Enforcement Decision Document
Remedial Alternative Selection

Site: Reilly Tar and Chemical Corporation
St. Louis Park, Minnesota

Documents Reviewed

The following documents have been reviewed by the United States Environmental Protection Agency (U.S. EPA), Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDH). These documents describe (1) the problem at and beneath the Reilly site caused by the wastes generated by the creosote production and wood-treating process used by the Reilly Tar and Chemical Corporation, (2) the potential health risks associated with ingestion of these compounds found in the ground water, and (3) the various remedies evaluated to cost-effectively mitigate the release of contaminants:

(1) "Soil and Ground Water Investigation, Coal Tar Distillation and Wood Preserving Site, St. Louis Park - Phase I Report" prepared by Barr Engineering Company, May 1976.

(2) "Soil and Ground Water Investigation, Coal Tar Distillation and Wood Preserving Site, St. Louis Park - Phase II Report", prepared by Barr Engineering Company, June 1977.

(3) "Health Implications of Polynuclear Aromatic Hydrocarbons, in St. Louis Park Drinking Water" prepared by the Minnesota Department of Health, November 1978.

(4) "Progress Report: Investigation of Coal Tar Derivatives in Ground Water - St. Louis Park" prepared by the United States Geological Survey (USGS), April 13, 1979.

(5) "Field Investigation of Uncontrolled Hazardous Waste Sites, Cost Estimates for Cleanup of Contaminated Ground Water and Soil at the Reilly Tar and Chemical Company Facility, St. Louis Park Minnesota" prepared by Ecology and Environment, Inc., 1980.

(6) "Preliminary Evaluation of Ground Water Contamination by Coal Tar Derivatives, St. Louis Park, Minnesota" prepared by the USGS, January, 1981.

(7) "Report on Drinking Water Treatment and Remedy Evaluation for St. Louis Park, Minnesota" prepared by Eugene A. Hickok and Associates, Inc., April 1981.

(8) "Study of General Water Contamination in St. Louis Park, Minnesota" prepared by Eugene A. Hickok and Associates et al., November 1981.

(9) "Degradation of Phenolic Contaminants in Ground Water by Anaerobic Bacteria: St. Louis Park, Minnesota" prepared by Eilich, Goerlitz Godsy and Hult, USGS, November 1982.

(10) "Evaluation of Ground Water Treatment and Water Supply Alternatives for St. Louis Park, Minnesota" prepared by CH_2M-Hill, 1982-83.

(11) "Recommended Plan for a Comprehensive Solution of the Polynuclear Aromatic Hydrocarbon Contamination Problem in the St. Louis Park Area" prepared by Environmental Research and Technology, Inc. for the Reilly Tar and Chemical Corporation, April 1983, plus Errata, June 27, 1983 and November 27, 1984.

(12) "Assessment of Ground Water Contamination by Coal Tar Derivatives, St. Louis Park Area" prepared by M. F. Hult, USGS, Open File Report 84-867, 1984.

(13) "Record of Decision, Remedial Action Alternative Selection" prepared by the United States Environmental Protection Agency (U.S. EPA), June 6, 1984.

(14) "Evaluation of Granular Activated Carbon for the Removal of Polynuclear Aromatic Hydrocarbons from Municipal Well Water in St. Louis Park, Minnesota" prepared by Calgon Carbon Corporation, September 10, 1984.

(15) "Ground Water Flow in Prairie du Chien-Jordan Aquifer Related to Contamination by Coal Tar Derivatives, St. Louis Park, Minnesota" prepared by J. R. Stark and M. F. Hult, USGS, 1985.

(16) "Pollutant Source Identification Study" prepared by Acurex Corporation for the U.S. EPA, September 1985.

(17) "Review and Evaluation of Ground Water Contamination and Proposed Remediation at the Reilly Tar Site, St. Louis Park, Minnesota" prepared by Dr. James W. Mercer, Geo Trans, Inc., December 1984.

(18) "Reilly Tar and Chemical Corporation Refining and Wood Preserving Operation at St. Louis Park, Minnesota" prepared by Dr. Warren S. Thompson, December, 1984.

(19) "Summary of Expected Testimony on Principles of Contaminant Transport in the Ground Water System with Application to a Coal Tar Derivative Contamination Problem, St. Louis Park, Minnesota" prepared by Dr. Hans-Olaf Pfannkuch, December, 1984.

(20) Progress Reports of Clean-up of Well W23 and Well W105 produced by Eugene A. Hickok and Associates, 1982-1984.

(21) Soil Borings and Chemical Analyses produced by the GCA Corporation, December, 1984.

(22) Analyses of Ground Water and Soil Samples by Midwest Research Institute under contract to the U.S. EPA, 1981.

(23) Analyses of Benzene Extractables and Soil Contamination Profiles about the Reilly Site produced by David Crisman, MPCA, in a memorandum to Paul Bitter on January 14, 1986.

Description of Selected Remedy

The Remedial Action Plan (RAP) attached to the Consent Decree, prescribes the following remedial actions, remedial investigations and feasibility studies to be completed over the next 5 years and to be operated until cessation criteria enumerated in the RAP are satisfied.

(1) Restoration of drinking water supply and water quality by construction of a Granular Activated Carbon (GAC) system at St. Louis Park Wells (SLP 15/10), in accordance with the June 6, 1984 Record of Decision. This task has been completed by the Reilly Tar and Chemical Corporation and is in the start-up process;

(2) Monitoring and contingency treatment of the Mt. Simon/Hinckley aquifer to maintain drinking water quality;

(3) Monitoring, pumping and treatment of the Ironton/Galesville aquifer to protect the deeper Mt. Simon/Hinckley aquifer;

(4) Monitoring, pumping and treatment of the Prairie du Chien/Jordan aquifer until such time that drinking water quality is uniformly established within the area of gradient control;

(5) Monitoring and contingent action for the maintenance of drinking water quality in the St. Peter aquifer;

(6) Monitoring, pumping and treatment of the Drift and Platteville aquifers to protect the down gradient use of the aquifer and the deeper St. Peter aquifer;

(7) Monitoring, pumping and treatment of the source material in the Glacial Drift aquifer and in well W23 in the Prairie du Chien/Jordan aquifer;

(8) Capping and filling of exposed hazardous wastes in the vicinity of the bog, south of the site, in accordance with the U.S. Fish and Wildlife and U.S. Environmental Protection Agency regulations;

(9) Discharge of hazardous wastes to a sanitary sewer for any contaminated material excavated and dewatered for the purposes of construction of an intersection in the vicinity of the bog;

(10) Further subsurface investigation in the vicinity of the site, to implement deed restrictions for current and future land use in the areas of contamination;

(11) Further Remedial Investigations/Feasibility Studies to determine the areal extent of, and remedy for the contamination in the Northern area of the Glacial Drift aquifer adjacent to the site; and

(12) Further Remedial Investigation and/or Feasibility Studies in the St. Peter aquifer as necessary to implement the remedial action prescribed to protect drinking water quality.

All of the above actions will be implemented in accordance with the relevant environmental laws and regulations. Cessation of the above actions will be decided by the Regional Administrator based on criteria already established or on criteria that may be proposed in the future.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that this Remedial Action Plan for the Reilly Tar and Chemical Corporation Site will produce cost-effective remedies that provide adequate protection of the public health, welfare and the environment. The State of Minnesota has been consulted and agrees with the approved Remedial Action Plan. In addition, the action will require future operation and maintenance activities to ensure the continued effectiveness of the remedies. These activities will be considered part of the approved action. Settlements have been reached between EPA, the State, the City of St. Louis Park, the City of Hopkins, Oak Park Village Associates, the Housing and Redevelopment Authority of St. Louis Park, Phillips Investment Company, and Reilly based on the Remedial Action Plan.

I have also determined that the actions being taken are cost-effective alternatives when compared to the other remedial options reviewed.

May 30, 1986
DATE

Valdas V. Adamkus

Regional Administrator
Region V
United States Environmental Protection Agency

Attachments:

Summary of Remedial Alternatives Selection
Record of Decision, June 6, 1984
Consent Decree
Remedial Action Plan

Summary of Remedial Alternatives Selection

Reilly Tar and Chemical Corporation

St. Louis Park, Minnesota

Site Location and Description

The Reilly Tar and Chemical Corporation site occupied 80 acres of land located in St. Louis Park, Minnesota (Figure 1). A copy of a site map is attached (Figure 2). The plant site, called the Republic Creosote Works, was located west of Gorham, Republic and Louisiana Avenues, south of 32nd Street, east of Pennsylvania Avenue, and north of Walker Street. The company no longer owns the land; the City of St. Louis Park purchased the land from Reilly in 1972 and it is currently owned by the St. Louis Park Housing and Redevelopment Authority. The City is contiguous to the City of Minneapolis and exhibits a similar population density. Currently, the site is a park with a portion of it developed with condominiums. It is located in the midst of a residential area with some small industry.

Site History

The site history is summarized in Appendix A, Record of Decision for construction of a Granular Activated Carbon System at St. Louis Park Wells SLP15 and SLP10. The following supplements that information.

Reilly Tar and Chemical Corporation produced creosote from its coal tar distillation process although for a few years pentachlorophenol (PCP) was used as a preservative. Reilly primarily treated railroad ties, timbers, poles, piling, and heavy duty products. PCP was commonly used on millwork or wood where a clear paintable surface was desired. It is not used for heavy products. Throughout the Remedial Investigations, PCP was not found in the soil, ground water, or in the coal tar found in the well bore of W23 on site. The wastes discharged or spilled on the site are predominantly polynuclear aromatic hydrocarbons (PAH) and phenolics. Discharges from the refinery went overland and through conduits to a bog south of the site. The pathways and sources of contamination are discussed, in detail, later in this document.

