Off-Plant Contaminant Loading Rates
Fourth Quarter 1986
Niagara Plant
Niagara Falls, New York

Woodward-Clyde Consultants

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Woodward-Clyde Consultants

June 10, 1987
87C2555D-1

E.I. du Pont de Nemours and Company
Buffalo Avenue and 26th Street
Niagara Falls, New York 14302

Attention: Richard Gentilucci
Operations Manager
Environmental Affairs

OFF-PLANT CONTAMINANT LOADING RATES
FOURTH QUARTER 1986

Gentlemen:

In accordance with your request, Woodward-Clyde Consultants (WCC) has calculated contaminant loading rates for the Niagara Plant using data from the fourth quarter 1986 sampling period. The loading rates were calculated using the same indicator organic compounds as in previous loading rate calculations.

We appreciate this opportunity to be of service to you and DuPont on this project. If you have any questions, please contact us.

Very truly yours,

WOODWARD-CLYDE CONSULTANTS

Madalyn Dixon
Staff Geologist

Lynn Rubisch Penniman, CPSS
Project Manager

MD/vbg/WM-5K

cc: Rick Marczewski
Frank Waller
Al Hirsch

EXECUTIVE SUMMARY

Off-plant contaminant loading rates have been calculated by Woodward-Clyde Consultants using groundwater elevation and water quality data from the fourth quarter 1986. The loading rates were calculated for the indicator organic compounds that have been used for all previous quarters. Loading rates for the current study period were compared to loading rates calculated using data from the fourth quarter of 1984 through the third quarter 1986.

The total contaminant loading rates were separated into that portion captured by the current bedrock remediation program (Olin Production Wells) and that portion migrating to the off-plant hydrologic environment. The total fourth quarter 1986 loading rate was 51 pounds per day. Of this total, 44 pounds per day were estimated to be captured by the bedrock groundwater remediation program. Seven pounds per day is the contaminant migration rate to the off-plant hydrogeologic environment.

These results indicate the present groundwater remedial action contains approximately 87 percent of the off-plant contaminant migration. The percent containment for the fourth quarter is consistent with that of previous sampling periods.

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1.0 INTRODUCTION

In accordance with the Niagara Plant environmental monitoring program, Woodward-Clyde Consultants (WCC) calculated contaminant loading rates using groundwater elevation and water quality data for the fourth quarter of 1986. These loading rates, in conjunction with loading rates calculated for previous sampling periods, reflect the impact of the operating bedrock groundwater remediation program.

Based on our understanding of groundwater flow and contaminant transport in the overburden and bedrock water-bearing zones, these loading rates are believed to represent the natural system with a limited degree of uncertainty. The contaminant loading rates were calculated for total indicator organics (TIO).

2.0 METHODS

Contaminant loading rates were calculated using water quality and groundwater elevation data gathered from monitoring wells installed at the plant (Plate 1). Loading rates were not calculated for the C-, E-, and J-zones. These zones are not present throughout an area large enough to merit consideration as significant water-bearing zones. The methodology used in preparation of these and previous contaminant loading rates is presented in Appendix A. The compounds used for this and all previous contaminant loading rate calculations are listed in Table 1.

3.0 RESULTS

Appendix B contains contour maps used to estimate hydraulic gradients, transmissivities, and contaminant concentrations for water-bearing zones A, B, CD, and F from measurements obtained during the month of December 1986. Figures B-1 through B-5 present the groundwater contour maps for each zone. Flow sections are delineated within each zone for all maps. Figures B-6 through B-10 present transmissivity contour maps. Figures B-11 through B-15 present TIO concentration contour maps for all flow sections per zone. Appendix C contains the tabulated parameters used in calculations and the resultant flow rates. Appendix D contains the flow rates and TIO concentrations used in the loading rate calculations and the resultant loading rates in tabular form. Appendix E presents average TIO concentrations and loading rates for all sampling to date.

3.1 OFF-PLANT GROUNDWATER FLOW RATES

Table 2 presents the estimated off-plant groundwater flow rates for each hydrologic zone of the fourth quarter 1986. Groundwater flow rates for all monitoring periods to date are plotted over time on Plate 2. The groundwater flow rates ranged from a maximum of 76 gpm in the CD-zone to a minimum of 3.4 gpm in the D-zone. These values are consistent with averages of the previous sampling periods (see WCC report "Off-Plant Contaminant Loading Rates Fourth Quarter 1985 through Third Quarter 1986").

3.2 CONTAMINANT LOADING RATES

Table 3 presents the TIO loading rates by zone for the fourth quarter 1986. The total contaminant loading rates, loading rates from those flow sections discharging to the Olin production wells, and off-plant loading rates from those areas beyond the influence of the Olin production wells are included on this table.

The total contaminant loading rates by hydrogeologic zone for all samplings to date are plotted over time on Plates 3 and 4. These values represent an estimate of the total contaminant migration rate from the plant in all flow sections including those discharging to the Olin production wells.

The remedial influence of the two Olin production wells has been shown by WCC to extend throughout most of the west plant area (WCC report "Hydraulic Impact of Olin Production Wells at the Niagara Plant," dated April 3, 1986 and "Final Report Pump Test Program," dated June 19, 1985). A groundwater divide geographically located near Gill Creek marks the eastern extent of the remediated area. Because groundwater levels in the production wells are not available for use in preparing the groundwater elevation contours, the impact of the wells may not be completely represented by the trends indicated on the contour maps. Flow sections estimated to discharge to the Olin wells in their entirety include B-1, CD-1, CD-2, D-1, and F-2. In addition, 90 percent of flow section CD-3, 80 percent of B-2 and 35 percent of F-2 are estimated to discharge to the Olin wells.

F-1

The net off-plant loading rates are estimated for those flow sections beyond the remedial influence of the Olin production wells. These include the total of the A-zone loading rates. (The A-zone overburden deposits are not directly influenced by the bedrock groundwater remediation program.) Those flow sections within the bedrock located east of Gill Creek are also considered to discharge primarily off-plant.

Values for total loading rates, loading rates to the Olin wells, and net off-plant loadings for all samplings to date are plotted over time on Plate 5. Running averages to date for the above-mentioned values are presented in Table 4.

4.0 CONCLUSIONS

The estimated total contaminant loading rate for the fourth quarter 1986 is 51 lb/day. The estimated total loading rate discharging to the Olin production wells is 44 lb/day. The indicated percent containment was 87 percent (Table 3). Excluding the A-zone, which is not directly influenced by the bedrock groundwater remediation program, the percent containment was 92 percent. The net off-plant loading rate is 6.7 lb/day. Excluding the A-zone, the rate of off-plant contaminant migration is 4.0 lb/day.

Contaminant loading rates calculated for the fourth quarter 1986, with the exception of the A-zone, indicate a lower rate of off-plant contaminant migration than that of the previous quarter. The A-zone does show an increase relative to extremely low loading rates calculated for that zone in the third quarter 1986 (see WCC report "Off-Plant Contaminant Loading Rates Fourth Quarter 1985 through Third Quarter 1986"). However, the estimated total loading rate for the A-zone in the fourth quarter 1986 (2.7 lb/day) is less than the average rates for this zone from fourth quarter 1984 through third quarter 1986 (2.9 lb/day). The average total loading rate (all zones) for all sampling prior to fourth quarter 1986 was 84 lb/day. Including the fourth quarter 1986 the average total loading rate to date is 81 lb/day. The sum of contaminant loading rates for the fourth quarter 1986 shows a decrease in relation to second and third quarters 1986 (Plate 5).

5.0 LIMITATIONS

These methods will yield estimates of groundwater flow and contaminant loading rates with order-of-magnitude accuracy, and could be expected to vary from the estimates provided. The loadings presented are calculated from available subsurface geologic and groundwater chemistry data and are subject to confirmation and/or revision as additional information becomes available.

WM-5K

Tables

TABLE 1

TOTAL INDICATOR ORGANIC COMPOUNDS USED IN LOADING RATE CALCULATION FOURTH QUARTER 1986 Niagara Plant E.I. du Pont de Nemours and Company

Benzene

Chlorobenzene

Chloroform

Trans-1,2-dichloroethylene

Methylene chloride

1,1,2,2-Tetrachloroethane

Tetrachloroethylene

Trichloroethylene

Vinyl chloride

A-BHC

B-BHC

D-BHC

G-BHC

PCB-1254

TABLE 2

FOURTH QUARTER 1986
OFF-PLANT GROUNDWATER FLOW RATES
Niagara Plant
E.I. du Pont de Nemours and Company

	Groundwater Flow Rate (gpm)
A-zone	51.3
B-zone	27.4
CD-zone	76.4
D-zone	3.4
F-zone	5.6

TABLE 3

CONTAMINANT LOADING RATES BY ZONE
FOURTH QUARTER 1986
TOTAL, TO OLIN, AND NET OFF-PLANT
Niagara Plant
E.I. du Pont de Nemours and Company

Water-Bearing Zone	TIO Loading Rates (lb/day) Total	To Olin(1)	Net Off-Plant	Percent Containment
A-zone(2)	2.7	0.0	2.7	0.0
B-zone	12.8	12.1	0.73	95
CD-zone	34.6	31.7	2.8	92
D-zone	0.16	0.11	0.06	69
F-zone	0.33	0.02	0.31	6
TOTAL	50.5	43.9	6.6	87
TOTAL EXCLUDING A-ZONE	47.8	43.9	3.9	92

(1) Flow sections B-1, CD-1, CD-2, D-1, and F-1 discharge entirely to the Olin wells, 80 percent of B-2, 90 percent of CD-3, and 35 percent of F-2 also discharge to the Olin wells.

