ND-2900 D1774

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

PHASE I INVESTIGATION

STAUFFER CHEMICAL, NORTH LOVE CANAL,
SITE NUMBER 932034
TOWN OF LEWISTON, NIAGARA COUNTY

September 1989

Prepared for:

New York State Department
of Environmental Conservation

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Division of Hazardous Waste Remediation
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1. EXECUTIVE SUMMARY

1.1 SITE BACKGROUND

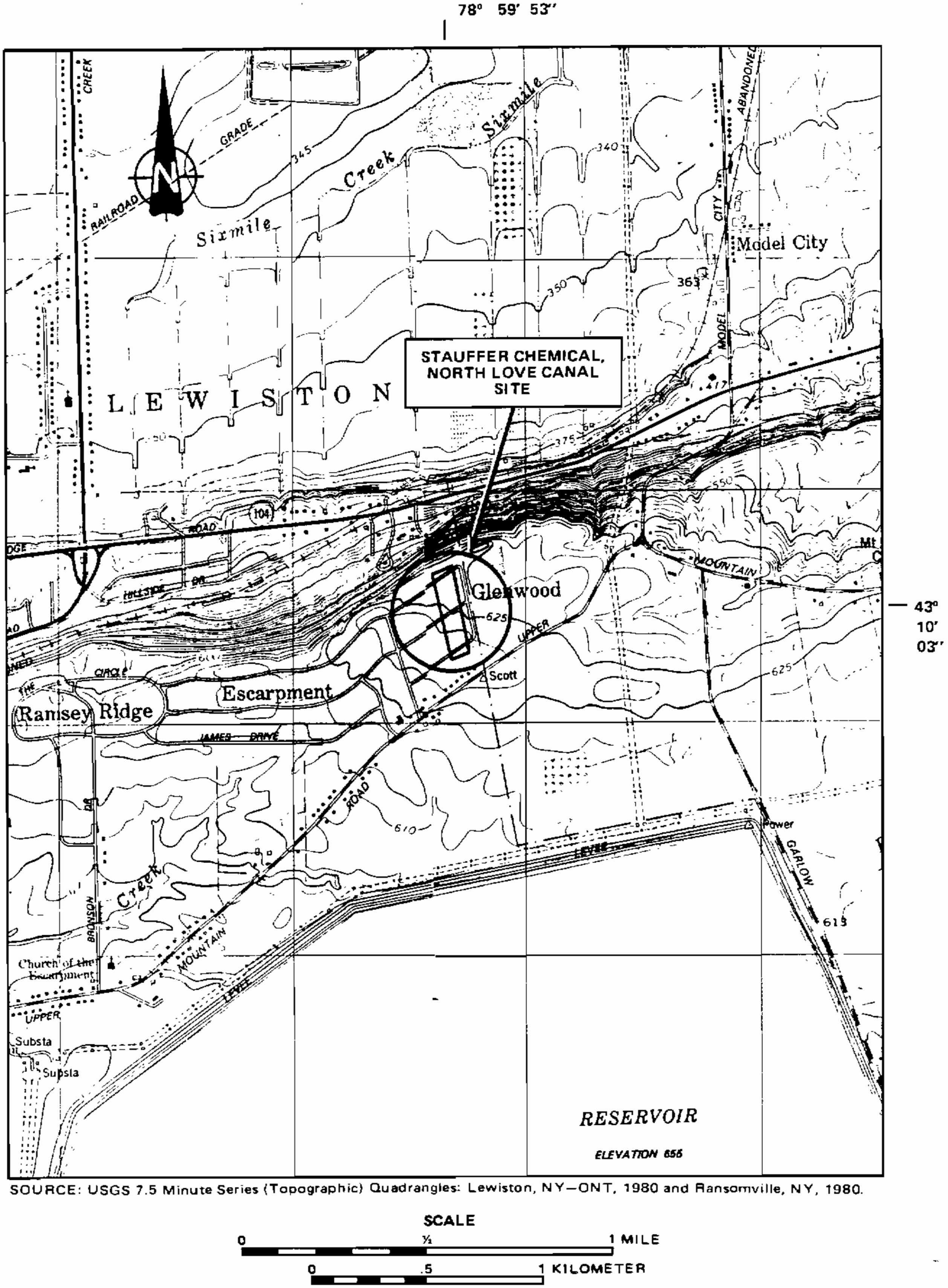
The Stauffer Chemical, North Love Canal site, in the Town of Lewiston, was used by Stauffer from 1930 to 1952 to dispose of industrial wastes (see Figure 1-1). These wastes are reported to be 50,000 to 75,000 cubic yards of asbestos, concrete cell parts, reactor linings, scrap sulfur, graphite, scrap metal, silicon, zirconium and titanium oxides, flux, cinders, and phenols.

The site was subsequently covered and developed. Whittaker Subdivision, a residential development, is now located directly over the former disposal site.

The site comprises approximately 5 acres and consists of private residences and surrounding yards and gardens (see Figure 1-2). The former disposal area crosses several roadways in the eastern section of the Whittaker Subdivision. Soil borings and water samples were taken in 1979 by Dominion Soils Investigations, Inc., under the direction of USEPA. The Niagara County Health Department (NCHD) collected one water/sediment sample from a roadside ditch in April 1988 and two basement sump samples during January 1989.

1.2 PHASE I EFFORTS

The site was visited on September 7, 1987 by Ecology and Environment, Inc., (E & E) personnel to conduct a physical inspection of the site in support of this investigation. Prior to the inspection, available state, federal, and municipal files were reviewed, and individuals having knowledge of the site were contacted. The site inspection consisted of a walk-over survey around the perimeter and into adjacent areas of the site. Of interest to the inspection were:



SOURCE: USGS 7.5 Minute Series (Topographic) Quadrangles: Lewiston, NY–ONT, 1980 and Ransomville, NY, 1980.

Figure 1–1 LOCATION MAP

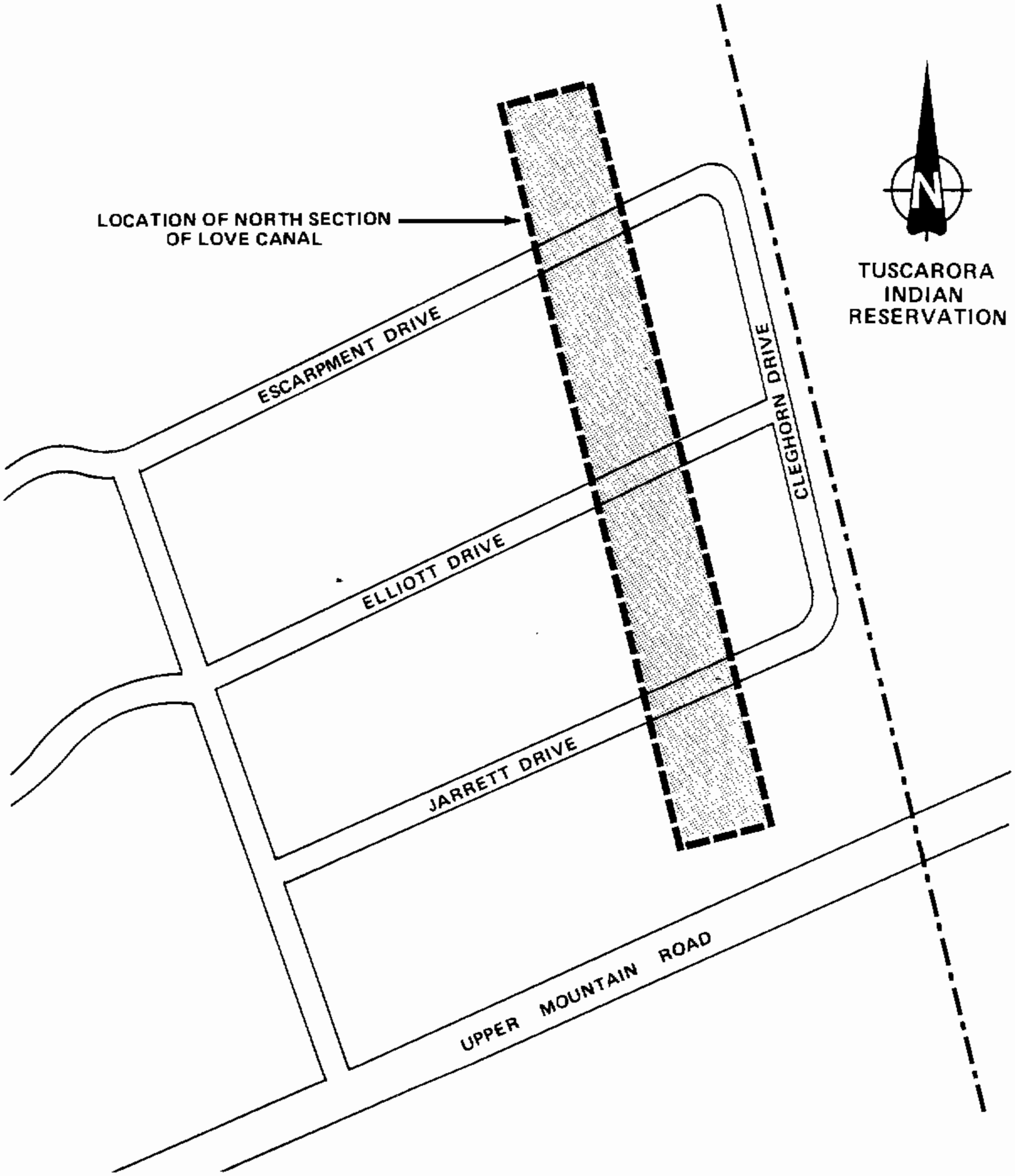


Figure 1–2 SITE MAP

- Overall site conditions; and
- Determination of former waste disposal areas.

1.3 ASSESSMENT

Stauffer Chemical has indicated that it has disposed of sulfates, cinders, cell parts, graphite, concrete, chlorides, silicon, and zirconium and titanium oxides at this site. The landfill itself was not visible during an onsite inspection, although the contour of the land was slightly mounded (1 to 2 feet) above the disposal area. No stressed vegetation was noted and no waste material was seen on the surface of the former disposal area. Houses, yards, and driveways were all maintained in very good condition.

Overall this site appeared very well maintained and no signs of former disposal were noted. Further investigation is recommended to fully assess any environmental or health hazards presented by this site.

1.4 HRS SCORE

A preliminary application of the Hazard Ranking System (HRS) was made to quantify the risk associated with this site. As the Phase I investigation is limited in scope, not all the information needed to fully evaluate the site is available. An HRS score was completed on the basis of the available data. Absence of necessary data may result in an unrealistically low HRS score.

Under the HRS, three numerical scores are computed to express the site's relative risk or damage to the population and the environment. The three scores are:

- S_M reflects the potential for harm to humans or the environment from migration of a hazardous substance away from the facility by routes involving groundwater, surface water, or air. It is a composite of separate scores for each of the three routes (S_{GW} = groundwater route score, S_{SW} = surface water route score, and S_A = air route score).

- S_{FE} reflects the potential for harm from substances that can explode or cause fires.

- S_{DC} reflects the potential for harm from direct contact with hazardous substances at the facility (i.e., no migration need be involved).

The preliminary HRS score was:

$S_M = 39.04$ ($S_{GW} = 67.35$; $S_{SW} = 5.03$; $S_A = 0$)
S_{FE} = not scored
$S_{DC} = 37.5$

2. PURPOSE

This Phase I investigation was conducted under contract to the New York State Department of Environmental Conservation (NYSDEC) Superfund Program. The purpose of this investigation was to provide a preliminary evaluation of the potential environmental or public health hazards associated with past disposal activities at the Stauffer Chemical, North Love Canal site. This initial investigation consisted of a detailed file review of available information and a site inspection. This evaluation includes both a narrative description and preliminary HRS score.

3. SCOPE OF WORK

The Phase I effort involved:

- The review of available information from state, municipal, and private files;
- Interviews with individuals knowledgeable of the site; and
- A physical inspection of the site.

State files reviewed were maintained by the New York State Department of Environmental Conservation (NYSDEC) Region 9 in Buffalo, New York. County files reviewed were maintained by Niagara County Department of Health.

Mr. Michael Hopkins of the Niagara County Health Department was contacted in person on May 1, 1987, to discuss information maintained in the county files.

A site inspection was conducted by E & E on September 7, 1987. Photographs were taken during the site inspection and are included in Appendix A.

No samples were collected by E & E during the inspection. A physical inspection of the site and review of pertinent USGS 7.5 minute topographic maps was completed. A summary of agencies contacted, along with contact persons and addresses is presented in Table 3-1.

Table 3-1

SOURCES CONTACTED FOR THE NYSDEC PHASE I INVESTIGATION AT STAUFFER CHEMICAL, NORTH LOVE CANAL SITE

New York State Department of Environmental Conservation,
Region 9
600 Delaware Avenue, Buffalo, New York 14202
Telephone Number: (716) 847-4600

- Division of Solid and Hazardous Waste
  Contact: Lawrence Clare, Ahmed Tayyebi; Jack Tygert
  Telephone Number: (716) 847-4600
  Dates Contacted: May 8, October 7, 1987
  Information: Background information, analytical data

- Division of Regulatory Affairs
  Contact: Paul Eismann
  Telephone Number: (716) 847-4551
  Dates Contacted: May 8, 1987, and June 2, 1987
  Information: Permits; wetlands information.

- Division of Environmental Enforcement
  Contact: Joann Gould
  Telephone Number: (716) 847-4582
  Date Contacted: May 6, 1987
  Information: Enforcement actions

- Division of Water
  Contact: Rebecca Anderson
  Telephone Number: (716) 847-4590
  Date Contacted: June 2, 1987
  Information: Floodplain locations

- Bureau of Wildlife
  Contact: James R. Snider
  Telephone Number: (716) 847-4550
  Date Contacted: June 2, 1987
  Information: Critical habitat locations

New York State Department of Health,
Regional Toxic Program Office
584 Delaware Avenue, Buffalo, New York 14202
Contact: Linda Rusin, Cameron O'Connor
Telephone Number: (716) 847-4365
Dates Contacted: May 5, 1987, June 4, 1987, April 13, 1989
Information: Contact with NYSDOH on May 5, 1987 indicated that the office was newly established and file information was extremely limited; therefore, the county health departments were visited in lieu of NYSDOH. NYSDOH files were searched on April 13, 1989.

Table 3-1 (Cont.)

State of New York Department of Health, Corning Tower
The Governor Nelson A. Rockefeller Empire State Plaza
Albany, New York 12237
Contact: Lani Rafferty
Telephone No.: (518) 458-6310
Date Contacted: April 5,6, 1989
Information: File search for site history, correspondence, background information.

Niagara County Health Department
10th and East Falls Street, Niagara Falls, New York, 14302
Contact: Michael Hopkins
Telephone Number: (716) 284-3128
Dates Contacted: May 1, 1987
Information: Site history, profile report

Tuscarora Nation
2006 Mt. Hope Road, Lewiston, New York 14092
Contact: Chief Leo R. Henry
Telephone Number: (716)297-3757
Date Contacted: November 25, 1987
Information: Groundwater usage

Buffalo Society of Natural Sciences
Humboldt Parkway, Buffalo, New York 14211
Telephone Number: (716) 896-5200
Contact: Patricia M. Eckel
Date Contacted: August 18, 1987
Information: Endangered or rare species on the Niagara Escarpment

Town of Lewiston Water Authority
1445 Swan Road
Lewiston, New York
Contact: S. Reiter
Telephone Number: (716) 754-8214
Dates Contacted: October 29, 1987; November 29, 1988
Information: Groundwater usage

4. SITE ASSESSMENT

4.1 SITE HISTORY

The Stauffer Chemical, North Love Canal site comprises the northern section of Love Canal, which was originally excavated near the turn of the century, but remained unfinished due to declining economic conditions. This section of the canal measured approximately 100 feet by 2,000 feet by 10 feet. The excavated material was placed on either side of the excavation and, over the course of years, was used to cover filled portions of the canal, or transported from the site. The canal remained empty for a time and became overgrown with vegetation.

Standing water was noted at times in small pools and overgrown marshy areas (Moriarty 1979). Throughout this time residences were constructed up to the edge of the canal. From 1930 to 1946, Niagara Smelting, a Stauffer subsidiary, used the site for the purposes of disposal. Stauffer Chemical Company used the site from 1946 to 1952 for waste disposal. During this time the site was owned by Mrs. Whittaker, address unknown (Muraoka 1979). Union Carbide may have used the site for disposal during this time also. The canal was filled in at irregular intervals by industry and local developers. Rough estimates of the volume in the canal are between 50,000 and 75,000 cubic yards, assuming at least 1 foot of cover was placed over the waste material (Moriarty 1979). Following the filling of the canal, residential homes and roadways were built directly over the fill material. It has been reported that many of the driveways and street beds in the area have a slag base, and that cinders and slag were dumped throughout the fill material. This fill was also reported to contain a yellow material that is alleged to be sulfur. In 1979 the United States Environmental Protection Agency (EPA) conducted a study of the site and came to the following conclusions:

- The site poses no health or safety hazard;
- There is no concern for groundwater contamination; and
- Residents contacted did not appear to be concerned about the fill area.

In October 1987, Ecology and Environment, Inc. (E & E) conducted a site inspection. This inspection noted no stressed vegetation or signs of exposed waste throughout the site. Rain water runoff was noted draining east and west from a knoll near the center of the fill area. No storm drains were noted. Vegetable gardens were noted in some yards (E & E 1987).

On April 14, 1988, NCHD collected one water/sediment sample in a drainage ditch located along Escarpment and Cleghorn drives. Subsequently, NCHD surveyed residents of the Whittaker Subdivision concerning their basements and sumps to identify any unusual odors or brown/tan sediments similar to the material observed in the ditch. Based on the results of the survey, NCHD collected sump water samples from 1176 and 1179 Jarrett Drive on January 31, 1989.

NCHD concluded that:

- There may be a high potential for direct public contact with the waste material or leachate;
- Additional sampling and analysis should be conducted; and
- A formal evaluation of the site (e.g., Phase II) should be conducted.

4.2 SITE TOPOGRAPHY

The Stauffer Chemical, North Love Canal site is located along the eastern edge of Whittaker Subdivision near Upper Mountain Road in the Town of Lewiston, Niagara County, New York. The original canal was approximately 100 feet by 2,000 feet and oriented in a north-south direction. The Niagara Escarpment is approximately 200 feet to the north. This feature presents the most topographic relief in the area, rising 235 feet from the lake plain to the north and running in an east to west direction. The site elevation is 625 feet above mean sea level and slopes gently to the north and south. The New York Power Authority Reservoir is located approximately 0.3 mile to the south. The 2.5-square-mile reservoir has its surface elevation maintained up to 655 feet above sea level by surrounding levees (Johnson 1964; USGS 1980). The Lower Niagara River is located 2.5 miles to the west. The Tuscarora Indian Reservation is adjacent to the east of the site. Fish Creek is adjacent to the Power Reservoir and flows west to the Niagara River. The Town of Lewiston business district is located 2 miles to the west, adjacent to the Niagara River, and the City of Niagara Falls is 3 miles to the southwest. This site is surrounded by a semirural, residential area with rural areas located within 1 mile to the north and east (USGS 1980). The canal is located in an area characterized by low relief (except for the escarpment) broken by some small hills and low ridges to the east. Lake Ontario is located approximately 7.5 miles to the north. The lake plain north of the escarpment is an area of almost imperceptible relief. This flat-lying area slopes gently toward Lake Ontario (Johnston 1964). This site is approximately 1 mile from a Class II state wetland, and is not located on a floodplain (NYSDEC 1987; FEMA 1980).

4.3 SITE HYDROLOGY

4.3.1 Regional Geology and Hydrology

The geology of the Niagara Falls area is well understood due to its simplicity and excellent bedrock exposures along the Niagara River gorge and Niagara Escarpment.

The overburden in the Niagara Falls area is relatively thin. Three types of unconsolidated deposits are present. The lowermost is glacial till and regolith, an unsorted mixture of boulders, clay, and sand deposited by glaciers, which directly overlies the bedrock. This is covered by clays, silts, and fine sands of lacustrine origin. These are the surface soils throughout most of the region. In isolated spots, sand and gravel deposits are found above the lacustrine soils. These were deposited by glacial melt streams and by wave action of the ancestors of the Great Lakes.

The bedrock in the Niagara Falls area consists of nearly flat-lying sedimentary rocks, including dolomite, shale, limestone, and sandstone units. The several beds of bedrock slope southward approximately 30 feet per mile.

The entire region south of the Niagara escarpment, extending almost to Erie County, is directly underlain by the Lockport Dolomite. The Clinton and Albion groups underlie the Lockport but outcrop only along the escarpment and the Niagara River gorge. These units are underlain by the Queenston shale. This unit is the uppermost bedrock unit underlying the plain north of the escarpment.

Groundwater in the Niagara Falls area occurs in both the unconsolidated deposits and bedrock. The Lockport Dolomite is the principal source of groundwater in the Niagara Falls area. Three types of bedrock openings contain the groundwater: bedding joints, vertical joints, and solution cavities.

The bedding joints, which transmit most of the water in the Lockport, are fractures along prominent bedding planes which have been widened up to 1/8 inch by solutioning of the rock. These joints extend several miles, constituting effective water conduits.

The vertical joints are generally too short and sparse to account for significant groundwater storage and transmission, except in the top 10-25 feet of bedrock. Solution cavities, formed when gypsum is dissolved, are also not important components of the aquifer. Although they increase the storage capacity of the aquifer, they are isolated and do not contribute to groundwater transmission.

Two distinct sets of groundwater conditions exist in the Lockport Dolomite. The first is the upper 10 to 25 feet of the bedrock. This region is highly fractured resulting in moderate permeabilities. In some areas in the region a confining layer of clay above this zone can produce artesian groundwater conditions. The second class of groundwater conditions is found deeper in the bedrock, where at least seven different permeable zones have been identified. These zones are surrounded by impermeable bedrock and are not likely hydraulically connected (Johnston 1964).

4.3.2 Site Geology and Hydrogeology

The soil at this site consists of the Rhinebeck silt loam of the Hilton-Ovid-Ontario association. The Rhinebeck soils are deep, somewhat poorly drained and moderately fine textured to medium textured. The soils are formed in limey lake deposits of silt and clay. They are nearly level to gently sloping and occur in basins of former glacial lakes (Higgens et al. 1972). Soil samples collected from 18 boreholes on site during an investigation in 1979 indicate that the overburden on site consists of a few inches of organic topsoil overlying 1.5 to 17 feet of reddish brown clayey glacial silt till. This till is a well-graded mixture of sand, silt, and clay with a firm to very stiff consistency. Some embedded gravel and occasional hard zones were encountered. Few fissures were noted, thereby reducing permeability (Dominion Soils 1979). The underlying bedrock consists of slightly fractured grey dolomite limestone. Recovered cores showed massive crystaline rock with some weathered fractures. Permeability of the unfractured rock is expected to be low, but overall bedrock permeability is influenced by the size and frequency of fractures and amount of solutioning by groundwater. Groundwater was encountered from depths of 1.1 feet to 12.1 feet below ground surface. Average depth to groundwater was 5.3 feet below ground surface. Bedrock was encountered at depths ranging from 1.5 feet to 17 feet below ground surface with an average depth of 9 feet for 18 boreholes (Dominion Soils 1979). Bedrock thickness is approximately 30 feet in the vicinity of the site (Johnston 1964). Groundwater flow from this site is expected to be north toward the escarpment (Moriarty 1979).

Groundwater is used extensively for drinking water purposes on the adjacent Tuscarora Indian Reservation (Henry 1987).

4.3.3 Hydraulic Connections

As previously discussed, the aquifer of concern at this site is the Lockport Dolomite. This is the aquifer of concern for the entire Niagara Falls region south of the Niagara escarpment.

The Lockport can be divided into two zones on the basis of water-transmitting properties. The upper 10 to 25 feet of rock is a moderately permeable zone that contains relatively abundant bedding planes and vertical joints enlarged by solutioning of dolomite and abundant solution cavities left by solutioning of gypsum. These zones are more than likely hydraulically connected. The remainder of the formation contains low to moderately permeable bedding planes with as many as seven major water-bearing zones. These zones are surrounded by fine-grained crystalline dolomite and are probably not hydraulically connected.

4.4 SITE CONTAMINATION

The Lewiston section of the Love Canal was used by Niagara Smelting (a subsidiary of Stauffer Chemical Company) from 1930 to 1952. Stauffer has confirmed that it disposed of concrete cell parts, graphite, scrap sulfur, cinder and silicon, zirconium and titanium oxides (Muraoka 1979). Other wastes reportedly disposed of by Stauffer include asbestos and scrap metal (NYSDEC 1986). This landfill was not monitored during its years of operation. Residents have reported that Union Carbide had been observed dumping wastes into the canal, although the company has not confirmed this. The Union Carbide wastes may have contained phosphates, phenols, and flux containing fluorides. Also, roads in the area were reportedly built on a slag base. In addition, a fire in the area was reportedly extremely difficult to extinguish (Moriarty 1979).

Eighteen boreholes were drilled to the bedrock by Dominion Soil Investigation in 1978. Soil samples were analyzed for sulfur, phosphorous, manganese, magnesium, cyanide, fluoride, nitrate, phosphate, phenol, and chloride. Groundwater samples were analyzed for pH and sulfate. The analytical results are tabulated in Tables 4-1 and 4-2. Elevated concentrations of phenol, sulfur, fluorides, and chlorides were found. Magnesium also was elevated, but may be attributable to weathering of the underlying dolomite bedrock. During borehole installation, lumps of pure sulfur were encountered. The presence of sulfur is also represented as high sulfate concentrations found in the groundwater (see Table 4-2). Five of the 18 groundwater samples exceeded the 250 ppm limit set forth in the New York State Water

Quality Regulations for Class GA waters. Groundwater is used extensively for drinking purposes in the adjacent Tuscarora Indian Reservation.

Other evidence of contamination at the site also exists. The excavation of a sanitary sewer during the 1970s revealed discolored industrial debris and scattered lumps of sulfur. One resident of the subdivision now built on the site indicated that, because of surfacing of chemicals, grass would not grow in a 50-foot by 50-foot portion of his backyard. Also, a 6-inch cast iron water pipe installed beneath Jarrett Drive at the site corroded and needed to be replaced in 1962 (Moriarty 1979).

Garden vegetables grown at a residence on the site were tested for pesticides and herbicides. No evidence of contamination was found (Aro 1979).

On April 14, 1988, the NCHD collected one water/sediment sample in a drainage ditch located along Escarpment and Cleghorn drives. The analysis of the material found no detectable HSL organics and no metal concentrations above expected background levels (NCHD 1988). Subsequently, NCHD surveyed residents of the Whittaker Subdivision concerning their basements and sumps to identify any unusual odors or brown/tan sediments similar to the material observed in the ditch. Based on the results of the survey, NCHD collected sump water samples from 1176 and 1179 Jarrett Drive on January 31, 1989. Samples were tested for volatile halogenated organics, aromatic purgeables, ketones, organochlorine, pesticides, and PCBs. The analysis of the sump samples found no HSL organic compounds above expected background levels or water quality standards except for PCBs at 1176 Jarrett Drive.

Table 4-1

CHEMICAL ANALYSIS OF SELECTED SOIL SAMPLES: NORTH LOVE CANAL SITE

Sample		Contaminants (ppm)									
Borehole	Sample Number	Sulphur (S)	Phosphorus (P)	Manganese (Mn)	Magnesium (Mg)	Cyanide (CN)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Phenol (C_6H_5OH)	Chloride (Cl)
1	1	2	--	--	10	--	--	--	--	--	--
2	1	118	--	--	40	--	--	--	--	--	--
	2	655	--	--	2	0.01	6.1	0.3	--	0.14	846
4	1	7	--	--	11	--	--	--	--	--	--
6	1	12	--	--	7	--	--	--	--	--	--
	2	11	--	--	7	--	--	--	--	--	--
	4	4	--	--	9	--	--	--	--	--	--
	7	100	--	--	48	0.01	64	28	--	0.001	--
7	1	27	--	--	16	--	--	--	--	--	--
	2	5	--	--	11	0.01	86	5	--	0.005	--
8	1	965	0.7	0.08	32	--	--	--	--	--	--
	2	1,910	1.2	0.28	96	--	--	--	--	--	--
	3	1,662	1.0	0.12	2.4	--	--	--	--	--	--
9	1	420	0.5	0.01	14	--	--	--	--	--	--
	2	8,797	3.4	40	744	--	--	--	--	--	--
	3	4,487	2.8	12	852	--	--	--	--	--	--
10	2	335	0.8	0.01	13	--	--	--	--	--	--
	3	949	1.6	0.01	29	0.47	70	4.2	8.6	0.38	--
	4	21	0.1	0.01	3.6	--	--	--	--	--	--
13	1	14	--	--	4	--	--	--	--	--	--
	2	9	--	--	1	--	--	--	--	--	--
	4	21	--	--	4	--	--	--	--	--	--
14	1	29	--	--	4	--	--	--	--	--	--

Table 4-1 (Cont.)

Sample		Contaminants (ppm)									
Borehole	Sample Number	Sulphur (S)	Phosphorus (P)	Manganese (Mn)	Magnesium (Mg)	Cyanide (CN)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Phenol (C_6H_5OH)	Chloride (Cl)
14	2	14	--	--	4	0.01	112	17	--	0.006	--
	4	10	--	--	3	--	--	--	--	--	--
17	1	1,398	1.9	0.24	16	--	--	--	--	--	--
	2	1,710	2.0	0.01	16	0.01	152	8.8	--	0.001	--
	3	504	--	--	21	--	--	--	--	--	--
	4	121	--	--	5	--	--	--	--	--	--
	5	196	--	--	8	--	--	--	--	--	--
18	1	0.22	--	--	16	--	--	--	--	--	--
	2	0.43	--	--	2	0.01	0.2	0.1	--	0.001	0.03
	3	4.8	--	--	0.8	--	--	--	--	--	--

Source: Dominion Soil Investigation, Inc. 1979.

Table 4-2

CHEMICAL ANALYSIS OF SELECTED GROUNDWATER SAMPLES: NORTH LOVE CANAL SITE

Sample	pH	Sulphate (SO_4) (ppm)
BH 2	9.7	368
BH 3	8.0	52
BH 6	7.8	67
BH 7	7.4	136
BH 8	7.4	664
BH 9	7.9	160
BH 10	7.3	111
BH 11	7.5	124
BH 12	7.3	53
BH 13	7.4	107
BH 13	7.9	123
BH 14	6.8	88
BH 15	6.8	100
BH 16	7.6	116
BH 17	7.1	2,006
BH 18	7.7	31
1176 Jarrett (sump)	7.1	1,575
Bottom of escarpment	8.0	283

Source: Dominion Soil Investigation, Inc. 1979.

5. PRELIMINARY APPLICATION OF THE HAZARD RANKING SYSTEM

5.1 NARRATIVE SUMMARY

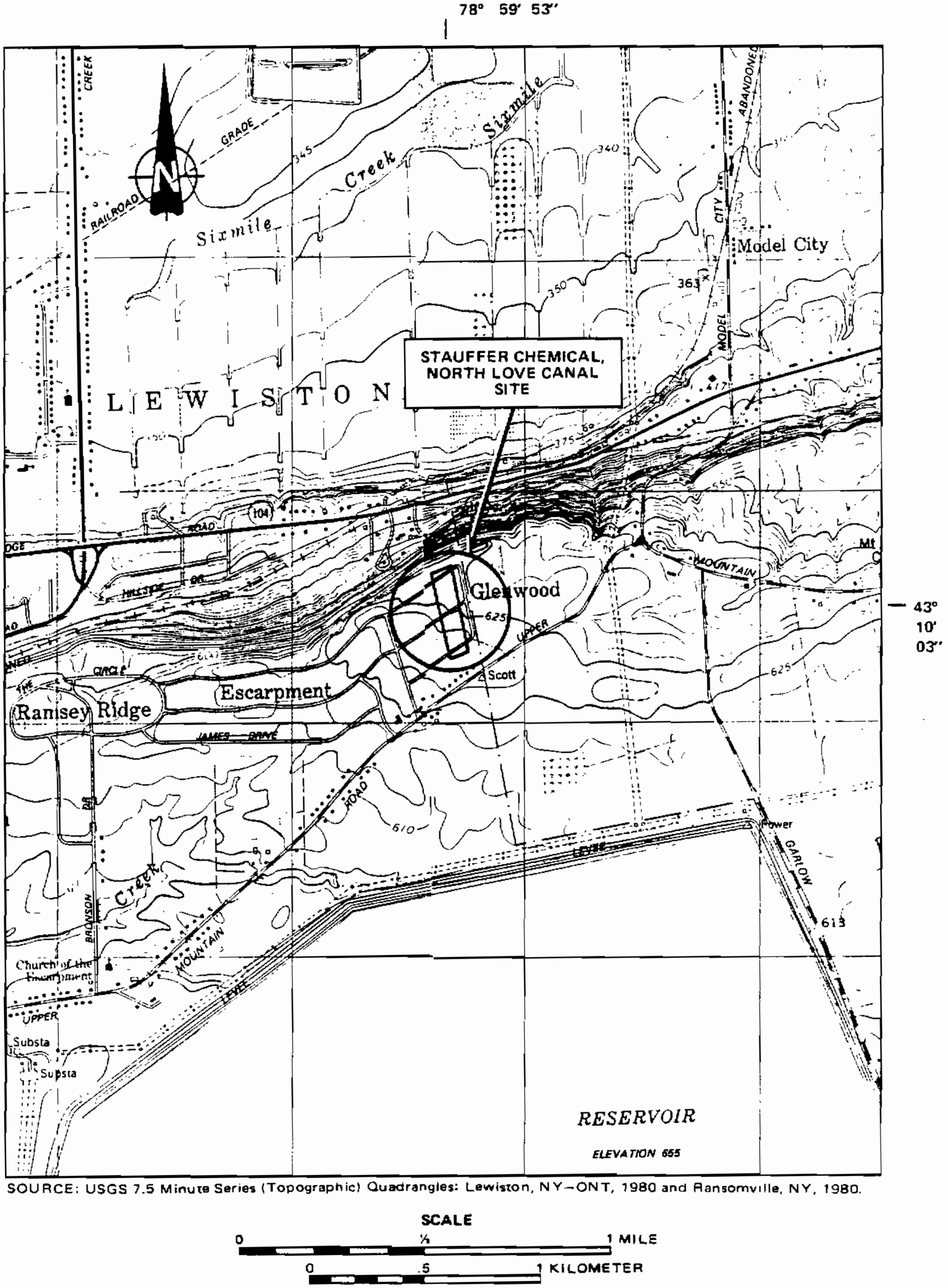
The Stauffer Chemical, North Love Canal site occupies an area of approximately 5 acres near Upper Mountain Road in Lewiston, Niagara County, New York (see Figure 5-1). The site was originally excavated near the turn of the century but remained unfinished due to declining economic conditions. From 1930 to 1946, Niagara Smelting, a Stauffer Chemical Company subsidiary, used the site for disposal. Stauffer Chemical Company used the site for waste disposal until 1952. During this time the site was owned by Mrs. Whittaker, address unknown (Muraoka 1979). Union Carbide may also have used the site for disposal.

Reported wastes on site include asbestos, graphite, cinders, concrete cell parts, reactor linings, scrap sulfur, scrap metal, silicon, zirconiun and titanium oxides, phenols, slag, and flux containing fluorides. The suspected quantity of waste is between 50,000 and 70,000 cubic yards. Soil samples collected and analyzed by Dominion Soils Investigations for the Town of Lewiston confirmed the presence of sulfur, magnesium, manganese, sulfate, chloride, fluoride, nitrate, cyanide, and phenol.

The North Love Canal site is surrounded by a semirural, residential area with rural areas located within 1 mile to the north and east (USGS 1980). The Niagara Escarpment is approximately 200 feet to the north and the New York Power Authority Reservoir is located approximately 0.3 mile to the south. The Lower Niagara River is 2.5 miles to the west and Fish Creek is adjacent to the reservoir and flows west into the river.

Groundwater on the site was encountered from depths of 1.1 to 12.1 feet below ground surface with an average depth of 5.3 feet. Groundwater flow is expected to be north towards the escarpment and is used for drinking water on the adjacent Tuscarora Indian Reservation.

This site has been investigated by EPA in 1979; by the Town of Lewiston in 1979; and by NCHD in 1988. EPA recommended no further studies for the site; whereas, the Town of Lewiston study recommended onsite groundwater sampling and analysis for heavy metals and halogenated organics. NCHD suggested that a Phase II study be conducted.



SOURCE: USGS 7.5 Minute Series (Topographic) Quadrangles: Lewiston, NY–ONT, 1980 and Ransomville, NY, 1980.

Figure 5–1 LOCATION MAP

FIGURE 1

HRS COVER SHEET

Facility Name: Stauffer Chemical, North Love Canal

Location: Near Upper Mountain Road, Lewiston, New York

EPA Region: II

Person(s) in Charge of Facility: Now owned by various homeowners.

Name of Reviewer: D. Sutton

Date: 10/14/87

General Description of the Facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action; etc.)

The Stauffer Chemical, North Love Canal site, in the Town of Lewiston, was used by Stauffer during 1930-1952 to dispose of industrial wastes. These wastes are reported to be 50,000 to 70,000 cubic yards of asbestos, concrete, cell parts, reactor linings, scrap sulfur, graphite, scrap metal, silicon, zirconium and titanium oxides, flux, cinders and phenols. The site was then covered and developed. Whittaker subdivision, a residential development, is now located directly over the former disposal site. The site comprises approximately 5 acres and consists of private residences and surrounding yards and gardens. The former disposal area crosses several roadways in the eastern portion of the subdivision. Groundwater is the major route of concern for contamination. The Tuscarora Indian Reservation is adjacent to the site and groundwater is used for drinking on the reservation. Further investiation is needed to determine amount of waste disposed of and extent of possible migration.

Scores: S_M = 39.04 (S_{gw} = 67.35 S_{sw} = 5.03 S_a = 0)

S_{FE} = not scored

S_{DC} = 37.5

D1774

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 [✓ 45]	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
	Total Route Characteristics Score			15	
3 Containment	0 1 2 3	1		3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 [✓ 18]	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 [✓ 8]	1	8	8	
	Total Waste Characteristics Score		26	26	
5 Targets					3.5
Ground Water Use	0 1 2 [✓ 3]	3	9	9	
Distance to Nearest Well/Population Served	0 4 6 8 10 12 16 18 20 [✓ 24] 30 32 35 40	1	24	40	
	Total Targets Score		33	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			38,610	57,330	
7 Divide line 6 by 57,330 and multiply by 100	S_{gw} = 67.35				

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	[✓ 0] 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	[✓ 0] 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 [✓ 2] 3	1	2	3	
Distance to Nearest Surface Water	0 1 [✓ 2] 3	2	4	6	
Physical State	0 1 2 [✓ 3]	1	3	3	
Total Route Characteristics Score			9	15	
3 Containment	0 1 2 [✓ 3]	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 [✓ 12] 15 18	1	12	18	
Hazardous Waste Quantity	0 1 2 3 4 5 8 7 [✓ 8]	1	8	8	
Total Waste Characteristics Score			20	26	
5 Targets					4.5
Surface Water Use	0 1 [✓ 2] 3	3	6	9	
Distance to a Sensitive Environment	[✓ 0] 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	[✓ 0] 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			3,240	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} =	5.03		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Observed Release	[✓ 0] 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line $\boxed{1}$ is 0, the S_a = 0. Enter on line $\boxed{5}$. If line $\boxed{1}$ is 45, then proceed to line $\boxed{2}$.					
$\boxed{2}$ Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
$\boxed{3}$ Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				35,100	
$\boxed{5}$ Divide line $\boxed{4}$ by 35,100 and multiply by 100		S_a =	0		

FIGURE 9
AIR ROUTE WORK SHEET

	s	s^2
Groundwater Route Score (S_{gw})	67.35	4,536.02
Surface Water Route Score (S_{sw})	5.03	25.30
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$	▨	4,561.32
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$	▨	67.54
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$	▨	39.04

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
$\boxed{1}$ Containment	1 3	1		3	7.1
$\boxed{2}$ Waste Characteristics					7.2
Direct Evidence	0 3	1		3	
Ignitability	0 1 2 3	1		3	
Reactivity	0 1 2 3	1		3	
Incompatibility	0 1 2 3	1		3	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
$\boxed{3}$ Targets					7.3
Distance to Nearest Population	0 1 2 3 4 5	1		5	
Distance to Nearest Building	0 1 2 3	1		3	
Distance to Sensitive Environment	0 1 2 3	1		3	
Land Use	0 1 2 3	1		3	
Population Within 2-Mile Radius	0 1 2 3 4 5	1		5	
Buildings Within 2-Mile Radius	0 1 2 3 4 5	1		5	
	Total Targets Score			24	
$\boxed{4}$ Multiply $\boxed{1}$ x $\boxed{2}$ x $\boxed{3}$				1,440	
$\boxed{5}$ Divide line $\boxed{4}$ by 1,440 and multiply by 100		S_{FE} =	Not scored		

FIGURE 11
FIRE AND EXPLOSION WORK SHEET

Direct Contact Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Incident	[✓ 0] 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility	0 1 2 [✓ 3]	1	3	3	8.2
3 Containment	0 [✓ 15]	1	15	15	8.3
4 Waste Characteristics Toxicity	0 1 2 [✓ 3]	5	15	15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 [✓ 3] 4 5	4	12	20	
Distance to a Critical Habitat	[✓ 0] 1 2 3.	4	0	12	
Total Targets Score			12	32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			8,100	21,600	
7 Divide line 6 by 21,600 and multiply by 100		S_{DC} =	37.5		

FIGURE 12
DIRECT CONTACT WORK SHEET

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

Instructions: As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference. Include the location of the document.

Facility Name: Stauffer Chemical, North Love Canal

Location: Near Upper Mountain Road, Lewiston, New York

Date Scored: 10/15/87

Person Scoring: Dennis Sutton

Primary Source(s) of Information (e.g., EPA region, state, FIT, etc.):

NYSDEC, Region 9, Buffalo, New York
Niagara County Development of Health, Niagara Falls, New York

Factors Not Scored Due to Insufficient Information:

Comments or Qualifications:

Fire and explosion factor not scored as site has not been declared a fire hazard by a fire marshal.
Ref. No. 18

GROUNDWATER ROUTE

1. OBSERVED RELEASE

Contaminants detected (3 maximum):

Sulfate
Concentrations above drinking water standards.
Ref. No. 2

Rationale for attributing the contaminants to the facility:

Groundwater samples obtained from boreholes on site, sulfur compounds were landfilled at this site.
Ref. No. 2

* * *

2. ROUTE CHARACTERISTICS

Depth to Aquifer of Concern

Name/description of aquifer(s) of concern:

Lockport Dolomite
Ref. No. 3

Depth(s) from the ground surface to the highest seasonal level of the saturated zone [water table(s)] of the aquifer of concern:

1.1 to 12.1 feet, average of 5.3 feet
Ref. No. 1

Depth from the ground surface to the lowest point of waste disposal/storage:

10 feet
Ref. No. 1

Net Precipitation

Mean annual or seasonal precipitation (list months for seasonal):

31 inches/year
Ref. No. 4

Mean annual lake or seasonal evaporation (list months for seasonal):

27 inches/year
Ref. No. 4

Net precipitation (subtract the above figures):

4 inches

Permeability of Unsaturated Zone

Soil type in unsaturated zone:

Rhinebeck silt loam of the Hilton - Ovid - Ontario Association
Ref. No. 5

Permeability associated with soil type:

10^{-4} to 10^{-6} cm/sec
Ref. Nos. 4, 5

Physical State

Physical state of substances at time of disposal (or at present time for generated gases):

Solid, slurry
Ref. Nos. 1, 2

* * *

3. CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill
Ref. No. 1

Method with highest score:

Landfill with inadequate cover
Ref. Nos. 1, 4

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

Phenols, cyanide, fluoride, PCB
Ref. No. 2, 17

Compound with highest score:

PCB
Ref. No. 4

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

Estimated at 50,000 to 70,000 cubic yards
Ref. No. 6

Basis of estimating and/or computing waste quantity:

Listed as such on Ref. No. 6

* * *

5. TARGETS

Groundwater Use

Use(s) of aquifer(s) of concern within a 3-mile radius of the facility:

Drinking water; no municipal water from alternate unthreatened sources presently available.
Ref. No. 14

Distance to Nearest Well

Location of nearest well drawing from aquifer of concern or occupied building not served by a public water supply:

1169 Ridge Road (residence)
Ref. No. 13

Distance to above well or building:

Residence is approximately 2,050 feet from the landfill
Ref. Nos. 13,14

Population Served by Groundwater Wells Within a 3-Mile Radius

Identified water-supply well(s) drawing from aquifer(s) of concern within a 3-mile radius and populations served by each:

The known wells within a 3-mile radius include 1169 Ridge Road (residence) and the Tuscarora Indian Reservation. The population served is estimated between 1,000 and 3,000.
Ref. Nos. 13, 14

Computation of land area irrigated by supply well(s) drawing from aquifer(s) of concern within a 3-mile radius, and conversion to population (1.5 people per acre):

Wells and springs used on the Tuscarora Indian Reservation are used to irrigate lawns and small garden plots, but are not used for commercial farming.
Ref. No. 14

Total population served by groundwater within a 3-mile radius:

1,000 to 3,000
Ref. Nos. 13, 14

SURFACE WATER ROUTE

1. OBSERVED RELEASE

Contaminants detected in surface water at the facility or downhill from it (5 maximum):

None detected

Rationale for attributing the contaminants to the facility:

NA

* * *

2. ROUTE CHARACTERISTICS

Facility Slope and Intervening Terrain

Average slope of facility in percent:

0.005%
Ref. No. 7

Name/description of nearest downslope surface water:

Fish Creek
Ref. No. 7

Average slope of terrain between facility and above-cited surface water body in percent:

0.008%
Ref. No. 7

Is the facility located either totally or partially in surface water?

No
Ref. No. 7

Is the facility completely surrounded by areas of higher elevation?

