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October 24, 1984
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Attention: Mr. Beverly Adams
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SUPPLEMENTAL
MANMADE PASSAGEWAY INVESTIGATIONS
NIAGARA PLANT
NIAGARA FALLS, NEW YORK

Gentlemen:

We are pleased to present herein our report of the "Supplemental Manmade Passageway Investigations, Niagara Plant Site, Niagara Falls, New York". This study was conducted in accordance with DuPont's plan dated April 10, 1984, entitled "Supplemental Groundwater Investigation Plan", and your subsequent authorization. This plan for supplemental investigations was developed to further define the site geohydrologic regime, including the manmade passageways, and to provide additional information for the design and implementation of a remediation program. WCC has prepared a companion report as part of this supplemental investigation, entitled "Supplemental Geohydrologic Investigations, Niagara Plant Site, Niagara Falls, New York", which is being transmitted to you under separate cover.

The report presented herein was prepared using field data collected during installation of the five new utility (monitoring) wells and analytical data generated from May, June and August 1984 soil and groundwater sampling. These new data were used to reassess previously developed interpretations presented in WCC's "Manmade Passageways Investigations" report dated February 17, 1984. The data utilized during the preparation of this report are included as tables, plates and appendices.

Bot #14

We sincerely appreciate the opportunity of providing these services to you on this on-going Niagara Plant project. If you have any questions, please contact us.

Very truly yours,

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SUPPLEMENTAL
MANMADE PASSAGEWAY INVESTIGATIONS
NIAGARA PLANT
NIAGARA FALLS, NEW YORK

Prepared for:

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EXECUTIVE SUMMARY

This supplemental investigation was undertaken at the DuPont Niagara Plant site to evaluate the presence or movement of suspect chemical contaminants through manmade passageways. Manmade passageways are defined as those portions of the subsurface which have been excavated and refilled to accommodate the placement of buried utilities, such as water, sewer or electrical lines. This report presents our findings and conclusions regarding contaminant transport within and through the manmade passageways in accordance with DuPont's plan dated April 10, 1984 and entitled "Supplemental Groundwater Investigation Plan". The information developed during this study can be used in conjunction with that presented in our previous reports entitled "Manmade Passageways Investigations", dated February 17, 1984, and "Supplemental Geohydrologic Investigations Report", dated October 24, 1984, to provide additional information regarding recommendations for remedial action.

During May 1984, five test pits were excavated along three manmade passageways. These excavations were made in order to obtain samples for an evaluation of the physical and chemical properties of the materials surrounding and beneath the buried utilities. Further, the test pits were utilized for the installation of well screens with riser pipes to permit sampling and analysis of the water flowing in the surrounding bedding materials. Sampling and analysis of groundwater and soils was completed in August, 1984. Based upon the results of the chemical analyses, the concentration for any given parameter has been found to vary from below detectable limits up to 138 ppm for the areas sampled. The results of these analyses were compared with those obtained during our previous Manmade Passageways Investigation in order to evaluate the potential for contaminant transport west along the Adams Avenue Sewer and and the presence of elevated barium concentrations in the west yard. Further, groundwater levels were obtained in each of the installed utility wells and these levels were compared with the site-wide groundwater flow patterns to assess the presence of preferential flow pathways along the passageways.

Based upon the available data, regarding the level of contamination in the underlying material, the bedding material and the groundwater, coupled with an assessment of the groundwater flow directions between the manmade passageways and the

adjacent overburden, conclusions regarding the potential of the manmade passageway to act as a pathway for contaminant transport have been drawn. Based upon these available data and the subsequent analyses, it is concluded that the Adams Avenue Sewer (Location 1 and 14) is likely a pathway for contaminant transport. However, it appears that the migration is not leaving the plant site. Data collected from the west yard at Location 15 (SPA line 9), Location 17 (SPA line 44), Location 18 (SPA line 47) and Location 16 indicate that these locations are not pathways for contaminant transport off-site. The previously installed utility wells were resampled as part of this study. Analytical results were similar to the first sampling round, therefore, our conclusions as given in the February 17, 1984 Manmade Passageways Investigation remain valid.

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INTRODUCTION

The subsurface investigations, laboratory testing and well installations reported herein were made at the request of the E.I. duPont de Nemours and Company, Inc. as part of the Supplemental Geohydrologic Investigations of the Niagara Plant. The DuPont Niagara Plant Site is located in Niagara Falls, New York, as shown on the Regional Location Plan, Plate 1. The objective of these investigations was to further define the presence and movement of chemical contaminants along manmade passageways. Man-made passageways are defined as those portions of the subsurface that have been excavated and backfilled to accommodate the placement of buried utilities such as water, sewer or electrical lines. The specific locations studied were numbered 14 through 18 and are shown on Plate 2, Test Pit/Utility Well Location Plan.

Test pits were excavated to allow evaluation of physical and chemical properties of materials surrounding and beneath the buried utilities. Soil samples of the bedding and underlying material around the utility lines were obtained and analyzed for selected chemical parameter analyses. Well screens with riser pipes, hereafter called utility wells (UW), were installed upon completion of the test pit excavation and prior to backfilling to permit sampling and analysis of the water flowing in the surrounding bedding material. A schematic of the sample locations and utility well installations is presented on Plate 3. The scope of this investigation included the monitoring of the field exploration work, analysis of all relevant subsurface and analytical data, and the preparation of this report.

A description of the field investigations, laboratory analyses and findings and conclusions are presented in the following sections. A description of the materials encountered in the test pits is contained in the test pit logs which are presented in Appendix A. The Utility (Monitoring) Well Installation Reports are included in Appendix B. Analytical results of the bedding material, the underlying material and the groundwater sampled from the manmade passageways are included in Appendix C.

FIELD INVESTIGATIONS

The subsurface conditions at selected utility locations were investigated via five test pits. A well screen and riser pipe were then installed at each of these test pit locations. The selection of the utility lines to be investigated and the locations of the test pits were determined based upon Woodward-Clyde Consultants (WCC) discussions with DuPont. These additional areas were identified after analysis of the data presented in WCC's report entitled "Manmade Passageways Investigations", dated February 17, 1984. The five additional locations reported herein were selected (1) to further assess the potential for contaminant migration west along the Adams Avenue sewer channel, and (2) to provide additional data concerning barium concentrations in the west yard of the DuPont plant. Included in the latter area were two test pit/utility well excavations located along the Niagara River side of the Robert Moses Parkway, south of the plant's west yard.

The supplemental manmade passageways investigations were described in "Supplemental Groundwater Investigation Plan", dated April 10, 1984, submitted by DuPont to the New York State Department of Environmental Conservation. A location plan of the five test pits and associated utility wells is included as Plate 2. The excavations were completed by Sicoli and Massaro Inc., Niagara Falls, New York, under contract with DuPont. The excavation procedures used for the Supplemental Passageway Investigations were similar to those used for the Manmade Passageway Investigation. Samples of the bedding material, the underlying material and groundwater were analyzed by Advanced Environmental Systems, Inc. (AES) Niagara Falls, New York.

SOIL SAMPLING

Soil samples for chemical analysis were collected from the five test pits. The soils from the test pits were logged for physical properties and examined for evidence of chemical contamination. The soil samples were generally obtained from the backhoe bucket by the WCC geologist.

Three of the five bedding soil samples were hand excavated from the test pits. The bedding soil sample from Location 16 was collected from the backhoe bucket because of unsafe conditions in the test pit (i.e., uncontrolled wall sloughing and undermining of the near surface area). The bedding soil sample from Location 18 was collected from the backhoe bucket because of uncontrolled groundwater conditions. Underlying soil samples were collected at Locations 15, 16 and 18 from the backhoe bucket. The underlying soil sample collected from Location 17 was hand excavated. No underlying soil sample was collected from Location 14, as the underlying material was bedrock. Table 1 summarizes the soil sampling methods.

The bedding material samples collected by hand excavation were obtained two to three inches below the center of the utility. The samples of the underlying material were taken below and adjacent to the utility. The sampling locations of bedding and underlying materials are shown on Plate 3.

Soil samples for chemical analysis were placed in volatile organic analysis (VOA) vials and 8 ounce bottles, sealed, labeled and placed on ice in a cooler to minimize volatilization. Strict chain of custody procedures were followed and samples were transferred to AES for analysis.

WELL INSTALLATION AND SAMPLING

The utility wells were installed in general accordance with the procedures for the previous Manmade Passageway Investigation. The details of each utility well are presented in Appendix B. Utility Wells 1 and 15 through 18 were sampled by AES on August 16, 1984. Utility Wells 2 through 14 were sampled on June 1, 1984.

LABORATORY INVESTIGATIONS

SOIL

The soil samples collected were relinquished to AES at the site for subsequent chemical analyses. Analyses were performed for specific indicator

parameters, consistent with the on-going site assessment. The specific indicator parameters which were tested are the same as those measured for the previous Manmade Passageway Investigation. The results of the chemical analyses are included in Appendix C, with a summary of analytical test results for the bedding and underlying material presented in Table 2.

GROUNDWATER

Groundwater samples were collected from four of the new utility wells plus Utility Well 1 on August 16, 1984 by AES. In addition, the other twelve original utility wells were resampled on June 1, 1984 by AES. Utility well 14 was also sampled on this date. A field report was submitted by AES, for both sampling occurrences, which described the sampling techniques. This report is attached as part of Appendix C. Analyses were performed for specific indicator parameters consistent with the previous and on-going site assessment. The results of the analyses are also included in Appendix C, with a summary of the analytical test results presented in Tables 3 and 4.

SUBSURFACE CONDITIONS

The subsurface conditions and materials encountered were similar to those described in WCC's reports entitled "Manmade Passageways Investigations", dated February 17, 1984, and "Geohydrologic Investigations, Niagara Plant Site, Niagara Falls, New York", dated December 23, 1983. The subsurface materials encountered in the five test pits generally consisted of fill materials. A summary of the depth of materials encountered is included in Table 5. Location 14 was the only location where natural material, a clayey till, was encountered. For additional detail, the logs for each test pit are presented in Appendix A.

OVERBURDEN

Fill materials consisting of clayey silt/silty clay, sand, gravel, brick, tile, wood and metal were encountered at Locations 15, 16, 17, and 18. Shot rock well chocked

with fine material was also encountered at Location 15. Approximately 2.5 feet of fill material (crushed stone, cobbles and sand) overlies the natural material at Location 14. The natural material encountered at this location was a stiff silty clay with sand and gravel. Bedrock was encountered only at Location 14.

GROUNDWATER

Groundwater was encountered during the test pit excavations at depths ranging from 1.5 feet to 8 feet below ground surface. The groundwater elevation in the overburden materials ranged from 562.3 to 564.5. Various methods were used to control groundwater flow into the test pits, including use of two and three inch centrifugal pumps and a two inch diaphragm pump. In addition, small sumps were excavated in some of the test pits to divert groundwater flow away from the utility line. These methods effectively controlled groundwater at Locations 14, 16, and 17. It was not possible to effectively control the groundwater flow into test pits at Locations 15 and 18 which were located along the Niagara River.

AIR

The air quality at the excavation was monitored by means of a Century Systems Organic Vapor Analyzer (OVA) Model OVA-128. This unit, when set on the most sensitive scale, is capable of monitoring trace quantities of organic material, as low as 1 ppm above background levels. When the test pits were shored for protection (limited access), the air quality within the excavation was monitored at least once an hour for oxygen deficiency, concentration of flammable gases and organic vapors.

The air quality monitoring for all of the excavations indicated that organic vapors in excess of 1 ppm above background were not encountered, except at Location 18. At Location 18, the OVA registered 1 to 2 ppm above background at the excavated material pile and in the test pit. Away from the pile and test pit, the OVA registered non-detectable levels. Therefore, only those personnel entering the test pit and the backhoe operator were required to wear half-face respirators.

ANALYSIS OF FINDINGS

The findings of the supplemental manmade passageways investigations were compared to those previously presented in Woodward-Clyde Consultant's report entitled, "Manmade Passageways Investigation", dated February 17, 1984.

SUBSURFACE CONDITIONS

The materials encountered during the excavation of the five test pits reported herein were consistent with those previously encountered at the Niagara Plant. A summary of materials encountered in the test pits is presented in Table 5. Fill materials were encountered from south of Adams Avenue and continue to the present shoreline of the Niagara River. A layer of natural material consisting of a clayey till was encountered at Location 14. This finding was consistent with the material previously encountered in the excavation at Location 1, which is located approximately 150 feet east of Location 14 along Adams Avenue. Bedrock was also encountered at Location 14. The depth to bedrock was about 2 feet higher than that encountered at Location 1.

The material encountered in the test pits showed no indication of non-aqueous phase liquids. The water at Location 14 did show a slight sheen on its surface, but lacked any odor. While showing no visible signs of organics at Location 18, there was a distinct chemical odor coming from the excavation and the monitoring indicated 1 to 2 ppm above background when analyzed by the OVA.

GROUNDWATER

Groundwater levels were measured on four occasions in the utility wells; May 31, June 1, July 30 and August 16, 1984. These water elevations are included in Appendix A. Comparison of elevations with "A" zone monitoring well elevations indicate that an "elevated groundwater condition" is present at Locations 15 through 18. This indicates "perched" water levels in this area. Data for Location 14 indicate that the groundwater level is lower than that of the "A" zone monitoring wells in the vicinity. This generally indicates groundwater flow toward the utility.

ANALYTICAL RESULTS

A group of both DuPont-related and non-DuPont related compounds have been selected by DuPont as indicator parameters based on analytical results from previous groundwater sampling rounds. These indicator parameters can be grouped as volatile organic, organic and inorganic compounds. Four of the indicator compounds, benzene, chlorobenzene, BHC's and phenolics, are considered non-DuPont related. The analytical data are summarized in Tables 2, 3 and 4. In addition, a comparison summary of analytical data for the previous and new sampling rounds in the old utility wells is presented in Table 6. The analytical results of the most recent soil and groundwater sampling for all utility wells were plotted on maps for the major indicator parameters (Plates 4 through 18). The data for the underlying material, the bedding material and the groundwater were also plotted as total "C-1" and total "C-2" compounds (Plates 19 and 20).

DUPONT RELATED VOLATILE ORGANIC COMPOUNDS: Seven DuPont-related volatile organic compounds were selected for chemical analyses. They can be divided into two groups based on the number of carbon atoms in their molecular structure, C-2 and C-1 compounds. The C-2 compounds are organic compounds that contain two carbon atoms in the molecular structure. They include tetrachloroethylene, trans-1,2-dichloroethylene, trichloroethylene, vinyl chloride, and 1,1,2,2-tetrachloroethane. The C-1 compounds contain one carbon atom and include chloroform and methylene chloride. Results of the DuPont-related volatile organic compounds analyses indicate that concentrations ranged from Below Method Detection Limit (BMDL) to 67 ppm in the bedding material and underlying material for the five new locations (see Table 2). Concentrations of the DuPont-related volatile organic compound in all 18 of the utility groundwater samples ranged from BMDL to 268 ppm.

The concentration of the C-1 compounds at the new locations ranged from 5.65 to 28.3 ppm, 0.28 to 16.4 ppm, and 0.07 to 161.2 ppm in the underlying material, bedding material, and groundwater samples, respectively (Plate 19). The concentration of C-2 compounds at the new locations ranged from 1.95 to 53.2 ppm, 0.15 to 94.7 ppm, and

0.066 to 25.4 ppm in the underlying material, bedding material, and groundwater samples, respectively (Plate 20).

DUPONT RELATED ORGANIC COMPOUNDS: The DuPont-related organic indicator parameters include PCB compounds (1016, 1221, 1232, 1242, 1248, 1254 and 1260). It is noted that all PCB compounds are considered to be DuPont related for this investigation, however, only one compound, PCB-1248, was used at Building B-310. The analytical results indicate that only four PCB compounds (1221, 1232, 1242, 1248) were detected in the bedding or underlying material samples (Table 2). Only PCB 1221 was detected in the new utility wells groundwater samples (Table 4). PCB compounds were BMDL in all of the groundwater samples collected from the original utility wells.

PCB compound 1232 was detected at Location 16 in the bedding and underlying materials at concentrations of 0.17 and 0.52 ppm, respectively. PCB compound 1232 was also detected in the bedding material at Locations 17 and 18 at concentrations of 1.24 and 1.49 ppm, respectively. PCB compound 1221 was also detected in the bedding material at Location 18 at a concentration of 3.20 ppm. PCB compounds 1242 and 1248 were detected in the underlying (9.5 ppm) and bedding materials (0.39 ppm), respectively.

DUPONT RELATED INORGANIC COMPOUNDS: Barium was detected in all but two of the soil samples collected (Table 2 and Plate 17). Concentrations ranged from BMDL in Location 15 bedding material and Location 18 underlying material to 959 ppm in the underlying material at Location 16. Soluble barium was detected in only two of the groundwater samples (Tables 3 and 4). Soluble barium was measured at concentrations of 2500 and 2100 ppm in Utility Wells U10 and U11, respectively. The barium concentrations in the water samples collected from Utility Wells 10 and 11 are consistent with previous results (3530 and 450 ppm), respectively. This barium is most likely associated with the sodium cell tear down and weathering areas. Although barium was not detected in groundwater from the new Utility Wells 16 and 17, which are also located in this area, concentrations of barium were detected in the soil samples collected from these two locations.

Total cyanide was not detected in any of the bedding or underlying material samples. However, the detection limits may be too high to facilitate detection in the ppm range. Total cyanide was detected in most of the utility wells. Concentrations ranged from BMDL to 8.3 ppm. The highest concentrations were detected in Utility Wells U11 (8.3 ppm) and U1 (7.2), the former of which is located near the reported cyanide wash area (Plate 16).

Total copper was detected in most of the underlying material and bedding material samples (Tables 2 and Plate 18). The bedding material concentrations of total copper ranged from 23 to 182 ppm. The underlying materials had total copper concentrations ranging from 32 to 184 ppm. Total copper was also detected in some of the groundwater samples. Concentrations ranged from BMDL to 3.7 ppm (Tables 3 and 4 and Plate 18). These values are within the range of concentrations of soluble copper detected during the previous October/November 1983 and June/July, 1984 sampling rounds.

NON-DUPONT RELATED VOLATILE ORGANIC COMPOUNDS: Samples were analyzed for two non-DuPont related volatile organic compounds. Detectable concentrations of chlorobenzene were not measured in any of the underlying material samples, bedding material samples or utility groundwater samples. Detected concentrations of benzene were not measured in any of the bedding or underlying materials sampled during this study. Benzene was detected in water samples collected from seven of the old utility wells (U4, U5, U6, U7, U8, U9, U10 and in U14). The measured concentrations of benzene and chlorobenzene are shown on Plates 4 and 5, respectively.

NON-DUPONT RELATED ORGANIC COMPOUNDS: Analytical results of samples collected from the bedding material and groundwater indicate measurable concentrations of hexachlorocyclohexane isomers (BHC's) (Plate 13). The total BHC concentrations in the bedding material ranges from 0.021 to 0.73 ppm. The highest BHC concentration was measured in the bedding material at Location 18. Total BHC concentrations in the underlying materials ranged from 0.042 to 4.75 ppm.

Total Recoverable Phenolics have been detected in most of the samples (Plate 15). The measurable concentration of total recoverable phenolics for the underlying material, bedding material and water samples ranged from not detected to 0.003 ppm, not detected to 0.003 ppm and 0.030 to 2.22 ppm, respectively. As reported previously, there does not appear to be an apparent pattern to the presence of the phenolics.

COMPARISON OF SAMPLING ROUNDS: The old utility wells, Locations 1 through 13, were sampled in December 1983 as part of the previous Manmade Passageways Investigation. They were resampled in the summer of 1984 as part of the supplemental investigation (Table 6 and Appendix C). Comparison of data from the two sampling rounds indicate that the water quality results are similar.

PASSAGEWAY ANALYSIS

The following discussion addresses each of the passageways investigated with respect to the contaminant encountered and potential for contaminant transport.

LOCATION 14: Location 14 is located near the Adams Avenue sewer, west of Location 1 and Chemical Road as shown on Plate 2. The sewer at this location is channeled in bedrock and flows to the west. It is noted that the Adams Avenue Sewer is blocked about 70 $\pm$ feet west of Chemical Road and 240 $\pm$ feet east of Location 1. Reportedly, the sewer is used as a conduit for three lines, one effluent and two process lines. The Adams Avenue lift station picks up the effluent and reportedly pumps it to M.H. 145, just west of Building 83. Thus, the Adams Avenue sewer is inactive east of the Adams Avenue lift station for DuPont, but could carry fluid west of the lift station. It is noted that the sewer at this location is inactive with regard to fluid entering the sewer from the DuPont site. The groundwater levels at Location 14 and 1 are lower than those recorded for the A-zone contours in the area, which would indicate that groundwater flows toward the Adams Avenue sewer. Based upon the data in Tables 3 and 4, in the immediate vicinity of Location 14, it is apparent that the concentration of the compounds at Location 14 are generally less than those at Location 1. The data also suggests that

there are higher levels of contamination at Location 1 than in the adjacent A-zone groundwater. The data indicate that the Adams Avenue sewer is not presently a pathway for contaminants leaving the site.