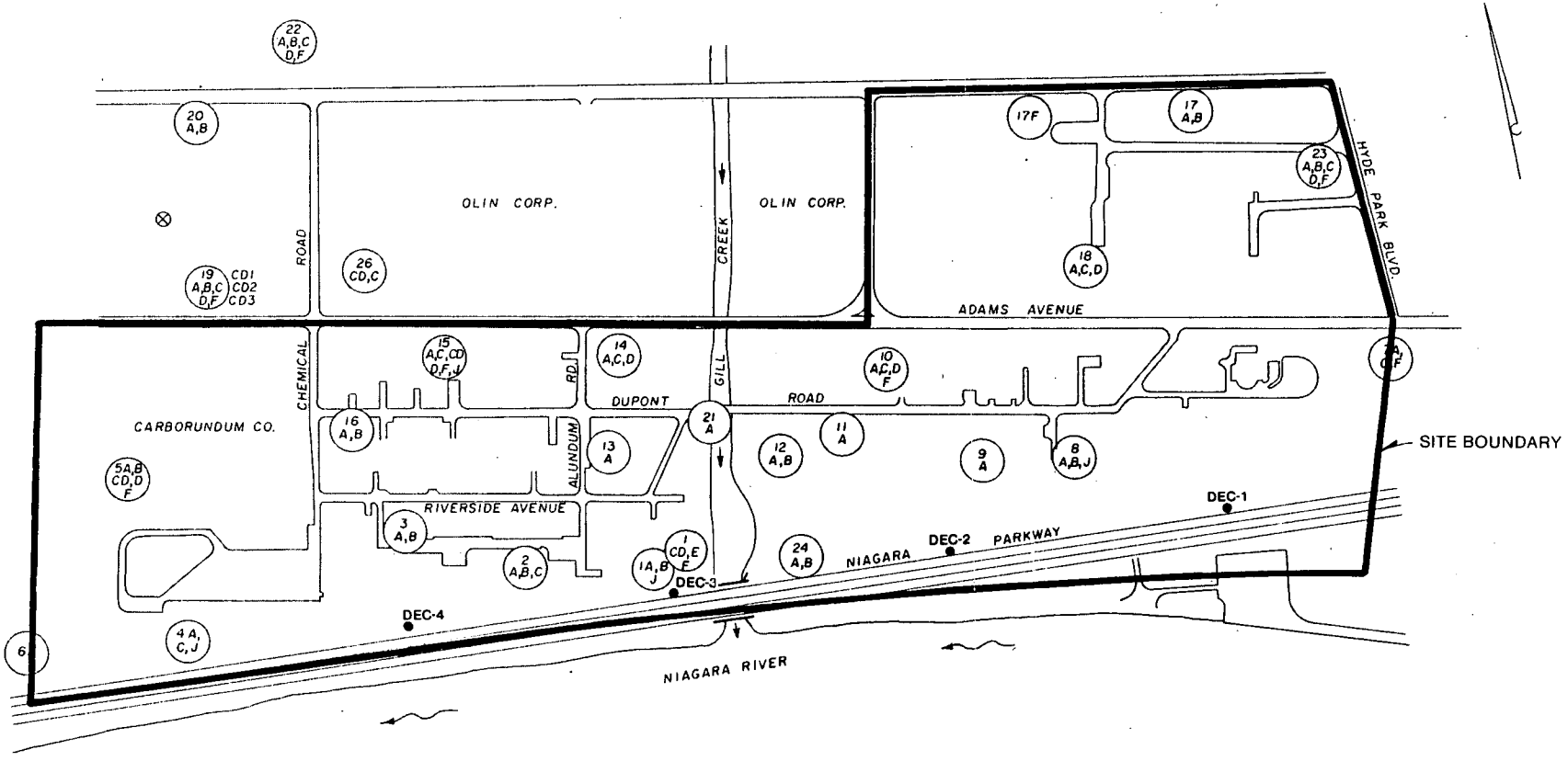
(2) The A-zone is considered overburden and is not influenced by the bedrock groundwater remediation program.

TABLE 4

AVERAGES TO DATE
INDICATOR ORGANIC LOADING RATE TOTALS
FOURTH QUARTER 1984 THROUGH FOURTH QUARTER 1986
Niagara Plant
E.I. du Pont de Nemours and Company

Water-Bearing Zone	Average for 4th Qtr. 1984 to 3rd Qtr. 1986	4th Qtr. 1986 Rates	Average To Date
TOTAL LOADING RATES (lb/day)			
A	2.9	2.7	2.9
B	13	13	13
CD	67	35	64
D	0.4	0.2	0.4
F	0.6	0.3	0.5
TOTAL	84	51	81
LOADING RATES TO THE OLIN WELLS (lb/day)			
A	0.0	0.0	0.0
B	10	12	10
CD	62	32	59
D	0.4	0.1	0.4
F	0.05	0.02	0.05
TOTAL	73	44	69
LOADING RATES OFF-PLANT			
A	2.9	2.7	2.9
B	3.0	0.7	2.8
CD	4.3	2.8	4.2
D	0.01	0.06	0.01
F	0.5	0.3	0.5
TOTAL	11	6.7	10
Total Excluding A-Zone	8.1	4.0	7.1

Plates



LEGEND:

- 17 A,B — WELL CLUSTER NUMBER (NO.); WELL TYPE (LETTER)
- ⊗ OLIN PRODUCTION WELL

MONITORING WELL LOCATION PLAN
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

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Checked by: M.D.		Job: 87C2556P-1

