Occidental Chemical Corporation

OFF-SITE INVESTIGATION (OSI) PROGRAM PHASE 2 REPORT

Buffalo Avenue Plant
Module III - Corrective Action and
Waste Minimization Requirements
DEC Permit Number 90-86-0707

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NOVEMBER 1993

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CONESTOGA-ROVERS & ASSOCIATES

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ARC	American Ref-Fuel Company of Niagara Falls
BNAs	Base/Neutral Acid Extractables
BTOR	Below Top of Rock
EBDTS	Energy Boulevard Drain Tile System
EFW	Energy From Waste (renamed RRF)
GZA	GZA GeoEnvironmental of New York
HCCH	Hexachlorocyclohexane
ISSS	Iroquois Street Sanitary Sewer
NAPL	Non-Aqueous Phase Liquids
NYPA	New York Power Authority
OSI	Off-Site Investigation
OxyChem	Occidental Chemical Corporation
Plant	OxyChem's Buffalo Avenue Plant
PP	Priority Pollutant
RCRA	Resource Conservation and Recovery Act
RRF	Resource Recovery Facility (formerly EFW)
SDCP	Supplemental Data Collection Program
SSI	Site Specific Indicators
State	New York State Department of Environmental Conservation
TCL	Target Compound List
UDG	United Development Group
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

On August 19, 1992, Occidental Chemical Corporation (OxyChem) submitted to the New York State Department of Environmental Conservation (State) the report entitled "Off-Site Investigation (OSI) Summary Report" (hereafter: Summary Report) which described the investigation completed in the areas to the north and west of OxyChem's Buffalo Avenue Plant (Plant) in Niagara Falls, New York. Following discussions between the State and OxyChem, it was agreed that some additional geological and groundwater chemical data were required to finalize the OSI program. Consequently, a Phase 2 of the OSI was developed and implemented.

This report has been prepared to present the results of the OSI - Phase 2 bedrock and overburden investigation conducted.

This report concludes the OSI program. The database now sufficiently characterizes the bedrock and overburden off-Site conditions to allow development of corrective measures for the Plant boundary areas.

The OSI program was undertaken as part of the Buffalo Avenue Plant Corrective Action Program, with the following purpose and scope of investigation:

- To determine the magnitude and extent of Site-related chemical presence in the overburden and bedrock groundwater regimes in the off-Site areas which are downgradient of those areas along the Plant boundary that exhibit the ~~highest~~ chemical ~~concentrations~~ contamination; and

- To evaluate the extent to which the New York Power Authority (NYPA) Power Conduit drains, the Falls Street Tunnel/South Side Interceptor Sewer and the Energy Boulevard Drain Tile System (EBDTS) influence the off-Site migration of chemicals in the groundwater.

In addition to the Phase 2 data, bedrock groundwater analytical results documented in the report entitled "Environmental Study

Data Report, September 1993", prepared by GZA GeoEnvironmental of New York (GZA) on behalf of American Ref-Fuel Company of Niagara Falls (ARC) at the former OxyChem Energy From Waste Facility (EFW) and non-contiguous parcels has been incorporated into this OSI database. The GZA/ARC bedrock groundwater analytical results are presented in the report entitled "Bedrock Groundwater Analytical Results American Ref-Fuel Resource Recovery Facility, November 1993", which is included in this report as Appendix E. The EFW was renamed the Resource Recovery Facility (RRF) by ARC.

1.1 BACKGROUND

1.1.1 Study Location

The OSI study area is located adjacent to the north and west boundaries of the Plant and includes lands east of the NYPA Power Conduits, south of Royal Avenue and west of 53rd Street. This area is predominantly industrial and includes several acres of vacant land. Figure 1.1. shows the OSI study area and property ownership within the study area.

1.1.2 OSI Summary

During Phase 1 of the OSI, nine overburden monitoring wells (OW553 through OW561) and 11 bedrock monitoring wells (OW649 through OW659) were installed to determine the magnitude and extent of Site-related chemical migration to the off-Site areas north and west of the Plant in both the overburden and bedrock groundwater regimes. The locations of these 20 wells are shown on Figure 1.2.

There are numerous man-made structures which influence groundwater flow in the overburden and bedrock within the OSI study area. These structures include the NYPA Power Conduits, the Falls Street Tunnel and Southside Interceptor System, the Iroquois Street and

47th Street Sanitary Sewers, the EBDTS, various underground utilities, building and structure foundations and foundation drainage systems. These major hydraulic influences are shown on Figure 1.3.

Two rounds of chemical sampling were completed during Phase 1 of the OSI. Samples were collected from the 21 OSI wells, five existing off-Site wells (MW88-6A and MW88-68 at Frontier Chemical and 7B, 23B and 23C installed by Dupont), the EBDTS and the RRF foundation drainage system. All samples were analyzed for Site Specific Indicator (SSI) parameters.

- Overburden Conditions

The results of the Phase 1 OSI showed that the overburden groundwater flow direction was southward in areas north of the Plant, and westward in the vicinity of the NYPA Power Conduits.

Two areas of off-Site overburden groundwater chemical presence were identified to be present. These two areas were centered around wells OW554 (85 and 1500 µg/L of total SSI organics for Round 1/Round 2) and OW559 (220 and 45 µg/L). All other overburden wells were less than 45 µg/L of total SSI organics for each of the two sampling rounds.

- Bedrock Conditions

The Phase 1 OSI showed bedrock groundwater flow direction for the D-Zone was generally north-northwest toward the intersection of the Falls Street Tunnel and the NYPA Power Conduits. The C-Zone flowed in the same general direction, while the B-Zone groundwater flowed in a north-northeast direction.

Bedrock groundwater chemistry in the D-Zone showed a consistent pattern of chemical distribution through the off-Site area north of the Plant. Results from the first line of wells located 1,000 feet north of the Plant boundary (OW650, OW651, OW652 and OW653) showed chemical concentrations significantly lower than those observed in wells along the

Plant boundary (OW403D, OW404D, OW405D, OW406D and OW407D). Samples from the OW654D and OW655D wells along Royal Avenue (and 500 feet further north of the first line of wells) showed chemical concentrations which were greater than those observed in the first line of wells. Also, well MW88-6B, located on the Frontier Chemical property north of Royal Avenue, showed elevated chemical concentrations; higher than those observed in the first line of wells. The C-Zone wells showed the same general pattern, with concentrations in the first line C-Zone wells being lower than the concentrations in the wells along the Plant boundary and the OW654 C-Zone well to the north. The only B-Zone well to the north of the Plant (OW654B) showed a total SSI organic concentration significantly lower than concentrations observed along the Plant boundary.

Non-Aqueous Phase Liquids (NAPL) were not observed during bedrock well installation, except for a trace NAPL staining on the rock core from OW650 which is located to the west of the NYPA Power Conduits. NAPL was observed in OW654D during well development. Trace NAPL was observed in the overburden during installation of OW554. As NAPL migrates by gravity, it is believed that the NAPL presence at OW654D did not migrate northward from the Plant as the bedrock bedding planes dip southerly toward the river making northward NAPL migration from the Plant unlikely over such a long distance. Additionally, OW652D, which is located between OW654D and the Plant, did not have any NAPL presence.

In conclusion, the OSI Summary Report indicated that the Plant was not contributing to the elevated groundwater chemical presence observed in the vicinity of Royal Avenue. The results suggested that an off-Site source of chemical presence existed in the vicinity of Royal Avenue. In an effort to confirm these conclusions, the additional OSI Phase 2 investigation described within was completed. Details on the OSI Phase 1 are contained in the Summary Report, August 1992.

2.0 OSI - PHASE 2 PROGRAM SUMMARY

The Phase 2 components of the OSI were:

i) installation and hydraulic testing of three bedrock well nests (OW657, OW658, OW659) along the first line of wells (approximately 100 feet) north of the Plant boundary.

ii) installation and hydraulic testing of intermediate bedrock wells (C-Zone and B-Zone) at two locations where Phase 1 D-Zone bedrock wells exist (OW652, OW653);

iii) investigation of the Iroquois Street Sanitary Sewer (ISSS) bedding as a potential NAPL migration route (BH11D-92);

iv) chemical and hydraulic monitoring of the Phase 2 bedrock wells and selected existing bedrock wells; and

v) chemical and hydraulic monitoring of appropriate OxyChem overburden wells and selected United Development Group (UDG) overburden wells adjacent to the northeast boundary of the Plant.

The OSI Phase 2 investigation, which is described in this report, has been conducted in compliance with the following documents:

- Off-Site Investigation Work Plan
  Buffalo Avenue Plant
  February 1991;

- Appendix A
  Site Operations Plan (SOP)
  Buffalo Avenue Plant
  Supplemental Data Collection Program (SDCP)
  March 1988;

- Appendix B
  Environmental Health and Safety Plan
  Buffalo Avenue Plant
  Supplemental Data Collection Program (SDCP)
  March 1988; and

- Appendix C
  Chemical Sampling and Quality Assurance Plan
  Buffalo Avenue Plant
  Supplemental Data Collection Program (SDCP)
  March 1988.

The following subsections discuss the OSI Phase 2 investigations completed and the protocols/procedures utilized.

2.1 BEDROCK WELL INSTALLATIONS

2.1.1 Bedrock Well Locations

The locations of the Phase 2 off-Site bedrock wells installed during the OSI program are shown on Figure 2.1. A total of 13 bedrock wells were installed in Phase 2 at five well nests as follows:

OW652	B-Zone Monitor C-Zone Monitor (D-Zone Monitor completed in Phase 1)
OW653	B-Zone Monitor C-Zone Monitor (D-Zone Monitor completed in Phase 1)
OW657	B-Zone Monitor C-Zone Monitor D-Zone Monitor
OW658	B-Zone Monitor C-Zone Monitor D-Zone Monitor

OW659 B-Zone Monitor
C-Zone Monitor
D-Zone Monitor

These wells were installed to supplement the existing data regarding:

a) groundwater flow directions in the bedrock,
b) the nature and distribution of chemicals in the bedrock groundwater,
c) the nature and distribution of NAPL in the bedrock, and
d) the transmissivity of the stratigraphic formations of the Lockport Group.

2.1.2 Bedrock Well Installation Procedures and Protocols

The following subsections describe the installation procedures and the determination of the monitoring intervals installed at each bedrock well nest. A typical bedrock well nest is presented on Figure 2.2.

- Overburden Casing Installation

Permanent steel casings were installed through the overburden material to prevent the vertical migration of chemicals from the overburden into the bedrock. These casings were installed as follows:

a) Continuous split spoon samples were collected in the overburden regime from the top of the ground surface to the top of bedrock in advance of augering. Soil samples were collected, recorded and placed into Plant storage for a geologic record. Soil samples were collected at only one location per well nest. At the well nests where D-Wells were already installed (OW652, OW653) and the overburden stratigraphy was already logged, no split spoon sampling was performed.

b) Twelve-inch outside diameter augers were advanced through the overburden to refusal (six± inches below the bedrock/overburden

interface) to generate a notch in the bedrock for the overburden casing at each location.

c) A clean six-inch inside diameter steel casing was set inside the augers and permanently grouted into the bedrock notch. Grout placement was performed by filling the overburden borehole with grout and immersing the 6-inch steel casing, with the lower end plugged off, in the grout. The casing was pushed securely into the bedrock notch using the drill rig.

- Hydrostatic Testing of Overburden Casing

a) After the grout had set, the grout within the six-inch diameter casing was removed to the bottom of the overburden casing/bedrock interface.

b) The casing was filled with potable water and water loss over a 25-minute period was measured. If a water level drop was observed, an allowable water loss was calculated and compared to the actual water loss. No casing installations during the Phase 2 activities required regrouting as a result of failure of the grout seals.

- Bedrock Coring and Injection Testing

Bedrock coring and injection testing of the bedrock were first completed to the base of the deepest well of each well nest. The typical bedrock coring and testing procedures used are described in the following paragraphs.

At each bedrock well nest (i.e. OW657, OW658 and OW659), coring continued until the top of the Gasport Formation was encountered. Water returns during coring were estimated to determine water loss. The return water was also observed for NAPL presence. NAPL was not observed at any of the installed wells. After coring to the top of the Gasport formation, the bedrock was tested using a double packer injection test assembly which permitted testing of 15±-foot intervals. Typically,

testing was performed from the bottom of the corehole to the bottom of the overburden casing.

All rock core collected from each well nest was geologically logged, photographed and placed in storage at the Plant for future reference.

The B and C-Zone wells in each nest were drilled and completed to the depths determined using the injection test data which identified the appropriate waterbearing intervals to be monitored. These wells were installed by drilling a six-inch borehole to the top of the bedrock monitoring interval. A four-inch inside diameter steel casing was grouted in place and the grout was allowed to set for 24 hours before drilling continued. The monitoring interval was cored to a four-inch diameter.

The initial well drilled at each well nest was grouted back through the intermediate bedrock intervals (B and C-Zone) to become the shallow (D-Zone) well.

At locations OW652 and OW653, where intermediate B and C-Zone wells were installed adjacent to an existing D-Zone well, a six-inch borehole was drilled and a four-inch casing was installed to just below the existing D-Zone monitoring interval. Coring from the bottom of the four-inch casing to the top of the Gasport formation and injection testing were performed. After the B and C-Zone monitoring intervals were selected, this initial well was grouted back to become the C-Zone Monitor and the last well was installed as the B-Zone Monitor.

Details on the completed wells in each nest, including bedrock logs are included in Appendix A.

- Injection Testing

The injection test results are summarized in Appendix B - Injection Test Results. Injection testing during the drilling of the deepest bedrock well at each well nest was completed in the following manner:

a) A double-packer test assembly (see Figure 2.3) was used for all tested intervals. The bottom interval was tested using the double-packer assembly with only the upper packer inflated. This resulted in a tested interval of approximately 20 feet for the lowest test while all other test intervals were approximately 15 feet.

b) A typical test consisted of four to five flow steps per interval. In some instances, due to equipment problems or injection pressure restrictions, testing at only three pressure steps was performed.

c) A typical test proceeded as follows:

1. The assembly was lowered into the open borehole to the appropriate depth.

2. A static reading of the water pressure in the borehole was recorded and compared to a calculated value for the transducer depth. This comparison was to calibrate the transducer operation.

3. If the transducer was functioning correctly, the packer(s) were inflated, the interval was allowed to equilibrate, and the pressure (P_o) of the water (measured in psi) in the borehole between the packers was recorded.

4. Each pressure step value (P_i) is calculated using P_o plus increments of 1/5 of the hydrofracture value in psi which is calculated as $P_{max} = 0.7 \times$ (thickness in feet of overburden and bedrock above top packer). Water was then pumped into the monitored interval at a flow rate of 5 gallons per minute (gpm), 10 gpm, 15 gpm and 20 gpm. If these flow rates caused the downhole borehole pressure to exceed the calculated P_x value for that step, the flow rate was reduced for that step until a downhole pressure close to P_x was obtained. The test was then run at the appropriate flow rate.

5. For each minute during the test, the water flow rate in gpm and the downhole pressure (psi) were recorded. Each step of the test was run for a minimum of ten stable downhole readings or a maximum of 20 minutes. The line pressure and the temperature of the water were periodically recorded.

6. After completing the pressure steps, the test was terminated and the packer was raised fifteen feet to begin the test in the next borehole interval.

7. The results of these injection tests were used to estimate the hydraulic conductivities of the zones being tested and to determine the intervals to be monitored by each well in a bedrock well nest.

- Well Development

Development was performed in accordance with Section 8.4 of Appendix A of the SDCP.

Bedrock well development was considered complete after 10 well volumes were removed and observed sediment presence was minimal. Groundwater pH and specific conductance were measured for each well volume removed.

At OW653B, after removal of 16 well volumes (990 gallons) the water was still cloudy with a high pH and specific conductance. The well was re-developed the next day with periodic surging of the groundwater in the well. The water cleared and pH dropped rapidly. Stability was achieved after removal of seven well volumes (455 gallons). OW653C went dry during development and was pumped dry three times over two consecutive days. Well OW659D was developed on an intermittent basis over three hours because of limited water availability. The required 10 well volumes were removed and stability of pH and specific conductance was achieved.

2.1.3 Selection of Bedrock Monitoring Intervals

The wells in each bedrock well nest were installed in accordance with Section 8.2 of Appendix A of the SDCP.

a) Installation of A-Zone wells was not required during the OSI. The A-Zone extends from the mid-section of the Gasport to the top of the Rochester Shale.

b) One well to monitor the upper bedrock interval which usually included the upper 40 to 50 feet of bedrock. This well was designated the D-Zone well in each nest.

c) Two wells to monitor all of the waterbearing zones between the A-Zone and the D-Zone well based on the following guidelines:

   i) One well, designated the C-Zone well, to monitor the interval from the bottom of the upper bedrock well installed as the D-Zone well to the top of the most significant non-waterbearing zone, if any, above the Gasport.

   ii) One well designated the B-Zone well, to monitor the interval from the bottom of the non-waterbearing zone identified in the C-Zone well description above, to the top of the Gasport.

   iii) If no non-waterbearing zone was located between the bottom of the upper weathered zone and the top of the Gasport, each of the two wells were installed to monitor an equal portion of this bedrock interval.

The bedrock monitoring intervals for the OW652 and OW653 bedrock nests were determined based on injection tests completed at the OW652 and OW653 C-Zone wells as the D-Zone well at each location was installed previously during the Phase 1 of the OSI.

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The bedrock monitoring intervals for the OW657, OW658 and OW659 bedrock well nests were determined based on injection testing completed at OW657D, OW658D and OW659D respectively. The injection test results are presented in Appendix B. The selection of monitoring intervals was reviewed and approved by the State prior to the installation of the remaining wells in each nest.

2.1.4 Stratigraphy and Instrumentation

A summary of the overburden/bedrock stratigraphic unit thickness is presented in Section 3.3. Details on the completion of the Phase 2 bedrock wells, including the well depths, casing depths and the monitoring intervals are contained in Appendix C. The Stratigraphic and Instrumentation Logs describing the stratigraphy of each well nest, are presented in Appendix A.

Bedrock Well Completion/Grouting Summary

At OW652 and OW653, the C-Zone well was drilled to the top of the Gasport Formation. The injection tests were completed on these wells and the appropriate monitoring intervals selected. The C-Zone well was filled with grout from the top of the Gasport to the bottom of the proposed C-Zone well monitoring interval. At OW652, 31 gallons of grout was added in two lifts. Grout came up to 91.0 feet BGS. At OW653, 37 gallons of grout was added in two lifts. Grout came up to 96.0 feet BGS.

At OW657, OW658 and OW659, the D-Zone well was drilled to the top of the Gasport Formation, injection tested and grouted back to become the shallow monitor. At OW657D, 78 gallons of grout was added in three lifts, resulting in a grout level of 94.5 feet BGS. At OW658, 44.5 gallons of grout was added and the grout level rose to 65.0 feet BGS. At OW659, 78 gallons of grout was added and the grout came up to 63.5 feet. On March 29, 1993 after adding grout to OW659D, a grout level of 39.0 feet was measured in the borehole. Since the grout was set too high, the grout was reamed out. After breaking through a small bridge of grout, the hole was

open to 63.5 feet BGS. During development of OW659D, the well was pumped dry after 40 gallons (1.5 calculated well volumes) were removed. Well recovery of about 0.7 gallons per minute was measured. It was decided to ream this hole to 6-inch diameter in an attempt to remove any rock which might have been coated with grout. This was done to a depth of 64.0 feet BGS on March 30, 1993. The well was pumped dry on March 31, 1993, and a recovery of about 1.0 gallon per minute was observed. The required 10 well volumes were removed by pumping intermittently, and stable groundwater pH and specific conductance were achieved.

2.1.5 Natural Gas Presence

Natural gas was not encountered during the drilling of any of the bedrock wells.

2.2 IROQUOIS STREET SANITARY SEWER BEDDING INVESTIGATION

A number of borings were installed into the sewer bedding between the Plant and well nest OW654 to evaluate the possibility that the ISSS bedding was providing a preferential route for NAPL migration from the Plant toward OW654. The locations, procedures and sampling performed are described in the following subsections.

2.2.1 Sanitary Sewer Details

An inquiry was made to the City of Niagara Falls regarding the ISSS and its construction (specifically bedding components and piping materials). Plan #309 - Sewer Contract - Sheet No. 3 was acquired and reviewed. The following information has been obtained from Plan #309 and verbal discussions with the City Engineering Department.

i) The sewer dimensions where drilling was completed were on the order of 54 inches - MH'A' (BH11-92); enlarging to 60 inches at MH'B' (BH12-92); sewer construction was completed in 1917.

ii) The sewer pipe was vitrified clay segment blocks (i.e. clay blocks with a 54- or 60-inch diameter hole) placed into the rock cut and likely backfilled with concrete. Backfill details were not available. The sewer contract documents were missing from City records for this section of sewer. Common practice for this type of sewer was to use concrete as a backfill material.

iii) Plan #309 indicated that an open cut extended southward from the area of MH'A'. It did not describe the installation method north of this point. Tunneling may have been performed from MH'A' north to Royal Avenue, but the City Engineering Department did not think it was likely.

iv) During the visit to the City Engineering Department, a markup of Plan #309 was observed which described an internal inspection of the 54 and 60-inch sewer. The date, time and who conducted this inspection were not referenced on the markup. Written comments observed on the markup stated that numerous points of groundwater leakage into the sewer were observed along the top, the bottom and sides of the sewer, and that the volume of infiltration observed range from minor quantities to large quantities. No estimate of the volumes were indicated on the markup. The comments observed on the markup show groundwater infiltration to the ISSS was occurring during the time period of the inspection.

2.2.2 Sewer Bedding Borehole Locations

Figure 2.4 shows the sewer bedding borehole locations adjacent to the sanitary sewer. In total 11 boreholes were drilled in two separate areas along the sanitary sewer length (MH'A'/MH'B'). All borings were completed adjacent to existing sanitary manholes to insure that the

location of the sewer was defined and to prevent any possibility of drilling into the sewer. Four borings (BH11-92, BH11A-92, BH11B-92 and BH11C-92) were completed in the vicinity of MH'A' with the initial borehole converted to a shallow bedrock monitoring well (BH11D-92). Seven boreholes (BH12-92 and BH12A-92 through BH12F-92) were completed in the vicinity of MH'B'.

2.2.3 Borehole Procedures

The borings were installed using 8-inch outside diameter hollow stem augers. Samples were collected in advance of the augers using 2-inch diameter split spoon samplers. Visual examination of the soil materials was noted and samples for a geologic record were collected and stored for future reference at the Plant.

Each boring was installed adjacent to an existing manhole to permit a visual reference with the sewer pipe and allow an exact measurement to the invert of the sewer. An attempt was made to sample continuously until the base of the sewer bedding was encountered or until the maximum depth of the sewer was passed, whichever was deeper.

Once the boreholes were completed, they were backfilled with cement/bentonite grout using positive placement techniques. The top six inches of each borehole was backfilled with material which matched existing surface materials.

BH11-92

BH11-92 was located west of Union Carbide, south of Royal Avenue and north of OSI well OW652. The boring was completed near the third manhole south of Royal Avenue (designated MH'A') along the 54-inch ISSS. The expected depths to the top of the sewer pipe, to the invert of the sewer pipe, and to the top of the bedrock near the third manhole were obtained from Plan #309 and are as follows:

	Elevation (ft. AMSL)	*Depth (ft. BGS)*
Ground Surface	570.3	0
Bedrock Surface	554.4	15.9
Top of Pipe	551.8	18.5
Invert of Pipe	547.4	22.9

Four attempts were made to advance the borehole beyond the top of pipe elevation with no success. Bedrock was encountered between 16.7 and 16.8 feet BGS. This demonstrated that the bedrock in the immediately adjacent areas was not disturbed during construction of the sewer.

In order to obtain additional information, an exploratory bedrock corehole (BH11D-92) was drilled in the area adjacent to MH'A'.

A 4-inch inside diameter black steel casing was installed to the top of bedrock (auger refusal) and grouted in place. A hydrostatic test was conducted to check the overburden seal. The overburden seal passed the hydrostatic test and coring proceeded from 17.8 feet BGS to a depth of 26.9 feet BGS. The bedrock log for BH11D-92 is presented in Appendix A. At completion, the bedrock exploratory boring was secured with a flush mount protective cover.

A highly fractured dolostone in a gray and pink gray cement matrix was found in the interval 17.8 to 19.7 feet BGS. Bedrock from 19.7 to 26.9 feet BGS consisted of a weathered to slightly weathered dolostone (Oak Orchard Formation). No visual or olfactory evidence of NAPL or chemical presence was noted from the core or in the water circulated during the bedrock drilling.

<u>BH12-92</u>

BH12-92 was located west of Union Carbide and south of Royal Avenue and OSI well OW654. The boring was completed near the second manhole south of Royal Avenue (designated MH'B') along the

54-inch diameter ISSS. The expected depths to the top of the sewer pipe, to the invert of the sewer pipe, and to the bedrock near the second manhole south of Royal Avenue were obtained from Plan #309 and are as follows:

	Elevation (ft. AMSL)	*Depth (ft. BGS)*
Ground Surface	569.95	0
Bedrock Surface	555.4	14.6 feet
Top of Pipe	551.1	18.9 feet
Invert of Pipe	546.76	23.2 feet

A visual check inside this sewer manhole revealed a ledge or benching at approximately 12 feet BGS. As a result, an accurate field measurement of the invert of the 54-inch pipe could not be obtained. Groundwater infiltration along the sidewall approximately 11 feet BGS was observed.

Six attempts were made to advance the borehole beyond 14.7 feet BGS with no success. This elevation matched the expected elevation of the top of bedrock demonstrating that the bedrock immediately adjacent to the sewer was not disturbed during the construction of the sewer.

2.2.4 Chemical and Hydraulic Monitoring • BH11D-92

Two rounds (Rounds 1 and 2) of groundwater hydraulic and chemical monitoring were performed during Phase 2 of the OSI. In conjunction with the Phase 2 Round 1 bedrock groundwater hydraulic and chemical monitoring activities, BH11D-92 was sampled once and analyzed for the SSI parameters. The results of this analysis are presented and discussed in Section 4.0.

Prior to this sampling event, a groundwater level was recorded from BH11D-92.

2.3 BEDROCK WELLS - CHEMICAL AND HYDRAULIC MONITORING

The following subsections describe the procedures and protocols to complete the bedrock hydraulic and chemical monitoring tasks during Phase 2 of the OSI.

Two rounds (Rounds 1 and 2) of SSI sampling and analysis were completed at each Phase 2 bedrock well ands selected existing wells. Figures 2.5 and 2.6 show the bedrock well locations selected for hydraulic and chemical monitoring, respectively. A summary of the bedrock wells sampled and monitored is shown on Table 2.1.

2.3.1 Hydraulic Monitoring/Well Depth Soundings • Bedrock

Water level elevations were measured for all SDCP wells (except A-Wells), all OSI wells and selected existing wells on adjacent properties prior to each sampling round. The bottom of each OSI well was sounded to determine whether silting of these wells had occurred. The results of the depth sounding program are recorded in Table 2.2. Groundwater contours prepared from the water level data (May 1993 and July 1993) are shown on Figures 2.7 through 2.12 for the D, C and B bedrock zones.

2.3.2 Bedrock Groundwater Sampling Locations

Bedrock groundwater samples for the OSI Phase 2 SSI Rounds 1 and 2 were collected during May and July 1993 respectively. The bedrock wells sampled for each round are shown on Table 2.1.

A few wells were sampled only during Round 1. These included three existing OSI bedrock wells (OW650D, OW652D and OW653D), one ISSS well (BH11D-92) and a NYPA well (PASNY 139) located north of Royal Avenue and east of the NYPA Power Conduits.

2.3.3 Sampling Procedures

The sampling protocols used during the OSI - Phase 2 program were those described in the following SDCP documents:

i) Appendix A - Site Operations Plan - April 1988

Section 8 - well development, well preparation and well sampling
Section 10 - waste handling
Section 11 - equipment cleaning

ii) Appendix C - Chemical Sampling and Quality Assurance Plan - April 1988.

Sections 3.6, 6 - general description of program
- sampling requirements
- all QA/QC requirements

After development and prior to purging for Round 1, each well was allowed to stabilize over a period of at least 30 days. The sampling process included the measurement of static water levels at each well (Section 2.3.1) followed by well purging. Each bedrock well was purged a minimum of five well volumes. Following purging, pH and specific conductance were measured.

2.3.3.1 Field QA/QC

Field QA/QC requirements with respect to field blanks and sample duplicates were met. One blind sample duplicate and one field blank were submitted for analysis during each Round. The field blank was collected using a bottom loading bailer to check decontamination procedures. Distilled deionized water was used for the field blank.

2.3.3.2 State Split Samples

The State elected not to receive split samples during the OSI - Phase 2 activities (Round 1 and Round 2 - SSI Survey).

2.3.4 Analytical Parameters

The Phase 2, Round 1 and Round 2 groundwater samples were analyzed for the parameters listed on Table 2.3.

2.4 OVERBURDEN WELLS - CHEMICAL AND HYDRAULIC MONITORING

For OSI Phase 2, two rounds (Rounds 1 and 2) of hydraulic monitoring were completed at selected OxyChem overburden wells located in the northeast sector of the Plant and UDG wells MW-1, MW-2 and MW-3 (see Table 2.1). Two UDG wells (MW-2 and MW-3) were sampled for chemical analysis during Round 1 and one UDG well (MW-1) was sampled during Round 2. Figure 2.13 shows the overburden well locations selected for chemical and hydraulic monitoring.

2.4.1 Hydraulic Monitoring • Overburden

Water level measurements were measured prior to the Round 1 and Round 2 sample events (May and July 1993). The overburden groundwater levels for May and July 1993 are shown on Figures 2.14 and 2.15, respectively.

2.4.2 Sampling Locations • Overburden

UDG overburden wells MW-2 and MW-3, located on the UDG property adjacent to the northeast boundary of the Plant, were sampled

once (Round 1) and UDG overburden well MW-1 was sampled once (Round 2) during the OSI - Phase 2 activities.

2.4.3 Sampling Procedures

The sampling protocols used during the OSI - Phase 2 program were described in Section 2.3.3.

The sampling process included the measurement of static water levels at each well followed by well purging. Each overburden well was purged a minimum of five well volumes. Prior to completion of purging, temperature, pH and specific conductance were measured.

2.5 GENERAL PROGRAM PROTOCOLS

The following subsections describe the protocols which were used for Waste Material Handling, Health & Safety and Equipment Cleaning. Section 2.5.4 describes the program modifications which were necessary due to conditions encountered during the course of the OSI - Phase 2.

2.5.1 Waste Material Handling

All wastes generated as a result of OSI Phase 2 activities including aqueous phase liquids, soils, rock cuttings, and safety equipment (e.g. Tyveks, gloves) and used sampling equipment (e.g. tubing) were collected and handled in accordance with Section 10 of Appendix A of the SDCP.

2.5.2 Health and Safety

Health and safety protocols implemented during the installation of the overburden and bedrock wells were as described in Appendix B of the SDCP.

2.5.3 Equipment Cleaning

All equipment requiring cleaning was cleaned in accordance with Section 11.0 of Appendix A of the SDCP. All pipe was inspected and cleaned prior to being used.

2.5.4 Program Modifications

Due to the possibility that grout was affecting the permeability of the bedrock in well OW659D (ie the well was pumped dry during development and a recovery rate of approximately 0.7 gpm was observed), the diameter of the borehole was enlarged to a 6 inch diameter to remove rock which may have been coated with grout. The well was pumped dry following enlargement and an increased recovery rate of approximately 1 gpm was observed.

3.0 GEOLOGIC AND HYDROGEOLOGIC SUMMARY

3.1 STRATIGRAPHIC DATA

A series of bedrock wells were installed during Phase 2 of the OSI Program in the off-Site area to collect additional geologic and hydrogeologic information. Geologic and hydrogeologic information from the three UDG wells within the study area was also obtained. The Stratigraphic and Instrumentation Logs are contained in Appendix A. The information from the Phase 2 OSI Program has been summarized on the following tables contained in Appendix C:

C1	Stratigraphic Data - Off-Site Investigation Program
C2	Overburden Stratigraphic Thickness - Off-Site Investigation Program
C3	Bedrock Stratigraphic Thickness - Off-Site Investigation Program
C4	Bedrock Monitoring Intervals - Off-Site Investigation Program

Table C1 contains the following information for each installation: ground surface elevation, horizontal survey data presented in terms of the N-Area Grid coordinate system, depth and elevation of each stratigraphic unit encountered, and occurrence of NAPL or iridescent sheens.

Based on the information contained in Table C1, the thickness of each overburden stratigraphic unit has been determined and is presented in Table C2. The stratigraphic thickness for each bedrock unit encountered during Phase 1 and 2 of the OSI Program is presented in Table C3. Table C4 presents the monitoring intervals and units for each of the bedrock wells.

For reference, the stratigraphic information for the Plant can be found in one of the following documents:

Historical Information - Historical Data Base, Buffalo Avenue Plant, June 1984, Appendix A.

SDCP Overburden Information - Overburden Summary Report, Appendix A, November 1989.

SDCP Bedrock Information - Bedrock Information Summary Report, March 1991.

3.2 OVERBURDEN GEOLOGY

In general, the OSI - Phase 2 hydrogeologic investigations support the descriptions provided in the OSI Summary Report. Specific differences identified during Phase 2 are presented below. In general, the overburden materials within the off-Site area are comprised of the following four stratigraphic units: Fill Material, Alluvial River Deposits, Glacial Lake Deposits and Glacial Till.

Fill Material

The Phase 2 results are consistent with the description of the Fill Material provided in the OSI Summary Report. Thus, no changes in the fill description are required.

Alluvial River Deposits

The OSI Summary Report stated that the Alluvial River Deposits (alluvium) ranged in thickness up to 10 feet. Phase 2 information showed that the unit ranged in thickness up to 11 feet with an average thickness of 3.6 feet.

Glacial Lake Deposits

The Phase 2 results confirmed that the thickness of the Glacial Lake Deposits (clay) varied across the OSI study area and reached a maximum thickness of 12 feet with an average thickness of 6.0 feet.

Glacial Till

The OSI Summary Report stated that the Glacial Till (till) thickness ranged up to 4.5 feet. The Phase 2 results showed that the thickness of this unit ranged up to 7 feet with an average thickness of 3.5 feet.

3.3 BEDROCK GEOLOGY

In general, the OSI - Phase 2 hydrogeologic investigations support the descriptions provided in the OSI Summary Report. A summary of the bedrock geology, including specific differences identified during Phase 2, are presented below. The stratigraphic sequence of the bedrock within the OSI study area consists of the Oak Orchard, Eramosa, Goat Island and Gasport Formations of the Lockport Group. Site-specific stratigraphic information for these units for the Phase 2 wells is summarized in Table C3. Figure 3.1 presents the orientation of a cross-section of the Lockport Group. Figure 3.2 presents the bedrock cross-section A-A'.

The lithology and thickness ranges of the formations were as follows:

Oak Orchard	73 to 81 feet thick	bituminous, light to dark gray, very thin to medium bedded, fine to medium grained saccharoidal dolostone
Eramosa	11 to 20 feet thick	bituminous, light to medium gray, thin to medium bedded, fine to medium grained argillaceous dolostone
Goat Island	11 to 15 feet thick	bituminous, medium to dark gray, thin to medium bedded, fine to medium grained dolostone

Gasport	thickness not determined (typically 30 feet thick)	bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained dolomitic limestone

The bedrock stratigraphic thicknesses measured during the OSI-Phase 2 study are summarized in Table 3.1.

3.4 OVERBURDEN HYDROGEOLOGY

The hydrogeologic characteristics of the overburden in the OSI study area were confirmed by the installation of the OSI - Phase 2 wells. In the OSI study area the overburden waterbearing unit ranged in thickness from 2 feet to 15 feet and the underlying confining layer ranged from 7 feet to 12 feet thick.

3.4.1 Hydraulic Conductivities

The OSI - Phase 2 overburden wells were not tested to determine hydraulic conductivity.

3.4.2 Groundwater Movement

A detailed description of overburden groundwater movement in the OSI study area can be found in the OSI Summary Report.

The overburden groundwater contours presented on Figures 2.13 and 2.14 for the May and July 1993 groundwater levels respectively confirm the groundwater flow directions presented in the OSI Summary Report. In general, the groundwater contour patterns shown on Figures 2.13 and 2.14 are similar.

Figures 2.13 and 2.14 show that the overburden groundwater is influenced by local effects. The EBDTS acts as a line sink drawing overburden groundwater toward the Plant from off-Site areas north of the Plant. The 47th Street sewer acts as a localized groundwater sink, drawing groundwater toward it from the surrounding areas. The EBDTS and other underground utilities are discussed more fully in the OSI Summary Report.

A downward vertical gradient exists in the OSI study area between the alluvium/fill unit and the monitored bedrock zones as illustrated by the OSI water level data.

Overburden groundwater levels measured during the OSI-Phase 2 study are summarized in Table 3.2.

3.5 REGIONAL BEDROCK HYDROGEOLOGY

A detailed discussion of the regional bedrock hydrogeology can be found in the OSI Summary Report.

3.6 OFF-SITE BEDROCK HYDROGEOLOGY

The OSI - Phase 2 studies, which included hydraulic properties testing such as in-situ injection testing, support the off-site hydrogeology presented in the OSI Summary Report.

3.6.1 Hydraulic Conductivities

Injection tests were performed in conjunction with the installation of the OSI - Phase 2 bedrock wells. Appendix B shows the results of this testing. The OSI- Phase 2 hydraulic conductivity values were similar to those determined from the OSI - Phase 1 study and on-Site programs.

All bedrock intervals tested during the well installations at well nests OW652, 653, 657, 658 and 659 were found to be waterbearing except the 20 feet to 50 feet below top of rock (BTOR) interval and the 100 feet to 120 feet BTOR interval at OW653, the 20 to 35 feet BTOR interval at OW658, and the 50 feet to 65 feet BTOR interval at OW659. A waterbearing unit is defined as a unit with a hydraulic conductivity of 5×10^{-5} cm/sec or greater.

The injection test results show that the hydraulic conductivity values for the D-Zone ranged from 7.8×10^{-6} to 3.6×10^{-1} cm/sec. The C-Zone hydraulic conductivity values ranged from 3.9×10^{-4} to 3.2×10^{-2} cm/sec. The B-Zone hydraulic conductivity values ranged from 2.5×10^{-5} to 1.1×10^{-1} cm/sec.

3.6.2 Bedrock Groundwater Movement

Figures 2.6 to 2.11 present the bedrock groundwater contours for the intervals monitored by the D, C, and B-Zone wells, respectively. These water levels were measured in May 1993 and July 1993.

The groundwater flow directions shown on Figures 2.6 to 2.11 confirm the flow directions presented in the OSI Summary Report. In summary, the groundwater flow direction in the D-Zone bedrock (Figures 2.6 and 2.9) was north/northwest towards the NYPA power conduits and the Falls Street Tunnel. The northerly limit of groundwater flow in the D-Zone is the Falls Street Tunnel which has also been identified to be a line sink for groundwater flow. The westernmost limit for bedrock groundwater flow from the Plant is the NYPA power conduits. These conduits sever the D, C and B Zones in the bedrock and physically cut off all northwesterly groundwater flow in these zones from the Plant.

Groundwater elevations for the C-Zone wells are shown on Figures 2.7 and 2.10. The groundwater flow pattern across this bedrock zone was similar to that of the D-Zone bedrock groundwater system with groundwater flow towards the north/northwest. The vertical gradient

between the units monitored by the C and D-wells was small and fluctuated between upwards and downwards at various well locations.

Groundwater elevations for the B-wells are shown on Figures 2.8 and 2.11. Groundwater flow was generally towards the north/northeast. The vertical gradient between the units monitored by the B and C-Zone wells was downward with a potentiometric differential ranging on the order of less than one foot to over two feet.

Bedrock groundwater levels measured during the OSI-Phase 2 study are summarized in Table 3.3.

A detailed discussion of the subsurface structures which exert the most influence on bedrock groundwater flow in the OSI study area is presented in the OSI Summary Report.

4.0 CHEMICAL PRESENCE SUMMARY

4.1 NAPL PRESENCE

4.1.1 Overburden NAPL Observation

No overburden soils containing NAPL were observed during the drilling operations for any of the Phase 2 OSI well installations.

4.1.2 Bedrock NAPL Observation

NAPL was observed once during the OSI Phase 2 well depth sounding activities of OW655D. Measurement of the total well depth at OW655D showed 1.3 feet of sediment in the bottom of the well and 0.4 feet of NAPL overlying the sediment. NAPL was not detected in any other new or existing bedrock location during the OSI Phase 2 studies.

On June 9, 1993 a sample of the NAPL from OW655D was collected and analyzed pursuant to the NAPL analytical protocols described in Appendix C of the SDCP. Analytical results are presented in Appendix D.

The analysis of the OW655D NAPL showed the primary components to be chlorobenzenes (61 percent) and chlorotoluenes (6 percent). Although chlorotoluenes were not included in an analysis of a NAPL sample collected from Frontier Chemical's well MW-84-11 performed by ECCO Incorporated, chlorobenzenes accounted for 93 percent of the concentrations of detected compounds. This demonstrated that the NAPL found in OW655D and the NAPL found in MW-84-11 were similar.

4.2 GROUNDWATER ANALYTICAL SUMMARY

The analytical protocols used for the OSI - Phase 2 Sampling Program were those described in the SDCP document entitled, "Appendix C - Chemical Sampling and Quality Assurance Plan - April 1988".

Each of the groundwater samples collected during the OSI - Phase 2 were analyzed for the SSI parameters shown in Table 2.3.

In order to present the results of the SSI, the parameters have been subdivided into parameter groups representative of the chemical families to which they belong. Since these chemical families would typically have been manufactured in the same areas and handled in a similar manner, combining them for presentation purposes is appropriate. The chemical families into which the SSI parameters have been grouped are presented in Table 4.1.

Bedrock groundwater samples were collected on March 8 and 9, 1993 by ARC/GZA at the RRF as part of ARC's environmental study of the RRF. The bedrock groundwater samples were analyzed for priority pollutant (PP) volatile organic compounds (VOCs), PP base/neutral acid extractables (BNAs), PP pesticides/PCBs, PP metals, and dechlorane plus. The RRF foundation drain sample was analyzed for target compound list (TCL) VOCs and BNAs, Resource Conservation and Recovery Act (RCRA) metals (plus aluminum, copper, lead and zinc), dechlorane plus, and sulfate. A summary of the analytical parameters and methodologies are presented on Table 4.2. The analytical results and QA/QC review are included as Appendix E.

4.2.1 Overburden Groundwater Chemistry

Groundwater samples were collected from three overburden wells during Phase 2 of the OSI program. UDG wells MW-2 and MW-3 were sampled during Round 1 and well MW-1 was sampled during Round 2. The results demonstrate that there is minimal chemical presence north of the area where OW554 is located. Well OW554 had exhibited the highest off-Site chemical presence in Phase 1 of the OSI.

To graphically present the overburden SSI results, the analytical data have been plotted adjacent to the respective well locations (see

Figures 4.1.1 through 4.1.4). The concentration of parameters of each chemical family have been summed and are reported as a total concentration on the figures. The following subsections discuss the chemical presence shown on Figures 4.1.1 through 4.1.4. Due to the low concentrations of chemicals present and minimal parameter detection, only four parameter/parameter groups are presented in a figure format.

Total Organic Halides (Figure 4.1.1)

TOX data from the UDG wells sampled has been rejected due to laboratory deficiencies (see Appendix F - QA/QC Summary). For reference the TOX results for adjacent wells from previous studies have been presented.

Total Organic Carbon (Figure 4.12)

Total Organic Carbon (TOC) concentrations were not detected at a method detection level of 3 mg/L and 6 mg/L (MW-2, MW-3 Round 1) and 4 mg/L (MW-1, Round 2).

Total Soluble Phosphorus (Figure 4.1.3)

Total soluble phosphorus concentrations were low, ranging from not detected at a method detection level of 10 µg-P/L (MW-3, Round 1) to 14 µg-P/L (MW-2, Round 1) and 17 µg-P/L (MW-1, Round 2).

Total Organic SSI Concentrations (Figure 4.1.4)

Organic SSI parameter presence was limited to trichloroethylene at a concentration of 3 µg/L (MW-3, Round 1), and tetrachloroethylene at a concentration of 7 µg/L (MW-2, Round 1). No other analytes were detected at MW-2, MW-3 or MW-1 (Round 2).

Lead (No Figure)

Lead concentrations ranged from not detected at a method detection level of 30 µg/L (MW-2, Round 1) to 37 µg/L (MW1, Round 2) and 41 J µg/L (MW3, Round 1).

Arsenic, Mercury (No Figures)

Arsenic and mercury were not detected above their respective method detection levels in any UDG overburden well sampled (MW-1, MW-2, MW-3).

Acids

None of the acids (benzoic acid, 2-chlorobenzoic acid, 3-chlorobenzoic acid, 4-chlorobenzoic acid, and chlorendic acids) were detected above their respective detection limits.

4.3 BEDROCK GROUNDWATER CHEMISTRY

The purpose of the Phase 2 OSI bedrock SSI Survey was to provide additional groundwater chemical data suitable for defining the extent of the chemical plume from the Plant into the OSI study area bedrock groundwater regime. Of primary importance was to determine whether the chemicals found along Royal Avenue were connected to the chemical plume beneath the Plant. The gap in the data base existed in the off-Site area 1,000 feet from the Plant boundary. The new wells provided the information necessary to fill this gap.

The collection of groundwater samples from the OSI bedrock wells for Phase 2/Round 1 - SSI was conducted during May 1993. Phase 2/Round 2 sampling was conducted in July 1993. The samples were analyzed for the SSI parameters listed in Table 2.3.

Bedrock groundwater samples were collected by ARC in March 1993 and were analyzed for the parameters listed in Table 4.2. The ARC samples were collected between OSI Phase 1 and Phase 2. Since the ARC samples were analyzed for different parameter lists (i.e. PP and TCL) and the OxyChem samples were analyzed for the SSI parameters, some analytes included in one list are not included in the other list. Thus, it is not possible to provide a comparison between the ARC and OxyChem results for analytes which are not common to the lists. The discussion below for the ARC analytical results focuses on the common analytes.

The ARC analytical results shown on Table 2.1 of Appendix E show that low level concentrations of principally chlorobenzene and chloroethylene compounds were detected. The ARC and OxyChem concentrations for well OW650 are generally consistent except for the chlorobenzene compounds. The ARC chlorobenzene compounds analytical results show higher concentrations (8.6 to 69 µg/L) than the OxyChem analytical results which ranged from ND1 to 2 µg/L.

The ARC analytical results for OW653D, OW407C and the RRF foundation drain are presented on Tables 2.2, 2.3 and 2.4 respectively in Appendix E. The principal compounds detected were chlorotoluene, chlorobenzene, and chlorobenzotrifluoride compounds. For the chlorobenzene compounds, the analytical results for the above three sample locations are consistent (i.e. the concentrations are of the same order magnitude). Since the ARC analytical results are generally consistent with OxyChem's analytical results, further discussion of the ARC results is not required and the following discussion utilizes OxyChem data only.

The Phase 2 - SSI analytical results for Round 1 and Round 2 for all monitoring intervals have been plotted adjacent to their respective well locations (see Figures 4.2.1 through 4.2.24) with the previous Phase I OSI results and SDCP results from selected Plant boundary wells. The concentrations of parameters of each chemical family have been summed and are reported as a total concentration on the figures (see Table 4.1 for parameter groupings).

Table 4.3 presents a comparison of the average chemical concentrations found in the D-interval 1,000 feet north of the Plant boundary with that of the D-interval wells located along the Plant boundary and the wells along Royal Avenue 1,500 feet north of the Plant boundary (south of the Falls Street Tunnel). Consistent with the OSI Summary Report a pattern of chemical presence emerges which showed elevated chemical presence along the Plant boundary and Royal Avenue (1,500 feet) whereas the chemical concentrations decreased in the area 1,000 feet from the Plant boundary. As shown in Table 4.3 the average concentrations for 14 of the 18 comparable parameter groups decreased when the first line of wells (1,000 feet - OW651D, OW652D, OW653D, OW657D, OW658D and OW659D) are compared to the Plant boundary wells (OW404D, OW405D, OW406D, OW408D and OW417D). Comparison of the parameter groups for the first line of wells (1,000 feet) with the Royal Avenue wells (1,500 feet) shows that the average concentration of 7 of the 18 comparable parameter groups was higher at the Royal Avenue wells (OW654D/OW655D) than at the first line of wells. The average concentration for 9 parameter groups at the Royal Avenue wells was similar to that for the first line of wells; two parameter groups increased in concentration from the Royal Avenue Wells to the first line of wells.

Tables 4.4 and 4.5 present a comparison of the average chemical concentrations found in the C-Zone and B-Zone wells 1,000 feet north of the Plant boundary with those of the C-Zone and B-Zone wells located along the Plant boundary and the well (OW654) along Royal Avenue 1,500 feet north of the Plant boundary.

Consistent with the pattern described above for the D-Zone, elevated chemical concentrations were detected in the C-Zone along the Plant boundary and Royal Avenue whereas the chemical concentrations decreased in the area 1000 feet from the Plant boundary. As shown in Table 4.4, the average concentrations for 10 of the 18 comparable parameter groups decreased when the first line of wells is compared to the Plant boundary wells. The remaining 8 of the 10 comparable parameter groups were ND for both lines of wells. Comparison of the parameter groups for the first line of wells with the Royal Avenue wells shows that the average concentration of 3 of the 18 parameter groups, including total organic SSI,

were higher at the Royal Avenue wells, 6 of the 18 were lower, and 9 of the 18 were ND for both lines of wells.

The average chemical concentrations shown in Table 4.5 for the B-Zone show a different pattern than observed for the D and C-Zones. In the B-Zone, the chemical concentrations for the majority of the 18 comparable parameter groups (16 of the 18 from Plant boundary wells first line wells and 14 of the 18 from the first line wells to Royal Avenue wells) either decreased or were the same. The two parameter groups that increased in concentration from the Plant boundary wells to the first line wells were total soluble phosphorus and total chloroethylenes. The four parameter groups that increased in concentration from the first line of wells to the Royal Avenue wells were total soluble phosphorus, total chlorotoluenes, benzene and total HCCH. Comparison of the Plant boundary wells with the Royal Avenue wells shows that 19 out of 20 comparable parameter groups (adding TOX and specific conductance which were qualified as rejected and not available, respectively, for the first line wells) decreased in concentrations from the Plant boundary to Royal Avenue. The one parameter that consistently increased in concentration with distance from the Plant was total soluble phosphorus.

Tables 4.6, 4.7 and 4.8 present a comparison of the average chemical concentrations found the three lines of wells (i.e. Plant boundary, first line and Royal Avenue) with depth (i.e. D, C and B-Zones).

Table 4.6 shows that the highest concentrations in the Plant boundary wells were detected in the D-Zone, followed in order of decreasing concentration by the B-Zone and then the C-Zone.

Table 4.7 shows that the total organic SSI chemical concentrations in all three intervals for the first line wells, while increasing with depth, were of the same order of magnitude. The primary reason for the increase in concentrations with depth was elevated benzene (1,200 µg/L) and chlorobenzene (1,600 µg/L) concentrations in OW659B; whereas only low level concentrations of benzene (4 µg/L) and chlorobenzene (86 µg/L) were detected in OW659D. This occurrence is directly attributable to the pattern of

bedrock groundwater migration (i.e. vertically downward and horizontally to the north/northeast from the Plant in the D and C-Zone and to the north/northeast from the Plant in the B-Zone). Upgradient of well nest OW659, SDCP studies identified elevated D, C and B-Zone benzene and total chlorobenzene concentrations at the Plant boundary well nests OW405 and OW406. At these locations, concentrations of benzene ranged from 2900 to 27,000 µg/L (D-Zone), 1,300 to 5,500 µg/L (C-Zone), and 3,200 µg/L to 25,000 µg/L (B-Zone). Chlorobenzene concentrations ranged from 14,000 to 20,000 µg/L (D-Zone), 7,900 to 11,000 µg/L (C-Zone), and 2,800 to 24,000 µg/L (B-Zone).

Table 4.8 shows a pattern of decreasing concentration with depth for the Royal Avenue wells. The dominant parameter groups detected in the D-Zone were total chlorotoluenes, benzene, total chlorobenzenes and total chloroethylenes. The dominant parameter group for the C-Zone was total chloroethylenes. The dominant parameter groups for B-Zone were total chlorotoluenes, benzene and total chlorobenzenes.

A detailed discussion of chemical distribution is presented below, dividing the chemical presence along the 1,000-foot alignment into three categories (i.e. non-detection, chemical presence less than one ppm, and chemical presence greater than one ppm) and comparing these chemical level categories to the Plant boundary and Royal Avenue areas. This discussion clearly shows the distinct chemical plume originating from the Plant proper, and the chemical plume originating from areas north of Royal Avenue:

- <u>Non Detection</u>

  In the vicinity of the 1,000-foot alignment of bedrock monitoring wells, TOC; total mercury; total lead; total arsenic; toluene; total hexachlorobutadiene, hexachlorocyclopentadiene, octachlorocyclopentene and perchloropentacyclodecane; 2,4,5-trichlorophenol; total hexcachlorocyclohexanes, benzoic acid, total chlorobenzoic acids and chlorendic acid were all generally found to be in the non-detect to low µg/L (mg/L for TOC) range of concentration.

Total mercury; total lead; total arsenic; 2,4,5-trichlorophenol, total chlorobenzoic acids and chlorendic acid were essentially non-detect at the Plant boundary and in the Royal Avenue areas, subsequently, no further discussion is warranted. TOC concentrations along Royal Avenue ranged from ND (PASNY 139) to 80 mg/L (MW-88-6B); whereas TOC concentrations along the Plant boundary or the 1,000-foot well alignment did not exceed 18 mg/L.

Toluene concentrations along Royal Avenue and the Plant boundary within the D Zone were present at concentrations of 460/590 µg/L (MW-88-6B), 230 µg/L (MW-88-6A); and 84/25 µg/L (OW404D), 82/130 µg/L (OW405D); whereas toluene was essentially non-detect to trace concentrations (i.e. <3 µg/L) along the 1,000-foot alignment.

Total hexachlorobutadiene, hexachlorocyclopentadiene, octachlorocyclopentene, perchloropentacyclodecane; and total hexachlorocyclohexanes were detected at OW654D and MW-88-6B (Royal Avenue) and at OW404 and OW405B,C,D (Plant boundary), whereas along the 1,000-foot alignment these compounds were essentially non-detect to trace concentrations.

Benzoic acid was only detected in the Royal Avenue area at one well (MW-88-6B) at a concentration of 620/1,800 µg/L. Benzoic acid was not detected at any Plant boundary well nor along the 1,000-foot alignment.

- Less Than One mg/L

In the vicinity of the 1,000-foot alignment of bedrock wells, total organic halides (TOX), total chlorobenzotrifluorides, total chloroethylenes, total chlorotoluenes and total soluble phosphorus were generally present at concentrations of 1 mg/L or less.

TOX concentrations along the 1,000-foot alignment were typically non-detect to 800 µg/L (OW653D), whereas along the Plant boundary elevated levels generally ranged from 1,000 µg/L to 31,000 µg/L. In the

Royal Avenue area TOX concentrations ranged from 220 µg/L (OW654B) to 22,000 µg/L (MW-88-6B).

Total chlorobenzotrifluoride concentrations along the 1,000-foot alignment were present at trace to non-detect concentrations in the westerly wells (i.e. OW651, OW657 and OW652) and tended to increase in concentration (i.e. 4 to 360 µg/L) to the east (i.e. OW658, OW659 and OW653) throughout the D, C and B Zones. This was likely reflecting groundwater/chemistry movement from the Plant boundary areas of total chlorobenzotrifluoride presence in the vicinity of OW404, OW405 and OW406 where concentrations ranged from 4 to 600 µg/L. Total chlorobenzotrifluoride concentrations in the area of Royal Avenue ranged from 3 (MW-88-6B) to 200 µg/L (OW655).

Total chloroethylene concentrations were typically in the low mg/L range along Royal Avenue, OW654D,C (1 to 2 mg/L), MW-88-6B (7 mg/L/10 mg/L) and MW-88-6A (1 mg/L); whereas in the D unit of the 1,000-foot alignment, total chloroethylene did not exceed 300 µg/L. It is interesting to note that movement of total chloroethylenes from the Plant boundary in the C Zone was evident from the area of OW404C (3 mg/L) to OW657C (1 mg/L). Groundwater contouring of the C Zone shows that groundwater flow from OW404 to the north in the vicinity of OW657 was likely.

Total chlorotoluenes along Royal Avenue were present at concentrations of 1 µg/L (OW656) to 6,700/7,800 µg/L (MW-88-6B). In the Plant boundary area, total chlorotoluenes were detected as high as 2,400/2,500 µg/L at the RRF foundation drain (D-Zone) and 1,400/1,600 µg/L at OW406D.

Concentrations of total chlorotoluenes along the 1,000-foot alignment were generally non-detect or low level (i.e. <65 µg/L) to the west (i.e. OW651, OW657 and OW652) but increased to the east throughout the D, C and B-Zones (OW658, OW659 and OW653). This was likely reflecting groundwater chemistry movement from the Plant boundary to these off-Site areas.

Soluble phosphorus was detected in two areas along the 1,000-foot alignment; each area with concentrations generally less than 100 µg/L. In the westerly area (OW651, OW657, OW652 and BH11D-92) low level soluble phosphorus concentrations were detected which was likely sourced from the Plant boundary area of OW404 (i.e. 20 to 1,000 µg/L - soluble phosphorus). To the east, a second area of soluble phosphorus presence existed at OW653 which was likely associated with groundwater/chemistry movement from the area of OW407/OW408 (i.e. 20 to 5,400 µg/L - soluble phosphorus).

- Greater Than One mg/L

In the vicinity of the 1,000-foot alignment of bedrock wells, benzene and total chlorobenzenes were present at concentrations above 1 mg/L.

Benzene was detected along the Plant boundary at elevated concentrations (i.e. 71,000 µg/L) in the D, C and B-Zones of OW405 and OW406. In the immediate downgradient areas from OW405/OW406, benzene was detected at off-Site wells OW658 and OW659 at concentrations up to 1,000 µg/L. Along Royal Avenue, benzene was detected at concentrations ranging from 1 µg/L (MW-88-6A) to 2,700 µg/L (MW-88-6B).

Total chlorobenzene presence exhibits a similar pattern of chemical migration as benzene, where elevated levels (i.e. typically greater than 10,000 µg/L) are noted in the D, C and B-Zones of OW405/OW406 on the Plant boundary. In the immediate downgradient off-Site wells OW658 and OW659, total chlorobenzenes are present at concentrations of less than 3,000 µg/L.

D-Zone concentrations of total chlorobenzenes along the 1,000-foot alignment range from 1,200 µg/L (OW658D) to non-detect at OW651. In the vicinity of Royal Avenue total chlorobenzene concentrations increase within the D-Zone, i.e. OWD654D (5,700/2,300 µg/L), MW-88-6B (8,000/9,000 µg/L) and OW655 (9,300/3,800 µg/L).

In summary, a decrease in concentrations from the Plant boundary wells to the first line wells with an increase in concentration from the first line wells to the Royal Avenue wells are shown on both Tables 4.3 and 4.4 (D and C-Zones, respectively). Table 4.5 (B-Zone) shows a continuous decrease in concentrations from the Plant boundary wells to the Royal Avenue wells with a rapid decrease from the Plant boundary wells to the first line wells.

The concentration patterns with respect to depth are shown on Tables 4.6, 4.7 and 4.8. In the Plant boundary wells (Table 4.6) the highest average concentrations were detected in the D-Zone wells (e.g. average total organic SSI = 65,000 µg/L), followed by the B-Zone wells (e.g. average total organic SSI = 23,000 µg/L) and then the C-Zone wells with the lowest concentrations (e.g. average total organic SSI = 7,100 µg/L) for this line of wells. The principal parameters/parameter groups at the Plant boundary wells were benzene and total chlorobenzenes. In the first line of wells (Table 4.7) a pattern of increasing concentrations with depth is shown with average total organic SSI concentrations for the D, C and B-Zones of 640, 800 and 900 µg/L, respectively. The principal compounds in this line of wells were total chlorotoluenes, benzene, total chlorobenzenes and total chloroethylenes.

In contrast to the first line of wells, the Royal Avenue wells showed a continuous decrease in concentrations with depth (see Table 4.8) with average total organic SSI concentrations of 6,500 µg/L; 2,300 µg/L; and 300 µg/L for the D, C and B-Zones, respectively. The principal compound detected in the D-Zone was total chlorobenzenes (5,300 µg/L); in the C-Zone, total chloroethylenes (2,300 µg/L); and in the B-Zone, total chlorobenzenes (130 µg/L) and total chloroethylenes (100 µg/L).

The chemical analytical results show that the concentrations of the bedrock chemical plumes in the D, C and B-Zones attributable to the Plant decrease rapidly with distance from the Plant with a pattern of decreasing concentrations from the Plant boundary wells to the first line of wells and then increasing concentrations from the first line of wells to the Royal Avenue wells. In addition, the pattern of elevated concentrations

for benzenes and chlorobenzenes in the D, C and B-Zones of the Plant boundary wells with lower level concentrations increasing with depth in the first line of wells and then elevated concentrations decreasing with depth, in the Royal Avenue wells, shows that the Plant is not the source for the elevated chemical concentrations detected in the Royal Avenue Wells. Thus, OxyChem believes that the chemicals detected in the Royal Avenue wells did not migrate from the Plant.

5.0 DISCUSSION

5.1 OVERBURDEN GROUNDWATER CHEMISTRY

The Phase 2 analytical results for the UDG wells (MW-1, MW-2 and MW-3) show that minimal chemical presence existed past the Plant boundary in the vicinity of OW554. The total organic SSI concentrations at OW554 during Phase 1 were 870 and 1,500 µg/L for Rounds 1 and 2, respectively. By comparison the total organic SSI concentrations at the UDG overburden wells were ND, 3 and 7 µg/L for MW-1, MW-2 and MW-3, respectively. These results show that there was no significant off-Site migration of Plant chemicals through the overburden groundwater in this area.

An area of elevated chemical presence (i.e. >10,000 µg/L) existed south of UDG and OW554 in the vicinity of on-Site wells OW308, OW320, OW321, WS107 and WS109 (see Figure 4.1.4). Total organic SSI concentrations declined to the north as evidenced by the reduced concentrations observed at OW554 and non-detect to trace chemical presence at MW-1, MW-2 and MW-3. This was consistent with the limits of chemical presence exhibited along the entire northern Plant property boundary. Beyond the Plant boundary, chemical migration via the overburden groundwater flow regime was very limited. As shown on Figures 2.13 and 2.14, the EBDTS acts as a line sink drawing overburden groundwater from both the north and the south towards the EBDTS.

With the southerly flow of groundwater, the EBDTS prevents groundwater/NAPL migration (i.e. trace NAPL observed at OW554) to the north beyond the Plant boundary. In the vicinity of 47th Street, the overburden drains toward the sanitary sewer on 47th Street. The combination of these flow factors in conjunction with the natural hydrogeologic setting, has prevented extensive chemical migration from the Plant's northern boundary. Thus only limited off-Site chemical presence exists north of the Plant.

5.2 BEDROCK GROUNDWATER CHEMISTRY

5.2.1 North of Plant

The analytical results from the OSI (Phase 1 and Phase 2) showed a consistent pattern of chemical distribution through the off-Site area north of the Plant. The data for the D and C-Zones for the first line of bedrock wells located approximately 1,000 feet beyond the northern Plant boundary (OW651, OW652, OW653 OW657, OW658 and OW659) showed chemical concentrations significantly lower than concentrations in samples collected from wells along the Plant boundary (see Tables 4.3 and 4.4, and Figures 4.2.18 and 4.2.19). Further to the north, samples collected from the two wells along the south side of Royal Avenue (OW654 and OW655) and from the two wells on the north side of Royal Avenue (MW-84-11, MW88-6B) showed elevated chemical presence. These wells are located 500 to 600 feet further north of the first line of wells. The data for the B-Zone showed a pattern of continuously decreasing concentrations from the Plant boundary wells to the Royal Avenue wells (see Table 4.5 and Figure 4.2.20).

OxyChem believes that the chemical presence detected in the Royal Avenue wells did not migrate from the Plant. The reasons for this are as follows:

i) the pattern of decreasing concentrations in the D and C Zone from the Plant boundary wells to the first line of wells and then increasing concentrations from the first line of wells to the Royal Avenue wells was inconsistent with a plume originating from the Plant; and

ii) the detection of elevated benzene and chlorobenzene concentrations in the D, C and B-Zone for the Plant boundary wells, in the B-Zone for the first line of wells, and in the D-Zone (upper bedrock) for the Royal Avenue wells was inconsistent with a plume originating from the Plant. That is, a plume originating from the Plant would be expected to migrate to greater depths as distance from the Plant increased, as shown by the pattern from the Plant boundary wells to the first line of wells, due to the effect of "clean" infiltration in the off-Site areas

1000 feet north of the Plant. The detection of elevated benzene and chlorobenzene concentrations in the upper bedrock (D-Zone) in the Royal Avenue wells north of the first line of wells was inconsistent with the expected migration pathways.

The chemical concentrations measured at OW651, OW657, OW658, OW659, OW652 and OW653 demonstrated that a significant APL chemical concentration reduction occurred within close proximity to the northern plant boundary. The results for all three intervals showed that elevated chemical presence was primarily limited to an area close to the Plant.

The analytical results from OW656, which is located on the north side of Royal Avenue, showed that the chemical concentrations reduce beyond the groundwater divide created by the Falls Street Tunnel. The chemical concentrations measured in groundwater at OW656, which is on the opposite side of the hydraulic divide provided by the Falls Street Tunnel, were not from the Plant.

The source of the elevated chemical presence observed at OW654 and OW655 may be due to migration from areas north of OW654 and OW655. A potential migration pathway may have been below grade construction activities, (i.e. for building foundations, sewers and other underground works) which may have penetrated the clay/till unit throughout the OSI study area. The clay/till unit acted as a confining layer to protect the bedrock groundwater flow regime from surficial chemical presence in the overburden. This confining layer appears to have been breached, so that chemicals could have penetrated the fill/alluvium layer and passed into the bedrock groundwater regime.

The NAPL presence observed at wells OW-84-11 and MW-88-6B located on the Frontier Chemical property north of Royal Avenue may be one of the sources of the chemicals detected in the Royal Avenue wells. A discussion of the NAPL presence in areas along Royal Avenue (OW654, OW655, MW-84-11 and MW-88-6B) and its potential migration and impact on bedrock groundwater concentrations was presented in the OSI Summary Report.

5.2.2 West of Plant

Bedrock groundwater samples were collected and analyzed from well OW650D during Round 1 of Phase 2. Well OW650D, located west of the NYPA conduits, was sampled and analyzed to verify the low chemical concentrations detected during OSI - Phase 1. The low Phase 1 results were inconsistent with the identified presence of NAPL on the rock core from this well. The Phase 2 results confirmed that only low chemical concentrations were present in the groundwater at this location (total organic SSI concentrations: 34 µg/L/11 µg/L Phase 1:Round 1/Round 2 and 6 µg/L Phase 2:Round 1). Consequently, this indicates that the NAPL, if actually present, was having little impact on the groundwater quality in this area.

5.3 NAPL PRESENCE

NAPL presence observed during Phase 1 of the OSI was discussed in the OSI Summary Report. During Phase 2, NAPL was not observed in any overburden soils. In the bedrock, NAPL was identified in well OW655D and was confirmed to still exist at OW654D.

A potential path of NAPL migration to OW654D from the Plant was identified as the ISSS. The ISSS runs from Buffalo Avenue to Royal Avenue and passes OW654D at a distance of approximately 50 feet to the west. Evaluation of this sewer presented in the OSI Summary Report has determined that NAPL does not flow northwards from the Plant to OW654D through the ISSS or its bedding. Can't be concluded; it could migrate through a fracture in the rock

To evaluate the possibility of a northerly NAPL entry point to the ISSS bedding, BH11-92 and BH12-92 were completed. Overburden soils and the bedrock opposite the sanitary sewer were examined and one bedrock groundwater sample was collected to evaluate NAPL presence. NAPL was not identified in the borings or well completed. In addition, the APL concentrations of SSI parameters in the collected

groundwater sample were not indicative of NAPL presence. The total organic SSI concentration in well BH11D-92 was only 90 µg/L. Since this well is located immediately adjacent to the sewer, it would be the most likely location for NAPL or elevated chemical presence to be identified if the sanitary sewer was a migration pathway. In addition to the chemical evidence, it is believed that the sewer was installed using concrete backfill in the bedrock. Having a solid concrete mass as the bedding for the ISSS prevented the sewer bedding from being a NAPL migration pathway.

The elevation of the NAPL in the area has also been reviewed. The elevation of the top of the NAPL at OW654D has been revised to a depth of 57 feet below ground surface (513.4 feet, OxyChem datum) based on Phase 2 results. NAPL has also been observed at other D-Zone wells during the SDCP. The elevation of the NAPL is approximately 505 feet and 512 feet (OxyChem datum) at OW405D and OW409D, respectively. These elevations show the NAPL located at OW654D would be moving south towards OW405D and OW409D, not north from the Plant towards OW654D. The elevation of NAPL in OW655D is approximately 508 feet. This elevation shows that the NAPL at OW655D is at a higher elevation than at OW405D and thus would likely move southwards with the dip of the bedding planes. The NAPL elevation at OW655D is lower than the NAPL elevation at OW409D, indicating the potential for NAPL to migrate northward from OW409D. However, due to the southerly dipping bedding planes and the distance between OW409D and OW655D, it is unlikely the NAPL detected at OW655D migrated from the Plant, particularly since the wells located between the two well nests have not identified any NAPL to be present.

The elevation of NAPL at OW654D and OW655D is well below the elevation of the invert of the Falls Street Tunnel (539±). The Falls Street Tunnel is acting as a line sink for APL collection through this area.

3

It is apparent that the NAPL observed in OW654D and OW655D has migrated to the area of OW654D/OW655D from the north. Given the depth of NAPL observed, NAPL movement underneath the Falls Street Tunnel from areas north of Royal Avenue is likely. NAPL has been shown to be present at four of the wells north of OW654D. Two of the wells

(BH-87-4B and MW-88-2) monitor the overburden while the third and fourth monitor the upper bedrock zone (MW-88-6B and MW84-11). MW-88-6B and MW-84-11 are positioned northeast of OW654D and northwest of OW655D. The presence of NAPL northeast of OW654 is anticipated to be a likely candidate for NAPL migration into the OW654 area. This is particularly likely due to the southerly dip of the bedrock bedding planes. The elevation of NAPL at MW-88-6B is on the order of 542± feet. The Falls Street Tunnel and the Southside Interceptor Sewer (inverts 539± feet) may intercept a portion of the NAPL migrating south past the Falls Street Tunnel/Southside Interceptor Sewers.

6.0 CONCLUSIONS

Based upon the data collected during the OSI - Phase 1 and Phase 2, the following conclusions can be made:

- The EBDTS acts as a line sink to the overburden groundwater flow in the area of the EBDTS and prevents any further northward migration of overburden groundwater chemistry past the north Plant boundary of that area.

- Significant chemical migration through the overburden regime to off-Site areas adjacent to the Plant has not occurred. Two areas near wells OW554 and OW559 exhibited some chemical presence which was elevated although the concentrations were substantially reduced when compared to adjacent on-Site Plant boundary wells and off-Site wells by others (UDG wells). The entire extent of the elevated chemical presence at OW554 is limited to the immediate area adjacent to OW554.

- Bedrock groundwater in the D-Zone and C-Zone flowed to the north/northwest towards the NYPA power conduits and the Falls Street Tunnel. The vertical gradients between the zones was small and fluctuated between upwards and downwards at various well locations.

- Bedrock groundwater in the B-Zone flowed towards the north/northeast. The vertical gradient between the B-Zone and C-Zone was downward with a potentiometric differential ranging on the order of less than one foot to over two feet.

- The OSI program has shown that the NYPA Power Conduit drains act as a line sink for bedrock groundwater flow in the area to the west of the off-Site area. Similarly the Falls Street Tunnel and the Southside Interceptor Sewer act as line sinks for shallow bedrock groundwater in the north part of the off-Site area. These structures act as boundaries to further northerly or westerly flow of bedrock groundwater from the Plant.

- Elevated chemical concentrations are not present in the bedrock groundwater flow regime to the west of the Plant or along a line of wells located 1,000 feet north of the Plant. This includes observations made in each of the waterbearing zones investigated at depth in the bedrock flow regime.