The contamination of the aquifers beneath the site occurred through spills of coal tar product that eventually migrated down Well W23 on-site and contaminated multiple aquifers, and through leachate generated by discharge of waste water overland into a bog south of the site. This leachate from the bog contaminates the surficial aquifer (Drift) after which the contamination either leaks downward to the Platteville aquifer or is conveyed through the Drift aquifer to the Platteville and St. Peter aquifers through the geological pathways that exist downgradient from the site. Over the years 1917-1970, millions of gallons of waste water were discharged to the bog on an annual basis. The bog, therefore, serves as a continuous source of release of contamination to the subsurface environment.

FIGURE 1

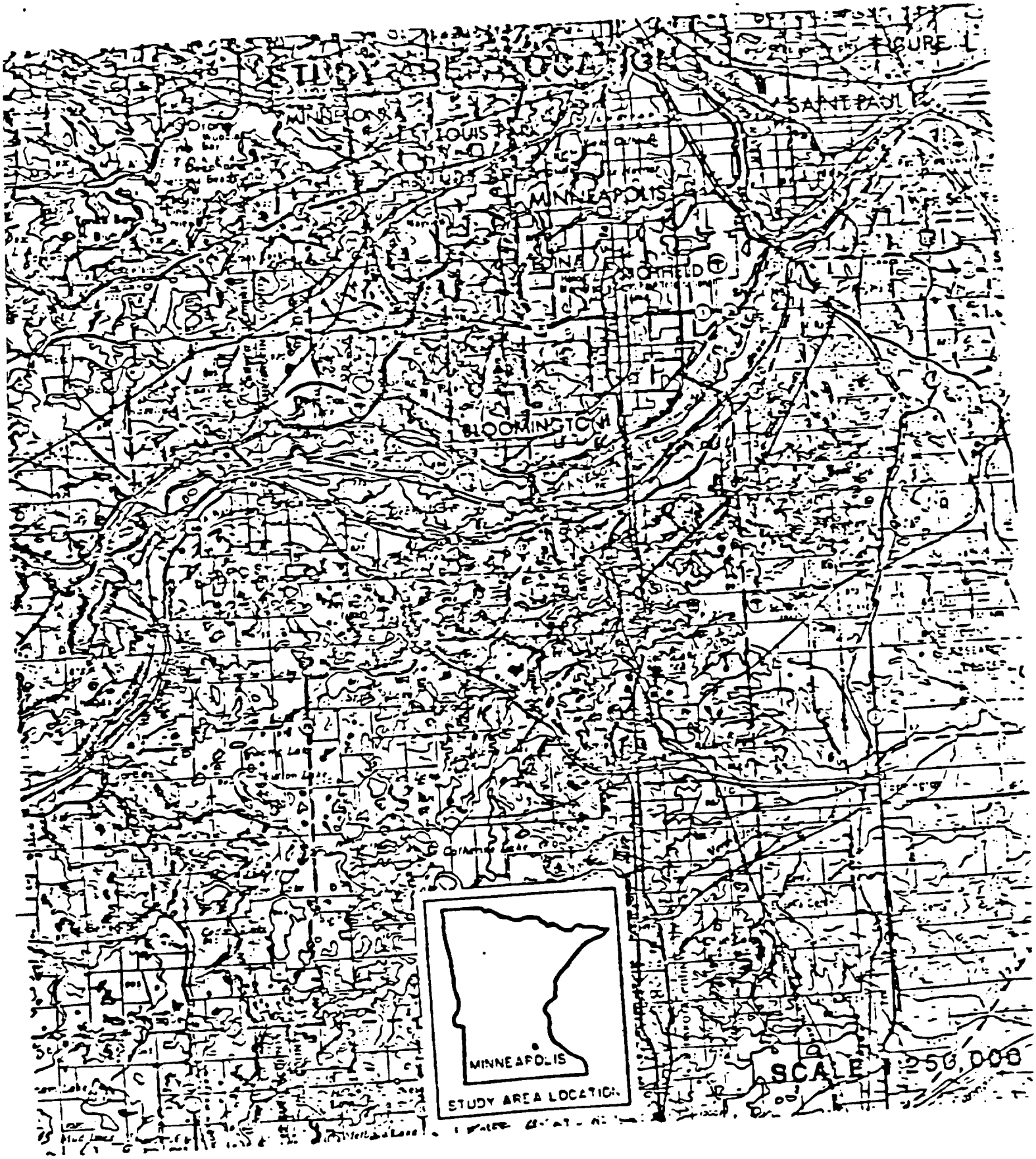
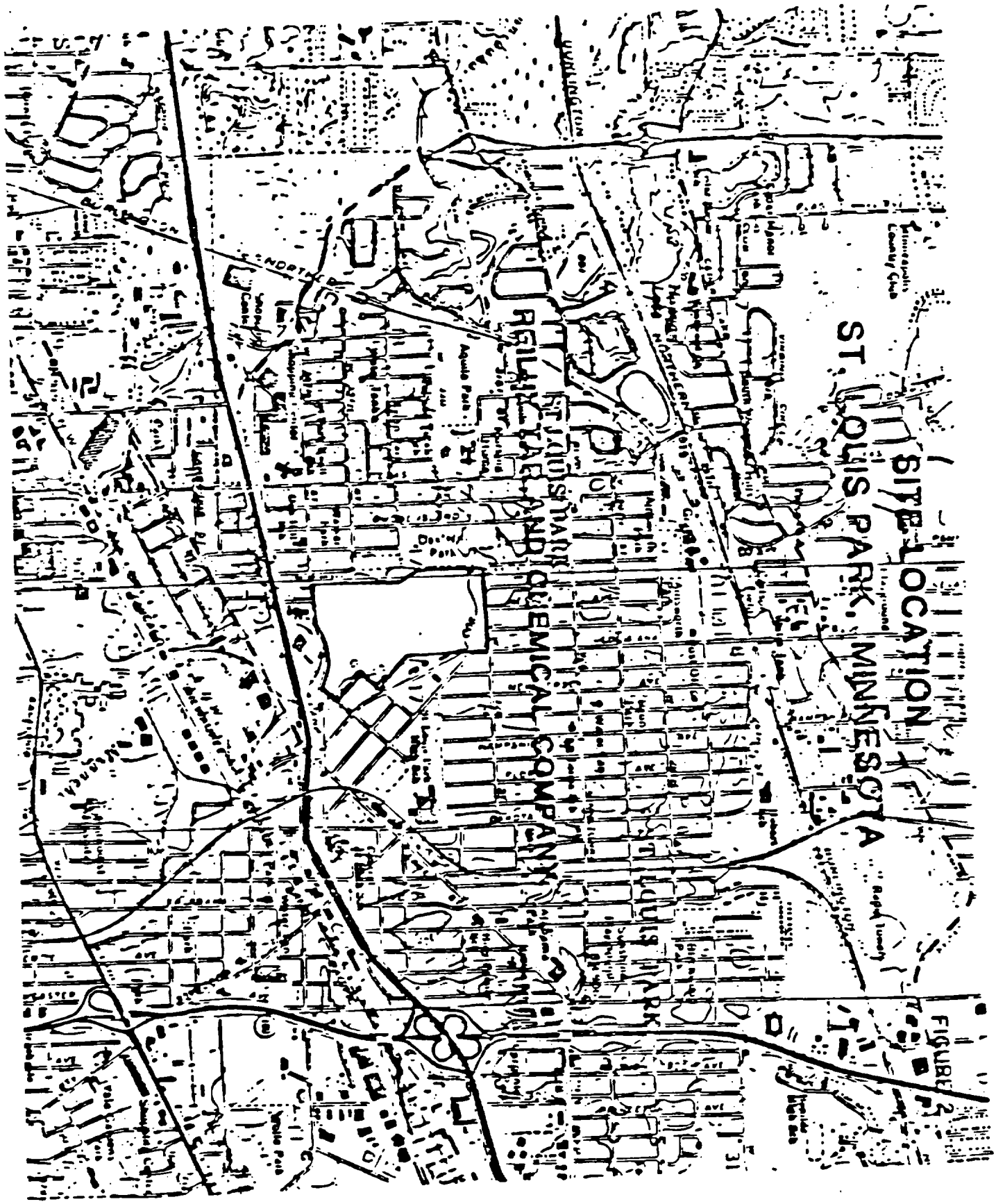

SAINT PAUL
MINNEAPOLIS
BLOOMINGTON
MINNEAPOLIS
STUDY AREA LOCATION
SCALE

FIGURE 2


SITE LOCATION
ST. LOUIS PARK, MINNESOTA
REILLY TAR AND CHEMICAL COMPANY
NORTH

Current Site Status

This is also summarized in Appendix A. The only substantive addition to the appendix that should be mentioned here is that the City of St. Louis Park Housing and Planning Commission plans on developing more of the site, which is currently used primarily as a park, and the City continually stores old timber and contaminated soil excavated on the southwest corner of the site; below the surface. These soils were excavated during the development of the site, and are further addressed in the Alternatives Analysis of this EDD and in the Remedial Action Plan, which is part of the Consent Decree, implemented by Reilly. Appendix A addresses the contamination in the Prairie du Chien/Jordan aquifers. This section will summarize all of the contamination measured in the aquifers and on the site.

The 80 acre site once owned by Reilly is primarily park land today, but contamination exists throughout the subsurface of the site although not to the same magnitude as the contamination in the bog. The receptors on site would be individuals who build foundations into the depths of the contaminated subsurface. For this reason the MPCA has instituted procedures to monitor and inspect areas under development at the site and to require proper disposal of contaminated earthen material. This will be further discussed in the Screening of Alternatives sections. The largest amount of potential receptors are those who may ingest the ground water near the site.