LOCATION 15: Location 15 is located near the outfall of State Power Authority (SPA) Line 9 on the south side of the Niagara Parkway, as shown on Plate 2. The bedding material at this location was a silty fine sand with the underlying material composed of shot rock with clayey silt, sand and gravel. The groundwater is generally about three to five feet higher than the A-zone groundwater and is possibly a perched groundwater table. In addition, the elevations at Location 15 are similar to those of the Niagara River. Elevated levels of barium were measured in the soil samples at Location 15. However, the groundwater samples were <1.0 ppm. The barium appears to be tied up in the soil and is not mobile in the groundwater. Therefore, SPA line 9 is not a pathway for contaminant transport off site.

LOCATION 16: Location 16 is located just north of the Niagara Parkway on an SPA line that drains a catch basin just outside the DuPont Plant site to the Niagara River, as shown on Plate 2. The pipe at this location is bedded in crushed stone underlain by silty clay with occasional cobbles and gravel. The groundwater level is generally about three feet higher than the A-zone groundwater indicating a perched groundwater condition. Groundwater levels at Location 16 are similar to those of the Niagara River. The contaminants at this location are similar to those detected at Location 10, but with lower concentrations of barium. The barium appears to be immobilized by the soil and therefore Location 16 is not a pathway for contaminant transport off-site.

LOCATION 17: Location 17 is located on SPA line 44 just inside the DuPont Plant site as shown on Plate 2. The pipe is bedded in a silty medium to find sand and underlain by sandy silty clay overlying a concrete slab. The groundwater level at this location is about five feet above the A-zone groundwater contours indicating a perched groundwater condition. It is noted that Location 17 is near MW4, with Location 17 being in the overlying material. Location 17 is in the vicinity of the old cyanide weathering and cyanide wash areas and the current sodium cell tear down area. Thus, the presence of

cyanide in the groundwater at Location 17 is not unexpected and is greater than that found at MW4A, although both locations have BMLD of barium. Based upon the available data, SPA line 44 is not likely a passageway for contaminant transport off-site because the barium appears to be tied up in the soil.

LOCATION 18: Location 18 is at the south end of SPA line 47, south of the Niagara Parkway, near the water intake for Building 102 as shown on Plate 2. The SPA line 47 at this location is embedded in the underlying material consisting of silty clayey sandy gravel, cobbles and shot rock. The groundwater level at this location is about three feet higher than that recorded at MW4A, with a gradient from Location 11 to Location 18. The concentration of barium in the groundwater at Location 18 is less than 1.0 ppm. This concentration is less than that at Location 11 and about the same as MW4A. Based upon the available data primarily the absence of significant concentrations of barium in the groundwater at Location 18, it is likely that SPA line 47 is not presently a passageway for contaminant transport off-site.

SUMMARY AND CONCLUSIONS

In summary, based upon the available data regarding the level of contamination in the underlying material, the bedding material and the groundwater, coupled with an assessment of the groundwater flow directions between the manmade passageways and the adjacent overburden, the following conclusions regarding the potential of the manmade passageway to act as a pathway for contaminant transport have been drawn:

(1) the Adams Avenue Sewer (Locations 1 and 14) are most likely a pathway for contaminant transport. However, flow appears to be in an eastward direction and, hence, off-site migration is not likely.

(2) The remainder of the manmade passageways investigated (Locations 15 through 18) do not appear to be pathways for contaminant transport off-site. This conclusion is based upon the fact that the elevated levels of barium

present in the soil at these locations appear to be effectively tied up in the soil. Groundwater concentrations of barium in the "A" zone are less than 1 ppm.

(3) The results of an additional round of analytical testing on the original 13 utility wells have shown similar levels of chemical concentrations; thus, the conclusions drawn in the previous manmade passageways report are reconfirmed.

LIMITATIONS

The findings and conclusions presented in this report are based upon the interpretations developed from the available geologic, subsurface and groundwater chemistry data. These findings and conclusions are subject to confirmation and/or revision as additional information becomes available. Factors which influence the utilization of the data have been discussed in this report and local anamolies should be expected.

Tables

TABLE 1
SOIL SAMPLING METHODS
SUPPLEMENTAL MANMADE PASSAGEWAY INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

	LOCATION				
	14	15	16	17	18
Bedding Material Sample	Collected by hand excavation	Collected by hand excavation	Collected from backhoe bucket	Collected by hand excavation	Collected from backhoe bucket
Underlying Material Sample	No sample; Bedrock	Collected from backhoe bucket	Collected from backhoe bucket	Collected by hand excavation	Collected from backhoe bucket

TABLE 2
ANALYTICAL RESULTS FOR BEDDING AND UNDERLYING MATERIAL[1]
SUPPLEMENTAL MANMADE PASSAGEWAY INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

	LOCATION								
Compound	14 Bedding 5/10/84	15 Bedding 5/24/84	15 Underlying 5/25/84	16 Bedding 5/21/84	16 Underlying 5/21/84	17 Bedding 5/3/84	17 Underlying 5/3/84	18 Bedding 5/29/84	18 Underlying 5/29/84
Benzene	<0.06	<0.05	<0.05	< 0.002	<0.05	< 0.65	< 0.06	<0.05	<0.06
Chlorobenzene	<0.15	<0.12	<0.12	< 0.006	<0.12	< 1.66	< 0.15	<0.13	<0.15
Chloroform	0.48	0.04	2.47	0.02	0.28	0.05	0.04	0.10	0.12
Trans-1,2-dichloroethane	<0.06	<0.04	<0.05	< 0.002	<0.05	< 0.06	< 0.06	<0.05	<0.06
Methylene Chloride	9.08	0.86	8.84	1.77	28.0	16.36	7.47	0.18	5.53
1,1,2,2-Tetrachloroethane	37.39	0.26	6.28	0.04	4.50	67.14	37.57	3.99	0.22
Tetrachloroethylene	21.66	0.14	1.33	0.07	2.97	22.84	13.69	0.35	1.20
Trichloroethylene	4.72	0.16	3.74	0.04	1.20	4.70	1.91	0.46	0.53
Vinyl Chloride	<0.05	<0.04	<0.04	< 0.002	<0.04	< 0.06	< 0.05	<0.05	<0.05
Alpha-BHC	0.24	0.28	3.23	0.01	0.01	0.15	0.41	0.68	1.39
Beta-BHC	0.02	0.01	1.40	0.01	0.03	0.01	0.002	0.04	0.14
Gamma-BHC	< 0.001	< 0.001	0.12	0.001	0.002	0.01	0.002	0.01	0.02
PCB-1016	<0.02	<0.03	<0.35	< 0.007	<0.02	< 0.02	< 0.03	0.11	<0.48
PCB-1221	<0.05	<0.05	<0.69	<0.02	<0.04	< 0.05	< 0.05	3.20	<0.23
PCB-1232	<0.02	<0.02	<0.28	0.17	0.52	1.24	< 0.02	1.49	<0.38
PCB-1242	<0.04	<0.04	9.5	<0.01	<0.03	< 0.04	< 0.07	<0.17	<0.73
PCB-1248	<0.03	0.39	<0.45	< 0.008	<0.03	< 0.03	< 0.03	<0.14	<0.59
PCB-1254	< 0.7	< 0.7	<0.07	< 0.2	< 0.6	<0.7	0.8	< 0.6	< 0.6
PCB-1260	< 1.3	< 1.4	<0.04	< 0.3	< 0.9	<1.3	<1.4	< 1.2	< 1.2
Total Recoverable Phenols	0.5	—	—	2.7	3.0	3.5	0.5	ND	ND
Total Cyanide	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	163	<100	163	610	959	340	840	270	< 100
Copper	182	100	32	23	39	76	184	40	36

ND Not Detected
1 All units mg/kg (ppm)

TABLE 3

ANALYTICAL RESULTS OF GROUNDWATER SAMPLES, RESAMPLING OLD UTILITY WELLS [a,b]
SUPPLEMENTAL MANMADE PASSAGEWAY INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

	UTILITY WELL NUMBER											
Compound	U1	U2	U4	U5	U6	U7	U8	U9	U10	U11	U12	U13
Benzene	<1.6	< 1.61	12.91	2.15	5.38	5.92	2.15	12.91	7.53	< 0.093	< 0.101	< 0.101
Chlorobenzene	<5.81	< 2.95	< 2.95	< 2.95	< 2.95	<2.95	<2.95	<2.95	< 2.95	< 0.309	< 0.298	< 0.298
Chloroform	138,285	11.4	544.8	9.2	< 0.8	< 0.8	< 0.8	< 0.8	39.0	< 0.8	4.5	136.8
Trans-1,2-dichloroethane	< 200	<1.0	<1.0	<1.0	<1.0	< 6.1	< 1.0	< 1.0	<1.0	< 1.0	< 5.0	<1.0
Methylene Chloride	22,895	<0.3	19.8	<0.3	4.4	< 0.3	< 0.3	9.7	470.1	6.3	35.0	121.8
1,1,2,2-tetrachloroethane	650	<7.7	27.6	10.0	<7.7	< 7.7	122.1	< 7.7	<7.7	13,410	1,742	402.3
Tetrachloroethylene	6,250	41.0	164.6	17.6	164.4	23.4	69.4	335.1	320.5	7,610	4,031	483.4
Trichloroethylene	18,525	42.8	138.6	96.5	6.5	40.6	0.9	63.1	474.7	75.8	837.5	732.1
Vinyl Chloride	< 76	<0.8	<0.8	15.6	< 0.8	< 0.8	< 0.8	1.0	31.4	< 0.8	5.5	6.5
Alpha-BHC	1.65	1.64	0.289	0.274	1.51	<0.002	< 0.002	< 0.002	0.463	< 0.002	1.18	0.221
Beta-BHC	2.04	2.86	1.97	0.172	1.53	0.138	0.037	0.197	0.209	< 0.005	0.483	< 0.005
Gamma-BHC	2.79	0.529	0.186	0.153	1.68	0.131	0.033	0.040	0.852	0.051	0.349	0.174
PCB-1016	< 6.0	< 0.19	< 0.19	< 0.19	< 1.9	< 3.8	<0.19	<0.19	< 0.19	< 3.8	<0.19	< 0.19
PCB-1221	<19.0	< 1.5	< 0.15	< 0.15	< 3.1	< 1.5	<0.15	< 1.5	< 3.1	< 3.1	<0.15	< 0.15
PCB-1232	< 7.0	< 0.15	< 0.15	< 0.15	< 1.5	< 3.1	<0.15	<0.15	< 0.15	< 3.1	<0.15	< 0.15
PCB-1242	< 7.5	< 0.29	< 0.29	< 0.29	< 0.29	< 5.8	<0.29	<0.29	< 0.29	< 5.8	<0.29	< 0.29
PCB-1248	< 8.5	< 0.24	< 0.24	< 0.24	< 2.4	< 4.7	<0.24	<0.24	< 0.24	< 4.7	<0.24	< 0.24
PCB-1254	< 5.6	< 0.14	< 0.14	< 0.14	< 0.14	<0.14	<0.14	<0.14	<7.1	<0.14	< 3.6	< 0.14
PCB-1260	< 7.8	< 0.19	< 0.19	< 0.19	< 0.19	<0.19	<0.19	<0.19	<9.6	<0.19	< 4.8	< 0.19
TOC	15.2	17.90	62.0	19.76	5.13	3.69	3.60	2.96	135.88	2.56	1.69	4.44
Total Recoverable Phenolics	0.108	0.180	0.105	0.068	0.210	0.175	0.030	0.030	2.22	0.030	0.080	0.110
Total Cyanide	7.2	<0.05	0.78	0.74	0.15	0.05	0.05	0.95	< 0.05	8.3	0.05	0.05
Soluble Barium	<1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2500	2100	< 1	< 1
Total Copper	3.7	<0.1	<0.1	<0.1	<0.1	0.17	<0.1	<0.1	0.39	< 0.1	< 0.1	<0.1

a. All wells sampled June 1, 1984.
b. All units ppb except TOC, total cynaides, total recoverable phenols, soluble barium, and total copper, which are ppm.

TABLE 4
ANALYTICAL RESULTS GROUNDWATER SAMPLES
NEW UTILITY WELLS[a,b]
SUPPLEMENTAL MANMADE PASSAGEWAYS INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

Compound	Utility Well Number				
	U14	U15	U16	U17	U18
Benzene	11.83	<1.6	<1.6	<1.6	<1.6
Chlorobenzene	<2.95	< 5.81	< 5.81	< 5.81	< 5.81
Chloroform	268.5	35	27	23	9
Trans-1,2-dichloroethane	< 1.0	< 10	< 10	< 10	< 10
Methylene Chloride	5.3	40	60	47	214
1,1,2,2-tetrachloroethane	< 7.7	< 11	< 11	< 11	< 11
Tetrachloroethylene	4.2	37	35	27	46
Trichloroethylene	37.0	11	18	<7	20
Vinyl Chloride	< 0.8	505	78	63	<4
Alpha-BHC	0.329	0.40	0.60	2.09	0.37
Beta-BHC	<.005	1.51	0.66	1.38	0.23
Gamma-BHC	0.529	0.16	0.58	2.52	0.13
PCB-1016	<0.19	< 0.23	<1.1	<6.0	< 0.23
PCB-1221	<0.15	19.2	<3.8	<9.5	26.5
PCB-1232	<0.15	< 0.26	<1.3	<7.0	< 0.26
PCB-1242	<0.29	< 0.31	<1.5	<7.5	< 0.31
PCB-1248	<0.24	< 0.34	<1.7	<8.5	< 0.34
PCB-1254	<0.14	< 0.11	<1.1	<2.8	<2.8
PCB-1260	<0.19	< 0.16	<1.6	<3.9	<3.9
TOC	17.98	3.05	15.4	10.9	6.22
Total Recoverable Phenols	0.140	0.041	0.057	0.057	0.064
Total Cyanides	< .05	0.60	0.16	1.99	0.67
Soluble Barium	< 1.0	<1.0	<1.0	<1.0	<1.0
Total Copper	0.11	0.28	0.38	0.36	0.10

a All wells sampled August 16, 1984
b All units ppb except TOC, Total Cyanides, Total Recoverable Phenols, Soluble Barium and Total Copper (ppm).

TABLE 5
SUMMARY OF DEPTH OF MATERIALS,
ENCOUNTERED IN TEST PITS
SUPPLEMENTAL MANMADE PASSAGEWAYS INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

Location	Surf. Elev.	Depth Fill (feet)	Depth Clay/Till (feet)	Depth Bedrock (feet, elevation)	Total Depth (feet)	Water Level Below G.S. (feet)	Water Elevation	Bedding Material	Underlying Material
14	568.9	0-2.5	2.5-6.0	6.0	14.8	12.1	556.8	Gravelly sandy silty clay/ clayey silt under shot rock	Bedrock
15	570.4	0-9.8	N. Enc.	N. Enc.	9.8	7.6	562.8	Silty fine sand	Shot rock with clayey silt, sand and gravel
16	570.3	0-11.6	N. Enc.	N. Enc.	11.6	7.5	562.8	Crushed Stone	Silty clay with ocasional cobbles and gravel
17	570.5	0-6.5	N. Enc.	N. Enc.	6.5	5.8	564.7	Silty medium to fine sand	Sandy silty clay on top of concrete slab
18	568.9	0.10	N. Enc.	N. Enc.	10	6.3	562.6	Silty fine sand	Silty clayey sandy gravel, cobbles and shot rock

G.S. - Ground Surface
N. Enc. - Not Encountered

TABLE 6
SUMMARY COMPARISON OF ANALYTICAL DATA[1] FOR UTILITY WELLS
SUPPLEMENTAL MANMADE PASSAGEWAY INVESTIGATIONS
DUPONT NIAGARA FALLS PLANT

	UTILITY WELL NUMBER									
	U1		U2		U4		U5		U6	
	Dec. 1983	Aug. 1984	Dec. 1983	June 1984	Dec. 1983	June 1984	Dec. 1983	June 1984	Dec.1983	June 1984
Benzene	ND	< .0016	BMDL	<.0016		.0129	BMDL	.0022	ND	.0054
Chlorobenzene	ND	< .0058	ND	<.0029	No	<.0029	ND	<.0029	ND	<.0029
Chloroform	240.0	138.3	.018	.0114		.5548	BMDL	.0090	ND	<.0008
Trans-1,2-dichloroethylene	.990	<.200	.018	<.0010	Sample	.0010	.1800	<.0010	ND	<.0010
Methylene Chloride	17.0	22.9	ND	<.0003		.0198	ND	<.0003	ND	.0044
1,1,2,2-tetrachloroethane	.380	<.650	ND	<.0077		.0276	BMDL	.0100	BMDL	< .0077
Tetrachloroethane	6.200	6.25	.060	.041		.1646	.0066	.0176	.013	.1644
Trichloroethylene	12.000	18.5	.097	.0428		.1386	.160	.0960	.010	.0065
Vinyl Chloride	BMDL	<.076	ND	<.0008		<.0008	BMDL	.0156	ND	<.0008
Alpha-BHC	.00006	.00165	.00038	.00164		.000289	.00002	.000274	.0061	.0015
Beta-BHC	.00027	.00204	.00005	.00286		.00197	.00003	.000172	<.00001	.0015
Delta-BHC	<.00001	---	<.00001	--		---	< .00001	---	<.00001	---
Gamma-BHC	.00002	.00279	.00017	.000529		.000186	.00001	.00153	.0019	.0017
PCB-1016	<.0001	<.006	< .0001	< .00019		< .00019	< .0001	< .00019	< .0001	<.0019
PCB-1221	<.0002	< .019	< .0002	< .00024		< .00024	< .0002	< .00024	< .0002	<.0024
PCB-1232	<.0002	< .007	< .0002	< .00029		< .00029	< .0002	< .00029	< .0002	<.0029
PCB-1242	<.0001	<.0075	< .0001	< .00014		< .00014	< .0001	< .00014	< .0001	< .00014
PCB-1248	<.0001	<.0085	< .0001	< .00019		< .00019	< .0001	< .00019	< .0001	< .00019
PCB-1254	<.0001	<.0056	< .0001	< .0015		< .00015	< .0001	< .00015	< .0001	<.0031
PCB-1260	<.0001	<.0078	< .0001	< .00015		< .00015	< .0001	< .00015	< .0001	<.0015
Total Organic Carbon	19.0	15.2	24.	17.90		62.0	5.5	19.76	7.0	5.13
Total Recoverable Phenolics	15	.108	<.018	0.18		0.105	< .01	0.068	15.0	.210
Total Cyanide	19	7.2	.029	< .05		0.78	.18	0.74	.01	.15
Soluble Barium	.31	<1.0	.55	<1.0		<1.0	.13	<1.0	.31	<1.0
Soluble Copper	8.2	0.1	.067	<0.1		<0.1	< .008	<0.1	.019	<0.1

(1) Notes: ND = Not Detected
BMDL = Below Method Detection Limit
Utility wells No. 3 was dry; no sample analyzed. Utility well No. 4 was dry in Dec. 1983; no sample analyzed.
All units is mg/l (ppm)

TABLE 6 (CONT'D)