- Elevated chemical concentrations in the bedrock groundwater flow regime were present at locations 1,500 feet north of the Plant. The installation of additional wells along the 1,000-foot alignment has confirmed that the elevated chemical concentrations in the bedrock groundwater in the area of Royal Avenue were not due to a groundwater chemical plume originating from the Plant.

- The OSI has shown that the NAPL present at OW654D/OW655 did not migrate from the Plant. Evaluation of the APL chemistry has shown that the concentrations of SSI parameters decreased substantially at a distance of 1000 feet north of the Plant boundary and are not high enough to be indicative of NAPL presence at the first line of wells. NAPL migration along the bedrock in a northerly direction is unlikely as the bedrock surface and bedding planes slope southerly. NAPL migration along the northward sloping ISSS does not occur. In addition, a review of the historical construction information indicates that the ISSS sewer was embedded in concrete.

- The available data sufficiently define the extent of chemical presence in the overburden and bedrock groundwater flow regime off Site of the Plant. The OSI is complete and has shown the data and conditions to be consistent with the results of the Regional Groundwater Assessment.

- The proposed bedrock Corrective Measure designed to provide hydraulic containment of the APL plume along the northwestern and western Plant boundaries will effectively contain the on-Site chemical plume thereby eliminating additional chemical migration into the off-Site area. The proposed hydraulic containment system will also draw some of the off-Site chemical plume back toward the Plant but the extent of this

additional benefit will not be determined until the hydraulic system is operating.

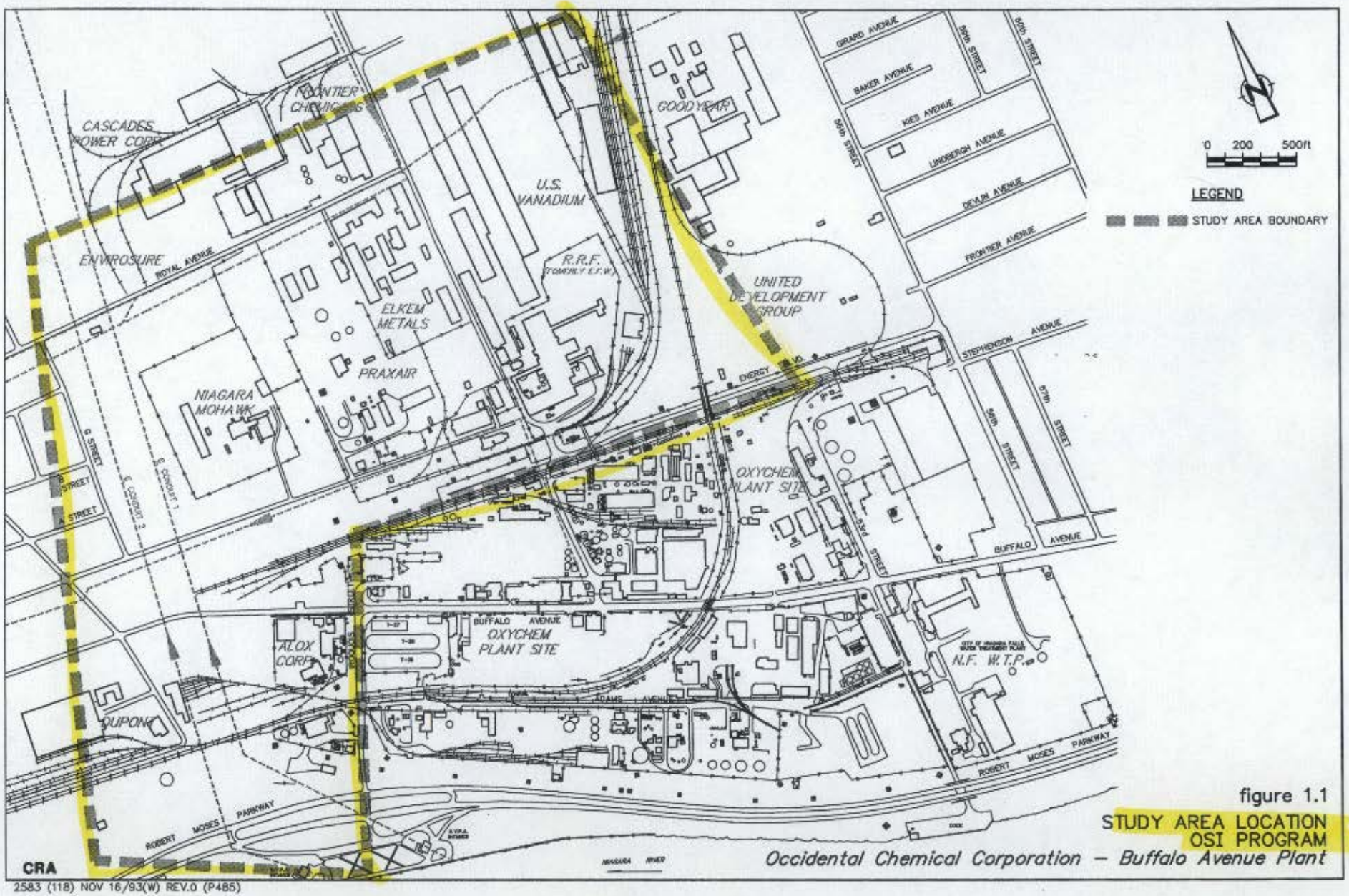


figure 1.1
STUDY AREA LOCATION
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 16/93(W) REV.0 (P485)

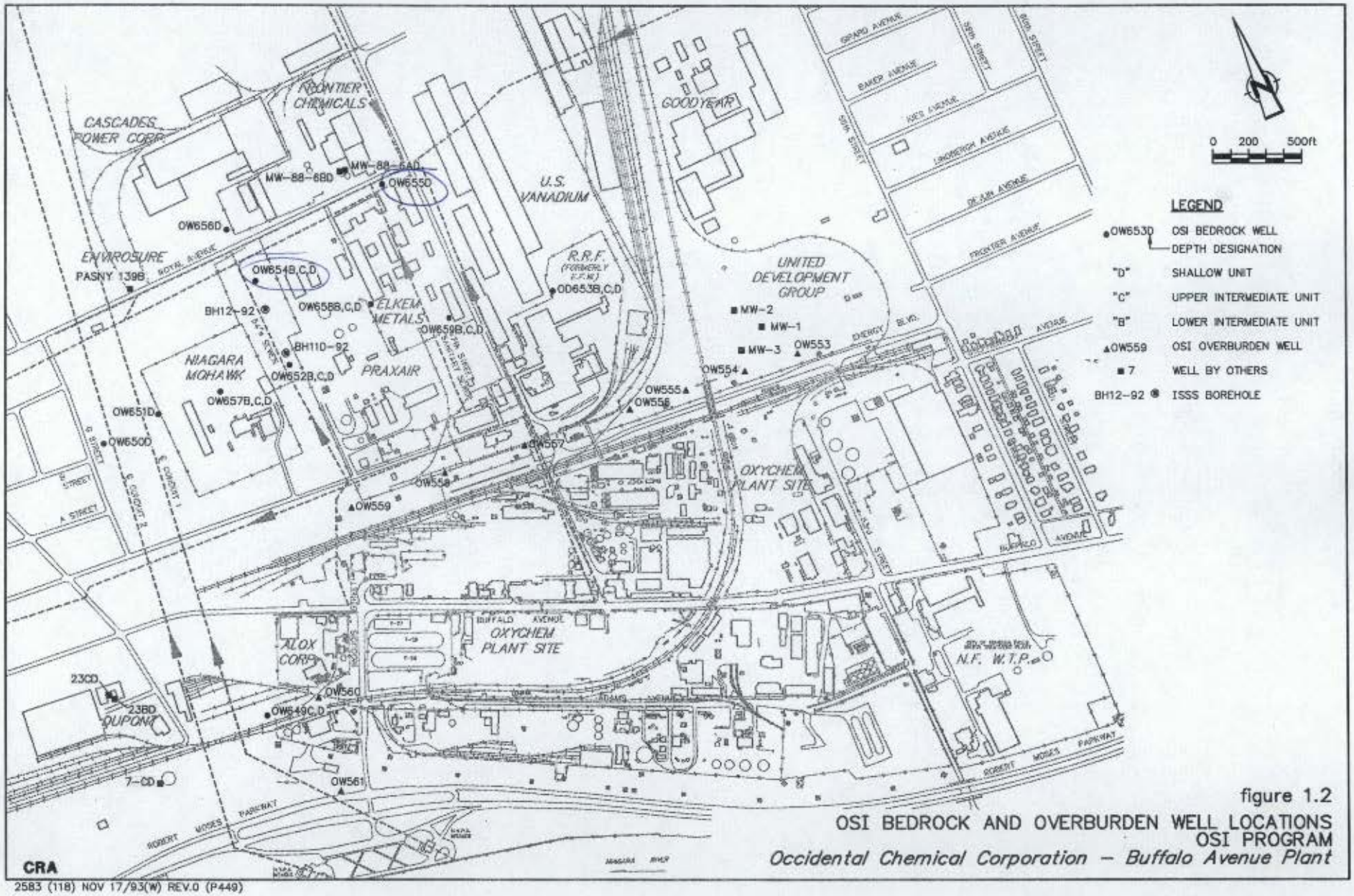


figure 1.2

OSI BEDROCK AND OVERBURDEN WELL LOCATIONS
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P449)

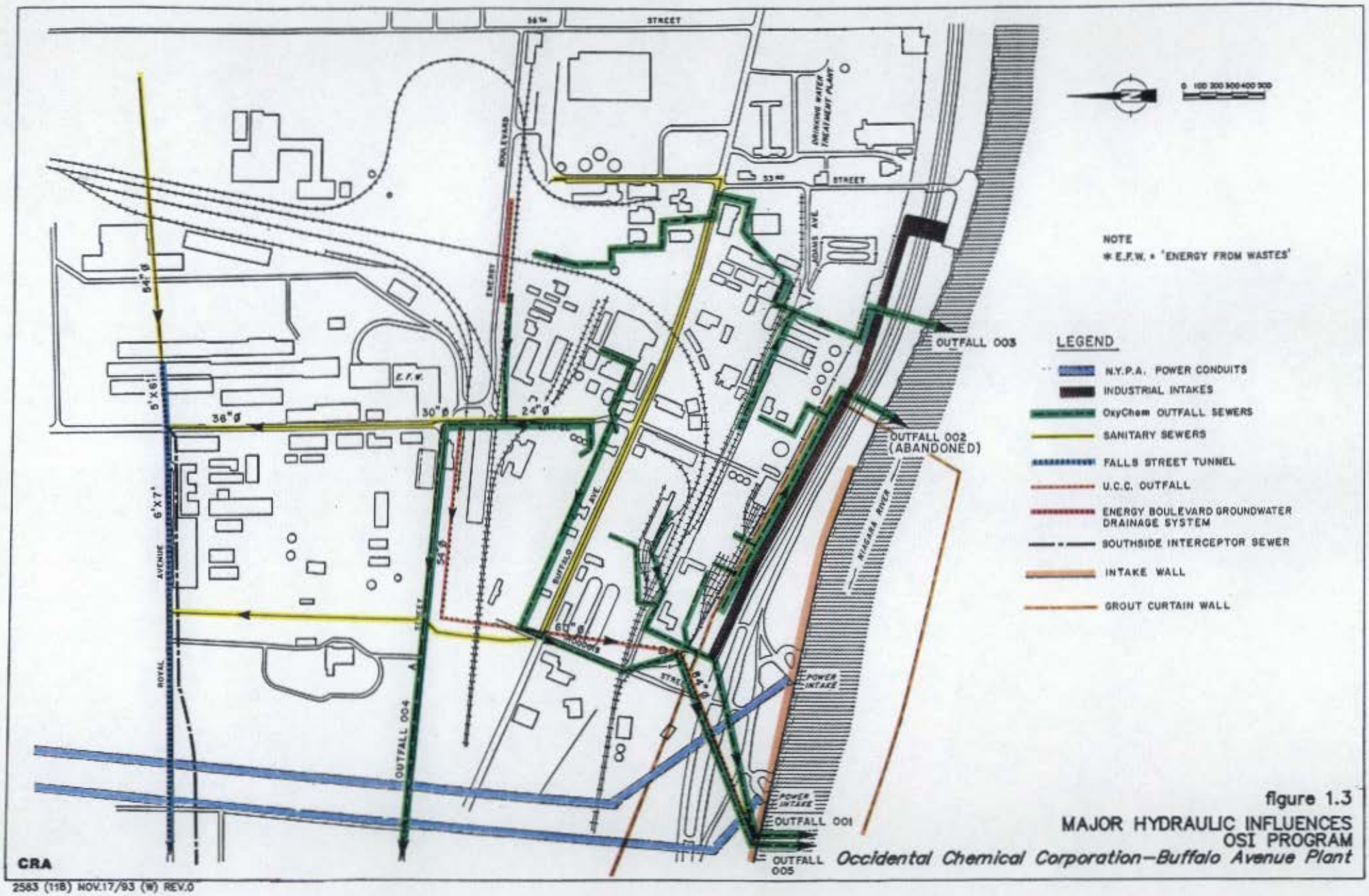
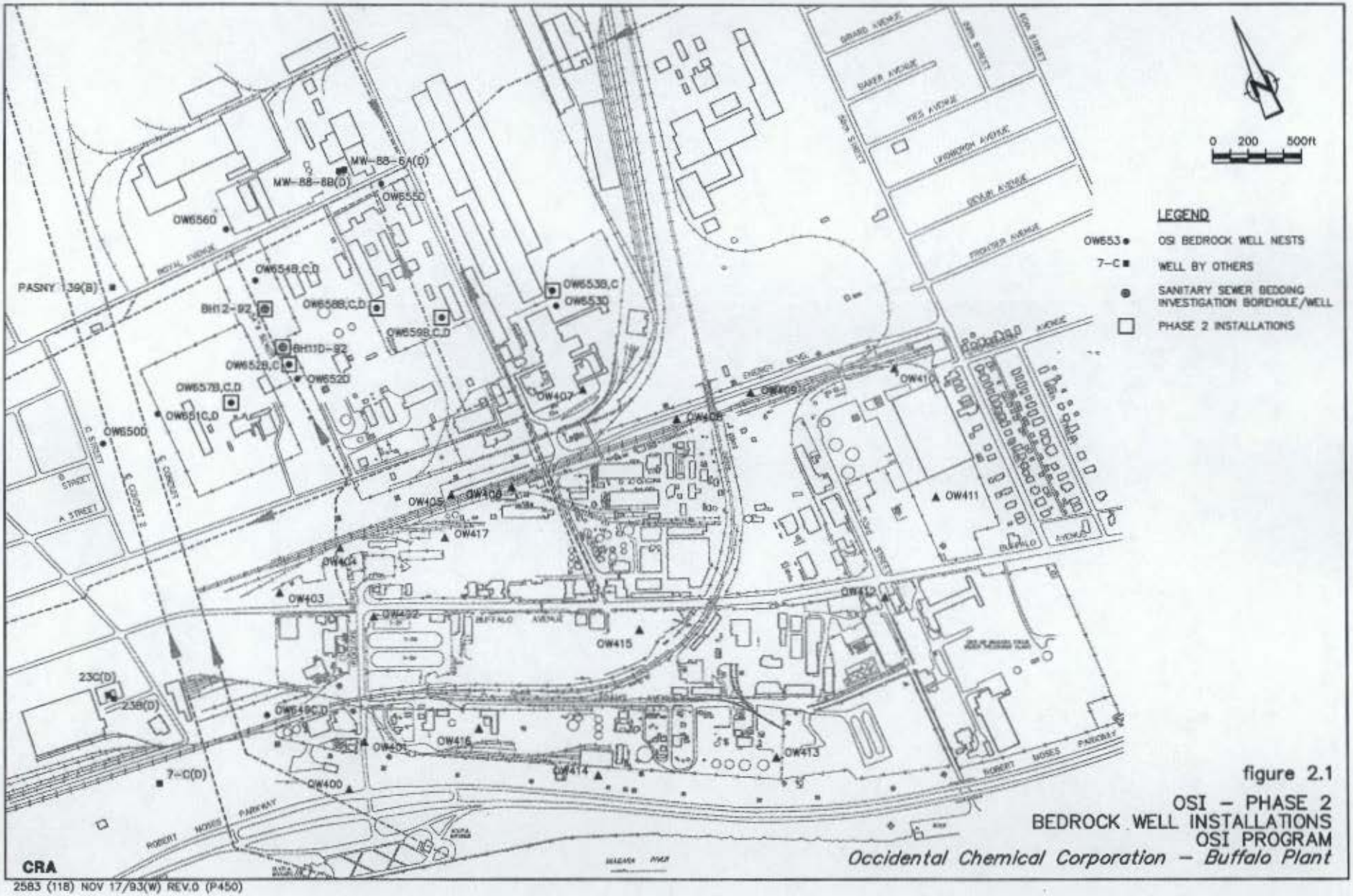


figure 1.3
MAJOR HYDRAULIC INFLUENCES
OSI PROGRAM
Occidental Chemical Corporation–Buffalo Avenue Plant

CRA

2583 (118) NOV.17/93 (W) REV.0



2583 (118) NOV 17/93(W) REV.0 (P450)

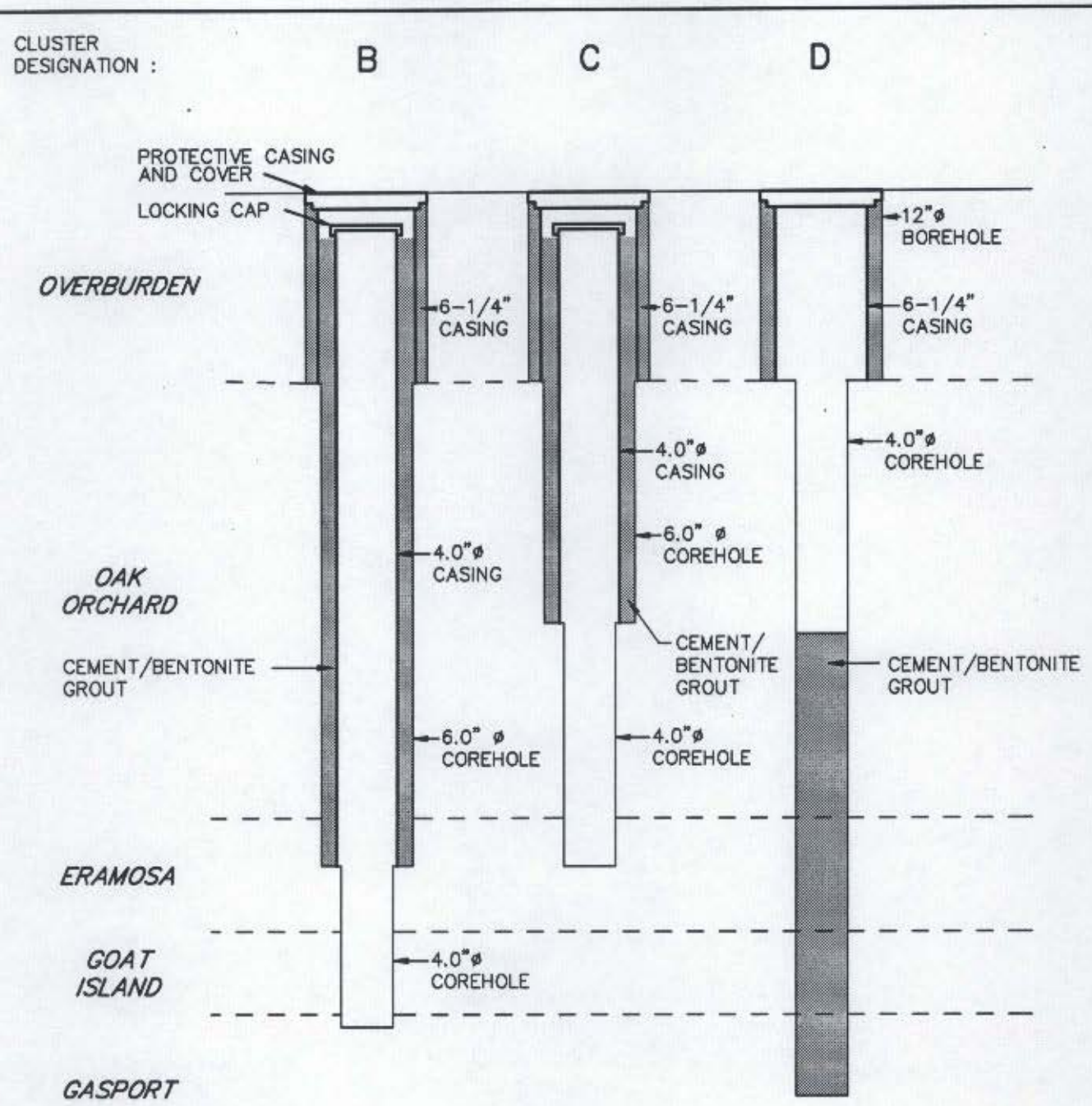


figure 2.2

TYPICAL BEDROCK WELL NEST INSTALLATION
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

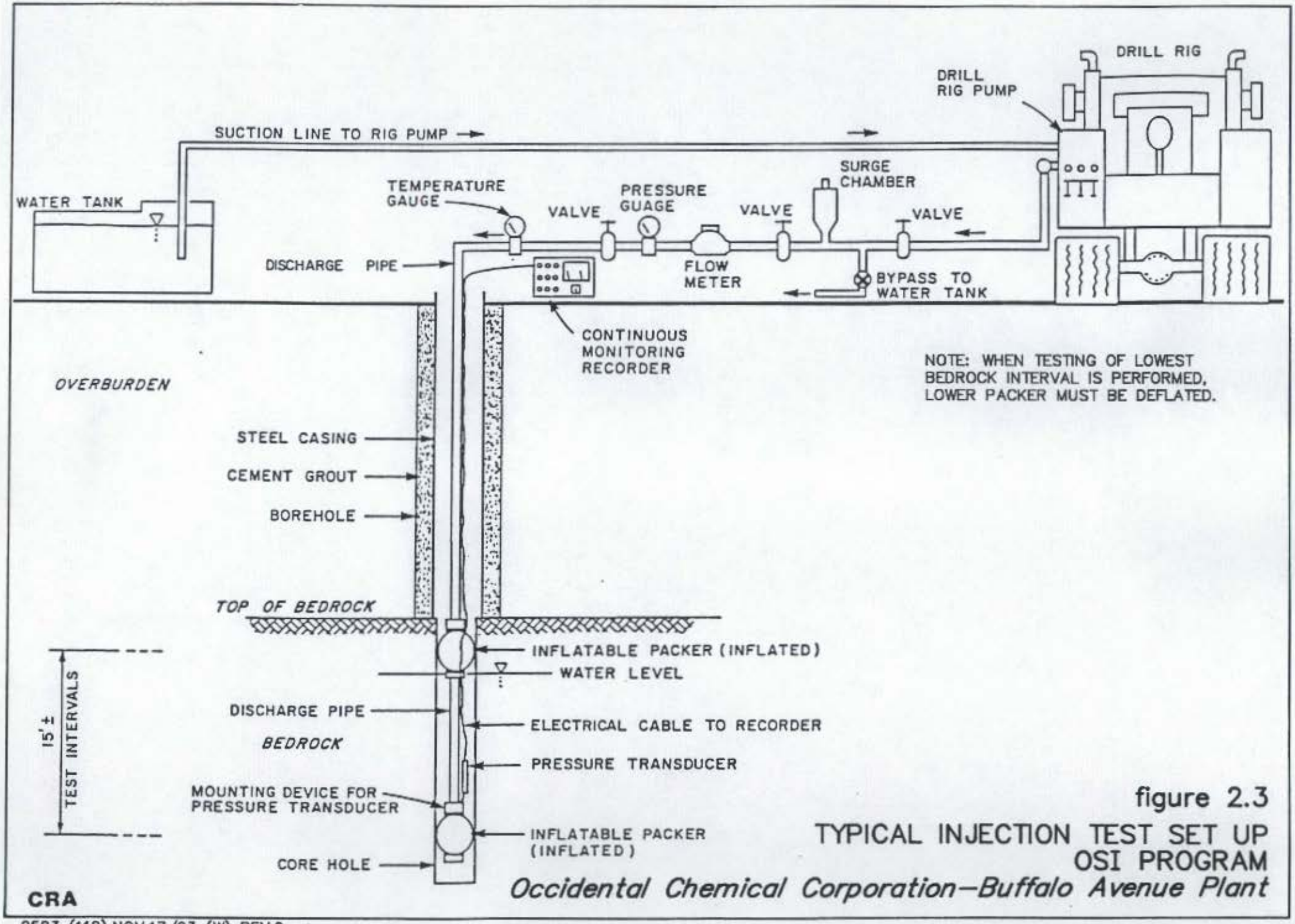


figure 2.3

TYPICAL INJECTION TEST SET UP
OSI PROGRAM

Occidental Chemical Corporation–Buffalo Avenue Plant

CRA

2583 (118) NOV.17/93 (W) REV.0

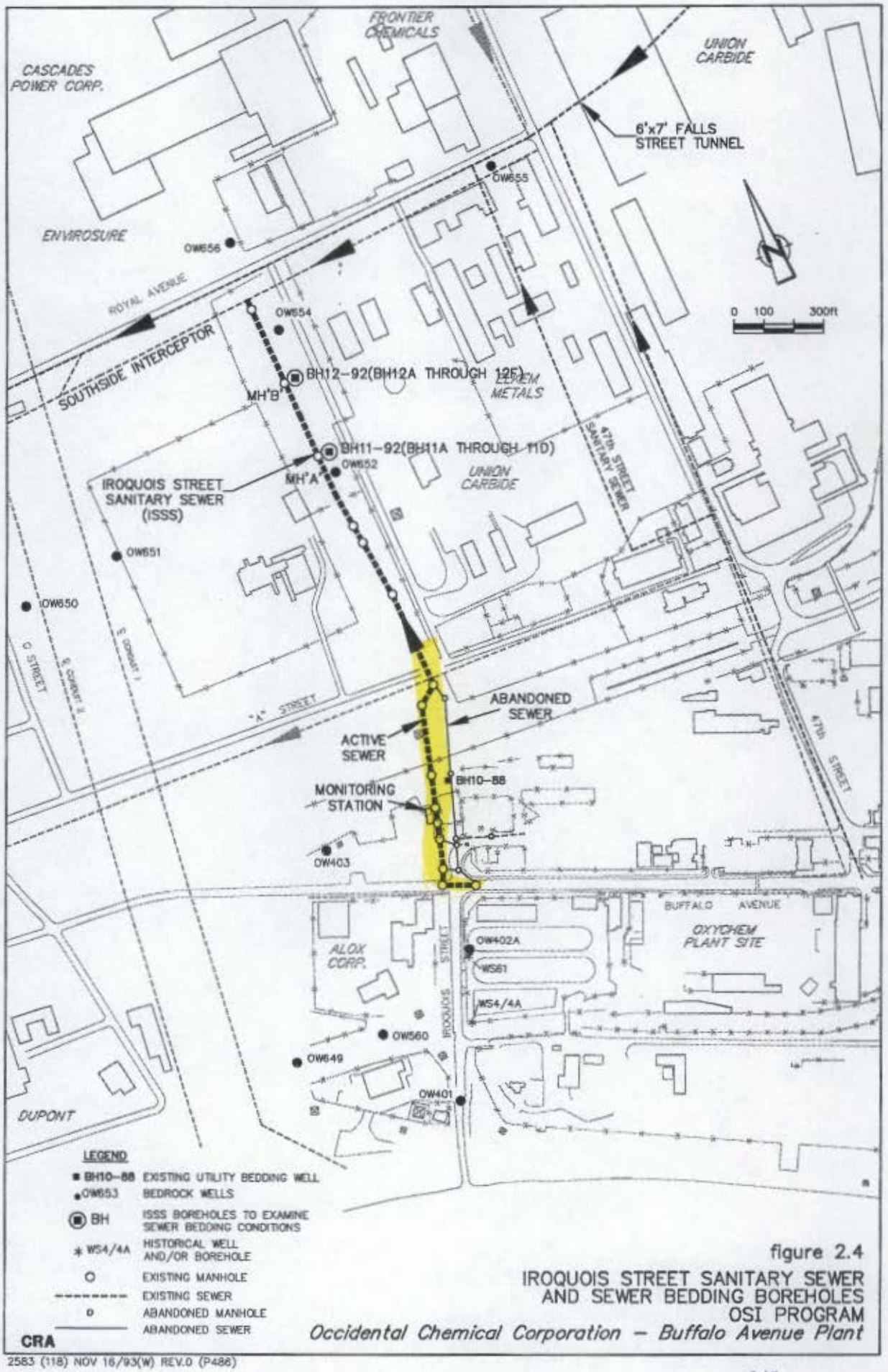


figure 2.4
IROQUOIS STREET SANITARY SEWER
AND SEWER BEDDING BOREHOLES
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

2583 (118) NOV 16/93(W) REV.0 (P486)

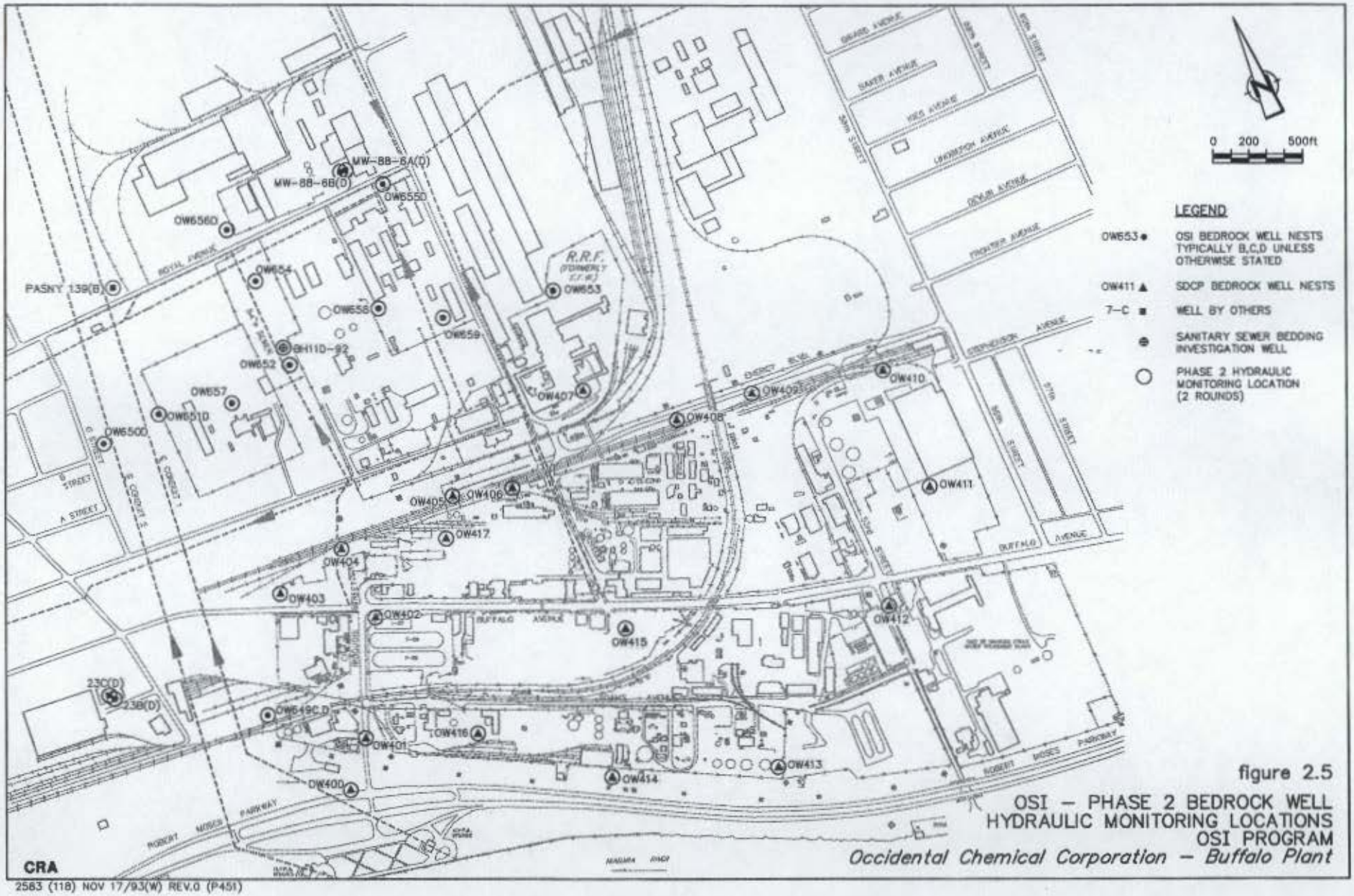


figure 2.5

OSI – PHASE 2 BEDROCK WELL HYDRAULIC MONITORING LOCATIONS
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P451)

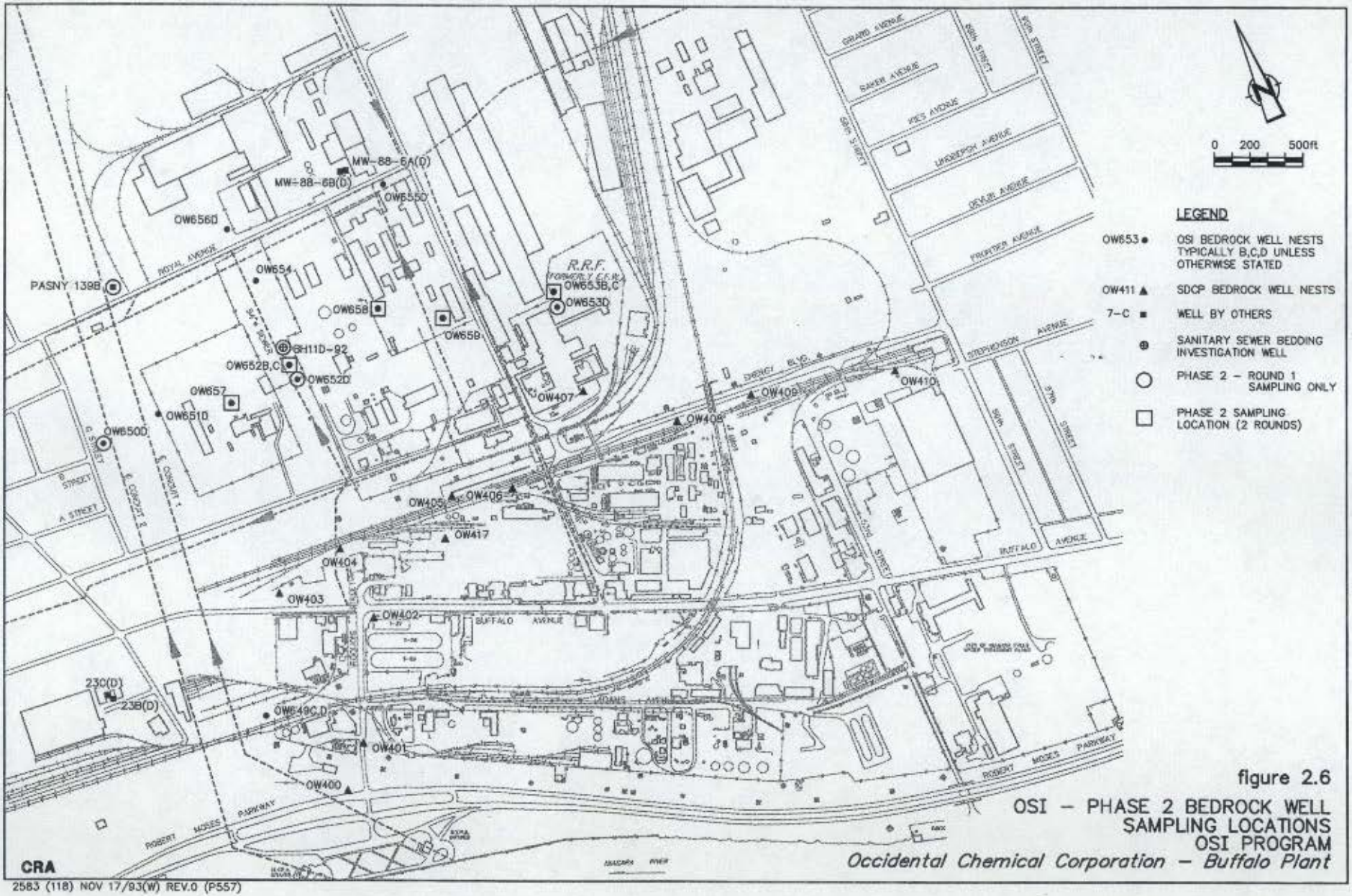


figure 2.6

OSI – PHASE 2 BEDROCK WELL SAMPLING LOCATIONS
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P557)

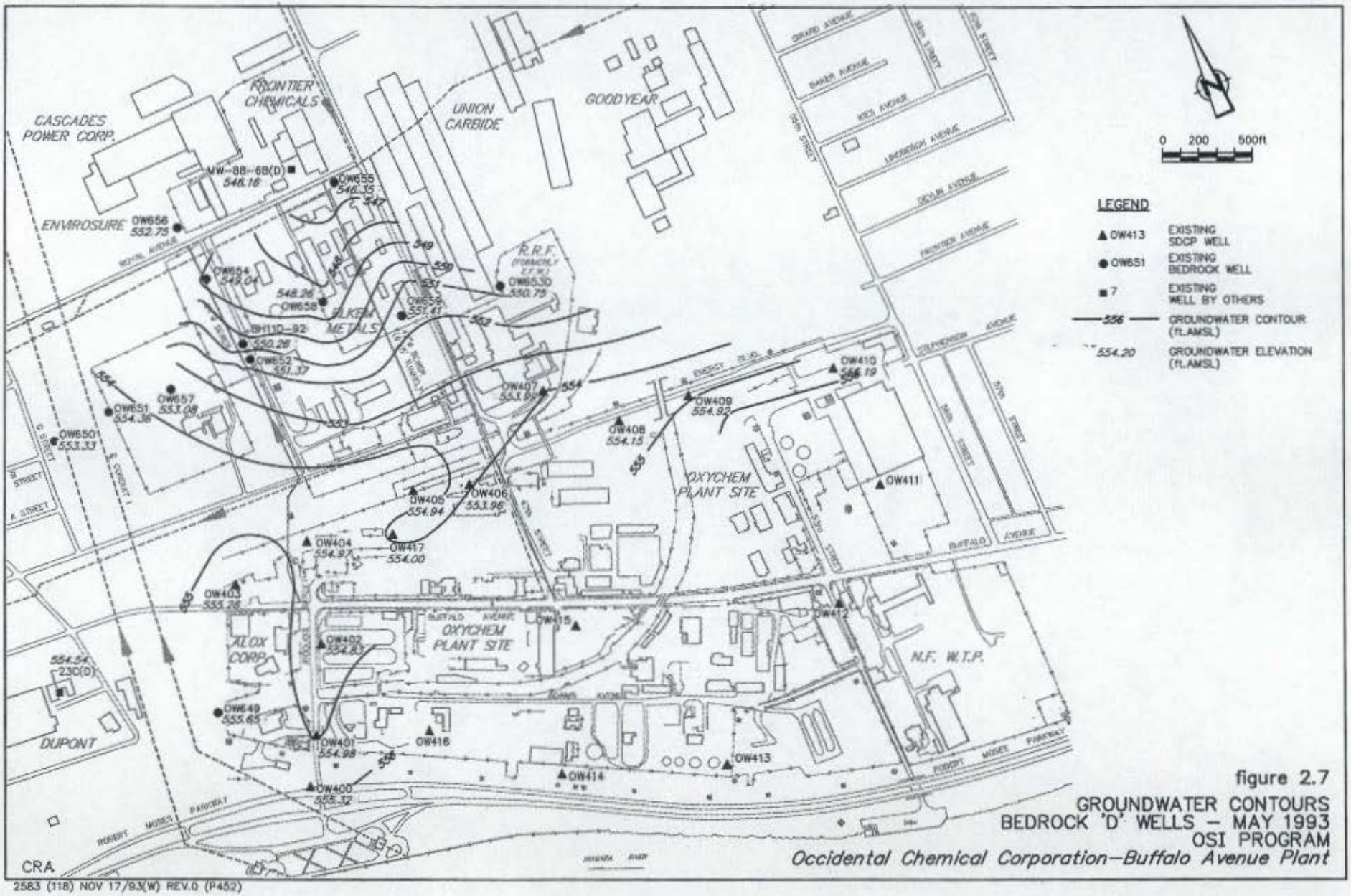


figure 2.7
GROUNDWATER CONTOURS
BEDROCK 'D' WELLS – MAY 1993
OSI PROGRAM
Occidental Chemical Corporation–Buffalo Avenue Plant

2563 (118) NOV 17/93(W) REV.0 (P452)

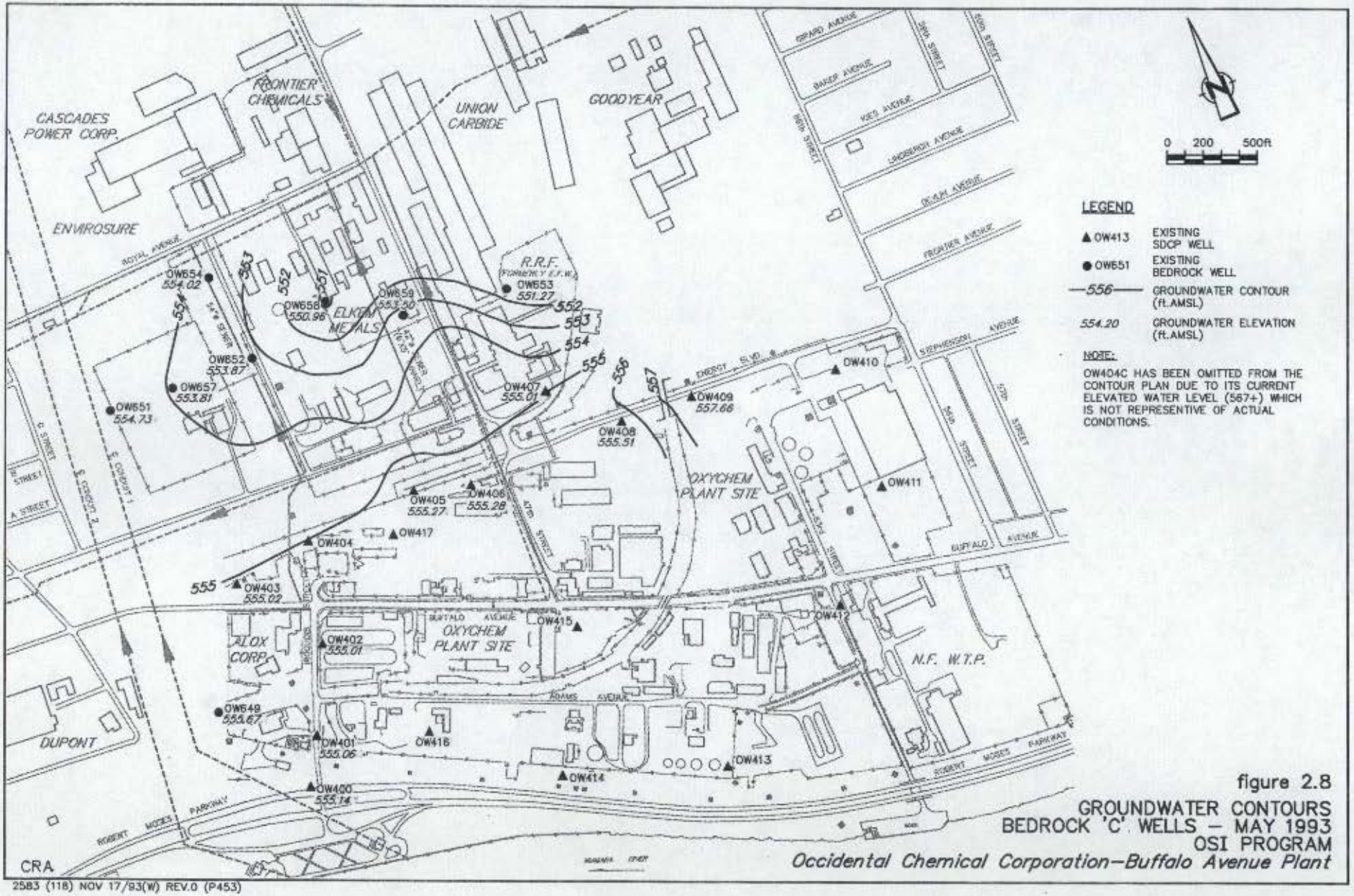


figure 2.8
GROUNDWATER CONTOURS
BEDROCK 'C' WELLS – MAY 1993
OSI PROGRAM
Occidental Chemical Corporation–Buffalo Avenue Plant

CRA
2583 (118) NOV 17/93(W) REV.0 (P453)

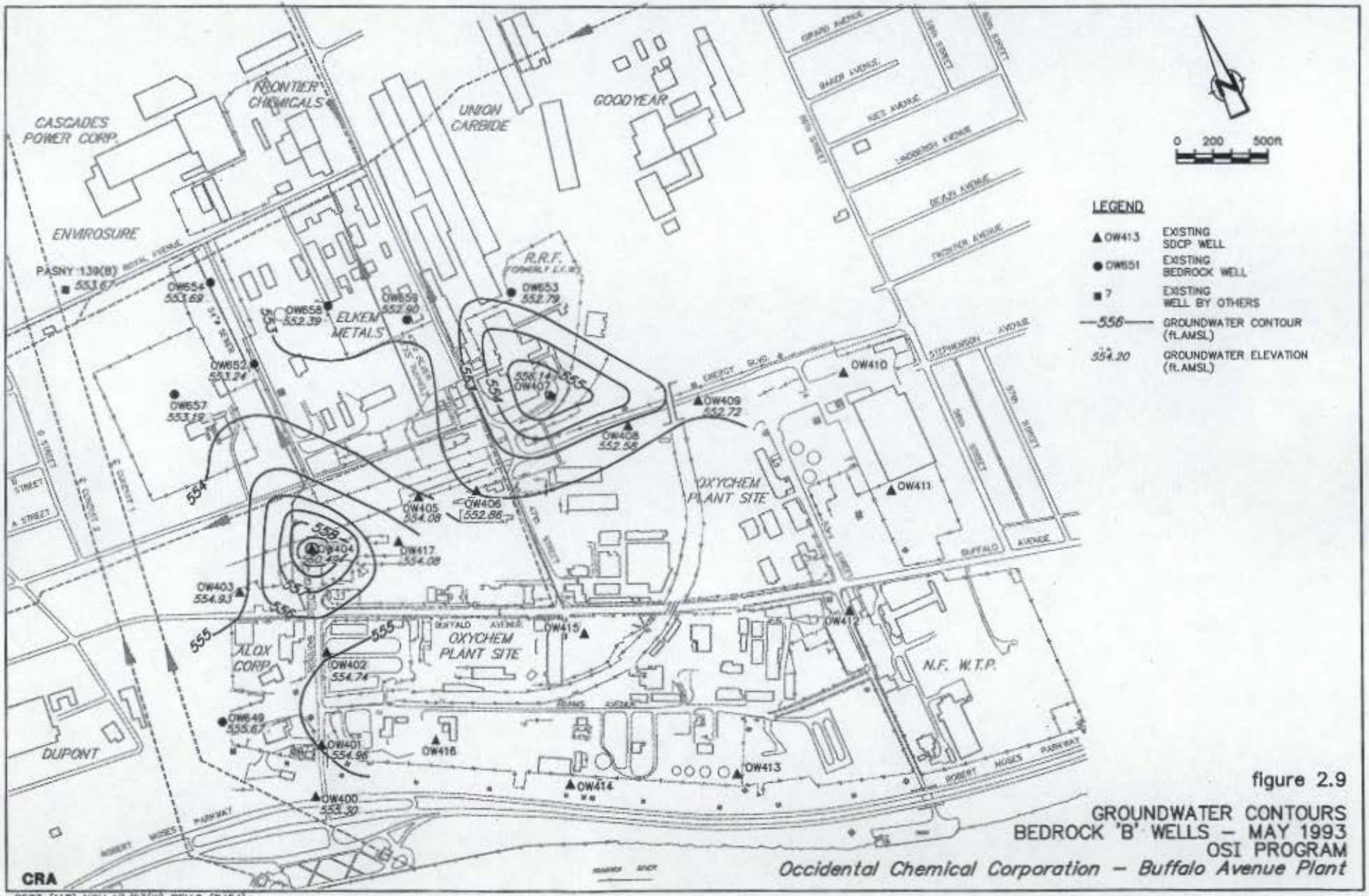


figure 2.9

GROUNDWATER CONTOURS
BEDROCK 'B' WELLS – MAY 1993
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

2583 (118) NOV 17/93(W) REV.0 (P454)

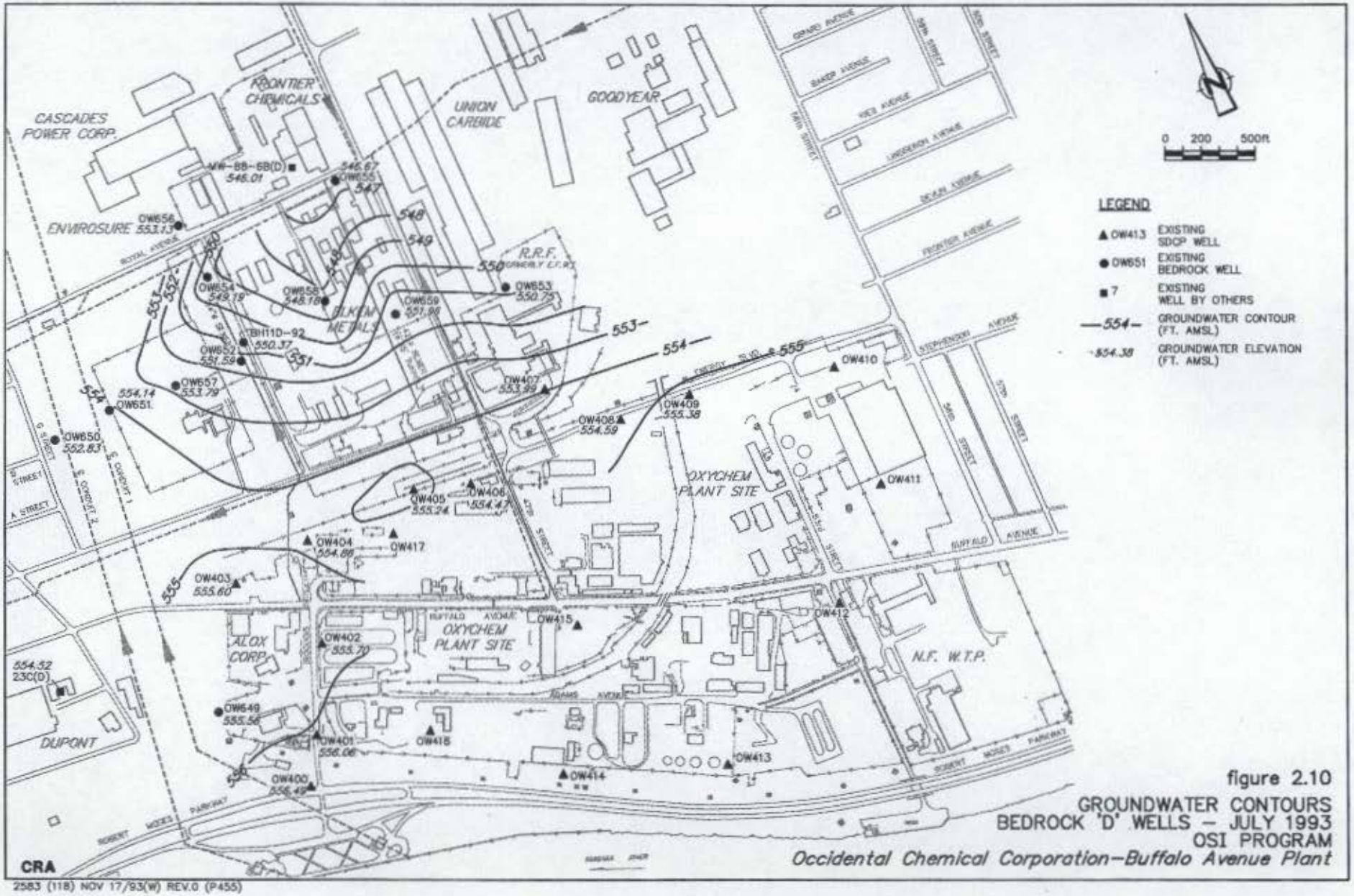


figure 2.10
GROUNDWATER CONTOURS
BEDROCK 'D' WELLS – JULY 1993
OSI PROGRAM
Occidental Chemical Corporation–Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P455)

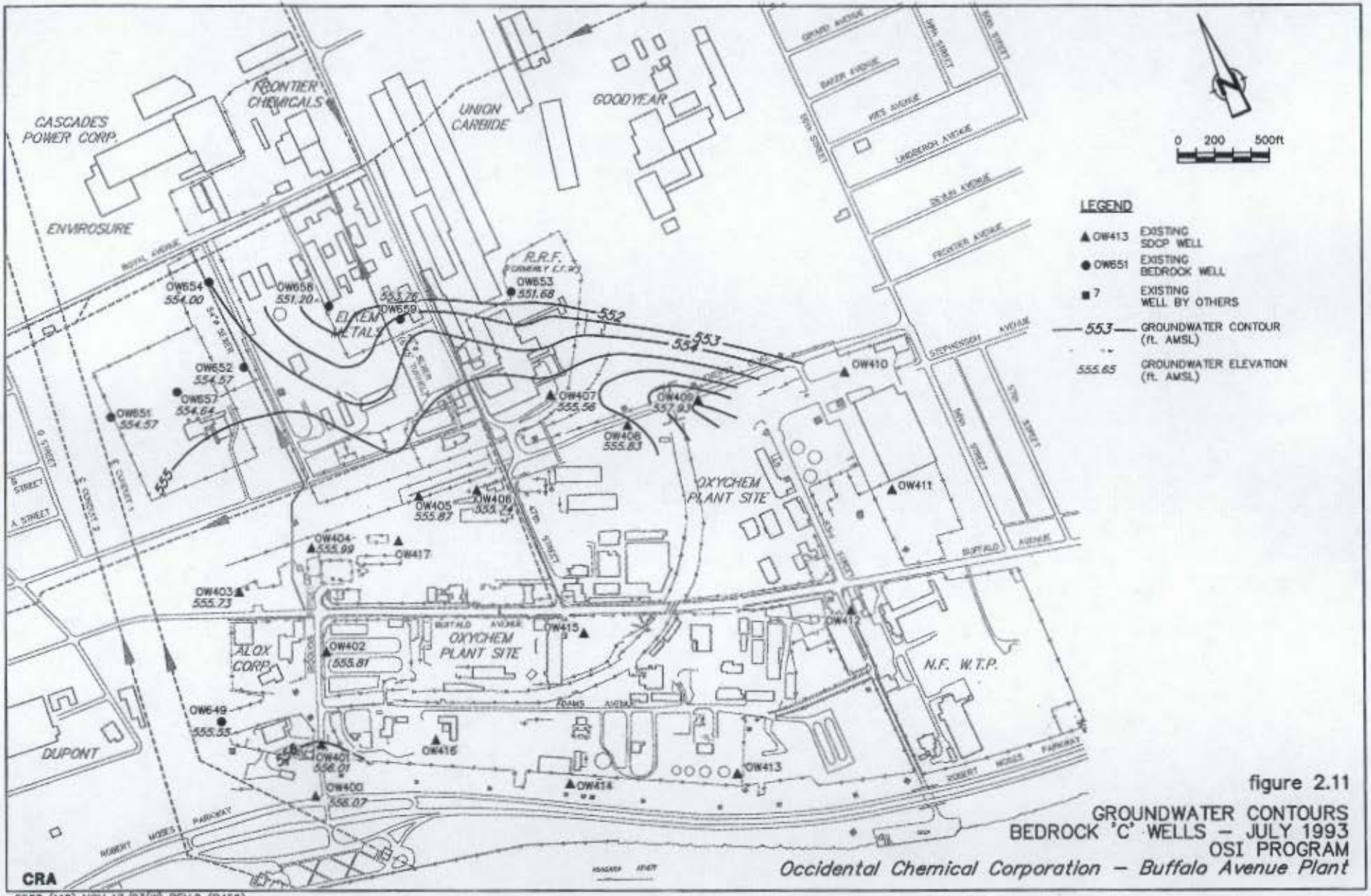


figure 2.11

GROUNDWATER CONTOURS
BEDROCK 'C' WELLS – JULY 1993
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P456)

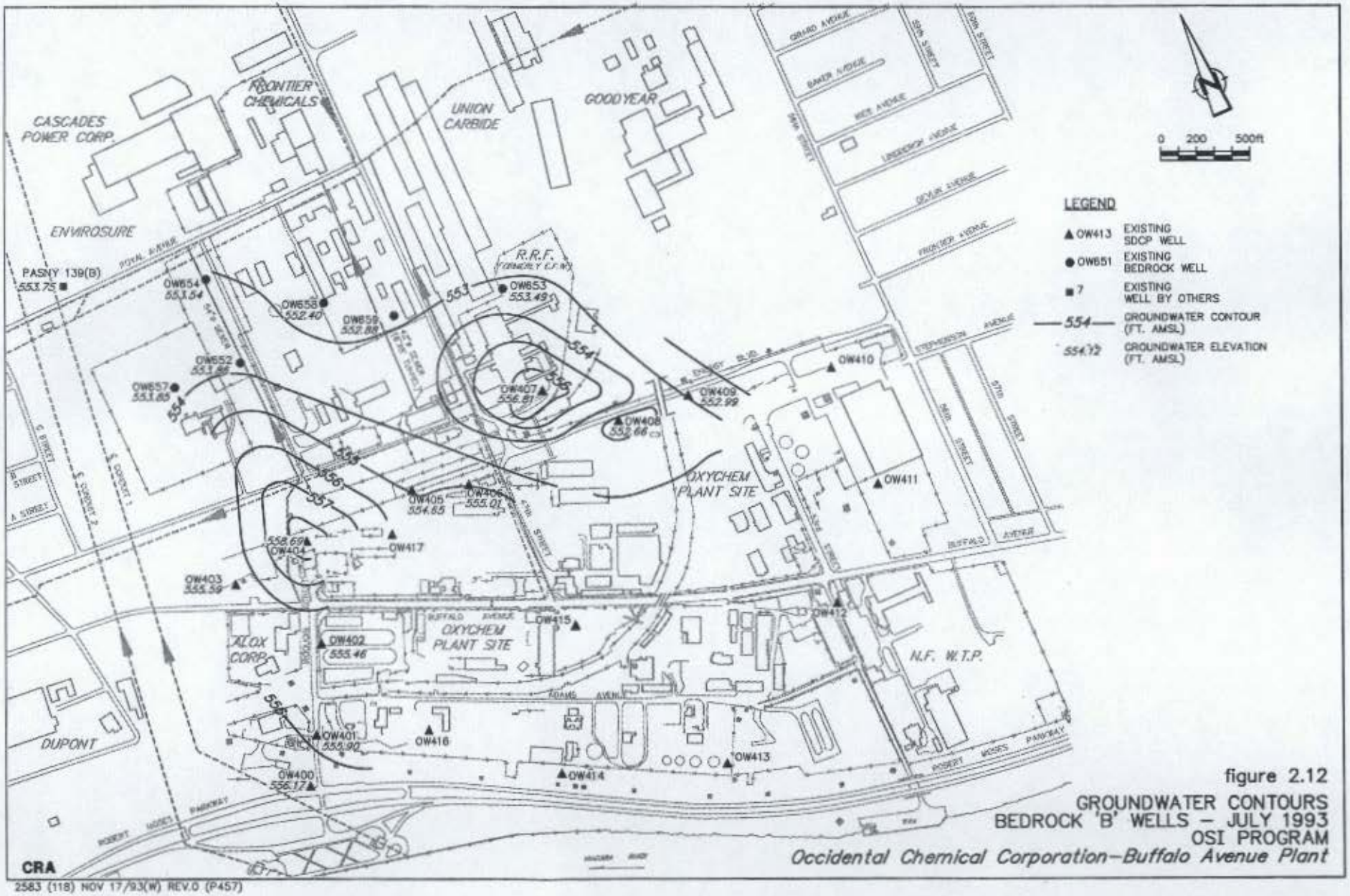


figure 2.12
GROUNDWATER CONTOURS
BEDROCK 'B' WELLS – JULY 1993
OSI PROGRAM
Occidental Chemical Corporation–Buffalo Avenue Plant

2583 (118) NOV 17/93(W) REV.0 (P457)

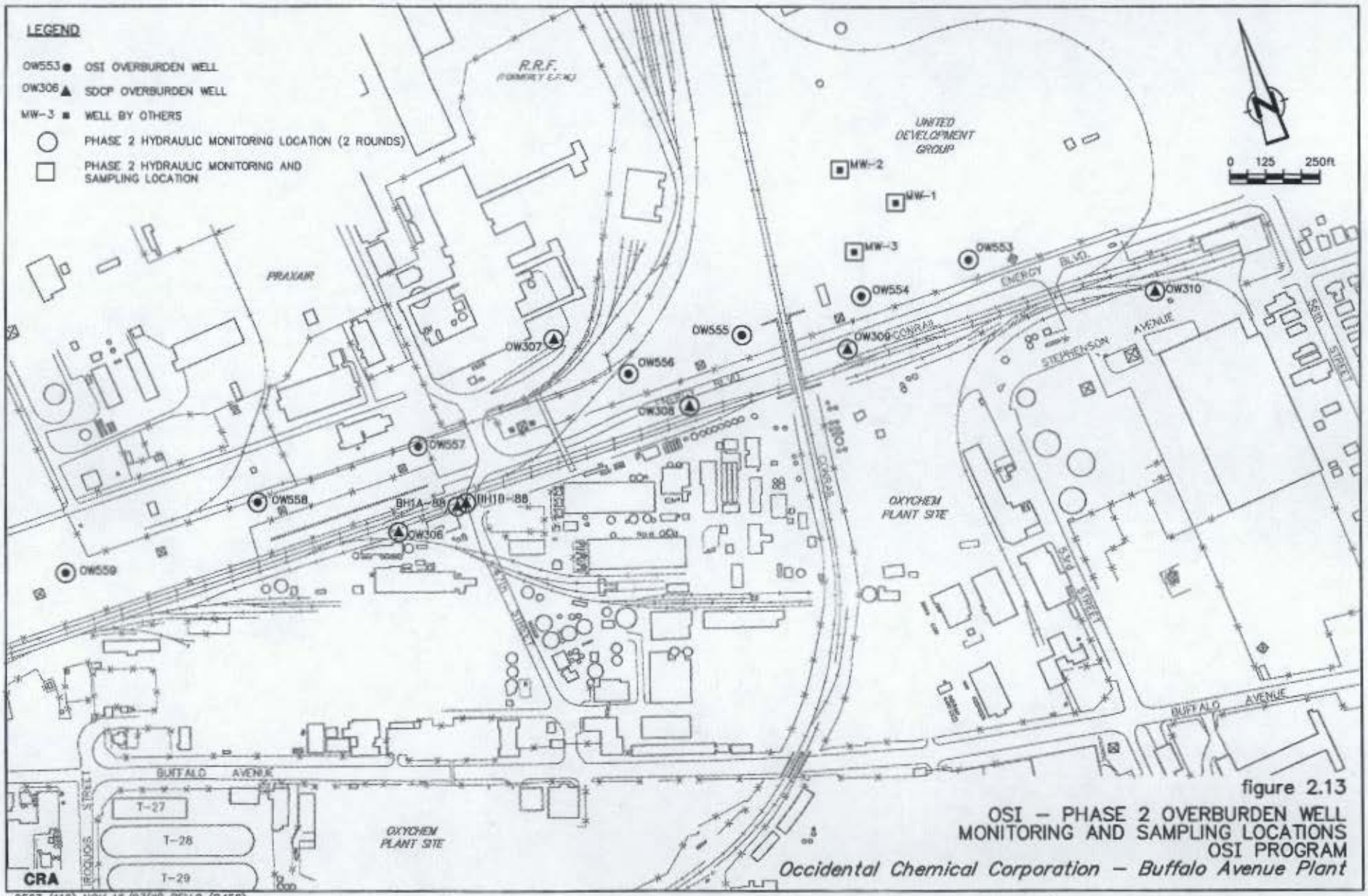


figure 2.13

OSI – PHASE 2 OVERBURDEN WELL MONITORING AND SAMPLING LOCATIONS OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

2583 (118) NOV 16/93(W) REV.0 (P458)

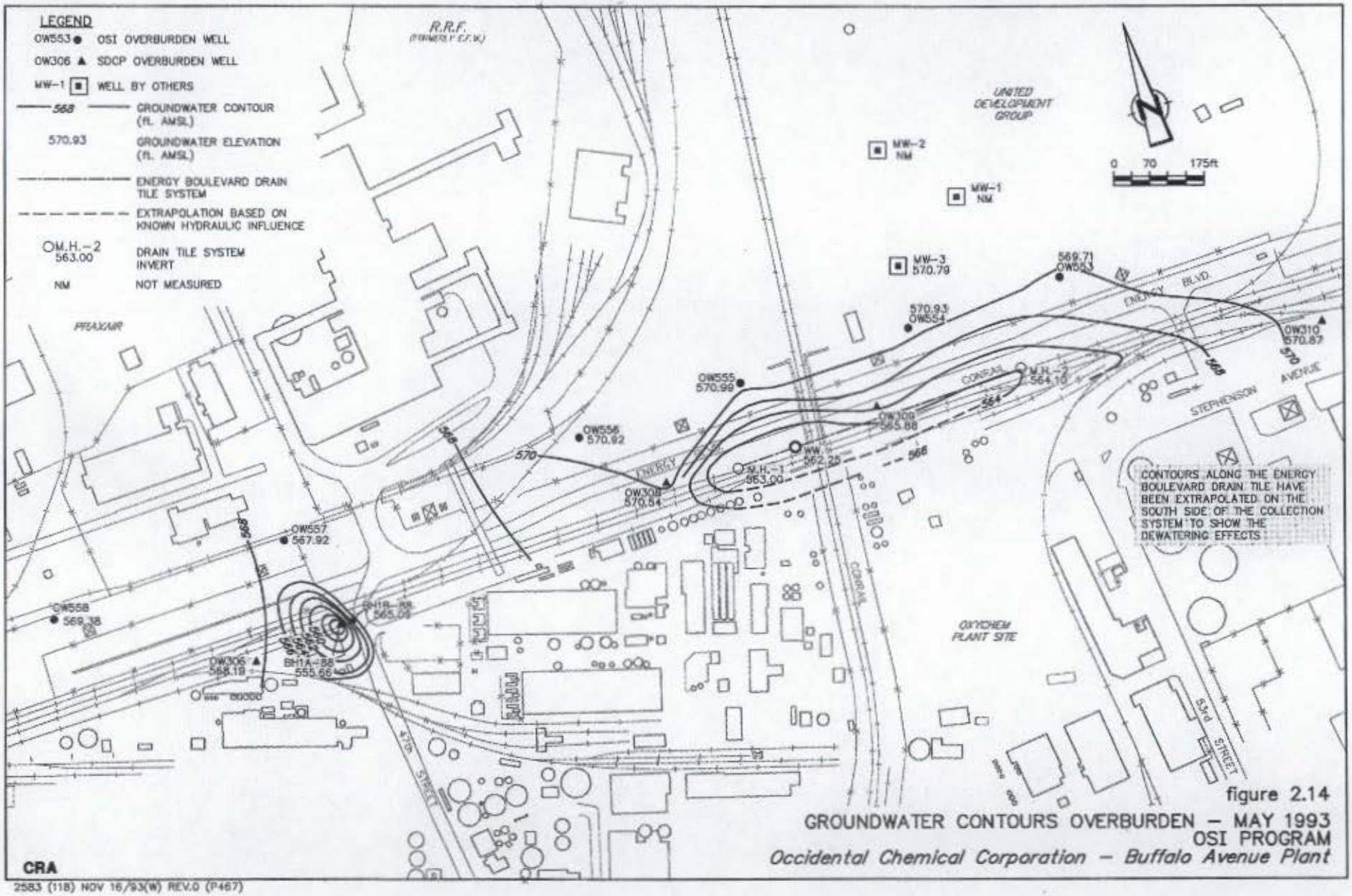


figure 2.14

GROUNDWATER CONTOURS OVERBURDEN – MAY 1993
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

2583 (118) NOV 16/93(W) REV.0 (P467)

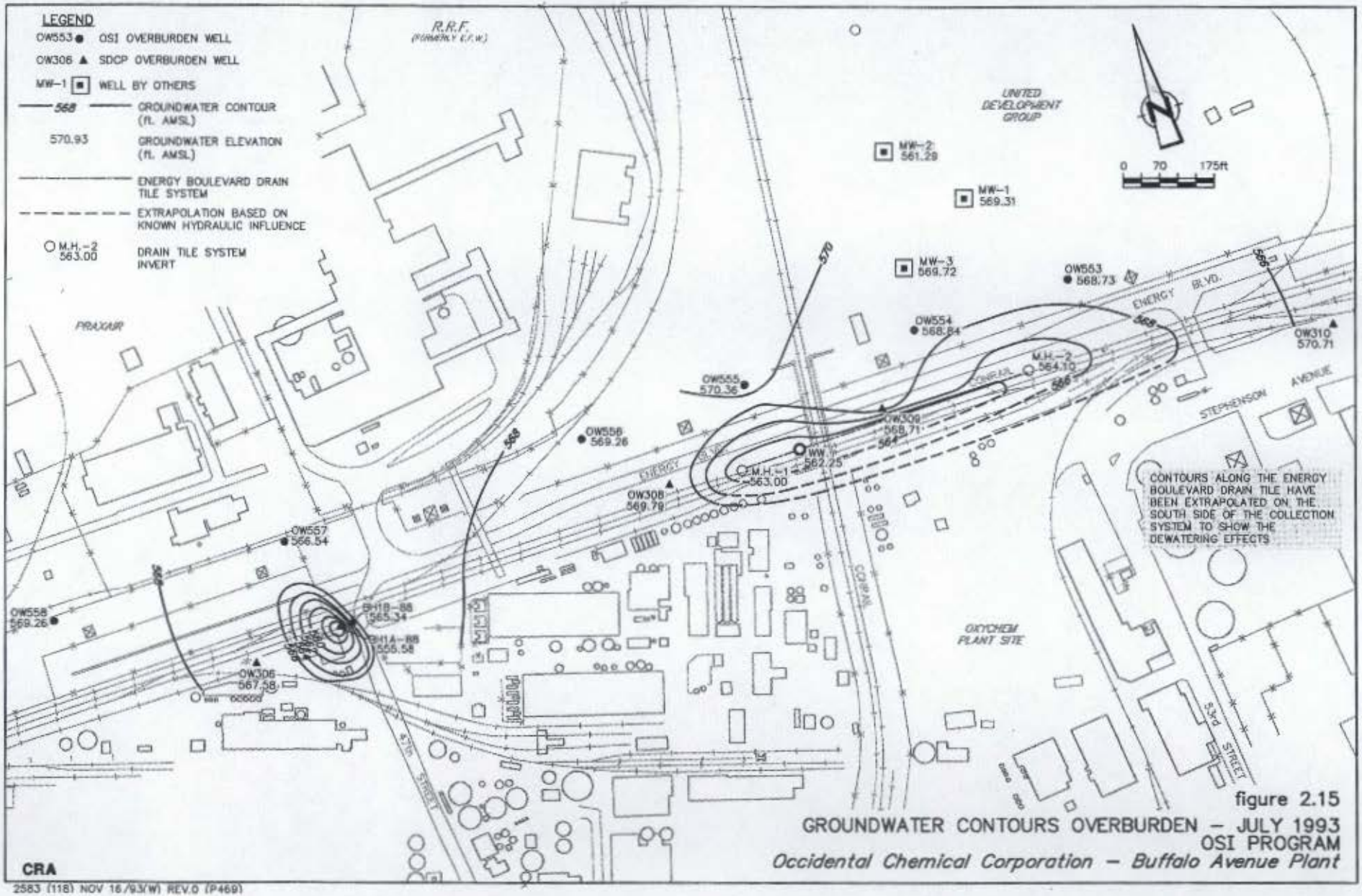


figure 2.15

GROUNDWATER CONTOURS OVERBURDEN – JULY 1993
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 16/93(W) REV.0 (P469)