Since the City provides municipal wells finished into the St. Peter, Prairie du Chien/Jordan and Mt. Simon/Hinckley aquifers, these wells can be monitored for contamination as discussed later.

The physical/chemical parameters of peat allow for it to significantly adsorb large amounts of coal tar compounds. Nevertheless, a continuous release of contamination occurs from the peat deposits south of the site. Evaluation of the chemical analyses shows that contamination in the Drift aquifer can be measured at least over one-half mile east of the site. There are three major pathways for contamination of the aquifers: (1) leachate into the Drift from spills and precipitation into the ground water over the years, (2) drainage to the south of the site to surface water ponds and Minnehaha Creek, and (3) W23, the well that contained coal tar compounds (solid and organic phase) and which conveyed approximately 15 gpm from the St. Peter aquifer to the Prairie du Chien/Jordan, contaminating that aquifer with solubilized PAH compounds.

Soil Contamination

Soil borings collected at various depths and measured for Benzene Extractable Organics provided a visual and analytical description of contamination found beneath the vicinity of the site. Contour lines were produced to display the approximate locations where the chemical data exceed the backgound concentration of 500 to 800 mg/kg, dry weight, of benzene extractable organics measured in uncontaminated peat found at the site. The peat generally undulates throughout the subsurface to a depth of 20 feet.

Review of the information shows that most of the contamination is above the 10 foot level within the site boundaries. The bog, south of the site, for the purposes of this EDD is bounded by Walker Street to the north, Lake Street to the south, the extension of Louisiana Avenue to the east and the intersection of an imaginary line extending south of the western boundary of the site where it abuts Walker Street with an imaginary line extending westward from the Western-most terminus of Lake Street as shown on Figure 2. The area of contamination within the bog remains somewhat constant with depth. The deposit of creosote contamination serves as the source of contamination to the surficial (Glacial Drift) aquifer. This volume of contaminated earth was first estimated at 400,000 cubic yards. Further considerations using data collected from local monitoring wells extend the depth of contamination substantially such that as much as 800,000 cubic yards of earth may need excavation and proper treatment or disposal in a RCRA compliant landfill. The plant site, by comparison, shows most of the contamination to a depth of 5 feet with only small areas showing contamination at a depth of 10-15 feet.

The adverse effects due to these deposits of creosote wastes are the associated health risks manifested from exposure to these compounds. Exposure can occur by excavating the soils or by drinking or bathing in water that has been contaminated by leachate emanating from the site. The remedial investigations and remedial actions prescibed for this site and for the surficial aquifer are based on limiting the exposure to these compounds. Therefore, the City of St. Louis Park has the responsibility of complying with laws and regulations pertinent to the disposal of hazardous wastes found at the site and must consider the appropriate land use for this area. Similarly the U.S. Fish and Wildlife Service will partake, with the other agencies, in overseeing and regulating any backfilling, excavation or alteration of that part of the bog which is construed as a wetland. The migration of contaminants in the Glacial Drift Aquifer will be mitigated by a pumpout system in order to protect downgradient users. These alternatives are fully discussed later in this EDD.

Aquifer Contamination

Coal tar released from the site has contaminated four aquifers located beneath the site (see Table 1, Figure 3 and Figure 4). The aquifers that are being and will be studied under the Remedial Action Plan are the following:

TABLE 1

Hydrogeology Below the Reilly Tar and Chemical Corporation Site

Aquifer	Approximate Depth (ft.)	Use	Upper Range of Contamination (Total PAH)
(1) Drift/ Platteville	0-90	Private/Industrial wells	1000 ug/1 off-site

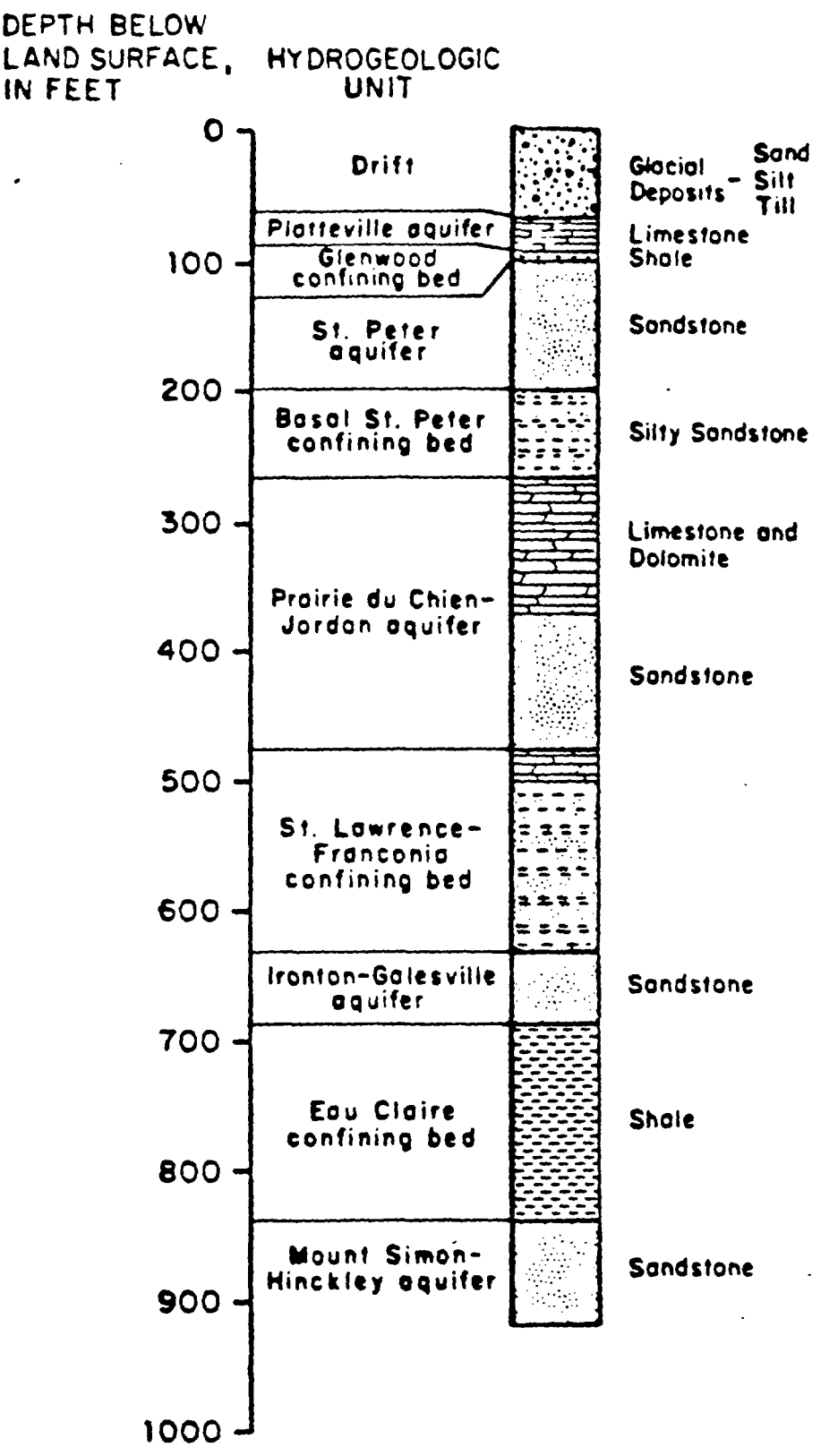
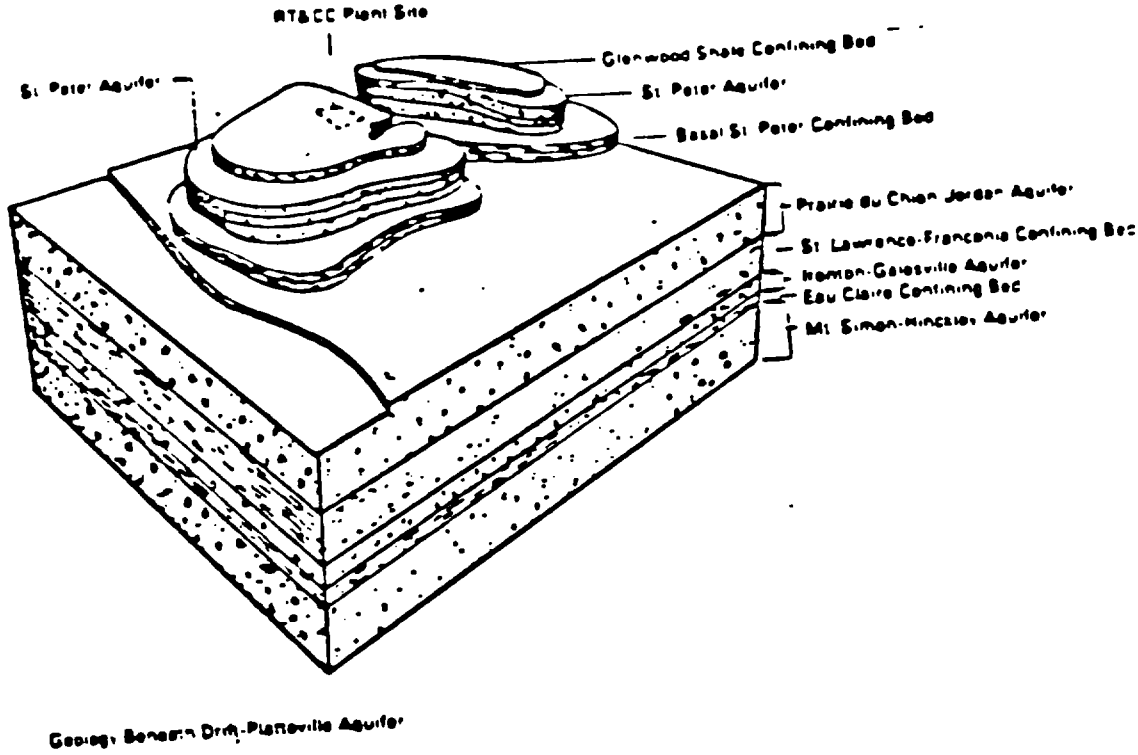