No
Ref. No. 7

1-Year 24-Hour Rainfall in Inches

Approximately 2.1 inches
Ref. No. 4

Distance to Nearest Downslope Surface Water

0.5 mile
Ref. No. 7

Physical State of Waste

Solid
Ref. Nos. 1, 2

* * *

3. CONTAINMENT

Containment

Method(s) of waste or leachate containment evaluated:

Landfill
Ref. No. 1

Method with highest score:

Landfill without adequate cover
Ref. No. 4

4. WASTE CHARACTERISTICS

Toxicity and Persistence

Compound(s) evaluated:

Phenols, cyanides, fluorides
Ref. No. 2

Compound with highest score:

Phenol, cyanides, fluorides
Ref. No. 4

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility, excluding those with a containment score of 0 (give a reasonable estimate even if quantity is above maximum):

50,000 to 70,000 cubic yards
Ref. No. 6

Basis of estimating and/or computing waste quantity:

Listed as such on Ref. No. 6

* * *

5. TARGETS

Surface Water Use

Use(s) of surface water within 3 miles downstream of the hazardous substance:

Fish Creek is a Class D stream suitable for fishing.
Lewiston Reservoir used commercially
Ref. No. 7

Is there tidal influence?

No
Ref. No. 7

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

NA
Ref. No. 7

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

5,000 feet
Ref. No. 10

Distance to critical habitat of an endangered species or national wildlife refuge, if 1 mile or less:

NA
Ref. No. 11

Population Served by Surface Water

Location(s) of water-supply intake(s) within 3 miles (free-flowing bodies) or 1 mile (static water bodies) downstream of the hazardous substance and population served by each intake:

NA--no intakes within 3 miles of site
Ref. No. 9

Computation of land area irrigated by above-cited intake(s) and conversion to population (1.5 people per acre):

NA
Ref. No. 9

Total population served:

NA
Ref. No. 9

Name/description of nearest of above water bodies:

NA
Ref. No. 9

Distance to above-cited intakes, measured in stream miles:

NA
Ref. No. 9

AIR ROUTE

1. OBSERVED RELEASE

Contaminants detected:

None detected

Date and location of detection of contaminants:

NA

Methods used to detect the contaminants:

HNu photoionization detector

Rationale for attributing the contaminants to the site:

NA

* * *

2. WASTE CHARACTERISTICS

Reactivity and incompatibility

Most reactive compound:

NA

Most incompatible pair of compounds:

NA

Toxicity

Most toxic compound:

Phenols, cyanides, PCB
Ref. No. 4

Hazardous Waste Quantity

Total quantity of hazardous waste:

50,000 to 70,000 cubic yards
Ref. No. 6

Basis of estimating and/or computing waste quantity:

Listed as such on Ref. No. 6

* * *

3. TARGETS

Population Within 4-Mile Radius

Circle radius used, give population, and indicate how determined:

0 to 4 mi [✓ 0 to 1 mi] 0 to 1/2 mi 0 to 1/4 mi

1,273
Ref. No. 12

Distance to a Sensitive Environment

Distance to 5-acre (minimum) coastal wetland, if 2 miles or less:

NA
Ref. No. 7

Distance to 5-acre (minimum) fresh-water wetland, if 1 mile or less:

5,000 feet
Ref. No. 10

Distance to critical habitat of an endangered species, if 1 mile or less:

NA
Ref. No. 11

Land Use

Distance to commercial/industrial area, if 1 mile or less:

0.5 mile
Ref. No. 7

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

NA
Ref. Nos. 7, 11

Distance to residential area, if 2 miles or less:

Adjacent
Ref. No. 8

Distance to agricultural land in production within past 5 years, if 1 mile or less:

0.1 mile
Ref. No. 5

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

0.1 mile
Ref. No. 5

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

NA
Ref. No. 15

FIRE AND EXPLOSION

1. CONTAINMENT Not Scored

Hazardous substances present:

Phenols, cyanide, fluoride, PCB
Ref. Nos. 2, 17

Type of containment, if applicable

Landfill with inadequate cover
Ref. No. 1

* * *

2. WASTE CHARACTERISTICS

Direct Evidence

Type of instrument and measurements:

NA

Ignitability

Compound used:

NA

Reactivity

Most reactive compound:

NA

Incompatibility

Most incompatible pair of compounds:

NA

Hazardous Waste Quantity

Total quantity of hazardous substances at the facility:

50,000 to 70,000 cubic yards
Ref. No. 6

Basis of estimating and/or computing waste quantity:

Listed as such on Ref. No. 6

* * *

3. TARGETS

Distance to Nearest Population

Adjacent
Ref. Nos. 7, 8

Distance to Nearest Building

0.01 mile
Ref. No. 12

Distance to a Sensitive Environment

Distance to wetlands:

5,000 feet
Ref. No. 10

Distance to critical habitat:

NA
Ref. No. 11

Land Use

Distance to commercial/industrial area, if 1 mile or less:

0.5 mile
Ref. No. 7

Distance to national or state park, forest, or wildlife reserve, if 2 miles or less:

NA
Ref. Nos. 7, 11

Distance to residential area, if 2 miles or less:

Adjacent
Ref. No. 8

Distance to agricultural land in production within past 5 years, if 1 mile or less:

0.1 mile
Ref. No. 5

Distance to prime agricultural land in production within past 5 years, if 2 miles or less:

0.1 mile
Ref. No. 5

Is a historic or landmark site (National Register of Historic Places and National Natural Landmarks) within the view of the site?

NA
Ref. No. 15

Population Within 2-Mile Radius

6,237
Ref. No. 12

Buildings Within 2-Mile Radius

2,244
Ref. No. 12

DIRECT CONTACT

1. OBSERVED INCIDENT

Date, location, and pertinent details of incident:

None observed

* * *

2. ACCESSIBILITY

Describe type of barrier(s):

Waste is covered by approximately 1 foot of soil, residential homes, roads, yards, and driveways

* * *

3. CONTAINMENT

Type of containment, if applicable:

Landfill with inadequate cover
Ref. No. 1

* * *

4. WASTE CHARACTERISTICS

Toxicity

Compounds evaluated:

Phenol, cyanides, fluorides, PCB
Ref. Nos. 2, 17

Compound with highest score:

Phenol, cyanides, fluorides
Ref. No. 4

* * *

5. TARGETS

Population within one-mile radius

1,273
Ref. No. 12

Distance to critical habitat (of endangered species)

NA
Ref. No. 11

REFERENCES

If the entire reference is not available for public review in the EPA regional files on this site, indicate where the reference may be found:

Reference Number	Description of the Reference
1	Moriarty, L.R., P.E., 1979, USEPA, Rochester Program Support Branch, Surveillance and Analysis Division, Report on Love Canal Section, Lewiston, New York. Document location: E & E, Buffalo, New York.
2	Dominion Soil Investigation Inc., 1979, Report of Lewiston Escarpment Project, Analysis of Subsoil Conditions, Whittaker Subdivision, Lewiston, New York. Document location: E & E, Buffalo, New York.
3	Johnston, R.H., 1964, Groundwater in the Niagara Falls Area, New York, State of New York Conservation Department Water Resources Commission, Bulletin GW-53. Document location: E & E, Buffalo, New York.
4	Barrett, S.W., S.S. Chang, S.A. Haus, A.M. Platt, 1982, Uncontrolled Hazardous Waste Site Ranking System, A Users Manual, MITRE Corporation. Document location: E & E, Buffalo, New York.
5	Higgins, B.A., P.S. Puglia, R.P. Leonard, T.D. Yoakum, W.A. Wirtz, 1972, Soils Survey of Niagara County, New York; United States Department of Agriculture, Soil Conservation Service. Document location: E & E, Buffalo, New York.
6	New York State Department of Environmental Conservation, Division of Solid and Hazardous Waste, Inactive Hazardous Waste Disposal Report, December. 1986. Document location: E & E, Buffalo, New York.
7	USGS 7.5-Minute Topographic Map, 1980, Ransomville and Lewiston, New York quadrangles. Document location: E & E, Buffalo, New York.
8	Ecology and Environment, October 7, 1987, site inspection and photo log book. Document location: E & E, Buffalo, New York.
9	New York State Atlas of Community Water System Sources, 1982, New York State Department of Health, Division of Environmental Protection, Bureau of Public Water Supply Protection. Document location: E & E Buffalo, New York.
10	NYSDEC wetlands maps. Document location: NYSDEC Region 9 Offices, Buffalo, New York.
11	James Snider, Wildlife Biologist, 1987, NYSDEC Region 9, personal communication. Document location: E & E, Buffalo, New York.
12	Graphical Exposure Modeling System (GEMS), General Sciences Corporation, 1987. Information location: E & E, Buffalo, New York.
13	Reiter, S., October 29, 1987 and November 28, 1988, personal communication, Town of Lewiston Water Authority. Document location: E & E, Buffalo, New York.
14	Chief Mt. Pleasant, E., and Chief Henry, November 12, 1987, personal communication, Tuscarora Nation, Lewiston, New York. Document location: E & E, Buffalo, New York.
15	Murtagh, W.J., 1976, The National Register of Historic Places, with Updates from the Federal Register in 1980, 1981, and 1982, USDI National Park Service, Washington, D.C., Document location: E & E, Buffalo, New York.
16	State of New York, Official Compilation of Codes, Rules, and Regulations, 1983, Title 6 Environmental Conservation, Part 700, Division of Water Resources.
17	Niagara County Health Department, 1989, Sampling Notes and Analytical Results, Whittaker Subdivision, Lewiston, New York. Document location: E & E, Buffalo, New York.
18	Hopkins, Michael, 1987, personal communication, Niagara County Health Department, Niagara Falls, New York. Document location: E & E, Buffalo, New York.

REFERENCE NO. 1

John McMahon

J B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
26 FEDERAL PLAZA
NEW YORK NEW YORK 10007

January 4, 1980

Mr. Charles N. Goddard
Director, Bureau of Hazardous Waste
Division of Solid Waste Management
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233

Dear Charlie:

Please find enclosed a copy of an investigation report on Love Canal prepared by our field office in Rochester. It involves an evaluation of the northern portion of the area. Also enclosed are copies of related reports and materials which may be of interest to you.

Sincerely yours,

John S Frisco

John S. Frisco, Chief
Hazardous Waste Section

Enclosure

REPORT ON

LOVE CANAL SECTION

LEWISTON, N.Y.

BY:

Lawrence R. Moriarty, P.E.
U.S. Environmental Protection Agency
Rochester Program Support Branch
Surveillance and Analysis Division
Rochester, NY 14614

Date: 9-7-79

LOVE CANAL

(Lewiston Section)

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LOVE CANAL

(Lewiston Section)

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- III. Profile of canal from test boring results
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- V. Relative locations of the north and south sections of Love Canal

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- I. Location of homes near and on Love Canal, Lewiston
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- I. Stauffer Chemical Company waste disposal (Interagency Task Force)
- II. Union Carbide - waste disposal for Metals and Linde Divisions (Interagency Task Force)
- III. Gene H. Bedell - comments on Dominion Soil Investigation, Inc.
- IV. Love Canal description (Interagency Task Force)
- V. Department of Energy report "Aerial Radiological Survey, Lake Ontario Ordnance Works, Lewiston, NY"
- VI. News clips Love Canal, Lewiston
- VII. Dominion Soil Investigation, Inc. report of "Lewiston Escarpment project, Analysis of Subsoil Conditions, Whittaker Subdivision, Lewiston, NY"

LOVE CANAL

(Lewiston Section)

3A (cont'd.)

D. References

   I. Fluorides (Water Quality Criteria)

   II. Phenol (Water Quality Criteria)

E. Photographs

   I. Diagram showing direction from which photos taken

   II. Four pages, 8 photos of the Love Canal, Lewiston area.

LOVE CANAL

(Lewiston Section)

I. Problem

In light of the conditions found in the south section of Love Canal (near the Niagara River), local government officials asked EPA to evaluate the north section of the canal in Lewiston: chemical companies had dumped waste in the canal and homes were built on same. The local government officials had concern for the people living in the area.

II. Location

The Lewiston section of the canal (See Fig. I) is located off the Upper Mountain Road in Niagara County, New York, in the Town of Lewiston. The canal runs north and south and crosses Jarrett, Elliott and Escarpment Drives, and the Upper Mountain Road. It parallels Cleghorn Drive.

III. Characteristics

The canal is approximately 90 to 100 feet wide and 2000 feet long. It is in a residential area with approximately ten homes on or partially on the filled portion (See Fig. II and Table I). The canal is approximately 140 feet west of the centerline of Cleghorn Drive at Escarpment Drive and 215 feet west of Cleghorn Drive at Jarrett Drive. It extends several hundred feet north of Escarpment Drive and south of Upper Mountain Road. The canal is on the top of a slight ridge and surface drainage is in a northerly and southerly direction.

As the filled-in portion of the canal exists today, rock depth (limestone) averages about 9.3 feet and ranges from 4 to 14 feet. Ground water level averages 5 feet and ranges from 3 to 10 feet. Figure III gives a general cross section through the canal looking to the east. As the figure shows, a loose and a stiff clay make up a major portion of the cover material. (The above information from Item VII.

Ground water flow would appear to be to the north.

IV. History

The canal was originally excavated about the turn of the century; however, bad times stopped construction. The canal remained empty and became overgrown with cattails. The excavated earth was placed to either side of the excavation and people built up to the edge of the canal. The canal at times contained water but no one seems to remember the canal as a large pond or lake but more like small ponds and overgrown marshy areas.

The piled-up dirt over the years was carted off for various reasons and also used to cover much of the filled-in area.

A property owner on Ellicot Drive indicated he lived on the edge of the canal, saw it filled in the late 30's to the early 40's, and covered. He sold a lot east of his within the canal boundaries, and watched as a home was built on same.

The gentleman indicated that Stauffer Chemical dumped material (See Item I) for a number of years in the canal. He also indicated Union Carbide dumped material but not on a routine basis. On one occasion, his new car when following a Union Carbide truck was splattered with waste and the paint damaged.

He also indicated that as a volunteer fireman he fought a fire on the canal. The fire with a low burning flame and noxious gas was difficult to put out. The whole area had to be flooded to extinguish the flame.

He saw the roads placed over the canal. More recently, the property owner observed along with his next-door neighbor the excavation for a sanitary sewer. The excavation disclosed a discolored industrial debris with some sulfur lumps scattered through same (See Photos #7 and #8).

Another gentleman on Escarpment Drive remembers open trucks with a brown slurry being dumped at the canal. He also indicated salt and sulfur were dumped into the canal.

Item II lists, as drawn up by the Interagency Task Force, some of the waste materials produced by Union Carbide. There is some similarity between the Union Carbide wastes and the material in Love Canal, Lewiston, as reported by Dominion Soil Investigation, Inc. (See Item VII). Such parameters as fluorides, phenols and phosphates could have come from Union Carbide but such information has not been confirmed. Several parties at Union Carbide have been contacted but they could not confirm that Union Carbide trucks had used Love Canal, Lewiston for disposal purposes. It was their opinion that the Union Carbide name, as such, was not in use at that time.

In discussing the dumping at the canal, no one could give an estimate of the number of trucks a day or week, etc., that used the canal. From this standpoint, the volume of waste dumped could not be estimated. The canal was filled in at irregular intervals by industry and a few local people without any clear-cut idea of the volume used. Rough estimates put the useable volume between 50,000 and 75,000 cubic yards, assuming at least a foot of cover material was placed over the fill.

Item IV is a copy of the summary of the Interagency Task Force review of Love Canal. The summary, for this report, only locates the north canal section. In no way does the description of the south section of the canal fit the north section. It should not be construed that a similarity in chemicals exists between the two sections.

V. Investigation - Photograohs

On May 22, 1979, William Librizzi, now deputy director of the Air and Hazardous Waste Division asked that an investigation of the north portion of Love Canal in Lewiston, New York be made. With the consent of the Surveillance and Analysis personnel, an initial investigation was made on May 23, 1979. Other visits were made on June 12, 1979 and August 3, 1979.

Contacts were made (See Table II) with various local individuals and discussions were had with same. These people were private citizens and government officials.

Phone conversations were had with the NYS Department of Environmental Conservation personnel in Buffalo and Albany, the Niagara County Department of Health personnel, and with members of the Interagency Task Force.

Conversations were had with a sewer construction crew and their foreman. They excavated trenches and laid sewer pipe through four cuts that traversed the canal at both ends and at the third points.

Manhole covers were pulled in the area of the canal (See Fig. IV) and a survey for possible leachate locations was made.

Photographs were taken of the area (See Attachment) showing the canal section as a quiet residential area.

VI. Findings

After Mr. Librizzi's phone call of May 22, 1979, a visit was made to the canal area on May 23, June 12, and August 3, 1979. As a result of the visits the following was ascertained:

1. Stauffer Chemical, Niagara Falls, New York did dump waste into the north section of the canal (See Item I).

2. Union Carbide Corp, location unknown, was observed dumping occasional loads of waste into the canal. This was not confirmed in contacts with the company officials (See Item II). They have no records to indicate dumping in that area.

3. No other company, industry, or governmental agency was observed by local residents dumping waste into the canal.

4. Residents believe many of the driveways and street beds in the area have a slag base. The slag could have come from any of the following companies: Buffalo Slag, ~~Oldensburg~~ Electrochemical, Tonawanda Iron, or Union Carbide. OLDBURY

5. The canal was filled in the late 1930 to the early 1940. The then owner of the subdivision (Whitteker) wanted the canal filled and solicited the aid and consent of the people living next to the canal. Mr. Jones at 1137 Ellicot Drive was one of those who agreed to the filling in of the canal without any cost to himself. Cinders and slag along with white and yellow material were dumped throughout the fill. Some yellow material (sulfur) showed up on Ellicot Drive (See Photos #7 and #8).

6. Mr. Dowd, an attorney, formerly of 1140 Escarpment Drive, indicated he lived in the house just after it was built. It was his recollection that the house was built on clean fill ground but about 50 feet south of his home, the industrial waste material was evident. Because of the surfacing of chemicals, he could not get grass to grow in a portion of his backyard. He had the area paved about 50' x 50' and installed a basketball court. He raised six children from infancy and never attributed a day of sickness to their playing in and around the filled area of Love Canal, Lewiston.

7. If there is ground water seepage from the landfill, it is not evident. There are several sources of water emanating from the escarpment but none that can be directly attributed to or related to the landfill. A slight sewage odor and algae growth in one trickling stream is more than likely from septic systems on the escarpment or systems near the base of the escarpment. (When laterals are allowed for the new sewer system, some of these small streams should dry up). Mr. Schultz, the town highway superintendent, knows of no seepage coming from the landfill. Surface drainage is such that most of the surface water is carried off in roadside ditches. No standing water was noted in the ditches or on what would be considered the filled area of Love Canal, Lewiston.

8. The drainage from the escarpment ends up in unnamed tributaries to Four Mile Creek and eventually flows to Lake Ontario.

9. Relative to health, the people interviewed indicated:

a. No health problem existed or exists relative to the chemical deposits.

b. No one became sick or felt sick recently while working in the trenches in which sanitary sewers were installed. Chemical odors were not noticeable while the excavation was taking place.

c. The people who worked in the trenches have no knowledge of any one having a delayed reaction and then becoming sick.

d. Vegetable gardens appear to grow very well on property immediately adjoining the filled canal. One property owner, Mr. Huckins, 1146 Escarpment Drive, is concerned the plants would assimilate and concentrate fluoride from the ground. This would make the vegetables, he claims, uneatable. (By Ref 1, page 191, this is not so. Plants will not accumulate excessive amounts of fluorides). Mr. Huckins would like his vegetables tested. See Ref I.

e. The Dominion Soil Investigation, Inc.'s report cites fluorides in that "the possibility of the fluorides being absorbed by fruits and vegetables grown in the area should be further investigated." (See Ref 1, page 191).

f. The Dominion Soil Investigation, Inc.'s report also cites Phenol with "Every precaution should, therefore, be made to prevent the consumption of the ground water and the possibility of Phenol being absorbed by the fruits and vegetables should be investigated." (Reference II, page 238, indicates Phenols of 40-50 mg/l strength were used in waters to irrigate crops without any detrimental effect). Phenol levels in Borehole <u>sediment</u> samples ranged from 0.001 to 0.38 parts per million.

g. There are no known private wells in the area for either drinking or watering purposes. A public water distribution system supplies the area.

h. The Department of Energy's flyover of Niagara County about Oct. 28, 1978 did not show radiation in excess of normal background levels for the Love Canal, Lewiston area. Item V was presented to the writer relative to radiation levels, also found by the Department of Energy on property several miles away. There is no apparent connection to deposits at Love Canal, Lewiston and the sites pinpointed in Item V.

10. Relative to property:

a. Several people interviewed indicated they had heard that the chlorides in the fill were causing concrete foundations to spall. Interviews with three people in the area did not confirm this was taking place on their property, nor was the problem observed. This is not to say the condition does not exist.

b. Calvin Shultz, the present highway superintendent for the Town of Lewiston, then working on the water system, remembers a 6 inch cast iron water pipe deteriorated to the point of excessive leaking. The pipe had been laid in cinders and slag in the Love Canal filled area. The line was on Jarrett Street and the work done about 1962.

11. A review of Gene H. Bedell's memo regarding the Dominion Soil Investigation, Inc.'s report to Supervisor James Lombardi states basically what the Dominion Soil Investigation, Inc.'s report concludes. (See Item No. III).

12. The Dominion Soil Investigation, Inc.'s report indicates they drilled 18 bore holes, sampled 15 of them for water, six of same being in the canal fill area. Two other samples were taken, one at 1176 Jarrett Drive, and one at the bottom of the escarpment.

13. During the course of the survey, no one who observed the filling of the landfill or the excavation through the landfill saw or found any drums or parts of drums that had been buried in the fill.

14. Mr. Shultz claims he contacted someone in Edison several years from EPA to look at the site and he was advised that "unless someone was sick, they had no time." He does not have the name of the person or the exact date but estimates it was about 1975 to 1976.

15. Mr. Huckins, 1146 Escarpment Drive, whose home is on the north end and east of the filled area, has a sump pump in his basement. He has had the same pump for 30 years. He just replaced same and uses the old pump as a standby. Mr. Huckins' sump is several feet into rock and pumps ground water to the roadside ditch. The water has always run clear and has not had any odor.

Most of the sump pump discharges are to roadside ditches or to tile fields. Other contacts did not complain of deteriorating sump pumps or problem with them due to conditions of the ground water.

16. During visits on June 12, 1979 and August 3, 1979, nine and 7 manholes respectively in the new sanitary sewer system were examined. While no sanitary wastes had been discharged to the new system, a minor amount of infiltration was noted in the sewers. On the two occasions, these manholes, which connect sewers that run through and around the filled canal did not give off chemical odors. (See Fig. III).

17. Item VI contains two recent news clips that relate to Love Canal, Lewiston.

18. Concern by local government officials was expressed concerning the installation of lateral sewers to homes from the new sanitary sewers particularly when such construction is through chemically-filled areas.

VII. Conclusions

1. The filled areas in Love Canal, Lewiston, containing chemicals are not dangerous to health or are a safety hazard.

2. The canal is on high ground and has excellent surface drainage. Stagnet water is not evident on the fill or drainage ditches.

3. No significant seepage from the canal itself was found.

4. The people in the houses built on fill appear to not have health related problems. No health hazard exists.

5. No safety hazards appear to exist from gases, odors, or chemicals within the homes built on the filled area.

6. No sickness attributed to canal fill by those interviewed.

7. The fill is relatively shallow, average depth 9 feet with an unknown amount of cover material.

8. No private wells found or hinted to in the area and the use of public water supply indicates no contaminated water used as a drinking water supply.

9. There is correlation between some of the material Union Carbide produces and what was found in the canal; however, confirmation from other than local residents was lacking.

10. Stauffer Chemical was the main and possibley the only major contribution to filling the canal. No governmental agency used the area for fill.

11. Local people contacted (5) appear to not be concerned about the area, or the fill, and it is their belief that few if any of the residents are concerned. They know of no one who wants to move away because of the fill.

12. Slag used for driveway and roadbeds may have some bearing on the chemistry of the filled area.

13. Any seepage from the filled area, if it does exist, flows north to Lake Ontario rather than to the Niagara River to the west.

14. Cast iron pipes were rusted through when laid in cinders.

15. Vegetables grown in the area are of concern to one family because of possible chemical uptake.

16. No radiation problem exists from filled material.

17. Spalling cement may be a problem in basements but it was not observed or indicated to be a problem by those interviewed.

18. No drums of chemicals were buried on the site or encountered when the sanitary sewer line was excavated.

19. Only one spot of significant size, the yard of 1140 Escarpment Drive, was observed where chemicals surfaced, or were too close to the surface of the ground, preventing the growth of grass.

VIII. Recommendations

1. Since the findings and conclusions indicate no major health or hazardous condtions exist, it is recommended that EPA do nothing concerning further involvement with the Love Canal, Lewiston.

2. It is recommended that in laying or replacing pipe in the canal area that good engineering practices in the type of pipe and bedding used be followed.

3. It is recommended that sewer laterals to the homes on or immediately adjoining the Love Canal, Lewiston landfill proceed without concern.

4. It is recommended that as building is authorized by the town on what would appear to be a vacant lot at 1169 Jarrett Drive (on the canal) and 1147 Ellicot Drive (adjacent to the canal), the town notify the Niagara County Health Department and the NYS Departmental Conservation. When excavation starts for the foundation, the agencies should take a close look at the material excavated.

Homes - On and Near Love Canal
Lewiston, NY

Street	Number	Name	Phone (716)	< Feet Location
Escarpment Drive (North Side)	1135	R. Ford	297-6651	100 W
	1141	A. Intemill Wiebhec		On
	1153	H. Lee	297-2338	100 E
(South Side)	1132			100 W
	1136	Barends		25 W
	1140	P. McMahan	297-3294	On
	1146	S. Huckins	297-0842	25 E
	1154	E. Worak		50 E
Ellicot Drive (North Side)	1131	M. Fleice		100 W
	1137	H. Jones	297-4071	25 W
	1143	C. Caccesse	297-0690	On
	1147	Vacant Lot		100 E
(South Side)	1128			100 W
	1132	W. Draper	297-5559	On
	1136	H. Wood	297-3758	On
	1144	A. Incorvia	297-5963	75 E

TABLE I (cont'd.)

Homes - On and Near Love Canal
Lewiston, NY

Street	Number	Name	Phone (716)	< Feet Location
Jarrett Drive (North Side)	1165	G. T. Miller		100 W
	1171	Vacant Lot		On
	1179	R. A. Wood	297-2324	On
	1183	J. Hanrahan		75 E
(South Side)	1164	S. Ludwicki	297-3690	100 W
	1170	J. Butler	297-4961	On
	1176	H. Schmidt		On
	1182	F. Orfano	297-5777	50 E
Mountain View Road (North Side)	1159	S. A. Storino		100 W
	1165	G. A. Bright		On
Upper Mountain Road	1169	R. McKay ✓	297-3005	On
	1175	A. Smith		50 E
(South Side)	Vacant Lots			

E = East

W = West

TABLE II

Contacts

1. Mrs. Joan Gipp, councilwoman, Town of Lewiston, 1375 Ridge Road, Lewiston, NY, (Home) 716-754-7169, 716-754-8214. Contacted 6/12/79.

2. Mr. Cawin Shultz, highway superintendent, Town of Lewiston, Lewiston, NY. 716-754-8266. Contacted 5/23 and 8/3/79.

3. Mr. S. J. Huckins, property owner, 1146 Escarpment Drive, Lewiston, NY 14092, 716-297-0842. Contacted 5/23 and 8/16/79.

4. Mary Beth Brado, clerk, Town of Lewiston, NY, 716-754-8213. Contacted 5/23/79.

5. Mr. H. Jones, property owner, 1137 Ellicot Drive, Lewiston, NY, 716-297-4071. Contacted 6/12 and 8/16/79.

6. Mr. Chris Caccese, property owner, 1143 Ellicot Drive, Lewiston, NY 14092, 716-297-0690. Contacted 5/23/79.

7. Mrs. R. Woods, property owner, 1179 Jarrett Drive, Lewiston, NY 14092, 716-297-2324. Contacted 5/23/79.

8. Mr. R. Raab, superintendent of construction, 830 Moyer Road, Room 4, Lewiston, NY (or) 3311 Walden Avenue, Depew, NY 14043, 716-694-9364, 716-297-5288, 716-684-1555. Contacted 6/12/79.

9. Two members of construction crew working for Mr. Raab - Name Unknown.. Contacted 6/12/79.

10. John Beecher, chemical engineer, NYS Department of Environmental Conservation, Buffalo, NY, 716-842-5041. Contacted 7/16/79.

11. Judy Shriber, NYS Department of Health, Albany, NY, 518-474-5577. Contacted 5/22/79.

12. John Ionette, NYS Department of Environmental Conservation, Albany, NY, 518-457-3273.

13. George Shanahan, attorney, EPA 26 Federal Plaza, New York, NY 10007, 212-264-4347. Contacted 8/13/79.

14. George Rees, plant manager, Union Carbide Corp., Linde Div., Niagara Falls, NY 14302, 716-278-3220. Contacted 8/13/79.

TABLE II (cont'd.)

Contacts

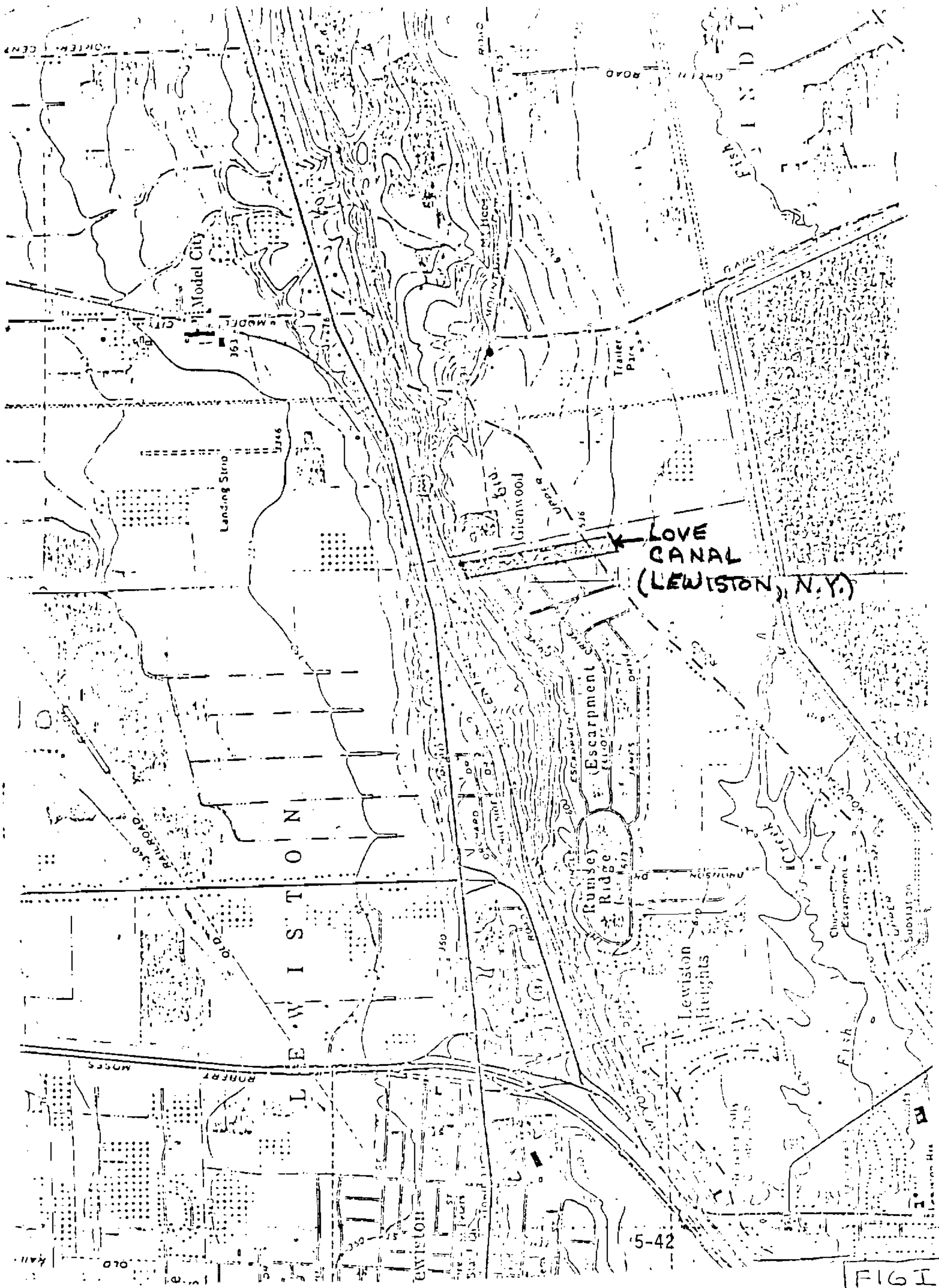
15. William Librizzi, engineer, EPA, 26 Federal Plaza, New York, NY 10007 Contacted 4/27, 5/8, and 5/22/79.

16. Mr. Temple, plant manager, Union Carbide Corp., Metals Division, Niagara Falls, NY, 716-278-3440. Contacted 8/14/79.

17. Ira Garalick, EPA, Air & Hazardous Materials Division, Radiation Branch, New York, NY, 212-264-4418. Contacted 8/14/79.

18. John G. Dowd, former owner of 1140 Escarpment Drive, now living at 5243 Hewitt Drive, Lewiston, NY 14092, 716-284-2327 (Office). 716-284-2311 (Maid of the Mist). Contacted 8/29/79.

19. George Amery, Niagara County Health Dept., Niagara Falls, NY, 716-284-3124. Contacted 8/21/79.



LOVE CANAL (LEWISTON, N.Y.)

FIG I

LOVE CANAL
LEWISTON

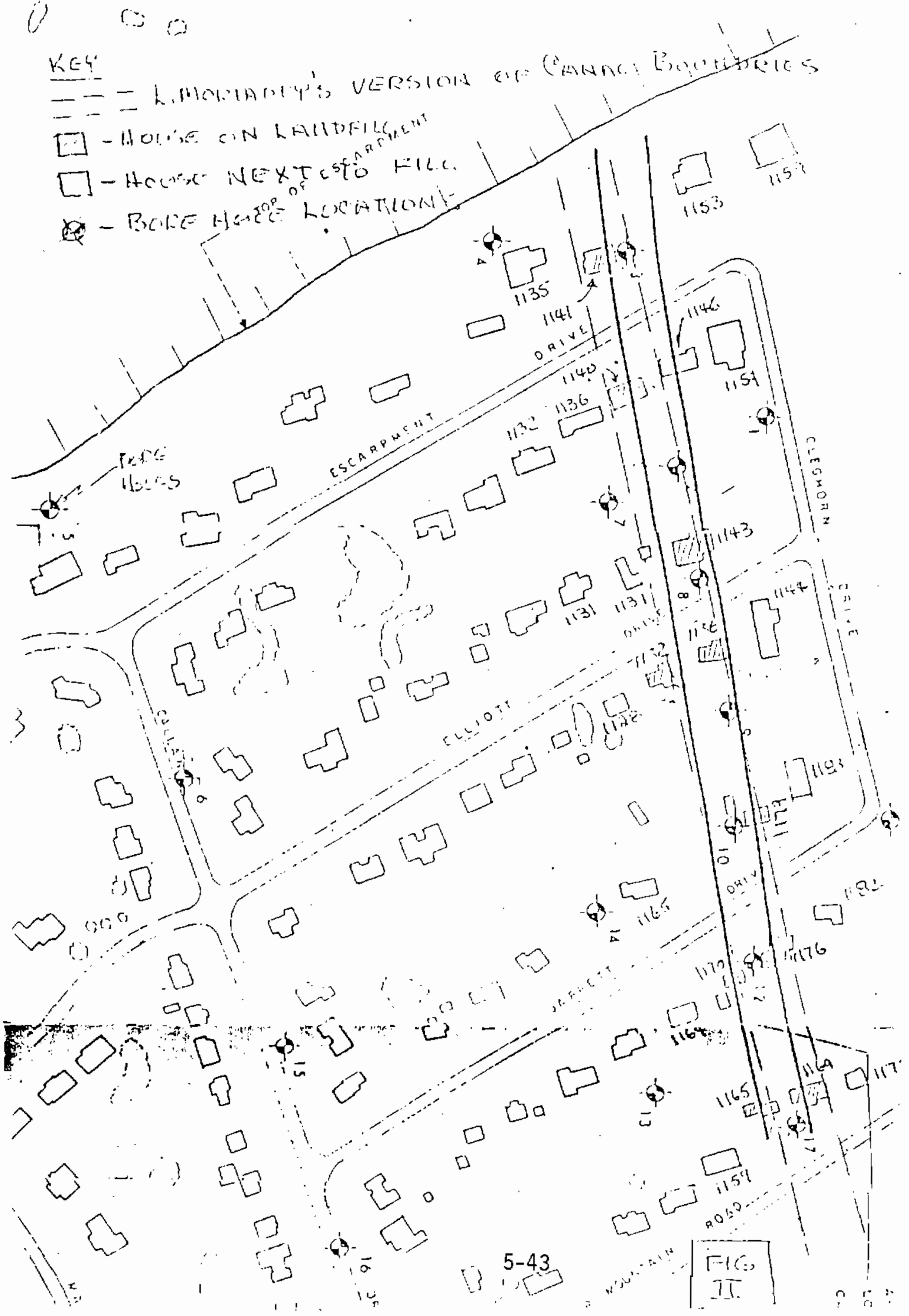


FIG II

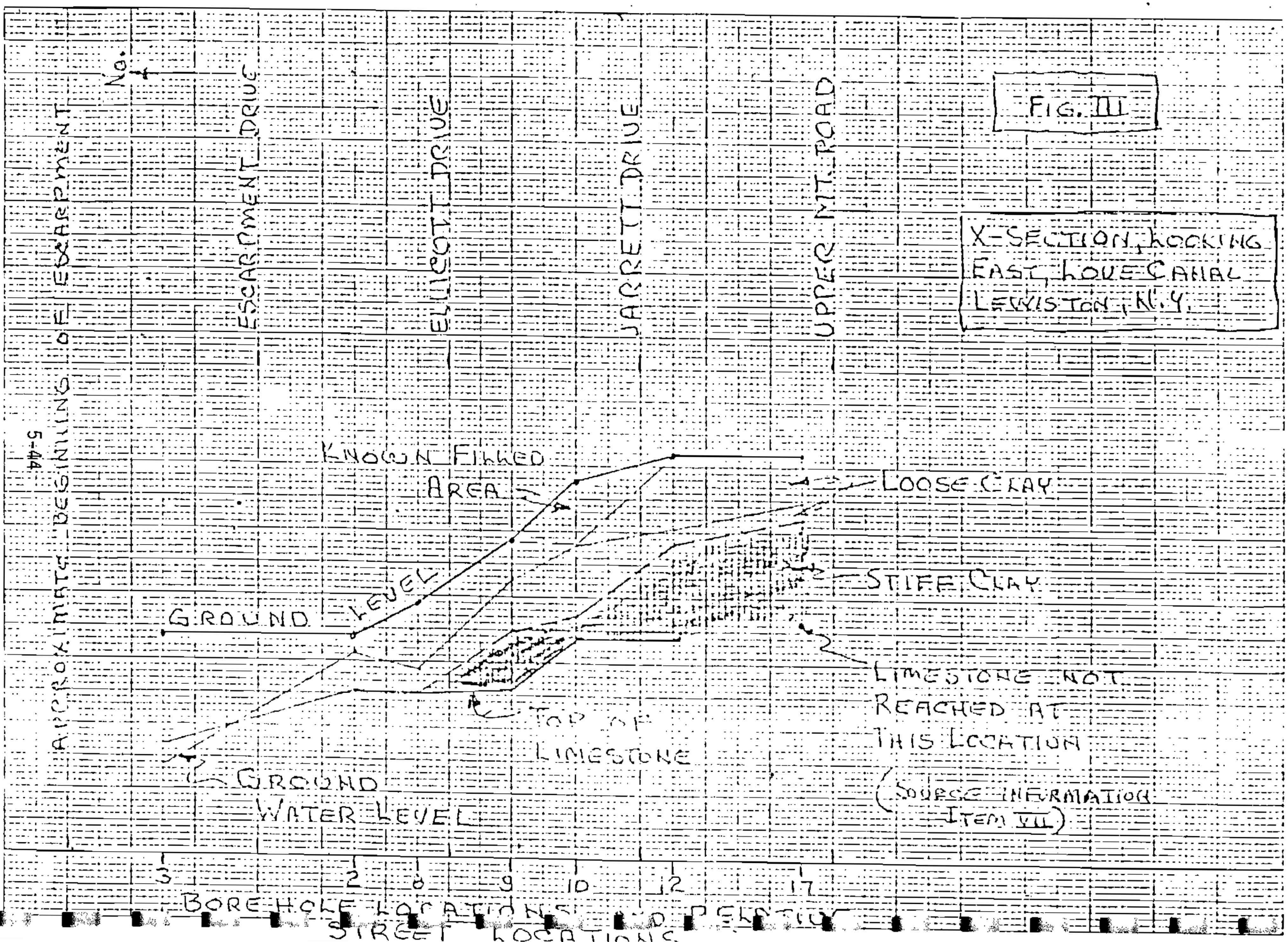


FIG. III

X-SECTION, LOOKING EAST, LOVE CANAL
LEWISTON, N.Y.

REFERENCE NO. 2

DOMINION SOIL INVESTIGATION INC.
CONSULTING SOIL & FOUNDATION ENGINEERS
104 CROCKFORD BLVD., SCARBOROUGH, ONTARIO, CANADA, M1R 3C6 (416) 751-6565

REPORT OF LEWISTON ESCARPMENT PROJECT
ANALYSIS OF SUBSOIL CONDITIONS
WHITTAKER SUBDIVISION
LEWISTON, N.Y.

Ref. No. 78-9-16

MARCH 9 1979

Prepared for:

Town of Lewiston,
1375 Ridge Road,
Lewiston, N.Y., 14092,
U.S.A.

DISTRIBUTION:

8 copies - Town of Lewiston
1 copy - Mr. J.P. Bartolomei
2 copies - Dominion Soil Investigation Inc.

Ref. No. 78-9-16

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(Cont'd.)

1.0 INTRODUCTION

The Whittaker Subdivision is located in the southern part of the Town of Lewiston, on top of the Niagara Escarpment. About 85 years ago an ambitious project was undertaken to excavate a canal through this area. After doing some excavation, however, the plans and the construction of the canal were abandoned and some 30 or 40 years later, the partially excavated canal was used to bury chemical waste. As this section of the Town of Lewiston is now a residential area, the Town if concerned whether there might be any harmful chemicals within this area of buried chemical wastes, and whether any harmful chemicals may have leaked from this disposal area into the surrounding ground, which might presently or at some time in the future adversely affect the health or property of the residents of the subdivision and the adjacent areas.

The Town of Lewiston has, therefore, retained the services of Dominion Soil Investigation Inc. to investigate the subsurface condition and to submit a report to the Town on the findings of the investigation.

The scope of the investigation was:

1. to drill approximately 20 test holes for the purpose of obtaining samples of the chemical waste in the backfilled area and of the subsoil and groundwater in the surrounding area;
2. to determine the type and nature of chemical contaminants in the recovered soil and water samples;

3. to determine the concentration of potentially dangerous or dilatorious chemicals; and

4. to comment on the potential hazard these chemicals may present to the property or the health of the residents.

The report that follows presents the results of this investigation.

.../...

2.0 METHOD OF INVESTIGATION

A total of eighteen (18) exploratory boreholes were drilled at the locations shown on the Borehole Location Plan, presented on Drawing No. 1. Seven boreholes were drilled on the line where the abandoned canal has been reported to exist and ten additional boreholes were located to the east and west of the canal, at distances ranging between 200 and 1,000 ft. One borehole (Borehole No. 18) was drilled about 2,800 ft. west of the canal at a distance which was believed to be outside the affected area to serve as a reference borehole to which the results of the other boreholes can be compared. It was intended to drill two additional boreholes at the base of the escarpment, but permission to do this was not given by the property owners and, therefore, these boreholes were not drilled.

The boreholes were drilled with a power auger machine to the surface of the bedrock and at seven locations the bedrock was cored with diamond tools to a depth of 5 ft. From the ground surface to the surface of the rock the subsoil was sampled continuously, using a 24-inch long, 1.5-inch diameter split barrel sampler. The sampler was driven into the soil by 350 foot pound energy. The recovered samples were visually examined and described in the field by an engineer and put into sealed glass containers in which they were shipped to the laboratory for further examination and testing.

Upon the completion of the boreholes, standpipes were installed in the holes to permit water level observations and also to obtain groundwater samples using a special torpedo sampler. Additional water samples were obtained from the sump of the existing dwelling at 1176 Jarrett Street and from a surface drainage ditch near the base of the escarpment and on the line of the canal. The water samples were collected in glass jars and were also transported to the laboratory for testing.

The results of the borings and water level observations are presented on Enclosures 1 to 18 inclusive.

The field work was under the supervision of a soils engineer who laid out the boreholes, obtained the ground surface elevations using local benchmarks and who kept a record of the borings and the recovered samples.

Ground surface elevations of the boreholes have been referred to several temporary benchmarks established around the site by a contractor who was installing the underground utilities at the time the field work took place. The elevations are referred to the geodetic datum.

All samples of soil and groundwater were returned to our laboratory for a visual and tactile examination and classification. Representative soil and groundwater samples were submitted to a chemical laboratory for testing. As the chemicals buried at the site were reported to be mainly slag containing sulphur compounds, the initial testing programme was aimed to determine the form of the sulphur that is sulphide (S), sulphate (SO_4) and sulphite (SO_3). In addition, several samples were analyzed for a broad spectrum of compounds to determine what in particular might be

.../...

present in the samples. Among the parameters that were investigated were pH, metals (e.g., forty metal semi-quantitative spectographic analyses), acid radicals such as Chlorides, Cyanide, Fluoride, Nitrate, Phosphate, Sulphate, Sulphides, total Sulphur, Organic Carbon and Phenols.

The results of the chemical tests are reported on Tables 1 and 2.

.../...

3.0 DESCRIPTION OF THE SITE AND PHYSIOGRAPHY

The Whittaker Subdivision is bounded on the south by Upper Mountain Road and on the north by the Niagara Escarpment. The escarpment at this site is approximately 100 to 150 ft. high and projects above the Town of Lewiston, which lies on a lower lying plateau adjacent to the Niagara River gorge. The caprock of dolomitic limestone and the underlying shales which form the Niagara Escarpment are visible in the adjacent road cuts.

