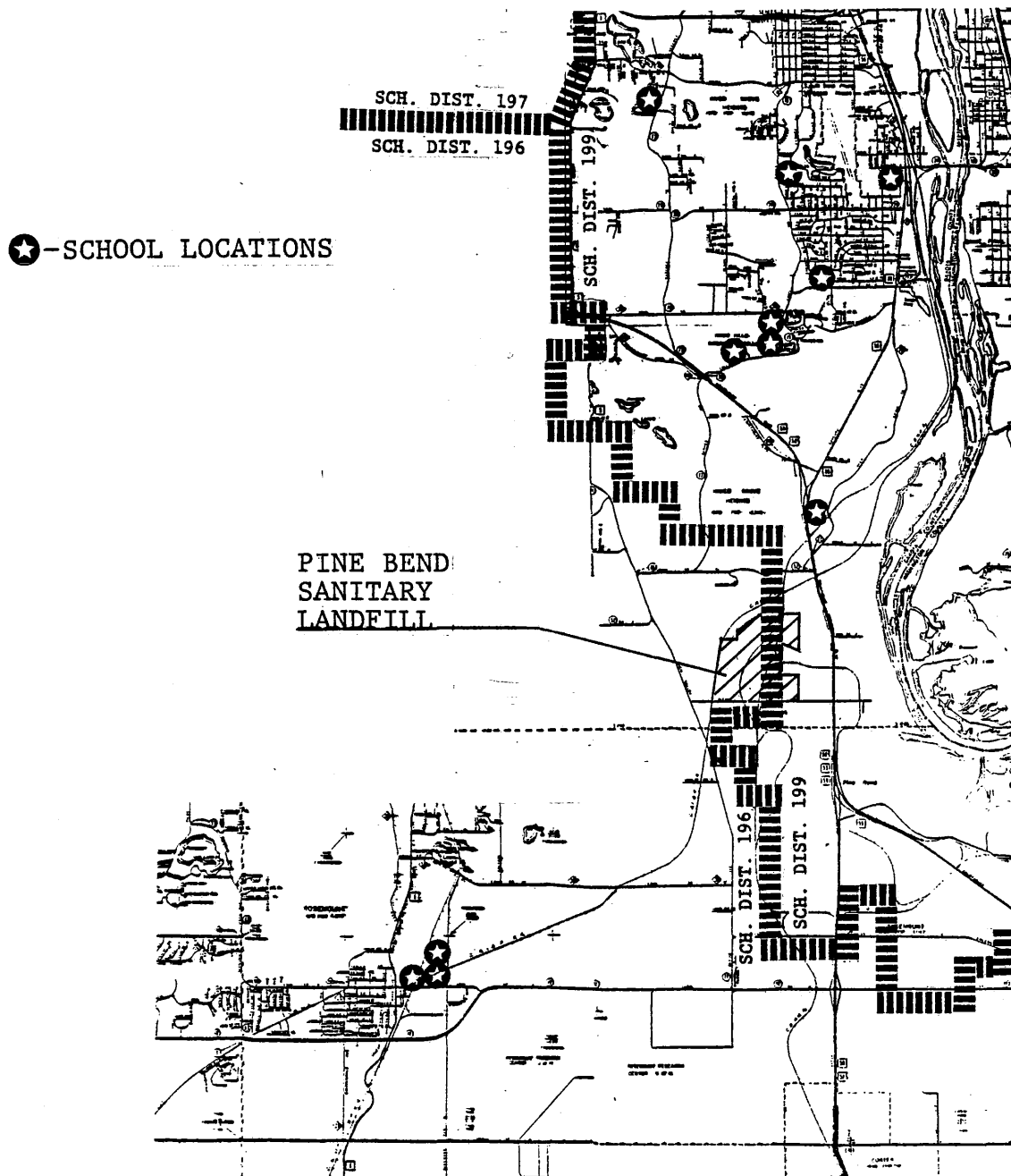
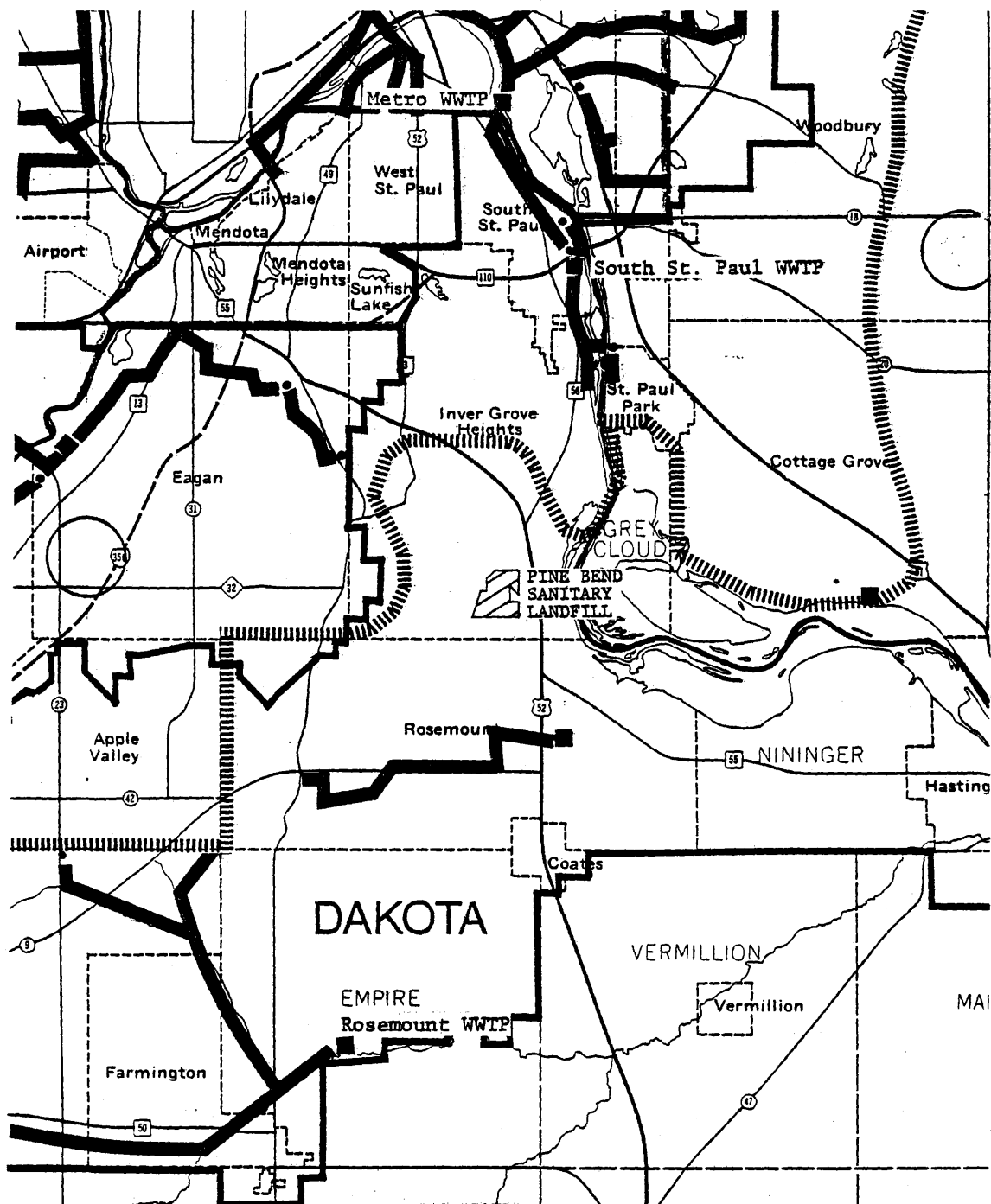


Figure III - 25

PRIMARY SEWER SYSTEM FOR INVER GROVE HEIGHTS AND SURROUNDING AREA



- EXISTING INTERCEPTORS
- EXISTING TREATMENT PLANTS
- LIFT STATIONS
- PROPOSED 1990 MUSA BOUNDARY

Figure III - 26

provided. The extreme western fringe of Inver Grove Heights is served by the Eagan interceptor which flows to the Seneca Treatment Plant.

The southern one-third of Inver Grove Heights, including the Pine Bend Landfill area, is presently unsewered; on-site, owner-installed septic systems are used. This area is not expected to receive sewer service until after 1990 as designated in the Metropolitan Council's Development Framework. Inver Grove Heights has primary responsibility for carrying out a management and regulatory program for on-site disposal systems in the area.

The central portion of Rosemount is serviced by sewers. The Rosemount interceptor generally flows in an easterly direction to the new Rosemount Wastewater Treatment Plant. This interceptor has a capacity to serve Rosemount and southern Inver Grove Heights. However, the treatment plant only serves Rosemount at this time.

Table III-31 shows wastewater flow projections for Rosemount and Inver Grove Heights. These figures serve as the basis for local planning and regional planning by the Metropolitan Council to determine future treatment facility needs.

Storm Sewer Services

The topography of the Inver Grove Heights and Rosemount areas lends itself to relatively rapid surface drainage; relief is more than 320 feet. Both communities have constructed storm sewer systems and developed storm water management plans. These systems have been in place for several years and are performing satisfactorily.

The Pine Bend Landfill area, however, is not serviced by a storm sewer system. Surface runoff in this area follows natural drainage patterns.

Water Supply Services

Both Inver Grove Heights and Rosemount depend on ground water for their water supply. Ground water has been a dependable high quality source of water, as is the case generally in the Metropolitan Area. Most wells terminate in the Prairie du Chien-Jordan Aquifer, a high-yielding layer of sandstones and dolomites, approximately 250 to 400 feet below the surfaces. Beneath this aquifer, two minor aquifers, the St. Lawrence-Franconia and the Iron-ton-Galesville, supply a small portion of the area's water. The Mt. Simon-Hinkley Aquifer also supplies a portion of the area's water.

Approximately 56 percent of the population of Inver Grove Heights is served by the city's municipal water system supplied by four wells ranging in depth from 360 to 440 feet. The total system capacity in 1978 was 5.94 million gallons per day (mgd) and the average daily demand was 1.1 mgd. This demand is not expected to increase beyond 1.8 mgd by 1990.

Table III - 31
WASTEWATER FLOW PROJECTIONS

	<u>Inver Grove Heights</u>	<u>Rosemount</u>
<u>1980</u>		
Population	17,500	5,500
Sewered Population	16,400	4,000
Domestic Flow (MGD)	1.05	.35
Industrial Flow (MGD)	0.01	0.00
Total Flow (MGD)	1.06	.35
<u>1990</u>		
Population	24,000	9,200
Sewered Population	24,000	7,700
Domestic Flow (MGD)	1.66	.72
Industrial Flow (MGD)	0.02	0.00
Total Flow (MGD)	1.68	.72
Percent Increase from 1980	58	106
<u>2000</u>		
Population	29,200	11,500
Sewered Population	29,000	11,000
Domestic Flow (MGD)	2.17	1.08
Industrial Flow (MGD)	0.03	0.00
Total Flow (MGD)	2.20	1.08
Percent Change from 1990	31	50

In Rosemount, approximately 70 percent of the community's population is served by a municipal water system supplied by four wells ranging from 470 to 520 feet deep. In 1978, the total capacity for this system was 3.55 mgd and the average daily demand was 0.36 mgd. Rosemount's water demand is not expected to increase beyond an average of 0.6 mgd by 1990.

Most residences and industries in the Pine Bend Landfill area rely on private individual wells for their water supply. Pumping rates for industrial wells in the Pine Bend area have been generally found to range from 0 to 950 gallons per month (gpm) in the Jordan Aquifer and 0 to 880 gpm in the Mt. Simon-Hinkley aquifer. Six Jordan industrial wells just south of the landfill are pumped at rates ranging from 110 gpm to 950 gpm and three Mt. Simon-Hinkley industrial wells in the same area are pumped at rates of 50 gpm to 800 gpm. Domestic water supply wells in the area probably have maximum pumping rates of 25 gpm.

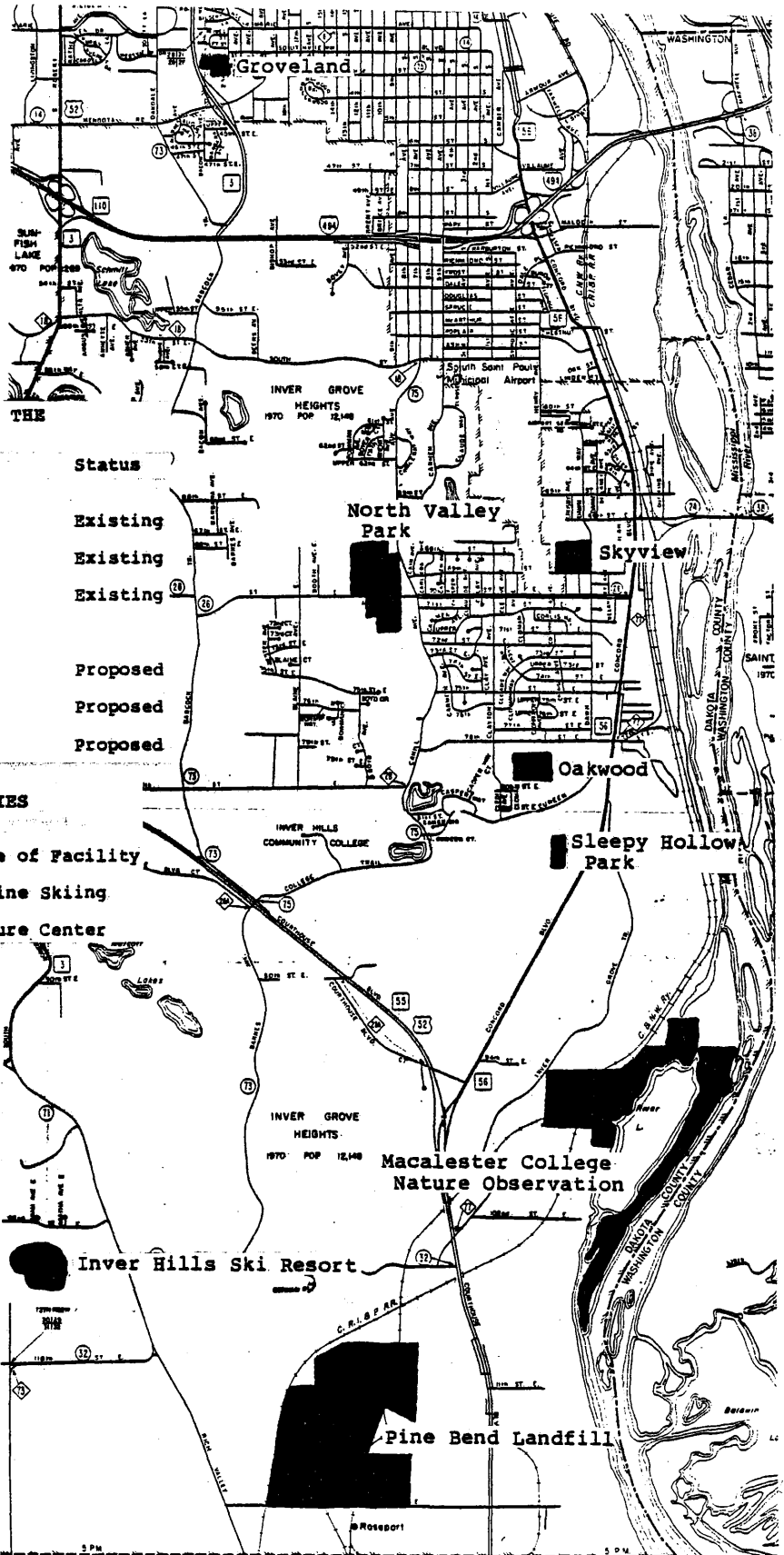
Park and Recreation Open Space Facilities

Inver Grove Heights has three city parks: Oakwood, Skyview and Groveland. These are fully developed recreation facilities with ballfields, skating rinks, shelters, tennis courts, and playgrounds. There are also two privately managed facilities which provide the residents of the area recreational and learning opportunities. The city's Park Commission is presently undertaking a major planning effort concentrating on the proposed North Valley Park which is intended to be a two-part, fully developed park and recreation facility. Plans for a smaller neighborhood park, the Sleepy Hollow Park, are also being developed. Figure III-27 shows the location of existing and proposed park facilities for the City of Inver Grove Heights.

Within Inver Grove Heights' long-range park plans, the western portion of the Pine Bend Landfill, upon closure, will be dedicated to the community for development as a recreational park (see Description of Existing Landfill and Proposed Action, Section II). Closure plans call for the landfill owner to grade portions of the landfill as they are completed, to accommodate the concept of a park. The community's conditional use permit for the site requires the owner of the landfill, prior to closure, to deliver a bond to the city to assure that corrections will be made concerning any defects which may occur after closure of the facility.

Since 1971, the City of Rosemount's park system has grown from Erickson Field, an undeveloped, 56-acre parcel, to a system of six developed parks and over 80 acres of undeveloped open space. The largest parcel in the park system is the Carroll's Woods area, immediately west of Rosemount Senior High School. Figure III-28 shows the location of Rosemount's park facilities; none of these are located close to the landfill area.

EXISTING AND PROPOSED PUBLIC AND PRIVATE PARKS IN THE CITY OF INVER GROVE HEIGHTS



EXISTING AND PROPOSED PUBLIC PARKS IN THE CITY OF INVER GROVE HEIGHTS

Park	Facilities	Status
Oakwood	ballfield, skating, shelter, tennis, playground	Existing
Skyview	ballfield, skating, shelter, tennis, playground	Existing
Groveland	skating, tennis, shelter, playground	Existing
North Valley Park	North Section: ballfields, playground, etc. South Section: trails, nature center, shelter	Proposed
Sleepy Hollow Park		Proposed
Pine Bend Landfill	ballfields, trails, shelter	Proposed

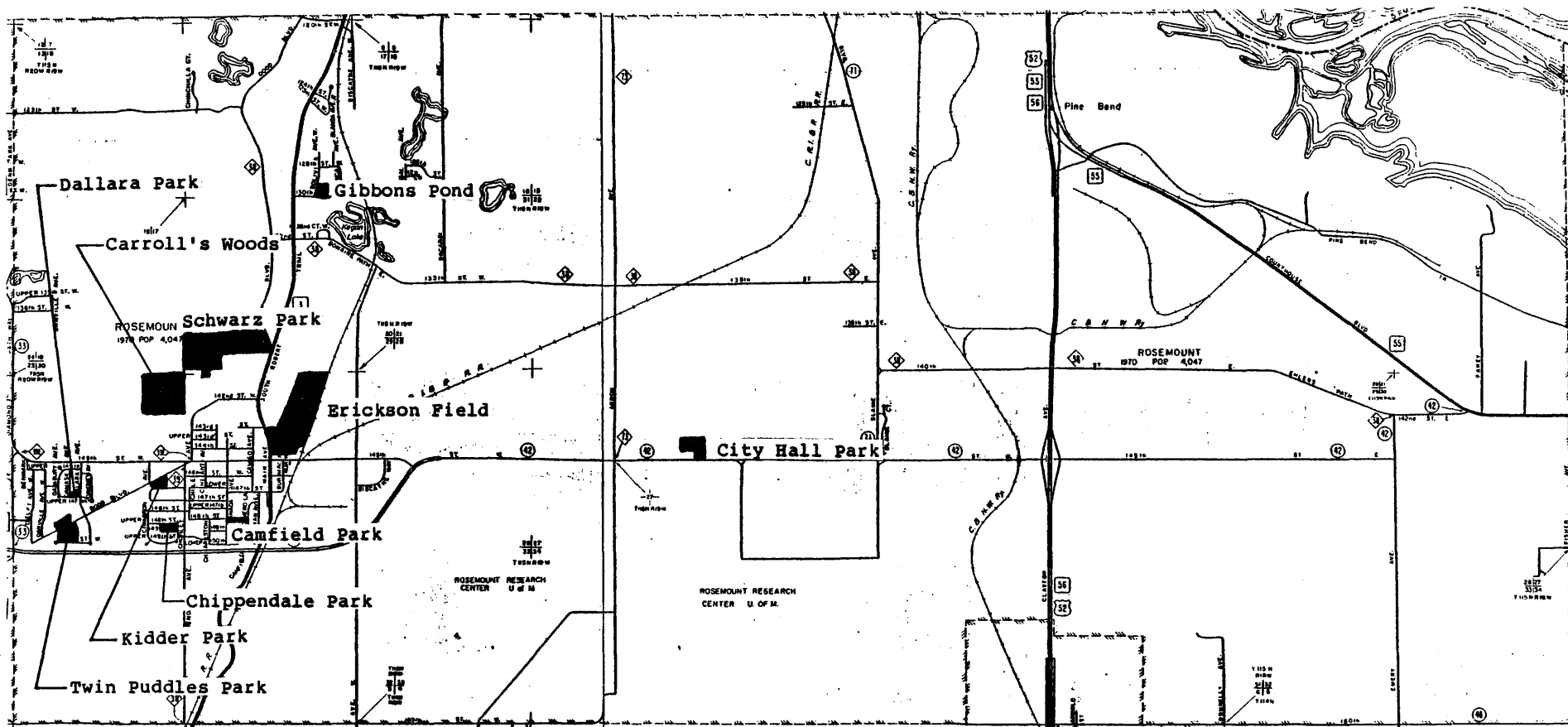
EXISTING PRIVATELY OWNED FACILITIES

Name	Type of Facility
Inver Hills Ski Resort	Alpine Skiing
Macalester College	Nature Center
Nature Observation	

Figure III - 27



APPROXIMATE
LOCATION OF
LANDFILL



Park	Facilities
Erickson Field	ballfields, hockey, soccer-football
Camfield Park	ballfields, playground, picnic shelter, skating
Chippendale Park	ballfield, playground, skating, warming house
Dallara Park	playground, skating
Twin Puddles Park	ballfield
City Hall Park	ballfield, playground
Carroll's Woods	undeveloped
Gibbons Pond	undeveloped
Kidder Park	undeveloped
Schwarz Park	undeveloped

EXISTING AND PROPOSED PARKS IN THE CITY OF ROSEMOUNT

Figure III - 28

TRANSPORTATION

General

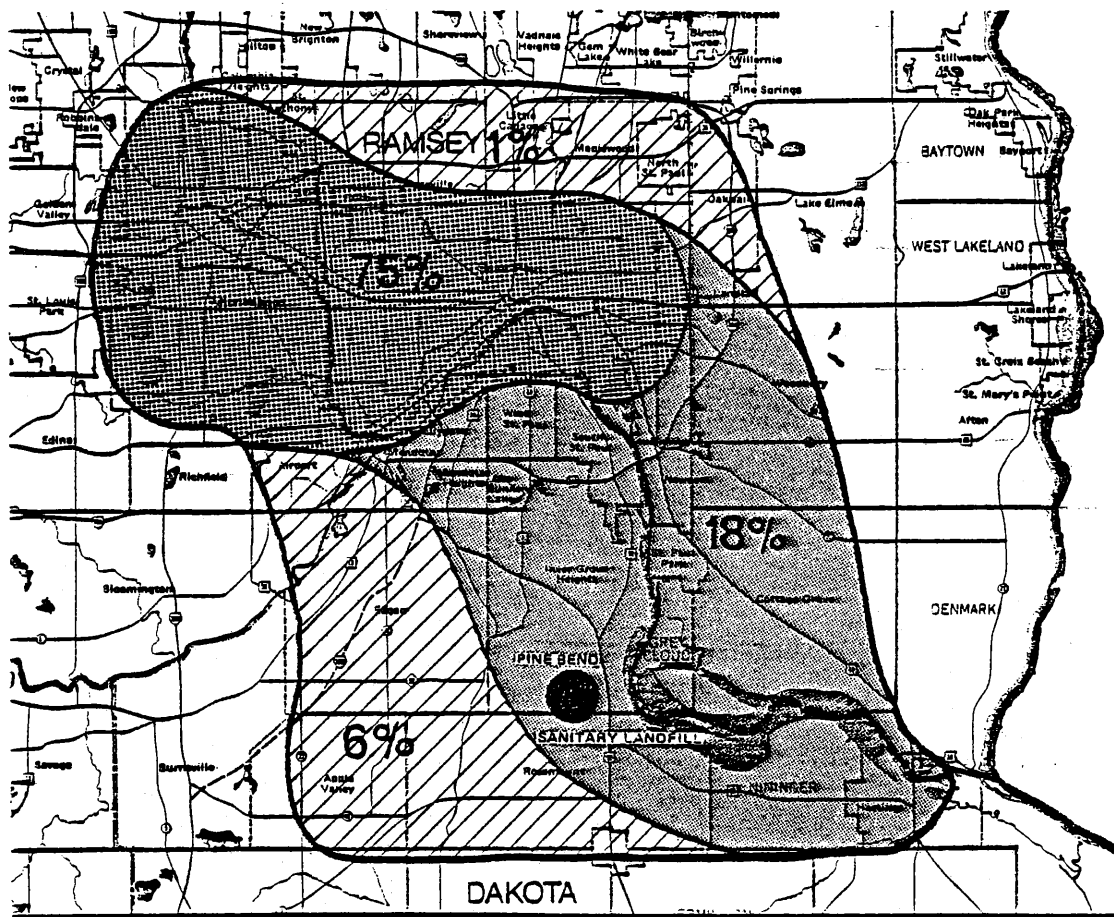
The Pine Bend Sanitary Landfill watershed covers approximately five hundred square miles and includes parts of Dakota, Hennepin, Ramsey and Washington counties. Thirty municipalities, two townships and the Fort Snelling area utilize the Pine Bend Sanitary Landfill. As shown in Figure III-29, the landfill's watershed extends from Hastings in the southeast to Minneapolis' north boundary in the northwest, and from Apple Valley in the southwest to North St. Paul in the northeast. An estimated seventy-five percent of the refuse annually deposited at the Pine Bend site is generated within the central cities, with St. Paul contributing approximately forty-five percent and Minneapolis approximately thirty percent. The remaining twenty-five percent originates mainly from northcentral Dakota County and south Washington County municipalities.

St. Paul's sanitation department and approximately 50 independent haulers presently transport refuse to the Pine Bend site on a regular basis.

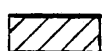
Principal Haul Routes

The principal haul routes to the Pine Bend Sanitary Landfill extend from the central cities and are oriented north-to-south. Figure III-30 shows the location and estimated relative importance of these haul routes. The principal haul routes from Minneapolis to the landfill site commence at the two refuse transfer stations located, respectively, north and south of downtown Minneapolis. These two transfer stations are owned and operated by Phoenix, Inc. The Minneapolis Northside and Southside transfer stations contribute approximately twelve and eighteen percent, respectively, of the annual total refuse deposited at the Pine Bend site. This compacted refuse (mainly residential with some commercial) is transported through Minneapolis via Interstate 35E and Crosstown Freeway from the Northside station and via Hiawatha Avenue (TH 55) from the Southside station. Trunk Highway 55 serves as the principal haul route from Minneapolis and for the "on-route" municipalities of Mendota, Mendota Heights, the northern portion of Eagan and the northwestern portion of Inver Grove Heights.

Lafayette Freeway (TH 3) and Concord (TH 56) serve as the principal haul routes from St. Paul, South St. Paul and the northern portion of Inver Grove Heights. Haulers that use Lafayette Freeway for a portion of their trips from St. Paul connect with Concord via TH 110 as shown in Figure III-30. Concord, south of the Interstate 494 interchange, carries in addition to the refuse originating in St. Paul and South St. Paul, refuse collected in the southern Washington County municipalities of Woodbury, Newport, St. Paul Park, Cottage Grove, the southern portion of Maplewood, and Grey Cloud Township. This refuse represents an estimated additional ten



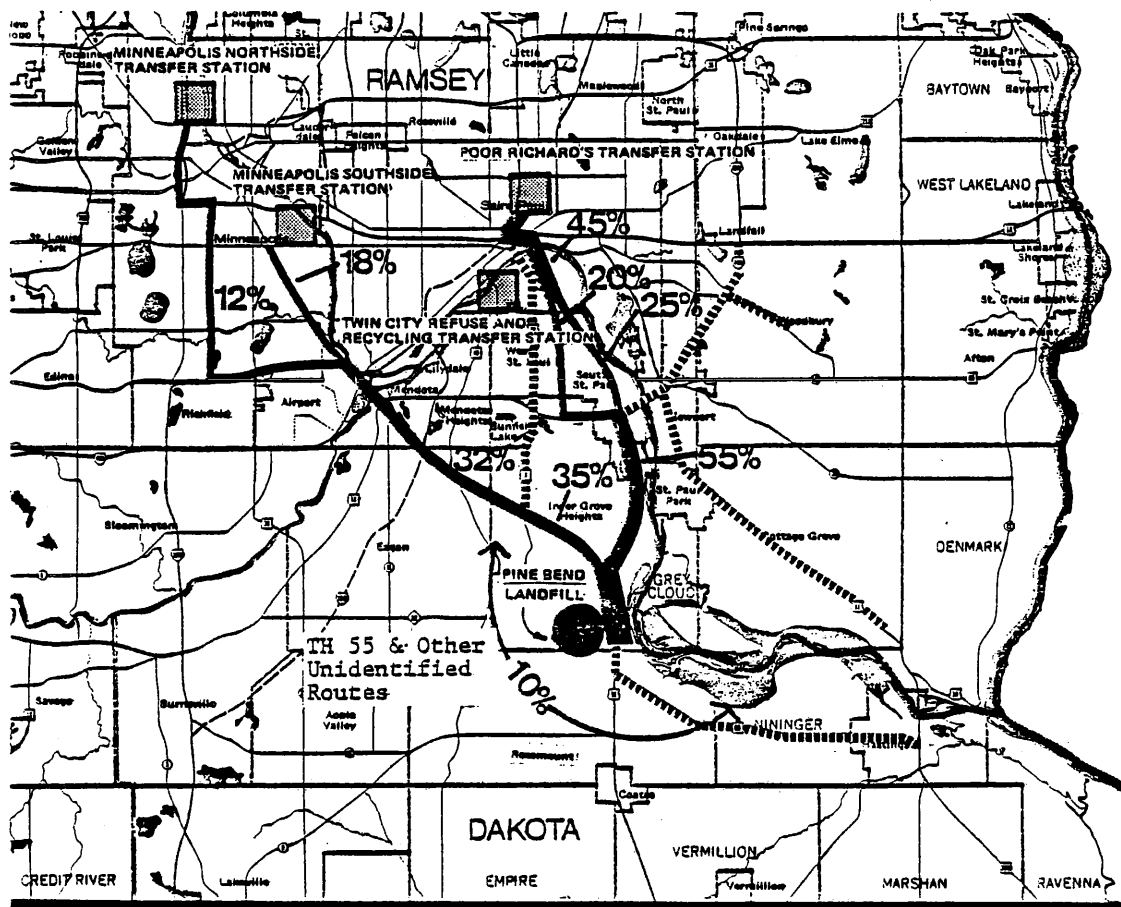
% — Estimated Relative Contribution of Designated Wasteshed to Annual Total Refuse Deposited at Pine Bend Sanitary Landfill (450,000 cubic yards)

-  Primary Source Area
-  Secondary Source Area
-  Tertiary Source Area

Source: Phoenix, Inc./Metropolitan Council

PINE BEND SANITARY LANDFILL WASTESHED, 1980

Figure III - 29



Principal Haul Route

Important Secondary Haul Route

(Haul Routes Show Percentages of Annual Total Refuse Deposited at Pine Bend Sanitary Landfill)

% - Estimated Percentage of Annual Total Refuse Deposited at Pine Bend Sanitary Landfill by Haul Routes

Source: Phoenix, Inc./Metropolitan Council

PRINCIPAL AND IMPORTANT SECONDARY HAUL ROUTES
TO PINE BEND SANITARY LANDFILL

Figure III - 30

percent of the annual total refuse deposited at the Pine Bend site. Approximately 55 percent of all refuse hauled to the Pine Bend Landfill is carried on Concord between Interstate 494 and TH 55, a distance of five miles. Trunk Highway 55, from its junction with Concord Boulevard to East 117th Street (the landfill site access road), a distance of one mile, carries approximately 90 percent of the total deposited refuse.

Secondary Haul Routes

In addition to the principal haul routes, five secondary haul routes have been identified (see Figure III-30). One of these routes is South Robert Street from downtown St. Paul through West St. Paul and Inver Grove Heights to TH 55. South Robert Street is designated TH 52 in West St. Paul and TH 3 in Inver Grove Heights. This route is used primarily by haulers servicing the "West Side" of St. Paul and West St. Paul. Interstate 494, TH 61 and Lower Afton Road (CSAH 20) serve as important haul routes for municipalities in south Washington County. Refuse from the Hastings area, is carried via TH 55 to the landfill site.

The present functional classification of both principal and important secondary haul routes are shown in Figure III-31.

Existing Traffic Volumes in the Vicinity of Pine Bend Sanitary Landfill

Approximately 16,500 average daily vehicle trips (ADT) occur on TH 52/55 at the East 117th Street intersection (the main access link to the landfill site from TH 52/55) of which approximately 2000 of these vehicles are trucks (see Figure III-32). Approximately five-hundred of these two thousand truck trips are landfill-related. The average daily vehicle count by month at Pine Bend Landfill for 1979 is shown in Figure III-33. The average daily gate count during 1980 is anticipated to be 270 vehicles of which approximately 95 percent will be trucks.

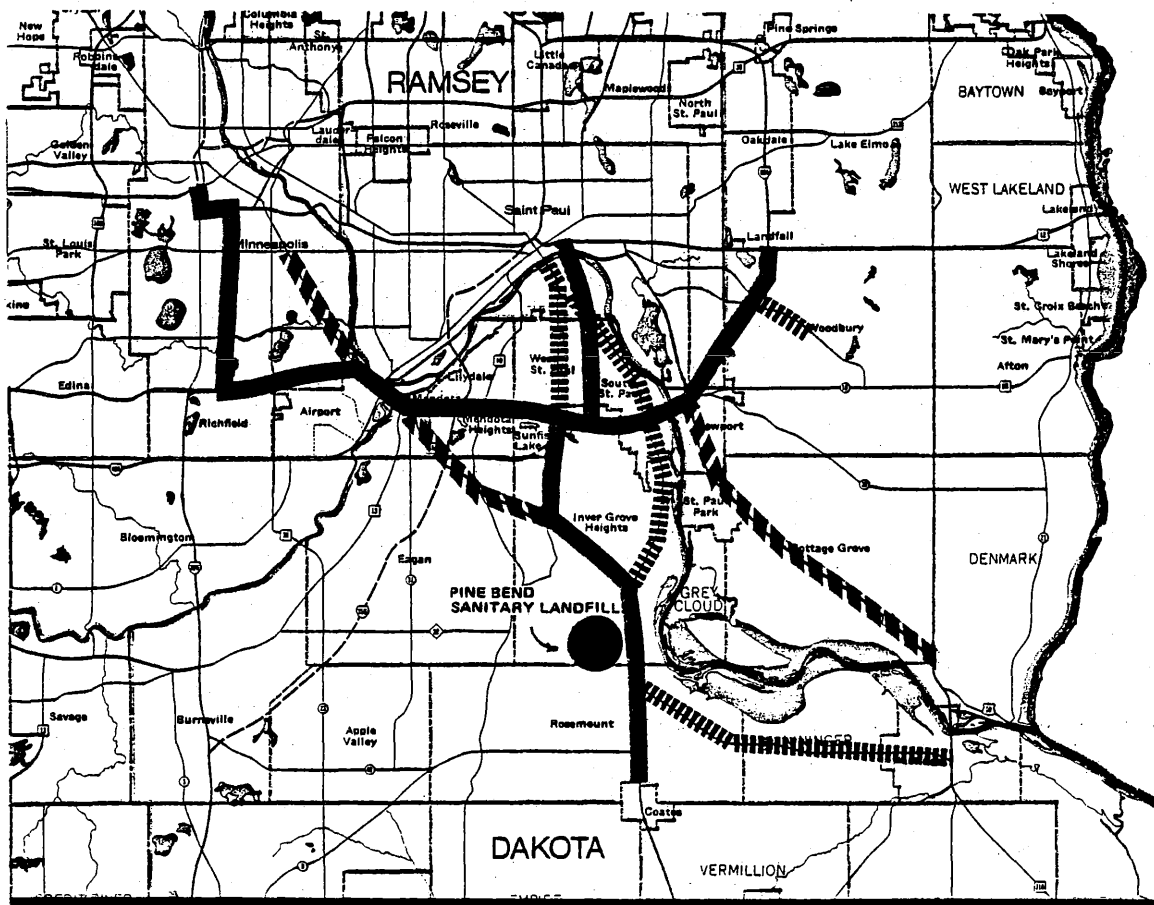
Types of Trucks Hauling to Pine Bend Sanitary Landfill Site

Six basic types of trucks are utilized in hauling refuse to the Landfill site. Their identification and capacities are given in Table III-32. The majority (80 percent) of daily truck trips to the landfill site are made equally between 17/18 cubic yard Packers and 10-40 cubic yard Roll-Offs. The other identified types of trucks represent approximately five percent each of the average daily truck trips to the landfill site.

