Five-Year Review Report
Love Canal Superfund Site
City of Niagara Falls
Niagara County, New York

Prepared by
U.S. Environmental Protection Agency

September 2003

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: Love Canal

EPA ID *(from WasteLAN)*: NYD000606947

Region: 2	**State:** NY	**City/County:** Niagara Falls/Niagara

SITE STATUS

NPL status: **O** Final **G** Deleted **G** Other (specify) _____

Remediation status (choose all that apply): **G** Under Construction **O** Constructed **O** Operating

Multiple OUs?* **O** YES **G** NO	**Construction completion date:** 09/29/1999

Are portions of the site and/or investigated adjacent properties in use or suitable for reuse? **O** YES **G** NO **G** N/A (site involves groundwater plume and not real property)

REVIEW STATUS

Lead agency: **O** EPA **G** State **G** Tribe **G** Other Federal Agency _____

Author name: Damian Duda

Author title: Remedial Project Manager	**Author affiliation:** EPA

Review period:** 09/29/1999 to 03/31/2003

Date of site inspection: June 12, 2003

Type of review: **G** Post-SARA **O** Pre-SARA **G** NPL-Removal only **G** Non-NPL Remedial Action Site **G** NPL State/Tribe-lead **G** Regional Discretion

Review number: **O** 1 (first) **G** 2 (second) **G** 3 (third) **G** Other (specify) _____

Triggering action:
G Actual RA Onsite Construction at OU #____ **G** Actual RA Start at OU#____
O Construction Completion **G** Previous Five-Year Review Report
G Other (specify) _____

Triggering action date *(from WasteLAN)*: 09/29/1999

Is the site protective of public health? **O** yes **G** no **G** not yet determined
Does the report include recommendation(s) and follow-up action(s)? **G** yes **O** no **G** not yet determined
Is human exposure under control? **O** yes **G** no **G** not yet determined
Is contaminated groundwater under control? **O** yes **G** no **G** not yet determined
Is the remedy protective of the environment? **O** yes **G** no **G** not yet determined

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

LIST OF IMPORTANT ACRONYMS

CDC . . . . . Centers for Disease Control
CNF . . . . . City of Niagara Falls
CERCLA . . . . . Comprehensive Environmental Response, Compensation, and Liability Act
COR . . . . . Close Out Report
DHHS . . . . . U.S. Department of Health and Human Services
DM . . . . . EPA's 1982 Decision Memorandum
DOI . . . . . U.S. Department of the Interior
EDA . . . . . Emergency Declaration Area
EMS . . . . . 1982 Environmental Monitoring at Love Canal Study
ESD . . . . . Explanation of Significant Differences
EPA . . . . . U.S. Environmental Protection Agency
FEMA . . . . . Federal Emergency Management Agency
HD . . . . . NYSDOH Decision on Habitability of the EDA
LC . . . . . Love Canal
LCARA . . . . . Love Canal Area Revitalization Agency
LCHS . . . . . 1988 Love Canal EDA Habitability Study
LCL . . . . . Love Canal Landfill
LCTF . . . . . Love Canal Leachate Collection and Treatment Facility
MATA . . . . . Maintenance and Technical Assistance Cooperative Agreement
MSRM . . . . . Miller Springs Remediation Management, Inc.
NAPL . . . . . Non-Aqueous Phase Liquid
NFBE . . . . . Niagara Falls Board of Education
NOAA . . . . . National Oceanic and Atmospheric Administration
NPL . . . . . National Priorities List
NYS . . . . . New York State
NYSDEC . . . . . New York State Department of Environmental Conservation
NYSDOH . . . . . New York State Department of Health
O&M . . . . . Operation and Maintenance
OM&M . . . . . Operation, Maintenance and Monitoring
OCC . . . . . Occidental Chemical Corporation
ORD . . . . . Office of Research and Development
PACA . . . . . Property Acquisition Cooperative Agreement
PCD . . . . . 1989 Partial Consent Decree
PCOR . . . . . Preliminary Close-Out Report
PRP . . . . . Potentially Responsible Party
RAR . . . . . Remedial Action Report
RPM . . . . . Remedial Project Manager
ROD . . . . . Record of Decision
SARA . . . . . Superfund Amendments and Reauthorization Act
TRC . . . . . Love Canal Technical Review Committee

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I. Introduction

This five-year review was conducted by Damian Duda, U.S. Environmental Protection Agency (EPA) Remedial Project Manager (RPM). This is the first five-year review for the Love Canal site (Site). This review was performed in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The purpose of a five-year review is to ensure that implemented remedies are protective of public health and the environment and that they function as intended by the decision documents. This report will become part of the Site file.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
President Carter issued the first Emergency Declaration at the Love Canal landfill (LCL).	August 1978
Construction of the LC Leachate collection system and treatment facility (LCTF)	October 1978 - December 1979
The Emergency Declaration Area (EDA) surrounding the LCL established.	May 1980
Love Canal Area Revitalization Agency (LCARA) created to revitalize the EDA.	June 18, 1980
The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted. A National Priorities List (NPL) of Superfund sites established.	December 1980
NYSDEC assumes control of LCTF from Elia Construction Company. Conestoga Rovers and Associates Remain as Consultant.	March 1981
Love Canal site proposed to the National Priorities List (NPL).	1981
EPA issued Environmental Monitoring at Love Canal study.	May 1982
EPA issued a Decision Memorandum: Cooperative Agreement with the State of New York for Love Canal, a precursor to the Superfund Record of Decision (ROD).	July 1982

EPA opened Public Information Office in Niagara Falls to manage Superfund sites in the Niagara Falls area.	September 1982
New York State Department of Environmental Conservation (NYSDEC) opened Public Information Office (PIO) in the EDA.	March 1983
EPA initiated Love Canal EDA Habitability Study (LCHS).	1983
Love Canal Superfund site was added to the NPL.	1983
Rings I and II homes and 99th Street School, surrounding and near the LCL, demolished.	June 1983
EPA established multi-agency Love Canal Technical Review Committee (TRC) [EPA, Centers for Disease Control, NYSDOH and NYSDEC].	August 1983
Collection system cleaned [high pressure] by OH Materials - NYSDEC oversight	1983
NYSDEC installed 40-acre high-density polyethylene liner cap on the LCL.	November 1984
Modifications made to the LCTF	December 1984
EPA issued ROD (I) to remediate the EDA sewers and Black Creek and Bergholtz Creek.	May 1985
Superfund Amendments and Reauthorization Act (SARA): Section 312 Provisions for Love Canal: Love Canal EDA Habitability Study (LCHS), Property Acquisition and Maintenance and Technical Assistance Cooperative Agreements (PACA/MATA).	1986
Sewer sediments' remediation.	1986-1987
Construction of new Administration Building on LCL.	1987
EPA entered into first cooperative agreement with LCARA to implement the PACA mandates of Section 312 of SARA.	June 1987
EPA issued ROD (II) to address final disposal of sewer and creek sediments.	October 1987
EPA issued ROD (III) for the 93rd Street School selected remedy [separate study].	September 1988
The NYS Commissioner of Health issued a Decision on Habitability of the EDA, determining that EDA Areas 1-3 were nonhabitable but available for commercial/industrial use and EDA Areas 4-7 were deemed habitable.	September 1988

Creek sediments remediation: 1) dewatered, 2) stabilized and 3) bagged at 93rd Street School staging facility. Previously remediated sewer sediments bagged in this operation.	1987-1989
All dewatered, stabilized and bagged sewer and creek sediments stored at Occidental Chemical Corporation's (OCC) Niagara Falls Main Plant.	1989-1998
OCC and EPA sign partial consent decree for OCC to perform part of the Love Canal cleanup activities.	May 1989
EPA entered into second cooperative agreement with LCARA to implement the MATA mandates of Section 312 of SARA.	May 1989
EPA published an Explanation of Significant Differences (ESD) to 1985 and 1987 RODs.	1989
Rehabilitated EDA Homes offered for sale by LCARA.	1990
EPA issued an amendment to the 1988 93rd Street School ROD to excavate soils and dispose of off-site.	May 1991
Programable Logic Controller (PLC) system installed at LCTF to operate field pumps, holding tank and process tanks.	Summer 1991
Collection system high pressure cleaned and videotaped with NYSDEC oversight.	November 1991
93rd Street School soils' remediation completed.	September 1992
NYSDEC closed its PIO in the EDA	March 1993
NYSDEC cost recovery settlement with OCC: $130 million.	1995
OCC begins operation of LCTF monitoring program and issuance of O&M reports.	April 1995
EPA cost recovery settlement with OCC: $129 million plus interest.	March 1996
EPA issued ESD (II), authorizing thermal treatment and/or land disposal of Love Canal waste materials at off-site commercial incinerator and landfill.	November 1996
OCC shipped bagged Love Canal wastes for final disposal.	February 1998-August 1999
EPA issued ESD (III), granting a treatability variance to OCC to permit Love Canal waste materials containing dioxin at concentrations between 1 and 10 ppb be incinerated [approved disposal to landfill].	December 1998

Preliminary Close-Out Report [construction completion]	September 1999
Bagged Love Canal wastes incineration [completed].	October 1999
Five-Year Review Site Inspection	June 2003
LCARA, as an agency of NYS, formally dissolved be NYS statute	August 27, 2003
Five-Year Review Report issued	September 2003

III. Background

Physical Characteristics

The Site is in an urban area in the southeast corner of the City of Niagara Falls (CNF), approximately 1/4 mile north of the Niagara River in Niagara County, New York (see Figure 1). Approximately 2000 people are located within a mile of the Love Canal landfill (LCL), and 10,000 people live within 3 miles. The area is served by a public water supply system; the CNF water treatment plant serves 77,000 people.

History of Contamination

The Site includes the original channel or canal [3,200 feet by 80 feet] built by William T. Love in the late 1800s for a proposed hydroelectric power project, which was subsequently abandoned. Between 1942 and 1952, the Hooker Chemicals & Plastics Corporation (now Occidental Chemical Corporation (OCC)) disposed of approximately 22,000 tons of drummed and liquid chemical wastes, including polycyclic aromatic hydrocarbons, halogenated organics, pesticides, chlororobenzenes and trichlorophenols, containing dioxin, in the abandoned canal, which subsequently became known as the Love Canal Landfill (LCL). In 1953, the LCL was covered with soil and deeded by Hooker Chemicals to the CNF Board of Education (NFBE).

Subsequently, the surrounding area near the covered LCL was extensively developed with the construction of numerous homes and an elementary school (99th Street School). Problems with odors and residues in the basements and backyards of the affected properties were first reported in the 1970's. Also, during the 1970's, unusually high precipitation in the region caused the water table within the LCL to rise, which allowed contaminants to spread laterally in surficial soils and along utility bedding, eventually seeping into the basements of nearby homes. Various studies, conducted at this time, verified that numerous toxic chemicals had migrated into the surrounding area directly adjacent to the original disposal area. Dioxin and other contaminants also migrated from the LCL to the sanitary and storm sewers which extended outside the LCL boundaries, some with outfalls into nearby Black, Bergholtz and Cayuga creeks, as well as the Niagara River. In 1978, the New York State Department of Health (NYSDOH) identified more than 80 chemicals in the LCL and adjacent soils. The two rings

of homes (239 properties), *i.e.*, those directly abutting the LCL and those areas across the street from the houses abutting the LCL, were subsequently identified as Ring I and Ring II, respectively.