FIG. 3. GENERALIZED STRATIGRAPHIC COLUMN BASED ON WELL LOGS FROM W 23 ON SITE
(AFTER HULT AND SCHOENBERG 1984)



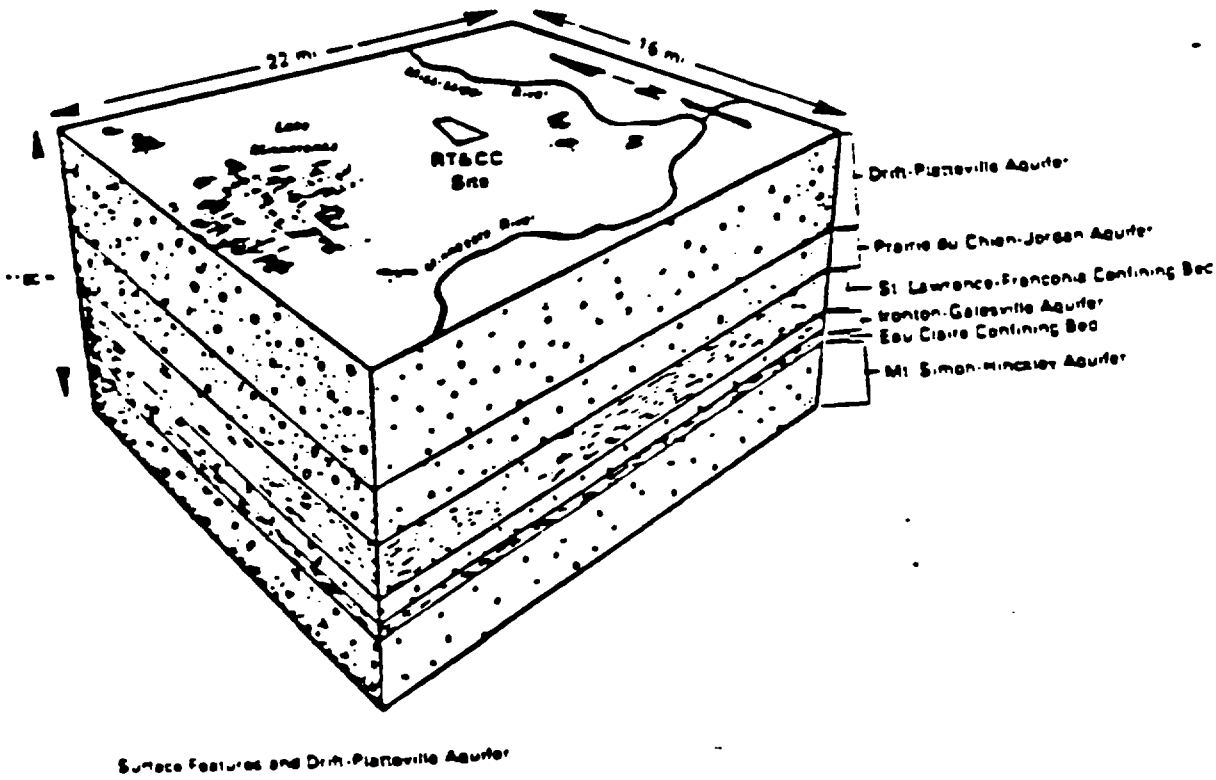


Figure 4 - Schematic View of Twin Cities Basin Geology

(2) St. Peter	90-200	Municipal/Private drinking water wells	< 10 ug/l off-site
(3) Prairie du Chien-Jordan	250-500	Municipal drinking water wells	10 ug/l off-site
(4) Ironton-Galesville	700-750	Industrial usage	< 10 ug/l is estimated to be on-site
(5) Mt. Simon-Hinckley	800-1100	Municipal drinking water wells	Not detected

Ground water contamination in each aquifer under the site is approximately ten times higher than the off-site concentration shown above.

The Prairie du Chien-Jordan aquifer is the primary source of drinking water for 110,000 people in St. Louis Park, Edina, Hopkins and all communities adjacent to Minneapolis. The City of Minneapolis depends exclusively on the Mississippi River as its drinking water source and has considered utilizing the Prairie du Chien-Jordan as its secondary source of water supply in the future. The deeper Mt. Simon-Hinckley aquifer is the second most extensively used drinking water aquifer for the area and it is utilized to such an extent that the Minnesota Department of Natural Resources is concerned about further significant appropriation of water from this aquifer. The St. Peter aquifer, while it once was a major source of water supply, is now a minor source of municipal drinking water supply because of the better water quality of the Prairie du Chien.

The uppermost aquifers, the Drift and Platteville, have in the past provided potable water to numerous private wells, but with municipal supplies becoming available, they are no longer used for potable purposes to any significant extent. However, there are still many private wells in the shallow aquifers which can be used for irrigation of lawns and gardens.

The extent of contamination in each aquifer varies greatly. No contamination has as yet been found in the Mt. Simon-Hinckley. The hydrogeology of the site suggests that the St. Peter aquifer is contaminated. Further sampling of wells near the site is expected to confirm this assumption. The area of contamination in the Prairie du Chien-Jordan extends east beyond Highway 169/100 and has the greatest potential public health impact due to the number of municipal water supply wells located just outside the presently known contaminated zone. The spread of contamination usurps the aquifer's potential as the primary source of drinking water.

Contamination of the Prairie du Chien-Jordan aquifer occurred by two modes. One is through direct contact of the aquifer with the coal tar material found in W-23. The material in this well has, for the most part, been removed. Another mode of contamination is through the inadequately constructed multiaquifer wells that allow contaminated water from the upper aquifers to be transported along the outer diameter of the casing into the deeper cleaner aquifers. These two mechanisms are the primary pathways of contamination of the Prairie du Chien-Jordan aquifer which resulted in the closure of six St. Louis Park wells and one City of Hopkins Well.

Releases of PAH and related coal-tar distillate material to the environment are still occuring. The primary methods of contamination of the uppermost aquifer (Drift/Platteville aquifer) is through the contaminated soil at the site and the bog south of the site which act as sources for migration into the ground water. Contamination of the uppermost aquifer has been found to a depth of 90 feet in the bog area. It seems that the contamination is not evenly distributed throughout the bog, rather, the area and depth of soil contamination appears to be representative of channel into the bog area. This is probably a consequence of the ditches used by Reilly to dispose of wastes. As the contamination dissolves into the aquifer it moves east, southeasterly where it migrates through a bedrock valley into the Platteville aquifer and toward the St. Peter aquifer.

Status of Remedial Action

Since 1981, the MPCA has been performing various actions at the site funded through a Cooperative Agreement with the U.S. EPA. This, among other things, led to a Record of Decision for construction of a GAC plant at SLP15/10 (Appendix A) for restoration of drinking water for the City of St. Louis Park. Well W23 was a major source of, and conduit for, contamination of the Prairie du Chien/Jordan aquifer, the Ironton/Galesville aquifer and potentially the Mt. Simon/Hinckley aquifer. In 1982-83 two multiaquifer wells, W23 and W105, were cleaned and reconstructed to the Prairie du Chien/Jordan and Ironton/Galesville aquifers, respectively, thus serving as monitoring and potential purge wells in the area. About 100 feet of coal tar material was removed from W23. No solid coal tar material was found in Well W105, although the water in that well down to the Ironton/Galeville aquifer was contaminated by dissolved coal tar material. The task to clean out and properly reconstruct W23, although intended as an initial investigation of the well, actually was a significant cleanup and preventive measure that removed a substantial source of contamination to the major drinking water aquifer in the area (Prairie du Chien/Jordan) and eliminated potential multi-aquifer transfer of contaminated water still in the Drift/Platteville aquifers to the Prairie du Chien/Jordan aquifer.

Other tasks performed through funding by the U.S. EPA/MPCA Cooperative Agreement resulted in the Record of Decision (ROD) attached in Appendix A and investigation of numerous private wells that could serve as conduits of contamination to deeper aquifers as did W23. Reilly Tar and Chemical Corporation has implemented the ROD at SLP15/10 and the GAC plant is now

operating under test procedures and it is scheduled for full scale start-up in June 1986. The GAC system can be used for a peak flow of 1100 gallons per minute (gpm) with an average use of approximately 500-600 gpm. This significant effort is the first of a major remediation program of the aquifers in the area of St. Louis Park.

Alternatives Analyses

The following analyses are presented in a format starting with the deepest aquifer known to be potentially affected by the activities at the site, the Mt. Simon/Hinckley aquifer, and concluding with analysis of the remedy for surface and subsurface soil contamination at the site (Figure 3). Of particular complexity are the analyses of the Mt. Simon/Hinckley aquifer, the Prairie du Chien/Jordan aquifer, and the subsurface soil contamination. Thus, most of the discussion relates to these three formations.

It should be noted herein that the Remedial Action Plan (RAP) for the site to be implemented by Reilly Tar and Chemical Corporation is 96 pages. The RAP is very specific with respect to action levels and cessation criteria for each remedial action requiring the pumping of an aquifer. It is not reproduced in this EDD and is noted here by reference as the RAP. Also, extensive water and soil quality analyses have been conducted throughout the Remedial Investigations. Two families of compounds, PAH and phenolics, are consistently found, directly relate to the coal tar distillation processes, and are the compounds of health concern found in the water supplies. Other organic and inorganic compounds have been monitored and found in substantially lower quantities, order(s) of magnitude less than the PAH and phenolic compounds identified in the Remedial Action Plan for implementation at the site. This is not unexpected due to the known process used by Reilly in its distillation and wood treating. The target list of compounds for monitoring is given in the RAP, pages 92-94.