COLLECTION AND MANAGEMENT SYSTEM COSTS

Metropolitan Area Refuse Collection Industry

The responsibility for managing solid waste disposal in the



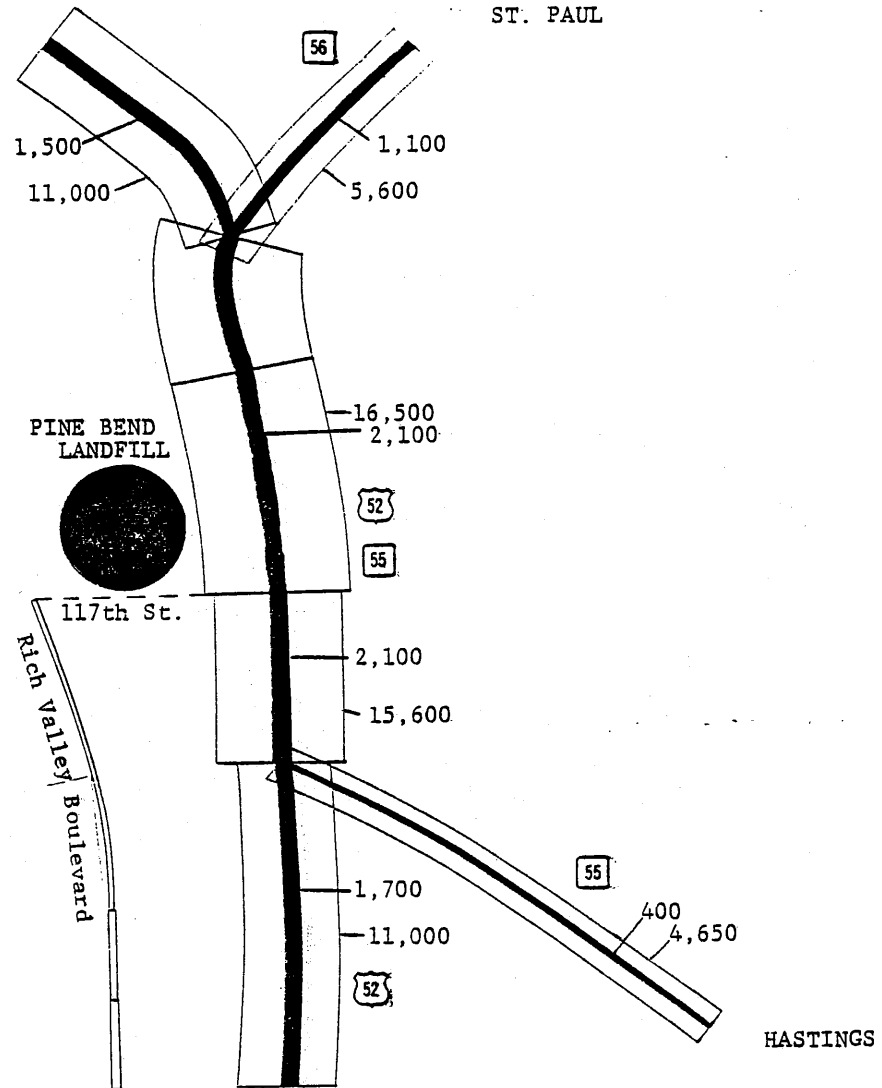
■ Principal Arterial
 ▨ Intermediate Arterial
 ▩ Minor Arterial

FUNCTIONAL CLASSIFICATION OF
 PRINCIPAL AND IMPORTANT SECONDARY
 HAUL ROUTES TO PINE BEND SANITARY
 LANDFILL

Figure III - 31

MINNEAPOLIS

ST. PAUL



Source: MnDot

- Average Daily Total Truck Trips
- Average Daily Total Vehicle Trips

AVERAGE DAILY TOTAL VEHICLE AND TRUCK TRIPS
IN VICINITY OF PINE BEND SANITARY LANDFILL
1978

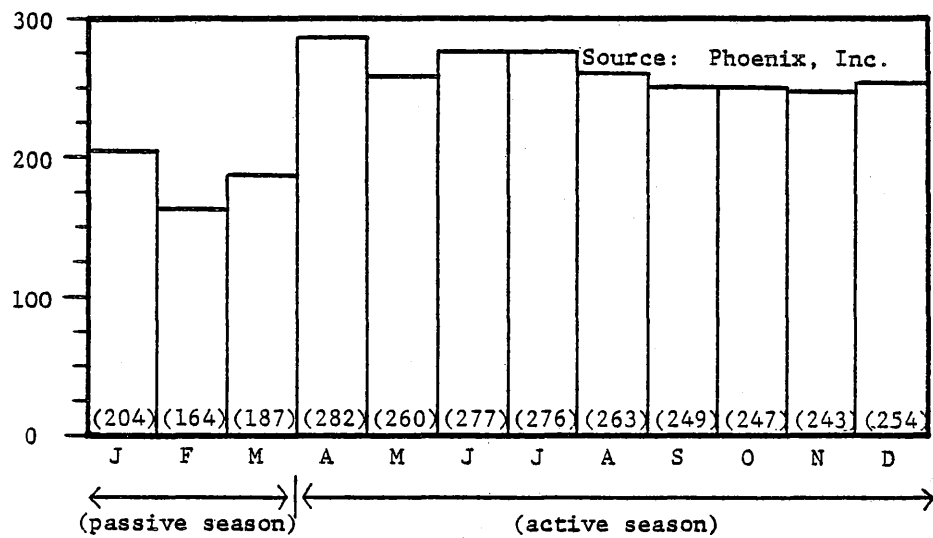


Figure 5. AVERAGE DAILY VEHICLE GOUNT BY MONTH,
PINE BEND SANITARY LANDFILL, 1979

Table III - 32

TYPES AND CAPACITIES OF HAUL TRUCKS TO PINE BEND SANITARY LANDFILL

<u>Types</u>	<u>Capacity (in cubic yards)</u>	<u>Percent of Average Total Daily Truck Trips</u>
Open-Top Semi	100	5%
Roll-Off	10-40	40
Tandem	25-35	5
Front-End Loader	25-35	40
Packer	17-18	5
Dump	5-15	5-

Metropolitan Area has been delegated by the Minnesota Legislature to the Minnesota Pollution Control Agency, the Metropolitan Council, and the seven metropolitan counties. Management of the collection end of the system has remained primarily a local government responsibility. Municipalities and townships in the Region are required to adopt collection ordinances and may license and/or bond private solid waste haulers or choose to operate their own collection system. This is a part of the reason that the Metropolitan Area collection system is characterized by a great deal of diversity in collection practices and management policies.

There are basically five different types of residential refuse collection in the Region. (1) In most Area suburbs, homeowners contract directly with a private hauler of their choice, and there is no municipally-financed refuse collection. (2) St. Paul has an open hauling system. Individual homeowners have the option of either contracting with the city or making arrangements with a private hauler of their choice. City crews handle about 35 percent of the city's households, with the remaining 65 percent by private haulers. (3) In some Area suburbs, the community provides mandatory, municipally-financed refuse collection for all residents by contracting with a private hauler, selected on a competitive bid basis. (4) In Minneapolis, approximately 40 percent of the city's system is served by municipal crews, and the remaining 60 percent is served by a consortium of private haulers, Minneapolis Refuse Incorporated (MPI) comprised of 44 collection firms, under contract with the city. There is no bidding. Both municipal crews and private haulers transport refuse to the Northside and Southside transfer stations, owned by Phoenix, Inc. All refuse is then transported to suburban landfills. (5) Two Area communities, Hopkins and Farmington, provide mandatory, municipally-financed refuse collection entirely by city crews. No private haulers are involved.

Commercial and industrial waste collection, which accounts for approximately 47 percent of the volume of solid waste generated in the Region, is handled in a more uniform manner. Commercial and industrial establishments contract directly with private haulers with no involvement of municipal crews.

Payment for solid waste collection services also varies in the Metropolitan Area. Minneapolis relies solely on general revenues, including property taxes and intergovernmental aide to finance its refuse collection system. In St. Paul, the costs of municipal refuse collection are financed by service fees paid to the city by individual homeowners. St. Paul also uses general revenue to subsidize refuse collection for low income and senior citizen households. About 6,000 of the city's 16,000 customers receive this subsidy. In most Area suburbs, homeowners contract on their own for collection services and are billed directly by the collection firms, such as is the case in the Inver Grove Heights and Rosemount areas. In other Area

suburbs, collection services are municipally financed; in which case, homeowners are billed directly by the municipality or the cost is carried as a part of the general revenue.

See Appendix V for a description of solid waste collection ordinances in Inver Grove Heights.

Service Area Determination

Figure III-29 of the transportation section shows the approximate service area or "wasteshed" for the Pine Bend Sanitary Landfill. Within this area, at least a portion of the solid waste generated is disposed of at the Pine Bend Landfill. Solid waste generated outside of this area, would be disposed of generally at other landfill facilities. The service area determination is based on conversations with the landfill manager, private haulers and transfer station operators.

The Metropolitan Area relies on 11 sanitary landfills for disposal of its solid waste. Service area configurations for these landfills are based on decisions to use any one of a number of these sites by collection firms, individual haulers and municipal collection departments. These decisions are the result of a number of interdependent variables, the basis of which cannot easily be determined or generalized. Moreover, once a particular landfill has been selected as the final disposal place, that decision will ultimately be reflected in generator collection charges.

Some of the variables that will result in a decision to use a particular landfill include haul distance, fuel costs, disposal or tipping charges, condition and restrictions of access roads, operating hours, location of competing disposal facilities, governmental regulations, and the landfill owner's individual management policies. The following discussion briefly covers some of these areas with respect to decisions to use the Pine Bend Landfill.

Haul Distance

Figure III-30 of the transportation section illustrates the various haul routes used to get to the Pine Bend Landfill. Calculated from the last pick-up stop, the average one way haul distance to the landfill is approximately 16 miles while the maximum distance traveled by any one hauler is about 24 miles. The minimum distance is about one mile, from the last pick-up stop, for haulers serving the Inver Grove Heights and Rosemount areas. Based on an average haul speed of 40 miles per hour, round-trip travel time to the landfill would average about 50 minutes and range from approximately a few minutes to 75 minutes. These time calculations, however, do not include dumping time at the landfill.

Hennepin County (1979) calculated haul costs in the Metropolitan Area based on the type of vehicle used, labor and travel speed. For 3-man and 1-man collection crew vehicles and 1-man transfer vehicles, the following cost assumptions were made (in 1979 dollars):

1. 3-man collection crew

Data based on fleet of 20-16 cubic yard packers, 15-20 cubic yard packers and 1-25 cubic yard packer.

Assumed average compaction factor of 500 lb/ cubic yard

\$42,000 Purchase price

- 6,300 Salvage value at 15% of capital costs

\$35,700

Average life - 80,000 miles (7 years)

Capital costs per mile $\$35,700/80,000 = \$0.45/\text{mile}$

Maintenance costs per year \$5,710 = \$0.22/mile
11,400 miles

Fuel costs (2,660 gal.year @ \$0.95/gal.) = \$0.22/mile

TOTAL \$1.17/mile

Labor Costs:

1 - Driver x \$7.75 x 1.20 benefits \$ 9.30

2 - Helpers x 6.75 x 1.20 benefits 16.20

Subtotal \$25.50

Management & Overhead projected at 18% 4.59

\$30.09

2. 1-man collection crew

20 cubic yard packer, average compaction factor assumed at 500 lb/cubic yard

Purchase price \$44,000

Salvage value -6,600 at 15% of capital costs

\$37,400

Estimated 5 year/100,000 mile life

Per mile haul costs:

Capital costs	\$0.37/mile
Dept and insurance costs @ 14%	0.06/mile
Maintenance costs (15% x \$44,000/20,000 miles)	0.33/mile
Fuel costs (6 MPG @ \$.95/gal)	0.16/mile

TOTAL	\$0.92/mile

Labor Costs:

Average labor rate, including benefits	\$13.80/hr
Management, overhead and profit at 100% of labor rate	-----
TOTAL	\$27.60/hr

3. 1-man crew transfer vehicles

65 cubic yard transfer trailer

600 lb/cubic yard average compaction factor

Purchase price \$33,000 Tractor

52,500 Trailer and Cover

Salvage -12,800 15% of Capital Cost

TOTAL	\$72,700
-------	----------

With an estimated 300,000 mile/5 year life, costs are summarized as follows:

Capital cost	\$0.24/mile
Fuel (#2 diesel @ 4 mpg and \$.95/gal.)	0.24/mile
Maintenance and Tires	0.19/mile

Subtotal	\$0.67/mile
Insurance & debt service @ 12%	0.08/mile

TOTAL	\$0.75/mile

Using an average labor rate, including benefits, of \$15.90/hour, and management, overhead and profit at 100% of labor rate, total per hour costs are approximated at \$31.80/hour.

The per ton-mile haul costs, assuming full capacity and equal distance return trip, are summarized in Table III-33. As can be seen, haul costs on a per mile basis vary almost proportionately with travel speed, vehicle type and crew number. If these haul costs are escalated by perhaps 20 to 30 percent, they would reflect more realistically costs presently being incurred by various hauling firms. Based on conversations with area haulers, it has been found that haul costs for packer trucks are generally now over \$1.00 per ton-mile.

A major factor influencing haul distance costs is the use of transfer stations. Transfer stations are fixed facilities at which waste is transferred from small vehicles (18 to 25 cubic yards) to larger (40 to 100 cubic yards) trucks. These facilities may contain storage areas, scales for weighing the waste, and compactors for reducing its volume and can produce significant savings in operating as well as labor costs when large amounts of waste are hauled over long distances. As can be seen from Table III-33, the use of transfer trailer vehicles to transport waste is substantially less on a cost per ton-mile basis than regular collection vehicles. There are seven transfer stations in the Metropolitan Area, four of which deliver quantities of solid waste to Pine Bend; these include the Northside and Southside transfer stations in Minneapolis, responsible for about 30 percent of the total volume of solid waste delivered to Pine Bend, and the Poor Richards and Twin City Refuse transfer stations in St. Paul.

Fuel Costs

One of the major factors in the increasing costs for refuse collection and disposal has been the dramatic rise in fuel prices over the past two years. It is anticipated that by the end of 1980, gasoline and diesel fuel prices will be over \$1.50 per gallon, an increase of more than 60 percent over 1979 prices. Heavy duty packer trucks generally average only three to four miles per gallon; an operator's total costs, therefore, are extremely sensitive to changes not only in fuel costs but to changes in collection routes and disposal locations as well.

Table III-34 shows the percent breakdown for various operating expenses for both large and small refuse collection firms in the Metropolitan Area. This table is not meant to be representative of all collection firms in the Region, but to provide some general guidance concerning the operating budgets of these types of firms. As can be seen, fuel costs range from 5 to 18 percent of the total budget. When fuel costs are combined with other vehicle operating expenses, such as depreciation, garage rent, maintenance, and insurance, this may account for as much as 25 to 35 percent of the total budget.

Table III - 33

CURRENT PER TON-MILE
COST ESTIMATES, FULL CAPACITY
(Includes equal distance return trip)

<u>Vehicle</u>	<u>AVERAGE SPEED, MPH</u>		
	<u>20</u>	<u>30</u>	<u>40</u>
3-man crew, fleet average for 16, 20 & 25 cu. yd packers	\$1.19/ ton-mile	\$0.97/ ton-mile	\$0.86/ ton-mile
1-man crew, 20 cu. yd. packer	\$0.92/ ton-mile	\$0.74/ ton-mile	\$0.64/ ton-mile
Transfer vehicle 65 cu. yd. transfer trailer	\$0.23/ ton/mile	\$0.18/ ton-mile	\$0.15/ ton-mile

Table III - 34

Percent Breakdown For Various Refuse Collection Budgets

April 1980

<u>Budget Item</u>	<u>MRI</u> ⁺	<u>St. Paul</u>	<u>Firm A</u>	<u>Firm B</u>	<u>Farmington</u>
Labor	30%	51%	35-40%	27%	60%*
Payroll Taxes	2				
Workmen's Comp	3				
Group Insurance	2				
Vehicle Expenses		36			
Depreciation	8				2
Garage Rent	2				
Truck Ins.	2			5-6	2
Fuel	5		15-18	6	10
Repair	6				2
Disposal Charges	18			10	10
Return on Investment	16				

*Includes labor, payroll taxes, workmen's comp and group insurance

⁺Minneapolis Refuse Inc.

The Pine Bend Sanitary Landfill is located about as close to the major waste generation sources (primarily the urbanized portions of the Region) as other landfills in the Metropolitan Area. In addition, the landfill is serviced by major high speed arterial routes and there is relatively direct and easy access to the site. Because of its location, Pine Bend would not present greater fuel or labor costs for haulers that would normally go to this site. Some area haulers, however, because of rising disposal charges at other landfills and now going to Pine Bend as a result of this, would incur higher fuel and labor costs and would have to absorb or pass on to their customers these additional expenses.

Disposal Charges

The disposal charges (tipping fees) at a landfill are based on a number of factors including equipment prices, labor costs, environmental protection requirements and other regulations, disposal practices, and accounting systems. Table III-35 shows past and current disposal charges by sanitary landfills and transfer stations in the Metropolitan Area. As can be seen, present charges, on a per cubic yard basis, range from \$1.00 to \$2.25 for landfills and \$3.00 to 3.75 for transfer stations. Since 1973, landfill disposal charges have increased on the average of 166 percent. Since 1976, disposal charges at transfer stations have increased about 50 percent.

As can be seen from Table III-34, disposal charges generally represent 10 to 18 percent of a collection firm's total budget. Hauling firms have no control over the level of disposal charges and they generally have to absorb or pass on to their customers any increases. For instance, disposal charges have increased over the last six months most notably at the Freeway, Burnsville, and Woodlake landfills. As a result, haulers that normally use these facilities are now going to other more distant landfills; they have subsequently realized increased operating, labor and fuel costs. The landfills, in turn, faced with increased volume, principally Pine Bend and Flying Cloud, are now experiencing increased operational expenses and may soon have to increase their charges. The net effect is that collection rates to area customers will eventually rise.

Rising disposal charges at some landfills and the subsequent shift to the use of other landfills by some area haulers will also have the effect of extending the life of those landfills raising their disposal charges and decreasing the life of those landfills now receiving increased volumes of waste material. The overall effect, however, on the Metropolitan Area land disposal system's capacity would not change and projected total capacity exhaustion by the mid-1980s would still hold true.

Table III - 35

Disposal Rates* charged by Transfer Stations
and Landfills in the Metropolitan Area, 1973-1980

(\$ per cubic yard)

	1973	1976	March 1979	April 1980
	----	----	-----	-----
<u>TRANSFER STATIONS</u>				
Anoka Co.: Re-Cy-Co		1.75	2.50	**
Hennepin Co.: Mpls. Northside		2.25	3.00	3.75
Mpls. Southside		2.25	3.00	3.75
North Hennepin		2.00	2.00	3.00
Ramsey Co: Midway	1.30	2.00	3.00	(closed)
Poor Richards		**	**	**
Twin City Refuse		1.88+	2.25+	2.50+
Washington Co: Bellaire Sanitation Service	**	**	**	**
<u>SANITARY LANDFILLS</u>				
Anoka Co: Anoka Municipal	0.40	0.55	0.90	1.30
East Bethel	0.45	0.65	0.80	1.00
Oak Grove	0.60		0.80	1.00
Waste Disposal Engineering	0.60	1.00	1.00	1.25
Dakota Co: Burnsville	0.58+	0.63+	0.94+	2.25+
Dakhue	0.70	0.80	1.10	1.30
Freeway	0.70	0.80	1.10	2.00
Pine Bend	0.70	1.00	1.20	1.56
Hennepin Co: Flying Cloud	0.56+	0.63+	0.88+	1.50+
Woodlake	0.50	0.80	1.10	2.00
Scott Co: Louisville	0.50	0.60	0.80	1.25

* Disposal rates are for compacted, municipal refuse

**Disposal rates are charge on a per load basis and are therefore
not comparable

+ Disposal rates charged on a per ton basis, conversion of 0.25
tons per cubic yard employed

Collection Rates

Table III-36 shows 1979 collection rates and services for a number of communities in the Metropolitan Area. As can be seen, rates vary from community to community depending on the type of service, contract, and other variables. Collection rates are quite sensitive to changes in other components of the disposal system, particularly fuel and labor costs and disposal charges. Kelley (1980) found, for instance, that increasing the disposal fee at the present rate of approximately \$6.00 per ton to \$12.00 per ton would result in a \$.50 per month, or \$6.00 per year, increase in residential collection costs to the homeowner. An increase in disposal fees from \$6.00 to \$18.00 per ton would result in a \$1.00 per month, or \$12.00 per year increase in residential collection costs to the homeowner.

Generators of commercial solid waste, such as businesses, office buildings, etc., would experience even greater increases in collection rates given the above increases in disposal charges. Table III-37 shows increases in collection rates for various commercial accounts developed by Kelley. As can be seen, a small commercial account could see a yearly collection cost increase of \$288 due to disposal fees alone, whereas a large commercial account could see a yearly collection cost increase of \$25,344 due to disposal fees alone.

HISTORIC/ARCHAEOLOGICAL

The Minnesota Historical Society upon reviewing the Pine Bend Sanitary Landfill's location concluded the site contains no historic, architectural, cultural or archaeological significance. There are no sites in the area which are on the National Register or eligible for inclusion on the National Register.

AESTHETICS

General

Aesthetic concerns are generally more related to the collection of solid waste rather than its disposal, simply because solid waste disposal sites are usually located in out of the way, remote locations. However, where disposal sites are located near communities, residential areas, or heavily traveled roads, visual appearance will often affect human emotional reactions more so than perhaps other impacts that might be associated with a particular site. Other miscellaneous environmental effects associated with the aesthetics of a site include fugitive dust, litter, noise and odors.

Table III - 36

COLLECTION RATES AND SERVICES - SELECTED COMMUNITIES IN THE METROPOLITAN AREA

COMMUNITY	COST PER MONTH	EXTRA CHARGE	TYPE OF CONTRACT	CARRY-OUT, CURB, OR ALLEY	CANS PICK-UP	PLASTIC BAG PICK-UP	LARGE ITEMS PICK-UP
Minneapolis, M.R.I. Contract	\$4.10 Collections; \$3.00 Disposal; Administrative Cost = 9¢	None	Non-negotiated, 5 year	Alley and Carry-out No Curb	No limitation	No limitation	Two (2) Items per week
	(3)	(5)		(5)	(5)	(5)	(5)
St. Paul, Municipal Crews	1 Family - \$6.34, 2 Family - \$9.00, Senior Citizens - \$3.33, Administrative Cost ?	Large Items	Municipal	Alley or Curb; no Carry-out	No limitation	No limitation	Extra Charge
	(4)	(0)		(2)	(5)	(5)	(0)
Anoka	\$3.50 Administrative Cost 25¢	Large Items	Negotiated	Curb only	No limitation	Leaves & Grass Clippings Only (3)	Extra Charge
	(5)	(0)		(2)	(5)	(3)	(0)
Arden Hills	\$5.00	Large Items	Private	Driveway	2 Cans	Yes	Extra Charge
	(3)	(0)		(2)	(2)	(3)	(0)
Blaine	\$2.93; Administrative Cost = 40¢	Large Items	Bid B.P.I.	Carry-out (Limit 2 cans only) & Curb (3)	No limitation	No limitation	Extra Charge
	(5)	(0)		(3)	(5)	(5)	(0)
Bloomington	\$4.00 to \$6.00	Large Items Spring & Fall Cleanup \$3.00 each	Private 12 Licensed & Bonded	Alley, Curb & Carry-out	32 Gal. Cans w/ tight covers	Leaves & Grass Clippings	Extra Charge
	(3)	(0)		(5)	(5)	(3)	(0)
Brooklyn Center	\$5.00 to \$6.00	Large Items	Private 5 Licensed Firms	Alley & Curb	No limitation	Reasonable Amount	Extra Charge
	(3)	(0)		(2)	(5)	(2)	(0)
Brooklyn Park	\$4.00 to \$6.00	Large Items	Private 75 Licensed Firms	Alley, Curb & Driveway	No limitation	No limitation	Extra Charge
	(3)	(0)		(5)	(5)	(5)	(0)
Burnsville	\$5.10 per Month	Large Items	Private Licensed	Curb, Alley, Carry-out & Driveway (5)	No limitation	Reasonable	Extra Charge
	(3)	(0)		(5)	(5)	(2)	(0)
Columbia Heights	Cans only, \$3.30-5.15, includes Administrative Cost = 40¢	Large Items	Bid - Dick's Sanitation Negotiation Clause	Carry-out, (Limit), Curb & Alley	2- 32 Gallon w/Covers	On Curb Only	Extra Charge
	(5)	(0)		(3)	(3)	(1)	(0)
Coon Rapids	\$5.00 to \$6.00	Large Items	Private 8 Licensed Firms	Alley or Driveway	No limitation	Reasonable	Extra Charge
	(3)	(0)		(2)	(5)	(2)	(0)
Crystal	\$51.00 per year in advance; \$4.25 per month	Large Items	Private Licensed Haulers	Carry-Out, & Alley	2 Cans	No limitation	Extra Charge
	(4)	(0)		(5)	(2)	(5)	(0)
Deephaven	2 cans = \$3.54 plus \$1.00 for each (additional) container or bag, Administrative Cost ?	Large Items	Bid Village Sanitation	Within 30' of packer, plus \$2.00 for Carry-out	2- 30-Gallon Cans	Additional Charge	Extra Charge
	(3)	(0)		(0)	(2)	(0)	(0)
Eden Prairie	\$4.50	Large Items	Private City Clerk said most use B.P. Sanitation	Curb only	3-4 Cans; 2 only; within reason	2 only; Extra Charge for leaves	Extra Charge
	(4)	(0)		(2)	(4)	(1)	(0)
Edina	\$5.00 to \$6.00	Large Items	Private	Carry-out	No limitation	No limitation	Extra Charge
	(3)	(0)		(5)	(5)	(5)	(0)

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COMMUNITY	COST PER MONTH	EXTRA CHARGE	TYPE OF CONTRACT	CARRY-OUT, CURB, OR ALLEY	CANS PICK-UP	PLASTIC BAG PICK-UP	LARGE ITEMS PICK-UP
Excelsior	\$3.17	Large Items	Bid, Village Sanitation	Alley & Curb	2 - 30-Gallon Cans only, 90¢ extra per can	\$1.00 for leaves; \$4.50 for Spring & Fall clean-up (0)	Extra Charge (0)
	(5)	(0)		(2)	(2)		
Falcon Heights	\$6.00	Large Items	Private	Alley & Curb; no Carry-out (2)	No limitation (5)	No limitation (5)	Extra Charge (0)
	(3)	(0)					
Fridley	\$4.00 to \$6.00	Large Items	Private Licensed & Inspected	Curb & Driveway (2)	No limitation (5)	No limitation (5)	Extra Charge (0)
	(3)	(0)					
Golden Valley	\$5.00	Large Items	Private Licensed & Inspected	On Curb Only (2)	2 Cans on Carry-out; Balance on Curb (3)	No limitation (5)	Extra Charge (0)
	(3)	(0)					
Hopkins	Paid out of General Fund; estimated \$3.70; Administrative Cost ?		Municipal	Alley or Curb	No limitation	No limitation	Do not take large items; Discontinued Fall & Spring Clean-ups (0)
	(5)	(0)		(2)	(5)	(5)	
Inver Grove Heights	\$4.00 to \$6.00	Large Items	Private Licensed and Inspected	Alley, Curb & Carry-out (5)	No limitation (5)	Reasonable amount of leaves (2)	Extra Charge (0)
	(3)	(0)					
Lexington	\$4.50	Large Items	3 Licensed Haulers	Driveway (2)	No limitation (5)	2 plastic bags per week (1)	Extra Charge (0)
	(4)	(0)					
Little Canada	1 Firm - \$1.00 per bag; all others - \$5.00 (3)	Large Items (0)	4 Licensed Firms	Curb only (2)	No limitation * (note) (5)	No limitation * 1 Firm by the bag only (5)	Extra Charge (0)
Maplewood	Regular - \$5.00; Bag System - \$24.00 for 50 (3)	Large Items (0)	Private - Licensed Firm	Curb & Carry-out (5)	No limitation * (note) (5)	No limitation * 1 Firm by the bag only (3)	Extra Charge (0)
Mendota Heights	From \$10.50 Quarter; Twice a month (\$7.00) to \$4.50 (4)	Large Items (0)	Private Licensed Haulers	On Street or End of Driveway (2)	All Containable (5)	No limitation (5)	Extra Charge (0)
Morningside	\$4.50 Twice a week Pick-up (5)	Large Items (0)	Bid; Viceroy Disposal	Carry-out (5)	Complete Containable (5)	No limitation (5)	Extra Charge (0)
Moundsview	\$4.50 (4)	Large Items (0)	Private 7 Licensed Haulers	Curb or Alley (2)	No limitation (5)	Reasonable (2)	Extra Charge (0)
New Brighton	\$5.00 (3)	Large Items (0)	Private Licensed Haulers	Carry-out, Curb & Alley (5)	No limitation (5)	No limitation (5)	Extra Charge (0)
New Hope	\$4.50 (4)	Large Items (0)	Private 5 Licensed Haulers	Limit of 2 Cans; Carry-out and the rest on Curb (3)	No limitation (see variable) (3)	No limitation (see variable) (3)	Extra Charge (0)
Newport	\$4.00 Curb \$5.00 Carry-out (4)	Large Items (0)	Private Licensed Haulers	See Price (1)	All Containable (5)	No limitation (5)	Extra Charge (0)
North Oaks	\$6.00 to \$7.50 (2)	Large Items (0)	Private	Carry-out (5)	No limitation (5)	No limitation (5)	Extra Charge (0)
North St. Paul	\$4.50 to \$5.00 (4)	Large Items (0)	9 Licensed Haulers	Carry-out, Curb & Alley (5)	No limitation (5)	No limitation (5)	Extra Charge (0)

Table III - 36

COMMUNITY	COST PER MONTH	EXTRA CHARGE	TYPE OF CONTRACT	CARRY-OUT, CURB, OR ALLEY	CANS PICK-UP	PLASTIC BAG PICK-UP	LARGE ITEMS PICK-UP
Osseo	\$3.50 (5)	Large Items (0)	Bid	Carry-Out & Curb (2)	2 - 30-Gallon Cans (2)	Must be on Curb (3)	Extra Charge (0)
Plymouth	\$4.50 to \$5.00 (4)	Large Items (0)	Private Licensed Hauler	Curb or Alley (2)	No limitation (5)	No limitation (5)	Extra Charge (0)
Richfield	\$4.50 to \$5.00 (4)	Large Items; Too many leaves; Spring & Fall Cleanup \$3.00 each (0)	Licensed and Inspected	Ordinance says on Curb on Pick-up day (2)	No limitation (9)	No limitation (5)	Extra Charge (0)
Robbinsdale	\$2.51 (5)	Large Items (0)	Bid - M.C.S.	Mostly Alley (3)	No limitation (5)	No limitation (5)	Extra Charge (0)
Roseville	\$4.00 to \$4.50 (4)	Large Items (0)	Licensed and Inspected	Curb or Alley (2)	\$4.00 - 2 - 30-gallon Cans; \$4.50 - No limit (4)	Reasonable amount (2)	Extra Charge (0)
St. Anthony	\$5.00 to \$5.50 (3)	Large Items (0)	Private Licensed	Alley & Curb (2)	Reasonable amount (4)	8-bag limit on leaves (3)	Extra Charge (0)
St. Louis Park	\$3.63; Administrative Cost = 37¢ (4)	None (5)	Bid - B.F.I.	Garbage only carried. All other on Curb or Alley. (2)	No limitation (5)	No limitation (if carry) or Alley. (5)	Yes - on request (5)
St. Paul Park	\$4.50 (4)	Tree Branches (0)	2 Licensed & Bonded Private Firms	Curb or Alley (2)	All Containable (5)	No limitation (5)	Extra Charge (0)
Savage	\$4.00 to \$5.00 (4)	Large Items (0)	4 Licensed Haulers	Alley and Carry (5)	No limitation (5)	No limitation (5)	Extra Charge (0)
Shakopee	\$3.12 (5)	Large Items (0)	Bid B.F.I.	Alley only (2)	All containable (5)	No limitation (5)	Extra Charge (0)
Shoreview	\$4.00 to \$5.00 (4)	Large Items (0)	Licensed & Inspected	Curb or Driveway (2)	No limitation (5)	No limitation (5)	Extra Charge (0)
South St. Paul	\$4.50 to \$5.50 (3)	Large Items (0)	Private Licensed by City	Alley & Curb (2)	No limitation (5)	Reasonable Amount (2)	Extra Charge (0)
Vadnais Heights	\$4.00 to \$6.00 (4)	Tires Branches Large Items (0)	5 Licensed Firms 2 B.F.I.	Alley or driveway (2)	All containable (5)	Normal Amount (2)	Extra Charge (0)
Wayzata	\$4.00 to \$6.00 (4)	Large Items (0)	Bid AB/C San.	Easily Accessible (2)	No limitation (5)	Must be in cans (0)	Extra Charge (0)
West St. Paul	\$5.00 (3)	Large Items (0)	Private Licensed & Inspected	Carry Alley & Curb (5)	No limitation (5)	No limitation (5)	Extra Charge (0)
White Bear Lake	\$3.83; Administrative Cost = 45¢ Senior Citizen \$1.50 per month (4)	\$12.00 charge for large items (0)	Bid TARCO (MCS)	Alley or on driveway (2)	50 lb. weight limit (4)	20 lb. weight limit (3)	Extra Charge (0)

* This column is a weighted comparison of the Metropolitan Area garbage services. Each service has been rated on a 0-5 scale. "Five" represents the optimum relative service.

IMPACT OF INCREASES IN DISPOSAL COSTS ON COMMERCIAL COLLECTION

	<u>Small Commercial Account*</u> (e.g. small convenience store, drugstore, or 50- unit apartment building)		<u>Medium-Size Commercial Account**</u> (e.g. medium-size supermarket)		<u>Large Commercial Account***</u> (e.g. an office build- ing the size of the IDS or First National Bank building in Minneapolis)	
	Monthly Increase in Disposal Costs	Yearly Increase in Disposal Costs	Monthly Increase in Disposal Costs	Yearly Increase in Disposal Costs	Monthly Increase in Disposal Costs	Yearly Increase in Disposal Costs
Increase in tipping fee from \$6/ton (approx. present landfill rate) to \$12/ton	\$12	\$144	\$168	\$2,016	\$1,056	\$12,672
Increase in tipping fee from \$6/ton to \$18/ton	\$24	\$288	\$336	\$4,032	\$2,112	\$25,344

*Generates 2 tons of refuse per month
 **Generates 28 tons of refuse per month
 ***Generates 176 tons of refuse per month

Minnesota Waste Association
 February 27, 1980

Visual Aesthetics

The Pine Bend Landfill is located in a rural portion of the community of Inver Grove Heights. Immediately east of the site, land elevations increase and the site is not observable from homes located in that direction or from traffic using State Highway 52. There is also vegetative cover on the eastern perimeter of the site, further obstructing view of the landfill from beyond that area. The appearance of the landfill is somewhat sudden approaching from the east on 117th Street, the main access road; this is because the area approached from this direction becomes hilly just before reaching the landfill.

There are, however, a number of homes in the area in the line-of-sight of the landfill (see Figure III-34). Immediately north of the landfill fairly extensive vegetative growth obstructs view of most of the site. Notwithstanding, limited view of the landfill is possible from homes located northwest and northeast of the site. Generally only the highest portions of the landfill can be seen from these directions. West and south of the site along Rich Valley Boulevard, the landfill can be seen from as far away as approximately three-quarters of a mile in either direction. There are also a number of homes along Rich Valley Boulevard that face directly upon the landfill.

Much of the filling of the western portion of the landfill has been completed and a large portion of this area has received final cover and attained some vegetative growth. Further filling of permitted areas of the landfill will take place primarily on the eastern portion of the site away from off-site receptors. It appears, therefore, that most adverse visual impacts from operation of the landfill have already occurred and that future filling should result in less of such impacts. Moreover, the working area of the landfill is generally always maintained on easterly facing slopes and, thus, away from off-site receptors. Working areas of the landfill are only visible when they are at the top elevations of the landfill.

For a discussion of impacts from fugitive dust, litter, noise and odors refer to Air Quality, Sections III, IV and V.

LOCATION OF NEARBY HOMES

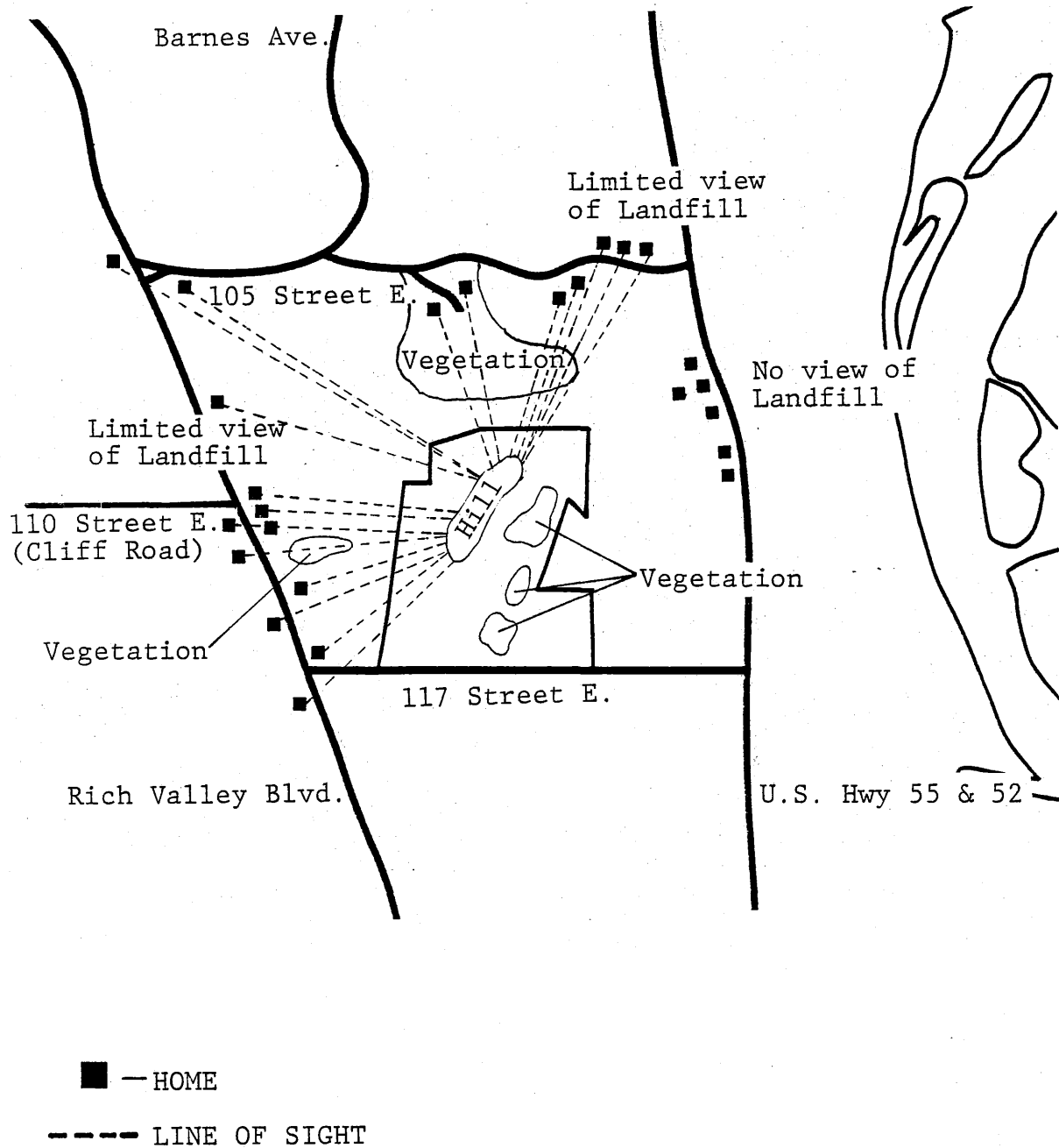


Figure III - 34

HUMAN HEALTH

GENERAL

Human health can be affected by the operation of sanitary landfills in a number of ways. Certain air contaminants, often associated with landfill operations, can produce physiological effects in the human respiratory system such as coughing, shortness of breath and bronchial infections. Noise from equipment operated at landfills can cause fatigue, nervousness, irritability and hypertension. Solid waste, improperly disposed at landfills, may provide food, water, and harborage for breeding and infestation of rats, flies, mosquitoes, birds and other vermin which serves as reservoirs or vectors of human disease. Improper operation of landfills can also result in contamination of ground and surface waters; if such waters are used for drinking water supplies they can produce health effects such as gastrointestinal and kidney disorders, hypertension and cancer. Finally, employees at landfills are often exposed to potential injurious situations while performing routine physical operations at landfill facilities.

AREAWIDE HEALTH SERVICE

The Metropolitan Council, with its Metropolitan Health Board, has been designated by the federal government as the Health Systems Agency for the Twin Cities Metropolitan Area under the National Health Planning and Resources Development Act of 1974. The Metropolitan Health Board assists with health care planning and advises the Council about applications for Certificates of Need in the Region for new hospitals and nursing home facilities or proposed major expansions of health care facilities. The Board also helps develop plans to ensure coordination and a maximum use of present health care facilities, services and manpower.

The Metropolitan Health Board has divided the Region into 108 health planning areas (HPAs). The City of Inver Grove Heights and the Pine Bend area are located in Health Planning Area 922. Major medical services for HPA 922 are available at the Divine Redeemer Memorial Hospital located in South St. Paul. Divine Redeemer provides physicians in-house 24 hours a day and advanced life support ambulance services (paramedics). Other hospital facilities and ambulance services in Dakota County are also available to HPA 922.

It is important to point out that no health problems or conditions for potential health problems on-site or in the surrounding area have been found to exist that can be associated with the existing operation of the Pine Bend Sanitary Landfill. According to discussions with Health Board planners, the general health of communities in Dakota County, including those located near the landfill, is good. The population of the county is primarily young, in the 15-44 age category, health service delivery is good and no unusual incidences of disease or illness have been reported.