Initial Response

In August 1978, further sampling prompted the New York State (NYS) Commissioner of Health to order the closure of the 99th Street School and to recommend that pregnant women and children under two years of age who lived in the Rings I and II homes evacuate the area immediately and that residents avoid the use of their basements as much as possible and avoid consuming home-grown produce. An eight-foot-high chain-link fence was installed around the LCL and the Rings I and II homes.

Also, in August 1978, President Carter issued the first of two Emergency Declarations at the Site. The first emergency declaration provided Federal funding for remedial work to contain the chemical wastes at the Site and for the relocation of the Ring I and Ring II residents.

In May 1980, President Carter issued the second Declaration of Emergency at the Site. This emergency declaration specifically established the Emergency Declaration Area (EDA) (see Figure 1), the approximately 350-acre neighborhood surrounding the LCL, and authorized $20 million of Federal funds for the purchase of homes. The Federal Emergency Management Agency (FEMA) disbursed these funds and, together with the New York State Department of Environmental Conservation (NYSDEC), relocated hundreds of the affected families. As a result, approximately 950 families, of the more than 1,050 families affected, were evacuated from a 10-square-block area surrounding the LCL.

In December 1980, the contamination problem discovered at the LCL and suspected at other sites nationwide led to Congress enacting the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to address thousands of hazardous waste sites nationwide. The law established a "Superfund" Trust Fund based on excise taxes from crude oil and certain commercially-produced chemicals. Based on state referrals, EPA began a National Priorities List (NPL) of sites requiring comprehensive cleanup.

Basis for Taking Action

Early in 1978, NYSDOH and NYSDEC contacted EPA for technical assistance. EPA and NYSDOH sampled indoor air and stream sediments, biota and water. NYSDOH also sampled sumps, and EPA evaluated ambient air and storm sewers around the LCL. This additional sampling showed significant chemical contamination in private homes adjacent to the LCL.

In 1981, EPA proposed the addition of the Site to the NPL, making it available for funding under the Superfund legislation. The Site was added to the NPL in 1983.

In 1982, the U.S. Department of Health and Human Services and NYSDOH determined that the homes in the EDA outside Ring I and Ring II could be reoccupied. This decision was based on data presented in the May 1982 Environmental Monitoring at Love Canal study, prepared by EPA's Office of Research and Development (ORD). However, because the ORD study was heavily criticized, EPA initiated additional study activities in 1983 to determine the habitability of the EDA. This effort represented the early work of what became known as the Love Canal EDA Habitability Study (LCHS), which is described below.

In addition to the investigations described above, there were other field investigations and studies conducted at the Site, which included the following:

- EPA-ORD - Environmental Monitoring at Love Canal Study (EMS) [May 1982] (evaluated the nature and extent of contamination throughout the EDA, including air, soils, surface water, sediments and biota sampling).
- Malcolm Pirie - Environmental Information Document - Site Investigations and Remedial Action Alternatives - Love Canal [October 1983] (evaluated contamination in creeks and sewers and alternatives for remediation).
- CH2M Hill - Love Canal Sewer and Creek Remedial Alternative Evaluation and Risk Assessment [March 1985] (evaluated risks posed by contamination in creeks and sewers, further evaluated alternatives for remediating the creeks and presented a proposed remedial action plan). This report represented the Feasibility Study for the May 1985 Record of Decision (ROD).
- E.C. Jordan - Long-Term Monitoring Program Design for the Love Canal Remedial Project [August 1985] (evaluated contamination in the groundwater and effectiveness of the barrier drain and cap system). Hundreds of monitoring wells were installed between 1985 and 1987.
- LCHS [May-July 1988] (evaluated indoor air and soil contamination in the EDA and comparison neighborhoods, using the developed habitability criteria).
- 93rd St. School Remedial Investigation and Feasibility Study (RI/FS) [March 1988] (evaluated the nature and extent of contamination at the 93rd St. School and alternatives for remediating this contamination).

EDA Habitability, Property Acquisition and Maintenance and Technical Assistance

In August 1983, EPA, in order to address Congressional concerns raised by the 1982 EMS, established the multi-agency Love Canal Technical Review Committee (TRC) to act as a management group to provide interagency coordination and oversight for further remedial and habitability activities for the Site. The TRC was comprised of senior-level representatives from EPA, the Centers for Disease Control, NYSDOH and NYSDEC. The principal task of the TRC was to determine the habitability of the EDA surrounding the Site. The EDA was subsequently divided into seven distinct sampling areas.

In order to insure that the criteria for habitability were technically sound and to assist in the actual development of the criteria, the TRC convened a group of scientists, consisting of experts in various fields. For the habitability criteria, the experts reviewed environmental data, executed and planned remedial measures and published and unpublished health studies. Various EPA contractors were involved in the preparation of this study, including CH2M Hill for sampling analysis, management and preparation for the report and PRC, Life Systems and ACER for peer review of the study design and final report.

The 1986 Superfund Amendments and Reauthorization Act (SARA) to CERCLA included specific provisions for the Site. These provisions were identified in Section 312 of SARA. Section 312 addressed significant program aspects of the Site, including:

- Completion of a study of the habitability of the EDA, *i.e.*, the LCHS.
- Acquisition of those properties which were not eligible for government acquisition under the FEMA acquisition program.
- Maintenance of property acquired under the FEMA and SARA acquisition programs.
- Provision of technical assistance to the LCARA[1] to facilitate their efforts to revitalize the EDA.

The LCHS was completed during May-July 1988. In September 1988, using the results of the LCHS, the NYS Commissioner of Health issued a Decision on Habitability (HD), which identified appropriate land uses for the seven designated areas of the EDA. Areas 1-3 were declared not suitable for residential use, *i.e.*, nonhabitable, but were suitable for commercial/industrial use. Areas 4-7 were deemed habitable, *i.e.*, suitable for residential use.

In 1987, EPA entered into the first of two cooperative agreements with LCARA to implement the mandates of Section 312 of CERCLA. This first agreement dealt with EDA property acquisition. EPA's September 1996 Remedial Action Report for the Site under the LCARA Property Acquisition Cooperative Agreement documents the EPA property acquisition program; LCARA purchased approximately 100 properties under this EPA program and approximately 500 additional properties under the FEMA acquisition program.

In 1989, EPA entered into a second cooperative Agreement with LCARA to implement the maintenance and technical assistance (MATA) mandates of Section 312 of CERCLA. Under this MATA agreement, EPA provided LCARA with funding to maintain improved and unimproved properties in the EDA. EPA's funding for this program has terminated. While the majority of these funds were used to maintain those EDA homes slated for rehabilitation, a portion of the funds were also used to demolish EDA homes that had deteriorated to the extent that they presented safety concerns or a net loss to the overall value of the property. Over 250 homes were demolished under the MATA program. EPA's closed out LCARA's MATA grant in May 2003.

EPA's technical assistance has supported LCARA's efforts to revitalize the EDA. The offices of LCARA were located in the EDA, and LCARA's Board of Directors conducted monthly meetings in a public forum on the progress of the revitalization of the EDA. The final meeting of the LCARA Board was held in May 2000. LCARA sold approximately 260 homes in the areas slated for residential use

[1] The Love Canal Area Revitalization Agency (LCARA) was a New York State Agency which was designated as the lead agency in the rehabilitation effort of the properties in the Love Canal EDA. LCARA was abolished by the New York State legislature in June 2003, effective August 31, 2003.

and prepared a master plan for the areas slated for commercial/industrial use. LCARA, an agency of NYS, was formally abolished by NYS legislature in June 2003, to be made effective on August 31, 2003.

Records of Decision Findings

In July 1982, the EPA Region 2 Administrator issued a Decision Memorandum: Cooperative Agreement with the State of New York for Love Canal (DM); this document was a precursor to the Superfund ROD. The DM documented the work that had been performed by NYSDEC, approved additional Federal funding and identified a phased approach for conducting eight additional tasks, which included the following:

- Undertake Site containment via an expanded leachate collection system and/or other containment option.
- Investigate/remediate contamination in the north end storm and sanitary sewer system.
- Investigate/remediate contamination in Black and Bergholtz creeks.
- Investigate/remediate contamination in the south end storm sewers.
- Investigate/remediate contamination in the western sanitary sewers and life stations.
- Develop long-term monitoring to ensure the effectiveness of the cleanup activities.
- Investigate/remediate 102nd Street outfall.
- Prepare summary document with conclusions.

Please note that the original leachate collection system was not extended but was high pressure cleaned in 1983 to ensure that it continued to perform, according to specifications.

In May 1985, EPA issued a ROD with a selected remedy to remediate the sediments in the sewers and the creeks in the EDA. This ROD called for:

- hydraulically cleaning the sewers;
- dredging and hydraulically cleaning the Black Creek culverts;
- removing Black and Bergholtz creeks' sediments with dioxin concentrations exceeding one part per billion (ppb);
- construction of an on-site interim storage facility for the creek and sewer sediments; and,
- remediation of the 102nd Street outfall area. (Please note that this action was subsequently addressed under the remedial action performed on the 102nd Street Landfill Superfund site).

In October 1987, EPA issued a second ROD and selected a remedy to address the destruction and disposal of the dioxin-contaminated sediments from the sewers and creeks. The ROD called for:

- construction of an on-site facility to dewater the sewer and creek sediments and to contain the dewatered sediments;

- construction of a separate on-site facility to treat the dewatered sediments through high temperature thermal destruction;
- on-site thermal treatment of the residuals stored at the Site from the leachate treatment facility and other associated Love Canal waste materials; and,
- on-site disposal of any nonhazardous residuals from the thermal treatment or incineration process.

In 1989, EPA published an ESD to the 1985 and 1987 RODs, which specified that creek sediments were to be dewatered at creek side, placed in polyethylene bags and then transported and stored at OCC's RCRA-permitted storage buildings at its Niagara Falls Main Plant, pending high temperature thermal destruction at OCC's Niagara Falls Main Plant. In addition, other Love Canal wastes, including the sewer sediments and other remedial wastes originally targeted for thermal treatment at the Site, were also to be thermally treated at OCC's Niagara Falls Main Plant rather than at the Site. In 1989, OCC, the United States and the State of New York entered into an agreement, *i.e.*, a partial consent decree (PCD), filed in U.S. District Court, to implement this modification to the 1985 and 1987 RODs.

In November 1996, EPA issued a second ESD for the 1987 ROD. This ESD authorized thermal treatment and/or land disposal of the stored Love Canal waste materials at an off-site commercial incinerator and landfill rather than at OCC's Niagara Falls Main Plant. In December 1998, EPA issued a third ESD which provided notice that EPA was granting a treatability variance to OCC to eliminate the requirement that the stored Love Canal waste materials containing dioxin at concentrations between 1 and 10 ppb be incinerated. As a result of this variance, these materials could be disposed at a commercial hazardous waste landfill without treatment.

In September 1988, EPA issued a third ROD for the Site, which selected a remedy for contaminated soils at the 93rd Street School. The selected remedy included the following actions:

- excavation of approximately 7500 cubic yards of contaminated soil adjacent to the school;
- on-site solidification and stabilization of the contaminated soils; and,
- return of the stabilized soils to the excavated area.