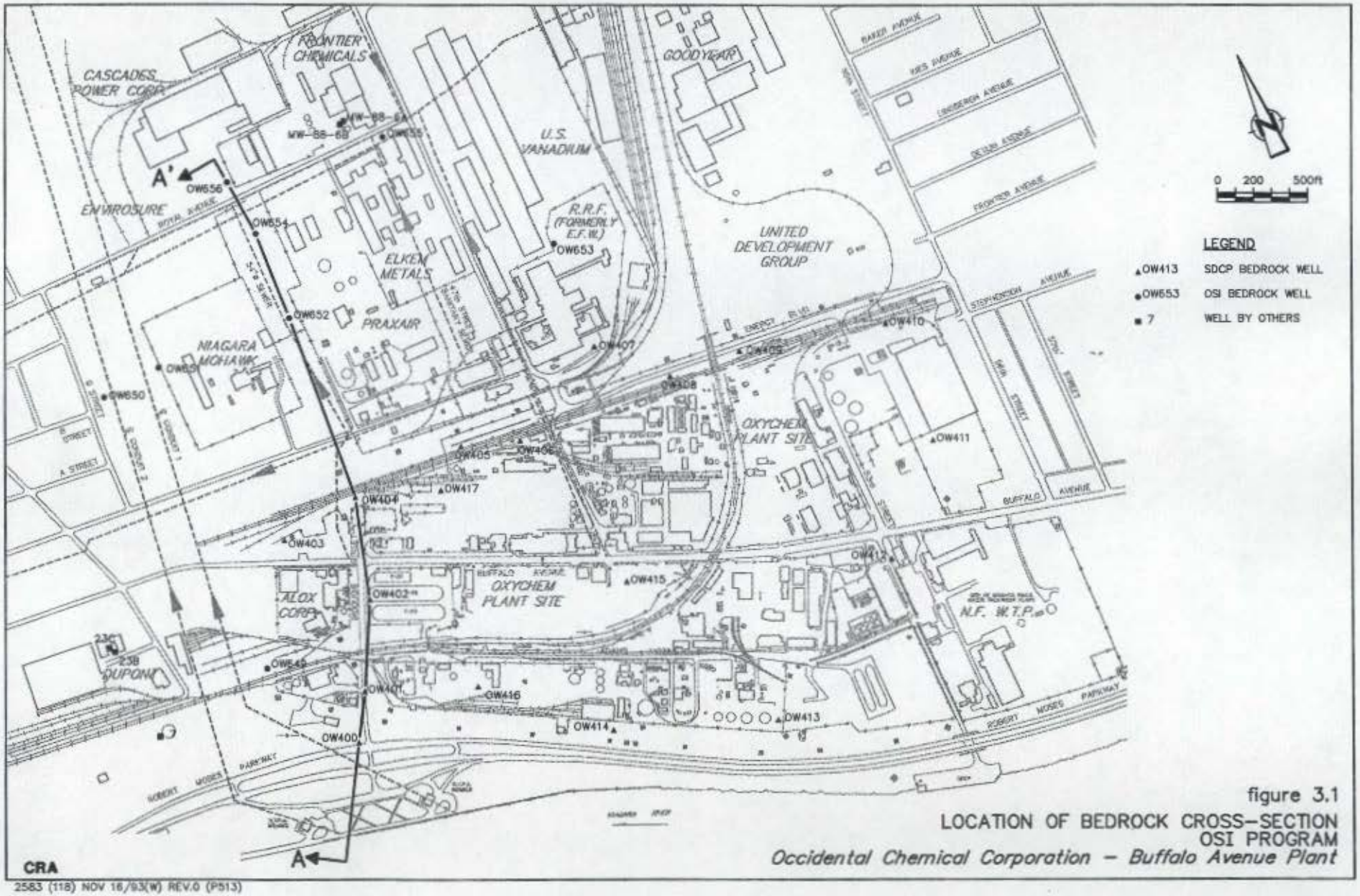


figure 3.1
LOCATION OF BEDROCK CROSS-SECTION
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

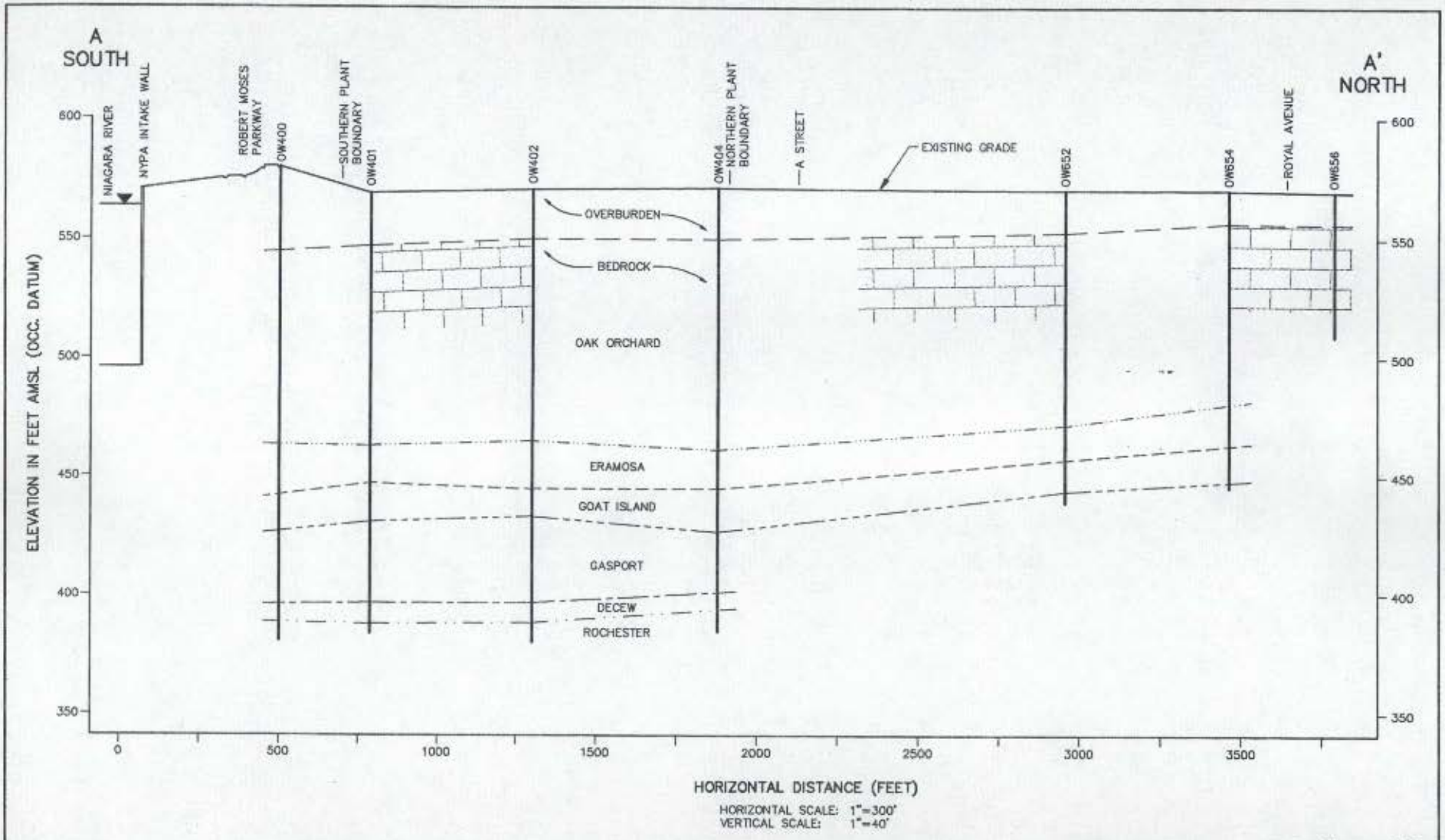


figure 3.2
BEDROCK CROSS-SECTION A – A'
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 16/93(W) REV.0 (X-66)

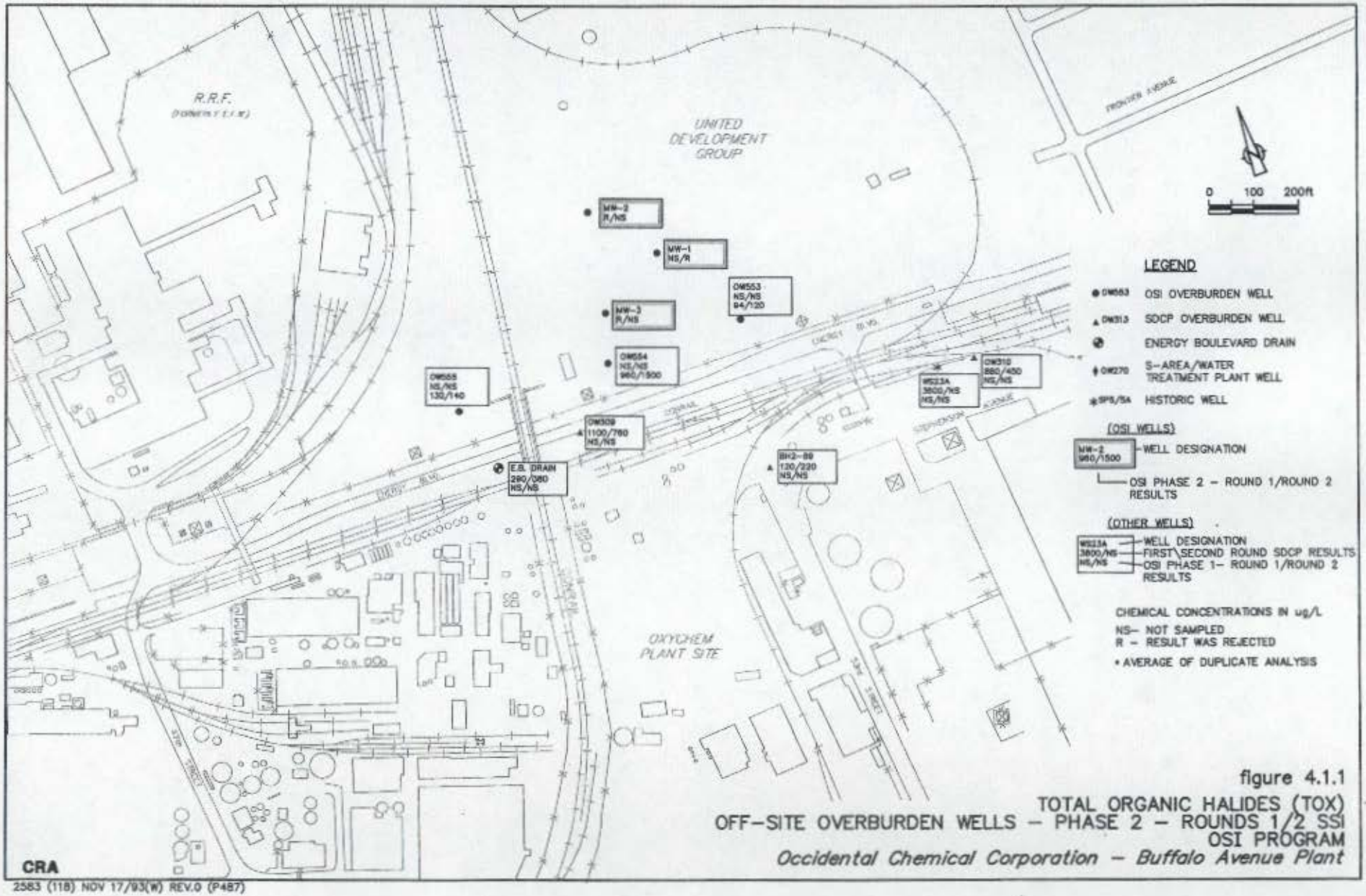


figure 4.1.1

TOTAL ORGANIC HALIDES (TOX)
OFF-SITE OVERBURDEN WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P487)

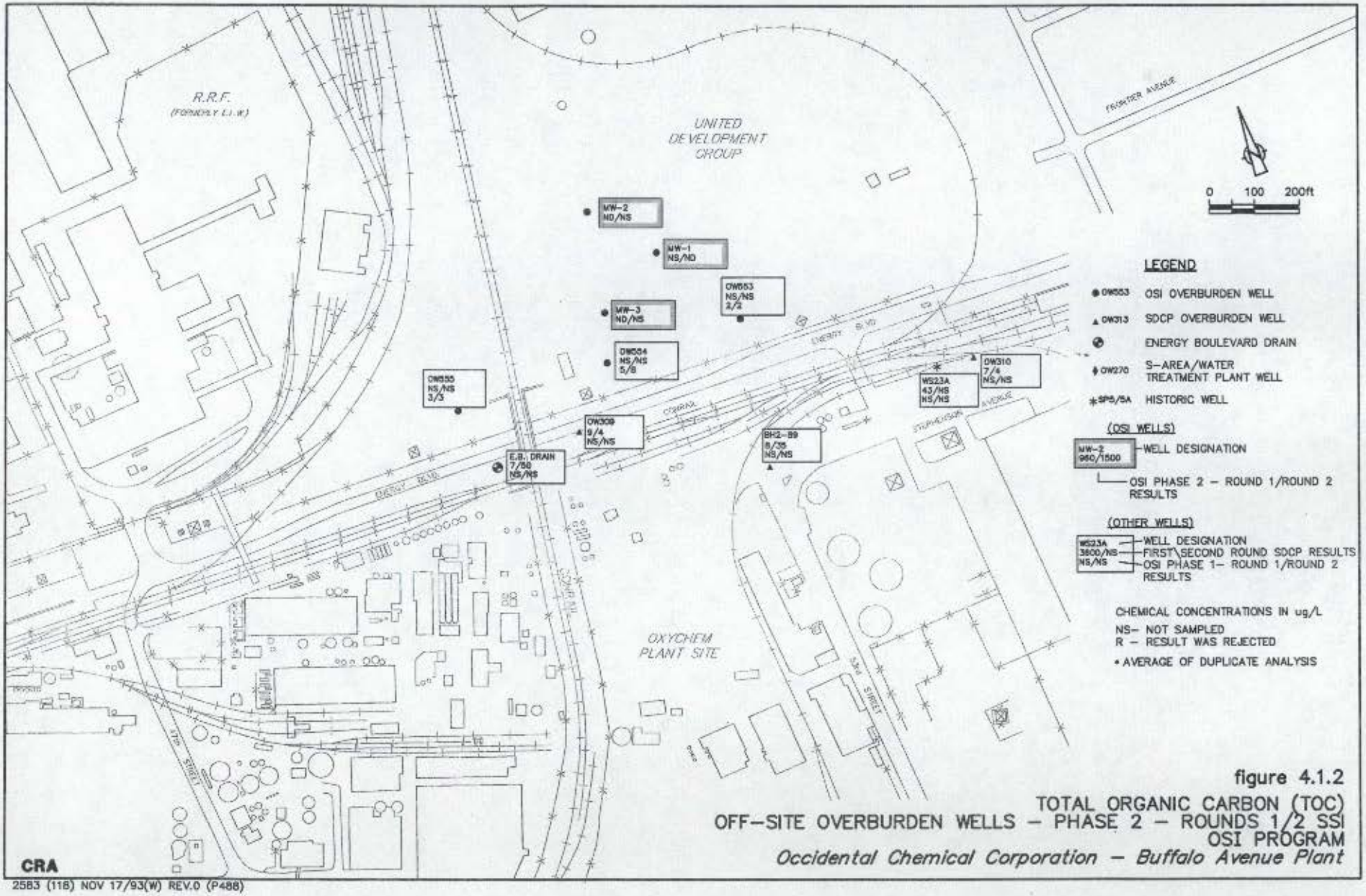


figure 4.1.2

TOTAL ORGANIC CARBON (TOC)
OFF-SITE OVERBURDEN WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P488)

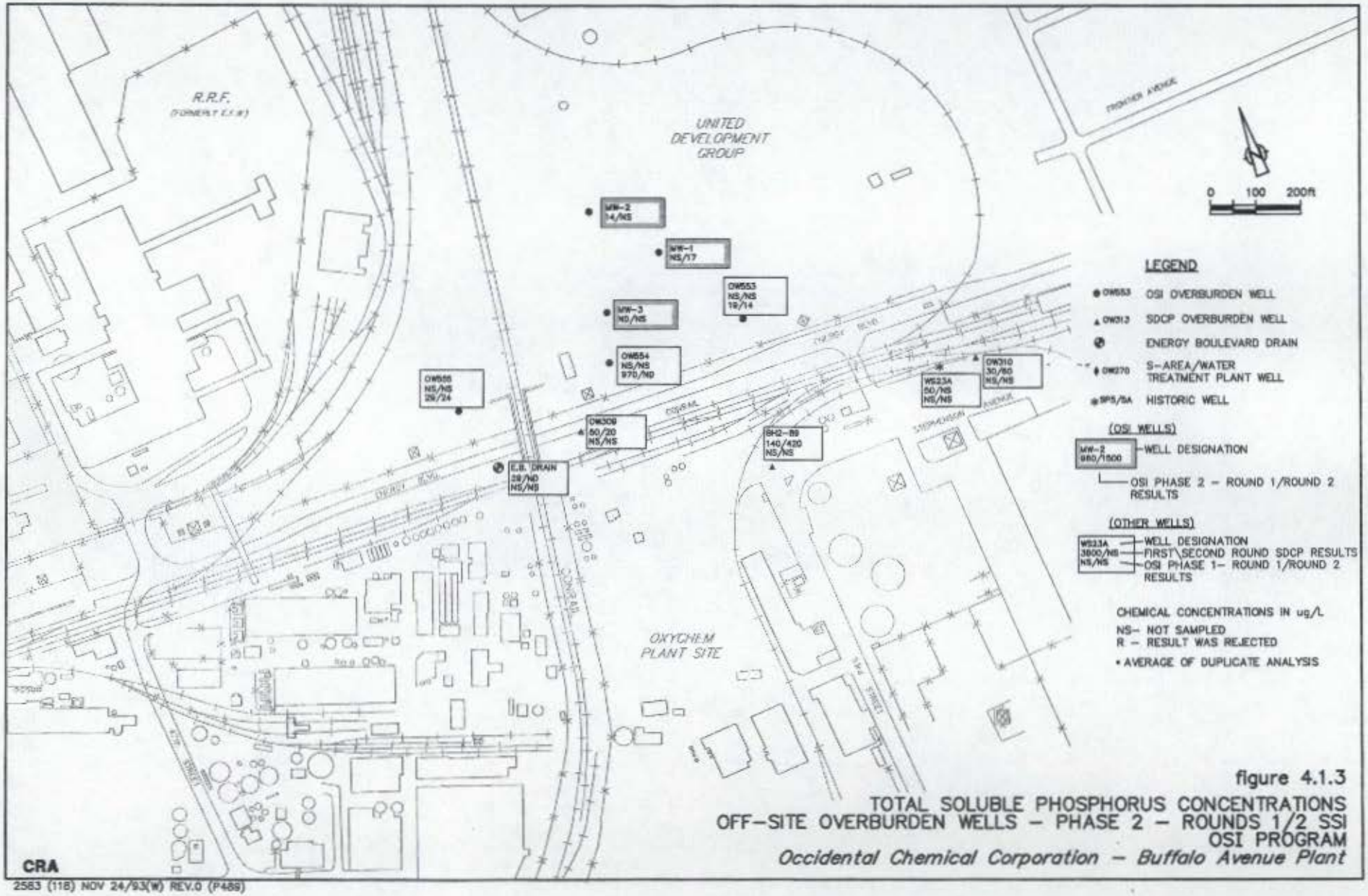


figure 4.1.3

TOTAL SOLUBLE PHOSPHORUS CONCENTRATIONS
OFF-SITE OVERBURDEN WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 24/93(W) REV.0 (P489)

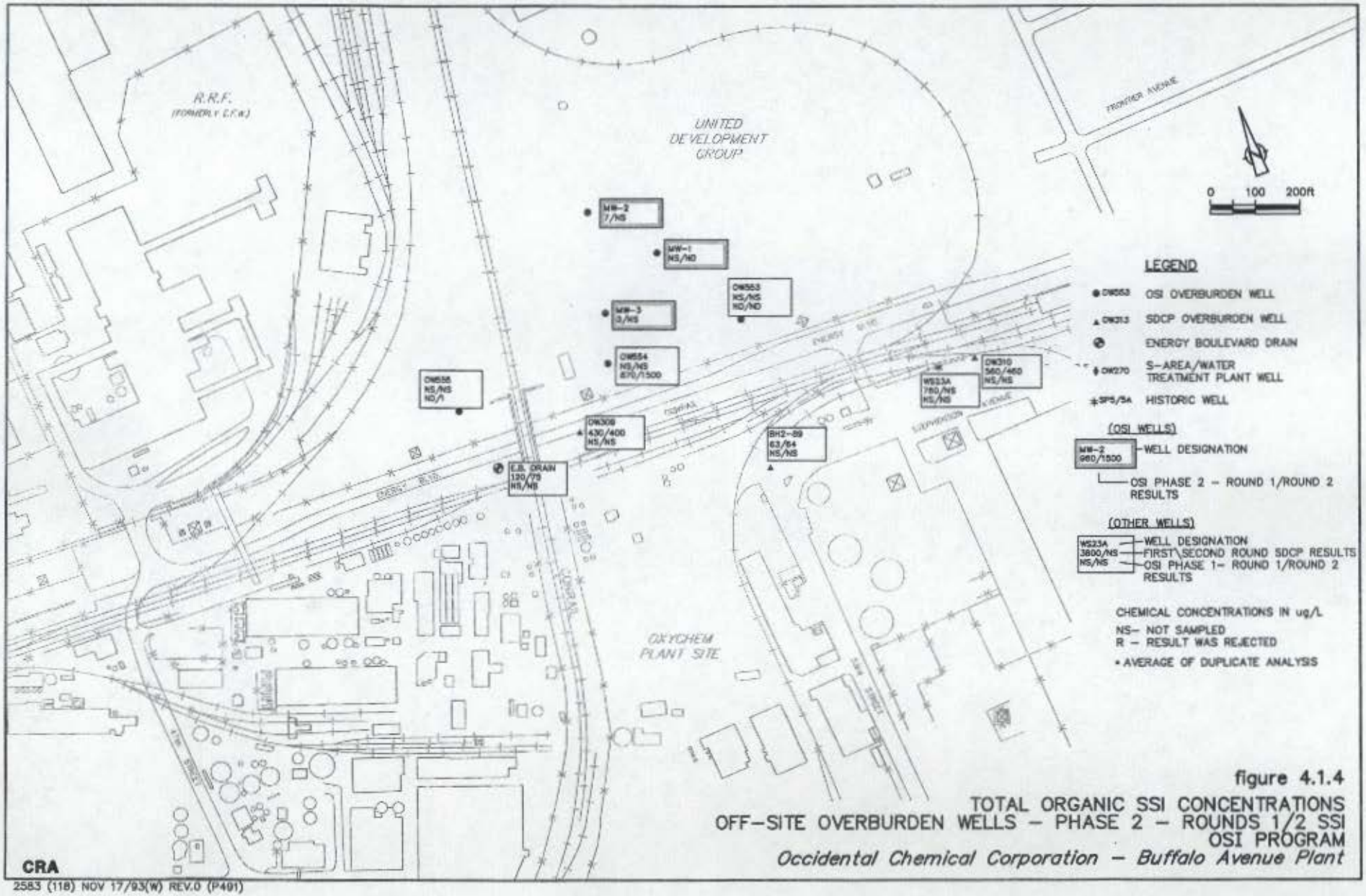


figure 4.1.4

TOTAL ORGANIC SSI CONCENTRATIONS
OFF-SITE OVERBURDEN WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM
Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P491)

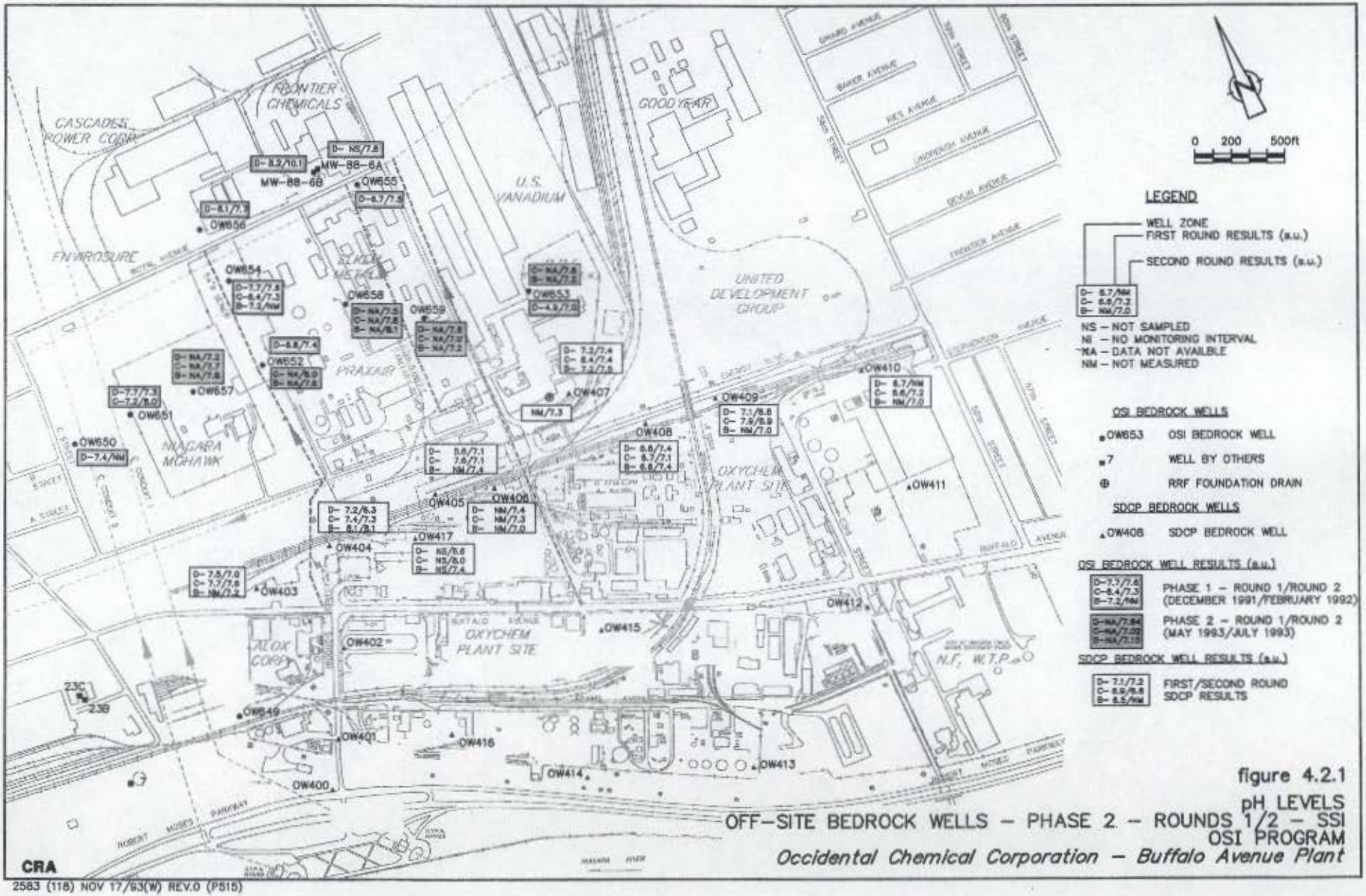


figure 4.2.1

pH LEVELS

OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 – SSI

OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P515)

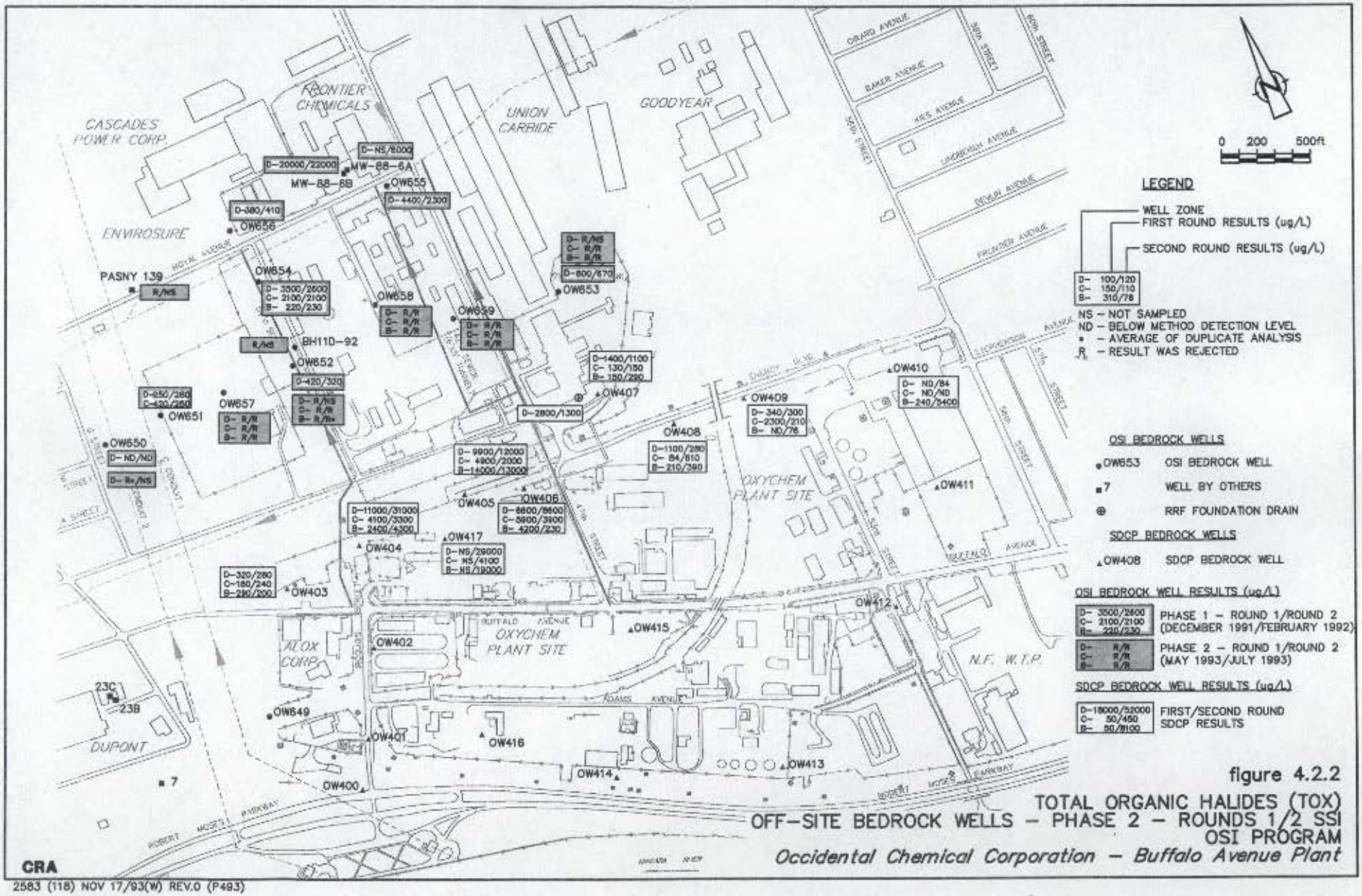


figure 4.2.2

TOTAL ORGANIC HALIDES (TOX)
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P493)

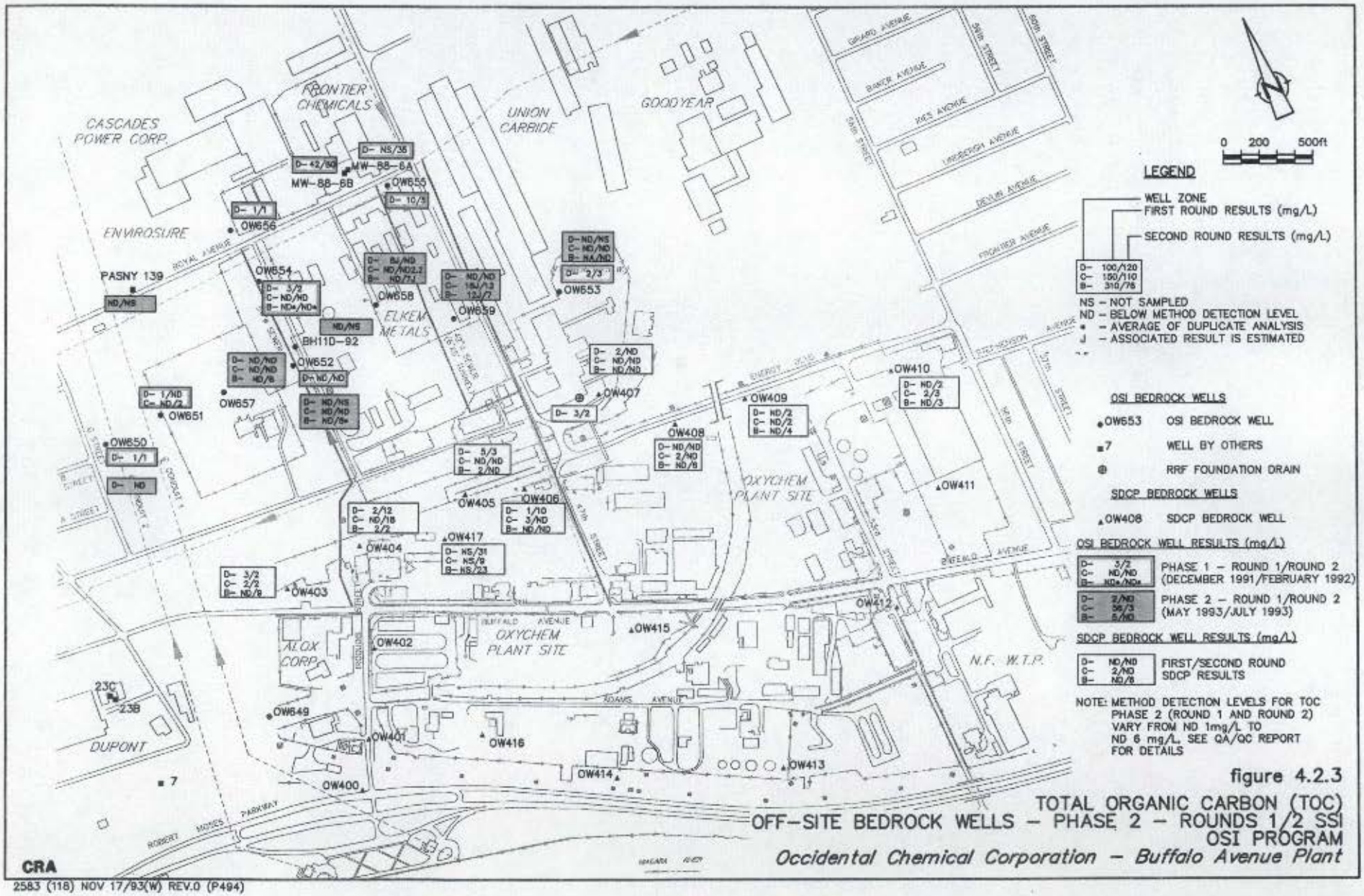


figure 4.2.3

TOTAL ORGANIC CARBON (TOC)
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P494)

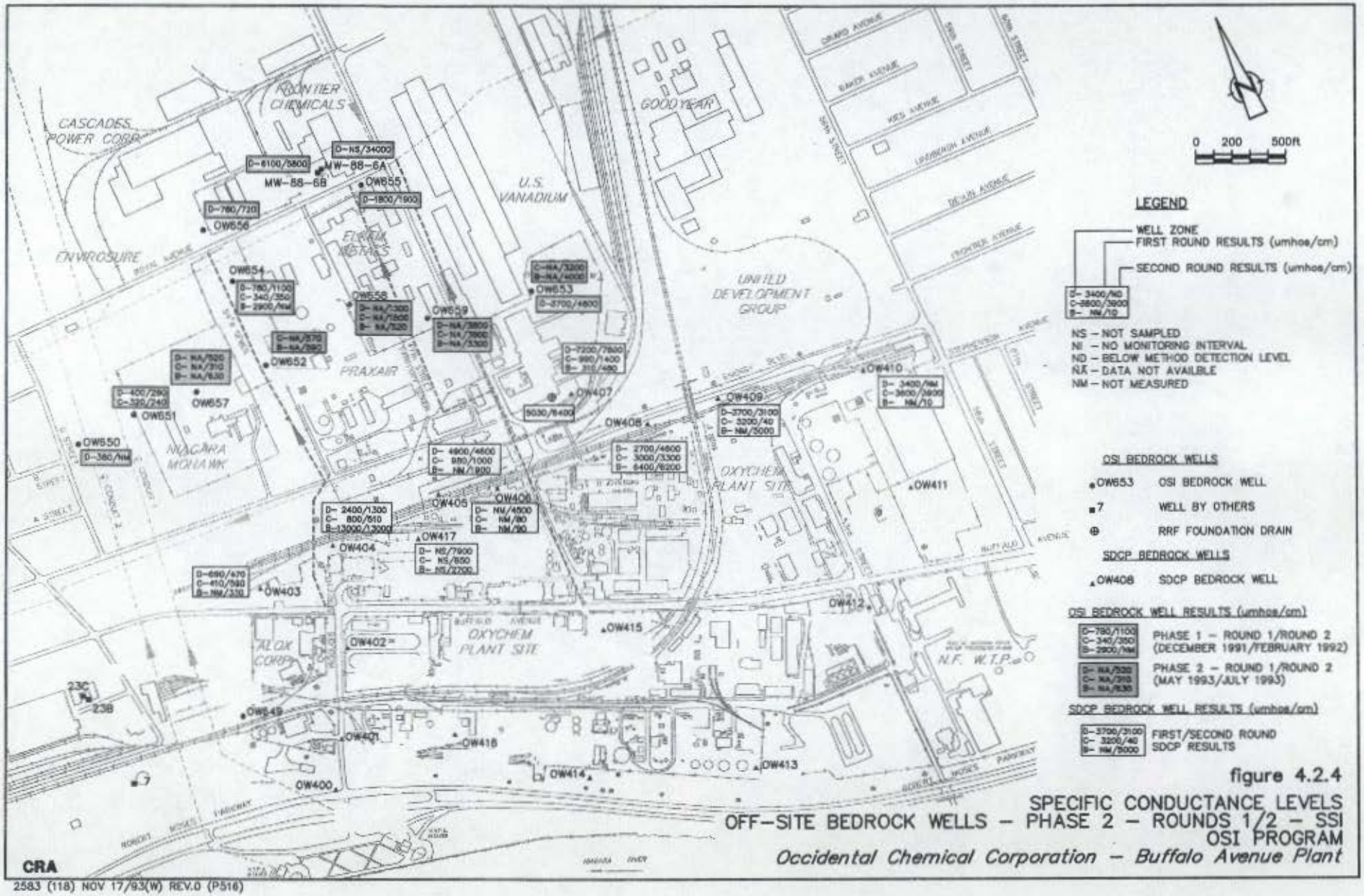


figure 4.2.4

SPECIFIC CONDUCTANCE LEVELS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 – SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

2583 (118) NOV 17/93(W) REV.0 (P516)

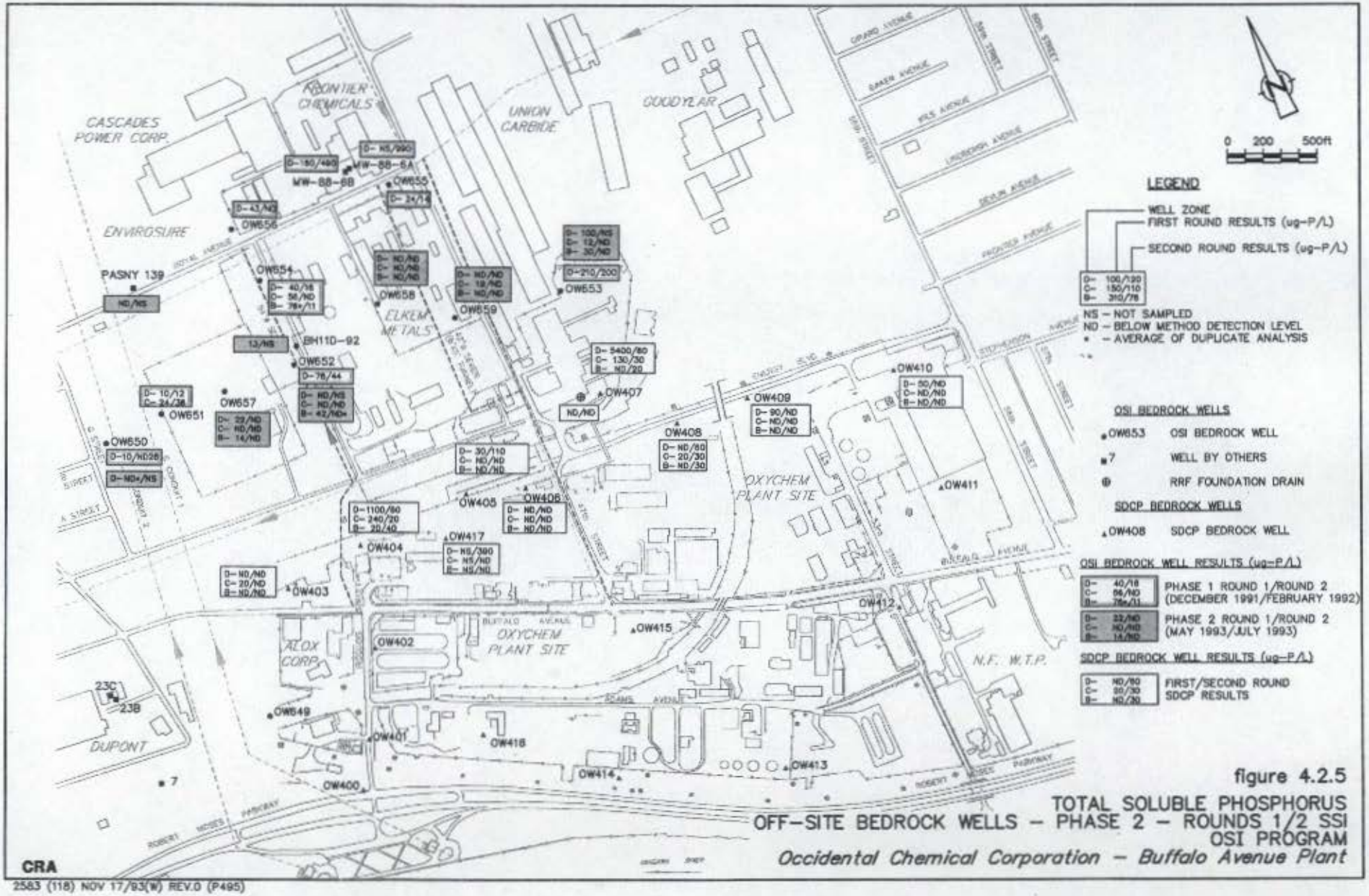


figure 4.2.5

TOTAL SOLUBLE PHOSPHORUS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P495)

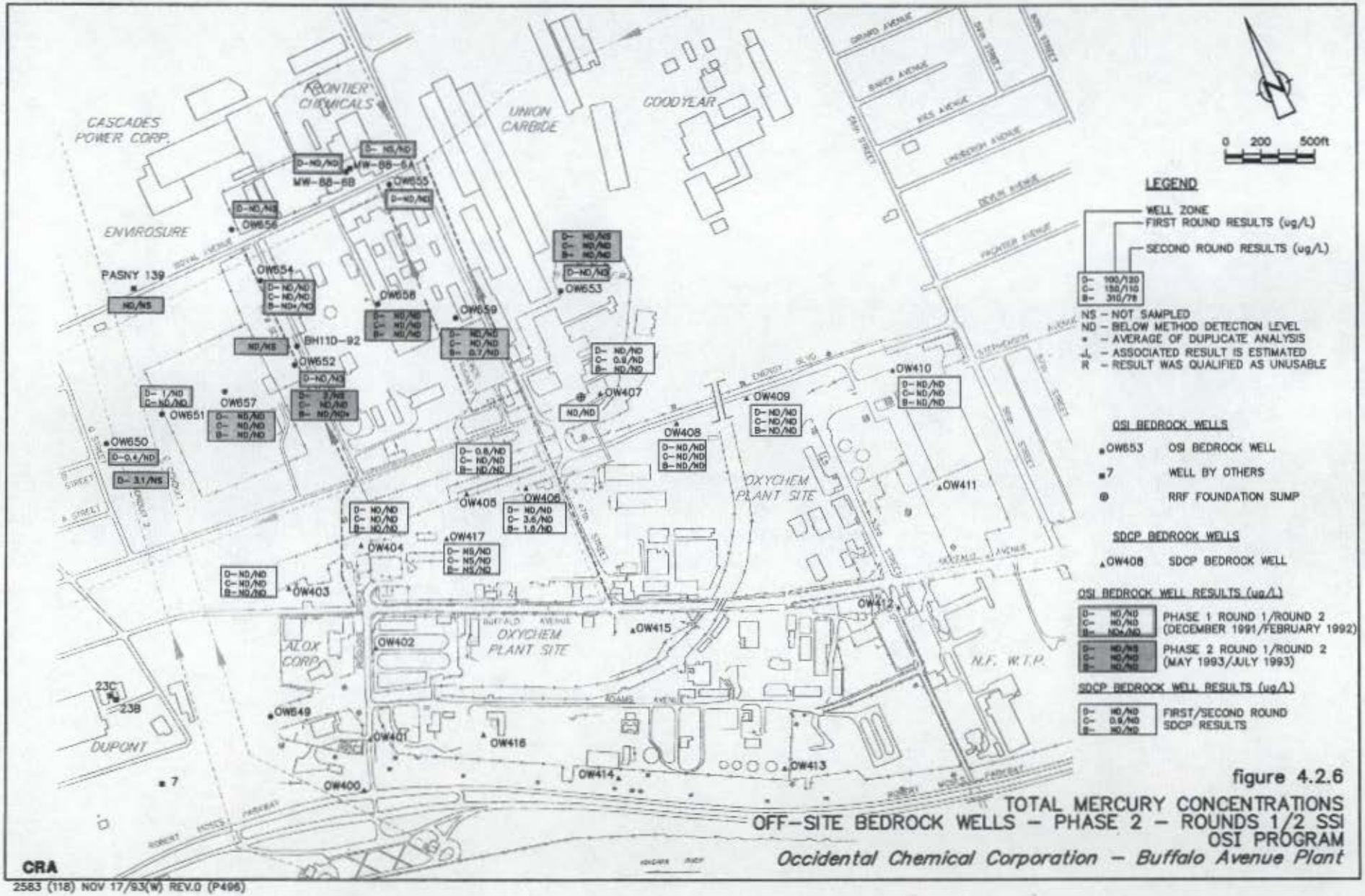


figure 4.2.6

TOTAL MERCURY CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P496)

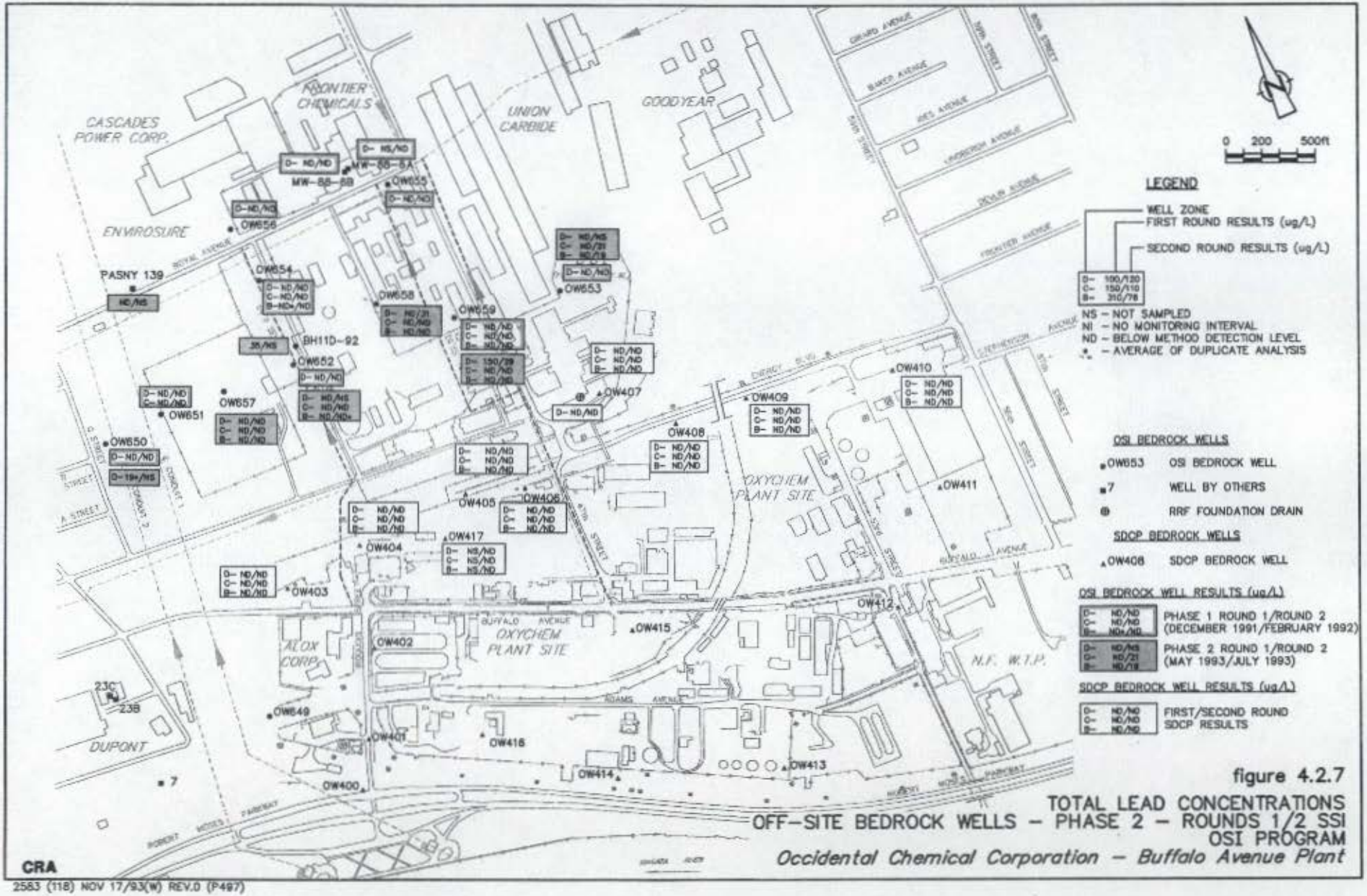


figure 4.2.7

TOTAL LEAD CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P497)

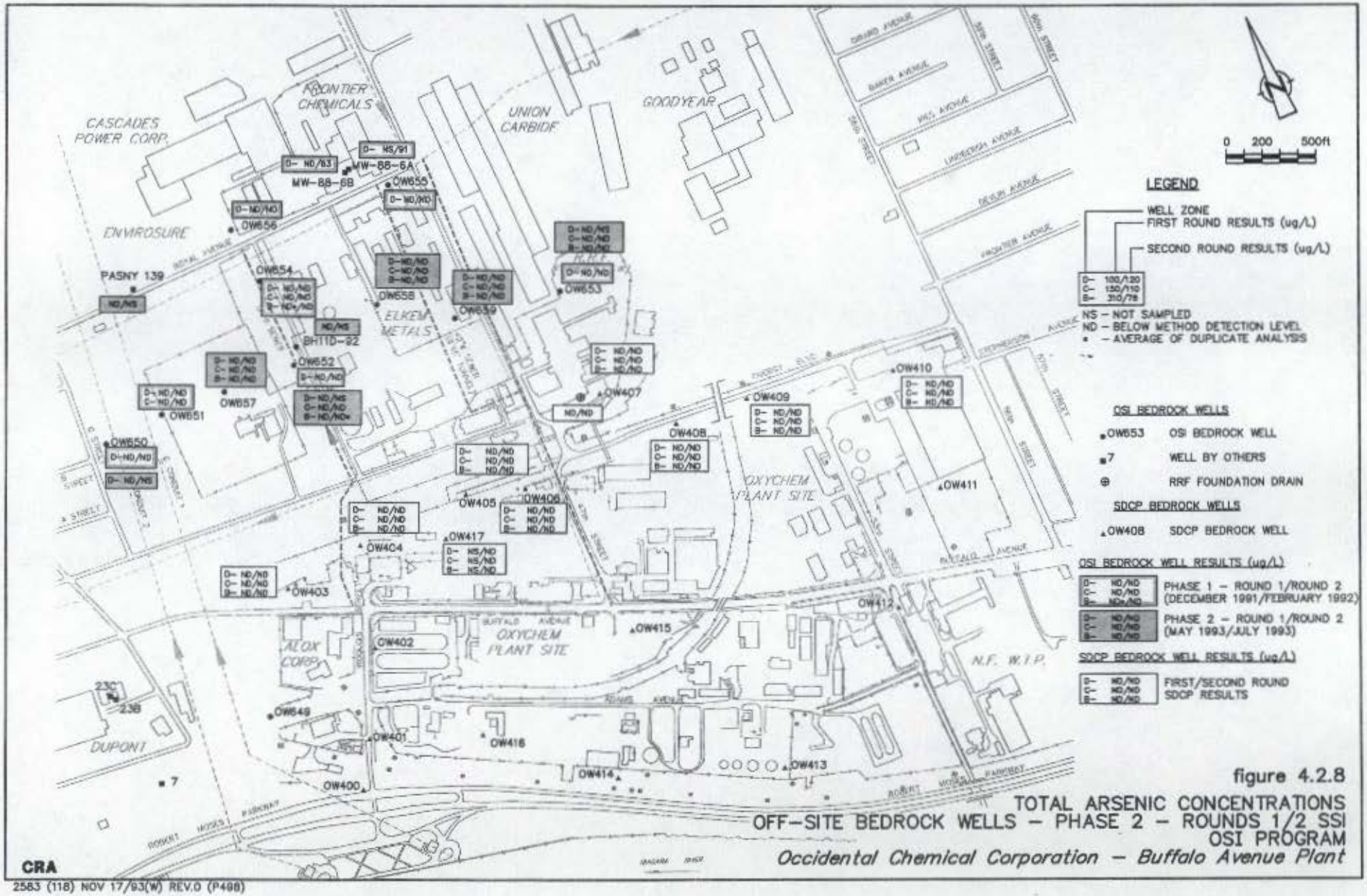


figure 4.2.8

TOTAL ARSENIC CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P498)

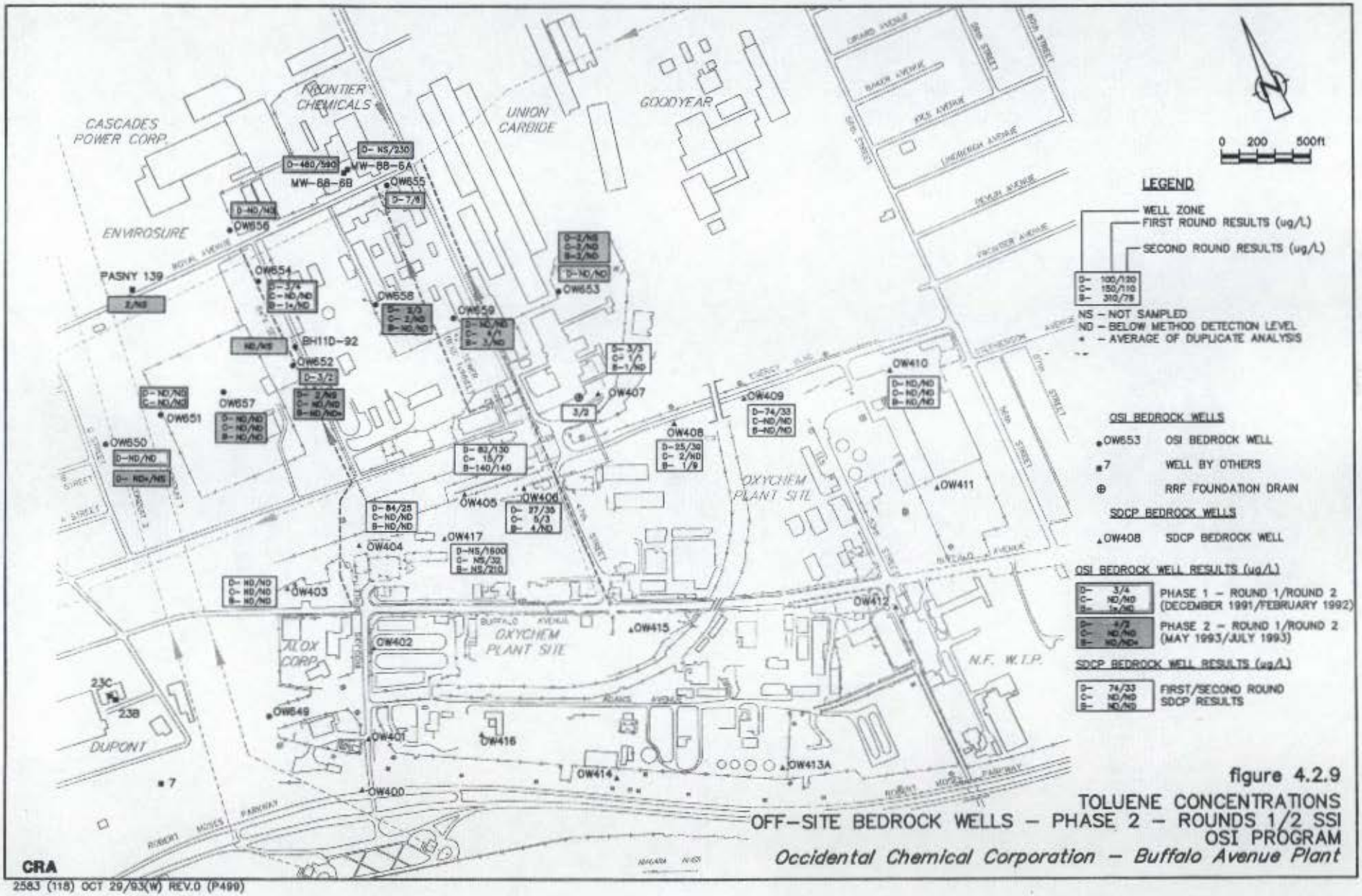


figure 4.2.9
TOLUENE CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM
Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) OCT 29/93(W) REV.0 (P499)

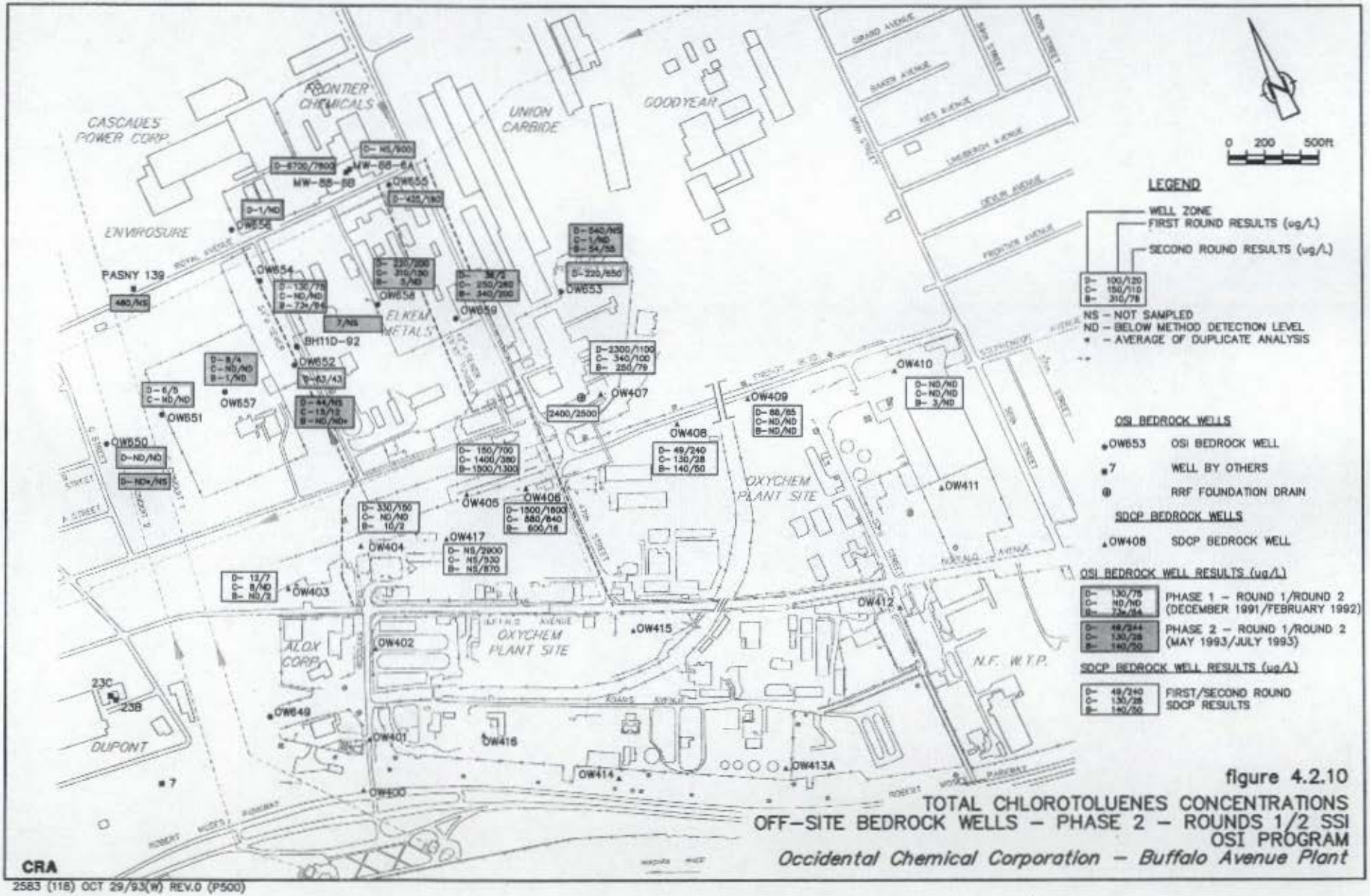


figure 4.2.10

TOTAL CHLOROTOLUENES CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) OCT 29/93(W) REV.0 (P500)

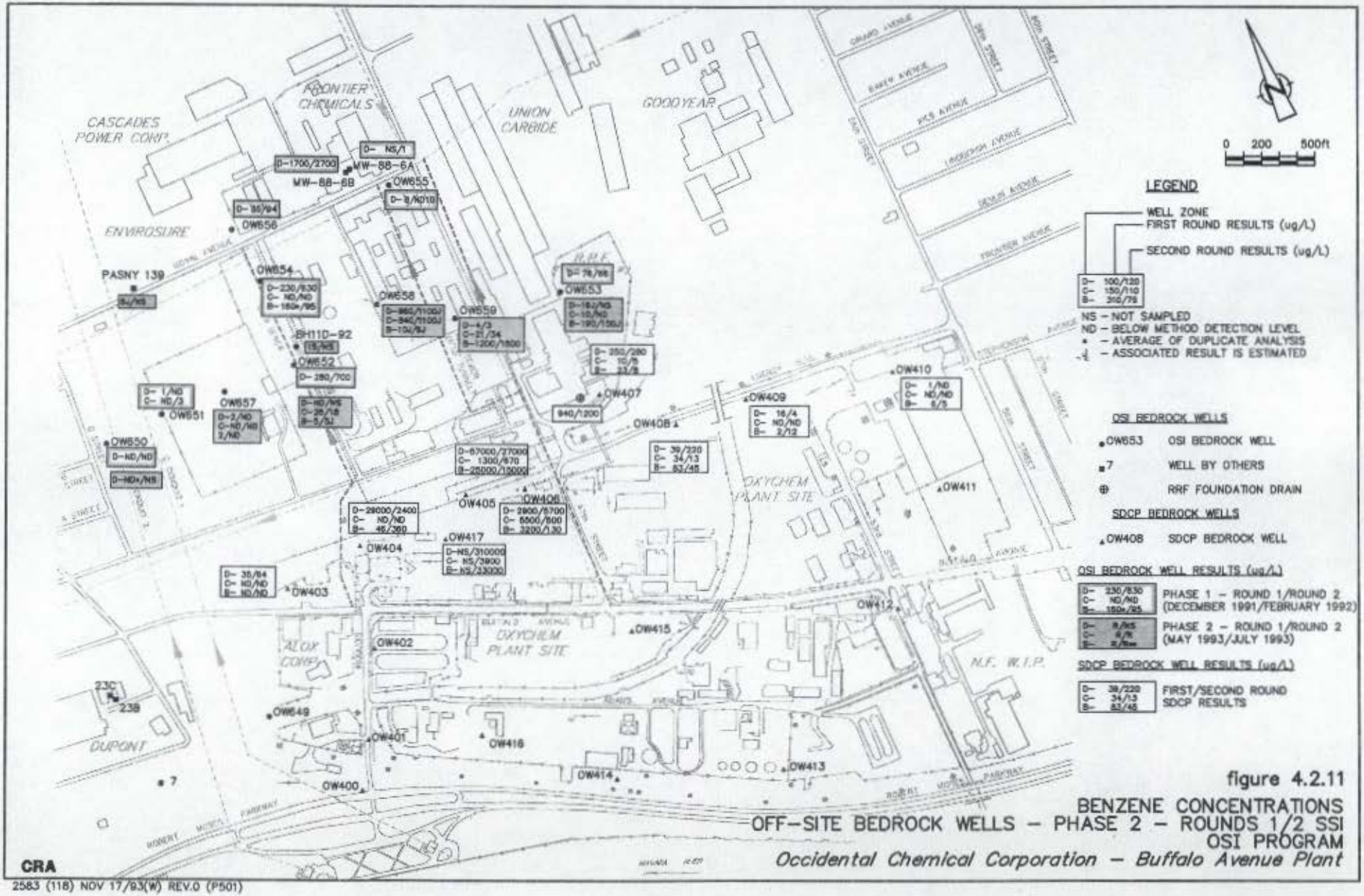


figure 4.2.11

BENZENE CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P501)

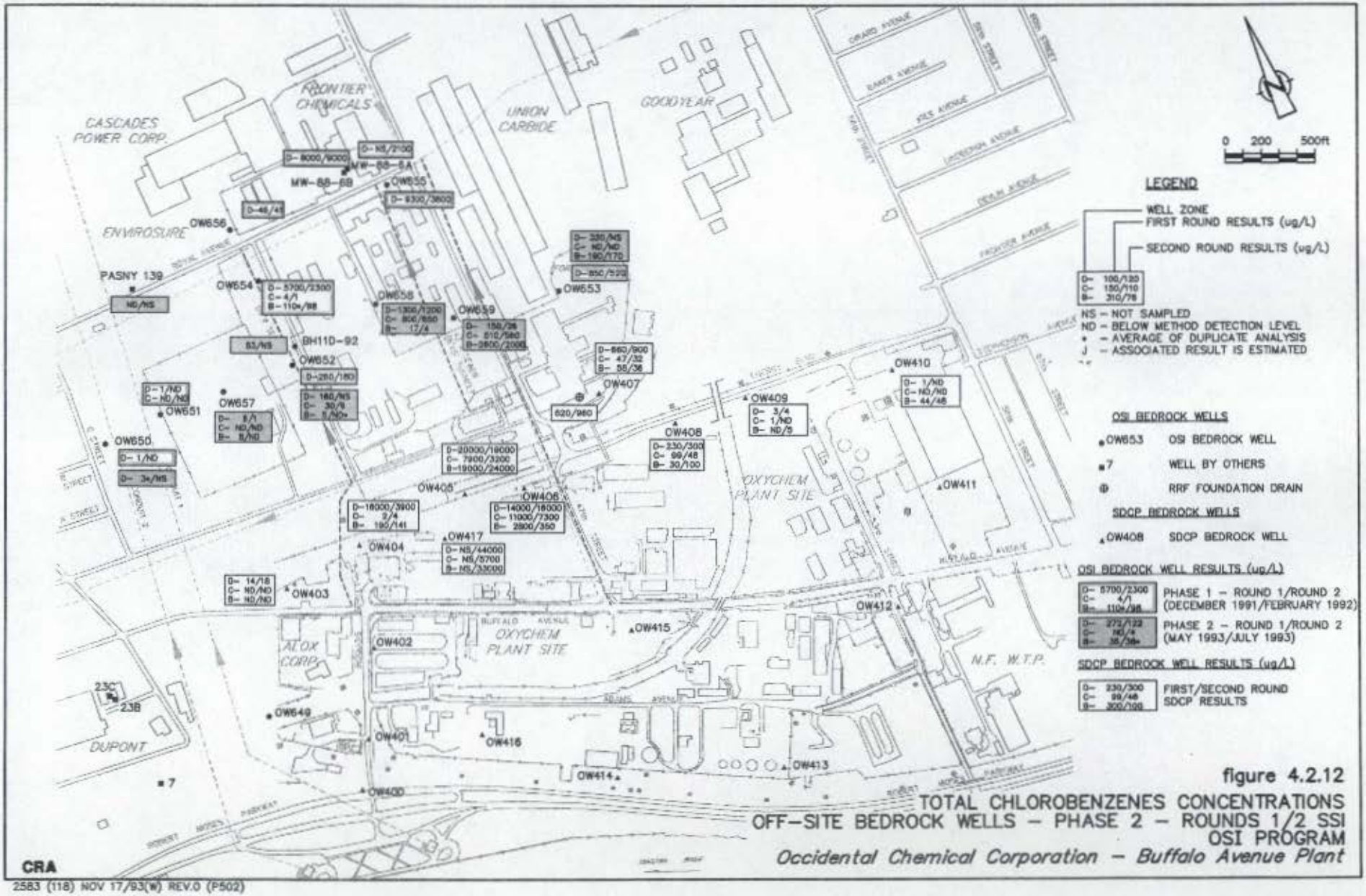


figure 4.2.12

TOTAL CHLOROBENZENES CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P502)

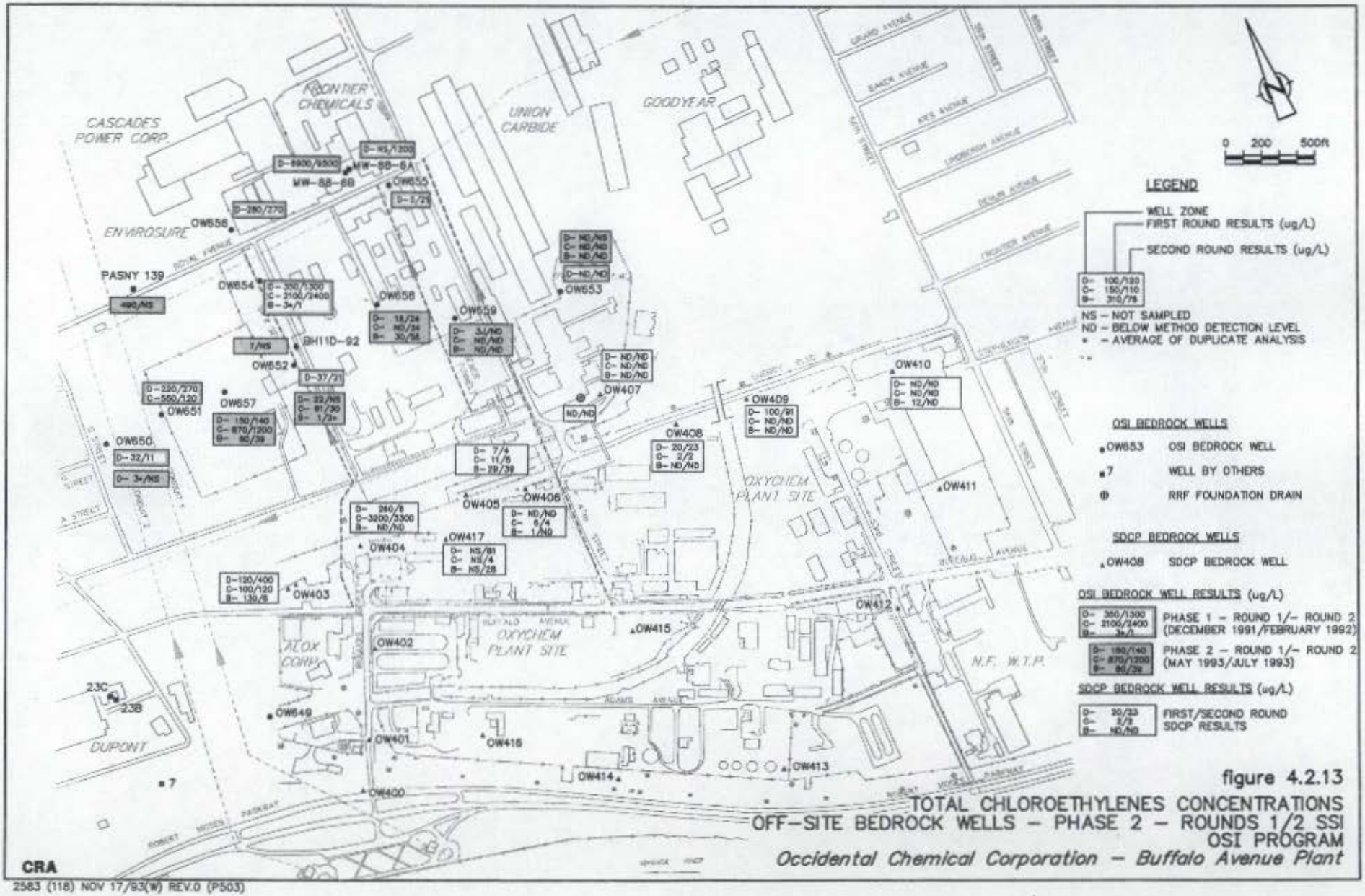


figure 4.2.13

TOTAL CHLOROETHYLENES CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P503)