AIR QUALITY

Air quality contaminants directly associated with the operations of sanitary landfills can affect human health. They are fugitive dust, methane gas and odor generated from the fill itself and equipment operated at a landfill and carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides and particulates generated from motorized equipment and vehicles used at a landfill facility.

Fugitive Dust

Health Effects -- In discussing the health effects from fugitive dust emissions, it is useful to distinguish between acute and repetitive chronic exposure. Chronic exposure could lead to bronchitis, asthma and emphysema; however, an evaluation of health problems in terms of chronic exposure is difficult and the picture can often be complicated by the synergistic effects of other pollutants. The primary health effect of acute dust exposure is irritation and minor inflammation to exposed membranes of the respiratory system.

An area of increasing concern is the deposition and retention of submicron particles which penetrate deeply into the lung alveoli. Removal may involve transfer to the blood, lymph or intestinal tract; the particles may then exert harmful effects elsewhere in the body.

Besides the threat to human health, fugitive dust emissions are potentially hazardous to animals and plants. Heavy dusts, forming a film on plant leaves, may reduce or stop photosynthesis. Fugitive dust emissions can also present nuisance problems such as degradation of nearby property and reduced visibility for motor vehicles and aircraft.

The suspension in air time and particle size determines the likelihood of a dust particle being inhaled and its penetration and retention in the human respiratory system. Particles over 5,000 microns have no physiological significance as they drop from the respirable zone immediately. Particles over 10 microns are usually captured in the nasal chambers and removed from the respiratory tract in mucus discharges.

For particles less than 10 microns the percentage deposited in the lung increases with decreasing particle size down to approximately 0.5 microns. Maximum deposition occurs between 1 and 2 microns. Particles under 0.1 micron are in indefinite suspension. True dusts, however, do not have such small sizes.

The engineering method of sanitary landfilling is by nature a construction activity, and as such, it produces fugitive emissions. The amount of dust produced and area affected depend on a number of factors including the number and size of vehicles operating at the facility, dust controls in use, and climatic conditions such as wind speed and direction and moisture. Generally speaking, fugitive dust produced at landfills has not presented a major health problem for employees of landfills or residents of nearby communities. No documentation from available published sources or health records could be found showing adverse health effects from fugitive dust emissions produced at landfill facilities.

Existing Landfill and Surrounding Area -- There have been no reported incidences of health problems by employees at the landfill or residents of nearby communities that can be attributed to fugitive dust emissions produced by the operations of the Pine Bend Sanitary Landfill. Potential fugitive dust emissions, from refuse trucks entering and leaving the facility, are reduced at least 85 percent because the road to the active fill area and access roads to the facility are paved. Furthermore, the speed of vehicles on the landfill property itself are generally under 15 miles per hour further reducing dust emissions by approximately 85 percent.

It is estimated that about 70 percent of the fugitive dust produced at the landfill is in the 30 to 100 micron range. Particles of this size generally settled out quickly, within 30 to 200 feet from the generation point. Respirable particles, those less than 10 microns in size, represent probably less than 15 percent of the fugitive dust generated at the landfill.

For a discussion of fugitive emission controls presently used at the landfill, see Air Quality, Section III.

Methane Gas

Health Effects -- Methane gas is a simple asphyxiant. Displacement of air by methane could possibly lead to health effects such as shortness of breath, unconsciousness, and even death from hypoxemia. For methane gas produced from a landfill to reach concentrations that would have such health effects it would have to be confined. Such accumulations could occur in structures on the landfill itself or in structures near the landfill. However, based on available information, there have been no reported occurrences of illness or death resulting from employees of landfills or nearby residents breathing landfill gas. The health effects of breathing gases produced from landfills are minimal.

The main health concern with methane gas produced from landfills is injury from explosion of the gas. Alone, methane is not explosive, but when it accumulates at concentrations of 5 to 15 percent it is highly explosive. Since oxygen is virtually void in a densely compacted and sealed landfill when methane is produced, there is no danger of the fill exploding. However, if methane moves through the soil and accumulates in structures, it may cause explosive conditions. With proper venting of the landfill, methane should not pose a problem.

Besides the threat to human health from explosions, methane migrating through the sides or top of landfills may adversely affect plant life. In some instances, methane gas has killed vegetation and trees at landfill sites. What appears to have happened in those instances is that methane has vented through fissures and eroded portions of the cover material in concentrations high enough to be toxic to vegetation. Where disposal sites are located next to planted areas, or where parks and recreational areas are planned after disposal operations cease, the affect of methane on plant life is of particular concern.

Existing Landfill and Surrounding Area -- There have been no reported incidences of health problems by employees at the landfill or residents nearby that can be attributed to methane gas emissions produced by the operations of the Pine Bend Sanitary Landfill. However, the impact of methane generation after the facility is closed should be investigated before other uses are made of the property. For a discussion of methane gas controls presently used at the landfill, see Air Quality, Section III.

Odor

Health Effects -- Odorous emissions generated by the operation of sanitary landfills do not produce severe adverse health effects unless they are associated with volatile gases or leachate. Odorous emissions can cause nausea, headaches and tension. Generally speaking, odorous emissions from landfill operations are repugnant but harmless to human health.

Proper operation of sanitary landfills should prevent most odorous emissions from occurring. Daily cover is the best control for odorous emissions. However, strong odors should be investigated, for they may indicate the presence of potential gas or leachate problems occurring at the landfill.

Existing Landfill and Surrounding Area -- Odorous emissions have not been a problem at the Pine Bend Sanitary Landfill. No adverse health effects have been reported by employees at the landfill or nearby residents that could be attributed to odorous emissions produced at the landfill. For a discussion of odorous emission controls presently used at the landfill, see Air Quality, Section III.

Other Air Pollutants

Health Effects -- The operation of equipment and the movement of refuse trucks at landfills cause carbon monoxide, nitrogen oxides, sulfur oxides and hydrocarbons to be emitted to the ambient air. Concentration of these pollutants in the ambient air have been associated with health problems such as eye and respiratory tract irritations, pulmonary and cardiac disorders, and central nervous system disorders. However, the operation of motorized equipment and movement of vehicles at landfills are intermittent activities generating relatively low levels of these pollutants.

Available information provides no documentation of the health effects from exposure to air pollutants attributed to vehicles and other motorized sources at landfills. It is highly unlikely that these sources would have adverse health effects on employees at a landfill or nearby residents, unless traffic control at a site was poorly handled or access difficult resulting in lines of operating vehicles where pollutants could concentrate.

Existing Landfill and Surrounding Area -- No adverse health effects have been reported by employees at the Pine Bend Sanitary Landfill or nearby residents that could be attributed to emissions produced by on-site equipment or by traffic entering or leaving the site. Traffic flow into and out of the facility is good.

NOISE

Health Effects

The potential human health effects from exposure to noise are hearing changes and losses, interference with speech communication, annoyance and sleep interruption, and other physiological and psychological responses such as fatigue, nervousness, irritability and hypertension. Disease symptoms or physiological impairment other than hearing loss have not been attributable to noise.

The non-health or socio-economic effects of noise include damage to property and impairment of property values. Property damage by actual vibrational destruction and by depreciation because noise paths and patterns impinge on the property is known, and is to some degree measurable and predictable.

In the occupational setting, it has been found that exposures of eight hours a day for several years to sound pressure levels above 105 dBA, for the normal unprotected ear are sure to produce a hearing loss from which there is no recovery (noise-induced permanent threshold shift or NIPTS). The NIPTS will appear in about 50 percent of those exposed similarly to a level of 95 dBA. It will not appear in anyone at a level below 80 dBA.

Noise generated by the operations of a landfill is from equipment used on-site and from vehicles entering and leaving the facility. The major refuse truck noise occurs when vehicles accelerate and when they discharge their load on the working face of the fill. The range of dBA levels for the following typical equipment used at a landfill site are: scraper 89-95 dBA, dozer 87-89 dBA, motor grader 77-87 dBA and refuse trucks 85-95 dBA.

The impact of noise on the health of employees working at a landfill and residents and other sensitive receptors near a landfill has been studied very little. The health impacts on employees will depend on the particular job the individual is performing. If the employee is operating heavy equipment, such as a bulldozer or scraper, or working near such equipment, for considerable lengths of time without wearing protective ear phones, hearing damage and other physiological and psychological responses could occur. Generally, however, the operation of a landfill is an intermittent rather than a continuous activity and employee exposure to noise is similar. Employees that are exposed to high levels of noise over a period of time should wear protective ear phones.

The off-site health impacts of noise from a landfill are directly related to distance and surrounding land-use patterns. As expected, the impact is most severe where residential and other sensitive receptors adjoin the facility. The level of impact will vary depending upon the area of the fill being worked and the number and type of sources in operation. For example, if the working face of the fill is near the property line of the landfill where sensitive receptors are located and a number of sources are in operation, such as the simultaneous unloading of several refuse trucks, the noise impacts could be considerable.

Generally speaking, off-site exposures to noise from a landfill will be on an intermittent basis as with employee exposure mentioned above. It is not expected that there would be considerable off-site health effects from exposure to noise from landfill operations. Such noise is usually more an annoyance rather than a health problem. Noise reaching off-site receptors is probably more likely to have an adverse effect on property values, particularly residential areas.

Existing Landfill and Surrounding Area

No known adverse health effects have been reported that have occurred on-site or off-site because of noise generated from the operations of the Pine Bend Sanitary Landfill. A safety committee, consisting of shop personnel and vehicle operators, advises the owner of the landfill on the necessary health precautions for employees and visitors to the site. Ear protectors are available for employees operating noisy equipment or working near such operating equipment.

It has been determined that in a typical hour the following equipment is in use at the landfill during operating hours: one scraper, two compactors and six refuse trucks. The approximate cumulative ambient noise produced by this equipment is 100.2 dBA. The noise received by the nearest off-site receptor (2100 feet from the working area of the fill) is 67.7 dBA. This is a substantial reduction of noise; however, it does slightly exceed the MPCA NAC-1 daytime L10 standard of 65 dBA. This analysis does not assume topographical variations at the landfill which could dramatically change sound levels.

For a further discussion, see Noise and Occupational Safety and Health, Section III.

WATER QUALITY

Contamination

The principle source of surface and ground water contamination from landfills is leachate, caused by water percolating through the refuse. Leachate is produced when precipitation or other moisture passes through wastes in a landfill, picking up various mineral, organic, and other contaminants. Depending on the types of wastes received at the landfill, leachate may contain various decaying organics, bacteria and viruses, and heavy metals and other toxic chemicals.

Unless controlled, leachate will migrate different distances based primarily on the type of operation, the physical and chemical properties of the contaminants, and the hydrogeologic conditions around the site. If allowed to migrate from the site, leachate may contaminate ground or surface water and result in damages such as polluted wells or fishkills. The occurrence of such damages is directly related to the proximity of the resource to the disposal site, the direction of surface or ground water (leachate) flow, and dilution.

In general, it has been found that the quantity of leachate is a direct function of the amount of moisture entering the landfill. In fact, if a landfill is constructed and operated properly, the production of measurable quantities of leachate will be eliminated.

Health Effects

Contaminated drinking water is often first evidenced by offensive taste, brackishness, odors, or discoloration. Depending on its constituents, the consumption of contaminated water can have a number of adverse health effects including those that are toxic (poisonous to living things), carcinogenic (cancer-causing), teratogenic (causing abnormal offspring in the next generation), and mutagenic (harmful to future generations). The health effects of drinking contaminated water can produce acute or chronic symptoms such as cramps, nausea, vomiting, diarrhea, nervousness and hypertension, bladder and kidney disorders, intestinal hemorrhaging, ulceration and many others.

Ground water in aquifers is often suitable for human consumption with little or no treatment necessary. Often contamination of such waters has been discovered only after a drinking water well has been affected. Not only have such cases presented potential serious health problems, but the loss of ground water supplies can have significant local economic problems. The cost of making new drinking water sources available can be a financial burden on a community.

Surface waters, such as rivers, streams, and lakes, are a vital aesthetic, ecological, and economic resource, serving as recreational places for people, sources of water for drinking and industrial purposes, and the dwelling place for a wide variety of fish and other aquatic organisms that depend on an oxygen-sufficient, uncontaminated living environment. Contamination of such water resources have not only potential health effects, but social, economic, and ecological consequences as well.

Existing Landfill and Surrounding Area

Surface Water Related Health Effects -- Surface water in the Pine Bend Landfill area includes a number of small ponds and the Mississippi River located approximately one mile east of the landfill. There have been no reported adverse health effects from surface water contamination that could be attributed to the present landfill operation.

Based on available data (see Section III, Water Quality), there is presently no measurable impact on leachate from the landfill on the quality of the Mississippi River. Moreover, it appears that future quantities of leachate generated from the landfill will be sufficiently attenuated and diluted that the impact on the river should be negligible. The potential for adverse health effects from leachate contamination of the river, therefore, appears very minimal.

Some of the closer off-site ponds and on-site ponds, which serve as catchment areas for surface water runoff from the landfill, could be affected by leachate seepage which has occurred in the past at the landfill. These ponds will also be affected from surface runoff carrying suspended solids. Because the

designated use of these ponds is for runoff catchment purposes, there is no potential for human health problems even if the ponds are contaminated. However, since this area will be converted to park and recreational uses upon closure of the landfill, future use of these catchment areas should be carefully considered. Domestic consumption of these waters should be avoided.

Ground Water Related Health Effects -- It has been theorized that leachate from the landfill will, in time, reach the underlying surficial drift aquifer. Figure III-14 of the water quality section shows the probable area of influence of leachate generated from the current permitted areas of the Pine Bend and Crosby American Landfills.

Records show that there are 53 known non-public water supply wells within a one mile radius of the Pine Bend Landfill. Twelve of these wells are within the zone of influence of leachate from the landfill identified in Figure III-14. Analysis of recent water quality data for six wells located within or nearby the leachate zone of influence show compliance with most standards (see Section III, Water Quality). There was no indication of the presence of leachate in the wells sampled. Moreover, there have been no reported adverse health effects from drinking water from these wells.

There is, however, the potential for leachate contamination of these wells in the future, particularly after the landfills (Pine Bend and Crosby American) reach field capacity. As leachate generated from the landfills moves toward the river there will be some vertical dispersion. Depending on well depths and their types the potential for contamination may exist. These wells should be periodically tested in the future and any evidence of adverse health symptoms associated with contaminated drinking water should be carefully followed up.

DISEASE TRANSMISSION VIA VECTORS

Health Effects

Solid waste improperly disposed at landfills may provide food, water, and harborage for breeding and infestation of rats, flies, mosquitoes, birds and other vermin which serve as reservoirs of transmitters of human diseases. Stagnant water bodies on landfills may also serve as a breeding area for vermin.

The commensal rat thrives wherever food waste is carelessly handled or disposed. Rats are responsible for the spread of a number of diseases, either by contaminating food directly, rat bites, or through flies and mites. Rats can spread diseases such as rat-bite fever, leptospirosis (a mild to severe infection), trichinosis (an infection of the intestine and muscles), and murine typhus fever.

Flies pose less of a threat to human health than do rats; nevertheless, they do act as mechanical carriers of diseases such as typhoid fever, paratyphoid and other salmonella infections. The fly's instinct for survival and attraction to odors leads it to open dumps or sanitary landfills. Flies will deposit their eggs in the organic matter of solid waste prior to collection or at the disposal site if it is not covered rapidly. Flies can emerge from refuse through as much as five feet of uncompacted cover material.

Mosquitoes will oviposit in rain water held in solid waste materials. The organic debris associated with solid wastes can serve to nourish the mosquito larvae either directly or indirectly by permitting the growth of microorganisms upon which the larvae feed. Mosquitoes will also breed in stagnant ponds on landfills. Mosquitoes may transmit such diseases as encephalitis, malaria, and yellow fever.

Birds can be attracted in large numbers to exposed solid waste materials at landfills. The gathering of flocks of birds at landfills is both a potential nuisance and health hazard. Birds are carriers of diseases such as histoplasmosis.

The most effective method of controlling vectors is to minimize harborage and readily available foodstock, thereby creating an inhospitable habitat. This requires that landfills are well operated and properly maintained. Such efforts will minimize the carriers of diseased pathogens and thus protect the health of on-site personnel and adjacent communities.

Rat and fly control can be achieved by maximum compaction of the refuse and placement of an adequately compacted soil cover at the end of each operating day. Studies have shown that six inches of daily cover, well-graded and compacted, is generally sufficient to serve vector control functions.

Mosquito control is best obtained by the application of daily cover and by preventing development of stagnant water bodies anywhere on the site. Continuous grading may be required to fill in depressions resulting from incomplete compaction or differential settling of wastes.

In the event vector populations become established or show a seasonal increase, extermination using insecticides and rodenticides may be necessary. However, such programs should be carefully controlled and monitored so that they do not pose a health or safety hazard.

Existing Landfill and Surrounding Area

The Pine Bend Sanitary Landfill is generally a well operated facility. There have been no reported adverse health effects either on-site or off-site that can be attributed to vector control problems at the landfill.

Refuse deposited at the landfill is compacted by repeated travel by landfill compactors over the layers of refuse. At the completion of each day's refuse unloading activities, the exposed compacted refuse is covered with a six-inch compacted layer of clean earthen material. These practices should be adequate to prevent most vector problems from occurring at the landfill.

Periodically, or at the County Engineer's request, the operator has the landfill inspected by a licensed exterminator company, who sends a report of the inspection to the operator. This report is available to the MPCA and the County Engineer's Office. Inspections that have been conducted have shown no vector problems existing at the landfill. There have, however, been no inspections by an exterminator over the past two years.

MPCA site inspections, over the past nine years the facility has been opened, have shown no vector problems existing at the facility (see Appendix II). In addition, the site inspections have shown that violations of permitted operating practices that would contribute to potential vector problems have been very few. There has been only one violation (April 4, 1973) of the daily cover requirement since the facility begun operation, and this was because of equipment breakdown. There have been very few violations of litter control since the facility begun operation and none in almost the last three years of operation.

The ponds in the northeast and southeast corners of the landfill could present potential mosquito control problems. They should be closely monitored and appropriate steps should be taken if mosquito problems arise.

OCCUPATIONAL SAFETY AND HEALTH

Health Effects

A variety of routine operational and maintenance procedures that are conducted at landfills may expose employees of the facility to potential health hazards. Employees may be exposed to waste containing sharp objects, pathogens, and toxic, explosive or flammable materials. Injuries can also occur from the operation of heavy equipment and haul vehicles.

Workers at landfills can incur injuries such as cuts, abrasions, bruises, back strain, and broken bones. Other risks include heat or cold stress and respiratory and skin irritations. In rare instances, deaths have occurred.

In addition to measures previously discussed such as fire control, vector control, and access control, a number of procedures can contribute toward providing safety for personnel and visitors. For example, personal safety devices such as hard hats, gloves, safety glasses, and footwear should be provided to facility employees and available to visitors.

The proposed "Guidelines For Landfill Disposal Of Solid Waste" under the Resource Conservation and Recovery Act suggest that a landfill site be designed, constructed, and operated in a manner so as to protect the health and safety of personnel and users through compliance with relevant provisions of the Occupational Safety and Health Act of 1970 (OSHA) (Public Law 91-596) and regulations promulgated thereunder. Appendix VI discusses briefly relevant portions of the act.

The "Guidelines" also specifically suggest the following safety procedures that should be used at landfill operations:

1. safety manuals should be provided and employees instructed in application of its procedures;
2. safety devices such as rollover protective structures and seat belts should be provided on all equipment used to spread and compact solid wastes;
3. communications equipment should be available on-site for emergency situations;
4. quantitative and qualitative records of solid wastes received and location of disposal should be maintained;
5. a source of water should be provided on-site for fire and dust control and for employee convenience; and,
6. following closure of a completed landfill a long-term maintenance program should be initiated.

Existing Landfill

Phoenix, Inc., owner of the Pine Bend Sanitary Landfill has instituted several safety measures for employee protection. First aid equipment is provided at the main office facility for adequate treatment of injuries due to minor accidents. A safety committee has been organized consisting of shop personnel and vehicle operators. Fire extinguishers are installed on all heavy equipment and at the main office. Employees are required to wear hard hats and ear protectors are available for those operating noisy equipment. Shower facilities are available at the main office building. Finally, with the exception of having a safety manual, the operator of the landfill has implemented safety procedures that were covered above as part of the "Guidelines For Landfill Disposal Of Solid Waste."

The landfill operator, upon checking 1979 records, verified that one minor accident occurred last year due to operations of the landfill. A dozer operator slipped on a dozer arm, twisted his knee and subsequently missed two weeks of work. 1978 records show that one accident occurred when an employee received a whiplash from operating landfill equipment; this resulted in

seven man-days being lost. In 1977, records show that one accident occurred when an employee cut his hand. Records for 1976, 1975 and 1974 show that no accidents occurred at the landfill.

The operator of the landfill estimates that one to two accidents occur per year with one to two man-days lost per accident that can be directly attributable to the landfill operations. It should be noted that employees of the landfill are skilled operators of heavy equipment and aware of the potential hazards and appropriate safety precautions necessary to operate a landfill facility.

The landfill has never been inspected by Minnesota OSHA officials for compliance under the Federal OSHA standards.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION IV

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

Primary Impacts

The construction and operation of the new expansion area and earthen berm at the Pine Bend Sanitary Landfill will have no effect on the large scale (macro-climate) meteorological processes (i.e., prevailing winds, air masses, semi-permanent pressure centers) which basically determine the climate of the Minneapolis-St. Paul vicinity. Local factors, however, can affect the climate on a small scale (micro-climate). The construction and operation of the new expansion area and the earthen berm could have a small but essentially undetectable impact on the micro-climate since virtually all human activity influences the micro-climate to a certain degree. Routine maintenance, closure and post-closure activities associated with the proposed new expansion area and earthen berm will have no significant impact on the existing climate of the area.

Direct or Indirect Effects That Cannot Be Avoided

The construction, operation, maintenance, closure and post-closure activities associated with the proposed new expansion and earthen berm will have no direct or indirect effects on meteorology/climatology.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources associated with meteorology/climatology will result from the construction, operation, maintenance, closure and post-closure activities of the proposed new expansion area and earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The construction, operation, maintenance, closure and post-closure activities associated with the proposed new expansion area and earthen berm will have no impact on short-term uses of man's environment and the relationship between maintenance and enhancement of long-term productivity.

Cumulative Impacts

The construction, operation, maintenance, closure and post-closure activities associated with the proposed new expansion area and earthen berm will have no cumulative impacts.

AIR QUALITY

Primary Impacts

Fugitive Dust -- The construction, operation, maintenance, closure and post-closure activities associated with the proposed new expansion area and earthen berm will generate fugitive dust. Activities such as landclearing, excavation, grading, stockpiling, moving heavy equipment over unpaved areas, the transport of cover materials, and the movement and unloading of refuse trucks will generate fugitive dust.

The dust impacts from the proposed new expansion area will not vary significantly in magnitude from those resulting from the existing landfill since the nature and level of dust generating activities at the proposed new fill area will be similar to existing conditions. The potential impact zone may shift somewhat because the area of dust emissions will be moved to the proposed expansion area. The construction of the earthen berm is a one-time activity and thus will be only a short-term source of fugitive dust.

No significant adverse dust impacts are expected. In fact, construction of the earthen berm, its subsequent seeding, and proper operation of the proposed new expansion area should reduce the level fugitive emissions presently produced at the existing facility.

Methane Gas -- The proposed new expansion area has the potential for adverse methane gas impacts. Since an additional 1.7 million tons of refuse are being proposed for the disposal in the expansion area, the increase in methane production will correspond accordingly. Based on lysimeter and full-scale landfill tests it appears that typical generation rates of .2 to .75 std. cu. ft. of methane/lb. can be expected from the landfill. Given that generation rate, an approximate gross production of 11 billion cu. ft. of methane gas can be expected from the landfill including the proposed expansion area.

Proper operation of the landfill should, however, minimize potential methane impacts to satisfactory levels. The filling of the proposed expansion area should help to divert surface water runoff away from fill areas into runoff storage areas which are removed from contact with the buried refuse. The amount of water in contact with the buried refuse will be lessened, and as a result, methane gas will be produced in small amounts over a long period of time. The low rate of methane

production reduces the possibility of explosive concentrations being reached. Methane gas that is produced within the landfill will be vented through the cover material and at the landfill perimeter, ultimately dissipating at harmless concentrations into the atmosphere.

The existing landfill has not demonstrated methane gas problems.

Odors -- The proposed new expansion area has the potential for adverse odor impacts. However, proper design and operation of the landfill should minimize odor impacts to satisfactory levels.

The existing landfill has not demonstrated odor problems.

Other Air Pollutants -- The operation of equipment and the movement of refuse trucks into the expansion area will cause low levels of carbon monoxide, nitrogen oxides, sulfur oxides, and hydrocarbons to be emitted to the ambient air. However, these activities should not cause significant adverse impacts other than that occurring at the existing landfill. The proposed expansion will not increase the number of vehicular trips to the landfill or the operation of on-site equipment.

Direct or Indirect Effects That Cannot Be Avoided

No significant direct or indirect effects associated with the proposed expansion area and earthen berm are anticipated to occur in the area of air quality.

Fugitive Dust -- Fugitive emissions from a landfill are an effect that cannot be avoided. However, state-of-the-art engineered operational procedures, can minimize a large percentage of the fugitive emissions.

Construction-related activities associated with the proposed expansion area and earthen berm such as landclearing, excavation, grading, stockpiling, moving heavy equipment over unpaved areas and the transport of fill material will unavoidably generate fugitive dust for relatively short periods of time. However, dust impacts from construction activities will be minimal.

Routine operational and maintenance activities associated with the proposed expansion area and earthen berm will also generate fugitive dust in similar quantities to that produced by the existing landfill. Such activities in the past have not produced any serious fugitive dust problems. Therefore, no significant impact on the existing environment by these activities will result from fugitive dust emissions.

No significant adverse impacts regarding transportation-related emissions will occur since the proposed expansion and earthen berm will not generate any increase in vehicular traffic to the site.

Some fugitive dust will be generated by activities associated with closure of the landfill including the proposed expansion area. However, these impacts will be minimal. In the long run, dust emissions from the landfill will be reduced by revegetation.

Methane Gas -- The potential for adverse methane gas impacts will be increased by the proposed expansion area. In comparison, the impact that methane gas generation has had on the environment at other landfills has generally been minimal. In some instances, methane gas has killed vegetation and trees at landfill sites. What appears to have happened in those instances is that methane has vented through fissures and eroded portions of the cover material in concentrations high enough to be toxic to vegetation. Operational practices employed at the Pine Bend Sanitary Landfill should prevent such impacts from occurring at the site.

Phoenix, Inc., is in the process of developing a gas monitoring program to be installed at the landfill in conjunction with an investigation of the feasibility of a methane gas recovery system.

Odors -- The potential for adverse odor impacts will be increased by the proposed expansion. However, no significant adverse impacts are anticipated. The placement of cover material should minimize the emission of odorants into the air to satisfactory levels.

Other Air Pollutants -- Low levels of carbon monoxide, nitrogen oxides, sulfur oxides, and hydrocarbons will be emitted into the air by construction and operational activities associated with the proposed expansion area and earthen berm. The impacts from these pollutants should be negligible.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of air resources will result from the activities associated with the proposed expansion area and the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The short term impacts due to construction of the proposed expansion area and earthen berm will involve potential fugitive dust and transportation-related emissions. No significant adverse air quality impacts on the maintenance and enhancement of the long-term productivity of the existing environment will result from the construction activities.

Short-term impacts due to operation of the proposed expansion area involve potential fugitive dust emissions, odor and methane emissions, and transportation-related emissions. Air quality

impacts on the maintenance and enhancement of the long-term productivity of the existing environment from these operations will be minimal.

Short-term impacts due to closure and post-closure activities of the proposed expansion area involve potential fugitive dust and transportation-related emissions. Adverse air quality impacts on the maintenance and enhancement of the long-term productivity of the existing environment from these operations will be minimal. Revegetation will actually reduce dust emission from the landfill in the long-term.

Cumulative Impacts

Fugitive Dust -- The construction of the earthen berm and the preparation and operation of the proposed expansion area will occur concurrently. The combination of these activities will increase the potential for short-term cumulative impacts on ambient air quality from fugitive dust. However, completion of construction of the earthen berm will be much sooner than completion of filling of the proposed expansion area and other permitted areas of the existing landfill. Once completed, the earthen berm should lessen considerably potential adverse air impacts from the operations of the proposed expansion area and other permitted areas of the existing landfill.

Methane Gas -- The potential for cumulative impacts of methane will increase with the expansion of the landfill. However, the total cumulative effects are not expected to be significant.

Other Air Pollutants -- Cumulative impacts are not expected to result from the emission of other air pollutants by the proposed expansion area and the earthen berm.

NOISE

Primary Impacts

The construction, operation and closure of the proposed expansion area and the earthen berm are activities that will produce noise. Noise will be generated by equipment used at the proposed expansion area for hauling, compacting and covering the refuse. Noise will be generated by equipment used to prepare and grade the earthen berm. The level of noise generated, however, by activities at the proposed expansion area and the earthen berm should not be any greater than that of the current landfill operation.

The closest sensitive receptor (home) to the proposed expansion area is located approximately 2,100 feet from the border of the proposed expansion area. As a general rule, sound from an essentially localized source spreads out uniformly as it travels away from the source, and the sound level drops off at the rate of 6 dBA for each doubling of distance. Assuming that a

bulldozer producing 88 dBA measured at 50 feet is operated at the proposed expansion area for an hour, noise levels at the receptor would be approximately 55 dBA. This is within the MPCA NAC-1 daytime hourly noise standard of 65 dBA. The preceding analysis does not take into account topographical variations which would further reduce noise at the receptor.

Activities associated with the proposed expansion area and earthen berm will not affect nighttime noise levels since the landfill is not operational during the night.

Construction of the earthen berm should decrease noise levels from activities associated with the proposed expansion area and other permitted areas of the landfill.

Direct or Indirect Effects That Cannot Be Avoided

The generation of noise from the operation of a landfill is an effect that cannot be avoided. However, proper operation of the proposed expansion area and construction of the earthen berm should reduce noise impacts to satisfactory levels.

There have been no adverse noise impacts associated with the existing landfill operation.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources with regards to noise generating activities will occur from the proposed expansion area and construction of the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Short-term impacts due to construction, operation and closure of the proposed expansion area and the construction of the earthen berm will involve potential noise emissions. The major long-term benefit of the proposed action will be to provide an environmentally acceptable outlet for the regional disposal of solid waste.

Cumulative Impacts

The construction of the earthen berm and the preparation and operation of the proposed expansion area will occur concurrently. The combination of these activities will increase the potential for short-term cumulative impacts on the existing environment from noise. However, completion of construction of the earthen berm will be much sooner than completion of filling of the proposed expansion area and other permitted areas of the existing landfill. Once completed, the earthen berm should lessen considerably noise impacts from the operations of the proposed expansion area and other permitted areas of the existing landfill.

WATER QUALITY

SURFACE WATER QUALITY

Primary Impacts

The primary impact on surface water quality from operation of the proposed expansion area would be an increased potential for minor leachate contamination and siltation of on-site and nearby off-site ponds. Construction of the proposed earthen berm should not result in any impacts on surface water quality with the exception of possible minor siltation of nearby ponds.

Filling of the proposed expansion area will increase the volume of refuse disposed of at the landfill by about 1,780,000 tons, representing about a 42 percent increase in the site's disposal capacity. The holding capacity of the landfill will similarly increase and the quantity of leachate eventually produced at the site may also increase (given similar compaction ratios, cover material and surface conditions). However, as explained below, the rate of leachate discharge from the landfill, because of filling the proposed expansion area, will not necessarily increase much above the estimated rate of 6,265 cubic feet per day for the presently permitted area of the landfill.

Filling the proposed expansion area will improve surface water runoff and subsequently lessen the rate of infiltration at the landfill. As previously discussed, under existing operations, a large portion of the surface runoff that occurs at the landfill drains by way of the abandoned railroad right-of-way, the proposed expansion area. This has presented problems. The grade of the abandoned railroad right-of-way is very flat, a slope of less than 0.3 percent. Surface water runoff has had a tendency to collect in this area of the landfill. Under present permitted conditions, once the landfill is completed the railroad right-of-way will remain as a long narrow valley between the east and west portions of the landfill. The side slopes of this valley will exceed 12 percent and surface water runoff will subsequently continue to collect in the valley, probably in even greater quantities, and not readily be diverted to the ponding areas which are not in contact with buried refuse (see Figure III-10). Ditches are located on both sides of the abandoned railroad right-of-way. There is the possibility that water could exfiltrate from the ditch areas to the refuse.

Filling the abandoned railroad right-of-way will bring the final elevations of this area up to the final elevations presently proposed for the east and west portions of the landfill, 1010 and 1020 feet respectively. As various portions of the expansion area are completed (reach final elevation) they will receive final cover, be graded and seeded for vegetative growth. As shown in Figure IV-1, the completed expansion area will result in a general northwest to southeast ridge and northeast

to southwest slopes. Such final configuration should greatly promote surface water runoff at the landfill. Surface water runoff will be quickly diverted to the on-site and off-site catchment ponds.

Much of the completed landfill, including the proposed expansion area, will be graded to final slopes not to exceed 25 percent in order to further promote surface water runoff and reduce infiltration, the maximum allowed by the MPCA. In addition, as with the proposed expansion area, as areas of the landfill reach final fill elevation they will be covered with two feet of compacted earth, graded and seeded, instead of waiting until an entire phase of the landfill is completed before final cover is added. These practices will also improve surface water drainage at the landfill and reduce infiltration.

Surface runoff diversion and increased runoff rates resulting from filling the proposed expansion area and continued implementation of current final cover, grading and seeding procedures should greatly reduce uncontrolled infiltration of precipitation at the landfill. Since the final elevation of the landfill, including the proposed expansion area, will be higher than surrounding land areas, infiltration will only occur as a result of precipitation and not by runoff from other surface water bodies. Reduced infiltration will minimize the waste moisture content and lessen the rate of anaerobic waste degradation. The time period for the landfill to reach holding capacity will subsequently increase and the quantity of leachate generated before holding capacity will be reduced. Once holding capacity is reached, reduced infiltration will lessen the rate of leachate discharge and total volume from the landfill.

Filling of the proposed expansion area will increase the thickness of certain presently permitted areas of the landfill, those areas that would have been the valley slopes had the expansion area not been filled. For these areas of the landfill, the increase in thickness will also increase the time holding capacity is reached at the site and subsequent steady state leachate discharge conditions. Sunde estimated 20 years before holding capacity would be reached at the presently permitted landfill. Increased thickness of the landfill and reduced infiltration because of filling the proposed expansion area should extend Sunde's prediction.

Filling of the proposed expansion area will extend the holding capacity of the site. Once holding capacity is reached, a larger volume of leachate would be expected to be produced at the landfill. However, as discussed above, filling of the proposed expansion area will reduce infiltration and the subsequent rate of leachate discharge. The reduced rate of leachate discharge will offset, at least to some extent, the increased volume of leachate produced. The rate of leachate discharge may not be much greater than Sunde's estimate of 6,265 cubic feet per day for the presently permitted landfill.

The theoretical total volume of leachate produced at the landfill, however, may increase as a result of filling the proposed expansion area. It appears that filling the proposed expansion area and the subsequent increase in holding capacity and reduced infiltration, will increase, perhaps considerably, the timeframe for leachate generated from the completed landfill. Notwithstanding, as shown below, the environmental impact of leachate produced at a landfill depends largely on its rate of discharge and strength and composition. The total quantity produced by a landfill over time is generally a negligible factor, unless the site is one of a number of pollutant sources in an area where cumulative contaminant sources might impact the environment.

As discussed in Section III, the strength of leachate diminishes with the age of its production from a landfill. The majority of leachate generated from the Pine Bend Landfill will be quite old. Filling the proposed expansion area and the reduced rate of infiltration achieved at the landfill because of this action will increase the timeframe to reach holding capacity. Filling the expansion area will, therefore, further age and reduce the strength of leachate generated by the facility. Oleckno (1976) found that the composition of 17 year old leachate may be 0.01 percent to 8 percent of the composition of 2 year old leachate.

Leachate produced at the landfill will migrate downward through from 80 to 130 feet of unsaturated soils to the water table. Leachate produced within the expansion area refuse will also migrate a similar distance through unsaturated soils to the water table. In this soil zone, the strength of the leachate will begin to be reduced by the attenuation processes of adsorption, ion exchange, chemical precipitation, oxidation-reduction reactions and biological activity. In general, substances present in the leachate in large concentrations will be attenuated by chemical precipitation, substances present in small concentrations will be attenuated by adsorption, or ionexchange, and heavy metals will be attenuated by adsorption or oxidation-reduction reactions.

Once leachate reaches the surficial drift aquifer it must travel one mile before discharge to the Mississippi River. It is expected that the rate of discharge of leachate from the landfill after filling the proposed expansion area may not increase much beyond Sunde's estimate for the presently permitted area of 6,265 cubic feet per day. Leachate, including that from the proposed expansion should, therefore, also take about four to five years to reach the river. Further attenuation of the leachate will occur during this time period, largely by dilution.

Once leachate is discharged by the surficial drift aquifer to the Mississippi River, according to Sunde, its strength would be reduced by five to six orders of magnitude by dilution. This dilution factor should not change, at least measurably, with the filling of the expansion area since the rate of discharge of leachate is not expected to increase much over the rate

estimated for the presently permitted landfill. Therefore, given attenuation and dilution of the leachate, its rate of discharge and decreasing strength with the age of the landfill, the net effect of leachate produced from the landfill including the proposed expansion area on the quality of the Mississippi River should be negligible. The on-site and off-site ponds would not be impacted by the underground movement of leachate, regardless of whether the volume of leachate increases or not because of filling the expansion area, since these are perched water bodies.

Should leachate move laterally through the fill area and seep to the surface of the landfill through voids in the refuse and cover material, this substance could present a particular problem at the catchment ponds since they generally receive the majority of the surface runoff (see Figure IV-1). The on-site and off-site catchment ponds may, nevertheless, be already considerably degraded from previous seeps and siltation that have occurred at the landfill. Only the northeast ponds have been sampled where high iron concentrations were found to exist (see Water Quality, Section III). Increased leachate flowage into these ponds may not make a difference one way or another. Notwithstanding, it is important to point out that generally such seepage can be kept to a minimum with proper refuse compaction, cover soil placement, grading, and seeding. Filling of the proposed expansion area will in effect lessen the potential for such seepage since improved surface water runoff and less infiltration will be achieved as a result of this action. The catchment ponds are landlocked and will not degrade other nearby surface waters.

The on-site and off-site catchment ponds serve as settling ponds for suspended solids received in the surface runoff as a result of minor erosion on the landfill that may occur and operational activities. Operational activities in the proposed expansion area and construction of the earthen berm could result in the further discharge of suspended solids in surface runoff and the eventual siltation of the catchment ponds. Again, such impacts may not make a difference one way or another, since these ponds may probably already degraded to some degree. Other off-site ponds should not be affected.