PLATE 1

GROUNDWATER FLOW RATES BY ZONE
DuPont Niagara Plant

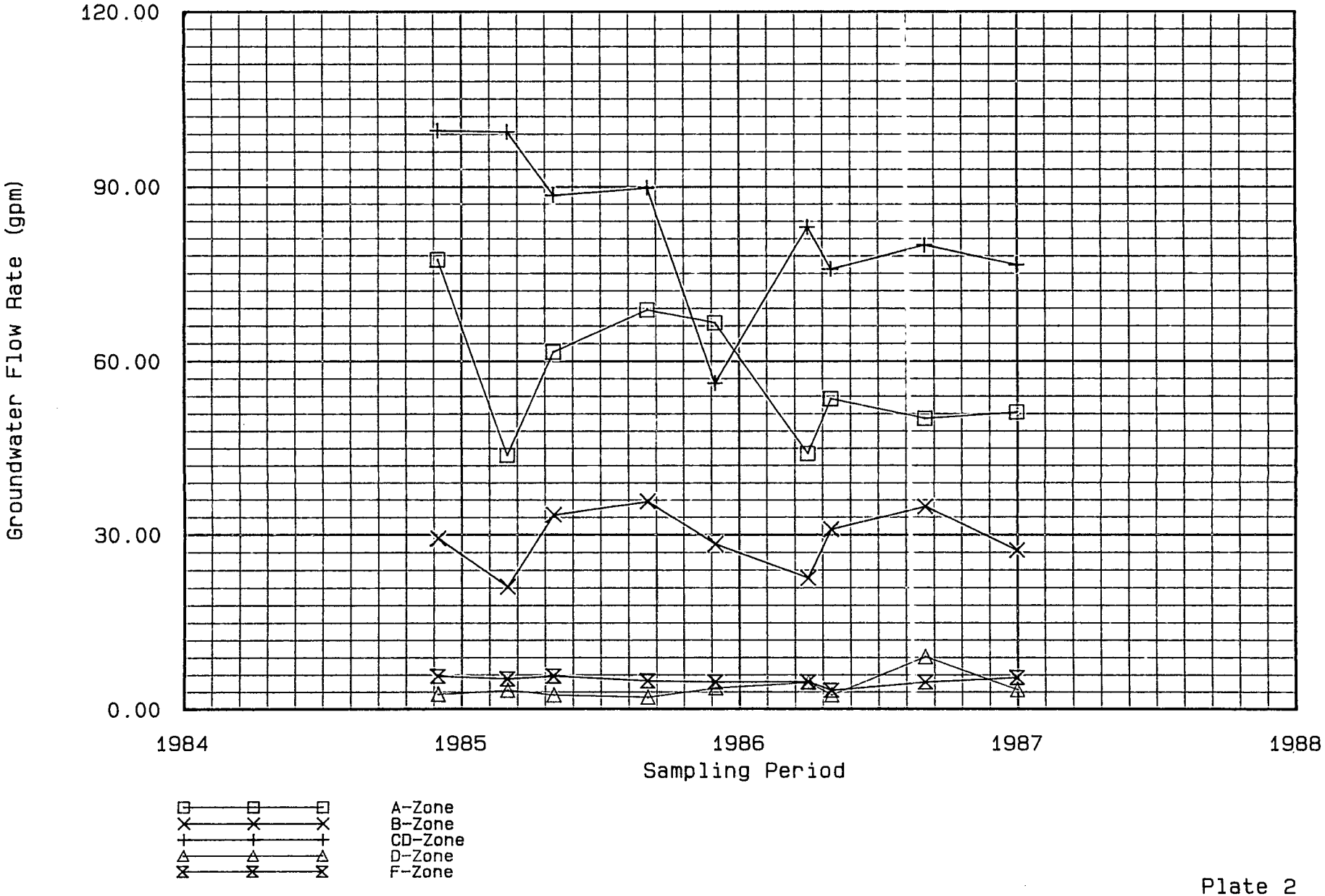


Plate 2

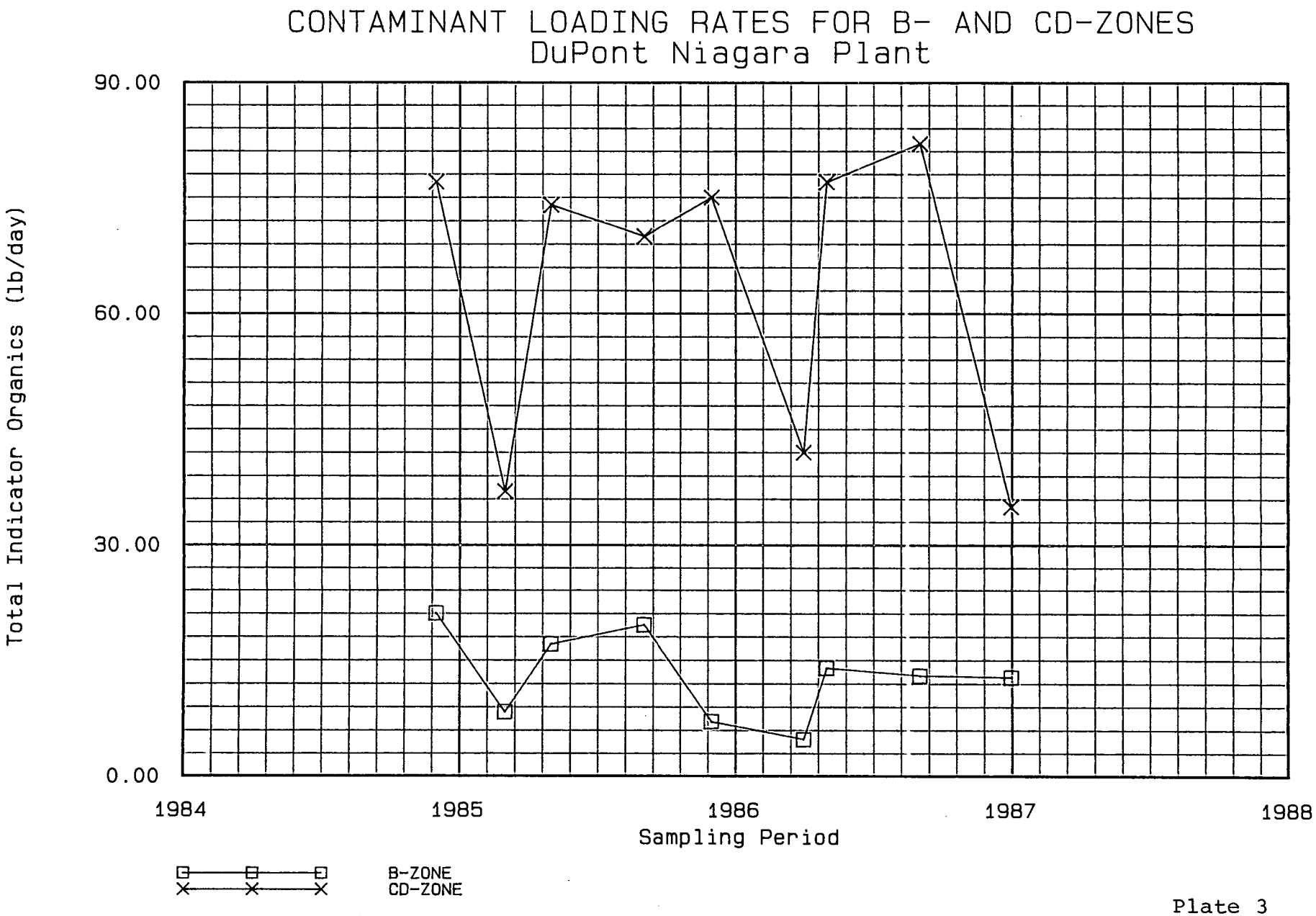

CONTAMINANT LOADING RATES FOR B- AND CD-ZONES
DuPont Niagara Plant
Total Indicator Organics (lb/day)
90.00
60.00
30.00
0.00
1984
1985
1986
1987
1988
Sampling Period
B-ZONE
CD-ZONE

Plate 3

CONTAMINANT LOADING RATES FOR A-, D-, AND F-ZONE
DuPont Niagara Plant

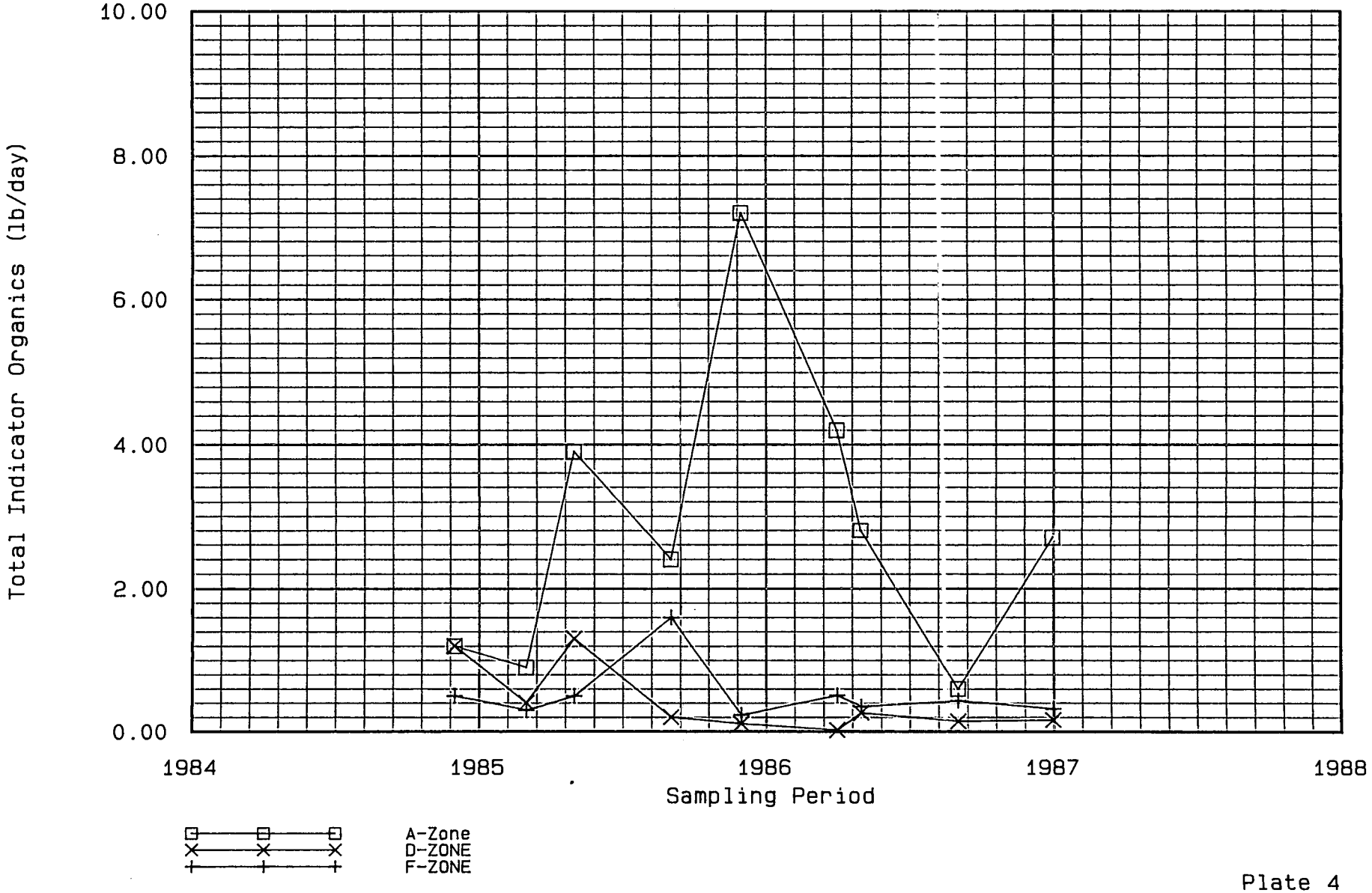


Plate 4

TOTAL CONTAMINANT LOADING RATES, DUPONT NIAGARA PLANT
Total, to Olin, and Net Off-Plant