After the issuance of the 1988 ROD, the NFBE raised concerns that leaving the treated soils on-site would limit its options for reuse of the property. In May 1991, EPA issued an amendment to the 1988 ROD, which modified the remedy and called for excavation and off-site disposal of the contaminated soils.

IV. Remedial Actions

Between 1978 and 1982, various remedial cleanup measures were conducted at the Site by NYSDEC. As indicated above, these specific remedial activities were formally memorialized and documented by EPA in its 1982 DM. The DM was a precursor to the ROD and also identified necessary further remedial measures. These future cleanup measures were specified in the various Records of Decision which were issued subsequent to EPA's DM.

Improvements to the Containment System

By June 1983, the homes in Rings I and II, adjacent to the LCL, had been demolished, as well as the nearby 99th Street School. Some of the remedial actions, specified in the July 1982 DM, were completed by 1985. In 1985, NYSDEC installed the 40-acre cap [expanding from the original 22-acres, covered by the original 3-foot clay cap], consisting of high-density polyethylene liner which was then covered by 18 inches of clean soil and seeded for grass. In December 1984, technical and structural modifications were made to the LCTF. These actions are documented in the Final Report Love Canal Remedial Action Project - Northern and Central Sectors, November 1985.

Removal of Contaminated Creek and Sewer Sediments

The remediation of the contaminated sewers was performed during 1986 and 1987. A total of 68,000 linear feet of storm and sanitary sewers were cleaned. An on-site facility was constructed to dewater sewer contaminants. From 1987 until 1989, Black and Bergholtz creeks were dredged of approximately 14,000 cubic yards of sediments. Clean soils and riprap was placed in the creek beds, and the banks were replanted with grass. These two remedial actions conformed with the portions of the 1985 ROD, requiring the removal of dioxin-contaminated sediments from the creeks and sewers. Some additional sewer cleanup work was completed in 1987. The creek work is documented in the Final Engineering Report - Love Canal Black and Bergholtz Creeks Remediation, October 1990.

Short-Term Remedial Projects

In November 1988, 10 cubic yards of dioxin-contaminated soils were removed from a location in EDA 2, identified as Lot C on 100th Street. These excavated soils were drummed and stored at the Site, prior to final disposal off-site.

In September 1993, three other short term projects were also completed: 1) the Frontier Avenue Sewer Project required excavation and disposal of contaminated pipe bedding and replacement with new pipe and bedding--excavated materials have been transported for off-site thermal treatment and/or land disposal. Also, a small section of the Frontier Avenue sewer which ran along the outskirts of the containment system was rerouted in 1992; 2) the EDA 4 Project required the excavation and disposal of a hot spot of pesticide contaminated soils in the EDA with backfill with clean soils; excavated materials were disposed of off-site; and 3) the Love Canal Cap Repair required the liner replacement and regrading of a portion of the cap. These actions are documented in the Remedial Action Report

for the Love Canal Site: EDA 4, Frontier Avenue/100th Street and the Love Canal Cap Repair, September 1993.

Interim Storage and Treatment/Disposal of Creek and Sewer Sediments and Other Love Canal Waste Materials

The treatment and disposal of the sewer and creek sediments represents the last remedial action that was completed for the Site. In 1988, concurrent with the excavation of the creek sediments by Sevenson Environmental, Inc., contractor to NYSDEC, OCC's contractor, Conestoga-Rovers & Associates Limited, received the sediments at a staging area near the 93rd St. School. At this staging area, the creek sediments were dewatered, stabilized, bagged and transported to OCC's Niagara Falls Main Plant for temporary storage in its RCRA-permitted storage buildings, awaiting thermal treatment and/or land disposal. The sewer sediments and other Love Canal wastes targeted for treatment under the 1987 ROD were also bagged and transported for storage to OCC's Niagara Falls Main Plant. A total of 15,496 bags, representing approximately 39,000 cubic yards of Love Canal waste materials, were stored at OCC's Niagara Falls Main Plant. In February 1998, OCC began shipping the bagged Love Canal wastes from its storage facilities for disposal. In August 1999, the last remaining bags of wastes were shipped for ultimate disposal, either for thermal destruction or for landfilling at facilities outside of New York State. Of these, 10,262 bags were directly land disposed in a Subtitle C facility at the Grassy Mountain Landfill, Utah. The remaining 5,234 bags were incinerated at Deer Park, Texas and Originate, Utah, prior to land disposal of the ash residue in Subtitle C facilities at Deer Park, Texas and Grassy Mountain, Utah, respectively. This Remedial Action was completed in August 1999 and is documented in the March 2000 Remedial Action Report (RAR): Final Treatment/Disposal of Love Canal Sewer and Creek Sediments and Other Remedial Wastes.

Excavation and Off-site Disposal of Contaminated Soils at the 93rd Street School Site

In 1992, the contaminated soils at the 93rd Street School were excavated; these materials were used for alternate grading material at the 102nd Street Landfill Superfund site. This remedial action was completed in September 1992 and is documented in the September 1992 Final Report for the Remediation of the 93rd Street School Site.

V. Operation, Maintenance and Monitoring

The operation, maintenance and monitoring (OM&M) of the remedial systems at the Site is to ensure that there is no off-site migration of chemical contaminants from the Site. Remedial operations first began in October 1978 with the installation of a barrier drain along the east and west sides of the south section of the LCL. The barrier drain was later extended to completely encompass the LCL. The barrier drain, designed to intercept the shallow lateral groundwater flow, consists of a trench that is 15-to-25 feet deep and 4 feet wide. Within the trench are 6-inch and 8-inch diameter perforated clay tile drains, centered in 2 feet of uniformly sized stone which is overlain to the surface with sand. Lateral trenches filled with sand were excavated perpendicular to the barrier drain in the direction of the LCL. The tile drain is graded toward a series of manholes and wet wells (PC-1A/PC-2A North/Central and

wet well 7 and 8) where the leachate is collected. The leachate is then pumped from the wet wells to two underground holding tanks (PC-3A North/Central and PC-3 South) where it is held prior to being treated at the on-site treatment facility and subsequently discharged into the CNF sanitary sewer system.

Responsibility of the OM&M of the Site was transferred from NYSDEC to OCC in April 1995. Effective July 1, 1998, OCC's responsibility at the Site have been carried out by Miller Springs Remediation Management, Inc. (MSRM), a subsidiary of Occidental Petroleum Corporation. To date, there have been eight annual reports prepared by or on behalf of OCC, which cover OM&M activities from 1995 through 2002.

MSRM now manages the day-to-day OM&M activities at the Site. NYSDEC oversees MSRM's OM&M activities and provides direction to MSRM on the scope and extent of the annual monitoring and reporting tasks, include the following: groundwater monitoring at various wells on or around the Site; groundwater elevation measurement at piezometers located around the Site; operation and maintenance of the leachate collection and treatment system; and, an annual performance assessment of the leachate collection and treatment facility (LCTF) and the barrier drain system.

The OM&M report that is completed by MSRM examines the long-term monitoring program (LAMP) that is in effect for the Site. The LAMP examines hydrogeologic and chemical data from the Site in order to evaluate the effectiveness of the containment system.

In order to cover all 206 monitoring wells in and around the Site, a different group of about 30-40 wells is sampled each year. This round-robin technique allows for the complete array of bedrock and overburden monitoring wells to be sampled over a period of years. Some wells located on-site are routinely sampled every year.

Water levels are measured through various piezometers in and around the Site. The piezometers show the overburden groundwater flow conditions. Overall, the groundwater level data shows that groundwater flow direction in the vicinity of the barrier drain is towards the barrier drain. The barrier drain is successfully capturing horizontal groundwater flow from the LCL and is also drawing groundwater from outside the drain.

Sludges and sediments (classified as non-aqueous phase liquids or NAPLs) are received from the base of the pump chambers, storage tanks and LCTF clarifier. All collected NAPL is eventually sent out to a permitted facility for incineration.

Hazardous wastes that are generated at the Site include: 1) spent carbon from the treatment process, 2) debris, filters and personal protective equipment, 3) NAPL and other sludges [from both LCL and 102nd Street Landfill] and 4) soils and debris from sampling activities. These wastes are transported to a permitted incinerator for final disposal.

NYSDEC performs yearly oversight sampling and overview of operations at the LCTF. The NYSDEC Division of Environmental Remediation presents the oversight information, including split sampling data, in an Inactive Hazardous Waste Site Operations and Maintenance Review report.

From 1996 until the present (2003), NYSDEC concluded that, for both inside and outside the containment area, that the LC remedy continues to be effective. Split sampling occurred at select monitoring wells, as chosen by NYSDEC. The 2002 data showed some contamination at or below detection limits in four monitoring wells [MW-10225C, MW-10215, MW-10270 and MW-10278], located west and southwest of the containment area. Wells were tested for volatile organic compounds (VOCs), semi-VOCs and organochlorine pesticides. Of the four wells spilt- sampled, only MW-10225C has had some historical chemical presence.

Historically, MW-10135 has been the most contaminated of the various monitoring wells on the Site and within the containment area. MW-10135 is also used as a comparison well in order to confirm that any presence of low levels of contamination in other monitoring wells is not necessarily indicative of a problem with the remedy. The 1992-2002 data from MW-10135 are shown in Table 2. The groundwater in the vicinity of this well is effectively captured by the leachate collection system.

Table 3 presents the 2002 summary of detected compounds in sampled monitoring wells. Compounds were detected during 2002 at similar concentrations to those compounds detected in previous years.

Overall, for the years 1995-2002, NYSDEC recommended some maintenance and repair corrective actions. These maintenance activities were performed by MSRM. NYSDEC found that the remedy continued to remain effective.

The 2002 OM &M Report data results show that there has been no significant change in chemical concentration conditions and that the barrier drain system is successfully capturing leachate from the Site and preventing off-site migration of contamination. Hence, monitoring results continue to confirm that the remediation and containment system, *i.e.*, the leachate collection and treatment system, is functioning properly.

In an effort to assess the performance of the MSRM in the day-to-day management of the Site operations, Table 4 reports the operational repairs made at the Site during the year.

Similar data and information have been recorded for the previous years' O&M reports. The latest O&M report provides a thorough overview of data and other information that continues to show that the LCTF is performing as designed.

Appendix B includes Figures 2 through 6 which show the extent of the groundwater sampling program for the years 1998-2002. These five figures show an areawide view of the Site and identify the locations of the select monitoring wells which were sampled, as configured both inside and outside of

the containment area. Please note, as discussed above, approximately 30-40 monitoring wells are sampled each year on a rotational basis and not all monitoring wells shown were sampled each year of the five-year period from 1998-2002.

VI. Five-Year Review

Review Process

This five-year review was conducted by Damian Duda, EPA-RPM. This review was conducted in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The agency's Five-Year Review team consisted of Damian Duda, John Malleck, Marian Olsen, Rob Alvey, George Shanahan and Mike Basile from EPA; Jerry Rider, John Strang and Brian Sadowski from NYSDEC and Ed Horn from NYSDOH.