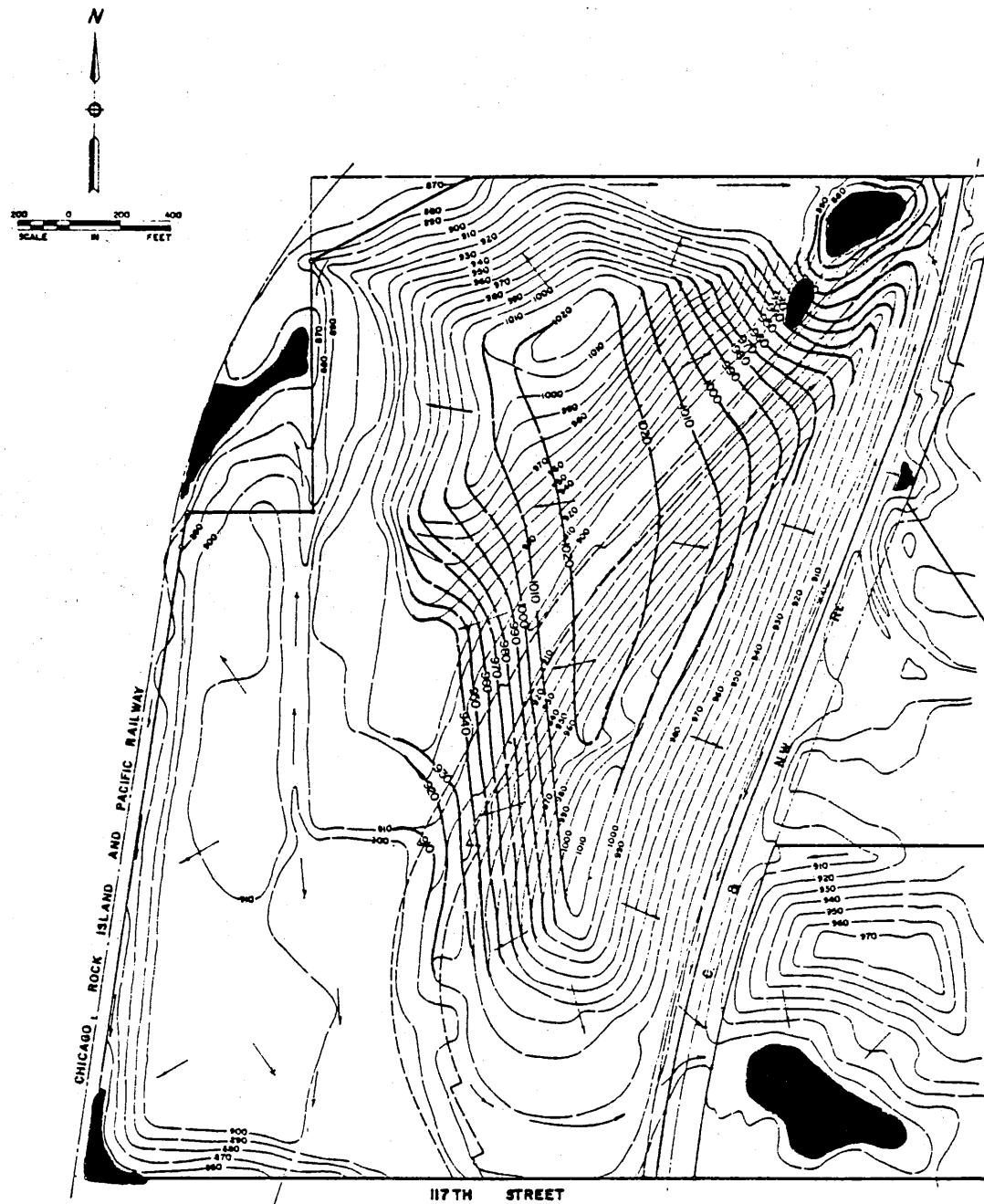
Direct of Indirect Effects That Cannot Be Avoided

As a result of filling the proposed expansion area there may be a very minor increase in the rate of leachate discharge to the Mississippi River, a direct effect that cannot be avoided. The steady-state discharge of leachate to the river should not occur for a number of years, at least until after the landfill has reached holding capacity. Given attenuation of the leachate as it moves toward the river and its dilution in the river, the effect of leachate on the river, including minor increases in its rate of discharge, will be negligible.

The on-site and off-site catchment ponds will receive additional sediment as a result of filling the expansion area and

PINE BEND SANITARY LANDFILL

FINAL GRADING AND DRAINAGE PLAN



NOTES

MAP SYMBOLS DENOTE

— FINAL CONTOURS AS PROPOSED
BY 1979 AMENDMENT

— FINAL CONTOURS PRESENTLY
PERMITTED

— DIRECTION OF SURFACE
DRAINAGE

● SURFACE WATER
PONDING AREAS

Figure IV-1

construction of the earthen berm, a direct effect that cannot be avoided. Sanitary landfilling by its very nature is a construction activity; surface runoff, particularly over fill areas yet to receive final cover and attain vegetative growth, will carry minor amounts of suspended solids to nearby receiving areas. Implementation of current operational procedures while filling the expansion area and constructing the earthen berm should be sufficient to mitigate major erosion of these areas and sediment discharge to the pond areas. Although minor increases of sedimentation of the pond areas will occur as a result of the proposed actions, the net effect should be negligible.

Irreversible and Irretrievable Commitment of Resources

Minor leachate seeps and erosion of the landfill surface may have degraded the on-site and off-site catchment ponds to some degree. These catchment areas will further degrade from operations associated with the filling of the expansion area and construction of the earthen berm. The net effect, however, of the proposed actions should be negligible since these are landlocked catchment areas designated purposely as the receiving areas for the landfill's surface runoff.

No other significant irreversible or irretrievable commitments of surface water resources are associated with the proposed filling and construction activities.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The long-term use of the catchment ponds will be impacted by the filling activities of the landfill operation, including those associated with the filling of the proposed expansion area. Depending on their use, the catchment ponds should be carefully monitored after closure of the landfill. Particular attention should be given to leachate seeps that might occur and flow to these areas. Future use of the catchment ponds should be carefully determined. Other long-term impacts on surface water resources should not result from the activities of the landfill including those associated with the proposed actions.

Cumulative Impacts

There are no cumulative impacts on surface water resources resulting from activities associated with filling the proposed expansion area and construction of the earthen berm.

GROUND WATER QUALITY

Primary Impacts

It has been theorized that leachate from the landfill will, in time, reach the underlying surficial drift aquifer. Leachate will then move toward the Mississippi River Valley, one mile east of the landfill. Sunde estimated this movement should take about four to five years. The leachate will finally discharge to the river.

Figure III-14 shows the probable area of influence of leachate generated from the current permitted areas of the Pine Bend and Crosby American landfills. The area shown follows the axis of the buried valley as previously discussed (see Section III, Water Quality). It was shown that potentiometric levels in the Prairie du Chien-Jordan Aquifer adjacent to the valley are higher than ground water levels in the buried valley area. Ground water should, therefore, flow to the valley and ground water carrying leachate within the valley area will not spread beyond the limits of the valley.

It has been further theorized that the filling the proposed expansion area may increase the total volume of leachate eventually produced at the landfill, however, the rate of leachate discharge to the ground water system should not be much greater than Sunde's estimate of 6,265 cubic feet per day for the presently permitted fill areas (see Surface Water Quality-Primary Impacts). What additional leachate is discharged over time, because of the filling of the expansion area, will not influence the direction or timeframe of its movement toward the river as described above.

Leachate produced at the landfill must travel downward through approximately 80 to 130 feet of unsaturated soil before reaching the ground water system. A similar zone of unsaturated soil exists under the proposed expansion area. This soil zone will serve to attenuate leachate moving through it by the processes of dilution, ion exchange, filtration, chemical precipitation and biological activity. Leachate will subsequently enter the ground water system containing fewer harmful constituents.

The attenuating capacity of the unsaturated soil zone, however, will diminish as leachate continues to move through this medium. Filling of the expansion area may increase the quantity of leachate eventually produced at the landfill. This additional leachate generated over time will place an increased burden on the attenuating capacity of the underlying soils. Natural purification processes have only a limited ability to remove contaminants, because the number of adsorption sites and exchangeable ions available is finite. Notwithstanding, this effect may be offset, at least partially, as leachate generated from the fill areas loses its strength with age of the refuse. As more well data becomes available, further analyses should be conducted to determine the effectiveness of the underlying soils in the area to attenuate leachate strengths.

Once leachate, including that generated from the expansion area, enters the ground water system it will continue to attenuate as it moves toward the river, principally by the process of dilution. Contaminants entering this system will not reach deep underlying aquifers nor spread beyond the limits of the buried valley. The primary area of influence of leachate generated from the landfill, including that produced from the proposed expansion area and the Crosby American landfill, is shown in Figure III-14. The net effect of additional leachate generated from the expansion area appears to be that this area of

influence will continue to exist for a longer time period. The rate of leachate discharge into this area and its component strengths should not change much beyond that which would occur from the presently permitted areas of the landfill.

Construction of the earthen berm should not have any impacts on the ground water system.

Direct of Indirect Effects That Cannot Be Avoided

Leachate generated from the Pine Bend Landfill will enter the ground water system. Over time, the proposed expansion area may contribute additional leachate to the ground water system. However, the daily rate of leachate discharge, its component strengths and movement through the ground water system would not be affected by the additional leachate produced at the landfill. The area of leachate influence will continue to exist for a longer timeframe because of the additional leachate generated.

Construction activities associated with the earthen berm will not have any direct effects on the quality of the ground water system.

Irreversible and Irretrievable Commitments of Resources

The ground water system near the landfill area would eventually purge itself of contaminants generated from the landfill. This could, however, take some time. Landfills have been known to generate leachate as long as 30 to 40 years after closure. Notwithstanding, no irreversible or irretrievable commitment of ground water resources will occur as a result of the activities associated with the filling of the expansion area and construction of the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Ground water resources within the leachate zone of influence shown in Figure III-14 will be affected for a considerable time period, most particularly after the landfill reaches field capacity and steady-state leachate discharge conditions exist. The magnitude of the impact on this area cannot be adequately determined without further hydrogeologic analysis. Filling of the proposed expansion area may increase the amount of leachate generated at the landfill and subsequently extend, perhaps considerably, the timeframe the leachate zone of influence exists. Nevertheless, leachate generated by the landfill, including the expansion area, should not adversely affect the long-term productivity of ground water resources in this area. As previously discussed, the deep underlying aquifers should not be affected from leachate even on a short-term basis.

Construction of the earthen berm will have no affect on the long-term productivity of ground water resources in the area.

Cumulative Impacts

The direction of ground water flow and the close proximity of the Crosby American balefill will make it difficult to separate water quality data from ground water samples for the two landfills. In actuality, the Crosby American and Pine Bend landfills should be considered as one landfill in terms of ground water impact.

Metropolitan Council (1978) estimates show a potential daily rate of discharge of leachate from the Crosby American balefill of approximately 1465 cubic feet. This rate added to Sunde's estimated daily discharge rate for the Pine Bend landfill gives a daily discharge rate of 7730 cubic feet for the two landfills. It was previously determined that filling the expansion area would not increase the daily discharge rate much beyond Sunde's estimates.

It has further been determined that because of its relatively small size, 27 acres, and high infiltration rate, 5.65 inches annually, the balefill will reach field capacity considerably sooner than the Pine Bend Landfill. Metropolitan Council estimates show field capacity for the balefill being reached in the mid-1980s. The total volume of leachate generated from the balefill will also be considerably less than the Pine Bend Landfill, probably less than 10 percent.

It is highly unlikely that the combined daily rate of discharge determined above for the two landfills would ever be achieved. Some combined effects will occur; however, the balefill will most likely have been leached out by the time steady-state leachate discharge conditions are reached at the Pine Bend Landfill. Cumulative effects on the ground water system should, therefore, be negligible at least as far as the majority of the leachate that will be generated from the two landfills. Future analysis of water quality data in the area should be careful as far as attributing leachate from one landfill or the other.

LOCAL WATER SUPPLY QUALITY

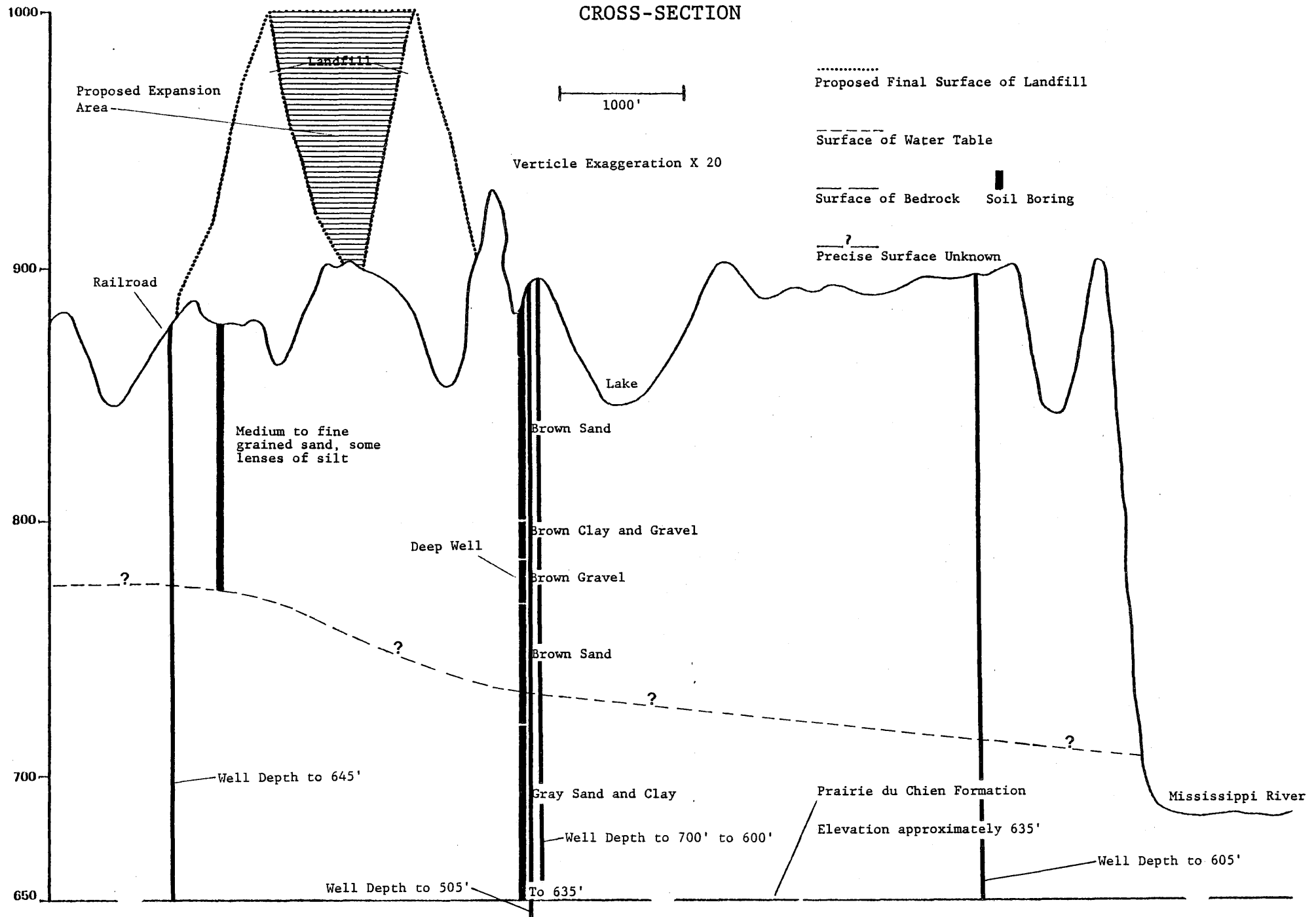
Primary Impacts

As shown in Figure III-11, 53 known nonpublic water supply wells exist within a one mile radius of the Pine Bend Sanitary Landfill. Twelve of these wells are within the zone of influence of leachate from the landfill previously identified in Figure III-14. Analysis of recent water quality data for six wells located within or nearby the leachate zone of influence show compliance with most standards (see Section III, Water Quality). There was no indication of the presence of leachate in the wells sampled.

There is, however, the potential for leachate contamination of these wells in the future, particularly after the landfills (Pine Bend and Crosby American) reach field capacity. Figure IV-2 shows a generalized cross-section of the Pine Bend Landfill area including some known wells within this area and their

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Verticle Exaggeration X 20



depths, also shown is the probable water table level. Generally water supply wells in the Pine Bend area have depths of 200 to 400 feet extending to the Prairie du Chien and Jordan aquifers. As leachate generated from the landfill moves toward the river there will be some vertical dispersion. Depending on well depths and their types the potential for contamination may exist. Notwithstanding, filling of the proposed expansion area and any subsequent additional leachate discharged by this action will not significantly contribute to the potential or risk from leachate contamination already presently existing from the two permitted landfill areas. In the event that elevated levels of the given parameters are identified in the ground water system the periodic sampling and analysis should be performed at potentially affected off-site wells.

Construction of the earthen berm will have no effect on local water supply quality.

Direct of Indirect Effects That Cannot Be Avoided

Filling of the proposed expansion area and construction of the earthen berm will not have any significant direct or indirect effects on local water supply quality.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitment of local water supply resources will occur as a result of the activities associated with the filling of the proposed expansion area and construction of the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Activities associated with the filling of the proposed expansion area and construction of the earthen berm will not adversely affect the maintenance and enhancement of the long-term productivity of local water supply resources.

There is potential for adverse impacts on the local water supply quality from leachate generated from current permitted areas of the landfill. This potential or risk will be greatest while steady-state leachate discharge conditions exist at the landfill. Filling of the proposed expansion area should not contribute, at least measurably, to this potential or risk.

Cumulative Impacts

The combined effects of leachate discharged from the Pine Bend Landfill, including filling the proposed expansion area, and from the Crosby American balefill should have no greater affect on the potential that already exists for adverse impacts on local water supply quality.

TERRESTRIAL AND AQUATIC ECOLOGY

VEGETATION AND WILDLIFE

Primary Impacts

Construction activities associated with the proposed actions include preparing the expansion area for refuse disposal and construction of the earthen berm. In effect, all existing vegetation in the proposed areas will be removed by these activities. This will eventually include the removal of approximately two to four acres of mixed hardwoods and five to ten acres of intermediate shrubs/grassland. This compares to the removal of approximately 10 to 70 acres of mixed hardwoods, 20 to 40 acres of intermediate shrubs/grassland, 12 to 14 acres of lowland forest, and one to two acres of wetland remaining on presently permitted areas of the landfill. The vast majority of the existing vegetation cover has already been permitted for removal.

Wildlife populations associated with plant communities on the expansion and berm parcels are likely supported by vegetative cover on the existing permitted and unpermitted areas of the landfill and the nearby surrounding area. There are small numbers of individuals which predominantly use the expansion and berm parcel habitats, such as the black-capped chickadees sighted in the alder-sumac-poplar thickets in the southern one-third of the expansion area. The staghorn sumac and alder stands on the expansion area also provide for a limited food source for cottontail rabbits and rodents, and nesting area for other smaller song birds. These and other species utilizing the expansion and berm areas will be displaced during the construction stage. The surrounding area is undeveloped and wildlife could be expected to use it as an alternate habitat and feeding area unless these areas are already at their natural carrying capacity. The movements of deer, fox, weasels and other mammals will also be restricted during construction activities, primarily during daylight hours.

The indigenous vegetation and associated wildlife species located on the proposed expansion and berm areas, are not unique to these areas. The total individual members of the affected populations are very small in comparison to the total available areawide resources. In effect, the proposed expansion and berm area construction activities will not result in significant direct impacts on terrestrial populations.

The operating phase of the landfill with respect to the proposed expansion area will consist of, for each successive work area, actual waste placement, cover placement, and environmental control operations (i.e., litter control, dust control, etc.). Day-to-day operations will affect a larger area than the active face area due to refuse truck and landfill equipment traffic on the access points. Wildlife populations, which have presumably adjusted to existing landfill activities, will not be additionally affected by the expansion area operations.

The closure phase of the expansion area will consist of, for each successive work area, final cover placement and revegetation activities. Since the closure period is relatively brief, such activities have only very minimal impacts on terrestrial vegetation and wildlife.

The potential, however, exists for more substantive impacts on terrestrial populations, and particularly terrestrial flora, due to biological processes inherent at a landfill site during the post-closure period. Specifically, decomposition of landfilled organic materials results in or contributes to leachate generation and methane gas production. For surface oriented flora and fauna, leachate generation would not be expected to have significant impacts. Methane gas production, on the other hand, has resulted in numerous cases in the creation of anoxic root zone conditions resulting in slow growth or die-off of associated plant species. Potential impacts are generally unpredictable in practice, as well as, generally localized in extent. Given the site topography (elevated), type of cover soil (relatively impermeable) and site history (no evidence of methane problems) no substantial impacts are expected either on or off-site. Should substantial vegetative stresses develop, a number of mitigative measures are available (see Section V).

Direct or Indirect Effects That Cannot Be Avoided

Construction activities associated with the proposed expansion and berm areas, particularly the excavation and fill procedure, will unavoidably eliminate vegetation on the areas involved. Reduction of vegetation will, in turn, decrease the habitat of associated wildlife populations. This action will also have a minimal effect on areawide predator populations faced with a decrease in their food supply. While considerable time will lapse between replanting and full restoration of a vegetative cover, and consequent reintroduction of associated wildlife species, impacts are generally not substantial.

Filling activity on the expansion area will have two additional indirect impacts. First, it will eliminate a wildlife or pathway between the two large presently permitted areas. Mammal tracks found in this area indicate that this land is presently being used for feeding and a pathway, although not specifically for nocturnal or diurnal dens. Second, the extreme variation in topography caused by the unfilled railroad bed of the expansion area provides various slope conditions for a wider variety of plant communities. Filling in this area will create a more

uniform final topography which will result in less vegetative and wildlife diversity.

Irreversible and Irretrievable Commitments of Resources

During construction activities, several stands of mixed hardwoods, intermediate shrubs and grassland areas will be removed. Since mixed hardwood stands consisting of red maple, red oak and poplars represent the climax vegetation for the site, they cannot be replaced within a relatively short time frame. This oak-maple-savannah comprises the dominant vegetation in the area. Elimination of a small portion of these hardwoods would not, however, be a significant impact upon the area's vegetative resources.

No significant irreversible or irretrievable commitments of vegetation or wildlife resources are associated with the operational, closure and post-closure phases of the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The primary short-term impact associated with the proposed construction activities will be the removal of vegetation from the fill and berm areas. In the long-term, revegetation of the site will occur. However, normal plant successional growth patterns could potentially be modified due to the combined earth/decomposing waste substrata available for plant growth.

Operation of the proposed landfill expansion area eliminates approximately 19.2 acres from natural ecological production. Operation of the facility, however, should result in secure disposal of approximately 8,007,550 cubic yards of municipal wastes over a 3.9 year period.

No significant short-term impacts are expected due to closure and post-closure activities. Beneficial long-term impacts would include the designation of more than 250 acres for recreational and industrial open space purposes. Wildlife may relocate to this area if adequate vegetation exists for habitat and feeding.

Cumulative Impacts

The proposed expansion will add 19.2 acres to an existing, 233 acre landfill. Consequently, the vast majority of natural vegetation on the landfill will be removed. Although the expansion and earthen berm areas contain several types of habitat communities, the relative impact will be minimal compared to destruction of the surrounding vegetation on the existing permitted areas. Essentially, both habitat and feeding areas for most mammals and some birds will be eliminated.

No significant cumulative impacts are expected from operation of the expansion area or during the closure and post-closure periods associated with the expansion and berm areas.

AQUATIC ECOLOGY

Primary Impacts

The completed landfill with the expansion will generally be at a higher elevation than the surrounding area and, therefore, will not receive surface water runoff from surrounding areas. Surface water runoff from the landfill will be diverted around fill areas into the two collection ponds away from contact with any buried refuse. These runoff storage ponds will allow sediment suspended in surface runoff to settle out. Runoff away from buried refuse should be improved by the expansions, and conversely the suspended sediment loadings into the two on-site ponds should increase. However, this increased loading of suspended matter should not significantly impact the existing aquatic ecology of the ponds.

The only significant body of surface water which might be affected by leachate from the Pine Bend Sanitary Landfill is the Mississippi River, one mile east of the landfill boundary. The recent hydrogeologic report (Sunde, 1978) shows that leachate strength should be reduced by five to six orders of magnitude by dilution alone if it reaches the river. Subsurface movement of the leachate prior to reaching the river, 80 to 130 feet vertically in unsaturated soils, then one mile horizontally, should provide sufficient attenuation of leachate to reduce any ecological impacts on the river to insignificant levels (see Water Quality Section for further discussion).

Operation activities in the proposed expansion area should have only negligible impacts on on-site and off-site ponds. Increased loadings of suspended matter caused by filling the expansion area may occur in the southeast pond because of diverted runoff from the northeast pond. With daily cover and surface runoff controls (e.g., slope structure, seeding, etc.), potential impacts should be negligible.

While activities related to closure and post-closure of the expansion area would not be expected to result in substantial adverse impacts on aquatic resources, on-going leachate generation could result in potential impacts. The two on-site ponds are the only possible receiving bodies for potential lateral leachate seepage due to the construction and configuration of the landfill. The impacts would probably be only minimal because of the existing conditions in the ponds. There is little potential for contamination of off-site ponds from lateral leachate seepage with proper construction, operation and closure practices.

Direct and Indirect Effects That Cannot be Avoided

The only unavoidable direct or indirect effect of the expansion on aquatic ecology is the increased sedimentation of the southeast pond described in the preceding sections. This impact should be negligible compared to existing pollution conditions.

Direct or indirect impacts relating to surface water runoff and leachate generation can be minimized by appropriate design and operational procedures.

No significant direct or indirect impacts relating to closure and post-closure activities would be expected given appropriate design and operational procedures.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of aquatic resources are associated with construction, operation, closure, and post-closure activities of the proposed expansion area and earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The construction, operation, closure, and post-closure activities of the proposed expansion area and earthen berm are not expected to result in substantive short or long-term impacts on aquatic resources.

Cumulative Impacts

Impacts on aquatic species resulting from operation, closure and post-closure phases of the proposed expansion area relating to leachate generation and surface water runoff would be in addition to those impacts currently experienced due to the escape of leachate into the on-site ponds and wetland areas.

WETLANDS

Primary Impacts

There is the potential for soil erosion from the activities of the proposed actions, with sediment potentially entering on-site wetlands. The on-site wetland areas, B and B₂, will be eliminated under current permitted operations, and therefore, the relative damage of loadings from runoff would be insignificant (see Figure III-19). The wetland area surrounding the southeast pond (C₂) will be maintained according to present plans.

Leachate and landfill gas production will occur during operation, closure and post-closure activities associated with the proposed expansion area. Gas migration cannot occur through saturated soil and, as such, there would be no expected impact on the wetlands via horizontal or vertical gas migration.

Although leachate production may occur for a number of years, final cover should substantially reduce leachate quantities.

Direct or Indirect Effects That Cannot be Avoided

The generation of leachate and methane gas is inevitable; however, the impact of leachate and gas on on-site and off-site wetlands will be limited due to the distance and landfill design. No significant adverse impacts are expected.

Irreversible and Irretrievable Commitments of Resources

No additional wetland resources will be irrevocably committed because expansion area activities will not occur in the wetlands, and mitigative measures to control sedimentation will be employed.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

In the short-term, the on-site wetland will be minimally stressed by activities of the proposed expansion and berm areas before it is filled in. In the long-term, the proposed action will provide the Metropolitan Area with a continued outlet for the disposal municipal solid wastes.

Cumulative Impacts

Current surface water runoff direction will be reversed as the construction on the expansion area progresses. Presently, the northeast pond is receiving the majority of the runoff from the active area. Once construction and operation activities commence on the northern portion of the proposed expansion area, the change in slope characteristics should reverse the direction of surface water runoff towards the wetland area and the southeast pond. The long-term cumulative impacts of the expansion area will be no different since the wetland area is presently permitted to be filled.

The present condition of the off-site wetland area as a viable functioning upland wetland ecosystem would be affected by expansion of the existing landfill. However, the apparent lack of significant impacts on this area by the existing landfill and the environmental controls currently used and proposed for the expansion and berm areas suggest that additional impacts would not be significant.

RARE AND ENDANGERED SPECIES

Primary Impacts

No impacts on rare or endangered species will occur on-site or the surrounding area as none of these species associated with the area.

Direct or Indirect Effects That Cannot be Avoided

There are no rare or endangered species associated with the area; therefore, no impacts on such populations will occur.

Irreversible and Irretrievable Commitments of Resources

No rare or endangered species are associated with the area; therefore, no commitments of such resources will be involved with the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

No significant adverse impacts on neighboring populations of rare, endangered, or "unusual" species are expected.

Cumulative Impacts

No cumulative impacts on rare or endangered species are predicted.

SOCIO-ECONOMICS

LAND USE, ZONING

Primary Impacts

There are no significant primary impacts related to land use or zoning due to filling the proposed expansion area and construction of the earthen berm at the Pine Bend Sanitary Landfill. The proposed actions are consistent with land use and zoning for the area. Final use of the landfill for park and recreational purposes is consistent with land use and zoning for the area.

The adjacent Mississippi River Critical Area may possibly be adversely affected due to leachate contamination of ground water and the river itself in the designated area. However, as previously discussed, the impacts in this area should be minimal because of attenuation of the leachate as it leaves the landfill and the dilution it achieves as it moves toward the river and enters the river itself (see Water Quality, Sections III and IV).

Direct or Indirect Effects that Cannot Be Avoided

There are no significant direct or indirect effects relating to land use or zoning that will result from the proposed actions.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources relating to land use or zoning will result from the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The filling of the proposed expansion area and the construction of the earthen berm will have no significant impact on the short-term uses of man's environment. However, upon the landfill's closure a park will be located on the present landfill site which will enhance the long-term productivity of the area.

Cumulative Impacts

The proposed actions will not result in any cumulative impacts that are related to land use or zoning in the area.

POPULATION CHARACTERISTICS

Primary Impacts

The filling of the proposed expansion area and the construction of the earthen berm will have no significant impacts on the population, housing, or employment patterns for the Inver Grove Heights and Rosemount areas.

Direct or Indirect Effects that Cannot Be Avoided

There are no significant direct or indirect effects relating to population, housing or employment patterns that will result from implementation of the proposed actions.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources relating to population, housing or employment patterns will result from implementation of the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed actions will have no significant impact on population characteristics for the area either on a short-term or long-term basis.

Cumulative Impacts

The proposed actions will not result in any cumulative impacts that are related to population, housing or employment patterns in the area.

PUBLIC FACILITIES AND SERVICES

Primary Impacts

The only significant impact of the proposed actions on future public facilities, is the delay of Inver Grove Height's plan for development and construction of community park facilities on the landfill property. If the expansion is granted, the city will have to delay park facility development by approximately four years, extending the date of land acquisition from 1988 to 1992. The landfill area has the potential to be the largest park in the city's park system. There are, however, adequate available park facilities until the landfill area is developed assuming the expansion is approved.

Filling of the proposed expansion area will enhance future development of the site as a park and recreation facility. Filling the expansion area will result in more level acreage and, thus, more flexibility for park designers to determine recreational and park area configurations.

Direct or Indirect Effects that Cannot be Avoided

The only direct or indirect effect of the expansion on public facilities will be the delay in developing the land as a community park facility. The facility demand that would have been served by the Pine Bend park, will temporarily have to be met by other community parks in the area.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources related to public facilities that will result from the expansion of the landfill.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed expansion of the Pine Bend Sanitary Landfill would have the short-term benefits of the secure disposal of an additional 4.7 million cubic yards of municipal refuse and thereby eliminate the need for alternative disposal methods. Approval of the expansion would also have the short-term effect of delaying Inver Grove Heights park development plans for the site by approximately four years. However, granting the expansion will result in more useable open space for the city in the long-run by eliminating the railroad bed valley's steep slopes.

Cumulative Impacts

No cumulative impacts relating to public facilities are predicted other than the added demand on other city park facilities due to the delay in developing the completed Pine Bend Sanitary Landfill as an active recreational, community park.

TRANSPORTATION

Primary Impacts

A telephone survey of the municipalities located on the principal haul routes to Pine Bend Sanitary Landfill was conducted to identify issues relating to the hauling of refuse through their communities. The two major issues that have been identified are:

1. Occasional use of non-designated routes by haulers
2. Fugitive debris from haul trucks.

Table IV-1 summarizes the findings of this telephone survey. Only one community, Inver Grove Heights, of the several municipalities that are most directly affected from the hauling of refuse to the Pine Bend Sanitary Landfill has identified

Table IV-1 IDENTIFIED ISSUES RELATING TO REFUSE HAULING TO PINE BEND SANITARY LANDFILL

Municipality	Issue	Interviewee
Minneapolis	Previous routing issue in vicinity of South transfer station resolved	Roger Stolsom Department of Public Work
St. Paul	None	Floyd Forsberg Manager, Solid Waste and Energy Division
Inver Grove Heights	Occasional unauthorized use of Babcock Trail (OSAH 73) by haulers Fugitive debris (especially tree debris) along Concord Blvd. and South Robert Street	Robert W. Schaefer City Administrator
West St. Paul	None	Phipp Stefaniak City Engineer
South St. Paul	None	Robert Simon City Engineer
Mendota Heights	None	Fred Pfeifer Department of Public Work
Sunfish Lake	None	Myra Hamper City Clerk
Eagan	None	Tom Colbert City Engineer

existing adverse effects that might be continued under the proposed action.

Direct or Indirect Effects That Cannot be Avoided

The proposed action will extend the use of established haul routes approximately four years.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources associated with the hauling of refuse to the Pine Bend Sanitary Landfill will be the fuel consumed for transport.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The four-year extended use of the designated haul routes will have no significant impact on short-term uses of man's environment and the relationship between maintenance and enhancement of long-term productivity.

Cumulative Impacts

The four-year extended use of the designated haul routes resulting from the proposed action will have no significant cumulative impacts.

COLLECTION AND MANAGEMENT SYSTEM COSTS

Primary Impacts

Filling of the proposed expansion area will extend the life of the Pine Bend Sanitary Landfill by about four years. Area haulers that normally use this site can continue to do so for the additional time period. Area customers serviced by haulers using the landfill, will continue to be charged collection fees, based in part, on the disposal charges set at Pine Bend. Disposal charges at the Pine Bend Landfill are presently below those of the nearby Burnsville and Freeway landfills. The site, therefore, provides a low cost alternative and helps to maintain present collection rates in the Region.

Filling of the proposed expansion area will also extend the timeframe for the need to develop new landfills in the Region (see Section VI, Alternatives). Hennepin County (1979) found, for example, that it will cost between \$3.5 and \$4 million to develop a 120-acre parcel that could handle 500 tons of refuse per day. When legal, administrative and engineering expenses are added, landfill development costs could reach \$4.2 and \$5.6 million. Landfill development costs are reflected in disposal charges and ultimately in generator collection rates. Minimal development is necessary to use the Pine Bend expansion area;

filling of this area will, therefore, help to maintain present collection rates in the Region by avoiding the costs of developing new land disposal areas.

There are no adverse primary impacts on collection and management system costs that can be attributed to filling the proposed expansion area and construction of the earthen berm.

Direct or Indirect Effects That Cannot Be Avoided

Filling of the proposed expansion area will extend the life of the Pine Bend Landfill and subsequently provide additional capacity for area haulers. This will, in turn, lessen the need and expense for new landfills and changes in routing and additional fuel costs for area haulers. Filling of the proposed expansion area will, therefore, help meet future regional land disposal capacity needs and help keep collection rates down.

There are no adverse direct or indirect effects on collection and management system costs that can be attributed to the proposed actions.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of resources with respect to collection and management system costs that can be attributed to the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed actions will not result in any impacts on collection and management system costs that would adversely affect either short-term or long-term uses of the site for land disposal or the long-term productivity of the surrounding environment.

Cumulative Impacts

The most significant cumulative impact of continued disposal at Pine Bend as a result of using the expansion area, is the extension of the Metropolitan Area's landfill capacity. The expansion will add about one to two years of life to the metropolitan disposal system. Filling the expansion area will, therefore, lessen the need to develop new landfills sooner and help to maintain present land disposal charges and collection rates.

HISTORICAL/ARCHAEOLOGICAL

Primary Impacts

No historical or archaeological impacts are associated with the present site. The proposed actions are contained within the perimeter of the landfill property. Therefore, no historical or archaeological impacts will be associated with the expansion of the present site.

Direct or Indirect Effects that Cannot be Avoided

The present site contains no historical or archaeological significance, therefore, no historical or archaeological impacts will occur due to the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no historical or archaeological impacts associated with the proposed actions that will adversely affect the maintenance and enhancement of the long-term productivity of the area.

Cumulative Impacts

No cumulative impacts relating to historical or archaeological significance are predicted.

AESTHETICS

Primary Impacts

Filling of the proposed expansion area and construction of the earthen berm will result in the landfill operating about four years longer. Nearby homes that look directly upon the landfill will be exposed to the operation of the facility for these additional years and any subsequent visual impacts. However, such impacts should be less than those already present, because filling will take place primarily on the eastern portion of the site away from on-site receptors and mostly on easterly facing slopes.

Direct or Indirect Effects that Cannot be Avoided

Visual impacts from operation of the landfill will occur for a longer time period as a result of the filling of the expansion area and construction of the earthen berm, a direct effect that cannot be avoided. Off-site receptors will also have to wait this additional time period (approximately four years) before the site can be used for other purposes, a park and recreational area, a much more pleasant visual use of the property.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources with respect to the visual impacts of the facility will occur as a result of the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no significant aesthetic impacts associated with the proposed action that will adversely effect the maintenance and enhancement of the long-term productivity of the existing surrounding environment.

Cumulative Impacts

There are no cumulative impacts with respect to the visual impacts of the facility that are assoiciated with the proposed actions.

HUMAN HEALTH

AIR QUALITY

Primary Impacts

Fugitive Dust -- No significant adverse health impacts are expected that would be associated with fugitive dust emissions generated from operation in the proposed expansion area and from construction of the earthen berm as independent activities (see Cumulative Impacts). For a discussion of the primary impacts of fugitive dust from the proposed action, refer to Air Quality, Section IV.

Methane Gas -- The proposed new expansion area will increase the quantity of methane gas produced from the landfill facility. However, the potential for adverse health impacts that would be associated with methane gas generated from the landfill will decrease at least during the operating life of the facility.

The rate of methane production in a landfill is increased according to the amount of moisture coming in contact with the refuse. Construction and proper operation of the proposed expansion area should improve surface water runoff. This proposal, along with the current covering and grading practices on the existing permitted area of the landfill, should keep water in contact with the buried refuse at a minimum. The rate of refuse decomposition will, therefore, be slow, and as a result methane gas will be produced in small amounts over a long period of time. This low rate of methane production reduces the possibility of explosive concentrations being reached. The small amount of methane gas that is produced within the landfill will vent through the cover material and at the landfill perimeter, ultimately dissipating at harmless concentrations into the atmosphere. The potential for adverse health effects that would be attributed to methane gas generated from the facility during its operating life will probably decrease.

The net effect of the proposed expansion will be to increase the quantity of methane generated but at a lower rate of production. Methane will continue to be produced for several years after the landfill facility is closed. If structures are placed on the former fill area or near the perimeter of the landfill, there exists the potential for gas to accumulate in these structures to explosive concentrations. The lower rate of methane production may lessen the potential for gas to accumulate, however, this isn't expected to be significant. The potential for explosive concentrations of gas to accumulate would still be there, as would the potential for injury.

Odor -- No significant adverse health impacts are expected that would be associated with odorous emissions generated from operation in the proposed expansion area. No odorous emissions will be generated from construction of the earthen berm and subsequently no adverse health impacts will occur. For a discussion of the primary impacts of odorous emissions from the proposed action, refer to Air Quality Section IV.