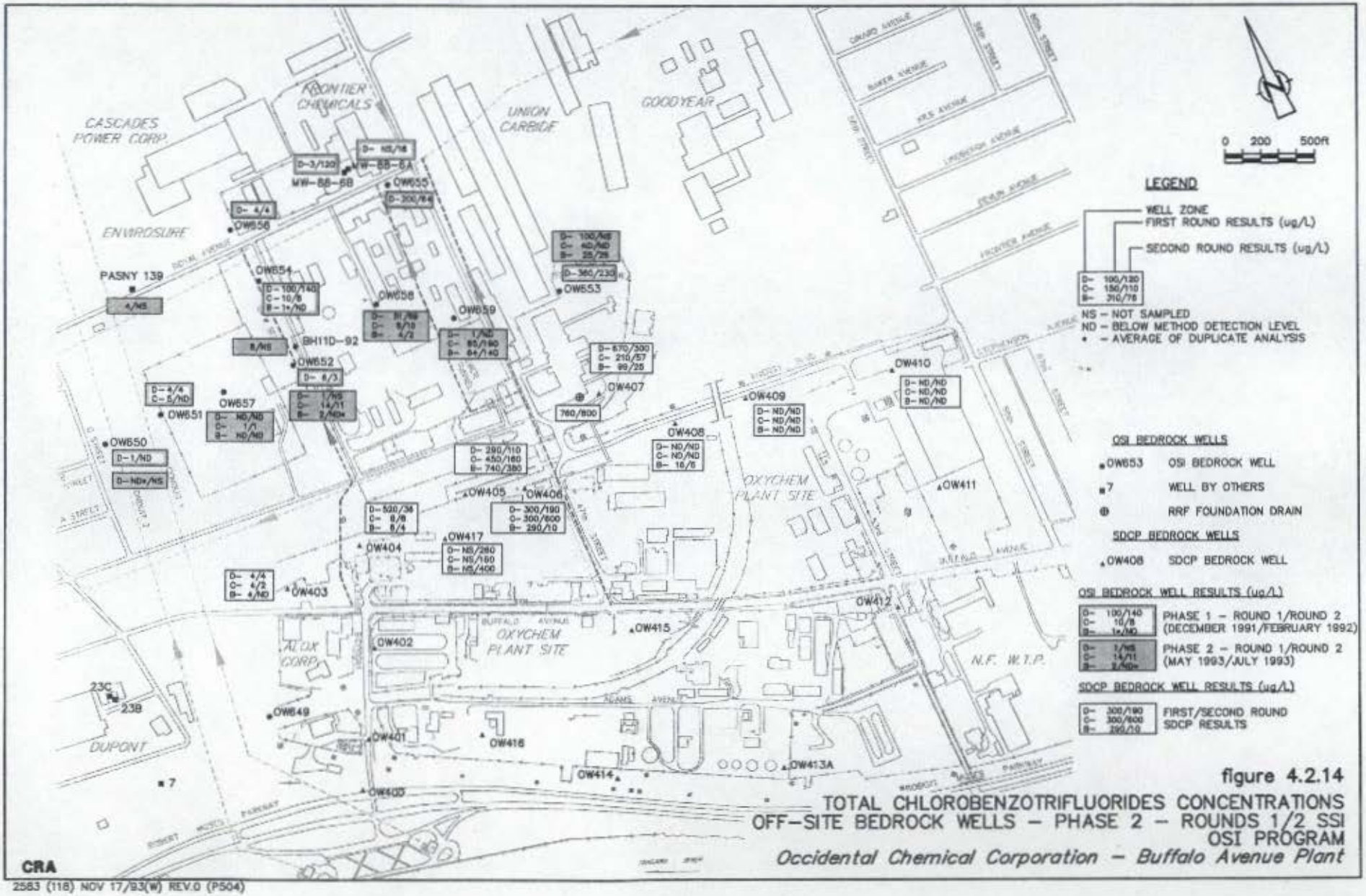


figure 4.2.14

TOTAL CHLOROBENZOTRIFLUORIDES CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P504)

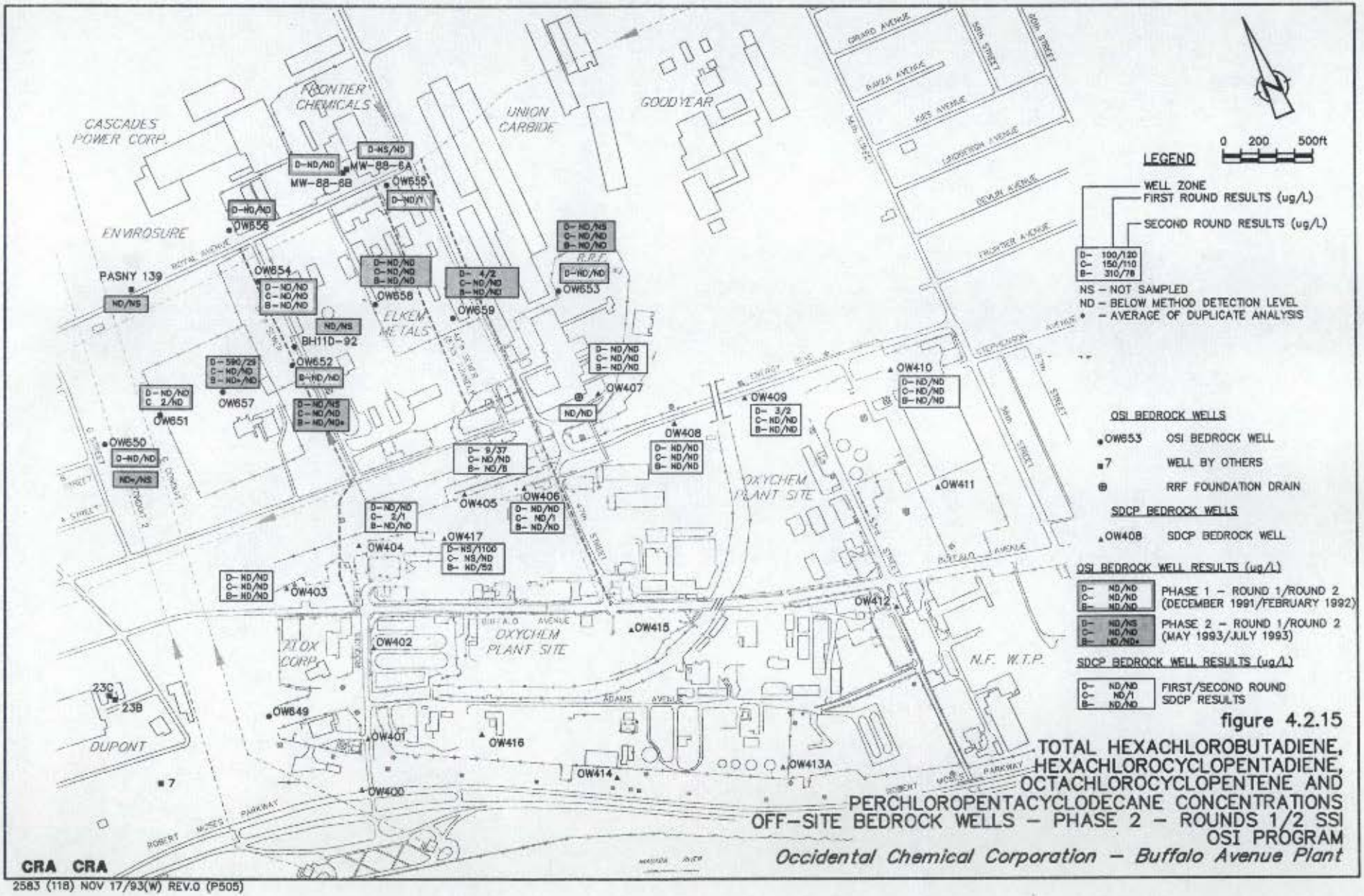


figure 4.2.15

TOTAL HEXACHLOROBUTADIENE, HEXACHLOROCYCLOPENTADIENE, OCTACHLOROCYCLOPENTENE AND PERCHLOROPENTACYCLODECANE CONCENTRATIONS OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA CRA

2583 (118) NOV 17/93(W) REV.0 (P505)

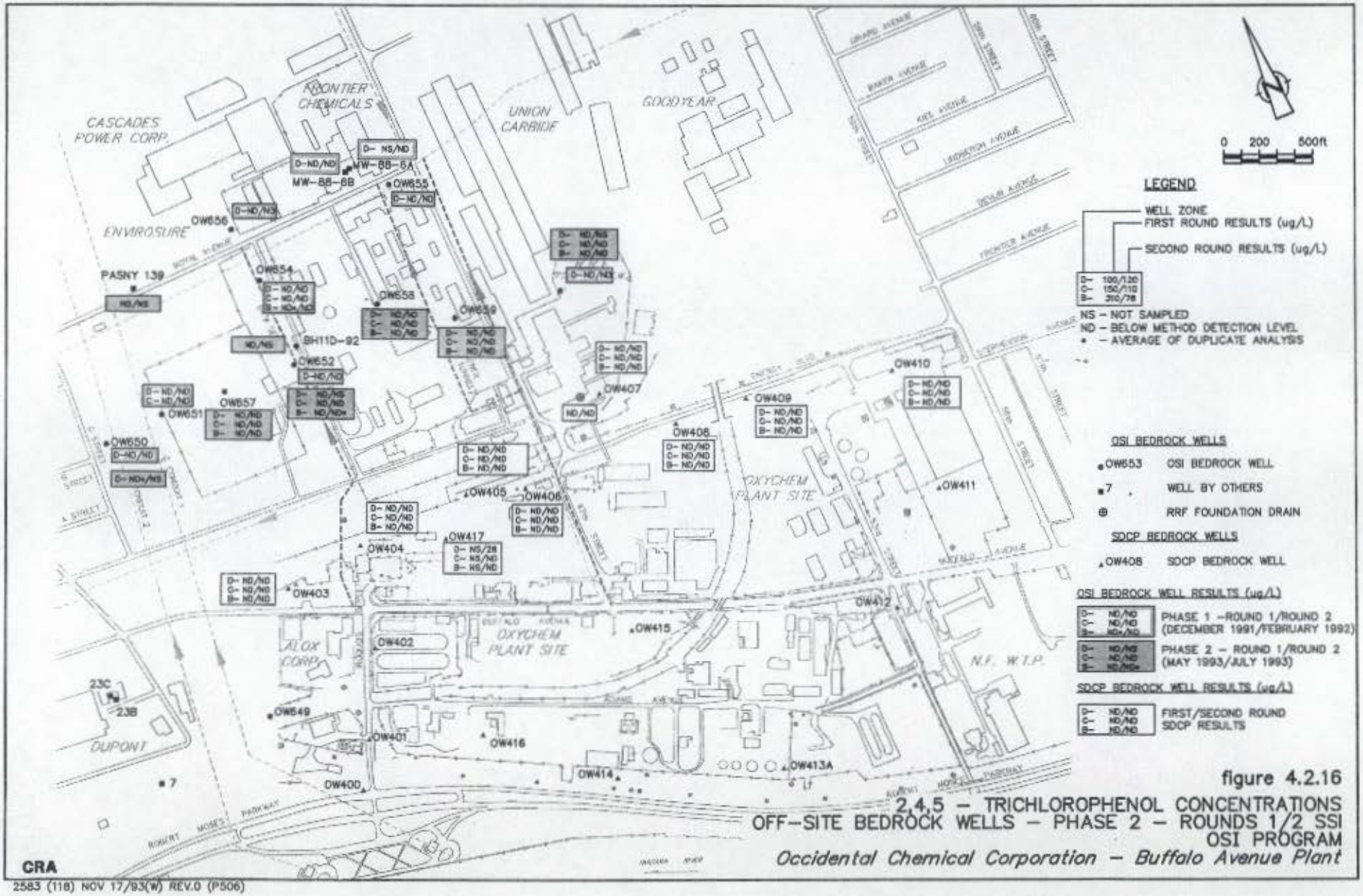


figure 4.2.16

2,4,5 - TRICHLOROPHENOL CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P506)

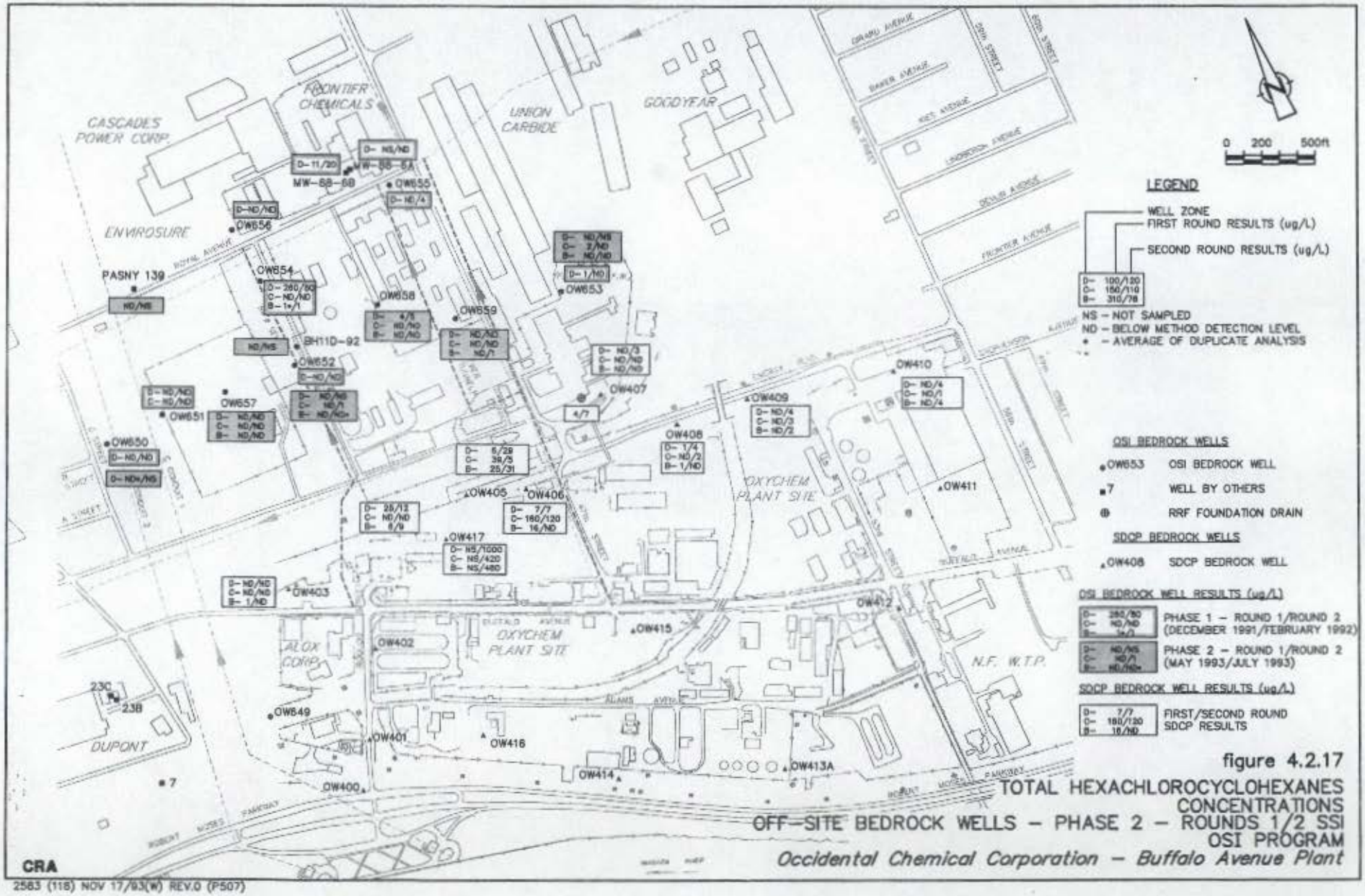


figure 4.2.17

TOTAL HEXACHLOROCYCLOHEXANES CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P507)

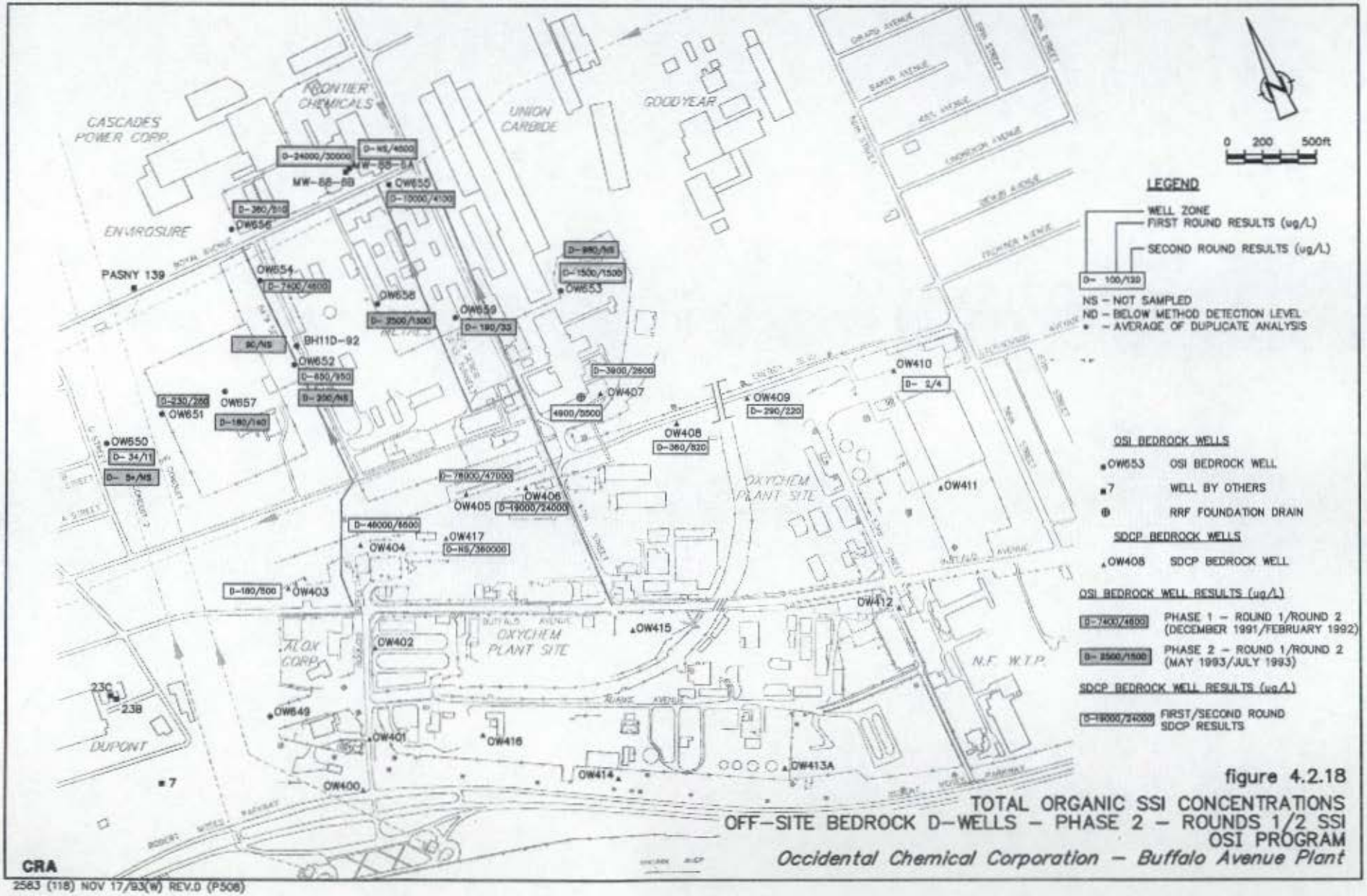


figure 4.2.18

TOTAL ORGANIC SSI CONCENTRATIONS
OFF-SITE BEDROCK D-WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2563 (118) NOV 17/93(W) REV.0 (P508)

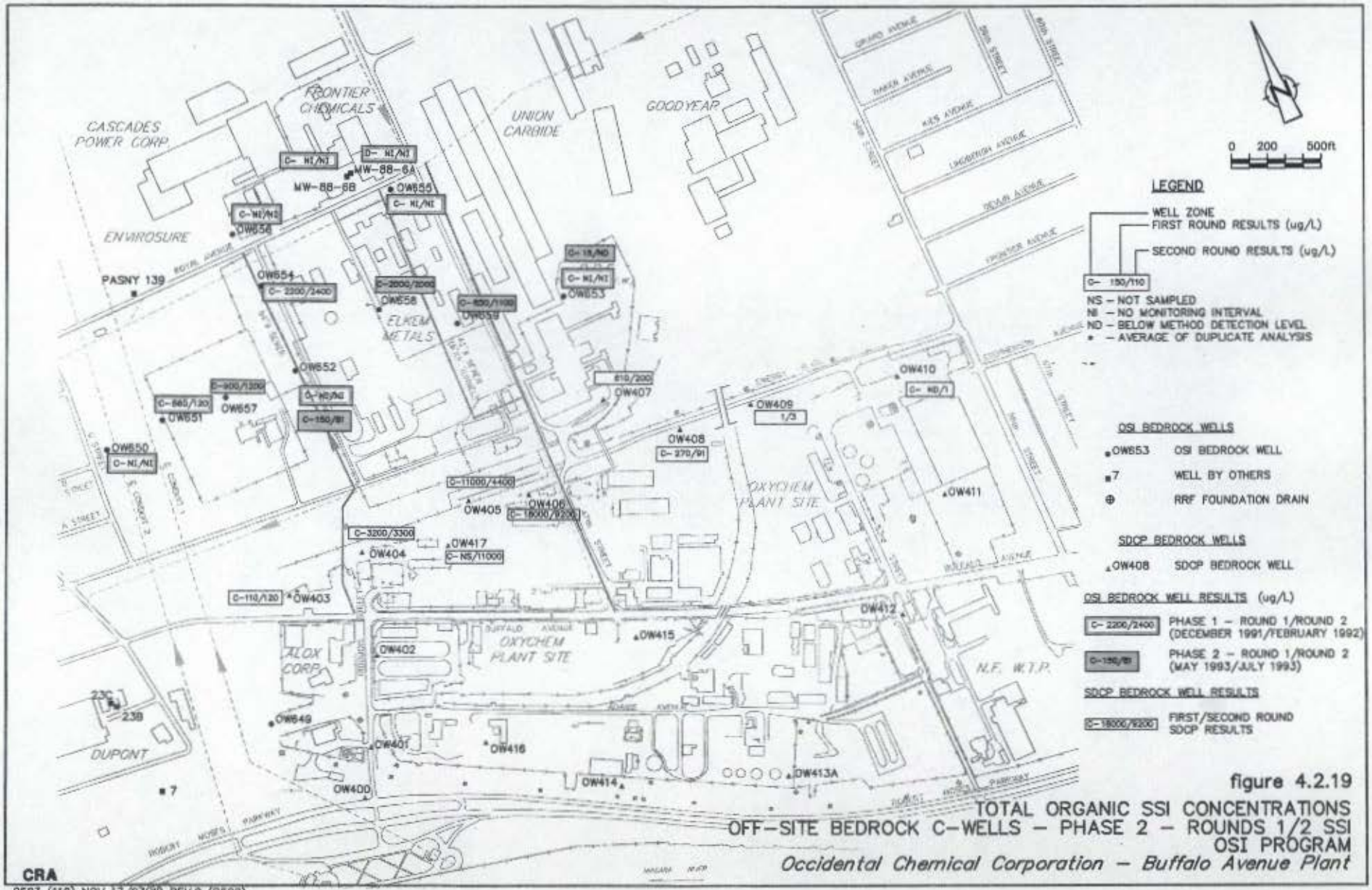


figure 4.2.19

TOTAL ORGANIC SSI CONCENTRATIONS
OFF-SITE BEDROCK C-WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P509)

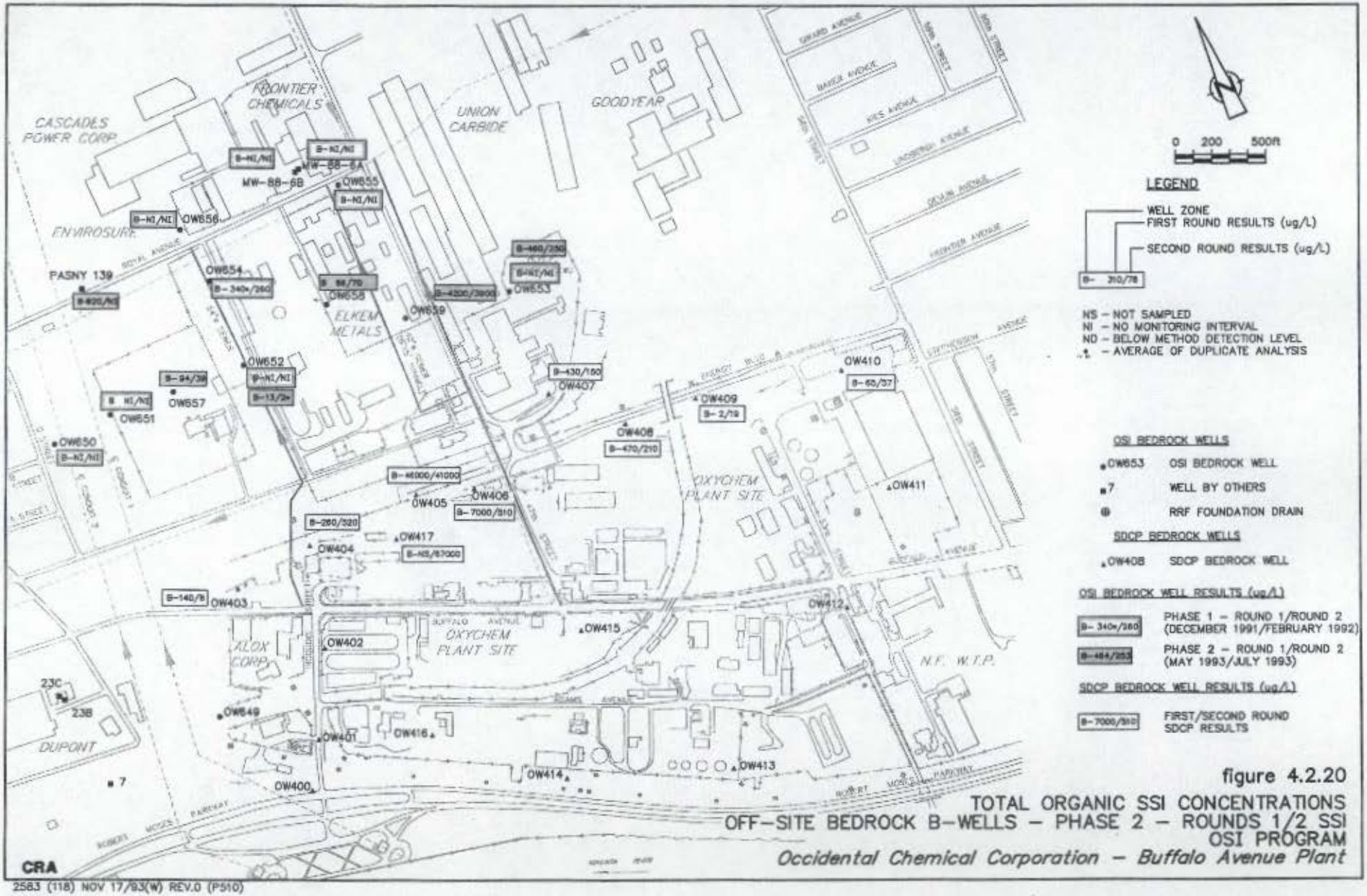


figure 4.2.20

TOTAL ORGANIC SSI CONCENTRATIONS
OFF-SITE BEDROCK B-WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P510)

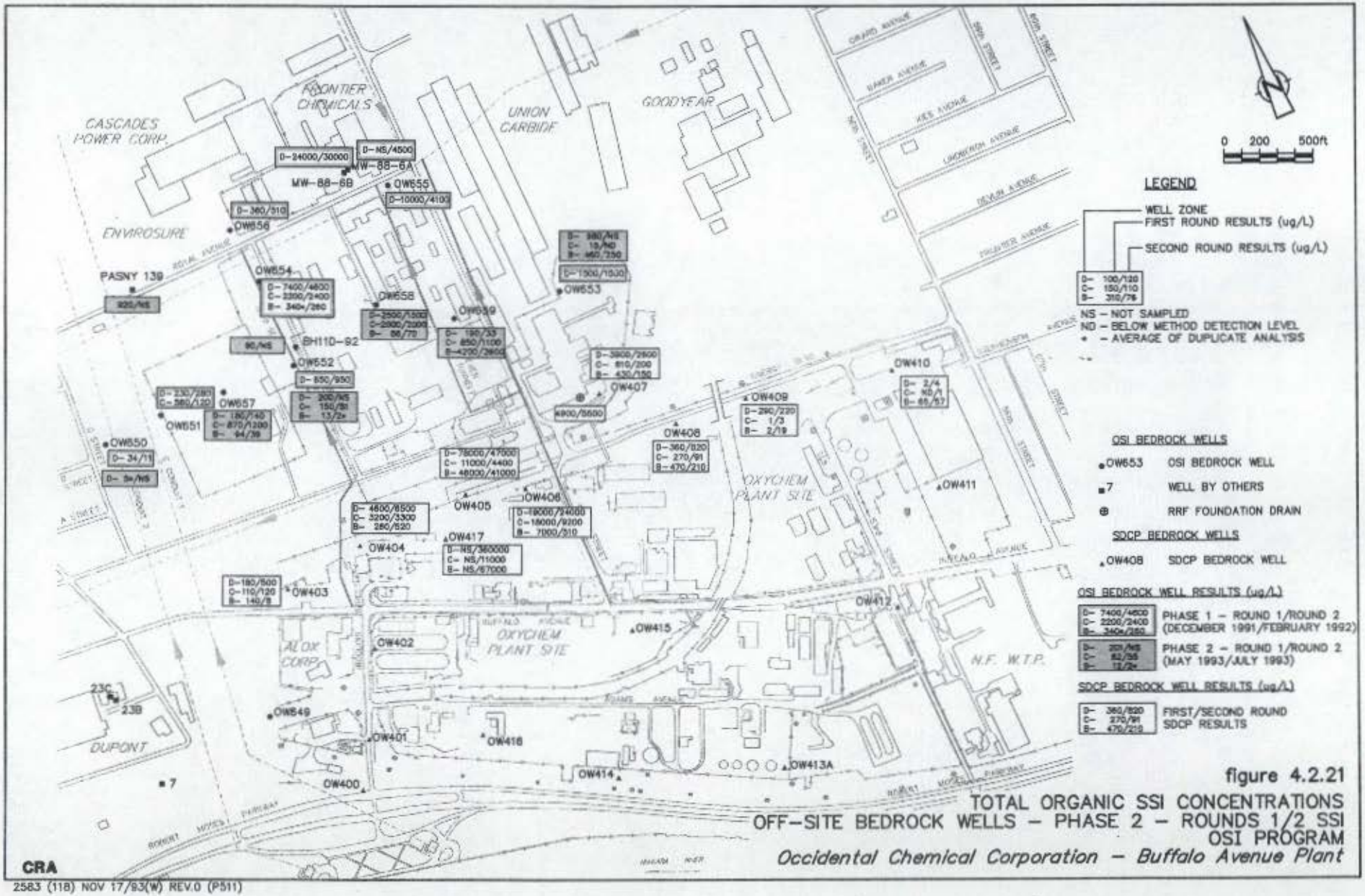


figure 4.2.21

TOTAL ORGANIC SSI CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P511)

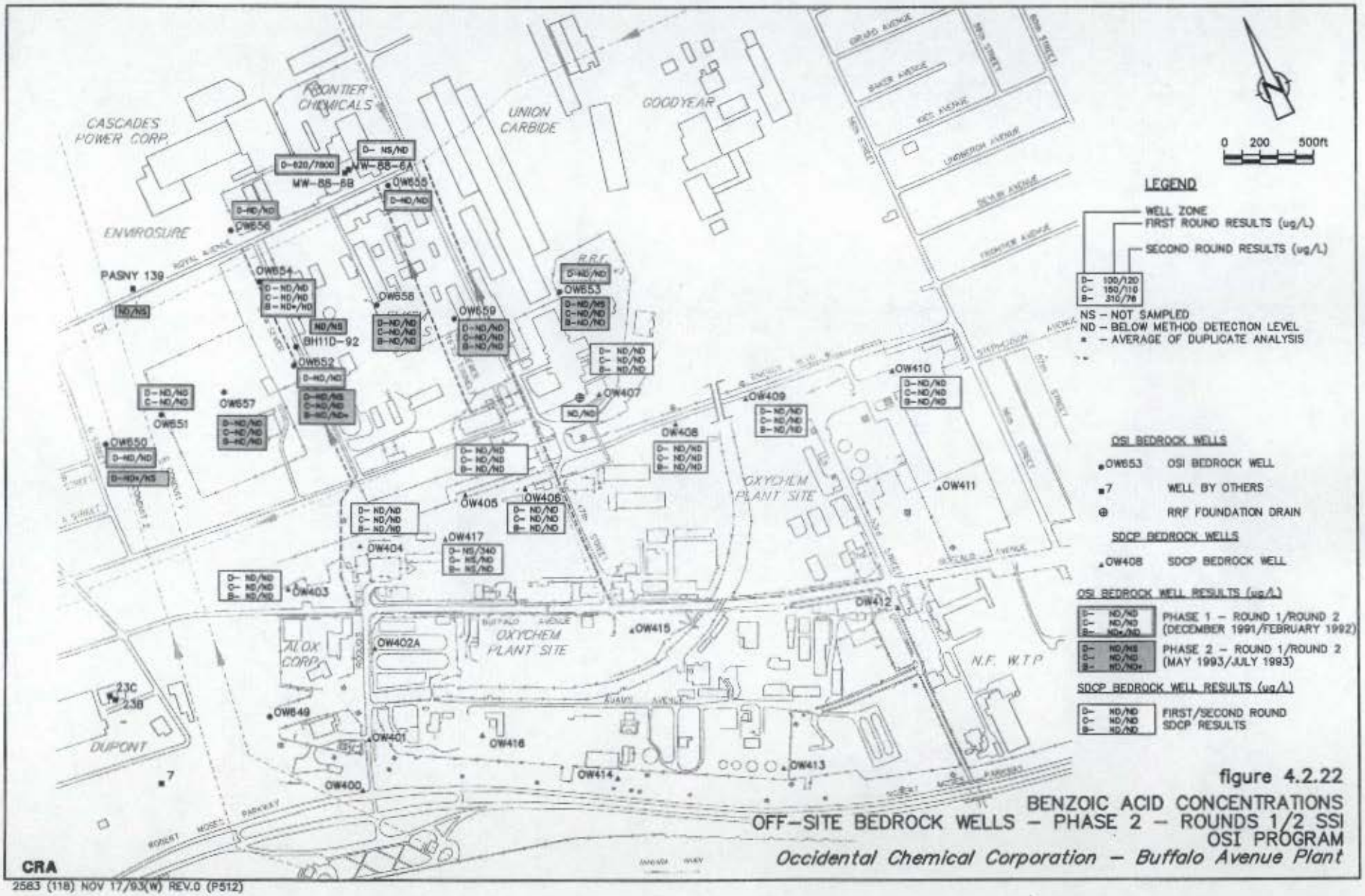


figure 4.2.22

BENZOIC ACID CONCENTRATIONS
OFF-SITE BEDROCK WELLS – PHASE 2 – ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P512)

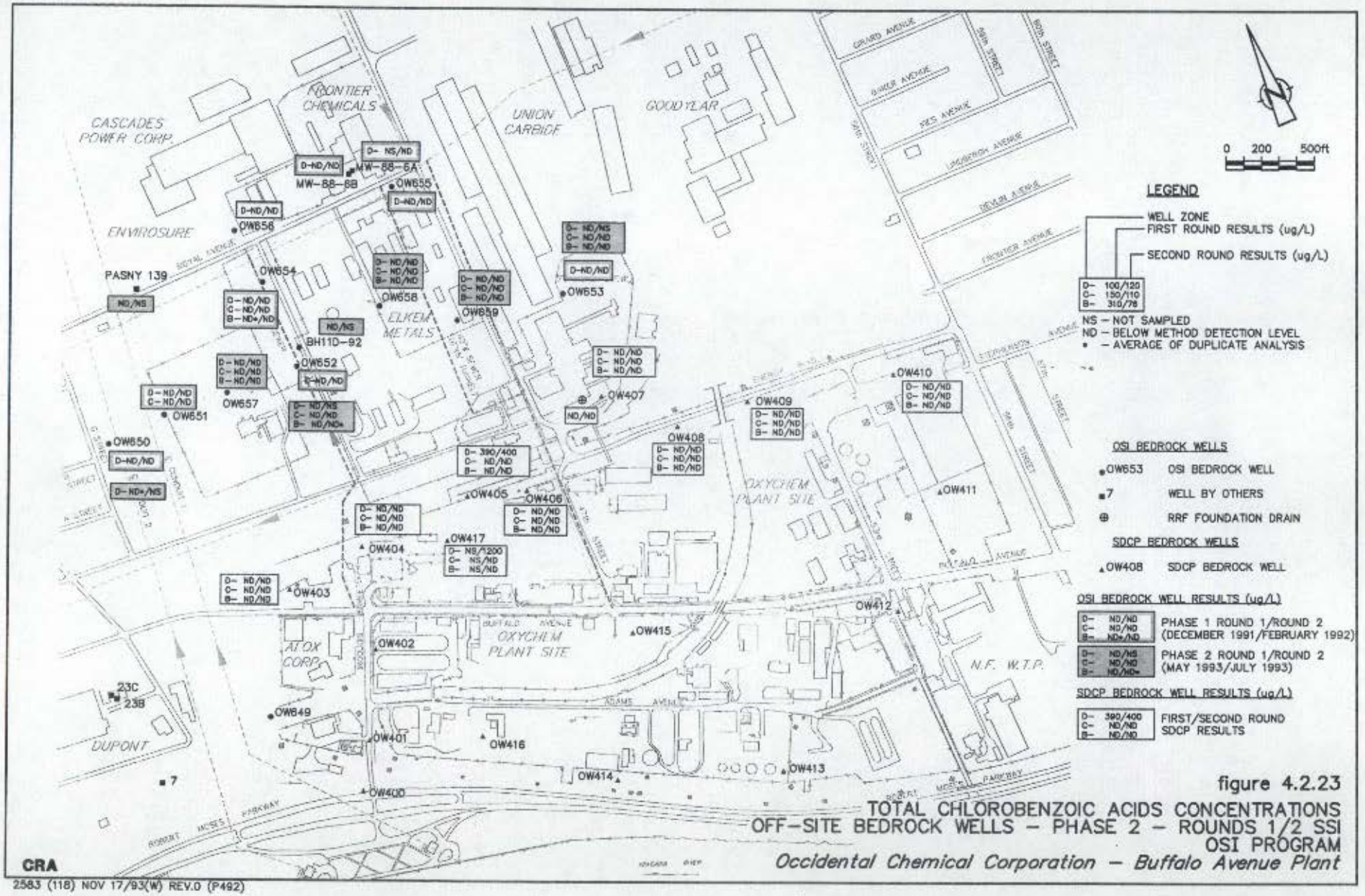


figure 4.2.23

TOTAL CHLOROBENZOIC ACIDS CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P492)

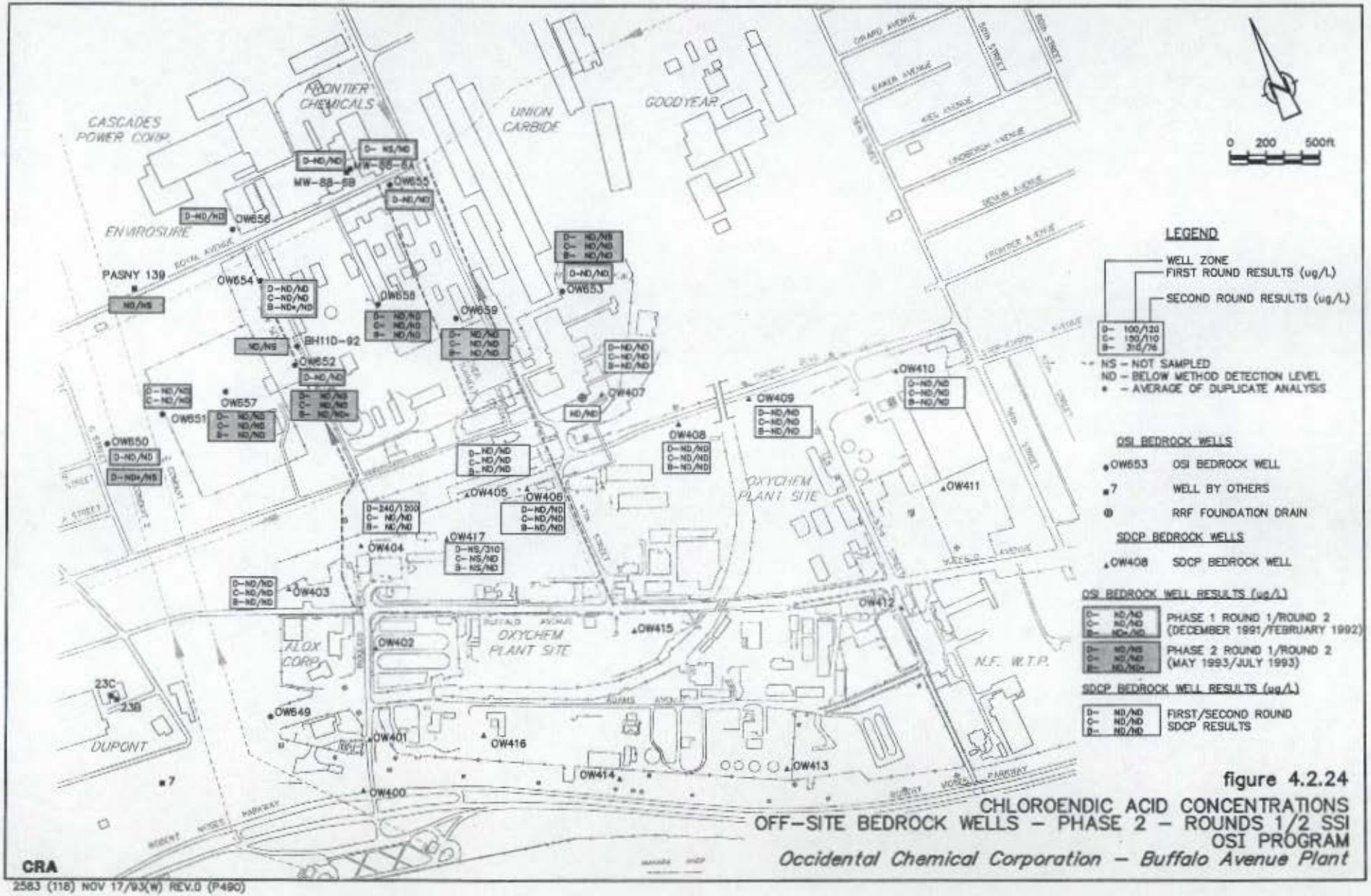


figure 4.2.24

CHLOROENDIC ACID CONCENTRATIONS
OFF-SITE BEDROCK WELLS - PHASE 2 - ROUNDS 1/2 SSI
OSI PROGRAM

Occidental Chemical Corporation - Buffalo Avenue Plant

CRA

2583 (118) NOV 17/93(W) REV.0 (P490)

TABLE 2.1

BEDROCK HYDRAULIC MONITORING /SAMPLING SUMMARY
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

A) Hydraulic Monitoring Locations

(i) *Bedrock Well Locations - (Round 1, Round 2)*

OW400 B, C, D; OW401 B, C, D; OW402 B, C, D; OW403 B, C, D; OW404 B, C, D; OW405 B, C, D; OW406 B, C, D; OW407 B, C, D; OW408 B, C, D; OW409 B, C, D; OW410 B, C, D; OW411 B, C, D; OW412 B, C, D; OW413 B, D; OW414 B, C, D; OW415 B, C, D; OW416 B, C, D; and OW417 B, C, D.

OW649 C, D; OW650 D; OW651 C, D; OW652 B, C, D; OW653 B, C, D; OW654 B, C, D; OW655; OW656; OW657 B, C, D; OW658 B, C, D; OW659 B, C, D; BH11D-92, PASNY139, MW-88-6B, MW-88-6A, MW23 C and MW23 B.

(ii) *Overburden Well Locations - (Round 1, Round 2)*

OW306, OW307, OW308, OW309, OW310, BH1A and BH1B.
OW553, OW554, OW555, OW556 and OW557.
MW1, MW2 and MW3.

B) SSI Sampling Locations

	Round 1	*Round 2*
(i) *Bedrock Well Locations*		
PASNY 139	yes	no
BH11D-92	yes	no
OW65OD, OW652D, OW653D	yes	no
OW652B, OW652C	yes	yes
OW653B, OW653C	yes	yes
OW657B, OW657C, OW657D	yes	yes
OW658B, OW658C, OW658D	yes	yes
OW659B, OW659C, OW659D	yes	yes
(ii) *Overburden Well Locations*		
MW-1	no	yes
MW-2, MW-3	yes	no

TABLE 2.2

BEDROCK WELL SOUNDED DEPTH RESULTS
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Well No.	*Drilled Depth (ft BGS)*	*Measured Depth* (ft BGS)*	*Difference (ft.)*
OW649C	109.6	107.90	1.7
OW649D	58.0	56.38	1.6
OW650D	58.5	50.07	8.4
OW651C	91.3	90.36	0.8
OW651D	61.0	58.20	2.8
OW652B	127.0	126.10	0.9
OW652C	93.0	90.40	2.6
OW652D	60.5	59.72	0.8
OW653B	122.0	119.22	2.8
OW653C	96.0	88.50	7.5
OW653D	70.2	69.00	1.2
OW654B	125.5	128.50	-3.0
OW654C	88.5	87.50	1.0
OW654D	59.6	55.30	4.3
OW655D	64.0	62.72	1.3
OW656D	60.2	59.77	0.4
OW657B	130.5	128.60	1.9
OW657C	95.1	94.60	0.5
OW657D	64.5	58.11	6.4
OW658B	131.0	129.55	1.4
OW658C	95.1	95.02	0.1
OW658D	65.0	64.70	0.3
OW659B	130.0	129.90	0.1
OW659C	94.5	93.45	1.0
OW659D	64.4	60.70	3.7
BH11D-92	26.9	25.64	1.3
PASNY139	unknown	133.50	NA
MW-88-6A	22.4	24.60	-2.2
MW-88-6B	32.0	34.12	-2.1

Notes:

* Measured May 3, 1993.
NA - Not Aplicable.

TABLE 2.3

SITE SPECIFIC INDICATORS (SSI)
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Analytes	*Unit*	*Method Detection Level*
pH	S.U.	
Specific Conductance	µmhos/cm	1
Phosphorus, Total Soluble (As P)	µg-P/L	10
Arsenic	µg/L	19/23*
Mercury	µg/L	0.2/0.4*
Lead	µg/L	16/18*
Toluene	µg/L	1
2-Chlorotoluene	µg/L	1
4-Chlorotoluene	µg/L	1
2,2/2,5-Dichlorotoluene	µg/L	1
2,6-Dichlorotoluene	µg/L	1
2,3/3,4-Dichlorotoluene	µg/L	1
2,3,6-Trichlorotoluene	µg/L	1
2,4,5-Trichlorotoluene	µg/L	1
Benzene	µg/L	1
Chlorobenzene	µg/L	1
1,2-Dichlorobenzene	µg/L	1
1,3-Dichlorobenzene	µg/L	1
1,4-Dichlorobenzene	µg/L	1
1,2,3-Trichlorobenzene	µg/L	1
1,2,4-Trichlorobenzene	µg/L	1
1,2,3,4-Tetrachlorobenzene	µg/L	1
1,2,4,5-Tetrachlorobenzene	µg/L	1
Hexachlorobenzene	µg/L	1
Trichloroethylene	µg/L	1
Tetrachloroethylene	µg/L	1
2-Chlorobenzotrifluoride	µg/L	1
4-Chlorobenzotrifluoride	µg/L	1
2,4-Dichlorobenzotrifluoride	µg/L	1
3,4-Dichlorobenzotrifluoride	µg/L	1
Hexachlorobutadiene	µg/L	1
Hexachlorocyclopentadiene	µg/L	1
Octachlorocyclopentene	µg/L	1
Perchloropentacyclodecane (Mirex)	µg/L	1
2,4,5-Trichlorophenol	µg/L	10
a-Hexachlorocyclohexane	µg/L	1
b-Hexachlorocyclohexane	µg/L	1
g-Hexachlorocyclohexane	µg/L	1
d-Hexachlorocyclohexane	µg/L	1
Benzoic Acid	µg/L	100
2-Chlorobenzoic Acid	µg/L	30
3-Chlorobenzoic Acid	µg/L	30
4-Chlorobenzoic Acid	µg/L	30
Chlorobenzoic Acids, Total	µg/L	90
Chlorendic Acid	µg/L	250
Total Organic Carbon (TOC)	mg/L	1
Total Organic Halides (TOX)	µg/L	50

Note:

*MDL Round 1/MDL Round 2

TABLE 3.1

BEDROCK STRATIGRAPHIC THICKNESS SUMMARY
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Well No.	*Overburden Thickness (ft)*	*Oak Orchard Thickness (ft)*	*Eramosa Thickness (ft)*	*Goat Island Thickness (ft)*
OW652C	14.5	84.0	14.3	13.4
OW653C	20.8	83.4	18.8	13.3
OW657D	18.0	78.0	20.0	12.6
OW658D	17.5	80.1	19.7	11.5
OW659D	20.3	79.3	17.7	11.0
BH11D-92	16.8	–	–	–

TABLE 3.2

HYDRAULIC MONITORING - OVERBURDEN
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Well No.	*May 1993 Water Elevation (ft AMSL)*	*July 1993 Water Elevation (ft AMSL)*
SDCP Wells		
BH1A-88	555.66	555.58
BH1B-88	565.09	565.34
OW306	568.19	567.58
OW308	570.54	569.79
OW309	565.88	568.71
OW310	570.87	570.71
OSI Wells		
OW553	569.71	568.73
OW554	570.93	568.84
OW555	570.99	570.36
OW556	570.92	569.26
OW557	567.92	566.54
OW558	569.38	569.26
OW559	569.30	568.95
UDG Wells		
MW-3	570.79	569.72
MW-2	570.84	NA
MW-1	NM	569.31

Notes:

NM - Not Measured
NA - Not Available

TABLE 3.3

HYDRAULIC MONITORING - BEDROCK
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Well No.	*May 1993 Water Elevation (ft AMSL)*	*July 1993 Water Elevation (ft AMSL)*
SDCP Wells		
OW400D	555.32	556.49
OW400C	555.14	556.07
OW400B	555.30	556.17
OW401D	554.98	556.06
OW401C	555.06	556.01
OW401B	554.96	555.90
OW402D	554.83	555.70
OW402C	555.01	555.81
OW402B	554.74	555.46
OW403D	555.26	555.60
OW403C	555.02	555.73
OW403B	554.93	555.59
OW404D	554.97	554.86
OW404C	567.46	555.99
OW404B	560.49	558.69
OW405D	554.94	555.24
OW405C	555.27	555.87
OW405B	554.08	554.65
OW406D	553.96	554.47
OW406C	555.28	555.74
OW406B	552.86	555.01
OW407D	553.99	553.99
OW407C	555.01	555.56
OW407B	556.14	556.81
OW408D	554.15	554.59
OW408C	555.51	555.83
OW408B	552.58	552.66
OW409D	554.92	555.38
OW409C	557.66	557.93
OW409B	552.72	552.99
OW410D	555.19	555.67
OW410C	558.10	552.94
OW410B	552.49	554.12
OW411D	560.16	560.38
OW411C	558.05	558.00
OW411B	553.10	553.08
OW412D	559.56	559.98
OW412C	558.03	557.96
OW412B	556.97	556.90
OW413D	560.66	560.81
OW413B	566.03	surcharged
OW414D	559.30	559.69
OW414C	559.17	560.04

TABLE 3.3

HYDRAULIC MONITORING - BEDROCK
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Well No.	*May 1993 Water Elevation (ft AMSL)*	*July 1993 Water Elevation (ft AMSL)*
OW414B	556.89	557.75
OW415D	555.59	555.92
OW415C	555.12	555.48
OW415B	555.42	555.81
OW416D	556.09	557.32
OW416C	555.13	555.84
OW416B	554.22	554.84
OW417D	554.00	554.38
OW417C	555.33	555.85
OW417B	555.52	556.02
OSI Wells		
OW649D	555.65	555.56
OW649C	555.67	555.55
OW650D	553.33	552.83
OW651D	554.36	554.14
OW651C	554.73	554.57
OW652D	551.37	551.59
OW652C	553.87	554.57
OW652B	553.24	553.86
OW653D	550.75	550.75
OW653C	551.27	551.68
OW653B	552.79	553.49
OW654D	549.04	549.19
OW654C	554.02	554.00
OW654B	553.69	553.54
OW655D	546.35	546.67
OW656D	552.75	553.13
OW657D	553.08	553.79
OW657C	553.81	554.64
OW657B	553.19	553.85
OW658D	548.26	548.18
OW658C	550.96	551.20
OW658B	552.39	552.40
OW659D	551.41	551.96
OW659C	553.50	553.76
OW659B	552.90	552.88
BH11D-92	550.26	550.37
Wells by Others		
PASNY139	553.67	553.75
MW-88-6B	546.16	546.01
MW23C	554.54	554.52

TABLE 4.1

SUMMARY OF PARAMETERS AND PARAMETER GROUPS SELECTED FOR GRAPHICAL PRESENTATION OSI PROGRAM - PHASE 2 OCCIDENTAL CHEMICAL CORPORATION BUFFALO AVENUE PLANT

General Parameter Survey Analysis List	*Figure Title*	*Figure #* *Bedrock*	*Overburden*
pH	pH Levels	4.2.1	--
Total Organic Halides (TOX)	Total Organic Halides (TOX)	4.2.2	4.1.1
Total Organic Carbon (TOC)	Total Organic Carbon (TOC)	4.2.3	4.1.2
Specific Conductance	Specific Conductance Level	4.2.4	--
Phosphorus, Total Soluble (as P)	Total Soluble Phosphorus Concentration	4.2.5	4.1.3
Mercury	Total Mercury Concentration	4.2.6	--
Lead	Total Lead Concentration	4.2.7	--
Arsenic	Total Arsenic Concentration	4.2.8	--
Toluene	Toluene Concentration	4.2.9	--
2-Chlorotoluene 4-Chlorotoluene 2,5/2,4-Dichlorotoluene 2,3/3,4-Dichlorotoluene 2,6-Dichlorotoluene 2,3,6-Trichlorotoluene 2,4,5-Trichlorotoluene	Total Chlorotoluenes Concentration	4.2.10	--
Benzene	Benzene Concentration	4.2.11	--
Chlorobenzene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2,3-Trichlorobenzene 1,2,4-Trichlorobenzene 1,2,3,4-Tetrachlorobenzene 1,2,4,5-Tetrachlorobenzene Hexachlorobenzene	Total Chlorobenzenes Concentration	4.2.12	--
Trichloroethylene Tetrachloroethylene	Total Chloroethylenes Concentration	4.2.13	

TABLE 4.1

SUMMARY OF PARAMETERS AND PARAMETER GROUPS SELECTED FOR GRAPHICAL PRESENTATION OSI PROGRAM - PHASE 2 OCCIDENTAL CHEMICAL CORPORATION BUFFALO AVENUE PLANT

General Parameter Survey Analysis List	*Figure Title*	*Figure # Bedrock*	*Overburden*
2-Chlorobenzotrifluoride 4-Chlorobenzotrifluoride 2,4-Dichlorobenzotrifluoride 3,4-Dichlorobenzotrifluoride	Total Chlorobenzotrifluorides Concentrations	4.2.14	--
Hexachlorobutadiene Hexachlorocyclopentadiene Octachlorocyclopentene Perchloropentacyclodecane (MIREX)	Total Hexachlorobutadiene, Hexachlorocyclopentadene, Octachlorocyclopentene, and Perchloropentacyclodecane Concentration	4.2.15	--
2,4,5-Trichlorophenol	2,4,5-Trichlorophenol Concentration	4.2.16	--
a-Hexachlorocyclohexane b-Hexachlorocyclohexane g-Hexachlorocyclohexane d-Hexachlorocyclohexane	Total Hexachlorocyclohexane Concentration	4.2.17	--
Benzoic Acid	Benzoic Acid Concentrations	4.2.22	--
Total Chlorobenzoic Acids	Total Chlorobenzoic Acid Concentrations	4.2.23	--
Chlorendic Acid	Chlorendic Acid Concentrations	4.2.24	--

TABLE 4.2

SUMMARY OF ANALYTICAL METHODOLOGY
AMERICAN REF-FUEL
MARCH 1993

Parameter	*Analytical Method*
Target Compound List Volatile Organic Compounds	624(2)
Priority Pollutant Volatile Organic Compounds	8240(1)
Priority Pollutant Base/Neutral Acid Extractables	625(2)
Target Compound List Base/Neutral Acid Extractables	8270(1)
Priority Pollutant Pesticides/Polychlorinated Biphenyls	608(2)
Dechlorane Plus	8080(1)
Priority Pollutant Metals	6000/7000 Series(1)
Resource Conservation and Recovery Act Metal	6000/7000 Series(1)
Sulfate	9038(1)

Notes:
(1) Referenced from USEPA SW-846, 3rd Edition, 1986.
(2) Referenced from USEPA "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", July 1982.

TABLE 4.3

COMPARISON OF D-ZONE AVERAGE CHEMICAL CONCENTRATIONS WITH DISTANCE FROM NORTH PLANT BOUNDARY OSI PROGRAM - PHASE 2 OCCIDENTAL CHEMICAL CORPORATION BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*Plant Boundary Wells 404D, 405D, 406D, 408D & 417D* (1)	*1st Line of Wells 651D, 652D, 653D, 657D, 658D & 659D*	*Royal Avenue Wells 654D & 655D* (2)
pH	S.U.	6.8	NA	7.4
Total Organic Halides (TOX)	µg/L	12,000	R	3,200
Total Organic Carbon (TOC)	mg/L	7	2	5
Specific Conductance	µmhos/cm	4,100	NA	1,400
Total Soluble Phosphorus	µg-P/L	190	23	24
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	ND	26	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	230	1	5
Total Chlorotoluenes	µg/L	840	140	200
Benzene	µg/L	48,000	180	220
Total Chlorobenzenes	µg/L	15,000	270	5,300
Total Chloroethylenes	µg/L	44	69	420
Total Chlorobenzotrifluorides	µg/L	200	28	130
Total C46, C56, C58 and Mirex	µg/L	130	ND	160
2,4,5-Trichlorophenol	µg/L	3	ND	ND
Total Hexachlorocyclohexanes	µg/L	130	ND	86
Total Organic SSI	µg/L	65,000	640	6,500
Benzoic Acid	µg/L	40	ND	ND
Chlorobenzoic Acid	µg/L	220	ND	ND
Chlorendic Acid	µg/L	200	ND	ND

Notes:

R - Associated results were qualified as unusable.
NA - Not Available
(1) SDCP SSI analytical results.
(2) Phase 1 analytical results.

TABLE 4.4

COMPARISON OF C-ZONE AVERAGE CHEMICAL CONCENTRATIONS WITH DISTANCE FROM NORTH PLANT BOUNDARY OSI PROGRAM - PHASE 2 OCCIDENTAL CHEMICAL CORPORATION BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*Plant Boundary Wells 404C, 405C, 406C, 408C & 417C (1)*	*1st Line of Wells 652C, 653C, 657C, 658C & 659C*	*Royal Avenue Well 654C (2)*
pH	S.U.	7.6	NA	6.9
Total Organic Halides (TOX)	µg/L	3,300	R	2,100
Total Organic Carbon (TOC)	mg/L	4	3	ND
Specific Conductance	µmhos/cm	1,100	NA	350
Total Soluble Phosphorus	µg-P/L	30	ND	33
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	ND	ND	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	10	1	ND
Total Chlorotoluenes	µg/L	450	100	ND
Benzene	µg/L	1,600	200	ND
Total Chlorobenzenes	µg/L	4,100	260	3
Total Chloroethylenes	µg/L	650	210	2,300
Total Chlorobenzotrifluorides	µg/L	180	31	9
Total C46, C56, C58 and Mirex	µg/L	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	ND	ND	ND
Total Hexachlorocyclohexanes	µg/L	120	ND	ND
Total Organic SSI	µg/L	7,100	800	2,300
Benzoic Acid	µg/L	ND	ND	ND
Chlorobenzoic Acid	µg/L	ND	ND	ND
Chlorendic Acid	µg/L	ND	ND	ND

Notes:

R - Associated results were qualified as unusable.
NA - Not Available
(1) SDCP SSI analytical results.
(2) Phase 1 analytical results.

TABLE 4.5

COMPARISON OF B-ZONE AVERAGE CHEMICAL CONCENTRATIONS WITH DISTANCE FROM NORTH PLANT BOUNDARY OSI PROGRAM - PHASE 2 OCCIDENTAL CHEMICAL CORPORATION BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*Plant Boundary Wells 404B, 405B, 406B, 408B & 417B(1)*	*1st Line of Wells 652B, 653B, 657B, 658B & 659B*	*Royal Avenue Well 654B (2)*
pH	S.U.	7.4	NA	7.2
Total Organic Halides (TOX)	µg/L	7,300	R	230
Total Organic Carbon (TOC)	mg/L	6	6	ND
Specific Conductance	µmhos/cm	4,800	NA	2,900
Total Soluble Phosphorus	µg-P/L	ND	12	44
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	ND	ND	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	72	ND	ND
Total Chlorotoluenes	µg/L	490	65	69
Benzene	µg/L	11,000	300	130
Total Chlorobenzenes	µg/L	11,000	500	100
Total Chloroethylenes	µg/L	13	21	2
Total Chlorobenzotrifluorides	µg/L	220	26	ND
Total C46, C56, C58 and Mirex	µg/L	11	ND	ND
2,4,5-Trichlorophenol	µg/L	ND	ND	ND
Total Hexachlorocyclohexanes	µg/L	105	ND	1
Total Organic SSI	µg/L	23,000	900	300
Benzoic Acid	µg/L	ND	ND	ND
Chlorobenzoic Acid	µg/L	ND	ND	ND
Chlorendic Acid	µg/L	ND	ND	ND

Notes:

R - Associated results were qualified as unusable.
NA - Not Available.
(1) SDCP SSI analytical results.
(2) Phase 1 analytical results.

TABLE 4.6

COMPARISON OF BEDROCK GROUNDWATER AVERAGE CHEMICAL CONCENTRATIONS
PLANT BOUNDARY WELLS(1)
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*D-Zone*	*C-Zone*	*B-Zone*
pH	S.U.	6.8	7.6	7.4
Total Organic Halides (TOX)	µg/L	12,000	3,300	7,300
Total Organic Carbon (TOC)	mg/L	7	4	6
Specific Conductance	µmhos/cm	4,100	1,100	4,800
Total Soluble Phosphorus	µg-P/L	190	30	ND
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	ND	ND	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	230	10	72
Total Chlorotoluenes	µg/L	840	450	490
Benzene	µg/L	48,000	1,600	11,000
Total Chlorobenzenes	µg/L	15,000	4,100	11,000
Total Chloroethylenes	µg/L	44	650	13
Total Chlorobenzotrifluorides	µg/L	200	180	220
Total C46, C56, C58 and Mirex	µg/L	130	ND	11
2,4,5-Trichlorophenol	µg/L	3	ND	ND
Total Hexachlorocyclohexanes	µg/L	130	120	105
Total Organic SSI	µg/L	65,000	7,100	23,000
Benzoic Acid	µg/L	40	ND	ND
Chlorobenzoic Acid	µg/L	220	ND	ND
Chlorendic Acid	µg/L	200	ND	ND

Notes:

R - Associated results were qualified as unusable.
NA - Not Available
(1) Plant Boundary Wells 404, 405, 406, 408 and 417.

TABLE 4.7

COMPARISON OF BEDROCK GROUNDWATER AVERAGE CHEMICAL CONCENTRATIONS
FIRST LINE OF WELLS (1)
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*D-Zone*	*C-Zone*	*B-Zone*
pH	S.U.	NA	NA	NA
Total Organic Halides (TOX)	µg/L	R	R	R
Total Organic Carbon (TOC)	mg/L	2	3	6
Specific Conductance	µmhos/cm	NA	NA	NA
Total Soluble Phosphorus	µg-P/L	23	ND	12
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	26	ND	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	1	1	ND
Total Chlorotoluenes	µg/L	140	100	65
Benzene	µg/L	180	200	300
Total Chlorobenzenes	µg/L	270	260	500
Total Chloroethylenes	µg/L	69	210	21
Total Chlorobenzotrifluorides	µg/L	28	31	26
Total C46, C56, C58 and Mirex	µg/L	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	ND	ND	ND
Total Hexachlorocyclohexanes	µg/L	ND	ND	ND
Total Organic SSI	µg/L	640	800	900
Benzoic Acid	µg/L	ND	ND	ND
Chlorobenzoic Acid	µg/L	ND	ND	ND
Chlorendic Acid	µg/L	ND	ND	ND

Notes:

R - Associated results were qualified as unusable.
NA - Not Available
(1) First Line Wells 651, 652, 653, 657, 658 and 659.

TABLE 4.8

COMPARISON OF BEDROCK GROUNDWATER AVERAGE CHEMICAL CONCENTRATIONS
ROYAL AVENUE WELLS (1)
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION
BUFFALO AVENUE PLANT

Parameters/Parameter Groups	*Unit*	*D-Zone*	*C-Zone(2)*	*B-Zone(2)*
pH	S.U.	7.4	6.9	7.2
Total Organic Halides (TOX)	µg/L	3,200	2,100	230
Total Organic Carbon (TOC)	mg/L	5	ND	ND
Specific Conductance	µmhos/cm	1,400	350	2,900
Total Soluble Phosphorus	µg-P/L	24	33	44
Total Mercury	µg/L	ND	ND	ND
Total Lead	µg/L	ND	ND	ND
Total Arsenic	µg/L	ND	ND	ND
Toluene	µg/L	5	ND	ND
Total Chlorotoluenes	µg/L	200	ND	69
Benzene	µg/L	220	ND	130
Total Chlorobenzenes	µg/L	5,300	3	100
Total Chloroethylenes	µg/L	420	2,300	2
Total Chlorobenzotrifluorides	µg/L	130	9	ND
Total C46, C56, C58 and Mirex	µg/L	160	ND	ND
2,4,5-Trichlorophenol	µg/L	ND	ND	ND
Total Hexachlorocyclohexanes	µg/L	86	ND	1
Total Organic SSI	µg/L	6,500	2,300	300
Benzoic Acid	µg/L	ND	ND	ND
Chlorobenzoic Acid	µg/L	ND	ND	ND
Chlorendic Acid	µg/L	ND	ND	ND

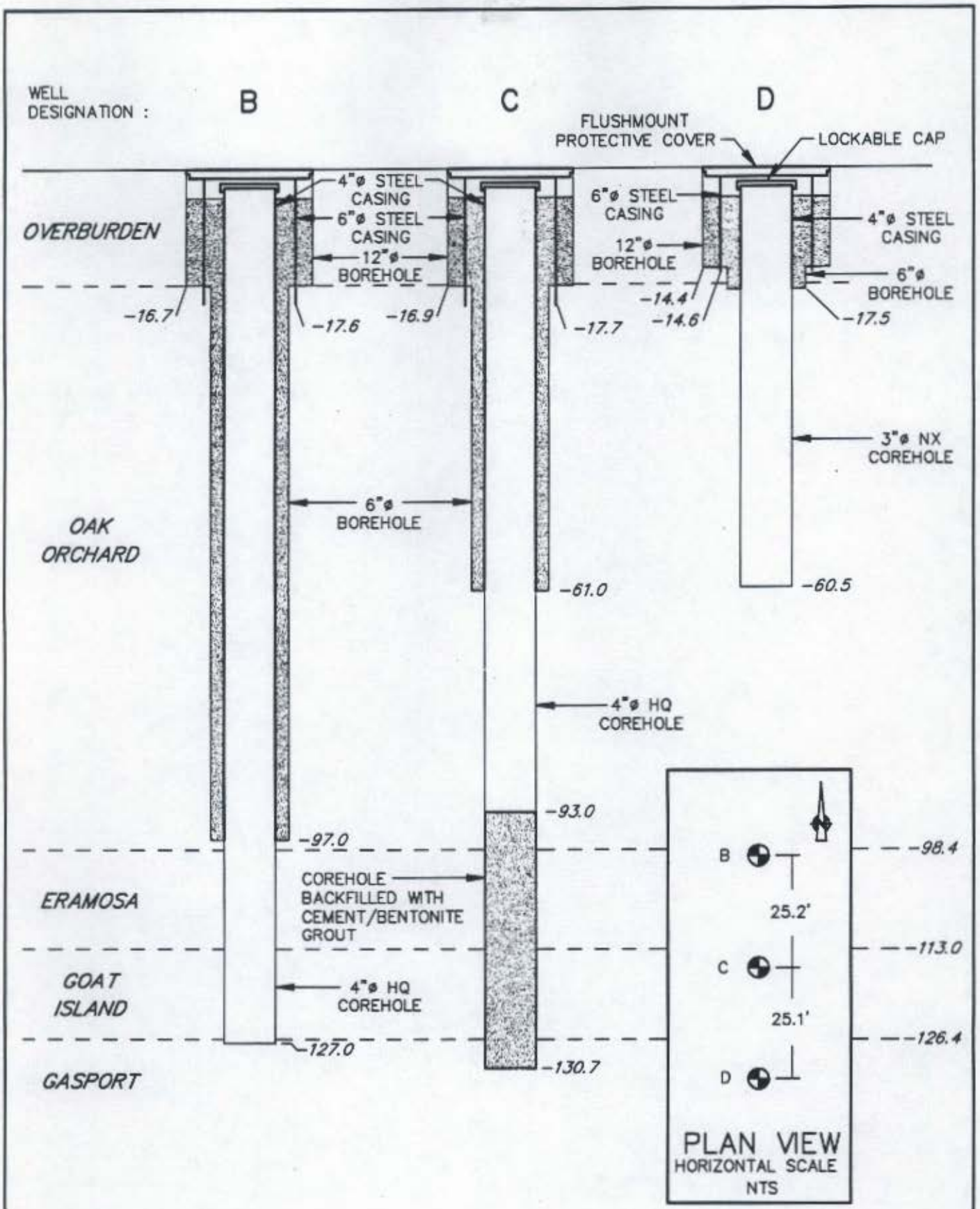
Notes:

(1) Royal Avenue Wells: 654 and 655
(2) Well 654 only.