Community Involvement

In September 1982, EPA established a satellite Public Information Office (PIO) in downtown Niagara Falls to handle the Site, as well as other EPA Superfund sites in the Niagara Falls and Buffalo, New York area. All decisions made about the Site were conducted in a public forum, especially during the development of the LCHS, which included the monthly TRC meetings, as well as expert panel meetings, which were all open to the public. Residents of the EDA were informed of each meeting and were encouraged to attend. All associated minutes, reports and other documents generated during the more than 70 TRC meetings, as well as each expert panel meeting, *et al.*, were made available to the public for review at the EPA offices in Niagara Falls. The final TRC meeting was held in 1991.

In March 1983, NYSDEC opened a Public Information Office in the EDA to address growing local public concerns. Until March 1993, the NYSDEC office remained opened on a daily basis, interacting with the local community on an as needed basis.

The offices of LCARA were also located in the EDA, and LCARA's Board of Directors conducted monthly meetings on the progress of the revitalization of the EDA in a public forum. The final meeting of the LCARA Board was held in May 2000. LCARA was formally abolished as an agency of the State of New York by the New York State Legislature on June 11, 2003. The governor signed the legislation on August 27, 2003.

Michael Basile, EPA's Community Involvement Coordinator at the EPA PIO for the Site, published notices on May 22, 2003 in both the *Niagara Gazette* and the *Buffalo News*, the local newspapers, notifying the community of the five-year review process. The notice indicated that EPA would be conducting a five-year review of the remedy for the Site to ensure that the implemented remedy remains protective of public health and the environment and is functioning as designed. It also indicated that

once the five-year review is completed, the results will be made available in the EPA Public Information Office, the local Site repository. In addition, the notice included the RPM's address, telephone number and e-mail address for questions related to the five-year review process for the Site.

Document Review

In order to provide a thorough assessment of the LC project, Appendix C at the conclusion of this report provides a list of the major documents that were produced during the roughly 20-year period of activities conducted at the Site. Many of these documents have been referenced during the preparation of this Five-Year Review report.

Monitoring and Data Review

The LC treatment system consists of clarification of the collected leachate to separate out sediments and NAPLs from the contaminated wastewater, bag filtration and carbon treatment prior to the discharge of the treated wastewater to the CNF sanitary sewer system under a permit, issued by the CNF. Any collected sludges and NAPLs are sent off-site to OCC's CNF liquids incinerator.

As part of the permit requirements, CNF and MSRM personnel completed an annual verification sampling; quarterly effluent sampling was also performed. The sample results were submitted to the CNF and Federal and State agencies; analytical results were below CNF's permitted limits for the sampled parameters during all events. The leachate collection system continued to function as designed, drawing groundwater toward the underground drain system from both the landfill and the surrounding area beyond the cap.

The effectiveness of the LC containment system has been monitored for more than 20 years. An extensive array of 206 monitoring wells currently exists around the containment area. In the past, the monitoring data have undergone significant scrutiny, especially during the LCHS. Effective containment of the disposal area was a requirement for residential use of any part of the EDA. In June 1987, the final report from the first year's monitoring data showed that the containment system was working effectively.

In 1988, in its HD, NYSDOH acknowledged that the system was working effectively. The leachate collected in the barrier drainage system is treated by an on-site activated carbon system. The treated wastewater is discharged to the CNF Wastewater Treatment Plant, according to specified discharge limitations. Other remedial wastes have been and/or are currently stored on-site for eventual incineration at OCC's liquid incinerator at OCC's Niagara Falls Main Plant or at permitted facilities outside New York State. Extensive monitoring data from the various perimeter monitoring wells, which ring the capped LCL, indicate that the containment system is working effectively. Monitoring will continue to be conducted indefinitely.

The 2002 data indicate that there was no significant change in chemical and hydrological conditions at the Site. The barrier drain is successfully capturing leachate from the Site and preventing off-site migration of chemicals. The remediation system is functioning as designed: 4,751,200 gallons of leachate were treated and discharged from the Site, of which 4,115,626 gallons of leachate were collected on-site and the remaining 635,574 gallons were pumped from the 102nd Street Landfill Superfund site. Table 5 shows the monthly volumes of groundwater treated from 1995-2002. Operations and maintenance activities in 2002 were routine in nature. The collection system has maintained inward gradients and has been effective in preventing chemical migration. The LCTF has met all conditions of the sewer use discharge permit.

Site Inspection and Availability Session

A Site visit and inspection was conducted on June 12, 2003. The Site inspection team included the following: Damian Duda (Site RPM), John Malleck (Section Chief) and Mike Basile (CIC) from EPA, Brian Sadowski and Jeff Konsella from NYSDEC, Frank Cornell, former Executive Director of LCARA and Don Tubridy and Brian Downie from MSRM, who prepare the Annual Operation and Monitoring Reports.

The Site's landfill cap and LCTF, which include the Operations and Administration Buildings, were inspected. A walk-through inspection was completed through both buildings, identifying the various segments of the collection, treatment and discharge process. It was noted that during the treatment process tour that very little sludge or NAPL is collected at this time. The bag filters are changed twice-a-year and one of the two carbon beds are changed out every other year. The entire process treats and discharges approximately 150-175 gallons per minute (gpm), up to approximately three to four millions gallons per year, as reflected in the annual O&M reports.

An original part of the 1985 ROD remedy for the Site, a Dewatering Containment Facility (DCF) was constructed to contain construction and demolition (C&D) debris. The DCF was constructed according to the required specifications and divided into two cells (A&B). As part of the original design, a full drainage collection system was constructed for the DCF. Circumstances were such that only Cell A was used for the original purpose of receiving and containing C&D material. Cell B was originally intended to receive and store the sediments excavated from Black and Bergholtz creeks; however, the processed creeks' sediments were subsequently stored at OCC's Niagara Plant, prior to off-site disposal. Cell B was then backfilled with clean fill and abandoned as a containment facility. After testing, precipitation that collected in Cell B was permitted to gravity feed to the 95th Street CNF sanitary and storm sewers. Both DCF cells were leveled in 1995/1996. Only the lower collection system in Cell A was left intact. Presently, it collects relatively clean drainage water which is subsequently discharged to a 10,000-gallon tank at the LCTF where it is pumped through the treatment process with the rest of the collected leachate. Since the drainage collection system is still operational, MSRM is requesting that this uncontaminated drainage water be discharged directly into the nearby CNF sanitary sewer and not treating and discharging it with the collected leachate through the LCTF.

Another other operational issue which was discussed was the elimination of the four sludge storage tanks near the Operations Building. Since very small quantities of sludges are currently collected, these quantities have been reducing every year, MSRM is interested in eliminating the need for these tanks to be located at the Site. Since these tanks are not currently being utilized, MSRM will contact the oversight agencies to request permission to dismantle the tanks, cut them up and dispose of the tank materials in proper disposal facilities. Also, with the removal of the tanks, the associated concrete cradles and the containment area on which the tanks are configured would also be broken up and disposed at an appropriate disposal facility. Subsequently, MSRM would further expand the greenspace around the LCTF in the area that the sludge tanks occupied. MSRM will be preparing a letter to Mr. Gerald Rider of NYSDEC, copying EPA, requesting approval for this action. This action seems appropriate, considering the very minimal sludge quantities generated through the system.

The participants also performed a walk-through across the LCL cap and inspected some of the monitoring wells and piezometers, as identified in the O&M Sampling Plan, both immediately within the Site fence line and outside the Site fence line in the EDA. The inspection team also performed a drive-through of the EDA revitalization area, assessing EDA Areas 1-7. Newly constructed senior housing was identified in EDA Area 7. The 93rd Street School site was also identified, and the remediation associated with the site was assessed. Community baseball fields are now located in the area where the 93rd Street School building once stood. The dredged creeks within EDA Areas 4 and 5 were also identified.

During the Site inspection, it was noted that there may not be an accurate count of all the monitoring wells which were extant and those which were decommissioned. Brian Downie of MSRM is going to verify the entire assay of monitoring wells and piezometers at the Site and report back to NYSDEC and EPA by the end of 2003. EPA and NYSDEC also noted that MSRM personnel had expressed some concern of instances of isolated dumping of household trash throughout various open areas in EDA 2 and 3.

On June 12, 2003 subsequent to the Site inspection, a four-hour availability session was conducted at the EPA PIO office in Niagara Falls. Two persons attended: a representative from NYSDOH and a staff person from Congresswoman Louise Slaughter's office. EPA described the latest results of the annual O&M report and presented a brief overview of the five-year review process. The attendees had no further concerns or questions.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The cap, the fence, the Site drainage system, the leachate collection and treatment system and the monitoring wells are all intact and in good repair. Monitoring wells on the Site and surrounding the Site

indicate that contaminated groundwater and NAPL releases from the LCL are being contained by the collection and treatment system. Proper institutional controls are in place.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

Toxicity

The 1985 ROD identified only one remedial action objective (RAO) for the Site: a cleanup goal of one part per billion (ppb) of dioxin in soils, derived by the Centers for Disease Control and Prevention (CDC). One ppb remains the recommended clean-up goal for dioxin, based on the Office of Solid Waste and Emergency Response (OSWER) directive, signed on April 13, 1998 (OSWER Directive 9200.4-26). During the Agency's ongoing reassessment of the dioxin cleanup standard, the cleanup goal remains one ppb. If any future modifications are made to the dioxin cleanup standard, EPA will consider any such modifications in standards, as they occur, in future Five-year Reviews for the Site.

Risk Assessment

At the time of the remedial investigation and feasibility study activities being conducted at the Site during the early 1980's, the Risk Assessment Guidances for the Superfund Program were under development. As a result, an alternative type of assessment was conducted and is briefly described below.

Sampling

In 1982, as stated in the LCHS Report, EPA requested that the U.S. Department of Health and Human Services (DHHS) evaluate samples from air, water, sediment, soil and biota for a wide range of chemical pollutants. Section 1.4 of the LCHS Report indicates that the DHHS and the National Bureau of Standards found the sampling methods were appropriate; concentrations of chemicals in the Emergency Declaration Area (excluding storm sewers) were comparable to levels detected in control areas elsewhere in Niagara Falls; concentrations of chemicals in air, water and soil in EDA (excluding storm sewers) were well below established regulatory or advisory exposure limits for those identified chemicals where guidelines exist and, by inference, for closely related compounds. In this context, levels detected were judged not to present risks to human health different from those in the control areas in Niagara Falls.

Habitability Study/Exposure Assessment

In 1983, EPA assembled a TRC to develop habitability criteria for the EDA areas. Section 2.0 of the LCHS identifies the basic goal of the habitability study to determine whether any chemicals from Love Canal have migrated or have been transported to the EDA and not to evaluate the possible significance of background chemicals from other sources. Habitable was defined as suitable for normal residential

use without any restrictions. EPA subsequently convened an expert panel that recommended using a comparison approach to determine habitability of the EDA properties. The approach was to test soil and residential indoor air samples for evidence of chemical contamination in the EDA and in comparison areas outside the EDA. The comparison areas were residential neighborhoods in western New York, at least half a mile from a known landfill, which had soils similar to that of the EDA.