Other Air Pollution -- The proposed expansion will not increase the number of vehicular trips to the landfill on the operation of on-site equipment. No significant adverse health impacts are expected that could be attributable to emissions from on-site equipment and refuse trucks because of the operation of the proposed expansion area or the construction of the earthen berm as independent activities (see Cumulative Impacts). For a discussion of the primary impacts of other air pollutants from the proposed action, refer to Air Quality, Section IV.

Direct or Indirect Effects That Cannot Be Avoided

There are no significant direct or indirect effects on human health associated with the proposed expansion area and earthen berm anticipated in the area of air quality.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources associated with human health and air quality impacts will result from the activities of the proposed expansion area and the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

No impacts associated with human health and air quality will adversely affect the maintenance and enhancement of the long-term productivity of the existing surrounding environment from the construction activities.

Cumulative Impacts

Fugitive Dust -- The construction of the earthen berm and the preparation and operation of the proposed expansion area will occur concurrently. The combination of these activities will increase the potential for short-term cumulative impacts on ambient air quality from fugitive dust. It is not expected, however, that any adverse health effects or cumulative health effects would occur as a result of these concurrent activities.

Methane Gas -- The potential for cumulative impacts of methane will increase with the expansion of the landfill. However, as previously discussed, the primary impacts of methane generation appear to indicate that the potential for adverse health effects from the methane will probably decrease at least during the operating life of the facility. On the other hand, there will

be a potential for adverse health effects after closure of the facility if gas should accumulate in new structures on the property.

Odor -- There are no cumulative impacts from the activities of the proposed expansion and earthen berm that will contribute to the odorous emissions generated at the facility or can be attributed to the odorous emissions generated at the facility. No adverse health effects or cumulative health effects are expected related to odorous emissions.

Other Air Pollutants -- The construction of the earthen berm and the preparation and operation of the proposed expansion area will occur concurrently. The combination of these activities will increase the potential for cumulative impacts on the existing environment from the emissions that are produced from the operation of equipment and refuse trucks associated with the proposed activities. It is highly unlikely that the proposed concurrent activities will increase the potential for adverse health effects or cumulative health effects from the low level of emissions that will be produced.

NOISE

Primary Impacts

The level of noise generated by activities at the proposed expansion area or the earthen berm should not be any greater than that of the current landfill operation. It is not expected there will be any increase in potential health effects from each of the proposed activities. Presently, the ambient noise level received by the nearest off-site receptor (2100 feet from the working area of the fill) is 67.7 dBA, slightly exceeding the MPCA NAC-1 daytime hourly standard of 65 dBA. This analysis, however, does not assume topographical variations at the landfill which could dramatically change sound levels.

Activities of the proposed expansion area and earthen berm will be undertaken concurrently and, as such, noise levels produced by the facility will increase at least for the short-term. For further discussion (see Cumulative Impacts).

Direct or Indirect Effects That Cannot Be Avoided

The generation of noise from the operation of a landfill is an effect that cannot be avoided. It is not expected, however, that there will be significant direct or indirect health effects associated with noise produced from the facility.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources with regards to noise generating activities and subsequent health impacts will occur from the proposed expansion area and construction of the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Short-term impacts due to the construction and operation of the proposed expansion area and the construction of the earthen berm will involve potential noise emissions. Noise generated by the proposed action, however, is not expected to adversely effect human health or the maintenance and enhancement of the long-term productivity of the existing surrounding environment.

Cumulative Impacts

Noise levels produced by the landfill facility will increase over present levels because construction and operation of the proposed expansion area and construction of the earthen berm will be undertaken concurrently. The combination of these activities, however, is not expected to generate noise that would result in any significant adverse health effects. Notwithstanding, completion of construction of the earthen berm will be much sooner than completion of filling of the proposed expansion area and other permitted areas of the existing landfill. Once completed, the earthen berm should lessen considerably noise impacts from the operations of the proposed expansion area and other permitted areas of the existing landfill.

WATER QUALITY

Primary Impacts

As a result of filling the proposed expansion area there will probably be a minor increase in the rate of leachate discharge to the Mississippi River (see Section IV, Water Quality). However, given attenuation of the leachate as it moves toward the river and its dilution in the river, the net effect of leachate on the river, including minor increases in its rate of discharge, will be negligible. There should be, therefore, no adverse health effects from contamination of the river that would be associated with filling the proposed expansion area.

The on-site and off-site catchment ponds will receive additional sediment as a result of filling the expansion area and construction of the earthen berm (see Section IV, Water Quality). Although minor increases of sedimentation of the pond areas will occur as a result of the proposed actions, the potential for adverse health effects will not increase greatly over the potential which already exists from contamination of these ponds from operation of the present permitted facility. Careful use should be made of these ponds in the future after the landfill is closed.

Over time, the proposed expansion area would contribute additional leachate to the ground water system. However, as shown in the water quality section, the daily rate of leachate discharge, its component strengths and movement through the

ground water system would not be affected by the additional leachate produced at the landfill. Filling of the expansion area and the subsequent additional leachate discharged by this action will not contribute, at least significantly, to the potential or human health risk from leachate contamination of the nearby water supply wells already presently existing from the Pine Bend and Crosby American landfills.

Direct or Indirect Effects That Cannot Be Avoided

Filling of the proposed expansion area and construction of the earthen berm will not result in any significant adverse health effects that cannot be avoided.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of local drinking water supply resources and subsequent health impacts will occur as a result of the activities associated with filling the proposed expansion area and construction of the earthen berm.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Activities associated with the filling of the proposed expansion area and construction of the earthen berm should not adversely affect the maintenance and enhancement of the long-term productivity of local water supply resources.

There is potential for adverse impacts on the local water supply quality from leachate generated from current permitted areas of the landfill. This potential for health problems will be greatest while steady-state leachate discharge conditions exist at the landfill. Filling of the proposed expansion area should not contribute, at least measurably, to this potential health hazard.

Cumulative Impacts

The combined effects of leachate discharged from the Pine Bend Landfill, including filling the proposed expansion area, and from the Crosby American landfill should have no greater effect on the potential that already exists for adverse impacts on local water supply quality hence human health.

DISEASE TRANSMISSION VIA VECTORS

Primary Impacts

The construction and operation of the proposed expansion area and the construction of the earthen berm should result in no adverse health effects either on-site or off-site that can be attributed to vector control problems at the landfill. Present

safety procedures used at the facility should be sufficient to minimize potential vector control problems.

Direct or Indirect Effects that Cannot Be Avoided

There are no significant direct or indirect effects stemming from vector control problems and human health impacts associated with the proposed action that cannot be avoided.

Irretrievable and Irretrievable Commitment of Resources

No irreversible or irretrievable commitments of resources with regards to vector control and human health impacts will occur from the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no significant vector control problems and human health impacts associated with the proposed action that will adversely effect the maintenance and enhancement of the long-term productivity of the existing surrounding environment.

Mosquito problems may occur from time to time at the ponds located on the landfill; however, appropriate action can be taken if the situation becomes a threat to human health.

Cumulative Impacts

There are no cumulative impacts associated from vectors or vector control because of the proposed action. Routine refuse disposal procedures presently used at the landfill should be sufficient to prevent vector problems and associated health problems from occurring because of the proposed action.

OCCUPATIONAL SAFETY AND HEALTH

Primary Impacts

The construction and operation of the proposed expansion area and the construction of the earthen berm will expose employees of the facility to health hazards, hazards that are normally encountered in the operation of the existing landfill facility. Employees may be exposed to waste containing sharp objects, pathogens, and toxic, explosive or flammable materials. Injuries are also possible from the operation of heavy equipment and haul vehicles.

It is not expected, however, that the potential for adverse health effects to employees will increase because of activities associated with the proposed expansion or earthen berm. Existing safety procedures currently used at the landfill are sufficient to handle any potential health hazard or accident that might be associated with the proposed action. For further discussion, refer to Safety and Security Practices, Section II, and Occupational Safety and Health, Section III.

Direct or Indirect Effects That Cannot Be Avoided

Sanitary landfilling is a construction activity, and by its very nature employees of such facilities will be exposed to a number of potential hazards associated with routine operational and maintenance procedures that are conducted at landfills. A number of measures, however, can be taken to minimize these hazards and contribute toward the safety of personnel and visitors to the facility. Existing safety procedures of the Pine Bend Landfill are sufficient to minimize routine health hazards that will be associated with the proposed action.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources with regards to occupational safety and health will occur because of the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no significant health and safety problems associated with the proposed action that will adversely effect the maintenance and enhancement of the long-term productivity of the existing surrounding environment.

Cumulative Impacts

There are no cumulative impacts associated with occupational safety and health because of the proposed action. Existing safety practices are sufficient to ameliorate potential hazards associated with the proposed action.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION V

MITIGATION MEASURES TO REDUCE OR MINIMIZE SIGNIFICANT ADVERSE EFFECTS

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

The activities associated with the construction, operation and closure of the proposed expansion area and the construction of the earthen berm will not produce any significant adverse effects on the existing climate. Consequently, no mitigative measures are necessary.

AIR QUALITY

As noted in Section IV, the construction, operation and closure of the proposed expansion area will result in minimal production of fugitive dust, odors, and methane gas. In addition, the construction of the earthen berm will produce a minimal amount of fugitive dust.

Current operational procedures used at the existing landfill should be sufficient to handle most of the air emission problems associated with the proposed expansion area and the earthen berm. In addition, the surrounding topographic and land use features of the area should provide adequate protection from adverse impacts on local receptors. Finally, construction and proper operation of the proposed expansion area should improve surface runoff resulting in better methane gas control, and construction of the earthen berm should lessen noise and fugitive dust impacts from activities associated with the proposed expansion area and other permitted areas of the landfill.

The potential cumulative impacts resulting from fugitive dust will increase temporarily as the construction and operation of the proposed expansion area and the construction of the earthen berm are undertaken concurrently. A mitigative action to this, would be to phase development and operation of the proposed expansion area with the completion of portions of the earthen berm.

The following are other mitigative measures that might be undertaken to further reduce potential impacts from air pollutants.

- Provision of dust control via surface paving
- Reduction of dust generation via prompt revegetation
- Periodic perimeter methane monitoring

NOISE

The potential cumulative impacts resulting from noise will increase temporarily as the construction and operation of the proposed expansion area and the construction of the earthen berm are undertaken concurrently. A mitigative action to this, would be to phase development and operation of the proposed expansion area with the completion of portions of the earthen berm.

WATER QUALITY

SURFACE WATER QUALITY

It was found that filling of the proposed expansion area will improve surface water runoff at the landfill and lessen infiltration of moisture into the fill areas. Construction of the earthen berm should also improve surface runoff and further protect nearby off-site water bodies from being impacted by operations of the landfill. Adverse surface water quality effects that were found to be associated with the proposed actions can be mitigated sufficiently by continued implementation of current operational procedures used at the landfill.

The application and grading of daily and final cover material at the landfill will serve to direct on-site drainage to the catchment ponds. The catchment ponds will prevent sediment-laden runoff and minor leachate seepage from reaching off-site water bodies. Leachate surface seeps should rarely occur with continued implementation of current cover soil placement, grading and seeding practices. Continued seeding will promote natural vegetative growth which will subsequently stabilize fill surface areas, prevent erosion, promote optimum evapotranspiration, and enhance the appearance of the site.

GROUND WATER QUALITY

Adverse ground water quality effects that were found to be associated with the filling of the proposed expansion area should be mitigated sufficiently by continued implementation of current operational procedures used at the landfill. An important part of Pine Bend's ground water protection system consists of a recently implemented water quality monitoring program (see Figure III-15). This monitoring system appears adequate to detect existing or potential pollution caused by leachate by periodically measuring the extent and rate of any leachate migration from the landfill site, and the degree and nature of leachate contamination. Periodic monitoring should aid in determining the need for and nature of future leachate controls, and in evaluating the effectiveness of presently implemented leachate control procedures.

Filling of the proposed expansion area will improve surface water runoff and lessen infiltration at the landfill. Such improvements, along with continued implementation of present cover, grading and seeding procedures, will minimize waste moisture content resulting in a reduced rate of anaerobic waste degradation. The rate of leaching of waste contaminants will, therefore, be minimized as will the severity of impact on ground water supplies. The 90 to 130 feet of unsaturated soil underlying the landfill including the expansion area will also reduce the strength of the leachate generated and its impact on the ground water system.

Leachate collection and treatment does not appear necessary for the proposed expansion area.

LOCAL WATER SUPPLY QUALITY

There is the potential for leachate contamination for the water supply wells within the area of influence of leachate identified in Figure III-14. Notwithstanding, filling of the proposed expansion area and the subsequent additional leachate discharged by this action will not contribute, at least significantly, to the potential or risk from leachate contamination already presently existing from the two permitted landfill areas.

It is important that these water supply wells are periodically tested in the future in the event that elevated levels of water quality parameters are identified in the landfill monitoring system. The landfill monitoring system will detect leachate that may present potential contamination problems at these wells. Further controls may be necessary at the landfill should leachate begin affecting local water supply quality.

TERRESTRIAL AND AQUATIC ECOLOGY

CONSTRUCTION

The two major impacts associated with the construction phase of the expansion and berm areas are sedimentation and removal of vegetation. As such, a number of mitigative measures are available. These include

1. Avoiding equipment encroachment on non-landfill area.
2. Minor modifications of proposed landfill area boundaries to avoid taking large individual woody plant specimens (i.e., over 6" in caliper).

OPERATION

Impacts associated with operation of the proposed expansion area include impacts on vegetation and wildlife as caused by surface runoff, leachate production and methane gas migration. A potential mitigative measure might include utilization of surface runoff controls to minimize direct surface runoff drainage

into the wetland areas (i.e., berms, ponding, routing of runoff away from wetland areas, etc.).

CLOSURE AND POST-CLOSURE

Impacts associated with the final phases of landfill operation are essentially identical to those experienced during the operational phase. Additional mitigative measures which could be implemented include:

1. Utilization of a final cover consisting of two feet of clay overlain by six inches of sandy loam topsoil to promote vegetative growth. Additional effects relating to maintaining appropriate vegetative growth conditions such as liming, fertilization, watering, insect control could be considered.
2. Selection of a variety of plant species noted for potential adaptability to landfill conditions.

SOCIO ECONOMICS

LAND USE, ZONING

The activities associated with the construction, operation and closure of the proposed expansion area and the construction of the earthen berm will not produce any effects on the existing land use or zoning. Consequently, no mitigative measures are necessary.

POPULATION CHARACTERISTICS

The proposed actions will have no impact on the population, housing or employment patterns for the area. No mitigative measures are, thus, necessary.

PUBLIC FACILITIES

The only potential adverse impact of the proposed expansion on public facilities will be the delay in the City of Inver Grove Heights' plan for development of the land for a community park. A possible mitigative measure might be for the city to stipulate in its conditional use permit for the site, that as portions of the landfill are completed they are turned over to the city for development as soon as possible. The city could begin to prepare the property for its final use and, thus, gain some lead time on final development of the site. The property would then be available to the public sooner for park and recreational purposes. Notwithstanding, the advantages gained by the city in more immediately satisfying the demand for park and recreation

facilities in the southern part of the city, must be weighed against the disadvantages of possible interference with ongoing landfill operations.

TRANSPORTATION

Only one community, Inver Grove Heights, of the several municipalities that are most directly affected from the hauling of refuse to the Pine Bend Sanitary Landfill has identified existing adverse effects that might be continued under the proposed action. These adverse effects and suggested mitigative measures are given in Table V-1.

COLLECTION AND MANAGEMENT SYSTEM COSTS

The proposed actions will have no adverse effects on collection and management system costs in the Metropolitan Area. No mitigative measures are, therefore, recommended.

HISTORICAL/ARCHAEOLOGICAL

Since the present site contains no historical or archaeological significance, the activities associated with the construction, operation and closure of the proposed expansion area and the construction of the earthen berm cannot have any influence on historical or archaeological considerations. Therefore, no mitigative measures are necessary.

AESTHETICS

The proposed actions will result in less adverse visual impacts to off-site receptors than those that have occurred with previously filled areas of the landfill. No mitigative measures are, therefore, recommended.

Table V-1 IDENTIFIED ADVERSE EFFECTS AND MITIGATIVE MEASURES
RELATING TO THE HAULING OF REFUSE TO PINE BEND
SANITARY LANDFILL

<u>Suggested Mitigative Measure</u>	<u>Identified Adverse Effect</u>
- Occasional use of non-designated routes (especially Babcock Trail) for hauling refuse to the landfill site.	- Notification of refuse haulers regarding posted roads in the vicinity of the landfill site. This notification to be given through the St. Paul Refuse Haulers Association to its members and/or at the gate

of the landfill site by Phoenix Inc. personnel. Such notification should include a map showing designated routes.

- Fugitive debris from haul trucks, especially tree debris.
- Appropriate citation to violators.
- Appropriate citation for inadequately covered refuse trucks.

HUMAN HEALTH

AIR QUALITY

Current operational procedures used at the existing landfill should be sufficient to avoid significant adverse health effects associated with air emissions caused by the proposed expansion area and earthen berm. For a discussion of mitigative measures to reduce air emissions associated with the proposed action, refer to Meteorology/Climatology, Air Quality and Noise, Section V.

It was found that there may be a potential for adverse health impacts from methane gas after closure of the landfill, if gas should accumulate in new structures on the property because of the additional gas production in the proposed expansion area. It may be necessary, prior to closure of the facility, to install a gas monitoring system to evaluate any future requirements for on-site and perimeter gas control measures. Such a monitoring program will also help determine future use of the property and whether new structures should be placed on the property.

NOISE

No significant adverse health effects are anticipated because of the noise generated from the activities associated with the proposed expansion area and the earthen berm. Construction of the earthen berm should lessen noise generated by activities associated with the proposed expansion area and other permitted areas of the landfill.

The potential cumulative impacts resulting from noise will increase temporarily as the construction and operation of the proposed expansion area and construction of the earthen berm are undertaken concurrently. Although not expected, should the combination of these activities present noise problems for off-site receptors, a mitigative action might be to phase development and operation of the proposed expansion area with the completion of portions of the earthen berm. Employees at the landfill may also have to wear ear protectors.

WATER QUALITY

There is the potential for leachate contamination of the water supply wells within the area of influence of leachate identified in Figure III-14. Notwithstanding, filling of the proposed expansion area and the subsequent additional leachate discharged by this action; will not contribute, at least significantly, to the potential or risk from leachate contamination already presently existing from the two permitted landfill areas.

It is important that these water supply wells are periodically tested in the future. The landfill monitoring system will also detect leachate that may present potential contamination problems at these wells. Further controls may be necessary at the landfill should leachate begin affecting local water supply quality.

DISEASE TRANSMISSION VIA VECTORS

No significant adverse health effects should occur as a result of vector control problems associated with the proposed expansion area and earthen berm. Present daily cover procedures at the landfill should be sufficient to control vectors.

Should mosquitoes become a problem in the ponds on the landfill, extermination using insecticides, may be necessary. Such programs should be carefully controlled and monitored so that they do not pose a health or safety hazard.

OCCUPATIONAL SAFETY AND HEALTH

No significant adverse health effects should occur with respect to employee safety because of activities associated with the proposed expansion area and earthen berm. Present safety precautions used at the facility should be sufficient to handle any potential health hazard or accident that might be associated with the proposed action.

For a discussion of mitigative measures currently used at the facility refer to Safety and Security Practices, Section II and Occupational Safety and Health, Section III.

PINE BEND SANITARY LANDFILL

SECTION VI

ALTERNATIVES TO PROPOSED ACTION

BACKGROUND INFORMATION

The following alternatives analyses are based on estimated closing dates of the existing sanitary landfills derived by projecting the continuing use rates and remaining capacities. These projections must necessarily be based on a set of data and assumptions. Because of the number of variables involved in the Regional landfill system during the next 10 years, the resulting closing dates are predictions to be used for general planning purposes only and are subject to change.

Table VI-1 summarizes the base data for the Regional landfill system including the predicted closing dates. The following assumptions were used in this analysis:

1. Presently remaining and expansion volumes, as given in acre-feet as of January 1980 reflect the remaining air space volume only. Cubic yard conversions are based on the definition of acre-feet: 1613 cubic yards (CY) per acre-foot (AF).
2. Presently remaining volume for Burnsville Sanitary Landfill is based on the recent stipulation agreement with the Minnesota Pollution Control Agency. This agreement essentially trades side-slope space for vertical space allowing 700,000 CY (434 AF) to be used on top of the existing refuse. Added to the previously existing space of 600,000 CY (372 AF) brings the total existing volume of Burnsville Sanitary Landfill to 1.3 million CY (806 AF).
3. 1980 use rates are calculated by using the best available receiving rate data (County and MPCA recorded data and/or landfill operators) and then converting to acre-feet using the conversion constant of 672 tons received through the gate per acre-foot in place in the landfill.
4. Use rates are assumed to increase somewhere within a range of 0.0 to 1.3 percent per year. Reported closing date reflect the median use rate increase of 0.65 percent per year.
5. The closing dates reflect projections based on the inter-related nature of solid waste flow within the Regional landfill system. When the first landfill closes, the landfill's last use rate (AF/Yr) is dispersed evenly between the remaining "neighboring" landfills depending on relative proximity.

Table VI-1

Base Data For Regional Landfill System

Landfill	(A) Presently Remaining Volume (As of 1/80)	(B) Expansion Volume	Total Available Volume (A + B)	1980 Use Rate	Predicted Closing Dates (Burnsville & Freeway Expansions Granted)	Predicted Closing Dates (Burnsville & Freeway Expansions not Granted)
Pine Bend	5952	2790	8742	792	April, 1989 (Without Expansion: April, 1987)	Jan. 1987 (Without Expansion: June, 1985)
Freeway	951	1860	2811	158	April, 1988	June, 1983
Burnsville	806	2418	3224	237	December, 1987	Sept., 1982
Flying Cloud	1046	0	1046	607	September, 1981	Sept. 1981
Louisville	1395	650	2045	79	March, 1988	October, 1985
Dakhue	333	0	333	27	1987	1987
Woodlake	67	1550	1617	150	1986	1986
Anoka Municipal	786	0	786	340	1982	1982
Oak Grove	211	0	211	174	1981	1981
East Bethel	807	0	807	11	?	?
WDE	<u>245</u>	<u>0</u>	<u>245</u>	<u>40</u>	<u>1983</u>	<u>1983</u>
7-County Region Total	12,599	9,268	21,867	2,611	1989 (1988 without Pine Bend Expansion)	1987 (1986 without Pine Bend Expansion)

6. A subregional scenario was used to predict effects of other landfills' closing on Pine Bend Sanitary Landfill. Louisville, Flying Cloud, Freeway and Burnsville were determined to have the greatest impact on Pine Bend's use rate due to proximity and overlapping wastesheds. Therefore, the use rates of these neighboring landfills were dispersed among the remaining landfills when closed.
7. Two scenarios were used to project Pine Bend's closing dates: a) Both Burnsville and Freeway Sanitary Landfills are granted their expansion permits; b) Both Burnsville and Freeway are not granted their expansion permits. These two scenarios result in a range of predicted closing dates for Pine Bend.

Results of this analysis based on the assumptions given are as follows. If all landfills including Pine Bend are granted expansions, then Pine Bend will be the last to close in 1989. If Pine Bend is not granted the expansion and the other four sanitary landfills applying for expansions are granted, then Pine Bend will close approximately two years earlier in 1987. Figure VI-1 shows the impact of the Pine Bend expansion on the Region's capacity. The Pine Bend expansion represents about seven percent of the Region's landfill capacity needs through the year 2000 after the present generation of landfills close (including Louisville's expansion only).

Figure VI-2 represents the subregional system in more detail showing the effect of closing neighboring landfills. The shaded area represents the difference between the effect of granting or not granting the Freeway and Burnsville expansions. If Pine Bend is granted the expansion, the significant increase in use rate should occur early in 1988 if Burnsville and Freeway are both granted expansions resulting in Pine Bend closing in 1989. If Freeway and Burnsville Sanitary Landfills are not granted expansions, the effect of their closing is dispersed over four years resulting in Pine Bend (with expansion) closing in early 1987. Similar effects occur if Pine Bend is not granted the expansion, only Louisville Sanitary Landfill will close after Pine Bend. In this case, Pine Bend will close in mid-1985.

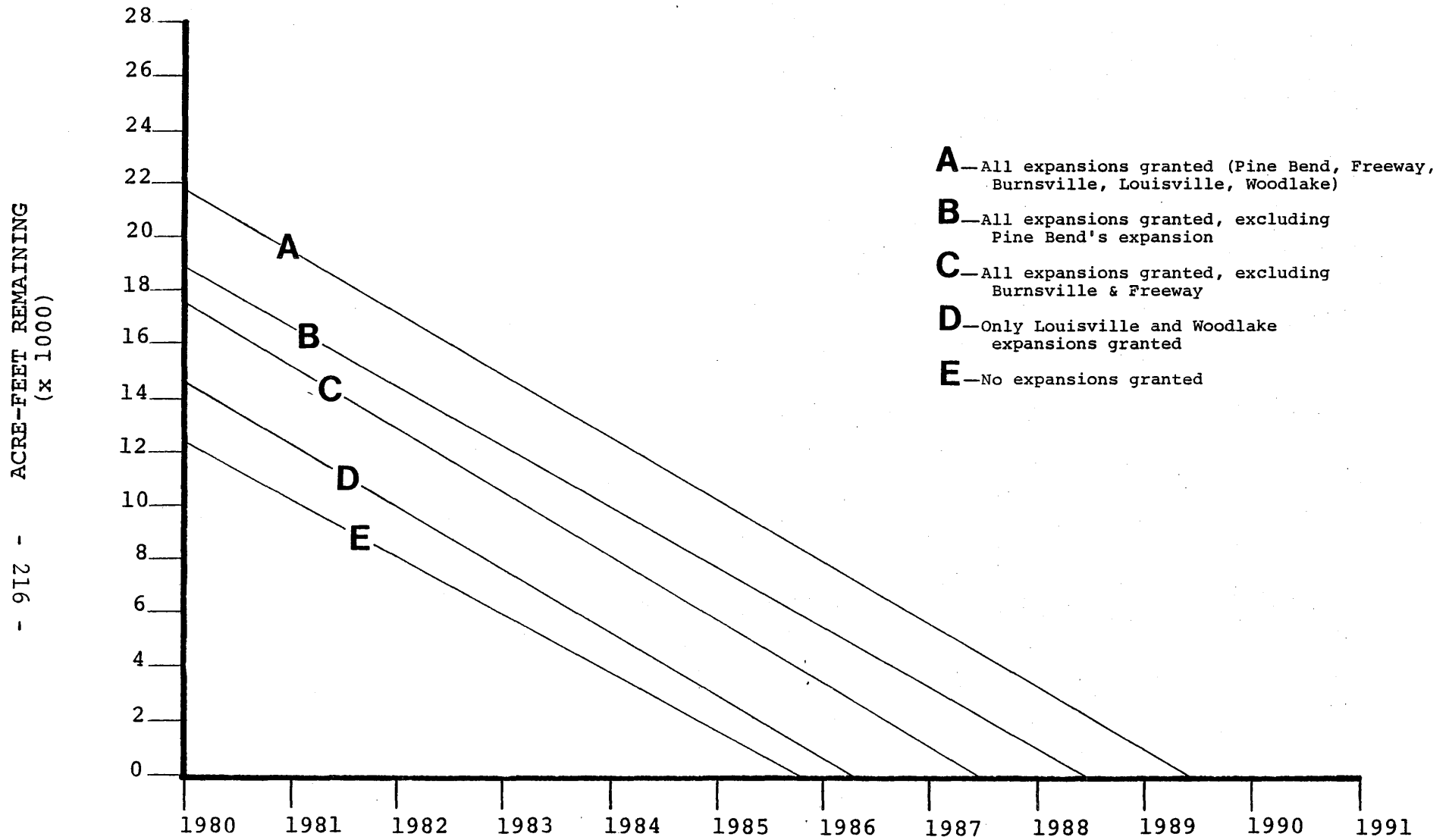
NO ACTION ALTERNATIVE

SOCIO-ECONOMIC IMPACTS

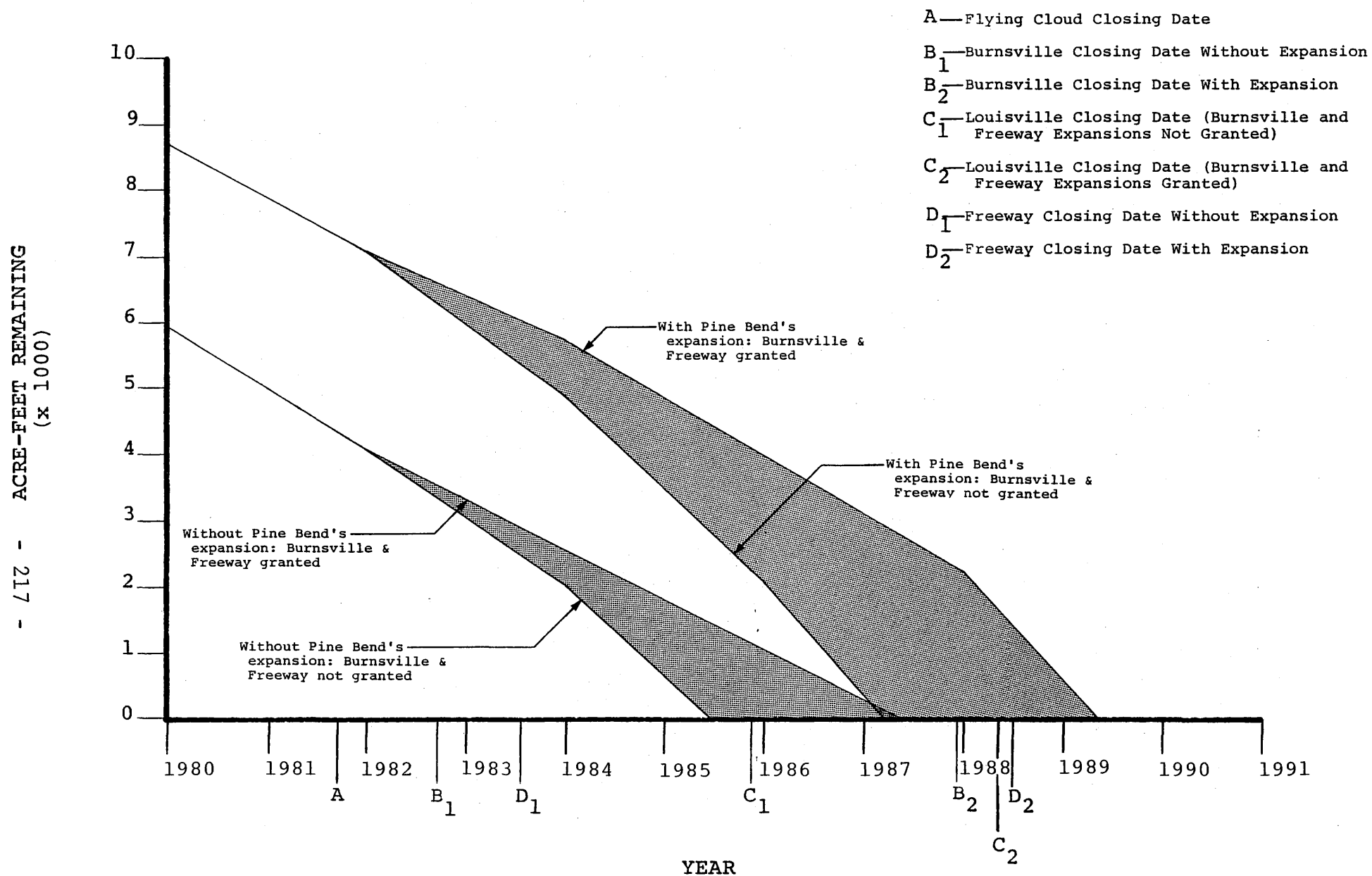
If the proposed expansion to Pine Bend Sanitary Landfill is not granted, three elements of the Regional solid waste management system would be affected directly: refuse haulers, neighboring landfills, and County and Regional government charged with siting new landfills. The general population served will be affected either directly or indirectly through secondary effects of changes in the solid waste management system. Finally, the City of Inver Grove Heights would also be affected by an earlier closing date.

Figure VI - 1

SEVEN COUNTY REGION LANDFILL SYSTEM:
DISPOSAL CAPACITY PROJECTION



PINE BEND DISPOSAL CAPACITY PROJECTION



As noted earlier, if Pine Bend is not granted the expansion, it will close in mid-1985 or early 1987 depending on whether neighboring landfills are granted expansions. The haulers using Pine Bend Sanitary Landfill will then have to dump their loads at other landfills which are still open. This will result in increased nonproductive driving time for some haulers. Both labor and fuel costs for these haulers will increase resulting in increased collection fees to the residents. Also new haul routes may have to be established resulting in increased wear and nuisance problems (e.g., litter, noise, fugitive dust, etc.)

The increased receiving rates at other landfills may result in increased operational expenses in order to handle the additional volume. This may result in higher disposal charges which may in turn result in higher collection fees to residents.

The proposed expansion represents 2790 acre-feet of new landfill capacity. If not granted, it is reasonable to consider this capacity as part of that required by any new landfill serving the area. Developing a new landfill involves three phases or elements of work. These are preliminary planning, siting and site preparation, and operation. Generally the first two phases include assessment of need, alternatives analysis, site inventory, site selection and acquisition, environmental impact statement, hearings, permit applications, and construction and site preparation. Operation is an immediate occurrence following the first two phases.

Table VI-2 is an example of landfill development costs for a 120 acre parcel of land which will be used as a sanitary landfill. The first phase in the development of a site will be landfill base preparation which will involve grubbing, excavation and overburden material, grading, and the emplacement of lining material. Leachate collection and treatment system costs will vary depending on site conditions. Additional costs pertaining to a sedimentation basin and drainage facilities are included in this report. To prevent scavenging, vandalism, and unauthorized dumping, a 10-foot high heavy gauge chain-link fence be erected. Additional cost factors include the construction of an access road, buildings for site personnel and equipment storage, landfill equipment and monitoring facilities.

If the entire site (120 acres) is developed initially, the estimated total construction costs would be about \$3,500,000 to \$4,000,000 as indicated in Table VI-2. Contingencies, legal, administrative and engineering costs can increase this amount by 20 to 40 percent, depending upon the complexities of the project. Thus, total estimated construction cost would approximate \$4,200,000 to \$5,600,000 to fully develop the site. Annual operation and maintenance costs, cover material, and site closure are not included in the above example.

If the expansion is not granted, a new landfill facility will have to be sited at least one year sooner. The planning, development and operation phases of landfill siting and construction for a new facility to serve the Region would have

TABLE VI-2

SUMMARY OF EXAMPLE
LANDFILL DEVELOPMENT CONSTRUCTION COSTS

<u>ITEM</u>	<u>ESTIMATED COST</u>	
Base Preparation		
Clearing & Grubbing	\$	\$ 180,000
Grading	\$ 97,000 -	\$ 170,000
Liner (Synthetic material w/o sand layer)		\$2,100,000
Subtotal	\$2,377,000 -	\$2,450,000
Leachate Collection System	\$ 80,000 -	\$ 92,000
Leachate Treatment System	\$ 85,000 -	\$ 600,000
Sedimentation Basin		\$ 4,000
Drainage Facilities		\$ 38,000
Chain-Link Fence and Gate		\$ 124,000
Access Road		\$ 4,000
Equipment Storage Facility		\$ 24,000
Personnel Facility		\$ 10,000
Monitoring Facilities		\$ 3,000
Landfill Equipment		\$ 625,000
TOTAL	\$3,374,000 - \$3,974,000	

- NOTES:
1. Cost estimates are based on similar constructed projects, adjusted to reflect mid-1979 costs.
 2. Contingencies, legal, administrative and engineering costs can increase this amount by 20 to 40 percent, depending upon the complexities of the project. These costs are not reflected in this table.

to be accelerated accordingly. The proposed expansion of Pine Bend Sanitary Landfill represents about seven percent of the Region's new landfill capacity needs through the year 2000. Even if all other landfills are granted expansions in absence of the Pine Bend expansion, resulting in Pine Bend's closure in early 1987, the margin of remaining capacity in the Region will be increasingly small.

The City of Inver Grove Heights will be affected by Pine Bend closing nearly two years sooner. Primarily, the city will be able to begin development of their City Park that much sooner. Secondary effects include reduction in truck traffic, noise, fugitive dust emissions and litter.

All of the impacts mentioned above will be similar whether Pine Bend closes in 1985 without the expansion or in 1987 with the expansion. Therefore, the net impacts are relative to the time of closing and changes in the Regional solid waste management system.

ENVIRONMENTAL IMPACTS

Three significant environmental impacts would result directly from not granting the expansion to Pine Bend Sanitary Landfill. First, the abandoned railroad bed bisecting the existing landfill would remain as an empty valley between the two permitted halves of the landfill. Surface water runoff characteristics, with this irregular site plan continued, will be much more conducive to water infiltration into the buried refuse material via the railroad bed valley and settling pond. This increased infiltration will result in the landfill reaching field capacity sooner. (Refer to Water Quality Section - Surface Water for further discussion.)

Second, the expansion represents 2790 acre-feet of additional refuse material. This added quantity of refuse will increase the total leaching potential of Pine Bend Sanitary Landfill. The amount of leachate any landfill generates is a direct function of the amount of refuse buried (see Water Quality Section). If the expansion is not granted, the leaching potential would not be increased when considering volume of refuse only. This consideration must be balanced with the improved surface water runoff characteristics as a result of granting the expansion as mentioned above.

Third, if the expansion is granted, the railroad bed "valley" will be filled in to the height of the presently permitted areas. Therefore, if the expansion area is not granted there will be less usable final surface area for active recreation use by the City of Inver Grove Heights. The expansion increases the amount of relatively level surface area by over 50 percent. The surface area under the presently permitted site plans could be used for other uses such as passive recreation. However, the City of Inver Grove Heights greatest present needs are for active recreation areas suitable for ballfields.

SITE SPECIFIC DESIGN ALTERNATIVES

SURFACE WATER RUNOFF CONTROL

The landfill boundaries, as currently permitted, exclude the areas being proposed now for lateral expansion. Final grades on those areas to be filled are sloped to promote surface runoff into existing natural graded areas where the runoff water is ponded or flows via natural drainage channels into adjacent areas away from the landfill. Grading to promote surface runoff is necessary to minimize rainfall penetration into the fill volume where it would percolate and leach soluble constituents from the waste and form leachate.

The proposed project expands laterally the areas to receive fill; the final landfill elevation remains the same as currently permitted and a revised final grading plan indicates a greatly improved situation will exist regarding surface runoff if the old railroad right-of-way (which currently bisects the landfill) is included in the area to be filled. The net benefit of including the proposed areas into the landfill is the achievement of improved surface runoff control therefore, decreased potential for pollution of subsurface water because of reduced leachate generation rates. On this same basis, the alternative to deny expansion would maintain a situation that is environmentally less acceptable than that provided by the proposed surface runoff plan. Additional or alternative surface runoff controls other than those in the proposed site development plans are not necessary.

LEACHATE CONTROL

Geologic and hydrologic conditions at the Pine Bend Sanitary Landfill site are such that installation of a liner beneath the refuse to be deposited there was not required, therefore, a leachate collection and treatment system was not installed at the time the landfill was constructed in 1971. Monitoring of the ground water in accordance with recommendations in a report prepared by a consulting engineer, Gerald M. Sunde, titled "Hydrogeologic Study of the Pine Bend Sanitary Landfill" dated December, 1978, has not revealed any effects on ground water from the existing landfill operation. The report theorizes that some leachate, in time, will reach the underlying drift aquifer but due to the process of attenuation while percolating through the unsaturated alluvial soils (80 to 130 feet thick), the composition and strength (concentration) of the leachate will be such that there will be a minimal polluting effect therefore, a leachate collection/treatment system was not proposed in the lateral expansion areas. Since the landfill was designed and must be operated to minimize leachate generation to the extent possible, and in view of natural attenuation (treatment) taking place within the 80 to 130 feet of subsoils lying beneath the fill, a requirement for liner installation was and still is deemed very costly, therefore, uneconomical and an unreasonable alternative.