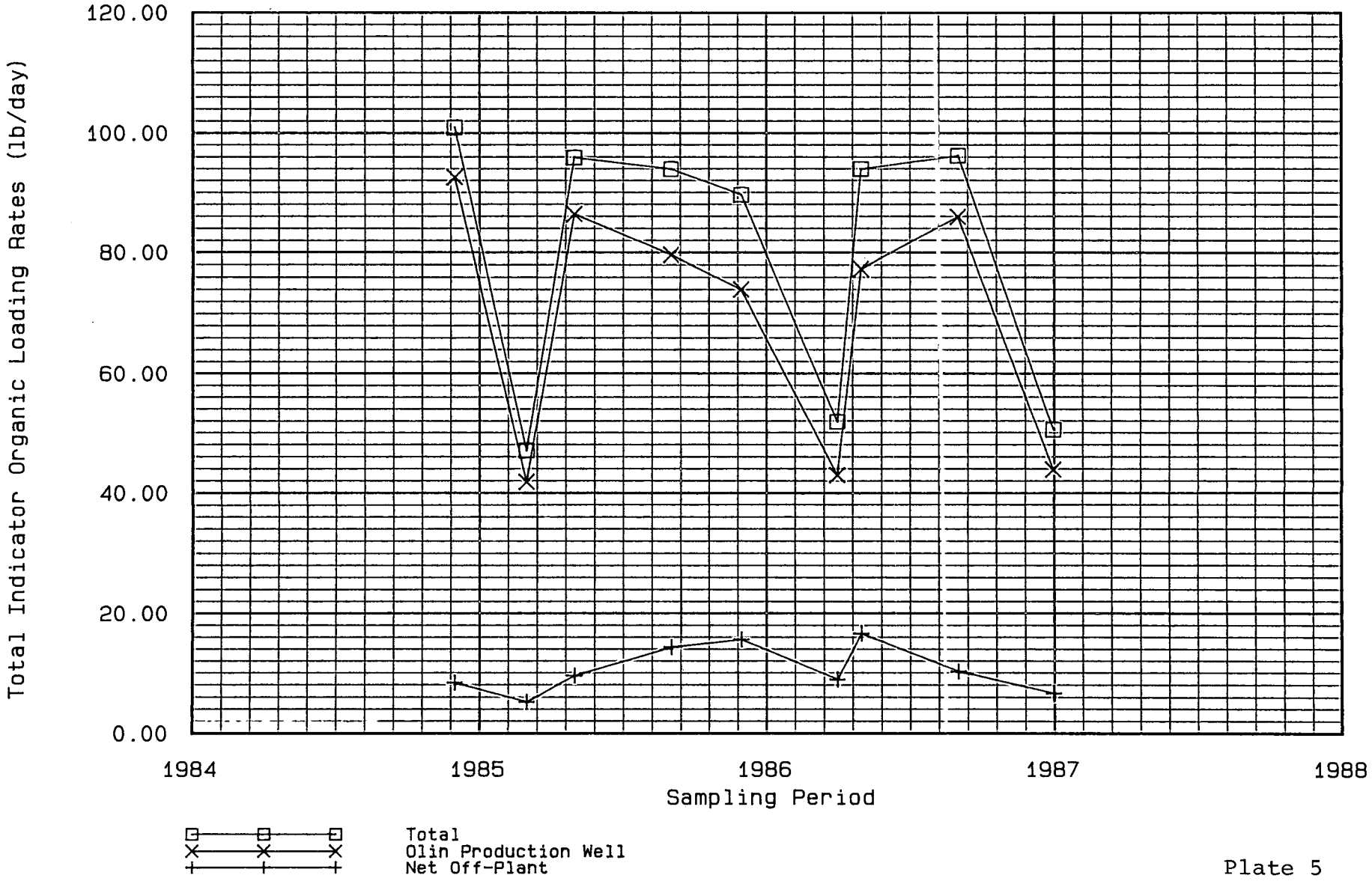


Plate 5

Appendix A

APPENDIX A

METHODOLOGY

Contaminant loading rates are a measure of contaminant migration through the subsurface at a designated site boundary. Contaminant concentrations from groundwater monitoring wells, estimated groundwater flow rates, and Darcy's Law are used to calculate contaminant loading rates. This methodology describes the procedures used to calculate contaminant loading rates at DuPont's Niagara Plant.

ESTIMATION OF GROUNDWATER FLOW RATE AND DISTRIBUTION

Groundwater flow rates are calculated using Darcy's Law as it is applied to fractured media for which a regional spatial continuum is assumed.

$$Q = Tiw$$

where: Q = groundwater flow (ft^3/sec)
T = transmissivity (ft^2/sec)
i = hydraulic gradient
w = flow section width (ft)

Application of the above equation requires definition on the subsurface groundwater flow system. Groundwater elevation data are contoured on a site base map to estimate the hydraulic gradient and its distribution within the subsurface. Elevation data are plotted and equipotential lines are interpolated between data points, yielding a representation of the distribution of fluid potential for each water-bearing zone.

On the basis of the hydraulic head distribution, each hydrologic zone is divided into distinct regions of flow bounded by flow lines. Each flow section boundary represents theoretically impermeable boundaries; that is, there is no groundwater flow across flow lines. The projection of flow sections reduces the region of flow for more accurate calculation of flow rates and also creates a visible sense of the flow system.

The hydraulic gradient (i) is the change in groundwater head with a change in distance in a given direction. The hydraulic gradient is measured from the contour maps within each flow section the site boundary. The change in hydraulic head is divided by the corresponding change in linear distance. The width (w) of each flow section is measured at the downgradient plant site boundary.

Transmissivity (T) is the hydraulic conductivity of a unit width of the full thickness of the aquifer under a unit hydraulic gradient. Transmissivity is determined using site-specific slug test data for confined hydraulic conditions. Transmissivity for unconfined conditions, such as the overburden zone, is determined by multiplication of saturated thickness and measured hydraulic conductivity values. The transmissivity data were plotted and contour maps were prepared. The values used in calculating flow rates for each flow section were obtained from the contour maps using weighted averaging at the downgradient flow zone boundary.