Aquifer Characteristics Analysis -

Mount Simon/Hinckley Aquifer

The Mt. Simon/Hinckley Aquifer is the deepest aquifer in the geologic sequence beneath the Reilly site that may have been contaminated. During the Remedial Investigation no contamination was measured in the Mt. Simon/Hinckley. The physical characteristics of the aquifer are -

Geologic characteristics:	Sandstone, grayish white to pink, silty to course grained, well cemented, quartzose; parts are medium to course grained, well sorted.
Approximate range of thickness:	Up to 260 to 270 feet; starts at approximately 800 to 850 feet beneath the surface.

Areal extent:	Underlies the entire study area (Figure 1).
Water bearing characteristics:	Porosity is intergranular; high transmissivity. Generally discharges more than 1000 gallons per minute to high capacity wells.
Use:	Supplies about 15% of ground water pumped to St. Louis Park and the seven-county metropolitan area.

Wells of interest	Year Constructed	Depth (feet)	Original Construction
W 105	1899	940	multi aquifer
W 23	1917	909	multi aquifer
W 38	1913	1002	multi aquifer
SLP 11	1961	1093	single aquifer
SLP 12	1963	1095	single aquifer
SLP 13	1964	1040	single aquifer
SLP 17	1983	1082	single aquifer

Multi-aquifer wells W105, W23 and W38 were of similar construction and could have allowed downward migration of contaminants from overlying aquifers to the Mt. Simon/Hinckley. Wells W105 and W38 have been reconstructed and grouted to the depth of the Ironton/Galesville aquifer by the MPCA and are used for monitoring wells.

Well 23 was investigated to a depth of 860 feet, the top of the Mt. Simon/Hinckley aquifer, before it was resealed. During this investigation, at a depth of 600 to 740 feet, a plug of coal tar derivative was removed and caused some contamination of the water entering the bore hole into the Mt. Simon/Hinckley aquifer. One sample taken at the depth of 860 feet showed contamination of 1 part per million of PAH compounds which was probably due to the material that was removed from the bore hole 120 to 180 feet above the Mt. Simon/Hinckley aquifer. W23 is probably the only source of contamination to the Mt. Simon/Hinckley Aquifer. None of the municipal wells finished into the Mt. Simon/Hinckley aquifer, SLP: 11, 12, 13 and 17, displayed evidence of contamination.

Representative samples of the Mt. Simon/Hinckley aquifer could not be collected during clean out of wells W105 and W23. Many scenarios exist as to the mechanism and duration of contamination, if any, entering the Mt. Simon/Hinckley aquifer and are separated into best case and worse case hypothetical situations. If contamination did enter the Mt. Simon/Hinckley aquifer, it would have entered via down through the multi-aquifer wells W23, W105, and W38. All of the wells were found to be backfilled, due to their open-hole construction, above the Mt. Simon/Hinckley aquifer. This process probably occurred over several years following construction of the wells, and thus probably greatly impeded downward flow of contaminants into the Mt. Simon/Hinckley through the well bore. Based on the

data gathered during the clean out of W105 by the MPCA in 1984, this well does not appear to have significant coal tar material beneath the Ironton/ Galesville aquifer. W38 own by the Milwaukee Railroad Company, briefly a multi-aquifer well during its construction was capable of allowing contaminants from the upper aquifers to disburse into the Mt. Simon/Hinckley aquifer. However, it did not regularly have any coal tar material seeping into it as W23. The well was drilled to the Mt. Simon/Hinckley in 1913 and casing placed down to the St. Peter aquifer. The open borehole between the St. Peter and Mt. Simon/Hinckley aquifers filled with native aquifer material, and thus is not considered a conduit of contamination to the Mt. Simon/Hinckley aquifer. Therefore, the most probable source of contamination to the Mt. Simon/Hinckley aquifer is W23. With much less probability W105, 200 feet away from W23, could have briefly acted as a dilute point source of contamination by multi-aquifer transfer. For remedial purposes these two wells, due to their proximity, can be considered a point source of contamination to the Mt. Simon/Hinckley aquifer.

Screening of Alternatives and Alternatives Analysis for the Mt. Simon/ Hinckley Aquifer

To investigate the Mt. Simon/Hinckley aquifer to test the hypotheses stated earlier, an expensive remedial investigation, nearly equivalent to the cost of remedial action, would be necessary if only to document that the Mt. Simon/Hinckley aquifer is either not contaminated, contaminated below an action level, or contaminated above an action level. Since the aquifer is more than 900 feet deep no other action than pumping can be considered, since the only possible contaminant source to the aquifer, the coal tar plug in W23, was removed by the MPCA in 1982. At that time the well was properly sealed to eliminate the possibility of communication of the Mt. Simon/Hinckley aquifer with the contaminated upper aquifers.

The following tables (Tables:2-7) provide the costs to investigate the Mt. Simon/Hinckley aquifer for: 1) the least contaminated scenario, which assumes that contamination flowed down-hole into the aquifer while W23 was being cleaned and reconstructed in 1982, and 2) the worst case scenario, where W23, W105 and W38 are assumed to have allowed downward flow over a number of years with the injection rates of contaminated water into the aquifer decreasing with time as the well bores filled with natural aquifer materials. There is also a third case, where no contamination of the Mt. Simon/Hinckley has occurred; the cost to investigate and confirm this scenario would be equivalent to the worst case scenario, since in both cases the goal is establishing the confines of a plume, which is dependant upon the analytical capability of chemical instrumentation.

Present worth costs were evaluated using both 5 and 10 percent interest rates. The 10 percent, 30 year rate is currently used in RI/FS work. The 5 percent rate more closely represents a long-term historical average and may be more appropriate considering the long-term monitoring and contingent actions anticipated. Present worth cost beyond 100 years for each interest rate are essentially the same as the present worth cost at 100 years.

It can be deduced from Table 5 that the cost for further remedial investigation, i.e., drilling new wells, dominates the costs of remedial action. The comparison of remediation costs based on the findings of contamination above drinking water levels varies between $270,000 and $1,400,000, substantially exceeding the estimated cost range of $33,000 to $79,000 needed to continue present aquifer usage with monitoring and contingent treatment at the drinking water wells, SLP11 and SLP17.

The costs for contingent treatment at SLP 11 and SLP 17 (Tables 3 and 4) are based on known flow patterns which have been long established and documented through historical pumping records kept by the City.

Therefore, the Remedial Action Plan (attached to the Consent Decree, Appendix C) specifies that treatment systems will be placed in wells used for drinking water purposes as a contingency measure. This measure will be applied for 30 years after the effective date of the Consent Decree, at which time new information pertaining to the aquifer will be reassessed; if necessary, contingencies for treatment of drinking water wells finished in the Mt. Simon/Hinckley aquifer and any new municipal potable water wells installed in that aquifer within a one mile radius of well W23 will be monitored and subject to the above contingency. The drinking water criteria are established in Appendix A and further explained in Appendix B. Contingent actions apply to a radius of one mile from W23, due to the measurable contamination found approximately within a one mile radius of W23 in the Prairie du Chien/Jordan aquifer. Similarly, contamination has been measured in the surficial (Drift) aquifer up to approximately one mile east of the site from where the leachate plume is generated.

TABLE 2

Present Worth Cost Estimate Summary for Remedial Approaches to Mount Simon - Hinckley Aquifer Contamination *

	Present Worth Cost (X$1000)			
Remedial Approach	Best Case Contamination		Worst Case Contamination	
Interest Rate	5%	10%	5%	10%
Monitoring and Contingent Treatment	33-39	18-21	79	19
Remedial Investigation	201	201	1002	1002
Remedial Action	65-142	21-98	394	231
Remedial Investigation and Remedial Action	266-343	240-317	1396	1252

* Assumes 100 year time frame

TABLE 3

Estimated Costs for Monitoring and Contingent Treatment

Best Case Contamination

Element	Years Needed	Present or Unit Cost (X$1000)	Present Worth, 5% (X$1000)	Present Worth, 10% (X$1000)
Annual monitoring of SLP11, SLP12, SLP13, SLP17	0-100	1.6/yr*	33	18
ossibly Treat SLP11	100[a]+	200**	0-1.5	0.0
Possibly Treat SLP17	100[a]+	600**	0-4.5	0.0
Total			33-39	18

@ Based on hydraulic model utilized to predict transport of contaminants.

* Assumes unit cost of $400 per sample for collection, analysis and reporting.

**New treatment plant capital cost of $600,000 is assumed. Capital cost for treatment of SLP11 estimated at $200,000 due to existing facility at this location for SLP10 & 15 in Prairie du Chien-Jordan aquifer.

TABLE 4

Estimated Costs for Monitoring and Contingent Treatment

Worst Case Contamination

Element	Years Needed	Present or Unit Cost (X$1000)	Present Worth, 5% (X$1000)	Present Worth, 10% (X$1000)
Annual Monitoring of SLP12, SLP13, SLP17	0-100	1.2/yr	25	13
Annual Monitoring SLP11	0-60	0.4/yr	8	4
Treat SLP11				
- Treatment Plant	60-100@	200	11	0.7
- Quarterly Monitoring of SLP11	60-100	1.6/yr	1.6	0.1
- SLP11 Treatment Operation and Maintenance	60-100	30/yr*	29	1.1
Treat SLP17	100+@	600	4.5	0.0
Total			79	19

@ Based on hydraulic model utilized to predict transport of contaminants.

* Operation and maintenance consists mostly of carbon replacement and electricity costs. Low-end of carbon replacement cost was $18,000/yr and electricity estimate was $10,000/yr in CH2M-Hill (1982) report.