The overburden in this area is quite thin, varying in depth from 1.5 to 17 ft. The terrain at the site slopes from south to north, that is towards the escarpment, at a gradient of approximately 1.5%. Drainage in the area is controlled by shallow ditches along the roadways and surface drainage appears to discharge over the escarpment through shallow ravines cut into the top of the escarpment.

A visual examination of the lower part of the escarpment directly underneath the Whittaker Subdivision revealed groundwater seepage emmanating from the slopes and flowing overland to the drainage ditches along Ridge Road. Samples of the seepage water were collected and submitted for chemical analysis.

.../...

4.0 SUBSOIL CONDITIONS

Details of the subsoil conditions are shown on the individual Borehole Logs, presented as Enclosures 1 to 18 inclusive.

Reference to these boreholes indicates that underlying a few inches of organic topsoil, the overburden is reddish brown clayey silt of glacial origin (glacial till). The thickness of this overburden ranges between 1.5 (Borehole No. 4) and 17 ft. (Borehole No. 6). The till is a well graded mixture of sand, silt and clay size particles with occasional embedded gravel. It has a firm to very stiff consistency with occasional hard zones. The till is relatively free of fissures and has a low permeability.

The underlying bedrock consists of sound, slightly fractured grey dolomitc limestone. The core recovery was generally between 80 and 100% and the recovered cores showed massive crystaline material with occasional weathered fractures. Although the permeability of the intact rock is very low, the mass permeability of the rock could be high, depending on the size and frequency of the fractures.

The free surface of the groundwater table was not encountered in each borehole. The shallower boreholes were dry and where groundwater was encountered, the position of the water level is given on the borehole logs.

.../...

Boreholes 2, 3, 8, 9, 10, 12 and 17, which were located in the area of the abandoned canal, encountered fill material. The matrix of the fill is similar in composition to the native clayey silt. Occasionally, lumps of sulphur, magnesium and phosphorus were also encountered. Beside these, no other substances could be visually observed. Chemical tests, however, indicated the presence of derivatives of metallic waste in the form of Chloride, Sulphate, Fluoride and Nitrate. A more detailed description of the chemicals present in the fill and the leachates is given in the following section of the report.

5.0 CHEMICAL CONTAMINANTS

Sulphur (S)

High concentrations of sulphur were encountered within the backfilled canal covered by Boreholes 2, 8, 9, 10, 12 and 17. Sulphur concentrations ranging from 21 to 8800 parts per million (ppm) were encountered. In addition to this, lumps of pure sulphur were also observed. Sulphur itself is not a harmful chemical, but it is soluble and its oxidized derivatives in the form of sulphide and sulphate are corrosive and dilaterious to steel and concrete. This will be discussed in more detail below.

Magnesium (Mg)

Magnesium or the salts of magnesium are generally present in the water as bi-carbonate sulphate or chloride. It is generally not considered to be a contaminant although concentrations more than 125 ppm can exert a cathartic or diarrhetic effect. In concentrations between 200 and 500 ppm, it has a laxative effect on susceptible persons and over 1000 ppm concentration it affects most people. In the samples taken from the canal area, the magnesium content ranges between 2 and 852 ppm. Outside the canal area, the concentration is between 1 and 48 ppm, while in the reference borehole located outside the possible influence zone (Borehole No. 18), the concentration is between 0.8 and 16 ppm.

Manganese (Mn)

Manganese usually occurs in water as manganous bi-carbonate. It is generally non-toxic and -contaminant, although the U.S. Public Health Service limits the manganese content in drinking water to 0.05 ppm.

Higher concentrations will stain fixtures, could interfer with laundering (discolouration of clothing), and causes off flavours in beverages. Managanese can also be oxidized into a sediment which clogs pipes and stimulates organic growth. The manganese concentration in the canal area ranges between 0.08 and 40 ppm.

Sulphate (SO_4)

As mentioned earlier, sulphur (S) is soluble in water and will readily oxidize to form sulphate compounds. While sulphur is generally considered to be inert, sulphate (SO_4) will attack concrete. Sulphate concentrations of less than 150 ppm are considered to represent negligible danger to concrete; concentrations between 150 and 1000 ppm represent a mild attack; and concentrations over 1000 ppm constitute a severe attack on concrete. Sulphate concentrations in the canal area range between 111 to over 2000 ppm. Particularly heavy concentrations were encountered in the area of Boreholes 12 and 17 and also in the area of Boreholes 2 and 8. Outside the canal area, the sulphate concentration is generally less than 150 ppm although a concentration of 203 ppm was recorded in the seepage water obtained from near the bottom of the escarpment, indicating that soluble sulphates are migrating with the groundwater in this direction. Similarly, a high concentration of sulphate (1557 ppm) was obtained from a water sample obtained from the sump of the home at 1175 Jarrett Street. The water soluble sulphate content of the water obtained from the reference borehole (Borehole 18) was 31 ppm.

Chloride (Cl)

Chloride as a contaminant is usually the residue of road salting, but in small quantitites it is usually present in most soils. In Borehole 18, the reference borehole, the chloride concentration is 0.03 ppm. A very high chloride concentration was observed in Borehole 2 where it was measured 846 ppm. The U.S. Public Health Service limits the chloride content in drinking water at 250 ppm, although the preferable level is less than 25 ppm. In large concentration, its effect is similar to sulphate as it will attack not only concrete but also steel and cast iron, especially at high pH values.

pH

The pH or hydrogen-ion concentration is a measure of the acidity (low pH) or alkalinity (high pH) of water and soil. A pH content of 7.0 indicates a neutral environment. The measured pH values range between 6.8 (acid) and 9.7 (very alkaline). In the reference borehole, the pH is 7.7.

Fluoride (F)

Fluoride is usually used for the manufacturing of insecticides. In small concentrations (0.6 to 1.2 ppm), it is helpful to prevent tooth decay, but the U.S. Public Health Service recommends a rejection of drinking water with more than 1.4 to 2.4 ppm. Three (3.0) to 8.0 ppm in water will stain and mottle the teeth, while concentrations of 8 to 20 ppm may cause bone changes in man. A daily dosage of 20 ppm for about 20 years could be crippling, while a single dose of 2250 ppm is lethal. In the canal area, fluoride concentrations range between 6.1 (Borehole No. 2) and 152 (Borehole No. 17). Outside the canal area,

.../...

in Boreholes 7 and 14, located 150 to 300 ft. west of the canal, the fluoride concentration is between 86 and 112 ppm. In Borehole No. 6, located 1000 ft. west of the canal, the fluoride concentration is still high, 64 ppm. In comparision, in Borehole No. 18, located about 2800 ft. west of the canal, the fluoride concentration is only 0.2 ppm.

Nitrate (NO_3)

The U.S. Public Health Service considers 10 ppm as the acceptable level of nitrate in drinking water. High concentrations of nitrate may cause methemoglobinemia, which is a disease of the red blood cells in humans and also animals. In the canal area, the nitrate content ranges between 0.3 and 8.8 ppm. In Boreholes 7 and 14, located 150 to 300 ft. west of the canal, the nitrate concentration is 5 to 17. In Borehole No. 6, which is about 1000 ft. west of the canal, the nitrate concentration is 28. In comparison, in the background borehole, Borehole No. 18, a nitrate concentration of only 0.01 ppm was measured.

Cyanide (CN)

Cyanide is the waste product of metal finishing and electroplating plants. The cyanide salts form hydrocyanic acids at pH levels less than 8.2 and are extremely poisonous at acidic pH levels. The permissible drinking water content is 0.2 ppm, as established by the U.S. Public Health Service and, similarly, the cyanide level in effluents discharged into rivers or lakes must be less than 0.2 to 1 ppm. The cyanide concentration in the canal area ranges between 0.01 and 0.47 ppm. Outside the canal area, the concentration is less than 0.01 ppm.

Phenol (C_6H_3OH)

Phenol is the generic name of aromatic alcohols or compounds containing one or more hydroxil functions. They are colourless liquids or white solids at room temperature and are detected in decaying organic matter and animal urine. It is a common industrial pollutant of petroleum refineries, coke plants, resin plants, pharmaceutical, textile and plastic plants. It is a highly toxic substance and the U.S. Public Health Service limits the phenol content to 0.001 ppm in drinking water. In the boreholes put down in the canal area, the phenol concentration ranges between 0.14 and 0.38 ppm, that is 140 to 380 times the safe limit. In Boreholes 7 and 14, which were located outside the canal area, the phenol concentration is much less and ranges between 0.005 and 0.006 ppm, that is only 5 to 6 times the safe limit. At a distance of 1000 ft. from the canal (Borehole 6), the phenol concentration is already less than 0.001 ppm.

.../...

6.0 DISCUSSION OF THE RESULTS

The investigation identified the presence of a number of chemical contaminates at the site. The chemicals can be divided into three broad categories: (i) inert or harmless chemicals (ii) corrosive chemicals, and (iii) chemicals which present a potential hazard to health.

Some of the chemicals, such as Sulphur (S) and Magnesium (Mg), although present in high concentrations, are considered to be inert and not dangerous. Other chemicals, such as Phosphorus (P) and Phosphate (PO_4) are present in low concentrations.

The concentration of some chemicals, such as Sulphate (SO_4) and Chloride (Cl), is sufficiently high to cause concern for the possible deterioration of concrete and metal which is buried underground and is in contact with the groundwater. For an easier review, we have plotted the sulphate concentrations of the recovered groundwater samples on Drawing No. 2 and delineated the areas where, based on the Sulphate concentration measured, the degree of attack on concrete is considered to be negligible (less than 150 ppm), positive but mild (150 to 1,000 ppm) and severe (greater than 1,000 ppm). In the latter area (that is where the Sulphate concentration is > 1,000 ppm), it would be prudent to investigate and inspect the footings and foundation walls to detect any signs of attack. Similarly, the condition of any steel or cast iron pipe should be investigated in the area of high Chloride concentration and high pH levels (e.g., in the areas of Boreholes 2 and 3). The clogging of some pumps and piping leading into

.../...

the sumps can be expected in areas where high levels of Manganese (Mn) were recorded (e.g., the area of Borehole 9).

Nitrate (NO_3) levels 2 to 3 times as high as the permissible levels in drinking water were recorded but, since to the best of our knowledge there are no operating wells in the subdivision and the groundwater is not used for drinking, the nitrate concentration in our opinion does not represent immediate danger or hazard to health. It may be prudent, however, to obtain a second opinion on this matter, possibly from the local health authority. We are of the similar opinion on the Cyanide (CN) level, as the highest concentration found was only twice the permissible level in drinking water.

There are two chemicals, however, which are present in potentiall dangerous concentrations. Fluoride (F) concentrations ranging between 60 and 150 ppm were measured throughout the subdivision (see Drawing No. 3). As a daily dosage of 20 mg (the approximate equivalent of 1 quart of water containing 20 ppm flouuride) could cause serious bone damage or crippling in humans, this concentration is potentially dangerous. Although the groundwater to the best of our knowledge is not used for drinking in the area, it is possible that vegetables or fruits grown on the site could absorb higher than safe levels of fluoride and may, thus, become the source of fluoride consumption by humans. We recommend that this aspect of a possible health hazard to further investigated.

A yet potentially more dangerous chemical identified at the site is the Phenol. In places, the concentration of this very toxic substance was found to be 140 to 380 times the safe limit established by the U.S. Public Health Service. Dangerously high levels of phenol appear to be limited to the immediate area of the canal and in the samples collected outside the canal area the phenol concentration is at or only slightly above the permissible level. To be toxic, phenol has to be ingested and, therefore, in our opinion, there is no immediate danger unless water collected in the sumps used for the dewatering of the basements is consumed. We recommend that water samples from the sumps located within the affected area be obtained and tested for phenol content. We also recommend that the possibility of phenol being absorbed by vegetation and fruits through the groundwater should be investigated and the opinion of the local health unit and the Department of Agriculture be obtained on this matter.

.../...

7.0 CONCLUSIONS

The investigation has identified a number of chemicals of which, however, only a few are considered to be potentially harmful. These can be divided into two categories:

1.) Chemicals which present a potential danger to property; and
2.) which present potential health hazard.

Sulphate (SO_4) and Chloride (Cl) belong to the first category and the presence of high concentrations of these chemicals could shorten the lifetime of underground concrete structures or buried steel or cast iron pipes. The areas of high concentration and, consequently, potential high risk of damage are shown on Drawing No. 2 attached in the side pocket of this report.

In the second category, that is chemicals which may represent health hazard, belong the Nitrates (NO_3), Cyanide (CN), Fluoride (F) and Phenol (C_6H_3OH). Nitrate and cyanide are present at concentrations approximately twice the acceptable limit in drinking water as established by the U.S. Public Health Service, but as the groundwater is not used as a source of drinking water, these, in our opinion, do not present a threat or danger to the health of the residents. Fluoride concentration is at a potentially dangerous level, but again, since the groundwater is not used for human consumption, there is no immediate threat, but the possibility of the fluoride being absorbed by the fruits and vegetables grown in the area should be further investigated.

.../...

The most toxic substance found at the site is Phenol, which is present in toxic concentrations in the groundwater. Every precuation should, therefore, be made to prevent the consumption of the groundwater and the possibility of Phenol being absorbed by the fruits and vegetables should also be investigated.

It is our opinion, therefore, that although there is no immediate threat or danger to health, certain precautionary measures should be taken to prevent the accidental ingestion of the groundwater by children. Access to the sumps by children should be prevented and the water from the sumps should not be discharged in areas where children could get access to it. We also recommend that the quality of the water collected by the sumps located in the canal area be determined and tested for sulphate, fluoride, nitrate, cyanide and phenol content. Based on the findings of this testing, a regular monitoring programme could then be set up.

DOMINION SOIL INVESTIGATION INC.

REGISTERED PROFESSIONAL ENGINEER
CIVIL
I. P. LIESZKOWSZKY
PROVINCE OF ONTARIO

I.P. Lieszkowszky, P.Eng.

IPL:esp/kmj

TABLES

TABLE 1
CHEMICAL ANALYSIS OF SELECTED SOIL SAMPLES

SAMPLE		CONTAMINANTS PARTS PER MILLION (p.p.m)									
BOREHOLE	SAMPLE NO.	SULPHUR (S^-)	PHOSPHORUS (P)	MANGANASE (Mn)	MAGNASIUM (Mg)	CYANIDE (CN)	FLUORIDE (F)	NITRATE (NO_3)	PHOSPHATE (PO_4)	PHENOL (C_6H_3OH)	CHLORIDE (Cl)
1	1	2	--	--	10	--	--	--	--	--	--
2	1	118	--	--	40	--	--	--	--	--	--
	2	655	--	--	2	0.01	6.1	0.3	--	0.14	846
4	1	7	--	--	11	--	--	--	--	--	--
6	1	12	--	--	7	--	--	--	--	--	--
	2	11	--	--	7	--	--	--	--	--	--
	4	4	--	--	9	--	--	--	--	--	--
	7	100	--	--	48	0.01	64	28	--	0.001	--
7	1	27	--	--	16	--	--	--	--	--	--
	2	5	--	--	11	0.01	86	5	--	0.005	--
8	1	965	0.7	0.08	32	--	--	--	--	--	--
	2	1910	1.2	0.28	96	--	--	--	--	--	--
	3	1662	1.0	0.12	2.4	--	--	--	--	--	--
9	1	420	0.5	0.01	14	--	--	--	--	--	--
	2	8797	3.4	40	744	--	--	--	--	--	--
	3	4487	2.8	12	852	--	--	--	--	--	--
10	2	335	0.8	0.01	13	--	--	--	--	--	--
	3	949	1.6	0.01	29	0.47	70	4.2	8.6	0.38	--
	4	21	0.1	0.01	3.6	--	--	--	--	--	--
13	1	14	--	--	4	--	--	--	--	--	--
	2	9	--	--	1	--	--	--	--	--	--
	4	21	--	--	4	--	--	--	--	--	--
14	1	29	--	--	4	--	--	--	--	--	--

TABLE I (Cont'd)
CHEMICAL ANALYSIS OF SELECTED SOIL SAMPLES

SAMPLE		CONTAMINANTS PARTS PER MILLION (p.p.m)									
		SULPHUR	PHOSPHORUS	MANGANASE	MAGNASIUM	CYANIDE	FLUORIDE	NITRATE	PHOSPHATE	PHENOL	CHLORIDE
BOREHOLE	SAMPLE NO.	(S^-)	(P)	(Mn)	(Mg)	(CN)	(F)	(NO_3)	(PO_4)	(C_6H_3OH)	(Cl)
14	2	14	--	--	4	0.01	112	17	--	0.006	--
	4	10	--	--	3	--	--	--	--	--	--
17	1	1398	1.9	0.24	16	--	--	--	--	--	--
	2	1710	2.0	0.01	16	0.01	152	8.8	--	0.001	--
	3	504	--	--	21	--	--	--	--	--	--
	4	121	--	--	5	--	--	--	--	--	--
	5	196	--	--	8	--	--	--	--	--	--
18	1	0.22	--	--	16	--	--	--	--	--	--
	2	0.43	--	--	2	0.01	0.2	0.01	--	0.001	0.03
	3	4.8	--	--	0.8	--	--	--	--	--	--

TABLE II

CHEMICAL ANALYSIS OF SELECTED GROUND WATER SAMPLES

SAMPLE	pH	SULPHATE (SO_4) p.p.m.
BH 2	9.7	368
BH 3	8.0	52
BH 6	7.8	67
BH 7	7.4	136
BH 8	7.4	664
BH 9	7.9	160
BH 10	7.3	111
BH 11	7.5	124
BH 12	7.3	53
BH 13	7.4	107
BH 13	7.9	123
BH 14	6.8	88
BH 15	6.8	100
BH 16	7.6	116
BH 17	7.1	2006
BH 18	7.7	31
1176 Jarrett St (sump)	7.1	1575
Bottom of escarpment	8.0	283

ENCLOSURES

LOG OF BOREHOLE 1

Enclosure No. 1

ur Reference No. 78-9-16

LIENT: TOWN OF LEWISTON
ROJECT: LEWISTON ESCARPMENT PROJECT
OCATION: WHITTAKER SUBDIVISION, LEWISTON
ATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: OCTOBER 30, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_P — NATURAL W — LIQUID LIMIT W_L	REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
1.3	0	GROUND SURFACE								
0.3	1.0	TOPSOIL		STANDPIPE						Standpipe installed to 4 ft., hole dry Auger refusal on probable bedrock at 4 ft.
		Stiff brown Clayey Silt TILL			1	SS	11	o		
7.3	4.0	END OF BOREHOLE								
	5									
	10									
	15									

LOG OF BOREHOLE 2

Enclosure No. 2

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: OCTOBER 31, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
21.8	0	GROUND SURFACE								
		TOPSOIL	~	▼ STANDPIPE						Standpipe installed to 7.5 ft. W.L. Elev. 620.7 ft. Nov. 3/78
20.8	1.0	Soft reddish/brown Clayey Silt FILL	☒		1	SS	5	○		
					2	SS	11	○		
17.8	4.0	Grey LIMESTONE	▨		3	RC	80%			
13.3	8.5	END OF BOREHOLE								
	10									
	15									

recycled paper

LOG OF BOREHOLE 3

Enclosure No. 3

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: OCTOBER 30, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
522.1	0	GROUND SURFACE								
521.1	1.0	TOPSOIL		STANDPIPE						
		Firm reddish/brown Clayey SILT TILL	T		1	SS	7	o		Standpipe installed to 11.5 ft. W.L. Elev. 612.1 ft. Nov. 2/78
			T		2	SS	4	o		
5-74	5		T		3	SS	7	o		
513.6	7.5	Grey LIMESTONE			4	SS	50/0"	→		
	10			▼	5	RC	Rec. 83%			
510.3	11.8	END OF BOREHOLE								
	15									

VERTICAL SCALE 1 inch to 5 feet

LOG OF BOREHOLE 4

Enclosure No. 4

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 2, 1978

SUBSURFACE	PROFILE				SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
5.1	0	GROUND SURFACE 6" TOPSOIL Brown CLAYEY SILT			1	AS	--			Auger refusal on probable bedrock at 1.5 ft.
4.6	1.5	END OF BOREHOLE								
	5									
	10									
	15									

DRAWN: E.I. CHECKED:

LOG OF BOREHOLE 5

Enclosure No. 5

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA

Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 2, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
0.5	0	GROUND SURFACE								
		TOPSOIL								Standpipe installed to 3.5 ft., hole dry Auger refusal on probable bedrock at 3.9 ft.
9.5	1.0	Firm to soft brown Clayey SILT TILL			1	SS	9	o		
					2	SS	4	o		
6.6	3.9	END OF BOREHOLE								
	5									
	10									
	15									

VERTICAL SCALE: 1inch to 5 feet

DRAWN:

CHECKED:

LOG OF BOREHOLE 6

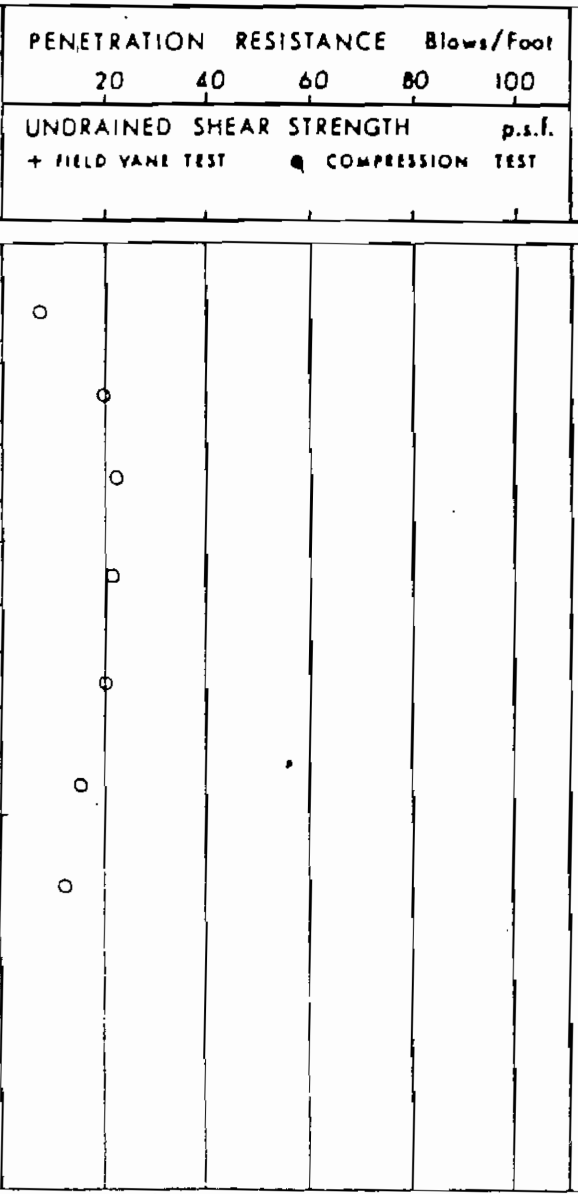
Enclosure No. 6

ur Reference No. 78-9-16

LIENT: TOWN OF LEWISTON
ROJECT: LEWISTON ESCARPMENT PROJECT
OCATION: WHITTAKER SUBDIVISION, LEWISTON
ATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 2, 1978

SUBSURFACE PROFILE					SAMPLES			REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	
8.1	0	GROUND SURFACE						
		TOPSOIL						
2.1	1.0	Firm to very stiff Clayey SILT TILL		STANDPIPE	1	SS	8	Standpipe installed to 16.2 ft.
					2	SS	20	
	5				3	SS	22	W.L. Elev. 621.0 ft. Nov. 3/78
					4	SS	21	
	10				5	SS	20	
		reddish/brown			6	SS	17	
	15	grey			7	SS	14	Auger refusal on probable bedrock at 17 ft.
5.1	17.0	END OF BOREHOLE						



WATER CONTENT %

PLASTIC LIMIT W_P — NATURAL W — LIQUID LIMIT W_L

LOG OF BOREHOLE 7

Enclosure No. 7

ur Reference No. 78-9-16

LIENT: TOWN OF LEWISTON
ROJECT: LEWISTON ESCARPMENT PROJECT
OCATION: WHITTAKER SUBDIVISION, LEWISTON
ATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 2, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
.2	0	GROUND SURFACE								
.2	1.0	TOPSOIL								Standpipe installed to 4.5 ft. W.L. Elev. 622.0 ft. Nov. 3/78
		Firm to very stiff reddish brown Clayey SILT TILL			1	SS	6			
					2	SS	21			
					3	SS	35/ 5"			
.8	5.4	END OF BOREHOLE								Sampler refusal on probable bedrock at 5.4 ft.
	10									
	15									

VERTICAL SCALE: 1inch to 5 feet

DRAWN:

CHECKED:

LOG OF BOREHOLE 8

Reference No. 78-9-16

Enclosure No. 8

ENT: TOWN OF LEWISTON
JECT: LEWISTON ESCARPMENT PROJECT
CATION: WHITTAKER SUBDIVISION, LEWISTON
UM ELEVATION: GEODETIC

DRILLING DATA

Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: OCTOBER 31, 1978

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
0	GROUND SURFACE								
0–6.8	Red/brown Clayey Silt FILL	⊠	▼	1	SS	7	○		W.L. Elev. 619.1 ft. Nov. 3/78
				2	SS	10	○		
				3	SS	19	○		
6.8–11	Grey LIMESTONE	▨		4	RC	Rec. 80%			
11	END OF BOREHOLE								

5-79

LOG OF BOREHOLE 9

Enclosure No. 9

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: OCTOBER 31, 1978

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
29.4	0	GROUND SURFACE								
		Red/brown Silty Clay FILL			1	SS	4	○		W.L. Elev. 626.3 ft. Nov. 3/78
5-80				▽	2	SS	2	○		
	5				3	SS	2	○		
22.4	7.0	Stiff reddish/brown Clayey Silt TILL			4	SS	13	○		
	10				5	SS	38	○		
17.9	11.5	Grey LIMESTONE			6	RC	Rec. 90%			
	15									
12.9	16.5	END OF BOREHOLE								

VERTICAL SCALE: 1 inch to 5 feet

LOG OF BOREHOLE 11

Enclosure No. 11r

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REMARKS
1.0	0	GROUND SURFACE						
		TOPSOIL		STANDPIPE				Standpipe installed to 12 ft.
0.0	1.0	Soft to hard reddish/brown Clayey Silt TILL			1	SS	4	
					2	SS	8	W.L. Elev. 626.2 ft. Nov. 3/78
	5				3	SS	16	
					4	SS	23	Auger refusal on probable bedrock at 12 ft.
	10				5	SS	31	
9.0	12.0	END OF BOREHOLE						
	15							

PENETRATION RESISTANCE Blows/Foot: 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f.: + FIELD VANE TEST ● COMPRESSION TEST
WATER CONTENT %: PLASTIC LIMIT W_p — NATURAL W — LIQUID LIMIT W_L

LOG OF BOREHOLE 12

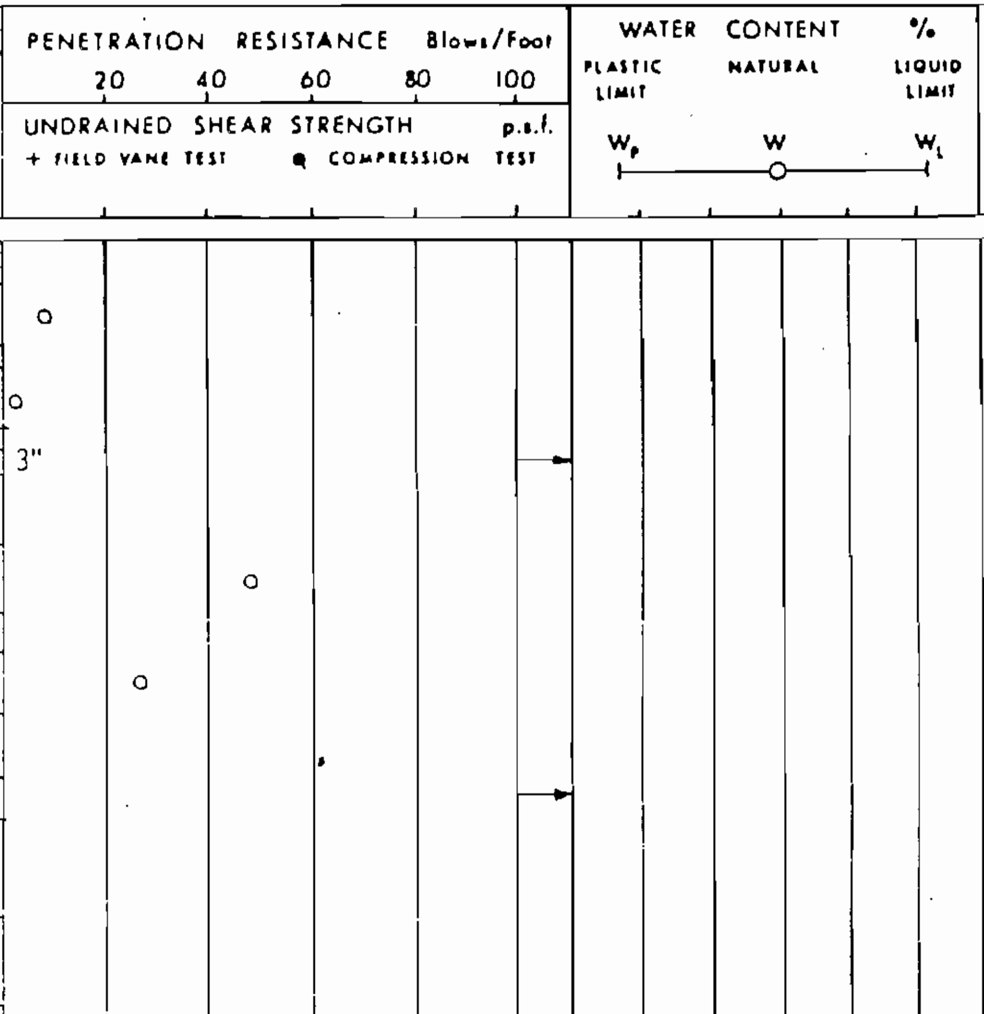
Enclosure No. 12

r Reference No. 78-9-16
IENT: TOWN OF LEWISTON
OJECT: LEWISTON ESCARPMENT PROJECT
CATION: WHITTAKER SUBDIVISION, LEWISTON
TUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

SUBSURFACE PROFILE			SAMPLES			REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	NUMBER	TYPE	'N' Blows/Ft.	
.9	0	GROUND SURFACE TOPSOIL				Standpipe installed to 17 ft.
.9	1.0	Firm to soft dark brown Clayey Silt FILL,	1	SS	8	W.L. Elev. 630.4 ft. Nov. 3/78
			2	SS	3	
			3	SS	50/ 3"	
.4	5.5	Pieces of CONCRETE				
.4	6.5	Hard to firm reddish/brown Clayey Silt TILL	4	SS	49	
			5	SS	27	
			6	SS	6	
.1	13.8	Grey LIMESTONE	7	RC	Rec. 93%	
			8	RC	Rec. 71%	
.1	18.8	END OF BOREHOLE				

STANDPIPE



LOG OF BOREHOLE 13

Enclosure No. 13

Our Reference No. 78-9-16

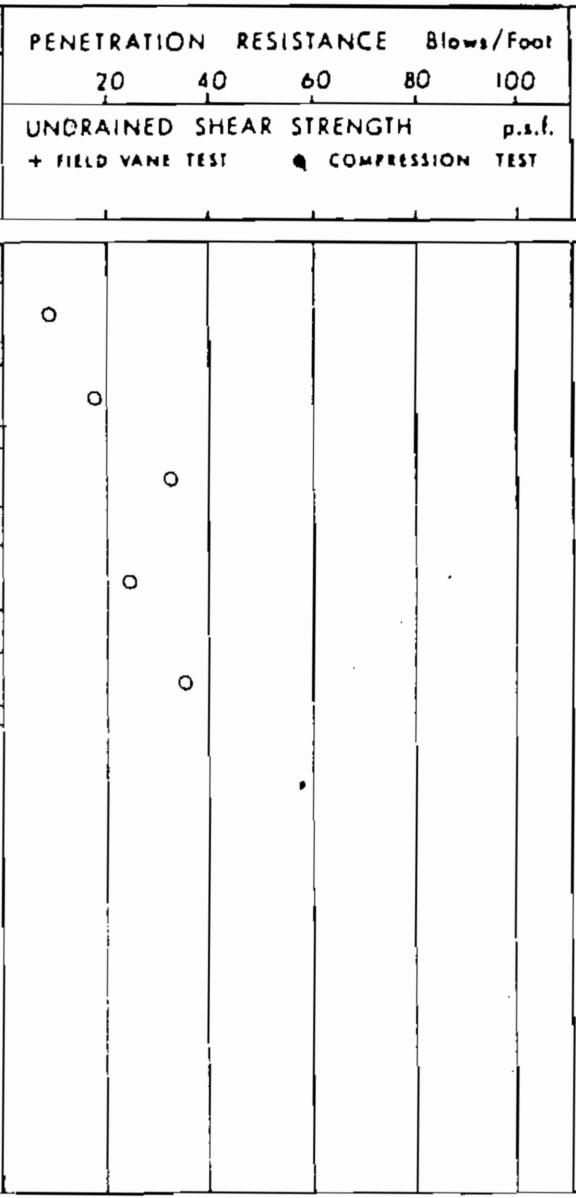
CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REMARKS
34.0	0	GROUND SURFACE						
33.0	1.0	TOPSOIL						Standpipe installed to 10.3 ft.
		Firm to hard brown Clayey SILT TILL		STANDPIPE	1	SS	9	W.L. Elev. 630.0 ft.
	5				2	SS	19	Auger refusal on probable bedrock at 11.8 ft.
					3	SS	34	
					4	SS	24	
	10				5	SS	37	
22.1	11.9	END OF BOREHOLE						
	15							

PENETRATION RESISTANCE Blows/Foot
UNDRAINED SHEAR STRENGTH p.s.f.
+ FIELD VANE TEST ● COMPRESSION TEST

WATER CONTENT %
PLASTIC LIMIT W_P — NATURAL W — LIQUID LIMIT W_L



LOG OF BOREHOLE 14

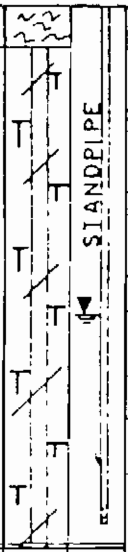
Enclosure No. 14

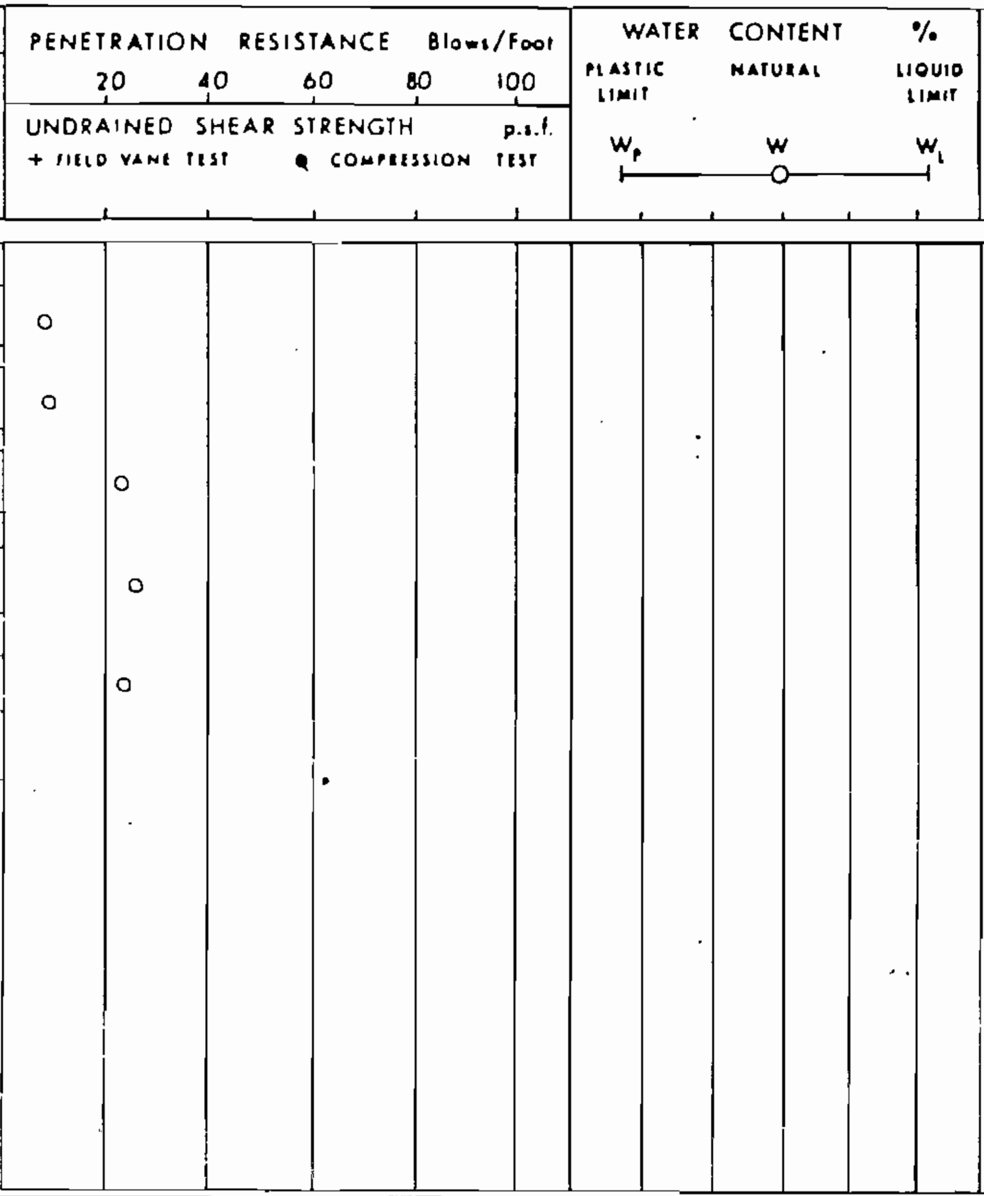
ur Reference No. 78-9-16

LIENT: TOWN OF LEWISTON
ROJECT: LEWISTON ESCARPMENT PROJECT
OCATION: WHITTAKER SUBDIVISION, LEWISTON
ATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

SUBSURFACE PROFILE			SAMPLES			REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	NUMBER	TYPE	'N' Blows/Ft.	
.8	0	GROUND SURFACE				
.8	1.0	TOPSOIL				Standpipe installed to 12.5 ft. W.L. Elev. 628.3 ft.
		Firm to very stiff brown Clayey Silt TILL	1	SS	8	
			2	SS	10	
	5		3	SS	25	
			4	SS	27	
	10		5	SS	25	Auger refusal on probable bedrock at 13 ft.
.8	13.0	END OF BOREHOLE				
	15					





VERTICAL SCALE: 1inch to 5 feet

DRAWN: F.L.

CHECKED:

LOG OF BOREHOLE 16

Enclosure No. 16

ur Reference No. 78-9-16

LIENT: TOWN OF LEWISTON
ROJECT: LEWISTON ESCARPMENT PROJECT
OCATION: WHITTAKER SUBDIVISION, LEWISTON
ATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

SUBSURFACE	PROFILE				SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST	WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.			
.2	0	GROUND SURFACE								
.2	1.0	TOPSOIL								Standpipe installed to 8.5 ft.
		Firm to hard brown Clayey Silt TILL		STANDPIPE	1	SS	6	○		W.L. Elev. 624.9 ft. Nov. 3/78
	5-85				2	SS	15	○		Auger refusal on probable bedrock at 9.0 ft.
	5				3	SS	28	○		
					4	SS	32	○		
.2	9.0	END OF BOREHOLE								
	10									
	15									

LOG OF BOREHOLE 17

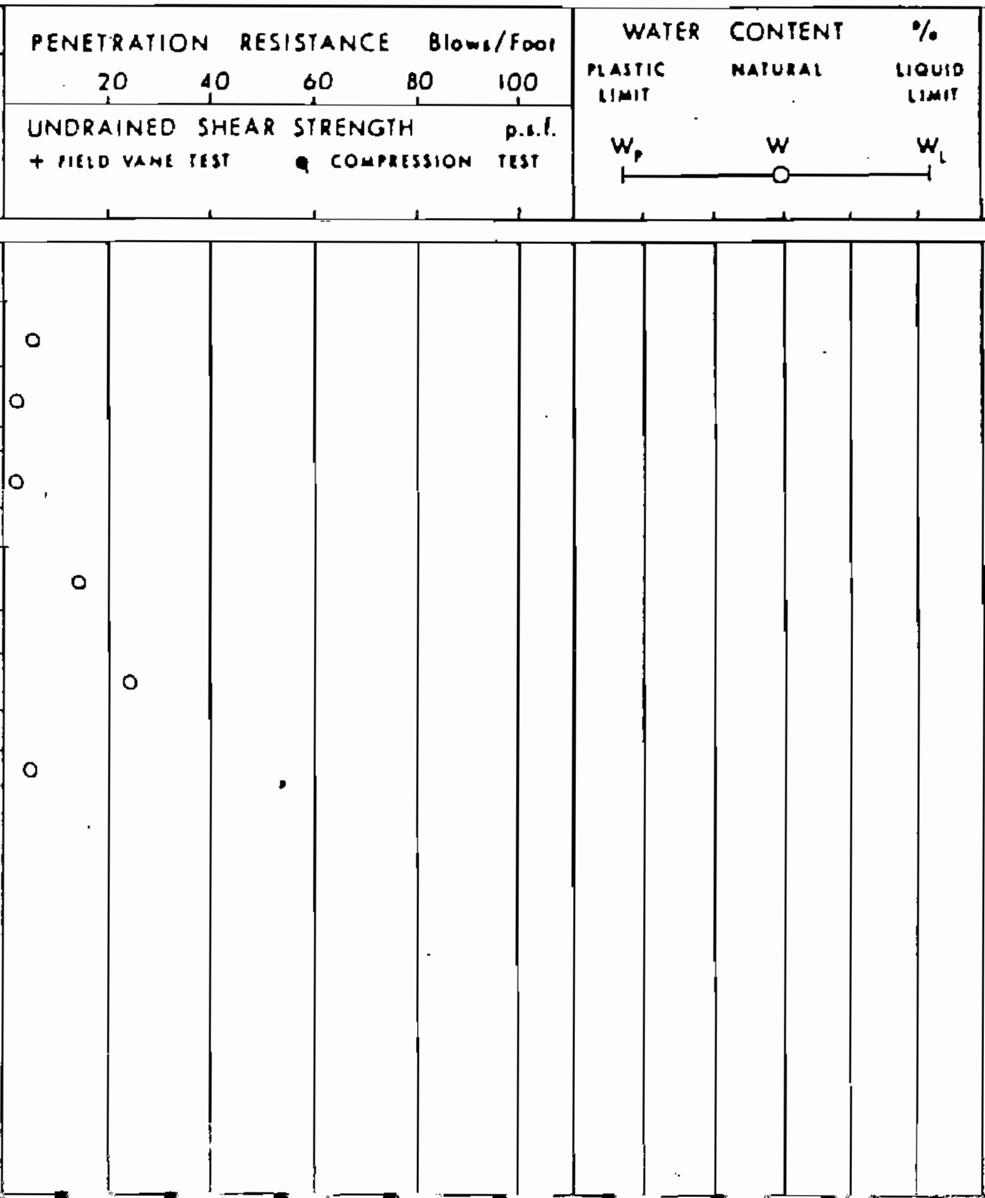
Enclosure No. 17

Our Reference No. 78-9-16

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING (H/S)
Diameter: 6 1/2"
Date: NOVEMBER 2, 1978

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	GROUND WATER	SAMPLES NUMBER	TYPE	'N' Blows/Ft.	REMARKS
635.9	0	GROUND SURFACE					
634.9	1.0	TOPSOIL	STANDPIPE				Standpipe installed to 12.5 ft.
		Clayey Silt FILL		1	SS	7	
				2	SS	3	W.L. Elev. 632.6 ft. Nov. 3/78
630.9	5	Very soft to stiff brown Clayey Silt		3	SS	2	
				4	SS	14	
	10			5	SS	25	
622.8	13.1			6	SS	6	Auger refusal on probable bedrock at 13.1 ft.
		END OF BOREHOLE					
	15						



VERTICAL SCALE: 1 inch to 5 feet
DRAWN: E.L.
CHECKED:

LOG OF BOREHOLE 18

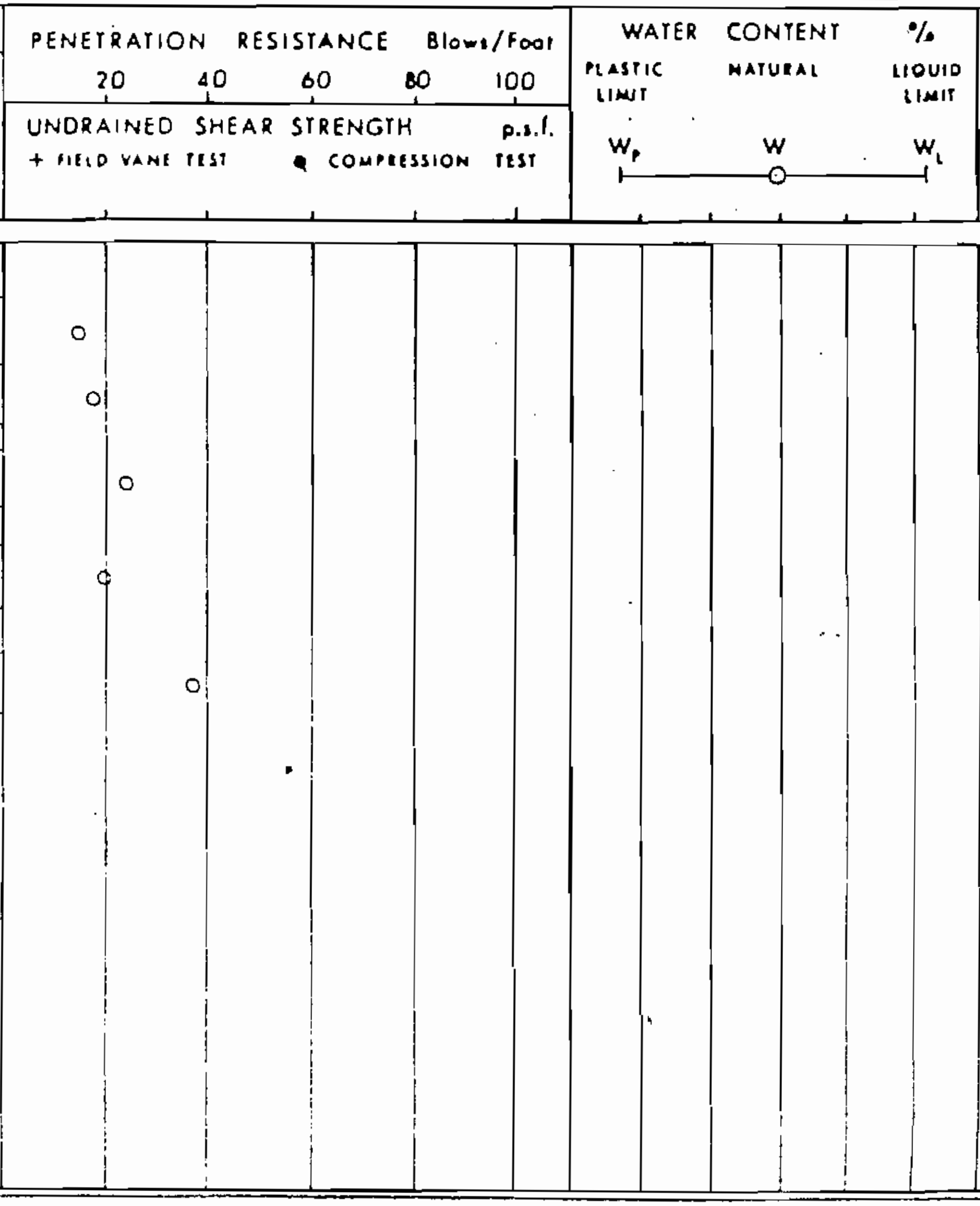
Our Reference No. 78-9-16

Enclosure No. 18

CLIENT: TOWN OF LEWISTON
PROJECT: LEWISTON ESCARPMENT PROJECT
LOCATION: WHITTAKER SUBDIVISION, LEWISTON
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: AUGERING AND ROCK CORING
Diameter: 6 1/2"
Date: NOVEMBER 1, 1978

SUBSURFACE		PROFILE			SAMPLES			REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	
622.9	0	GROUND SURFACE						
621.9	1.0	TOPSOIL		STANDPIPE				Standpipe installed to 13 ft.
		Stiff to hard brown clayey SILT TILL			1	SS	15	
				▼	2	SS	19	W.L. Elev. 619.0 ft. Nov. 3, 1978
	5				3	SS	25	
					4	SS	20	
	10				5	SS	38	
611.4	11.5	Grey LIMESTONE			6	RC	Rec. 87%	
	15							
606.4	16.5	END OF BOREHOLE						



DATE: March 28, 1979

TO: Mr. James Lombardi, Supervisor

FROM: Gene H. Bidell

SUBJECT: Comment on Whittaker Subdivision Subsoil Analysis Report

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CONCLUSIONS

1. The high fluoride concentrations which ranged from 60 - 150 ppm are potentially dangerous. Fluoride ingestion through consumption of fruits and vegetables can lead to concentration of the element in bones and particularly body joints. As an example; high fluoride concentrations in some western states are ingested by cattle eating vegetation. This has resulted in livestock being crippled, to the point where they cannot stand up.