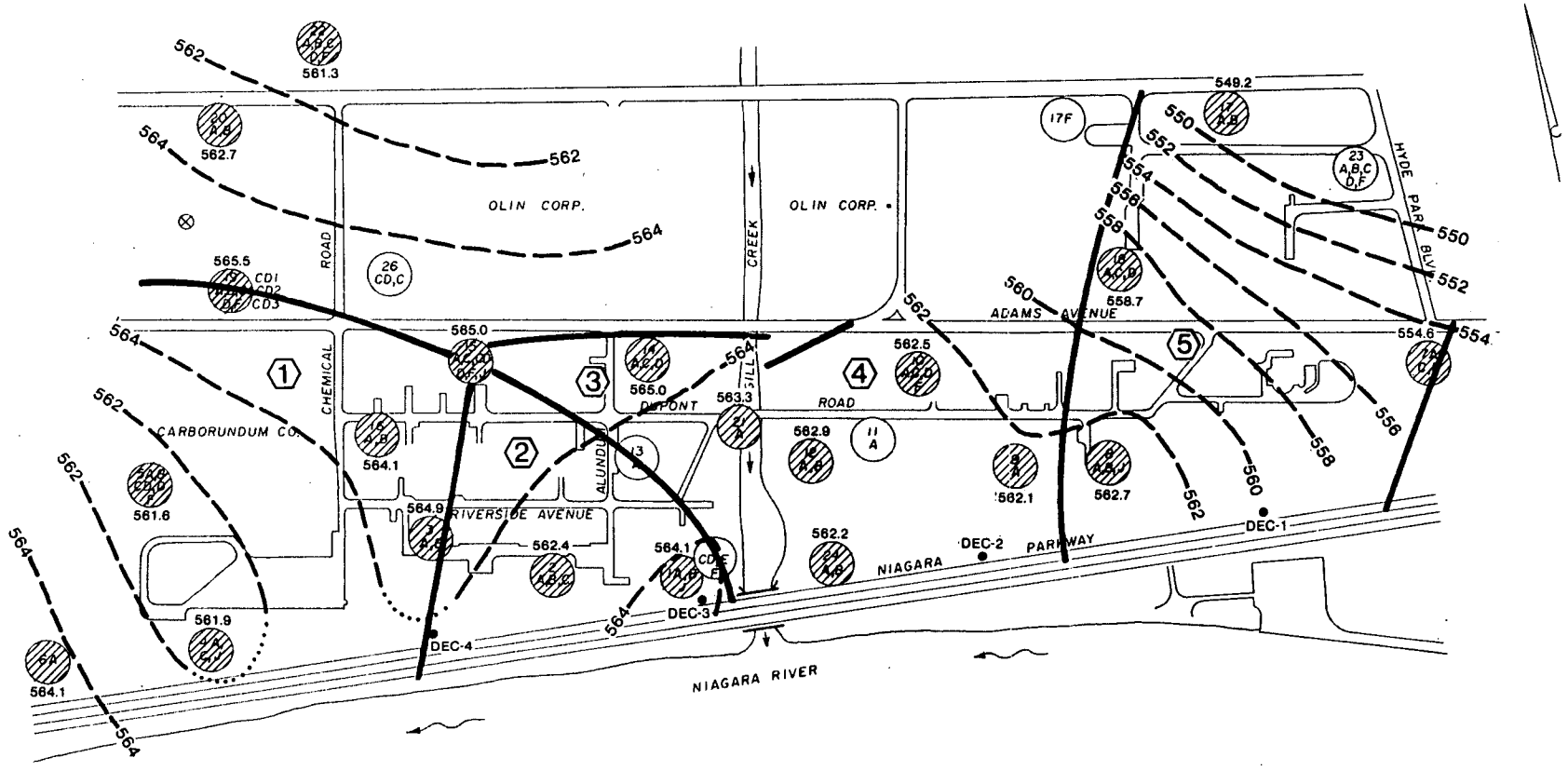
ESTIMATION OF CONTAMINANT CONCENTRATIONS

Total indicator organic data from samples taken at the site were plotted and isoconcentration contour maps were constructed. TIO concentration values are used in calculations obtained through weighted averaging of concentrations at the downgradient flow section boundary.

ESTIMATION OF CONTAMINANT LOADING RATES

Average concentration values and groundwater flow rates are used to calculate contaminant loading rates per flow section. These values are expressed in pounds per day leaving the plant. The total of all flow sections is equal to the off-plant loading rate per water-bearing zone. Loading rates are calculated at a line perpendicular the groundwater flow section used. This line is coincident with the plant boundaries (where possible) and may change depending on the configuration of the groundwater contours.

Appendix B

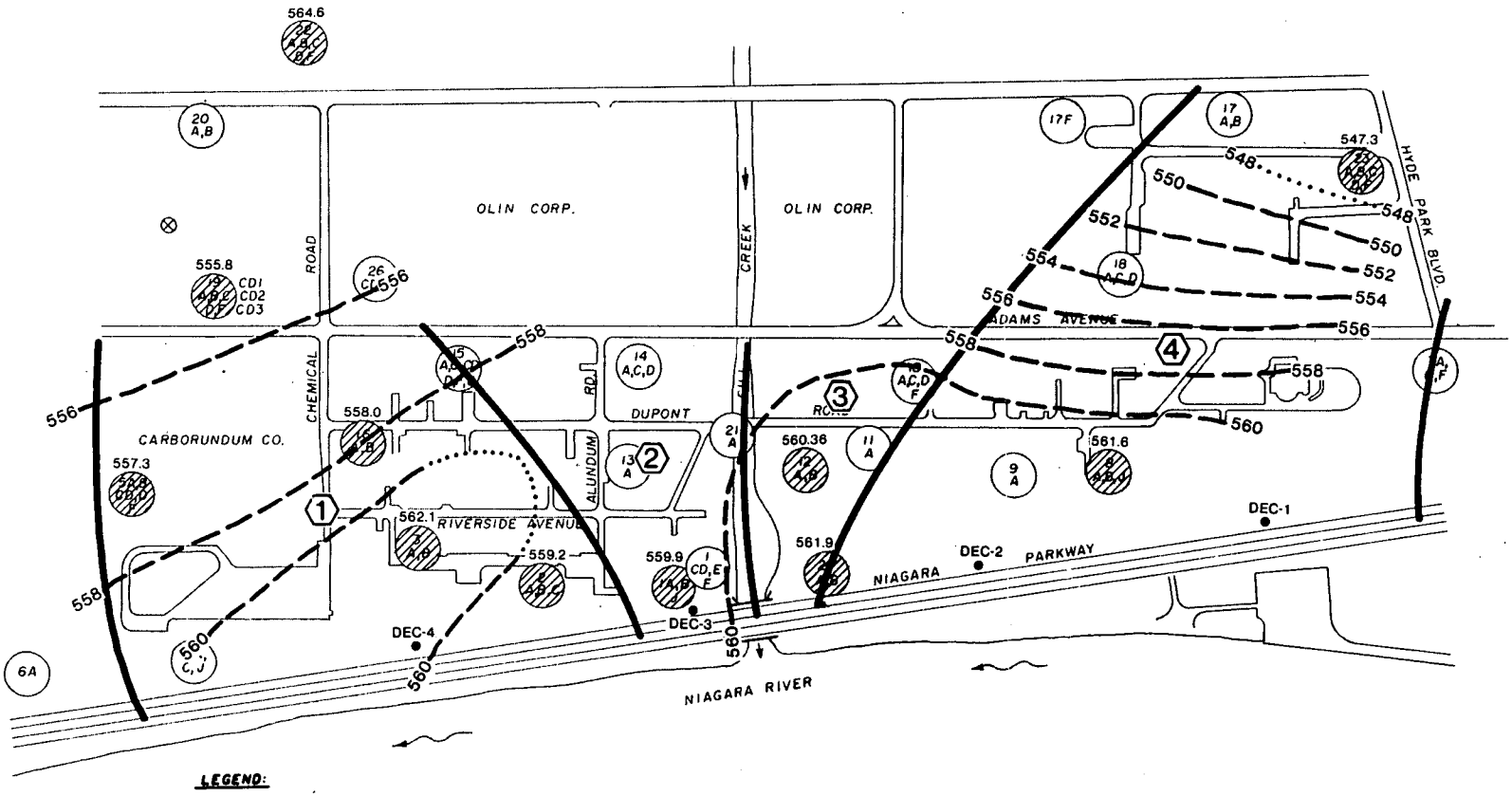


A-ZONE GROUNDWATER ELEVATION CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-1



B-ZONE GROUNDWATER ELEVATION CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

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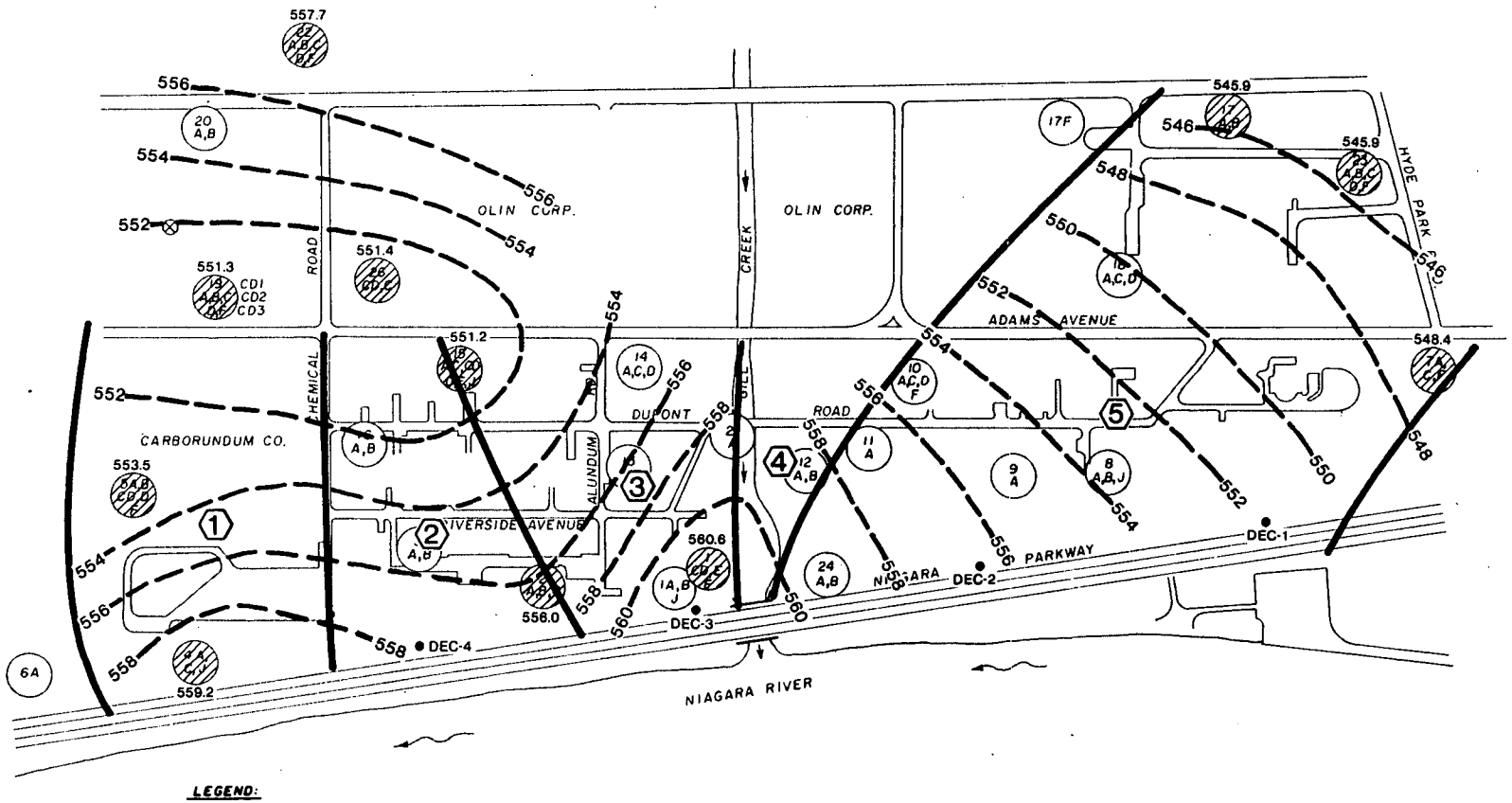
FIGURE B-2