Section 1.3 of the LCHS Report indicated that the initial remedial actions identified (for the Site) included containing contaminants present at the Site; limiting discharges to the groundwater, the surface water or the atmosphere; covering the landfill with a 3-foot-thick compacted clay cap to reduce infiltration of water from rain and snowmelt and to retard the formation of leachate and contaminated surface runoff; cleaning and plugging the sewers within Rings I and II and removing them from further service, preventing the spread of additional contamination from man-made pathways into nearby creeks and the Niagara River; and, the final phase of remediation addressed areas affected by chemicals that had moved off-site into the EDA sewers and creeks. These actions addressed current and potential routes of exposure and reduced potential cancer risks and non-cancer health hazards to individuals from exposures at the Site.

In September 1988, the NYS Commissioner of Health issued its Habitability Determination (HD), which identified appropriate land uses for the seven designated areas of the EDA. The HD thoroughly assessed the results of the LCHS and concluded that EDA Areas 4 through 7 met all of the habitability criteria and should be used for residential or other similar purposes. Whereas, EDA Areas 1 through 3 did not meet the criteria for habitability and, as such, were not suitable for normal residential use without remediation or cleanup of contaminated soils. EDA Areas 2 and 3 exceeded the comparison criteria for habitability although to a lesser extent than EDA Area 1. Remediation was required to make these areas as habitable as other neighborhoods in Niagara Falls. The conclusion drawn is that, at the time of the release of the LCHS final report on which NYSDOH's HD is based, EDA Areas 1 through 3 were not be considered appropriate for unrestricted residential use but may be used for other purposes (for instance, commercial or industrial) without remediation.

The LCHS incorporated exposures to a residential population based on the comparison of the residences to residences within one-half mile of the facility not impacted by the contamination. The assumptions utilized in the LCHS are not substantially different from the residential exposure assumptions currently used in EPA's risk assessment process.

Risk Conclusions

Monitoring results from an array of more than 200 monitoring wells in and around the containment area have met appropriate QA/QC guidelines. Monitoring results also indicate that the groundwater is being properly contained and that contaminated groundwater removed is being properly treated and discharged. The LCL is fenced and the landfill cap is being continually maintained. The Site remains secure from public access. The June 1987 Long-Term Monitoring Report showed that the

concentrations of various contaminants in groundwater and surface water outside of the perimeter of the containment system were at low levels or below detection.

The PCOR indicated that O&M activities, performed on an annual basis at the Site, include groundwater monitoring at select monitoring wells in and around the containment area; taking groundwater elevations at piezometers, located in and around the containment area; and, assessing the performance of the barrier drain system and the associated LCTF. The latest data results show that there has been no significant change in chemical conditions and that the barrier drain is operating successfully.

The remedial actions conducted at the Site have interrupted potential exposure pathways of direct contact (inhalation, ingestion and dermal contact) with soil, leachate and groundwater. In the absence of current exposure, a risk assessment is not necessary at this time.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

VIII. Recommendations and Follow-up Actions

This Site has ongoing operations, maintenance and monitoring activities. As expected by the decision documents, these activities are subject to routine modifications and/or adjustments. This report includes some suggested modifications and/or adjustments to these activities. Additional modifications and/or adjustments may occur in the future. However, there are no recommendations or follow-up actions necessary to protect public health or the environment.

IX. Protectiveness Statement

The implemented remedies at the Site were intended to protect public health and the environment. The leachate collection and treatment system is in good repair and in good operational order. Access to the Site is controlled within the fenced LCL, and extensive monitoring indicates that there are no exposures of contaminated materials to human or environmental receptors. Sewers and creeks were cleaned of Site contaminants, and drainage within the surface waters and sewers has contributed to their continued cleaning.

The vacant parcels of land in EDA Areas 2 and 3 are properly zoned and have deed restrictions in place to comply with the original HD, identifying commercial/industrial use only, unless remediated. These properties are currently in the process of being sold to real estate developers. EPA and

NYSDEC will review any planned development in these areas in order to ensure that the deed restrictions are enforced. EPA and NYSDEC is particularly aware of any projected development which may involve children, *e.g.*, daycare facilities and schools. At this time, EDA Areas 4 through 7 remain suitable for residential use, and Areas 1 to 3 are limited to commercial/industrial use and, as indicated above, that control is maintained by zoning and deed restrictions.

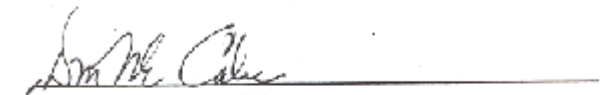
Two major surface water projects are currently underway that include the Niagara River: 1) Niagara River Toxic Management Plan and 2) the Lake Ontario Lakewide Management Plan. These two studies are being managed by a joint United States, Canada and New York State group, which includes Environment Canada, Ontario Ministry of the Environment, NYSDEC and EPA. Significant improvements have been made with additional work to come to address toxics loading into these waterways. At this time, since contaminated groundwater is being contained by the operations at the Site, there is no available scientific information to suggest that the Site is a contributing source to any degradation in the Niagara River or Lake Ontario water quality, as related to these two projects.

Currently, the remedies implemented at this Site adequately control exposures of Site contaminants to human and environmental receptors to the extent necessary for the protection of human health and the environment.

X. Next Five-Year Review

The next Five-Year Review for the Love Canal Superfund site should be completed before September 2008.

Approved:



George Pavlou, Director
Emergency and Remedial Response Division

9-30-09
Date

APPENDIX A

TABLES

Table 2

SUMMARY OF DETECTED COMPOUNDS FOR SELECTED WELLS, 1990 TO 2002
LOVE CANAL LONG-TERM MONITORING PROGRAM
OCCIDENTAL CHEMICAL CORPORATION

Well Number:	10135										
Sample Date:	08/26/1992	08/19/1993	06/22/1994	06/01/1995	06/27/1996	07/07/1997	06/17/1998	06/16/1999	06/22/2000	05/11/2001	06/12/2002
Volatiles (ug/L)											
1,1,2,2-Tetrachloroethane		12			26		94J	32/29	27J/26J	100J/120J	500U/56
1,1,2-Trichloroethane					14		29J	15/12	14J/16J	29J/34J	500U/27
1,1-Dichloroethane		15						4J/3J	4J/4J	4J/4J	500U/4J
1,2-Dichloroethene (total)	700	840			560		58J	67/70	67J/70J	60J/59J	
2-Butanone		5200							10UJ/10J	12J/11J	
2-Hexanone											500U/72
Acetone		270	100B		60		110J		28J/46J		5900/6400
Benzene			6000E	4900D	4800	5600/5000	5300J	5600/5700	6400/6900J	7600/8500J	
Carbon Disulfide								ND/2J			
Chlorobenzene	2600	1700		2000D	1500	2300/ND	1900J	1800/1900	2300J/2300J	2700J/3000J	2200/2400
Chloroform		100			110		150J	120/110	100J/130J	150J/160J	500U/160
Ethylbenzene		13					12	10J/9J	12J/12J	22J/24J	500U/15
Methylene Chloride		41			11				24J/24J		500U/39
Tetrachloroethene							40J	13/12	16J/14J	50J/61J	500U/38
Toluene	2700	1700E	21500BE	18000D	14000	19000/17000	16000J	16000/17000	21000J/21000J	22000/24000	20000J/19000
Trichloroethene		24			36		170J	70/58	60J/72J	140J/180J	130J/160
Vinyl Acetate	6800		12B								
Vinyl Chloride					50		48J	62/61	110J/85J	75J/66J	500U/48
Xylene (total)		47	10B		28		55J	43/44	42J/44J		500U/51
Semi-volatiles (ug/L)											
1,2,4-Trichlorobenzene		74	87B				78J	65J/45J	45J/36J	42J/65J	
1,2-Dichlorobenzene		35						30J/24J	22J/18J	ND/48J	
1,4-Dichlorobenzene	110	94	91					74J/61J	59J/52J	69J/110J	
2-Butanone (Methyl Ethyl Ketone)							38J		0.9J/ND		
2,4,5-Trichlorophenol		70							1J/ND		
2,4,6-Trichlorophenol								610/690	1400J/470J	620J/1200J	1500J/1800J
2,4-Dichlorophenol	1200B	420	610	150		2100/2100	2000		ND/2J		
2,4-Dimethylphenol										370J/550J	
2-Chloronaphthalene				150							
2-Chlorophenol							28J	25J/ND			
2-Methylphenol		51					55J	35J/42J	160J/ND	ND/41J	
2-Nitrophenol									ND/1J		
4-Chloro-3-methylphenol								33J/25J			
4-Methylphenol		80					130J	120/95J	99J/300J	86J/130J	
Benzoic Acid				6400D	4000	30000J/27000J	23000J	5000/4300	19000J/4700J	4400J/6200J	25000/31000
Benzyl Alcohol				380		1900/1600	2700	540/680	14000/3200J	330J/630J	1700J/2000
Bis(2-Chloroethyl)Ether		23					24J	26J/25J			
bis(2-Ethylhexyl)Phthalate		50							41J/24/J		
Dimethyl Phthalate											
Di-n-Octyl Phthalate											
Naphthalene								2000J/1400J	4000J/1800J	1100/1400	
Pentachlorophenol		52									
Phenol		96	91	140				120/96J		ND/51J	
Pesticides/PCBs (ug/L)											
4,4'-DDD								0.020J/0.21	0.071J/0.13J		
Aldrin	0.53	0.24P						0.21J/0.74JN		0.95JN/1.5JN	0.12J/0.12J
Alpha-BHC	84	42C	24CEP	28D	29	39/39	59	37J/40	50/50	43J/50J	39/43
Alpha-Chlordane											0.031J/0.017J
Beta-BHC				10D	11	8.1/8.6	12	11J/12	15/16	16J/16J	13J/14J
Delta-BHC	15	9.8P	7.5CE	4.7	5.2	ND/5.1	8.9	9.6J/11	14/13	10J/12J	9.0J/11J
Endosulfan I								0.43J/0.34		1.5JN/1.6JN	
Endosulfan II									0.52J/0.69J		
Endosulfan Sulfate		0.43P						0.17J/0.18	0.17J/0.10UJ		
Endrin			0.15P								
Gamma-BHC (Lindane)	33	19.5	20.4CE			13.2/14.8	6.5J	4.1J/5.5	8.0/6.4	5J/7.3	6.1J/7.1J
Gamma-Chlordane									0.16J/0.18J		0.34J/0.29J
Heptachlor								0.68JN/0.63			
Heptachlor epoxide								0.058J/0.043J	0.029J/0.031J		0.016J/0.025J

Notes:
B - Found in Blank
U - Non-Detected at the associated estima
C - Confirmed data.
J - Estimated Concentration.
JN - Presumptively present at the associate
D - Diluted Sampled.
E - Exceeded calibration range of the instr
P - Greater than 25% difference for detecti

Table 3

SUMMARY OF DETECTED COMPOUNDS
2002 LONG-TERM MONITORING PROGRAM
LOVE CANAL
OCCIDENTAL CHEMICAL CORPORATION

Overburden Wells	*Well*	*VOCs*	*SVOCs*	*Pesticides/PCBs*
7115	B-II	1	1	ND
7125	B-II	ND	2	ND
7130	A	ND	ND	ND
7132	A	ND	ND	ND
8106	X	ND	ND	ND
8115	B-II	ND	ND	ND
8125	B-II	ND	ND	ND
9105	B-II	ND	ND	ND
9113	B-II	ND	ND	ND
9118	A	ND	ND	ND
10135	A	5/16	8/8	3/3
10178	B-II	ND	ND	ND
		6	**11**	**3**
Bedrock Wells				
3257	X	N/M	N/M	N/M
5222	A	1	ND	ND
6209	X	ND	ND	ND
7205	A	ND	ND	ND
8210	A	ND	ND	ND
9205	A	ND	3	ND
9210	A	ND	ND	ND
10205	A	ND	ND	ND
10215	X	ND	ND	ND
10270	X	ND	ND	2
10272	A	ND	ND	ND
10278	A	2	ND	ND
10210A	A	1	ND	ND
10210B	A	1	ND	ND
10210C	A	ND	ND	ND
10225A	A	2	2	ND
10225B	A	1	ND	ND
10225C	A	1	1	ND
		9	**6**	**2**
Total # of Detections		**15**	**17**	**5**

Notes:

ND/ND = Duplicate analyses.
ND = No parameters detected at or above detection limits.
A =Annual Well
B-I = Bi-Annual Well Group I
B-II = Bi-Annual Well Group II
X = Additional Well
N/M = Not Monitored

Table 4

2002 LOVE CANAL SYSTEM REPAIRS
OCCIDENTAL CHEMICAL CORPORATION
GLENN SPRINGS HOLDINGS, INC.
MILLER SPRINGS REMEDIATION MANAGEMENT, INC.