2. Phenol behaves like an "acidic" alcohol. This gives it a corrosive, burning action on the human body; and it is toxic. The high levels (140 to 380 times the safe limit established by the U.S. P.H.S.) are cause for concern. Phenol is C_6H_5OH not C_6H_3OH as stated in their report.

3. I agree that Nitrate (NO_3) and Cyanide (CN) do not represent an immediate danger or hazard to health.

   The dolomitic composition of the Niagara Escarpment should, I believe, tend to keep the pH on the alkaline side. Cyanides are dangerous in an acidic environment.

4. I agree that the concentration of sulfate (SO_4) and Chloride (Cl) warrant an inspection of concrete footings, foundations and steel/cast iron pipe.

   Since these are the anions of strong acids (H_2SO_4 and HCl) there is a possibility of deterioration. However, the range of pH (6.8 to 9.7) suggests to me that an alkaline action could be buffering this effect somewhat.

5. Their statement that the two chemicals present in potentially dangerous concentrations, are fluoride and phenol, is correct. These are dangerous to human health.

DISCUSSION

1. According to the report, slag containing sulfur compounds were reported buried at the dumpsite. Slag, a by-product of steel production, could contain all of the materials they found in their study for the following reasons:

   A. Fluorspar (CaF_2) is used in producing steel. Fluoride would be a by-product.

B. Coke is made by steel companies. Phenol is a by-product.

C. The anions and metals would be found in the slag.

CRITICISM

1. Samples placed in glass containers should not be analyzed for fluoride. Fluoride can etch glass and you may not be getting a representative sample. Plastic containers are recommended for samples collected for Fluoride analysis. (Although EPA lists plastic and glass, I disagree).

2. They state that 40 metal semi-quantitative spectrographic analyses were performed.

   They apparently are referring to emission spectrographic analysis. I would have used atomic absorption spectroscopy. The analyses then are specific for the metal and definitely quantitative (down to parts per billion for certain metals).

3. No method is described for phenols and the anion radicals. The authors should specify how the lab analyzed all the parameters. For example, the combination of gas or liquid chromatography and infra-red spectroscopy is one accepted procedure for phenol analysis.

4. Technical reports should specify procedures and their reference source.

RECOMMENDATIONS

1. Continue the investigation, collecting ground water samples. Also, collect samples of vegetation (fruits and vegetables) during growing season.

2. Perform the analyses on these samples, but broaden the spectrum; e.g. - halogenated organics, heavy metals.

REFERENCE NO. 3

GROUND WATER IN THE NIAGARA FALLS AREA, NEW YORK

With Emphasis on the Water-Bearing Characteristics of the Bedrock

BY
RICHARD H. JOHNSTON
GEOLOGIST
U.S. GEOLOGICAL SURVEY

STATE OF NEW YORK
CONSERVATION DEPARTMENT
WATER RESOURCES COMMISSION

BULLETIN GW-53
1964

because studies made on the Lockport may contribute to a better understanding of the occurrence of ground water in bedrock generally. The Queenston Shale and Clinton and Albion Groups are poor aquifers in comparison to the Lockport Dolomite, and less is known of their water-bearing characteristics.

LOCKPORT DOLOMITE

Character and extent

The Lockport Dolomite is the uppermost bedrock formation in about one-third of the Niagara Falls area. Its outcrop area extends from the Niagara escarpment on the north to the southern boundary of the area covered by this report except in two small areas that may be underlain by the Salina Group. (See plate 3.) One of these areas is in the vicinity of the hamlet of Nashville and the other is in the extreme southeast corner. Because of a lack of rock outcrops in these areas the position of the contact between the Lockport and the Salina cannot be accurately determined. However, the Salina Group is not discussed as a separate water-bearing unit in this report because at most only a few feet of it occurs in the area. Continuous exposures of the Lockport are found along the gorge of the Niagara River and along the Niagara escarpment. The formation is about 150 feet thick in the southern part of the area but has been eroded to a thickness of only about 20 feet along the escarpment (pl. 2). The excellent exposures at Niagara Falls (fig. 5), where the Lockport forms the lip of the Falls, are shown in many geology textbooks as a classic example of flat-lying sedimentary rocks. Throughout most of the remainder of the area, which is relatively flat, the Lockport is concealed by a thin cover of glacial deposits.

As its name implies, the Lockport Dolomite consists mainly of dolomite; however, the formation also includes thin beds of limestone and shaly dolomite near the base. The Lockport consists of five lithologic types which, from top to bottom, are:

(a) brownish-gray, coarse- to medium-grained dolomite, locally saccharoidal with thin intervals of curved bedding (algal structures).

(b) gray to dark-gray, fine-grained dolomite, containing abundant carbonaceous partings.

(c) tannish-gray, fine-grained dolomite.

(d) light-gray, coarse-grained limestone containing abundant crinoid fragments (Gasport Limestone Member).

(e) light-gray shaly dolomite, laminated in part (DeCew Limestone Member of Williams, 1919).

Fisher (1960) divides the Lockport Dolomite into six units based on fossils as well as rock types. An excellent discussion of the stratigraphy of the

Lockport, including measured sections in the Niagara Falls area, is given in the recent thesis by Zenger [1].

The detailed breakdowns by Fisher and Zenger, although helpful for geologic mapping and correlating the Lockport with rocks of similar age elsewhere, are not necessary in descriptions of the water-bearing properties of the formation. For this purpose the Lockport is subdivided as follows (figure 5 and table 1): (1) upper and middle parts of the Lockport, and (2) lower part of the Lockport, including the Gasport Limestone Member and DeCew Limestone Member of Williams (1919).

Most of the beds in the Lockport are described as either "thick" (1 foot to 3 feet) or "thin" (1 inch to 1 foot). However, massive beds up to eight feet thick and very thin beds (1/4 to 1 inch) occur within the formation. The bedding is generally straight, but curved bedding occurs in some places in the upper part of the formation. The curved bedding is caused by dome-shaped algal structures called "stromatolites" (Zenger, p. 140). These reefs (bioherms), which occur as lens-like masses up to 50 feet across and 10 to 20 feet thick, contain no bedding.

Gypsum (calcium sulfate) is common in the Lockport, occurring chiefly as small irregularly shaped masses (commonly 1/2 to 5 inches in diameter) and as selenite. Sulfide minerals, particularly sphalerite (zinc sulfide), galena (lead sulfide), and pyrite (iron sulfide) occur as particles disseminated throughout the formation.

Water-bearing openings

Types.--Ground-water occurs in the Lockport Dolomite in three types of openings: (1) bedding joints which constitute at least seven important water-bearing zones, (2) vertical joints, and (3) small cavities from which gypsum has been dissolved. Of these, the bedding joints are the most important and transmit nearly all the water moving through the formation. The three types of openings were observed in the dewatered excavations for the conduits of the Niagara Power Project. (See the description of the power project in the introduction and the location of the conduits in figure 3.) The rock faces along the four-mile length of the conduits provided an unequaled opportunity to study water-bearing openings in the entire stratigraphic thickness of the Lockport and to observe the lateral extent of these openings for a few thousand feet. At the time the observations were made (July - August 1960), approximately one-third of the length of the conduits was available for inspection by the writer.

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[1] Zenger, D. H., 1962, Stratigraphy of the Lockport Formation (Silurian) in New York State: Unpublished doctoral thesis, Cornell University.

The bedding joints, which transmit most of the water in the Lockport, are fractures along prominent bedding planes which have been widened very slightly by solution of the rock. These planar openings persist laterally for distances of at least 3 to 4 miles. The separation along individual bedding joints is small (less than 1/8 inch). However, their continuity makes them effective "conduits" for movement of ground water. The large water-transmitting capacity of the bedding joints was shown by the fact that they supplied nearly all the ground-water seepage entering the conduit excavations. The almost continuous lines of seepage from bedding joints was strikingly apparent in the conduits. Figure 7 shows seepage from two bedding joints.

The bedding joints transmitting ground water comprise at least seven distinct water-bearing zones within the Lockport. These water-bearing zones could be traced laterally for distances of 1 to 4 miles. Figure 8 shows the stratigraphic position and part of the lateral extent of the seven zones. The water-bearing zones have been numbered from 1 to 7 from bottom to top. The three sections shown in figure 8 were surveyed by transit and then correlated on the following basis: (1) lithologic similarities, (2) laterally tracing seepage from individual water-bearing zones, and (3) in the case of section A, the distance above the Rochester Shale as shown by core holes. The correlation of water-bearing zone 6 between sections A and B has been changed slightly from an earlier published version (Johnston, 1962, fig. 110.2).

A water-bearing zone may consist of a single open bedding joint (for example zone 4, section C, fig. 8) or it may consist of an interval of rock measuring up to one foot in thickness containing several open bedding joints (zone 7, section A, fig. 8). Where the water-bearing zone consists of several joints, the open joint transmitting most of the water at one locality may "pinch out" laterally and be replaced by another open joint within the same zone elsewhere. For example, at section B (fig. 8) most seepage from water-bearing zone 6 came from a joint at the top of a thin-bedded interval; however, at section A all seepage came from a joint at the bottom of the interval. The opening along one bedding joint thus becomes closed while a parallel opening along an adjacent bedding joint becomes open.

The water-bearing zones occur most commonly within intervals of the Lockport containing thin beds from 1/4 to about 4 inches thick which are directly overlain by thick or massive beds. The thin beds generally contain open vertical joints, and at the intersection of such vertical joints with open bedding joints ground-water seepage is greatest. At a few such points water was observed to squirt from the openings into the conduit excavations in much the same manner as it would from a broken water pipe. It seems likely that open joints occur most commonly in thin-bedded intervals because the greater structural rigidity of the overlying thick or massive beds permits the joints to remain open.

Water-bearing zones occur less commonly within thick-bedded intervals. In such cases all seepage occurs from one distinct bedding joint rather than from several joints. Seepage from zone 4 at section C (fig. 8) came from one prominent bedding joint within an interval of beds averaging one foot in thickness. This bedding joint is open about 1/16 to 1/8 inch locally and appears to transmit as much ground water as any water-bearing zone in the Lockport.

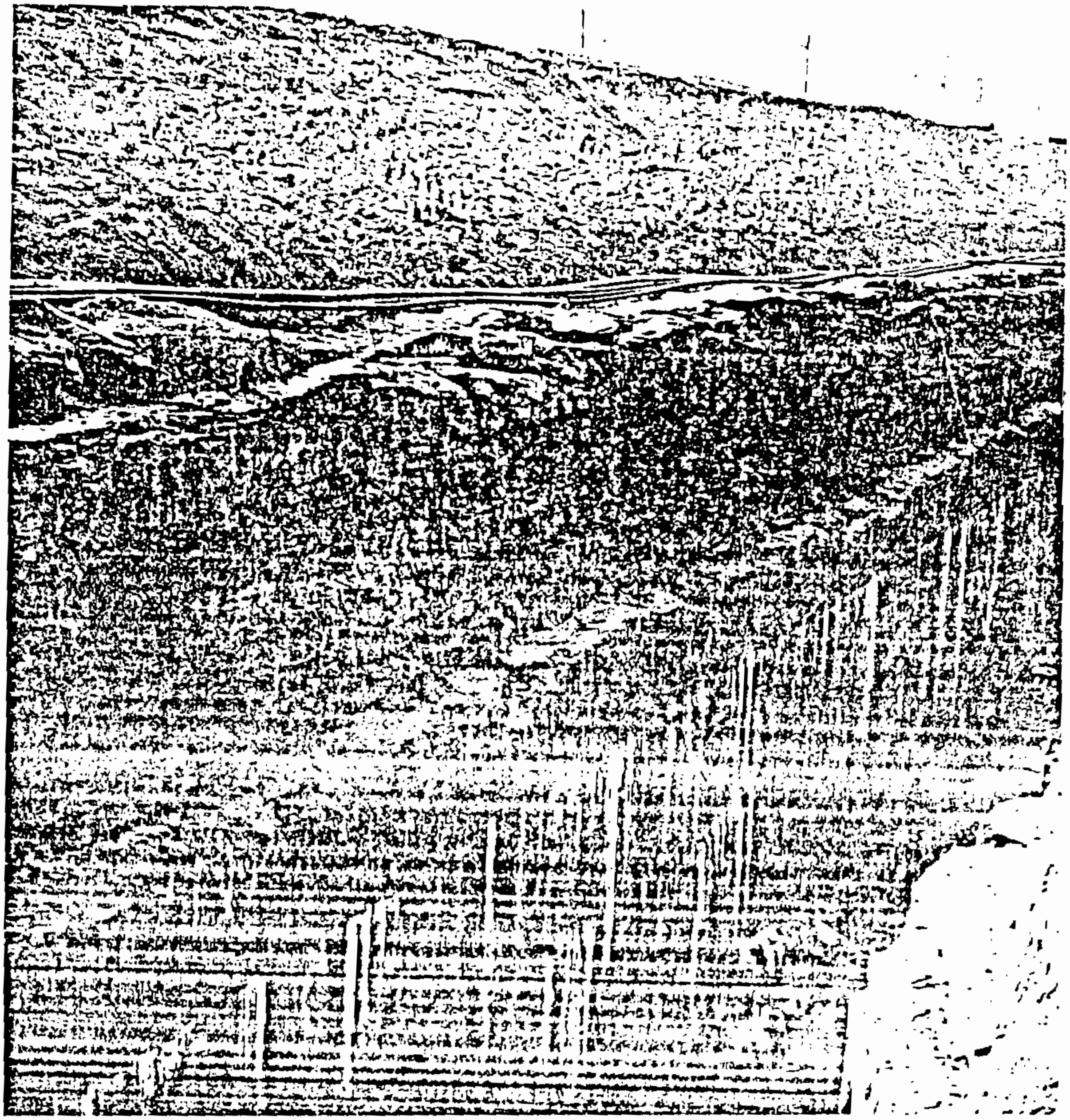


Figure 7.--Seepage from bedding joints in the Lockport Dolomite. View is of east wall of conduit number 1, looking south from Porter Rd. bridge. (Photograph by the Power Authority of the State of New York.)

Vertical joints, excluding those mentioned above which are associated with open bedding joints in thin-bedded intervals, are not important water-bearing openings in the Lockport, except within the top few feet of rock. Two prominent sets of vertical joints exist in the Niagara Falls area; one set oriented N. 65° E. and the other N. 30° W. These joints are fractures in the rock which must be widened by solution before they can become effective water-bearing openings. Such widening is apparent in outcrops of the Lockport. For example, open vertical joints are particularly prominent in the rock cliffs of the Niagara River Gorge and the Niagara escarpment. The width of these joints in many areas exceeds several inches. However, in fresh exposures of the Lockport, such as the conduit excavations, vertical joints are tight and often not apparent to the eye except in the upper few feet of the rock.

Cavities formed by solution of gypsum occur in the Lockport Dolomite. These cavities range in size from 1/16 inch or less to 5 inches but are generally less than one inch in size. The cavities are formed by the dissolving of gypsum by percolating ground water, and there is a complete range in the development of cavities from voids containing no gypsum to pin-point openings in gypsum nodules. The cavities are most abundant in the top 10 to 15 feet of rock but they also occur along water-bearing zones in the lower part of the rock (for example, water-bearing zone 3, section C, fig. 8). In the upper part of the rock, the abundance of cavities locally gives a vuggy appearance to the dolomite.

The cavities in the Lockport resulting from solution of gypsum increase the ability of the Lockport to store water (porosity) but probably have little effect on the water-transmitting ability of the formation. This is because the water-transmitting ability (or permeability) is dependent upon the size of the continuous openings rather than the size of isolated openings. Thus, the relatively thin but continuous bedding joints determine the permeability of the Lockport rather than the larger but isolated cavities resulting from solution of gypsum.

The character and interrelationships of the three types of water-bearing openings described above result in two distinct sets of ground-water conditions in the Lockport Dolomite: (1) a moderately permeable zone at the top of rock, generally 10 to 15 feet thick, characterized by both vertical and bedding joints that have been widened by solution and by gypsum cavities, and (2) the remainder of the formation consisting of seven permeable zones (composed of bedding joints) surrounded by essentially impermeable rock.

Areal extent.--Relatively little is known about the areal extent of the seven water-bearing zones in the Lockport Dolomite, except as observed in the conduits (fig. 8). Many of the individual bedding joints tend to "pinch out" laterally, and be replaced by adjacent joints in the same zone. Such "pinching out" of joints transmitting water was observed in the conduits. Observations in the conduits and data from wells suggest that a few of the zones may persist for tens of miles. The water-bearing zones of greatest areal extent are those which occur at distinct lithologic breaks in the formation. Zone 1, occurring at the base of the Lockport (fig. 8), is frequently reported to be a water-bearing zone by drillers throughout the area. Zone 2, which occurs at the contact between coarse-grained limestone (Gasport Member) and shaly dolomite (DeCew Limestone Member of Williams, 1919) is the source of most of the springs along the Niagara escarpment. Other water-bearing zones, not located at contacts between distinct lithologic units, probably tend to pinch out within a few miles. In summary, at any point in the area, a number of water-bearing zones parallel to bedding exist in the Lockport. All such zones, however, are not necessarily equivalent to the seven water-bearing zones observed in the conduit excavations at Niagara Falls.

It was also noted in the conduit excavations that there were places, even along the most prominent water-bearing zones, where no seepage was occurring. Many such places doubtless represent natural supports for the overlying rock because no extensive horizontal opening below the earth's surface can exist for any great distance. Little is known either about the nature or the size of these support areas or the distance between them. The available data suggest, however, that they encompass an area of at least a few square feet and are separated by a few tens of feet. It may be expected that with depth the size of the supports increases and the distance between them decreases.

The occurrence of ground water principally in zones parallel to bedding is probably characteristic of flat-lying Paleozoic carbonate rocks in many other places. This type of occurrence was reported by Trainer and Salvas (1962, p. 42) in the Beekmantown Dolomite near Massena, N. Y. They observed that "... The openings which are horizontal or gently dipping, and most of which are probably joints or other fractures parallel to the bedding of the rocks, are wider and more numerous than the steeply dipping openings." Although the Beekmantown Dolomite is of an older geologic age than the Lockport, certain similarities exist between the two formations: (1) both units consist of indurated Paleozoic dolomite and limestone; (2) both units are gently dipping, neither having been subjected to extensive folding and faulting which would result in the development of more prominent vertical joints or fractures associated with faulting; (3) both units were subjected to scouring by ice during glaciation within the last 10,000 to 15,000 years and thus, the extensive solution features common to limestones and dolomites in unglaciated areas have not had time to develop. It seems probable that any flat-lying carbonate rock, possessing the characteristics just stated, will contain ground water principally within joints parallel to bedding.

Origin of water-bearing openings.--The origin and the sequence of development of both the vertical joints and bedding joints are of considerable importance in developing an understanding of the occurrence of water in bedrock. Although it was not possible to investigate the origin or the development during this study, speculations based on fundamental principles of geology, especially regarding the origin of the bedding joints, may be worthwhile.

It is widely recognized that joints are formed by forces which tend to pull the rock apart (tension joints) or slide one part of the rock past an adjacent part (shear joints); see, for example, the discussion by Billings (1954, p. 115). The vertical joints were probably formed by a combination of tension and shear forces during or following the folding of the Appalachian Mountains about 200 million years ago. The bedding joints represent tension fractures that formed as a result of expansion of the rock in a vertical direction during more recent geologic time. The Lockport as recently as 200 million years ago was doubtless buried under thousands of feet of other rocks in the Niagara Falls area just as it is at the present time in the southern part of New York State. During the erosion of the overlying rocks the Lockport expanded vertically. The expansion caused fracturing to occur along bedding planes which are natural planes of weakness in the rock and which are approximately parallel to the land surface. Vertical joints, being at right angles to the land surface were little affected by the removal of the overlying rock.

The bedding joints may have been further expanded by stresses produced in the rock during the recession of the glaciers 10 to 15 thousand years ago. The melting of several thousand feet of ice was doubtless accompanied by an expansion of the rock. This expansion either resulted in an enlargement of existing bedding-plane openings or the formation of new openings along other bedding planes.

In recent geologic times, chemical solution of the rock has widened both the vertical and bedding joints. In the already well-developed openings along bedding joints, slight widening by solution has occurred to depths of 100 feet or more. Enlargement of vertical joints, in contrast, is generally restricted to the upper 10 to 15 feet of rock. Cavities formed by solution of gypsum exist where water moving along joints in the Lockport came into contact with gypsum. Gypsum is much more soluble than dolomite; thus, openings formed by the solution of gypsum are wider than other openings along joints. Water moving down vertical joints has dissolved the gypsum to a depth of about 15 feet leaving irregularly-shaped cavities, and water moving along bedding joints has dissolved gypsum to depths of at least 70 feet.

Water-bearing characteristics

Ground water exists in the Lockport Dolomite under artesian, semiartesian, and unconfined conditions. Unconfined conditions occur where the water table is the upper surface of the zone of saturation within an aquifer. The water table in an unconfined aquifer moves freely upward as water is added to storage, or downward as water is taken from storage. In contrast, an artesian aquifer contains water which is confined by an overlying impermeable bed and which is under sufficient pressure to rise above the top of the aquifer. The level to which water in an artesian aquifer will rise forms an imaginary surface which is called a piezometric surface. Water levels in artesian aquifers change in response to pressure changes on the aquifer rather than to changes in the amount of water stored in the aquifer.

Both artesian and water-table conditions exist in the Lockport. However, artesian conditions predominate. Figure 9 illustrates the occurrence of both artesian and water-table conditions in the Lockport. The wells shown in the diagram are cased through the clay and silt, but are open holes in the bedrock. A packer is installed in each well which tapped water at two or more distinct levels. The packers make possible the measurement of two distinct water levels in each well; a water level above the packer reflecting conditions in the upper part of the rock and a water level below the packer reflecting conditions in the lower part of the rock.

In the upper part of the rock, either artesian or water-table conditions may exist locally. The clay and silt overlying the Lockport are less permeable than the rock and thus act as a confining bed. Artesian conditions exist where the water in the Lockport has sufficient head to rise above the bottom of the overlying clay and silt. In contrast, unconfined (or water-table) conditions exist where the water level occurs within the fractured upper part of the rock, as at well 309-901-5 in figure 9. Locally a 'washed till" or dirty gravel zone occurs just above the top of rock. In these localities good connection probably exists between the bedrock and the overlying till or gravel, and the upper part of the rock and washed till zone together form a continuous semi-confined aquifer.

In the lower part of the rock, artesian conditions occur exclusively. The seven water-bearing zones in the Lockport are surrounded by essentially impermeable rock and therefore act as separate and distinct artesian aquifers. The hydraulic nature of the water-bearing zones was observed during the drilling of observation wells in the vicinity of the Niagara Power Project. These wells, whose locations are shown in plate 1, were drilled to observe the effects of the reservoir on ground-water levels in the area. The piezometric level for each successively lower water-bearing zone is lower than for the zone just above it in most of the wells. The reasons for this will be discussed in the section entitled "Ground-Water Movement and Discharge." During construction, the water level in the wells progressively declined in a steplike sequence as the wells were drilled deeper--that is, when a well had been drilled through the uppermost water-bearing zone, the water level in the well remained approximately at a constant level until the next lower zone was penetrated, at which time the water level abruptly declined to the piezometric level of the next lower zone. The difference between the piezometric levels of any two water-bearing zones is large, and in some places is comparable to the distance between zones. If no packer is installed in a well tapping two water-bearing zones, the upper zone will continue to drain into the well indefinitely. This condition exists in a few of the power project observation wells. In these wells the sides of the well remain wet from the level of the upper zone down to the water level in the well. The nature of the water-bearing zones as described above substantiates the reports by drillers and others of "finding water and losing it" in a well, or of wells with "water running in the top and out the bottom." These phenomena occur in some wells tapping two or more water-bearing zones in the Lockport Dolomite.

A well drilled into the Lockport may penetrate several water-bearing zones, but only one of the zones may be hydraulically effective at the site of the well. This is the case for wells 309-901-1, 3, and 5 shown in figure 9. These wells are open below the packers to zones 1, 2, and 3. However, because the water levels observed below the packers in these three wells apparently represents the piezometric surface of zone 3, zones 1 and 2 are not believed to contain effective openings at the sites of the wells. A well also may be drilled through the section occupied by several zones and not be open to any of them. For example, well 309-901-7 shown in figure 9, is apparently open only to the weathered zone at the top of rock.

Yield and specific capacity of wells

The yield of a well in the Lockport Dolomite depends mainly upon which water-bearing zone or zones are penetrated and the degree to which the bedding joints comprising the zones are open to the well. Near the top of rock, the number of open vertical joints and gypsum cavities penetrated may also be important. The average yield of 56 wells tapping the upper and middle parts of the Lockport (which includes water-bearing zones 4 through 7) is 31 gpm (gallons per minute). In contrast, 15 wells penetrating only the lower 40 feet of the Lockport (which includes water-bearing zones 1, 2, and 3) have an average yield of 7 gpm. The yields of individual wells range from less than 1 gpm to 110 gpm. (These figures do not include a few exceptionally high yield wells which obtain water by induced infiltration from the Niagara River and which are discussed in a following paragraph.) Wells tapping the same water-bearing zone may have different yields. For example, wells 309-901-3 and 309-901-5, which are 500 feet apart and tap water-bearing zones 1 through 4 (fig. 9) yielded 7 gpm and 39 gpm, respectively, before the packers were installed. The bedding joints comprising the water-bearing zones are thus more open at well -5 than at well -3.

Increases in yield during drilling in the Lockport Dolomite occur abruptly rather than gradually. As drilling proceeds through the rock, relatively little increase in the yield of a well will be observed until a water-bearing zone is tapped. At that time a marked increase in yield usually occurs. For example, during the drilling of well 308-901-7, the bailing rate abruptly increased from 12 to 50 gpm when water-bearing zone 5 was tapped. During the drilling of well 308-900-21, three distinct increases in yield were observed. The yield, which was 3 gpm at 17 feet (water-bearing zone 7), increased to 9 gpm at 22 feet (an open vertical? joint or solution cavity?) and abruptly increased to 30 gpm at 34 feet (water-bearing zone 6).

Wells in an area about a half mile wide adjacent to the Niagara River above the falls have substantially higher yields than wells elsewhere in the area. The higher yields in this area are caused by two conditions: (1) the Lockport Dolomite is thickest in the area, and (2) more importantly, conditions are favorable for the infiltration of water from the Niagara River. The greater thickness of the Lockport provides the maximum number of water-bearing zones to supply water to the wells. The Niagara River provides an unlimited source of recharge to the water-bearing zones.

Evidence that a substantial part of the water pumped is supplied by induced infiltration from the Niagara River is indicated by the high yields, which exceed 2,000 gpm at some wells, and the chemical character of the water. The chemical composition of the water in well 304-901-6 (which has been pumped at 2,100 gpm) is more similar to Niagara River water than "typical" ground water in the Lockport. (See the following discussion of the chemical character of water and figure 11.) Similar infiltration of Niagara River water into the bedrock at Tonawanda, N. Y., a few miles south of Niagara Falls, was described by Reck and Simmons (1952, p. 19-20).

Infiltration from the river can occur where pumping has lowered ground-water levels below river level to such an extent that a hydraulic gradient is created between the river and the wells. The amount of the infiltration depends on the gradient and the nature of the hydraulic connection between the river and Lockport. The hydraulic connection is controlled by the character of the river bottom. Throughout most of its length in the Niagara Falls area the bottom of the river is covered by a layer of unconsolidated deposits including both till and clay and silt. This layer was found to be from 10 to 20 feet thick in the vicinity of the Niagara Falls water-system intake. (See logs 304-900-i and -j in figure 19.) In the section of the river occupied by rapids, extending a half mile or more above the falls, the bottom has been scoured clean by the river. Where the layer of unconsolidated deposits is present its low permeability greatly retards infiltration. Where the layer is thin or absent infiltration can readily occur.

One of the most striking features in plate 2 is that all wells yielding more than 1,000 gpm are located in a narrow band that intercepts the river about two miles east of the falls. This band trends in a northeasterly direction roughly parallel to one of the two major directions of vertical jointing. Thus, the very high yields may be caused by a greater abundance of vertical joints within the band of high-yielding wells. Vertical joints provide avenues through which water could readily move from the river downward to the bedding joints comprising the water-bearing zones in the Lockport Dolomite.

Wells in the Lockport Dolomite are almost always adequate for domestic needs of a few gallons per minute. Supplies of 50 to 100 gpm, which are adequate for commercial uses and small public supplies, can be obtained in much of the area underlain by the upper part of the Lockport (pl. 2). Large supplies (over 1,000 gpm), as previously noted, are available only in a small area adjacent to the Niagara River.

Wells inadequate for domestic needs are occasionally reported. All wells that are perennially inadequate are located near the Niagara escarpment and therefore tap only the lowest and least permeable water-bearing zones (1, 2, and 3) in the Lockport. Throughout the area a few shallow wells that derive nearly all their water from a single water-bearing zone become inadequate during the summer and autumn of some dry years. Such is the case with well 308-853-1. This well is 27 feet deep and reportedly obtained over 50 gpm from a water-bearing zone 17 feet below land surface. During the drought in 1960, this zone was dewatered as the water table declined in the fall of the year, and the yield of the well quickly declined to less than 1 gpm. The inadequacy of some wells in the Lockport Dolomite can normally be overcome by deepening the well until it penetrates one or more lower water-bearing zones.

Information on the specific capacity of a well is more meaningful than a simple statement of yield. The specific capacity is the yield per unit drawdown, generally expressed as gallons per minute per foot of drawdown. For example, well 307-903-1 was pumped at 20 gpm with 54 feet of drawdown which indicates a specific capacity of 0.37 gpm per foot. The yield and the drawdown for a number of wells in the Lockport are shown in plates 2 and 3. These data must be used with care as they apply only so long as no part of the formation is dewatered.

As water-bearing zones in the Lockport are dewatered, the specific capacity declines. The decline in specific capacity caused by dewatering a water-bearing zone is shown by the data obtained during a pumping test on well 309-859-1. This well was pumped at 2.2 gpm with 5.0 feet of drawdown for 70 minutes--specific capacity of 0.44 gpm per foot. After 70 minutes, water-bearing zone 3 was partially dewatered and a drawdown of 8.2 feet was required to maintain the pumping rate of 2.2 gpm. This indicates a specific capacity of 0.27 gpm per foot. At the time the well was drilled, it was bailed at 3 gpm with a drawdown of about 60 feet. Thus, during the bailing the entire 42 feet of Lockport penetrated by the well was dewatered. The specific capacity of the well with the Lockport dewatered is 0.07 gpm per foot (3 gpm with 42 feet of drawdown) compared to 0.44 gpm per foot with no dewatering.

water from the Queenston are usually found in two areas--(1) in a band about two miles wide immediately north of the Niagara escarpment, and (2) in areas immediately adjacent to streams. Both these areas are believed to be places of ground-water discharge--that is, areas where ground water is moving upward from the Queenston to discharge naturally.

The origin of the salty water in the Queenston is unknown. In commenting on a similar occurrence of salty water in the bedrock in northern St. Lawrence County, N. Y., Trainer and Salvas (1962, p. 103) suggest three causes for the salty water in that area: (1) connate water, (2) the Champlain Sea, and (3) evaporite deposits. They conclude that the Champlain Sea, which covered the area about 10 or 20 thousand years ago, is the most likely source. This source is not applicable to the Niagara area, however, because the Champlain Sea did not extend into the area. Furthermore, it is unlikely that the salty water in the Niagara area is derived from evaporite beds because no such deposits are known to exist in the Queenston. Nor do any salt beds occur in the bedrock formations overlying the Queenston Shale (fig. 5) in the Niagara Falls area. The nearest salt beds occur about 40 miles to the southeast in the Salina Group which overlies the Lockport Dolomite. However, it is very improbable that salty water from the Salina beds has entered the Queenston Shale because (1) the salt beds themselves act as impermeable barriers to water moving downward from the Salina to the Queenston, and (2) it is more likely that salty water from the Salina would be discharged at points between the outcrop areas of the two formations.

Although direct evidence is lacking, the writer believes that the salty water in the Queenston Shale is most likely derived from connate water. The discharge of connate water begins as soon as a deeply buried bed is brought up into the zone of circulating ground water. The Queenston rocks were deposited as a sea-bottom clay about 350 million years ago, and have been deeply buried throughout most of the intervening time. During some thousands of years of Recent geologic time, connate water has been flushed from the upper several hundred feet of the Queenston. However, it is probable that flushing of the deeper part of the formation is continuing at present.

OCCURRENCE OF WATER IN UNCONSOLIDATED DEPOSITS

The unconsolidated deposits in the Niagara Falls area are not important sources of water. These deposits may be classified into two types based on their water-bearing properties: (1) coarse-grained materials of high permeability (sand and gravel), and (2) fine-grained materials of very low permeability (glacial till and lake deposits). The unconsolidated deposits in the Niagara Falls area are predominantly of the fine-grained type. However, the lack of sand and gravel deposits in the Niagara Falls area, other than a few deposits of very limited thickness and extent, has severely limited the development of large ground-water supplies in the area. Most large ground-water supplies in New York State are derived from sand and gravel deposits.

Table 2 shows selected chemical constituents from wells tapping unconsolidated deposits. Water from the different types of unconsolidated deposits is not easy to differentiate on the basis of quality because many wells tap more than one type of deposit. Thus, water samples from such wells are mixtures of water from two or more deposits. In general, water from the unconsolidated deposits is very hard, but not so highly mineralized as water from the bedrock. A complete analysis of water from well 312-859-1, which taps both till and lake deposits, is listed in table 9. This is a calcium bicarbonate water, very hard (568 ppm of total hardness) containing a moderately high chloride content (105 ppm). Water from the unconsolidated deposits generally has a wide range in chloride content. Those wells which yield water with a high chloride content are probably affected either by (1) local pollution, or by (2) upward discharge of saline water from the underlying bedrock.

SAND AND GRAVEL

Sand and gravel is found in small isolated hills and in a narrow "beach ridge" which crosses the area along an east-west line (pl. 3). The sand and gravel deposits are of limited areal extent, generally thin, and occur as topographic highs. The deposits commonly consist of two lithologic types: (1) fine-grained reddish-brown sand, and (2) coarse sand and pebbles with a matrix of fine to medium sand. The origin of both the beach ridge and small hills of sand and gravel is associated with glaciation in the Niagara Falls area. The small hills are kames, i.e. hills of sand and gravel formed originally against an ice front by deposition from sediment-laden melt-water streams. The long, narrow beach ridge is believed to represent a former shore line of glacial Lake Iroquois. This large lake, the predecessor of the present Lake Ontario, existed in the Niagara Falls area near the end of the Ice Age. The sand and gravel composing the beach ridge apparently was produced from pre-existing material by wave action at the shore which winnowed out most of the silt and clay originally contained in the glacial deposit.

Although the sand and gravel deposits in the Niagara Falls area are much more permeable than the other unconsolidated deposits or the bedrock, their occurrence as small topographic highs permits them to drain rapidly. As a result, ground water generally occurs only within a thin zone at the base of the sand and gravel. This is shown in the cross section of the beach ridge in figure 12. It can be seen that the water table is only a few feet above the base of the sand and gravel. Extensive pumping of any of the wells shown would quickly dewater the sand and gravel. In general, wells in the beach ridge and kames will yield only the small amounts of water required for domestic and small-farm needs.

Moderate supplies of ground water can be obtained from a sand and gravel deposit (probably a kame) just east of Lockport, N. Y. (pl. 3). This is the largest sand and gravel deposit in the area, measuring 1 1/2 by 3/4 miles in size. The thickness of the deposit is highly variable because of the hummocky nature of the land surface, but probably averages 60-70 feet. Some notion of the ability of this deposit to yield water is shown by the yield of 165 gpm pumped from a sand pit during excavation. One large-diameter supply well has been constructed in this deposit. This well (311-838-3) was reportedly pumped at a rate of 200 gpm for 24 hours in 1956.

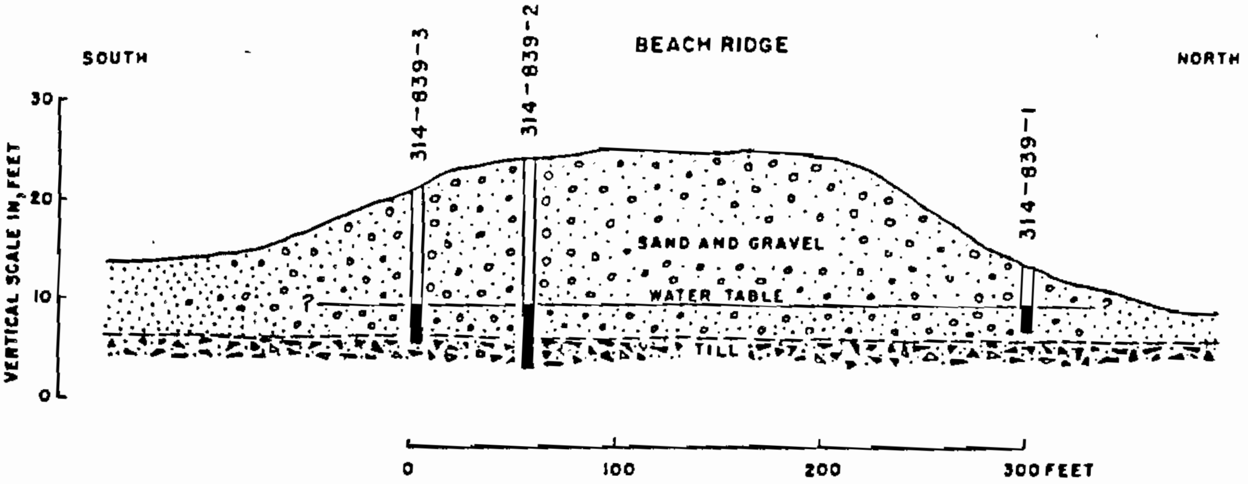


Figure 12.--Cross section of sand and gravel "beach ridge" through wells 314-839-1, -2, and -3.

LAKE DEPOSITS

Lake deposits consisting of silt, clay, and fine sand occur throughout the Niagara Falls area. These deposits are predominantly composed of laminated silt and clay which is characteristically dense and compact. Thin beds of fine sand (locally called quicksand) occur in the lake deposits. The clay, silt, and sand were deposited in lakes which existed in the area at the close of the Pleistocene Epoch (10,000 to 15,000 years ago). The lakes, which formed in the wake of the melting ice sheet, provided large bodies of quiet water for the slow accumulation of fine-grained deposits. Thus, the lake deposits are found at the surface nearly everywhere in the Niagara Falls area. The deposits are thinnest in the area south of the Niagara escarpment where they rarely exceed 20 feet in thickness. On the lake plain north of the escarpment the deposits average 30 to 40 feet in thickness; however, locally they vary from 0 to 90 feet in thickness. The greater thickness on the lake plain results from the persistence of a lake in this area (glacial Lake Iroquois) after the area south of the escarpment was above water.

The silt and clay have extremely low permeability and yield little water to wells. The thin beds of fine sand have comparatively greater permeability. Wells which tap only clay and silt will yield less than 100 gpd; those wells tapping sand beds yield more water and are usually adequate for domestic or very small agricultural needs. The lake deposits are utilized for water supplies only in the lake plain (north of the Niagara escarpment); to the south of the escarpment the deposits are too thin and are underlain by the much more permeable Lockport Dolomite.

The impermeable nature of the silt and clay was shown by a recovery test conducted on well 315-859-1. This well is believed to penetrate only clay and silt. After being pumped dry, the well required 4 1/2 months for the water level to rise to its static level 13 feet above the bottom. The permeability of the clay and silt, as calculated from the recovery data, was 0.04 gallons per day per square foot. The well was originally intended to provide water for a domestic supply, but was inadequate. In contrast, well 315-859-2, which is located about 500 feet to the south, provides an adequate domestic supply. This well undoubtedly penetrates a thin bed of sand.

GLACIAL TILL

A thin veneer of glacial till lies between the lake deposits described above and the bedrock throughout nearly all of the Niagara Falls area. The till is a mixture containing mostly sandy silt with boulders, pebbles, and some clay. The till was deposited directly by the ice sheet and is composed of rock which was quarried by the advancing ice, then ground up, and "plastered down" beneath the ice. The till cover in the Niagara Falls area is generally less than 10 feet thick. The greatest thickness of till (30 to 40 feet) is found in the moraines in the eastern part of the area. These features are the low ridges which trend approximately east-west located in the area southeast of Lockport and south of Medina (pl. 3). The moraines are composed of debris which was piled up in front of the advancing ice front. The moraines in the Niagara Falls area are believed to represent four minor readvances of the ice sheet during its retreat from the area (Kindle and Taylor, 1913, p. 10).

The poorly sorted nature of the till causes it to have very low permeability. An indication of the low permeability was obtained from a "slug" test on well 309-900-8. This well penetrates 7.5 feet of lake clay and silt and 1.5 feet of glacial till, and is cased through the lake deposits. The permeability of the till at this well was determined to be 23 gallons per day per square foot. This value for permeability may be too high because the well bottomed at the top of the Lockport Dolomite. Thus an open joint in the rock could have contributed to the yield of the well. However, the value for permeability may be representative of the "washed till-top of rock" aquifer tapped by many dug wells in the Niagara Falls area.

Yields adequate for domestic needs are obtained from till wells which tap: (1) sand lenses within the till, (2) the relatively permeable ("washed") zone at the top of rock, or (3) the sandy till making up the moraines. Wells which do not tap these more permeable horizons in the till are often inadequate to supply even domestic needs. Such inadequate wells yield less than 100 gpd.

separating Lake Erie from Lake Ontario. The winds are thus less moisture-laden than if they had passed over the lakes. Even those winds which may be moisture-laden (from evaporated lake water) may retain most of their moisture until they reach the more hilly areas east of Lake Ontario. The Niagara escarpment appears to have a local effect on the amount of precipitation also. As can be seen from the precipitation data given in table 5, Lewiston (elevation 320 feet), which is located below the escarpment, receives less precipitation than Lockport (elevation 520 feet), which is at the escarpment. Table 5 also shows that precipitation is fairly evenly distributed throughout the year. Within a given year, however, large variations from the average figures listed may occur. Note that the minimum monthly precipitation for each month during the 25-year period is between 1/2 and 1/20 the average precipitation for that month. However, the minimum annual precipitation (1941) is more than 1/2 the average annual precipitation. Average annual temperature is 48°F at Lewiston. The length of the growing season averages 160 days.

GROUND WATER

A part of the rain and snow falling on the Niagara Falls area seeps into the ground and continues downward to the water table to become ground water. The ground water is in constant, but generally very slow, movement from points of recharge to points of discharge. Ultimately all ground water in the area is discharged into Lake Ontario or the Niagara River either directly or via small tributary streams. The Niagara Falls area is, in effect, a peninsula-shaped catchment area in which the ground-water reservoir is being repeatedly replenished by precipitation, and constantly discharging to the surrounding surface-water bodies. This section of the report describes: (1) recharge to the unconsolidated deposits and the bedrock, (2) movement and discharge of ground water in the area, and (3) changes in storage in the ground-water reservoir as shown by water-level fluctuations.