TABLE 5

Estimated Costs for Remedial Investigation

Best Case Contamination		Worst Case Contamination	
Element	Cost (X$1000)	Element	Cost (X$1000)
One Well North of W23	200*	Two wells North of W38, Three Wells North of W23	1000*
Two Monitoring Events	0.8	Two Monitoring Events per Well	2
Total	201	Total	1002

* Assumes well construction, development, permanent sampling pump installation and mobilization costs totalling $200,000 per well.

TABLE 6

Estimated Costs for Limiting Contaminant Spread *

Best Case Scenario

Element	Years Needed	Present or Unit Cost (X$1000)	Present Worth, 5% (X$1000)	Present Worth, 10% (X$1000)
Possible Gradient Control At W23 Area (50gpm)				
- Monitoring Well Conversion	0	0-15[a]	0-15	0-15
Electricity for Pumping	0-2.5	2/yr[b]	0-5	0-5
- Quarterly Effluent Monitoring	0-2.5	1.6/yr	0-4	0-4
- Sanitary Sewer	0-2.5	21/yr[c]	0-53	0-53
- Post-pumping Annual Monitoring	3-100	0.4/yr	32	3
Annual Monitoring of SLP11, SLP12, SLP13, SLP17	0-100	1.6/yr	33	18
Total for Remedial Action			65-142	21-98

*Does not include capital cost for well construction used in RI (Table 5).

[a]Includes pump installation/modification, controls and sewer and power connection.

[b]Assumes electricity charge of $0.05/kilowatt-hour and 70 percent efficiency.

[c]Assumes sanitary sewer charge of $0.80/1000 gallons.

TABLE 7

Estimated Costs for Limiting Contaminant Spread *

Worst Case Scenario

Element	Years Needed	Present or Unit Cost (X$1000)	Present Worth, 5% (X$1000)	Present Worth, 10% (X$1000)
Gradient Control Pumping Second Well North of W23 at 250gpm				
- Monitoring Well Conversion	0	15[a]	15	15
- Electricity for Pumping	0-65	10.3/yr[b]	208	113
Quarterly Effluent Monitoring	0-65	1.6/yr	32	18
- Post-pumping Annual Monitoring	65-100	0.4/yr	0.3	0.0
Gradient Control Pumping Well Nearest W38 at 50gpm				
- Monitoring Well Conversion	0	15[a]	15	15
- Electricity for Pumping	0-40	2/yr[b]	36	22
- Quarterly Effluent Monitoring	0-40	1.6/yr	29	17
- Post-pumping Annual Monitoring	40-100	0.4/yr	1.1	0.1
Annual Monitoring of Four SLP and Three Monitoring Wells	0-100	2.8/yr	58	31
Total			394	231

*Does not include capital cost of new well construction used for RI (Table 5).
[a]Includes pump installation/modification, controls and sewer and power connection.
[b]Assumes electricity charge of $0.05/kilowatt-hour and 70 percent efficiency.

Aquifer Characteristics Analysis -

Eau Claire Confining Bed

Geologic characteristics	:	Siltstone and shale, green glauconitic.
Approximate range of thickness	:	Up to 105 feet.
Areal extent	:	Underlies entire study area.
Water bearing characteristics	:	Confining bed; hydraulic characteristics poorly known.
Use	:	Aquitard. No remedial action necessary.

Ironton/Galesville Aquifer

Geologic characteristics	:	Sandstone, white to light green, moderately well sorted, fine to course grained, quartzose.
Approximate range of thickness	:	Up to 50 feet.
Areal extent	:	Underlies entire study area.
Water bearing characteristics	:	Porosity is intergranular; low transmissivity.
Use	:	Regionally an aquifer, but no wells are known to yield water exclusively from this unit in the study area.

Screening of Alternatives and Alternatives Analysis for the Ironton/Galesville Aquifer

Because of the aquifer's depth, and limited sources of contamination by W23 and at one time possibly W105, pumping the aquifer and contingent actions were evaluated. The only known source, W23, already has been corrected as previously discussed. Because of the limited yield and naturally high inorganic levels found in this aquifer it serves limited use due to the abundance of better water yielding aquifers above and below the Ironton/ Galesville.

Due to the aquifer hydraulic and physical characteristics, contamination introduced through Wells W23 and W105 should still be in the vicinity of those two wells. Little hydraulic or pumping stresses are exhibited in this aquifer. The aquifer is not used for municipal supplies due to its depth, inorganic water chemistry and yield. Conceptually, remedial action in this aquifer should be applied at the source where contamination may exist (W23 and/or W105) and thereby withdraw a relatively high percentage of contaminants in a relatively short time period. This would reduce the effect, if any, of contaminant migration through the Eau Claire confining bed into the Mt. Simon/Hinckley aquifer. For these purposes, W105, which

has been reconstructed into the Ironton/Galesville aquifer, will be pumped for two years or until the cessation criterion of 10 micrograms per liter of total PAH is reached, whichever is a longer time frame. Discharge of the extracted groundwater to the MWCC sanitary sewer will be proposed by Reilly. As a contingency, in the unlikely event that a municipal drinking water well is established in this aquifer within one mile of W23, that well will be monitored and if its water quality exceeds the drinking water criteria established in Appendix A and B, treatment facilities will be installed.

Aquifer Characteristics Analysis -

St. Lawrence - Franconia Confining Bed

Geologic characteristics : Siltstone and sandstone, gray to green poorly sorted, glauconitic and dolomitic.

Approximate range of thickness : 150-250 feet.

Areal extent : Underlies the entire study area.

Water bearing characteristics : Confining bed; hydraulic characteristics poorly known.

Use : Aquitard. No remedial action necessary.

Prairie du Chien/Jordan Aquifer

Geologic characteristics :

- Prairie du Chien Group - Dolomite, sandstone, sandy dolomite, light brown, buff, gray, thinly to thickly bedded.

- Jordan Sandstone - Sandstone, white to pink, fine to coarse-grained, moderately well cemented, quartzose to dolomitic.

Approximate range of thickness :

- Prairie du Chien Group - 0-170 feet

- Jordan Sandstone - 0-130 feet

Areal Extent :

- Prairie du Chien Group - Absent in north and west parts of study area. Locally absent due to erosion.

- Jordan Sandstone - Absent in extreme west and northern parts of study area.

Water bearing characteristics :

- Prairie du Chien Group - Generally yields more than 1,000 gpm to high capacity wells. Hydraulic conductivity is due to fractures, open joints, and solution channels.

- Jordan Sandstone - Hydraulic conductivity is mostly intergranular but may be due to joint parting in cemented areas. Prairie du Chien/Jordan aquifer generally yields more than 1,000 gpm to high capacity wells.

Use: The Prairie du Chien/Jordan aquifer not only supplies about 80 percent of the groundwater pumped in the study area, but also provides approximately 75 percent of the annual ground-water supply in the Twin Cities.

Screening of Alternatives and Alternatives Analyses For the Prairie du Chien/Jordan Aquifer

As discussed in the ROD (Appendix A) the Prairie du Chien/Jordan aquifer is a high priority resource in the study area and throughout the State of Minnesota. The population of St. Louis Park and the neighboring communities of Edina and Hopkins, depend heavily on the Prairie du Chien/Jordan aquifer for their water supply. It also serves as a potential secondary source of water supply for the Twin Cities.

Well W23 has been cleaned within the borehole and properly reconstructed to the Prairie du Chien/Jordan aquifer. As such, it becomes a source control well which can be utilized to remove the contamination in the aquifer remaining near the borehole. Near W23 there are relatively high concentrations of PAH and to a lesser extent phenolics, which rapidly decrease as pumping goes on for 24 hours. Thus, W23 provides the opportunity to control the remaining source of contamination in the aquifer. As part of the aquifer's management, this well will be pumped until cessation criteria are reached. The discharge will go to a sanitary sewer under permit by the Metropolitan Waste Control Commission (MWCC). The well will be pumped at 50 gpm for a minimum of 5 years or until 10 micrograms per liter of total PAH is measured, in accordance with the cessation criteria presented in the RAP.

In addition to the source control at W23, a hydraulic control of the aquifer will be implemented for the purpose of restoring drinking water quality to St. Louis Park Wells and to protect the use of uncontaminated water by St. Louis Park, Hopkins, and Edina. Models produced by Reilly and the USGS/MPCA indicate that the existing drinking water well, SLP4, which has been closed due to the presence of PAH compounds, should be restarted and pumped at approximately 1,000 gpm. A NPDES discharge permit will be necessary and a study to determine the feasibility and the location of the discharge will be conducted by Reilly Tar and Chemical Corporation.

A gradient control well system will be implemented in the Prairie du Chien/ Jordan aquifer. The actual placement or utilization of existing wells for gradient control will be defined in the forthcoming FS specified in the RAP. Water pumped from SLP4 can be used for drinking water if drinking water criteria are consistently satisfied over a one year time period and a monitoring plan for this well is submitted by the Reilly Tar and Chemical Corporation and approved by the Department of Health Commissioners. A total of 10 wells (including the possibility of constructing new wells in locations determined necessary by ground water modeling, providing existing wells are not accessable) surrounding the contaminant plume will be monitored in the Prairie du Chien/ Jordan aquifer semi-annually for the first five years, and annually thereafter. Additionally, nine more wells are to be monitored annually. Contingent actions also apply to these wells.

In the event that any more drinking water wells become contaminated, treatment facilities will be constructed at such wells.

In the event that any monitoring well exceeds drinking water criteria, Reilly shall propose a plan for adjusting existing pumping rates, adding new pumps to existing monitoring wells or any solution that is approvable by the regulatory agencies that are party to the Consent Decree.