Any leachate treatment system will vary depending on site conditions which influence flows and pollutant loadings. Capital costs for treatment facilities can vary from an estimated \$85,000 (for leachate with low strength pollutant loadings) to \$600,000 (for leachate with high strength pollutant loadings). The alternative to no liner and leachate control is continued extensive monitoring of ground water for possible effects during the active filling period and postmonitoring for a period (as yet unspecified) following final closure of the landfill.

GAS CONTROL

The existing Pine Bend Sanitary Landfill has no special gas control system installed, nor does the proposal for lateral expansion contain a provision for such control. Phoenix, Inc. owner, made an investigation of the feasibility of capture and utilization of methane produced at the landfill. The investigation concluded that the landfill is still at too early a stage of decomposition for methane production.

The landfill's operational practices provide an additional protection against any methane hazard since the amount of water in contact with the buried refuse is kept to a minimum, the rate of decomposition is slow and only small amounts of methane gas will be produced over a long period of time. The low rate of gas production reduces the possibility of explosive concentrations being reached. Also, no occupied buildings are adjacent to the landfill which might be subjected to any lateral movement of gas from within the landfilled refuse. Therefore, no new gas control alternatives would be deemed reasonable.

The option not included in the Phoenix, Inc., expansion proposal is the installation of a methane gas recovery system which would provide for recovery of a valuable resource material from such a waste source. Assuming an increasing market over the entire time this huge mass of refuse generates gas, consideration should be given again to this energy resource recovery option before the landfill capacity remaining would make it an unnecessarily expensive installation. Such an installation would be considered environmentally and socially acceptable and should provide an income producing source to the landfill operator and future industrial property managers over a relatively long period of time. If this option is to be considered, certain operational changes to enhance the production of methane gas should be implemented. One such change would be separation and placement of municipal refuse in certain parts of the landfill and general demolition (lower organic content) wastes in another area where the gas recovery system would be installed. Other inexpensive operational changes might also be made but should in no way increase the potential environmental impacts of such a landfill at that site. Obviously any efforts to increase rainwater entry into the refuse to promote generation of methane and assure a viable recovery system is contrary to gas control measures now in site, it would cause greater leachate generation and increase the potential for pollution of the ground water. If present efforts to minimize this potential are continued, detailed analyses would be required to determine if there would be sufficient payback from such a gas recovery system.

COMPACTION, SHREDDING, BALING

Compaction

Compaction of solid wastes to achieve volume reduction can significantly increase the capacity and life of a sanitary landfill. Compaction also results in minimization of vectors and potential fire hazards. Pine Bend Sanitary Landfill currently utilizes the latest mobile waste compaction equipment. The use of these specialized steel-wheeled landfill compactor vehicles results in significantly greater compaction (10 to 15 percent) than that of rubber-tired or tracked machines of comparable weight. Coupled with proper operational techniques, the use of these compactor vehicles has resulted in excellent compaction ratios at Pine Bend in the range of 1200-1600 pounds per acre-foot. More effective compaction alternatives are presently not available.

Shredding

Shredding is a solid waste volume reduction technique which consists of milling the wastes to reduce waste constituents to smaller, more uniformly sized particles.

A shredding operation normally consists of a shredding unit, a transport network, and the shredfill (landfill accepting shredded wastes). Several types of shredding devices are used including vertical and horizontal axis hammer mills, vertical axis grinders, and horizontal axis impactors. These shredders also usually include a variety of conveyors for waste routing scales, truck loading and unloading platforms, and storage bins or areas.

In the shredding process, solid wastes are milled to produce uniform particle sizes on the order of two to four inches in diameter. Waste size reduction results in up to 30 percent greater in-place waste density at the shredfill site. On a site specific basis, daily cover may not be required, since litter and vector problems are reduced. Decreased settlement and improved operation during cold and wet weather have also been noted.

Full scale shredder technology is currently economically unfeasible at small disposal sites. For a 300 TPD facility, current costs are on the order of \$7.00 per ton (\$7.89 per metric ton). A detailed analysis would be required to determine if the benefits in terms of saved landfill space and reduced cover would be sufficient to justify the capital and operating costs incurred to implement a shredder system.

Baling

Baling is a solid waste volume reduction technique which consists of compacting solid wastes in high density, (approximately 1800 lbs/cu. yd.) rectangularly shaped bales.

An on-site solid waste baling operation includes a baling plant and a specially designed balefill (landfill accepting baled wastes). Alternatively, the baling plant may be located at a large quantity source of solid waste or at a waste transfer collection point.

A typical baling plant may consist of stationary equipment such as horizontal and inclined conveyors, a load-cell scale, a high density baler, a central control tower with control panels, hydraulic bale push rams, and a bale truck loading platform. Mobile equipment might include an articulated front-end loader, a small general purpose "bobcat" loader, and a forklift.

Once processed the bales are stacked for disposal at the active face. Soil cover may be applied periodically.

The basic advantages of the process increase reductions in required landfill volume, ease of waste transport and placement, vector and litter reduction, decreased settlement, and reduced requirements for cover material. A potential disadvantage is that the compaction process slows the decomposition process, thus potentially extending the period of time during which the landfill will continue to generate gas and leachate. Accordingly, the conditions which favor this alternative are in areas in which long hauls are needed to reach the landfill, and in areas in which there is a shortage of landfill sites thus requiring maximum utilization of available land.

There is currently a study underway by the U.S. Environmental Protection Agency to determine the relative environmental advantages of balefill sites over conventional landfills. This information is not available in final form at this time.

Full scale baling technology is currently economically unfeasible at small disposal sites. For a 300 TPD facility current costs are on the order of \$5.00 per ton (\$5.60 per metric ton).

WASTE REDUCTION

Waste reduction (or source reduction) seeks to control and minimize the quantity of waste produced by changing product designs and/or consumer behavior. The policies adopted by the U.S. EPA, the Minnesota Pollution Control Agency, and the Metropolitan Council of the Twin Cities Area place the highest priority on waste reduction methods of solid waste management.

Reducing the amount of waste will reduce:

- Production costs
- Public expenditures for waste management
- The rate of resource consumption
- Potential environmental impacts

Waste reduction works as a solid waste management tool by preventing waste where possible. Waste reduction is accomplished through redesign of final products and packaging through increased product lifetime, and through reduced consumption levels. Although waste reduction will at best reduce the volume of solid waste of 15 percent, waste reduction has been given a favored status in solid waste management policies because the total savings from disposal costs, reduced energy use, and reduced materials use are greatest when establishing waste reduction methods before implementing recycling and energy recovery programs.

There are several approaches that can be used to reduce waste generation at its source:

- Deposits
- Packaging Reduction
- Paper Reduction
- Waste Reduction and Public Education
- Produce Charges
- Waste Charges
- Bans
- Warranties
- Newsprint Conservation

DEPOSITS

A deposit is an extra charge to the consumer to encourage reuse of a product. The deposit is refunded when the reusable portion of the product is returned. Although the deposit may be mandatory, the consumer may elect to forfeit the deposit and not return the reusable product. Deposit measures are limited to products that have a readily reusable component, such as beverage containers, tires or automobile hulks.

Deposits provide an economic incentive to return a product to a central collection point so it can be used again with minimal recovery costs. A benefit of deposits is that a portion of the deposit may be used to defray the cost of recovering and properly disposing of products that are not returned.

Container deposit laws have been proven effective as a method of waste reduction. National estimates indicate that container deposit legislation can reduce the solid waste stream by two to four percent.

Mandatory deposit measures have been enacted by Oregon, Vermont, Michigan, Delaware, Iowa and Maine. Similar action by the Minnesota Legislature would be required to implement mandatory deposit programs in Minnesota.

PACKAGING REDUCTION

Three basic approaches to packaging reduction exist: the regulator approach, standardized packaging laws, and the industrial education approach. The regulatory approach allows the State to review and suspend the use of packaging that constitutes a serious solid waste or environmental problem. Minnesota Statute 116.06 and Minnesota Rules SR-1 through SR-6 represent one form of the regulatory approach. The second approach--standardized packaging laws--would require certain products to be sold in packages meeting requirements for standard size, weight, durability and reusability. For example, based on national data the amount of packaging material could be reduced to 1958 levels by reducing packaging of foods, consumer goods, and the use of returnable beverage containers. The Minnesota Pollution Control Agency estimates that, such a change could reduce the state's solid waste volume by 11 percent annually. Minnesota's present packaging law will not be able to reduce waste by eleven percent, since the majority of wasteful packaging is not new and is, therefore beyond the scope of the law.

The third approach--industrial education--seeks to provide industry with information and assistance in researching and developing packaging methods that reduce solid waste. It is difficult to know how effective industrial education will be in reducing solid waste since information is not available on such a program in the United States.

OFFICE PAPER REDUCTION

Office paper reduction, a series of policies that shrink office paper consumption can be established by the public and private sectors to reduce solid waste. These policies include carbon paper reduction, increased use of microfiche, increased use of magnetic medium (computer discs and tapes), computer printout paper reduction, letter paper reduction, scratch paper reduction, machine copy reduction, and business forms reduction.

It is estimated by the Minnesota Pollution Control Agency that office paper reduction could reduce paper consumption by 4.5 percent annually. But, since only 52 percent to 53 percent of all consumer office paper is discarded, the potential reduction of solid waste amounts to 0.7 percent of the solid waste stream.

VOLUNTARY WASTE REDUCTION AND PUBLIC EDUCATION

Voluntary waste reduction has had moderate success in the past. Consumer preferences for purchasing products in bulk, for more durable products, and for smaller and more efficient automobiles are indicators of voluntary waste reduction. However, the attempts of state government to reduce solid waste generation have been insufficient and irregular to date.

The primary thrust of voluntary waste reduction is through increased consumer education and advertising. A program to reduce litter through education has had moderate success in Washington State. A large well-run advertising and education campaign is perhaps the only way of stimulating the personal initiative which is the heart of such a program.

An educational tool that has been suggested is requiring that designated products have information relating to the cost of the package and the composition of the product, particularly with relation to the presence of recycled or recyclable materials. Such aids to consumers in the marketplace may greatly enhance any education efforts.

Since very little literature is available on the reduction impacts of public education programs, an adequate method of estimating potential reductions is not available. Education programs, however, may provide the most effective means of waste reduction because of political and economic problems with regulatory approaches.

PRODUCT CHARGE

Today's prices for products generally do not reflect the costs imposed on society for disposal of solid waste. The goal of product charges is to incorporate those costs into the cost of the product. The charge could take three forms: a unit charge, a weight charge, or a combination of both. The unit charge has the least administrative burden, while the combination would have the greatest reduction impact. This approach has appeal, as it uses the market to encourage solid waste reduction, and provides funds for the solid waste management costs imposed by products. While this policy could solve financial problems encountered by local government for solid waste collection and disposal, it is doubtful whether a product charge could be applied on a state level, because of potential conflict with interstate commerce.

WASTE CHARGE

A waste charge is a fee levied on each ton or cubic yard of waste being disposed. The fee would be collected at the landfill and high technology facility as a part of the dump fee. Although there is little literature available about the impacts of waste charges, it is expected that such a charge would be less effective than a national product charge in curbing waste. It is estimated that a waste charge would reduce waste by less than two percent. Hence, a waste charge may be more effective as a funding mechanism rather than a waste reduction technique.

BANS

Bans can be used to eliminate solid waste that creates waste management problems. Such product controls can generally be applied only if alternative products and materials exist. For example, the Minnesota Legislature has banned nonreturnable plastic milk containers because they were deemed to pose a major waste problem. Bans of certain kinds of tires and packaging may lead to a reduction in solid waste generation.

WARRANTIES

Warranties on durable goods could be extended for a specified length of time to reduce the flow into the solid waste stream. The U.S. Environmental Protection Agency has determined that if all autos and trucks were sold with radial ply tires, the solid waste stream would be reduced by 0.7 percent. Minnesota could facilitate this waste reduction technique by requiring a 40,000 mile warranty on new tires sold in Minnesota and providing incentives (e.g. deposits) for tire recapping. Since little literature is available, it is difficult to judge the waste impact of other warranty programs.

NEWSPRINT CONSERVATION

Newsprint conservation is accomplished through thinner paper and changes in printing format. The American Paper Institute has reported that newsprint weighing 5 percent less than common newsprint has performed satisfactorily. Also, changing the standard six-column printing format to eight columns for news and nine columns for advertising will reduce current usage by 5 percent.

Based on Minnesota PCA estimates, if both forms of newsprint conservation were used in Minnesota, about 20,000 tons of waste could be prevented annually. This represents about 0.7 percent of the municipal solid waste stream.

SUMMARY

From the preceding discussion of various waste reduction techniques, it may be concluded that container deposits, packaging reduction public education and office paper reduction offer the greatest potential in Minnesota at this time. Container deposits and packaging reduction offer the largest potential reductions of waste. Public education has great potential because it may provide a politically acceptable and cost-effective alternative to regulatory approaches to waste reduction. Finally, office paper reduction has the greatest potential economic savings to State taxpayers.

Voluntary waste reduction seems promising at the moment. Mandatory programs would require legislative action. Inasmuch as broad-scale government intervention may have a significant impact on the market, legislative action on waste reduction should be initiated only after the potential effects have been thoroughly analyzed.

Table VI-3 summarizes the potential and current status of waste reduction efforts in Minnesota. Although a maximum of 15 percent of the total waste stream in the state could potentially be reduced through full implementation of these methods (which often require new state legislation), a more realistic estimate of the waste reduction impacts on the solid waste stream by 1985 is no more than two or three percent.

TABLE VI-3

Summary of Waste Reduction Methods:
Potential and Current Status

<u>Waste Reduction Method</u>	<u>Maximum Potential Reduction of Waste Stream by 1985 (percent of total waste stream)</u>	<u>Implementing Bodies</u>	<u>Current Status in Minnesota</u>	<u>Feasibility Outlook</u>
A. Packaging Reduction (includes container deposit)	11.0%	State or industry voluntarily.	MS 116-06, MN Rules SR-1 through SR-6* Effect to date: <u>0.0%</u>	Current scope of law too limited to have substantial immediate impact.
B. Office Paper Reduction	0.2%	Any governmental unit or private firm.	N.A.	Excellent; economic incentive currently exists.
C. Waste Charge	1.0%	Local or state government.	No ongoing program.	Little information available; possibly more effective as a funding mechanism.
D. Newsprint Conservation	0.7%	State or industry voluntarily.	N.A.	Good; format change very feasible.
E. Radial Ply Tires, instead of Non-Radials	0.7%	State government.	Currently controlled by private industry and supply-demand.	New legislation possible.
F. Other Conservation Techniques (voluntary waste reduction, public education, product charges, leans and warranties)	1.4%	Any governmental unit.	Limited public educa- tion currently exists; other methods results in only moderate success.	Data not available.
TOTAL POTENTIAL WASTE STREAM				
REDUCTION BY 1985.....		15.0%		

* MS 116-06: Packaging program statutes
SP-1 through SR-6: Packaging program rules.

MATERIALS RECOVERY

SYSTEM TYPES

General

Materials recovery encompasses methods and procedures for extracting useful materials from solid waste for return to the economy. The prime objectives in the development of materials recovery systems are: 1) to conserve natural resources and energy; 2) to reduce land requirements for disposal; 3) to facilitate the preparation of refuse derived fuels for energy recovery systems.

The purpose of a materials recovery system is the separation of the valuable marketable fractions in the solid waste. Traditionally this has been accomplished by scavenging or picking (a technique whereby an employee manually removes items from mixed waste). This type of picking operation can either be established at the landfill site or at a transfer station type of facility. Mechanical separation methods capable of segregating solid waste into valuable components have developed, based on techniques used in the mining and paper industries. Material recovery systems have concentrated on the reclamation of paper (the most abundant component in solid waste); magnetic metals (the most easily extractable); aluminum (the most highly valued); and glass (to date the hardest to extract).

Component separation is a necessary operation in the recovery of resources from solid wastes. The required separation may be accomplished manually or mechanically. When manual separation is used, preprocessing of the wastes is not required; in most mechanical techniques, however, some form of size reduction is required as a first step.

There are two basic approaches to mechanical material separation; wet processing and dry processing. In the wet processing concept, separation technology presumes preliminary size reduction using a hydropulper. The light fraction from the hydropulper contains the majority of the aluminum, paper fiber, and glass. The heavy fraction from the pulping operation contains the majority of the magnetics. Each of these streams is processed to remove the marketable products. When the preprocessor is a dry system, air classifier heavies can be placed in an aqueous slurry and processed using wet processing techniques.

In the dry processing concept, separation technology begins with size reduction using a shredder. After shredding, the solid waste is air classified, where it is separated into light and heavy fractions. The light fraction contains the paper fraction, and the heavy fraction contains the magnetics, aluminum, and glass. Each of the two streams produced by air classification can be further processed to recover the marketable materials.

SOURCE SEPARATION

Source separation is a grass roots approach to resource recovery. It involves having the generators of solid waste (households and businesses) divide their waste into recyclable and nonrecyclable fractions. Recyclable fractions include paper, glass, ferrous metal, aluminum, plastic, textile, motor oil, auto hulks and yard waste, principally leaves for compost. The segregated materials can either be collected as part of the regular municipal or private collection service or the waste generators can bring the recyclables to a collection or "drop-off" center. Several methods are used to collect the separated materials, specifically; curbside pick-up with separate vehicle, curbside pick-up with rack, curbside pick-up with trailer, collection centers, labeled green boxes, office paper collection programs, and corrugated collection programs. Source separation can also involve yard wastes which can be delivered to a community facility for composting and later reuse as a soil amendment.

SIZE REDUCTION

This is the term applied to the conversion of solid wastes as they are collected into smaller pieces. The objective of size reduction is to obtain a final product that is reasonably uniform and considerably reduced in size in comparison to its original form. It is important to note that size reduction does not necessarily imply volume reduction. In some situations, the total volume of the material after size reduction may be greater than that of the original volume. In practice, the terms shredding, grinding, and milling are used interchangeably to describe mechanical size-reduction operations.

Size reduction is an important factor not only in the design and operation of solid waste disposal systems, but also in the recovery of materials for reuse and for conversion to energy. For example, some form of size reduction is necessary for the liquid transport of solid wastes.

Shredding is commonly used in systems designed to recover materials and energy from solid wastes. Because of varying particle size, moisture content, chemical composition, and physical characteristics, municipal solid wastes are not an ideal fuel. However, by dry (as received) or wet shredding, following by separation, the organic materials in raw solid wastes can be transformed into a relatively homogeneous mixture with uniform size, heating value, and moisture content. Components from the remaining inorganic materials can also be recovered more easily because of their reduced size.

Potential Markets: Typical Materials

In general, secondary materials markets are volatile and subject to fluctuations depending on the specific material. Marketability of recovered materials is subject to large variations dependent on the technology used for recovery and resultant quality of each material. Historical experience has indicated that secondary materials recovery systems have been inconsistent in producing secondary materials of such quality that will be readily marketable, and that the material markets themselves have been subject to substantial fluctuations that are not always favorable toward resource recovery.

There are markets available in the metropolitan area for recoverable waste materials. These markets are not large enough to incorporate all of the waste material that is presently available. The total metro area recycling capacity for 1980 is 312,000 tons of paper. The total amount of waste in the form of paper available in the metro area is 821,025 tons. Analogous information is not available for other types of typical waste, i.e., glass, iron, aluminum, etc. In general, the markets for corrugated, aluminum and glass are excellent in the Metropolitan Area. The newsprint market is relatively good at this time but is subject to fluctuation. Increasing demand for wood and pulp products is strengthening secondary paper markets in the Region.

Potential Markets: Atypical Materials

The composting of refuse either with or without sewage sludge is a method of reducing the size and volume of refuse through biological and mechanical action into a usable product. Composting can be done by using a revolving drum to hold the waste which allows maximum airflow into the waste for the bacterial action to digest it. Or, it can be done by the simple spreading of refuse into linear piles and occasionally turning them. The reduction of volume in a typical composting operation is approximately 50 percent. As in other resource recovery methods, the success of composting is market dependent. There is a sufficient number of compost markets in and around the Metropolitan Area to help stabilize this form of recovery.

Plastics

There is little information available on markets for plastics.

ENERGY RECOVERY

TECHNOLOGIES

Refuse Derived Fuel (RDF)

The basic RDF system processes municipal solid waste to produce a transportable alternative solid fuel for use in fossil-fuel fired energy systems.

RDF fuel may be classified as coarse, fluff, or dust, depending on the degree of processing. Coarse RDF can be used in boilers equipped with grates, fluff RDF can be used in suspension-fired boilers, and dust RDF can be burned alone or emulsified with oil to form a slurry for use in conventional boilers. Each of the fuels can be substituted for ones which have received less processing.

Coarse RDF is prepared by shredding raw refuse. During this stage of processing, the nominal size of the incoming refuse is reduced resulting in partial homogenization of the waste. Coarse RDF contains large quantities of grit. All the undesirable components of the refuse (glass, grit, metal, chlorinated plastics) which present corrosion, erosion, and material handling problems are contained within the fuel. Coarse RDF bridges easily (hangs up in hoppers and will not flow) in storage. Coarse RDF has the same thermal properties as raw solid waste; i.e., 4600 btu/lb, 26 percent moisture and 29 percent ash.

Fluff RDF is prepared by air classifying and screening coarse RDF to remove most of the grit and large inerts such as cans, rocks, and metal debris. Air classification vacuums off light material, separating it from most of the chlorinated plastics. Unfortunately, large wood fragments are also separated, thus causing the loss of a desirable fuel component. Removal of screenable dirt, grit, and glass fragments to decrease the fuel ash content, further increases the heating value of the fuel while reducing the amount of material to be handled in the boiler's ash handling system. Fluff RDF has a nominal shelf life of about five days. Longer storage encourages spontaneous combustion. The material has the same bridging and flow characteristics as coarse RDF. Unscreened fluff RDF has a heating value of 5000 btu/lb, 26 percent moisture, and 22 percent ash. Screened material has a higher heating value of 5550 btu/lb and 12 percent ash. It must be recognized that less total tonnage of screened fluff RDF is made because of grit removal; hence, while screening improves the fuel product, some recoverable energy is sacrificed.

Dust RDF is the most advanced RDF form. Fluff RDF is blended with an embrittling agent (a chemical which hardens cellulose so that paper and cardboard will shatter upon impact) and processed in a heated ball mill until the product will pass a 100 mesh screen (0.15 mm). The product is homogeneous and is believed to

exhibit the least variability of any RDF. Dust RDF consists primarily of small paper fiber platelets. Consequently, it behaves like a powder, can be stored in silos, and can be handled with conventional flour and pulverized coal handling equipment. It is important to recognize, however, that an explosion potential exists when dust RDF mixed with air comes into contact with a spark. This is not a major drawback to the system, because explosion-proof handling equipment and fixtures are routinely employed when handling coal dust and flour. Of particular interest, dust RDF can be slurred with oil and burned in conventional oil-fired boilers. Dust RDF has a higher heating value of 6900 btu/lb and contains 10 percent ash and 2 percent moisture. It appears to have unlimited shelf life.

Finally, any of the three forms of RDF may be agglomerated or densified to form densified RDF (d-RDF). Coarse and fluff RDF agglomerate well in pelletizers, briquetters, and extruders, but agglomeration of dust RDF requires a lignin binder and processing in a briquette.

Waterwall Furnaces

Municipal refuse is delivered to the facility and deposited on a tipping floor or in the storage pits from which it is transferred to the furnace feed hopper. From the feed hopper, wastes are continuously drawn into the furnace where they are burned and heat is recovered.

Waterwall furnaces are enclosed by closely spaced water filled tubes. Water circulates through the tubes to recover heat radiated from the burning fuel bed. Integrally constructed (attached) waste heat recovery boilers generate steam while reducing the temperature of the exhaust gases. Heat is transferred by convection from hot gases passing over boiler tubes in the convection section of the boiler. Thus, a marketable product is created while reducing the stack gas volume and, consequently, permitting the use of smaller gas cleaning equipment.

In the combustion process, oxygen is required to burn the fuel and release heat. The combustion process can be improved considerably by agitating the fuel bed. Agitating results in rapid ignition, effective mixing, and leveling of the fuel bed. These factors combine to assure that all refuse particles will come in contact with air and thus increase the completion of combustion and minimize the amount of residue to be disposed.

Bottom ash falling off the end of the grate is generally quenched in a water trough and taken to an ash storage area prior to disposal. Fine materials (siftings) fall through the grates and are conveyed to a residue collection system. In some designs, siftings are reinjected into the furnace to recover the heat loss they represent by not burning to completion. Bottom ash and siftings are disposed in a sanitary landfill.

Flue gases leaving the boiler may also be passed through an economizer where some waste heat is used to heat the boiler feed water. Economizers improve the thermal efficiency of the unit.

The cooled combustion gases are passed through air pollution control devices and, after cleaning, are vented to the atmosphere through a stack.

Modular Incinerators

Modular incinerator systems which recover energy are considered to be an effective resource recovery approach for small communities or smaller energy users. These units are prefabricated and shipped to the site and consequently are suitable for smaller volumes of waste (5 to 30 TPD per unit), although several may be colocated to achieve capacities of up to 160 TPD. Modular units operate as a mass burning incinerator, which does not process the waste before combustion. Extremely large or dangerous objects may be sorted prior to incineration, but the remainder of the noncombustibles are landfilled as part of the residue.

The modular incinerators, generally consisting of a primary and a secondary combustion chamber, employ controlled air techniques to reduce the amount of air required to combustion in the primary chamber and to lower the level of their particulate emissions.

Ash and other noncombustible residue which settle on the hearth of the primary chamber after the combustion process are periodically removed by manually or automatically operated systems. In the manual system the operator scoops out the ash (by shovel or front-end loader) after the unit has been shut off and cooled down. In the automatic system, the ash is pushed or forced ahead of the burning waste until it exits the chamber, generally through a drop chute into a water-sealed pit or an air-lock chamber.

POTENTIAL MARKETS

In a study conducted by Hennepin County, several markets for refuse derived energy have been identified. These markets are shown in Table VI-4. This table shows the size of the market in tons of waste per day, and a preliminary estimate of feasibility. Probably the best potential market for steam in the Twin Cities is the Hoerner-Waldorf Plant in the Midway district of St. Paul. Hoerner-Waldorf is a large consumer of steam and would be a good candidate for a water wall combustion system.

TABLE VI-4
POTENTIAL MARKETS FOR REFUSE DERIVED ENERGY

Consumer	Average Base Load (Tons/Day)	Preliminary Estimate of Feasibility	Comments
<u>Promising Markets</u>			
Cargill	80	Possible	MCU technology
FMC Northern Ordnance	140	Low	Base load under 50 TPD refuse equivalent
Hoerner-Waldorf	1100	Good	High, stable energy use
Munsingwear	75	Good	MCU technology
Olympia Brewing ¹	240	Good	Cluster member
3M (Bush Ave.) ¹	250	--	Good feasibility as cluster member
Whirlpool ¹	50	--	Low rummer energy use. Good feasibilty as cluster member
3M (Maplewood)	<u>375</u>	Good	Energy use may increase 20% to 40% in 5 years
Subtotal	2310		
Northern States Power Company	1000		
Minnegasco Energy Center, Inc.	<u>250</u>		
TOTAL	3560		
<u>Uncertain Markets</u>			
Buckbee Mears	--	--	Market insta- bility
Metro Airport	--	--	Limited baseload; should be con- sidered with Northwest Airlines
Twin City Ammo	--	--	No contact

¹3M/Olympia/Whirlpool Cluster - Good estimate of feasibility for integrated project.

The basic conclusions pertaining to each of the identified markets for energy are discussed following:

1. Hoerner-Waldorf - appears to be the most attractive potential market for refuse derived energy. A resource recovery facility, for approximately 1100 TPD of refuse, would be required to meet the stable 250,000 lb/hr load demands. Traffic considerations and impacts should be minimized by use of existing interstate highway systems. Plant siting may be subject to local opposition.
2. Olympia Brewing Company - the plant, as a facility by itself, could provide for implementation of a steam-producing plant burning an estimated 240 TPD on refuse. This would be just within the present economical low end of the capacity range of field erected boiler plants and within the economical range for package incinerator units (MCUs). The economics of steam generation, as well as traffic impacts and siting considerations, would require investigation in greater detail (beyond the scope of this study) to fully ascertain the potential of this market. This plant should also be considered as part of a three-plant cluster serviced by a central refuse fired steam generating plant (see below).
3. Whirlpool Company - this plant, as a facility by itself, has fuel usage considered too seasonal to serve as an economical market for refuse derived energy. The plant is considered a feasible refuse derived energy market only if it is included in a three-plant cluster.
4. 3M (Bush Avenue) - this plant as a facility by itself, has a load requirement of approximately 250 TPD. Its present equipment, however, does not have ash handling equipment, limiting its potential as an RDF market. This plant may be considered as a potential market for refuse derived steam as a market alone, or if it is included as part of a three-plant cluster.
5. 3M/Olympia/Whirlpool - the three plant cluster configuration, which would use approximately 540 TPD of refuse, is a potential market for refuse derived energy. Problems which would require special consideration include implementation and management strategies, siting considerations, traffic problems and potential neighborhood nuisances.
6. 3M (Maplewood) - this plant appears to be a potential market for refuse derived energy. Planned expansion in the near future should increase the present average energy requirements (approximately 375 TPD of refuse) by 20 to 50 percent. Coordination with the planned expansion, siting considerations and traffic problems are prime considerations.
7. Munsingwear, Inc. - this plant appears to be a potential market for refuse derived energy, using approximately 75 TPD of refuse. Siting considerations, traffic problems and limited usage (290 days per year) would require careful planning.

8. Northern States Power Company - a portion of NSP's Riverside plant was offered as a possible market for refuse derived fuel. However, the County would be expected to assume full responsibility for upgrading flue gas discharges to air pollution control standards, disposal of ash residue, etc. The most attractive alternative at Riverside appears to be the recommissioning of the 400# boilers for units No. 1 and No. 2, thereby providing potential refuse disposal capacity of about 1,000 TPD.

Siting considerations at NSP's Black Dog plant will make facility implementation difficult. The use of other NSP area facilities is not feasible, due to insufficient RDF technological advancements.

9. Minnegasco Energy Center, Inc. - the center is a possible market for refuse derived fuel, but only for the lowest seasonal energy demands (approximately 250 TPD of refuse). Siting problems may become an issue of importance for use of this center.
10. Cargill - this plant is not considered a potential market because: 1) the existing boilers have no ash handling capability; 2) no sites are available near the boiler for handling and storage; 3) there might be possible local opposition to using nearby sites; and 4) an energy demand could be insufficient alone to justify an RDF production facility.
11. FMC Northern Ordnance - this plant is not considered a potential market because of: 1) past coal burning experiences and minimal overall experience in firing RDF; 2) unavailability of adequate space for the required boilers and fuel storage on or near the plant site; 3) no other large energy users are located adjacent to the plant; and 4) large seasonal fluctuations.
12. Metro Airport - the extent of this market is uncertain. Metro Airport should be kept informed as to the status of solid waste plans and offer assistance in determining the feasibility of including refuse as a fuel for any planned energy systems.
13. Metropolitan Waste Control Commission - the Metro plant is not considered a potential market for refuse derived energy.

If all of these promising markets listed were developed, approximately 3210 TPD (tons per day) of refuse would be burned to generate steam. However, the seasonal changes in refuse generation, variations in operating costs for different facilities, and the need for dependable capacity (a way to dispose of solid wastes when, for any reason, a resource and energy facility is out of service) complicate the alternatives which may be considered.

POTENTIAL PROJECTS

Hennepin County has been actively evaluating energy resource recovery systems for several years. Recently, Hennepin County entered into contractual arrangements with several consulting firms to organize and evaluate several energy resource recovery options. These options include the sale of RDF to Northern States Power Company, the production of solid waste energy for a heating district, and the evaluation of solid waste modular combustion units. Another alternative which has not yet been fully developed is the use of solid waste energy for a new industrial plant within Hennepin County, such as an alcohol production plant.

Hennepin County has retained a consulting firm to determine the technical and economic feasibility of processing 1,000 to 2,000 tons of RDF for sale to Northern States Power Company. Two of Northern States Power Company's electrical generating plants are possible users of RDF: The Riverside plant, approximately three miles north of the Minneapolis central business district (CBD) and the Blackdog plant, 13 miles south of the Minneapolis CBD. The consultant, under the direction of Northern States Power Company, will analyze these plants and report on how the RDF can be used in existing facilities. The study will include an evaluation of modifications necessary to NSP's plant, specifications of the RDF product, and an estimate of the economics of RDF use. Other studies, which will coincide with the NSP study, will consist of an evaluation of the establishment, cost, and location of an RDF plant, the evaluation of other markets for RDF, and a financial and legal evaluation necessary to implement the RDF proposal.

Another alternative for refuse in Hennepin County would be the production of solid waste energy for a heating district. The objective of this study is to examine the technical and economic feasibility of producing a solid waste fuel or steam for heating districts and the Minneapolis CBD. The consultant will evaluate mass burning, in a water wall combustion system, the use of RDF directly by existing heating systems. Possible markets to be analyzed are the Central Heating Company, the University of Minnesota and the Metropolitan Medical Center.

Hennepin County also has retained a consultant to determine the economic and technical feasibility of using solid waste or RDF at industrial plants with modular combustion units or existing in-house facilities. A preliminary study should identify several markets for this type of modular combustion unit. This study, however, will proceed further to identify a feasible site, estimate capital and operating costs, determine delivery conditions of waste, and will evaluate the elements of market contracts for such systems.

Hennepin County has also considered the location of a new industrial plant in the county as a large energy consumer for solid waste energy. Additional work remains to be done including the identification of energy intensive industries that could be attracted to Hennepin County by a long term energy supply at a reasonable cost, identification of potential plant sites which meet a company's requirements, and preparation of schematic designs, and estimates of capital and operating costs of a solid waste energy plant.

One of the major considerations in siting an energy resource recovery system within Hennepin County is its location and proximity to Ramsey County. It may be most economic, all factors considered, to use waste from Ramsey County in a Hennepin County system or vice versa. Such a waste management decision will require planning and coordination involving all parties involved in the decision and subsequent operation of the system.

The City of St. Paul has retained a consultant to analyze the existing solid waste management system in St. Paul, to identify and analyze alternative markets in the St. Paul area for use of energy from solid waste, and to coordinate with Hennepin County planning efforts. Some of the alternatives identified in Ramsey County are modular incineration units, handling up to 400 tons per day of waste, and Hoerner-Waldorf Co. which could use the energy from 1200 tons per day of waste. Hoerner-Waldorf is a large paper manufacturing complex located in the Midway district of St. Paul. Hoerner-Waldorf became actively interested in refuse-derived energy in 1973, and since then has been the center of several energy resource recover proposals, including the Twin-RESCO Proposal in 1976. The Twin-RESCO Proposal, it is understood, never reached the implementation stage because of problems involved in tipping fees, neighborhood opposition to siting, and proposed steam escalation clauses. The Hoerner-Waldorf plant probably provides one of the best markets for steam in the Twin Cities. The watershed for the Hoerner-Waldorf project could quite likely include both Hennepin and Ramsey Counties. This would require some form of waste management agreement between the two counties.

The City of St. Paul also is proceeding with efforts to establish organized waste collection and to develop and define a waste transfer and transportation plan. These efforts are viewed as necessary to resource recovery implementation and part of the overall program to develop resource recovery.

Anoka, Dakota, Washington, Scott and Carver Counties have the potential for small scale resource recover systems within their boundaries. The likely types of resources recovery systems used in these counties would be modular combustion units and/or composting systems. In these counties, as elsewhere, it is a necessary condition for success that any resource recovery system must be linked to a market for the energy to be produced. Decisions to implement resource recovery should be made only with firm commitments from a consumer of the product energy.

Three resource recovery scenarios have been developed by the Metropolitan Inter-County Council (MICC) staff as presented in the Background Study For Solid Waste Master Plans (Interim Study II). Briefly, these scenarios involve various combinations of small, medium or large refuse to energy facilities coming on line beginning in 1985 (in Hennepin and Ramsey Counties) and adding additional facilities in a logical sequence according to each county's need. Each resource recovery scenario also includes a source separation and waste reduction program beginning in 1985 which accounts for four percent of the total waste generated over 20 years.

Table VI-5 is derived from the MICC Interim Study II and provides estimates of the waste diverted from Pine Bend Sanitary Landfill from each resource recovery facility as outlined in the MICC staff report. The calculations in Table VI-5 were made by the Metropolitan Council to evaluate the potential alternatives to the proposed expansion and represent maximum recovery capacities. Figure VI-3 is a graphical representation of the same data. Results indicate that only scenario 3, involving the largest capacity resource recovery facilities in Hennepin and Ramsey Counties would have more "diversion capacity" by 1989 than the proposed Pine Bend expansion. Even this maximum scenario would not be in operation in time to substantially affect the present Region's landfill system if none of the other landfills were granted their expansions. In summary, if all other landfills were granted expansions except Pine Bend, only a maximum resource recovery scenario could provide enough capacity to extend the useful life of Pine Bend Sanitary Landfill the same length of time as the proposed expansion.

SYSTEM ECONOMICS

The following discussion of system economics includes another type of high technology, resource recovery method--mechanized composting. Although composting is typically handled as a method of materials recovery, it provides a relevant comparison of high technology costs.

Figures VI-4 through VI-6 indicate the estimated costs and revenues for each process by ton per day capacity range, based on a compendium of current data available. Historical data have been used whenever possible and published estimates have been used where actual data are not yet available. All capital cost estimates are in 1978 dollars. Amortized capital costs are based on a seven percent interest rate and 20-year amortization period. Capital costs in most cases include all contingency, engineering, legal and administrative costs, as well as bond acquisition, site preparation and construction costs.