RECHARGE

The source of nearly all the ground-water recharge in the Niagara Falls area is precipitation; however, a small amount of recharge also occurs in the area beneath and immediately adjacent to the Niagara Power Project reservoir by infiltration from the reservoir. Recharge of ground water means simply the addition of water (or quantity added) to the zone of saturation (Meinzer, 1923, p. 46). The rate and amount of recharge depends mainly upon the permeability of the soil, the amount of precipitation, and the soil-moisture condition at the time of precipitation. The rate of infiltration of water into the soil increases with increase of permeability. In the relatively small part of the Niagara Falls area underlain by sand and gravel, infiltration rates are greatest. However, throughout most of the area underlain by glacial till and lake clays and silts infiltration rates are low and surface runoff is high.

Table 5.--Monthly precipitation at Lewiston and Lockport, N. Y., 1936-60
(Data from reports of U.S. Weather Bureau)

Month	Lewiston (1 mile north of; elevation 320 feet)		Lockport (2 miles northeast of; elevation 520 feet)	
	Average (inches)	Minimum (inches)	Average (inches)	Minimum (inches)
January	1.98	0.59 (1946)	2.38	0.67 (1946)
February	2.35	.54 (1947)	2.52	.85 (1947)
March	2.49	.63 (1958)	2.56	.71 (1958)
April	2.66	.83 (1946)	2.80	.91 (1946)
May	3.08	.71 (1941)	3.26	.94 (1936)
June	2.18	.66 (1953)	2.41	.33 (1953)
July	2.44	1.15 (1955)	2.70	.90 (1954)
August	2.57	.21 (1948)	2.97	.36 (1948)
September	2.97	.46 (1941)	2.92	.14 (1941)
October	2.55	.47 (1947)	2.85	.60 (1938)
November	2.33	.75 (1939)	2.62	.64 (1939)
December	2.02	.39 (1958)	2.39	.71 (1943)
Annual	29.62	17.64 (1941)	32.38	19.75 (1941)

The mechanism of recharge to the Lockport Dolomite is of primary concern in this report because this bedrock unit is by far the most important aquifer in the Niagara Falls area. As discussed previously, most ground water occurs in the Lockport within seven relatively permeable zones parallel to bedding which are separated by essentially impermeable rock. Recharge to these water-bearing zones occurs by one of two mechanisms: (1) downward movement of water through vertical joints or (2) recharge directly to the water-bearing zones at the outcrop of the bedding joints composing the zones.

Several lines of evidence suggest that recharge to the Lockport Dolomite occurs predominantly at the outcrop of the water-bearing zones. The lack of persistent open vertical joints in the Lockport as observed in the conduit excavations, suggests that vertical joints are not important avenues for downward movement of water. However, this is not conclusive evidence in itself because on an areal basis, many vertical joints, although apparently tight, might be able to transmit appreciable quantities of water when considered as a whole even though each joint singly might transmit a very small quantity of water. More conclusive evidence of a negligible movement of water along vertical joints is the occurrence of "dry" open bedding joints below the "wet" bedding joints comprising the water-bearing zones in the Lockport (fig. 8). This phenomenon could not occur if permeable vertical joints connected the "dry" and "wet" bedding joints. It seems probable that the "dry" bedding joints exist because they receive little or no recharge in their outcrop area. This lack of recharge would be particularly applicable to those bedding joints cropping out along the Niagara escarpment where there is very little opportunity for recharge.

The most important indication that recharge to the water-bearing zones of the Lockport Dolomite occurs at the outcrop of the zones, is the alignment of water levels approximately parallel to the dip of the zones themselves. This alignment of water level is shown for water-bearing zone 3 in figure 9.

The wells shown in the cross section are adjacent to the reservoir of the Niagara Power Project; however, the water levels shown were measured prior to flooding of the reservoir. If recharge to the water-bearing zones did occur throughout the area by downward movement through vertical joints, the gradient along the zones would steepen in the downdip direction rather than continue roughly parallel to the dip of the zones--that is, if it is assumed that there is no increase in transmissibility downdip. This steepening of the hydraulic gradient would be required in order to transmit the ever-increasing amounts of water supplied to the zone by the vertical joints. No such steepening of the gradient was observed.

In summary, it appears that recharge occurs principally at the outcrop of the water-bearing zones in the Lockport Dolomite and that water then moves down the dip of the zone with a relatively constant loss of head. Recharge is probably not limited to the actual line of outcrop of a zone, however, but occurs throughout the area where the zone is reached by the enlarged vertical joints that occur in the upper few feet of the rock.

Little is known about the recharge to the other bedrock formations underlying the Niagara Falls area. It is probable that a very small amount of water moves downward from the Lockport Dolomite into the Rochester Shale and the underlying bedrock units. As was pointed out in the preceding discussion, however, vertical openings even in the Lockport Dolomite appear to transmit relatively little water except in the upper few feet of the rock. Therefore, movement of water from the Lockport into the underlying formations probably occurs only along widely spaced major vertical joints. Some of the water in the deeper bedrock units in the Niagara Falls area may also be derived from recharge to these beds in the area to the south. Such water would move through the Niagara area toward the Niagara gorge and Lake Ontario, both of which are regional discharge areas.

GROUND-WATER MOVEMENT AND DISCHARGE

Ground water moves from points of high head to points of low head (or potential), in other words from points where the water table or piezometric surfaces are highest to points where they are lowest. The direction of ground-water movement in the upper few feet of bedrock and in the unconsolidated deposits (where water-table conditions exist) is shown by the configuration of the water table. The direction of movement in the remainder of the bedrock is shown by the configuration of the piezometric surfaces associated with each of the artesian water-bearing zones in the different bedrock formations.

As discussed previously, each of the seven water-bearing zones in the Lockport is a distinct artesian aquifer with an associated piezometric surface. To show in detail the ground-water movement in the Niagara Falls area, it would be necessary to construct a water-table map, and piezometric maps for each of the water-bearing zones. Such maps are not included in this report because water levels could be measured in relatively few wells and because of the difficulty of differentiating between water levels which represent the water table and water levels which represent the piezometric surfaces associated with each of the several water-bearing zones. In a few wells constructed with packers, such as shown in figure 9, it was possible to measure separate water levels associated with the water table and with distinct water-bearing zones. In wells not equipped with packers, which includes all domestic and industrial wells in the area, a measured water level is an average of the heads of the different water-bearing openings penetrated by the well. Such an average water level represents neither the water table nor the piezometric surface of a single water-bearing zone.

Nearly all water-level data that could be used in determining direction of ground-water movement were obtained from wells in the vicinity of the pumped-storage reservoir. These data show that in general the configuration of the water table follows the surface of the land, being highest under hills and in interstream tracts and lowest in stream valleys. The configuration of the piezometric surfaces associated with each water-bearing zone in the Lockport has little relationship to the land surface. The piezometric surfaces are approximately parallel to the slope of the water-bearing zones. The disparity in the configuration of the water table and the piezometric surfaces is shown in figure 9, which was previously referred to in the discussion of artesian and water-table conditions in the Lockport. As shown in the figure, the water table slopes from all directions toward Fish Creek, whereas the piezometric surface for water-bearing zone 3 slopes to the south away from the creek. Thus, ground-water movement in the upper fractured part of rock and in the overlying unconsolidated deposits is toward the creek, but movement along water-bearing zone 3 and, presumable in the other water-bearing zones, is to the south toward the upper Niagara River.

Figure 14 shows the inferred direction of ground-water movement in the upper water-bearing zones of the Lockport Dolomite. This figure is based on adequate data only in the vicinity of the reservoir. Because only a few scattered water-level observations are available for the area south of the reservoir, the flow lines in that area are based largely on the fundamental principles governing ground-water movement.

It may be observed in figure 14 that ground water in the Lockport Dolomite moves north toward the Niagara escarpment in a narrow area parallel to the escarpment. This northerly direction of ground-water movement is shown by (1) the location of springs near the base of the Lockport along the escarpment (pl. 1), and (2) the decline of water levels in wells in the direction of the escarpment. A divide in the water table and in the upper fractured part of the rock apparently exists at a distance of 1,000 to 2,000 feet south of the escarpment. The existence of this divide is shown by the reversal of hydraulic gradient in the area. The gradient is toward the escarpment in the area less than 1,000 feet south of the escarpment. However, a hydraulic gradient to the southeast (approximately parallel to the dip of the beds in the Lockport) was observed in wells located over 2,500 feet south of the escarpment.

Prior to the start of the investigation it was assumed that water in the Lockport Dolomite in the western part of the Niagara Falls area moved west to the gorge to discharge. It was observed very early in the study, however, that there was practically no evidence of seepage on the sides of the gorge. The lack of seepage could be explained by (1) assuming that the water moving toward the gorge was intercepted by enlarged vertical joints parallel to the gorge, or (2) assuming that there was little or no movement of water toward the gorge.

Because the city of Niagara Falls and the area along the gorge north of the city is supplied by the Niagara Falls municipal water system, very few wells suitable for water-level observations were found in the area. The only wells readily accessible for water-level measurements were in the vicinity of the power station and canal. The data from these wells indicate that water moves toward the gorge. The width of the area supplying water to the gorge, however, could not be determined. Indirect information relative to this problem was derived from the water-level measurements in the vicinity of the reservoir. It was found that if the slope of the piezometric surface for a specific water-bearing zone (for example, zone 3 in figure 9) was extended to the south, the pressure reached the level of the upper Niagara River a short distance south of the reservoir. This does not prove but certainly strongly suggests that under natural (pre-power project) conditions the water in the Lockport Dolomite turned west to discharge into the Niagara River gorge, roughly midway between the escarpment and the upper Niagara River (fig. 14). The absence of seepage on the sides of the gorge, therefore, is believed to be attributable to enlarged vertical joints parallel to the gorge.

Ground-water movement as it probably existed in 1962 may be summarized as follows: (1) water moves northward in a narrow area parallel to the Niagara escarpment, (2) water moves southward (downdip) in the area around the reservoir (which acts as a recharge mound and tends to deflect the water moving from the north), (3) water moves into the canal, conduits, and area of industrial pumping to discharge, and (4) water moves toward the gorge in the southwestern part of the area.

On the lake plain, north of the Niagara escarpment, ground water moves in a generally northward direction toward Lake Ontario. The water table is located within the lake deposits about 3 to 10 feet below the surface. The water table very nearly parallels the land surface and slopes regionally toward Lake Ontario with a gradient of 5 to 20 feet per mile. It also slopes toward the streams crossing the lake plain in a narrow area adjoining each stream. The direction of ground-water movement in the Lockport Dolomite in the eastern part of the Niagara Falls area is not known.

WATER-LEVEL FLUCTUATIONS

Fluctuations of ground-water levels reflect changes in the amount of water stored in an aquifer. A decline in water level shows a decrease in storage in the aquifer, and means simply that discharge from the aquifer is exceeding recharge. A rise in water level indicates the reverse situation--recharge is greater than discharge. In wells tapping unconfined aquifers, water-level fluctuations show changes in the position of the water table. In wells tapping artesian aquifers, water-level fluctuations show changes in artesian pressure.

Natural fluctuations

Water-level fluctuations of natural origin can be broadly classified as either short- or long-term fluctuations. The short-term fluctuations are produced mainly by changes in atmospheric pressure, ocean tides, and earth tides. Fluctuations due to atmospheric pressure and earth tides occur in the Niagara Falls area but are of relatively little importance in the description of the ground water. Such short-term fluctuations are observed only in wells tapping artesian aquifers. Long-term fluctuations are largely a product of climate, particularly precipitation and temperature. The long-term fluctuations in water levels show changes in the natural rate of recharge to an aquifer compared to its rate of discharge to springs and stream beds.

The most noticeable fluctuation of ground-water levels in the Niagara Falls area are seasonal fluctuations. In general, water levels in the area reach their peak during the spring of the year (March and April) because of the large amount of recharge provided by snow melt and precipitation. Water levels generally decline throughout the summer because most of the precipitation is lost by evaporation and the transpiration of plants. Such water loss is characteristic of the summer growing season. During other seasons substantial amounts of water pass through the soil zone and continue downward to the water table. Water levels generally reach their yearly lows near the end of the growing season during September or October. Thereafter, water levels begin to rise and this rise is more or less continuous through March or April. Because the amount of precipitation is normally evenly spaced throughout the year in the Niagara Falls area (table 4), seasonal fluctuations are more a product of air temperature than of precipitation. The air temperature controls whether precipitation falls as snow or rain, whether the ground is frozen at the time of precipitation, and the length of the growing season; all of these are factors that affect water levels.

SPRINGS

Springs are not widely utilized as ground-water supplies in the Niagara Falls area. Springs are common along the Niagara escarpment but rarely occur elsewhere in the area. (See plates 1 and 3.)

Most of the springs along the escarpment originate near the base of the Lockport Dolomite. The source is nearly always seepage from bedding joints at the contact between the DeCew Limestone Member of Williams (1919) and the Gasport Limestone Member of the Lockport (water-bearing zone 2 in fig. 8). The springs occur where vertical joints intersect the water-bearing zone. Enlargement of both vertical and bedding joints is common at the springs, and in some cases has proceeded to the point where small caves have developed.

Springs are uncommon along the cliffs of the Niagara River Gorge. This lack of springs probably results from the development of extensive open vertical joints parallel to the face of the gorge. These joints drain water readily from the Lockport Dolomite through the underlying rocks and talus to the river. (See figure 6.)

Notable exceptions to the lack of springs along the gorge are springs 309-902-2Sp and -3Sp which are located just south of the Niagara escarpment (pl. 1). These springs are located in caves developed by solution of the shaly dolomite of the DeCew Member of Williams (1919) of the Lockport. The source of the springs, like the source of most springs along the escarpment, are bedding joints at the contact between the DeCew and Gasport Members (water-bearing zone 2 in fig. 8). Extensive solution features, such as sink holes, exist in the area drained by these two springs. Fish Creek, which crosses the area, loses water as it flows across the bedrock, and apparently contributes a major part of the water discharging from the springs. Dye introduced into Fish Creek reappeared at the springs, 1,000 feet away, 38 minutes after introduction (personal communication from C. P. Benziger of Uhl, Hall & Rich). The yield of these springs is therefore highly variable; the yields varying from about 15 gpm during dry periods to reportedly thousands of gallons per minute following heavy rains or periods of melting snow. The water from springs 309-902-2Sp and -3Sp is polluted by nearby septic tanks as shown by the strong odor of sewage and the sudsy character of the water.

The yield of single springs in the Niagara Falls area ranges from about 2 to 30 gpm during the dry parts of the year. The yields of most springs increase following rains but not nearly so much as the increase noted for springs 309-902-2Sp and -3Sp in the discussion above. Spring 310-859-6Sp is the only spring in the area utilized as a water supply on a year-round basis. This spring provides an adequate domestic supply for a trailer court with eight families.

PRESENT UTILIZATION

An estimated 10 mgd (million gallons per day) of ground water was obtained from wells in the Niagara Falls area during 1961-62. This figure contrasts with an estimated 60 mgd of water obtained from surface sources

REFERENCE NO. 4

Uncontrolled Hazardous Waste Site Ranking System

A Users Manual

Kris W. Barrett
S. Steven Chang
Stuart A. Haus
Andrew M. Platt

August 1982

MTR-82W111

SPONSOR:
U.S. Environmental Protection Agency
CONTRACT NO.:
68-01-6278

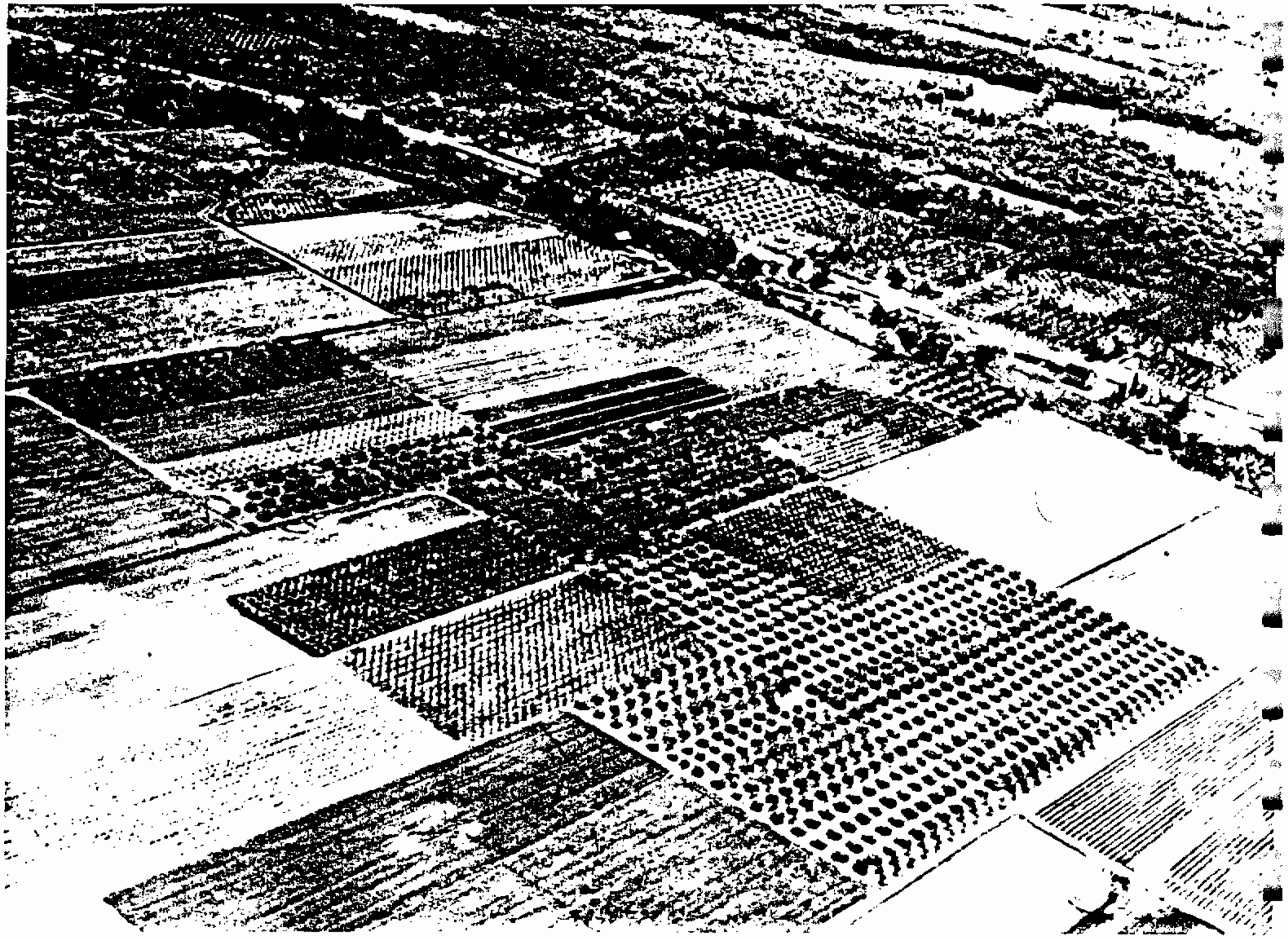
The MITRE Corporation
Metrek Division
1820 Dolley Madison Boulevard
McLean, Virginia 22102

3 202 - .36

REFERENCE NO. 5

SOIL SURVEY OF

Niagara County, New York



NIAGARA COUNTY SOIL & WATER
CONSERVATION DISTRICT
FARM HOME CENTER 4487 LAKE AVE.
LOCKPORT, NEW YORK 14094

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University Agricultural Experiment Station

Issued October 1972

Natural drainage and slow permeability are the two most limiting factors for community development. Sanitary sewers and an adequate drainage system are needed. Because the soils in most of this association are underlain by firm glacial till, bearing strength and soil stability are generally favorable for foundations.

About 75 percent of the association is open land. The remaining 25 percent is scattered farm woodlots or idle land that is reverting to forest. Openland wildlife is plentiful in many areas. Pheasants and rabbits are the most commonly hunted wildlife species. The potential for wetland wildlife is good. Many dug-out ponds are in this association. Marsh occurs in the northern part of Hartland. Recreation consists mostly of hunting and fishing. Scenic areas are few.

2. Hilton-Ovid-Ontario association

Deep, well-drained to somewhat poorly drained soils having a medium-textured or moderately fine textured subsoil

This association occurs in nearly level to strongly sloping areas in which till deposits are dominant (fig. 3). One continuous area occupies the central part of the county. The association crosses the county in a general east-west direction. A limestone escarpment is prominent, and there is a sandy delta in an area that begins near the city of Lockport and extends eastward to the village of Gasport.

The Hilton-Ovid-Ontario association occupies about 15 percent of the county. About 24 percent of this association is Hilton soils, 14 percent is Ovid soils, 7 percent is Ontario soils, and the remaining 55 percent is soils of minor extent.

The Hilton soils are deep, moderately well drained, and medium textured. They have a gravelly loam or silt loam surface layer, have a heavy loam or silt loam subsoil, and are underlain by calcareous loamy glacial till. In some areas limestone bedrock is at a depth of 3 1/2 to 6 feet. These areas have large stones above the bedrock in many places. Hilton soils are nearly level or gently sloping. They commonly are at intermediate elevations on the glacial till plain. In a few places, they are on fairly large lateral moraines or small drumlins.

The Ovid soils are deep and somewhat poorly drained, and they have a moderately fine textured subsoil. Typically, they have a silt loam surface layer, have a silty clay loam subsoil, and are underlain by heavy loam glacial till. They are nearly level to gently sloping and occur at a slightly lower elevation than the Hilton soils. In some places Ovid soils are along drainageways. Some areas of Ovid soils are underlain by limestone bedrock at a depth of 3 1/2 to 6 feet.

The Ontario soils are deep, well drained, and medium textured. Typically, they have a loam surface layer, have a heavy loam subsoil, and are underlain by calcareous loamy glacial till. Ontario soils are nearly level to strongly sloping. They occupy the higher elevations, such as the tops and sides of drumlins or lateral moraines. In places the Ontario soils have limestone bedrock at a depth of 3 1/2 to 6 feet. In these areas they are nearly level or gently sloping and contain some large stones.

The minor soils are mainly of the Appleton, Cazenovia, Cayuga, Churchville, Sun, and Arkport series. The Appleton and Cazenovia soils are intermingled with the major soils on the till plain. The Cayuga and Churchville soils are along the fringes of the till plain where lacustrine sediments cap the till. Sun soils are in depressions, and Arkport soils are mainly on the sandy delta between the city of Lockport and the village of Gasport. Also, Rock land occurs in small areas.

This association has a medium value for farming. In much of the area, farming competes with nonfarm uses. Most of the city of Lockport and the villages of Sanborn, Gasport, and Middleport are in this association. Many estate-type homes are near the limestone escarpment.

Dairying is the major farm use. In the sandy area along the escarpment between Lockport and Gasport, fruit growing is fairly intensive. The 1958 Conservation Needs Inventory indicates that about 50 percent of the association is cropland, 15 percent is forest or woodland, 10 percent is urbanized, and the remaining 25 percent is pasture and miscellaneous open land.

In places stones and bedrock are limitations for farming and urban development. Natural drainage is a limitation in the wetter areas. Slope and erosion are concerns, mainly near the escarpment. In many places installing artificial drainage is difficult because of stones and underlying bedrock.

This association has a high potential for dairying, raising livestock, and part-time farming. Stones and depth to bedrock are limitations to use locally. Lime needs generally are low. Vegetable growing is mostly restricted to the relatively stone-free, level or nearly level soils. Fruit is more susceptible to frost damage than in areas closer to Lake Ontario.

Wet areas, stones, and bedrock near the surface are the most limiting factors for urban development. Sanitary sewers are needed for concentrated housing developments. In many places underground installations are costly. Most soils in this association have adequate strength for building foundations. The association contains some of the most scenic sites for homes in the county.

This association contains five county parks and most of the Tuscarora Indian Reservation. Also, there are several municipal parks and playgrounds. Some of the most scenic views in the county are in this association. Especially near the scenic escarpment, there is a potential for more hiking, nature, and horseback-riding trails.

for the series. It is in areas that were occupied by glacial Lake Tonawanda. It occurs on slightly higher landscapes in close association with poorly drained Canandaigua soils. Areas are generally more than 10 acres in size, but some are more than 100 acres. Areas generally are irregular in shape, but some are oblong and parallel Tonawanda Creek.

Most commonly included with this soil in mapping are areas of poorly drained Canandaigua soils. Also included are areas of coarser textured Minoa soils and finer textured Rhinebeck soils. Other inclusions, near the southern boundary of the Raynham soils, are areas where the silty sediments are underlain by reddish clay. In these areas there are inclusions of Rhinebeck soils, thick surface variant, in many places.

If undrained, this soil is suited to hay, pasture, trees, or other uses of low intensity. If adequately drained and fertilized, the soil can be used for most of the cultivated crops grown in the county. It is excellent for growing some kinds of vegetables. Suitability for fruit is questionable because of the geographic location of this soil. Drainage outlets may be difficult to establish. Also, maintaining good tilth is difficult if this soil is used intensively. (Capability unit IIIw-1; woodland suitability group 3w2)

Raynham silt loam, 2 to 6 percent slopes (RaB).--This soil has a profile similar to that described as representative for the series, except that the surface layer is thinner or finer textured in some places. This soil is in the same general areas as Raynham silt loam, 0 to 2 percent slopes. It normally is near drainageways where erosion is starting to dissect the landscape. Areas range from about 5 to 25 acres in size. They are in fairly narrow strips along drainageways.

Commonly included with this soil in mapping are Canandaigua or Wayland soils in the lowest part of drainageways. At higher elevations areas of Galen or Collamer soils are included in some places. Other inclusions are areas of Niagara soils. The largest inclusion is of the nearly level Raynham soil.

This gently sloping soil has about the same uses and needs about the same management as the nearly level Raynham soil, though in most places this gently sloping soil is more difficult to manage because of slope and drainageways. Some erosion control measures are needed in intensively cultivated areas. Drainage may be easier on this soil because most areas have adequate outlets. (Capability unit IIIw-5; woodland suitability group 3w2)

Rhinebeck Series

The Rhinebeck series consists of deep, somewhat poorly drained, moderately fine textured and medium-textured soils. These soils formed in calcareous lacustrine deposits of silt and clay. They are nearly level to gently sloping and occur in the basins of old glacial lakes. Slopes range from 0 to 6 percent.

A representative profile of a Rhinebeck soil has a very dark grayish brown silt loam surface layer that is neutral and 8 inches thick. This layer i underlain by friable, grayish-brown silt loam 2 inches thick. It is neutral and contains many, prominent mottles. The subsoil is between depths of 10 and 23 inches. It consists of firm, plasti dark grayish-brown heavy silty clay loam that is mottled and neutral. Next is a very firm, calcareous substratum that consists of brown silty clay loam and thin lenses of silt. It has many mottle and some thin, pinkish-white streaks of lime.

The seasonal high water table rises to within 1 foot of the surface early in spring and in excessively wet periods. Some areas are ponded for short periods. The water table is generally perched above the slowly permeable subsoil and substratum.

Roots are restricted to the dark plow layer early in spring. As the season progresses and th water table drops, roots can extend downward to the calcareous substratum. Most roots, however, are confined to the uppermost 20 inches of soil. The available moisture capacity is moderate.

Representative profile of Rhinebeck silt loam, 0 to 2 percent slopes, in the town of Porter, 1 mile west of Ransomville Road and 800 yards south of State Route 18 (Lake Road); cultivated area:

Ap--0 to 8 inches, very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) wh rubbed; weak, medium and fine, granular structure; very friable; abundant, fine roots; neutral; abrupt, smooth boundary. 7 to 10 inches thick.

A2--8 to 10 inches, grayish-brown (2.5Y 5/2) silt loam; many (about 50 percent), fine and medium, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular block structure; friable; abundant fine roots; neutral; clear, broken boundary. 0 to 4 inches thick.

B2t--10 to 23 inches, dark grayish-brown (10YR 4/ heavy silty clay loam; many (about 50 percent), fine, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, fine, subangular blocky structure within moderate, coarse, prismatic structure; firm, plastic; dark-gr (10YR 4/1) coats on prism faces; clay films are nearly continuous on ped faces and fairly thick in pores; material from A2 horizon interfingers around peds in the upper part B2t horizon; neutral; plentiful fine roots; clear, wavy boundary. 4 to 26 inches thick

C--23 to 60 inches, brown (7.5YR 5/2) silty clay loam and thin lenses of silt; many (about 5 percent), fine, distinct, strong-brown (7.5YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; moderate, medium and thick, platy structure; strong, coarse, prismatic structure in the upper part; very firm; gray (5YR 5/1) and greenish-gray (5GY 5/1) coats on prism faces; thin, pinki white (7.5YR 8/2) streaks and patches of lime;

roots few in upper part and decrease to none with depth; calcareous.

Thickness of the solum ranges from 20 to 40 inches and corresponds well with depth to carbonates. The solum is neutral to slightly acid. Coarse fragments are typically absent, but up to 5 percent may occur in any horizon. Bedrock is at a depth of more than 40 inches and typically is deeper than 6 feet.

The Ap horizon is 10YR or 2.5Y in hue and 3 or 2 in chroma. Value is 4 or 3 when the Ap horizon is moist, but is more than 5.5 when the horizon is dry and is 4 or more when the material is rubbed. Texture ranges from silt loam to silty clay loam. The A2 horizon is absent in some places. If present, the A2 horizon ranges from 10YR to 5Y in hue, is 5 or 6 in value, and is 2 or 3 in chroma. Texture ranges from silt loam to silty clay loam.

The Bt horizon has hues ranging from 10YR to 5Y, value of 4 or 5, and chroma ranging from 2 to 4. A chroma of 2 does not dominate more than 59 percent of the Bt horizon. Ped coats and prism faces have a dominant chroma of 2 or less. Texture ranges from silty clay loam to clay. The average clay content is between 34 and 55 percent. Interfingering of A2 material into the upper part of the Bt horizon is interpreted as degradation.

The C horizon ranges from 7.5YR to 5Y in hue, is 4 or 5 in value, and ranges from 1 to 3 in chroma. This horizon ranges from silt loam to silty clay, but it contains strata of sand, silt, or clay in some places. The C horizon typically has thick, platy structure that was imparted by the varved lake deposits.

The Rhinebeck soils formed in deposits similar to those of the moderately well drained to well drained Hudson soils and the poorly drained to very poorly drained Madalin soils. Rhinebeck soils are similar to Churchville soils in texture and drainage but lack the underlying glacial till that is characteristic of Churchville soils. Rhinebeck soils are wetter than Cayuga soils and do not have glacial till within a depth of 3 1/2 feet. The Bt horizon of Rhinebeck soils is finer textured than that of the Niagara soils. Rhinebeck soils have a Bt horizon, but Raynham soils do not. They are better drained than Canandaigua soils, which do not have a Bt horizon.

Rhinebeck silt loam, 0 to 2 percent slopes (RbA).--This soil has the profile described as representative for the series. It occupies broad, nearly level areas within glacial lake plains. Areas are fairly large in most places and are more than 100 acres in size. The areas are roughly oblong in many places. Most of the acreage of this soil is north of the limestone escarpment. Much of it is in the towns of Porter, Wilson, and Somerset within 5 miles of Lake Ontario.

Most commonly included with this soil in mapping are areas of Niagara soils that contain less clay in the subsoil than this Rhinebeck soil. Also included are areas of Hudson or Collamer soils on knolls and at higher elevations and of poorly drained Madalin or Canandaigua soils in depressions and along drainageways. Cayuga or Churchville soils are included in areas where the lacustrine deposits are moderately deep over glacial till. The Ovid soils are included where the lacustrine deposits have been mixed with glacial till or glacial beach deposits. Other inclusions are sand or gravel smears, which are normally indicated on the soil map by the appropriate symbol.

This soil is suited to most crops grown in the county if drainage is adequate. Undrained areas are better suited to some grains, hay, pasture, trees, or wildlife than to row crops. Because the soil is only a short distance from Lake Ontario, this soil is used intensively for fruit, especially for apples, pears, and grapes. Alfalfa generally does well because of the high lime content of the soils.

Because this soil is plastic when wet and is cloddy, hard, or crusty when dry, cultivation at the proper moisture content is needed. Machinery bogs down if used when this soil is wet. Seed germination is generally poor if this soil is cultivated and planted when dry. Maintenance of good tilth is difficult in intensively cultivated areas. Runoff is slow because this soil is nearly level. (Capability unit IIIw-2; woodland suitability group 3w1)

Rhinebeck silt loam, 2 to 6 percent slopes (RbB).--This soil has a profile similar to that described as representative for the series, except that the surface layer is likely to be thinner or finer textured. This soil is in the same general areas as the nearly level Rhinebeck silt loam. It occupies the slope breaks and, in many places, is along drainageways. Areas are generally small but in some places are as much as 50 acres or more in size. They are roughly oblong in many places.

Most commonly included with this soil in mapping are areas of Hudson or Collamer soils on knolls. Madaline or Canandaigua soils are included in depressions or in the lowest parts of the drainageways. Also included, in some places, are silty Niagara soils. Other inclusions are of Cayuga, Churchville, and other soils that are underlain by glacial till. In a few included areas of Cazenovia or Ovid soils, material has been mixed with glacial till or glacial beach deposits. Some included areas are severely eroded. Areas of sand or gravel smears are normally indicated on the soil map by the appropriate symbols.

This soil is suited to about the same use and requires about the same management as the nearly level Rhinebeck silt loam, but drainage is normally easier to establish on this soil because it is more sloping. Erosion is a hazard in some places, especially if this soil is intensively cultivated. Runoff is moderate to moderately rapid. (Capability unit IIIw-5; woodland suitability group 3w1)

Rhinebeck silty clay loam, sandy substratum, 0 to 2 percent slopes (RhA).--This soil has a profile

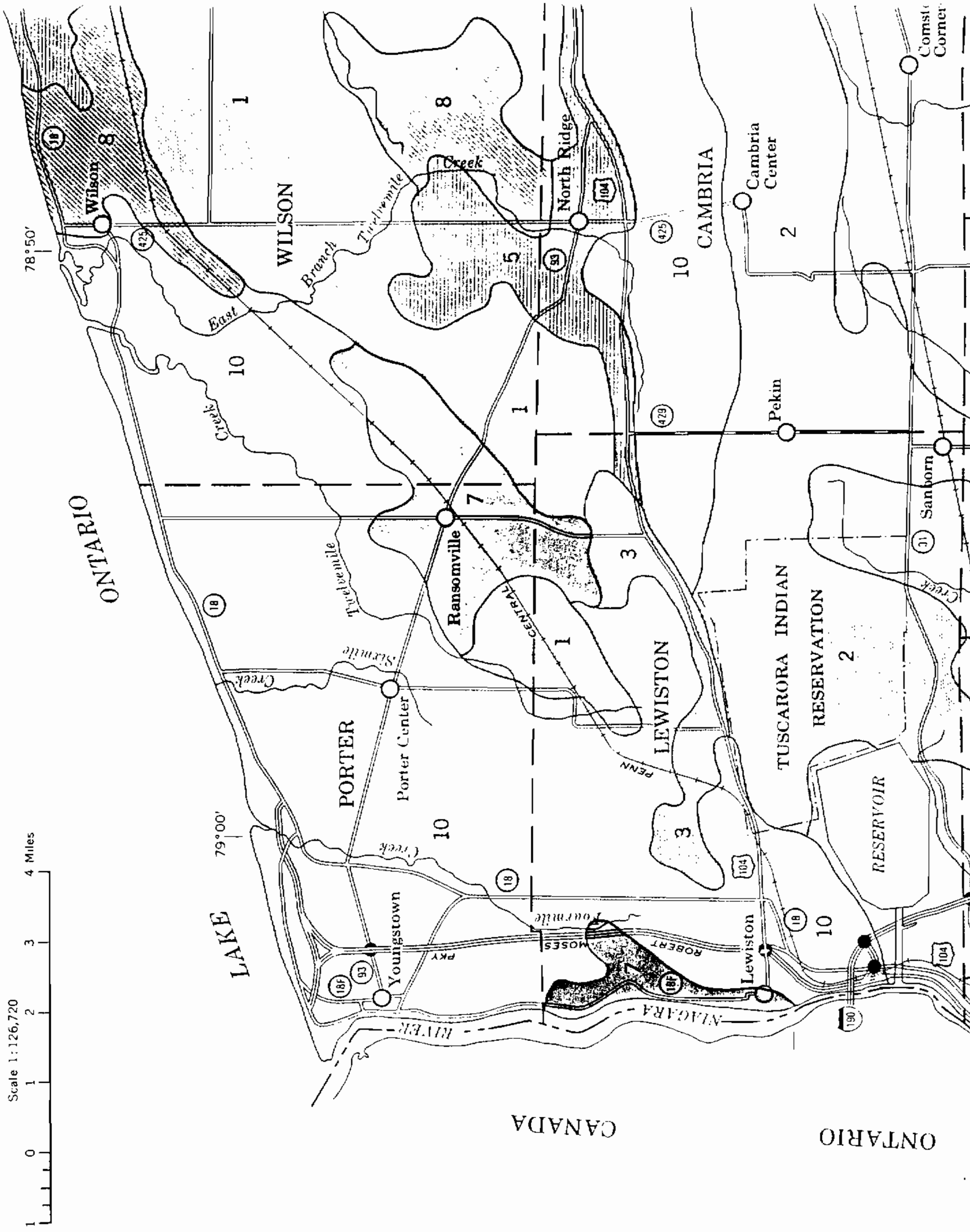
NIAGARA COUNTY, NEW YORK — SHEET NUMBER 36

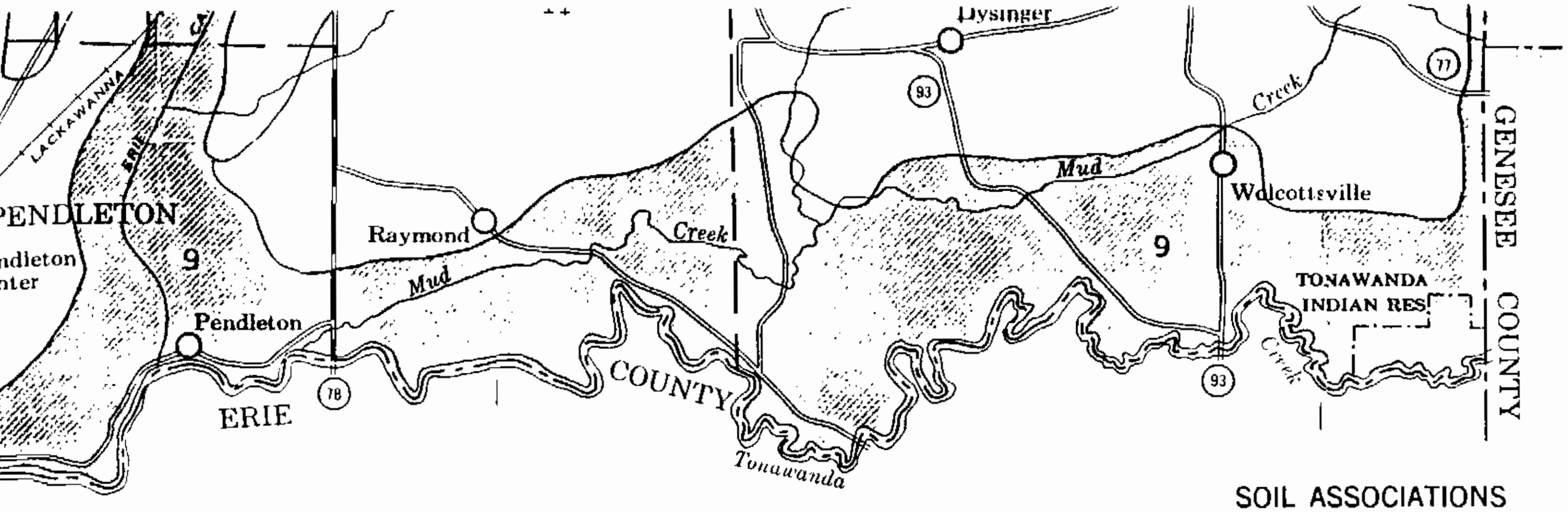
5-120

SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

NIAGARA COUNTY, NEW YORK





SOIL ASSOCIATIONS

AREAS DOMINATED BY SOILS FORMED IN GLACIAL TILL

1 Appleton-Hilton-Sun association: Deep, moderately well drained to very poorly drained soils having a medium-textured subsoil

2 Hilton-Ovid-Ontario association: Deep, well-drained to somewhat poorly drained soils having a medium-textured or moderately fine textured subsoil

3 Lockport-Ovid association: Moderately deep and deep, somewhat poorly drained soils having a fine textured or moderately fine textured subsoil

AREAS DOMINATED BY SOILS FORMED IN GRAVELLY GLACIAL OUTWASH OR IN BEACH AND BAR DEPOSITS

4 Howard-Arkport-Phelps association: Deep, somewhat excessively drained to moderately well drained soils having a medium-textured to moderately coarse textured subsoil, over gravel and sand

5 Otisville-Altmar-Fredon-Stafford association: Deep, excessively drained to poorly drained soils having a dominantly medium-textured to coarse-textured subsoil, over gravel and sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SANDS

6 Minoa-Galen-Elnora association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured, moderately coarse textured, or coarse textured subsoil, over fine and very fine sand

7 Claverack-Cosad-Elnora association: Deep, moderately well drained and somewhat poorly drained soils having a coarse-textured subsoil, over clay or fine sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SILTS AND VERY FINE SANDS

8 Niagara-Collamer association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured to moderately fine textured subsoil

9 Canandaigua-Raynham-Rhinebeck association: Deep, somewhat poorly drained to very poorly drained soils having a dominantly medium-textured to fine-textured subsoil

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID CLAYS AND SILTS

10 Rhinebeck-Ovid-Madalin association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly brown or olive in color

11 Odessa-Lakemont-Ovid association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly reddish in color

REFERENCE NO. 6

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SOLID AND HAZARDOUS WASTE
INACTIVE HAZARDOUS WASTE DISPOSAL REPORT

CLASSIFICATION CODE: 3 REGION: 9 SITE CODE: 9320
EPA ID: NYD9805

NAME OF SITE : Stauffer Chemical, North Love Canal
STREET ADDRESS: Upper Mountain Rd., Wittaker Subdivision
TOWN/CITY: Lewiston
COUNTY: Niagara
ZIP:

SITE TYPE: Open Dump-X Structure- Lagoon- Landfill- Treatment Pond
ESTIMATED SIZE: 1 Acres

SITE OWNER/OPERATOR INFORMATION:
CURRENT OWNER NAME....: Various
CURRENT OWNER ADDRESS.:
OWNER(S) DURING USE...: Mr. Whittaker
OPERATOR DURING USE...: Stauffer Chemical Co.
OPERATOR ADDRESS......: Westport, CN 06881
PERIOD ASSOCIATED WITH HAZARDOUS WASTE: From 1930 To 1952

SITE DESCRIPTION:
The site was used by Stauffer Chemical to bury approx. 50,000 cubic yards of asbestos, cell parts, reactor linings, scrap sulfur and oth metallic industrial wastes. Burial of wastes took place in the area Wittaker subdivision, including Callan Drive, Jeret Drive, Cleghorn and parts of Ellicott Dr. and Escarpment Dr. It is suspected that site was also used by Union Carbide for disposal of their fluoride containing flux. U.S.E.P.A. directed an investigation of the site May and June of 1979.

HAZARDOUS WASTE DISPOSED: Confirmed-X Suspected-

TYPE	QUANTITY (units)
asbestos, graphite, cinders, concrete cell parts, reactor linings, scrap sulfur, scrap metal, silicon zirconium and titanium oxides phenols, slag and flux containing fluorides	50,000-70,000 cu y[illegible]s

ANALYTICAL DATA AVAILABLE:
Air- Surface Water- Groundwater-X Soil-X Sediment- None-

CONTRAVENTION OF STANDARDS:
Groundwater-X Drinking Water- Surface Water- Air-

LEGAL ACTION:

TYPE..: none State- Federal-
STATUS: Negotiation in Progress- Order Signed-

REMEDIAL ACTION:

Proposed- Under design- In Progress- Completed-
NATURE OF ACTION: none

GEOTECHNICAL INFORMATION:
SOIL TYPE: deep poorly drained soil
GROUNDWATER DEPTH: unavailable

ASSESSMENT OF ENVIRONMENTAL PROBLEMS:

Some chemical constituents have elevated concentrations in soil and water sample. However, based on existing data, the potential for off-site migration of contaminants appears to be minimal.