- Replacement of Decon Containment Facility (DCF) #3 pump Starter/Level controller in the Motor Control Center (MCC).
- A slight build-up of debris (rocks and sludge) was found in Manhole 6B (Second Manhole North of PC2A) within the Northwest section of the collection system. The manhole was cleaned of debris and the drains entering the manhole were flushed.
- Repair of the three of the powered overhead doors in the Decon Drum Storage Facility (DDSF), shaft and bearings replaced in all.
- Treatment Bldg. control room HVAC repaired, switch replaced.
- An internal visual inspection of the Main Carbon Transfer Bed (V-2) was performed.
- Replacement of fiber-cast inlet nozzle of Main Carbon bed (V2) and repaired support for nozzle and distribution piping in vessel.
- Annual inspection of the back-flow preventers was performed replacement of two preventers (3/4" & 2") in treatment building.
- Replaced all (17) ventsorbs (activated carbon canisters) with new Calgon ventsorbs re-piped as needed.
- The DCF Main Storage Tank (Station #4) pump and motor replaced with a 2hp submersible pump (Gorman Rupp), re-piped to fit. Disconnect panel mounted on outside of chamber.
- Cleaned out pump chambers and storage tanks (PC1, PC2, PC3, PC1A, and PC2A & PC3A) high pressure water and vacuumed as needed. Residual in to tanker and shipped off Site for incineration.
- Clarifier's sludge removal system was activated and sludge was removed assisted via vacuum truck.
- Repaired leaking (groundwater) PC3/PC3A flow meter chamber, grouted around all of incoming/exiting piping through the walls.
- Replaced existing flow meters in PC3/PC3A chamber with Yokogawas re-piped as needed.
- Outside light fixtures were replaced on the Treatment Building. Photo sensor eyes were replaced as needed on the Administration building.

- Replace the security system in the Administration Building, including repositioning the motion detector and rewiring.
- A dike inspection of Outside Storage Tanks was performed.
- Replaced PC1A pumps with 2hp submersible pumps (Gorman Rupp), re-piped as needed. Replaced existing flow meter with a Yokogawa meter.
- Replaced PC2A pumps with 2hp submersible pumps (Gorman Rupp), re-piped as needed. Fabricated spool piece for future placement of flow meter (Yokogawa).
- Maintenance and landscaping of the Site and surrounding areas.
- Repaired leaking valves on Site's process water distribution unit.
- Installed into the process air system a new auxiliary supply connection.
- Maintenance of flowerbeds and shrubs along Colvin Blvd. and Frontier Avenue.
- Raw feed pump coupler replaced on Gould's pump.
- Replaced shrubs in front of treatment building side door.
- Cleanup of discarded debris around fence line and adjacent lots.

Table 5

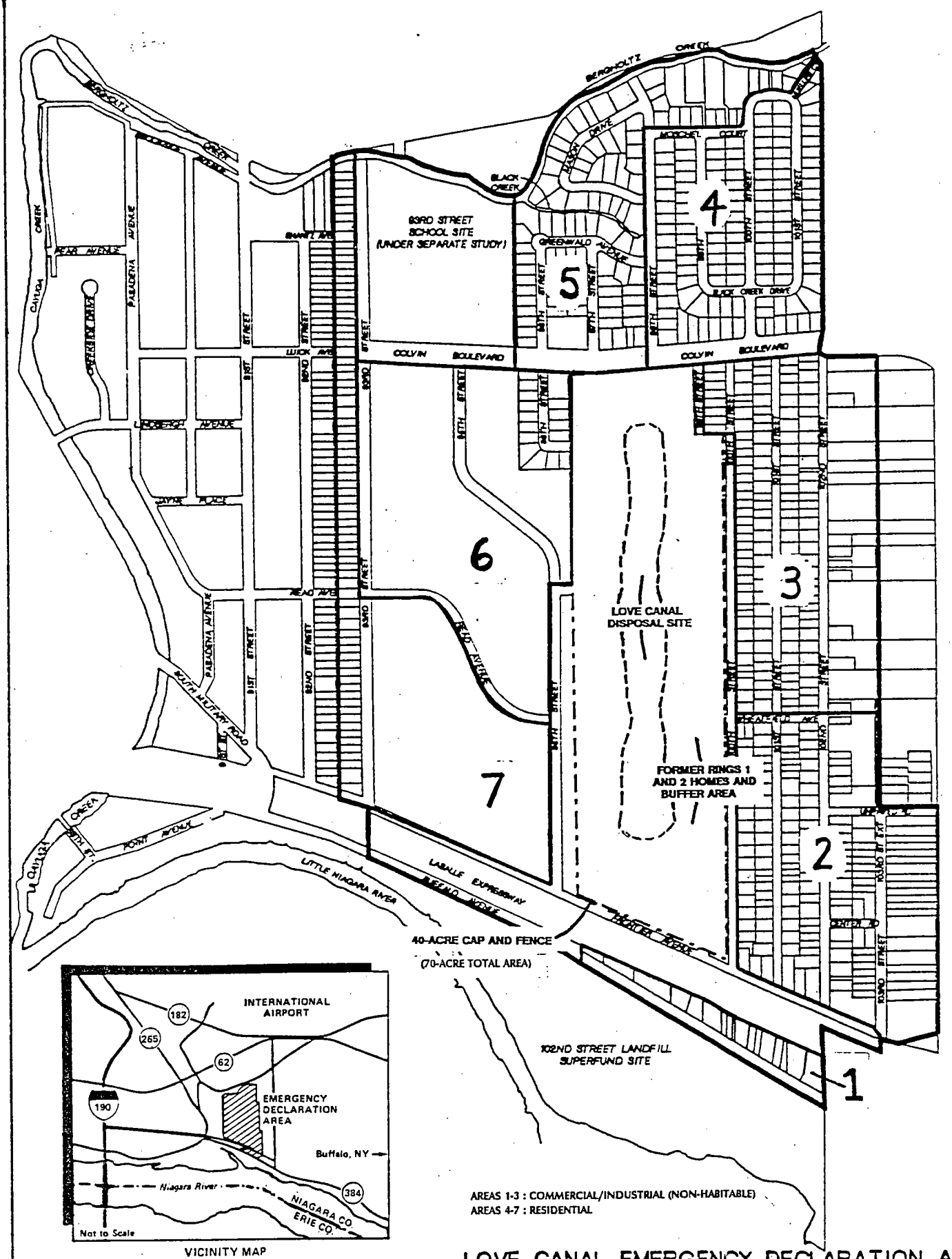
MONTHLY VOLUMES OF GROUNDWATER TREATED
LOVE CANAL LEACHATE TREATMENT FACILITY
OCCIDENTAL CHEMICAL CORPORATION

		Volume (gal)							
		1995	1996	1997	1998	1999	2000	2001	2002
January	Gross (1)	597,650	474,330	337,720	700,070	335,700	495,800	396,900	488,900
	Net (2)	-	-	-	-	335,700	280,364	282,480	422,682
	Days (3)	N/A	N/A	N/A	N/A	N/A	21	20	21
February	Gross	202,235	252,450	456,800	539,838	270,100	480,400	560,000	663,700
	Net	-	-	-	-	270,100	368,492	468,863	608,116
	Days	N/A	N/A	N/A	N/A	N/A	21	19	20
March	Gross	385,910	331,690	520,600	615,133	409,300	505,500	616,400	364,900
	Net	-	-	-	-	321,558	290,501	493,476	316,696
	Days	N/A	N/A	N/A	N/A	N/A	23	21	21
April	Gross	132,790	615,350	184,400	437,817	555,200	675,600	352,300	689,700
	Net	-	-	-	-	296,535	547,926	262,946	629,683
	Days	N/A	N/A	N/A	N/A	N/A	20	20	20
May	Gross	123,140	513,310	126,850	139,600	401,500	473,300	311,200	589,500
	Net	-	-	-	-	123,790	335,331	207,580	532,251
	Days	N/A	N/A	N/A	N/A	N/A	20	17	20
June	Gross	125,300	251,400	210,630	99,800	323,500	632,200	202,200	395,100
	Net	-	-	-	-	63,658	486,721	132,132	347,485
	Days	N/A	N/A	N/A	N/A	N/A	20	16	14
July	Gross	132,400	113,300	96,810	130,200	143,600	333,900	182,200	194,500
	Net	-	-	-	-	104,649	184,955	111,941	145,344
	Days	N/A	N/A	N/A	N/A	N/A	20	16	16
August	Gross	112,910	146,700	223,390	138,300	230,600	437,100	267,200	151,300
	Net	-	-	-	-	97,423	286,925	194,821	107,928
	Days	N/A	N/A	N/A	N/A	N/A	23	18	17
September	Gross	111,200	310,550	116,790	95,200	232,100	209,600	144,900	148,600
	Net	-	-	-	-	62,759	82,263	81,619	94,401
	Days	N/A	N/A	N/A	N/A	N/A	20	16	12
October	Gross	491,440	532,360	326,100	71,500	283,400	264,300	438,500	154,600
	Net	-	-	-	-	175,837	134,248	348,153	108,226
	Days	N/A	N/A	N/A	N/A	N/A	20	18	13
November	Gross	641,210	393,730	346,550	46,200	491,800	250,900	250,400	360,800
	Net	-	-	-	-	344,145	132,728	194,481	306,258
	Days	N/A	N/A	N/A	N/A	N/A	17	16	14
December	Gross	235,900	499,540	524,760	73,800	695,500	522,600	555,300	549,600
	Net	-	-	-	-	397,912	421,149	475,856	496,556
	Days	N/A	N/A	N/A	N/A	N/A	17	18	15
Total	Gross	3,292,085	4,434,710	3,471,400	3,087,458	4,372,300	5,281,200	4,277,500	4,751,200
	Net	-	-	-	-	2,594,066	3,551,603	3,254,348	4,115,626
	Days	N/A	N/A	N/A	N/A	N/A	242	215	203
Monthly Average	Gross	274,340	369,560	289,280	257,288	364,358	440,100	356,458	395,933
	Net	-	-	-	-	216,172	295,967	271,196	342,969
	Days	N/A	N/A	N/A	N/A	N/A	20	18	17
Rainfall Inches		33.99	48.22	41.17	38.77	34.08	42.2	35.18	39.74

NOTES:
(1) Gross: Total Treated; As of March 1999 Treatment at LCTF included leachate collected from 102nd Street Landfill Site.
(2) Net: LC (Love Canal) Treated; Total treated less received from 102nd Street.
(3) Days: Number of days Treatment Facility discharged to the sanitary sewer.
N/A Not Available

APPENDIX B

FIGURES



VICINITY MAP

AREAS 1-3 : COMMERCIAL/INDUSTRIAL (NON-HABITABLE)
AREAS 4-7 : RESIDENTIAL

LOVE CANAL EMERGENCY DECLARATION ARE.