Compounds	U7		U8		U9		U10		U11	
	Dec. 1983	June 1984	Dec. 1983	June 1984	Dec. 1983	June 1984	Dec. 1983	June 1984	Dec.1983	June 1984
Benzene	ND	.0059	ND	.0022	BMDL	.0129	.0099	.0075	ND	<.00009
Chlorobenzene	ND	<.0029	BMDL	<.0029	ND	<.0029	ND	<.0029	ND	<.0003
Chloroform	ND	<.0008	ND	<.0008	ND	<.0008	.1200	.0390	ND	<.0008
Trans-1,2-dichloroethylene	.056	.0061	ND	<.0010	.079	<.0010	.1700	<.0010	.140	<.0010
Methylene Chloride	ND	<.0003	ND	<.0003	ND	.0097	4.500	.4701	ND	.0063
1,1,2,2-tetrachloroethane	BMDL	<.0077	ND	.1221	.0077	<.0077	.022	<0077	.0079	3.410
Tetrachloroethane	BMDL	.0234	.0084	.0694	.0051	.3351	.290	.3205	.0077	7.610
Trichloroethylene	.072	.0406	ND	.0009	.040	.0631	1.800	.4747	.120	.0758
Vinyl Chloride	.018	<.0008		<.0008	BMDL	.0010	.068	.0314	ND	<.0008
Alpha-BHC	<.0001	<.000002	.00003	<.000002	.00006	<.000002	.00005	.000463	<.00001	.000002
Beta-BHC	<.0001	.000138	.0001	.000037	<.00001	.00197	<.00001	.000209	<.00001	.000005
Delta-BHC	<.00001	---	.00001	—	.0002	—	.00003	—	<.00001	—
Gamma-BHC	<.0001	.000131	.00001	.000003	<.00001	.00004	.00003	.000852	<.00001	.000051
PCB-1016	<.0001	<.0038	<.0001	<.00019	<.0001	<.00019	<.0001	<.00019	<.0001	<.0038
PCB-1221	<.0002	<.0047	<.0002	<.00024	<.0002	<.00024	<.0002	<.00024	<.0002	<.0047
PCB-1232	<.0002	<.0058	<.0002	<.00029	<.0002	<.00029	<.0002	<.00029	<.0002	<.0058
PCB-1242	<.0001	<.0014	<.0001	<.00014	<.0001	<.0071	<.0001	<.0071	<.0001	<.00014
PCB-1248	<.0001	<.00019	<.0001	<.00019	<.0001	<.0096	<.0001	<.0096	<.0001	<.00019
PCB-1254	<.0001	<.0015	<.0001	<.00015	<.0001	<.0031	<.0001	<.0031	<.0001	<.0031
PCB-1260	<.0001	<.0031	<.0001	<.00015	<.0001	<.00015	<.0001	<.0031	<.0001	<.0031
Total Organic Carbon	15.	3.69	6.0	3.60	6.5	2.96	110.	135.88	1.0	2.56
Total Recoverable Phenolics	.021	0.175	<.01	.030	<.01	.03	3.6	2.22	<.01	.030
Total Cyanide	.012	0.05	<.01	.05	1.8	.95	.086	.05	3.8	8.3
Soluble Barium	.23	<1.0	0.26	< 1.	.45	< 1.	3530.	2500.	450.	2100.
Soluble Copper	.014	0.17	0.015	<.1	.015	.1	.098	.39	.014	< 0.1

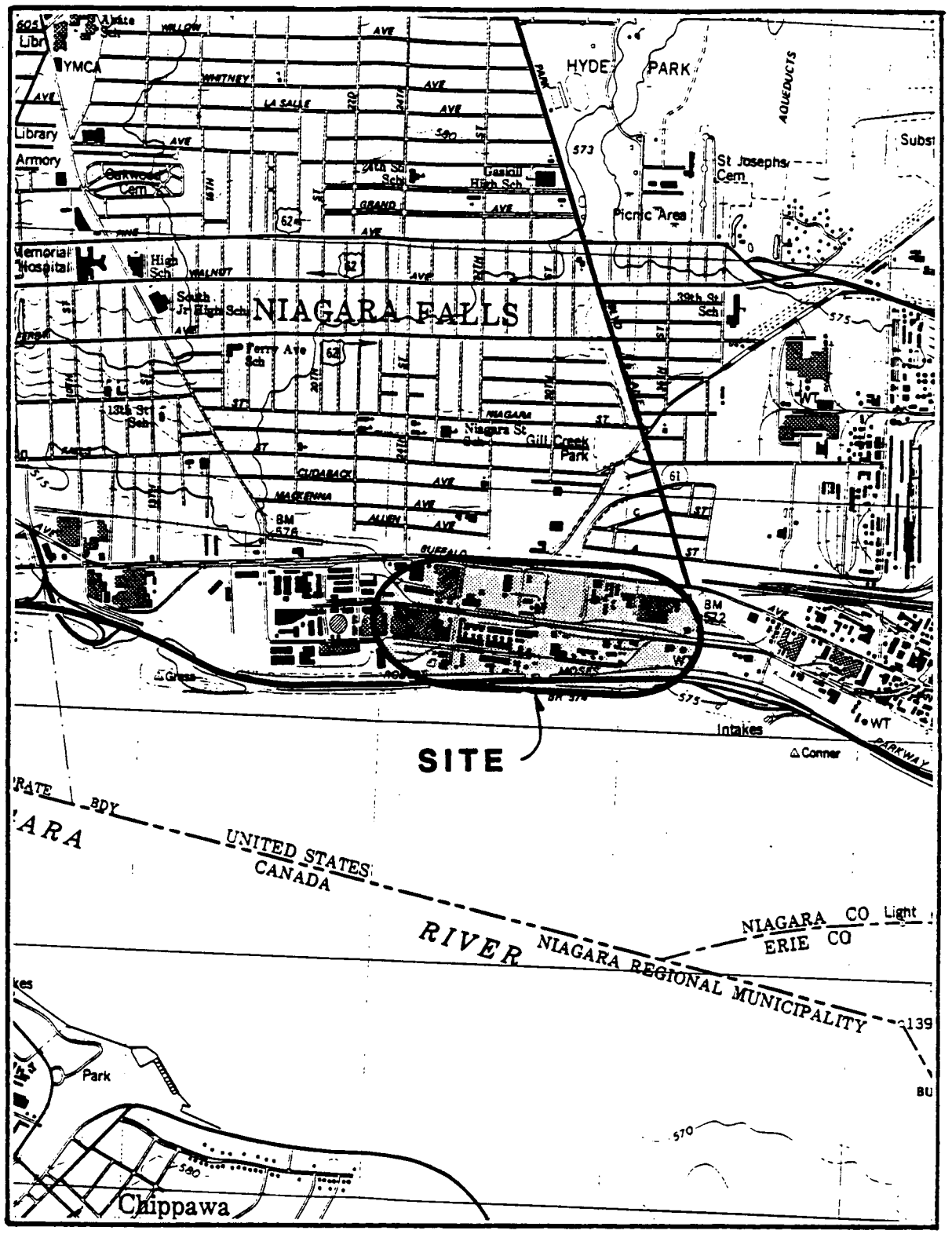
Notes: ND = Not Detected
BMDL = Below Method Detection Limit
Utility well No. 3 was dry; no sample analyzed. Utility well No. 4 was dry in December 1983; no sample analyzed.
All units mg/l (ppm)

TABLE 6 (CONT'D)

Compound	U12		U13	
	Dec. 1983	June 1984	Dec. 1983	June 1984
Benzene	ND	<.0001	ND	<.0001
Chlorobenzene	ND	<.0003	ND	<.0003
Chloroform	.048	<.0045	.014	<.1368
Trans-1,2-dichloroethylene	.057	<.0050	.240	<.0010
Methylene Chloride	ND	.0350	ND	.1218
1,1,2,2-tetrachloroethane	.034	1.742	.011	.4023
Tetrachloroethane	.014	403.1	.012	.4834
Trichloroethylene	.086	.8375	.400	.7321
Vinyl Chloride	ND	.0055	.012	.0065
Alpha-BHC	<.00001	.0012	<.00001	.000221
Beta-BHC	<.00001	.0005	<.00001	<.000003
Delta-BHC	<.00001	---	<.00001	---
Gamma-BHC	<.00002	.000349	<.00001	.000174
PCB-1016	<.0001	<.00019	<.0001	<.00019
PCB-1221	<.0002	<.00024	<.0002	<.00024
PCB-1232	<.0002	<.00029	<.0002	<.00029
PCB-1242	<.0001	<.00014	<.0001	<.00014
PCB-1248	<.0001	<.00019	<.0001	<.00019
PCB-1254	<.0001	<.00015	<.0001	<.00015
PCB-1260	<.0001	<.00015	<.0001	<.00015
Total Organic Carbon	<1.	1.690	4.0	4.44
Total Recoverable Phenolics	<.01	0.080	<.01	0.110
Total Cyanide	<.01	<0.050	<.01	.05
Soluble Barium	30	<1.	.27	<1.0
Soluble Copper	.015	<.1	.022	<.1

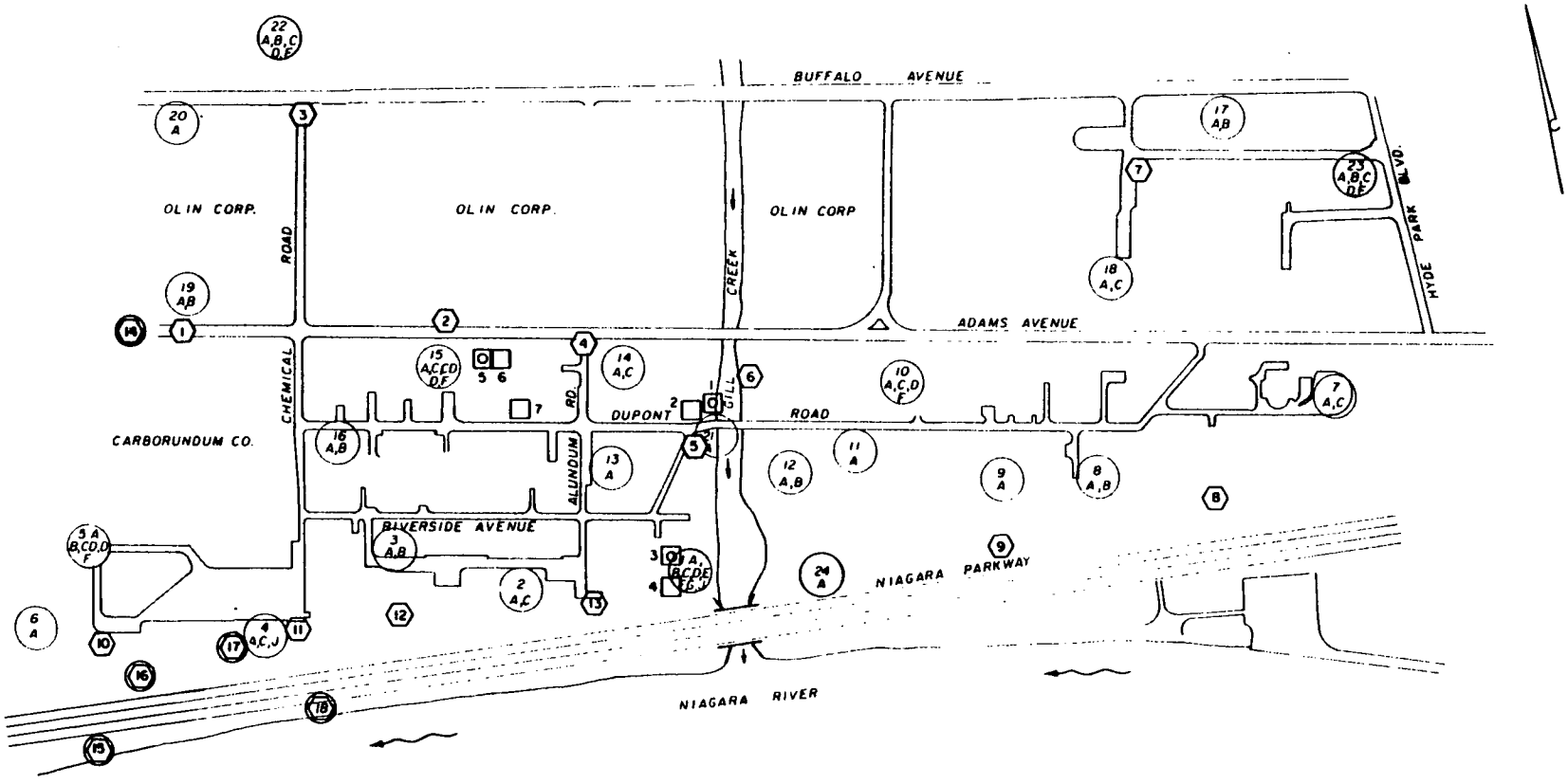
Notes: ND = Not detected
BMDL = Below Method Detection Limit
Utility well No. 3 was dry; no sample analyzed. Utility well No. 4 was dry in December 1983; no sample was analyzed.
All units mg/l (ppm)

Plates



REGIONAL LOCATION PLAN

PLATE 1



LEGEND:

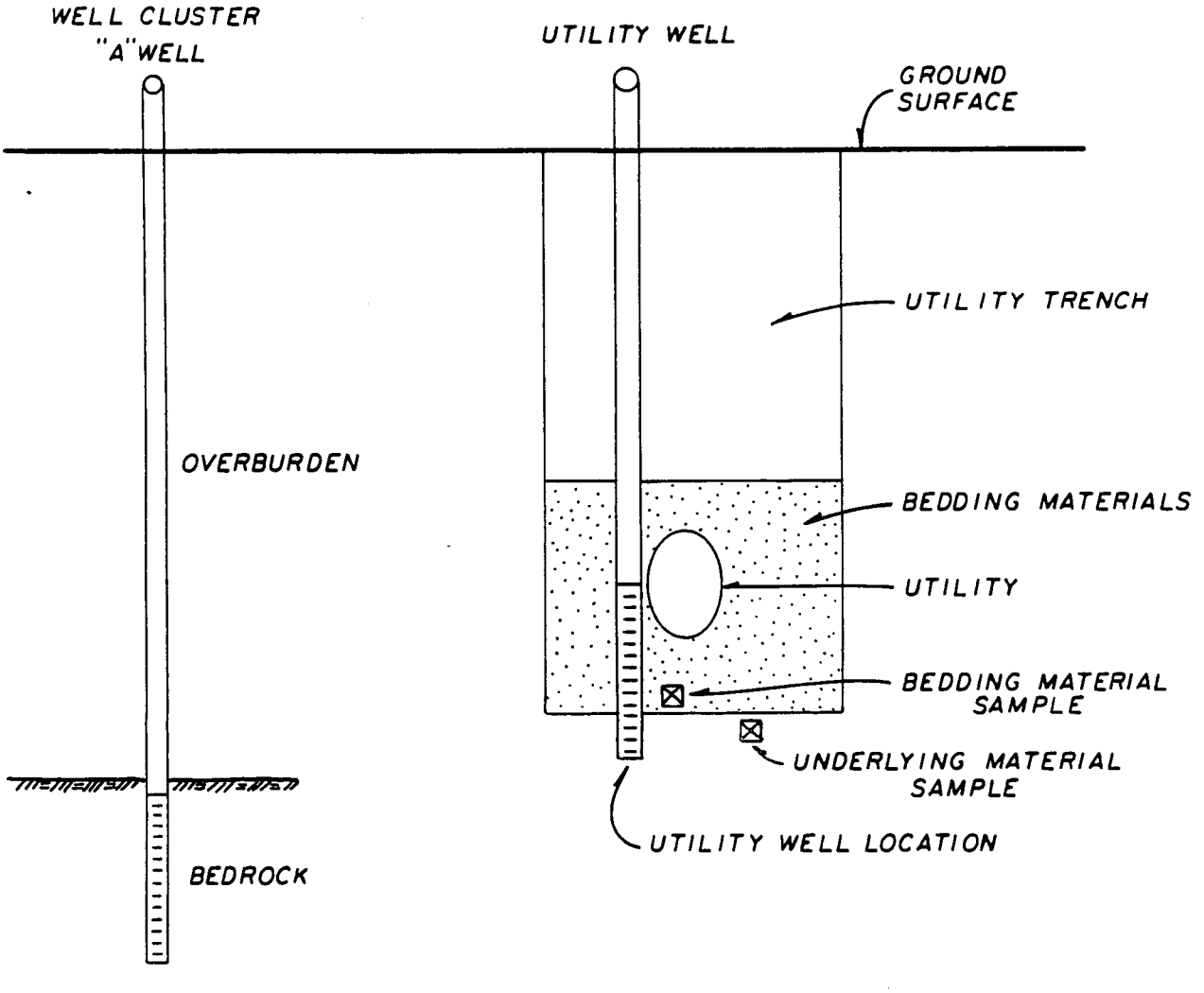
- 17 A,B — WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- UTILITY WELL LOCATION AND NUMBER
- TEST PIT LOCATION
- TEST PIT / RECOVERY WELL LOCATION
- UTILITY WELL INSTALLED FOR THIS INVESTIGATION

TEST PIT/RECOVERY WELL LOCATION PLAN
NIAGARA PLANT
E. I. DUPONT DE NEMOURS & CO.

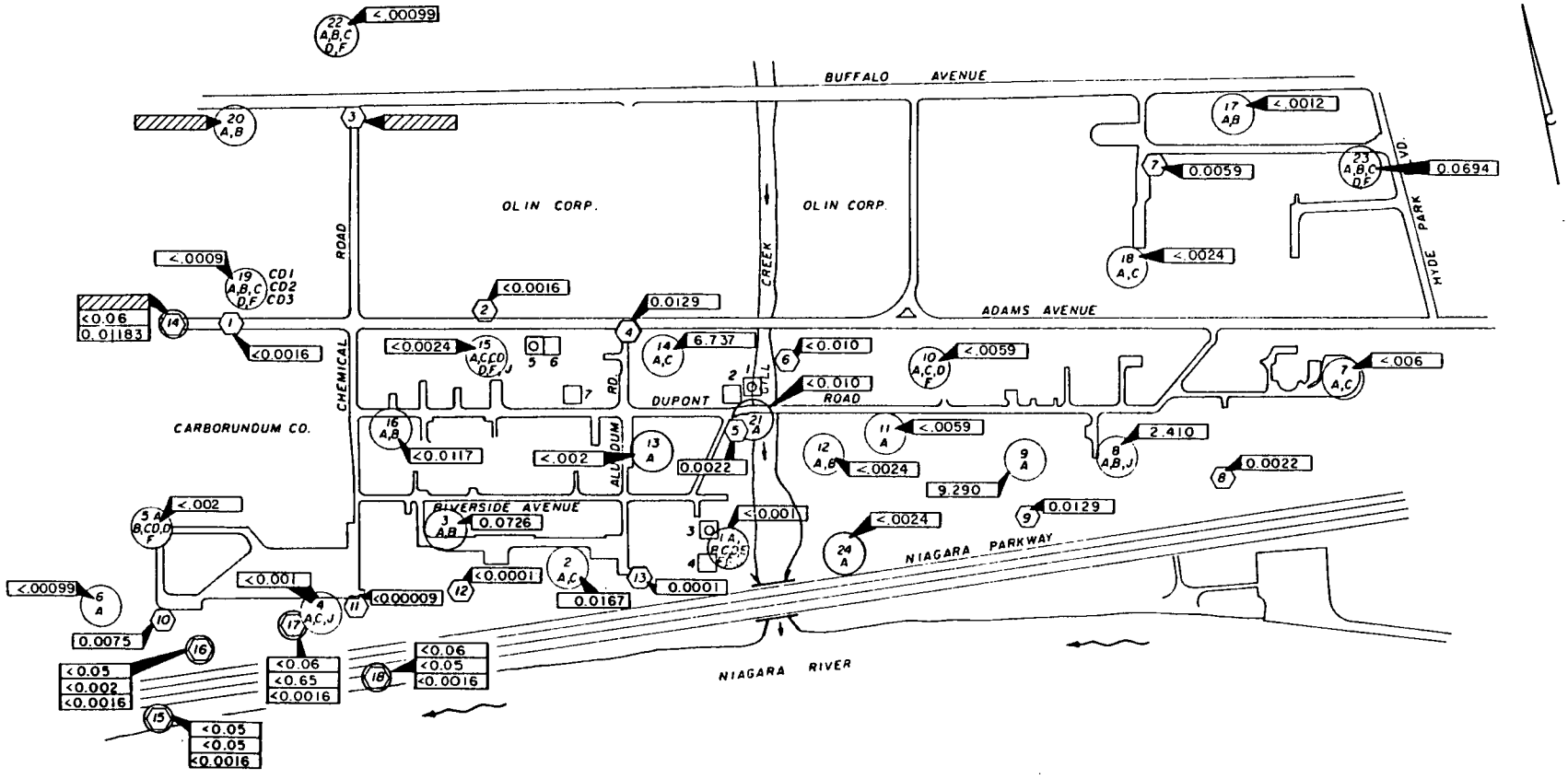
WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE IN FEET 0 300	DATE: 10/15/84
CHECKED: J.C.E.		JOB: 83C2236-7

PLATE 2



SCHEMATIC DIAGRAM OF UTILITY WELLS
AND "A" WELLS
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.