APPENDIX A

STRATIGRAPHIC AND INSTRUMENTATION LOGS

- BEDROCK WELLS
- IROQUOIS SANITARY SEWER BEDDING BOREHOLES
- OVERBURDEN WELLS



WELL CLUSTER OW652
SDCP – OFF SITE INVESTIGATION
Occidental Chemical Corporation–Niagara Plant

CRA

2583 (87) NOV 16/93(W) REV.0 (LD24)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L285)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: WEST OF UNION CARBIDE PLANT

HOLE DESIGNATION: OW652D

DATE COMPLETED: AUGUST 26, 1991
DRILLING METHOD: 12" OD HSA
CRA SUPERVISOR: A.P. KISIEL

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser) GROUND SURFACE	569.93 570.2				
	Brown SILT, little clay, trace sand, moist, FILL	569.7	ROAD BOX			
2.5	Blue, green and gray SLAG, some gravel and sand, dry	568.4		1SS		16
	Mottled brown and rust brown SILT, some clay, moist	568.2		2SS		7
5.0	Mottled brown and gray fine SAND, some silt, trace fine gravel, trace clay, moist to wet, NATIVE	564.4	6"ø BLACK IRON PIPE	3SS		8
	Same, with trace fine subangular gravel, trace shells, moist to wet		4"ø BLACK IRON PIPE	4SS		19
7.5	Red brown SILT, some clay, moist	562.2		5SS		5
	Same, except laminating, increased clay content, moist to wet					
10.0	Laminated red brown and gray CLAY, some silt, trace fine sand lenses, moist	559.6	12"ø BOREHOLE	6SS		1
	Same, except red brown and brown, trace coarse gravel, trace sand, moist to wet					
12.5	Red brown SAND, little to some fine to coarse gravel, little silt, trace to little clay, wet, TILL	556.7		7SS		6
	Red brown SILT, some sand, little fine to coarse gravel, trace clay, moist to wet	555.8	CEMENT/ BENTONITE GROUT	8SS		>50
15.0	Same, with increased gravel content, moist					
	NON COMPETENT BEDROCK – auger to 14.6 ft BGS and set 6"ø casing, advanced roller bit to 17.5 ft BGS and set 4"ø casing		6"ø BOREHOLE			
17.5	END OF OVERBURDEN HOLE @ 17.5 FT. BGS	552.7				
20.0			3"ø NX COREHOLE			
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L286)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: WEST OF UNION CARBIDE PLANT

HOLE DESIGNATION: OW652D (Page 2 of 6)
DATE COMPLETED: SEPTEMBER 16, 1991
DRILLING METHOD: NX
CRA SUPERVISOR: A.P. KISIEL

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RNUUNMBER	CRORECOVERY	RQD	WRAETTURRN
ft BGS		ft. AMSL				%	%	%
	Overburden		6"ø BLACK IRON PIPE; 4"ø BLACK IRON PIPE; 12"ø BOREHOLE; CEMENT/ BENTONITE GROUT; 6"ø BOREHOLE; 3"ø NX COREHOLE					
12.5								
15.0	DOLOSTONE(Oak Orchard Formation): bituminous, light to dark gray, very thin to medium bedded, fine to medium grained, saccharoidal, carbonaceous partings and trace stylolites	555.8						
17.5	– light gray, fine grained, stylolites, few weathered fractures, calcite deposits in fractures (14.4 to 20.0 ft BGS)				1	67	17	17
					2	90	0	17
20.0	– light to medium gray, medium grained, abundant vugs and weathered fractures, calcite deposits in fractures (20.0 to 22.1 ft BGS)				3	83	19	0
22.5	– light to medium gray, medium grained, some stylolites, occasional vugs (22.1 to 33.0 ft BGS)							
25.0								
27.5	– light gray, fine grained, some stylolites, deformed bedding planes (26.4 to 27.6 ft BGS)				4	100	80	0
30.0					5	98	98	0
32.5								
35.0	– large calcite filled vug (@ 33.6 ft BGS) – large calcite filled vug (@ 34.7 ft BGS) – weathered fracture (@ 35.4 ft BGS) – vertical fracture (@ 36.7 ft BGS)				6	87	64	0
37.5	– highly fractured zone, calcite deposits in fractures (37.1 to 38.2 ft BGS)							
40.0	– highly fractured zone, some calcite deposits in fractures, bands of pitted rock, few stylolites (40.6 to 47.5 ft BGS)				7	89	55	0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L286)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: WEST OF UNION CARBIDE PLANT

HOLE DESIGNATION: OW652D (Page 3 of 6)
DATE COMPLETED: SEPTEMBER 16, 1991
DRILLING METHOD: NX
CRA SUPERVISOR: A.P. KISIEL

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
42.5	– calcite filled vug (@ 40.9 ft BGS)		3"ø NX COREHOLE		7	89	55	0
45.0								
47.5								
50.0	– highly fractured, highly weathered fractures, abundant vugs, calcite deposits in fractures, few stylolites (49.9 to 51.2 ft BGS)				8	92	74	0
52.5								
55.0	– highly fractured zone, weathered fractures, little calcite deposits in fractures, occasional vug and stylolite (55.5 to 60.5 ft BGS)							
57.5					9	62	20	0
60.0								
62.5	END OF HOLE @ 60.5 FT. BGS NOTES: 1. In January and February 1993 a "B" zone and "C" zone monitoring well were installed at this well cluster.	509.7						
65.0								
67.5								
70.0								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L304)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW652C

PROJECT NO.: 2583
DATE COMPLETED: FEBRUARY 5, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: WEST OF UNION CARBIDE PLANT
CRA SUPERVISOR: J. WILLIAMS

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIT ENDT RERO RCVK AL	RUN NUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	REFERENCE POINT (Top of Riser)	*570.06*						
	GROUND SURFACE	*570.35*						
60.0	NOTE: Overburden Stratigraphy and Bedrock Stratigraphy from 14.6 to 60.5 ft BGS is from OW652D well located 2.0 ft south.	*509.2 (Cont.)*						
62.5	DOLOSTONE(Oak Orchard Formation): bituminous, light to medium gray, fine to medium grained, thin to medium bedded, saccharoidal, carbonaceous partings, some gypsum lined partings, highly fractured and weathered zone							
65.0	– slightly weathered, occasional stylolites, vugs and solution pitting (61.0 to 64.2 ft BGS)		← 4"ø HQ COREHOLE		10	96	96.0	100
67.5	– horizontal fracture, no weathering (@ 61.9 ft BGS)							
	– horizontal fracture, no weathering (@ 63.2 ft BGS)							
70.0	– moderately weathered, numerous vugs, some gypsum filled, occasional stylolites, trace coral (64.2 to 66.6 ft BGS)							
	– horizontal fracture, no weathering (@ 66.2 ft BGS)							
72.5	– trace weathering, occasional stylolites, trace vugs, abundant coral (66.6 to 71.3 ft BGS)							
75.0	– moderately weathered, numerous vugs and solution pits, some coral, few stylolites (71.3 to 80.4 ft BGS)				11	100	98.0	100
	– horizontal fracture, slightly weathered (@ 72.9 ft BGS)							
77.5	– horizontal fracture, moderately weathered, shaly (@ 75.7 ft BGS)							
	– 45° fracture, moderately weathered, shaley (@ 75.8 ft BGS)							
80.0	– no weathering, no vugs (80.4 to 81.2 ft BGS)							
	– highly fractured zone occuring at shaley partings, horizontal and conchoidal, no weathering to mildly weathered (81.2 to 83.5 ft BGS)							
82.5	– lost water return (@ 82.0 ft BGS)							
	– vertically fractured (82.8 to 83.1 ft BGS)							
85.0	– moderately weathered, numerous vugs and solution pits, occasionally infilled with gypsum, trace stylolites (83.5 to 86.6 ft BGS)				12	100	93.0	48
	– horizontal fracture, slightly weathered (@ 85.0 ft BGS)							
87.5	– trace weathering, trace vugs, few stylolites (86.6 to 92.5 ft BGS)							
	– partial water return (@ 88.0 ft BGS)							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L304)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW652C (Page 5 of 6)
PROJECT NO.: 2583
DATE COMPLETED: FEBRUARY 5, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: WEST OF UNION CARBIDE PLANT
CRA SUPERVISOR: J. WILLIAMS

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIOTREORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
90.0					12	100	93.0	48
92.5	– horizontal fracture, no weathering (91.9 ft BGS) – moderately weathered, numerous gypsum filled vugs, occasional unweathered shaley fracture, few stylolites (92.5 to 98.4 ft BGS)		4"ø HQ COREHOLE					
95.0					13	95	82.0	30
97.5	– finer grained (@ 97.6 ft BGS)							
100.0	ARGILLACEOUS DOLOSTONE(Eramosa Formation): bituminous, light to medium gray, thin to medium bedded, fine grained, trace chert nodules, weathered fractures	471.8						
102.5	– mildly weathered, numerous slightly weathered shaley fractures, occasional horizontal and vertical stylolite, few gypsum filled vugs (98.4 to 108.7 ft BGS)		CEMENT/ BENTONITE GROUT					
105.0					14	104	85.0	0
107.5								
110.0	– moderately weathered, numerous partially gypsum infilled vugs, numerous moderately weathered fractures trace stylolites (108.7 to 111.0 ft BGS) – no weathering, occasional gypsum filled vugs and stylolites (111.0 to 113.0 ft BGS)							
112.5								
115.0	DOLOSTONE(Goat Island Formation): bituminous, medium to dark gray, thin to medium bedded, fine to medium grained, cherty, trace stylolites	457.2			15	103	100.0	0
117.5	– slightly weathered, medium grained, light gray, occasional stylolite, few chert nodules (113.0 to 120.0 ft BGS)							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L304)

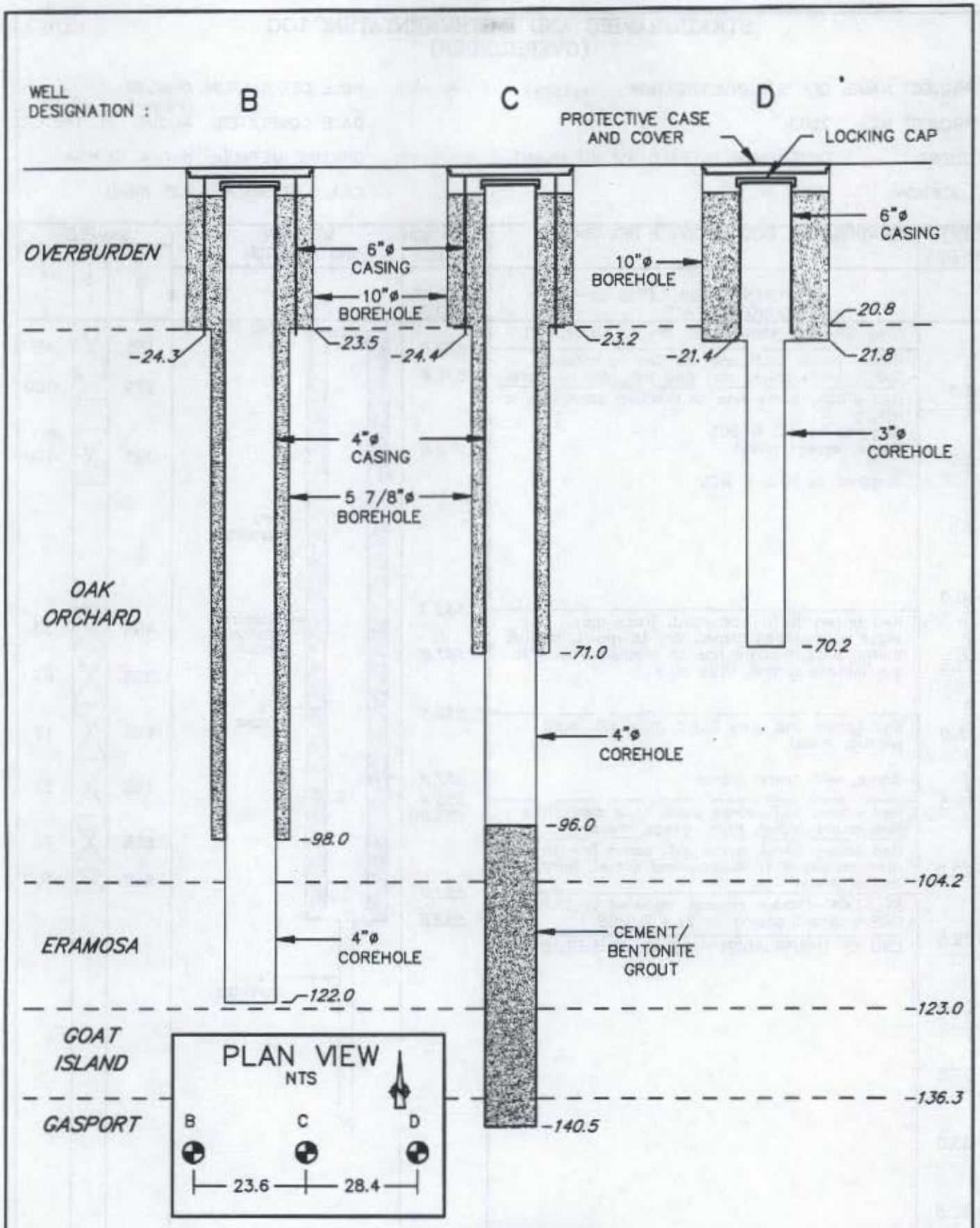
PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: WEST OF UNION CARBIDE PLANT

HOLE DESIGNATION: OW652C (Page 6 of 6)
DATE COMPLETED: FEBRUARY 5, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: J. WILLIAMS

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CRECOVERY	RQD	WRAETTEURRN
ft BGS		ft. AMSL				%	%	%
120.0	– no weathering, fine grained, light gray, chert nodules more abundant, few shaley layers (120.0 to 126.4 ft BGS)		CEMENT/ BENTONITE GROUT		15	103	100.0	0
122.5	– horizontal fracture, conchoidal, moderately weathered (@ 121.0 ft BGS) – horizontal fracture, conchoidal, slightly weathered (@ 122.9 ft BGS)							
125.0	– shaly partings, slightly weathered (@ 125.4 and 125.9 ft BGS)		4"ø HQ COREHOLE		16	99	95.0	0
127.5	DOLOSTONE LIMESTONE(Gasport Formation): bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained, shaly partings, trace stylolites – shale parting, no weathering (@ 126.8 ft BGS)	443.8						
130.0	– shale parting, slightly weathered (@ 126.8 ft BGS) – horizontal fracture, conchoidal, moderately weathered (@ 130.1 ft BGS) – shale parting, slightly weathered (@ 130.7 ft BGS)	439.2						
132.5	END OF HOLE @ 131 FT. BGS							
135.0	NOTE: At completion the OW652C well was backfilled with cement/bentonite grout to a depth of 93.0 ft BGS.							
137.5								
140.0								
142.5								
145.0								
147.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED



WELL INSTRUMENTATION SUMMARY OW653
OFF SITE INVESTIGATION
Occidental Chemical Corporation—Buffalo Avenue Plant

CRA

2583 (87) OCT 29/93(W) REV.0 (LD25)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

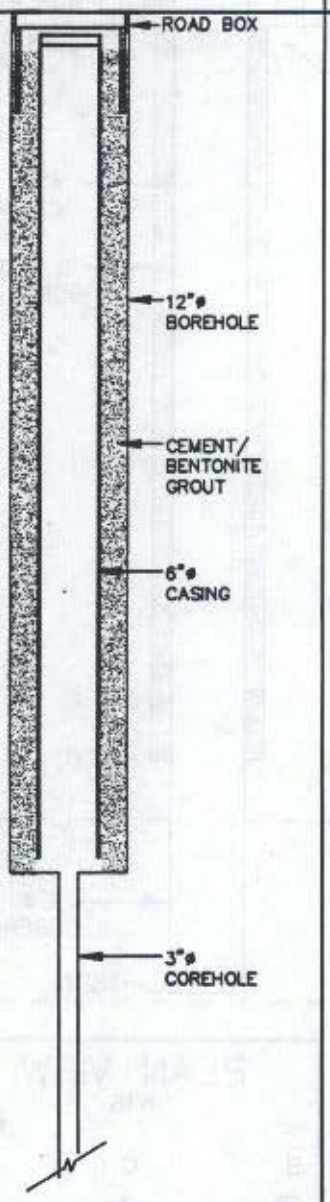
(L277)

PROJECT NAME: OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
LOCATION: EFW

HOLE DESIGNATION: OW653D

DATE COMPLETED: AUGUST 21, 1991
DRILLING METHOD: 8 1/4" ID HSA
CRA SUPERVISOR: A.P. KISIEL

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL
	REFERENCE POINT (Top of Riser)	573.47
	GROUND SURFACE	573.8
	Gray GRAVEL, some sand, dry to moist, FILL	572.8
	Black, yellow, buff and red fine to medium SAND, some brick, clay and ash, dry to moist	571.8
2.5	Red BRICK, some fine to medium sand, dry to moist	
	Augered to 4.0 ft BGS	
5.0	Same, except moist	569.8
	Augered to 10.5 ft BGS	
7.5		
10.0		
	Red brown SILT, little sand, trace clay, trace subrounded gravel, dry to moist, NATIVE	563.3
12.5	Same, except some fine to medium round to subrounded gravel, little clay	561.8
	Red brown and gray CLAY, little silt, soft, plastic, moist	559.5
15.0	Same, with trace gravel	557.8
17.5		556.4
	Red brown SILT, some sand, little clay, little fine round gravel, hard, dense, moist	555.8
20.0	Red brown SAND, some silt, some fine to medium round to subrounded gravel, hard, dense, moist	
	BEDROCK– spoon refusal, augered to 21.8 ft BGS and set casing to 21.4 ft BGS	553.0
22.5	END OF OVERBURDEN HOLE @ 21.8 FT. BGS	552.0
25.0		
27.5		
30.0		
32.5		



SAMPLE NUMBER	STATE	'N' VALUE
1SS		48
2SS		>100
3SS		>100
4SS		30
5SS		87
6SS		18
7SS		22
8SS		70
9SS		>100

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L278)

PROJECT NAME: OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
LOCATION: EFW

HOLE DESIGNATION: OW653D (Page 2 of 6)
DATE COMPLETED: SEPTEMBER 10, 1991
DRILLING METHOD: WET ROTARY
CRA SUPERVISOR: A.P. KISIEL

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	Overburden		12"ø BOREHOLE; CEMENT/BENTONITE GROUT; 6"ø BLACK IRON PIPE					
20.0								
22.5	DOLOSTONE(Oak Orchard Formation): bituminous, light to dark grey, very thin to medium bedded, saccharoidal, carbonaceous partings	551.6	3"ø COREHOLE					
25.0	– rock fragments, trace solution pits, trace coral (22.2 to 23.6 ft BGS)				1	71	46	100
	– trace inclined bedding, slightly weathered, trace coral (24.2 to 25.4 ft BGS)							
27.5	– slightly weathered, some fractures, some stylolites (28.1 to 31.0 ft BGS)							
30.0					2	90	41	100
	– moderately to highly weathered fractures, trace gypsum lined partings, some small to medium vugs, solution pitting (31.4 to 34.4 ft BGS)							
32.5	– slightly weathered (34.4 to 36.1 ft BGS)							
35.0					3	93	68	0
	– disturbed bedding, moderately weathered, trace stylolites (36.1 to 36.7 ft BGS)							
37.5	– slightly weathered, trace stylolites (37.2 ft to 40.2 ft BGS)				4	100	100	0
40.0	– slightly weathered, trace stylolites, trace sphalerite (40.2 to 44.0 ft BGS)							
	– fractured rock (41.5 to 41.7 ft BGS)							
42.5								
45.0	– slightly to moderately weathered, some small to medium vugs, some weathered coral, trace gypsum lined veinlets and partings (44.0 to 55.2 ft BGS)				5	98	95	0
47.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L278)

PROJECT NAME: OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
LOCATION: EFW

HOLE DESIGNATION: OW653D (Page 3 of 6)
DATE COMPLETED: SEPTEMBER 10, 1991
DRILLING METHOD: WET ROTARY
CRA SUPERVISOR: A.P. KISIEL

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIT RECOVERY	RUN NUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
50.0					5	98	95	0
52.5					6	99	99	0
55.0	– medium gypsum filled vug (@ 54.5 ft BGS) – trace small vugs (some sphalerite filled and some lined with dolomite), trace stylolites, trace weathered coral (55.5 to 70.2 ft BGS)		3" ø COREHOLE					
57.5								
60.0					7	100	98	0
62.5								
65.0								
67.5					8	90	88	0
70.0	END OF HOLE @ 70.2 FT. BGS NOTES: 1. In January and February 1993 a "B" zone and "C" zone monitoring well were installed at this well cluster.	503.6						
72.5								
75.0								
77.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L305)

PROJECT NAME: OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
LOCATION: EFW

HOLE DESIGNATION: OW653C (Page 4 of 6)
DATE COMPLETED: FEBRUARY 12, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BLOW COUNTS	RUN NUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	REFERENCE POINT (Top of Riser) GROUND SURFACE	573.75 574.05						
70.0	NOTE: Overburden Stratigraphy and bedrock stratigraphy from 20.8 to 71.0 ft BGS is from the OW653D well located 2 ft east.	502.8 (Cont.)	4"ø HQ COREHOLE					
72.5	DOLOSTONE(Oak Orchard Formation): bituminous, light to medium gray, fine to medium grained, thin to medium bedded, saccharoidal, carbonaceous partings, some gypsum lined partings, highly fractured and weathered zone							
75.0	– trace gypsum filled vugs and veinlets, occasional coral and solution pitting (73.5 to 74.6 ft BGS)				9	93	93.0	100
77.5	– slightly weathered fracture (@ 74.8 ft BGS)							
80.0	– small closed vertical fracture (79.0 to 79.4 ft BGS)							
82.5	– fracture, no weathering (@ 82.2 ft BGS) – gypsum lined slightly weathered fracture (@ 82.4 ft BGS) – closed vertical fracture (82.7 to 83.5 ft BGS)							
85.0	– solution pitted, occasional coral, slightly weathered (83.7 to 87.5 ft BGS)				10	98	86.0	100
87.5	– medium sized gypsum filled vug (@ 87.6 ft BGS) – fine grained, occasional shaly partings and shaly banding (87.9 to 90.2 ft BGS)							
90.0	– very slightly weathered fracture (@ 88.0 ft BGS) – rubble, moderately weathered (88.1 to 88.5 ft BGS)							
92.5	– moderately weathered fracture (@ 88.6 ft BGS) – numerous shaly partings, slightly weathered (89.1 to 89.3 ft BGS)							
95.0	– tightly closed vertical fracture, partly gypsum filled (88.9 to 90.0 ft BGS) – stylolite (@ 90.1 ft BGS) – medium grained, more weathered (@ 90.2 ft BGS)				11	98	95.0	100
97.5	– coral (@ 91.5 ft BGS) – slightly weathered fracture (@ 92.3 ft BGS) – vertical fracture, no weathering (92.9 to 93.4 ft BGS)		CEMENT/ BENTONITE GROUT					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L305)

PROJECT NAME: OFF SITE INVESTIGATION
HOLE DESIGNATION: OW653D (Page 5 of 6)
PROJECT NO.: 2583
DATE COMPLETED: FEBRUARY 12, 1993
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
DRILLING METHOD: HQ
LOCATION: EFW
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CREORECOVERY	RQD	WAETURRN
ft BGS		ft. AMSL				%	%	%
100.0	– vertical fracture, no weathering (92.9 to 93.4 ft BGS) – closed vertical fracture, no weathering (96.6 to 97.0 ft BGS) – slightly weathered shale lined fracture (@ 97.0 ft BGS) – occasional very small gypsum filled vug, trace stylolites (98.9 to 100.3 ft BGS) – more frequent gypsum in medium sized masses and veinlets (101.0 to 104.2 ft BGS)		4"ø HQ COREHOLE		11	98	95.0	100
102.5								
105.0	ARGILLACEOUS DOLOSTONE(Eramosa Formation): bituminous, light to medium gray, thin to medium bedded, fine grained, trace chert nodules, weathered fractures – 3/16" thick shaly band, slightly weathered (@ 104.2 ft BGS) – large sphalerite and gypsum mass (@ 105.5 ft BGS) – chert nodule (106.1 to 106.2 ft BGS) – moderately weathered calcite lined vugs, weathered chert (106.8 to 107.0 ft BGS) – moderately weathered shaly parting (@ 111.3 and 112.4 ft BGS)	469.6	CEMENT/ BENTONITE GROUT		12	102	91.0	100
107.5								
110.0								
112.5								
115.0	– moderately weathered shaly parting (@ 114.6 ft BGS) – shaly banding less frequent (below 114.8 ft BGS) – moderately weathered fracture (@ 115.5 ft BGS) – slightly weathered gypsum lined parting (@ 115.9 ft BGS) – occasional calcite filled vug and veinlet (116.0 to 116.4 ft BGS) – stylolite (@ 116.6 ft BGS) – medium sized sphalerite and gypsum deposit (@ 119.7 ft BGS) – shaly parting (@ 122.3 ft BGS)]				13	100	97.0	100
117.5								
120.0								
122.5								
125.0	DOLOSTONE(Goat Island Formation): bituminous, medium to dark gray, thin to medium bedded, fine to medium grained, cherty, trace stylolites – stylolite with sphalerite deposit (@ 125.4 ft BGS) – moderately weathered fracture, trace chert (@ 126.0 ft BGS)	450.8			14	100	100.0	60
127.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

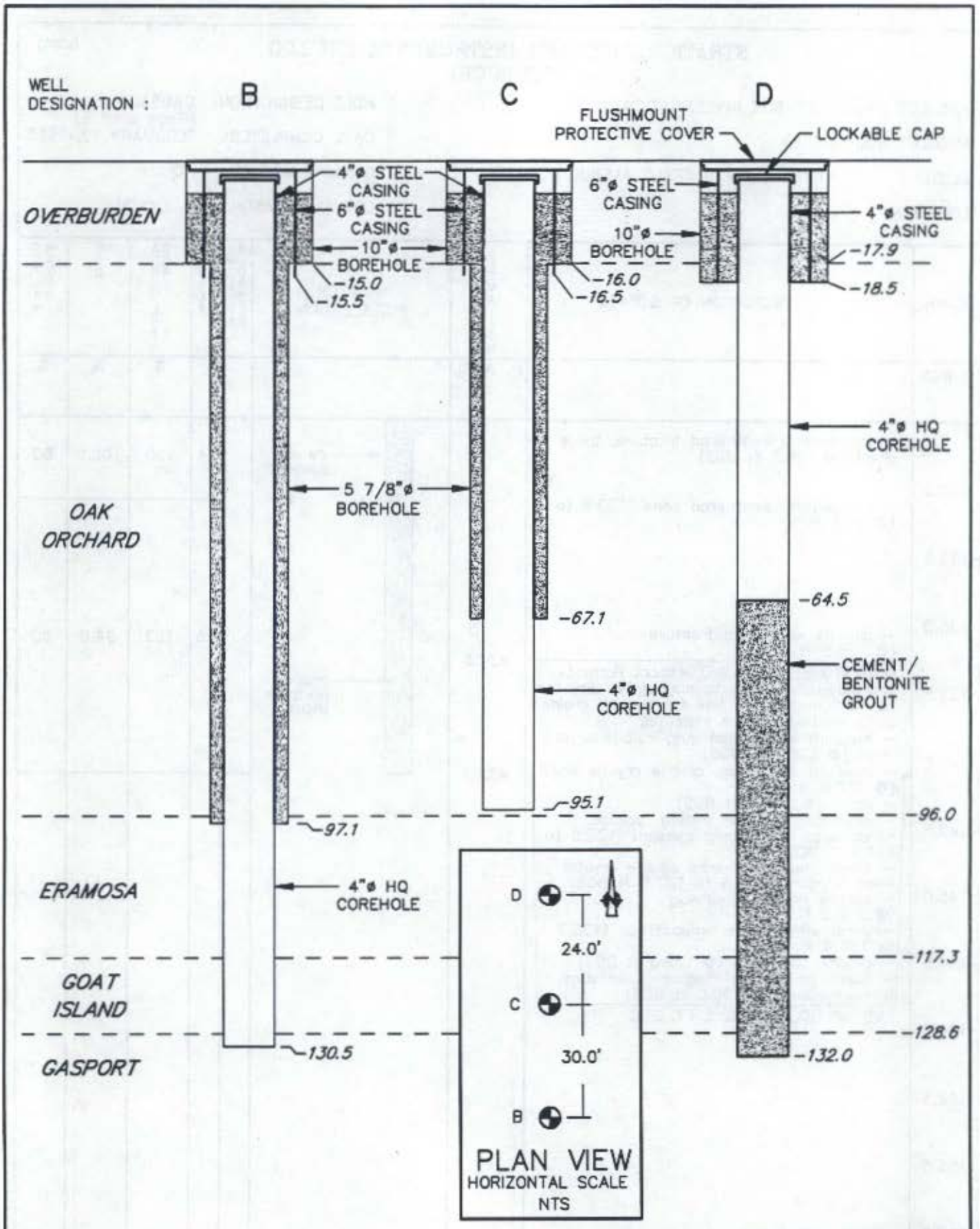
(L305)

PROJECT NAME: OFF SITE INVESTIGATION
HOLE DESIGNATION: OW653C (Page 6 of 6)
PROJECT NO.: 2583
DATE COMPLETED: FEBRUARY 12, 1993
CLIENT: OXYCHEM – BUFFALO AVENUE PLANT
DRILLING METHOD: HQ
LOCATION: EFW
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CRORECOVERY	RQD	WRAETTURRN
ft BGS		ft. AMSL				%	%	%
	– moderately weathered fracture, trace chert (@ 126.6 ft BGS)		4"ø HQ COREHOLE		14	100	100.0	60
130.0	– moderately weathered zone (130.8 to 131.0 ft BGS)							
132.5								
135.0	– slightly weathered fracture (@ 135.5 ft BGS)				15	102	94.0	50
	DOLOSTONE LIMESTONE(Gasport Formation): bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained, shaly partings, trace stylolites	437.5	CEMENT/ BENTONITE GROUT					
137.5	– medium sized open vug, calcite crystal lined (@ 136.7 ft BGS)							
140.0	– medium sized vug, calcite crystal lined (@ 137.0 ft BGS)	433.3						
	– coral (@ 137.4 ft BGS)							
142.5	– abundant solution pitting, calcite, coral, vugs, occasional gypsum (137.5 to 137.9 ft BGS)							
	– moderately weathered calcite crystal lined fracture (137.8 to 137.9 ft BGS)							
145.0	– calcite crystal filled vug (@ 138.2 ft BGS)							
	– coral with calcite redeposition (138.7 to 138.9 ft BGS)							
147.5	– calcite filled vug (@ 139.0 ft BGS)							
	– coral, occasional medium sized vugs, trace gypsum (@ 139.0 ft BGS)							
	END OF HOLE @ 140.5 FT. BGS							
150.0								
152.5								
155.0								
157.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED



WELL CLUSTER OW657
SDCP – OFF SITE INVESTIGATION
Occidental Chemical Corporation–Niagara Plant

CRA

2583 (87) OCT 29/93(W) REV.0 (LD26)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L306)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: NIAGARA MOHAWK HARPER STATION

HOLE DESIGNATION: OW657D

DATE COMPLETED: APRIL 9, 1993
DRILLING METHOD: 6 1/4" ID HSA
CRA SUPERVISOR: K. LYNCH

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser)	571.59				
	GROUND SURFACE	572.1				
	Dark brown SAND, some gravel and slag, moist, FILL		ROAD BOX	1SS	X	34
2.5		569.6				
	Black fine CINDERS, some sand, moist – beige sewer pipe fragments			2SS	X	49
5.0	Gray brown and black SILT, some sand, little clay in layers, moist, NATIVE	567.5		3SS	X	12
			10"ø BOREHOLE	4SS	X	15
7.5	Brown gray SAND, little silt, moist to wet	565.0				
	Same, except gray, moist	563.5		5SS	X	9
	Red brown SILT, little sand and clay, hard, dry		CEMENT/ BENTONITE GROUT			
10.0	Red brown CLAY, little silt, hard, dry	562.1		6SS	X	11
	Same, except gray, soft					
12.5	Gray medium grained SAND, little fine sand and silt, trace gravel and clay, soft, moist to wet	560.1	6"ø BLACK IRON PIPE	7SS	X	9
	Red brown CLAY, little silt and sand, moist to wet	558.4				
15.0	Red brown SILT, some fine round gravel, little sand, trace clay, hard, dry to moist, TILL	557.1		8SS	X	24
	Same, except dry to moist			9SS	X	56
17.5						
	BEDROCK – augered to 18.5 ft BGS	554.1				
	END OF OVERBURDEN HOLE @ 18.5 FT. BGS	553.6				
20.0			4"ø HQ COREHOLE			
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L307)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW657D (Page 2 of 5)
PROJECT NO.: 2583
DATE COMPLETED: APRIL 9, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: NIAGARA MOHAWK HARPER STATION
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	Overburden		10"ø BOREHOLE; 6"ø BLACK IRON PIPE; CEMENT/ BENTONITE GROUT					
17.5		553.6						
	DOLOSTONE(Oak Orchard Formation): bituminous, light to medium gray, fine to medium grained, thin to medium bedded, saccharoidal, carbonaceous partings, some gypsum lined partings, highly fractured and weathered zone		4"ø HQ COREHOLE		1	77	46.0	100
20.0								
22.5	– heavily weathered, numerous weathered fractures, solution pitting, gypsum lined fractures (18.5 to 23.7 ft BGS)							
25.0								
	– heavily weathered, solution pitting (26.1 to 27.1 ft BGS)				2	88	52.0	50
27.5	– vertical fracture, slightly weathered (26.1 to 27.9 ft BGS)							
	– rubble (26.5 to 26.8 ft BGS)							
	– heavily weathered (29.1 to 32.0 ft BGS)							
	– rubble (29.1 to 30.0 ft BGS)							
30.0	– lost all water circulation (@ 29.5 ft BGS)							0
32.5								
	– trace coral (@ 33.5 ft BGS)							
	– solution pitting, several very small vugs (33.9 to 35.3 ft BGS)							
35.0	– trace coral (34.2 to 34.7 ft BGS)							
	– gypsum filled veinlet (@ 36.5 ft BGS)				3	106	85.0	0
37.5	– medium sized gypsum filled vug (@ 37.6 ft BGS)							
	– trace coral, solution pitting, trace gypsum (38.0 to 38.8 ft BGS)							
40.0	– moderately weathered gypsum mass (@ 39.0 ft BGS)							
	– medium sized moderately weathered open vug (@ 39.2 ft BGS)							
42.5	– heavily weathered, rubble (39.4 to 40.5 ft BGS)							
	– slightly to moderately weathered gypsum lined parting (@ 40.9 ft BGS)							
45.0	– moderately weathered zone (41.2 to 41.6 ft BGS)				4	100	64.0	0
	– gypsum lined parting (@ 43.7 ft BGS)							
	– rubble, moderately weathered (43.8 to 44.4 ft BGS)							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L307)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW657D (Page 3 of 5)
PROJECT NO.: 2583
DATE COMPLETED: APRIL 9, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: NIAGARA MOHAWK HARPER STATION
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RNUUNMBER	CORE RECOVERY	RQD	WRAETTURRN
ft BGS		ft. AMSL				%	%	%
47.5	– gypsum lined parting (@ 44.9 ft BGS) – gypsum filled veinlets (45.0 to 45.2 ft BGS) – rubble, slightly to moderately weathered (45.9 to 47.5 ft BGS) – gypsum filled vug (@ 47.8 ft BGS)				4	100	64.0	0
50.0	– moderately weathered fracture (@ 49.2, 49.8 and 49.9 ft BGS) – rubble, moderately weathered, trace gypsum and coral (50.7 to 51.5 ft BGS)		4"ø HQ COREHOLE					
52.5	– moderately weathered fracture (@ 53.1 ft BGS)							
55.0	– rubble, slightly weathered (55.0 to 55.4 ft BGS)							
57.5					5	103	88.0	0
60.0	– coraliferous zone, solution pitting, slightly weathered (59.8 to 61.8 ft BGS)							
62.5								
65.0	– coraliferous zone, solution pitting, slightly weathered, trace stylolites and gypsum (64.8 to 67.0 ft BGS)							
67.5	– numerous weathered fractures (67.2 to 68.2 ft BGS)				6	100	89.0	0
70.0	– coral, mottled dark circular masses in dolomitic matrix (69.6 to 70.8 ft BGS)		CEMENT/ BENTONITE GROUT					
72.5	– solution pitting, slightly weathered, coral, trace gypsum (72.3 to 80.0 ft BGS)							
75.0					7	100	88.0	0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L307)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW657D (Page 4 of 5)

PROJECT NO.: 2583
DATE COMPLETED: APRIL 9, 1993

CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ

LOCATION: NIAGARA MOHAWK HARPER STATION
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
77.5	– moderately weathered fracture (● 76.4 ft BGS)							
80.0	– fine grained, very thinly bedded (80.0 to 82.4 ft BGS) – several shaly partings, shaly banding (80.8 to 81.7 ft BGS)		4"ø HQ COREHOLE		7	100	88.0	0
82.5								
85.0	– medium sized gypsum mass (84.2 to 84.3 ft BGS) – medium sized gypsum mass (● 85.8, 91.2 and 91.8 ft BGS)				8	100	97.0	0
87.5								
90.0			CEMENT/ BENTONITE GROUT					
92.5	– slightly to moderately weathered vertical fracture (93.0 to 94.5 ft BGS)							
95.0	– medium sized calcite lined and gypsum filled vug (● 95.4 ft BGS)	476.1						
97.5	ARGILLACEOUS DOLOSTONE(Eramosa Formation): bituminous, light to medium gray, thin to medium bedded, fine grained, trace chert nodules, weathered fractures – several moderately weathered fractures (97.4 to 98.0 ft BGS) – medium sized gypsum filled vug (● 99.3 ft BGS)				9	99	90.0	0
100.0								
102.5	– shaly partings (103.5 to 104.5 ft BGS)							
105.0					10	102	94.0	0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L307)

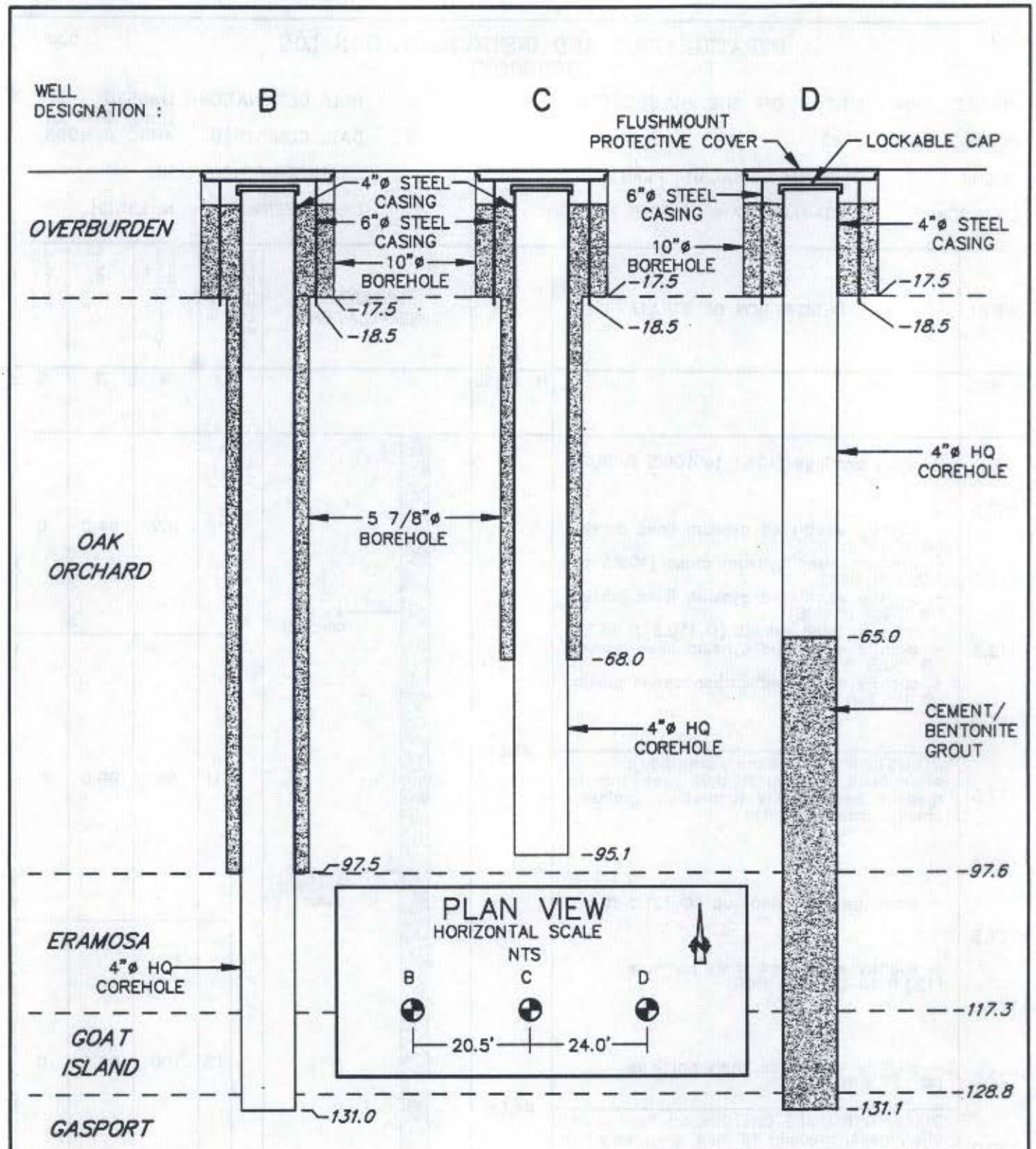
PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: NIAGARA MOHAWK HARPER STATION

HOLE DESIGNATION: OW657D (Page 5 of 5)
DATE COMPLETED: APRIL 9, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CROERCOVERY	RQD	WRAETTURRN
ft BGS		ft. AMSL				%	%	%
	– shaly partings (106.1 to 106.5 ft BGS)							
107.5								
	– slightly weathered gypsum lined parting (@ 108.4 ft BGS) – medium sized gypsum mass (108.5 to 108.7 ft BGS) – slightly weathered gypsum lined parting (@ 109.0 ft BGS) – gypsum filled veinlet (@ 110.2 ft BGS) – slightly weathered gypsum lined parting (@ 110.5 ft BGS) – slightly weathered carbonaceous parting (@ 111.3 ft BGS)		4"ø HQ COREHOLE		10	102	94.0	0
110.0								
112.5								
115.0								
	DOLOSTONE(Goat Island Formation): bituminous, medium to dark gray, thin to medium bedded, fine to medium grained, cherty, trace stylolites	456.1			11	99	99.0	0
117.5								
120.0			CEMENT/ BENTONITE GROUT					
	– small gypsum filled vug (@ 121.5 ft BGS)							
122.5								
	– slightly weathered shaly partings (123.8 to 123.9 ft BGS)							
125.0								
127.5	– slightly weathered shaly partings (@ 127.3 ft BGS)				12	100	94.0	0
	DOLOSTONE LIMESTONE(Gasport Formation): bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained, shaly partings, trace stylolites	443.5						
130.0	– detrital layer, crinoid fragments, gypsum (128.6 to 128.8 ft BGS)	440.1						
132.5	– slightly weathered fracture (128.7 to 128.8 ft BGS) – moderately weathered fracture (130.3 to 130.5 ft BGS)							
135.0	END OF HOLE @ 132 FT. BGS							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED



WELL CLUSTER OW658
SDCP – OFF SITE INVESTIGATION
Occidental Chemical Corporation–Niagara Plant

CRA

2583 (87) OCT 29/93(W) REV.0 (LD27)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L308)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: ELKEM METALS

HOLE DESIGNATION: OW658 (Page 1 of 5)
DATE COMPLETED: APRIL 6, 1993
DRILLING METHOD: 6 1/4" ID HSA
CRA SUPERVISOR: K. LYNCH

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser) GROUND SURFACE	570.65 571.1				
	Augered thru cement/asphalt to 1.0 ft BGS	570.1	ROAD BOX	1SS	X	5
2.5	Dark brown SAND, trace gravel, dry, FILL Same, except brown, moist			2SS	X	11
	Brown grading to gray SAND, moist, NATIVE	567.1		3SS	X	5
5.0			10"ø BOREHOLE			
7.5		563.3		4SS	X	12
	Red brown SILT, some clay, little sand, stiff, plastic, dry to moist Same, except red brown and gray, no silt		CEMENT/ BENTONITE GROUT	5SS	X	31
10.0	Same, with laminated sand and silt layers, varved			6SS	X	10
	Gray CLAY, soft, plastic	559.6	6"ø BLACK IRON PIPE	7SS	X	6
12.5						
	Gray brown SAND, some silt, some fine to medium gravel, moist	557.1		8SS	X	5
15.0						
				9SS	X	41
17.5	BEDROCK – augered to 18.5 ft BGS	553.6				
	END OF OVERBURDEN HOLE @ 18.5 FT. BGS	552.6	4"ø HQ COREHOLE			
20.0						
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L309)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW658 (Page 2 of 5)
PROJECT NO.: 2583
DATE COMPLETED: APRIL 6, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: ELKEM METALS
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	Overburden		10"ø BOREHOLE; 6"ø BLACK IRON PIPE; CEMENT/ BENTONITE GROUT					
17.5		552.6						
	DOLOSTONE(Oak Orchard Formation): bituminous, light to medium gray, fine to medium grained, thin to medium bedded, saccharoidal, carbonaceous partings, some gypsum lined partings, highly fractured and weathered zones				1	72	0.0	100
20.0								
22.5	– numerous slightly to moderately weathered fractures (18.5 to 22.5 ft BGS)		4"ø HQ COREHOLE					
25.0	– coral (25.0 to 25.3 ft BGS) – gypsum lined fracture (@ 25.9 ft BGS)				2	99	76.0	80
27.5								
30.0	– coral zone (30.5 to 31.5 ft BGS) – heavily weathered, little coral, small open vugs (31.5 to 32.7 ft BGS)							
32.5	– open vertical fracture (33.2 to 33.6 ft BGS) – gypsum lined parting (@ 33.6 ft BGS)							
35.0	– heavily weathered fracture (@ 33.9 ft BGS) – rubble (34.7 to 34.8 ft BGS) – medium gypsum filled vug (@ 35.2 and 35.6 ft BGS)				3	100	85.0	50
37.5	– heavily weathered coraliferous zone (35.8 to 36.3 ft BGS) – large vug, partly gypsum filled (36.4 to 36.6 ft BGS)							
40.0	– numerous medium sized gypsum filled vugs (36.6 to 37.1 ft BGS) – moderately weathered, numerous solution pits, trace coral and gypsum (38.1 to 39.4 ft BGS)							
42.5	– solution pitting, trace coral (41.7 to 42.4 ft BGS) – large gypsum (selenite) mass (@ 43.2 ft BGS)				4	98	97.0	20
45.0	– small coral (@ 43.8 ft BGS)							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L309)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: ELKEM METALS

HOLE DESIGNATION: OW658 (Page 3 of 5)
DATE COMPLETED: APRIL 6, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RNUUNMBER	CRECOVERY	RQD	WRAETTEURRN
ft BGS		ft. AMSL				%	%	%
47.5	– solution pitting, trace coral (48.7 to 55.4 ft BGS)				4	98	97.0	20
50.0	– lost water circulation (@ 51.0 ft BGS)							
52.5								
55.0			4"ø HQ COREHOLE		5	102	84.0	0
57.5	– numerous shaly and gypsum lined partings, trace sphalerite (57.0 to 59.1 ft BGS)							
60.0								
62.5	– coarser grained, solution pitting, trace coral (61.3 to 62.2 ft BGS)							
65.0					6	99	99.0	0
67.5	– coarser grained, darker, trace gypsum (66.9 to 67.0 ft BGS)		CEMENT/ BENTONITE GROUT					
70.0								
72.5								
75.0	– rubble, moderately weathered vertical fracture (74.8 to 75.2 ft BGS)				7	100	98.0	0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L309)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW658 (Page 4 of 5)
PROJECT NO.: 2583
DATE COMPLETED: APRIL 6, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: ELKEM METALS
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIT ENDT RERO RCV KAL	RUN NUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
77.5	– medium sized moderately weathered vug, little gypsum (@ 76.2 ft BGS) – solution pitting, moderately weathered, small gypsum filled vugs and veinlets (76.6 to 77.2 ft BGS)				7	100	98.0	0
80.0								
82.5	– finer grained, frequent shaly partings (81.8 to 83.6 ft BGS) – slightly weathered fracture (@ 82.5 and 83.1 ft BGS) – trace gypsum, calcite, very slight solution pitting (83.1 to 91.0 ft BGS)		4"ø HQ COREHOLE					
85.0					8	100	92.0	0
87.5								
90.0			CEMENT/ BENTONITE GROUT					
92.5	– inclined carbonaceous partings (@ 93.4, 94.5, 95.0 and 96.7 ft BGS)							
95.0					9	100	96.0	0
97.5	ARGILLACEOUS DOLOSTONE(Eramosa Formation): bituminous, light to medium gray, thin to medium bedded, fine grained, trace chert nodules, weathered fractures	473.5						
100.0	– shaly partings and shaly banding (97.6 to 97.8 ft BGS) – small gypsum mass (@ 99.4 ft BGS)							
102.5	– gypsum lined fracture (@ 100.3 ft BGS) – small gypsum mass (@ 100.6 ft BGS)				10	99	75.0	0
105.0								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L309)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW658 (Page 5 of 5)

PROJECT NO.: 2583
DATE COMPLETED: APRIL 6, 1993

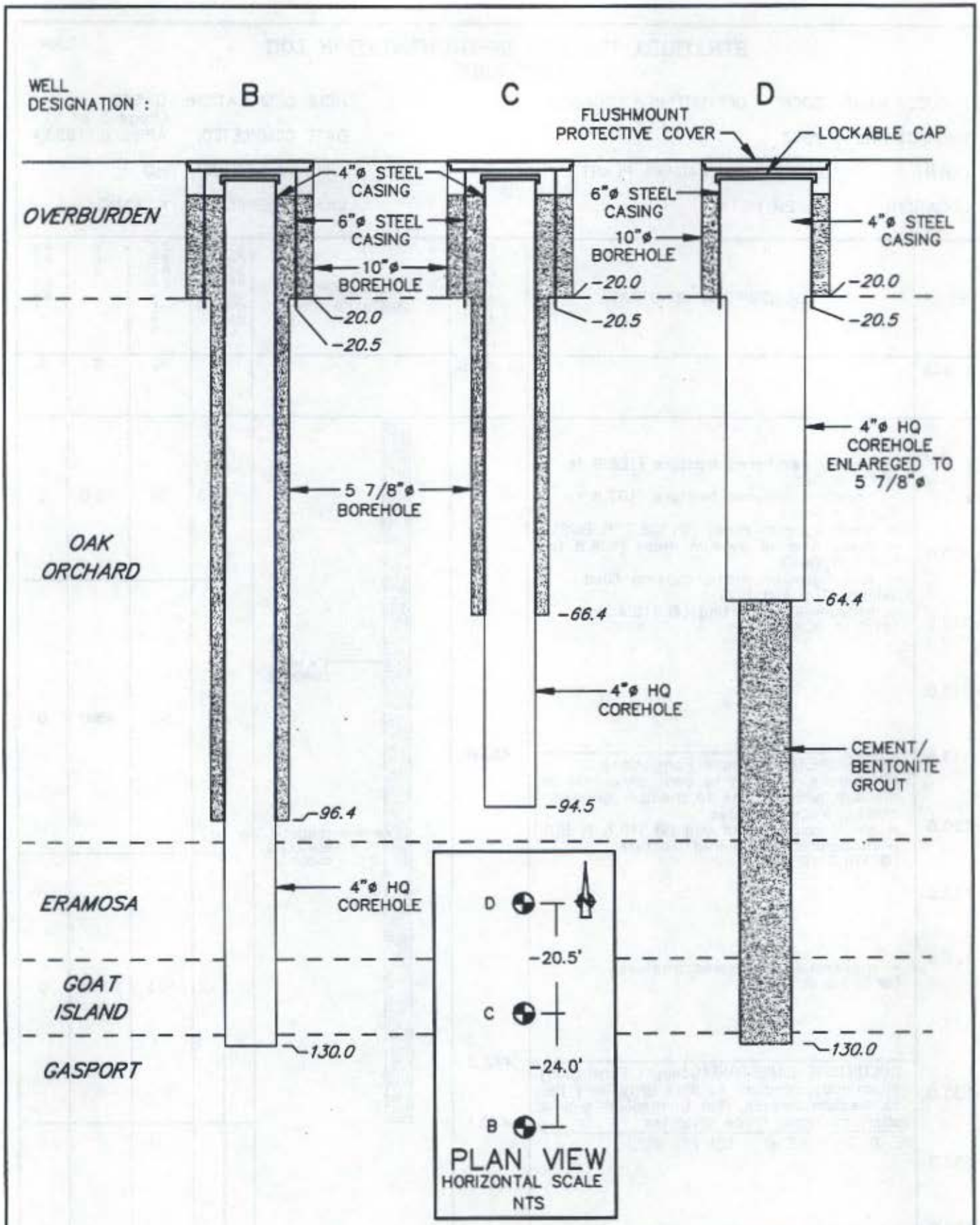
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ

LOCATION: ELKEM METALS
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
107.5	– heavily weathered fracture (106.9 to 107.1 ft BGS) – heavily weathered fracture (107.8 to 108.2 ft BGS) – small gypsum mass (@ 108.7 ft BGS) – medium sized gypsum mass (108.8 to 109.0 ft BGS) – small gypsum mass, gypsum filled veinlet (109.3 ft BGS) – gypsum lined parting (@ 110.4 and 111.0 ft BGS)				10	99	75.0	0
110.0								
112.5								
115.0			4"ø HQ COREHOLE		11	98	98.0	0
117.5	DOLOSTONE(Goat Island Formation): bituminous, medium to dark gray, thin to medium bedded, fine to medium grained, cherty, trace stylolites	453.8						
120.0	– small calcite filled vug (@ 119.5 ft BGS) – moderately weathered fracture (@ 119.9 ft BGS)		CEMENT/ BENTONITE GROUT					
122.5								
125.0	– moderately weathered fracture (@ 125.5 ft BGS)				12	103	103.0	0
127.5								
130.0	DOLOSTONE LIMESTONE(Gasport Formation): bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained, shaly partings, trace stylolites	442.3						
	END OF HOLE @ 131 FT. BGS	440.1						
132.5								
135.0								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED



WELL CLUSTER OW659
SDCP – OFF SITE INVESTIGATION
Occidental Chemical Corporation–Niagara Plant

CRA

2583 (87) OCT 29/93(W) REV.0 (LD28)

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L310)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: U.S. VANADIUM PLANT

HOLE DESIGNATION: OW659 (Page 1 of 5)
DATE COMPLETED: MARCH 30, 1993
DRILLING METHOD: 6 1/4" ID HSA
CRA SUPERVISOR: K. LYNCH

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top of Riser)	569.93				
	GROUND SURFACE	570.2				
	Augered through asphalt and gravel to 0.5 ft BGS – moist to wet	569.1	ROAD BOX	1SS		9
2.5	Dark gray SAND, some silt, moist, FILL	568.7				
	Light brown and brown SAND, little silt, trace clay, moist, NATIVE			2SS		22
	Same, except trace silt					
5.0	Same, except brown and gray, moist to wet			3SS		8
	Same, except gray	564.2	10"ø BOREHOLE			
	Red brown SILT, little clay, trace sand, stiff, dry			4SS		12
7.5						
	Gray CLAY, trace silt and sand, red seams, firm, moist	562.2		5SS		8
10.0	Same, except red brown, moist to wet		CEMENT/ BENTONITE GROUT			
				6SS		5
	Gray and red brown SAND, some fine gravel, moist to wet	558.7	6"ø BLACK IRON PIPE			
12.5				7SS		33
	Red brown SILT, little sand and gravel, trace clay, hard, TILL	557.1				
	Red brown fine SAND, some fine to medium angular to subrounded gravel, little silt, dry to moist	556.2		8SS		33
15.0	– augered to 18.0 ft BGS			9SS		>100
17.5						
				10SS		80
20.0				11SS		42
	BEDROCK – augered to 20.5 ft BGS	549.9				
	END OF OVERBURDEN HOLE @ 20.5 FT. BGS	549.7	4"ø HQ COREHOLE			
22.5						
25.0						
27.5						
30.0						
32.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L311)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW659 (Page 2 of 5)
PROJECT NO.: 2583
DATE COMPLETED: MARCH 30, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: U.S. VANADIUM PLANT
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RUNNUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
	Overburden		10"ø BOREHOLE; 6"ø BLACK IRON PIPE; CEMENT/ BENTONITE GROUT					
20.0		549.7						
	DOLOSTONE(Oak Orchard Formation): bituminous, light to medium gray, fine to medium grained, thin to medium bedded, saccharoidal, carbonaceous partings, some gypsum lined partings, highly fractured and weathered zone							
22.5	– numerous slightly weathered fractures (20.5 to 25.5 ft BGS)				1	100	8.0	90
25.0	– rubble (25.5 to 25.7 ft BGS)							
	– coraliferous zone with several moderately weathered fractures (26.2 to 27.0 ft BGS)							
27.5	– many small vugs and solution pits (28.3 to 29.0 ft BGS)				2	45	100.0	50
	– open vertical fracture (28.3 to 29.1 ft BGS)				3	100	100.0	50
30.0	– coarser grained, darker, sulfide deposition, some solution pitting (29.5 to 33.2 ft BGS)							
32.5	– lighter gray, less solution pitting (● 33.2 ft BGS)							
	– heavily weathered zone (34.6 to 34.8 ft BGS)							
35.0	– heavily weathered zone, trace coral (36.7 to 37.7 ft BGS)				4	100	70.0	80
37.5			4"ø HQ COREHOLE					
	– heavily weathered zone (38.8 to 39.0 ft BGS)							
40.0	– small vug (● 39.2 and 39.9 ft BGS)							
	– coral, moderately weathered (40.2 to 40.9 ft BGS)							
42.5	– gypsum mass (● 42.4 and 42.8 ft BGS)							
	– moderately weathered fracture (● 42.9 ft BGS)							
45.0	– finer grained, darker, stylolites, frequent small vugs, some calcite remineralization, some coral, some gypsum, trace sphalerite, moderately weathered (43.7 to 53.4 ft BGS)				5	97	97.0	85
47.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L311)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: U.S. VANADIUM PLANT

HOLE DESIGNATION: OW659 (Page 3 of 5)
DATE COMPLETED: MARCH 30, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CRORECOVERY	RQD	WRAETTURRN
ft BGS		ft. AMSL				%	%	%
50.0					5	97	97.0	85
52.5								
55.0	– coral zone with gypsum (55.2 to 55.6 ft BGS)				6	102	102.0	85
57.5								
60.0	– coral (59.0 to 59.2 ft BGS) – small vertical fractures (59.3 to 59.5 ft BGS) – coral zone (60.3 to 61.2 ft BGS)							
62.5	– small calcite and gypsum filled vug (61.8 to 61.9 ft BGS) – gypsum mass (62.8 to 63.1 ft BGS)							
65.0					7	100	100.0	90
67.5	– abundant solution pitting, trace coral and gypsum (67.1 to 67.6 ft BGS) – several gypsum filled vertical fractures (67.2 to 67.6 ft BGS)		4"ø HQ COREHOLE					
70.0								
72.5	– heavily weathered fracture (@ 73.0 ft BGS) – abundant solution pits, trace coral and gypsum (73.4 to 79.8 ft BGS)		CEMENT/ BENTONITE GROUT					80
75.0	– lost water circulation (@ 73.5 ft BGS) – moderately weathered fracture, rubble (@ 75.0 ft BGS)				8	99	98.0	0
77.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L311)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
HOLE DESIGNATION: OW659 (Page 4 of 5)
PROJECT NO.: 2583
DATE COMPLETED: MARCH 30, 1993
CLIENT: OXYCHEM – NIAGARA PLANT
DRILLING METHOD: HQ
LOCATION: U.S. VANADIUM PLANT
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BEDROCK	RUN NUMBER	CORE RECOVERY	RQD	WATER RETURN
ft BGS		ft. AMSL				%	%	%
80.0					8	99	98.0	0
82.5	– gypsum filled vug (82.5 to 82.7 ft BGS) – carbonaceous partings (@ 83.6 and 83.8 ft BGS)							
85.0	– carbonaceous parting, moderately weathered (@ 84.2 ft BGS) – moderately weathered fracture (85.0 to 85.1 ft BGS)				9	99	89.0	0
87.5								
90.0	– solution pitting, trace gypsum (91.0 to 94.3 ft BGS)							
92.5			CEMENT/ BENTONITE GROUT					
95.0	– finer grained, some gypsum filled vugs, trace calcite filled vugs (94.3 to 99.6 ft BGS)				10	100	97.0	0
97.5			4"ø HQ COREHOLE					
100.0	ARGILLACEOUS DOLOSTONE(Eramosa Formation): bituminous, light to medium gray, thin to medium bedded, fine grained, trace chert nodules, weathered fractures	470.6						
102.5	– shaly plating (99.6 to 99.7 ft BGS) – lighter gray, more frequent shaly partings, trace to little gypsum (99.7 to 112.8 ft BGS)							
105.0					11	99	62.0	0
107.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

(L311)

PROJECT NAME: SDCP – OFF SITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM – NIAGARA PLANT
LOCATION: U.S. VANADIUM PLANT

HOLE DESIGNATION: OW659 (Page 5 of 5)
DATE COMPLETED: MARCH 30, 1993
DRILLING METHOD: HQ
CRA SUPERVISOR: K. LYNCH

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRERORCVKAL	RNUUNMBER	CORE RECOVERY	RQD	WRETURRN
ft BGS		ft. AMSL				%	%	%
110.0					11	99	62.0	0
	– gypsum mass (111.3 to 111.5 ft BGS)							
112.5	– medium sized gypsum filled vug, moderately weathered gypsum filled fracture (@ 112.8 ft BGS)							
115.0					12	100	98.0	0
117.5	DOLOSTONE(Goat Island Formation): bituminous, medium to dark gray, thin to medium bedded, fine to medium grained, cherty, trace stylolites	452.9						
120.0	– medium sized gypsum filled vug (@ 119.4 and 121.1 ft BGS)		CEMENT/ BENTONITE GROUT					
122.5	– moderately weathered fracture (@ 121.9 ft BGS)							
125.0					13	99	98.0	0
127.5	– moderately weathered fracture (@ 126.8 to 126.9 ft BGS)		4"ø HQ COREHOLE					
130.0	DOLOSTONE LIMESTONE(Gasport Formation): bituminous, medium to dark gray, very thin to medium bedded, fine to medium grained, shaly partings, trace stylolites	441.9						
	– large shaly parting/layer, bioturbated zone (128.3 to 128.6 ft BGS)	439.7						
132.5	END OF HOLE @ 130.5 FT. BGS							
135.0								
137.5								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

▽ WATER FOUND ▼ STATIC WATER LEVEL NM – NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L301)

PROJECT NAME: OFFSITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM
LOCATION: NEAR LINDE ENTRANCE

HOLE DESIGNATION: BH11–92
DATE COMPLETED: SEPTMBER 16, 1992
DRILLING METHOD: 4 1/4" ID HSA
CRA SUPERVISOR: K. LYNCH

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE N VALUE
	Brown SAND, little gravel and vegetation, dry			1SS		24
2.5	Same, with some concrete, brick and gravel, dark gray, dry to moist (1.0 to 2.0 ft BGS) Same, except gray, moist (2.0 to 4.0 ft BGS)			2SS		74
		-4.0				
5.0	Red brown and brown SILT, little sand, trace gravel, moist Gravel seam (5.5 to 5.8 ft BGS)			3SS		34
		-6.0	4"ø BLACK IRON PIPE			
7.5	Gray and brown CLAY, some silt, little sand, moist			4SS		13
10.0	Brown fibrous material (@ 9.5 ft BGS) Same, except moist to wet (10.0 to 12.0 ft BGS)		CEMENT/ BENTONITE GROUT	5SS		5
12.5	Same, except high plasticity, red brown, moist to wet (12.0 to 14.3 ft BGS)		8"ø BOREHOLE	6SS		3
				7SS		4
		-14.3				
15.0	Red brown SILT, some fine to medium gravel, hard, dry to moist Same, with some clay and fine sand, little fine to medium gravel (16.0 to 16.8 ft BGS)			8SS		46
		-16.8		9SS		>100
17.5	BEDROCK – spoon refusal, augured to 18.0 ft BGS					
	END OF BH11–92 @ 18.0 FT BGS.					
	NOTES: 1. Moved 1.5 ft west, augered to 16 ft BGS (BH11A–92). – 16.0 to 16.8 ft BGS; 9A–SS Red brown SILT, some sand, some fine medium subangular gravel, fractured dolostone in shoe			9A–SS		100/4"
	2. Moved 1.5 ft further west, augered to 16.0 ft BGS (BH11B–92) – 16.0 to 16.7 ft BGS; 9B–SS Green SLAG or CONCRETE, laminated wood, strong resinous odor – augered to 18.0 ft BGS, BEDROCK			9B–SS		100/3"
	3. Moved 5 ft north, augered to 16.0 ft BGS (BH11C–92). – 16.0 to 17.5 ft BGS; 9C–SS Red brown and gray SILT, little sand and clay, little fine to medium subangular gravel, moist to wet			9C–SS		100/1"
	4. At completion boreholes were backfilled with cement/bentonite grout to surface.					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

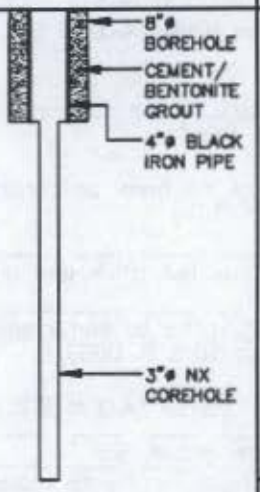
CHEMICAL ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

(L302)

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: OFFSITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM
LOCATION: NEAR LINDE ENTRANCE

HOLE DESIGNATION: BH11D-92
DATE COMPLETED: SEPTMBER 16, 1992
DRILLING METHOD: 4 1/4" ID HSA
CRA SUPERVISOR: A.P. KISIEL

DEPTH	DESCRIPTION OF STRATA	ELEVATION	MONITOR INSTALLATION	BIENDTRREORCVKAL	RNUUNMBBEER	CROERCEOVERY	RQD	WRAETTUERRN
ft BGS		ft. AMSL				%	%	%
17.5	Augered only to 17.8 ft BGS, for overburden stratigraphy see log BH11-92.							
		-17.8			1	62	0.0	100
20.0	DOLOSTONE, light to dark gray, highly broken with gray and pink gray cement matrix, some small vugs	-19.7			2	104	13.0	100
22.5	DOLOSTONE(Oak Orchard Formation): bituminous, light to dark gray, fine to medium grained, saccharoidal, fractured - trace small vugs and stylolites, weathered (19.7 to 22.2 ft BGS) - gypsum filled fracture (@ 20.5 ft BGS) - slightly weathered, few carbonaceous partings, trace stylolites, trace gypsum (22.2 to 26.9 ft BGS)							
25.0					3	100	75.0	80
		-26.9						
27.5	END OF HOLE @ 26.9 FT. BGS							
30.0								
32.5								
35.0								
37.5								
40.0								
42.5								
45.0								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

⧖ WATER FOUND ⧗ STATIC WATER LEVEL NM - NOT MEASURED

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L303)

PROJECT NAME: OFFSITE INVESTIGATION
PROJECT NO.: 2583
CLIENT: OXYCHEM
LOCATION: NEAR LINDE ENTRANCE

HOLE DESIGNATION: BH12-92
DATE COMPLETED: SEPTMBER 15, 1992
DRILLING METHOD: 4 1/4" ID HSA
CRA SUPERVISOR: K. LYNCH

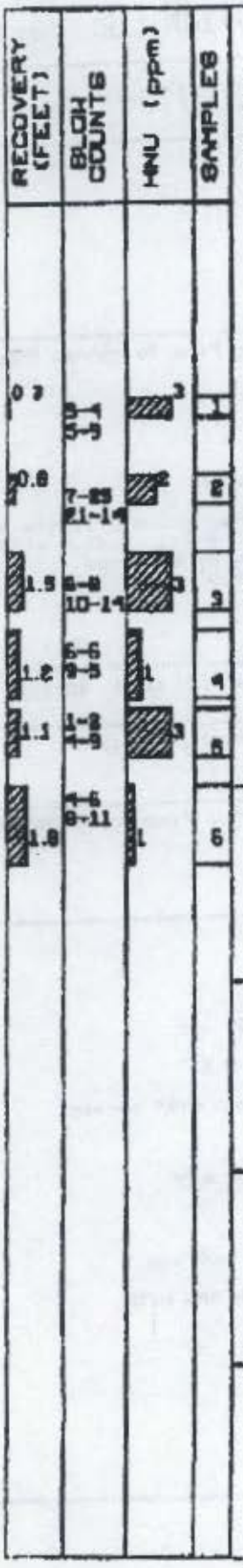
DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	Brown SAND, some silt, little clay, trace coal, dry to moist			1SS		7
		-2.0				
2.5	Black and brown SILT, some gravel, concrete, dry to moist (2.0 to 4.0 ft BGS)			2SS		4
	Same, with some red brick (4.0 to 6.0 ft BGS)					
5.0			8"ø BOREHOLE	3SS		6
	Same, with some sand, trace concrete and red brick (6.0 to 8.0 ft BGS)					
7.5	Same, with little clay, no brick or concrete, moist (8.0 to 9.5 ft BGS)		CEMENT/ BENTONITE GROUT	4SS		15
		-9.5		5SS		12
10.0	Light gray SAND, trace red brick and angular gravel, moist to wet	-9.8				
	Gray angular GRAVEL, little to some sand, moist to wet (9.8 to 13.5 ft BGS)			6SS		11
12.5						
	Same, except wet (13.5 to 14.0 ft BGS)			7SS		16
		-14.0				
	Gray fine SAND, little gravel, wet	-14.4		8SS		>100
15.0	Red brown SILT, some clay, dry to moist	-14.7				
	END OF HOLE @ 14.7 FT. BGS					
	NOTES:					
	1. Moved 1 ft west, augered to 14.0 ft BGS (BH12A-92). – 14.0 to 14.6 ft BGS; 8A-SS Gray GRAVEL, little silt and clay, wet			8A-SS		50/1"
	2. Moved 0.6 ft further west, augered to 14.0 ft BGS (BH12B-92) – 14.0 to 14.6 ft BGS; 8B-SS Gray GRAVEL, little silt and clay, wet			8B-SS		50/1"
	3. Moved 1 ft further west, augered to 14.0 ft BGS (BH12C-92) – 14.0 to 14.6 ft BGS; 8C-SS No recovery			8C-SS		50/1"
	4. Moved 7 ft north, augered to 14.0 ft BGS (BH12D-92) – 14.0 to 14.7 ft BGS; 8D-SS Red brown SILT, some clay, little sand, trace gravel			8D-SS		50/1"
	5. Moved 6 ft west, augered to 14.0 ft BGS (BH12E-92). – 14.0 to 14.7 ft BGS; 8E-SS No recovery					
	6. Moved onto center line of pipe, augered to 14.0 ft BGS (BH12F-92). – 14.0 to 14.5 ft BGS; 8F-SS Red brown SILT, gray concrete or slag, white marble, no dolostone					
	7. At completion boreholes were backfilled with cement/bentonite grout to ground surface.					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

CHEMICAL ANALYSIS (○) WATER FOUND ▽ STATIC WATER LEVEL ▼

SUBSURFACE AND WELL CONSTRUCTION LOG

MW-1



SOIL CLASSIFICATION

Gray fine to coarse Gravel, little fine to coarse Sand, loose (FILL).

- Brown Silt, some Clay, little fine Gravel, moist compact
- seam of brick fragments, trace fine Gravel, Clay
- grades to brown Silt, little fine Sand, trace fine Gravel to 4.7'
- seam of dark brown to black fine Sand, some Silt to 4.9'
- seam of brown Silt, some Clay to 5.5'
- brown to black Silt and fine Sand, moist, medium stiff

Dark brown to black SILT, little fine Sand, trace Clay, moist, medium stiff.

- seam of mottled green to brown Silt, some Clay
- seam of brown fine Sand and Silt.

Brown mottled SILT, some fine Sand, wet, firm.

Brown fine SAND, little Silt, wet, firm.

Boring terminated at 15.0'.