The objectives of protecting future current use and restoring future use of the Prairie du Chien/Jordan aquifer can be accomplished with the implementation of the above source/gradient control system and contingencies. It is estimated that the ground water can be purged sufficiently to become clean within a 30 year time period. Nevertheless, the cessation criteria for implementation of the above remedy are based on a statistical analysis of the water quality at all of the monitoring wells such that the gradient control system or its modifications must be operable if any one of the 19 monitoring wells shows contamination above drinking water criteria. Thus, the cessation criteria for implementation of this remedy are independent of time and the hazards of predicting a time period of operation.

Aquifer Characteristics Analysis -

Basal St. Peter Confining bed

Geologic Characteristics	:	Siltstone and claystone, red, green, and white; parts are plastic in texture and poorly indurated; interbedded with fine-grained quartz sandstone.
Approximate range of thickness	:	0-65 feet.
Areal extent	:	Generally present over most of the central part of the study area. Locally absent due to erosion.
Water bearing characteristics	:	Hydraulic conductivity is highly variable; siltstone and claystone restrict vertical flow but sandstone discharges as much as 100 gpm to wells.
Use	:	As a whole, the Basal St. Peter confining bed is an aquitard. No wells are known to yield water only from this unit in the study area. Thus, no remediation is necessary.

St. Peter Aquifer

Geologic characteristics	:	Sandstone, white to yellow, very well sorted, fine-to medium-grained, poorly cemented, quartzose.
Approximate range of thickness	:	0-100 feet
Areal extent	:	Generally present over must of the study area. Locally absent due to erosion.
Water bearing characteristics	:	Priority approximately 30%; can discharge more than 500 gpm to wells, Sandstone is poorly cemented and wells tend to pump sand or clog.
Use	:	Supplies about 10% of groundwater pumped in the St. Louis Park area. Most wells in this sandstone are of small diameter and used for domestic supply.

Screening of Alternatives and Alternatives Analysis for the St. Peter Aquifer

Recently, it has been confirmed that the St. Peter aquifer is contaminated, thus far, to a much smaller extent than the Prairie du Chien/Jordan aquifer. Samples collected and analyzed in 1984 and 1985 showed trace levels of PAH and phenolic compounds in two wells finished into the St. Peter aquifer. These well W24 and W133 are located near the bedrock valley where it has been theorized that water from the contaminated Drift and Platteville aquifers have migrated to the St. Peter aquifer.

The Glenwood shale which has very low hydraulic conductivity is eroded in the area of the bedrock valley and allows for downward migration of the contaminated water in the upper aquifers. Multi-aquifer wells connecting the contaminated Platteville aquifer with the St. Peter aquifer may also be a pathway for contaminant transport to the St. Peter aquifer. Since there are only 3 known St. Peter wells in the area of the bedrock valley, the precise extent of contamination is unknown. Therefore, further remedial investigation is required by the RAP whereby five new wells will be drilled into the St. Peter aquifer. These five wells and eight existing wells in the St. Peter aquifer will be monitored for PAH and phenolic compounds. If, after the remedial investigation, the Regional Administrator (RA) determines that a feasibility study is needed, Reilly will proceed with an analysis of alternatives to limit the spread of contamination that exceeds drinking water criteria. If necessary, a gradient control system will be established, similar in concept to that explained for the Prairie du Chien/Jordan aquifer and Reilly will propose cessation criteria consistent with the purpose of limiting the spread of contamination.

A multi-aquifer well investigation will also be performed by Reilly and a report describing the impact of the contamination contributed by the wells will be submitted to the RA. This investigation applies to any multi-aquifer wells located outside an area in the St. Peter aquifer under remediation. Thereafter, Reilly can propose or the RA require abandonment and/or reconstruction of those defective wells.

Aquifer Characteristics Analysis -

Glenwood Confining Bed

Geologic characteristics	:	Shale and claystone, green to buff, plastic to slightly fissil, lower 3 to 5 feet grade from claystone with disseminated sand grains to sandstone with clay matrix.
Approximate range of thickness	:	0-18 feet.
Areal extent	:	Present only in central part of study area. Dissected by erosion.

Water bearing characteristics	:	Very low hydraulic conductivity is estimated to be about 10^{-10} feet/second based on laboratory measurements of core samples.
Use	:	Aquitard. There are no wells in this confining bed and no remedial action is necessary.

Aquifer Characteristics Analysis -

Platteville Aquifer

Geologic characteristics	:	Dolomitic limestone and dolomite, gray to buff, then to medium bedded, some shale partings. Solution channels and fractures are concentrated in upper part and contain sand and gravel of glacial origin.
Approximate range of thickness	:	0-35 feet.
Areal extent	:	Present only in central part of study area. Dissected by erosion.
Water bearing characteristics	:	Hydraulic conductivity primarily from fractures, open joints and solution channels. Specific capacities of wells are generally between 10 and 100 gpm per foot of drawdown, if pumped at about 12 gallons/minute for 1 hour. Results from one aquifer test indicate that the transmissivity of the unit is about 9000 ft^2/day near the test site.
Use	:	The Platteville aquifer is a lower-capacity commercialized industrial water supply.

Screening of Alternatives and Alternative Analysis for the Platteville Aquifer

Due to its hydraulic relationship with the Drift aquifer, discussion of Alternatives Analyses is confined under the heading of the Drift aquifer.

Aquifer Characteristics Analysis -

Decorah Shale Confining Bed

Geologic characteristics	:	Shale, blueish-green to blueish-gray, blocky.

Approximate range of thickness	:	0-95 feet.
Areal extent	:	Locally present in the east of the area of study.
Water bearing characteristics	:	Confining bed.
Use	:	The Decorah Shale confining bed is an aquitard; there are no water supply wells and no remediation necessary.

Glacial Drift Aquifer

Geologic characteristics	:	Undifferentiated over most of the study area. Till, outwash and valley-train sand and gravel, lake deposits and alluvium; vertical and horizontal distribution of units is complex. In the immediate area of the plant site, units include an unconfined Upper Drift aquifer, a Middle Drift and a Lower Drift complex.
Approximate range of thickness	:	50 to 400 feet. Less in the area of study.
Areal extent	:	Underlies the entire study area.
Water bearing characteristics	:	Stratified, well sorted deposits of sand and gravel yield moderate to large supplies of water to wells (240 to 2000 gallons/ minute). Results from one aquifer test indicate that the transmissivity of the Middle Drift aquifer near the plant site is about 9000 ft^2/day.
Use	:	The Glacial Drift aquifer was a source of water supply, both domestic and commercial in the study area.

Screening of Alternatives for the Drift and Platteville Aquifers

As discussed previously, discharges from the Reilly plant into the bog south of the site introduced contaminants to the Drift aquifer. These discharges also had a large hydraulic impact to that area which enhanced vertical flow from the Drift through the basal Drift aquitard (which is relatively conductive) into the Platteville aquifer. Because of the relatively thin conductive shale between the Drift and Platteville aquifers and due to the relatively high levels of contamination in these two aquifers, it appears that both can be remedied with the same technology. Both source control and gradient control concepts apply to these aquifers.

For source control, Reilly is committed to installing two pump-out wells, one in the Drift and one in the Platteville within 500 feet east of well W13 located in the bog. These two new wells will pump for a minimum of 5 years and discharge into the sanitary sewer unless another treatment process is appropriate and approved by the RA. These two wells should effectively mitigate the high levels of contaminants migrating off-site. At the end of 5 years Reilly may submit a plan for ceasing operation of the wells. Cessation criteria are not developed for the Drift and Platteville aquifers since it is unlikely drinking water criteria will ever be attained near the site. The purpose of source control is to limit further migration of relatively highly contaminated ground water that would otherwise contaminate the St. Peter aquifer which has drinking water quality and use; and, to protect areas of the Drift/Platteville aquifers that are not yet contaminated by leachate from the Reilly site. The wells, therefore, may be pumped indefinitely or until such time Reilly can demonstrate, and the RA concurs, that no further off-site degradation that is harmful to the environment will occur.

The concept and purpose of gradient control in the Drift/Platteville aquifers is similar to source control. Once source control is implemented the residual contamination downgradient of the source control wells will still be free to migrate. Therefore, Reilly is committed to install a gradient control well east of the site, within 500 feet of the existing W12 monitoring well. Discharge to the MWCC sanitary sewer will be proposed by Reilly. The well will be finished into the Drift/Platteville aquifer since at this location, east of the site the two aquifers are, to a large measure, hydraulically connected.

Northern Area Remedial Investigation/Feasibility Study (RI/FS) for the Drift/Platteville Aquifers

In accordance with the Remedial Action Plan in the Consent Decree, Reilly will install a total of 6 new monitoring wells in the Drift/Platteville aquifer in locations north, northeast of the site or designated in the RAP. In addition to PAH and phenolic compounds, priority pollutants and other constituents specified in the RAP will be periodically monitored.

A FS will be conducted and submitted to the RA for review. As part of the FS, Reilly will develop alternatives to limit the spread of contamination in this area of the aquifer and propose cessation criteria applicable to the aquifers for review and approval by the RA. In any case, a comprehensive monitoring program along with a quality assurance project plan will be implemented by Reilly.

Based on the review of the data produced by the Northern area RI/FS, source control, gradient control and monitoring wells, the RA may require further actions for the purpose of limiting the spread of contamination in these aquifers.

Contingencies for Remedial Action in All Aquifers

During the course of remedial action and after review of multiple sampling events, the RA may decide that further remedial actions specified in the RAP shall be planned and/or implemented to protect the environment. Contingent actions are also prescribed in the RAP for the GAC treatment system (Appendix A) used for restoration of drinking water quality and quantity at SLP 15/10.