LEGEND:

- WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- UTILITY WELL LOCATION AND NUMBER
- TEST PIT LOCATION
- TEST PIT / RECOVERY WELL LOCATION
- UTILITY WELL INSTALLED FOR THIS INVESTIGATION
- SAMPLE FROM "A" WELL
- 40 — CONCENTRATION IN PPM
- — NOT DETECTED
- NO DATA/NO SAMPLE

CONCENTRATIONS FOR UTILITY WELLS

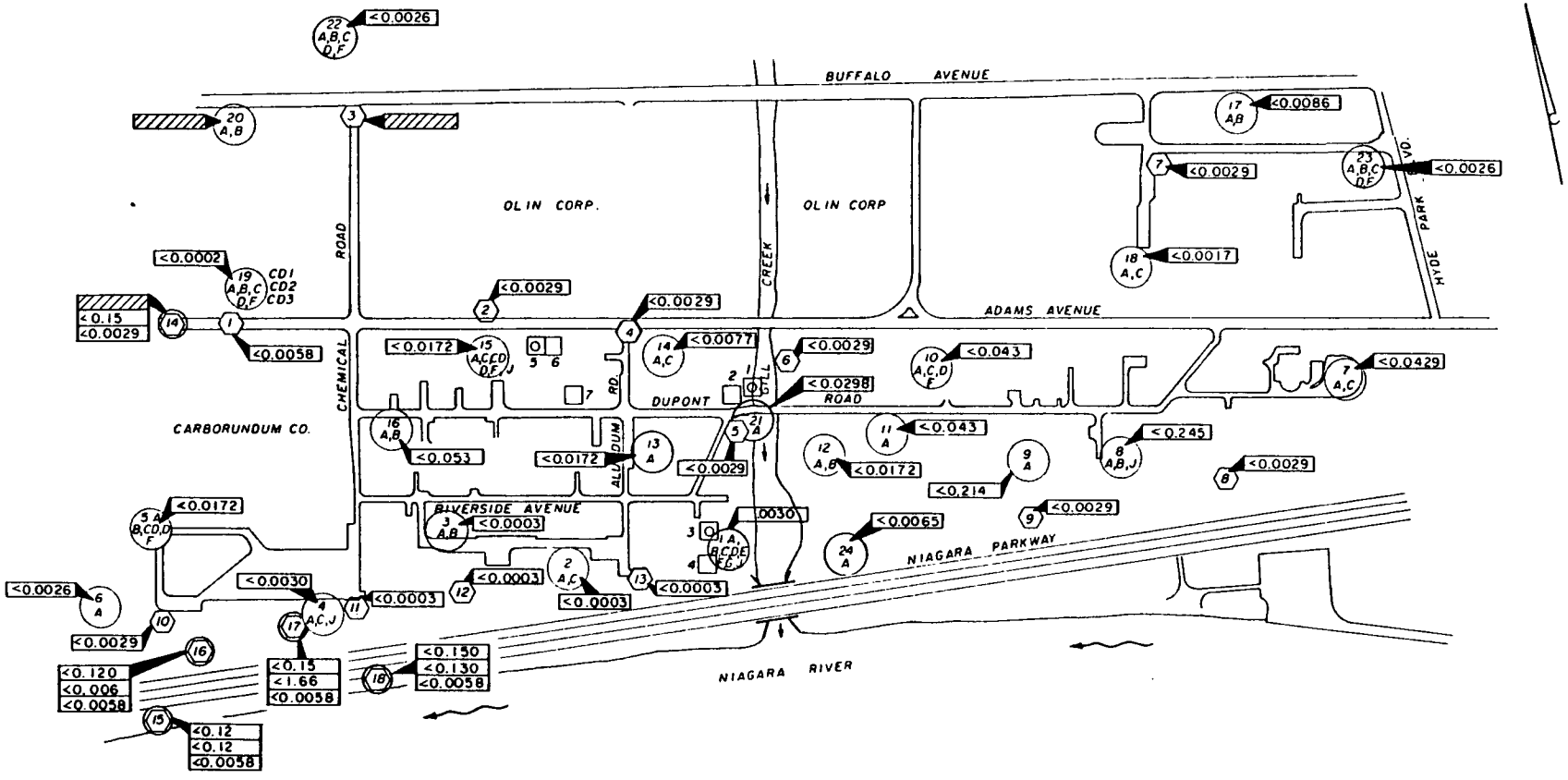
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

BENZENE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-B

PLATE 4



LEGEND:

- WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- UTILITY WELL LOCATION AND NUMBER
- TEST PIT LOCATION
- TEST PIT / RECOVERY WELL LOCATION
- UTILITY WELL INSTALLED FOR THIS INVESTIGATION
- SAMPLE FROM 'A' WELL
- 40 — CONCENTRATION IN PPM
- — NOT DETECTED
- NO DATA/NO SAMPLE

CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

CHLOROBENZENE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE In FEET 0 300	DATE: 10/12/84
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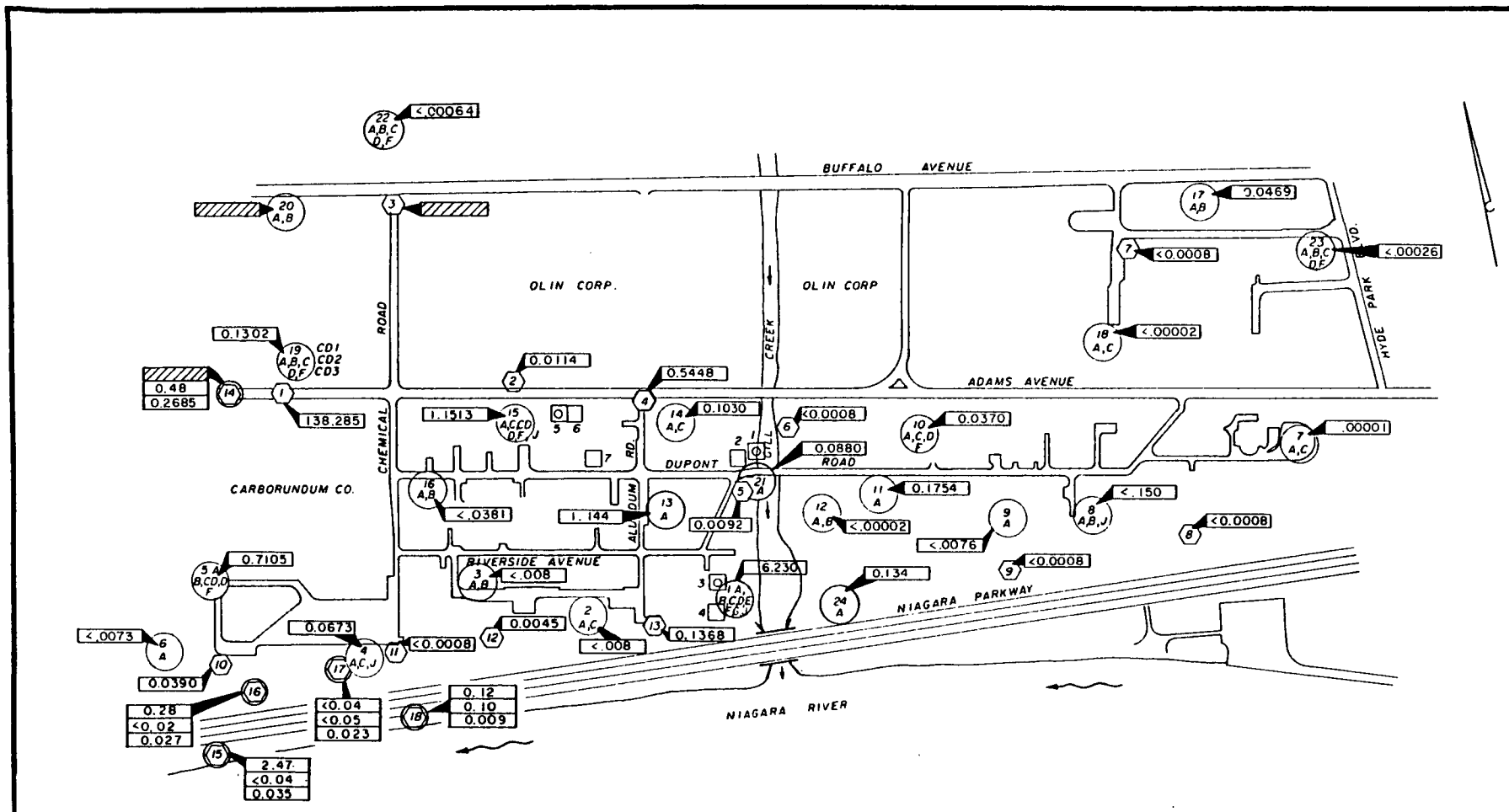
PLATE 5



LEGEND:

- WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- UTILITY WELL LOCATION AND NUMBER
- TEST PIT LOCATION
- TEST PIT / RECOVERY WELL LOCATION
- UTILITY WELL INSTALLED FOR THIS INVESTIGATION
- SAMPLE FROM 'A' WELL
- 40 — CONCENTRATION IN PPM
- NOT DETECTED
- NO DATA/NO SAMPLE

CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

CHLOROFORM CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

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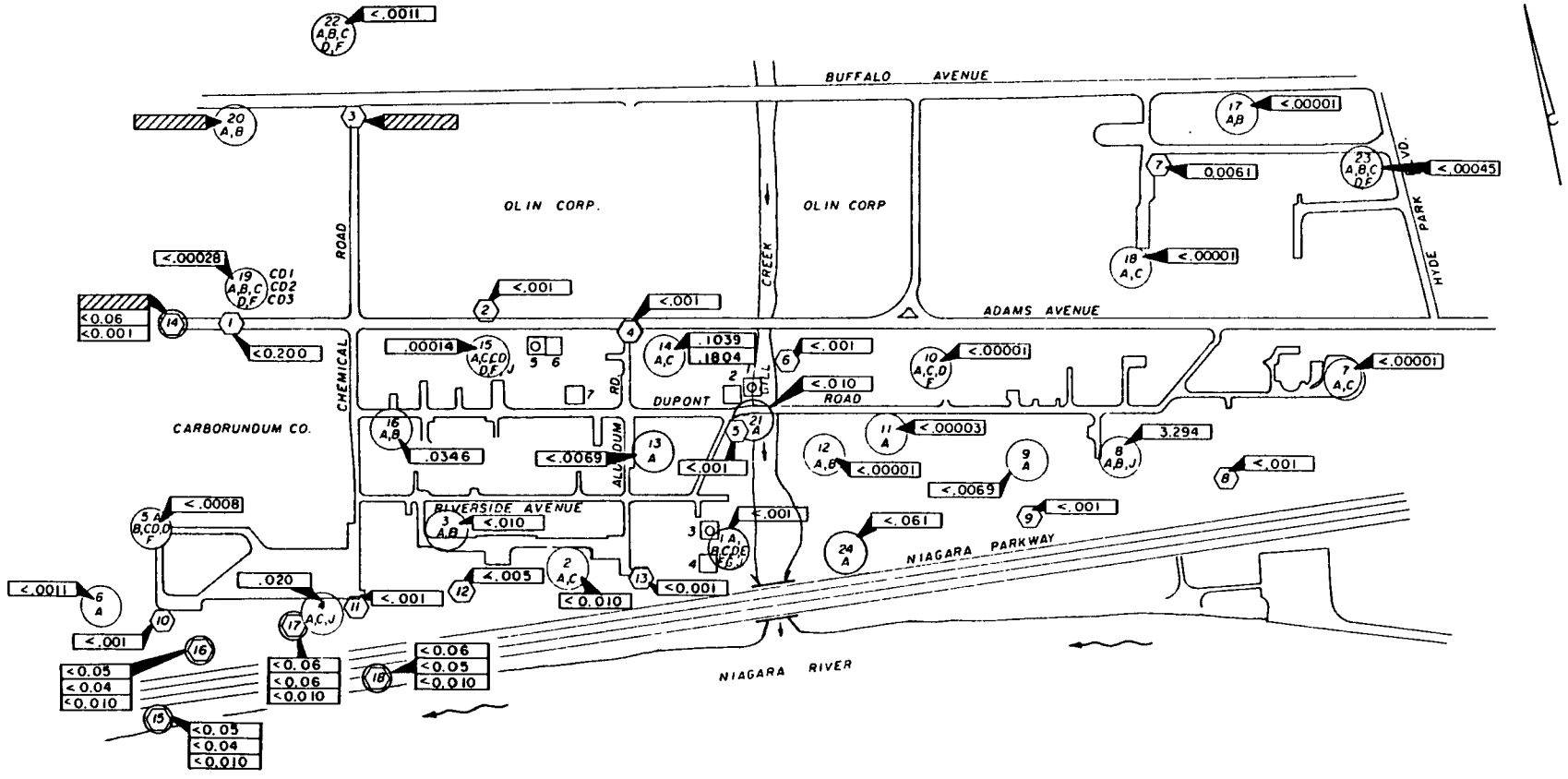
PLATE 6



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CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TRANS-1,2 DICHLOROETHYLENE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E.I.DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
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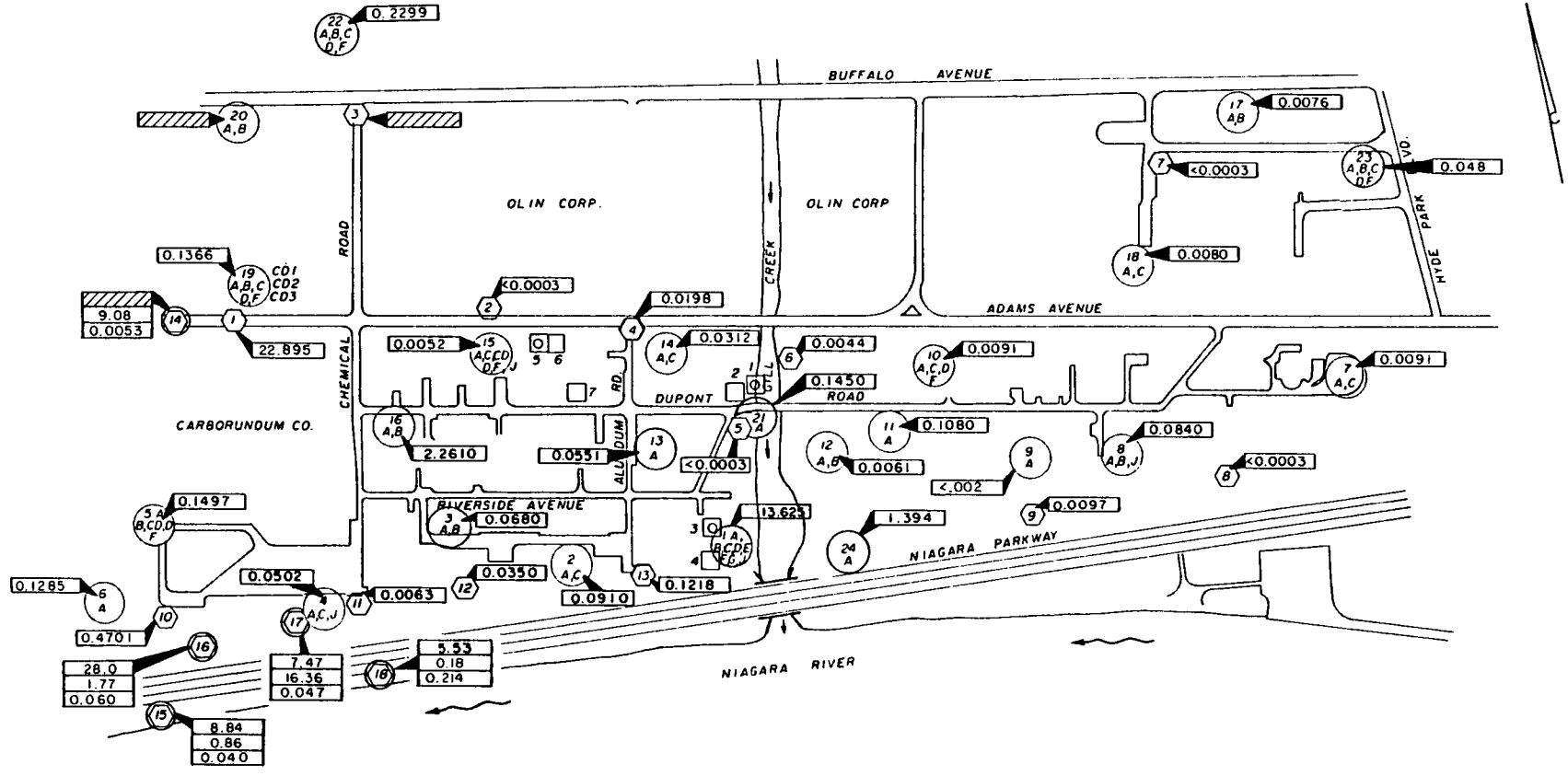
DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-8

PLATE 7



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CONCENTRATIONS FOR UTILITY WELLS

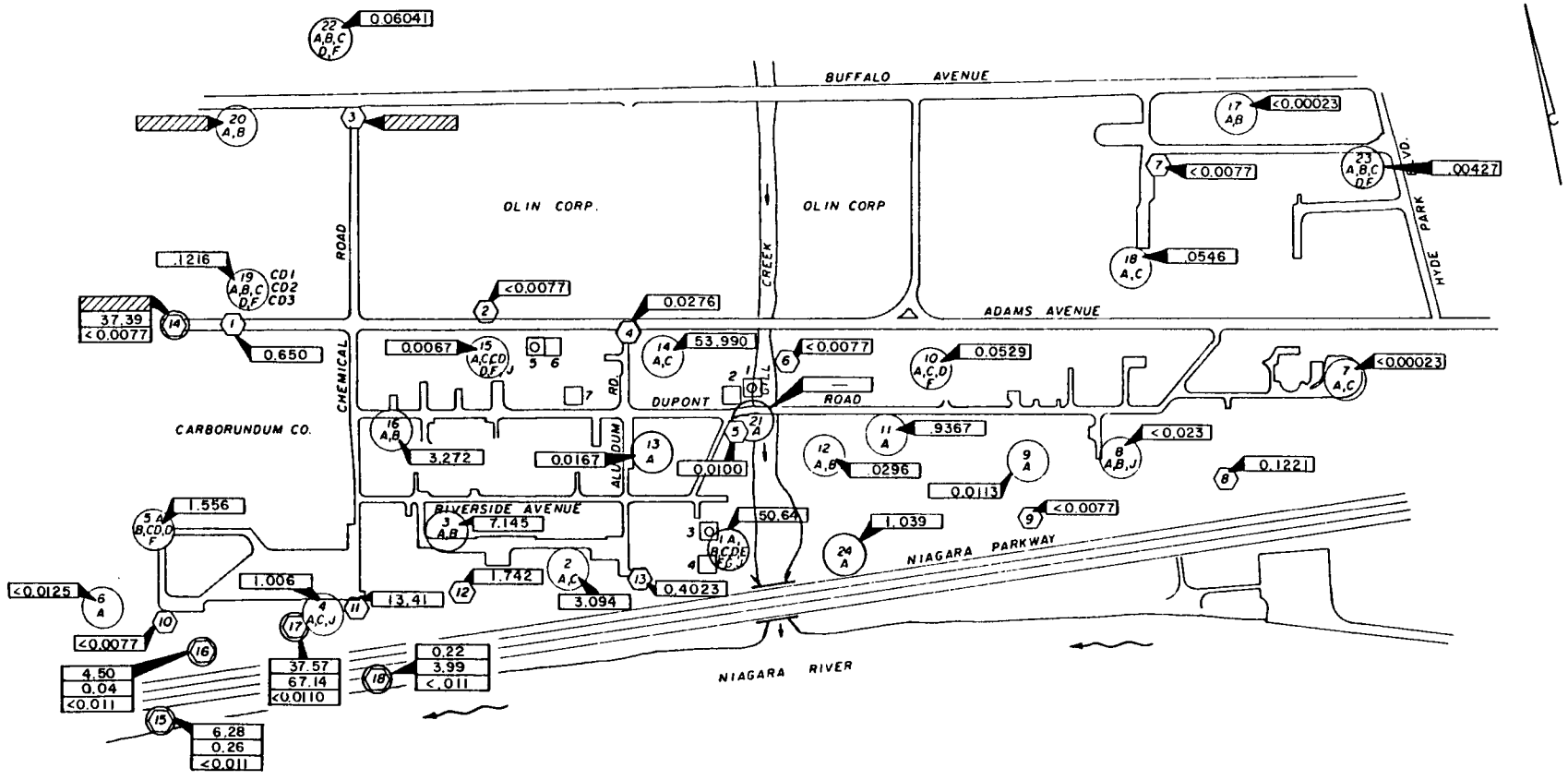
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

METHYLENE CHLORIDE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE In FEET 0 300	DATE: 10/12/84
CHECKED : L.R.P.		JOB : 83C2236-8

PLATE 8



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CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