MONITORING WELL CONSTRUCTION DETAILS

2 inch diameter PVC riser 5.0' - 0.2'

2 inch diameter PVC with 0.010-inch slot screen 14.5' - 5.0'

Grade '2' sand filter pack 15.0' - 4.0'

Bentonite pellet seal 4.0' - 2.0'

Cement surface seal 2.0' - ground surface

8 inch diameter flush mounted curb box with locking cap installed

SUBSURFACE AND WELL CONSTRUCTION LOG

MW-2

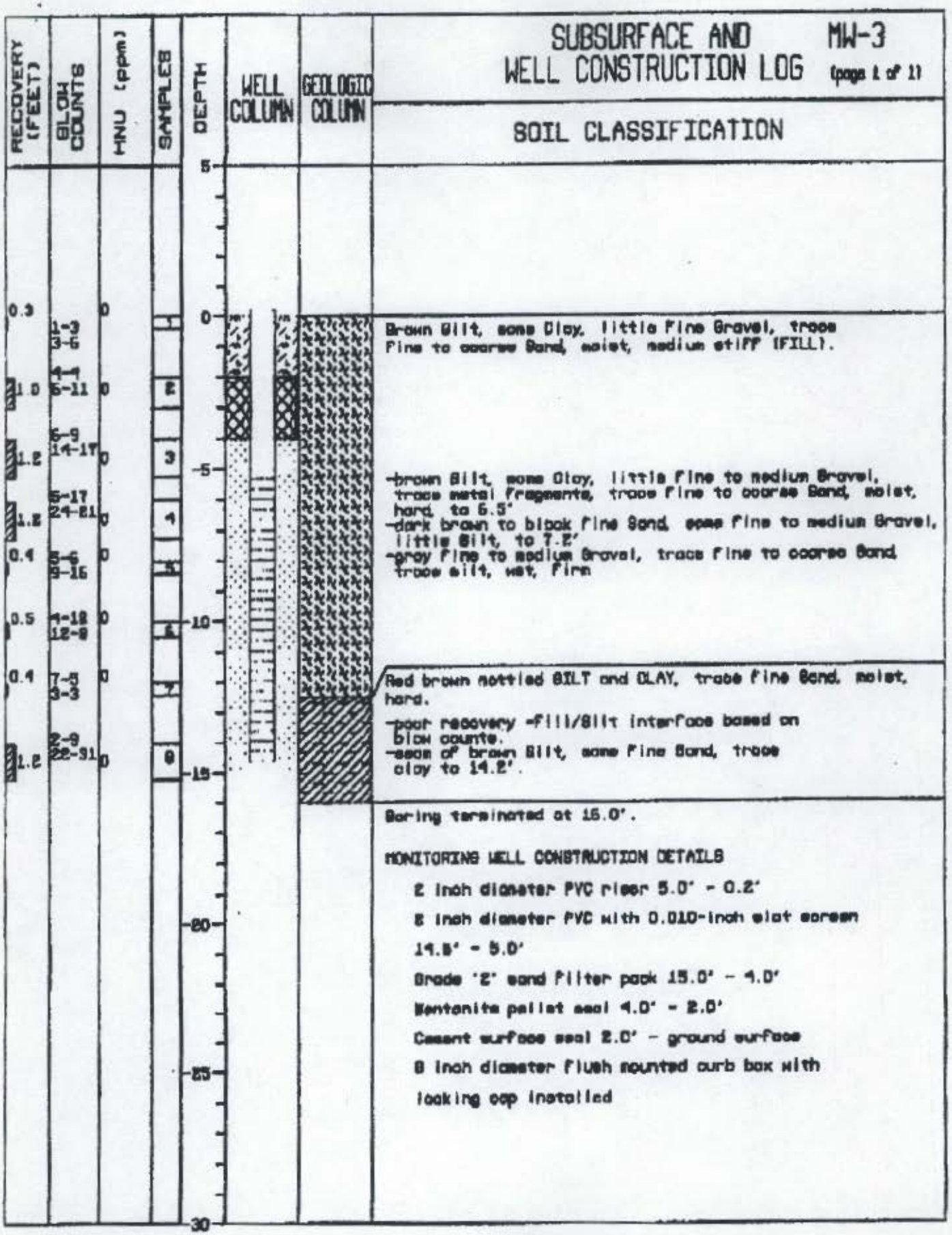
(page 1 of 1)

RECOVERY (FEET)	BLOW COUNTS	HNU (ppm)	SAMPLES	DEPTH	WELL COLUMN	GEOLOGIC COLUMN	SOIL CLASSIFICATION
				5			
0.6	14-25		1	0			Gray fine to medium Gravel, little fine to coarse Sand, trace Silt (FILL).
1.2	7-21 30-22	0	2				-trace brick fragments
							-encountered cobble - sample sequence skipped one foot.
1.5	4-5 6-8	0	3	-5			-gray brown Silt, some fine to medium gravel, little clay, trace fine to coarse Sand to 5.7', moist, medium stiff
1.7	2-3 3-3	0	4				-dark brown to black fine to coarse Sand, trace fine Gravel, trace Silt, wet, to 8.5'
1.5	2-6 7-10	0	5	-10			Gray brown SILT, little Clay, trace fine Sand, moist medium stiff.
							Yellow brown SILT and fine SAND, trace clay, wet.
1.5	3-3 7-13	0	6				Red brown mottled SILT and CLAY, trace fine Sand, moist, hard.
1.7	5-15 18-33	0	7	-15			Boring terminated at 15.0'.
				-20			MONITORING WELL CONSTRUCTION DETAILS 2 inch diameter PVC riser 5.0' - 0.2' 2 inch diameter PVC with 0.010-inch slot screen 14.6' - 5.0' Grade '2' sand filter pack 15.0' - 4.0' Bentonite pellet seal 4.0' - 2.0' Cement surface seal 2.0' - ground surface 8 inch diameter flush mounted curb box with locking cap installed
				-25			
				-30			

SUBSURFACE AND WELL CONSTRUCTION LOG

MW-3

(page 1 of 1)



APPENDIX B

INJECTION TEST RESULTS

TABLE B1 - OW652
TABLE B2 - OW653
TABLE B3 - OW657
TABLE B4 - OW658
TABLE B5 - OW659

TABLE B1

OW652 - HYDRAULIC CONDUCTIVITIES

Depth Below Ground Surface (ft)	*Depth Below Top of Rock (ft)*	*Hydraulic * Conductivity (cm/sec)*	*Waterbearing*	*Depth to Static Water Level (ft. BGS)*	*Date*
20.5 - 32.5	3.0 - 15.0	4.4E-03 - 8.5E-03	Yes	9.7	09/12/91
32.5 - 47.5	15.0 - 30.0	1.3E-03 - 3.7E-03	Yes	10.4	09/13/91
47.5 - 60.5	30.0 - 43.0	3.1E-03 - 7.8E-03	Yes	11.9	09/16/91
67.3 - 82.3	50.4 - 65.4	1.0E-03 - 4.7E-03	Yes	18.3	01/28/93
82.3 - 97.3	65.4 - 80.4	4.0E-03	Yes	18.3	01/27/93
97.3 - 112.3	80.4 - 95.4	1.3E-03 - 2.3E-03	Yes	18.3	01/27/93
112.3 - 127.3	95.4 - 110.4	1.3E-03 - 3.8E-03	Yes	18.3	01/27/93

Notes:

* Hydraulic conductivity calculated assuming R/ro = 10.

1. Bedrock interval from 61.0' to 67.3' BGS not tested. A positive seal with packer could not be achieved to prevent flowby.
2. Bedrock interval from 127.3' to 130.7' BGS not tested. The bottom packer was inadvertently not disconnected during the lower injection test.

TABLE B2

OW653 - HYDRAULIC CONDUCTIVITIES

Depth Below Ground Surface (ft)	*Depth Below Top of Rock (ft)*	*Hydraulic * Conductivity (cm/sec)*	*Waterbearing*	*Depth to Static Water Level (ft. BGS)*	*Date*
24.1 - 40.2	2.3 - 18.4	4.5E-03 - 6.7E-03	Yes	14.0	09/06/91
40.2 - 55.2	18.4 - 33.4	8.4E-06 - 2.0E-05	No	15.9	09/09/91
55.2 - 70.2	33.4 - 48.4	7.8E-06 - 1.6E-05	No	16.6	09/10/91
71.0 - 85.6	47.5 - 62.1	3.6E-05 - 5.7E-05	Yes	21.6	02/04/93
77.0 - 92.0	53.5 - 68.5	5.4E-05 - 8.9E-05	Yes	20.9	02/04/93
92.0 - 107.0	68.5 - 83.5	2.5E-05 - 5.1E-05	Yes	21.3	02/04/93
107.0 - 122.0	83.5 - 98.5	5.8E-02 - 1.1E-01	Yes	21.7	02/04/93
122.0 - 140.5	98.5 - 117.5	9.7E-07 - 2.4E-06	No	22.5	02/03/93

Note:

* Hydraulic conductivity calculated assuming R/ro = 10.

TABLE B3

OW657 - HYDRAULIC CONDUCTIVITIES

Depth Below Ground Surface (ft)	*Depth Below Top of Rock (ft)*	*Hydraulic * Conductivity (cm/sec)*	*Waterbearing*	*Depth to Static Water Level (ft. BGS)*	*Date*
22.1 - 37.1	4.2 - 19.2	6.8E-03 - 1.7E-02	Yes	20.0	02/17/93
37.1 - 52.1	19.2 - 34.2	1.9E-02 - 3.6E-01	Yes	19.3	02/17/93
52.1 - 67.1	34.2 - 49.2	3.4E-03 - 8.7E-03	Yes	19.5	02/17/93
67.1 - 82.1	49.2 - 64.2	4.3E-03 - 3.2E-02	Yes	19.5	02/17/93
82.1 - 97.1	64.2 - 79.2	4.2E-03 - 6.9E-03	Yes	22.2	02/16/93
97.1 - 112.1	79.2 - 94.2	8.2E-03 - 3.9E-02	Yes	22.2	02/16/93
112.1 - 130.5	94.2 - 112.6	5.4E-03 - 1.9E-02	Yes	20.0	02/15/93

Note:

* Hydraulic conductivity calculated assuming R/ro = 10.

TABLE B4

OW658 - HYDRAULIC CONDUCTIVITIES

Depth Below Ground Surface (ft)	*Depth Below Top of Rock (ft)*	*Hydraulic * Conductivity (cm/sec)*	*Waterbearing*	*Depth to Static Water Level (ft. BGS)*	*Date*
22.7 - 37.7	4.2 - 19.2	Note (1)	Yes	22.0	03/02/93
37.7 - 52.7	19.2 - 34.2	3.5E-05 - 6.3E-05	No	22.0	03/02/93
52.7 - 67.7	34.2 - 49.2	8.5E-05 - 1.9E-04	Yes	22.5	03/01/93
67.7 - 82.7	49.2 - 64.2	3.5E-04 - 4.7E-03	Yes	22.5	03/01/93
82.7 - 97.7	64.2 - 79.2	1.8E-04 - 5.2E-04	Yes	22.0	02/26/93
97.7 - 112.7	79.2 - 94.2	8.6E-03 - 1.7E-02	Yes	22.0	02/26/93
112.7 - 131.1	94.2 - 112.6	4.5E-05 - 1.2E-04	Yes	22.0	02/26/93

Notes:

* Hydraulic conductivity calculated assuming R/ro = 10.

1. Test valves acquired during testing of the upper interval were not considered valid; regardless the volume of water lost during injection testing reflects the presence of a water bearing interval.
2. The interval from 18.5 to 22.7 feet below ground surface was not tested.

TABLE B5

OW659 - HYDRAULIC CONDUCTIVITIES

Depth Below Ground Surface (ft)	*Depth Below Top of Rock (ft)*	*Hydraulic * Conductivity (cm/sec)*	*Waterbearing*	*Depth to Static Water Level (ft. BGS)*	*Date*
21.4 - 36.4	1.4 - 16.4	5.8E-04 - 6.4E-04	Yes	19.0	03/10/93
36.4 - 51.4	16.4 - 31.4	2.4E-04 - 4.0E-04	Yes	19.0	03/10/93
51.4 - 66.4	31.4 - 46.4	2.0E-05 - 3.3E-05	No	19.0	03/10/93
66.4 - 81.4	46.4 - 61.4	5.8E-03 - 6.2E-03	Yes	19.0	03/10/93
81.4 - 96.4	61.4 - 76.4	6.8E-04 - 9.4E-04	Yes	19.5	03/09/93
96.4 - 111.4	76.4 - 91.4	8.4E-03 - 1.2E-02	Yes	19.5	03/09/93
111.4 - 129.8	91.4 - 109.8	4.4E-04 - 6.9E-04	Yes	19.5	03/09/93

Notes:

* Hydraulic conductivity calculated assuming R/ro = 10.

APPENDIX C

STRATIGRAPHIC DATABASE • OSI PHASE 1/PHASE 2

TABLE C1 - STRATIGRAPHIC DATA
TABLE C2 - OVERBURDEN THICKNESS
TABLE C3 - BEDROCK STRATIGRAPHIC THICKNESS
TABLE C4 - BEDROCK MONITORING INTERVALS

TABLE C1

STRATIGRAPHIC DATABASE
OFF-SITE INVESTIGATION PROGRAM - PHASE 2

Well/BH #	*Ground Elevation (Ft. AMSL)*	*Grid Co-ordinates North (Feet)*	*East (Feet)*	*Depth to Alluvium (Feet)*	*Elev. of Alluvium (Ft. AMSL)*	*Depth to Clay (Feet)*	*Elevation of Clay (Ft. AMSL)*	*Depth to Till (Feet)*	*Elevation of Till (Ft. AMSL)*	*Depth to Bedrock (Feet)*	*Elevation of Bedrock (Ft. AMSL)*	*NAPL/Sheen Depth Observed (Feet)*
OW652C	570.12	2250.79	-2257.25	1.9	568.2	7.9	562.2	10.5	559.6	14.3	555.8	NO
OW653C	573.85	2668.46	-772.31	10.6	563.3	14.4	559.5	17.5	556.4	20.9	553.0	NO
OW657D	572.09	2100.30	-2640.70	4.6	567.5	10.0	562.1	15.0	557.1	18.0	554.1	NO
OW658D	571.05	2596.00	-1764.60	4.0	567.1	11.5	559.6	14.0	557.1	17.4	553.6	NO
OW659D	570.23	2530.50	-1343.70	1.5	568.7	8.0	562.2	13.1	557.1	20.3	549.9	NO
BH11D-92	570.93	2375.2	-2341.1	4.0	566.9	6.0	564.9	14.3	556.6	16.8	554.1	NO

Notes:

NO -Not Observed
AMSL -Above Mean Sea Level

TABLE C2

OVERBURDEN STRATIGRAPHIC THICKNESS
OFF-SITE INVESTIGATION PROGRAM - PHASE 2

Well/BH #	*Ground Elev. (Ft. AMSL)*	*Grid Co-ordinates North (Feet)*	*East (Feet)*	*Thickness of Fill (Feet)*	*Thickness of Alluv. (Feet)*	*Thickness of Clay (Feet)*	*Thickness of Till (Feet)*	*Thickness of Conf. Layer (Feet)*
OW652C	570.15	2250.79	-2257.25	1.9	6.0	2.6	3.8	6.4
OW653C	573.80	2668.46	-772.31	10.5	3.8	3.1	3.4	6.5
OW657D	572.09	2100.30	-2640.70	4.6	5.4	5.0	3.0	8.0
OW658D	571.05	2596.00	-1764.60	3.9	7.5	2.5	3.5	7.0
OW659D	570.23	2530.50	-1343.70	1.5	6.5	5.1	7.2	12.3
BH11D-92	570.93	2375.20	-2341.10	4.0	2.0	8.3	2.5	10.8

Notes:

AMSL -Above Mean Sea Level

TABLE C3

BEDROCK STRATIGRAPHIC THICKNESS
OFF-SITE INVESTIGATION PROGRAM - PHASE 2

Well/BH #	Ground Elevation (Ft. AMSL)	Grid Co-ordinates North (Feet)	Grid Co-ordinates East (Feet)	Depth to Bedrock (Feet)	Elev. of Bedrock (Ft. AMSL)	Depth to Eramosa (Feet)	Elev. of Eramosa (Ft. AMSL)	Depth to Goat Island (Feet)	Elev. of Goat Island (Ft. AMSL)	Depth to Gasport (Feet)	Elev. of Gasport (Ft. AMSL)	Depth to Decew (Feet)	Elev. of Decew (Ft. AMSL)	Depth to Rochester (Feet)	Elev. of Rochester (Ft. AMSL)	Bottom of Well (Feet)	Elev. of Bottom (Ft. AMSL)
OW652C	570.35	2274.10	-2264.90	17.7	552.7	98.6	471.8	113.2	457.2	126.6	443.8	--	--	--	--	131.2	439.2
OW653C	574.05	2668.46	-772.31	24.4	549.7	104.5	469.6	123.3	450.8	136.6	437.5	--	--	--	--	140.8	433.3
OW657D	572.09	2100.3	-2640.7	18	554.09	95.99	476.1	115.99	456.1	128.59	443.5	--	--	--	--	131.99	440.1
OW658D	571.05	2596	-1764.6	17.5	553.55	97.55	473.5	117.25	453.8	128.75	442.3	--	--	--	--	130.95	440.1
OW659D	570.23	2530.5	-1343.7	20.3	549.93	99.63	470.6	117.33	452.9	128.33	441.9	--	--	--	--	130.53	439.7
BH11D-92	570.93	2375.2	-2341.1	16.8	554.1	--	--	--	--	--	--	--	--	--	--	26.9	544

Notes:

-- -Bottom of well elevation above the unit.

TABLE C4

BEDROCK MONITORING INTERVALS
OFF-SITE INVESTIGATION PROGRAM - PHASE 2

Well/BH #	*Ground Elevation (Ft. AMSL)*	*Grid Co-ordinates North (Feet)*	*East (Feet)*	*Depth to Bedrock (Feet)*	*Elev. of Bedrock (Ft. AMSL)*	*Montored Interval (Ft. BGS)*	*Monitored Interval (Ft. AMSL)*	*Monitored Unit*
OW652B	570.76	2298.1	-2273.5	16.7	554.06	96.96 - 126.96	473.8 - 443.8	Oak Orchard/Eramosa/Goat Island/Gasport
OW652C	570.35	2274.1	-2264.9	16.9	553.45	60.95 - 92.95	509.4 - 477.4	Oak Orchard
OW653B	573.39	2642.4	-817	23.5	549.89	97.99 - 121.99	475.4 - 451.4	Oak Orchard/Eramosa
OW653C	574.05	2653.7	-795.8	23.2	550.85	71 - 96	503.05 - 478.05	Oak Orchard
OW657B	570.45	2148	-2665.9	15	555.45	97.1 - 130.5	473.35 - 439.95	Eramosa/Goat Island/Gasport
OW657C	570.78	2126.4	-2655.1	16	554.78	67.1 - 95.1	503.68 - 475.68	Oak Orchard
OW657D	572.09	2100.3	-2640.7	17.99	554.1	18.5 - 64.5	553.59 - 507.59	Oak Orchard
OW658B	570.85	2615.8	-1720	17.5	553.35	97.5 - 31	473.35 - 539.85	Eramosa/Goat Island/Gasport
OW658C	570.91	2605.6	-1743.3	17.5	553.41	68 - 95.1	502.91 - 475.81	Oak Orchard
OW658D	571.05	2596	-1764.6	17.45	553.6	18.5 - 65	552.55 - 506.05	Oak Orchard
OW659B	570.38	2569.9	-1363.1	20	550.38	96.4 - 130	473.98 - 440.38	Oak Orchard/Eramosa/Goat Island/Gasport
OW659C	570.33	2551.8	-1353.8	20	550.33	66.4 - 94.5	503.93 - 475.83	Oak Orchard
OW659D	570.23	2530.5	-1343.7	20.33	549.9	20.5 - 64.4	549.73 - 505.83	Oak Orchard
BH11D-92	570.93	2375.2	-2341.1	16.8	554.1	17.8 - 26.9	553.1 - 544.0	Oak Orchard

Notes:

AMSL -Above Mean Sea Level
BGS -Below Ground Surface

APPENDIX D

ANALYTICAL RESULTS

- **BEDROCK AND OVERBURDEN GROUNDWATER ANALYSIS**

TABLE D1

OSI - PHASE 2 - ROUND 1 ANALYTICAL DATA
MAY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Descripton:			*OW650D*	*OW660*	*OW652B*	*OW652C*	*OW652D*	*OW653B*
Compounds/Analytes	*Units*	*Detection Level*	*05/11/93*	*Dup.*	*05/06/93*	*05/06/93*	*05/06/93*	*05/13/93*
Phosphorus, Total Soluble	µg P/L	10	ND	ND	42	ND	ND	30
Arsenic	µg/L	19	ND 30	ND	ND 30	ND 30	ND 30	ND
Mercury	µg/L	0.2	3.1	ND	ND	ND	2	ND
Lead	µg/L	16	ND	38	ND 4	ND 4	ND 4	ND
Toluene	µg/L	1	ND	ND	ND	ND	2	2
2-Chlorotoluene	µg/L	1	ND	ND	ND	15	42	54
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	2	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
Benzene	µg/L	1	ND	ND	5	26	ND	190
Chlorobenzene	µg/L	1	ND	ND	ND	5	95	170
1,2-Dichlorobenzene	µg/L	1	1	2	ND	1	8	3
1,3-Dichlorobenzene	µg/L	1	ND	ND	3	14	27	10
1,4-Dichlorobenzene	µg/L	1	ND	ND	2	6	24	9
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	1	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	2J	1J	ND	3J	1J	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	2	2	ND	54J	21J	ND
Tetrachloroethylene	µg/L	1	1	1	1J	7J	1J	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	ND	2	14	1	24
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	1
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND 5	ND 4	ND 6	ND 3	ND 6	NA
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

OSI - PHASE 2 - ROUND 1 ANALYTICAL DATA
MAY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Descripton:			*OW653C*	*OW653D*	*OW657B*	*OW657C*	*OW657D*
Compounds/Analytes	*Units*	*Detection Level*	*05/15/93*	*05/14/93*	*05/06/93*	*05/06/93*	*05/05/93*
Phosphorus, Total Soluble	µg P/L	10	12	100	14	ND	22
Arsenic	µg/L	19	ND22	ND22	ND 23	ND 23	ND 23
Mercury	µg/L	0.2	ND	ND	ND	ND	ND
Lead	µg/L	16	ND21	ND21	ND 30	ND 30	ND 30
Toluene	µg/L	1	2	2	ND	ND	ND
2-Chlorotoluene	µg/L	1	1	480	ND	ND	8
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	55	2	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	7	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	1	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	10	16J	2	ND	2
Chlorobenzene	µg/L	1	ND	250	ND	ND	2
1,2-Dichlorobenzene	µg/L	1	ND	4	ND	ND	ND
1,3-Dichlorobenzene	µg/L	1	ND	24	ND	ND	2
1,4-Dichlorobenzene	µg/L	1	ND	52	8	ND	2
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	ND	ND	70	810	130
Tetrachloroethylene	µg/L	1	ND	ND	10	59	25
2-Chlorobenzotrifluoride	µg/L	1	ND	1	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	97	2	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	4	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	2	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND 5	ND 3	ND 4	ND 3	ND 3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

TABLE D1

OSI - PHASE 2 - ROUND 1 ANALYTICAL DATA
MAY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Descripton:			*OW658B*	*OW658C*	*OW658D*	*OW659B*	*OW659C*	*OW659D*
Compounds/Analytes	*Units*	*Detection Level*	*05/10/1993*	*05/10/1993*	*05/10/1993*	*05/05/93*	*05/05/93*	*05/08/93*
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	19	ND
Arsenic	µg/L	19	ND 23	ND	ND	ND 23	ND 23	ND 23
Mercury	µg/L	0.2	ND	ND	ND	0.7	ND	ND
Lead	µg/L	16	ND 30	ND	ND	ND 30	ND 30	150
Toluene	µg/L	1	ND	2	2	3	4	ND
2-Chlorotoluene	µg/L	1	5	240	180	320	240	32
4-Chlorotoluene	µg/L	1	ND	47	15	4	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	15	19	10	10	3
2,6-Dichlorotoluene	µg/L	1	ND	3	2	1	1	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	4	2	ND	ND	1
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
Benzene	µg/L	1	10J	840	960	1200	21	4
Chlorobenzene	µg/L	1	10	540	620	1600	290	86
1,2-Dichlorobenzene	µg/L	1	ND	43	69	77	8	1
1,3-Dichlorobenzene	µg/L	1	4	120	360	480	130	7
1,4-Dichlorobenzene	µg/L	1	3	98	210	410	80	6
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND	3
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND	9J
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	36
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	5
Hexachlorobenzene	µg/L	1	ND	ND2	ND	ND	ND	ND
Trichloroethylene	µg/L	1	22	ND	13	ND	ND	ND
Tetrachloroethylene	µg/L	1	8	ND	3	ND	ND	3J
2-Chlorobenzotrifluoride	µg/L	1	ND	5	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	4	3	51	61	65	1
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	3	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND	3
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND	1
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	4	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND 6	ND 4	8	12	18	ND 3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

OSI - PHASE 2 - ROUND 1 ANALYTICAL DATA
MAY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Descripton:			*PASNY 139*	*BH11D-92*	*MW-3*	*MW-2*
Compounds/Analytes	*Units*	*Detection Level*	*05/11/93*	*05/12/93*	*05/12/93*	*05/11/93*
Phosphorus, Total Soluble	µg P/L	10	ND	13	ND	14
Arsenic	µg/L	19	ND 23	ND 23	ND	ND
Mercury	µg/L	0.2	ND	ND	ND	ND
Lead	µg/L	16	ND	35	41	ND
Toluene	µg/L	1	2	ND	ND	ND
2-Chlorotoluene	µg/L	1	480	6	ND	ND
4-Chlorotoluene	µg/L	1	ND	1	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND
Benzene	µg/L	1	5J	15	ND	ND
Chlorobenzene	µg/L	1	ND	9	ND	ND
1,2-Dichlorobenzene	µg/L	1	ND	3	ND	ND
1,3-Dichlorobenzene	µg/L	1	ND	12	ND	ND
1,4-Dichlorobenzene	µg/L	1	ND	17	ND	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	1	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	5	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	4	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	2	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND
Trichloroethylene	µg/L	1	430	3	3	ND
Tetrachloroethylene	µg/L	1	61J	4	ND	7
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	4	5	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	1	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	2	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND 3	ND 6	ND 6	ND 3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.
NA Not Available.
J Associated result is estimated.
R Result was rejected.

TABLE D2

OSI - PHASE 2 - ROUND 2 ANALYTICAL DATA SUMMARY
JULY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Description:			*OW652B*	*OW661B*	*OW652C*	*OW653B*	*OW653C*
Sample Date:			*07/08/93*	*Dup.*	*07/09/93*	*07/13/93*	*07/13/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	ND
Arsenic	µg/L	19	ND 26	ND 26	ND 26	ND 23	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	ND 33	ND 33	ND 33	19	21
Toluene	µg/L	1	ND	ND	ND	ND	ND
2-Chlorotoluene	µg/L	1	ND	ND	12	55	ND
4-Chlorotoluene	µg/L	1	ND	ND		ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	5 J	5J	18	150J	ND
Chlorobenzene	µg/L	1	ND	ND	2	140	ND
1,2-Dichlorobenzene	µg/L	1	ND	ND	ND	4	ND
1,3-Dichlorobenzene	µg/L	1	ND	ND	4	12	ND
1,4-Dichlorobenzene	µg/L	1	ND	ND	2	12	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	1	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	2	2	26J	ND	ND
Tetrachloroethylene	µg/L	1	ND	ND	4	ND	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	ND	11	26	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	1	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	7	9	ND 3	ND 4	ND 3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

TABLE D2

OSI - PHASE 2 - ROUND 2 ANALYTICAL DATA SUMMARY
JULY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Description:			*OW657B*	*OW657C*	*OW657D*	*OW658B*	*OW658C*
Sample Date:			*07/07/93*	*07/07/93*	*07/07/93*	*07/12/93*	*07/12/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	ND
Arsenic	µg/L	19	ND 26	ND 26	ND 26	ND 23	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	ND 33	ND 33	ND 33	ND	ND
Toluene	µg/L	1	ND	ND	ND	ND	ND
2-Chlorotoluene	µg/L	1	ND	ND	4	ND	130
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	14
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	6
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	2
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	ND	ND	ND	6J	1100J
Chlorobenzene	µg/L	1	ND	ND	1	4	380
1,2-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	64
1,3-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	110
1,4-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	95
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	2
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	28	1100	120	46	34
Tetrachloroethylene	µg/L	1	11	120	21	12	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	1	ND	2	10
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	5
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	6	ND2	ND3	7J	ND 2
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

TABLE D2

OSI - PHASE 2 - ROUND 2 ANALYTICAL DATA SUMMARY
JULY 1993
OSI PROGRAM - PHASE 2
OCCIDENTAL CHEMICAL CORPORATION

Sample Description:			*OW658D*	*OW659B*	*OW659C*	*OW659D*	*MW-1*
Sample Date:			*07/12/93*	*07/08/93*	*07/07/93*	*07/13/93*	*07/16/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	17
Arsenic	µg/L	19	ND	ND 26	ND 26	ND 33	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	31	ND 33	ND 33	29	37
Toluene	µg/L	1	3	ND	1	ND	ND
2-Chlorotoluene	µg/L	1	160	190	250	2	ND
4-Chlorotoluene	µg/L	1	11	2	ND	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	22	5	11	ND	ND
2,6-Dichlorotoluene	µg/L	1	3	ND	2	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	2	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	1100J	1500	34	3	ND
Chlorobenzene	µg/L	1	540	1300	300	9	ND
1,2-Dichlorobenzene	µg/L	1	100	91	18	ND	ND
1,3-Dichlorobenzene	µg/L	1	340	360	160	ND	ND
1,4-Dichlorobenzene	µg/L	1	200	350	89	ND	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	34	ND	ND	3	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	14	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	23	ND	ND	ND	ND
Tetrachloroethylene	µg/L	1	1	ND	ND	ND	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	60	86	190	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	9	7	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	43	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	2	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	5	1	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND 2	7	12	ND 3	ND 4
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

APPENDIX E

BEDROCK GROUNDWATER ANALYTICAL RESULTS

- AMERICAN REF-FUEL RESOURCE RECOVERY FACILITY

BEDROCK GROUNDWATER ANALYTICAL RESULTS

American Ref-Fuel
Resource Recovery Facility
Niagara Falls, New York

NOVEMBER 1993
REF. NO. 5087 (1)
This report is printed on recycled paper.

CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

American Ref-Fuel Company of Niagara Falls (ARC) has purchased Occidental Chemical Corporation's (OxyChem's) Energy From Waste (EFW) facility (renamed Resource Recovery Facility (RRF) by ARC) located in Niagara Falls, New York (see Figure 1.1). In conjunction with the purchase, ARC contracted GZA GeoEnvironmental of New York (GZA) to perform environmental studies at the RRF, including the collection and analyses of bedrock groundwater samples.

This report presents a comparison of the analytical results of the bedrock groundwater samples collected by ARC/GZA and documented in its report entitled "Environmental Study Data Report" (September, 1993) to analytical results obtained by OxyChem during the Off-Site Investigation Program (OSI) and the Supplemental Data Collection Program (SDCP), as appropriate, for the same sample locations. This comparison of analytical results and the presentation of data herein has been performed by OxyChem.

2.0 SAMPLE COLLECTION AND ANALYTICAL RESULTS

Five bedrock groundwater samples (including one duplicate) were collected on March 8 and 9, 1993 by ARC/GZA at the RRF as part of ARC's environmental study of the RRF. The sample locations are shown on Figure 2.1. Four of the samples were analyzed for priority pollutant (PP) volatile organic compounds (VOCs), PP base/neutral acid extractables (BNAs), PP pesticides/PCBs, PP metals, and dechlorane plus. The fifth sample (FD-1 from the foundation drain of the RRF) was analyzed for target compound list (TCL) VOCs and BNAs, Resource Conservation and Recovery Act (RCRA) metals (plus aluminum, copper, lead and zinc), dechlorane plus, and sulfate.

The data have been QA/QC reviewed and judged acceptable with the specific exceptions and qualifications noted in the Data Validation included as Attachment A.

A comparison of the ARC and OxyChem detected analytes from previous studies is shown on Tables 2.1, 2.2, 2.3 and 2.4 for wells OW650, OW653D and OW407C and the RRF foundation drain respectively. Since the ARC samples were analyzed for different parameter lists (i.e. PP and TCL) and the OxyChem samples were analyzed for the Site Specific Indicators (SSI), some analytes included in one list are not included in the other list. Thus, it is not possible to provide a comparison between the ARC and OxyChem results for analytes which are not common to the lists. The discussion below focuses on the common analytes.

The ARC samples from well OW650 were collected between the OSI sample rounds performed by OxyChem. As shown on Table 2.1, low level concentrations of principally chlorobenzene and chloroethene compounds were detected. The ARC and OxyChem concentrations for well OW650 are generally consistent except for the chlorobenzene compounds. The ARC chlorobenzene compounds analytical results show higher concentrations (8.6 to 69 µg/L) than the OxyChem analytical results which ranged from ND1 to 2 µg/L.

The analytical results for OW653D, OW407C and the RRF foundation drain are presented on Tables 2.2, 2.3 and 2.4 respectively. The principal compounds detected were chlorotoluene, chlorobenzene, and chlorobenzotrifluoride compounds. For the chlorobenzene compounds, the analytical results are consistent (i.e. the concentrations are of the same order magnitude).

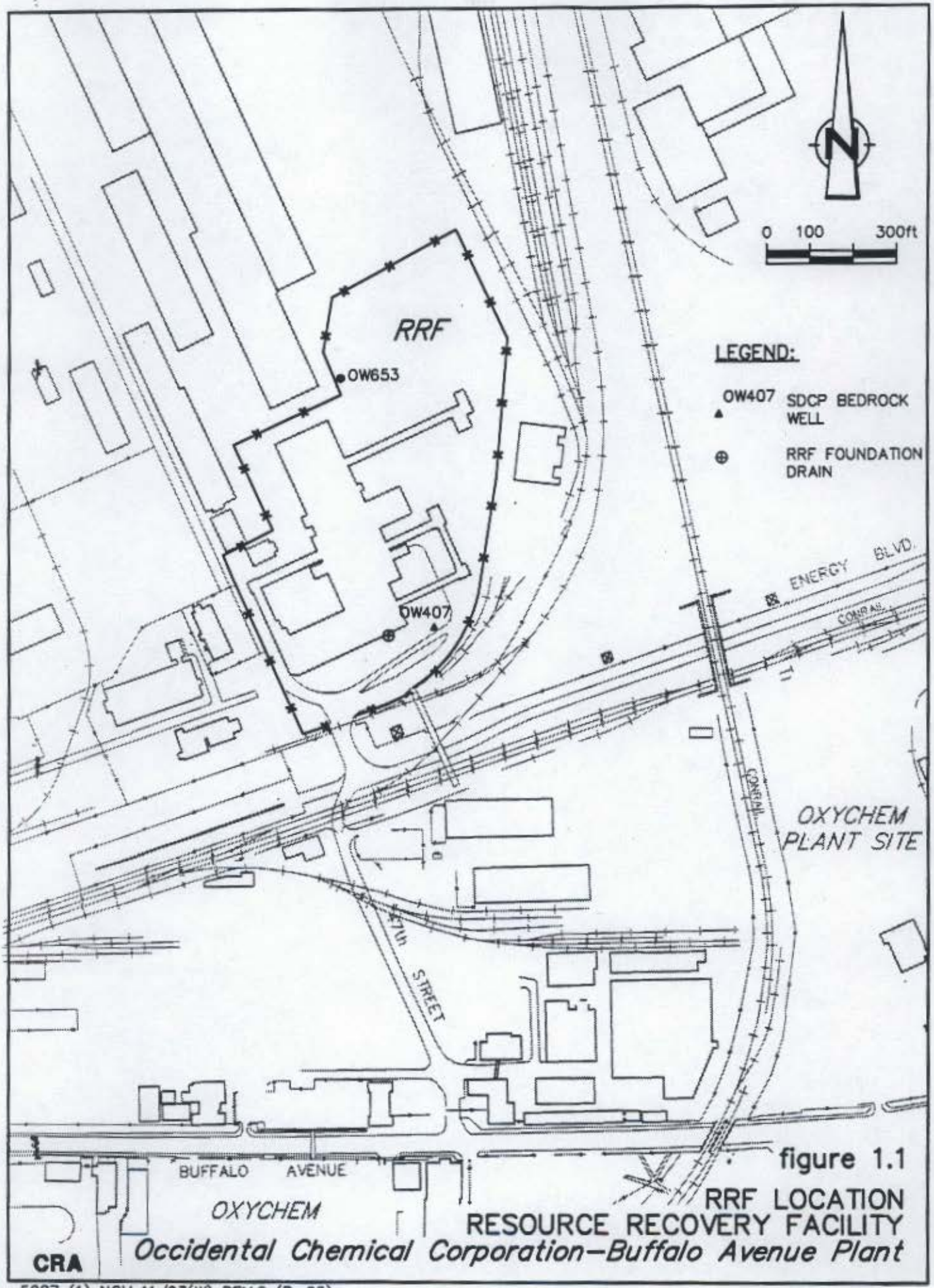
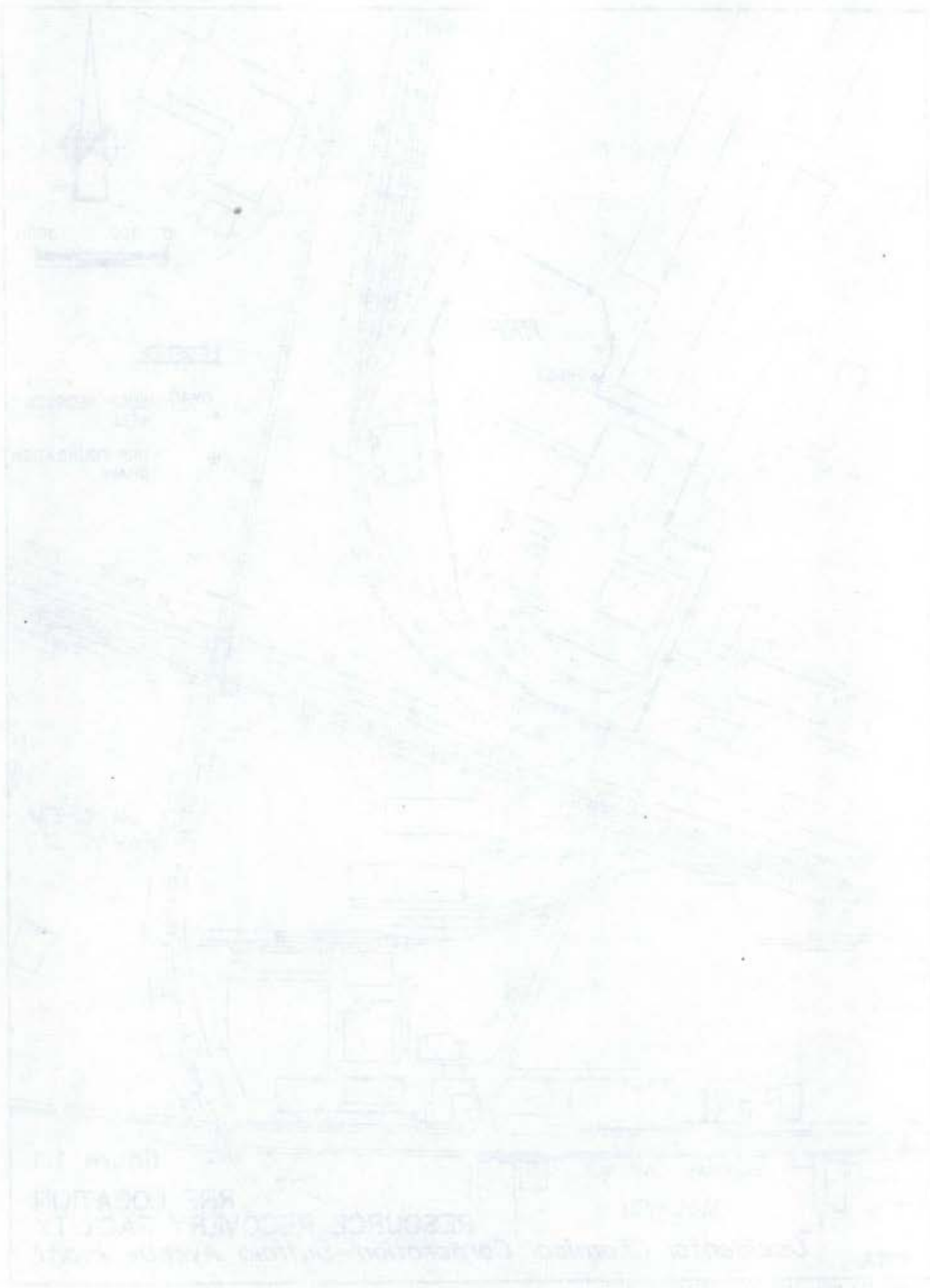


figure 1.1

RRF LOCATION

RESOURCE RECOVERY FACILITY

Occidental Chemical Corporation–Buffalo Avenue Plant



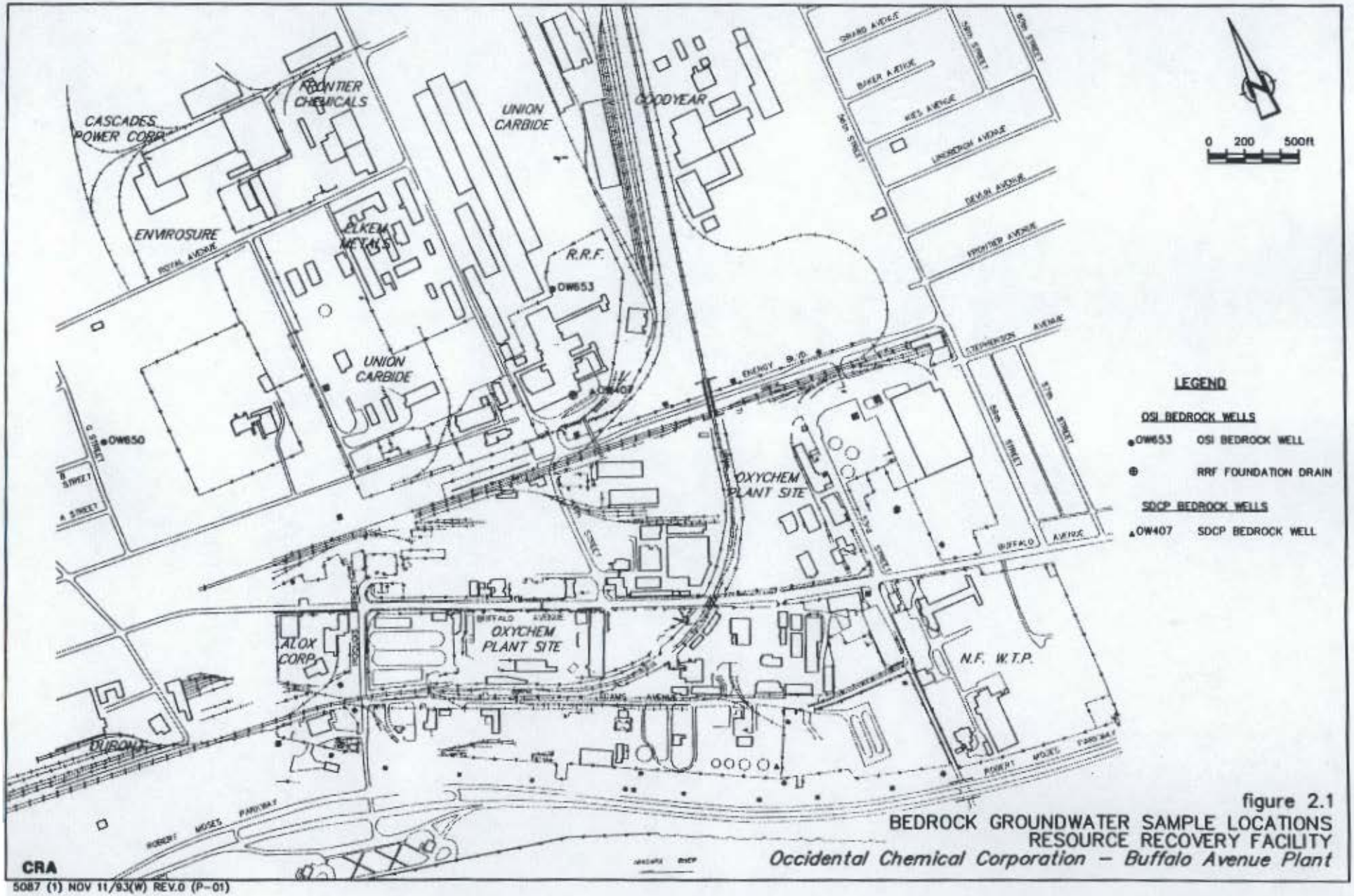


figure 2.1
BEDROCK GROUNDWATER SAMPLE LOCATIONS
RESOURCE RECOVERY FACILITY
Occidental Chemical Corporation – Buffalo Avenue Plant

CRA

5087 (1) NOV 11/93(W) REV.0 (P-01)

TABLE 2.1

SUMMARY OF DETECTED ANALYTES - OW650

	OSI Results				*ARC Results*
Analyte (µg/L)	*12/10/91*	*03/04/92*	*05/93*	*05/93 (Dup)*	*03/93*
Chlorobenzene	ND1	ND1	ND1	ND1	8.7
1,2-Dichlorobenzene	ND1	ND1	1	2	69
1,3-Dichlorobenzene	ND1	ND1	ND1	ND1	8.6
1,4-Dichlorobenzene	ND1	ND1	ND1	ND1	50
1,2,4-Trichlorobenzene	1	ND1	2	1	48
1,2-Dichloroethene	NA	NA	NA	NA	4.6
Tetrachloroethene	16	11	1	1	10
Trichloroethene	16	ND9	2	2	7.9
4-Chlorobenzotrifluoride	1	ND1	ND1	ND1	NA
Aroclor 1242	NA	NA	NA	NA	0.26
Copper	NA	NA	NA	NA	12
Lead	ND42	ND42	ND42	ND42	32
Mercury	0.4	ND0.4	3	ND0.4	2
Nickel	NA	NA	NA	NA	27
Zinc	NA	NA	NA	NA	110

Notes:

NA - Not analyzed.
NDx - Not detected at or above x µg/L.

TABLE 2.2

SUMMARY OF DETECTED ANALYTES - OW653D

	OSI Results			*ARC Results*
Analyte (µg/L)	*12/07/91*	*03/09/92*	*05/93*	*03/93*
Toluene	ND1	ND1	2	ND6
2-Chlorotoluene	100	580	480	NA
2,4-/2,5-Dichlorotoluene	100	59	55	NA
2,6-Dichlorotoluene	11	7	7	NA
2,3-/3,4-Dichlorotoluene	3	1	1	NA
Benzene	76	66	16	R
Chlorobenzene	700	430	250	R
1,2-Dichlorobenzene	12	8	4	4
1,3-Dichlorobenzene	37	21	24	14
1,4-Dichlorobenzene	100	56	52	30
2-Chlorobenzotriflouride	4	2	1	NA
4-Chlorobenzotriflouride	360	220	97	NA
2,4-Dichlorobenzotriflouride	1	ND1	ND1	NA
3,4-Dichlorobenzotriflouride	ND1	6	4	NA
g-HCCH	1	ND1	ND1	ND0.005
Selenium	NA	NA	NA	14

Notes:

NA - Not analyzed.
NDx - Not detected at or above x µg/L.
R - Data has been qualified as unusable. Values were outside linear calibration units.

TABLE 2.3

SUMMARY OF DETECTED ANALYTES - OW407C

	SDCP SSI Results		*ARC Results*
	Round 1	*Round 2*	
Analyte (µg/L)	*12/89 to 1/90*	*2/90*	*03/93*
Toluene	1	1	ND6/ND6
2-Chlorotoluene	320	100	NA
4-Chlorotoluene	9	4	NA
2,4-/2,5-Dichlorotoluene	8	1	NA
2,6-Dichlorotoluene	1	ND1	NA
2,3-/3,4-Dichlorotoluene	3	ND1	NA
Benzene	10	5	48J/48J
Chlorobenzene	25	19	130J/130J
1,2-Dichlorobenzene	4	2	ND1.9/5.9
1,3-Dichlorobenzene	15	5	7.4/ND1.9
1,4-Dichlorobenzene	ND1	4	7/ND4.4
1,2,4-Trichlorobenzene	3	2	ND1.9
2-Chlorobenzotriflouride	2	1	NA
4-Chlorobenzotriflouride	210	56	NA
1,2-Dichloroethene	NA	NA	51J/54J
Trichloroethene	ND1	ND1	2.6J/ND1.9
Aldrin	NA	NA	0.015/ND0.005
a-HCCH	ND1	ND1	ND0.005/0.034
Chromium	NA	NA	16/ND10
Copper	NA	NA	17/18
Lead	ND42	ND42	3/3
Mercury	0.9	ND0.4	ND0.4/ND0.4
Selenium	NA	NA	8J/10J
Zinc	NA	NA	10J/18J

Notes:

NA - Not analyzed.
NDx - Not detected at or above x µg/L.
J - Associated value is an estimate.

TABLE 2.4

SUMMARY OF DETECTED ANALYTES
RRF FOUNDATION DRAIN

	OSI Results		*ARC Results*
Analyte (µg/L)	*12/16/91*	*03/04/92*	*03/93*
Toluene	3	2	ND5
2-Chlorotoluene	2300	2400	NA
4-Chlorotoluene	ND1	4	NA
2,4-/2,5-Dichlorotoluene	62	70	NA
2,6-Dichlorotoluene	8	9	NA
2,3-/3,4-Dichlorotoluene	7	7	NA
Benzene	940	1200	R
Chlorobenzene	630	770	R
1,2-Dichlorobenzene	17	18	10
1,3-Dichlorobenzene	94	92	29
1,4-Dichlorobenzene	74	80	28
2-Chlorobenzotriflouride	9	ND1	NA
4-Chlorobenzotriflouride	750	800	NA
2,4-Dichlorobenzotriflouride	2	2	NA
g-HCCH	ND1	4	NA
d-HCCH	4	3	NA
Barium	NA	NA	30
Selenium	NA	NA	7

Notes:

NA - Not analyzed.
NDx - Not detected at or above x µg/L.
R - Data has been qualified as unusable. Values were outside linear calibration limits.

ATTACHMENT A

DATA VALIDATION
AMERICAN REF-FUEL
RESOURCE RECOVERY FACILITY
(FORMERLY ENERGY FROM WASTE FACILITY)
NIAGARA FALLS, NEW YORK
MARCH 8-9, 1993

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(Following Report)

1.0 EXECUTIVE SUMMARY

Five bedrock groundwater samples (including one duplicate) were collected March 8-9, 1993, by American Ref-Fuel (ARC)/GZA GeoEnvironmental of New York (GZA) at the Resource Recovery Facility (RRF), formerly called the Energy from Waste Facility, located in Niagara Falls, New York as part of ARC's environmental study of the RRF. Four of the samples were analyzed for priority pollutant (PP) volatile organic compounds (VOCs), PP base/neutral acid extractables (BNAs), PP pesticides/PCBs (polychlorinated biphenyls), PP metals, and PP dechlorane plus while the remaining sample was analyzed for target compound list (TCL) VOCs, TCL BNAs, Resource Conservation and Recovery Act (RCRA) metals (plus aluminum, copper, lead, and zinc), dechlorane plus, and sulfate.

VOCs

Chlorobenzene and benzene results reported for samples OW653 and FD-1 were qualified as unusable as they were outside of the linear calibration range. Although these compounds were present in the samples, usable quantitative results are not available.

All VOC samples were analyzed within the method holding time. VOCs were not detected at or above the detection limit in the method and trip blanks. Field duplicate results were acceptable, indicating good sampling and analytical precision were achieved. All internal standard recoveries were acceptable, while outlying (low) surrogate recoveries were reported for samples OW653, OW407C and Dup-1 (duplicate of sample OW407C). All VOC results above the detection limit for these samples were qualified as estimated due to a potential low bias.

BNAs

All BNA samples were extracted and analyzed within the method holding times. BNAs were not detected at or above the detection limit in the method blank. All surrogate and internal standard recoveries were acceptable, indicating good analytical accuracy was achieved. Based on

the RPD values reported for the analysis of field duplicate samples, analytical and sampling precision were deemed acceptable.

Pesticides/PCBs and Dechlorane Plus

All samples were analyzed within the method holding times. All surrogate recoveries were within laboratory control limits, indicating acceptable accuracy was achieved during analysis. RPD values reported for the field duplicate analysis indicate acceptable sampling and laboratory precision were achieved.

Metals

All samples were analyzed within the method holding times. Metals were not detected at or above the method detection limits in the method blank.

Metals analyses of the field duplicate samples yielded outlying RPD values for selenium and zinc. Because these results may indicate some variability in sampling and/or analytical procedures, results for these analytes were qualified as estimated in both samples (OW407C and Dup-1). All remaining QA/QC results indicate that the metals data provided by Recra were acceptable.

Sulfate Analysis

Sulfate analysis was performed on sample FD-1 within the method holding time. Sulfate was not detected at or above the detection limit in the method blank. Analysis of laboratory control samples yielded acceptable recoveries indicating good analytical accuracy was achieved during this analysis.

2.0 GENERAL

Five bedrock groundwater samples (including one field duplicate) were collected on March 8-9, 1993 by ARC/GZA at the RRF located in Niagara Falls, New York. A summary of the analytical parameters and methodologies employed is attached as Table 1. All analytical services for the ARC study were provided by Recra Environmental (Recra).

A summary of the analytical results is presented in Table 2. The Quality Assurance/Quality Control (QA/QC) criteria by which these data have been assessed are outlined in the methods listed above and the following documents:

i) "National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (OLMM01.0) and Low Concentration Water (OLC01.0)", 12/90 (Rev. 6/91); and

ii) "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses" (July 1, 1988), prepared by the USEPA Data Review Work Group.

Hereinafter, items i) and ii) will be referred to as the "Guidelines". The data quality assurance and validation is presented in the subsections which follow.

3.0 HOLDING TIMES

Technical sample holding times, as specified in the analytical methods employed, are as follows:

Parameter	*Holding Time*
VOCs	7 days from collection to analysis
BNAs	7 days from collection to extraction 40 days from extraction to analysis
Pesticide/PCBs	7 days from collection to extraction 40 days from extraction to analysis
Metals (except mercury)	6 months from collection to analysis
Mercury	28 days from collection to analysis
Dechlorane Plus	7 days from collection to extraction 40 days from extraction to analysis
Sulfate	28 days from collection to analysis

A summary of all sample holding times is attached as Table 3. Upon review of the collection and analysis dates obtained from the Chain of Custody forms and final analytical reports, respectively, it was determined that all samples were extracted and/or analyzed within the above holding times.

4.0 METHOD BLANK ANALYSES

The purpose of assessing the results of method blank analyses is to determine the existence and magnitude of contamination introduced during analysis. Method blanks were analyzed at a minimum frequency of one per 20 investigative samples and/or one per analytical sequence. A summary of the method blank analyses data is presented in Table 4.

The method blank extracted on March 12, 1993 for pesticide/PCB analysis contained low level concentrations of various pesticides. In accordance with the Guidelines, all samples extracted with this blank, exhibiting concentrations less than five times the associated blank concentration, should be qualified as ND. Since all associated sample results for these pesticides were ND, however, no qualification of the data was necessary. All other blank analyses yielded ND results, indicating that laboratory contamination was not a factor.

5.0 SURROGATE SPIKE RECOVERIES

In accordance with the analytical methods employed, all VOC, BNA, and pesticide/PCB samples and blanks are spiked with surrogate prior to analysis. Surrogate recoveries provide a means to evaluate the effects of individual sample matrices on analytical efficiency. A summary of all surrogate recoveries is presented on Table 5.

5.1 VOC ANALYSIS

In accordance with Methods 8240 and 624, toluene-d_8, bromofluorobenzene, and 1,2-dichloroethane-d_4 were employed as surrogates for VOC analysis. Control limits specified in the method were used to evaluate the surrogate recoveries. Low surrogate recoveries were reported for samples OW653, OW407C and Dup-1. Because this may indicate a low bias in the VOC analysis results, all VOC results above the detection limit were qualified as estimated for these samples (see Table 6).

In accordance with the Guidelines, all ND values should also be qualified as estimated for these samples. Because the surrogate recoveries were only slightly outside of the limits, however, ND values were deemed acceptable for the intended use of the data without qualification.

The analysis of sample FD-1 yielded high recoveries for surrogates toluene-d_8 and bromofluorobenzene. Because this may indicate a high bias, all positive VOC results should be qualified as estimated. Since all sample results were non-detect, however, qualification of the data was not necessary.

5.2 BNA ANALYSIS

In accordance with Methods 8270 and 625, nitrobenzene-d5, 2-fluorobiphenyl, terphenyl-d14, phenol-d5, 2-fluorophenol, and 2,4,6-tribromophenol were employed as surrogates for BNA analysis.

Control limits specified in the method were used to evaluate the surrogate recoveries.

All surrogate recoveries were within the method control limits, indicating that good analytical efficiency was achieved during the BNA analysis.

5.3 PESTICIDE/PCB ANALYSIS

In accordance with Method 608, dibutylchlorendate was employed as a surrogate for pesticide/PCB analysis. Laboratory control limits of 16 to 130 percent were used to evaluate the surrogate recoveries.

All surrogate recoveries were within the laboratory control limits, indicating that good analytical efficiency was achieved during the Pesticide/PCB analysis.

6.0 INTERNAL STANDARD ANALYSIS

To ensure that changes in gas chromatograph/mass spectrometer (GC/MS) sensitivity and response do not affect sample analysis results, internal standards are added to each sample prior to analysis. All results are then calculated as a ratio of the internal standard response. Internal standard recoveries between 50 and 200 percent, as compared to the daily calibration standard results, are considered acceptable. A summary of all internal standard recoveries is presented in Table 7.

6.1 VOC ANALYSIS

In accordance with Methods 8240 and 624, bromochloromethane, 1,4-difluorobenzene, and chlorobenzene-D5 were employed as internal standards for VOC analysis. All recoveries were within the acceptable range, indicating good instrument stability throughout the analysis period.

6.2 BNA ANALYSIS

In accordance with Methods 8270 and 625, phenanthrene-D10, chysene-D12, perylene-D12, 1,4-dichlorobenzene-D4, naphthalene-D8, and acenaphthene-D10 were employed as internal standards for BNA analysis. All recoveries were within the acceptable range, indicating good instrument stability throughout the analysis period.

7.0 LABORATORY CONTROL SAMPLE ANALYSIS - SULFATE

The laboratory control sample (LCS) serves as a monitor for overall analytical accuracy. LCSs are prepared and analyzed as samples, and recoveries are evaluated against control limits of 80-120 percent.

LCS standard were analyzed for sulfate and recoveries of 110 to 115 percent were reported (see Table 8). As these results were within the above control limits, analytical accuracy was deemed acceptable for this analysis.

8.0 ANALYTICAL DATA ASSESSMENT

It should be noted that chlorobenzene and benzene results reported for samples OW653 and FD-1 by VOC analysis were outside of the linear calibration range. In accordance with the Guidelines, these values were qualified as unusable (R). Although these compounds were present in the samples, usable quantitative results are not available. All other analytical results reported were within the associated linear calibration ranges and were acceptable.

9.0 FIELD QA/QC

9.1 TRIP BLANK ANALYSES

To evaluate the possibility of contamination arising from sample transport, the environment, and/or shipping, a trip blank was transported to the Site and kept in the field with water samples to be analyzed for TCL VOCs. It should be noted that the trip blank was transported to the laboratory two days after all the samples were submitted to the laboratory and therefore does not reflect possible sample contamination occurring during transport.

A summary of the trip blank analysis results is presented in Table 9. VOCs were not detected at or above the detection limit in the trip blank. It should be noted that the trip blank was analyzed for TCL VOCs which do not include acrolein, acrylonitrile, or chloroethylvinyl ether, all of which are priority pollutant VOCs. Since all three of these compounds were not detected at or above the detection limit in all samples, it is assumed that any possible contamination was negligible in this study.

9.2 FIELD DUPLICATE ANALYSES

In order to assess the analytical and sampling protocol precision, field duplicate samples are collected and submitted "blind" to the laboratory for analysis. Precision is then evaluated based on the RPD values reported.

For the ARC study, sample Dup-1 was a duplicate of sample OW407C. A summary of the field duplicate results and RPD values is presented in Table 10. RPD values less than 20 percent were considered acceptable for all parameters. Note that RPD values could not be calculated for analyses yielding one or more ND results.

9.2.1 VOC Analysis

All RPD values were acceptable, indicating good sample and analytical precision were achieved during this study.

9.2.2 BNA Analysis

All BNA compounds were non-detect in both samples except for the dichlorobenzenes which were present in sample OW407C but non-detect in the duplicate. Since RPD values cannot be calculated for the dichlorobenzene, precision cannot be assessed. All remaining BNA results indicated acceptable sampling and laboratory precision were achieved.

9.2.3 Pesticide/PCB/Dechlorane Plus Analysis

All RPD values were acceptable, indicating that good sampling and analytical precision were achieved during this analysis.

9.2.4 Metals Analysis

Outlying RPD values of 22 and 57 percent were reported for selenium and zinc, respectively. As this could indicate some variability in sampling and/or analytical precision for these analytes, the selenium and zinc results reported for these samples were qualified as estimated (see Table 11). All other RPD values were less than 20 percent, indicating acceptable sampling and analytical precision were achieved for these analytes.

10.0 CONCLUSION

Based on the assessment detailed in the foregoing, the data from Recra are acceptable with the specific exceptions and qualifications noted herein.

TABLE 1

SUMMARY OF ANALYTICAL METHODOLOGY
AMERICAN REF-FUEL RRF
MARCH 1993

Parameter	*Analytical Method*
Target Compound List Volatile Organic Compounds	624(2)
Priority Pollutant Volatile Organic Compounds	8240(1)
Priority Pollutant Base/Neutral Acid Extractables	625(2)
Target Compound List Base/Neutral Acid Extractables	8270(1)
Priority Pollutant Pesticides/Polychlorinated Biphenyls	608(2)
Dechlorane Plus	8080(1)
Priority Pollutant Metals	6000/7000 Series(1)
Resource Conservation and Recovery Act Metal	6000/7000 Series(1)
Sulfate	9038(1)

Notes:
(1) Referenced from USEPA SW-846, 3rd Edition, 1986.
(2) Referenced from USEPA "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", July 1982.

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID:	*Detection Limits*	*OW653*	*OW650*	*Dup-1 (OW407C)*	*OW407C*
P.P. VOCs by 624 (µg/L)					
Acrolein	400	ND	ND	ND	ND
Acrylonitrile	400	ND	ND	ND	ND
Benzene	4.4	R	ND	48J	48J
Bromodichloromethane	2.2	ND	ND	ND	ND
Bromoform	4.7	ND	ND	ND	ND
Bromomethane	10	ND	ND	ND	ND
Carbon tetrachloride	2.8	ND	ND	ND	ND
Chlorobenzene	6.0	R	8.7	130J	130J
Chloroethane	10	ND	ND	ND	ND
2-Chloroethylvinyl ether	10	ND	ND	ND	ND
Chloroform	1.6	ND	ND	ND	ND
Chloromethane	10	ND	ND	ND	ND
Dibromochloromethane	3.1	ND	ND	ND	ND
1,1,-Dichloroethane	4.7	ND	ND	ND	ND
1,2-Dichloroethane	2.8	ND	ND	ND	ND
1,1-Dichloroethene	2.8	ND	ND	ND	ND
1,2-Dichloroethene	1.6	ND	4.6	54J	51J
1,2-Dichloropropane	6.0	ND	ND	ND	ND
cis-1,3-Dichloropropene	5.0	ND	ND	ND	ND
trans-1,3-Dichloropropene	5.0	ND	ND	ND	ND
Ethyl benzene	7.2	ND	ND	ND	ND
Methylene chloride	2.8	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	6.9	ND	ND	ND	ND
Tetrachloroethene	4.1	ND	10	ND	ND
Toluene	6.0	ND	ND	ND	ND
1,1,1-Trichloroethane	3.8	ND	ND	ND	ND
1,1,2-Trichloroethane	5.0	ND	ND	ND	ND
Trichloroethene	1.9	ND	7.9	2.6J	ND
Vinyl chloride	10	ND	ND	130J	130J

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID:	*Detection Limits*	*OW653*	*OW650*	*Dup-1 (OW407C)*	*OW407C*
P.P. BNAs by 625 (µg/L)					
Acenaphthene	1.9	ND	ND2.2	ND	ND
Acenaphthylene	3.5	ND3.6	ND4.0	ND	ND
Anthracene	1.9	ND	ND2.2	ND	ND
Benzidine	44	NF45	ND50	ND	ND
Benzo(a)anthracene	7.8	ND8.0	ND8.9	ND	ND
Benzo(b)fluoranthene	4.8	ND4.9	ND5.4	ND	ND
Benzo(k)fluoranthene	2.5	ND2.6	ND2.8	ND	ND
Benzo(g,h,i)perylene	4.1	ND4.2	ND4.6	ND	ND
Benzo(a)pyrene	2.5	ND2.6	ND2.8	ND	ND
Bis(2-chloroethoxy)methane	5.3	ND5.4	ND6.0	ND	ND
Bis(2-chloroethyl)ether	5.7	ND5.8	ND6.5	ND	ND
Bis(2-chloroisopropyl)ether	5.7	ND5.8	ND6.5	ND	ND
Bis(2-ethylhexyl)phthalate	2.5	ND2.6	ND2.8	ND	ND
4-Bromophenyl phenyl ether	1.9	ND	ND2.2	ND	ND
Butylbenzyl phthalate	2.5	ND2.6	ND2.8	ND	ND
4-Chloro-3-methylphenol	3.0	ND3.1	ND3.4	ND	ND
2-Chloronaphthalene	1.9	ND	ND2.2	ND	ND
2-Chlorophenol	3.3	ND3.4	ND3.8	ND	ND
4-Chlorodiphenylether	4.2	ND4.3	ND4.8	ND	ND
Chrysene	2.5	ND2.6	ND2.8	ND	ND
Dibenzo(a,h)anthracene	2.5	ND2.6	ND2.8	ND	ND
1,3-Dichlorobenzene	1.9	14	8.6	ND	7.4
1,2-Dichlorobenzene	1.9	4	69	ND	5.9
1,4-Dichlorobenzene	4.4	30	50	ND	7
3,3'-Dichlorobenzidine	16	ND	ND18	ND	ND
2,4-Dichlorophenol	2.7	ND2.8	ND3.1	ND	ND
Diethyl phthalate	1.9	ND	ND2.2	ND	ND
2,4-Dimethylphenol	2.7	ND2.8	ND3.1	ND	ND
Dimethyl phthalate	1.6	ND	ND1.8	ND	ND
4,6-Dinitro-2-methylphenol	24	ND25	ND22	ND	ND
1,2-Diphenylhydrazine	10	ND	ND11	ND	ND
2,4-Dinitrophenol	42	ND43	ND48	ND	ND
2,4-Dinitrotoluene	5.7	ND5.8	ND6.5	ND	ND
2,6-Dinitrotoluene	1.9	ND	ND2.2	ND	ND
Di-n-butyl phthalate	2.5	ND2.6	ND2.8	ND	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID:	*Detection Limits*	*OW653*	*OW650*	*Dup-1 (OW407C)*	*OW407C*
P.P. BNAs by 625 (µg/L) (Cont'd.)					
Di-n-octyl phthalate	2.5	ND2.6	ND2.8	ND	ND
Fluoranthene	2.2	ND2.3	ND2.5	ND	ND
Fluorene	1.9	ND	ND2.2	ND	ND
Hexachlorobenzene	1.9	ND	ND2.2	ND	ND
Hexachlorobutadiene	0.90	ND0.92	ND1.0	ND	ND
Hexachlorocyclopentadiene	1.0	ND	ND1.1	ND	ND
Hexachloroethane	1.6	ND	ND1.8	ND	ND
Indeno(1,2,3-cd)pyrene	3.7	ND3.8	ND4.2	ND	ND
Isophorone	2.2	ND2.3	ND2.5	ND	ND
Naphthalene	1.6	ND	ND1.8	ND	ND
Nitrobenzene	1.9	ND	ND2.2	ND	ND
2-Nitrophenol	3.6	ND3.7	ND4.1	ND	ND
4-Nitrophenol	2.4	ND2.5	ND	ND	ND
N-nitrosodimethylamine	2.2	ND2.3	ND2.5	ND	ND
N-nitrosodi-n-propylamine	3.3	ND3.4	ND3.8	ND	ND
N-nitrosodiphenylamine	1.9	ND	ND2.2	ND	ND
Pentachlorophenol	3.6	ND3.7	ND4.1	ND	ND
Phenanthrene	5.4	ND5.5	ND6.1	ND	ND
Phenol	1.5	ND	ND1.7	ND	ND
Pyrene	1.9	ND	ND2.2	ND	ND
1,2,4-Trichlorobenzene	1.9	ND	48	ND	ND
2,4,6-Trichlorophenol	2.7	ND2.8	ND3.1	ND	ND
P.P. Pesticides/PCBs by 608 (µg/L)					
Aldrin	0.0050	ND	ND0.0054	0.015	ND
alpha-BHC	0.0050	ND	ND0.0054	ND	0.034
beta-BHC	0.0050	ND	ND0.0054	ND	ND
gamma-BHC	0.0050	ND	ND0.0054	ND	ND
delta-BHC	0.0050	ND	ND0.0054	ND	ND
Chlordane	0.050	ND	ND0.054	ND	ND
4,4'-DDD	0.010	ND	ND0.011	ND	ND
4,4'-DDE	0.010	ND	ND0.011	ND	ND
4,4'-DDT	0.010	ND	ND0.011	ND	ND
Dieldrin	0.010	ND	ND0.011	ND	ND
Endosulfan I	0.010	ND	ND0.011	ND	ND
Endosulfan II	0.010	ND	ND0.011	ND	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID:	*Detection Limits*	*OW653*	*OW650*	*Dup-1 (OW407C)*	*OW407C*
P.P. Pesticides/PCBs by 608 (µg/L) (Cont'd.)					
Endosulfan sulfate	0.010	ND	ND0.011	ND	ND
Endrin	0.010	ND	ND0.011	ND	ND
Endrin aldehyde	0.010	ND	ND0.011	ND	ND
Heptachlor	0.0050	ND	ND0.0054	ND	ND
Heptachlor epoxide	0.0050	ND	ND0.0054	ND	ND
Toxaphene	0.10	ND	ND0.11	ND	ND
Aroclor 1016	0.050	ND	ND0.054	ND	ND
Aroclor 1221	0.10	ND	ND0.11	ND	ND
Aroclor 1232	0.050	ND	ND0.054	ND	ND
Aroclor 1242	0.050	ND	0.26	ND	ND
Aroclor 1248	0.050	ND	ND0.054	ND	ND
Aroclor 1254	0.050	ND	ND0.054	ND	ND
Aroclor 1260	0.050	ND	ND0.054	ND	ND
Dechlorane Plus by 8080 (µg/L)					
Dechlorane plus	0.10	ND	ND	ND	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID:	*Detection Limits*	*OW653*	*OW650*	*Dup-1 (OW407C)*	*OW407C*
P.P. Metals (mg/L)					
Antimony	0.040	ND	ND0.0050	ND	ND
Arsenic	0.0040	ND	ND	ND	ND
Beryllium	0.0050	ND	ND	ND	ND
Cadmium	0.0070	ND	ND	ND	ND
Chromium	0.010	ND	ND	ND	0.016
Copper	0.010	ND	0.012	0.018	0.017
Lead	0.0030	ND	0.032	0.003	0.003
Mercury	0.00040	ND	0.0020	ND	ND
Nickel	0.020	ND	0.027	ND	ND
Selenium	0.0050	0.014	ND	0.01J	0.008J
Silver	0.010	ND	ND	ND	ND
Thallium	0.0050	ND	ND	ND	ND
Zinc	0.010	ND	0.11	0.018J	0.01J

Notes:

ND	Non-detect at or above the detection limit.
ND	Non-detect at or above x µg/L or mg/L.
J	Associated value is estimated.
R	Data was qualified as unusable. Values were outside linear calibration limits.