LEGEND:

- WELL CLUSTER NUMBER (NO.)
- WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 560 GROUNDWATER CONTOUR (ft.)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

CD-ZONE GROUNDWATER ELEVATION CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

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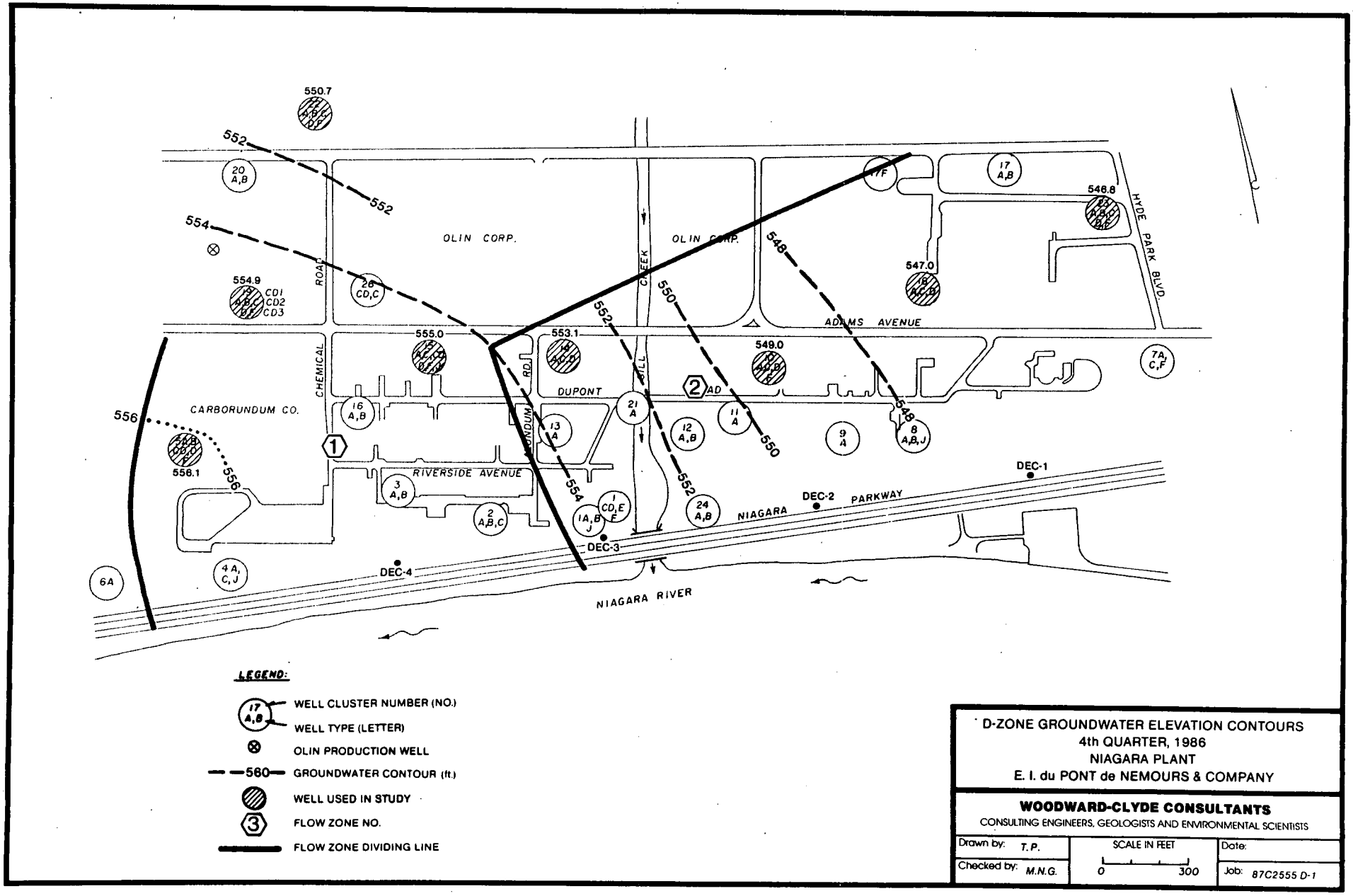
Drawn by: T.P.	SCALE IN FEET	Date:
Checked by: M.N.G.	0 300	Job: 87C2555 D-1

FIGURE B-3



D-ZONE GROUNDWATER ELEVATION CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

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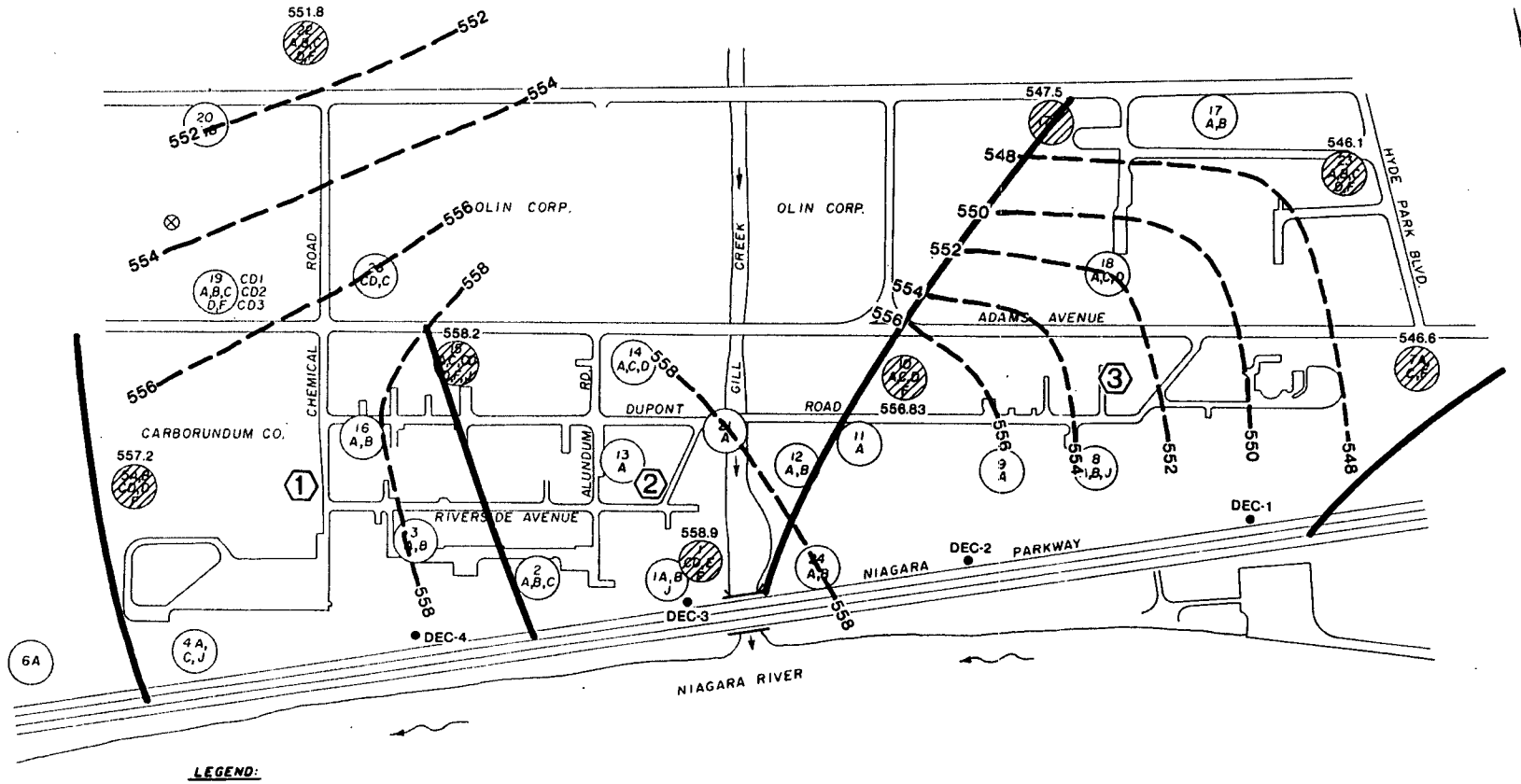
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-4