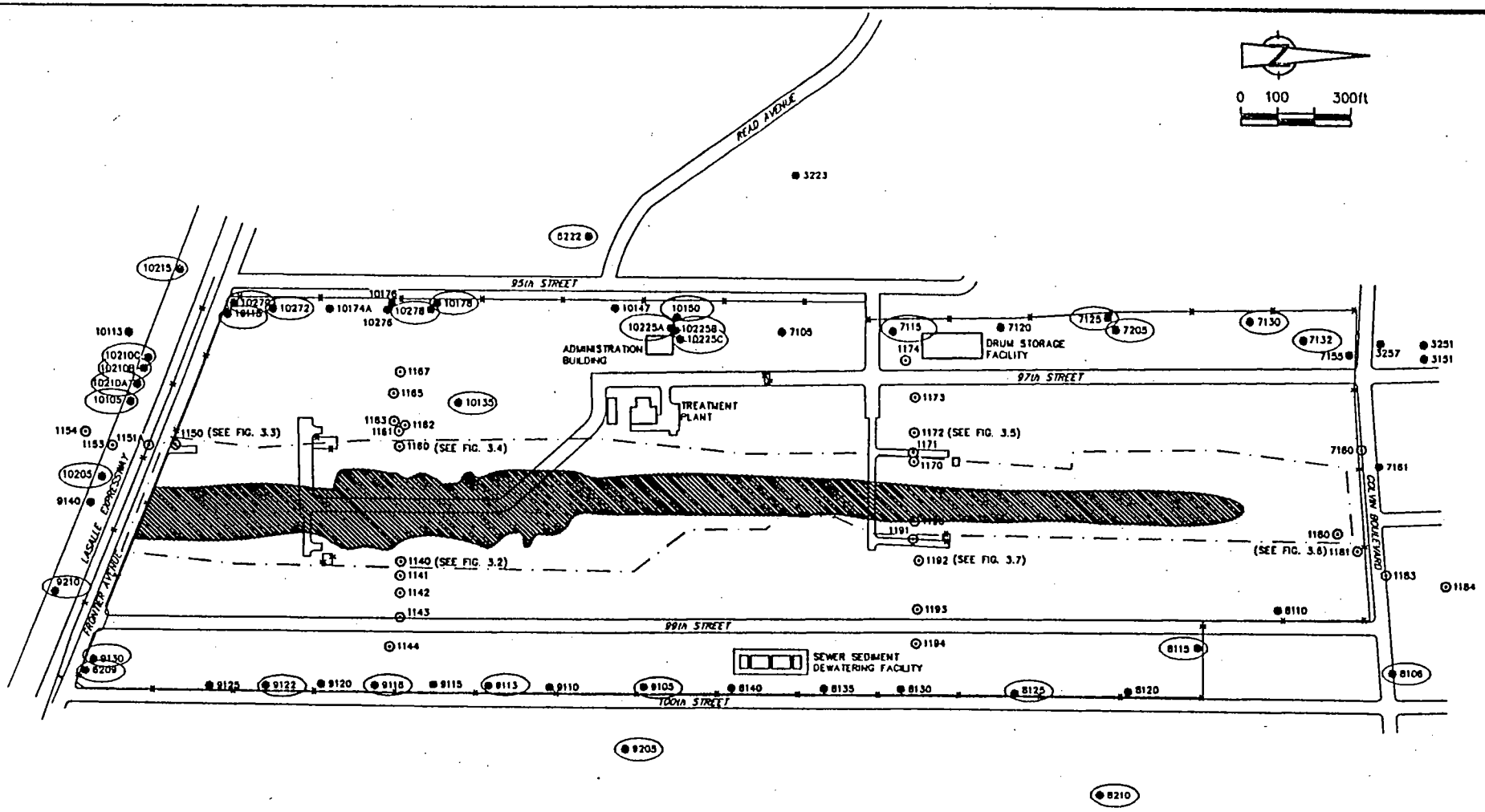
NIAGARA FALLS, NEW YORK SCALE: 1"=750' (SEVEN EDA NEIGHBORHOODS)

LEGEND

EMERGENCY DECLARATION AREA (EDA) BOUNDARY

SOURCE:
EDA BOUNDARIES TAKEN FROM NEW YORK STATE REAL PROPERTY TAX LAW ARTICLE 17, SECTION 1702

Figure 1



LEGEND

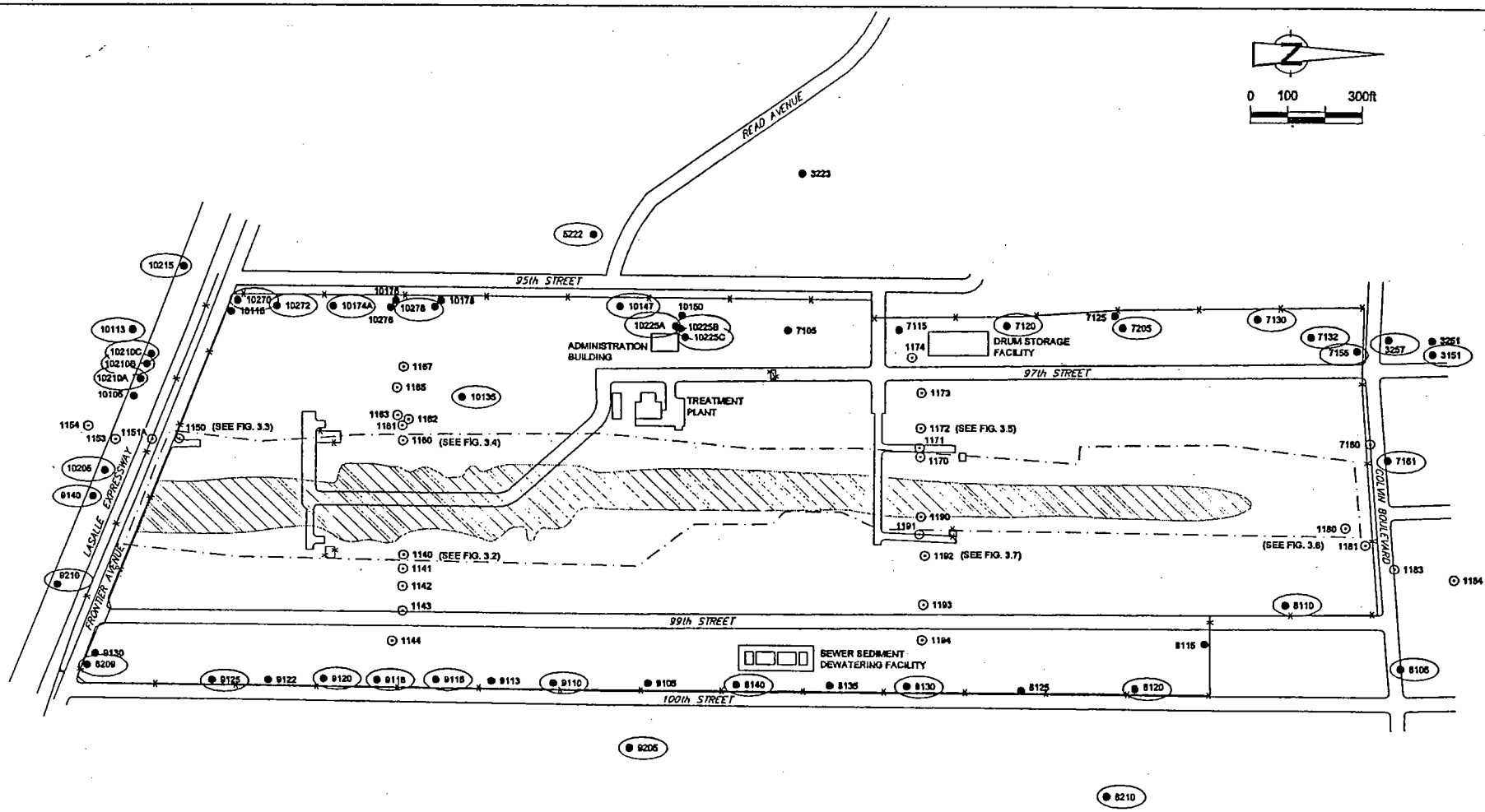
- FENCE LINE
- BARRIER DRAIN
- ⊙7105 PIEZOMETER WELL
- ●1187 OBSERVATION WELL
- WELLS SAMPLED IN 1997
- APPROXIMATE LIMITS OF DISPOSED WASTE

CRA SERVICES

9554 (1) FEB 22/99(W) REV.0 (P-07)