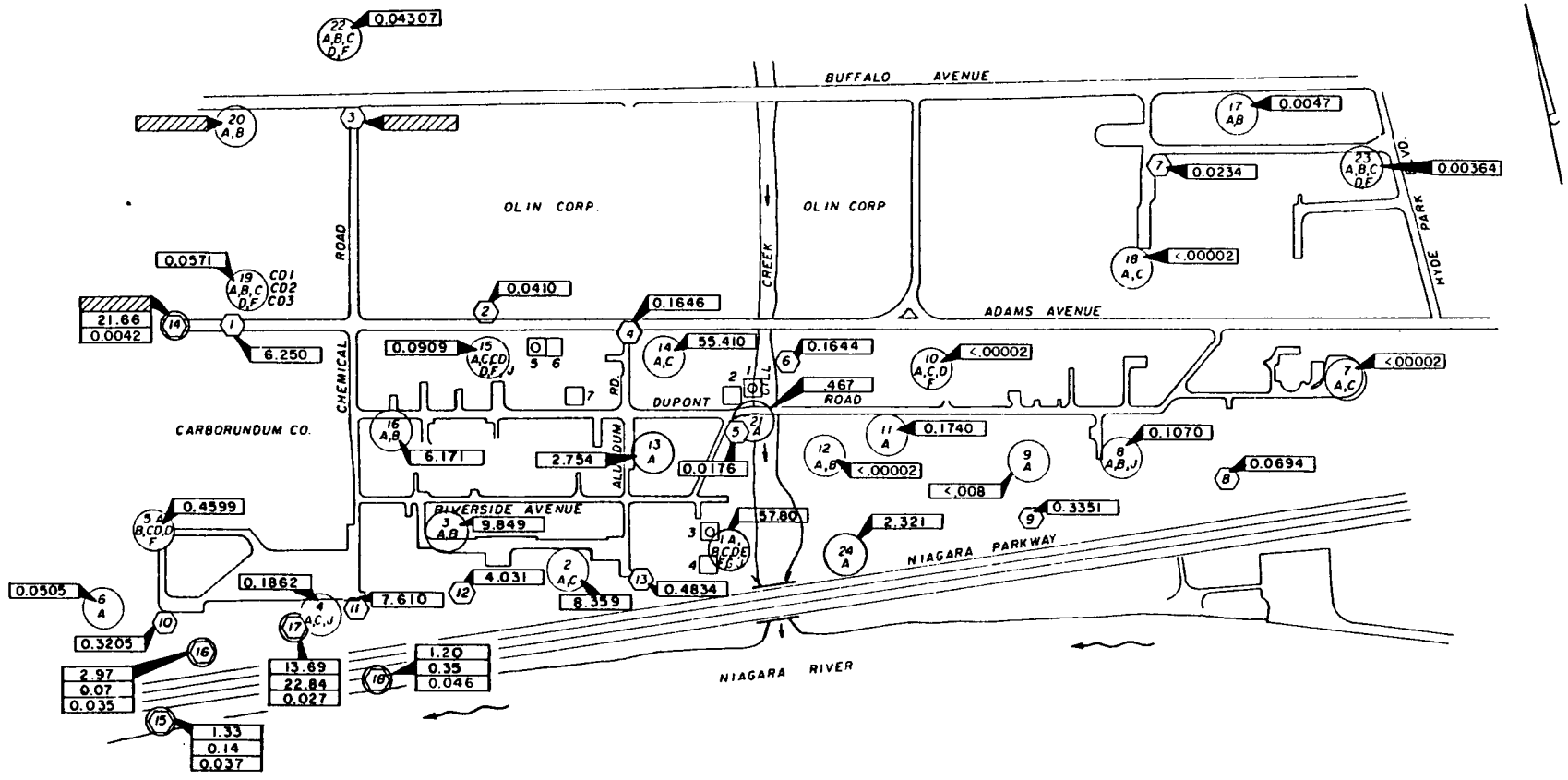
1,1,2,2 - TETRACHLOROETHANE CONCENTRATIONS SUMMER, 1984 NIAGARA PLANT E.I.DUPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-8

PLATE 9



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CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TETRACHLOROETHYLENE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

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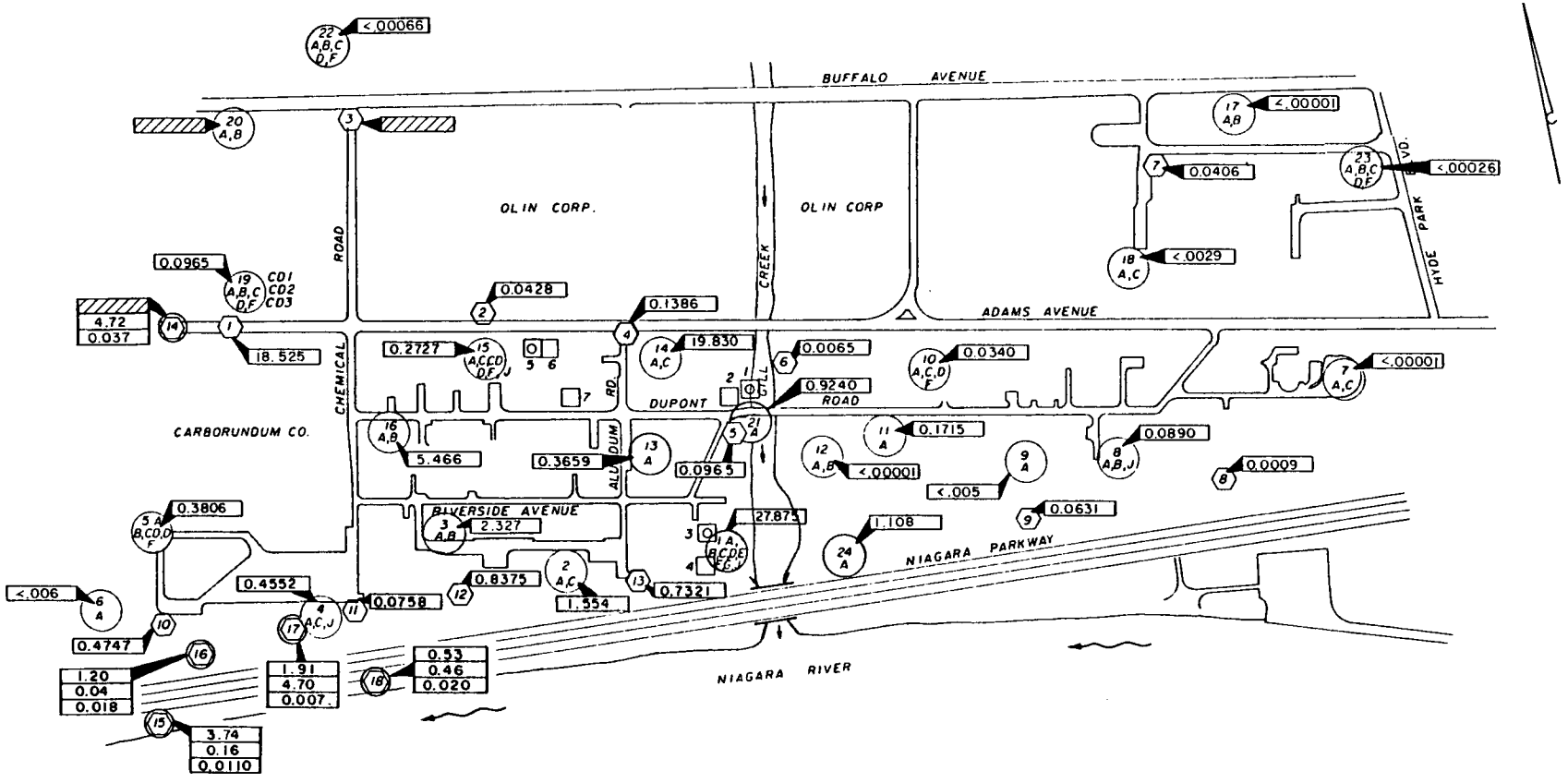
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED: L.A.P.		JOB: 83C2236-8

PLATE 10



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CONCENTRATIONS FOR UTILITY WELLS

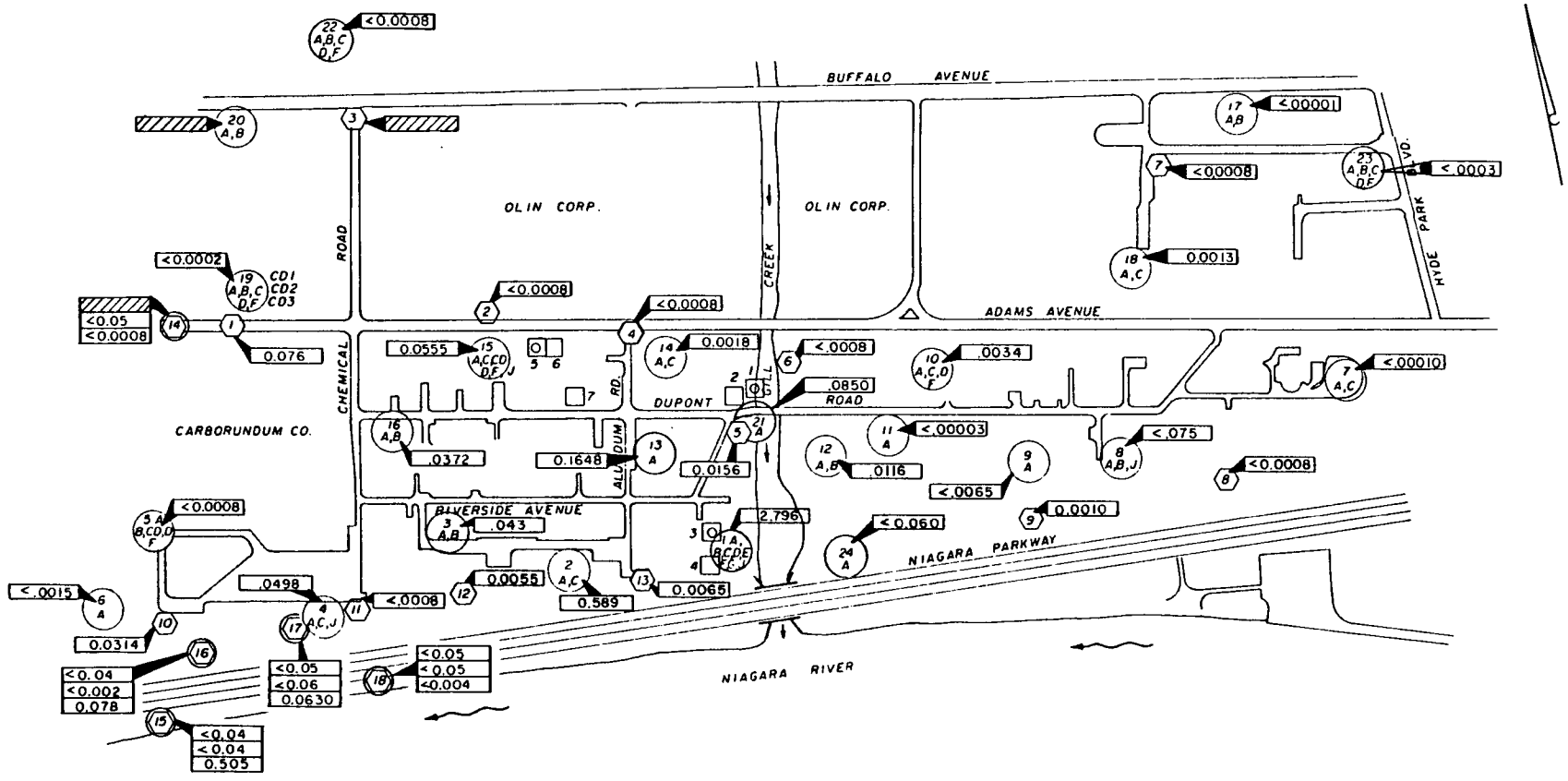
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TRICHLOROETHYLENE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE In FEET 0 300	DATE: 10/12/84
CHECKED : L.R.P.		JOB : 83C2236-8

PLATE 11



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CONCENTRATIONS FOR UTILITY WELLS

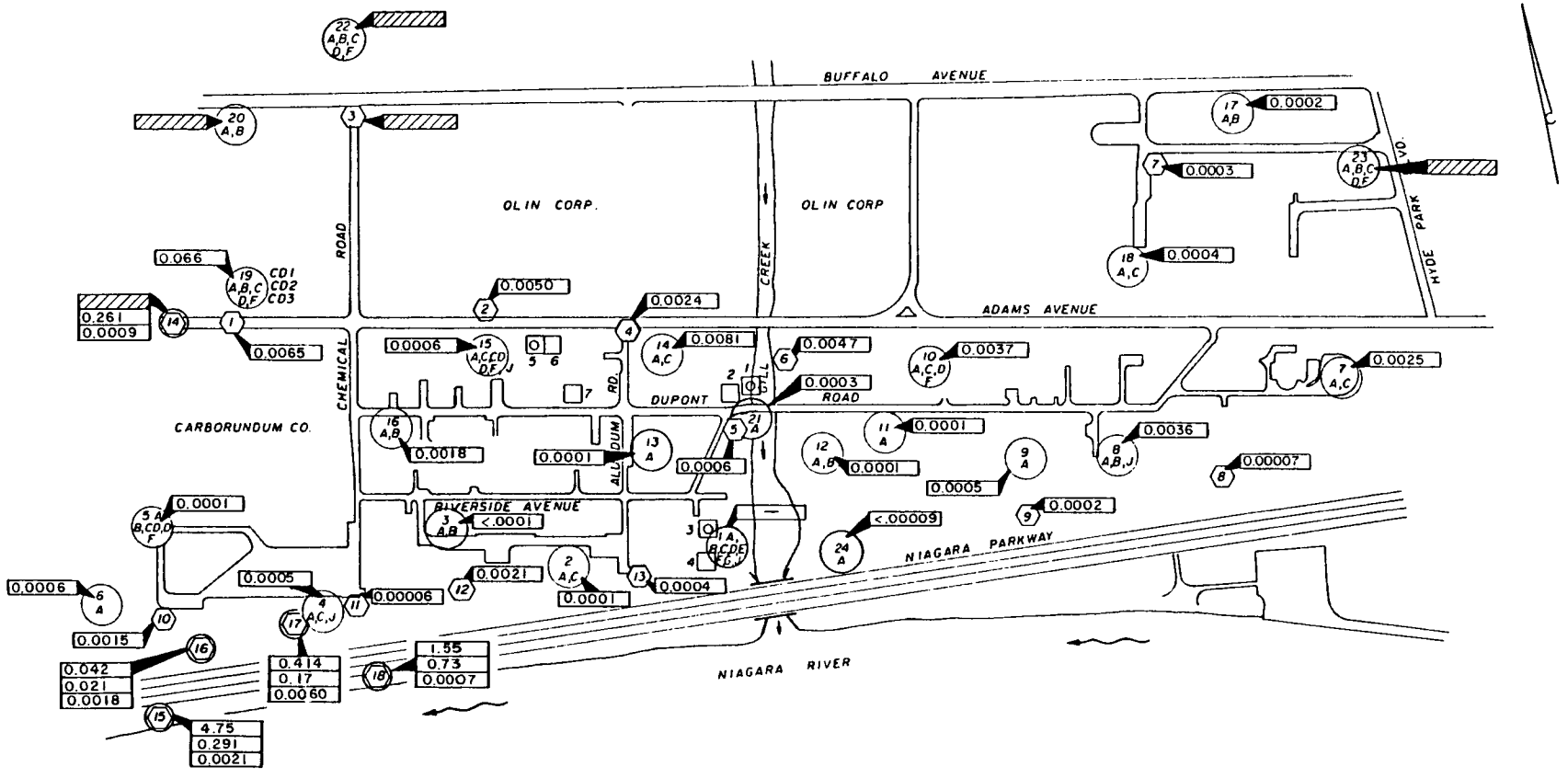
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

VINYL CHLORIDE CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E.I.DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET	DATE: 10/12/84
CHECKED : L.A.P.	0 300	JOB : 83C2236-8

PLATE 12



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CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

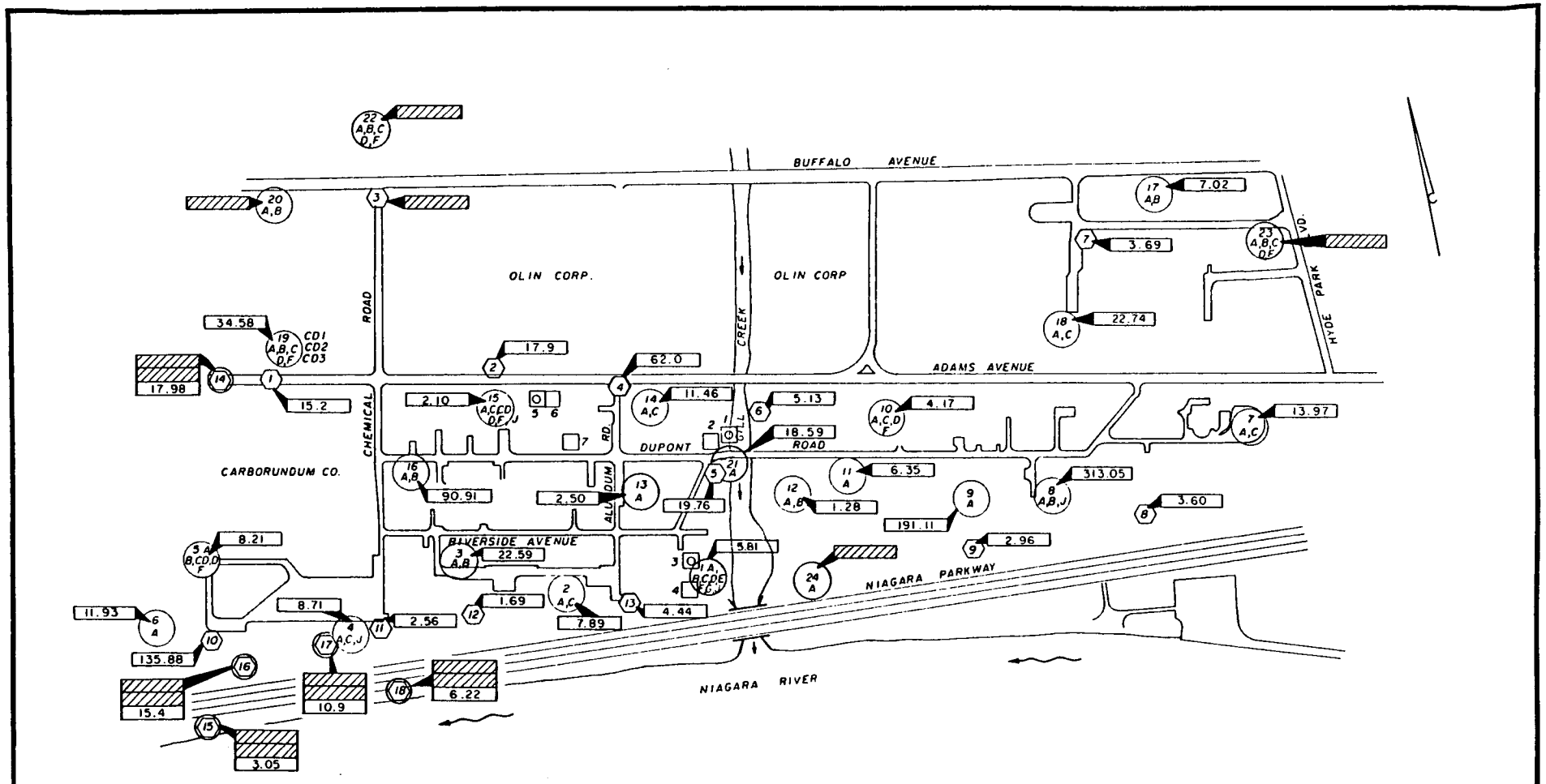
TOTAL BHC CONCENTRATIONS SUMMER, 1984 NIAGARA PLANT E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE In FEET 0 300	DATE: 10/12/84
CHECKED : L.A.P.		JOB : 83C2236-8

PLATE 13



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CONCENTRATIONS FOR UTILITY WELLS