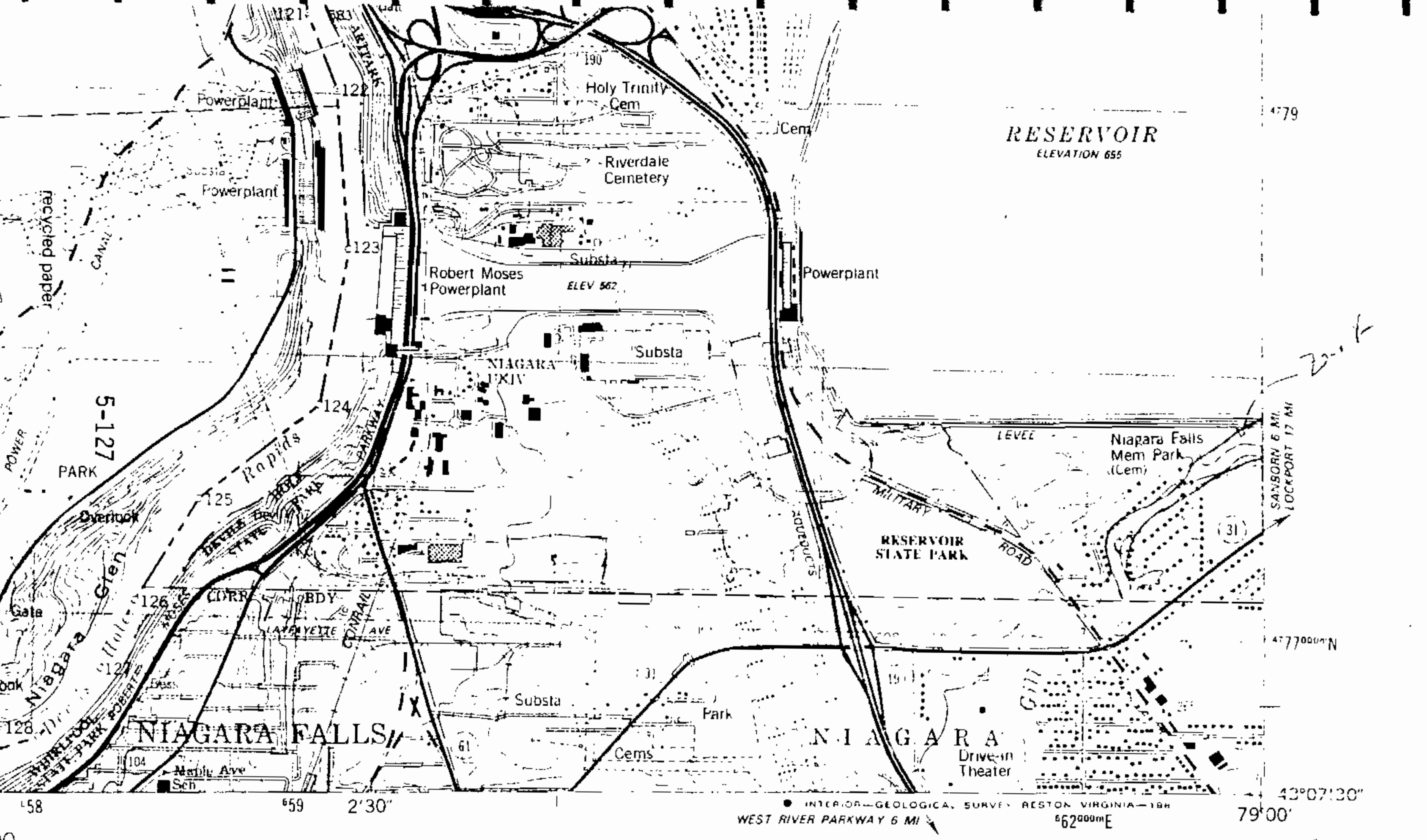
ASSESSMENT OF HEALTH PROBLEMS:

Medium	Contaminants Available	Migration Potential	Potentially Exposed Population	Need for Investigation
Air	Likely	Likely	Yes	High
Surface Soil	Likely	Likely	Yes	High
Groundwater	Likely	Unlikely	Yes	Medium
Surface Water	Likely	Unlikely	Yes	Medium

Health Department Site Inspection Date : 8/85

MUNICIPAL WASTE ID:

REFERENCE NO. 7



(TONAWANDA WEST)
5270 III SW

0

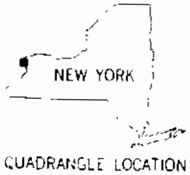
1 MILE

000 5000 6000 7000 FEET

1 KILOMETER

ATES AND 10 FEET IN CANADA
DATUM OF 1929
M IS LOW WATER 242.8 FEET

P ACCURACY STANDARDS
RESTON, VIRGINIA 22092
MBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

Interstate Route

U S Route

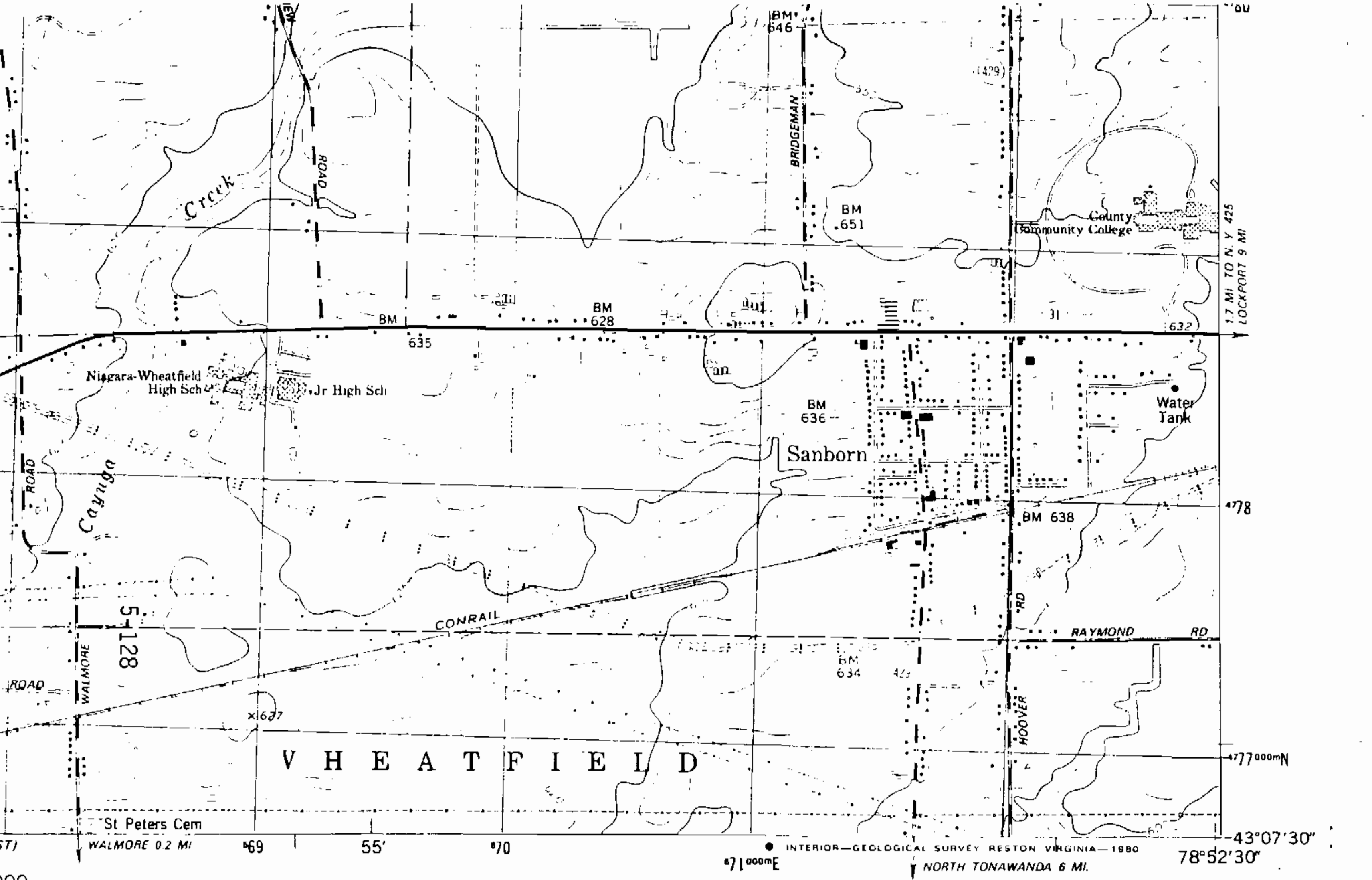
State Route

LEWISTON, N. Y.-ONT.

NE/4 NIAGARA FALLS 15' QUADRANGLE
N4307.5-W7900/7.5

1980

DMA 5170 II NE-SERIES V821



00

1 MILE

4000 5000 6000 7000 FEET

1 KILOMETER

5 FEET

DATUM OF 1929

QUADRANGLE LOCATION

MAP ACCURACY STANDARDS
Y, RESTON, VIRGINIA 22092
SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

Interstate Route

U S Route

State Route

RANSOMVILLE, N. Y.

NW/4 TONAWANDA 15′ QUADRANGLE
N4307.5—W7852.5/7.5

1980

DMA 5270 III NW—SERIES V821

REFERENCE NO. 8

North Love Canal Site Inspection
Oct 7, 1987

Weather: Raining, 50's, overcast

Arrived on site (intersection of Cleghorn and Escarpment Rds) at 10:00.

Review EPA map of site & identified houses on top former canal excavation.

1005 Frame 1, 1140 Escarpment Drive, on former excavation, located south of escarpment Drive. D. Sutton

1005 Frame 2, 1141 Escarpment Drive, on former excavation, located north of Escarpment Drive. J. Sundquist

All following shots are of houses on former excavation

007 Frame #3 - 1135 Escarpment (North side)
Name - R.N. Lein. D. Sutton

008 Frame #4 - 1136 Escarpment (South side)
Name Robert Arens J. Sundquist

009 Frame #5 1137 Elliott (not ~~E~~licott)
(Northside of road)
None Mr. HT & LF Jones
D. Sutton

1010 Frame #6 1138 Elliott (South)
No Name on mailbox J. Sundquist

101 Frame #7 1143 (A Incorvia) D. Sutton
Elliott (South)

1012 Frame #8 1144 Elliott (North) J. Sundquist
Name: Caccese

1013 Frame #9 Taken from Cleghorn, between D. Sutton
Elliott & Escarpment looking
west at yards between these
two streets. Canal excavation
site ~~[illegible]~~ within field of view

1015 Frame # 10 Taken from Cleghorn,
between Elliott & Jarrett,
looking West at yards between
these two streets (and excavation
site within field of view J. Sundquist

1020 Frame #11 photo showing slight
elevated grade looking west
along Jarrett Drive from
intersection of Jarrett and
Cleghorn Drive. D. Sutton

1021 Frame # 12 1176 Jarrett (South)
Name Muscatello J. Sundquist

1022 Frame # 13 1179 Jarrett (North)
~~No Name~~, Name: ~~Ro~~ R. Woods D. Sutton

1023 Frame #14 1170 Jarret (South) J. Sundquist
No Name

1024 Frame # 15 from Upper Mountain Road,
looking East toward Canal
Excavation site. Notice Mounding
in Road at former Canal site. D. Sutton

1025 Frome #16 Mr McKoy house
1169 Upper Mountain Rd
J. Sundquist

1026 Frome #17 Yellow house
1165 Upper Mountain Road
D. Sutton

Left site at 10:35
No site Representative Interviewed
in person

REFERENCE NO. 9

New York State Atlas of
Community Water System Sources
1982

NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF PUBLIC WATER SUPPLY PROTECTION

ERIE COUNTY

Municipal Community

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
	Akron Village (See No 1 Wyoming Co, Page 10)	3640	
1	Alden Village	3460	Wells
2	Angola Village	8500	Lake Erie
3	Buffalo City Division of Water	357870	Lake Erie
4	Caffee Water Company	210	Wells
5	Collins Water District #3	704	Wells
6	Collins Water Districts #1 and #2	1384	Wells
7	Erie County Water Authority (Sturgeon Point Intake)	375000	Lake Erie
8	Erie County Water Authority (Van DeWater Intake)	NA	Niagara River - East Branch
9	Grand Island Water District #2	9390	Niagara River
10	Holland Water District	1670	Wells
11	Lawtons Water Company	138	Wells
12	Lockport City (Niagara Co)		Niagara River - East Branch
13	Niagara County Water District (Niagara Co)		Niagara River - West Branch
14	Niagara Falls City (Niagara Co)		Niagara River - West Branch
15	North Collins Village	1500	Wells
16	North Tonawanda City (Niagara Co)		Niagara River - West Branch
17	Orchard Park Village	3671	Pipe Creek Reservoir
18	Springville Village	4169	Wells
19	Tonawanda City	18538	Niagara River - East Branch
20	Tonawanda Water District #1	91269	Niagara River
21	Wanakah Water Company	10750	Lake Erie

Non Municipal Community

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
22	Aurora Mobile Park	125	Wells
23	Bush Gardens Mobile Home Park	270	Wells
24	Circle B Trailer Court	50	Wells
25	Circle Court Mobile Park	125	Wells
26	Creekside Mobile Home Park	120	Wells
27	Donnelly's Mobile Home Court	99	Wells
28	Cowanda State Hospital	NA	Clear Lake
29	Hillside Estates	160	Wells
30	Hunters Creek Mobile Home Park	150	Wells
31	Knox Apartments	NA	Wells
32	Maple Grove Trailer Court	72	Wells
33	Hillgrove Mobile Park	100	Wells
34	Perkins Trailer Park	75	Wells
35	Quarry Hill Estates	400	Wells
36	Springville Mobile Park	114	Wells
37	Springwood Mobile Village	132	Wells
38	Taylors Grove Trailer Park	39	Wells
39	Valley View Mobile Court	42	Wells
40	Villager Apartments	NA	Wells

NIAGARA COUNTY

Municipal Community

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
	Lockport City (See No 12, Erie Co)	25000	
1	Middleport Village	2000	Wells (Springs)
	Niagara County Water District (See No 13, Erie Co)	48	
2	Niagara Falls City (See also No 14 Erie Co)	77384	Niagara River - East Branch
	North Tonawanda City (See No 16 Erie Co)	36000	

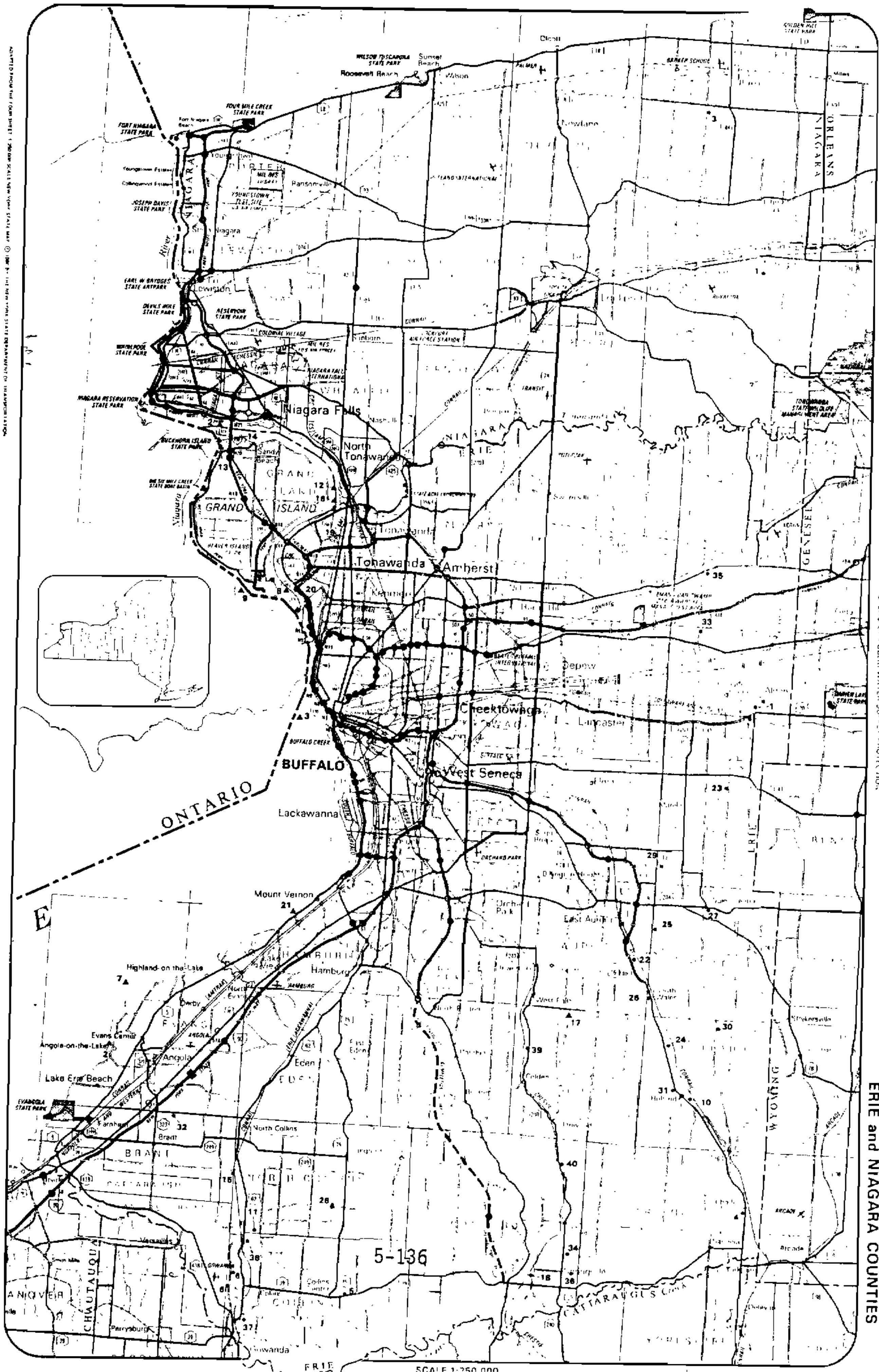
Non-Municipal Community

ID NO	COMMUNITY WATER SYSTEM	POPULATION	SOURCE
3	Country Estates Mobile Village	28	Wells

LOCATION OF COMMUNITY WATER SYSTEM SOURCES-1982

ERIE and NIAGARA COUNTIES

NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF PUBLIC WATER SUPPLY PROTECTION



ADAPTED FROM THE FOUR SHEET 1:250,000 SCALE NEW YORK STATE MAP © 1981 BY THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION

5-136

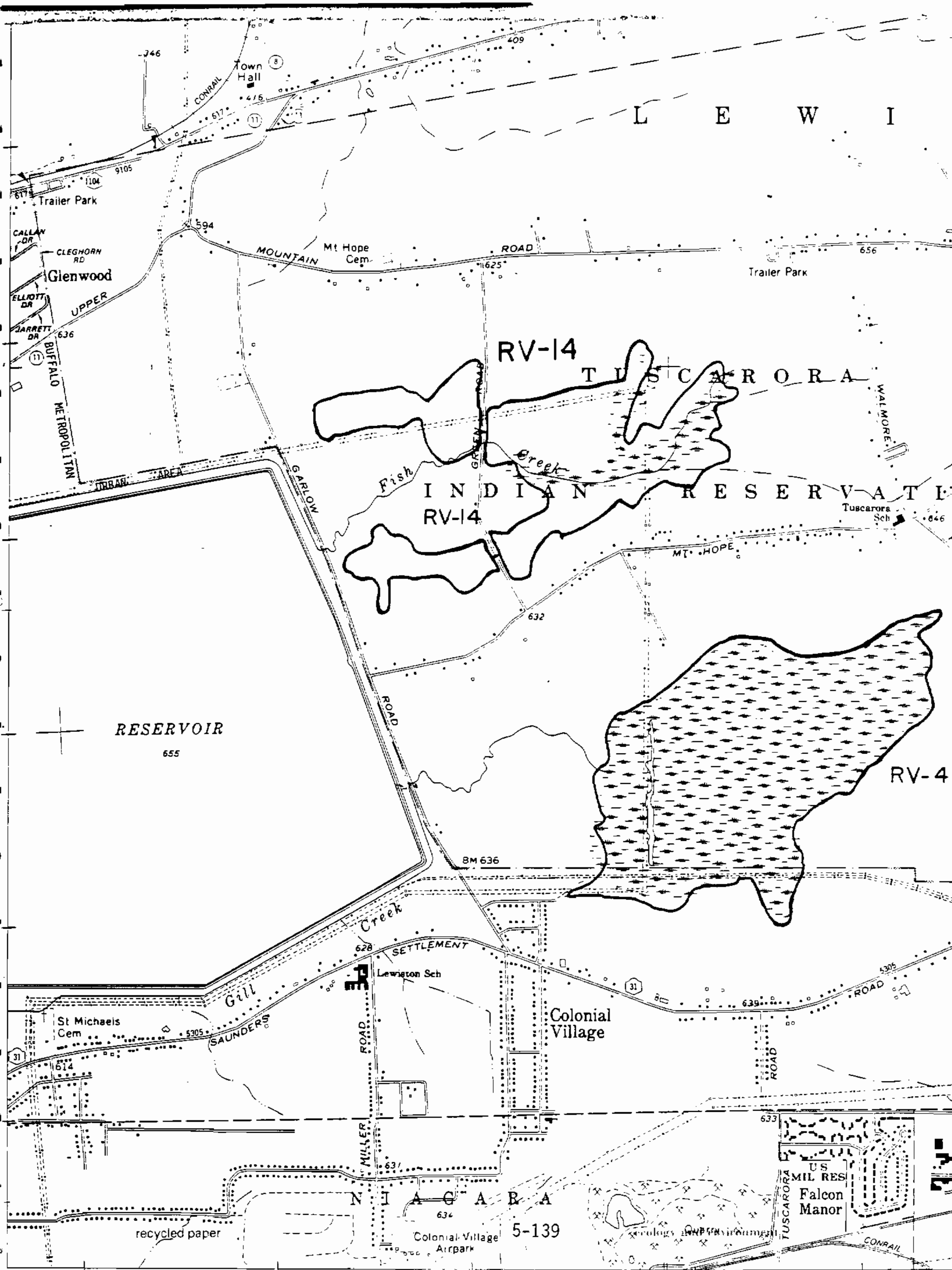
REFERENCE NO. 10

Freshwater Wetlands Classification Sheet

December 5, 1984

Niagara County
Map 8 of 18
Ransomville Quadrangle

Wetlands Identification Code	Municipality	Classification
RV-1	Porter, Lewiston Town	II
RV-2	Porter, Lewiston Town	III
RV-3	Lewiston Town	II
RV-4	Lewiston Town	II
RV-5	Lewiston Town	III
RV-6	Lewiston Town	II
RV-7	Porter	III
RV-8	Porter	III
RV-9	Porter	II
RV-10	Lewiston Town	III
RV-11	Lewiston Town	II
RV-12	Lewiston Town	II
RV-13	Lewiston Town	II
RV-14	Lewiston Town	II
RV-15	Porter	II
RV-16	Porter	III
RV-17	Lewiston Town	II
LE-17 (formerly LE, RV-17)	Porter	III
LE-18 (formerly LE, RV-18)	Porter, Lewiston Town	II
LE-19 (formerly LE, RV-19)	Lewiston Town	II



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REFERENCE NO. 11

CONTACT REPORT

AGENCY : New York State Department of Environmental Conservation, Region 9

ADDRESS : 600 Delaware Ave., Buffalo, NY 14202

PHONE : (716)847-4550

PERSON CONTACTED : James Snider, Senior Wildlife Biologist

TO : Jon Sundquist

DATE : June 2, 1987

SUBJECT : Critical Wildlife habitats near potential hazardous waste sites in Niagara County

In preparation of Phase 1 reports on potential hazardous waste sites in New York for the NYSDEC, information about nearby critical wildlife habitats is necessary. The following information is provided by Mr. James Snider of the Bureau of Wildlife, NYSDEC Region 9.

Except for the seasonal appearance of migratory birds, including, possibly the bald eagle, there are no critical habitats of endangered species within 2 miles of the suspected waste sites listed below:

- SKW Alloys
  Witmer Road at Maryland Ave.
  Niagara Falls, NY
- Dussault Foundries
  2 Washburn Street
  Lockport, NY
- North Love Canal
  Near Cleghorn Drive
  Lewiston, NY
- Carborundum Building 82
  Buffalo Ave.
  Niagara Falls, NY
- Ross Steel Company
  4237 Pine Ave.
  Niagara Falls, NY
- Frontier Bronze
  4870 Packard Rd.
  Niagara Falls, NY
- Roblin Steel
  101 East Ave.
  N. Tonawanda, NY

recycled paper ecology and environment

- LaSalle Expressway
  Niagara Falls, NY
- Diamond Shamrock
  Ohio Ave.
  Lockport, NY
- Town of Lockport Landfill
  Canal Road
  Lockport, NY
- Power Authority Road
  Lewiston, NY
- 64th Street South
  - Chevy Place
  Niagara Falls, NY
- Walmore Road
  Walmore Rd., 0.5 miles south of Lockport Road
  Wheatfield, NY

James R.

Signature

July 27, 1987

Date

REFERENCE NO. 12

GSC-TR8705

DRAFT

GRAPHICAL EXPOSURE MODELING SYSTEM

(GEMS)

USER'S GUIDE

VOLUME 1. CORE MANUAL

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
EXPOSURE EVALUATION DIVISION
Task No. 3-2
Contract No. 68023970
Project Officer: Russell Kinerson
Task Manager: Loren Hall

Prepared by:

GENERAL SCIENCES CORPORATION
6100 Chevy Chase Drive, Suite 200
Laurel, Maryland 20707

Submitted: February, 1987

1. INTRODUCTION

The Graphical Exposure Modeling System (GEMS) is an interactive computer system developed by General Sciences Corporation under the auspices of the Modeling Section in the Exposure Evaluation Division (EED), Office of Toxic Substances (OTS) of the Environmental Protection Agency (EPA). It provides a simple interface to environmental modeling, physiochemical property estimation, statistical analysis, and graphic display capabilities, with data manipulation which supports all of these functions. An overview of the basic GEMS components is shown in Figure 1-1. The system is installed on the OTS VAX 11/780 computer in Research Triangle Park, North Carolina, and is accessible through dial-up lines.

GEMS is being developed to support integrated exposure analyses at OTS. Its purpose is to provide environmental researchers and analysts with a set of sophisticated tools to perform exposure assessments of toxic substances without requiring them to become familiar with most aspects of computer science or programming.

GEMS is designed under a unique concept which integrates the computerized tools of graphics, mapping, statistics, file management, and special functions such as modeling and physiochemical property estimation, under a user-oriented and simple-to-learn interface. GEMS prompts the user or provides a menu for each action to be performed. The following features provide users with great flexibility during the GEMS execution:

- HELP commands - When you are using the GEMS system, you may not always have a user's manual readily available and/or you may need to see the format and type of a command or an answer before you enter it. Various HELP commands are available in GEMS which provide such information.

- Recovering from errors - If you enter a command or a response incorrectly, the system issues an error message and reprompts you for the correct information.

- Built-in defaults for model execution - GEMS is designed to guide inexperienced users through the execution of selected models. Default responses are usually available when you cannot specify a choice or supply an input to a prompt during model execution.

- Data management of modeling results - Data generated from execution of the SESOIL, ISC, SWIP, or AT123D models may be stored automatically in GEMS. These data may be accessed or analyzed via GEMS' file management, graphics, and statistics operations.

The purpose of this document is to describe GEMS from the user's point of view. It is intended as a comprehensive guide to the use of GEMS for personnel who have no specialized knowledge of computer programming. However, a working knowledge of environmental modeling is necessary for complete and accurate use of the system.

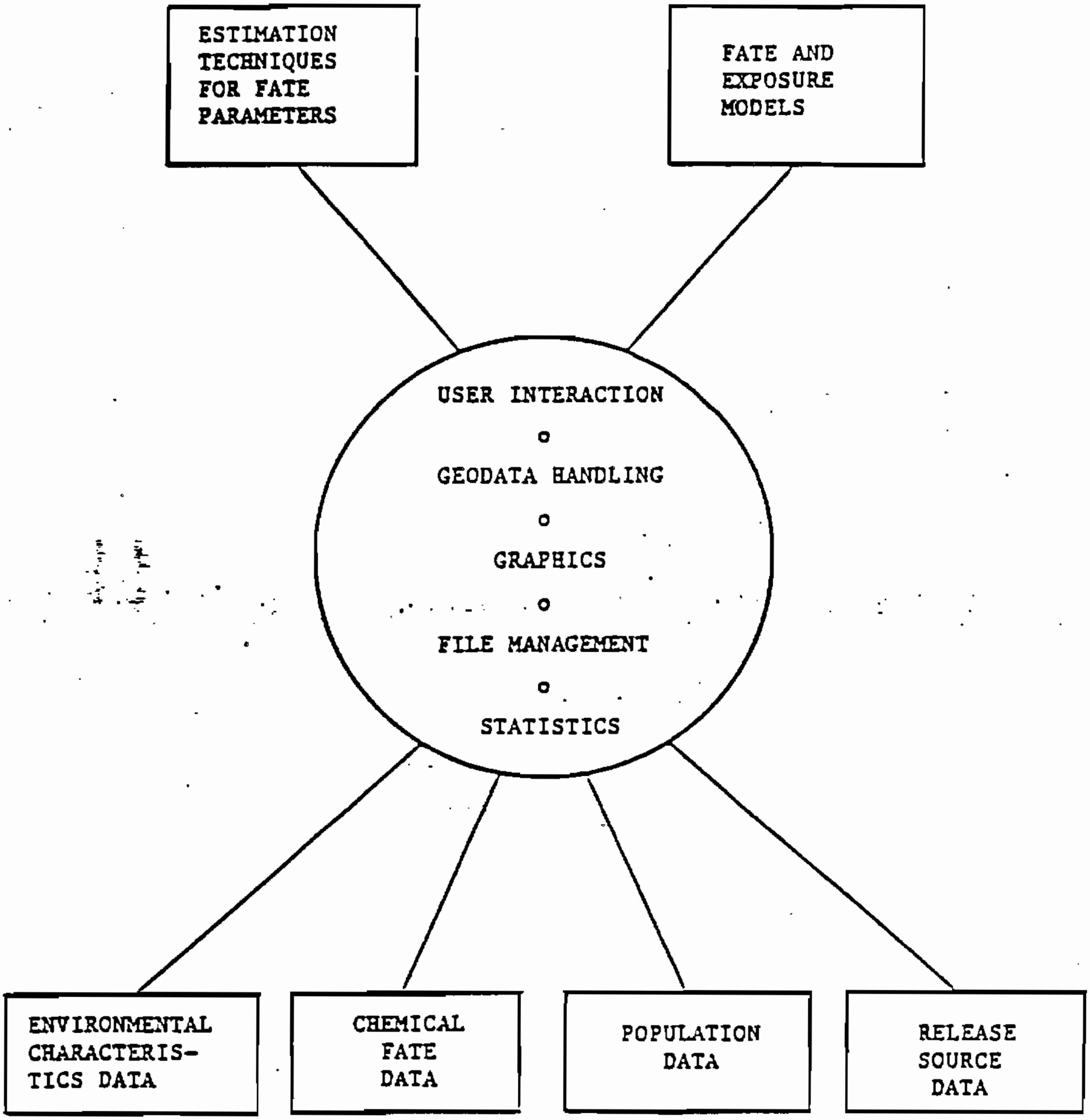


FIGURE 1-1. Components of the Graphical Exposure Modeling System (GEMS)

Since the last draft of the GEMS User's Guide, completed in June, 1984, the GEMS system has gone through a number of modifications and enhancements. It is no longer feasible to hold all sections in one single volume. This revised user's guide is designed in a modular fashion of six separate volumes described briefly below. In addition, GEMS has been adapted to function on an IBM PC/XT or AT. This prototype called PCGEMS has many of the same capabilities of the mainframe GEMS. These include environmental modeling procedures such as ENPART and AT123D as well as property estimation procedures such as CLOGP and AUTOCHEM. The prototype PCGEMS works in large part through interface with the OTS VAX 11/780 on which GEMS resides. a user's guide for PCGEMS will be available in the near future.

Volume 1: Core-Manual

This volume is a reference manual and introduction for first-time users. In addition to Section 1 - Introduction, a functional description of GEMS is presented in Section 2, a detailed guide to the use of the system is presented in Section 3, and summaries of the VAX operating environment and system and frequently used utilities are presented in Section 4. Two sample runs are given in the attachment to provide users with information in order to interact with the GEMS system, to generate a dataset, and subsequently, produce a map from the dataset.

Volume 2: Modeling

This volume consists of all GSC prepared user's manuals to GEMS models, grouped according to media. User's manuals are available for the following models: SESOIL, AT123D, SWIP, ENPART, TOX-SCREEN, INPUFF, and ISC/GAMS. A user's manual for EXAMS II model will be available later this year. Refer to Section 2.2 for further information.

Volume 3: Graphics and Geodata Handling

This volume contains two GEMS operations, Graphics and Geodata Handling. The Graphics operation contains a variety of graphics procedures which may be used to display results from modeling runs or from datasets. The Geodata Handling operation contains procedures that perform geographic data manipulation and generate maps of U.S. states or counties. Refer to Section 2.3 for further information.

Volume 4: Data Manipulation

This volume contains descriptions of GEMS system-installed datasets and two GEMS operations - File Management, and Utilities. Refer to Section 2.4 for further information.

Volume 5: Estimation

This volume consists of user's manuals for SFILES, FAP, CLOGP, and AUTOCHEM. These estimation programs may be used to provide estimated physiochemical properties for model input or for other environmental fate analyses. Refer to Section 2.5 for further information.

Volume 6: Statistics

This volume contains information on the GEMS Statistics operation which includes the Descriptive Statistics procedure and procedures to produce simple or multiple regression and contingency tables. Refer to Section 2.6 for further information.

REFERENCE NO. 13

ecology and environment, inc.
BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

December 9, 1988

Mr. Steven Reiter
Lewiston Water Authority
1445 Swan Road
Lewiston, New York 14092

Dear Mr. Reiter:

Ecology and Environment, Inc. (E & E) is conducting Phase I investigations for New York State Department of Environmental Conservation (NYSDEC). As part of these studies, Mr. Jon Sundquist of E & E obtained information from you regarding groundwater usage in the vicinity of the Stauffer Chemical, North Love Canal site (see attached map). I would appreciate it if you would review this information for accuracy. NYSDEC requires that all information in a Phase I report be fully documented. Please sign this letter to acknowledge that you have provided us with this information and that it (with any corrections or qualifications you may note) is correct to the best of your knowledge.

- o The closest well in use exclusive of those on the Indian Reservation is at 1169 Ridge Road (residence).
- o This residence is located approximately 2,050 feet from the landfill.

I certify that I have provided the above information to E & E, on October 29, 1987, and it is correct to the best of my knowledge.

Steven L. Reiter — 12-13-88
Signature — Date

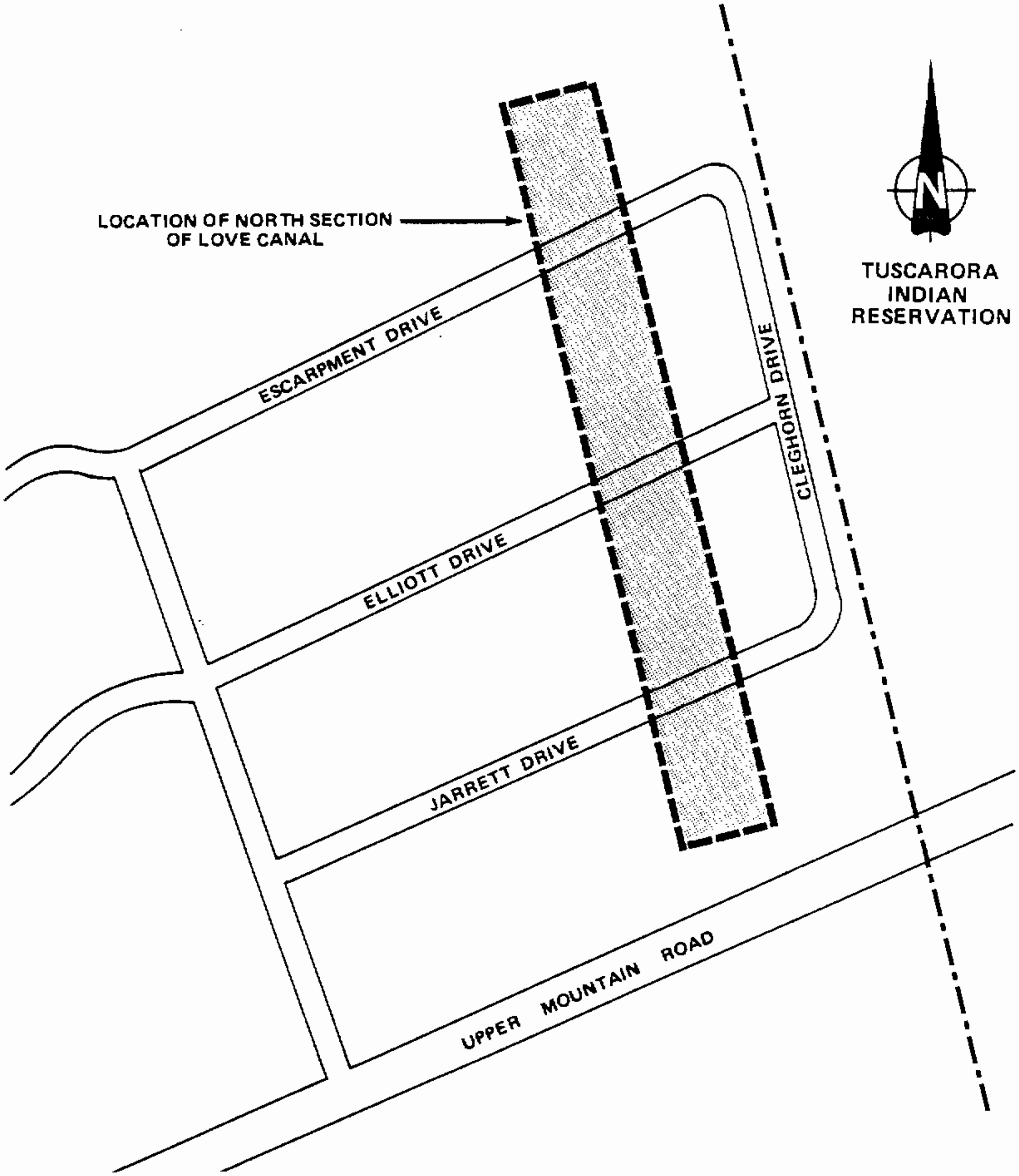
Your prompt attention to this matter is appreciated. If you have any questions, please call me at (716) 684-8060.

Sincerely,

Peggy Farrell

Margaret J. Farrell
Project Manager

MJF/wj
att.



NOT TO SCALE

Figure 1–2 SITE MAP

REFERENCE NO. 14

HAUDENOSAUNEE

TUSCARORA NATION
2006 MT. HOPE ROAD — VIA: LEWISTON, NEW YORK 14092

November 25, 1987

Mr. Dennis Sutton
Ecology and Environment, Inc.
195 Sugg Road
P.O. Box D
Buffalo, New York 14225

Dear Mr. Sutton:

This letter is in reply to your letter dated October 15, 1987, at which time you requested information to various items or questions in your letter.

It must be noted our main source of water is from wells or springs. No record is kept on the yield of these sources of water. The depth of the wells to our knowledge varies from 25 to 100 feet, depending on location within the Tuscarora Nation. Also the only irrigation from our wells or springs is not as may be used in commercial farming. Our people water their lawns or small garden plots. I hope this answers your questions, as Chief Edison Mt. Pleasant has spoke to you on the population.

Thank you for your cooperation in this matter and we will be looking forward to hearing from you on any impact assessment from former hazardous waste sites you may obtain or gather.

ONEH!

Chief Leo R Henry

Chief Leo R. Henry, CLERK
Tuscarora Nation

REFERENCE NO. 15

The
National Registe
of Historic Place

197

Irene Lewishon to carry forward their work in drama and dance with local children. *Multiple public/private:* NHL.

NIAGARA COUNTY

Lewiston. **FRONTIER HOUSE,** 460 Center St., 1824–1826. Stone, 3 1/2 stories, rectangular; gabled roof with stepped gables, paired chimneys, and balustrade; off-center and center entrances, full-width front porch with hipped roof, regular fenestration, oval windows in gables, N kitchen wings. Federal elements. Built as a tavern for Joshua Fairbanks and Benjamin and Samuel Barton, local prominent businessmen. *Private.*

Lewiston. **LEWISTON MOUND,** Lewiston State Park, Hopewellian affinities (c. 160). Oval burial mound. Partially investigated. *County.*

Lewiston vicinity. **LEWISTON PORTAGE LANDING SITE,** Prehistoric–19th C.. Gently sloping ravine leading from river remains of path used by travelers to avoid Niagara Falls. Archeological explorations yielded artifacts from Indian to British occupation, indicating this was a heavily used access point to a vital overland route. *State.*

Lockport. **LOWERTOWN HISTORIC DISTRICT,** Roughly bounded by Erie Canal and New York Central RR., 19th–20th C.. Primarily residential district, with some religious and commercial buildings and warehouses, facing the canal are 2 1/2-story brick and stone residences with Greek Revival and Italianate elements built in the 1830's; off the canal are 1–2-story frame structures with additions and modern siding built mid-19th C. and some stone structures; notable are the Gothic Revival former Christ Episcopal Church (1854) and the Italianate Vine Street School (1864). Systematic development of the village began after canal opened; district was Lockport's social, commercial, and industrial center, 1830's–1860's. *Multiple public/private:* HABS.

Lockport. **MOORE, BENJAMIN C., MILL (LOCKPORT CITY HALL; HOLLY WATER WORKS)** , Pine St. on the Erie Canal, 1864. Coursed rubble, 2 1/2 stories over basement on sloping site, trapezoidal shape, hipped roof sections with cross gables, interior chimney; front center entrance with transom and pediment on pilasters, triple round arched windows in gables, rock-faced stone lintels and sills, ashlar quoins, interior altered; rear 2-story addition 1893. Built as a flour mill, converted c. 1885 to a water pumping plant; adapted as city hall 1893; one of few survivors of 25 industrial buildings once clustered along this section of Erie Canal. *Municipal.*

Niagara Falls. **DEVEAUX SCHOOL COMPLEX,** 2900 Lewiston Rd., 1855–1888. Educational complex; contains 3 connected structures–Van Rensselaer Hall (1855–1857), Patterson Hall (1866), and Munro Hall (1888), and outbuildings–barn, shed, and gymnasium. Gothic Revival elements. Founded by Judge Samuel DeVeaux as an Episcopal school for poor and orphaned boys, later became a prominent preparatory school, closed, 1971. *Private.*

Niagara Falls. **NIAGARA FALLS PUBLIC LIBRARY,** 1022 Main St., 1902–1904, E. E. Joralemon, architect. Stone, yellow brick; 1 story, rectangular with semielliptical rear bow, flat roof with parapet, slightly projecting center entrance bay with pedimented double doorway, pedimented windows, string courses, fine interior detail intact. Neo-Classical Revival elements. One of many public libraries endowed by Andrew Carnegie. *Public.*

Niagara Falls. **NIAGARA RESERVATION,** 1885. Includes the falls, Goat Island and other islets, paths, and an observation tower. In establishing a reservation of over 400 acres, New York became the first state to use eminent domain powers to acquire land for aesthetic purposes. *State:* NHL.

Niagara Falls. **SHREDDED WHEAT OFFICE BUILDING,** 430 Buffalo Ave., 1900. Steel frame, brick, 5 stories, rectangular, flat roof, center entrance, 5 paired window bays, segmental arched basement windows, wide parapet; interior featured 4th-floor auditorium and 5th-floor cafeteria, doubled glazed windows. Commercial style. Administrative office building of original Shredded Wheat factory complex, developed by Henry D. Perky. *Private.*

Niagara Falls. **U.S. CUSTOMHOUSE,** 2245 Whirlpool St., 1863. Stone, 2 1/2 stories, square, hipped roof, arched window and door openings on W facade; built into railroad embankment, S side opens onto railroad tracks; renovated, 1928. Continues to serve as customs office for trains from Canada. *Private:* HABS.

Niagara Falls. **WHITNEY MANSION,** 335 Buffalo Ave., 1849–1851. Limestone, 2 1/2 stories, L-shaped, intersecting gabled roof sections; original section has off-center entrance with full-width Ionic portico, 19th C. side addition has front bay window and gabled dormer with 3 round arched windows. Greek Revival. Built according to 1830's design by Solon Whitney, son of Gen. Parkhurst Whitney, village founder and prominent hotel and tavern owner. *Private.*

Youngstown vicinity. **OLD FORT NIAGARA,** N of Youngstown on NY 18, 1678. Complex of stone buildings bounded by stone walls, earthworks, and a moat, restored. Original fort built in 1678, altered 1725–1726 and 1750–1759. Held alternately by French, British, and Americans in struggle for control of continent; strategically located in commanding the Great Lakes from Lake Erie to Ontario and in covering approaches to western NY. *State:* NHL.

ONEIDA COUNTY

Boonville. **ERWIN LIBRARY AND PR HOUSE,** 104 and 106 Schuyler St., 189 Vivian (Erwin Library); 1875, J. B. Lathro (Pratt House). Erwin Library: limestone, story, gabled and hipped roofs; square with pyramidal roof contains recessed arc entrance. Romanesque. Pratt House: brick, stories, mansard roof with dormers and centr tower crowned with iron cresting and sp ornate bracketed cornices and metal ha original interior wall coverings, fixtures, woodwork. Second Empire. *Private.*

Boonville. **FIVE LOCK COMBINE LOCKS 37 AND 38, BLACK RIVER CA (BOONVILLE GORGE PARK)** , NY 19th–20th C.. Section of the abandoned Black River Canal (built mid-19th C.) run through rugged terrain of Boonville Go contains locks 37 and 38 and a 5-lock com (locks 39–43), canal was 42′ deep; locks, 90′ by 15′, which accommodate 70-ton boats, w built 1895–early 1900's. Canal built to con Black River Valley to Erie Canal prov water supply for Erie Canal, allowed expansi of valley's lumbering industry, and fostere growth of towns. *State/county:* HAER.

Clinton. **HAMILTON COLLEGE CHAP** Hamilton College campus, 1827, Phil Hooker, architect. Coursed rubble, 3 stor rectangular, low pitched roof, interior chim modillion cornice, front and rear parapet, slightly projecting 4-story clock tower with stage frame belfry—2 stories, each with columns and entablature, surmounted by tagonal cupola, front center double-door trance with round arched window ab flanked by tall round arched windows, decorative frame panels; limestone as quoins, lintels, and sills, side elevations tiers of windows; apse added 1897; interior tered. Federal. Multipurpose classroom and chapel building designed by Philip Hooker, unusual 3-story interior plan attributed to J H. Lothrop, a trustee. *Private.*

Clinton. **ROOT, ELIHU, HOUSE,** 101 College Hill Rd., 1817. Frame, clapboarding; 2 stories irregular shape, gabled roof, interior chimne pedimented arched portico, off-center entra with semielliptical fanlight and side lights; story pilasters dividing bays in flush-sided ma facade, pedimented rear porch; side additio restored, 1900's. Federal. Home of Elihe R U.S. Secretary of War largely credited w conceptual foundation for 20th C. developme of American Army, Secretary of State, U.S. senator, and winner of 1912 Nobel Peace Pr *Private; not accessible to the public:* NHL.