1998 GROUNDWATER SAMPLE COLLECTION PROGRAM
LOVE CANAL
Miller Springs Remediation Management

Figure 2



LEGEND

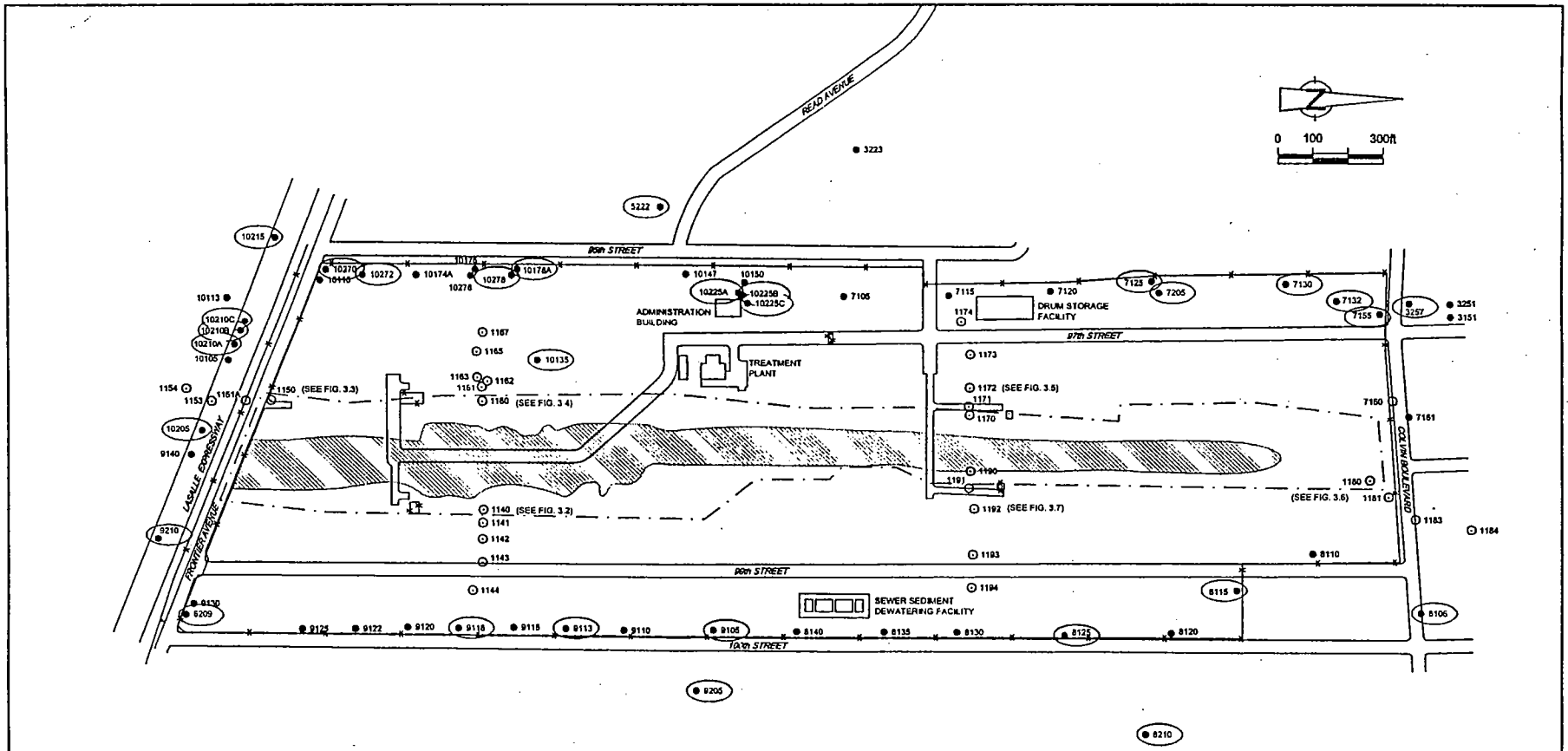
- FENCE LINE
- BARRIER DRAIN
- 7105 PIEZOMETER WELL
- 1167 OBSERVATION WELL
- WELLS SAMPLED IN JUNE 1999
- APPROXIMATE LIMITS OF DISPOSED WASTE

CRA

09954-00(002)GN-WA007 MAR 08/2000

1999 GROUNDWATER SAMPLE COLLECTION PROGRAM
LOVE CANAL
Miller Springs Remediation Management

Figure 3



2000 GROUNDWATER SAMPLE COLLECTION PROGRAM
LOVE CANAL
Miller Springs Remediation Management

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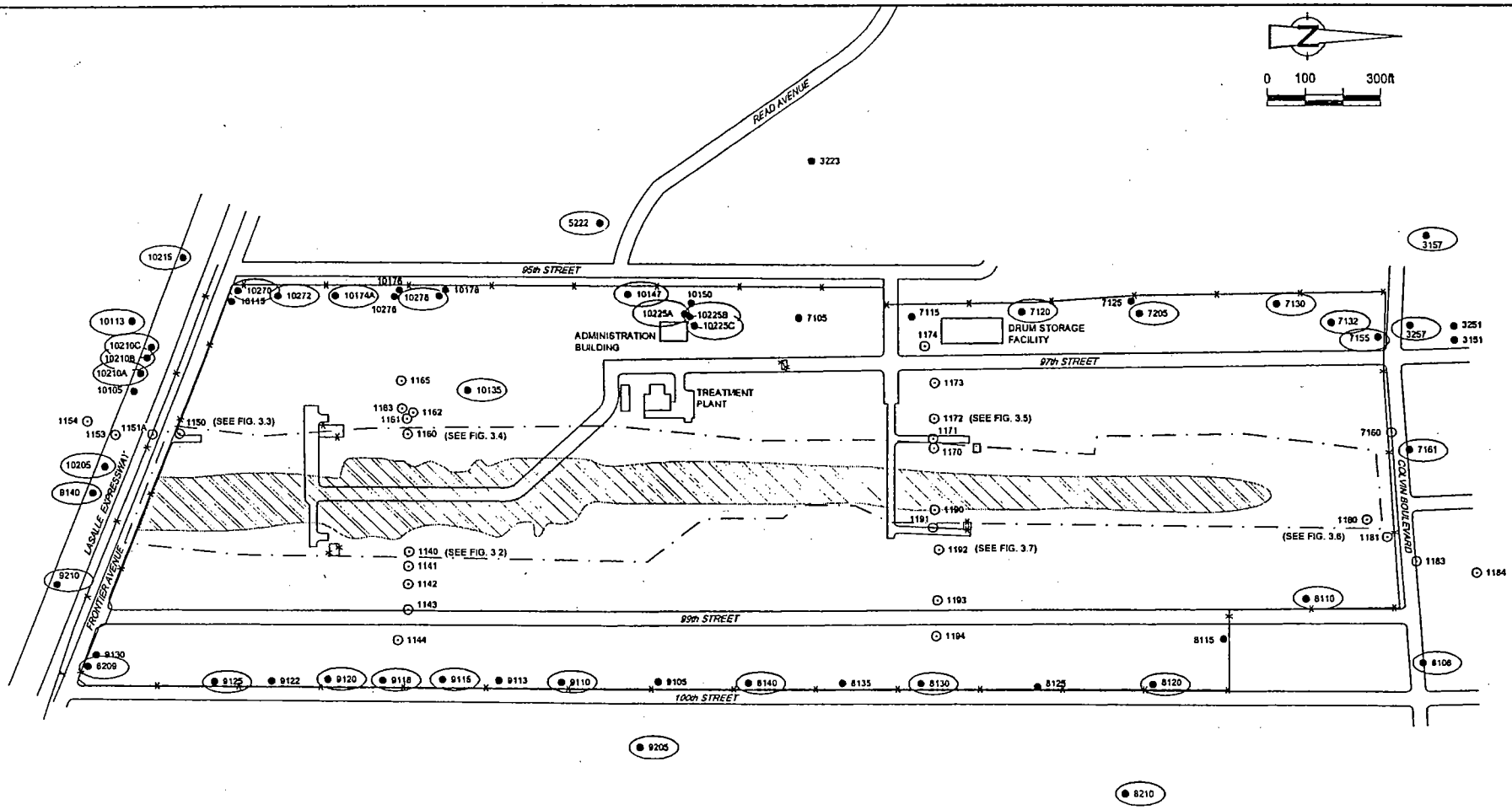
Figure 4



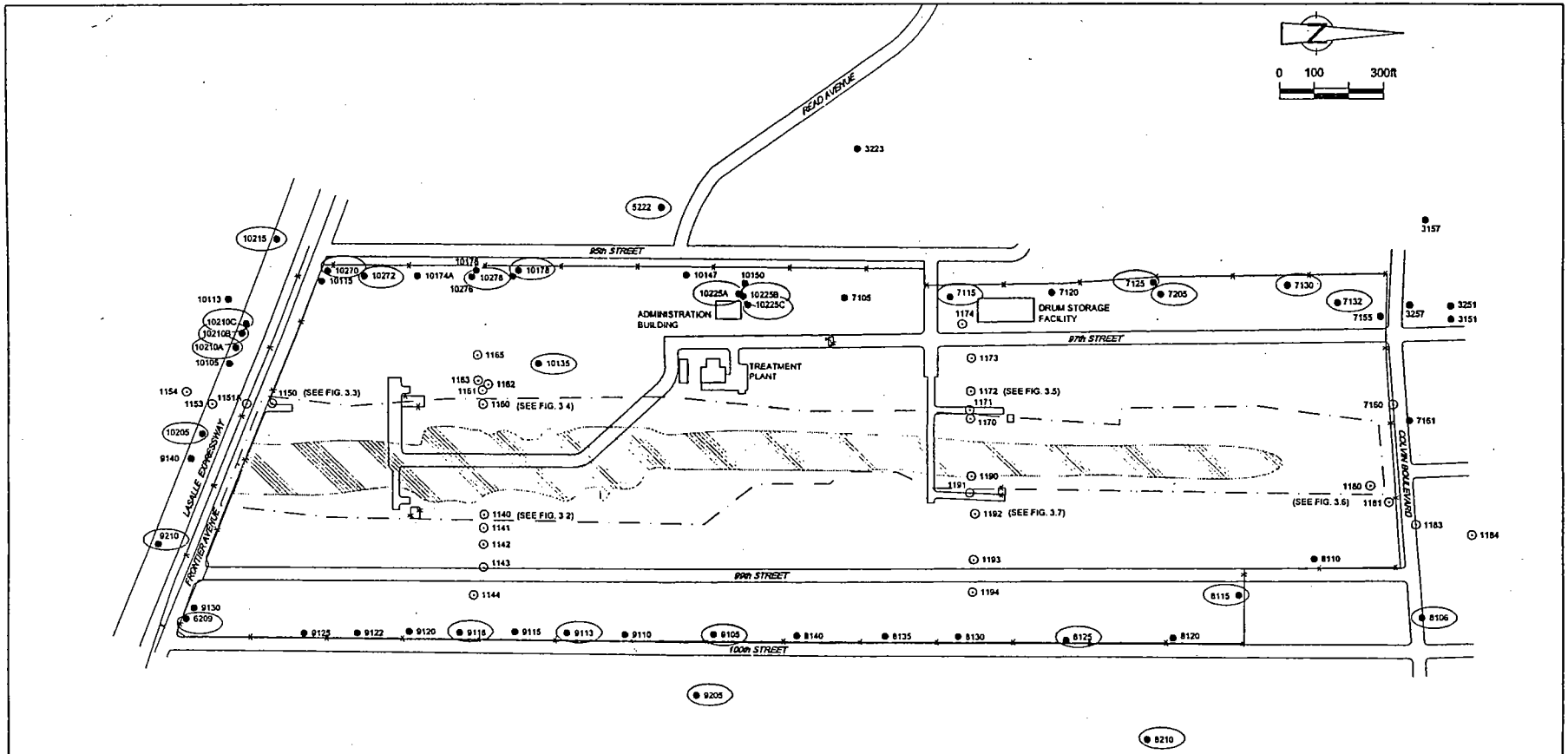
LEGEND

- FENCE LINE
- BARRIER DRAIN
- 7105 PIEZOMETER WELL
- 1167 OBSERVATION WELL
- WELLS SAMPLED IN MAY 2001
- APPROXIMATE LIMITS OF DISPOSED WASTE

2001 GROUNDWATER SAMPLE COLLECTION PROGRAM
LOVE CANAL
Miller Springs Remediation Management

09954-02(006)GN-WA007 FEB 07/2002

Figure 5



2002 GROUNDWATER SAMPLE COLLECTION PROGRAM
LOVE CANAL
Miller Springs Remediation Management

09954-02(008)GN-NF007 MAR 07/2003

Figure 6

APPENDIX C

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