LEGEND:

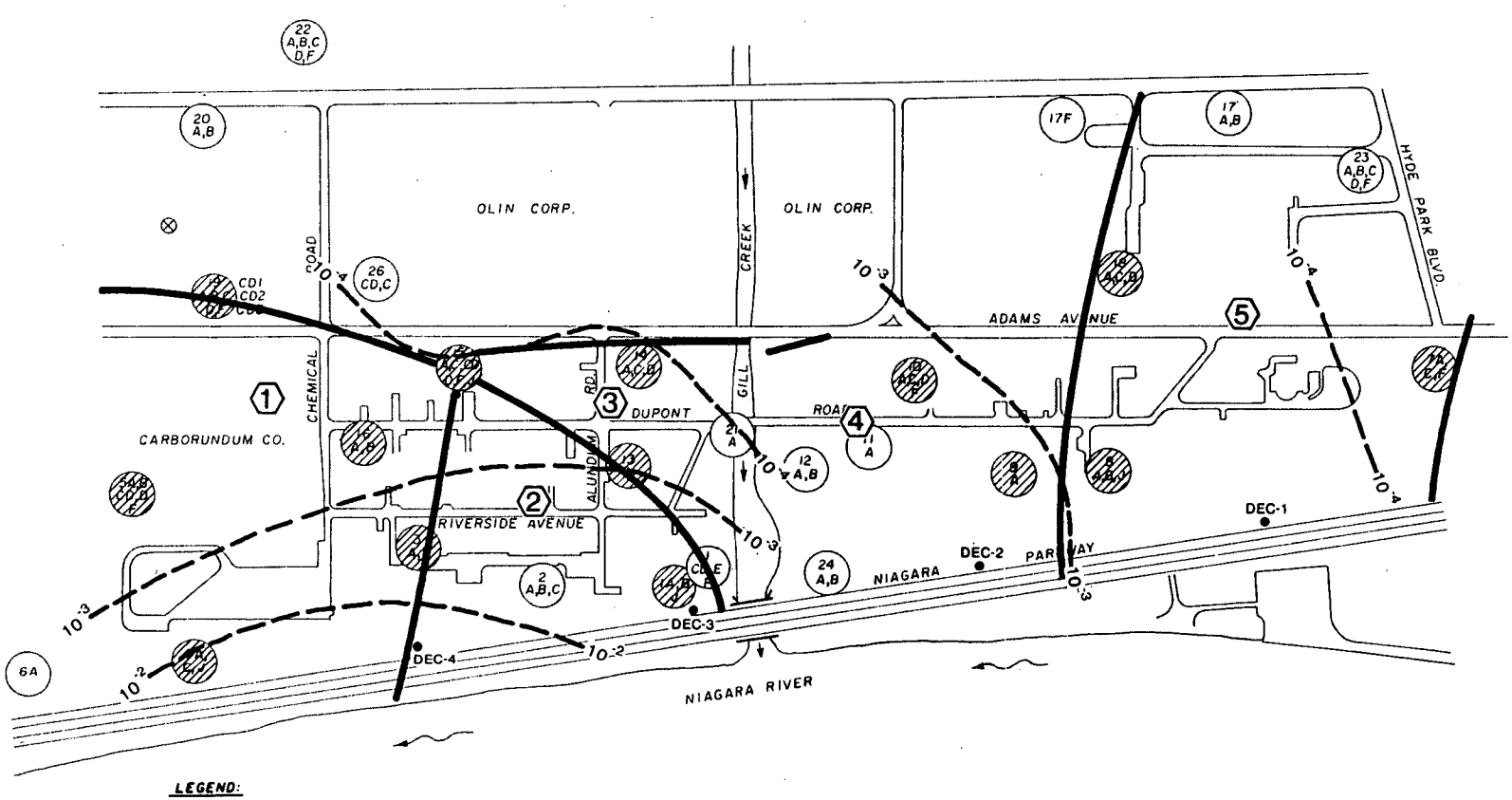
- WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 567 GROUNDWATER ELEVATION
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

F-ZONE GROUNDWATER ELEVATION CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-5



LEGEND:

- WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 10-3 TRANSMISSIVITY CONTOUR (ft.²/sec.)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

A-ZONE TRANSMISSIVITY CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

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CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

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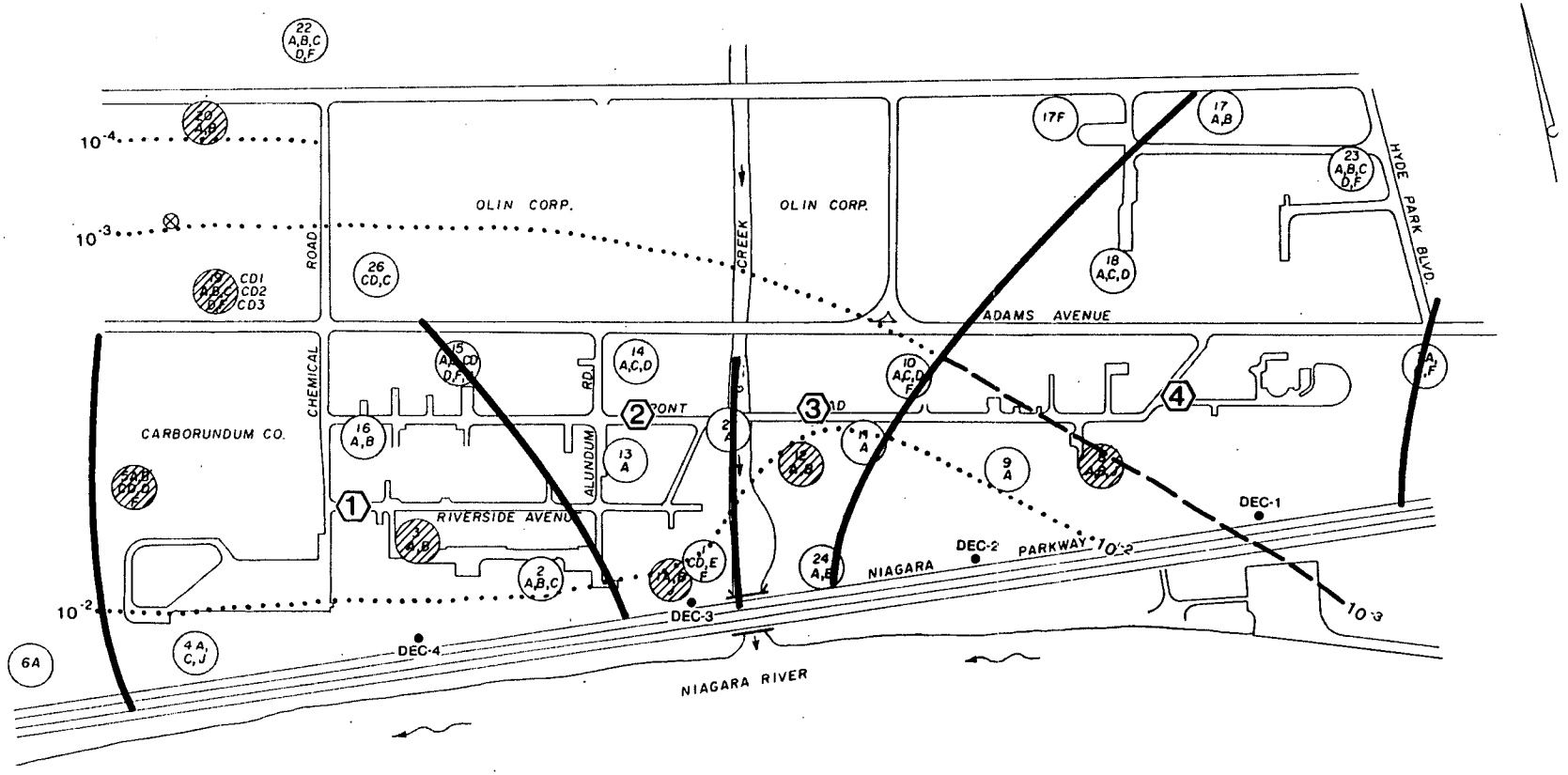
FIGURE B-6