TABLE VI-5

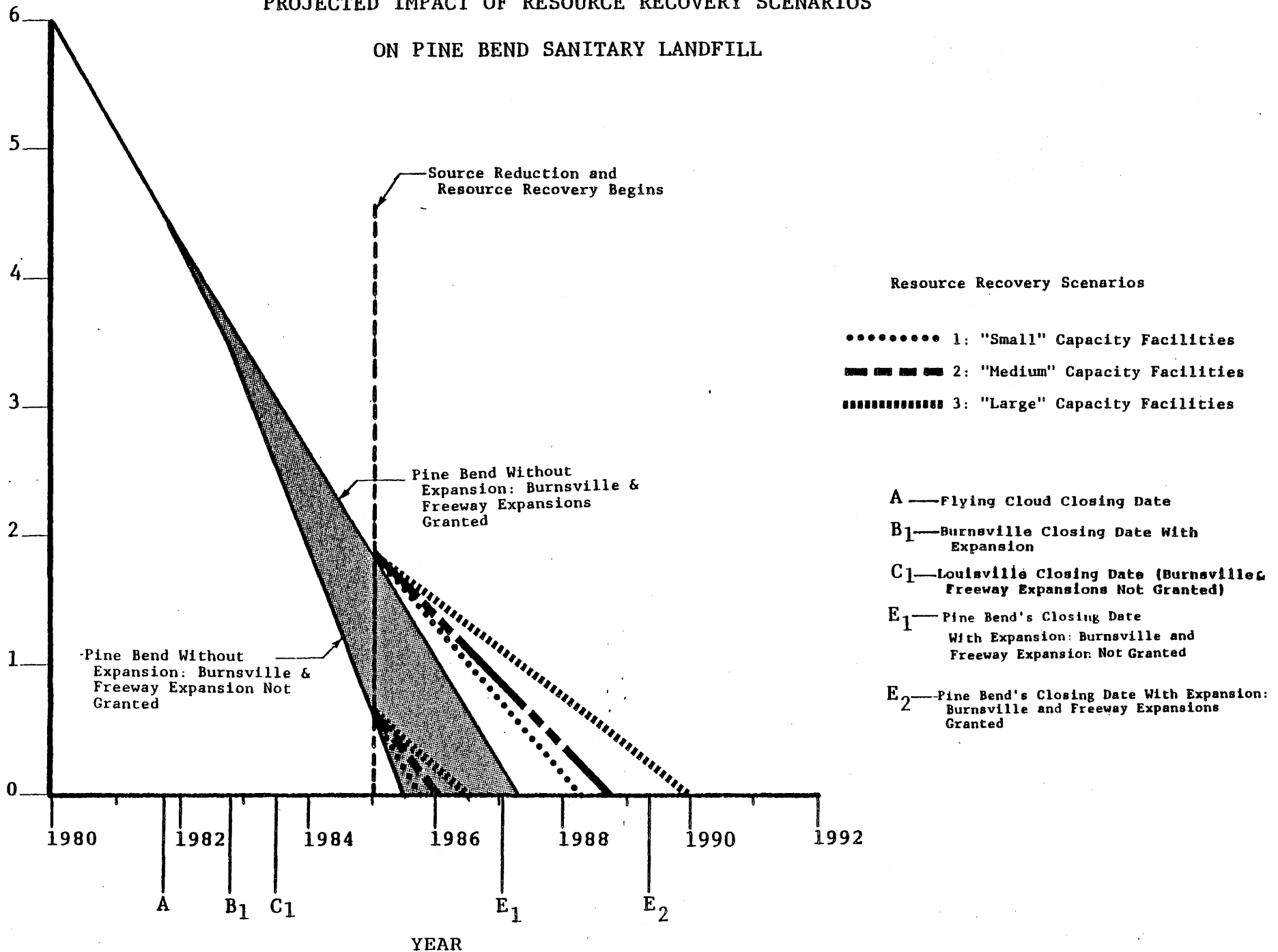
SOLID WASTE DIVERTED FROM PINE BEND
SANITARY LANDFILL THROUGH RESOURCE RECOVERY FACILITIES*

County	Facility Capacity (TPD)	Start-Up Date	Acre-Feet Diverted From Pine Bend During Start-Up Year	Acre-Feet Diverted From Pine Bend by 1989
<u>Scenario 1: "Small" Capacity Facilities</u>				
Anoka	25 TPD	1987	5	15
	25	1988	5	10
Dakota	100	1987	38	114
Hennepin	400	1985	88	551
	400	1987	124	523
	400	1989	160	160
Ramsey	100	1985	30	180
	100	1987	38	76
	100	1989	38	38
Wash.	25	1987	10	28
	25	1988	10	19
Total				1714 Acre-Feet
<u>Scenario 2: "Medium" Capacity Facilities</u>				
Hennepin	2000 TPD	1987	613	1416
Ramsey	400	1986	83	390
Total				1806 Acre-Feet
<u>Scenario 3: "Large" Capacity Facilities</u>				
Hennepin	2700 TPD	1987	786	1913
Ramsey	1200	1986	250	1169
Total				3082 Acre-Feet

* Adapted From: Pope-Reid Associates, 1980

Figure VI - 3

PROJECTED IMPACT OF RESOURCE RECOVERY SCENARIOS
ON PINE BEND SANITARY LANDFILL



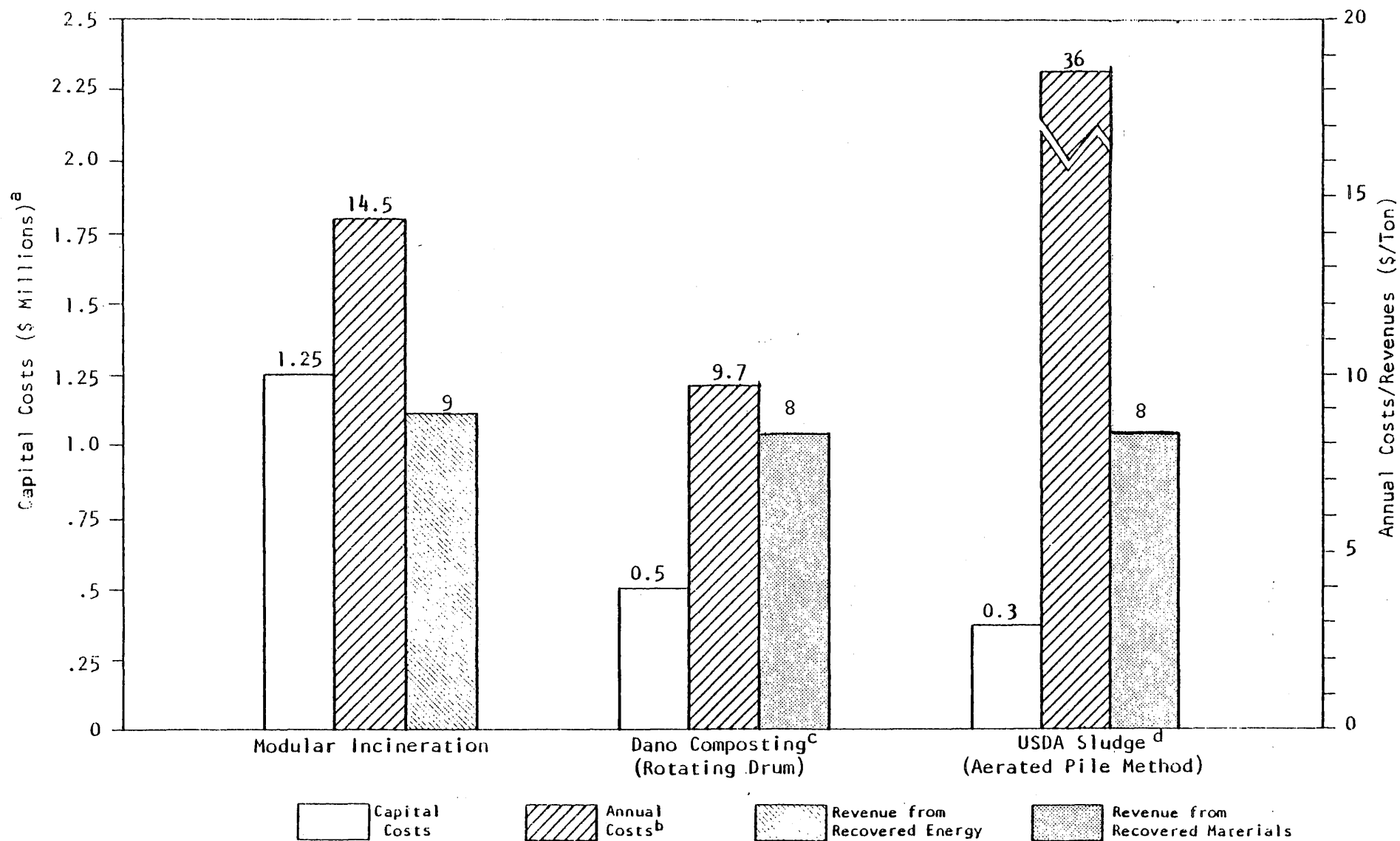
Generally, capital costs for high technology systems are fairly well documented; operating costs estimates are less reliable. Construction costs have been documented for several facilities, but shakedown-related problems and long construction time lags have the development of representative operating costs information. Furthermore, in many cases, existing operations data does not represent the cost of a system operating at its optimum level. There seems to be an emerging record of systems being over-designed. Anticipated solid waste streams in some cases have not materialized, therefore, operating costs are often higher than expected.

Most operations are also designed with some measure of redundancy (less than 100 percent in most cases) built into the processing streams. For most of the system presented in Figures VI-4 through VI-6 the actual unit cost range is broad. This appears to be a result of two factors: 1) the small number of facilities in actual operation, and 2) the site-specific nature of more solid waste disposal costs and revenues. The existing data base for high technology resource recovery is generally not yet broad enough to reliably determine solid waste disposal costs. It should be noted that for illustrative purposes, the data are presented as a single point representing the weighted average of the range of values.

The data with the greatest degree of variation are for revenues from the sale of recovered materials or energy. The range of values was determined from referenced sources, but the average revenues were adjusted based on experience with existing markets. Average material revenues were derived using EPA data for waste stream composition and recovery probabilities, applied to forecasted prices for the recovered products at the point of origin.

The results and revenue computations are also shown in Figures VI-4 through VI-6. Average net costs can be calculated as the difference between the annual costs and the total revenues. Revenues from tipping fees are not included. The net cost, in effect, represents the tipping fee that would have to be charged in order to ensure that the process breaks even. In reality, tipping fees are often determined more by local influences or by the costs of alternative disposal options, such as landfilling. For this reason, no tipping fee is specified; but, since the data are presented in terms of dollars per input ton, it is easy to calculate the effect of varying charges directly.

FIGURE VI-4 ECONOMICS OF HIGH TECHNOLOGY RESOURCE RECOVERY
ALTERNATIVES IN THE LESS THAN 100 TPD RANGE



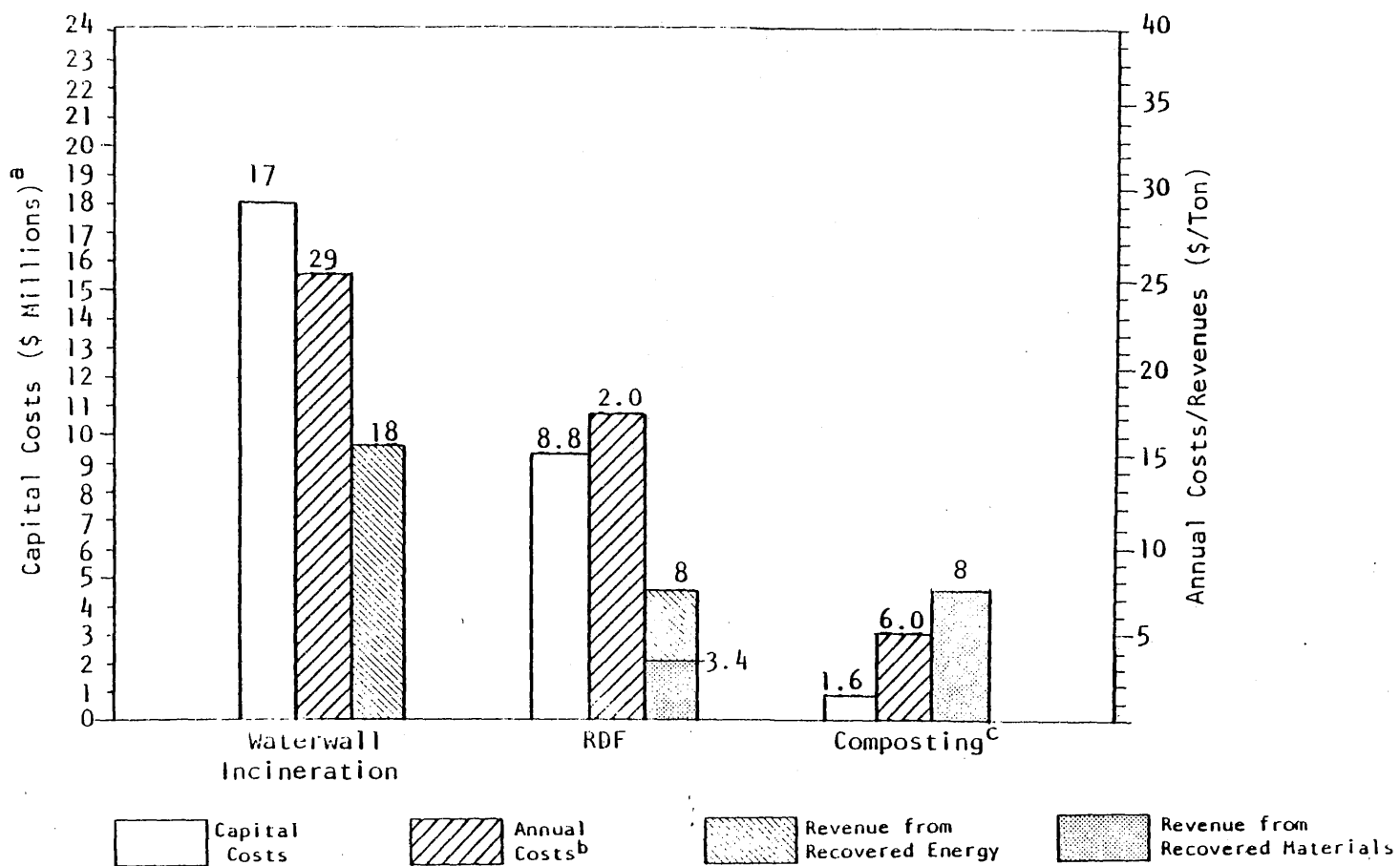
a - 1978 dollars based on ENR Construction Index

b - Includes capital amortized at 7% over 20 years

c - The composting data reflect capital costs and operating expenses using the Dano process of composting, from Dano Resource Recovery, Inc.

d - Sewage sludge only

FIGURE VI-5 ECONOMICS OF HIGH TECHNOLOGY RESOURCE RECOVERY
ALTERNATIVES IN THE 100 TO 500 TPD RANGE

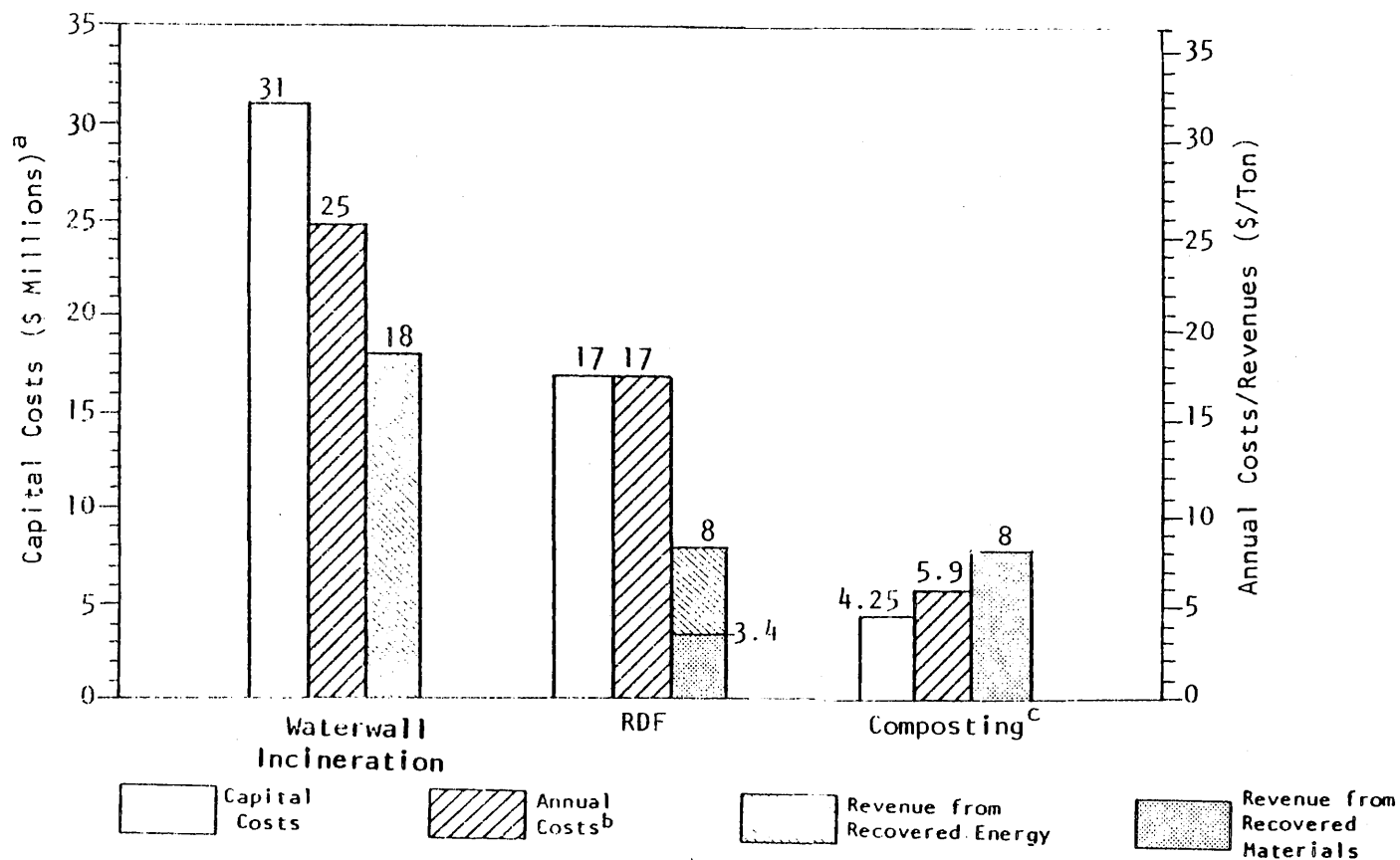


a - 1978 dollars based on ENR Construction Index

b - Includes capital amortized at 7% over 20 years

c - The composting data reflect capital costs and operating expenses using the Dano process of composting, from Dano Resource Recovery, Inc.

FIGURE VI- 6 ECONOMICS OF HIGH TECHNOLOGY RESOURCE RECOVERY
ALTERNATIVES IN THE OVER 500 TPD RANGE



a - 1978 dollars based on ENR Construction Index

b - Includes capital amortized at 7% over 20 years

c - The composting data reflect capital costs and operating expenses using the Dano process of composting, from Dano Resource Recovery, Inc.

ENVIRONMENTAL IMPACTS OF ENERGY RECOVERY ALTERNATIVES

General

Within the Metropolitan Area, three general types of resource recovery facilities are being considered: waterwall combustion, refuse derived fuel (RDF), and/or modular incinerators. Table VI-5 presented three possible combinations of various capacity facilities without specifying system types. Because no specific project or site has been formally proposed, the environmental impacts of energy recovery alternatives will be related to a national scenario as developed by the U.S. Environmental Protection Agency (EPA) and specific examples of ongoing projects.

The net environmental impact of resource recovery from municipal solid waste according to the EPA scenario for 1990 will be primarily beneficial. Emissions of most air pollutants will be reduced. The discharge of pollutants to surface waters will increase due to effluent from resource recovery facilities. The quantities of all pollutants present in leachate from landfilled municipal solid waste and resource recovery residue will decrease. Less landfill capacity will be required for disposal of municipal solid waste. Energy savings will be realized from energy conservation in materials production and energy recovery from municipal solid waste.

EPA projects that in 1990 30 million tons of municipal solid waste will be processed for resource recovery--one-half by front-end processing with materials separation and combustion of RDF, and one-half by mass burning of raw refuse with energy recovery and with materials recovery from the residue. The year 1990 was selected because it is the earliest date by which a reasonable number of resource recovery facilities would be fully operational and, therefore, resource recovery would be having a significant impact on the environment.

Air Emissions

Nationally -- The EPA has projected, on a nationwide basis, that emissions of carbon monoxide will be reduced in 1990 by about 2.3×10^6 tons and emission of carbon dioxide, nitrogen oxides, and methane will be reduced by 310,000 tons, 150,000 tons, and 114,000 tons, respectively. Smaller reductions will occur in emissions of sulfur oxides (approximately 23,000 tons) and hydrocarbons 7,200 tons). There will be slight increases in the quantities of total particulates (approximately 1,000 tons) and aldehydes (approximately 2,500 tons) emitted and a larger increase (approximately 140,000 tons) in chloride emissions.

RDF -- The major potential air pollutants from combined firing with RDF are particulate matter, sulfur oxides (SO_x), and nitrogen oxides (NO_x).

Particulate emission levels from the suspension burning of finely ground refuse are not known, but are expected to be substantially higher than from the burning of refuse on agitating grates in incinerators or from grate firing in combined units similar to the facilities in Europe.

Prepared municipal refuse is low in sulfur content. It has been suggested that when refuse and coal are co-fired, the ash from the refuse may absorb appreciable quantities of SO_2 from the flue gas and that a large portion (about 75 percent) of the sulfur in the refuse remains in the fly ash and ash residue. At a plant in Ames, Iowa, sulfur emissions tended to decrease with increasing percent of refuse fuel; however, at a plant in St. Louis, Missouri, no significant changes in the gaseous pollution loads occurred when refuse fuel and coal were fired together.

There has been insufficient testing to determine the behavior of nitrogen oxides when refuse is co-fired with fossil fuels. At Ames, NO_x emission tended to decrease with increasing percent of refuse fuel, while at St. Louis, no change in NO_x emissions was determined. A Battelle study that correlated emission data for utility boilers and municipal incinerators noted no change in NO_x emission levels when refuse was added.

Tests at the Ames plant showed no significant hydrocarbon emissions when refuse and coal were co-fired. Chloride emissions increased with increasing refuse fuel percentage for all boiler loads. Formaldehyde, cyanide, and phosphate emissions were quite variable, with no clear trend of emissions as a function of refuse fuel percentage. Many of the heavy organic compounds in the stack emissions were below detection levels and those which were detected were in the stack gases rather than in particulate forms. Finally, the trace element analysis of the uncontrolled particulate showed increases due to the burning of refuse fuel in only two of 19 elements analyzed.

Modular Incineration -- The 100 TPD North Little Rock, Arkansas plant was successfully designed to meet a state-imposed particulate standard of 0.2 gr/PSCF corrected to 12 percent CO_2 . However, this standard does not apply to the North Little Rock facility because each pair of incinerator units is rated at less than 50 TPD.

At the North Little Rock, Arkansas and Maryville, Ohio plants, no significant amount of pollutants were found at the upwind or downwind ambient air sample sites which were both at a 300 foot distance from the boiler exhaust stack.

A 100 TPD unit in Salem, Virginia, was designed to meet a state-imposed standard of 0.08 gr/DSCF, corrected to 12 percent CO_2 , but it has not succeeded in demonstrating that it can meet those requirements to date.

Monitoring the Rockwell International Corporation's Maryville, Ohio facility detected no significant amounts of pollutants in the residue or its laboratory-produced leachate.

Landfill Requirements

Nationally -- Implementation of the EPA's scenario for resource recovery from municipal solid waste will affect the landfill capacity required for disposal of the municipal solid waste. The requirement for landfill capacity to dispose of municipal solid waste and the residues from mass burning and resource recovery will be decreased by about 44,260 acre-feet under the scenario for resource recovery. The landfill capacity needed with resource recovery from municipal solid waste will be about 85 percent of the capacity that would be required if there were no resource recovery.

RDF -- It is estimated that the landfill requirements for the residual ash from combined firing will be less than 7-15 percent by weight of that now required for the landfilling of raw refuse. Similarly, it is estimated that combined firing with refuse produces about 50-70 percent by weight less residual ash (desired from the municipal solid waste) than straight incineration of raw refuse.

Experience at St. Louis has shown that the fly ash from combined firing has similar properties as the fly ash from coal-fired plants and in some cases may be marketed. However, the bottom ash from combined firing includes various noncombustibles not removed in the refuse processing as well as some incompletely burned combustible material, thus, limiting its market potential. The presence of these materials at St. Louis has lead Union Electric to isolate the bottom ash from combined firing from the regular ash pond. If both the bottom ash and fly ash can be marketed, and the noncombustible fraction recycled, there is essentially no solid waste when combined firing is employed.

Modular Incineration -- The use of modular combustion unit systems in small communities has shown measured volume reductions on the order of 90 percent.

Energy Content of Refuse Within the Proposed Expansion

Raw municipal solid waste has an energy value ranging from eight to 10 million Btu/ton. The different energy values of solid waste are a consequence of variances in the composition of the waste stream. It is speculated that the heating value of municipal waste will increase significantly with time. According to an estimate made in the early 70s, by 1990 the energy values are predicted to increase from 10 to 12.5 percent due to an increase in the paper and plastic fractions of the waste stream and decreases in yard waste, garbage and metal portions.

Estimates of the maximum overall efficiency ratings of the various energy recovery systems being proposed for the Metropolitan Area are as follows:

- 1) Water wall combustion - 72 percent;
- 2) RDF: (comparable ratings not available);
- 3) Modular Incinerator: - 55 to 65 percent; and
- 4) Methanation (composting): - 80 to 90 percent.

The proposed expansion contains the capacity for 1,875,000 tons of refuse which represents a heating value of 1.7×10^{13} Btus. Approximately 70 percent or 1.2×10^{13} Btus of this energy could be recovered using one of the resource recovery systems described earlier. This is comparable to:

- a. 570,000 tons of coal;
- b. 1.2×10^{10} cubic feet of natural gas;
- c. 87 million gallons of No. 2 fuel oil.

These figures do not take into consideration the cost of building or operating a resource recovery system; therefore, while this amount of energy is recoverable, it will cost a certain percentage of the energy to do so. Lastly, the overall efficiency conversion of raw refuse into actual work energy is significantly less than the energy efficiencies listed above for the conversion of raw refuse into a given energy form.

Some indirect effects of resource recovery from municipal solid waste derive from the recovery of materials and energy and their substitution for virgin materials in the production of materials (specifically steel, aluminum, and glass) and energy. Production of steel, aluminum, and glass from recycled material requires less energy than production from virgin materials. Conservation in energy required for materials recovery as well as energy recovery would result from substituting materials recovered from municipal solid waste for virgin materials in the production of the three substances. Conservation of energy in processing secondary materials is as follows: ferrous - 73 percent, aluminum - up to 93 percent, and glass 37 percent.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION VII

THE IMPACT ON STATE GOVERNMENT OF ANY FEDERAL CONTROLS ASSOCIATED WITH THE PROPOSED ACTION

GENERAL STATEMENT

Minnesota and federal laws and regulations relating to the Pine Bend Sanitary Landfill expansion interact in many areas. However, there does not appear to be any significant areas of conflict between the two sets of laws and regulations.

FEDERAL VERSUS MINNESOTA ENVIRONMENTAL IMPACT STATEMENT

The federal agency most directly involved with sanitary landfills is the Environmental Protection Agency (EPA). The National Environmental Policy Act PL91-190 requires that for any "...major federal actions significantly affecting the quality of the human environment, a detailed statement...on the environmental impact of the proposed action..." be prepared.

The Pine Bend Sanitary Landfill expansion is not a federal project nor does it involve federal funding of any type. Therefore, the EPA will not draft a federal EIS regarding the proposed action.

EFFECTS OF FEDERAL AIR, WATER, SOLID WASTE AND NOISE POLLUTION LAWS AND REGULATIONS UPON COMPARABLE MINNESOTA LAWS AND REGULATIONS

The federal authority over air, water and noise pollution derives primarily from the commerce clause of the U.S. Constitution. In theory, this power is limited to activities affecting commerce among the states. In practice, however, the power touches nearly every aspect of the U.S. economy including the externalities of environmental contaminants. The federal authority over air, water and noise pollution is not, however, plenary. Minnesota's authority to regulate air, water and noise pollution derives from the Minnesota Constitution and from the powers reserved to all states by Amendment X of the U.S. Constitution.

AIR QUALITY LAWS AND REGULATIONS

The EPA's authority over air pollution generally takes the form of approval and supervisory control. The EPA ambient air quality standards (AAQS) and emission regulations set maximum levels, which are to be met nationwide within certain time limits. The states retain the authority to establish regulations more restrictive, but they cannot cause the relaxation of the federal regulations.

The initial efforts of the EPA under the Clean Air Act Amendments of 1970 were directed toward establishment of the AAQS. Many regions of the country, and more specifically the Twin Cities Metropolitan Area, are not yet in compliance with the AAQS. In Minnesota, the AAQSs and most other air pollution control programs are implemented and enforced by the MPCA. Therefore, noncompliance is a problem primarily to be corrected by MPCA action. For example, the EPA has had no direct involvement in the formulation of the Air Quality Agreements between the MPCA and companies with emission sources which do not meet the allowable emission levels.

In severe cases of air pollution where state control schemes are ineffective, the EPA can assume direct control, place the major emitters on compliance schedules and monitor the progress. This has not been done in Minnesota.

The program for the regulation of emissions from new stationary sources, such as the emissions from the alternative of burning solid waste in a resource recovery facility, was implemented pursuant to the Clean Air Act to bring air pollution within the concentrations established by the AAQS. The EPA has promulgated emission regulations (New Source Performance Standards or NSPS) for 19 categories of stationary sources. The MPCA has adopted most of these verbatim. Consequently, the NSPS which apply to some of the alternatives to the proposed project will be enforced by the MPCA and will require no federal involvement. The MPCA prohibits open burning as do federal regulations. The emissions from fugitive dust and vehicle traffic do not fall under the NSPS rules as a major source. Therefore, federal rules do not apply to emissions resulting from the proposed action.

As a result of a recent lawsuit, the EPA is now required to ensure that air which is currently less polluted than the levels established by the AAQS remains at that "pristine" level of purity. This Prevention of Significant Deterioration (PSD) program has been adopted and delegated to the MPCA. The PSD regulations create the requirement that implementation of the alternative of combustion of solid waste at a resource recovery facility would require submittal of information to the MPCA from which the EPA can determine whether the emissions will significantly deteriorate the air quality in the vicinity of the resource recovery facility. Based on the information, the EPA would grant or deny the PSD permit for a resource recovery facility.

WATER QUALITY LAWS AND REGULATIONS

Minnesota agencies have had water pollution control powers over a longer period of time than have federal agencies. The Federal Water Pollution Control Act of 1972 (FWPCA) has, however, established a uniform, nationwide scheme within which the MPCA programs now operate. Once again, the MPCA administers the program while the EPA retains approval and supervisory control.

The FWPCA established a 1983 goal of swimmable and fishable waters and a 1985 goal of zero discharge. The MPCA has encoded these goals into water quality standards which limit the concentrations or ranges of various compounds or characteristics. The EPA has little involvement in this program, except to review MPCA water quality inventory reports (MPCA 1976) and other indications of progress toward the FWPCA goals.

The principal mechanism used to achieve the water quality goals is to reduce the discharge of pollutants by new and existing point sources. This program, called the National Pollutant Discharge Elimination System (NPDES), is administered in Minnesota by the MPCA. The program establishes the requirement of an NPDES permit for every major source of polluted effluents. The NPDES permits are issued by the MPCA, with the EPA retaining a veto authority over each permit. There is no point source discharge proposed at the Pine Bend Landfill. The discharge of wastes into ground water are controlled by Minnesota Rule WPC 22.

SOLID WASTE LAWS AND REGULATIONS

Federal rules promulgated under the Resource Conservation and Recovery Act of 1976 (RCRA) relate to the classification of solid waste disposal systems. The criteria require that solid waste disposal systems that are determined to be open dumps are subject to closure or upgrading. A specific site can be determined to be an open dump based on several criteria, the most significant being ground water considerations. The criteria specify that the facility or solid waste disposal practice shall not contaminate underground drinking water sources beyond the solid waste boundary or beyond a boundary established by the state (MPCA). Provisions of WPC 22 are at least as stringent as the federal criteria, thus the state rule is controlling.

NOISE CONTROL LAWS AND REGULATIONS

Noise emitted by stationary sources is a transient phenomenon which seldom causes interstate problems. Consequently, the federal government's role in controlling noise is limited to noise emissions from transportation related sources and from new products moved through interstate commerce. EPA has also recently published rules for the allowable level of noise from solid waste collection vehicles. These rules should lessen the noise impacts from the operation of collection vehicles at the site.

The noise levels allowable at receptors adjacent to transportation related sources of noise are more stringent in state rules than in federal rules. Therefore, the authority over noise emitted from transportation-related sources of the proposed action and its alternatives are under the regulation of the state.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION VIII

MULTISTATE RESPONSIBILITIES ASSOCIATED WITH THE PROPOSED ACTION

GENERAL STATEMENT

The Pine Bend Sanitary Landfill and the proposed expansion and construction areas lie well within Minnesota borders, and because of this, there are no formal multistate responsibilities associated with the proposed actions. There are, however, many multistate implications, as discussed below.

ENERGY

The fuel consumed in filling the proposed expansion area and construction of the earthen berm will come from outside the state since Minnesota is an importer of energy products. Current energy requirements to operate the landfill would continue with implementation of the proposed actions.

WATER QUALITY

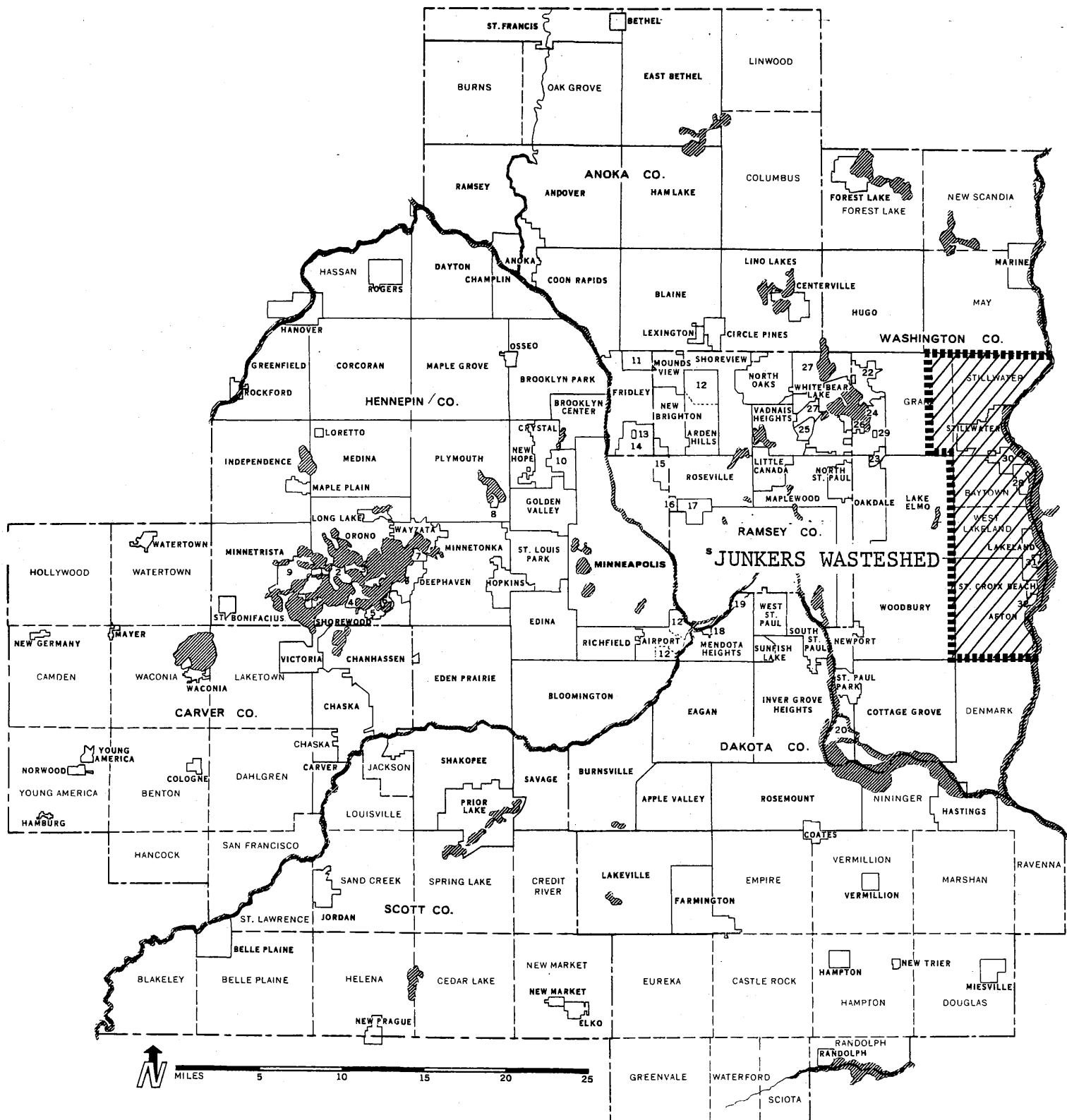
All leachate seepage entering the ground water system will eventually reach the Mississippi River and impact it accordingly. The Mississippi River is an interstate water body used as a water supply, fishery and for recreation by other states. As previously shown, the impact of leachate seepage into the river from the landfill, and that resulting from filling the proposed expansion area, will be negligible. There would, therefore, be no impact on the quality of the river in other states. However, the cumulative impacts of leachate from landfills and other sources of pollution in the Metropolitan Area will have a significant impact on the quality of the river in other states.

LAND DISPOSAL SYSTEM

A small percentage of the solid waste generated in the Twin Cities Metropolitan Area, mainly from Washington County, is disposed in St. Croix County, Wisconsin. Figure VIII-1 shows the Metropolitan Area portion of the wasteshed for Junkers Landfill in St. Croix County. As can be seen, the area from Stillwater south to Afton is included in this wasteshed. It is not expected, however, that filling of the proposed expansion area at the Pine Bend Landfill would result in a shift in waste import or export to or from Wisconsin.

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METROPOLITAN AREA PORTION OF JUNKERS LANDFILL WASTESHD,
ST. CROIX COUNTY, WISCONSIN



TWIN CITIES METROPOLITAN AREA

Figure VIII - 1

PINE BEND SANITARY LANDFILL EXPANSION

SECTION IX

IMPACTS ON COUNTY PLANNING

COUNTY SOLID WASTE MASTER PLANS

AUTHORITY

In 1976, the Minnesota legislature enacted the Metropolitan Solid Waste Act. This act significantly increased the responsibilities of the seven metropolitan counties and the Metropolitan Council for solid waste management. The law required the Council to prepare a policy plan and the seven counties to implement that plan through the preparation of their own plans. Once the county plans are completed and approved by the Council, they will provide the framework for the Council's approval of future solid waste facilities.

In February of 1979, the Metropolitan Council adopted a new regional solid waste policy plan, meeting its responsibilities under the 1976 Act. The seven metropolitan counties are presently preparing master plans that implement the Council's plan. The counties have, through the Metropolitan Inter-County Association, hired a consultant to prepare background information for their plans and as a resource to inform and educate public officials and the interested public. The county master plans will not, however, be completed until the end of 1980.

COUNTY MASTER PLAN CONTENT REQUIREMENTS

Each county master plan, as per requirements of the Council's solid waste plan, must contain, among other elements: (1) a statement of goals and objectives for solid waste management in the county, including quantities and composition of solid waste to be managed from 1979 to 2000; (2) a description of existing or proposed waste facilities together with schedules regarding the extent to which such facilities will implement the Council's plan; (3) an implementation program that identifies public programs, fiscal devices and other specific actions planned to implement the master plan; and (4) the feasibility of initiating waste reduction and source separation recycling programs. In addition, the counties are required to identify and acquire land disposal areas with sufficient capacities to satisfy regional land disposal needs for the next twenty years.

The solid waste planning undertaken by the counties has recently been strengthened with the recent passage of the Metropolitan Solid Waste Act of 1980. This act provides the counties with new authorities, including local zoning override, in order to further the planning and development of new solid waste disposal facilities (see Section X, Metropolitan Solid Waste Act of 1980).

COMPLIANCE WITH COUNTY MASTER PLANS

As previously mentioned, the county master plans are in the process of being prepared. Several land disposal, waste recovery and waste reduction scenarios have been developed by the counties as background information for their plans and these scenarios were used for discussion purposes in the alternatives analysis section (Section VI) of the environmental impact statement. However, until these plans are completed and approved by the Council, their compatibility with the proposals at Pine Bend cannot be determined.