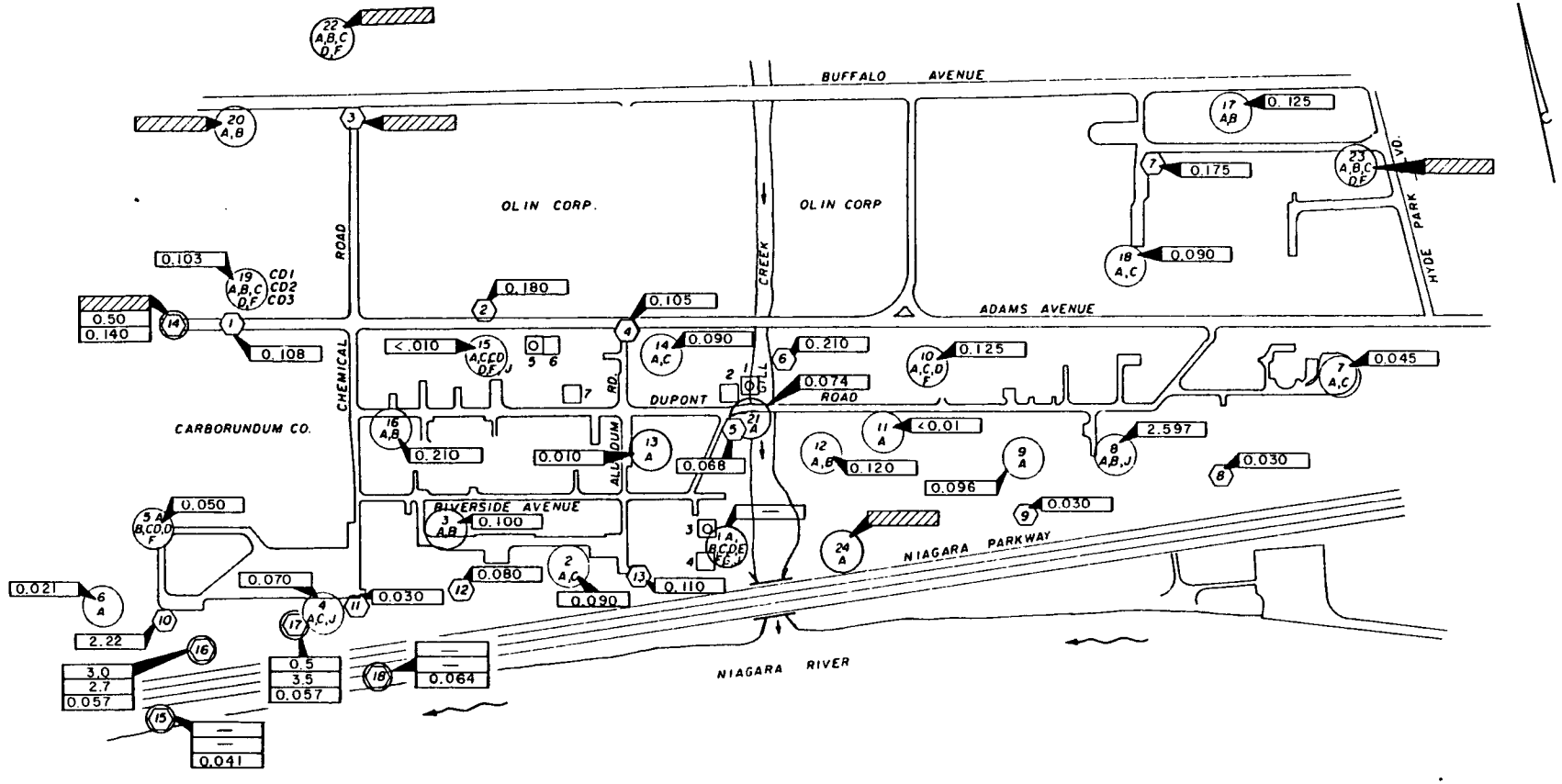
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TOTAL ORGANIC CARBON (TOC) CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E.I.DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET	DATE: 10/12/84
CHECKED : L.R.P.	0 300	JOB : 83C2236-8

PLATE 14



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CONCENTRATIONS FOR UTILITY WELLS

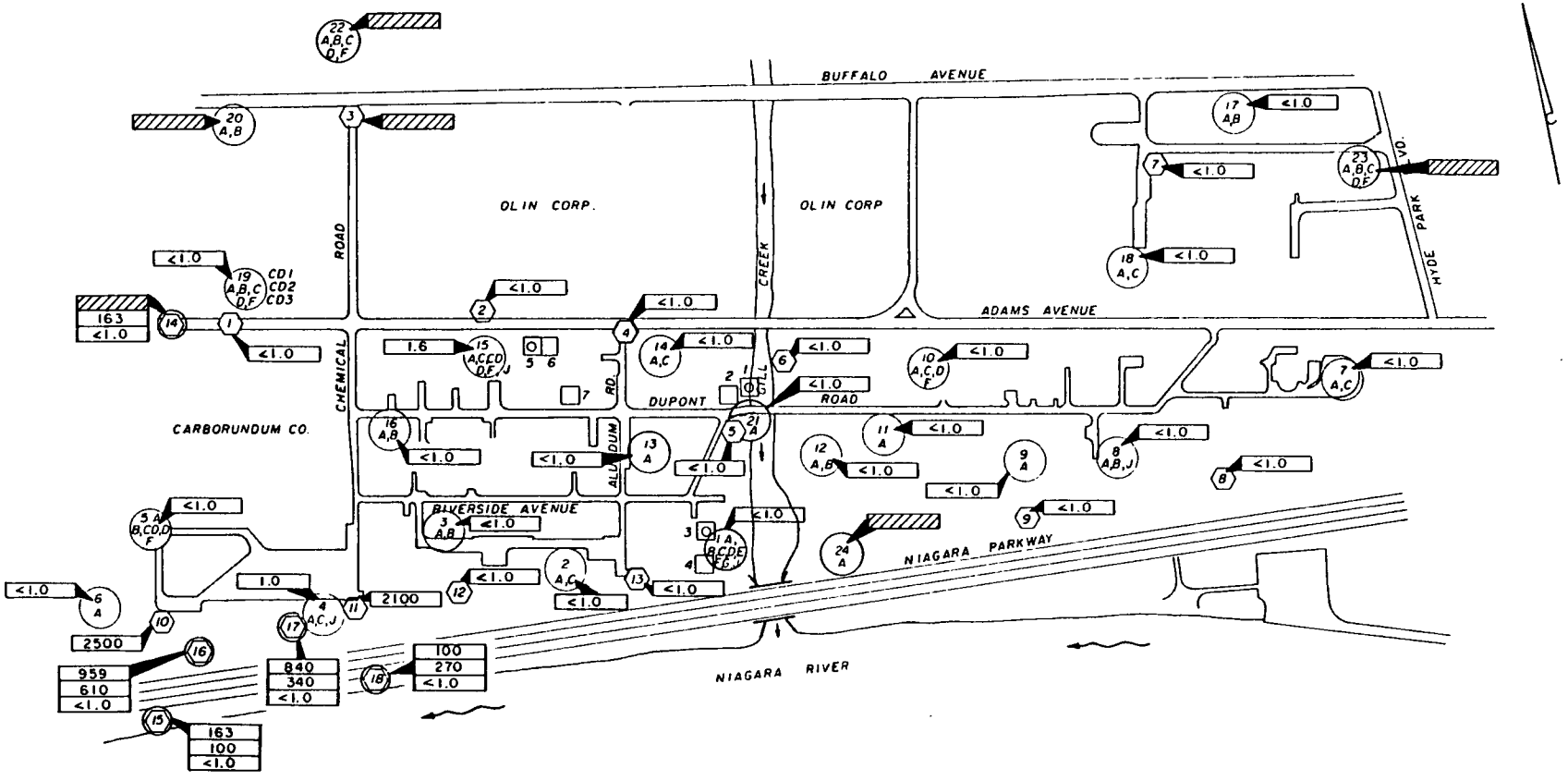
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TOTAL RECOVERABLE PHENOLS CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE IN FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-8

PLATE 15



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CONCENTRATIONS FOR UTILITY WELLS

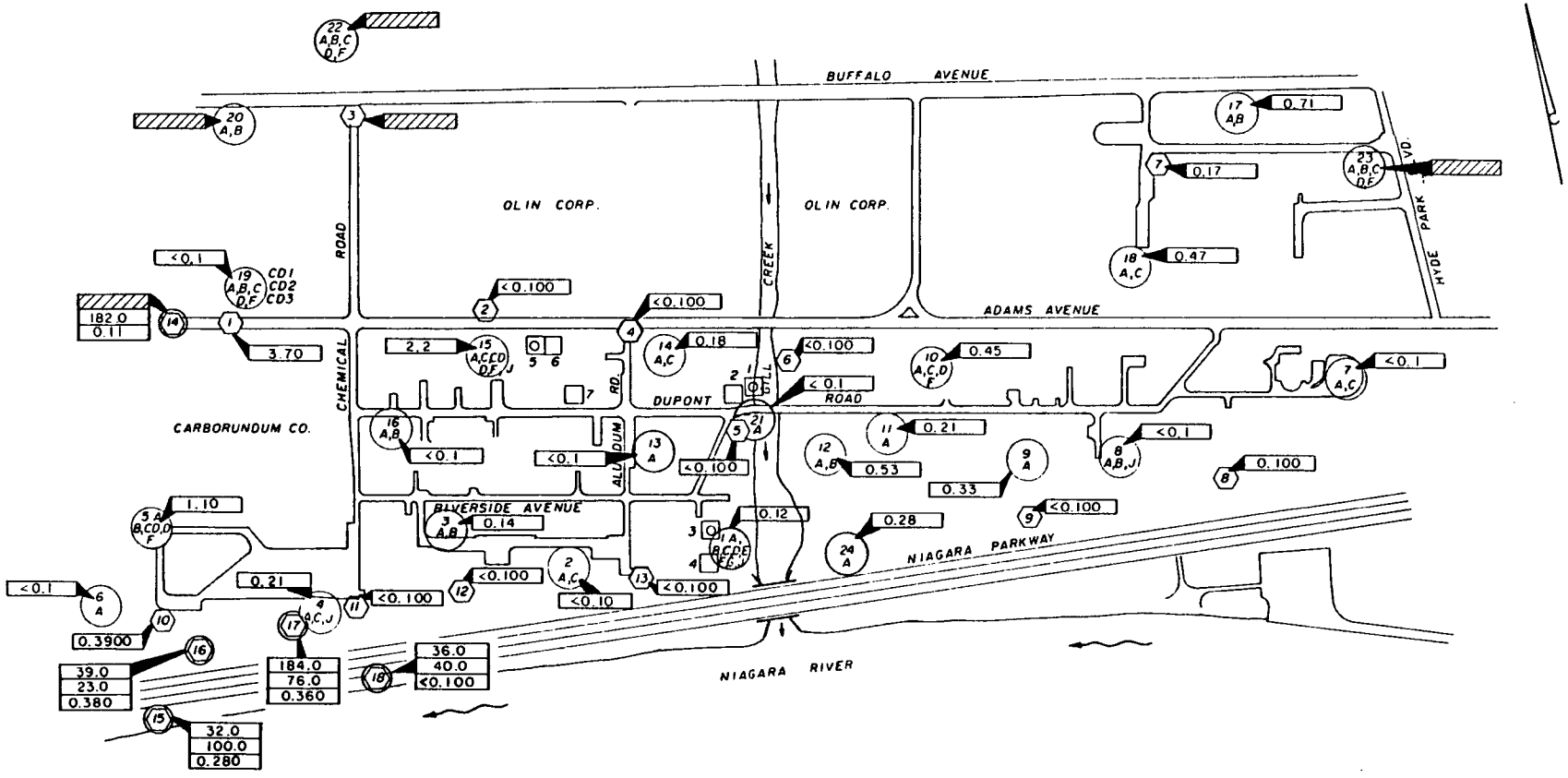
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

BARIUM CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E.I.DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED : L.R.P.		JOB : 83C2236-8

PLATE 17



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- SAMPLE FROM "A" WELL
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CONCENTRATIONS FOR UTILITY WELLS

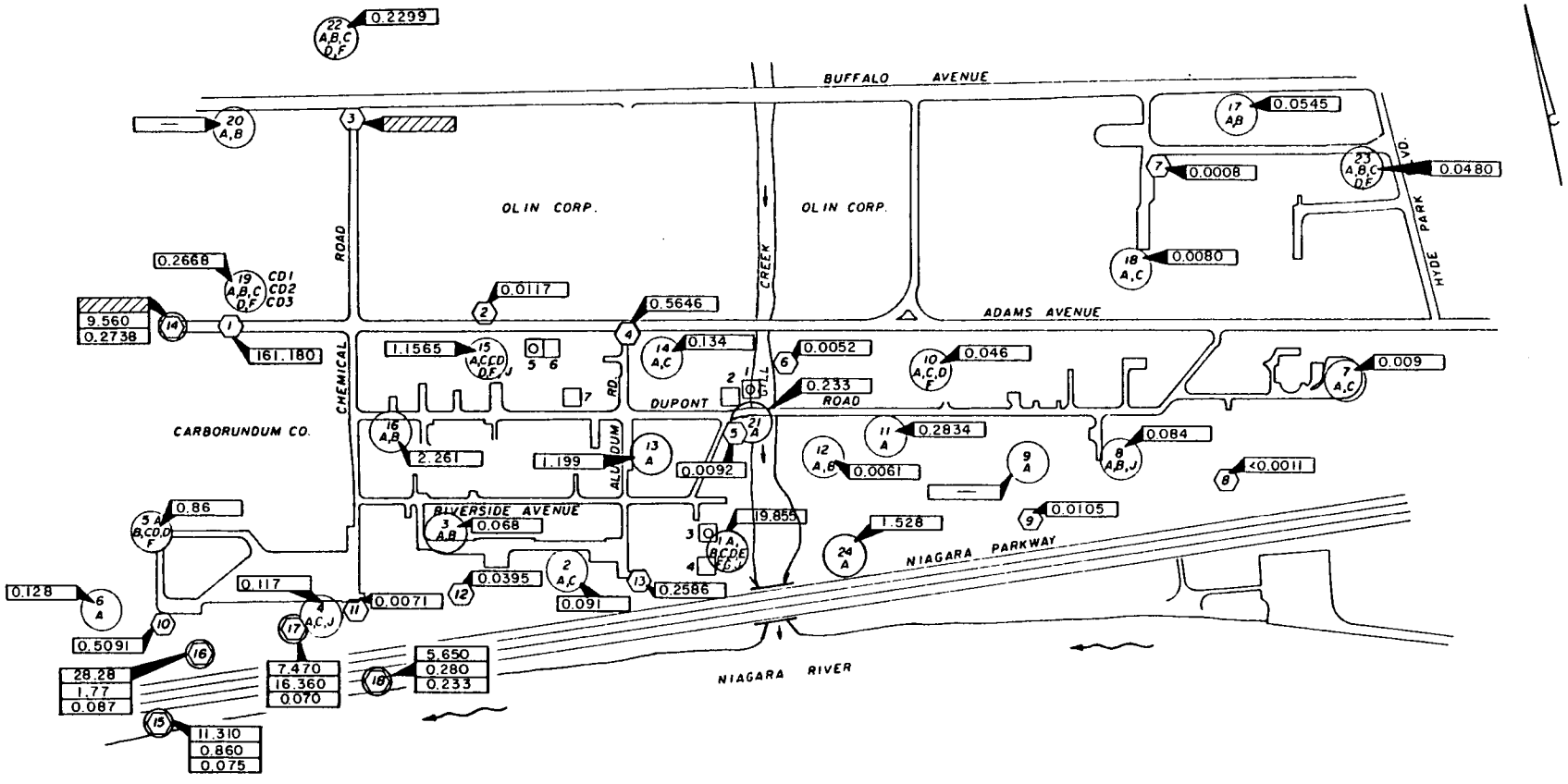
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

TOTAL COPPER CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE In FEET	DATE: 10/12/84
CHECKED : L.R.P.	0 300	JOB : 83C2236-8

PLATE 18



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CONCENTRATIONS FOR UTILITY WELLS

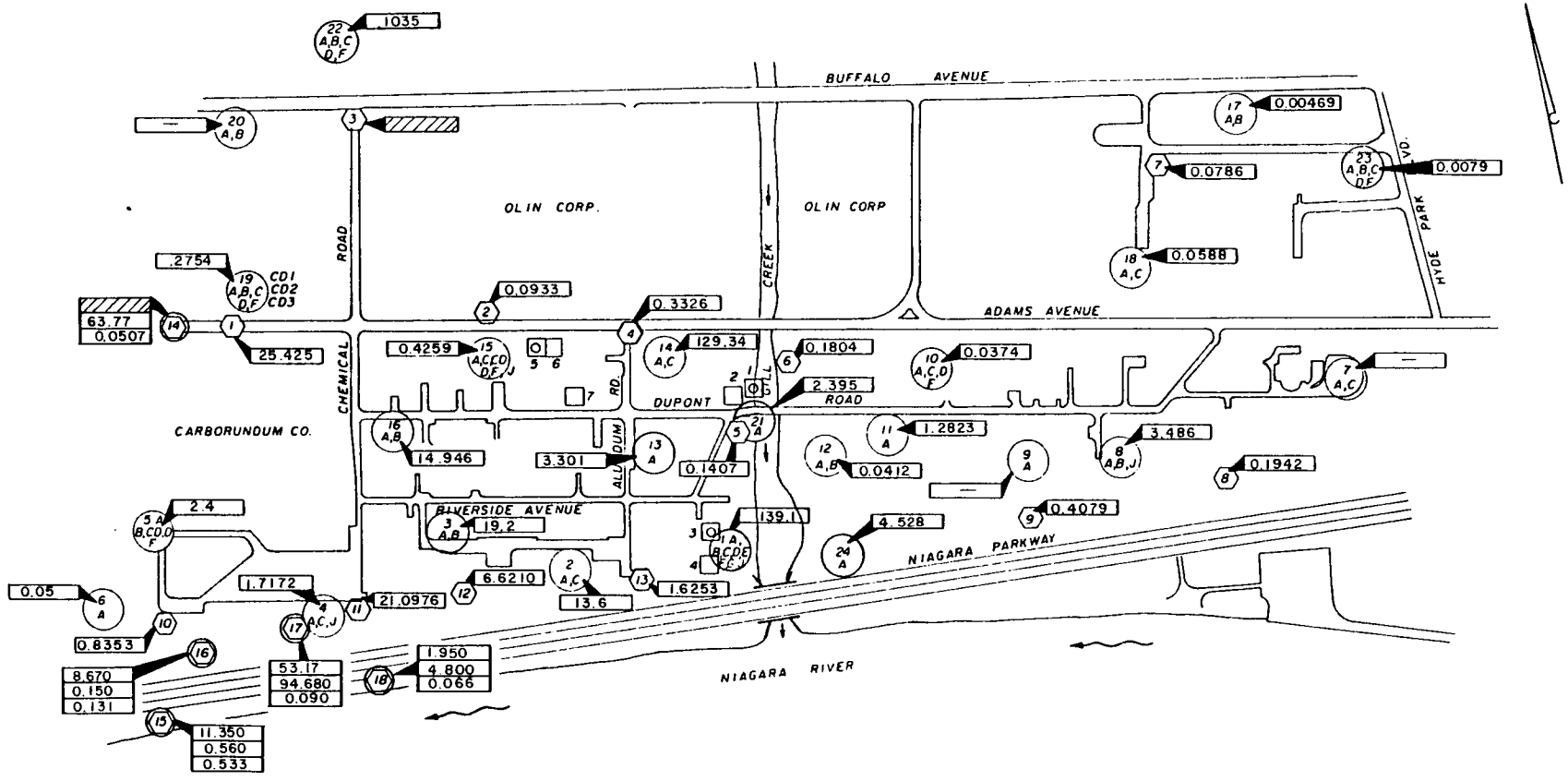
- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

C-1 COMPOUNDS CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE IN FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-8

PLATE 19



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CONCENTRATIONS FOR UTILITY WELLS

- UNDERLYING MATERIALS
- BEDDING MATERIALS
- GROUNDWATER

C-2 COMPOUNDS CONCENTRATIONS
SUMMER, 1984
NIAGARA PLANT
E. I. DuPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

DRAWN BY: T.P.	SCALE in FEET 0 300	DATE: 10/12/84
CHECKED: L.R.P.		JOB: 83C2236-8

PLATE 20

Appendix A

APPENIDX A

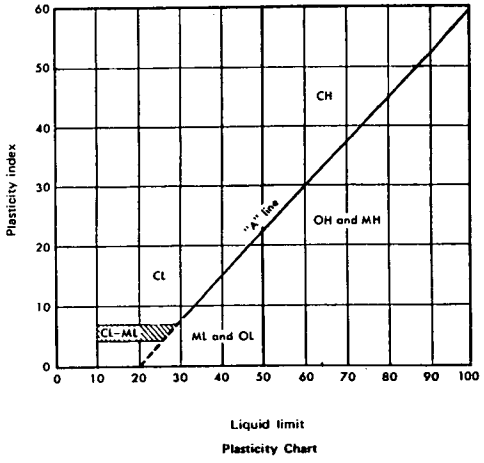
The subsurface investigation and utility well installation for the manmade passageways consisted of 5 test pits and utility wells installed at utility lines crossing the boundary of DuPont's Niagara Plant. The location of the Test Pits/Utility Wells are shown on Plate 2. The test pits were excavated and the utility wells installed by Sicoli and Massaro of Niagara Falls, New York under contract to DuPont. The test pit excavation and utility well installation commenced May 1 and was completed May 31, 1984.