Rome. **ARSENAL HOUSE,** 514 W. Dominick St., c. 1813–1814. Brick, 2 1/2 stories, rect gular, gabled roof, pairs of bridged interior e chimneys above single gable steps, central pe mented gable with elliptical window, 2 vertic elliptical windows in gabled ends betwe chimneys, stone sills and lintels; later fr porch with large modillion blocks, chamfer

REFERENCE NO. 16

STATE OF NEW YORK

OFFICIAL COMPILATION

OF

CODES, RULES AND REGULATIONS

MARIO M. CUOMO
Governor

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Secretary of State

Published by
DEPARTMENT OF STATE
162 Washington Avenue
Albany, New York 12231

1/83

837.4 Table I.

TABLE I

Classifications and Standards of Quality and Purity Which Are Assigned to All Surface Waters within the Lake Erie (East End) - Niagara River Drainage Basin; Erie, Niagara, Genesee, Orleans and Wyoming Counties, New York

Item No.	Waters Index Number	Name	Description	Map Ref. No.	Class	Standards
1	0-158	Niagara River American side	Waters from international boundary to American shore between confluence with Lake Ontario and Lake Erie. Latter point is defined as a line running due west from south end of Bird Island ier to international boundary. These waters include all bays, arms, and inlets thereof, but not trib. streams or Black Rock Canal.	1,2,6	A-Special (inter-national boundary waters)	A-Special (inter-national boundary waters)
2	Black Rock Canal	Black Rock Canal	Waters east of Sqaw Island and Bird Island ier between canal locks and a line from south end of Bird Island ier to Buffalo harbor light #6.	6	C	C
3	0-158-1 and 2	Tributaries of Niagara River	Enter Niagara River from east in Town of Lewiston approximately 4.5 and 7.0 miles respectively from mouth.	1	C	C
4	0-158-3	Fish Creek	Enters Niagara River from east approximately 2.0 miles north of Niagara-Lewiston town line.	1,2	D	D
5	0-158-4 and P 1	Tributary of Niagara River	Enters Niagara River from east approximately 0.7 mile north of Niagara-Lewiston town line.	1	D	D

3. Total dissolved solids.	None at concentrations which will be detrimental to the growth and propagation of aquatic life. Waters having present levels less than 500 milligrams per liter shall be kept below this limit.
4. Dissolved oxygen.	For cold waters suitable for trout spawning, the DO concentration shall not be less than 7.0 mg/l from other than natural conditions. For trout waters, the minimum daily average shall not be less than 6.0 mg/l. At no time shall the DO concentration be less than 5.0 mg/l. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/l. At no time shall the DO concentration be less than 4.0 mg/l

CLASS "D"

Best usage of waters. The waters are suitable for fishing. The water quality shall be suitable for primary and secondary contact recreation even though other factors may limit the use for that purpose. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the waters will not support fish propagation.

Conditions related to best usage of waters. The waters must be suitable for fish survival.

Quality Standards for Class "D" Waters

Items	*Specifications*
1. pH	Shall be between 6.0 and 9.5.
2. Dissolved oxygen.	Shall not be less than 3 milligrams per liter at any time.
3. Coliform.	The monthly median coliform value for 100 ml of sample shall not exceed 2,400 from a minimum of five examinations and provided that not more than 20 percent of the samples shall exceed a coliform value of 5,000 for 100 ml of sample and the monthly geometric mean fecal coliform value for 100 ml of sample shall not exceed 200 from a minimum of five examinations. This standard shall be met during all periods when disinfection is practiced.

Historical Note

Sec. added by renum. and amd. 701.4, filed July 3, 1985; amd filed Sept. 20, 1985 eff. 30 days after filing.

701.20 Classes and standards for saline surface waters. The following items and specifications shall be the standards applicable to all New York saline surface waters which are assigned the classification of SA, SB, SC or SD, in addition to the specific standards which are found in this section under the heading of each such classification.

REFERENCE NO. 17

4

NIAGARA COUNTY

HEALTH DEPARTMENT
HUMAN RESOURCES BUILDING
MAIN POST OFFICE BOX 428
10th AND EAST FALLS STREET
NIAGARA FALLS, NEW YORK 14302

February 1, 1989

Mr. David Mead
Bureau of Environmental Exposure Investigation
NYS Department of Health
Corning Tower
Empire State Plaza
Albany, NY 12237

**RE: JANUARY 31, 1989
SAMPLING - WHITTACKER SITE**

Dear Dave,

Enclosed are notes from the sampling of two basement sumps from homes located at the Whittacker Site.

The samples were shipped the same day via UPS. A chain of custody record form is also enclosed along with a copy of the UPS Pickup Record form for your file.

Please call me at (716) 284-3428 if you have any questions regarding this sampling.

Yours very truly,

Paul Dicky
Ass't. Public Health Engineer

PD:cs
Enclosure

RECEIVED

FEB 7 1989

[illegible] ENVIRONMENTAL
[illegible] INVESTIGATION

NIAGARA COUNTY
DEPARTMENT OF HEALTH

Code Activity
Code Location
Service Request No.
Date Received Complaint 1-31-89

rvice Request WHITTAKER SITE SAMPLING NOTES
ginator of Complaint Address
ner Address
upant Address

Hours	REPORT OF INVESTIGATION
10^{50} AM	1179 JARRET DRIVE

SAMPLED AT 10^{50}AM - JANUARY 31, 1989

- MR. WOOD/HOMEOWNER, EXPLAINED THAT RECHARGE INTO THE SUMP IS OCCURRING AT A SLOW RATE. THE SUMP WAS pumped down Sunday (1-26-89) Night AND SUMP HAS NOT yet fully RECHARGED / there WAS SUFFICIENT LIQUID FOR SAMPLING, However - ~~ALTHOUGH~~ THERE WASN'T SUFFICENT SEDIMENT TO SAMPLE
- Also NOTE:

THE COLOR OF SEDIMENT WAS NOT THE CHARACTERISTIC TAN/BROWN FLOCCULATING TYPE OF SEDIMENT WHICH HAS CHARACTERISTICALLY BEEN NOTED ON PREVIOUS INSPECTION OF SUMP & OTHER LOCATIONS (SUMP ACROSS STREET & DITCH SAMPLE). THE WATER APPEARED TO BE MORE OF A BLACK (BRACKISH) COLOR, black sediment.

- THE sump did NOT have ANY type of chemical ODOR.

Code Activity
Code Location
Service Request No.
Date Received Complaint 1-31-89

NIAGARA COUNTY
DEPARTMENT OF HEALTH

ervice Request WHITTAKER SITE SAMPLING NOTES
riginator of Complaint Address
wner Address
ccupant Address

REPORT OF INVESTIGATION

Hours	
10³⁰ Am	1176 JARRET DRIVE
	SAMPLED AT 10³⁰ AM – JANUARY 31, 1989
	- MR. MUSCATELLO / HOMEOWNER, EXPLAINED THAT RECHARGE INTO THE SUMP IS NOT OCCURRING AT THIS TIME THEREFORE SUMP WAS NOT PUMPED DOWN PRIOR TO SAMPLING.
	- THE SUMP WAS CLEANED OUT BY MR. MUSCATELLO SEVERAL MONTHS AGO / THE SUMP WAS WASHED OUT WITH CITY WATER AT THAT TIME & SEDIMENT RESIDUE WAS (RINSED) WASHED AND SCRAPED OUT AT THAT TIME.
	- RECHARGE OF THE SUMP HAS BEEN SLOW SINCE THAT TIME SO NOT MUCH SEDIMENT HAS collected yet. AN ADDITIONAL GLASS/ JAR WAS collected BY REMOVING MAXIMUM AMOUNT OF water from sump by in place pump – then Agitatin sediment as much as possible (sediment has tendan to easily flocculate) / I collected this sediment laddened water for possible sediment ANAlysis.
	- Also noted prior to sampling / a waxy-like surface scum on the water which readily broke-up during sampling.
	- the sump is Routinely kept covered excep for periodic cleaning.
	- the sump did not have any type of chemical ODOR

5-164

Date Abated By

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1　　　　RESULTS OF EXAMINATION　　　　FINAL REPORT

SAMPLE ID: 890356　　SAMPLE RECEIVED:89/02/01/　　CHARGE: 27.50
PROGRAM: 110:STATE SUPERFUND ANALYTICAL SERVICES
SOURCE ID:　　DRAINAGE BASIN:03　　GAZETTEER CODE:3152
POLITICAL SUBDIVISION:LEWISTON　　COUNTY:NIAGARA
LATITUDE: .　　LONGITUDE: .　　Z DIRECTION:
LOCATION: TOWN OF LEWISTON
DESCRIPTION:R. WOOD, 1179 JARRET DR.,BASEMENT SUMP
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: VOL3:PURGEABLES - HALOGENATED AND AROMATICS
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 89/01/31 10:50　　DATE PRINTED:89/02/10

ANALYSIS: VH05021　　VOLATILE HALOGENATED ORGANICS (DEC 310-29)
DATE REPORTED: 89/02/08　　REPORT MAILED OUT

-----------PARAMETER-----------	----------RESULT----------
CHLOROMETHANE	< 0.5 MCG/L
BROMOMETHANE	< 0.5 MCG/L
VINYL CHLORIDE	< 0.5 MCG/L
DICHLORODIFLUOROMETHANE (FREON-12)	< 0.5 MCG/L
CHLOROETHANE	< 0.5 MCG/L
METHYLENE CHLORIDE (DICHLOROMETHANE)	< 0.5 MCG/L
TRICHLOROFLUOROMETHANE (FREON-11)	< 0.5 MCG/L
1,1-DICHLOROETHENE	< 0.5 MCG/L
1,1-DICHLOROETHANE	< 0.5 MCG/L
TRANS-1,2-DICHLOROETHENE	< 0.5 MCG/L
CIS-1,2-DICHLOROETHENE	< 0.5 MCG/L
CHLOROFORM	2. MCG/L ←
1,2-DICHLOROETHANE	< 0.5 MCG/L
DIBROMOMETHANE	< 0.5 MCG/L
1,1,1-TRICHLOROETHANE	< 0.5 MCG/L
CARBON TETRACHLORIDE	< 0.5 MCG/L
BROMODICHLOROMETHANE	< 0.5 MCG/L
2,3-DICHLOROPROPENE	< 0.5 MCG/L
1,2-DICHLOROPROPANE	< 0.5 MCG/L
TRANS-1,3-DICHLOROPROPENE	< 0.5 MCG/L
TRICHLOROETHENE	< 0.5 MCG/L
1,3-DICHLOROPROPANE	< 0.5 MCG/L
DIBROMOCHLOROMETHANE	< 0.5 MCG/L
CIS-1,3-DICHLOROPROPENE	< 0.5 MCG/L
1,1,2-TRICHLOROETHANE	< 0.5 MCG/L
1,2-DIBROMOETHANE	< 0.5 MCG/L
2-CHLOROETHYLVINYL ETHER	< 0.5 MCG/L
BROMOFORM	< 0.5 MCG/L
1,1,1,2-TETRACHLOROETHANE	< 0.5 MCG/L
1,2,3-TRICHLOROPROPANE	< 0.5 MCG/L

**** CONTINUED ON NEXT PAGE ****

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RONALD TRAMONTANO, PE
BUR. ENVIRONMENTAL EXPOSURE INVESTIGAT.
NY STATE DEP'T. HEALTH
11 UNIVERSITY PLACE
ALBANY, NY 12237　INTERAGENCY MAIL

SUBMITTED BY:DICKY

SAMPLE ID: 890356 SAMPLE RECEIVED:89/02/01/ CHARGE: 27.50
POLITICAL SUBDIVISION:LEWISTON COUNTY:NIAGARA
LOCATION: TOWN OF LEWISTON
TIME OF SAMPLING: 89/01/31 10:50 DATE PRINTED:89/02/10

PARAMETER	RESULT
1,1,2,2-TETRACHLOROETHANE	< 0.5 MCG/L
TETRACHLOROETHENE	< 0.5 MCG/L
PENTACHLOROETHANE	< 0.5 MCG/L
1-CHLOROCYCLOHEXENE-1	< 0.5 MCG/L
CHLOROBENZENE	< 0.5 MCG/L
BIS(2-CHLOROETHYL)ETHER	< 0.5 MCG/L
1,2-DIBROMO-3-CHLOROPROPANE	< 0.5 MCG/L
BROMOBENZENE	< 0.5 MCG/L
O-CHLOROTOLUENE	< 0.5 MCG/L
BIS(2-CHLOROISOPROPYL)ETHER	< 0.5 MCG/L
1,3-DICHLOROBENZENE	< 0.5 MCG/L
1,2-DICHLOROBENZENE	< 0.5 MCG/L
1,4-DICHLOROBENZENE	< 0.5 MCG/L

ANALYSIS: 5031 AROMATIC PURGEABLES, EPA METHOD 503.1 (DES 310-22)
DATE PRINTED: 89/02/10 FINAL REPORT

PARAMETER	RESULT
BENZENE	< 5. MCG/L
TOLUENE	< 5. MCG/L
ETHYLBENZENE	< 5. MCG/L
P-XYLENE	< 5. MCG/L
M-XYLENE	< 5. MCG/L
O-XYLENE	< 5. MCG/L
CUMENE	< 5. MCG/L
STYRENE	< 5. MCG/L
P-BROMOFLUOROBENZENE	< 5. MCG/L
N-PROPYLBENZENE	< 5. MCG/L
TERT-BUTYLBENZENE	< 5. MCG/L
O/P-CHLOROTOLUENE	< 5. MCG/L
M-CHLOROTOLUENE	< 5. MCG/L
1,3,5-TRIMETHYLBENZENE	< 5. MCG/L
1,2,4-TRIMETHYLBENZENE	< 5. MCG/L
P-CYMENE	< 5. MCG/L
CYCLOPROPYLBENZENE	< 5. MCG/L
SEC-BUTYLBENZENE	< 5. MCG/L
N-BUTYLBENZENE	< 5. MCG/L
2,3-BENZOFURAN	< 5. MCG/L
HEXACHLOROBUTADIENE (C-46)	< 5. MCG/L
1,2,4-TRICHLOROBENZENE	< 5. MCG/L
NAPHTHALENE	< 5. MCG/L
1,2,3-TRICHLOROBENZENE	< 5. MCG/L
PH OF AROMATIC ALIQUOT	4

**** CONTINUED ON NEXT PAGE ****

SAMPLE ID: 890356 SAMPLE RECEIVED:89/02/01/ CHARGE: 27.50
POLITICAL SUBDIVISION:LEWISTON COUNTY:NIAGARA
LOCATION: TOWN OF LEWISTON
TIME OF SAMPLING: 89/01/31 10:50 DATE PRINTED:89/02/10

FOLLOWING PARAMETERS NOT PART OF TEST PATTERN

ANALYSIS: KET KETONES - PURGE & TRAP TECHNIQUE (DES 310-25)
DATE REPORTED: 89/02/08 REPORT MAILED OUT

-----------PARAMETER-----------	----------RESULT----------
2-BUTANONE (METHYL ETHYL KETONE)	< 10. MCG/L
4-METHYL-2-PENTANONE (MIBK)	< 10. MCG/L
ACETONE	63. MCG/L [EE]
METHYL TERT BUTYL ETHER	8. MCG/L [PL]

FOLLOWING PARAMETERS NOT PART OF TEST PATTERN

ANALYSIS: XPEST-PCB ORGANOCHLORINE PESTICIDES & PCB'S (DES310-2)
DATE PRINTED: 89/02/10 FINAL REPORT

-----------PARAMETER-----------	----------RESULT----------
HCH,ALPHA	< 0.04 MCG/L
HCH,BETA	< 0.04 MCG/L
HCH,GAMMA (LINDANE)	< 0.04 MCG/L
HCH,DELTA	< 0.04 MCG/L
HEPTACHLOR	0.05 MCG/L [PL]
ALDRIN	< 0.02 MCG/L
HEPTACHLOR EPOXIDE	< 0.05 MCG/L
ENDOSULFAN I	< 0.05 MCG/L
4,4'-DDE	0.05 MCG/L [PL]
DIELDRIN	< 0.02 MCG/L
ENDRIN	< 0.02 MCG/L
4,4'-DDD	0.05 MCG/L [PL]
ENDOSULFAN II	< 0.05 MCG/L
ENDRIN ALDEHYDE	< 0.02 MCG/L
ENDOSULFAN SULFATE	< 0.05 MCG/L
4,4'-DDT	< 0.05 MCG/L
METHOXYCHLOR	< 1.0 MCG/L
TOXAPHENE	< 1.0 MCG/L
CHLORDANE	< 0.1 MCG/L
MIREX	< 0.05 MCG/L
PCB,AROCLOR 1221	< 0.05 MCG/L
PCB,AROCLOR 1016/1242	< 0.05 MCG/L
PCB,AROCLOR 1248	< 0.05 MCG/L
PCB,AROCLOR 1254	0.56 MCG/L
PCB,AROCLOR 1260	< 0.05 MCG/L

**** END OF REPORT ****

WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION INTERIM REPOR

SAMPLE ID: 890357 SAMPLE RECEIVED:89/02/01/ CHARGE: 27.5
PROGRAM: 110:STATE SUPERFUND ANALYTICAL SERVICES
SOURCE ID: DRAINAGE BASIN:03 GAZETTEER CODE:3152
POLITICAL SUBDIVISION:LEWISTON COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: TOWN OF LEWISTON
DESCRIPTION:J. MUSCATELLO, 1176 JARRET DR.,BASEMENT SUMP
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: AQUEOUS-1:VOLATILES,KETONES,PESTICIDES,PCB'S,PRIORITY POLLU
SAMPLE TYPE: 250:GROUND WATER
TIME OF SAMPLING: 89/01/31 10:30 LAST ACTION DATE:89/02/0

*** THIS IS A PARTIAL REPORT, AND DATA IS ***
*** SUBJECT TO FINAL REVIEW AND REVISION. ***

ANALYSIS: VH05021 VOLATILE HALOGENATED ORGANICS (DES 310-29)
DATE REPORTED: 89/02/08 REPORT MAILED OUT

-----------PARAMETER-----------	----------RESULT----------
CHLOROMETHANE	< 0.5 MCG/L
BROMOMETHANE	< 0.5 MCG/L
VINYL CHLORIDE	< 0.5 MCG/L
DICHLORODIFLUOROMETHANE (FREON-12)	< 0.5 MCG/L
CHLOROETHANE	< 0.5 MCG/L
METHYLENE CHLORIDE (DICHLOROMETHANE)	< 0.5 MCG/L
TRICHLOROFLUOROMETHANE (FREON-11)	< 0.5 MCG/L
1,1-DICHLOROETHENE	< 0.5 MCG/L
1,1-DICHLOROETHANE	< 0.5 MCG/L
TRANS-1,2-DICHLOROETHENE	< 0.5 MCG/L
CIS-1,2-DICHLOROETHENE	< 0.5 MCG/L
CHLOROFORM	< 0.5 MCG/L
1,2-DICHLOROETHANE	< 0.5 MCG/L
DIBROMOMETHANE	< 0.5 MCG/L
1,1,1-TRICHLOROETHANE	< 0.5 MCG/L
CARBON TETRACHLORIDE	< 0.5 MCG/L
BROMODICHLOROMETHANE	< 0.5 MCG/L
2,3-DICHLOROPROPENE	< 0.5 MCG/L
1,2-DICHLOROPROPANE	< 0.5 MCG/L
TRANS-1,3-DICHLOROPROPENE	< 0.5 MCG/L
TRICHLOROETHENE	< 0.5 MCG/L
1,3-DICHLOROPROPANE	< 0.5 MCG/L
DIBROMOCHLOROMETHANE	< 0.5 MCG/L
CIS-1,3-DICHLOROPROPENE	< 0.5 MCG/L
1,1,2-TRICHLOROETHANE	< 0.5 MCG/L
1,2-DIBROMOETHANE	< 0.5 MCG/L
2-CHLOROETHYLVINYL ETHER	< 0.5 MCG/L

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RONALD TRAMONTANO, PE
BUR. ENVIRONMENTAL EXPOSURE INVESTIGAT.
NY STATE DEP'T. HEALTH
II UNIVERSITY PLACE
ALBANY, NY 12237 INTERAGENCY MAIL

SUBMITTED BY:DICKY

RESULTS OF EXAMINATION INTERIM REPORT

SAMPLE ID: 890357 SAMPLE RECEIVED:89/02/01/ CHARGE: 27.50
POLITICAL SUBDIVISION:LEWISTON COUNTY:NIAGARA
LOCATION: TOWN OF LEWISTON
TIME OF SAMPLING: 89/01/31 10:30 LAST ACTION DATE:89/02/09

*** THIS IS A PARTIAL REPORT, AND DATA IS ***
*** SUBJECT TO FINAL REVIEW AND REVISION. ***

-----------PARAMETER-----------	----------RESULT----------
BROMOFORM	< 0.5 MCG/L
1,1,1,2-TETRACHLOROETHANE	< 0.5 MCG/L
1,2,3-TRICHLOROPROPANE	< 0.5 MCG/L
1,1,2,2-TETRACHLOROETHANE	< 0.5 MCG/L
TETRACHLOROETHENE	< 0.5 MCG/L
PENTACHLOROETHANE	< 0.5 MCG/L
1-CHLOROCYCLOHEXENE-1	< 0.5 MCG/L
CHLOROBENZENE	< 0.5 MCG/L
BIS(2-CHLOROETHYL)ETHER	< 0.5 MCG/L
1,2-DIBROMO-3-CHLOROPROPANE	< 0.5 MCG/L
BROMOBENZENE	< 0.5 MCG/L
O-CHLOROTOLUENE	< 0.5 MCG/L
BIS(2-CHLOROISOPROPYL)ETHER	< 0.5 MCG/L
1,3-DICHLOROBENZENE	< 0.5 MCG/L
1,2-DICHLOROBENZENE	< 0.5 MCG/L
1,4-DICHLOROBENZENE	< 0.5 MCG/L

ANALYSIS: 5031 AROMATIC PURGEABLES, EPA METHOD 503.1 (DES 310-22)
DATE PRINTED: 89/02/10 FINISHED

-----------PARAMETER-----------	----------RESULT----------
BENZENE	< 2.5 MCG/L
TOLUENE	< 2.5 MCG/L
ETHYLBENZENE	< 2.5 MCG/L
P-XYLENE	< 2.5 MCG/L
M-XYLENE	< 2.5 MCG/L
O-XYLENE	< 2.5 MCG/L
CUMENE	< 2.5 MCG/L
STYRENE	< 2.5 MCG/L
P-BROMOFLUOROBENZENE	< 2.5 MCG/L
N-PROPYLBENZENE	< 2.5 MCG/L
TERT-BUTYLBENZENE	< 2.5 MCG/L
O/P-CHLOROTOLUENE	< 2.5 MCG/L
M-CHLOROTOLUENE	< 2.5 MCG/L
1,3,5-TRIMETHYLBENZENE	< 2.5 MCG/L
1,2,4-TRIMETHYLBENZENE	< 2.5 MCG/L
P-CYMENE	< 2.5 MCG/L
CYCLOPROPYLBENZENE	< 2.5 MCG/L
SEC-BUTYLBENZENE	< 2.5 MCG/L
N-BUTYLBENZENE	< 2.5 MCG/L
2,3-BENZOFURAN	< 2.5 MCG/L
HEXACHLOROBUTADIENE (C-46)	< 2.5 MCG/L
1,2,4-TRICHLOROBENZENE	< 2.5 MCG/L
NAPHTHALENE	< 2.5 MCG/L
1,2,3-TRICHLOROBENZENE	< 2.5 MCG/L

**** CONTINUED ON NEXT PAGE ****

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

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0551              NEW YORK STATE DEPARTMENT OF HEALTH
            WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 3                      RESULTS OF EXAMINATION                  INTERIM REPORT

SAMPLE ID:     890357       SAMPLE RECEIVED:89/02/01/          CHARGE:   27.
POLITICAL SUBDIVISION:LEWISTON                              COUNTY:NIAGARA
LOCATION:    TOWN OF LEWISTON
TIME OF SAMPLING: 89/01/31 10:30                         LAST ACTION DATE:89/02/0

             ***  THIS IS A PARTIAL REPORT, AND DATA IS   ***
             ***  SUBJECT TO FINAL REVIEW AND REVISION.   ***

 -----------PARAMETER-----------             ----------RESULT----------
 PH OF AROMATIC ALIQUOT                                5
 PH WAS NOT AS LOW AS REQUIRED BY METHOD             YES

ANALYSIS:        KET     KETONES - PURGE & TRAP TECHNIQUE (DES 310-25)
                         DATE REPORTED: 89/02/08            REPORT MAILED OUT

 -----------PARAMETER-----------             ----------RESULT----------
 2-BUTANONE (METHYL ETHYL KETONE)             < 10. MCG/L
 4-METHYL-2-PENTANONE (MIBK)                  < 10. MCG/L
 ACETONE                                      < 10. MCG/L
 METHYL TERT BUTYL ETHER                      < 10. MCG/L

ANALYSIS:  XPEST-PCB    ORGANOCHLORINE PESTICIDES & PCB'S (DES310-2)
                        DATE PRINTED: 89/02/10                          FINISHED

 -----------PARAMETER-----------             ----------RESULT----------
 HCH,ALPHA                                   < 0.04 MCG/L
 HCH,BETA                                    < 0.04 MCG/L
 HCH,GAMMA (LINDANE)                         < 0.04 MCG/L
 HCH,DELTA                                   < 0.04 MCG/L
 HEPTACHLOR                                  < 0.05 MCG/L
 ALDRIN                                      < 0.02 MCG/L
 HEPTACHLOR EPOXIDE                          < 0.05 MCG/L
 ENDOSULFAN I                                < 0.05 MCG/L
 4,4'-DDE                                    < 0.05 MCG/L
 DIELDRIN                                    < 0.02 MCG/L
 ENDRIN                                      < 0.02 MCG/L
 4,4'-DDD                                    < 0.05 MCG/L
 ENDOSULFAN II                               < 0.05 MCG/L
 ENDRIN ALDEHYDE                             < 0.02 MCG/L
 ENDOSULFAN SULFATE                          < 0.05 MCG/L
 4,4'-DDT                                    < 0.05 MCG/L
 METHOXYCHLOR                                 < 1.0 MCG/L
 TOXAPHENE                                    < 1.0 MCG/L
 CHLORDANE                                    < 0.1 MCG/L
 MIREX                                       < 0.05 MCG/L
 PCB,AROCLOR 1221                            < 0.05 MCG/L
 PCB,AROCLOR 1016/1242                       < 0.05 MCG/L
 PCB,AROCLOR 1248                            < 0.05 MCG/L
 PCB,AROCLOR 1254                            < 0.05 MCG/L
 PCB,AROCLOR 1260                            < 0.05 MCG/L
                **** CONTINUED ON NEXT PAGE ****
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SAMPLE ID:     890357       SAMPLE RECEIVED:89/02/01/         CHARGE:    27.
POLITICAL SUBDIVISION:LEWISTON                          COUNTY:NIAGARA
LOCATION:   TOWN OF LEWISTON
TIME OF SAMPLING: 89/01/31 10:30                        LAST ACTION DATE:89/02/

                  ***  THIS IS A PARTIAL REPORT, AND DATA IS   ***
                  ***  SUBJECT TO FINAL REVIEW AND REVISION.   ***

ANALYSIS:   GC-FID-A     PRIORITY POLLUTANTS*ACIDS*GC/FID RESULTS
                         DATA INCOMPLETE                          INTERIM REPOR

ANALYSIS:  GC-FID-BN     PRIORITY POLLUTANTS*BASE/NEUTRALS*GC/FID RESULTS
                         DATA INCOMPLETE                          INTERIM REPOR
                             **** END OF REPORT ****
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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 890358 SAMPLE RECEIVED:89/02/01/ CHARGE: 4.00
PROGRAM: 110:STATE SUPERFUND ANALYTICAL SERVICES
SOURCE ID: DRAINAGE BASIN: GAZETTEER CODE:3152
POLITICAL SUBDIVISION:LEWISTON COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: FIELD BLANK-WHITTAKER SITE
DESCRIPTION:WITH SAMPLE #890356+890357,DATE PREPARED 4/23/89
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: KET:KETONES IN WATER
SAMPLE TYPE: 297:FIELD BLANK / TRIP BLANK
TIME OF SAMPLING: 89/01/31 : DATE PRINTED:89/02/08

ANALYSIS: KET KETONES - PURGE & TRAP TECHNIQUE (DES 310-25)
DATE PRINTED: 89/02/08 FINAL REPORT

-----------PARAMETER-----------	-----------RESULT----------
2-BUTANONE (METHYL ETHYL KETONE)	< 10. MCG/L
4-METHYL-2-PENTANONE (MIBK)	< 10. MCG/L
ACETONE	< 10. MCG/L
METHYL TERT BUTYL ETHER	< 10. MCG/L

**** END OF REPORT ****

COPIES SENT TO: CO(2), RO(1), LPHE(2), FED( ), INFO-P( ), INFO-L( )

RONALD TRAMONTANO, PE
BUR. ENVIRONMENTAL EXPOSURE INVESTIGAT.
NY STATE DEP'T. HEALTH SUBMITTED BY:DICKY
II UNIVERSITY PLACE
ALBANY, NY 12237 INTERAGENCY MAIL

REFERENCE NO. 18

ecology and environment, inc.
195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491, TELEX 91-9183
International Specialists in the Environment

October 2, 1987

Mr. Michael Hopkins
Niagara County Department
of Health
10th and East Falls Street
Niagara Falls, New York 14302

Dear Mr. Hopkins:

On several occasions during the course of the Phase 1 investigations, E & E has contacted the Niagara County Department of Health to obtain information in regard to various characteristics of the sites under investigation. The DEC requires that all information contained in Phase 1 reports be fully documented. We ask you to review the information your department has provided, as presented in this letter, and sign this document to acknowledge that you have provided this information and that it (with any corrections or qualifications) is correct to the best of your knowledge.

Ross Steel

1) No hazardous waste is expected to be on site.
2) Groundwater is not used for irrigation within a 3-mile radius of the site.
3) Surface water within 3 miles of this site is used for commercial, industrial, and recreational purposes.
4) The drinking water intakes are upstream of site.

Dussault Foundry

1) There is no use of groundwater within 3 miles of site.
2) The surface water within 3 miles downstream of site is used for recreation (Erie Canal). *1

Town of Lockport Landfill

1) There is no use of groundwater within 3 miles of site.
2) The Erie Canal (surface water) is used for recreation near this site. *1
3) The drinking water intakes are located in the Niagara River, *2 located upstream of this site.

SKW Landfill

1) The drinking water surface intakes are located upstream of this site.
2) Groundwater is used within a 3 mile radius of this site for drinking water. * 3
3) The surface water downstream (Niagara River) is used for recreation (Maid of Mist, fishing).

Diamond Shamrock

1) There is no groundwater used within a 3 mile radius of this site.

Roblin Street

1) There is no use of groundwater within a 3 mile radius of this site, drinking or irrigation.

Electro Minerals U. S. (formerly Carborundum Bldg. 82)

1) The water supply intakes are located upstream of this site.

Frontier Bronze

1) There is no suspected hazardous waste disposal present at this site.
2) Groundwater for drinking purposes is used by a neighborhood approximately 2.5 miles to the NW, at the intersection of Pennsylvania and Witmer Road. Two families, roughly 8 people, use groundwater for drinking purposes.

Walmore Road

1) The well on site is used for irrigation. * 5
2) Approximately 1 acre of area is irrigated by this groundwater well.
3) There is no use of surface water 3 miles downstream of this site.

New York Power Authority Road Site

1) Hazardous waste is not suspected to be disposed of on site.
2) There is no land irrigated with groundwater within 3 miles of site.

I would also like you to confirm the fact that no fire official has declared any of the following sites a fire or explosion hazard: * 6

- SKW Alloys Landfill - Witmer Road, Town of Niagara.
- Dussault Foundry - Washburn Street, Lockport.
- Frontier Bronze - New Road, City of Niagara Falls.
- Staufer Chemical, North Love Canal - Town of Lewiston.

- Electro Minerals, U.S., Inc., (formerly Carobrundum Bldg. #82), Buffalo Avenue, City of Niagara Falls.
- Ross Steel Co. - Pine Avenue, Niagara Falls (now the site of the New York Power Authority water intake conduit right-of-way).
- Roblin Steel Company - Oliver Street, North Tonawanda.
- LaSalle Expressway - specifically near Love Canal.
- Diamond Shamrock, now Occidental Petroleum Corp., Ohio Street, Lockport, New York.
- Town of Lockport Landfill - East Canal Street, Lockport, New York.
- Power Authority Road Site - New Road, Lewiston, New York (across from Hyde Park Landfill).
- 64 Street South (owned by Russo Chevrolet) - 64th and Niagara Falls Blvd., Niagara Falls.
- Walmore Road, 6373 Walmore Road, Town of Wheatfield, New York.

I certify that I provided the above information to Ecology and Environment, Inc., and It is correct to the best of my knowledge.

Subject to footnotes & comments provided

Michael E Hopkins
Signature

10/7/87
Date

Please find maps enclosed to assist you in locating these sites. If you have any questions regarding the above, please contact me at 633-9881.

Thank you very much for your time and assistance in our ongoing investigations

Sincerely,

Dennis Sutton

oio

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 State	02 Site Number
NY	932034

II. SITE NAME AND LOCATION

01 Site Name (Legal, common, or descriptive name of site)	02 Street, Route No., or Specific Location Identifier
Stauffer Chemical, North Love Canal	near Cleghorn and Escarpment Drive

03 City	04 State	05 Zip Code	06 County	07 County Code	08 Cong. Dist.
Lewiston	NY		Niagara		

09 Coordinates Latitude 4 3 1 0 0 3.N Longitude 0 7 8 5 9 5 3.W

10 Type of Ownership (Check one)
[X] A. Private [ ] B. Federal ______ [ ] C. State [ ] D. County
[ ] E. Municipal [ ] F. Other ______ [ ] G. Unknown

III. INSPECTION INFORMATION

01 Date of Inspection 10 / 7 / 87 (Month Day Year)

02 Site Status [ ] Active [X] Inactive

03 Years of Operation 1930 (Beginning Year) 1952 (Ending Year) [ ] Unknown

04 Agency Performing Inspection (Check all that apply)
[ ] A. EPA [ ] B. EPA Contractor ______ (Name of Firm) [ ] C. Municipal [ ] D. Municipal Contractor ______ (Name of Firm)
[ ] E. State [X] F. State Contractor E & E* (Name of Firm) [ ] G. Other ______ (Specify)

05 Chief Inspector	06 Title	07 Organization	08 Telephone No.
Dennis Sutton	Geologist	E & E	(716) 684-8060

09 Other Inspectors	10 Title	11 Organization	12 Telephone No.
Jon Sundquist	Chemical Engineer	E & E	(716) 684-8060
			( )
			( )
			( )
			( )

13 Site Representatives Interviewed	14 Title	15 Address	16 Telephone No.
			( )
			( )
			( )
			( )
			( )

17 Access Gained By (Check one)
[X] Permission
[ ] Warrant

18 Time of Inspection 10:00

19 Weather Conditions Rain, cloudy, overcast, 55°F, 5 mph wind

IV. INFORMATION AVAILABLE FROM

01 Contact	02 Of (Agency/Organization)	03 Telephone No.
Walter E. Demick	NYSDEC	(518) 457-9538

04 Person Responsible for Site Inspection Form	05 Agency	06 Organization	07 Telephone No.	08 Date
M. Farrell		E & E	(716) 684-8060	10 / 7 / 87 (Month Day Year)

EPA Form 2070-13 (7-81)
*Ecology and Environment, Inc.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 State	02 Site Number
NY	932034

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 Physical States (Check all that apply)

[X] A. Solid
[ ] B. Powder, Fines
[ ] C. Sludge
[ ] D. Other ______ (Specify)
[ ] E. Slurry
[ ] F. Liquid
[ ] G. Gas

02 Waste Quantity at Site (Measure of waste quantities must be independent)

Tons ______
Cubic Yards 50,000
No. of Drums ______

03 Waste Characteristics (Check all that apply)

[X] A. Toxic
[ ] B. Corrosive
[ ] C. Radioactive
[X] D. Persistent
[ ] E. Soluble
[ ] F. Infectious
[ ] G. Flammable
[ ] H. Ignitable
[ ] I. Highly volatil
[ ] J. Explosive
[ ] K. Reactive
[ ] L. Incompatible
[ ] M. Not applicable

III. WASTE TYPE

Category	Substance Name	01 Gross Amount	02 Unit of Measure	03 Comments
SLU	Sludge			50,000 cubic yards of asbestos, graphite, cinders, concrete cell parts, reactor linings, scrap sulfur, scarp metal, silicon zirconium, titanium oxide, phenols, slag and fluoride-containing flux are reported to be buried on site.
OLW	Oily waste			
SOL	Solvents			
PSD	Pesticides			
OCC	Other organic chemicals			
IOC	Inorganic chemicals			
ACD	Acids			
BAS	Bases			
MES	Heavy Metals			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 Category	02 Substance Name	03 CAS Number	04 Storage/Disposal Method	05 Concentration	06 Measure of Concentrati

V. FEEDSTOCKS (See Appendix for CAS Numbers)

Category	01 Feedstock Name	02 CAS Number	Category	01 Feedstock Name	02 CAS Number
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

New York State Department of Environmental Conservation Division of Solid and Hazardous Waste, Inactive Hazardous Waste Disposal Report

E & E site inspection

USGS 7.5 Topographic Maps, Ransomville and Lewiston quadrangles

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

01 State
NY

02 Site Number
932034

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 [X] A. Groundwater Contamination — 02 [X] Observed (Date 1979) [ ] Potential [ ] Alleged
03 Population Potentially Affected Unknown — 04 Narrative Description:

Groundwater exceeds drinking water standards for sulfate and PCB.

01 [X] B. Surface Water Contamination — 02 [ ] Observed (Date) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown — 04 Narrative Description:

Groundwater discharge may be to Six Mile Creek or Fish Creek, although neither are used for drinking water.

01 [ ] C. Contamination of Air — 02 [ ] Observed (Date) [ ] Potential [ ] Alleged
03 Population Potentially Affected — 04 Narrative Description:

Low potential expected for air contamination from this site.

01 [ ] D. Fire/Explosive Conditions — 02 [ ] Observed (Date) [ ] Potential [ ] Alleged
03 Population Potentially Affected — 04 Narrative Description:

None expected.

01 [ ] E. Direct Contact — 02 [ ] Observed (Date) [ ] Potential [ ] Alleged
03 Population Potentially Affected Unknown — 04 Narrative Description:

Low potential for direct contact of waste is expected. Site is covered with soil.

01 [X] F. Contamination of Soil — 02 [ ] Observed (Date) [X] Potential [ ] Alleged
03 Area Potentially Affected 5 (Acres) — 04 Narrative Description:

The potential for soil contamination is expected to be high. The landfill is not lined and waste is in direct contact with the soil.

01 [X] G. Drinking Water Contamination — 02 [ ] Observed (Date) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown — 04 Narrative Description:

There is a potential for drinking water contamination. The Tuscarora Indian Reservation is approximately 1/2 mile to the east and wells on that reservation are used for drinking water.

01 [X] H. Worker Exposure/Injury — 02 [ ] Observed (Date) [X] Potential [ ] Alleged
03 Workers Potentially Affected Unknown — 04 Narrative Description:

The site is inactive, workers coud be exposed if adjacent land is excavated or utilities are being installed.

01 [X] I. Population Exposure/Injury — 02 [ ] Observed (Date) [X] Potential [ ] Alleged
03 Population Potentially Affected Unknown — 04 Narrative Description:

Residential area is located directly over the landfilled waste; although waste is covered with soil, there is the potential for population exposure through leachate migration.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

01 State	02 Site Number
NY	932034

II. HAZARDOUS CONDITIONS AND INCIDENTS (Cont.)

01 [X] J. Damage to Flora 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

04 Narrative Description:

The damage to flora is expected to be low. No stressed vegetation was noted upon inspection; however, one resident had difficulty growing grass for his lawn.

01 [ ] K. Damage to Fauna 02 [ ] Observed (Date ________) [ ] Potential [ ] Alleged

04 Narrative Description:

Damage to fauna is not expected, waste is not accessible to fauna.

01 [X] L. Contamination of Food Chain 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

04 Narrative Description:

The potential for food chain contamination is possible, vegetable gardens were noted at some residences.

01 [X] M. Unstable Containment of Wastes (Spills/Runoff/Standing liquids, Leaking drums) 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

03 Population Potentially Affected Unknown 04 Narrative Description:

Waste is contained in landfill ditch and covered with soil. No leachate was noted upon inspection.

01 [X] N. Damage to Offsite Property 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

04 Narrative Description:

There is a potential for offsite property damage if hazardous waste is present and leaches out of the landfill area or waste causes spalling of basement walls.

01 [X] O. Contamination of Sewers, Storm Drains, WWTPs 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

04 Narrative Description:

The potential for storm sewer contamination exists, but the canal is covered with about 1 foot of relatively impermeable soil.

01 [X] P. Illegal/Unauthorized Dumping 02 [ ] Observed (Date ________) [X] Potential [ ] Alleged

04 Narrative Description:

Site was not regulated during operation.

05 Description of Any Other Known, Potential, or Alleged Hazards

III. TOTAL POPULATION POTENTIALLY AFFECTED Unknown

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E & E site inspection October 8, 1987
Moriarty, Lawrence, 1979, USEPA Report on Love Canal Section, Lewiston, New York

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION	
01 State NY	02 Site Number 932034

II. PERMIT INFORMATION

01 Type of Permit Issued (Check all that apply)	02 Permit Number	03 Date Issued	04 Expiration Date	05 Comments
[ ] A. NPDES				
[ ] B. UIC				
[ ] C. AIR				
[ ] D. RCRA				
[ ] E. RCRA Interim Status				
[ ] F. SPCC Plan				
[ ] G. State (Specify)				
[ ] H. Local (Specify)				
[ ] I. Other (Specify)				
[X] J. None				

III. SITE DESCRIPTION

01 Storage Disposal (Check all that apply)	02 Amount	03 Unit of Measure	04 Treatment (Check all that apply)	05 Other
[ ] A. Surface Impoundment			[ ] A. Incineration	[X] A. Buildings On Site
[ ] B. Piles			[ ] B. Underground Injection	
[ ] C. Drums, Above Ground			[ ] C. Chemical/Physical	
[ ] D. Tank, Above Ground			[ ] D. Biological	
[ ] E. Tank, Below Ground			[ ] E. Waste Oil Processing	
[X] F. Landfill	50,000 - 75,000	cubic yards	[ ] F. Solvent Recovery	06 Area of Site
[ ] G. Landfarm			[ ] G. Other Recycling Recovery	
[ ] H. Open Dump			[ ] H. Other ______ (Specify)	5 Acres
[ ] I. Other ______ (Specify)				

07 Comments

IV. CONTAINMENT

01 Containment of Wastes (Check one)

[ ] A. Adequate, Secure [ ] B. Moderate [X] C. Inadequate, Poor [ ] D. Insecure, Unsound, Dangerous

02 Description of Drums, Diking, Liners, Barriers, etc.

Waste was placed in unlined excavated trench and covered with approximately 2 feet of soil.

V. ACCESSIBILITY

01 Waste Easily Accessible: [ ] Yes [X] No

02 Comments:

Waste is covered with soil; homes, roads and driveways are built over the site.

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E & E site inspection 1987

Moriarty, Lawrence, USEPA, Report on Love Canal Section, Lewiston, New York

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 State
NY

02 Site Number
932034

II. DRINKING WATER SUPPLY

01 Type of Drinking Supply (Check as applicable)	Surface	Well	02 Status: Endangered	Affected	Monitored	03 Distance to Site
Community	A. [X]	B. [X]	A. [ ]	B. [ ]	C. [X]	A 3.3; 1.0 (mi)
Non-community	D. [ ]	D. [X]	D. [ ]	E. [ ]	F. [ ]	B 0.4 (mi)

III. GROUNDWATER

01 Groundwater Use in Vicinity (Check one)

[ ] A. Only Source for Drinking

[X] B. Drinking (Other sources available) Commercial, Industrial, Irrigation (No other water sources available)

[ ] C. Commercial, Industrial, Irrigation (Limited other sources available)

[ ] D. Not Used, Unuseable

02 Population Served by Groundwater Approx. 1,000 to 3,000 (mainly on Tuscarora Indian Reservation)

03 Distance to Nearest Drinking Water well 0.4 (mi)

04 Depth to Groundwater 5-10 (ft)

05 Direction of Groundwater Flow North

06 Depth to Aquifer of Concern 10-25 (ft)

07 Potential Yield of Aquifer 15 (gpd)

08 Sole Source Aquifer [X] Yes [ ] No

09 Description of Wells (including usage, depth, and location relative to population and buildings)

Wells on Tuscarora Indian Reservation range from 25 to 100 feet deep.