Perhaps most important, once completed and adopted by county boards, the master plans will represent a number of policy positions that the counties have taken with respect to the future land disposal and recovery of solid waste. Expanding the Pine Bend Landfill will represent about a 35 percent increase in remaining disposal capacity in Dakota County, a county that is already disposing of about 50 percent of the solid waste generated in the Region. Quite clearly, decisions with respect to expanding the Pine Bend Landfill must not preclude or adversely affect the county planning and decision-making process, particularly Dakota County's.

PINE BEND SANITARY LANDFILL EXPANSION

SECTION X

IMPACTS ON REGIONAL PLAN

METROPOITAN SOLID WASTE PLAN

GENERAL

The Metropolitan Council, in February of 1979, adopted a new regional solid waste policy plan. This plan fulfills the Council's requirement to prepare and adopt a policy plan for the collection and processing of solid waste under the Metroplitan Solid Waste Act of 1976 (Minn. Statutes, Section 473). Each metropolitan county is directed under the Act to prepare a master plan that implements the Council's regional plan. The County plans are presently being prepared.

POLICY FRAMEWORK

The Council's solid waste plan calls for a shift in reliance upon sanitary landfilling to alternative disposal methods. In order of priority, the alternatives are:

Waste reduction--Industrial, commercial and residential generators of solid wastes are encouraged to voluntarily evaluate their use of energy and raw materials, and to reduce consumption where technically and economically feasible.

Source separation--Recycling programs and the separation of paper, glass, metals and other wastes for separate collection and processing is encouraged.

Central processing for resource recovery--Where waste reduction and source separation are not possible, the development of central waste facilities that reclaim materials, energy or both is encouraged.

Land disposal--The plan states that landfilling should be considered only where other waste management practices are not feasible.

In preparing the plan, however, it became apparent that landfilling will continue to be the primary means of refuse disposal in the Region. Under a "worst case" situation, without recovery of any type, about 4.5 times the size of the Region's present permitted landfill capacity must be identified if land disposal needs are to be accommodated over a twenty year period. Even with a strategy for maximum resource recovery, landfilling would be needed to provide adequate interim disposal capacity while recovery systems are being developed. It would also be needed to provide safe, efficient disposal capacity for

solid wastes that cannot be feasibly or safely processed, and for the residue from recovery operations. Residue may range from 10 to 30 percent of the processed residue.

The Council's plan, therefore, directs the metropolitan counties to accommodate the solid waste land disposal needs of the Region for the next twenty years. The plan identifies the land disposal needs of each county based on the amount of solid waste that the county is expected to generate. It is the county's responsibility to plan for the implementation of waste facilities that satisfy the land disposal needs of the county. Finally, the Council's plan states that the counties may increase or reduce their twenty year land disposal needs through intergovernmental agreements with other metropolitan counties to dispose of and/or process their wastes or a portion of their wastes, or by implementing waste reduction, source separation and/or resource recovery programs and facilities.

The Council's solid waste plan is also implemented through the Council's review and approval authority over new solid waste facilities. Before the MPCA can issue a permit for a proposed solid waste facility in the Metropolitan Area, that permit application must be approved by the Council. The Council has therefore, adopted as part of its solid waste plan, criteria to review solid waste permit applications. The Council's plan includes criteria that address a proposed waste facility's supply, capacity, processing technique, environmental impact, location, operations, economic affects and solid waste supply and processing contracts. In addition, for proposed waste facilities owned and/or operated by public agencies or supported primarily by public funds or obligations, the Council's plan contains criteria for financial self-sufficiency.

COMPLIANCE WITH REGIONAL PLAN

The following discussion concerns the proposed action's compliance with the policy framework and pertinent review criteria contained in the Council's regional solid waste policy plan.

Policy Framework

The Council's solid waste plan places emphasis on the recovery or reduction of solid waste over land disposal. Before land disposal can take place in the Region it must be demonstrated that recovery-reduction type of facilities or practices are not available. Notwithstanding, the Council's plan also recognizes that the future waste needs of the Region will be met by a comprehensive management system including recovery and reduction and that land disposal will be an integral part of this system.

Based on present disposal practices, the Region's remaining permitted landfill space will be exhausted by 1985. This will happen even sooner if more solid waste is disposed of in Area landfills. Even with maximum resource recovery, waste reduction or source separation in the Region, landfilling will be necessary to dispose of the residuals from resource recovery

facilities and other solid waste that is not or cannot be reduced or recovered. Moreover, the development and implementation of major recovery facilities, reduction techniques and source separation programs will take years, perhaps as long as 10 to 15 years, before substantial portions of the solid waste stream are recovered or reduced. Landfilling will, therefore, be needed to provide adequate interim disposal capacity while these systems are being developed.

The Council's solid waste plan states that the siting and development of new landfills and increasing the capacity of existing sites must begin soon to meet the Region's disposal needs. The proposed filling of the expansion area at the Pine Bend Landfill is certainly consistent with this objective. The proposal, however, must be balanced against the availability of present or future waste recovery or reduction technologies. It does appear, based on county solid waste planning scenarios (see Alternatives, Section VI), that some recovery and reduction of the Region's solid waste stream will be available beginning in the late 1980s. The extent to which these technologies can recover and reduce waste that would be going to the Pine Bend site is largely unknown at this time. Further work is necessary, which will be accomplished over the next couple of years as required by the new Metropolitan Solid Waste Act of 1980 (a discussion of this new law follows).

Review Criteria

Criterion 2c -- This criterion states that the development of proposed solid waste management facilities should be compatible with the Region's growth forecasts, the need to replace existing facilities and county schedules for implementing new waste facilities.

The proposed expansion of the Pine Bend Landfill will add to the life of the metropolitan land disposal system. The proposed expansion is consistent with the Council's determination that the siting of new landfills and expansion of existing landfills needs to be undertaken soon. However, the seven metropolitan counties are in the process of developing their solid waste master plans. These plans, along with the work required under the new Metropolitan Solid Waste Act, will provide development schedules for new land disposal, recovery and waste reduction facilities in the Region. Until this work is completed, it is difficult to determine the compatibility of the proposed expansion with other major planning efforts as required by this criterion (see Section IX, Impact on County Planning).

Criterion 4b -- This criterion states that sites should be accessible year round by highways that have adequate capacity. In addition, this criterion states that roads used for hauling must meet safety standards of the governmental units having jurisdiction over them and that access to the site should not depend on the use of local and collector streets through residential areas.

Access to the Pine Bend Landfill is good. Both Highway 55 and 117th Street, the major access roads to the site provide adequate capacity for the volume of disposal-related traffic generated by the landfill's location. There have been no traffic-related problems reported at the landfill. The state Department of Transportation has reviewed the conditions and capacities of the access roads to the landfill and found no major safety problems associated with refuse traffic using these roads. However, there have been complaints from Inver Grove Heights officials concerning the occasional use of nondesignated routes by haulers and fugitive debris from haul trucks in the community. Section V of the Socio-Economics portion of the environmental impact statement discusses mitigative measures regarding these traffic-related impacts.

Criterion 4d -- This criterion states that, where possible, sites should be visually compatible with adjacent property or development. This criterion further states that residential and other nonindustrial land uses are considered compatible only if there are barriers to reduce noise and obscure public view.

The Pine Bend Landfill, including the expansion area, is compatible with the adjacent land uses in the Area. The property surrounding the landfill is either zoned for industrial or agricultural uses (see Section III, Socio-Economics). Those homes located west of the landfill that directly face the site, are buffered from the expansion area by completed portions of the fill that have already attained some vegetative growth. However, the working area of the landfill and the proposed expansion area is maintained on easterly facing slopes, away from these off-site receptors. Working areas of the landfill will be only visible when they are at the top elevations of the fill area.

Criterion 5a -- This criterion states that the site selection process for land disposal facilities should include an evaluation of the site's capacity to assimilate waste and its constituents.

In recent years, the Pine Bend area has been the subject of extensive geologic and hydrologic study. This has been due, at least in part, to suspected groundwater problems in the industrial area of Pine Bend. The Pine Bend Landfill itself was also the subject of a hydrologic study in 1978. It appears, therefore, that given these studies, along with recent water quality monitoring the area, there is sufficient information to evaluate the site's capacity to assimilate waste and its constituents, particularly with respect to the additional leachate that will be generated by the expansion area. Further work, however, should be done to determine the attenuating abilities of the site's underlying soils (see Water Quality, Section III).

Criterion 5b -- This criterion provides that applicants should ensure that environmental monitoring will be conducted when the facility is operating, and should include evaluations of air and water quality.

The water quality portion of Section III discusses in detail the water monitoring program at the Pine Bend Landfill. Six wells at the site are sampled quarterly and tested for ph, chemical oxygen demand, specific conductance, nitrates, and chlorides. These wells are located up gradient and down gradient of the groundwater movement and this system appears adequate to properly determine potential leachate impacts on surface waters and nearby water supply wells.

Operation of the landfill has not resulted in any reported air quality problems at the facility itself or the surrounding area. There appears to be adequate measures to contain fugitive dust and other emissions generated by operations of the landfill (see Air Quality, Section III). Environmental monitoring for air quality related problems doesn't appear necessary at the site.

Criterion 5d -- This criterion states that, if necessary, an environmental control contingency plan should be developed before the facility is permitted to operate and that this plan should be implemented if the monitoring system indicates that contaminants are moving from the facility.

It has been determined, that the potential exists for contamination of nearby water supply wells within the area of influence of leachate (see Water Quality, Sections III, IV and V). It is important that these wells are periodically tested in the future. The landfill monitoring system will also detect leachate that may present potential contamination problems at these wells. Further controls may be necessary at the landfill should leachate begin affecting local water supply quality.

Criterion 5g -- This criterion states that the grounds of solid waste facilities should be landscaped wherever possible. The criterion further states that those areas where waste is dumped or salvaged should be screened from public view and routine measures should be instituted to control dust, blowing litter, odors and other potential nuisances.

It appears that landscaping or screening of the site isn't necessary to improve public view of the facility. Much of the filling of the western portion of the landfill has been completed and a large portion of this area has received final cover and attained some vegetative growth. Further filling of permitted areas of the landfill will take place primarily on the eastern portion of the site away from homes along Rich Valley Boulevard, the nearest off-site receptors. Much of the filling of the expansion area will be contained within the alley areas of the landfill.

The landfill is adequately controlled for dust, blowing litter, and odors (see Air Quality, Section III).

Criterion 6c -- This criterion states that proposed solid waste management facilities should have controlled access to prevent entry or unauthorized disposal during nonoperational hours.

The landfill has a gate at the entrance which is closed and locked when the landfill is not open. An attendant is on duty when the gate is unlocked and monitors incoming traffic. The landfill area, however, is not fenced and offroad access is possible.

Criterion 6c -- This criterion states that rules and regulations governing use and operating hours of the facility should be posted at the entrance.

The landfill facility complies with this criterion.

METROPOLITAN SOLID WASTE ACT OF 1980

PURPOSE

This new law sets forth a major land disposal siting process in the Metropolitan Area. It's an unusual siting process, in that it places heavy emphasis on reducing the need for land disposal in the Region. Important policy decisions are required under the law by a number of participants that may affect all or a portion of the solid waste going to Pine Bend given its expansion.

SITING PROCESS

Each of the seven metropolitan counties is required by June 1, 1981 to identify four eligible land disposal sites that will handle municipal solid waste. These sites are then reviewed and approved by the Metropolitan Council and adopted as part of a metropolitan inventory of eligible land disposal sites. The Council and counties will then undertake an abatement process to reduce the need for land disposal in the Metropolitan Area. Technologies and processes will be identified to recover and reduce the amount of solid waste generated in the Region. The timeframe for the implementation of these abatement strategies will also be determined. Once this process is completed, the final selection of needed landfill sites will take place. Land disposal sites will be acquired in fee for those scheduled for development as a facility through the year 1990; development rights will be acquired for those sites scheduled for development from 1991 through the year 2000. The entire site selection process is required by law to be completed by 1984.

THE NEW ACT AND EXPANSION OF THE PINE BEND LANDFILL

Expanding the Pine Bend Landfill will certainly reduce the need for land disposal space that would require to be identified under the new law. Moreover, expansion of an existing landfill

is socially and economically much more acceptable than the difficult, time consuming, expensive and controversial process of finding a new site. Expanding the Pine Bend Landfill, therefore, will lessen the apprehension and tension associated with what is becoming a major public issue in the Metropolitan Area, the disposal of refuse.

It is important to point out, however, that expansion of the Pine Bend Landfill will satisfy only a fraction of the Metropolitan Area's future land disposal needs, less than four percent over the next 20 years. Expansion of this site alone will not contribute greatly to the future land disposal needs of the Region.

A major portion of the new law requires the identification of a schedule for abating the land disposal of solid waste in the Metropolitan Area. This schedule of achievable abatement procedures is required to be implemented by the metropolitan counties as per direction provided by a Metropolitan Council land disposal abatement plan. This process is crucial with respect to Pine Bend and should provide the necessary information to determine approximately what portion of the solid waste going to Pine Bend can be recovered or reduced.

Presently, the Pine Bend Landfill has a remaining permitted capacity of about 5,952 acre-feet, or 7.3 years of life at the facility. Given the expansion, the landfill will have a remaining capacity of about 8,742 acre-feet, or 9.3 years of life. Both of these timeframes extend a number of years beyond completion of the metropolitan landfill siting-abatement process required under the new solid waste law. It is possible that a decision could be made to delay expansion of the site until the landfill siting-abatement process is completed; or perhaps a time limit is imposed on the permit or a trade-off made with respect to other permitted areas of the landfill until the siting-abatement process is completed. It is important that decisions with respect to expansion of the Pine Bend Landfill take into account information that will be gained in the future concerning the reduction and recovery of waste going to the site.

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Appendix I

PERMITTED PROPERTY

EXHIBIT "A"
to Contract for Deed dated January , 1975
between
PINE BEND DEVELOPMENT CO.
and
PHOENIX, INC.

LEGAL DESCRIPTION

The following parts of Section 33, Township 27, Range 22, Dakota County, Minnesota, according to the United States Government Survey thereof:

1. All that part of the Northeast 1/4 of the Southwest 1/4 and of the South half of the Northwest 1/4 of said Section lying East of the right-of-way of the Chicago, Rock Island and Pacific Railway Company; and
2. The Northeast 1/4 and the North half of the Southeast 1/4 of said Section, except the following parts thereof:
 - (a) The rights-of-way of the Chicago and North Western Railway Company;
 - (b) That part of said Northeast 1/4 conveyed to the Chicago Great Western Railway Company by that certain limited Warranty Deed dated October 1, 1964, and recorded November 20, 1964, in Book 284 of Deeds, page 414, Office of the Register of Deeds of said Dakota County; and
 - (c) That part of said Northeast 1/4 conveyed to Northern States Power Company by that certain special Warranty Deed dated April 14, 1970, and recorded April 30, 1970, as Document #372147, Office of the Register of Deeds of said Dakota County.

LEGAL DESCRIPTIONS

PARCEL 1

PROPOSED EXPANSION

That part of the Northeast Quarter and of the North half of the Southeast Quarter of Section 33, Township 27, Range 22, Dakota County, Minnesota described as follows: Commencing at the Northeast corner of said Northeast Quarter; thence South 89 degree 49 minutes 14 seconds West on an assumed bearing along the North line of the Northeast Quarter, a distance of 148.44 feet to the point of beginning of the tract to be described; thence continuing South 89 degrees 49 minutes 14 seconds West, a distance of 87.73 feet; thence Southwesterly, a distance of 216.46 feet along a non-tangential curve concave to the Northwest having a central angle of 8 degrees 58 minutes 18 seconds, a radius of 1382.41 feet and the chord of said curve bears South 37 degrees 11 minutes 53 seconds West; thence South 41 degrees 41 minutes 02 seconds West tangent to the last described curve, a distance of 1698.73 feet; thence Southwesterly a distance of 614.66 feet along a tangential curve concave to the Southeast having a central angle of 14 degrees 03 minutes 21 seconds and a radius of 2505.56 feet; thence South 27 degrees 37 minutes 41 seconds West tangent to the last described curve, a distance of 88.41 feet; thence North 62 degrees 22 minutes 19 seconds West, a distance of 25.00 feet; thence South 27 degrees 37 minutes 41 seconds West, a distance of 692.57 feet; thence Southwesterly, a distance of 30.54 feet along a tangential curve concave to the Southeast, having a central angle of 1 degree 25 minutes 59 seconds and a radius of 1220.93 feet to the South line of said Northeast Quarter; thence North 89 degrees 43 minutes 04 seconds East along the South line of said Northeast Quarter, a distance of 28.00 feet; thence Southerly, a distance of 1142.03 feet along a non-tangential curve concave to the East having a central angle of 54 degrees 42 minutes 48 seconds and a radius of 1195.93 feet, the chord of said curve bears South 0 degrees 33 minutes 49 seconds East; thence South 27 degrees 55 minutes 13 seconds East tangent to the last described curve, a distance of 249.51 feet to the South line of the North half of the Southeast Quarter; thence North 89 degrees 44 minutes 50 seconds East along said South line of the North half of the Southeast Quarter, a distance of 112.92 feet; thence North 27 degrees 55 minutes 13 seconds West, a distance of 86.13 feet; thence North 62 degrees 04 minutes 47 seconds East, a distance of 50.00 feet; thence North 27 degrees 55 minutes 13 seconds West, a distance of 215.81 feet; thence Northwesterly, a distance of 76.84 feet along a tangential curve concave to the Northeast having a central angle of 4 degrees 12 minutes 34 seconds and a radius of 1045.93 feet; thence North 66 degrees 17 minutes 21 seconds East non-tangent to the last described curve, a distance of 50.00 feet; thence Northerly, a distance of 892.40 feet along a non-tangential curve concave to the East having a central angle of 51 degrees 20 minutes 20 seconds, a radius of 995.93 feet and the chord of said curve bears North 1 degree 57 minutes 31 seconds East; thence North 27 degrees 37 minutes 41 seconds East tangent to the last described curve, a distance of 88.45 feet to the North line of said North half of the Southeast Quarter; thence South 89 degrees 43 minutes 04 seconds West along said North line, a distance of 56.58 feet; thence

North 27 degrees 37 minutes 41 seconds East, a distance of 443.52 feet; thence North 62 degrees 22 minutes 19 seconds West, a distance of 50.00 feet; thence North 27 degrees 37 minutes 41 seconds East, a distance of 275.50 feet; thence Northeasterly, a distance of 590.13 feet along a tangential curve concave to the Southeast having a central angle of 14 degrees 03 minutes 21 seconds and a radius of 2405.56 feet; thence North 41 degrees 41 minutes 02 seconds East tangent to the last described curve, a distance of 1698.73 feet; thence Northeasterly, a distance of 216.06 feet along a tangential curve concave to the Northwest having a central angle of 8 degrees 21 minutes 03 seconds and a radius of 1482.41 feet; thence Northerly, a distance of 68.90 feet along a non-tangential curve concave to the West having a central angle of 0 degrees 42 minutes 04 seconds, and a radius of 5629.65 feet, the chord of said curve bears North 10 degrees 19 minutes 04 seconds East to the point of beginning. (The foregoing legal description is, and is intended to convey, all of the right of way of the main line of the Chicago and North Western Transportation Company lying within the Northeast Quarter and the North half of the Southeast Quarter of said Section 33.)

PARCEL 2

Together with a 50.00 foot strip of land over and across the northeast Quarter and the North half of the Southeast Quarter of Section 33, Township 27, Range 22, Dakota County, Minnesota, the West line of said 50.00 foot strip is described as follows: Commencing at the Northeast corner of said Northeast Quarter; thence South 89 degrees 49 minutes 14 seconds West on an assumed bearing along the North line of said Northeast Quarter, a distance of 148.44 feet to the point of beginning of the line to be described; thence Southwesterly, a distance of 1035.35 feet along a non-tangential curve concave to the Northwest having a central angle of 10 degrees 32 minutes 14 seconds, a radius of 5629.65 feet and the chord of said curve bears South 15 degrees 14 minutes 09 seconds West; thence South 20 degrees 30 minutes 16 seconds West tangent to the last described curve, a distance of 1691.74 feet; thence Southerly, a distance of 1429.96 feet along a tangential curve concave to the East having a central angle of 14 degrees 03 minutes 15 seconds and a radius of 5829.65 feet to a point on the South line of the North half of the Southeast Quarter distance 1364.57 feet West of the Southeast corner of said North half of the Southeast Quarter as measured along the South line thereof and there terminating. The East line of said 50.00 foot strip shall be lengthened or shortened as necessary to terminate on the North line of said Northeast Quarter and the South line of the North half of said Southeast Quarter. The East line of said 50.00 foot strip also shall be a minimum of 50.00 feet, as measured at right angles, Westerly of the centerline of the Chicago and North Western Transportation Company tracks as laid out and traveled on January 19, 1978. (The foregoing legal description is, and is intended to convey, the Westerly 50 feet of the branch line of the Chicago and North Western Transportation Company as acquired by deed recorded in Book 284 of Deeds, Page 414 - 417, Office of the Dakota County Recorder, and as the same is presently located.)

(The foregoing legal descriptions of Parcel 1 and Parcel 2 are, and are intended to convey, all of the right, title and interest of the Grantor in and to lands within that part of the Northeast Quarter and the North half of the Southeast Quarter of said Section 33, which lies West of the East line of the 50 foot strip described herein as Parcel 2.)

Appendix II
Chronology of Significant Events
Inspections - Violations

September 7, 1971 - Permit issued Pine Bend, SW 45

December 8, 1971 - Violation--dumping area too large
--site not fenced or signed
--toxic waste area not signed
--response sent back December 14, 1971

March 8, 197 - Violation--dumping area too large
--approach road not an all-weather road

April 27, 1972 - Violation--blowing paper
--access road not properly maintained

March 29, 1973 - Violation--5 or 6 dumping areas; dump area too large
--site poorly maintained
--older fill eroded

April 4, 1973 - Violation--daily cover due to equipment breakdown

July 23, 1973 - Started accepting toxic and hazardous wastes to be later shipped to P.C.I.

September 13, 1973 - Met Council finds Pine Bend landfill in accord with the Council's Comprehensive Plan for Solid Waste Management

September 25, 1973 - Permit modified to allow filling to a higher elevation and use of the east side of the landfill.

November 7, 1973 - Violation--site maintenance

April 4, 1979 - U.S. Geologic Survey completed a Hydrogeologic Reconnaissance of Ground Water Pollution in the Pine Bend area

November 21, 1974 - Violation--litter, blowing paper

February 2, 1975 - Violation--litter

July 3, 1975 - Violation--access road

August 27, 1973 - Pine Bend accepted 780 gallons of sodium arsenite herbicide

July, 1975 - Violation--access road poorly maintained

November 22, 1975 - Sodium arsenite found and removal begun

September 22, 1975 - Violation--surface drainage
--ponded water at north end
--garbage in the water

Pine Bend Chronology
page 2

- October 15, 1975 - MPCA recommends having detailed geohydrologic study be conducted on the landfill due to the uncertain hydrologic system at the landfill. The present monitoring wells are probably not adequate. The study should define all aquifers and recommend an adequate monitoring system.
- March 19, 1975 - Pine Bend Sanitary Landfill sold to Phoenix, Incorporated
- April 23, 1976 - Violation--litter
--toxic wastes not properly prepared; has separate in barrels
- May 4, 1976 - Violation--litter
- May 26, 1976 - Phoenix, Incorporated and MPCA signed a Stipulation Agreement for the alleged dumping of sodium arsenite.
- January 10, 1977 - Accidental dumping of acetone; recovered
- December 29, 1976 - Violation--litter control
- April 12, 1977 - Violation--litter control
- May 9, 1977 - Violation--litter control
- December 1, 1978 - Hydrogeologic Study requested in October 1975 was completed.
- April 20, 1979 - Hydrogeologic Study requested in October 1975 was completed.
- May 4, 1979 - Hydrogeologic Study requested in October 1975 was completed.

Numerous inspections were made throughout the period where no violations were cited.

APPENDIX III

DEVELOPMENT FRAMEWORK PLAN

GENERAL

The Metropolitan Council is charged with developing a regional growth policy to effectively coordinate the various areas of public investment. The Council's Development Framework is designed to provide long-range policy direction for guiding growth and for making policy decisions. The aim of the Development Framework is to accommodate the area's growth rationally and economically while preserving the present quality of life in all aspects of metropolitan life - social, economic, governmental, and environmental.

To help meet these goals the Development Framework contains policies to guide present and future decision making. The Metropolitan Area consists of an Urban Service Area and a Rural Service Area. Metropolitan systems and urban services will be provided only within the Urban Service Area. Rural service standards will be met in the Rural Service Area, and persons choosing a rural lifestyle should not expect to receive urban services.

URBAN SERVICE AREA

The Urban Service Area is the portion of the Metropolitan Area in which governmental agencies should plan to support urban development and redevelopment. This should be done through community, county, and metropolitan planning to provide the necessary public facilities and services. Within the Urban Service Area, the Metropolitan Council will plan metropolitan systems such as highways, transit, and interceptor sewers. Local governments are charged with planning local systems such as streets, parks, sewers, water and schools. The Urban Service Area may be expanded when absolutely necessary to accommodate the growth in the Metropolitan Area.

FREESTANDING GROWTH CENTERS

These are small cities that have been designated as growth centers so that metropolitan investments can be concentrated in a limited number of rural centers that can potentially absorb urban growth. These small cities offer a living alternative to traditional large city and suburban living as well as to scattered housing tracts in rural areas.

RURAL SERVICE AREA

The Rural Service Area will not receive major urban services such as sewers, transit, and highways during the 1975-1990 planning period, but metropolitan investments will be made to the extent necessary to maintain rural standards of public services and inter-regional transportation links. This area should not undergo urban development before 1990.

The following categories of the Rural Service Area are indicated in the Development Framework.

Commerical Agriculture Regions -- Within this general area, the long term preservation of agriculture will be encouraged. Designation of more specific regions will be based on several factors including prime agricultural soils, economic strength of the farms in the area, and the present absence of urban influences.

Rural Centers -- These are rural trade centers that are generally smaller than freestanding growth centers or lack a sizable employment base. They will not receive metropolitan investments for urban services but those that have public utilities and services can accommodate modest residential and commercial developments.

General Rural Use Region -- This area contains a variety of uses including agriculture, parks, hobby farms, and residences. It also contains extensive areas of wet soils poorly suited for agriculture and residential use. Commercial farms should be encouraged to remain in this area. No new urban services will be provided before 1990, but the Urban Service Area may be expanded into the transitional area after that. Standards for the installation and maintenance of permanent on-site sewage disposal systems should be rigorously enforced. Low density residential land use may be suitable in general rural use regions if the local governments, including school districts, certify that the development will not require additional public services or harm natural resources.

APPENDIX IV

CRITICAL AREAS PLANNING PROCESS

On November 23, 1976, the Governor of Minnesota signed Executive Order Nos. 130 and 130A designating the Mississippi River Corridor as a Critical Area. Such a designation was done under the "Critical Areas Act" which was enacted in 1973 by the Minnesota State Legislature. The Act prescribed a process for planning and managing areas of regional and state-wide interests; that is, areas of significance that transcend any local government's authority. The process allows local, regional and state agencies to work together, coordinated through the offices of the Environmental Quality Board (EQB), to prepare a coordinated plan for the designated Critical Area. The Critical Area planning process is not a substitute for local planning; rather, it is a supplement to insure a concerted and coordinated planning effort by all affected communities.

The geographic area included in the 1976 Executive Order for the Mississippi River involved some 20 cities and four townships, stretching for a distance of approximately 80 river miles. By issuing the Critical Area Designation Order, the Governor set in motion the Critical Area Planning Process. This process entailed four preliminary steps, being;

- Step 1. A plan assessment wherein existing municipal plans and ordinances were assessed to determine whether they conform to Critical Area standards and guidelines. Any necessary modifications or additions were defined.
- Step 2: Critical Area grants were given to each affected community to assist in the cost of preparing an individual Critical Area Plan.
- Step 3: Individual communities began preparing Critical Area plans in 1978 and this is expected to result in all plans being completed during 1979.
- Step 4: Each plan submitted by the individual communities will be reviewed by the Metropolitan Council and finally, be approved by the Environmental Quality Board. This final step is also expected to be completed by November of 1979.

There are a large variety of existing land uses within the Critical Area along the portion of the Mississippi River bordering Rosemount and Inver Grove Heights.

There are:

Residential -- Existing residential development within the Critical Area consists almost exclusively of 210 single family homes and 350 mobile homes.

Industrial -- The largest industrial development is the Cenex complex, which provides both petroleum and agricultural products. Two other industrial developments are the B-TuMix sand and gravel operation and Pockrandt Lumber.

Public and Quasi-Public -- The most significant quasi-public development in the area is the Macalester Nature Center. Another quasi-public development is the Jolly Roger Marina. The marina provides slips, boat repair and storage for recreational boats. The city owns two parks in the area, Concord Park and a former sewage treatment plant site (it has not been officially designated as a future park site other than to be so indicated in the Park Guide Plan for the city).

Vegetation -- Vegetation in the Critical Area, within Inver Grove Heights, can generally be classified into two categories; the Upland Hardwood Forest and the Wetland Forest. The hardwood forest exists on the uplands where tree cover is predominately of oak and grasses, white oak, black oak and red oak. The wetland forest, which generally exists in the floodplain, consists of soft maples, poplar and elms.

Wildlife -- The wildlife associated with the Critical Area may also be classified into two categories which follow quite closely the vegetation categories. These are wildlife associated with the water areas and those associated with the forested areas. Wildlife common to the water areas are pheasant, deer, ducks, geese, snakes, turtles, raccoons and similar mammals.

In contrast, wildlife associated with the forested slopes and grasslands are birds such as woodpeckers, jays, thrushes, flycatchers, vireos, owls, and pheasants, and mammals such as squirrels, rabbits, fox, deer and raccoons.

Wetlands -- Virtually all of the wetlands within the Critical Area (of Inver Grove Heights) exist within the floodplain. Wetlands can generally be described as low, small depressions created in the Knob and Kettle type of terrain. Wetlands also occur adjacent or within natural drainageways, such as the River floodplain, or as free-standing ponding areas in low areas.

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APPENDIX V

SOLID WASTE ORDINANCES
INVER GROVE HEIGHTS

Section 605 - Garbage, Rubbish Disposal.

605.01. Disposal Requirements. It is unlawful for any person to fail to in a sanitary manner dispose of garbage and rubbish which is, or which may accumulate upon property owned or occupied by him or them. Every person who fails or refuses to make provisions for and secure such disposal is guilty of a misdemeanor. Persons desiring to make use of the services of licensed garbage and rubbish collectors may do so by notifying any of said collectors and paying the charges therefor. The names of the licensed collectors may be obtained from the Clerk.

605.03. Terms. The word "Garbage" as used herein includes only organic refuse resulting from the preparation of food, and decayed and spoiled food from any source. The word "rubbish" as used herein includes all inorganic refuse matter such as, but not limited to, tin cans, glass, paper, ashes, sweepings.

605.05. Garbage Containers. Every householder or occupant of any dwelling house and every operator of any boarding house, restaurant, or any other place of business having garbage to dispose of, who does not otherwise provide for the disposal of such garbage in a sanitary manner shall provide himself with one or more metal cans sufficient to receive all garbage in a sanitary manner and sufficient to receive all garbage which may accumulate between the times of collection. Each metal can shall have a capacity of not to exceed thirty gallons and shall be provided with a bail or handles and a tight fitting cover. All garbage accumulating between the times of collection shall be placed in said cans after having first been drained of surplus water and wrapped in paper in a manner sufficient to prevent leakage there from.

605.07. Location of Containers. Garbage cans shall be kept at or near the back door of the building using the same, at the rear of the property or in an enclosed area or garage, and shall be accessible to collectors at all reasonable times. Such garbage cans shall be used for garbage only and not for rubbish. Such garbage cans shall not be used as incinerators or for burning and no garbage shall be placed in any can or incinerator or container used for burning of paper or other combustibles. No garbage shall at any time be burned in any bonfire or other fire whether in a container or in the open.

605.09. Garbage Disposal. Every householder, owner, occupant or tenant of any premises who does not otherwise dispose of garbage in a sanitary manner, shall place all garbage in a container as hereinbefore provided and shall not allow the same to be kept or maintained upon said premises in excess of 15 days. It is the duty of each licensed garbage collector to haul away at least once each week to such places as designated in his license application all garbage from the premises of his customers located within the area in which he is authorized to collect garbage.

605.11. Rubbish Disposal. Every householder, owner, occupant or tenant of any premises who does not otherwise dispose of rubbish in a sanitary manner, shall place all rubbish in a tight receptacle and shall not allow the same to be kept or maintained upon said premises in excess of 32 days. If rubbish and garbage are placed in the same container, the entire contents shall be treated as garbage for disposal purposes. It shall be the duty of each licensed garbage or rubbish collector to haul away once each month to such places as designated in his license application all rubbish from the premises of his customers located within the area in which he is authorized to collect garbage or rubbish.

605.13. Regular Removal. It is the intention of this section to establish a system of complete, regular garbage and rubbish collection throughout the city so that the disposal of such materials shall be accomplished in a sanitary manner and so that the health and sanitary conditions of the residents of the city shall be properly safeguarded. All residents are required by this ordinance to make adequate provisions for sanitary removal of garbage and rubbish by means of licensed collectors unless such persons have provided other adequate means of disposal which meet with the approval of this Health Officer and which comply with all other ordinances and regulations of the city.

605.15. Unlicensed Collections. Any person who permits garbage or rubbish to be picked up from his premises by an unauthorized or unlicensed collector shall be guilty of a violation of this section. This indiscriminate discarding of garbage or rubbish on any streets, alleys, drives, parks, playgrounds or other public places or on any vacant lots privately owned shall constitute a violation of this section whether such garbage or rubbish is discarded by the individual upon whose premises the garbage or rubbish originates or whether it is discarded by some other person or collector, licensed or unlicensed.

605.17. Collection License. It is unlawful for any person, firm or corporation to collect garbage or rubbish without having first secured from the Council a license to do so. Subdivision 1. Application; Contents. Any person desiring a license to collect garbage shall make application for the same to the Clerk upon a form prescribed by the Council. The application shall set forth:

1. The name and address of the applicant;
2. A list of the equipment which he proposes to use in such collection;
3. The place or places to which the garbage or rubbish is to be hauled;
4. The manner in which said garbage or rubbish is to be disposed of;
5. The portion of the City in which collections are to be made.

Subd. 2. Health Officer Review. The application shall be submitted to the Health Officer for his investigation and report. If the Health Officer finds that the applicant is responsible and has proper equipment for such collections and that no nuisance is liable to be created by the granting of said license, he shall endorse his approval upon the application.

Subd. 3. Fee. Before any license may be issued, the applicant shall pay to the Clerk a license fee in the amount set by Chapter X, which fee shall accompany the application.

Subd. 4. Duration. No license issued hereunder shall be for a longer period than one year. All licenses shall expire on December 31st following the date of issuance unless sooner revoked or forfeited. If a license granted hereunder is not renewed previous to its expiration, then all rights granted by such license shall cease, and any work performed after the expiration of the license shall be in violation of this section.

Subd. 5. License Display. When a license is issued, the City shall furnish to the licensee for a charge of \$3.00 a license for each vehicle to be used by such licensee within the City, which license shall be affixed to each such vehicle in a conspicuous place.

605.19. Public Liability Insurance Required. Before any license may be issued, the applicant shall, if his application is approved by the Council, deposit with the Clerk, proof of the public liability insurance hereinafter required. Before any person is granted a license hereunder he shall file with the Clerk policies of public liability and property damage which shall remain and be in force and effect during the entire term of said license and which shall contain a provision that they shall not be cancelled without ten days' prior written notice given to the City. Public liability insurance shall not be less than \$25,000.00 for injuries, including accidental death to any one person, and, subject to the same limit for each person, in an amount of not less than \$50,000.00 on account of any one accident and property damage insurance in the amount of not less than \$10,000.00 for each accident or mishap. Said policies of insurance shall further provide for indemnity and security to the City of Inver Grove Heights against any liability and/or responsibility for the acts, actions, or omissions of the licensee, or of any of the agents or servants of such licensee subject, however, to the limitations as to amount herein stated. No work shall be done under any license hereunder until said insurance policies shall have been filed and approved by the Clerk.

605.21. Collection Truck. Each licensed garbage and/or rubbish collector shall provide a covered truck or wagon, so constructed that the contents will not leak or spill therefrom, in which all garbage and/or rubbish collected by him shall be conveyed to the place designated in his application. The wagon or conveyance used shall be kept clean and as free from offensive odors as possible, and shall not be allowed to stand in any street, alley, or public place longer than is reasonably necessary to collect garbage or rubbish.

605.23. Collection Hours and Discontinuance of Service. No collections of garbage or rubbish shall be made except between the hours of 6:00 a.m. and 9:00 p.m. The expense of garbage and rubbish collection shall be paid to the collector by the owner, agent, occupant or tenant of the premises from which such garbage or rubbish is collected and such charge shall be full compensation for his services of such collection. The collector may refuse to make collections from any premises when the fees are not paid within one week from the date such garbage or rubbish is collected. The collector shall notify the Health Officer and the Clerk of the discontinuance of service to any premises within 15 days after service is discontinued.

605.25. Renewal of License. Persons renewing their licenses after the expiration date shall be charged the full annual license fee. No prorated license fee shall be allowed for renewals.

605.27. Revocation or Suspension. The Council may suspend or revoke the license of any person licensed under this section whose conduct is found to be in violation of the provisions of this section or whose work hereunder or vehicle or vehicles used in connection therewith is found to be improper or defective or so unsafe as to jeopardize life or property. The person holding such license shall be given ten days' notice in writing of such complaint and shall be granted the opportunity to be heard before such action is taken. Notice hereunder shall be deemed sufficient if it is sent to the address of the licensee as shown on his most recent application for a license hereunder.

605.22. Revocation upon Violations. When any person holding a license has been convicted for the second time by a court of competent jurisdiction for violation of any of the provisions of this section, the Council shall revoke the license of the person so convicted. Such person may not make application for a new license for a period of one year.

APPENDIX VI

Occupational Health and Safety Act of 1970

Public Law 91-596

The purpose of the Occupational Safety and Health Act of 1970 is to assure, so far as possible, every working man and woman in the nation have safe and healthful working conditions. Under its terms, the federal government is authorized to develop and set mandatory occupational and health standards. The Act is administered by the Occupational Safety and Health Administration (OSHA).

Minnesota OSHA, a division of the Minnesota Department of Labor and Industry, has the responsibility for enforcing the federal OSHA standards. The Compliance Division of Minnesota OSHA has authority to make inspections of work sites and issue citations if they determine that certain standards are not in compliance.

Part 1910, Title 19 of the Code of Federal Regulations, contain general industry standards promulgated by the federal OSHA. Many of these standards apply to employees working at landfill facilities. They include:

- 1910.94 Ventilation
- 1910.95 Occupational noise exposure
- 1910.133 Eye and face protection
- 1910.134 Respiratory protection
- 1910.135 Occupational head protection
- 1910.136 Occupational foot protection
- 1910.137 Electrical protective devices
- 1910.141 Sanitation
- 1910.151 Medical services and first aid
- 1910.157 Portable fire extinguishers
- 1910.242 Hand and portable powered tools and equipment,
general
- 1910.252 Welding, cutting and abrading
- 1910.440 Recordkeeping requirements
- 1910.1000 Air contaminants

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