Soil samples for visual identification were taken as grab samples from the backhoe bucket for field identification and classification. Subsequent samples of bedding material and underlying material were obtained, where possible, for chemical analysis.

A "Key to Soil Symbols and Terms" used in this report is presented on Page A-2. Logs of the test pits are presented on Pages A-5 through A-9. The ground surface and brass ring (top of riser pipe) elevations are presented on Page A-3. Groundwater elevations for all eighteen of the utility wells are presented on Page A-4.

Major Divisions		Group symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size) — Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixture, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
	Gravels with fines (Appreciable amount of fines)	GM* (d, u)	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4; Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
		GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size) — Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
		SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
	Sands with fines (Appreciable amount of fines)	SM* (d, u)	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4; Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
		SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. > than 7
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		CH	Inorganic clays of high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils	Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than 5 per cent ..... GW, GP, SW, SP
More than 12 per cent ..... GM, GC, SM, SC
5 to 12 per cent ..... *Borderline* cases requiring dual symbols**



Plasticity Chart

Particle Size — Material	Particle Size — mm	Particle Size — Sieve Size
Silt or Clay	<0.074	<#200
Sand Fine	0.074 To 0.42	#200 To #40
Sand Med.	0.42 To 2.00	#40 To #10
Sand Coarse	2.00 To 4.76	#10 To #4
Gravel Fine	4.76 To 19.1	#4 To 3/4 In.
Gravel Coarse	19.1 To 76.2	3/4 In. To 3 In.
Cobbles	76.2 To 304.8	3 In. To 12 In.
Boulders	304.8 To 914.4	12 In. To 36 In.

KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density[1] as determined by laboratory tests or standard penetration resistance tests.

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 35%
Medium dense	35 to 65%
Dense	65 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compression Strength, tons/sq. ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

TEST AND SAMPLE IDENTIFICATION

15 — 15 — The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O. D. split-barrel sampler for the last 12 inches of penetration.
50/2 — 50/2 — Number of blows (50) used to drive the split-barrel a certain number of inches (2).
P — Thin-wall tube sample.
P/250 — P250 — Thin-wall tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.
C_1 — Denison or Pitcher-Type — core-barrel sample.
Ps — Ps — Piston sample.
A — Augar sample.
NX / 65 — BX — Rock cored with BX core barrel, which obtains a 1-5/8" diameter core.
NX — NX — Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.
65% — Percentage (65) of rock core recovered.
20 — 20% — Rock Quality Designation (RQD)[2]
VS — VS — Vane Shear Test.

Sample Recovered:
C — Consolidation and specific gravity tests.
D — Maximum & minimum density.
DS — Direct Shear test.
G — Specific gravity test.
K — Permeability test.
M — Mechanical (sieve or hydrometer) analysis.
T — Triaxial compression test
U — Unconfined compression test.
W — Unit weight & natural moisture content.
X — Special tests performed — see Laboratory test results.

Sample Not Recovered:

Laboratory Test Performed

*Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

(2) RQD = $\frac{\Sigma \text{Core Segments} > 4 \text{ Inches}}{\text{Core Interval}} \times 100$
Where Segmentation Is Not Caused By Drilling Effects

(1) ASTM 2049-69

SUMMARY OF GROUND SURFACE AND TOP OF CASING ELEVATIONS

Well Designation	Ground Elevation	Top of Casing Elevation
U14	568.9	569.0
U15	570.4	570.52
U16	570.3	576.26
U17	570.5	574.61
U18	568.9	569.01

Note : Elevations are according to Bev Adams, DuPont

GROUNDWATER ELEVATIONS

Well Designation	Date Measured			
	5-31-84	6-1-84	7-30-84	8-16-84
U1	—	—	DRY	561.0
U2	—	565.0	565.3	565.0
U3	—	DRY	DRY	560.1
U4	—	560.0	564.2	560.0
U5	—	564.4	565.3	565.4
U6	—	563.0	562.4	563.0
U7	—	562.5	562.6	562.5
U8	—	562.5	561.5	561.5
U9	—	562.8	562.5	562.8
U10	—	570.0	567.3	570.0
U11	—	565.8	565.7	565.8
U12	—	562.4	562.7	562.4
U13	—	567.2	567.3	567.2
U14	557.0	557.2	—	—
U15	562.8	—	562.9	562.6
U16	562.8	—	—	562.7
U17	564.8	—	564.9	564.6
U18	562.9	—	—	562.8

— Not measured

LOG of TEST PIT No. TP-14

DATE 5/2-17/84 SURFACE ELEVATION 568.9 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Crushed stone with fines for roadway	567.9
			Cobble size pieces of Dolomite (road base)	567.4
				566.4
			Tan to yellow-brown clayey silty fine sandy GRAVEL, with metal (FILL)	
5				562.9
			Red-brown gravelly fine sandy stiff silty CLAY (FILL)	
10			DOLOMITE, badly fractured (sewer trench cut into rock)	
				554.1
15			24 inch pipe Top of pipe approximately 14.6 feet below grade Pipe was bedded in a fine sandy silty CLAY to clayey SILT with gravel size rock fragments An angular hole was exposed in pipe and patched before backfilling	

Completion Depth 14.8 Feet Water Depth Dry Feet Date 5/17/84

Project Name Supplemental Manmade Passageways Investi. Project Number 83C2236-8

LOG of TEST PIT No. TP-15

DATE 5/23-29/84 SURFACE ELEVATION 570.4 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Couple inches of topsoil to a brown coarse to fine sandy clayey SILT, trace of plant material	567.9
			Gravel to cobble size Dolomite rock fragments with trace of sand and silt (FILL)	565.4
5			Red-brown stiff coarse to fine sandy clayey SILT (FILL)	561.9
				560.6
10			Shot Rock well chocked with a clayey silty sandy gravel (FILL)	
			24 inch cast iron pipe, intact	
			Top of pipe approximately 6.3 feet below grade	
			Pipe bedded in a silty fine SAND	

Completion Depth 9.8 Feet Water Depth 7 Feet Date 5/29/84

Project Name Supplemental Manmade Passageways Investig. Project Number 83C2236-8

Woodward-Clyde Consultants

LOG of TEST PIT No. TP-16

DATE 5/18-22/84 SURFACE ELEVATION 570.3 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Crushed stone with fines for roadway	568.3
5			Red-brown very stiff silty CLAY, trace of gravel with occasional cobbles, shot rock and pieces of tile (FILL)	558.7
10			18 inch reinforced concrete pipe, intact Top of pipe approximately 4 feet below grade Pipe bedded in #1 crushed stone	

Completion Depth 11.6 Feet Water Depth 8 Feet Date 5/21/84

Project Name Supplemental Manmade Passageways Investi. Project Number 83C2236-8

Woodward-Clyde Consultants

LOG of TEST PIT No. TP-17

DATE 5/1-16/84 SURFACE ELEVATION 570.5 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Dark brown to red-brown stiff coarse to fine sandy silty CLAY, with fine to coarse gravel, cobbles and brick (FILL)	
5				564.0
			15 inch reinforced concrete pipe, intact Top of pipe approximately 4.7 feet below grade Pipe was bedded in silty fine SAND with a trace of fine gravel Excavation was terminated when a concrete slab was encountered under the utility line	
10				

Completion Depth 6.5 Feet Water Depth 6 Feet Date 5/15/84

Project Name Supplemental Manmade Passageways Investi. Project Number 83C2236-8

Woodward-Clyde Consultants

LOG of TEST PIT No. TP-18

DATE 5/30-5/31/84 SURFACE ELEVATION 568.9 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Topsoil	568.1
			Dark brown gravelly clayey silty coarse to fine SAND	566.9
5			Red-brown silty clayey coarse to fine SAND and GRAVEL, with occasional cobbles, shot rock, brick and wood (FILL)	
10				558.9
			24 inch cast iron pipe, intact Top of pipe approximately 6.6 feet below grade Pipe bedded in a silty fine SAND	

Completion Depth 10 Feet Water Depth 6.5 Feet Date 5/30/84

Project Name Supplemental Manmade Passageways Investi. Project Number 83C2236-8

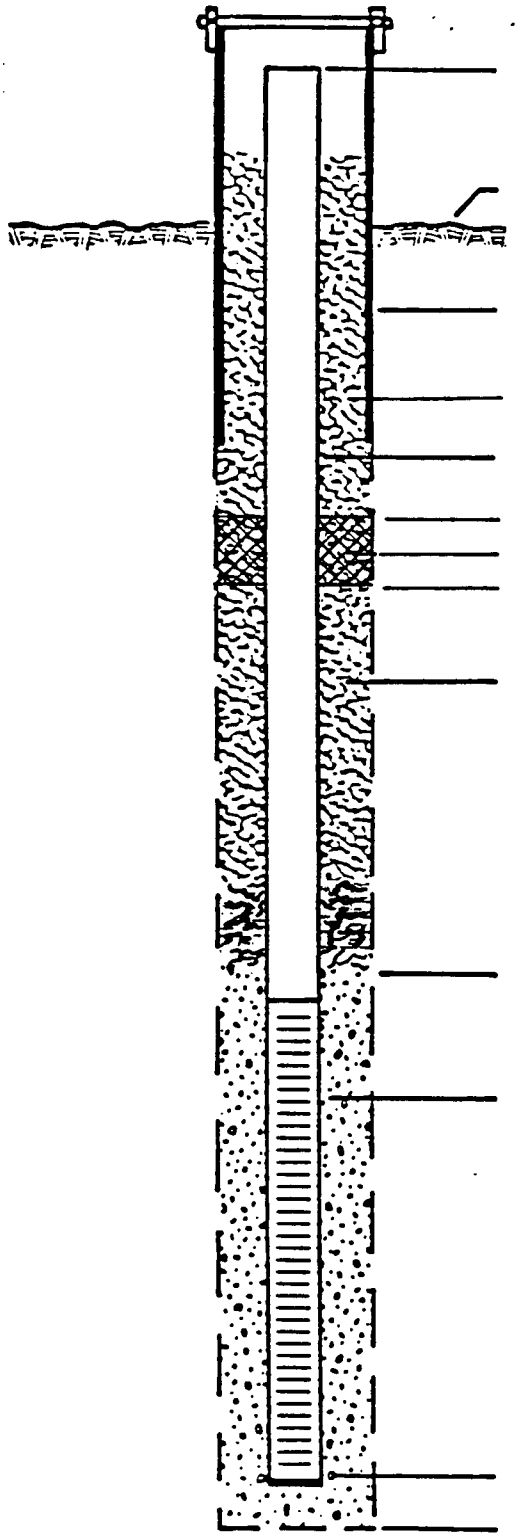
WCCAP 2

Woodward-Clyde Consultants

Appendix B

APPENDIX B

In order to assess the groundwater conditions in the bedding material at the five test pit locations, utility wells were installed in the test pits to allow water samples to be taken and analyzed. Presented in Appendix B, on pages B-2 through B-6, are the utility well installation reports.

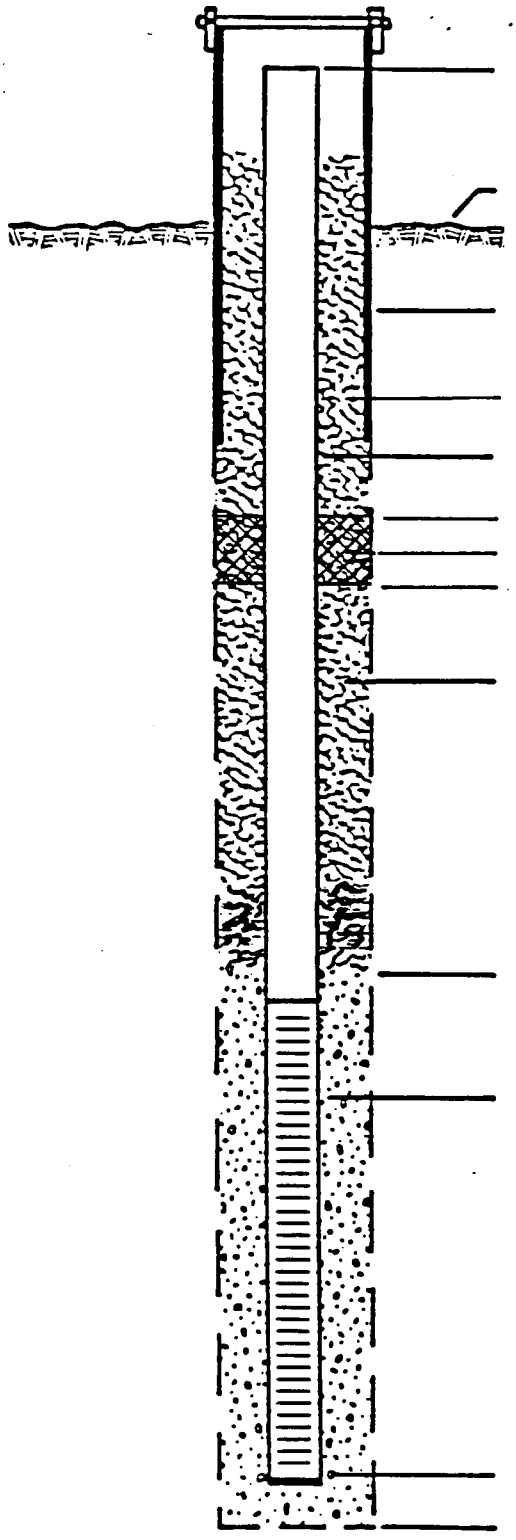


Elevation of top of riser pipe	569.0
Ground Elevation	568.9
I.D. of surface casing :	8 inches
Type of surface casing : steel with recessed flush cap	
Type of backfill: run of crusher	
I.D. of riser pipe : 4.0 inch	
Type of riser pipe : Black pipe	
Depth to top of Clay	3 feet
Type of seal : Compacted Clay	
Depth to top of Run of Crusher	5 feet
Type of backfill : Run of Crusher	
Depth to top of sand pack	11 feet
Depth to top of screen	12.3 feet
Type of screened section:	
Stainless Steel No. 10 Slot	
I.D. of screened section : 4.0 inch	
Depth to bottom of well	14.6 feet
Depth of test pit	14.8 feet

REPORT OF MONITORING WELL UW-14

DRAWN BY: LGR	CHECKED BY:	PROJECT NO.: 83C2236-8	DATE: 6/13/84	

Woodward-Clyde Consultants

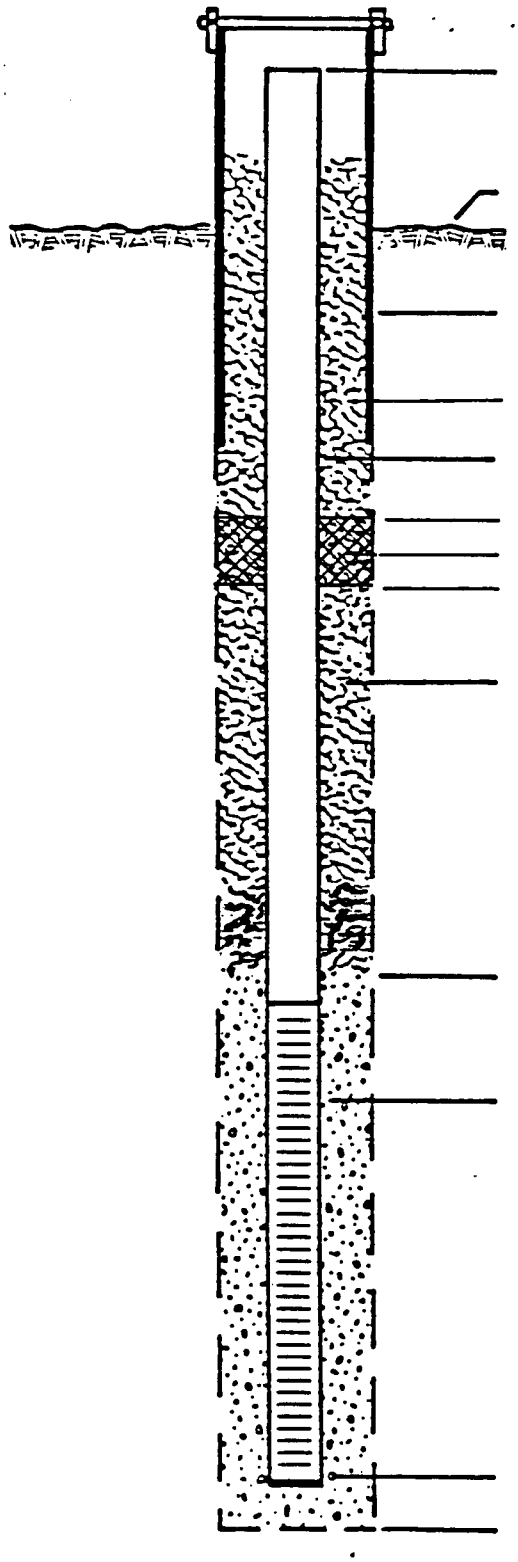


Elevation of top of riser pipe	570.52
Ground Elevation	570.4
I.D. of surface casing :	8 inches
Type of surface casing : steel with recessed flush cap	
Type of backfill: 6 inches of topsoil to run of crusher	
I.D. of riser pipe : 4.0 inch	
Type of riser pipe : Black pipe	
Depth to top of Clay	3.3 feet
Type of seal : Compacted Clay	
Depth to top of Run of Crusher	4.5 feet
Type of backfill : Run of Crusher	
Depth to top of sand pack	5.5 feet
Depth to top of screen	7.3 feet
Type of screened section: Stainless Steel No. 10 Slot	
I.D. of screened section : 4.0 inch	
Depth to bottom of well	9.6 feet
Depth of test pit	9.8 feet

REPORT OF MONITORING WELL UW-15

DRAWN BY: LGR	CHECKED BY:	PROJECT NO.: 83C2236-8	DATE: 6/13/84	

Woodward-Clyde Consultants

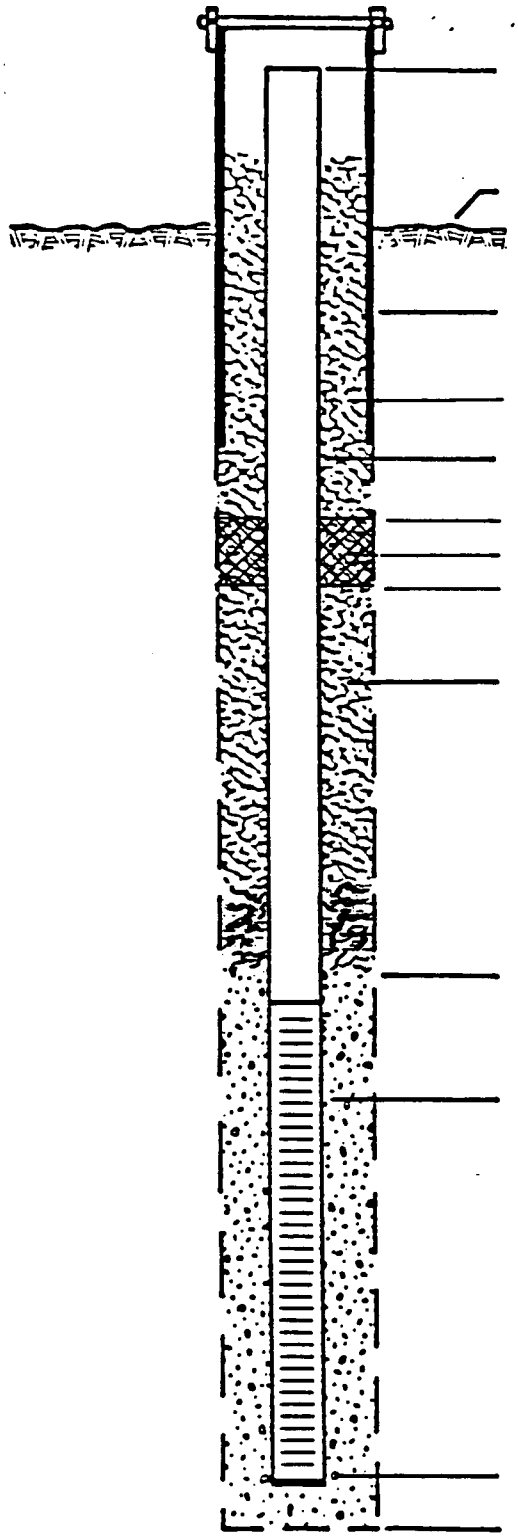


Elevation of top of riser pipe	576.26
Ground Elevation	570.3
I.D. of surface casing :	none
Type of surface casing :	none
Type of backfill: run of crusher	
I.D. of riser pipe : 4.0 inch	
Type of riser pipe : Black pipe	
Depth to top of Clay	1.5 feet
Type of seal : Compacted Clay	
Depth to top of Run of Crusher	3.6 feet
Type of backfill : Run of Crusher	
Depth to top of sand pack	4 feet
Depth to top of screen	7.4 feet
Type of screened section:	
Stainless Steel No. 10 Slot	
I.D. of screened section : 4.0 inch	
Depth to bottom of well	9.7 feet
Depth of test pit	11.6 feet