Screening of Alternatives for the Unsaturated and Saturated Soil Beneath the Site

Preliminary studies show that the amount and cost of removal and treatment or disposal of the contaminated subsurface to be very large. Initial estimates of 400,000 yds^3 of contaminated subsurface may be substantially conservative and must be considered a minimum value. Other estimates performed by the regulatory agencies and the USGS show as much as 1 million yds^3 of subsurface may be contaminated at least 10 times the background value. In either case remediation of the contaminated subsurface would require an ambiguous and costly program estimated minimally at 100 million dollars. The value of such action was considered over the years and due to the duration of the disposal of the contaminants into the subsurface (at least 50 years), the duration of migration of the contaminants off-site (probably more than 60 years), and the amount of excavation, backfilling and construction performed by the City of St. Louis Park Housing and Redevelopment Authority (a party to the Consent Decree), no substantial benefit to the off-site environment could be realized from a soil removal/treatment program. The reasons that the benefits from such action are dubious can be summarized by reviewing the distribution of the off-site contaminants. If all on-site contamination were removed, the amount of contamination in the Drift and Platteville aquifers would still be immense. Remediation of the aquifers by removal would still take greater than 30 years, more probably 100 years which is considered an infinite time on a present worth scale of 10%. This is the reasoning for pumping the Drift and Platteville aquifers for an indeterminant amount of time or until the RA determines that cessation of remedial action in these aquifers will cause no further hazard or degradation to the environment and receptors. The hazard remaining to potential receptors, then, is direct

contact to excavated contaminated material. This hazard can be and is mitigated through institutional controls to be implemented through the Consent Decree. The City and Housing and Redevelopment Authority have a vested interest in maintaining and providing a clean subsurface environment that is beneficial to their future needs.

Alternatives Analyses for the Saturated and Unsaturated Soil Beneath the Site

The area of the bog, south of the site has been analyzed for years. However, the area south of the bog, as delineated in the RAP, may have received some contamination due to leachate or natural drainage towards Minnehaha Creek. Thus, Reilly will perform between 15 and 25 soil borings in an area agreed upon by the RA after Reilly submits a plan for soil investigations in the area. Thereafter, a progression of submittals to the RA by owners and the City will acknowledge the owners' compliance with the State of Minnesota's Statutes regulating construction on such contaminated areas and the owners' affidavits will be filed with Recorder of Deeds. This provision applies to current and future land owners in the entire on site and off-site study area.

Wetlands Filling

As prescribed by the U.S. Fish and Wildlife Service, (FWS), Reilly will cover with at least one foot of clean fill specific areas located in the wetland area that exhibit surficial contamination. The RAP specified procedures and dates to follow. Reilly will provide sufficient advance notice to the FWS of wetland filling and the FWS, along with the other agencies, and shall coordinate its requirements with FWS as wetland filling proceeds. The FWS and U.S. EPA have the approval authority for compliance with the requirements for wetland filling.

The U.S. Army Corps of Engineers, (COE), recieved an application from the City of St. Louis Park for a Nationwide Filling permit. This type of permit does not require FWS and/or U.S. EPA input into a determination of mitigation, from loss of wetland areas. The COE, after consulting with FWS, considered the wetland loss to be insignificant and, consequently, no mitigation was required.

Highway Construction South of Site

If the City proceeds with its planned construction of Highway 7, the City will provide for proper disposal of contaminated soil and/or the water from this construction. If the intersection is not constructed by October 31, 1989, Reilly will continue to fill, cover and grade that area planned for the intersection, and will maintain that area to promote drainage to a collection system and otherwise minimize leachate of contaminants in the area delineated in the RAP.

Development of the Site

The City and the Housing and Redevelopment Authority are responsible for mitigating any hazards resulting from their development of the 80 acre site, which is currently used as a park for the most part, with two blocks of housing (condominiums). The RAP prescribes actions that require proper disposal of any contaminated excavated material removed off-site and otherwise to reduce releases to the environment due to actions taken by the City or the Housing and Redevelopment Authority. Before any development occurs a plan must be submitted to the RA for approval. This plan will specify procedures and schedules for accomplishing the remedial actions for mitigating releases of hazardous materials as prescribed in the RAP. All Federal and State laws pertaining to the handling and disposal of hazardous materials encountered during any site development apply and are acknowledged by the City and the Housing and Redevelopment Authority. Similarly, all Federal and State regulations pertinent to the handling and disposal of hazardous materials, such as, site safety plans, workers'safety plans, and quality assurance project plans for chemical monitoring apply to site development, are prescribed in the RAP and are recognized by the City and the Housing and Redevelopment Authority. The City and the Housing and Redevelopment Authority will also submit a site maintenance plan that will meet the objectives of reducing the release of hazardous materials resulting from these actions or removing or properly treating such hazardous materials in compliance with all applicable environmental laws as specified in the RAP.

The above objectives and conditions stipulated in the RAP and Consent Decree apply to all current and future land owners on the site.

Compliance with Environmental Laws

It should be noted here that negotiations with the Reilly Tar and Chemical Corporation and the City of St. Louis Park have been periodially progressing since the Fall of 1982. Since 1981 litigation, remedial investigations, feasibility studies and cleanout of two contaminated wells on the site have been completed. All of the work during this time frame was in accordance with U.S. EPA policies and the National Contingency Plan promulgated in 1981. The Consent Decree requires compliance with all environmental laws and is in compliance with specific environmental laws summarized here.

1) Resource Conservation and Recovery Act (RCRA) - This applies primarily to the handling and/or disposal of hazardous wastes at the site. The RAP is written in accordance with the RCRA requirements.

2) Toxic Substances Control Act (TSCA) - There were no TSCA regulated wastes found at the site.

3) Clean Water Act (CWA) - This Act and the Regulations under it are applicable to the proposed remedial activities with respect to the discharge of extracted groundwater, or contaminated surface water from site, to either the surface waters or the sanitary sewers. The CWA and its regulations set forth permitting requirements for point source discharges that implement minimum treatment technology standards and protect the quality of the receiving water. Reilly has committed to obtaining National Pollutant Discharge Elimination System (NPDES) permits as required for discharges to surface waters. The remedial action plan specifies effluent limitations for the draft permits; however, the final permits may contain additional or different limitations as necessary to meet NPDES requirements. Discharges to the sanitary sewers will be subject to, and comply with, pretreatment requirements determined by the Metropolitan Waste Control Commission. The conditions in the Consent Decree and Remedial Action Plan are intended to require full compliance with the CWA with regard to NPDES permitting and pretreatment requirements. Region V will maintain its formal approval role over all NPDES permitting and pretreatment.

The Act is also applicable to the remediation of wetland areas. U.S. EPA, normally, has the responsibility to review and evaluate work being performed in the waters of the United States for compliance with the 404(b)(1) Guidelines.

4) Safe Drinking Water Act (SDWA) - Since drinking water criteria for PAHs were not developed through the SDWA regulations, it was necessary to developed those criteria for PAH compounds. This was accomplished through consultations with expert witnesses, MDH, MPCA and U.S. EPA Drinking Water Program representatives. The criteria are listed in the RAP and attached to this EDD.

Responsiveness Summary -

The public has been well informed throughout the RI/FS work and continually informed throughout the recent past. The MPCA has been implementing a U.S. EPA approved Community Relations Plan since 1983. Public Hearings sponsored by Reilly and the MPCA/U.S. EPA were held in the Spring of 1983 (See Appendix A). Since then the City, U.S. EPA and MPCA have been participating in public meetings with citizens and media concerned over the Reilly site; on April 11, 1986, a press conference was held in St. Louis Park, Minnesota, followed on April 17, 1986 with a public meeting. Both events discussed the legal and technical aspects of the Consent Decree - RAP for the site.

Schedule and Estimated Costs of Remedial Actions -

In accordance with the ROD, Reilly Tar has completed construction of the GAC plant at SLP 15/10 to provide acceptable drinking water to the City.

The GAC plant is currently undergoing testing and should go into full scale operation by the peak summer water demands in 1986.

Since the RAP is performance oriented and time periods of implementation vary with each aquifer, it is very difficult to estimate costs. Therefore, costs for the remediation of the aquifers via source and gradient control systems will be defined in the appropriate remedial investigations and/or feasibility studies.

Enforcement (Confidential)

In 1980, the U.S. Environmental Protection Agency filed suit against Reilly alleging violation of the Resource Conservation and Recovery Act. The State of Minnesota and the Cities of St. Louis Park and Hopkins joined the lawsuit. After passage of CERCLA, a count under this act was added.

After release of a comprehensive report on the ground water contamination problem prepared by consultants to Reilly in May, 1983, the MPCA, U.S. EPA, U.S. Department of Justice, and Reilly conducted a series of meetings to determine if there was basis for a settlement of the lawsuit. When such meetings were unsuccessful, both the United States and the State took administrative actions in an attempt to bring about a settlement or otherwise compel Reilly to take the necessary remedial actions. On August 1, 1984, U.S. EPA issued an Administrative Order to Reilly reguiring Reilly to construct the drinking water treatment system as provided in the Record of Decision of June 6, 1984. The Minnesota Pollution Control Agency issued Reilly a Request for Response Action in December, 1984, which required Reilly to undertake a series of remedial investigations and response actions.

Following these administrative actions, extensive negotiations took place among the parties. General agreement on the terms and conditions of a Consent Decree was reached in September, 1985, although the complex nature of the settlement and the large number of parties involved delayed completion of the settlement until April, 1986. Under the Consent Decree, Reilly must undertake remedial investigations, feasibility studies, remedial designs, and remedial actions. Reilly must submit plans for each phase of the remedy, and these plans must be reviewed and approved by both the U.S. EPA and the MPCA, and in some cases the MDH. The Court will enter the Consent Decree following a 30-day public comment period which will end approximately June 30, 1986.