Key:

P.P.	Priority Pollutant
VOCs	Volatile Organic Compounds
BNAs	Base/Neutral Acid Extractables
PCBs	Polychlorinated Biphenyls
TCL	Target Compound List
RCRA	Resource Conservation and Recovery Act

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample I.D.:	*Detection Limits*	*FD-1*
TCL VOCs by 8240 (µg/L)		
Acetone	10	ND
Benzene	5	R
Bromodichloromethane	5	ND
Bromoform	5	ND
Bromomethane	10	ND
2-Butanone	10	ND
Carbon disulfide	5	ND
Carbon tetrachloride	5	ND
Chlorobenzene	5	R
Chloroethane	10	ND
Chloroform	5	ND
Chloromethane	10	ND
Dibromochloromethane	5	ND
1,1-Dichloroethane	5	ND
1,2-Dichloroethane	5	ND
1,1-Dichloroethene	5	ND
1,2-Dichloroethene	5	ND
1,2-Dichloropropane	5	ND
cis-1,3-Dichloropropene	5	ND
trans-1,3-Dichloropropene	5	ND
Ethyl benzene	5	ND
2-Hexanone	10	ND
Methylene chloride	5	ND
4-Methyl-2-pentanone	10	ND
Styrene	5	ND
1,1,2,2-Tetrachloroethane	5	ND
Tetrachloroethene	5	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample I.D.:	*Detection Limits*	*FD-1*
TCL VOCs by 8240 (µg/L) (cont.)		
Toluene	5	ND
1,1,1-Trichloroethane	5	ND
1,1,2-Trichloroethane	5	ND
Trichloroethene	5	ND
Vinyl acetate	10	ND
Vinyl chloride	10	ND
Total Xylenes	5	ND
TCL BNAs by 8270 (µg/L)		
Acenaphthene	10	ND
Acenaphthylene	10	ND
Anthrcaene	10	ND
Benzo(a)anthracene	10	ND
Benzo(b)fluoranthene	10	ND
Benzo(k)fluoranthene	10	ND
Benzo(g,h,i)perylene	10	ND
Benzo(a)pyrene	10	ND
Benzoic acid	50	ND
Benzyl alcohol	10	ND
Bis(2-chloroethoxy)methane	10	ND
Bis(2-chloroethyl)ether	10	ND
Bis(2-chloroisopropyl)ether	10	ND
Bis(2-ethylhexyl)phthalate	10	ND
4-Bromophenyl phenyl ether	10	ND
Butylbenzyl phthalate	10	ND
4-Chloroaniline	10	ND
4-Chloro-3-methylphenol	10	ND
2-Chloronahpthalene	10	ND
2-Chlorophenol	10	ND
4-Chlorodiphenylether	10	ND

TABLE 2
ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample I.D.:	*Detection Limits*	*FD-1*
TCL BNAs by 8270 (µg/L)		
Chrysene	10	ND
Dibenzo(a,h)anthracene	10	ND
Dibenzofuran	10	ND
Di-n-butyl phthalate	10	ND
1,2-Dichlorobenzene	10	10
1,3-Dichlorobenzene	10	29
1,4-Dichlorbenzene	10	28
3,3'-Dichlorobenzidine	20	ND
2,4-Dichlorophenol	10	ND
Diethyl phthalate	10	ND
2,4-Dimethylphenol	10	ND
Dimethyl phthalate	10	ND
4,6-Dinitro-2-methylphenol	50	ND
2,4-Dinitrophenol	50	ND
2,4-Dinitrotoluene	10	ND
2,6-Dinitrotoluene	10	ND
Di-n-octyl phthalate	10	ND
Fluoranthene	10	ND
Fluorene	10	ND
Hexachlorobenzene	10	ND
Hexachlorobutadiene	10	ND
Hexachlorocyclopentadiene	10	ND
Hexachloroethane	10	ND
Indeno(1,2,3-cd)pyrene	10	ND
Isophorone	10	ND
2-Methylnaphthalene	10	ND
2-Methylphenol	10	ND
4-Methylphenol	10	ND
Naphthalene	10	ND
2-Nitroaniline	50	ND
3-Nitroaniline	50	ND
4-Nitroaniline	50	ND
Nitrobenzene	10	ND
2-Nitrophenol	10	ND
4-Nitrophenol	50	ND
N-nitrosodiphenylamine	10	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample I.D.:	*Detection Limits*	*FD-1*
TCL BNAs by 8270 (µg/L) (Cont'd.)		
N-nitrosodi-n-propylamine	10	ND
Pentachlorophenol	50	ND
Phenanthrene	10	ND
Phenol	10	ND
Pyrene	10	ND
1,2,4-Trichlorobenzene	10	ND
2,4,5-Trichlorbenzene	50	ND
2,4,6-Trichlorophenol	10	ND
Dechlorane Plus by 8080 (µg/L)		
Dechlorane Plus	0.1	ND

TABLE 2

ANALYTICAL RESULTS SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample I.D.:	*Detection Limits*	*FD-1*
RCRA Metals (mg/L)		
Aluminum	0.1	ND
Arsenic	0.004	ND
Barium	0.02	0.03
Cadmium	0.007	ND
Chromium	0.01	ND
Copper	0.01	ND
Lead	0.003	ND
Mercury	0.0002	ND
Selenium	0.004	0.007
Silver	0.01	ND
Zinc	0.01	ND
Sulfate (mg/L)		
Sulfate	1.0	1800

Notes:

ND	Non-detect at or above the detection limit.
J	Associated value is estimated.
R	Data was qualified as unusable. Values were outside linear calibration limits.

Key:

P.P.	Priority Pollutant
VOCs	Volatile Organic Compounds
BNAs	Base/Neutral Acid Extractables
PCBs	Polychlorinated Biphenyls
TCL	Target Compound List
RCRA	Resource Conservation and Recovery Act

TABLE 3

SAMPLE HOLDING TIME SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID	*Analyses*	*Date Collected*	*Date Extracted*	*Date Analyzed (1)*	*Holding Time from Collection to Extraction (days)*	*Holding Time from Extraction to Analysis (days)*
OW653	P.P. VOCs	03/08/93		03/09/93		1
	P.P. BNAs	03/08/93	03/10/93	03/15/93	2	7
	P.P. Pest/PCBs	03/08/93	03/10/93	03/13/93	2	5
	Dechlorane Plus	03/08/93	03/10/93	03/11/93	2	3
	P.P. Metals	03/08/93		03/16/93		8
OW407C	P.P. VOCs	03/09/93		03/11/93		2
	P.P. BNAs	03/09/93	03/15/93	03/22/93	6	13
	P.P. Pest/PCBs	03/09/93	03/12/93	03/16/93	3	7
	Dechlorane Plus	03/09/93	03/15/93	03/17/93	6	8
	P.P. Metals	03/09/93		03/16/93		7
OW650	P.P. VOCs	03/09/93		03/11/93		2
	P.P. BNAs	03/09/93	03/15/93	03/22/93	6	13
	P.P. Pest/PCBs	03/09/93	03/12/93	03/16/93	3	7
	Dechlorane Plus	03/09/93	03/15/93	03/17/93	6	8
	P.P. Metals	03/09/93		03/16/93		7
FD-1	TCL VOCs	03/09/93		03/11/93		2
	TCL BNAs	03/09/93	03/15/93	03/22/93	6	13
	Dechlorane Plus	03/09/93	03/15/93	03/17/93	6	8
	RCRA Metals *	03/09/93		03/16/93		7
	Sulfate	03/09/93		03/17/93		8
Dup-1 (OW407C)	P.P. VOCs	03/09/93		03/11/93		2
	P.P. BNAs	03/09/93	03/15/93	03/22/93	6	13
	P.P. Pest/PCBs	03/09/93	03/12/93	03/17/93	3	8
	Dechlorane Plus	03/09/93	03/15/93	03/17/93	6	8
	P.P. Metals	03/09/93		03/16/93		7

Notes:
(1) Metals analysis were performed over several days. The latest analysis date is reported.
* RCRA metals plus aluminum, copper, lead, and zinc.

Key:
P.P. Priority Pollutant
VOC Volatile Organic Compound
BNA Base/Neutral Acid Extractable
TCL Target Compound List
RCRA Resource Conservation and Recovery Act

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. VOCs by 624	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Analyzed:		*03/09/93*	*03/11/93*
Lab I.D.:		*AR007467*	*AR007480*
Compound			
Acrolein	400	ND	ND
Acrylonitrile	400	ND	ND
Benzene	4.4	ND	ND
Bromodichloromethane	2.2	ND	ND
Bromoform	4.7	ND	ND
Bromomethane	10	ND	ND
Carbon tetrachloride	2.8	ND	ND
Chlorobenzene	6.0	ND	ND
Chloroethane	10	ND	ND
2-Chloroethylvinyl ether	10	ND	ND
Chloroform	1.6	ND	ND
Chloromethane	10	ND	ND
Dibromochloromethane	3.1	ND	ND
1,1,-Dichloroethane	4.7	ND	ND
1,2-Dichloroethane	2.8	ND	ND
1,1-Dichloroethene	2.8	ND	ND
1,2-Dichloroethene	1.6	ND	ND
1,2-Dichloropropane	6.0	ND	ND
cis-1,3-Dichloropropene	5.0	ND	ND
trans-1,3-Dichloropropene	5.0	ND	ND
Ethyl benzene	7.2	ND	ND
Methylene chloride	2.8	ND	ND
1,1,2,2-Tetrachloroethane	6.9	ND	ND
Tetrachloroethene	4.1	ND	ND
Toluene	6.0	ND	ND
1,1,1-Trichloroethane	3.8	ND	ND
1,1,2-Trichloroethane	5.0	ND	ND
Trichloroethene	1.9	ND	ND
Vinyl chloride	10	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. BNAs by 625	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*03/10/93*	*03/15/93*
Lab I.D.:		*AR007470*	*AR007481*
Compound/Analyte			
Acenaphthene	1.9	ND	ND
Acenaphthylene	3.5	ND	ND
Anthracene	1.9	ND	ND
Benzidine	44	ND	ND
Benzo(a)anthracene	7.8	ND	ND
Benzo(b)fluoranthene	4.8	ND	ND
Benzo(k)fluoranthene	2.5	ND	ND
Benzo(g,h,i)perylene	4.1	ND	ND
Benzo(a)pyrene	2.5	ND	ND
Bis(2-chloroethoxy)methane	5.3	ND	ND
Bis(2-chloroethyl)ether	5.7	ND	ND
Bis(2-chloroisopropyl)ether	5.7	ND	ND
Bis(2-ethylhexyl)phthalate	2.5	ND	ND
4-Bromophenyl phenyl ether	1.9	ND	ND
Butylbenzyl phthalate	2.5	ND	ND
4-Chloro-3-methylphenol	3.0	ND	ND
2-Chloronaphthalene	1.9	ND	ND
2-Chlorophenol	3.3	ND	ND
4-Chlorodiphenylether	4.2	ND	ND
Chrysene	2.5	ND	ND
Dibenzo(a,h)anthracene	2.5	ND	ND
1,3-Dichlorobenzene	1.9	ND	ND
1,2-Dichlorobenzene	1.9	ND	ND
1,4-Dichlorobenzene	4.4	ND	ND
3,3'-Dichlorobenzidine	16	ND	ND
2,4-Dichlorophenol	2.7	ND	ND
Diethyl phthalate	1.9	ND	ND
2,4-Dimethylphenol	2.7	ND	ND
Dimethyl phthalate	1.6	ND	ND
4,6-Dinitro-2-methylphenol	24	ND	ND
1,2-Diphenylhydrazine	10	ND	ND
2,4-Dinitrophenol	42	ND	ND
2,4-Dinitrotoluene	5.7	ND	ND
2,6-Dinitrotoluene	1.9	ND	ND
Di-n-butyl phthalate	2.5	ND	ND
Di-n-octyl phthalate	2.5	ND	ND
Fluoranthene	2.2	ND	ND
Fluorene	1.9	ND	ND
Hexachlorobenzene	1.9	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. BNAs by 625 (Cont'd.)	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*03/10/93*	*03/15/93*
Lab I.D.:		*AR007470*	*AR007481*
Compound/Analyte			
Hexachlorobutadiene	0.9	ND	ND
Hexachlorocyclopentadiene	1.0	ND	ND
Hexachloroethane	1.6	ND	ND
Indeno(1,2,3-cd)pyrene	3.7	ND	ND
Isophorone	2.2	ND	ND
Naphthalene	1.6	ND	ND
Nitrobenzene	1.9	ND	ND
2-Nitrophenol	3.6	ND	ND
4-Nitrophenol	2.4	ND	ND
N-nitrosodimethylamine	2.2	ND	ND
N-nitrosodi-n-propylamine	3.3	ND	ND
N-nitrosodiphenylamine	1.9	ND	ND
Pentachlorophenol	3.6	ND	ND
Phenanthrene	5.4	ND	ND
Phenol	1.5	ND	ND
Pyrene	1.9	ND	ND
1,2,4-Trichlorobenzene	1.9	ND	ND
2,4,6-Trichlorophenol	2.7	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. Pesticides/PCBs by 608	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*03/10/93*	*03/12/93*
Lab I.D.:		*AR007472*	*AR007483*
Compound/Analyte			
Aldrin	0.005	ND	ND
alpha-BHC	0.005	ND	ND
beta-BHC	0.005	ND	ND
gamma-BHC	0.005	ND	0.002J
delta-BHC	0.005	ND	ND
Chlordane	0.050	ND	ND
4,4'-DDD	0.010	ND	ND
4,4'-DDE	0.010	ND	ND
4,4'-DDT	0.010	ND	0.006J
Dieldrin	0.010	ND	0.007J
Endosulfan I	0.010	ND	ND
Endosulfan II	0.010	ND	ND
Endosulfan sulfate	0.010	ND	ND
Endrin	0.010	ND	0.008J
Endrin aldehyde	0.010	ND	ND
Heptachlor	0.005	ND	0.001J
Heptachlor epoxide	0.005	ND	ND
Toxaphene	0.10	ND	ND
Aroclor 1016	0.050	ND	ND
Aroclor 1221	0.10	ND	ND
Aroclor 1232	0.050	ND	ND
Aroclor 1242	0.050	ND	ND
Aroclor 1248	0.050	ND	ND
Aroclor 1254	0.050	ND	ND
Aroclor 1260	0.050	ND	ND

Dechlorane Plus by 8080	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*03/10/93*	*03/15/93*
Lab I.D.:		*AR007471*	*AR007482*
Compound/Analyte			
Dechlorane plus	0.10	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. Metals	*Detection Limit (mg/L)*	*Blank Conc. (mg/L)*	*Blank Conc. (mg/L)*
Mercury Digestion Date:		*03/15/93*	*03/15/93*
Remaining Metals Digestion Date:		*03/11/93*	*03/12/93*
Lab I.D.:		*AR007474*	*AR007484*
Analyte			
Antimony	0.04	ND	ND
Arsenic	0.004	ND	ND
Beryllium	0.005	ND	ND
Cadmium	0.007	ND	ND
Chromium	0.01	ND	ND
Copper	0.01	ND	ND
Lead	0.003	ND	ND
Mercury	0.0004	ND	ND
Nickel	0.02	ND	ND
Selenium	0.004	ND	ND
Silver	0.01	ND	ND
Thallium	0.005	ND	ND
Zinc	0.01	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

TCL VOCs by 8240	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Analyzed:		*03/11/93*	*03/11/93*
Lab I.D.:		*AR007480*	*AR007439*
Compound			
Acetone	10	ND	ND
Benzene	5	ND	ND
Bromodichloromethane	5	ND	ND
Bromoform	5	ND	ND
Bromomethane	10	ND	ND
2-Butanone	10	ND	ND
Carbon disulfide	5	ND	ND
Carbon tetrachloride	5	ND	ND
Chlorobenzene	5	ND	ND
Chloroethane	10	ND	ND
Chloroform	5	ND	ND
Chloromethane	10	ND	ND
Dibromochloromethane	5	ND	ND
1,1-Dichloroethane	5	ND	ND
1,2-Dichloroethane	5	ND	ND
1,1-Dichloroethene	5	ND	ND
1,2-Dichloroethene	5	ND	ND
1,2-Dichloropropane	5	ND	ND
cis-1,3-Dichloropropene	5	ND	ND
trans-1,3-Dichloropropene	5	ND	ND
Ethyl benzene	5	ND	ND
2-Hexanone	10	ND	ND
Methylene chloride	5	ND	ND
4-Methyl-2-pentanone	10	ND	ND
Styrene	5	ND	ND
1,1,2,2-Tetrachloroethane	5	ND	ND
Tetrachloroethene	5	ND	ND
Toluene	5	ND	ND
1,1,1-Trichloroethane	5	ND	ND
1,1,2-Trichloroethane	5	ND	ND
Trichloroethene	5	ND	ND
Vinyl acetate	10	ND	ND
Vinyl chloride	10	ND	ND
Total Xylenes	5	ND	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

TCL BNAs by 8270	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*
Date Analyzed:		*03/15/93*
Lab I.D.:		*AR007481*
Compound		
Acenaphthene	10	ND
Acenaphthylene	10	ND
Anthracene	10	ND
Benzo(a)anthracene	10	ND
Benzo(b)fluoranthene	10	ND
Benzo(k)fluoranthene	10	ND
Benzo(g,h,i)perylene	10	ND
Benzo(a)pyrene	10	ND
Benzoic acid	50	ND
Benzyl alcohol	10	ND
Bis(2-chloroethoxy)methane	10	ND
Bis(2-chloroethyl)ether	10	ND
Bis(2-chloroisopropyl)ether	10	ND
Bis(2-ethylhexyl)phthalate	10	ND
4-Bromophenyl phenyl ether	10	ND
Butylbenzyl phthalate	10	ND
4-Chloroaniline	10	ND
4-Chloro-3-methylphenol	10	ND
2-Chloronaphthalene	10	ND
2-Chlorophenol	10	ND
4-Chlorodiphenylether	10	ND
Chrysene	10	ND
Dibenzo(a,h)anthracene	10	ND
Dibenzofuran	10	ND
Di-n-butyl phthalate	10	ND
1,2-Dichlorobenzene	10	ND
1,3-Dichlorobenzene	10	ND
1,4-Dichlorobenzene	10	ND
3,3'-Dichlorobenzidine	20	ND
2,4-Dichlorophenol	10	ND
Diethyl phthalate	10	ND
2,4-Dimethylphenol	10	ND
Dimethyl phthalate	10	ND
4,6-Dinitro-2-methylphenol	50	ND
2,4-Dinitrophenol	50	ND
2,4-Dinitrotoluene	10	ND
2,6-Dinitrotoluene	10	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

TCL BNAs by 8270 (cont.)	*Detection Limit (µg/L)*	*Blank Conc. (µg/L)*
Date Analyzed:		*03/15/93*
Lab I.D.:		*AR007481*
Compound		
Di-n-octyl phthalate	10	ND
Fluoranthene	10	ND
Fluorene	10	ND
Hexachlorobenzene	10	ND
Hexachlorobutadiene	10	ND
Hexachlorocyclopentadiene	10	ND
Hexachloroethane	10	ND
Indeno(1,2,3-cd)pyrene	10	ND
Isophorone	10	ND
2-Methylnaphthalene	10	ND
2-Methylphenol	10	ND
4-Methylphenol	10	ND
Naphthalene	10	ND
2-Nitroaniline	50	ND
3-Nitroaniline	50	ND
4-Nitroaniline	50	ND
Nitrobenzene	10	ND
2-Nitrophenol	10	ND
4-Nitrophenol	50	ND
N-nitrosodiphenylamine	10	ND
N-nitrosodi-n-propylamine	10	ND
Pentachlorophenol	50	ND
Phenanthrene	10	ND
Phenol	10	ND
Pyrene	10	ND
1,2,4-Trichlorobenzene	10	ND
2,4,5-Trichlorophenol	50	ND
2,4,6-Trichlorophenol	10	ND

TABLE 4

METHOD BLANK DATA SUMMARY
AMERICAN REF-FUEL RRF
MARCH 1993

RCRA Metals	*Detection Limit (mg/L)*	*Blank Conc. (mg/L)*
Mercury Digestion Date:		*03/15/93*
Remaining Metals Digestion Date:		*03/11/93*
Lab I.D.:		*AR007445*
Analyte		
Aluminum	0.1	ND
Arsenic	0.004	ND
Barium	0.02	ND
Cadmium	0.007	ND
Chromium	0.01	ND
Copper	0.01	ND
Lead	0.003	ND
Mercury	0.0002	ND
Nickel	0.02	ND
Selenium	0.004	ND
Silver	0.01	ND
Zinc	0.01	ND

Wet Chemistry Parameters	*Detection Limit (mg/L)*	*Blank Conc. (mg/L)*	*Blank Conc. (mg/L)*
Date Analyzed:		*03/17/93*	*03/17/93*
Lab I.D.:		*AR007475*	*AR007485*
Compound/Analyte			
Sulfate	1.0	ND	ND

Notes:
ND Non-detect at or above the detection limit.

Key:
P.P. Priority Pollutant
VOC Volatile Organic Compound
BNA Base/Neutral Acid Extractable
PCB Polychlorinated Biphenyl
TCL Target Compound List
RCRA Resource Conservation and Recovery Act

TABLE 5

SURROGATE PERCENT RECOVERIES
AMERICAN REF-FUEL RRF
MARCH 1993

VOCs Sample ID	*Toluene-d8*	*Bromofluorobenzene*	*1,2,-Dichloroethane-d4*
OW653	91	85 *	99
OW407C	84 *	86	100
OW650	101	101	102
FD-1	113 *	121 *	105
Dup-1	87 *	87	104

BNAs Sample ID	*Nitrobenzene-D5*	*2-Fluorobiphenyl*	*Terphenyl-D14*	*Phenol-D5*	*2-Fluorophenol*	*2,4,6-Tribromophenol*
OW653	82	77	93	45	65	97
OW407C	59	56	81	36	56	89
OW650	81	78	65	34	55	67
FD-1	63	59	76	33	57	85
Dup-1	59	57	78	29	52	78

Pesticide/PCBs Sample ID	*Dibutylchlorendate*
OW653	81
OW407C	68
OW650	60
Dup-1	66

Notes:

* Surrogate recovery outside of method control limits.

Key:

VOC Volatile Organic Compound
BNA Base/Neutral Acid Extractable

TABLE 6

QUALIFIED DATA DUE TO OUTLYING VOC SURROGATE RECOVERIES
AMERICAN REF-FUEL RRF
MARCH 1993

Sample ID	*Surrogate*	*Surrogate Recovery (Percent)*	*Control Limits (Percent)*	*Qualifier (1)*
OW407C	Toluene d8	84	88-110	J
Dup-1	Toluene d8	87	88-110	J
OW653	Bromofluorobenzene	85	86-115	J

Notes:

(1) Qualifier applied to all positive VOC results for the associated samples.

J Estimated at the associated value.

Key:

VOC Volatile Organic Compound

TABLE 7

INTERNAL STANDARD PERCENT RECOVERIES
AMERICAN REF-FUEL RRF
MARCH 1993

VOCs *Sample ID*	*Bromochloromethane*	*1,4-Difluorobenzene*	*Chlorobenzene-D5*
OW653	99	104	118
OW407C	88	88	102
OW650	95	96	93
FD-1	84	85	74
Dup-1	89	91	103

BNAs *Sample ID*	*Phenanthrene-D10*	*Chrysene-D12*	*Perylene-D12*	*1,4-Dichlorobenzene-D4*	*Naphthalene-D8*	*Acenaphthene-D10*
OW653	94	84	75	83	83	92
OW407C	119	107	107	115	105	117
OW650	123	97	94	123	110	121
FD-1	127	100	100	120	112	129
Dup-1	131	108	106	139	119	129

Key:
VOC Volatile Organic Compound
BNA Base/Neutral Acid Extractable

TABLE 8

LABORATORY CONTROL SAMPLE ANALYSIS RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

Parameter	*Analysis Date*	*Percent Recovery*
Sulfate	3/17/93	110
Sulfate	3/17/93	115
Sulfate	3/17/93	110

TABLE 9 .

TRIP BLANK RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

TCL VOCs by 8240	*Detection Limit (µg/L)*	*Trip Blank Conc. (µg/L) Sampled 03/08/93*
Compounds		
Acetone	10	ND
Benzene	5	ND
Bromodichloromethane	5	ND
Bromoform	5	ND
Bromomethane	10	ND
2-Butanone	10	ND
Carbon disulfide	5	ND
Carbon tetrachloride	5	ND
Chlorobenzene	5	ND
Chloroethane	10	ND
Chloroform	5	ND
Chloromethane	10	ND
Dibromochloromethane	5	ND
1,1-Dichloroethane	5	ND
1,2-Dichloroethane	5	ND
1,1-Dichloroethene	5	ND
1,2-Dichloroethene	5	ND
1,2-Dichloropropane	5	ND
cis-1,3-Dichloropropene	5	ND
trans-1,3-Dichloropropene	5	ND
Ethyl benzene	5	ND
2-Hexanone	10	ND
Methylene chloride	5	ND
4-Methyl-2-pentanone	10	ND
Styrene	5	ND
1,1,2,2-Tetrachloroethane	5	ND
Tetrachloroethene	5	ND
Toluene	5	ND
1,1,1-Trichloroethane	5	ND
1,1,2-Trichloroethane	5	ND
Trichloroethene	5	ND
Vinyl acetate	10	ND
Vinyl chloride	10	ND
Total xylenes	5	ND

Notes:
ND Non-detect at or above the detection limit.

Key:
TCL Target Compound List
VOC Volatile Organic Compound

TABLE 10

FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. VOCs by 624	*Detection Limit*	*OW407C*	*Dup-1*	*RPD*
Compounds	*(µg/L)*	*(µg/L)*	*(µg/L)*	
Acrolein	400	ND	ND	*
Acrylonitrile	400	ND	ND	*
Benzene	4.4	48	48	0
Bromodichloromethane	2.2	ND	ND	*
Bromoform	4.7	ND	ND	*
Bromomethane	10	ND	ND	*
Carbon tetrachloride	2.8	ND	ND	*
Chlorobenzene	6	130	130	0
Chloroethane	10	ND	ND	*
2-Chloroethylvinyl ether	10	ND	ND	*
Chloroform	1.6	ND	ND	*
Chloromethane	10	ND	ND	*
Dibromochloromethane	3.1	ND	ND	*
1,1,-Dichloroethane	4.7	ND	ND	*
1,2-Dichloroethane	2.8	ND	ND	*
1,1-Dichloroethene	2.8	ND	ND	*
1,2-Dichloroethene	1.6	51	54	6
1,2-Dichloropropane	6	ND	ND	*
cis-1,3-Dichloropropene	5	ND	ND	*
trans-1,3-Dichloropropene	5	ND	ND	*
Ethyl benzene	7.2	ND	ND	*
Methylene chloride	2.8	ND	ND	*
1,1,2,2-Tetrachloroethane	6.9	ND	ND	*
Tetrachloroethene	4.1	ND	ND	*
Toluene	6	ND	ND	*
1,1,1-Trichloroethane	3.8	ND	ND	*
1,1,2-Trichloroethane	5	ND	ND	*
Trichloroethene	1.9	ND	2.6	*
Vinyl chloride	10	130	130	0

TABLE 10

FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. BNAs by 625	*Detection Limit*	*OW407C*	*Dup-1*	*RPD*
Compounds	*(µg/L)*	*(µg/L)*	*(µg/L)*	
Acenaphthene	1.9	ND	ND	*
Acenaphthylene	3.5	ND	ND	*
Anthrcaene	1.9	ND	ND	*
Benzidine	44	ND	ND	*
Benzo(a)anthracene	7.8	ND	ND	*
Benzo(b)fluoranthene	4.8	ND	ND	*
Benzo(k)fluoranthene	2.5	ND	ND	*
Benzo(g,h,i)perylene	4.1	ND	ND	*
Benzo(a)pyrene	2.5	ND	ND	*
Bis(2-chloroethoxy)methane	5.3	ND	ND	*
Bis(2-chloroethyl)ether	5.7	ND	ND	*
Bis(2-chloroisopropyl)ether	5.7	ND	ND	*
Bis(2-ethylhexyl)phthalate	2.5	ND	ND	*
4-Bromophenyl phenyl ether	1.9	ND	ND	*
Butylbenzyl phthalate	2.5	ND	ND	*
4-Chloro-3-methylphenol	3	ND	ND	*
2-Chloronaphthalene	1.9	ND	ND	*
2-Chlorophenol	3.3	ND	ND	*
4-Chlorodiphenylether	4.2	ND	ND	*
Chrysene	2.5	ND	ND	*
Dibenzo(a,h)anthracene	2.5	ND	ND	*
1,3-Dichlorobenzene	1.9	7.4	ND	*
1,2-Dichlorobenzene	1.9	5.9	ND	*
1,4-Dichlorobenzene	4.4	7	ND	*
3,3'-Dichlorobenzidine	16	ND	ND	*
2,4-Dichlorophenol	2.7	ND	ND	*
Diethyl phthalate	1.9	ND	ND	*
2,4-Dimethylphenol	2.7	ND	ND	*
Dimethyl phthalate	1.6	ND	ND	*
4,6-Dinitro-2-methylphenol	24	ND	ND	*
1,2-Diphenylhydrazine	10	ND	ND	*
2,4-Dinitrophenol	42	ND	ND	*
2,4-Dinitrotoluene	5.7	ND	ND	*
2,6-Dinitrotoluene	1.9	ND	ND	*
Di-n-butyl phthalate	2.5	ND	ND	*
Di-n-octyl phthalate	2.5	ND	ND	*
Fluoranthene	2.2	ND	ND	*

TABLE 10
FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. BNAs by 625 (cont.) *Compounds*	*Detection Limit (µg/L)*	*OW407C (µg/L)*	*Dup-1 (µg/L)*	*RPD*
Fluorene	1.9	ND	ND	*
Hexachlorobenzene	1.9	ND	ND	*
Hexachlorobutadiene	0.9	ND	ND	*
Hexachlorocyclopentadiene	1	ND	ND	*
Hexachloroethane	1.6	ND	ND	*
Indeno(1,2,3-cd)pyrene	3.7	ND	ND	*
Isophorone	2.2	ND	ND	*
Naphthalene	1.6	ND	ND	*
Nitrobenzene	1.9	ND	ND	*
2-Nitrophenol	3.6	ND	ND	*
4-Nitrophenol	2.4	ND	ND	*
N-nitrosodimethylamine	2.2	ND	ND	*
N-nitrosodi-n-propylamine	3.3	ND	ND	*
N-nitrosodiphenylamine	1.9	ND	ND	*
Pentachlorophenol	3.6	ND	ND	*
Phenanthrene	5.4	ND	ND	*
Phenol	1.5	ND	ND	*
Pyrene	1.9	ND	ND	*
1,2,4-Trichlorobenzene	1.9	ND	ND	*
2,4,6-Trichlorophenol	2.7	ND	ND	*

P.P. Pest/PCBs by 608 *Compounds*	*Detection Limit (µg/L)*	*OW407C (µg/L)*	*Dup-1 (µg/L)*	*RPD*
Aldrin	0.005	ND	0.015	*
alpha-BHC	0.005	0.034	ND	*
beta-BHC	0.005	ND	ND	*
gamma-BHC	0.005	ND	ND	*
delta-BHC	0.005	ND	ND	*
Chlordane	0.05	ND	ND	*
4,4'-DDD	0.01	ND	ND	*
4,4'-DDE	0.01	ND	ND	*
4,4'-DDT	0.01	ND	ND	*
Dieldrin	0.01	ND	ND	*
Endosulfan I	0.01	ND	ND	*

TABLE 10

FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. Pest/PCBs by 608 (cont.) *Compounds*	*Detection Limit (µg/L)*	*OW407C (µg/L)*	*Dup-1 (µg/L)*	*RPD*
Endosulfan II	0.01	ND	ND	*
Endosulfan sulfate	0.01	ND	ND	*
Endrin	0.01	ND	ND	*
Endrin aldehyde	0.01	ND	ND	*
Heptachlor	0.005	ND	ND	*
Heptachlor epoxide	0.005	ND	ND	*
Toxaphene	0.1	ND	ND	*
Aroclor 1016	0.05	ND	ND	*
Aroclor 1221	0.1	ND	ND	*
Aroclor 1232	0.05	ND	ND	*
Aroclor 1242	0.05	ND	ND	*
Aroclor 1248	0.05	ND	ND	*
Aroclor 1254	0.05	ND	ND	*
Aroclor 1260	0.05	ND	ND	*

Dechlorane Plus *Analytes*	*Detection Limit (µg/L)*	*OW407C (µg/L)*	*Dup-1 (µg/L)*	*RPD*
Dechlorane Plus	0.10	ND	ND	*

TABLE 10

FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

P.P. Metals Analytes	*Detection Limit (mg/L)*	*OW407C (mg/L)*	*Dup-1 (mg/L)*	*RPD*
Antimony	0.04	ND	ND	*
Arsenic	0.004	ND	ND	*
Beryllium	0.005	ND	ND	*
Cadmium	0.007	ND	ND	*
Chromium	0.01	0.016	ND	*
Copper	0.01	0.017	0.018	6
Lead	0.003	0.003	0.003	0
Mercury	0.0002	ND	ND	*
Nickel	0.02	ND	ND	*
Selenium	0.005	0.008	0.01	22**
Silver	0.01	ND	ND	*
Thallium	0.005	ND	ND	*
Zinc	0.01	0.01	0.018	57**

Notes:

* RPD value could not be calculated due to one or more non-detect results.

** RPD value above acceptable limit of 20 percent.

ND Non-detect at or above the detection limit.

Key:

RPD Relative Percent Difference

TABLE 11

QUALIFIED DATA DUE TO VARIABILITY IN FIELD DUPLICATE RESULTS
AMERICAN REF-FUEL RRF
MARCH 1993

Parameter	*Compound*	*OW407C Conc. (mg/L)*	*Dup-1 Conc. (mg/L)*	*RPD*	*Qualifier (1)*
Metals	Selenium	0.008	0.01	22	J
	Zinc	0.01	0.018	57	J

Notes:

J Associated value is estimated.

(1) Qualifier is applied to both original and duplicate results.

APPENDIX F

DATA VALIDATION

- OSI PROGRAM - PHASE 2 - ROUND 1
- OSI PROGRAM - PHASE 2 - ROUND 2

DATA VALIDATION
OCCIDENTAL CHEMICAL CORPORATION
OFF-SITE INVESTIGATION (OSI)

Niagara Falls, New York

NOVEMBER 1993

REF. NO. 2583 (DataVal-1)

This report is printed on recycled paper.

CONESTOGA-ROVERS & ASSOCIATES

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1.0 EXECUTIVE SUMMARY

Twenty-two (22) groundwater samples (including one field duplicate and one rinsate blank) were collected in May 1993, for the Occidental Chemical Corporation (OxyChem) Off-Site Investigation (OSI) in Niagara Falls, New York. The samples were analyzed for benzene, general organics[1] , HPLC parameters, total soluble phosphorous, total organic carbon (TOC), total organic halides (TOX), and various metals.

Benzene

All but two of the benzene results reported were acceptable without qualification. Most samples contained less than 30 µg/L of benzene. Samples OW658C, OW658D and OW659B contained levels of benzene ranging from 840 to 1200 µg/L.

General Organic Parameters

Most sample results were acceptable without qualification. A few positive sample results reported for trichloroethene, tetrachloroethene and 1,2,4-trichlorobenzene were qualified as estimated due to outlying quality control results.

Samples were reported to contain chlorotoluenes, chlorobenzene, dichlorobenzenes, chlorobenzotrifluorides, trichloroethylene, and tetrachloroethylene. The highest concentrations of general organic compounds were observed in samples OW658C, OW658D and OW659B.

HPLC Parameters

All quality control data were acceptable, indicating good accuracy and precision were achieved during sample analysis. All sample results were non-detect.

---

1 General Organic and HLPC parameters are listed in Table 2.

Total Soluble Phosphorus

All quality control data were acceptable, indicating good accuracy and precision were achieved during sample analysis. Some phosphorous was detected in samples OW652B, OW653B, OTW653C, OW653D, OW657B, OW657D and OW659D.

TOC

TOC results were not available for sample OW653B as it was received broken at the laboratory. Due to some variability in the Quality Assurance/Quality Control (QA/QC) data, all sample results were qualified as estimated. Positive TOC results ranged from 3 to 18 mg/L.

TOX

Upon review of the TOX data, several deficiencies in the execution of the method were observed. The most critical of these deficiencies was that column breakthrough exceeded the 10 percent limit established in Method 450.1. Due to the uncertainty of the resulting data, all TOX results were qualified as unusable (R).

The deficiencies have been addressed by the laboratory and corrective measures are being implemented to ensure the quality of future TOX analysis.

Metals Analysis

All quality control data provided for arsenic, lead and mercury analyses were acceptable indicating good accuracy and precision were achieved.

All arsenic results were non-detect. Mercury concentrations ranging from 0.7 to 3.1 µg/L were observed in samples

OW650D, OW652D and OW659B. Lead results ranging from 35 to 150 µg/L were reported for samples OW660, OW659D, BH11D-92 and MW-1.

2.0 GENERAL

Analytical services for Occidental Chemical Corporation (OxyChem) were provided by Recra Environmental Incorporated (Recra), Wadsworth/Alert Laboratories (WAL), OxyChem Technology Center - Central Sciences and the OxyChem Niagara Plant Works Laboratory.

Twenty-two (22) groundwater samples (including one field duplicate and one rinsate blank) were collected in May 1993 for the OSI. A sample key is presented in Table 1. The samples were submitted to the above laboratories for the following analyses:

Parameter	*Analytical Method*
Benzene	USEPA SW-846 Method 8020
General Organics[1]	Occidental Chemical Corporation Microextraction Method
HPLC Parameters[1]	Modified Solvent Exchange Method
Total Soluble Phosphorous	40 CFR Part 136 Method 365.2
Total Organic Carbon (TOC)	USEPA SW-846 Method 9060
Total Organic Halides (TOX)	USEPA Method 450.1 (Modified)
Arsenic and Lead	USEPA Method 200.7
Mercury	USEPA SW-846 Method 7470

The above methods are referenced from sources as detailed in "Appendix C - Chemical Sampling and Quality Assurance Plan, Niagara Plant Supplemental Data Collection Program", May 9, 1988 hereinafter referred to as the "QAP".

A summary of the analytical results is presented in Table 3. The Quality Assurance/Quality Control (QA/QC) criteria by which these data have been assessed are outlined in the QAP.

---

1 General Organic and HPLC Parameters are listed in Table 2.

3.0 HOLDING TIMES

Sample holding times as specified in the relevant methods and the "QAP" are summarized in Table 4. Adherence to these holding time criteria was evaluated by comparison of collection and extraction (and/or analysis) dates obtained from the Chain of Custody forms and final analytical reports respectively. A summary of all sample holding times is attached as Table 5.

Benzene analysis was performed on samples OW653B and OW653D outside of the seven day holding time sited in both the "QAP" and Method 8020. In general, holding time exceedances tend to demonstrate a low bias in results due to the potential loss of the analyte of concern. The associated benzene results were therefore qualified as estimated (see Table 6).

Samples analyzed for arsenic and lead were in exceedance of the 28 day holding time cited in the "QAP". Since these samples were analyzed within the 6 month holding time specified in EPA Method 200.7, however, the data were not qualified.

4.0 SAMPLE PRESERVATION

Upon review of the field log notebooks and sample Chain of Custody forms, it was determined that all samples were properly preserved after collection. All samples were received by the laboratory at 4°C (±2°C), indicating proper storage of samples during shipment.

5.0 METHOD BLANK ANALYSES

The purpose of assessing the results of laboratory blank analyses is to determine the existence and magnitude of contamination introduced during analysis. Laboratory blanks were analyzed at a minimum frequency of one per 20 investigative samples and/or one per analytical sequence. A summary of the method blank analyses data is presented in Table 7.

TOC values ranging from 1 to 2 mg/L were reported for three of the six blanks analyzed. All sample concentrations less than five times the associated blank concentration were qualified as non-detect, as these results are probably a reflection of laboratory contamination (see Table 8). Blank analyses for all other parameters yielded non-detect results, indicating that laboratory contamination was not a factor for these analyses.

6.0 SURROGATE SPIKE RECOVERIES

In accordance with Method 8020, all samples and blanks analyzed for benzene are spiked with surrogate prior to analysis. Surrogate recoveries provide a means to evaluate the effects of individual sample matrices on analytical efficiency. Control limits for acceptable surrogate recoveries are specified in the "QAP" as 50 to 120 percent.

The surrogate compound employed for VOC analysis was alpha, alpha, alpha-trifluorotoluene, and a summary of the surrogate recoveries is presented in Table 9. Surrogate recoveries could not be reported for samples OW652C, OW652D, OW657B, OW657C and OW657D due to sample matrix interferences. Thus, analytical efficiency could not be evaluated for these sample on the basis of surrogate recoveries.

Benzene analysis of samples OW658B and PASNY139 yielded no surrogate recoveries which indicate a severe problem with analytical efficiency, possibly due to sample matrix effects. Benzene results reported for these two samples were qualified as estimated (qualifier "J") and are summarized below:

Sample I. D.	*Analyte* ($\mu g/L$)	*Qualified Sample Conc.* ($\mu g/L$)
OW658B	Benzene	10J
PASNY139	Benzene	5J

Outlying (high) surrogate recoveries were reported for samples OW652B and MW-1. Potentially, this could indicate a high bias on all positive VOC data for these samples. Since benzene was reported as ND for both samples, however, qualification of the data was not necessary.

The analysis of all remaining samples yielded surrogate spike recoveries within the contract control limits. Laboratory performance was deemed acceptable on an individual sample basis, with the exceptions noted above.

7.0 BLANK SPIKE ANALYSES

Blank spikes are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects. Blank spike analyses are performed at a minimum frequency of one per 20 investigative samples, or one per analytical batch. Control limits for acceptable spike recoveries are specified in the "QAP" as 60 to 100 percent, however, recoveries up to 120 percent were considered acceptable.

Blank spikes were reported for the analyses of general organic and HPLC parameters, and a summary of the results is presented in Table 10. Some of the spike recoveries reported for various general organic compounds were outside of the control limits on the low side. This could indicate either a low bias in the calibration of the instrument or an inefficiency in the extraction of these compounds during preparation. Further review of associated reference standard and matrix spike recovery data was necessary to accurately assess the cause of these low recoveries, and is detailed in the following paragraphs.

The blank spike extracted on May 11, 1993 and analyzed on May 12, 1993 yielded low recoveries for trichloroethylene, tetrachloroethylene, 2-chlorobenzotrifluoride, 3,4-dichlorobenzotrifluoride and 2,4-dichlorobenzotrifluoride. The reference standard analyzed on May 12, 1993 yielded acceptable recoveries for all of the above compounds except for 1,2,4-trichlorobenzene which was below the control limits at 58 percent. The calibration of the instrument was therefore acceptable with the one exception. The analysis of the matrix spike and matrix spike duplicate samples extracted on May 11, 1993 yielded low recoveries for all of the above compounds. On this basis, it was concluded that there was inefficiency in the extractions performed on May 11, 1993 and all associated sample results for these compounds were qualified as estimated (see Table 11). Because the blank spike recoveries were only slightly outside of the control limits, however, ND values were deemed acceptable for the intended use of the data without qualification.

The blank spike extracted on May 12, 1993 and analyzed on May 13, 1993 yielded a low recovery for hexachlorocylcopentadiene. The reference standard analyzed on May 13, 1993 yielded an acceptable recovery for this compound indicating acceptable instrument calibration. The matrix spike and matrix spike duplicate samples extracted on May 12, 1993 both yielded acceptable recoveries for this compound indicating acceptable extraction efficiency. As the blank spike result appears to be anomalous, qualification of the data was not deemed necessary.

All other blank spike analyses for both general organic and HPLC parameters were within the control limits, indicating acceptable analytical efficiency was achieved.

8.0 REFERENCE STANDARD ANALYSES

In order to evaluate the accuracy of instrument calibration, reference standards are obtained from an independent source and analyzed. Reference standard analysis is performed at a minimum frequency of one per 20 investigative samples, or one per analytical batch. Reference standards were analyzed for general organics, arsenic and lead, and TOC analyses and the results are summarized in Table 12.

Control limits specified in the "QAP" for the analysis of general organics reference standards were 60 to 100 percent. Again, recoveries up to 120 percent were deemed acceptable. All reference standards recoveries were within these limits except for the reference standard analyzed on May 12, 1993 for general organic compounds. As previously stated, the recovery for 1,2,4-trichlorobenzene was below the control limits indicating a possible problem with instrument calibration. Positive results reported for this compound in all samples analyzed on May 12, 1993 were qualified as estimated (see Table 13). Because the reference standard recovery was only slightly outside the control limits, ND values were deemed acceptable for the intended use of the data without qualification.

The recovery for hexachlorobenzene was 121 percent which is above the upper control limit of 120 percent. Since all sample results for this compound were non-detect, however, qualification of the data was not necessary.

All reference standard analyses for TOC, arsenic and lead yielded recoveries within generally acceptable limits of 80 to 120 percent. Thus acceptable instrument calibration was achieved for these analyses.

9.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSES

The recoveries of MS/MSD analyses are used to assess the analytical accuracy achieved on individual sample matrices. The relative percent difference (RPD) values between the MS and MSD results are used to assess analytical precision. MS/MSD analyses were performed at a minimum frequency of one per 20 investigative samples for benzene, general organic and HPLC parameters. MS/MSD recoveries and RPDs are summarized in Table 14. As established in the "QAP", control limits for percent recovery were 60 to 100 percent (although, for data validation purposes, an upper control limit of 120 percent was employed) and a maximum RPD value of 20 percent was considered acceptable.

All MS/MSD recoveries and RPD values reported for the HPLC and benzene analyses were acceptable based on the criteria stated above. On this basis, analytical accuracy and precision were deemed acceptable for these analyses. Various MS/MSD results reported for the general organics analysis, however, were outlying as detailed in the following paragraphs.

Due to high trichloroethylene content in the samples, MS/MSD recoveries could not be reported for sample OW657C and PASNY139. Accuracy and precision of the trichloroethylene analyses performed on these samples could not be evaluated.

For sample OW657C, the MSD recoveries reported for tetrachloroethylene, 2-chlorobenzotrifluoride and 2,4-dichlorobenzotrifluoride were below the control limits. Since the recoveries reported for these compounds in the MS were acceptable, however, qualification of the data was not deemed necessary. Due to the low tetrachloroethylene recovery reported for the MSD, the resulting RPD was 43 percent. Analytical precision for this compound was not qualified on this basis alone, due to the possibility that the MSD recovery was in error, but overall analytical precision was further assessed in the evaluation of field duplicate samples (see Section 12.2).

Analysis of both the MS and MSD for sample PASNY139 yielded low recoveries for tetrachloroethylene. The tetrachloroethylene result reported for this sample was therefore qualified as estimated due to a potential low bias.

As previously noted in Section 6.0, analysis of the MS and MSD for sample OW652B yielded low recoveries for several compounds. All associated sample data were previously qualified as estimated.

Analysis of the MS for sample OW658B yielded a low recovery for Mirex. Since the MSD recovery reported for this compound was acceptable, however, qualification of the data was not necessary. The RPD reported for 1,2,4,5-tetrachlorobenzene was 25 percent, which is above the limit of 20 percent established in the "QAP". Since all other RPD values reported for this compound were within the control limits, sample data were not qualified on the basis of this outlying RPD. Overall analytical precision was further assessed in the evaluation of field duplicate samples (see Section 12.2).

10.0 MATRIX SPIKE (MS) ANALYSES

The recoveries of MS analyses are used to assess the analytical accuracy achieved on individual sample matrices. Matrix spikes were performed at a minimum frequency of one per 20 investigative samples for metals, phosphorous, and TOC analyses. Recoveries are summarized in Table 15.

All MS recoveries were evaluated against control limits of 75-125 percent. All recoveries were acceptable and thus analytical accuracy was deemed acceptable for these parameters.

11.0 DUPLICATE SAMPLE ANALYSES

In order to assess laboratory precision, duplicate samples are prepared and analyzed by the laboratory. Analytical precision is deemed acceptable if resulting RPD values are less than 20 percent for sample values greater than five times the contract required detection limits (CRDLs). For sample results less than five times the CRDL, a control limit of plus or minus two times the CRDL is employed.

For this study, duplicate phosphorous and mercury analyses were performed on samples PASNY139 and OW657, and duplicate arsenic and lead analyses were performed on samples OW657, OW658 and OW653C. A summary of the analytical data and resulting RPDs is presented in Table 16. Since all results for these analyses were non-detect, RPD values were not applicable and analytical precision was deemed acceptable.

12.0 FIELD QA/QC

12.1 RINSATE BLANK ANALYSES

Rinsate blanks are collected and analyzed to evaluate the possibility of cross-contamination introduced during sampling. For this study, a rinse blank was collected and analyzed for all parameters. A summary of the results is attached as Table 17.

TOC analysis of the rinse blank yielded a result of 1 mg/L. All sample results less than five times this concentration were qualified as non-detect due to the likelihood that they reflect contamination. A summary of the qualified data is presented in Table 18. All other analyses yielded non-detect results indicating that contamination introduced during sampling was not a factor in this study.

12.2 FIELD DUPLICATE ANALYSES

In order to asses the analytical and sampling protocol precision, field duplicate samples are collected and submitted "blind" to the laboratory for analysis. Precision is then evaluated based on the RPD values reported.

For this study, the field duplicate samples collected were samples OW650 and OW660. A summary of the field duplicate results and RPD values is presented in Table 19. In accordance with the "QAP", RPD values less than 20 percent were considered acceptable for general organics, benzene and HPLC analyses. For all other analyses, a general limit of 30 percent was employed to evaluate overall precision.

RPD values reported for 1,2-dichlorobenzene and 1,2,4-trichlorobenzene were greater than 20 percent. Since the results were at, or very near the detection limits, however, qualification of the data was not deemed necessary.

13.0 CONCLUSIONS

Based on the assessment detailed in the foregoing, the data produced by WAL, Recra, OxyChem Technology Center - Central Sciences and The OxyChem Niagara Plant Works Laboratory are acceptable with the specific exceptions and qualifications noted herein.

TABLE 1

SAMPLE KEY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample I.D.	*Well I.D.*
BH11D	BH11D
MW-1	MW-3*
MW-3	MW-2*
OW650D	OW650D
OW652B	OW652B
OW652C	OW652C
OW652D	OW652D
OW653B	OW653B
OW653C	OW653C
OW653D	OW653D
OW657B	OW657B
OW657C	OW657C
OW657D	OW657D
OW658B	OW658B
OW658C	OW658C
OW658D	OW658D
OW659B	OW659B
OW659C	OW659C
OW659D	OW659D
OW660	OW650D (Duplicate)
PASNY139	PASNY139

Notes:

* Inappropriate sample IDs were designated for these two wells. Throughout this validation, sample IDs are employed, therefore, sample results for MW-1 actually refer to well MW-3 and sample results reported for MW-3 refer to well MW-2.

TABLE 2

GENERAL ORGANIC AND HPLC PARAMETERS
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

General Organics	*HPLC Parameters*
Toluene	Benzoic Acid
Chlorobenzene	2-Chlorobenzoic Acid
2-Chlorotoluene	3-Chlorobenzoic Acid
4-Chlorotoluene	4-Chlorobenzoic Acid
1,3-Dichlorobenzene	Chlorobenzoic Acids, Total
1,4-Dichlorobenzene	Chloroendic Acid
1,2-Dichlorobenzene	
2,3-/3,4-Dichlorotoluene	
2,6-Dichlorotoluene	
2,3-/3,4-Dichlorotoluene	
Trichloroethylene	
Tetrachloroethylene	
4-Chlorobenzotrifluoride	
2-Chlorobenzotrifluoride	
3,4-Dichlorobenzotriflouride	
2,4-Dichlorobenzotriflouride	
1,2,4-Trichlorobenzene	
1,2,3-Trichlorobenzene	
Hexachlorobutadiene	
2,4,5-Trichlorotoluene	
2,3,6-Trichlorotoluene	
1,2,4,5-Tetrachlorobenzene	
Hexachlorocyclopentadiene	
2,4,5-Trichlorophenol	
1,2,3,4-Tetrachlorobenzene	
Octachlorocyclopentene	
a-Hexachlorocyclohexane	
b-Hexachlorocyclohexane	
Hexachlorobenzene	
g-Hexachlorocyclohexane	
d-Hexachlorocyclohexane	
Perchloropentacyclodene (Mirex)	

TABLE 3

ANALYTICAL DATA
PHASE 2 - ROUND 1
OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample Descripton:			*OW650D*	*OW660 Dup.*	*OW652B*	*OW652C*	*OW652D*	*OW653B*
Compounds/Analytes	*Units*	*Detection Level*						
Phosphorus, Total Soluble	µg P/L	10	ND	ND	42	ND	ND	30
Arsenic	µg/L	19	ND30	ND	ND30	ND30	ND30	ND
Mercury	µg/L	0.2	3.1	ND	ND	ND	2	ND
Lead	µg/L	16	ND	38	ND4	ND4	ND4	ND
Toluene	µg/L	1	ND	ND	ND	ND	2	2
2-Chlorotoluene	µg/L	1	ND	ND	ND	15	42	54
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	2	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
Benzene	µg/L	1	ND	ND	5	26	ND	190
Chlorobenzene	µg/L	1	ND	ND	ND	5	95	170
1,2-Dichlorobenzene	µg/L	1	1	2	ND	1	8	3
1,3-Dichlorobenzene	µg/L	1	ND	ND	3	14	27	10
1,4-Dichlorobenzene	µg/L	1	ND	ND	2	6	24	9
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	1	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	2J	1J	ND	3J	1J	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	2	2	ND	54J	21J	ND
Tetrachloroethylene	µg/L	1	1	1	1J	7J	1J	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	ND	2	14	1	24
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	1
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND5	ND4	ND6	ND3	ND6	NA
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

TABLE 3

ANALYTICAL DATA
PHASE 2 - ROUND 1
OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample Descripton:			*OW653C*	*OW653D*	*OW657B*	*OW657C*	*OW657D*
Compounds/Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	12	100	14	ND	22
Arsenic	µg/L	19	ND22	ND22	ND23	ND23	ND23
Mercury	µg/L	0.2	ND	ND	ND	ND	ND
Lead	µg/L	16	ND21	ND21	ND30	ND30	ND30
Toluene	µg/L	1	2	2	ND	ND	ND
2-Chlorotoluene	µg/L	1	1	480	ND	ND	8
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	55	2	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	7	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	1	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	10	16J	2	ND	2
Chlorobenzene	µg/L	1	ND	250	ND	ND	2
1,2-Dichlorobenzene	µg/L	1	ND	4	ND	ND	ND
1,3-Dichlorobenzene	µg/L	1	ND	24	ND	ND	2
1,4-Dichlorobenzene	µg/L	1	ND	52	8	ND	2
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	ND	ND	70	810	130
Tetrachloroethylene	µg/L	1	ND	ND	10	59	25
2-Chlorobenzotrifluoride	µg/L	1	ND	1	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	97	2	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	4	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	2	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND5	ND3	ND4	ND3	ND3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

TABLE 3

ANALYTICAL DATA
PHASE 2 - ROUND 1
OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample Descripton:			*OW658B*	*OW658C*	*OW658D*	*OW659B*	*OW659C*	*OW659D*
Compounds/Analytes	*Units*	*Detection Level*						
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	19	ND
Arsenic	µg/L	19	ND23	ND	ND	ND23	ND23	ND23
Mercury	µg/L	0.2	ND	ND	ND	0.7	ND	ND
Lead	µg/L	16	ND30	ND	ND	ND30	ND30	150
Toluene	µg/L	1	ND	2	2	3	4	ND
2-Chlorotoluene	µg/L	1	5	240	180	320	240	32
4-Chlorotoluene	µg/L	1	ND	47	15	4	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	15	19	10	10	3
2,6-Dichlorotoluene	µg/L	1	ND	3	2	1	1	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	4	2	ND	ND	1
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND	ND
Benzene	µg/L	1	10J	840	960	1200	21	4
Chlorobenzene	µg/L	1	10	540	620	1600	290	86
1,2-Dichlorobenzene	µg/L	1	ND	43	69	77	8	1
1,3-Dichlorobenzene	µg/L	1	4	120	360	480	130	7
1,4-Dichlorobenzene	µg/L	1	3	98	210	410	80	6
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND	3
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND	9J
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	36
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND	5
Hexachlorobenzene	µg/L	1	ND	ND2	ND	ND	ND	ND
Trichloroethylene	µg/L	1	22	ND	13	ND	ND	ND
Tetrachloroethylene	µg/L	1	8	ND	3	ND	ND	3J
2-Chlorobenzotrifluoride	µg/L	1	ND	5	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	4	3	51	61	65	1
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	3	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND	3
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND	1
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	4	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND6	ND4	8	12	18	ND3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

TABLE 3

ANALYTICAL DATA
PHASE 2 - ROUND 1
OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample Descripton:			*PASNY 139*	*BH11D-92*	*MW-1*	*MW-3*
Compounds/Analytes	*Units*	*Detection Level*				
Phosphorus, Total Soluble	µg P/L	10	ND	13	ND	14
Arsenic	µg/L	19	ND23	ND23	ND	ND
Mercury	µg/L	0.2	ND	ND	ND	ND
Lead	µg/L	16	ND	35	41	ND
Toluene	µg/L	1	2	ND	ND	ND
2-Chlorotoluene	µg/L	1	480	6	ND	ND
4-Chlorotoluene	µg/L	1	ND	1	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND
Benzene	µg/L	1	5J	15	ND	ND
Chlorobenzene	µg/L	1	ND	9	ND	ND
1,2-Dichlorobenzene	µg/L	1	ND	3	ND	ND
1,3-Dichlorobenzene	µg/L	1	ND	12	ND	ND
1,4-Dichlorobenzene	µg/L	1	ND	17	ND	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	1	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	5	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	4	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	2	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND
Trichloroethylene	µg/L	1	430	3	3	ND
Tetrachloroethylene	µg/L	1	61J	4	ND	7
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	4	5	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	1	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	2	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND3	ND6	ND6	ND3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R

Notes:

ND Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

NA Not Available.

J Associated result is estimated.

R Result was rejected.

TABLE 4

MAXIMUM HOLDING TIMES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Laboratory Analysis	*Method*	*Maximum Holding Times (1) (Contractural)*	*Maximum Holding Times (2) (Technical)*
General Organics	OxyChem Microextraction Method	7 days from collection to extraction 40 days from extraction to analysis	NA
Benzene	8020	7 days from collection to analysis	7 days from collection to analysis
HPLC Parameters	Solvent Exchange Method	30 days from collection to analysis	NA
Total Organic Carbon	9060	28 days from collection to analysis	28 days from collection to analysis
Total Organic Halides	450.1	7 days from collection to analysis	7 days from collection to analysis
Total Soluble Phosphorus	365.2	28 days from collection to analysis	28 days from collection to analysis
Arsenic and Lead	200.7	28 days from collection to analysis	6 months from collection to analysis
Mercury	7470	28 days from collection to analysis	28 days from collection to analysis

Notes:
(1) Contractual holding times in accordance with the "QAP".
(2) Technical holding times in accordance with the methods cited.

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW650D	General Organics	05/11/93	05/12/93	05/12/93	1	0
	Benzene	05/11/93		05/13/93		2
	HPLC Parameters	05/11/93	05/14/93	05/17/93	3	3
	TOC	05/11/93		05/11/93		1
	Arsenic and Lead	05/11/93		06/22/93		42*
	Mercury	05/11/93		05/14/93		3
	Soluble Phosphorous	05/11/93		05/15/93		3
OW660	General Organics	05/11/93	05/12/93	05/12/93	1	0
(duplicate of	Benzene	05/11/93		05/13/93		2
OW650D)	HPLC Parameters	05/11/93	05/14/93	05/17/93	3	3
	TOC	05/11/93		05/11/93		1
	Arsenic and Lead	05/11/93		06/22/93		42*
	Mercury	05/11/93		05/14/93		3
	Soluble Phosphorous	05/11/93		05/15/93		3
OW652B	General Organics	05/06/93	05/11/93	05/11/93	5	0
	Benzene	05/06/93		05/11/93		5
	HPLC Parameters	05/06/93	05/11/93	05/12/93	5	1
	TOC	05/06/93		05/07/93		1
	Arsenic and Lead	05/06/93		05/18/93		43*
	Mercury	05/06/93		05/12/93		6
	Soluble Phosphorous	05/06/93		05/14/93		8

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW652C	General Organics	05/06/93	05/11/93	05/11/93	5	0
	Benzene	05/06/93		05/12/93		6
	HPLC Parameters	05/06/93	05/14/93	05/17/93	8	3
	TOC	05/06/93		05/07/93		1
	Arsenic and Lead	05/06/93		06/18/93		43*
	Mercury	05/06/93		05/12/93		6
	Soluble Phosphorous	05/06/93		05/14/93		8
OW652D	General Organics	05/06/93	05/11/93	05/11/93	5	0
	Benzene	05/06/93		05/12/93		6
	HPLC Parameters	05/06/93	05/14/93	05/17/93	8	3
	TOC	05/06/93		05/07/93		1
	Arsenic and Lead	05/06/93		06/18/93		43*
	Mercury	05/06/93		05/12/93		6
	Soluble Phosphorous	05/06/93		05/14/93		8

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW653B	General Organics	05/13/93	05/17/93	05/18/93	4	1
	Benzene	05/13/93		05/21/93		8*
	HPLC Parameters	05/13/93	05/21/93	05/22/93	8	1
	TOC	05/13/93		NA	NA	NA
	Arsenic and Lead	05/13/93		06/22/93		40*
	Mercury	05/13/93		05/21/93		8
	Soluble Phosphorous	05/13/93		05/28/93		15
OW653C	General Organics	05/15/93	05/19/93	05/20/93	4	1
	Benzene	05/15/93		05/22/93		7
	HPLC Parameters	05/15/93	05/21/93	05/22/93	6	1
	TOC	05/15/93		05/18/93		3
	Arsenic and Lead	05/15/93		06/22/93		38*
	Mercury	05/15/93		05/21/93		6
	Soluble Phosphorous	05/15/93		05/28/93		13
OW653D	General Organics	05/14/93	05/19/93	05/20/93	5	1
	Benzene	05/14/93		05/22/93		8*
	HPLC Parameters	05/14/93	05/21/93	05/22/93	7	1
	TOC	05/14/93		05/18/93		4
	Arsenic and Lead	05/14/93		06/22/93		39*
	Mercury	05/14/93		05/21/93		7
	Soluble Phosphorous	05/14/93		05/28/93		14

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW657B	General Organics	05/06/93	05/07/93	05/07/93	1	0
	Benzene	05/06/93		05/11/93		5
	HPLC Parameters	05/06/93	05/11/93	05/12/93	5	1
	TOC	05/06/93		05/07/93		1
	Arsenic and Lead	05/06/93		06/18/93		43*
	Mercury	05/06/93		05/12/93		6
	Soluble Phosphorous	05/06/93		05/14/93		8
OW657C	General Organics	05/06/93	05/07/93	05/07/93	1	0
	Benzene	05/06/93		05/11/93		5
	HPLC Parameters	05/06/93	05/11/93	05/12/93	5	1
	TOC	05/06/93		05/07/93		1
	Arsenic and Lead	05/06/93		06/18/93		43*
	Mercury	05/06/93		05/12/93		6
	Soluble Phosphorous	05/06/93		05/14/93		8

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW657D	General Organics	05/05/93	05/07/93	05/07/93	2	0
	Benzene	05/05/93		05/11/93		6
	HPLC Parameters	05/05/93	05/11/93	05/12/93	6	1
	TOC	05/05/93		05/06/93		1
	Arsenic and Lead	05/05/93		06/18/93		44*
	Mercury	05/05/93		05/12/93		7
	Soluble Phosphorous	05/05/93		05/14/93		9
OW658B	General Organics	05/10/93	05/12/93	05/12/93	2	0
	Benzene	05/10/93		05/13/93		3
	HPLC Parameters	05/10/93	05/14/93	05/17/93	4	3
	TOC	05/10/93		05/11/93		1
	Arsenic and Lead	05/10/93		06/18/93		39*
	Mercury	05/10/93		05/14/93		4
	Soluble Phosphorous	05/10/93		05/14/93		4
OW658C	General Organics	05/10/93	05/12/93	05/12/93	2	0
	Benzene	05/10/93		05/13/93		3
	HPLC Parameters	05/10/93	05/14/93	05/17/93	4	3
	TOC	05/10/93		05/11/93		1
	Arsenic and Lead	05/10/93		06/22/93		43*
	Mercury	05/10/93		05/14/93		4
	Soluble Phosphorous	05/10/93		05/14/93		4

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW658D	General Organics	05/10/93	05/12/93	05/12/93	2	0
	Benzene	05/10/93		05/14/93		4
	HPLC Parameters	05/10/93	05/14/93	05/17/93	4	3
	TOC	05/10/93		05/11/93		1
	Arsenic and Lead	05/10/93		06/22/93		43*
	Mercury	05/10/93		05/14/93		4
	Soluble Phosphorous	05/10/93		05/14/93		4
OW659B	General Organics	05/05/93	05/07/93	05/07/93	2	0
	Benzene	05/05/93		05/11/93		6
	HPLC Parameters	05/05/93	05/11/93	05/12/93	6	1
	TOC	05/05/93		05/06/93		1
	Arsenic and Lead	05/05/93		06/18/93		44*
	Mercury	05/05/93		05/12/93		7
	Soluble Phosphorous	05/05/93		05/14/93		9

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
OW659C	General Organics	05/05/93	05/07/93	05/07/93	2	0
	Benzene	05/05/93		05/11/93		6
	HPLC Parameters	05/05/93	05/11/93	05/12/93	6	1
	TOC	05/05/93		05/06/93		1
	Arsenic and Lead	05/05/93		06/18/93		44*
	Mercury	05/05/93		05/12/93		7
	Soluble Phosphorous	05/05/93		05/14/93		9
OW659D	General Organics	05/08/93	05/11/93	05/11/93	3	0
	Benzene	05/08/93		05/13/93		5
	HPLC Parameters	05/08/93	05/11/93	05/12/93	3	1
	TOC	05/08/93		05/11/93		3
	Arsenic and Lead	05/08/93		06/18/93		41*
	Mercury	05/08/93		05/13/93		5
	Soluble Phosphorous	05/08/93		05/14/93		6
PASNY139	General Organics	05/11/93	05/17/93	05/18/93	6	1
	Benzene	05/11/93		05/14/93		3
	HPLC Parameters	05/11/93	05/14/93	05/17/93	3	1
	TOC	05/11/93		05/11/93		0
	Arsenic and Lead	05/11/93		06/22/93		42*
	Mercury	05/11/93		05/14/93		3
	Soluble Phosphorous	05/11/93		05/14/93		3

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
BH11D-92	General Organics	05/12/93	05/17/93	05/18/93	5	1
	Benzene	05/12/93		05/14/93		2
	HPLC Parameters	05/12/93	05/21/93	05/22/93	9	1
	TOC	05/12/93		05/14/93		2
	Arsenic and Lead	05/12/93		06/22/93		41*
	Mercury	05/12/93		05/21/93		9
	Soluble Phosphorous	05/12/93		05/28/93		16
MW-1	General Organics	05/12/93	05/17/93	05/18/93	5	1
	Benzene	05/12/93		05/12/93		0
	HPLC Parameters	05/12/93	05/21/93	05/22/93	9	1
	TOC	05/12/93		05/14/93		2
	Arsenic and Lead	05/12/93		06/22/83		41*
	Mercury	05/12/93		05/14/93		2
	Soluble Phosphorous	05/12/93		05/14/93		2

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Analyses*	*Date Sample*	*Date Extracted*	*Date Analyzed*	*Holding Time (days) (1)*	*Holding Time (days) (2)*
MW-3	General Organics	05/11/93	05/17/93	05/18/93	6	1
	Benzene	05/11/93		05/13/93		2
	HPLC Parameters	05/11/93	05/21/93	05/22/93	10	1
	TOC	05/11/93		05/11/93		0
	Arsenic and Lead	05/11/93		06/22/93		42*
	Mercury	05/11/93		05/14/93		3
	Soluble Phosphorous	05/11/93		05/14/93		3

Notes:

(1) Sample holding time from collection to extraction.
(2) Sample holding time to analysis.
* Holding time exceedence.
NA - Not available as sample was received at the laboratory broken.
TOC - Total Organic Carbon.

TABLE 6
QUALIFIED SAMPLE DATA DUE TO HOLDING TIME EXCEEDANCES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Parameter	*Compounds*	*Sample ID*	*Sample Concentration (µg/L)*	*Qualifier*
VOCs	Benzene	OW653B	190	J
VOCs	Benzene	OW653D	16	J

Notes:

VOCs - Volatile Organic Compounds
J - Associated value is estimated.

TABLE 7

METHOD BLANK DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

	Detection Limits (µg-P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)	Blank Conc. (µg P/L)
Date Analyzed		05/14/93	05/14/93	05/14/93	05/14/93	05/14/93	05/28/93	05/28/93	05/28/93
Analyte									
Phosphorus, Total Soluble	10	ND	ND	ND	ND	ND	ND	ND	ND

	Detection Limits (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)
Date Analyzed		05/12/93	05/13/93	05/14/93	05/14/93	05/21/93	05/21/93	05/21/93
Analyte								
Mercury	0.20	ND	ND	ND	ND	ND	ND	ND

	Detection Limits (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)
Date Analyzed		06/18/93	06/22/93	06/29/93
Analyte				
Arsenic	23	ND	ND19	ND22
Lead	30	ND	ND16	ND21

	Detection Limits (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)	Blank Conc. (µg/L)
Date Analyzed		05/11/93	05/12/93	05/12/93	05/14/93	05/14/93	05/14/93	05/21/93	05/21/93	05/21/93
Compound										
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 7

METHOD BLANK DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Extracted	*Detection Limits (µg/L)*	*Blank Conc. (µg/L) 05/07/93*	*Blank Conc. (µg/L) 05/11/93*	*Blank Conc. (µg/L) 05/12/93*	*Blank Conc. (µg/L) 05/17/93*	*Blank Conc. (µg/L) 05/19/93*
Compound						
Toluene	1	ND	ND	ND	ND	ND
2-Chlorotoluene	1	ND	ND	ND	ND	ND
4-Chlorotoluene	1	ND	ND	ND	ND	ND
2,4-/2,4-Dichlorotoluene	1	ND	ND	ND	ND	ND
2,5-Dichlorotoluene	1	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	1	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	1	ND	ND	ND	ND	ND
Chlorobenzene	1	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	1	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	1	ND	ND	ND	ND	ND
1,2,3,4-Tetrachlorobenzene	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	1	ND	ND	ND	ND	ND
Hexachlorobenzene	1	ND	ND	ND	ND	ND
Trichloroethylene	1	ND	ND	ND	ND	ND
Tetrachloroethylene	1	ND	ND	ND	ND	ND
2-Chlorobenzotrifluoride	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	1	ND	ND	ND	ND	ND
2,4-Dichlorobenzotrifluoride	1	ND	ND	ND	ND	ND
3,4--Dichlorobenzotrifluoride	1	ND	ND	ND	ND	ND

TABLE 7

METHOD BLANK DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

	Detection Limits (µg/L)	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted		***05/07/93***	***05/11/93***	***05/12/93***	***05/17/93***	***05/19/93***
Compound						
Hexachlorobutadiene	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	1	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	1	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	1	ND	ND	ND	ND	ND

	Detection Limits (µg/L)	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted		***05/11/93***	***05/14/93***	***05/21/93***
Compound				
Benzoic Acid	100	ND	ND	ND
2-Chlorobenzoic acid	30	ND	ND	ND
3-Chlorobenzoic acid	30	ND	ND	ND
4-Chlorobenzoic acid	30	ND	ND	ND
Chlorobenzoic acids, total	90	ND	ND	ND
Chlorendic acid	250	ND	ND	ND

TABLE 7

METHOD BLANK DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Analyzed	*Detection Limits (mg/L)*	*Blank Conc. (mg/L) 05/06/93*	*Blank Conc. (mg/L) 05/07/93*	*Blank Conc. (mg/L) 05/11/93*	*Blank Conc. (mg/L) 05/11/93*	*Blank Conc. (mg/L) 05/14/93*	*Blank Conc. (mg/L) 05/18/93*
Analyte							
Total Organic Carbon (TOC)	1	ND	ND	1	ND	2	2

TABLE 8

QUALIFIED SAMPLE DATA DUE TO METHOD BLANK CONTAMINATION
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHE MICAL CORPORATION
MAY 1993

Parameter	*Compound*	*Blank Analysis Date*	*Blank Conc. (mg/L)*	*Associated Sample*	*Sample Conc. (mg/L)*	*Qualified Sample Conc. (mg/l)*
TOC	TOC	05/11/93	1	OW650D	5	ND 5
				OW660	4	ND 4
				OW658B	6	ND 6
				OW658C	4	ND 4
				OW659D	3	ND 3
				PASNY139	3	ND 3
				MW-3	3	ND 3
TOC	TOC	05/14/93	2	BH11D-92	6	ND 6
				MW-1	6	ND 6
TOC	TOC	05/18/93	2	OW653C	5	ND 5
				OW653D	3	ND 3

Notes:
TOC - Total Organic Carbon.
ND - Non-detect at associated value.