REPORT OF MONITORING WELL UW-16

DRAWN BY LGR	CHECKED BY:	PROJECT NO.: 83C2236-8	DATE: 6/13/84	

Woodward-Clyde Consultants

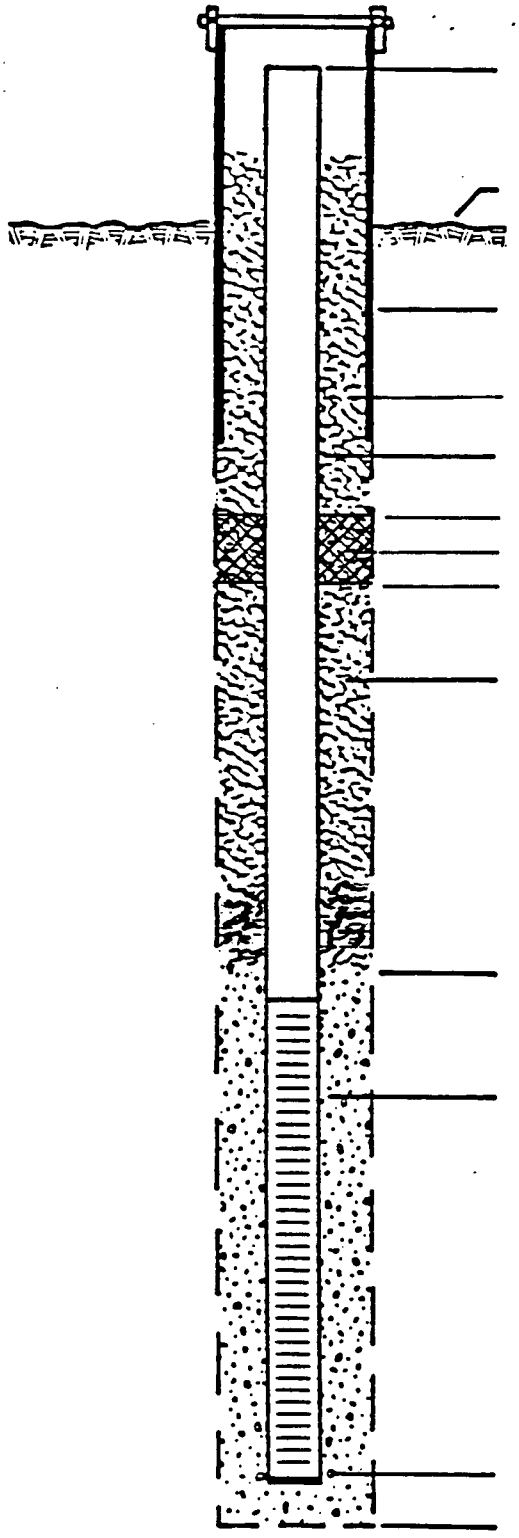


Elevation of top of riser pipe	574.61
Ground Elevation	570.5
I.D. of surface casing :	none
Type of surface casing :	none
Type of backfill: run of crusher	
I.D. of riser pipe : 4.0 inch	
Type of riser pipe : Black pipe	
Depth to top of Clay	1.8 feet
Type of seal : Compacted Clay	
Depth to top of Run of Crusher	3.3 feet
Type of backfill : Run of Crusher	
Depth to top of sand pack	3.8 feet
Depth to top of screen	4.2 feet
Type of screened section :	
Stainless Steel No. 10 Slot	
I.D. of screened section : 4.0 inch	
Depth to bottom of well	6.5 feet
Depth of test pit	6.5 feet

REPORT OF MONITORING WELL UW-17

DRAWN BY LGR	CHECKED BY:	PROJECT NO. : 83C2236-8	DATE : 6/13/84	

Woodward-Clyde Consultants



Elevation of top of riser pipe 569.01

Ground Elevation 568.9

I.D. of surface casing : 8 inches
Type of surface casing : steel with recessed flush cap

Type of backfill: 6 inches of topsoil to run of crusher

I.D. of riser pipe : 4.0 inch
Type of riser pipe : Black pipe

Depth to top of Clay 2 feet
Type of seal : Compacted Clay

Depth to top of Run of Crusher 4 feet

Type of backfill : Run of Crusher

Depth to top of sand pack 6 feet

Depth to top of screen 7.4 feet
Type of screened section:
Stainless Steel No. 10 Slot
I.D. of screened section : 4.0 inch

Depth to bottom of well 9.7 feet

Depth of test pit 10 feet

REPORT OF MONITORING WELL UW-18

DRAWN BY LGR	CHECKED BY:	PROJECT NO.: 83C2236-8	DATE: 6/13/84	

Woodward-Clyde Consultants

Appendix C

APPENDIX C

The analytical testing of the soil and water samples was conducted by Advanced Environmental Systems, Inc., of Niagara Falls, New York. The soil samples were collected at the time of the test pit excavation with test results dated July 24, 1984. A copy of the analytical results are presented in this Appendix. Note that classical chemistry parameters reported by AES on Tables 4 and 5 as milligram/gram should be corrected to milligrams/kilograms. Water samples were collected from utility wells 2 through 14 on June 1, 1984. Water samples were collected from utility wells 1 and 15 through 18 on August 16, 1984. The analytical results for the groundwater were integrated into DuPont's data base management system and are reproduced herein.

ANALYSIS OF SOIL SAMPLES

Report Prepared For

E. I. DuPONT DeNEMOURS & COMPANY, INC.

By

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

July 24, 1984

Prepared by:

AES Job AIO

Susan M. Cerquetti
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GC Division

Charlene M. Cameron
Charlene M. Cameron
Wet Chemistry Division

David P. Mix
David P. Mix
Metals Division

W. Joseph McDougall
W. Joseph McDougall, Ph.D.
Quality Control Verification

ANALYSIS OF SOIL SAMPLES
FOR INDICATOR PARAMETERS

Nine (9) soil samples were delivered to Advanced Environmental Systems, Inc. by Mr. Len Rafalko, Staff Geologist, Woodward-Clyde Consultants on each day that he collected the samples. Mr. Bev Adams of E. I. DuPont DeNemours and Company requested that the samples be tested for Indicator Parameters. Those parameters, and method references are provided in Appendix A.

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 1

TYPE OF ANALYSIS: Volatile Organics

UNIT OF MEASURE: milligrams/kilogram, or ppm

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/3/84 17 Bedding	5/3/84 17 Underlying	5/10/84 14 Bedding	5/21/84 16 Underlying	5/21/84 16 Bedding	5/24/84 15 Bedding
Benzene	<0.65	<0.06	<0.06	<0.05	<0.002	<0.05
Chlorobenzene	<1.66	<0.15	<0.15	<0.12	<0.006	<0.12
Chloroform	<0.05	<0.04	0.48	0.28	<0.02	<0.04
trans-1,2-dichloroethane	<0.06	<0.06	<0.06	<0.05	<0.002	<0.04
Methylene Chloride	16.36	7.47	9.08	28.0	1.77	0.86
1,1,2,2, Tetrachloroethane	67.14	37.57	37.39	4.50	0.04	0.26
Tetrachloroethylene	22.84	13.69	21.66	2.97	0.07	0.14
Trichloroethylene	4.70	1.91	4.72	1.20	0.04	0.16
Vinyl Chloride	<0.06	<0.05	<0.05	<0.04	<0.002	<0.04

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 1 (Cont'd)

TYPE OF ANALYSIS: Volatile Organics (Cont'd)

UNIT OF MEASURE: milligrams/kilograms, or ppm

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICTION					
	5/25/84 15 Underlying	5/29/84 18 Bedding	5/29/84 18 Underlying			
Benzene	<0.05	<0.05	<0.06			
Chlorobenzene	<0.12	<0.13	<0.15			
Chloroform	2.47	0.10	0.12			
trans-1,2 dichloroethane	<0.05	<0.05	<0.06			
Methylene Chloride	8.84	0.18	5.53			
1,1,2,2 tetrachloroethane	6.28	3.99	0.22			
tetrachloroethylene	1.33	0.35	1.20			
trichloroethylene	3.74	0.46	0.53			
Vinyl Chloride	<0.04	<0.05	<0.05			

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 2

TYPE OF ANALYSIS: PCB & Pesticide Concen.

UNIT OF MEASURE: milligrams/kilogram, ppm

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/3/84 17 Bedding	5/3/84 17 Underlying	5/10/84 14 Bedding	5/21/84 16 Underlying	5/21/84 16 Bedding	5/24/84 15 Bedding
Alpha-BHC	0.15	0.41	0.24	0.01	0.01	0.28
Beta-BHC	0.01	<0.002	0.02	0.03	0.01	0.01
Gamma-BHC	0.01	0.002	<0.001	0.002	0.001	<0.001
PCB 1016	<0.02	<0.03	<0.02	<0.02	<0.007	<0.03
PCB 1221	<0.05	<0.05	<0.05	<0.04	<0.02	<0.05
PCB 1232	1.24	<0.02	<0.02	0.52	0.17	<0.02
PCB 1242	<0.04	<0.07	<0.04	<0.03	<0.01	<0.04
PCB 1248	<0.03	<0.03	<0.03	<0.03	<0.008	0.39
PCB 1254	<0.7	<0.8	<0.7	<0.6	<.2	<0.7
PCB 1260	<1.3	<1.4	<1.3	<0.9	<0.3	<1.4

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 3

TYPE OF ANALYSIS: PCB's & Pesticides

UNIT OF MEASURE: milligrams/kilogram, or ppm

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/25/84 15 underlying	5/29/84 18 Bedding	5/29/84 18 Underlying			
Alpha-BHC	3.23	0.68	1.39			
Beta-BHC	1.40	0.04	0.14			
Gamma-BHC	0.12	0.01	0.02			
PCB 1016	<0.35	<0.11	<0.48			
PCB 1221	<0.69	3.20	<0.23			
PCB 1232	<0.28	1.49	<0.38			
PCB 1242	9.5	<0.17	<0.73			
PCB 1248	<0.45	<0.14	<0.59			
PCB 1254	<0.07	<0.6	<0.6			
PCB 1260	<0.04	<1.2	<1.2			

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 4

TYPE OF ANALYSIS: Classical Chemistry

Parameters

UNIT OF MEASURE: milligrams/gram

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/3/84 17 Bedding	5/3/84 17 Underlying	5/10/84 14 Bedding	5/21/84 16 Underlying	5/21/84 16 Bedding	5/24/84 15 Bedding
Total Recov. Phenols	3.5	0.5	0.5	3.0	2.7	ND*
Total Cyanide	ND	ND	ND	ND	ND	ND

COMMENTS: *None Detected

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 5

TYPE OF ANALYSIS: Classical Chemistry

Parameters

UNIT OF MEASURE: milligrams/gram

CLIENT: DuPont

ANALYSIS	SAMPLE IDENTIFICATION					
	5/25784 15 Underlying	5/29/84 18 Bedding	5/29/84 18 Underlying			
Total Recov. Phenols	ND	ND	ND			
Total Cyanide	ND	ND	ND			

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS TABLE NO. 6

TYPE OF ANALYSIS: Metal Concen. in Soil

UNIT OF MEASURE: milligram/kilograms

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/3/84 17 Bedding	5/3/84 17 Underlying	5/10/84 14 Bedding	5/21/84 16 Underlying	5/21/84 16 Bedding	5/24/84 15 Bedding
Barium	340	840	163	959	610	<100
Copper	76	184	182	39	23	<100

COMMENTS:

ADVANCED ENVIRONMENTAL SYSTEMS, INC.

RESULTS OF ANALYSIS

TABLE NO. 6 (Cont'd)

TYPE OF ANALYSIS: Metals Concen. in Soil

UNIT OF MEASURE: milligram/kilogram

CLIENT: DuPont (AIO)

ANALYSIS	SAMPLE IDENTIFICATION					
	5/25/84 15 Underlying	5/29/84 18 Bedding	5/29/84 18 Underlying			
Barium	163	270	<100			
Copper	32	40	36			

COMMENTS:

APPENDIX A

Indicator Parameters

Parameters, Method Numbers and References

INDICATOR PARAMETERS

Analysis	Method	Reference
Benzene	602	EPA 600/4-82-057
Chlorobenzene	602	EPA 600/4-82-057
Soil by Headspace	5020	SW-846, EPA 1982
Chloroform	601	EPA 600/4-82-057
Trans-1,2-Dichloroethane	601	EPA 600/4-82-057
Methylene Chloride	601	EPA 600/4-82-057
1,1,2,2-Tetrachloroethane	601	EPA 600/4-82-057
Tetrachloroethylene	601	EPA 600/4-82-057
Trichloroethylene	601	EPA 600/4-82-057
Vinyl Chloride	601	EPA 600/4-82-057
Soil by Headspace	5020	SW-846, EPA 1982
BHC (4 isomers)	608	EPA 600/4-82-057
PCB's (7 arochlors)	608	EPA 600/4-82-057
Soil Extraction	NYS Method	Analytical Handbook, 19
Total Barium (Soils)	208.1	EPA 600/4-79-020 (1983)
Total Copper	220.1	EPA 600/4-79-020 (1983)
Metals Processed by	4.1.4	EPA 600/4-79-020 (1983)
Total Cyanide	412C	Standard Methods, 1980
Total Phenols	420.1	EPA 600/4-79-020 (1983)

SITE GROUNDWATER INVESTIGATION

MONITOR WELL INDICATOR PARAMETER ANALYSIS

5/31/84 - 8/16/84

VOLATILES COMPOUND	UNITS OF MEASURE	WELL NUMBER U-1	U-2	U-4	U-5	U-6	U-7	U-8	U-9	U-10	U-11
Benzene	(ppb)	<1.6	<1.61	12.91	2.15	5.38	5.92	2.15	12.91	7.53	<0.093
Chlorobenzene	(ppb)	<5.81	<2.95	<2.95	<2.95	<2.95	<2.95	<2.95	<2.95	<2.95	<0.309
Chloroform	(ppb)	138285	11.4	544.8	9.2	<0.8	<0.8	<0.8	<0.8	39	<0.8
Trans-1,2-dichlorethylene	(ppb)	<200	<1.0	<1.0	<1.0	<1.0	6.1	<1.0	<1.0	<1.0	<1.0
Methylene chloride	(ppb)	22895	<0.3	19.8	<0.3	4.4	<0.3	<0.3	9.7	470.1	6.3
1,1,2,2-Tetrachloroethane	(ppb)	650	<7.7	27.6	10	<7.7	<7.7	122.1	<7.7	<7.7	13410
Tetrachloroethylene	(ppb)	6250	41	164.6	17.6	164.4	23.4	69.4	335.1	320.5	7610
Trichloroethylene	(ppb)	18525	42.8	138.6	96.5	6.5	40.6	0.9	63.1	474.7	75.8
Vinyl chloride	(ppb)	<76	<0.8	<0.8	15.6	<0.8	<0.8	<0.8	1	31.4	<0.8
TOTAL VOLATILES	(ppb)	186605	95	908	151	181	76	195	422	1343	21102
PESTICIDES/PCB's PARAMETER	UNITS OF MEASURE										
Alpha-BHC	(ppb)	1.65	1.64	0.289	0.274	1.51	<0.002	<0.002	<0.002	0.463	<0.002
Beta-BHC	(ppb)	2.04	2.86	1.97	0.172	1.53	0.138	0.037	0.197	0.209	<0.005
Gamma-BHC	(ppb)	2.79	0.59	0.186	0.153	1.68	0.131	0.033	0.04	0.852	0.051
PCB-1016	(ppb)	<6.0	<0.19	<0.19	<0.19	<0.19	<3.8	<0.19	<0.19	<0.19	<3.8
PCB-1221	(ppb)	<19.0	<1.5	<0.15	<0.15	<3.1	<1.5	<0.15	<1.5	<3.1	<3.1
PCB-1232	(ppb)	<7.0	<0.15	<0.15	<0.15	<1.5	<3.1	<0.15	<0.15	<0.15	<3.1
PCB-1242	(ppb)	<7.5	<0.29	<0.29	<0.29	<2.9	<5.8	<0.29	<0.29	<0.29	<5.8
PCB-1248	(ppb)	<8.5	<0.24	<0.24	<0.24	<2.4	<4.7	<0.24	<0.24	<0.24	<4.7
PCB-1254	(ppb)	<5.6	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<7.1	<0.14
PCB-1260	(ppb)	<7.8	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<9.6	<0.19
OTHER PARAMETER	UNITS OF MEASURE										
Total Suspended Solids	(ppm)	98.6	1818.6	2227.4	1108.6	518.6	422.6	445	34.6	1284.4	299.6
Total Organic Carbon	(ppm)	15.2	17.9	62	19.76	5.13	3.69	3.6	2.96	135.88	2.56
Total Cyanide	(ppm)	7.2	<0.05	0.78	0.74	0.15	0.05	0.05	0.95	0.05	8.3
Total Recoverable Phenols	(ppm)	0.108	0.18	0.105	0.068	0.21	0.175	0.03	0.03	2.22	0.03
Soluable Barium	(ppm)	<1	<1	<1	<1	<1	<1	<1	<1	2500	2100
Total Copper	(ppm)	3.7	<0.1	<0.1	<0.1	<0.1	0.17	0.1	<0.1	0.39	<0.1

FOOTNOTES: NR = Not reported

ND = Not detected

<X = < indicates below detection limit

VOLATILES COMPOUND	UNITS OF MEASURE	WELL NUMBER U-12	U-13	U-14	U-15	U-16	U-17	U-18
Benzene	(ppb)	<0.101	<0.101	11.83	<1.6	<1.6	<1.6	<1.6
Chlorobenzene	(ppb)	<0.298	<0.298	<2.95	<5.81	<5.81	<5.81	<5.81
Chloroform	(ppb)	4.5	136.8	268.5	35	27	23	9
Trans-1,2-dichlorethylene	(ppb)	<5.0	<1.0	<1.0	<10	<10	<10	<10
Methylene chloride	(ppb)	35	121.8	5.3	40	60	47	214
1,1,2,2-Tetrachloroethane	(ppb)	1742	402.3	<7.7	<11	<11	<11	<11
Tetrachloroethylene	(ppb)	4031	483.4	4.2	37	35	27	46
Trichloroethylene	(ppb)	837.5	732.1	37	11	18	<7	20
Vinyl chloride	(ppb)	5.5	6.5	<0.8	505	78	63	<4
TOTAL VOLATILES	(ppb)	6656	1883	327	628	218	160	289
PESTICIDES/PCB's PARAMETER	UNITS OF MEASURE							
Alpha-BHC	(ppb)	1.18	0.221	0.329	0.4	0.6	2.09	0.37
Beta-BHC	(ppb)	0.483	<0.005	<0.005	1.51	0.66	1.38	0.23
Gamma-BHC	(ppb)	0.349	0.174	0.529	0.6	0.58	2.52	0.13
PCB-1016	(ppb)	<0.19	<0.19	<0.19	<0.23	<1.1	<6.0	<0.23
PCB-1221	(ppb)	<0.15	<0.15	<0.15	19.2	<3.8	<9.5	26.5
PCB-1232	(ppb)	<0.15	<0.15	<0.15	<0.26	<1.3	<7.0	<0.26
PCB-1242	(ppb)	<0.29	<0.29	<0.29	<0.31	<1.5	<7.5	<0.31
PCB-1248	(ppb)	<0.24	<0.24	<0.24	<0.34	<1.7	<8.5	<0.34
PCB-1254	(ppb)	<3.6	<0.14	<0.14	<0.11	<1.1	<2.8	<2.8
PCB-1260	(ppb)	<4.8	<0.19	<0.19	<0.16	<1.6	<3.9	<3.9
OTHER PARAMETER	UNITS OF MEASURE							
Total Suspended Solids	(ppm)	95.5	1839.8	2982.6	698.9	10436.2	3677.8	9401.2
Total Organic Carbon	(ppm)	1.69	4.44	17.98	3.05	15.4	10.9	6.22
Total Cyanide	(ppm)	<0.05	0.05	<0.05	0.6	0.16	1.99	0.67
Total Recoverable Phenols	(ppm)	0.08	0.11	0.14	0.041	0.057	0.057	0.064
Soluable Barium	(ppm)	<1	<1	<1	<1	<1	<1	<1
Total Copper	(ppm)	<0.1	<0.1	0.11	0.28	0.38	0.36	<0.1