10 Recharge Area

[X] Yes
[ ] No

Comments: Recharge via precipitation

11 Discharge Area

[ ] Yes
[X] No

Comments: Groundwater does discharge, however, at the nearby Niagara escarpment

IV. SURFACE WATER

01 Surface Water (Check one)

[X] A. Reservoir, Recreation, Drinking Water Source

[ ] B. Irrigation, Economically Important Resources

[ ] C. Commercial, Industrial

[ ] D. Not Currently Used

02 Affected/Potentially Affected Bodies of Water

Name:	Affected	Distance to Site
Fish Creek	[ ]	0.5 (mi)
Six Mile Creek	[ ]	0.38 (mi)
Lake Ontario, Niagara River	[ ]	7.5, 3.3 (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 Total Population Within

One (1) Mile of Site	Two (2) Miles of Site	Three (3) Miles of Site
A. 1,273 No. of Persons	B. 6,327 No. of Persons	C. 14,673 No. of Persons

02 Distance to Nearest Population 0 (mi)

03 Number of Buildings Within Two (2) Miles of Site 2,244

04 Distance to Nearest Off-Site Building 0.01 (mi)

05 Population Within Vicinity of Site (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

A housing subdivision is located directly over the waste site. A residential area is located between the site and the Town of Lewiston which is located 1.5 miles to the west. The Tuscarora Indian Reservation is located 1 mile to the east.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 State: NY

02 Site Number: 932034

VI. ENVIRONMENTAL INFORMATION

01 Permeability of Unsaturated Zone (Check one)

[ ] A. 10^{-6} - 10^{-8} cm/sec [X] B. 10^{-4} - 10^{-6} cm/sec [ ] C. 10^{-4} - 10^{-3} cm/sec [ ] D. Greater Than 10^{-3} cm/sec

02 Permeability of Bedrock (Check one)

[ ] A. Impermeable (Less than 10^{-6} cm/sec) [ ] B. Relatively Impermeable (10^{-4} - 10^{-6} cm/sec) [X] C. Relatively Permeable (10^{-2} - 10^{-4} cm/sec) [ ] D. Very Permeable (Greater than 10^{-2} cm/sec)

03 Depth to Bedrock: 10 (ft)

04 Depth of Contaminated Soil Zone: Unknown (ft)

05 Soil pH: 6.1 to 7.6

06 Net Precipitation: 4 (in)

07 One Year 24-Hour Rainfall: 2.1 (in)

08 Slope

Site Slope: 0.005 %

Direction of Site Slope: North

Terrain Average Slope: 0.008 %

09 Flood Potential

Site is in NA Year Floodplain

10 [ ] Site is on Barrier Island, Coastal High Hazard Area, Riverine Floodway

11 Distance to Wetlands (5 acre minimum)

ESTUARINE	OTHER
A. NA (mi)	B. 1 (mi)

12 Distance to Critical Habitat (of Endangered Species)

NA (mi)

Endangered Species: NA

13 Land Use in Vicinity

Distance to:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS, NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS PRIME AG LAND	AG LAND
A. 0.5 (mi)	B. 0(residential)(mi)	C. 0.01 (mi)	D. 0.01 (mi)

14 Description of Site in Relation to Surrounding Topography

This site is located along the eastern edge of Whittaker subdivision near upper Mountain Road in the Town of Lewiston, Niagara County, New York. The original north Love Canal excavation was approximately 100 feet by 2,000 feet by 10 feet and oriented in a north-south direction. The Niagara Escarpment is approximately 200 feet to the north and visible from some residences on site. The escarpment rises 235 feet from the lake plain to the north and runs in an east-west direction. Site elevation is 625 feet above sea level and slopes to the north and south. The New York Power Authority Reservation is located approximately 0.3 mile to the south. The lower Niagara River is 2.5 miles to the west. The Tuscarora Indian Reservation is adjacent to the east. Fish Creek is adjacent to the north edge of the Power Reservoir and flows west to the Niagara River. The Town of Lewiston business district is located 2 miles to the west, adjacent to the Niagara River Gorge, and the city of Niagara Falls is 3 miles to the southwest. Surrounding land is rural/semirural residential. The site is located in an area with low relief. Lake Ontario is 7.5 miles to the north.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

USGS 7.5-Minute Topographic Map, Ransomville and Lewiston, New York Quad.
Higgins, B.A., et al., Soil Survey of Niagara County, New York
Uncontrolled Hazardous Waste Site Ranking System Users Manual
Johnston, R.H., Groundwater in the Niagara Falls Area, New York
New York State Community Water Atlas
Graphical Exposure Modeling System
NYSDEC Region 9, Buffalo, New York, Wildlife Division
Tuscarora Indian Reservation, Lewiston, New York, private communication

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 State	02 Site Numbe
NY	932034

II. SAMPLES TAKEN None

Sample Type	01 Number of Samples Taken	02 Samples Sent to	03 Estimated Date Results Availab
Groundwater			
Surface Water			
Waste			
Air			
Runoff			
Spill			
Soil			
Vegetation			
Other			

III. FIELD MEASUREMENTS TAKEN

01 Type	02 Comments
Air	HNu photoionization detector, no readings above background levels

IV. PHOTOGRAPHS AND MAPS

01 Type [X] Ground [ ] Aerial

02 In Custody of Ecology and Environment
(Name of organization or individual)

03 Maps
[X] Yes
[ ] No

04 Location of Maps
New York State DEC, Region 9, Buffalo, New York

V. OTHER FIELD DATA COLLECTED (Provide narrative description of sampling activities)

In 1979 Dominion Soils Inc. collected 18 soil and water samples from borings on site. Analysis of these samples indicated a presence of sulfur, magnesium, manganese, sulfate, chloride, fluoride, nitrate, cyanide, and phenols. Also in 1979 crops were sampled from area gardens and analyzed for herbicides and pesticides. The low concentrations found in these samples were considered not to pose an environmental problem. The NCHD collected one water/sediment sample from a roadside ditch in April 1988 and two basement sump samples during January 1989.

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

E & E site inspection October 8, 1987
NYSDEC files, Region 9, Buffalo, New York
Dominion Soil Investigation Inc., 1979, Report of Lewiston Escarpment Project Report
ARO Corporation, 1979, results of food crop analysis, Whittaker subdivision

D1774

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 State
NY

02 Site Number
932034

II. CURRENT OWNER(S)

01 Name
Various residences

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)
(see photographic record, Appendix A)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

PARENT COMPANY (If applicable)

08 Name

09 D+B Number

10 Street Address (P.O. Box, RFD #, etc.)

11 SIC Code

12 City

13 State

14 Zip Code

08 Name

09 D+B Number

10 Street Address (P.O. Box, RFD #, etc.)

11 SIC Code

12 City

13 State

14 Zip Code

08 Name

09 D+B Number

10 Street Address (P.O. Box, RFD #, etc.)

11 SIC Code

12 City

13 State

14 Zip Code

08 Name

09 D+B Number

10 Street Address (P.O. Box, RFD #, etc.)

11 SIC Code

12 City

13 State

14 Zip Code

III. PREVIOUS OWNER(S) (List most recent first)

01 Name
Mrs. Whittaker

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)
Unknown

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

IV. REALTY OWNER(S) (If applicable, list most recent first)

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Moriarty, Lawrence, 1979, USEPA Report on Love Canal section, Lewiston, New York

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION

01 State
NY

02 Site Number
932034

II. CURRENT OPERATOR (Provide if different from owner)

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

08 Years of Operation

09 Name of Owner

OPERATOR'S PARENT COMPANY (if applicable)

10 Name

11 D+B Number

12 Street Address (P.O. Box, RFD #, etc.)

13 SIC Code

14 City

15 State

16 Zip Code

III. PREVIOUS OPERATOR(s) (List most recent first; provide only if different from owner)

01 Name
Stauffer Chemical Company

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City
Westport

06 State
CT

07 Zip Code
06880

08 Years of Operation

09 Name of Owner During This Period

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

08 Years of Operation

09 Name of Owner During This Period

01 Name

02 D+B Number

03 Street Address (P.O. Box, RFD #, etc.)

04 SIC Code

05 City

06 State

07 Zip Code

08 Years of Operation

09 Name of Owner During This Period

PREVIOUS OPERATORS' PARENT COMPANIES (if applicable)

10 Name
Niagara Smelting

11 D+B Number

12 Street Address (P.O. Box, RFD #, etc.)

13 SIC Code

14 City

15 State

16 Zip Code

10 Name

11 D+B Number

12 Street Address (P.O. Box, RFD #, etc.)

13 SIC Code

14 City

15 State

16 Zip Code

10 Name

11 D+B Number

12 Street Address (P.O. Box, RFD #, etc.)

13 SIC Code

14 City

15 State

16 Zip Code

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Moriarty, Lawrence, 1979, USEPA Report on Love Canal section, Lewiston, New York
Muraoka, D., April 25, 1979, official communication to Interagency Task Force on Hazardous Waste

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 State NY	02 Site Number 932034

II. ON-SITE GENERATOR

01 Name	02 D+B Number	
03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code	
05 City	06 State	07 Zip Code

III. OFF-SITE GENERATOR(S)

01 Name Stauffer Chemical Company	02 D+B Number		01 Name	02 D+B Number	
03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code		03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code	
05 City Westport	06 State CT	07 Zip Code 06880	05 City	06 State	07 Zip Code
01 Name	02 D+B Number		01 Name	02 D+B Number	
03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code		03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code	
05 City	06 State	07 Zip Code	05 City	06 State	07 Zip Code

IV. TRANSPORTER(S)

01 Name	02 D+B Number		01 Name	02 D+B Number	
03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code		03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code	
05 City	06 State	07 Zip Code	05 City	06 State	07 Zip Code
01 Name	02 D+B Number		01 Name	02 D+B Number	
03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code		03 Street Address (P.O. Box, RFD #, etc.)	04 SIC Code	
05 City	06 State	07 Zip Code	05 City	06 State	07 Zip Code

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

D177

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT

PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 State	02 Site Number
NY	932034

II. PAST RESPONSE ACTIVITIES

01 ☐ A. Water Supply Closed 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ B. Temporary Water Supply Provided 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ C. Permanent Water Supply Provided 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ D. Spilled Material Removed 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ E. Contaminated Soil Removed 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ F. Waste Repackaged 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ G. Waste Disposed Elsewhere 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ H. On Site Burial 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ I. In Situ Chemical Treatment 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ J. In Situ Biological Treatment 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ K. In Situ Physical Treatment 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ L. Encapsulation 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ M. Emergency Waste Treatment 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ N. Cutoff Walls 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ O. Emergency Diking/Surface Water Diversion 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ P. Cutoff Trenches/Sump 02 Date ____________ 03 Agency ____________
04 Description:

01 ☐ Q. Subsurface Cutoff Wall 02 Date ____________ 03 Agency ____________
04 Description:

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 State
NY

02 Site Number
932034

II. PAST RESPONSE ACTIVITIES (Cont.)

01 [ ] R. Barrier Walls Constructed
02 Date
03 Agency
04 Description:

01 [ ] S. Capping/Covering
02 Date
03 Agency
04 Description:

01 [ ] T. Bulk Tankage Repaired
02 Date
03 Agency
04 Description:

01 [ ] U. Grout Curtain Constructed
02 Date
03 Agency
04 Description:

01 [ ] V. Bottom Sealed
02 Date
03 Agency
04 Description:

01 [ ] W. Gas Control
02 Date
03 Agency
04 Description:

01 [ ] X. Fire Control
02 Date
03 Agency
04 Description:

01 [ ] Y. Leachate Treatment
02 Date
03 Agency
04 Description:

01 [ ] Z. Area Evacuated
02 Date
03 Agency
04 Description:

01 [ ] 1. Access to Site Restricted
02 Date
03 Agency
04 Description:

01 [ ] 2. Population Relocated
02 Date
03 Agency
04 Description:

01 [ ] 3. Other Remedial Activities
02 Date
03 Agency
04 Description:

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION

01 State	02 Site Number
NY	932034

II. ENFORCEMENT INFORMATION

01 Past Regulatory/Enforcement Action [X] Yes [ ] No

02 Description of Federal, State, Local Regulatory/Enforcement Action

This site was evaluated by the USEPA in 1979. A report was written presenting results of the evaluation. The report is titled Report on Love Canal Section, Lewiston, New York by Lawrence R. Moriarty.

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Moriarty, L.R., 1979, Report on Love Canal Section, Lewiston, New York

7. REFERENCES

Aro Corporation, 1979, Crop Sample Analysis from Escarpment and Elliott Drives, Lewiston, New York.

Dominion Soil Investigation, Inc., 1979, Report of Lewiston Escarpment Project, Analysis of Subsoil Conditions, Whittaker Subdivision, Lewiston, New York.

Ecology and Environment, October 7, 1987, site inspection and photo logbook.

Federal Emergency Management Agency, 1980, National Flood Insurance Program, Flood Insurance Rate Map, Town of Lewiston, New York, Niagara County, Community-Panel No. 360502.0005B.

Henry, Chief Leo R., November 25, 1987, personal communication, Tuscarora Nation.

Higgins, B.A., P.S. Puglia, R.P. Leonard, T.D. Yoakum, W.A. Wirtz, 1972, Soil Survey of Niagara County, New York, USDA Soil Conservation Soil.

Johnston, R.H., 1964, Groundwater in the Niagara Falls Area, New York, State of New York Conservation Department, Water Resources Commission, Bulletin GW-53.

Moriarty, L.R., 1979, USEPA, Rochester Support Branch, Surveillance and Analysis Division, Report on Love Canal Section, Lewiston, New York.

Muraoka, D., April 25, 1979, personal communication, Environmental Control Administrator, Stauffer Chemical, to Peter Millock, Inter-agency Task Force on Hazardous Waste.

NYSDEC, 1986, Inactive Hazardous Waste Sites in New York State, Volume 9, Albany, New York.

USGS, 1980, 7.5-Minute Topographic Map, Ransomville and Lewiston, New York quadrangles.

APPENDIX A

PHOTOGRAPHIC RECORD

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC
E & E Job No.: ND2031

Camera: Make
SN:

Photographer: D. Sutton
Date/Time: 10/7/87 10:05
Lens: Type:
SN:
Frame No.: 1
Comments*: 1140 Escarpment Drive, on former disposal site, south side of Escarpment Drive.

Photographer: J. Sundquist
Date/Time: 10/7/87 10:05
Lens: Type:
SN:
Frame No.: 2
Comments*: 1141 Escarpment Drive, north side of street over former disposal area.

*Comments to include location

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: D. Sutton

Date/Time: 10/9/87 10:07

Lens: Type:

SN:

Frame No.: 3

Comments*: Looking north at 1135 Escarpment Drive, R.N. Lein residence.

Photographer: J. Sundquist

Date/Time: 10/9/87 10:05

Lens: Type:

SN:

Frame No.: 4

Comments*: Looking south at 1136 Escarpment Drive, Robert Arens residence.

*Comments to include location

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: J. Sundquist

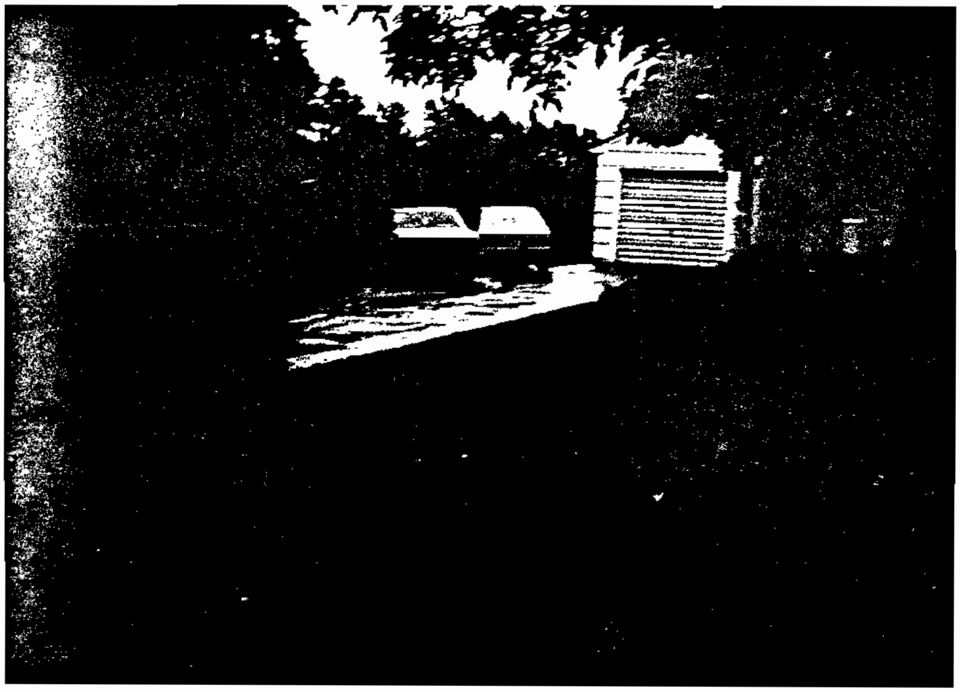
Date/Time: 10/9/87 10:09

Lens: Type:

SN:

Frame No.: 5

Comments*: Looking north at 1137 Elliott Drive, H.T. and L.F. Jones residence.



Photographer: D. Sutton

Date/Time: 10/9/87 10:10

Lens: Type:

SN:

Frame No.: 6

Comments*: Looking south at 1136 Elliott Drive.

*Comments to include location

ecology and environment, inc.

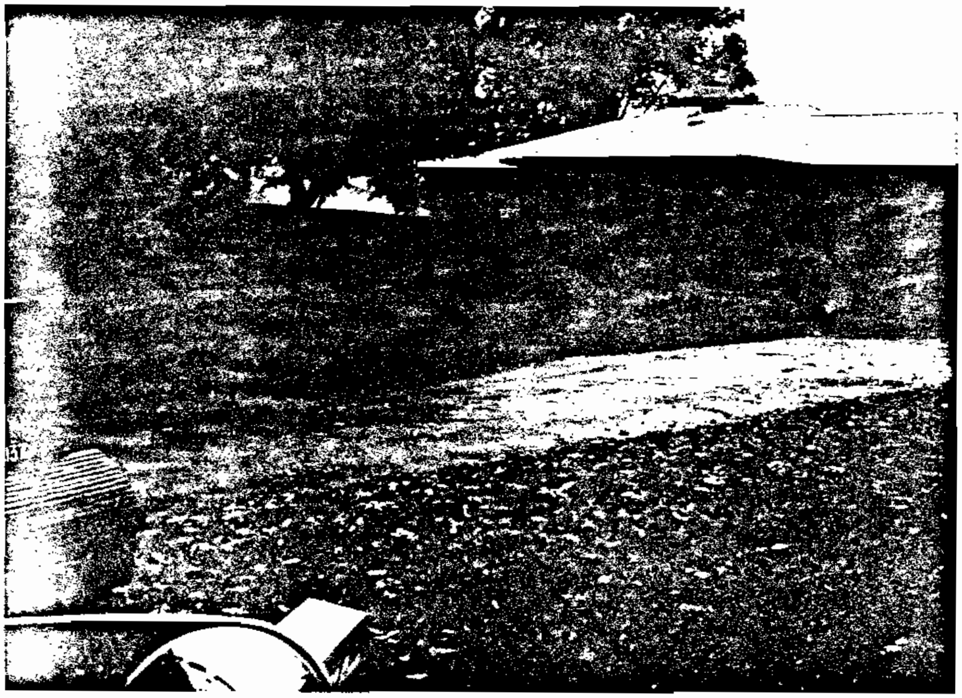
PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:



Photographer: D. Sutton

Date/Time: 10/9/87 10:11

Lens: Type:

SN:

Frame No.: 7

Comments*: Looking south at 1143 Elliott Drive, A. Incorula residence.

Photographer: J. Sundquist

Date/Time: 10/9/87 10:12

Lens: Type:

SN:

Frame No.: 8

Comments*: Looking north at 1144 Elliott Drive, Caccese residence.

*Comments to include location

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: D. Sutton

Date/Time: 10/9/87 10:13

Lens: Type:

SN:

Frame No.: 9

Comments*: Looking west at yards between Elliott and Escarpment drives from Cleghorn Drive. Disposal area within field of view. Note vegetable garden.

Photographer: J. Sundquist

Date/Time: 10/9/87 10:15

Lens: Type:

SN:

Frame No.: 10

Comments*: Looking west from Cleghorn Drive between Elliott and Jarrett drives showing yards between the streets. Disposal area within field of view.

*Comments to include location

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: D. Sutton

Date/Time: 10/9/87 10:20

Lens: Type:

SN:

Frame No.: 11

Comments*: Photo showing slight elevated grade looking west along Jarrett Drive from intersection of Jarrett and Cleghorn drives. Note rainwater runoff.

Photographer: J. Sundquist

Date/Time: 10/9/87 10:21

Lens: Type:

SN:

Frame No.: 12

Comments*: Looking south at 1176 Jarrett Drive, Muscatello residence.

*Comments to include location

D1774

ecology and environment, inc.

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: D. Sutton

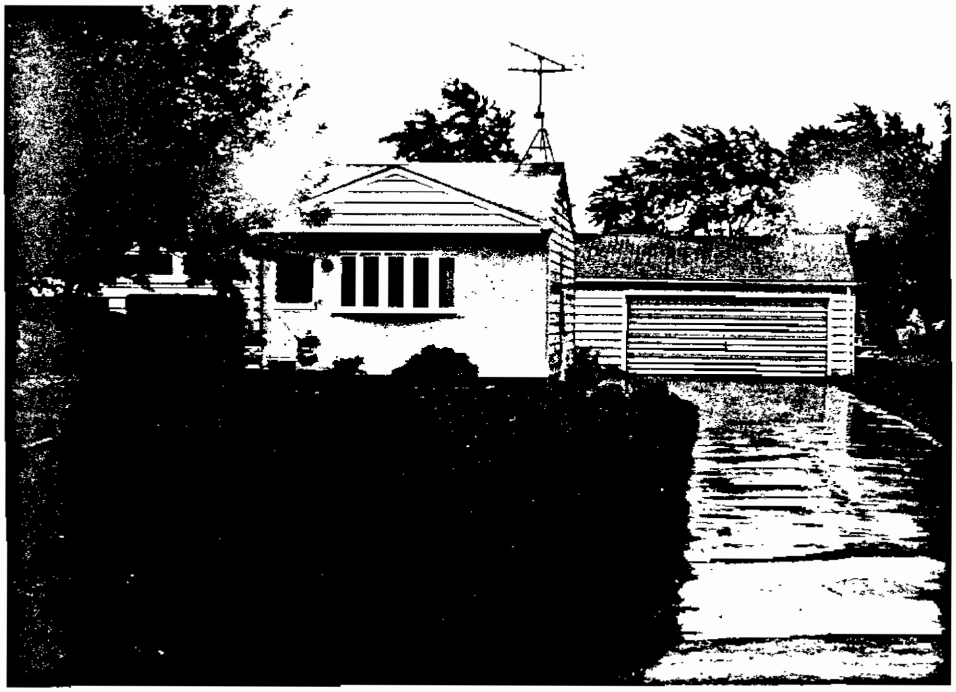
Date/Time: 10/9/87 10:22

Lens: Type:

SN:

Frame No.: 13

Comments*: Looking north at 1179 Jarrett Drive, R. Woods residence.



Photographer: J. Sundquist

Date/Time: 10/9/87 10:23

Lens: Type:

SN:

Frame No.: 14

Comments*: Looking south at 1170 Jarrett Drive.

*Comments to include location

D1774

PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:

Photographer: D. Sutton

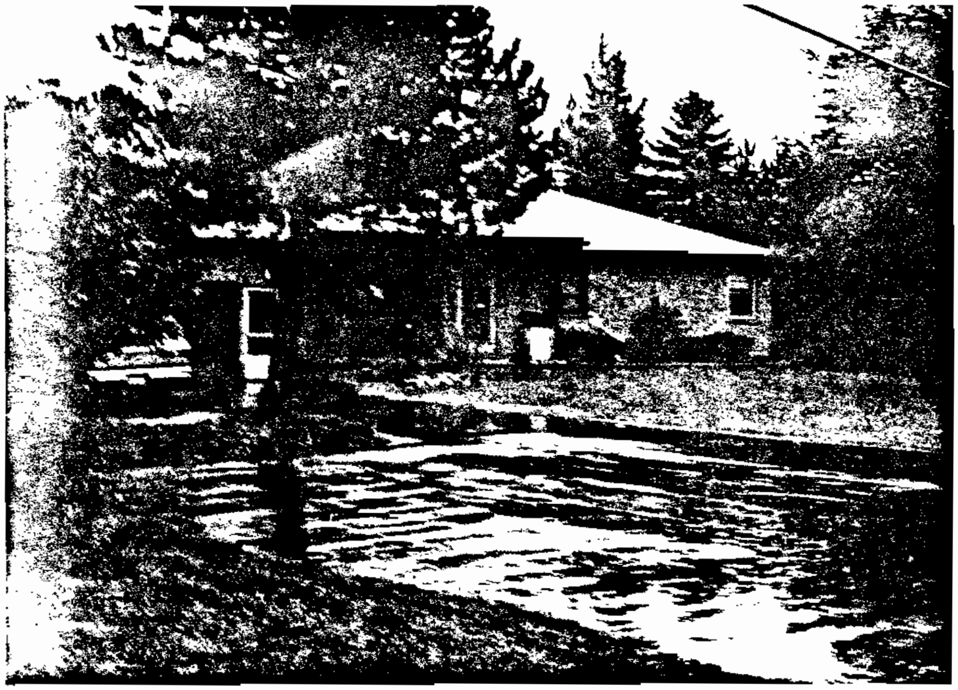
Date/Time: 10/9/87 10:24

Lens: Type:

SN:

Frame No.: 15

Comments*: Looking east toward canal excavation site along Upper Mountain Road. Note slight rise in roadway.



Photographer: J. Sundquist

Date/Time: 10/9/87 10:25

Lens: Type:

SN:

Frame No.: 16

Comments*: 1169 Upper Mountain Road, McKag residence.

*Comments to include location

ecology and environment, inc.

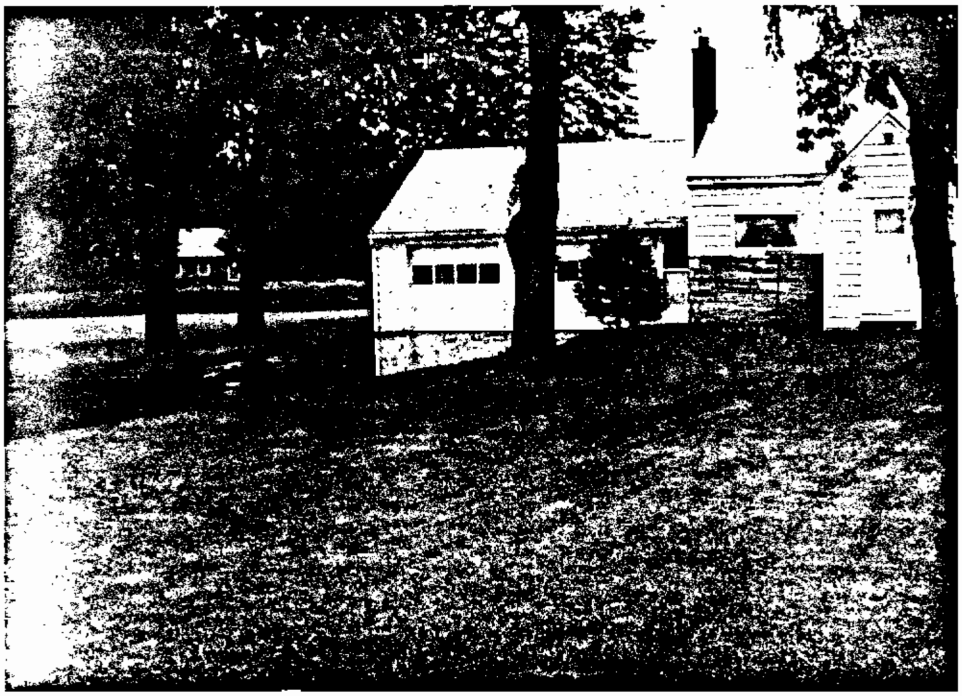
PHOTOGRAPHIC RECORD

Client: New York State DEC

E & E Job No.: ND2031

Camera: Make

SN:



Photographer: D. Sutton

Date/Time: 10/9/87 10:26

Lens: Type:

SN:

Frame No.: 17

Comments*: Photo showing 1165 Upper Mountain Road residence.

Photographer:

Date/Time:

Lens: Type:

SN:

Frame No.:

Comments*:

*Comments to include location

APPENDIX B

UPDATED NYSDEC INACTIVE HAZARDOUS WASTE DISPOSAL SITE REGISTRY FORM

47-15-11 (10/83)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF SOLID AND HAZARDOUS WASTE

INACTIVE HAZARDOUS WASTE DISPOSAL SITE REPORT

Priority Code: 2a Site Code: 932034

Name of Site: Stauffer Chemical North Love Canal Region: 9

Street Address: Near Upper Mountain Road

Town/City: Lewiston County: Niagara

Name of Current Owner of Site: various homeowners

Address of Current Owner of Site:

Type of Site: ☐ Open Dump ☐ Structure ☐ Lagoon
☒ Landfill ☐ Treatment Pond

Estimated Size: 5 acre(s)

Site Description:

Hazardous Waste Disposed: ☒ Confirmed ☐ Suspected

Type and Quantity of Hazardous Wastes Disposed:

Type	Quantity (Pounds, Drums, Tons, Gallons)
Asbestos, graphite, cinders, concrete cell	50,000 - 70,000 cubic yards
parts, reactor linings, scrap sulfur, scrap	
metal, silicon, zirconium and titanium oxides,	
phenols, slag, flux, fluorides	

Time Period Site was Used for Hazardous Waste Disposal:

__________, 1930 To __________, 1952

Owner(s) During Period of Use: Mr. Whittaker

Site Operator During Period of Use: Stauffer Chemical

Address of Site Operator: __________

Analytical Data Available: [ ] Air [ ] Surface Water [X] Groundwater
[X] Soil [ ] Sediment [ ] None

Contravention of Standards: [X] Groundwater [ ] Drinking Water
[ ] Surface Water [ ] Air

Soil Type: Silty loam

Depth to Groundwater Table: 1.1 to 12.1 feet

Legal Action: Type: __________ [ ] State [ ] Federal

Status: [ ] In Progress [ ] Completed

Remedial Action: [ ] Proposed [ ] Under Design
[ ] In Progress [ ] Completed

Nature of Action: __________

Assessment of Environmental Problems:

Contamination of soil and water.

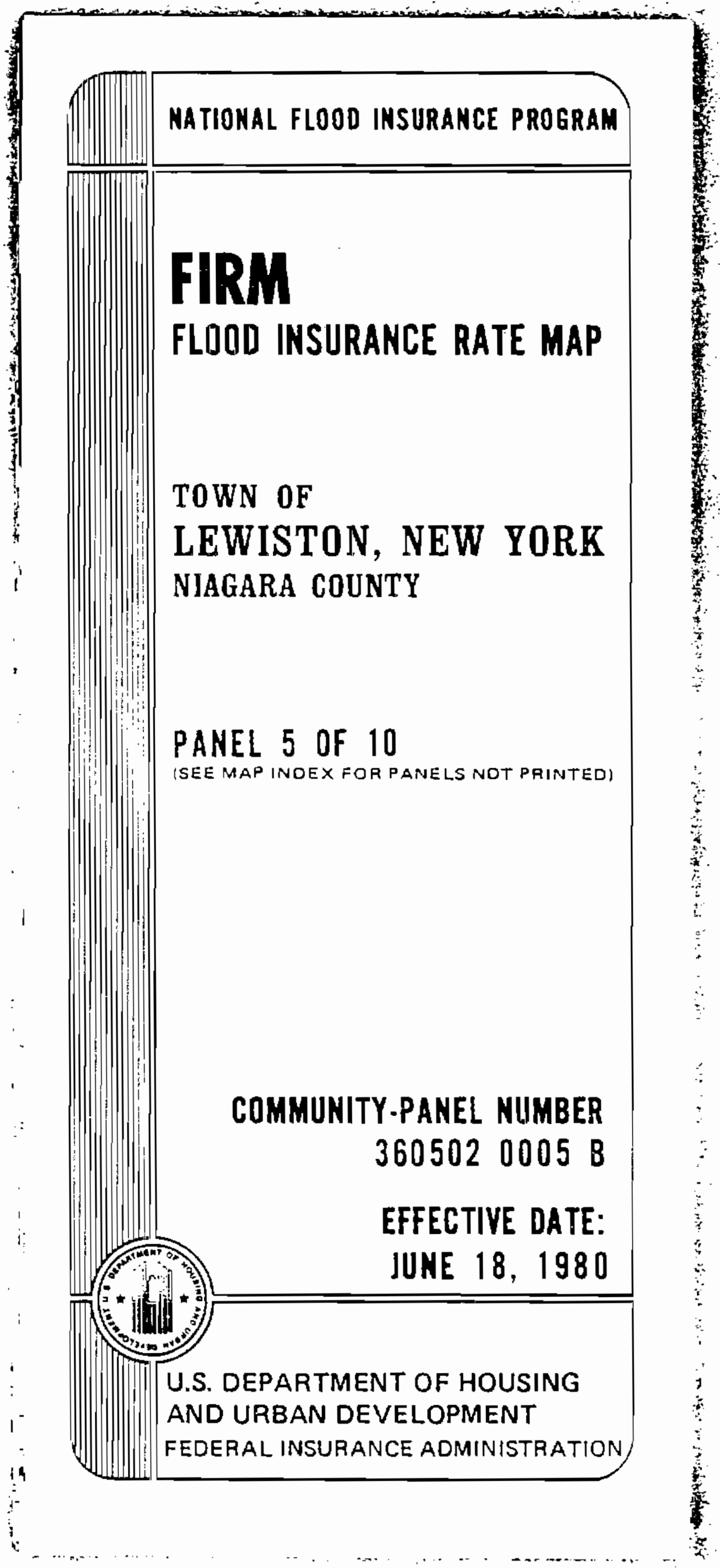
Assessment of Health Problems:

Person(s) Completing This Form:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION		NEW YORK STATE DEPARTMENT OF HEALTH	
Name:		Name:	
Title:		Title:	
Name:		Name:	
Title:		Title:	
Date:		Date:	

APPENDIX C

PHOTOCOPIED REFERENCES



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

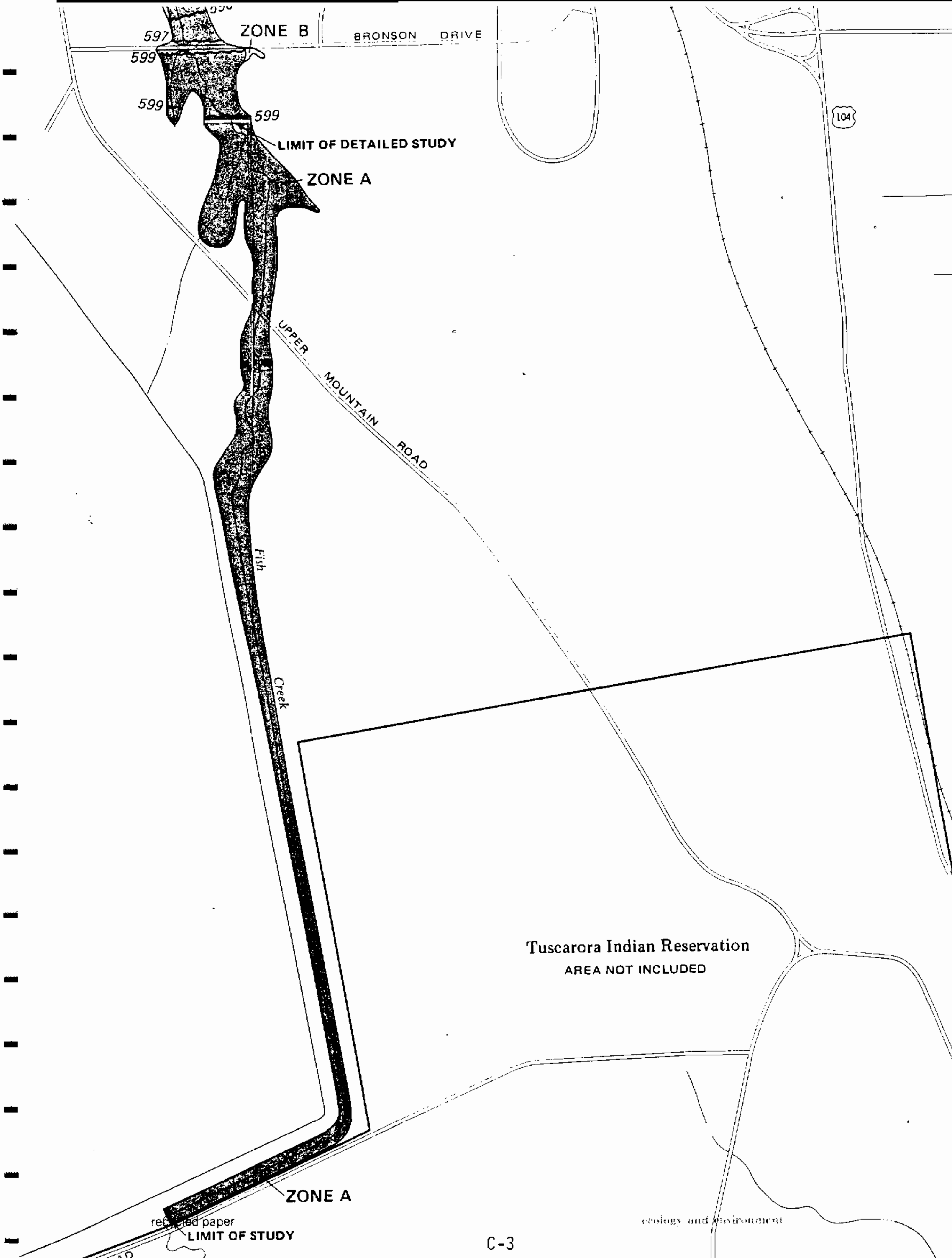
TOWN OF
LEWISTON, NEW YORK
NIAGARA COUNTY

PANEL 5 OF 10
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
360502 0005 B

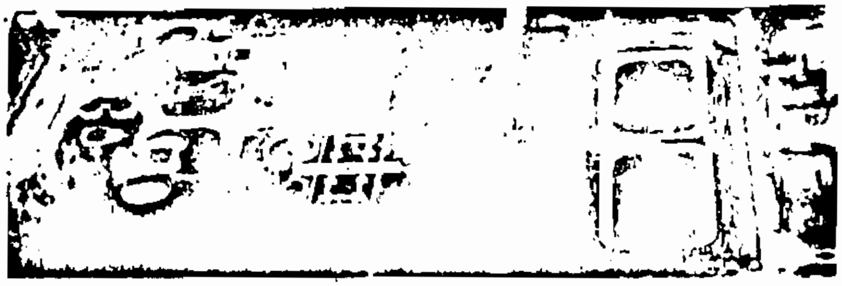
EFFECTIVE DATE:
JUNE 18, 1980

U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION


597
ZONE B
BRONSON DRIVE
599
599
599
LIMIT OF DETAILED STUDY
ZONE A
104
UPPER MOUNTAIN ROAD
Fish
Creek
Tuscarora Indian Reservation
AREA NOT INCLUDED
ZONE A
LIMIT OF STUDY

[illegible]

WATER POLLUTION CONTROL CENTER



TOWN OF LEWISTON
501 PLETCHER ROAD
LEWISTON, NEW YORK 14092
754-8291

Copy for Malinchak

DATE: January 18, 1980

TO: Honorable Supervisor, Town Board and Town Clerk

FROM: Gene H. Bidell

SUBJECT: Crop Samples from Escarpment and Elliott Drives

Enclosed is a copy of the laboratory report from Aro Corporation on the results of the pesticide/herbicide analysis on crop samples obtained by Steve Huckins from area residents.

The analytical results are expressed in parts per billion.

Please realize the last statement by Mr. Grucza refers to analytical detection limits and the samples in no way reflect high concentrations.

These low concentrations do not present an environmental problem.

This laboratory is certified by the New York State Health Department.

You may desire to forward this information to the interested parties.

GHB:eas

Enc.

cc

THE ARO CORPORATION ARO
BUFFALO DIVISION
3695 BROADWAY, BUFFALO, N.Y. 14227

TELEPHONE 716-683-0440
TELEX 9-1250

ARO No. 1132W-1225

Customer Water Pollution Control Center   Town of Lewiston, Gene Bidell

Sample: #3 Carrot; 1146 Escarpment Dr.   S. J. Huckis

Sampled By: Customer   Date Sampled: ?

Date Received: 12/21/79   Date Completed 1/10/80

ANALYTICAL RESULTS

PESTICIDES

Lindane	< 0.2 μg/L	Endrin	< 1.0 μ
Heptachlor	< 0.1 μg/L	p, p' -DDT	< 0.8 μ
Aldrin	< 0.08 μg/L	Methoxychlor	< 0.4 μ
Heptachlor Epoxide	--- μg/L	Chlordane	--- μ
Dieldrin	< 0.2 μg/L	Toxaphene	--- μ
		Mirex	< 0.8 μ

VOLATILE ORGANICS

1, 1, 2-trifluoro- 1, 2, 2-trichloroethane	μg/L	1, 1, 2-trichloroethylene	μ
Chloroform	μg/L	Dibromochloromethane	μ
1, 1, 1-trichloroethane	μg/L	Bromoform	μ
Carbon tetrachloride	μg/L	1, 2-dichloroethane	μ
Bromodichloromethane	μg/L	1, 1,2, 2-tetra- chloroethylene	μ

HERBICIDES

2, 4-D	< 2.0 μg/L	2, 4, 5-TP (Silvex)	< 2.0 μ

Note: In this case units of μg/L = μg/Kg = ppb

Bernard J. Grucza
Bernard J. Grucza, Director
Environmental Laboratory

THE ARO CORPORATION **ARO**
BUFFALO DIVISION
3695 BROADWAY, BUFFALO, N.Y. 14227

TELEPHONE 716-683-0440
TELEX 9-1230

ARO No. 1132W-1226

Customer Water Pollution Control Center   Town of Lewiston, Gene Bidell

Sample: #10; Potato; 1129 Escarpment Dr.   **Well:** Donald Ames

Sampled By: Customer   **Date Sampled:** ?

Date Received: 12/21/79   **Date Completed** 1/10/80

ANALYTICAL RESULTS

PESTICIDES

Lindane	< 0.18 $\mu g/L$	Endrin	< 0.90
Heptachlor	< 0.09 $\mu g/L$	p, p' -DDT	< 0.72
Aldrin	< 0.07 $\mu g/L$	Methoxychlor	< 0.36
Heptachlor Epoxide	--- $\mu g/L$	Chlordane	---
Dieldrin	< 0.18 $\mu g/L$	Toxaphene	---
		Mirex	< 0.72

VOLATILE ORGANICS

1, 1, 2-trifluoro-1, 2, 2-trichloroethane	$\mu g/L$	1, 1, 2-trichloroethylene	
Chloroform	$\mu g/L$	Dibromochloromethane	
1, 1, 1-trichloroethane	$\mu g/L$	Bromoform	
Carbon tetrachloride	$\mu g/L$	1, 2-dichloroethane	
Bromodichloromethane	$\mu g/L$	1, 1,2, 2-tetra-chloroethylene	

HERBICIDES

2, 4-D	< 1.8 $\mu g/L$	2, 4, 5-TP (Silvex)	< 1.8

Note: In this case units of $\mu g/L = \mu g/Kg$ = ppb

Bernard J. Gruczka
Bernard J. Gruczka, Director
Environmental Laboratory

THE ARO CORPORATION
BUFFALO DIVISION
3695 BROADWAY, BUFFALO, N.Y. 14227

ARO

TELEPHONE 716-683-0440
TELEX 9-1290

ARO No. 1132W-1227

Customer Water Pollution Control Center   Town of Lewiston, Gene Bidell

Sample: #12 Carrot; 1137 Eliot Dr.   ~~Well:~~ H. T. Jones

Sampled By: Customer   Date Sampled: ?

Date Received: 12/21/79   Date Completed 1/10/80

ANALYTICAL RESULTS

PESTICIDES

Lindane	< 0.63	μg/L	Endrin	< 3.1	μ
Heptachlor	< 0.31	μg/L	p, p' -DDT	< 2.5	μ
Aldrin	< 0.25	μg/L	Methoxychlor	< 1.3	μ
Heptachlor Epoxide	---	μg/L	Chlordane	---	μ
Dieldrin	< 0.63	μg/L	Toxaphene	---	μ
			Mirex	< 2.5	μ

VOLATILE ORGANICS

1, 1, 2-trifluoro-1, 2, 2-trichloroethane		μg/L	1, 1, 2-trichloroethylene		μ
Chloroform		μg/L	Dibromochloromethane		μ
1, 1, 1-trichloroethane		μg/L	Bromoform		μ
Carbon tetrachloride		μg/L	1, 2-dichloroethane		μ
Bromodichloromethane		μg/L	1, 1,2, 2-tetra-chloroethylene		μ

HERBICIDES

2, 4-D	< 6.3	μg/L	2, 4, 5-TP (Silvex)	< 6.3	μ

Note: In this case units of μg/L = μg/Kg=ppb

Bernard J. Grucza

Bernard J. Grucza, Director
Environmental Laboratory

Stauffer

Stauffer Chemical Company

Westport, Connecticut 06880 / Tel. (203) 222-3000 / Cable "Staufchem"

April 25, 1979

RECEIVED

APR 30 1979

OFFICE OF
GENERAL COUNSEL

Interagency Task Force on Hazardous Waste
Room 608
50 Wolf Road
Albany, New York 12233

Attention: Mr. Peter Millock

Dear Mr. Millock:

In response to your telephone inquiry of April 16, 1979 and subsequent letter of April 18, 1979, regarding the Upper Mountain Road Dumpsite, Stauffer Chemical Company offers the following:

1. What is the location of the Upper Mountain Road Dumpsite?

   To the best of our knowledge this site is a 100 foot wide strip, averaging 200 feet west of and parallel to Cleghorn Drive, bounded on the south by Upper Mountain Road and bounded on the north approximately by Escarpment Drive.

2. Who owned the site when Stauffer used it?

   Niagara Smelting, a Stauffer subsidiary, used the Upper Mountain Road Dumpsite from 1930 to 1946. Stauffer Chemical Company used the Upper Mountain Road Dumpsite from 1946 until 1952. During these periods it is our belief that the property was owned by a Mrs. Whittaker, address unknown.

   Who owns the site now?

   The site is presently a subdivision, having various personal real estate owners. Names and addresses should be available from the town of Lewiston.

3. Did any of the waste disposed by Stauffer contain any of the following: fluorides, phenols, nitrates, cyanides, sulfates and chlorides?

   To the best of our knowledge fluorides, phenols, nitrates and cyanides were not contained in any of the wastes disposed of by Stauffer.

The scrap sulfur and cinders from coal-fired boilers disposed at the site may have been contributors to the sulfates.

The cell parts, graphite and concrete may have had minor amounts of adhering chlorides and sulfates. The silicon, zirconium and titanium sands (oxides) may have contained adhering chlorides.

It is worth noting that the Upper Mountain Road Dumpsite was not controlled by Stauffer Chemical Company and anyone may have dumped there.

4. Is the location of site #62 in the Interagency Task Force on Hazardous Waste Draft Report correct?

   No. The site is the Upper Mountain Road Dumpsite and should be located as described in the response to question #1. See attached Figure 2.

   Is the Upper Mountain Road Dumpsite the northern excavation of the Love Canal?

   Yes.

5. What is the location of the PASNY site used by Stauffer Chemical Company?

   The State Power Authority Site used by Stauffer is not the site designated as #79 in the Interagency Task Force Draft Report. The site is located north of the Power Authority Forebay and is shown on attached Figure 2.

If we can be of further assistance or provide additional information, please contact us.

Sincerely,

D. Muraoka

D. Muraoka
Administrator
Environmental Control

DM/dlh
Att.