TABLE 9

SURROGATE SPIKE RECOVERIES FOR BENZENE ANALYSES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Sample ID	*Surrogate Recovery (Percent)*
OW650	117
OW660 (duplicate of OW650)	128*
OW652B	102
OW652C	I
OW652D	I
OW653B	95
OW653C	86
OW653D	77
OW657B	I
OW657C	I
OW657D	I
OW658B	0*
OW658C	106
OW658D	114
OW659B	95
OW659C	105
OW659D	88
PASNY 139	0*
BH11D-92	110
MW-1	138*
MW-3	119

Notes:

I - Surrogate recovery not available due to sample matrix interferences.
* - Surrogate recovery outside of contract limits (50-120%).

TABLE 10

BLANK SPIKE RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Extracted	*Blank Spike 05/07/93*	*Blank Spike 05/11/93*	*Blank Spike 05/12/93*	*Blank Spike 05/17/93*	*Blank Spike 05/19/93*
Compound/Analytes					
Toluene	100	92	92	92	100
Chlorobenzene	92	81	73	88	100
2-Chlorotoluene	116	108	104	108	120
4-Chlorotoluene	112	104	104	104	116
1,3-Dichlorobenzene	112	100	100	104	115
1,4-Dichlorobenzene	116	104	100	112	120
1,2-Dichlorobenzene	112	100	100	104	116
2,4-/2,4-Dichlorotoluene	112	104	104	104	115
2,6-Dichlorotoluene	120	108	108	108	116
2,3-/3,4-Dichlorotoluene	112	100	104	104	112
Trichloroethylene	77	58*	88	100	96
Tetrachloroethylene	76	56*	92	108	108
4-Chlorobenzotrifluoride	64	92	88	104	104
2-Chlorobenzotrifluoride	72	56*	96	108	108
3,4--Dichlorobenzotrifluoride	68	56*	96	104	108
2,4-Dichlorobenzotrifluoride	68	56*	92	104	104
1,2,4-Trichlorobenzene	77	50*	96	104	104
1,2,3-Trichlorobenzene	84	68	96	108	108
Hexachlorobutadiene	84	76	80	100	96
2,4,5-Trichlorotoluene	88	88	76	104	104
2,3,6-Trichlorotoluene	85	88	77	100	100
1,2,4,5-Tetrachlorobenzene	88	92	77	104	104
Hexachlorocyclopetadiene	88	92	56*	96	88
2,4,5-Trichlorophenol	72	68	84	88	84
1,2,3,4-Tetrachlorobenzene	93	93	74	104	104
Octachlorocyclopentene	96	100	76	96	96
a-Hexachlorocyclohexane	96	100	104	104	108
b-Hexachlorocyclohexane	88	92	88	92	100
Hexachlorobenzene	100	108	108	100	108
g-Hexachlorocyclohexane	96	100	100	100	108
d-Hexachlorocyclohexane	93	96	93	93	100
Perchloropentacyclodecane (Mirex)	100	108	96	104	113

Date Extracted	*Blank Spike 05/11/93*	*Blank Spike 05/14/93*	*Blank Spike 05/21/93*
Benzoic Acid	90	85	90
2-Chlorobenzoic acid	90	90	90
3-Chlorobenzoic acid	95	90	90
4-Chlorobenzoic acid	95	90	95
Chlorobenzoic acids, total	95	90	92
Chlorendic acid	96	77	90

TABLE 11

QUALIFIED SAMPLE DATA DUE TO OUTLYING BLANK SPIKE RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Parameter	*Compounds*	*Blank Spike Recoveries*	*Associated Samples*	*Sample Concentration (µg/L)*	*Data Qualifier*
General Organics	Trichloroethylene	58	OW652C	54	J
			OW652D	21	J
General Organics	Tetrachloroethylene	56	OW652B	1	J
			OW652C	7	J
			OW652D	1	J
			OW659D	3	J
General Organics	1,2,4-Trichlorobenzene	50	OW652C	3	J
			OW652D	1	J
			OW659D	9	J

Notes:

ND - Non-Detect at associated detection limit.

TABLE 12

REFERENCE STANDARD RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Extracted	*Reference Standard 05/08/93*	*Reference Standard 05/12/93*	*Reference Standard 05/13/93*	*Reference Standard 05/19/93*	*Reference Standard 05/19/93*
Compound/Analytes					
Toluene	100	106	95	95	100
Chlorobenzene	98	102	93	104	119
2-Chlorotoluene	108	114	100	104	115
4-Chlorotoluene	107	114	99	103	114
1,3-Dichlorobenzene	101	114	95	98	109
1,4-Dichlorobenzene	100	101	87	98	109
1,2-Dichlorobenzene	102	107	93	100	111
2,4-/2,4-Dichlorotoluene	102	112	97	101	113
2,6-Dichlorotoluene	105	112	97	102	114
2,3-/3,4-Dichlorotoluene	104	112	98	101	113
Trichloroethylene	100	107	94	103	101
Tetrachloroethylene	98	61	90	104	103
4-Chlorobenzotrifluoride	95	109	86	104	103
2-Chlorobenzotrifluoride	100	64	95	103	102
3,4–Dichlorobenzotrifluoride	98	108	93	102	102
2,4-Dichlorobenzotrifluoride	99	64	91	101	101
1,2,4-Trichlorobenzene	99	58*	91	99	99
1,2,3-Trichlorobenzene	95	63	85	95	93
Hexachlorobutadiene	96	78	95	100	97
2,4,5-Trichlorotoluene	96	97	79	98	98
2,3,6-Trichlorotoluene	97	98	80	98	99

TABLE 12

REFERENCE STANDARD RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Extracted:	*Reference Standard 05/08/93*	*Reference Standard 05/12/93*	*Reference Standard 05/13/93*	*Reference Standard 05/19/93*	*Reference Standard 05/19/93*
Compound/Analytes					
1,2,4,5-Tetrachlorobenzene	96	100	75	98	99
Hexachlorocyclopetadiene	98	102	97	88	90
2,4,5-Trichlorophenol	80	116	83	116	106
1,2,3,4-Tetrachlorobenzene	97	102	78	92	95
Octachlorocyclopentene	98	105	97	89	86
a-Hexachlorocyclohexane	95	108	88	96	92
b-Hexachlorocyclohexane	90	118	91	97	89
Hexachlorobenzene	97	121*	101	98	99
g-Hexachlorocyclohexane	94	111	86	96	90
d-Hexachlorocyclohexane	90	116	91	96	88
Perchloropentacyclodecane (Mirex)	94	121	99	100	91

Date Analyzed:	*Reference Standard 06/18/93*	*Reference Standard 06/22/93*	*Reference Standard 06/29/93*
Arsenic	91	100	96
Lead	92	100	96

TABLE 12

REFERENCE STANDARD RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Date Analyzed:	*Reference Standard 05/06/93*	*Reference Standard 05/07/93*	*Reference Standard 05/11/93*	*Reference Standard 05/11/93*	*Reference Standard 05/14/93*	*Reference Standard 05/18/93*
Total Organic Carbon (TOC)	100	103	104	100	100	100

Note:
* Recovery is outside of the applicable control limit.

TABLE 13

QUALIFIED SAMPLE DATA DUE TO OUTLYING REFERENCE STANDARD RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Parameter	*Compounds*	*Reference Standard Recovery (Percent)*	*Associated Samples*	*Sample Concentration (µg/L)*	*Data Qualifier*
General Organics	1,2,4-Trichlorobenzene	58	OW650D	2	J
			OW660	1	J

Notes:

ND - Non-Detect at associated detection limit.
J - Associated result is estimated.

TABLE 14

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

MS/MSD Sample ID:	*OW657C*			*PASNY139*			*OW-653C*			*OW-652B*			*OW-658B*		
Analytes	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*
Benzene	75	75	0	80	80	0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	80	76	5	72	76	5	76	80	5	76	76	0	72	76	5
Chlorobenzene	69	65	6	77	77	0	73	81	10	73	69	6	69	73	6
2-Chlorotoluene	96	92	4	96	96	0	96	104	9	100	96	4	84	88	5
4-Chlorotoluene	96	92	4	92	92	0	92	104	12	96	92	4	88	92	4
1,3-Dichlorobenzene	96	92	4	92	92	0	96	104	8	92	92	0	85	88	3
1,4-Dichlorobenzene	100	96	4	100	100	0	100	104	8	92	92	0	92	96	4
1,2-Dichlorobenzene	92	88	4	92	92	0	92	108	8	88	88	0	88	92	4
2,4-/2,4-Dichlorotoluene	96	92	4	96	92	4	96	100	8	92	92	0	92	92	0
2,6-Dichlorotoluene	96	92	4	96	92	4	96	104	8	92	92	0	92	92	0
2,3-/3,4-Dichlorotoluene	96	92	4	96	92	4	96	104	8	96	92	4	88	92	4
Trichloroethylene	NA	NA	NA	NA	NA	NA	73	81	10	50*	50*	0	62	69	11
Tetrachloroethylene	68	44*	43*	40*	44*	10	76	84	10	48*	44*	9	72	76	5
4-Chlorobenzotrifluoride	120	112	7	76	76	0	80	84	5	84	80	5	64	68	6
2-Chlorobenzotrifluoride	60	56*	7	84	84	0	80	88	10	44*	44*	0	76	84	10
3,4--Dichlorobenzotrifluoride	68	60	13	88	88	0	84	92	9	80	80	0	80	84	5
2,4-Dichlorobenzotrifluoride	60	56*	7	84	88	5	80	88	10	44*	44*	0	80	80	0
1,2,4-Trichlorobenzene	77	73	5	92	96	4	88	96	9	50*	50*	0	85	88	3
1,2,3-Trichlorobenzene	84	84	0	96	96	0	88	96	9	60	60	0	84	88	5
Hexachlorobutadiene	72	68	6	80	80	0	72	80	11	56*	56*	0	60	64	6
2,4,5-Trichlorotoluene	84	84	0	92	96	4	84	92	9	80	80	0	76	76	0
2,3,6-Trichlorotoluene	85	81	5	85	88	3	81	88	8	77	77	0	62	62	0
1,2,4,5-Tetrachlorobenzene	88	88	0	88	92	4	85	96	12	85	85	0	80	62	25*
Hexachlorocyclopetadiene	84	80	5	80	84	5	68	80	16	80	80	0	72	72	0
2,4,5-Trichlorophenol	76	76	0	80	88	10	100	104	4	80	84	5	72	68	6
1,2,3,4-Tetrachlorobenzene	93	96	3	93	100	7	85	96	12	89	89	0	63	63	0
Octachlorocyclopentene	92	92	0	76	84	10	72	84	15	88	88	0	80	80	0
a-Hexachlorocyclohexane	104	104	0	92	100	8	92	100	8	100	104	4	88	92	4
b-Hexachlorocyclohexane	92	92	0	84	88	5	80	88	10	88	92	4	76	76	0
Hexachlorobenzene	96	100	4	91	88	8	73	85	15	85	88	3	77	81	5
g-Hexachlorocyclohexane	100	100	0	88	96	9	85	96	12	100	100	0	85	88	3
d-Hexachlorocyclohexane	96	96	0	85	93	9	89	96	8	93	96	3	81	81	0
Perchloropentacyclodecane (Mirex)	92	92	0	83	88	6	71	67	6	71	75	5	58*	67	14

TABLE 14

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) RECOVERIES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

MS/MSD Sample ID:	*OW657C*			*OW-658C*			*OW-657C*			*BH-11D*		
Analytes	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*
Benzoic Acid	84	90	5	78	86	10	92	82	11	82	78	5
2-Chlorobenzoic acid	86	90	5	84	92	9	94	84	11	88	86	2
3-Chlorobenzoic acid	86	90	5	80	90	12	92	86	7	88	82	7
4-Chlorobenzoic acid	86	90	5	80	96	18	94	86	9	86	78	10
Chlorobenzoic acids, total	86	90	5	80	93	15	94	86	9	88	82	7
Chlorendic acid	86	88	2	76	94	21	74	84	13	99	81	20

Notes:
RPD - Relative Percent Difference
NA - Not Available
* - Results are outside of applicable control limits

TABLE 15

MATRIX SPIKE (MS) RECOVERIES FOR INORGANIC ANALYSES
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

MS Sample ID:	*OW657C*	*OW-658C*	*PASNY139*	*OW-653C*	*OW-650*
Analytes					
Phosphorus, Total Soluble	96	-	100	-	-
Arsenic	93	93	-	95	-
Mercury	92	-	115	-	-
Lead	93	92	-	92	-
Total Organic Carbon (TOC)	-	-	-	-	100

TABLE 16

DUPLICATE ANALYSIS DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

MS/MSD Sample ID:	*Units*	*PASNY139*			*OW657C*			*OW658C*			*OW653C*		
		Orig. Conc.	*Dup. Conc.*	*RPD*	*Orig. Conc.*	*Dup. Conc.*	*RPD*	*Orig. Conc.*	*Dup. Conc.*	*RPD*	*Orig. Conc.*	*Dup. Conc.*	*RPD*
Analytes													
Phosphorus, Total Soluble	µg-P/L	ND	ND	*	ND	ND	*	–	–	–	–	–	–
Arsenic	µg/L	ND	ND	*	ND	ND	*	–	–	–	–	–	–
Mercury	µg/L	–	–	–	ND	ND	*	ND	ND	*	ND	ND	*
Lead	µg/L	–	–	–	ND	ND	*	ND	ND	*	ND	ND	*

Notes:

RPD - Relative Percent Difference
ND - Non-detect at the associated detection limit
* RPD could not be calculated due to one or more non-detect values

TABLE 17

RINSATE BLANK DATA
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Compounds/Analytes	*Units*	*Detection Limit*	*Rinse Blank Concentration*
Phosphorus, Total Soluble	µg P/L	10	ND
Arsenic	µg/L	19	ND
Mercury	µg/L	0.4	ND
Lead	µg/L	16	ND
Toluene	µg/L	1	ND
2-Chlorotoluene	µg/L	1	ND
4-Chlorotoluene	µg/L	1	ND
2,4-/2,4-Dichlorotoluene	µg/L	1	ND
2,6-Dichlorotoluene	µg/L	1	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND
2,3,6-Trichlorotoluene	µg/L	1	ND
2,4,5-Trichlorotoluene	µg/L	1	ND
Benzene	µg/L	1	ND
Chlorobenzene	µg/L	1	ND
1,2-Dichlorobenzene	µg/L	1	ND
1,3-Dichlorobenzene	µg/L	1	ND
1,4-Dichlorobenzene	µg/L	1	ND
1,2,3-Trichlorobenzene	µg/L	1	ND
1,2,4-Trichlorobenzene	µg/L	1	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND
Hexachlorobenzene	µg/L	1	ND
Trichloroethylene	µg/L	1	ND
Tetrachloroethylene	µg/L	1	ND
2-Chlorobenzotrifluoride	µg/L	1	ND
4-Chlorobenzotrifluoride	µg/L	1	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND
Hexachlorobutadiene	µg/L	1	ND
Hexachlorocyclopentadiene	µg/L	1	ND
Octachlorocyclopentene	µg/L	1	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND
2,4,5-Trichlorophenol	µg/L	10	ND
a-Hexachlorocyclohexane	µg/L	1	ND
b-Hexachlorocyclohexane	µg/L	1	ND
g-Hexachlorocyclohexane	µg/L	1	ND
d-Hexachlorocyclohexane	µg/L	1	ND
Benzoic Acid	µg/L	100	ND
2-Chlorobenzoic acid	µg/L	30	ND
3-Chlorobenzoic acid	µg/L	30	ND
4-Chlorobenzoic acid	µg/L	30	ND
Chlorobenzoic acids, total	µg/L	90	ND
Chlorendic acid	µg/L	250	ND
Total Organic Carbon (TOC)	mg/L	1	1
Total Organic Halides (TOX)	µg/L	10	17

Notes:

ND - Non-detect at the specified detection limit

TABLE 18

QUALIFIED SAMPLE DATA DUE TO RINSATE BLANK CONTAMINATION
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Parameter	*Compounds*	*Rinsate Blank Conc. (mg/L)*	*Associated Samples*	*Sample Concentration (mg/L)*	*Qualified Sample Conc. (mg/L)*
TOC	TOC	1	OW650D	5	ND5
			OW660	4	ND4
			OW652B	6	ND6
			OW652C	3	ND3
			OW652D	6	ND6
			OW653C	5	ND5
			OW653D	3	ND3
			OW657B	4	ND4
			OW657C	3	ND3
			OW657D	3	ND3
			OW658B	6	ND6
			OW658C	4	ND4
			OW659D	3	ND3
			PASNY139	3	ND3
			BH11D-92	6	ND6
			MW-1	6	ND6
			MW-3	3	ND3

Notes:

ND - Non-Detect at associated collection limit.
TOC - Total Organic Carbon.

TABLE 19

FIELD DUPLICATE RESULTS
PHASE 2 - ROUND 1 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
MAY 1993

Compounds/Analytes	*Units*	*OW650*	*OW660 Dup.*	*RPD*
Phosphorus, Total Soluble	µg P/L	ND	ND	*
Arsenic	µg/L	ND	ND	*
Mercury	µg/L	3.1	ND	*
Lead	µg/L	ND16	38	*
Toluene	µg/L	ND	ND	*
2-Chlorotoluene	µg/L	ND	ND	*
4-Chlorotoluene	µg/L	ND	ND	*
2,4-/2,4-Dichlorotoluene	µg/L	ND	ND	*
2,6-Dichlorotoluene	µg/L	ND	ND	*
2,3-/3,4-Dichlorotoluene	µg/L	ND	ND	*
2,3,6-Trichlorotoluene	µg/L	ND	ND	*
2,4,5-Trichlorotoluene	µg/L	ND	ND	*
Benzene	µg/L	ND	ND	*
Chlorobenzene	µg/L	ND	ND	*
1,2-Dichlorobenzene	µg/L	1	2	67**
1,3-Dichlorobenzene	µg/L	ND	ND	*
1,4-Dichlorobenzene	µg/L	ND	ND	*
1,2,3-Trichlorobenzene	µg/L	ND	ND	*
1,2,4-Trichlorobenzene	µg/L	2	1	67**
1,2,3,4-Tetrachlorobenzene	µg/L	ND	ND	*
1,2,4,5-Tetrachlorobenzene	µg/L	ND	ND	*
Hexachlorobenzene	µg/L	ND	ND	*
Trichloroethylene	µg/L	2	2	0
Tetrachloroethylene	µg/L	1	1	0
2-Chlorobenzotrifluoride	µg/L	ND	ND	*
4-Chlorobenzotrifluoride	µg/L	ND	ND	*
2,4-Dichlorobenzotrifluoride	µg/L	ND	ND	*
3,4-Dichlorobenzotrifluoride	µg/L	ND	ND	*
Hexachlorobutadiene	µg/L	ND	ND	*
Hexachlorocyclopentadiene	µg/L	ND	ND	*
Octachlorocyclopentene	µg/L	ND	ND	*
Perchloropentacyclodecane (Mirex)	µg/L	ND	ND	*
2,4,5-Trichlorophenol	µg/L	ND	ND	*
a-Hexachlorocyclohexane	µg/L	ND	ND	*
b-Hexachlorocyclohexane	µg/L	ND	ND	*
g-Hexachlorocyclohexane	µg/L	ND	ND	*
d-Hexachlorocyclohexane	µg/L	ND	ND	*
Benzoic Acid	µg/L	ND	ND	*
2-Chlorobenzoic acid	µg/L	ND	ND	*
3-Chlorobenzoic acid	µg/L	ND	ND	*
4-Chlorobenzoic acid	µg/L	ND	ND	*
Chlorobenzoic acids, total	µg/L	ND	ND	*
Chlorendic acid	µg/L	ND	ND	*
Total Organic Carbon (TOC)	mg/L	5	4	22
Total Organic Halides (TOX)	µg/L	85	110	26

Notes:

RPD - Relative Percent Difference
ND - Non-detect at the associated detection limit
* RPD value could not be calculated due to one or more non-detect results
** RPD above the acceptable limit of 30.

DATA VALIDATION
OCCIDENTAL CHEMICAL CORPORATION
OFF-SITE INVESTIGATION (OSI)

Niagara Falls, New York

NOVEMBER 1993

REF. NO. 2583 (DataVal-2)

This report is printed on recycled paper.

CONESTOGA-ROVERS & ASSOCIATES

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1.0 EXECUTIVE SUMMARY

Sixteen (16) groundwater samples (including one field duplicate and one rinsate blank) were collected in July 1993, for the Occidental Chemical Corporation (OxyChem) Off-Site Investigation (OSI) in Niagara Falls, New York. The samples were analyzed for benzene, general organics[1], HPLC parameters, total soluble phosphorous, total organic carbon (TOC), total organic halides (TOX), and various metals.

Benzene

Most benzene results were acceptable without qualification. Qualification of the remaining data as estimated was due to holding time exceedances of one day and three slightly high surrogate recoveries. Most of the samples contained less than 40 µg/L of benzene. Samples OW653B, OW658C, OW658D and OW659B contained levels of benzene ranging from 150 to 1500 µg/L.

General Organic Parameters

Most sample analysis results were acceptable without qualification. The only exception was the trichloroethene result reported for sample OW652C which was qualified as estimated due to low MS/MSD recoveries.

Samples were reported to contain chlorotoluenes, chlorobenzene, dichlorobenzenes, chlorobenzotrifluorides, trichloroethylene, hexachlorocyclohexane, and tetrachloroethylene. The highest concentrations of general organic compounds were observed in samples OW658C, OW658D, OW659B and OW659C.

---

1 General Organic and HLPC parameters are listed in Table 2.

HPLC Parameters

All quality control data were acceptable, indicating good accuracy and precision were achieved during sample analysis. All sample results were ND.

Total Soluble Phosphorus

All quality control data were acceptable, indicating good accuracy and precision were achieved during sample analysis. A phosphorus concentration of 17 µg/L was reported for sample MW-1 while all other phosphorus results were ND.

TOC

Positive TOC results ranging from 2 to 12 mg/L were reported by the laboratory. Due to low level TOC concentrations reported for both the method blanks and rinse blank all sample concentrations less than or equal to 5 mg/L were qualified as non-detect. All remaining data were acceptable without qualification except for the result for sample OW658B which was flagged as estimated due to a slightly low matrix spike recovery.

TOX

Upon review of the TOX data, several deficiencies in the execution of the method were observed. The most critical of these deficiencies was that column breakthrough exceeded the 10 percent limit established in Method 450.1. Due to the uncertainty of the resulting data, all TOX results were rejected (R).

The deficiencies have been addressed by the laboratory and corrective measures are being implemented to ensure the quality of future TOX analysis.

Metals Analysis

All quality control data provided for arsenic, lead and mercury analyses were acceptable indicating good accuracy and precision were achieved.

All arsenic and mercury results were ND. Lead concentrations from 19 to 37 µg/L were reported for samples OW653B, OW653C, OW658D, OW659D and MW-1.

2.0 GENERAL

Analytical services for Occidental Chemical Corporation (OxyChem) were provided by Recra Environmental Incorporated (Recra), Wadsworth/Alert Laboratories (WAL), OxyChem Technology Center - Central Sciences and the OxyChem Niagara Plant Works Laboratory.

Sixteen (16) groundwater samples (including one field duplicate and one rinsate blank) were collected in July 1993 for the OSI. A sample key is presented in Table 1. The samples were submitted to the above laboratories for the following analyses:

Parameter	*Analytical Method*
Benzene	USEPA SW-846 Method 8020
General Organics[1]	Occidental Chemical Corporation Microextraction Method
HPLC Parameters[1]	Modified Solvent Exchange Method
Total Soluble Phosphorous	40 CFR Part 136 Method 365.2
Total Organic Carbon (TOC)	USEPA SW-846 Method 9060
Total Organic Halides (TOX)	USEPA Method 450.1 (Modified)
Arsenic and Lead	USEPA Method 200.7
Mercury	USEPA SW-846 Method 7470

The above methods are referenced from sources as detailed in Appendix C - Chemical Sampling and Quality Assurance Plan, Niagara Plant Supplemental Data Collection Program, May 9, 1988, hereinafter referred to as the "QAP".

A summary of the analytical results is presented in Table 3. The Quality Assurance/Quality Control (QA/QC) criteria by which these data have been assessed are outlined in the QAP.

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1 General Organics and HPLC Parameters are listed in Table 2.

3.0 HOLDING TIMES

Sample holding times as specified in the relevant methods and the "QAP" are summarized in Table 4. Adherence to these holding time criteria was evaluated by comparison of collection and extraction (and/or analysis) dates obtained from the Chain of Custody forms and final analytical reports respectively. A summary of all sample holding times is attached as Table 5.

Benzene analysis was performed on samples OW652B, OW658B, OW658C, OW658D AND OW661B outside of the seven day holding time sited in both the "QAP" and Method 8020. In general, holding time exceedences tend to demonstrate a low bias in results due to the potential loss of the analyte of concern. The associated benzene results for these samples were therefore qualified as estimated.

4.0 SAMPLE PRESERVATION

Upon review of the field log notebooks and sample Chain of Custody forms, it was determined that all samples were properly preserved after collection. All samples were received by the laboratory at 4°C (±2°C), indicating proper storage of samples during shipment.

5.0 METHOD BLANK ANALYSES

The purpose of assessing the results of laboratory blank analyses is to determine the existence and magnitude of contamination introduced during analysis. Laboratory blanks were analyzed at a minimum frequency of one per 20 investigative samples and/or one per analytical sequence. A summary of the method blank analyses data is presented in Table 6.

TOC values of 1 mg/L were reported for the method blanks analyzed. All sample concentrations less than five times the associated blank concentration were qualified as non-detect, as these results are probably a reflection of laboratory contamination (see Table 7).

A perchloropentacyclodecane result was not available for the method blank extracted on July 14, 1993 for general organics due to a broad interference peak. As all sample results reported for this compound were ND, this interference peak appeared to be an isolated incident and did not warrant qualification of sample data. Blank analyses for all other parameters yielded non-detect results, indicating that laboratory contamination was not a factor for these analyses.

6.0 SURROGATE SPIKE RECOVERIES

In accordance with Method 8020, all samples and blanks analyzed for benzene are spiked with surrogate prior to analysis. Surrogate recoveries provide a means to evaluate the effects of individual sample matrices on analytical efficiency. Control limits for acceptable surrogate recoveries are specified in the "QAP" as 50 to 120 percent.

The surrogate compound employed for VOC analysis was alpha, alpha, alpha-trifluorotoluene, and a summary of the surrogate recoveries is presented in Table 8. Surrogate recoveries could not be reported for samples OW652C, OW657B, OW657C, OW657D and OW658B due to sample matrix interferences. For all of these samples except OW658B, an alternative surrogate, 1-chloro-4-fluorobenzene, was employed to evaluate analytical efficiency. Surrogate performance could not be assessed for sample OW658B.

Outlying (high) surrogate recoveries were reported for samples OW652B, OW652C and OW661B (duplicate of OW652B). As this may indicate a high bias in the VOC data, all positive benzene results for these samples were qualified as estimated (see Table 9).

The analysis of all remaining VOC samples yielded surrogate spike recoveries within the contract control limits. Laboratory performance was deemed acceptable on an individual sample basis, with the exceptions noted above.

7.0 BLANK SPIKE ANALYSES

Blank spikes are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects. Blank spike analyses are performed at a minimum frequency of one per 20 investigative samples, or one per analytical batch. Control limits for acceptable spike recoveries are specified in the "QAP" as 60 to 100 percent, however, recoveries up to 120 percent were considered acceptable.

Blank spikes were reported for the analyses of general organic and HPLC parameters, and a summary of the results is presented in Table 10. The analysis of one blank spike (extracted on July 9, 1993 for general organic parameters) yielded a 121 percent recovery for perchloropentacyclodecane which is slightly above the control limits. This may indicate a high bias in positive results for this compound. As all sample results for perchloropentacyclodecane were ND, however, no qualification of the data was necessary.

Due to the broad interference peak previously reported for the method blank extracted on July 14, 1993 for general organic parameters, a spike blank recovery for perchloropentacyclodecane was also unavailable for evaluation.

All other blank spike analyses for both general organic and HPLC parameters were within the control limits, indicating acceptable analytical efficiency was achieved.

8.0 REFERENCE STANDARD ANALYSES

In order to evaluate the accuracy of instrument calibration, reference standards are obtained from an independent source and analyzed. Reference standard analysis is performed at a minimum frequency of one per 20 investigative samples, or one per analytical batch. Reference standards were analyzed for general organics, arsenic and lead, and TOC analyses and the results are summarized in Table 11.

Control limits specified in the "QAP" for the analysis of general organics reference standards were 60 to 100 percent. Again, recoveries up to 120 percent were deemed acceptable. All reference standards recoveries were within these limits indicating good analytical accuracy was achieved for this analysis.

All reference standard analyses for TOC, arsenic and lead yielded recoveries within generally acceptable limits of 80 to 120 percent. Thus, acceptable analytical accuracy was also achieved for these analyses.

9.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSES

The recoveries of MS/MSD analyses are used to assess the analytical accuracy achieved on individual sample matrices. The relative percent difference (RPD) values between the MS and MSD results are used to assess analytical precision. MS/MSD analyses were performed at a minimum frequency of one per 20 investigative samples for benzene, general organic and HPLC parameters. MS/MSD recoveries and RPDs are summarized in Table 12. As established in the "QAP", control limits for percent recovery were 60 to 100 percent (although, for data validation purposes, an upper control limit of 120 percent was employed) and a maximum RPD value of 20 percent was considered acceptable.

All MS/MSD recoveries and RPD values reported for the HPLC and benzene analyses were acceptable based on the criteria stated above. On this basis, analytical accuracy and precision were deemed acceptable for these analyses.

For general organic parameters analysis, MS/MSD recoveries for sample OW657C could not be reported for trichloroethylene and tetrachloroethylene due to high concentrations in the sample. Thus, accuracy and precision for the analysis of these compounds could not be evaluated on the basis of MS/MSD results.

Analysis of the MS for sample OW657C also yielded an outlying (high) recovery for perchloropentacyclodecane. Since the MS recovery reported for this compound was acceptable, however, qualification of the data was not necessary.

For sample OW652C, the MS and MSD recoveries reported for trichloroethylene were below the control limits. Since reference standard and blank spike recoveries for this compound were acceptable, the low recoveries appear to be matrix related. Because these recoveries may indicate a low bias, the trichloroethylene result reported for this sample was qualified as estimated.

All remaining MS/MSD recoveries and RPD values reported for general organic parameters analysis were acceptable, indicating good laboratory precision and accuracy were achieved.

10.0 MATRIX SPIKE (MS) ANALYSES

The recoveries of MS analyses are used to assess the analytical accuracy achieved on individual sample matrices. Matrix spikes were performed at a minimum frequency of one per 20 investigative samples for metals, phosphorous, and TOC analyses. Recoveries are summarized in Table 13.

All MS recoveries were evaluated against control limits of 75-125 percent. A recovery of 74 percent was reported for the TOC MS analysis. As the reference standard previously evaluated for TOC analysis was acceptable, the low recovery is probably caused by the sample matrix. As this result may indicate a low bias in TOC data reported for this sample, the TOC result for sample OW658B was qualified as estimated.

All MS recoveries reported for metals and phosphorus were acceptable, indicating acceptable analytical accuracy was achieved for these analyses.

11.0 DUPLICATE SAMPLE ANALYSES

In order to assess laboratory precision, duplicate samples are prepared and analyzed by the laboratory. Analytical precision is deemed acceptable if resulting RPD values are less than 20 percent for sample values greater than five times the contract required detection limits (CRDLs). For sample results less than five times the CRDL, a control limit of plus or minus two times the CRDL is employed.

For this study, duplicate arsenic and lead analyses were performed on sample OW658C. A summary of the analytical data and resulting RPDs is presented in Table 14. Since all results for these analyses were non-detect, RPD values were not applicable and analytical precision was deemed acceptable.

12.0 FIELD QA/QC

12.1 RINSATE BLANK ANALYSES

Rinsate blanks are collected and analyzed to evaluate the possibility of cross-contamination introduced during sampling. For this study, a rinse blank was collected and analyzed for all parameters. A summary of the results is attached as Table 15.

TOC analysis of the rinse blank yielded a result of 1 mg/L. All sample results less than five times these concentrations were qualified as non-detect due to the likelihood that they reflect contamination. A summary of the qualified data is presented in Table 16. All other analyses yielded non-detect results indicating that contamination introduced during sampling was not a factor in this study.

12.2 FIELD DUPLICATE ANALYSES

In order to asses the analytical and sampling protocol precision, field duplicate samples are collected and submitted "blind" to the laboratory for analysis. Precision is then evaluated based on the RPD values reported.

For this study, the field duplicate samples collected were samples OW652B and OW661B. A summary of the field duplicate results and RPD values is presented in Table 17. In accordance with the "QAP", RPD values less than 20 percent were considered acceptable for general organics, benzene and HPLC analyses. For all other analyses, a general limit of 30 percent was employed to evaluate overall precision.

All RPD values reported for field duplicate analyses were less than the limits cited above. Analytical and sampling precision were deemed acceptable for these parameters on this basis.

13.0 CONCLUSIONS

Based on the assessment detailed in the foregoing, the data produced by WAL, Recra, OxyChem Technology Center - Central Sciences and The OxyChem Niagara Plant Works Laboratory are acceptable with the specific exceptions and qualifications noted herein.

TABLE 1

SAMPLE KEY
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample I.D.	*Well I.D.*
MW-1	MW-1
OW652B	OW652B
OW652C	OW652C
OW653B	OW653B
OW653C	OW653C
OW657B	OW657B
OW657C	OW657C
OW657D	OW657D
OW658B	OW658B
OW658C	OW658C
OW658D	OW658D
OW659B	OW659B
OW659C	OW659C
OW659D	OW659D
OW661B	OW652B (Duplicate)

TABLE 2

GENERAL ORGANIC AND HPLC PARAMETERS
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

General Organics

Toluene
Chlorobenzene
2-Chlorotoluene
4-Chlorotoluene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichlorobenzene
2,3-/3,4-Dichlorotoluene
2,6-Dichlorotoluene
2,3-/3,4-Dichlorotoluene
Trichloroethylene
Tetrachloroethylene
4-Chlorobenzotrifluoride
2-Chlorobenzotrifluoride
3,4-Dichlorobenzotriflouride
2,4-Dichlorobenzotriflouride
1,2,4-Trichlorobenzene
1,2,3-Trichlorobenzene
Hexachlorobutadiene
2,4,5-Trichlorotoluene
2,3,6-Trichlorotoluene
1,2,4,5-Tetrachlorobenzene
Hexachlorocyclopentadiene
2,4,5-Trichlorophenol
1,2,3,4-Tetrachlorobenzene
Octachlorocyclopentene
a-Hexachlorocyclohexane
b-Hexachlorocyclohexane
Hexachlorobenzene
g-Hexachlorocyclohexane
d-Hexachlorocyclohexane
Perchloropentacyclodene (Mirex)

HPLC Parameters

Benzoic Acid
2-Chlorobenzoic Acid
3-Chlorobenzoic Acid
4-Chlorobenzoic Acid
Chlorobenzoic Acids, Total
Chloroendic Acid

TABLE 3
ANALYTICAL DATA SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING 1993
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample Description:			*OW652B*	*OW661B*	*OW652C*	*OW653B*	*OW653C*
Sample Date:			*07/08/93*	*Dup.*	*07/09/93*	*07/13/93*	*07/13/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	ND
Arsenic	µg/L	19	ND26	ND 26	ND 26	ND 23	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	ND 33	ND 33	ND 33	19	21
Toluene	µg/L	1	ND	ND	ND	ND	ND
2-Chlorotoluene	µg/L	1	ND	ND	12	55	ND
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	5J	5J	18	150J	ND
Chlorobenzene	µg/L	1	ND	ND	2	140	ND
1,2-Dichlorobenzene	µg/L	1	ND	ND	ND	4	ND
1,3-Dichlorobenzene	µg/L	1	ND	ND	4	12	ND
1,4-Dichlorobenzene	µg/L	1	ND	ND	2	12	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	1	ND	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	2	2	26J	ND	ND
Tetrachloroethylene	µg/L	1	ND	ND	4	ND	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	ND	11	26	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	1	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	7	9	ND3	ND4	ND3
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

TABLE 3
ANALYTICAL DATA SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING 1993
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample Description:			*OW657B*	*OW657C*	*OW657D*	*OW658B*	*OW658C*
Sample Date:			*07/07/93*	*07/07/93*	*07/07/93*	*07/12/93*	*07/12/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	ND
Arsenic	µg/L	19	ND 26	ND 26	ND 26	ND 23	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	ND 33	ND 33	ND 33	ND 18	ND 18
Toluene	µg/L	1	ND	ND	ND	ND	ND
2-Chlorotoluene	µg/L	1	ND	ND	4	ND	130
4-Chlorotoluene	µg/L	1	ND	ND	ND	ND	14
2,4-/2,5-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	6
2,6-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND	ND	ND	ND	2
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	ND	ND	ND	6J	1100J
Chlorobenzene	µg/L	1	ND	ND	1	4	380
1,2-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	64
1,3-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	110
1,4-Dichlorobenzene	µg/L	1	ND	ND	ND	ND	95
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	2
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	28	1100	120	46	34
Tetrachloroethylene	µg/L	1	11	120	21	12	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	ND	1	ND	2	10
2,4-Dichlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	5
3,4-Dichlorobenzotrifluoride	µg/L	1	ND.	ND	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	6	ND2	ND3	7J	ND2
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

TABLE 3
ANALYTICAL DATA SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING 1993
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample Description:			*OW658D*	*OW659B*	*OW659C*	*OW659D*	*MW-1*
Sample Date:			*07/12/93*	*07/08/93*	*07/07/93*	*07/13/93*	*07/16/93*
Analytes	*Units*	*Detection Level*					
Phosphorus, Total Soluble	µg P/L	10	ND	ND	ND	ND	17
Arsenic	µg/L	19	ND 23	ND 26	ND 26	ND 33	ND 23
Mercury	µg/L	0.4	ND	ND	ND	ND	ND
Lead	µg/L	18	31	ND 33	ND 33	29	37
Toluene	µg/L	1	3	ND	1	ND	ND
2-Chlorotoluene	µg/L	1	160	190	250	2	ND
4-Chlorotoluene	µg/L	1	11	2	ND	ND	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	22	5	11	ND	ND
2,6-Dichlorotoluene	µg/L	1	3	ND	2	ND	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	2	ND	ND	ND	ND
2,3,6-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	µg/L	1	ND	ND	ND	ND	ND
Benzene	µg/L	1	1100J	1500	34	3	ND
Chlorobenzene	µg/L	1	540	1200	300	9	ND
1,2-Dichlorobenzene	µg/L	1	100	91	18	ND	ND
1,3-Dichlorobenzene	µg/L	1	330	360	160	ND	ND
1,4-Dichlorobenzene	µg/L	1	200	350	89	ND	ND
1,2,3-Trichlorobenzene	µg/L	1	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	µg/L	1	34	ND	ND	3	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND	ND	ND	14	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Hexachlorobenzene	µg/L	1	ND	ND	ND	ND	ND
Trichloroethylene	µg/L	1	23	ND	ND	ND	ND
Tetrachloroethylene	µg/L	1	1	ND	ND	ND	ND
2-Chlorobenzotrifluoride	µg/L	1	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	µg/L	1	60	86	190	ND	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	9	7	ND	ND	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND	43	ND	ND	ND
Hexachlorobutadiene	µg/L	1	ND	ND	ND	2	ND
Hexachlorocyclopentadiene	µg/L	1	ND	ND	ND	ND	ND
Octachlorocyclopentene	µg/L	1	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	µg/L	10	ND	ND	ND	ND	ND
a-Hexachlorocyclohexane	µg/L	1	5	1	ND	ND	ND
b-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	µg/L	1	ND	ND	ND	ND	ND
Benzoic acid	µg/L	100	ND	ND	ND	ND	ND
2-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
3-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
4-Chlorobenzoic acid	µg/L	30	ND	ND	ND	ND	ND
Chlorobenzoic acids, total	µg/L	90	ND	ND	ND	ND	ND
Chlorendic acid	µg/L	250	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	mg/L	1	ND2	7	12	ND3	ND4
Total Organic Halides (TOX)	µg/L	50	R	R	R	R	R

Notes:

ND - Not detected at or above the detection level shown in the column entitled "Detection Level". Where detection levels vary, the detection level is shown with the respective analyses.

J - Associated result is estimated

R - Result was rejected

TABLE 4

MAXIMUM HOLDING TIMES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Laboratory Analysis	*Method*	*Maximum Holding Times (1) (Contractural)*	*Maximum Holding Times (2) (Technical)*
General Organics	OxyChem Microextraction Method	7 days from collection to extraction 40 days from extraction to analysis	NA
Benzene	8020	7 days from collection to analysis	7 days from collection to analysis
HPLC Parameters	Solvent Exchange Method	30 days from collection to analysis	NA
Total Organic Carbon	9060	28 days from collection to analysis	28 days from collection to analysis
Total Organic Halides	450.1	7 days from collection to analysis	7 days from collection to analysis
Total Soluble Phosphorus	365.2	28 days from collection to analysis	28 days from collection to analysis
Arsenic and Lead	200.7	28 days from collection to analysis	6 months from collection to analysis
Mercury	7470	28 days from collection to analysis	28 days from collection to analysis

Notes:
(1) Contractual holding times in accordance with the "QAP".
(2) Technical holding times in accordance with the methods cited.

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample ID	*Analyses*	*Date Sampled*	*Date Extracted*	*Date Analyzed*	*Holding Time (1) (days)*	*Holding Time (2) (days)*
OW652B	General Organics	07/08/93	07/12/93	07/13/93	4	1
	Benzene	07/08/93		07/16/93		8*
	HPLC Parameters	07/08/93	07/14/93	07/15/93	6	1
	TOC	07/08/93		08/05/93		28
	Arsenic and Lead	07/08/93		07/19/93		11
	Mercury	07/08/93		07/16/93		8
	Soluble Phosphorus	07/08/93		07/13/93		5
OW652C	General Organics	07/09/93	07/12/93	07/13/93	3	1
	Benzene	07/09/93		07/16/93		7
	HPLC Parameters	07/09/93	07/22/93	07/23/93	13	1
	TOC	07/09/93		08/05/93		27
	Arsenic and Lead	07/09/93		07/19/93		10
	Mercury	07/09/93		07/16/93		7
	Soluble Phosphorus	07/09/93		07/13/93		4
OW653B	General Organics	07/13/93	07/14/93	07/16/93	1	2
	Benzene	07/13/93		07/20/93		7
	HPLC Parameters	07/13/93	07/22/93	07/23/93	9	1
	TOC	07/13/93		08/05/93		23
	Arsenic and Lead	07/13/93		07/20/93		7
	Mercury	07/13/93		07/16/93		3
	Soluble Phosphorus	07/13/93		07/20/93		7
OW653C	General Organics	07/13/93	07/13/93	07/14/93	0	1
	Benzene	07/13/93		07/20/93		7
	HPLC Parameters	07/13/93	07/22/93	07/23/93	9	1
	TOC	07/13/93		08/05/93		23
	Arsenic and Lead	07/13/93		07/20/93		7
	Mercury	07/13/93		07/16/93		3
	Soluble Phosphorus	07/13/93		07/20/93		7

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample ID	*Analyses*	*Date Sampled*	*Date Extracted*	*Date Analyzed*	*Holding Time (1) (days)*	*Holding Time (2) (days)*
OW657B	General Organics	07/07/93	07/09/93	07/10/93	2	1
	Benzene	07/07/93		07/14/93		7
	HPLC Parameters	07/07/93	07/14/93	07/15/93	7	1
	TOC	07/07/93		07/09/93		2
	Arsenic and Lead	07/07/93		07/19/93		12
	Mercury	07/07/93		07/13/93		6
	Soluble Phosphorus	07/07/93		07/13/93		6
OW657C	General Organics	07/07/93	07/09/93	07/10/93	2	1
	Benzene	07/07/93		07/14/93		7
	HPLC Parameters	07/07/93	07/14/93	07/15/93	7	1
	TOC	07/07/93		07/09/93		2
	Arsenic and Lead	07/07/93		07/19/93		12
	Mercury	07/07/93		07/13/93		6
	Soluble Phosphorus	07/07/93		07/13/93		6
OW657D	General Organics	07/07/93	07/12/93	07/13/93	5	1
	Benzene	07/07/93		07/14/93		7
	HPLC Parameters	07/07/93	07/14/93	07/15/93	7	1
	TOC	07/07/93		07/09/93		2
	Arsenic and Lead	07/07/93		07/19/93		12
	Mercury	07/07/93		07/13/93		6
	Soluble Phosphorus	07/07/93		07/13/93		6
OW658B	General Organics	07/12/93	07/14/93	07/16/93	2	2
	Benzene	07/12/93		07/20/93		8*
	HPLC Parameters	07/12/93	07/22/93	07/23/93	10	1
	TOC	07/12/93		08/05/93		24
	Arsenic and Lead	07/12/93		07/20/93		8
	Mercury	07/12/93		07/16/93		4
	Soluble Phosphorus	07/12/93		07/20/93		8

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample ID	*Analyses*	*Date Sampled*	*Date Extracted*	*Date Analyzed*	*Holding Time (1) (days)*	*Holding Time (2) (days)*
OW658C	General Organics	07/12/93	07/14/93	07/16/93	2	2
	Benzene	07/12/93		07/20/93		8*
	HPLC Parameters	07/12/93	07/22/93	07/23/93	10	1
	TOC	07/12/93		08/05/93		24
	Arsenic and Lead	07/12/93		07/20/93		8
	Mercury	07/12/93		07/16/93		4
	Soluble Phosphorus	07/12/93		07/20/93		8
OW658D	General Organics	07/12/93	07/14/93	07/16/93	2	2
	Benzene	07/12/93		07/20/93		8*
	HPLC Parameters	07/12/93	07/22/93	07/23/93	10	1
	TOC	07/12/93		08/05/93		24
	Arsenic and Lead	07/12/93		07/20/93		8
	Mercury	07/12/93		07/16/93		4
	Soluble Phosphorus	07/12/93		07/20/93		8
OW659B	General Organics	07/08/93	07/12/93	07/13/93	4	1
	Benzene	07/08/93		07/15/93		7
	HPLC Parameters	07/08/93	07/14/93	07/15/93	6	1
	TOC	07/08/93		07/09/93		1
	Arsenic and Lead	07/08/93		07/19/93		11
	Mercury	07/08/93		07/13/93		5
	Soluble Phosphorus	07/08/93		07/13/93		5
OW659C	General Organics	07/08/93	07/09/93	07/10/93	1	1
	Benzene	07/08/93		07/14/93		6
	HPLC Parameters	07/08/93	07/14/93	07/15/93	6	1
	TOC	07/08/93		07/09/93		1
	Arsenic and Lead	07/08/93		07/19/93		11
	Mercury	07/08/93		07/13/93		5
	Soluble Phosphorus	07/08/93		07/13/93		5

TABLE 5

SAMPLE HOLDING TIME SUMMARY
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample ID	*Analyses*	*Date Sampled*	*Date Extracted*	*Date Analyzed*	*Holding Time (1) (days)*	*Holding Time (2) (days)*
OW659D	General Organics	07/13/93	07/14/93	07/16/93	1	2
	Benzene	07/13/93		07/20/93		7
	HPLC Parameters	07/13/93	07/22/93	07/23/93	9	1
	TOC	07/13/93		08/05/93		23
	Arsenic and Lead	07/13/93		07/20/93		7
	Mercury	07/13/93		07/16/93		3
	Soluble Phosphorus	07/13/93		07/20/93		7
OW661B	General Organics	07/08/93	07/12/93	07/13/93	4	1
	Benzene	07/08/93		07/16/93		8*
	HPLC Parameters	07/08/93	07/14/93	07/15/93	6	1
	TOC	07/08/93		08/05/93		28
	Arsenic and Lead	07/08/93		07/19/93		11
	Mercury	07/08/93		07/16/93		8
	Soluble Phosphorus	07/08/93		07/13/93		5
MW-1	General Organics	07/16/93	07/19/93	07/19/93	3	3
	Benzene	07/16/93		07/20/93		4
	HPLC Parameters	07/16/93	07/22/93	07/23/93	6	1
	TOC	07/16/93		08/05/93		20
	Arsenic and Lead	07/16/93		07/20/93		4
	Mercury	07/16/93		07/23/93		7
	Soluble Phosphorus	07/16/93		07/30/93		14

Notes:
(1) Sample holding time from collection to extraction
(2) Sample holding time to analysis
* Holding time exceedance

TABLE 6

METHOD BLANK DATA
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Analyzed:	*Detection Limit (µg P/L)*	*Blank Conc. (µg P/L) 07/13/93*	*Blank Conc. (µg P/L) 07/13/93*	*Blank Conc. (µg P/L) 07/20/93*	*Blank Conc. (µg P/L) 07/30/93*
Analyte					
Phosphorous, Total Soluble	10	ND	ND	ND	ND

Date Analyzed:	*Detection Limit (µg/L)*	*Blank Conc. (µg/L) 07/13/93*	*Blank Conc. (µg/L) 07/13/93*	*Blank Conc. (µg/L) 07/23/93*
Analyte				
Mercury	0.20	ND	ND	ND

Date Analyzed:	*Detection Limit (µg/L)*	*Blank Conc. (µg/L) 07/19/93*	*Blank Conc. (µg/L) 07/20/93*
Analyte			
Arsenic	26	ND	ND23
Lead	33	ND	ND18

TABLE 6

METHOD BLANK DATA
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Analyzed:	*Detection Limit (µg/L)*	*Blank Conc. (µg/L) 07/15/93*	*Blank Conc. (µg/L) 07/16/93*	*Blank Conc. (µg/L) 07/16/93*	*Blank Conc. (µg/L) 07/20/93*
Analyte					
Benzene	1	ND	ND	ND	ND

Date Extracted:	*Detection Limit (µg/L)*	*Blank Conc. (µg/L) 07/09/93*	*Blank Conc. (µg/L) 07/13/93*	*Blank Conc. (µg/L) 07/16/93*	*Blank Conc. (µg/L) 07/19/93*
Compound					
Toluene	ND	ND	ND	ND	ND
2-Chlorotoluene	ND	ND	ND	ND	ND
4-Chlorotoluene	ND	ND	ND	ND	ND
2,4-/2,5-Dichlorotoluene	ND	ND	ND	ND	ND
2,6-Dichlorotoluene	ND	ND	ND	ND	ND
2,3-/3,4-Dichlorotoluene	ND	ND	ND	ND	ND
2,3,6-Trichlorotoluene	ND	ND	ND	ND	ND
2,4,5-Trichlorotoluene	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
1,2,3,4-Tetrachlorobenzene	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND	ND
2-Chlorobenzotrifluoride	ND	ND	ND	ND	ND
4-Chlorobenzotrifluoride	ND	ND	ND	ND	ND
2,4-Dichlorobenzotrifluoride	ND	ND	ND	ND	ND
3,4-Dichlorobenzotrifluoride	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND
Octachlorocyclopentene	ND	ND	ND	ND	ND
Perchloropentacyclodecane (Mirex)	ND	ND	ND	*	

TABLE 6

METHOD BLANK DATA
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

	Detection Limit (µg/L)	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*07/09/93*	*07/13/93*	*07/16/93*	*07/19/93*
Compound					
2,4,5-Trichlorophenol	10	ND	ND	ND	ND
a-Hexachlorocyclohexane	ND	ND	ND	ND	ND
b-Hexachlorocyclohexane	ND	ND	ND	ND	ND
g-Hexachlorocyclohexane	ND	ND	ND	ND	ND
d-Hexachlorocyclohexane	ND	ND	ND	ND	ND

	Detection Limit (µg/L)	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Extracted:		*07/15/93*	*07/23/93*
Compound			
Benzoic acid	100	ND	ND
2-Chlorobenzoic acid	30	ND	ND
3-Chlorobenzoic acid	30	ND	ND
4-Chlorobenzoic acid	30	ND	ND
Chlorobenzoic acids, total	90	ND	ND
Chlorendic acid	250	ND	ND

	Detection Limit (µg/L)	*Blank Conc. (µg/L)*	*Blank Conc. (µg/L)*
Date Analyzed:		*07/09/93*	*08/05/93*
Compound			
Total Organic Carbon (TOC)	1	1	1

Notes:
* Result not available due to broad interference peak.

TABLE 7

QUALIFIED SAMPLE DATA DUE TO METHOD BLANK CONTAMINATION
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Parameter	*Compound*	*Blank Analysis Date*	*Blank Conc. (mg/L)*	*Associated Sample*	*Sample Conc. (mg/L)*	*Qualified Sample Conc. (mg/L)*
TOC	TOC	7/9/93	1	OW657C	2	ND2
				OW657D	3	ND3
TOC	TOC	8/5/93	1	OW652C	3	ND3
				OW653B	4	ND4
				OW653C	3	ND3
				OW658C	2	ND2
				OW658D	2	ND2
				MW-1	4	ND4

Notes:
TOC Total Organic Carbon.
J Associated value is estimated.
ND Non-Detect at associated limit.

TABLE 8

SURROGATE SPIKE RECOVERIES FOR BENZENE ANALYSES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample ID	*a,a,a-Trifluorotoluene Recovery (percent)*	*1-Chloro-4-Fluorobenzene Recovery (percent)*
OW652B	125*	-
OW652C	I	96
OW653B	122*	-
OW657B	I	107
OW657C	I	107
OW657D	I	100
OW658B	I	-
OW658C	111	-
OW658D	104	-
OW659B	103	-
OW659C	79	-
OW659D	109	-
OW661B	122*	-
MW-1	118	-

Notes:
I - Surrogate recovery not available due to sample matrix interferences.
* - Surrogate recovery outside of control limits (50-120%)

TABLE 9

QUALIFIED DATA DUE TO OUTLYING SURROGATE RECOVERIES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Sample I.D.	*Outlying Surrogate*	*Surrogate Recovery (Percent)*	*Control Limits (Percent)*	*Benzene Conc. (µg/L)*	*Qualifier*
OW652B	a,a,a-Trifluorotoluene	125	50-120	5	J
OW653B	a,a,a-Trifluorotoluene	122	50-120	150	J
OW661B (Dup. of OW652B)	a,a,a-Trifluorotoluene	122	50-120	5	J

Notes:
J Associated value is estimated.

TABLE 10

BLANK SPIKE RECOVERIES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Extracted:	*Blank Spike 07/09/93*	*Blank Spike 07/12/93*	*Blank Spike 07/14/93*	*Blank Spike 07/19/93*
Compounds/Analytes				
Toluene	80	88	92	72
Chlorobenzene	73	85	88	77
2-Chlorotoluene	68	80	84	68
4-Chlorotoluene	76	88	92	76
1,3-Dichlorobenzene	73	88	88	65
1,4-Dichlorobenzene	80	92	92	76
1,2-Dichlorobenzene	76	88	92	80
2,4-/2,5-Dichlorotoluene	73	88	88	73
2,6-Dichlorotoluene	76	88	88	72
2,3-/3,4-Dichlorotoluene	76	88	88	72
Trichloroethylene	100	73	81	96
Tetrachloroethylene	116	96	108	100
4-Chlorobenzotrifluoride	108	108	112	104
2-Chlorobenzotrifluoride	112	112	116	108
3,4-Dichlorobenzotrifluoride	112	112	116	108
2,4-Dichlorobenzotrifluoride	112	108	116	108
1,2,4-Trichlorobenzene	112	96	112	108
1,2,3-Trichlorobenzene	112	100	116	108
Hexachlorobutadiene	116	84	84	108
2,4,5-Trichlorotoluene	116	84	112	108
2,3,6-Trichlorotoluene	108	88	108	104
1,2,4,5-Tetrachlorobenzene	112	92	115	108
Hexachlorocyclopentadiene	120	88	96	100
2,4,5-Trichlorophenol	72	68	76	60
1,2,3,4-Tetrachlorobenzene	115	93	115	107
Octachlorocyclopentene	120	84	96	96
a-Hexachlorocyclohexane	108	88	100	104
b-Hexachlorocyclohexane	100	84	96	92
Hexachlorobenzene	115	77	108	100
g-Hexachlorocyclohexane	112	85	96	100
d-Hexachlorocyclohexane	100	85	93	93
Perchloropentacyclodecane (Mirex)	121*	88	**	100

TABLE 10

BLANK SPIKE RECOVERIES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Extracted:	*Blank Spike 07/14/93*	*Blank Spike 07/23/93*
Compounds/Analytes		
Benzoic acid	80	90
2-Chlorobenzoic acid	85	90
3-Chlorobenzoic acid	90	95
4-Chlorobenzoic acid	85	95
Chlorobenzoic acids, total	87	93
Chlorendic acid	85	98

Notes:

* Recovery of control limits (60-120 percent).

** Recovery not available due to broad interference peak in the method blank.

TABLE 11

REFERENCE STANDARD PERCENT RECOVERIES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Extracted: *Compounds*	*Reference Standard 07/12/93*	*Reference Standard 07/14/93*	*Reference Standard 07/20/93*
Toluene	87	92	98
Chlorobenzene	84	104	77
2-Chlorotoluene	99	101	102
4-Chlorotoluene	77	101	80
1,3-Dichlorobenzene	76	99	82
1,4-Dichlorobenzene	74	101	76
1,2-Dichlorobenzene	73	100	76
2,4-/2,5-Dichlorotoluene	75	100	78
2,6-Dichlorotoluene	75	101	78
2,3-/3,4-Dichlorotoluene	75	100	77
Trichloroethylene	101	110	101
Tetrachloroethylene	99	99	111
4-Chlorobenzotrifluoride	109	108	110
2-Chlorobenzotrifluoride	107	108	110
3,4-Dichlorobenzotrifluoride	112	111	116
2,4-Dichlorobenzotrifluoride	111	108	113
1,2,4-Trichlorobenzene	98	110	115
1,2,3-Trichlorobenzene	94	105	111
Hexachlorobutadiene	97	116	95
2,4,5-Trichlorotoluene	97	103	115
2,3,6-Trichlorotoluene	97	106	116
1,2,4,5-Tetrachlorobenzene	97	107	117
Hexachlorocyclopentadiene	107	92	103
2,4,5-Trichlorophenol	98	96	91
1,2,3,4-Tetrachlorobenzene	99	108	120
Octachlorocyclopentene	107	95	97
a-Hexachlorocyclohexane	102	101	109
b-Hexachlorocyclohexane	100	104	109
Hexachlorobenzene	99	98	118
g-Hexachlorocyclohexane	99	94	106
d-Hexachlorocyclohexane	98	96	104
Perchloropentacyclodecane (Mirex	102	102	111

TABLE 11

REFERENCE STANDARD PERCENT RECOVERIES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Date Analyzed: *Analytes*	*Reference Standard 07/19/93*	*Reference Standard 07/20/93*
Arsenic	94	99
Lead	100	103

Date Analyzed: *Analytes*	*Reference Standard* 07/09/93	*Reference Standard* 08/05/93
Total Organic Carbon (TOC)	104	98

TABLE 12

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES FOR GENERAL ORGANIC ANALYSES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

MS/MSD Sample I.D.:	OW657C			OW652C			OW-653C			MW-1			OW-658D		
Analytes	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD	MS	MSD	RPD
Benzene	105	102	3	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	72	68	6	84	80	5	76	72	5	84	88	5	-	-	-
Chlorobenzene	62	58	7	81	77	5	65	65	0	73	73	0	-	-	-
2-Chlorotoluene	84	76	10	96	92	4	64	60	6	68	68	0	-	-	-
4-Chlorotoluene	68	60	13	76	72	5	72	68	6	76	76	0	-	-	-
1,3-Dichlorobenzene	65	62	5	77	73	5	69	69	0	77	77	0	-	-	-
1,4-Dichlorobenzene	72	64	12	84	80	5	72	72	0	80	80	0	-	-	-
1,2-Dichlorobenzene	68	64	6	84	80	5	72	72	0	80	80	0	-	-	-
2,4-/2,5-Dichlorotoluene	65	62	5	77	73	5	69	69	0	77	77	0	-	-	-
2,6-Dichlorotoluene	64	60	6	76	72	5	72	68	6	76	76	0	-	-	-
2,3-/3,4-Dichlorotoluene	68	64	6	76	72	5	72	72	0	76	76	0	-	-	-
Trichloroethylene	NA(1)	NA(1)	-	58*	58*	0	119	123	3	92	92	0	-	-	-
Tetrachloroethylene	NA(1)	NA(1)	-	88	84	5	108	108	0	100	104	4	-	-	-
4-Chlorobenzotrifluoride	92	84	9	80	72	11	88	84	5	92	92	0	-	-	-
2-Chlorobenzotrifluoride	96	84	13	96	92	4	92	88	4	96	100	4	-	-	-
3,4-Dichlorobenzotrifluoride	100	88	13	96	92	4	96	92	4	100	100	0	-	-	-
2,4-Dichlorobenzotrifluoride	100	88	13	96	92	4	96	92	4	100	100	0	-	-	-
1,2,4-Trichlorobenzene	108	100	8	100	100	0	108	112	4	108	112	4	-	-	-
1,2,3-Trichlorobenzene	108	100	8	100	100	0	112	112	0	108	112	4	-	-	-
Hexachlorobutadiene	112	100	11	76	76	0	104	112	7	96	100	4	-	-	-
2,4,5-Trichlorotoluene	112	100	11	84	88	5	112	116	4	108	112	4	-	-	-
2,3,6-Trichlorotoluene	104	96	8	85	88	3	104	108	4	104	108	4	-	-	-
1,2,4,5-Tetrachlorobenzene	112	104	7	92	96	4	112	115	3	112	119	6	-	-	-
Hexachlorocyclopentadiene	120	112	7	84	84	0	76	73	4	88	88	0	-	-	-
2,4,5-Trichlorophenol	76	72	5	72	76	5	76	73	4	64	68	6	-	-	-
1,2,3,4-Tetrachlorobenzene	115	104	10	93	96	3	111	119	7	111	115	4	-	-	-
Octachlorocyclopentene	120	112	7	80	80	0	76	80	5	84	88	5	-	-	-
a-Hexachlorocyclohexane	115	108	6	85	88	3	119	119	0	92	100	8	-	-	-
b-Hexachlorocyclohexane	108	100	8	84	88	5	104	108	4	84	88	5	-	-	-
Hexachlorobenzene	115	108	6	77	81	5	108	112	4	108	115	6	-	-	-
g-Hexachlorocyclohexane	119	112	6	88	88	0	115	115	0	88	96	9	-	-	-
d-Hexachlorocyclohexane	104	100	4	81	85	5	111	111	0	85	89	5	-	-	-
Perchloropentacyclodecane (Mirex)	125*	113	10	83	83	0	100	100	0	83	88	6	-	-	-

TABLE 12

MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES FOR GENERAL ORGANIC ANALYSES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

MS/MSD Sample I.D.:	*OW657C*			*OW652C*			*OW-653C*			*MW-1*			*OW-658D*		
Analytes	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*	*MS*	*MSD*	*RPD*
Benzoic acid	96	90	6	-	-	-	-	-	-	-	-	-	86	NA (2)	-
2-Chlorobenzoic acid	98	96	2	-	-	-	-	-	-	-	-	-	84	NA (2)	-
3-Chlorobenzoic acid	100	98	2	-	-	-	-	-	-	-	-	-	88	NA (2)	-
4-Chlorobenzoic acid	102	96	6	-	-	-	-	-	-	-	-	-	84	NA (2)	-
Chlorobenzoic acids, total	100	97	3	-	-	-	-	-	-	-	-	-	85	NA (2)	-
Chlorendic acid	95	96	1	-	-	-	-	-	-	-	-	-	84	NA (2)	-

Notes:

NA (1) Not available as original sample concentration was too high in relation to spike concentration to determine percent recovery.

NA (2) Not available. Sample extract lost during processing.

RPD Relative Percent Difference.

* Recovery is outside of control limits (60-120 percent).

TABLE 13

MATRIX SPIKE (MS) RECOVERIES FOR INORGANIC ANALYSES
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

MS Sample I.D.:	*OW658B*	*OW658C*	*OW657C*	*OW652C*
Analytes				
Phosphorus, Total Soluble	-	-	94	106
Arsenic	-	100	-	-
Mercury	-	-	90	100
Lead	-	102	-	-
Total Organic Carbon (TOC)	74*	-	-	-

Notes:

* Recovery outside of control limits (75-125 percent).

TABLE 14

DUPLICATE ANALYSIS DATA
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

		OW658C		
Analytes	*Units*	*Original Conc.*	*Duplicate Conc.*	*RPD*
Arsenic	µg/L	ND	ND	*
Lead	µg/L	ND	ND	*

Notes:
RPD Relative Percent Difference.
ND Non-Detect at the associated detection limit.
* RPD could not be calculated due to one or more non-detect values.

TABLE 15

RINSATE BLANK DATA
PHASE 2 - ROUND 2 OSI SAMPLING
JULY 1993
OCCIDENTAL CHEMICAL CORPORATION

Analytes	*Units*	*Detection Limit*	*Rinse Blank Conc.*
Phosphorus, Total Soluble	µg P/L	10	ND
Arsenic	µg/L	26	ND
Mercury	µg/L	0.4	ND
Lead	µg/L	33	ND
Toluene	µg/L	1	ND
2-Chlorotoluene	µg/L	1	ND
4-Chlorotoluene	µg/L	1	ND
2,4-/2,5-Dichlorotoluene	µg/L	1	ND
2,6-Dichlorotoluene	µg/L	1	ND
2,3-/3,4-Dichlorotoluene	µg/L	1	ND
2,3,6-Trichlorotoluene	µg/L	1	ND
2,4,5-Trichlorotoluene	µg/L	1	ND
Benzene	µg/L	1	ND
Chlorobenzene	µg/L	1	ND
1,2-Dichlorobenzene	µg/L	1	ND
1,3-Dichlorobenzene	µg/L	1	ND
1,4-Dichlorobenzene	µg/L	1	ND
1,2,3-Trichlorobenzene	µg/L	1	ND
1,2,4-Trichlorobenzene	µg/L	1	ND
1,2,3,4-Tetrachlorobenzene	µg/L	1	ND
1,2,4,5-Tetrachlorobenzene	µg/L	1	ND
Hexachlorobenzene	µg/L	1	ND
Trichloroethylene	µg/L	1	ND
Tetrachloroethylene	µg/L	1	ND
2-Chlorobenzotrifluoride	µg/L	1	ND
4-Chlorobenzotrifluoride	µg/L	1	ND
2,4-Dichlorobenzotrifluoride	µg/L	1	ND
3,4-Dichlorobenzotrifluoride	µg/L	1	ND
Hexachlorobutadiene	µg/L	1	ND
Hexachlorocyclopentadiene	µg/L	1	ND
Octachlorocyclopentene	µg/L	1	ND
Perchloropentacyclodecane (Mirex)	µg/L	1	ND
2,4,5-Trichlorophenol	µg/L	10	ND
a-Hexachlorocyclohexane	µg/L	1	ND
b-Hexachlorocyclohexane	µg/L	1	ND
g-Hexachlorocyclohexane	µg/L	1	ND
d-Hexachlorocyclohexane	µg/L	1	ND
Benzoic acid	µg/L	100	ND

TABLE 15

RINSATE BLANK DATA
PHASE 2 - ROUND 2 OSI SAMPLING
JULY 1993
OCCIDENTAL CHEMICAL CORPORATION

Analytes	*Units*	*Detection Limit*	*Rinse Blank Conc.*
2-Chlorobenzoic acid	µg/L	30	ND
3-Chlorobenzoic acid	µg/L	30	ND
4-Chlorobenzoic acid	µg/L	30	ND
Chlorobenzoic acids, total	µg/L	90	ND
Chlorendic acid	µg/L	250	ND
Total Organic Carbon (TOC)	mg/L	1	ND

Notes:
ND - Non-detect at the associated detection limit.

TABLE 16

QUALIFIED SAMPLE DATA DUE TO RINSATE BLANK CONTAMINATION
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Parameter	*Compounds*	*Rinsate Blank Conc.*	*Associated Samples*	*Sample Conc.*	*Qualified Sample Conc.*	*Units*
TOC	TOC	1	OW652C	3	ND3	mg/L
			OW653B	4	ND4	mg/L
			OW653C	3	ND3	mg/L
			OW657C	2	ND2	mg/L
			OW657D	3	ND3	mg/L
			OW658C	2	ND2	mg/L
			OW658D	2	ND2	mg/L
			OW659D	3	ND3	mg/L
			MW-1	4	ND4	mg/L

Key:
TOC Total Organic Carbon.

TABLE 17

FIELD DUPLICATE RESULTS
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Compounds/Analytes	*Units*	*OW652B*	*OW661B Dup.*	*RPD*
Phosphorus, Total Soluble	µg P/L	ND	ND	*
Arsenic	µg/L	ND26	ND26	*
Mercury	µg/L	ND	ND	*
Lead	µg/L	ND33	ND33	*
Toluene	µg/L	ND	ND	*
2-Chlorotoluene	µg/L	ND	ND	*
4-Chlorotoluene	µg/L	ND	ND	*
2,4-/2,5-Dichlorotoluene	µg/L	ND	ND	*
2,6-Dichlorotoluene	µg/L	ND	ND	*
2,3-/3,4-Dichlorotoluene	µg/L	ND	ND	*
2,3,6-Trichlorotoluene	µg/L	ND	ND	*
2,4,5-Trichlorotoluene	µg/L	ND	ND	*
Benzene	µg/L	5	5	0
Chlorobenzene	µg/L	ND	ND	*
1,2-Dichlorobenzene	µg/L	ND	ND	*
1,3-Dichlorobenzene	µg/L	ND	ND	*
1,4-Dichlorobenzene	µg/L	ND	ND	*
1,2,3-Trichlorobenzene	µg/L	ND	ND	*
1,2,4-Trichlorobenzene	µg/L	ND	ND	*
1,2,3,4-Tetrachlorobenzene	µg/L	ND	ND	*
1,2,4,5-Tetrachlorobenzene	µg/L	ND	ND	*
Hexachlorobenzene	µg/L	ND	ND	*
Trichloroethylene	µg/L	2	2	0
Tetrachloroethylene	µg/L	ND	ND	*
2-Chlorobenzotrifluoride	µg/L	ND	ND	*
4-Chlorobenzotrifluoride	µg/L	ND	ND	*
2,4-Dichlorobenzotrifluoride	µg/L	ND	ND	*
3,4-Dichlorobenzotrifluoride	µg/L	ND	ND	*
Hexachlorobutadiene	µg/L	ND	ND	*
Hexachlorocyclopentadiene	µg/L	ND	ND	*
Octachlorocyclopentene	µg/L	ND	ND	*
Perchloropentacyclodecane (Mirex)	µg/L	ND	ND	*
2,4,5-Trichlorophenol	µg/L	ND	ND	*
a-Hexachlorocyclohexane	µg/L	ND	ND	*
b-Hexachlorocyclohexane	µg/L	ND	ND	*
g-Hexachlorocyclohexane	µg/L	ND	ND	*
d-Hexachlorocyclohexane	µg/L	ND	ND	*

TABLE 17

FIELD DUPLICATE RESULTS
PHASE 2 - ROUND 2 OSI SAMPLING
OCCIDENTAL CHEMICAL CORPORATION
JULY 1993

Compounds/Analytes	*Units*	*OW652B*	*OW661B Dup.*	*RPD*
Benzoic acid	µg/L	ND	ND	*
2-Chlorobenzoic acid	µg/L	ND	ND	*
3-Chlorobenzoic acid	µg/L	ND	ND	*
4-Chlorobenzoic acid	µg/L	ND	ND	*
Chlorobenzoic acids, total	µg/L	ND	ND	*
Chlorendic acid	µg/L	ND	ND	*
Total Organic Carbon (TOC)	mg/L	7	9	25

Notes:
RPD Relative Percent Difference.
ND Non-Detect at the specified detection limit.
* RPD value could not be calculated due to one or more non-detect results.