LEGEND:

- WELL CLUSTER NUMBER (NO.)
- WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 10-3 TRANSMISSIVITY CONTOUR (ft.^{2}/sec.)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

B-ZONE TRANSMISSIVITY CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

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CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

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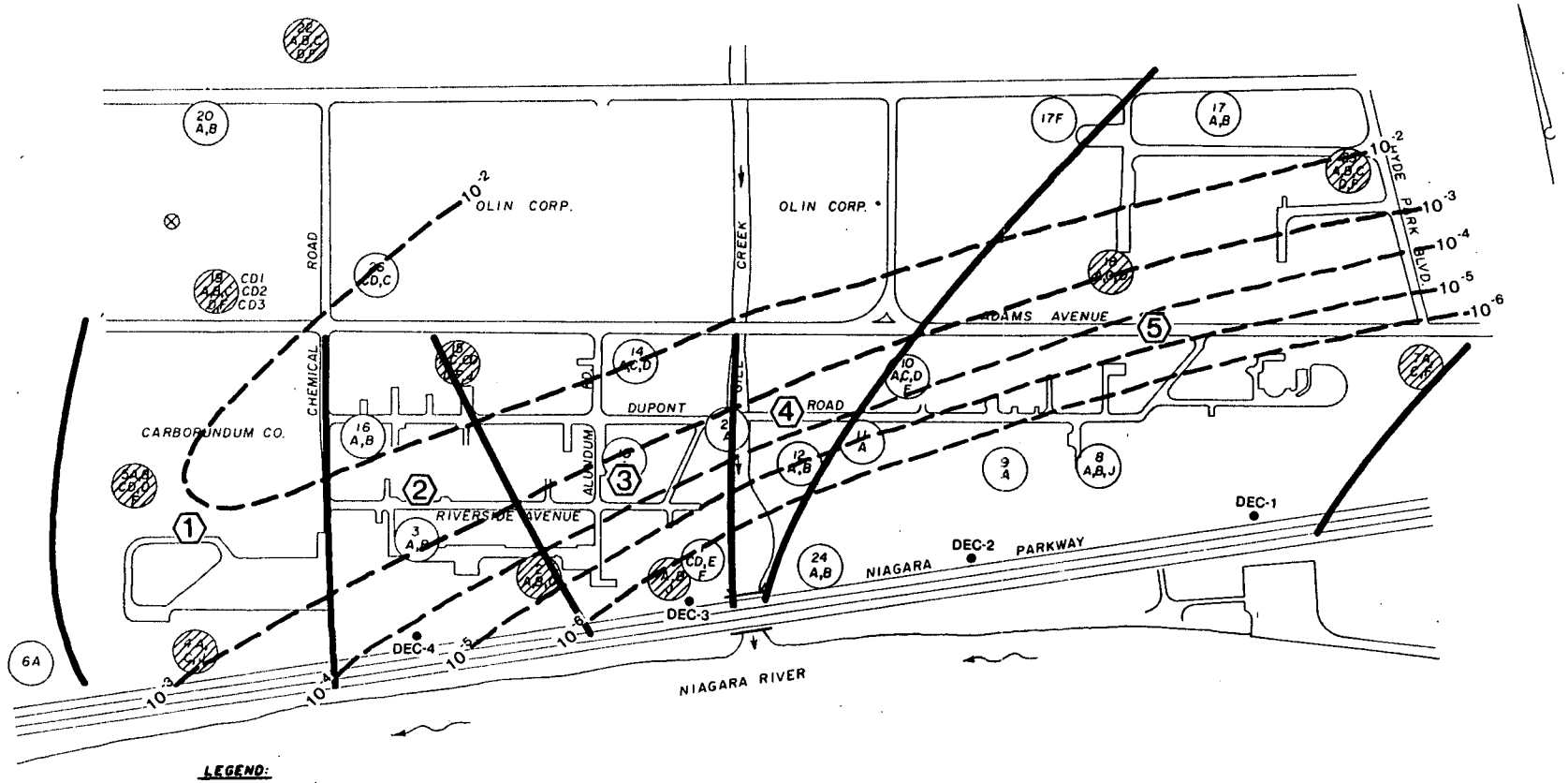
FIGURE B-7



LEGEND:

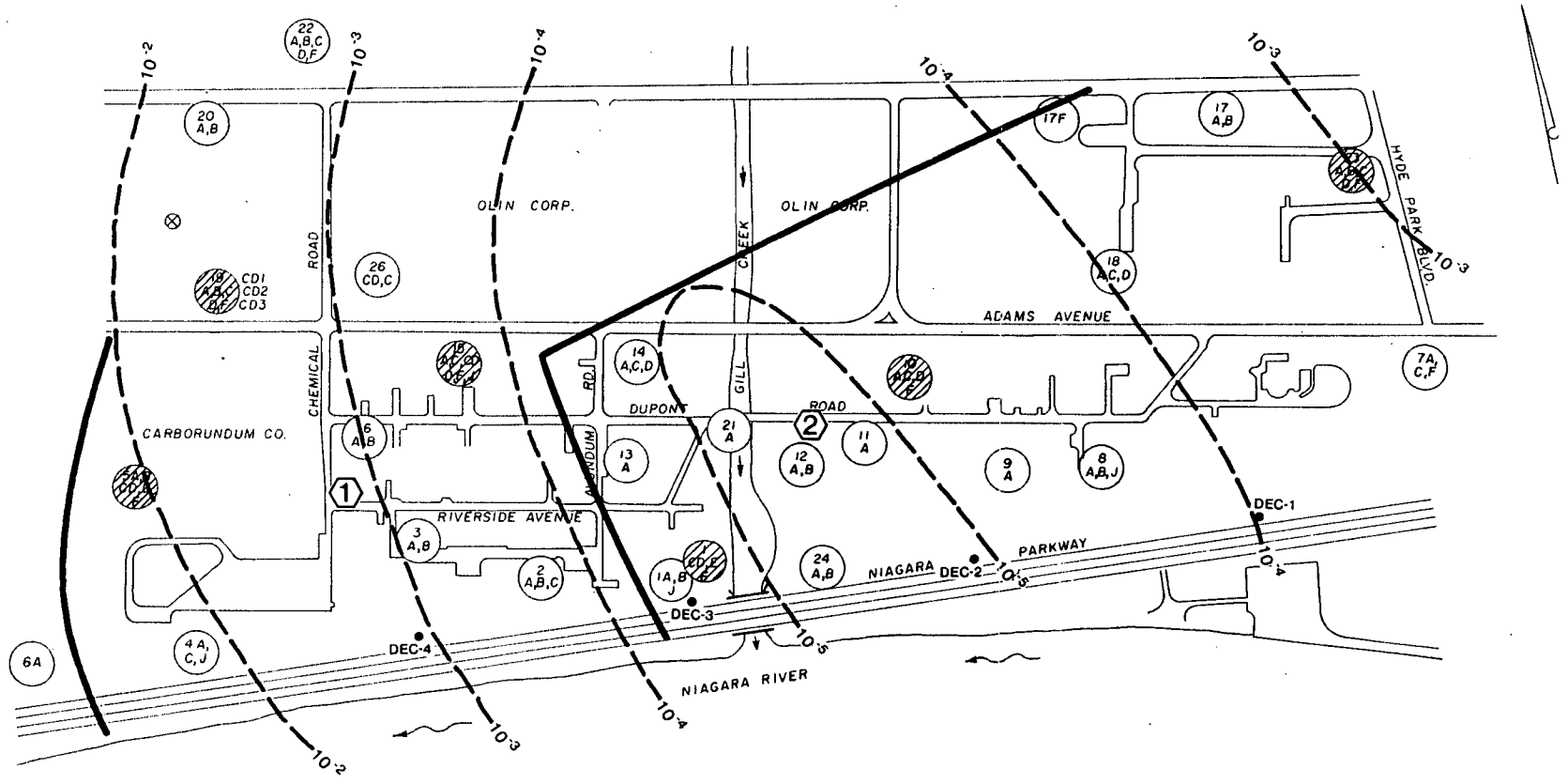
- WELL CLUSTER NUMBER (NO.)
- WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 10^{-3} TRANSMISSIVITY CONTOUR (ft²/sec.)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

CD-ZONE TRANSMISSIVITY CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET	Date:
Checked by: M.N.G.	0 300	Job: 87C2555 D-1

FIGURE B-8



LEGEND:

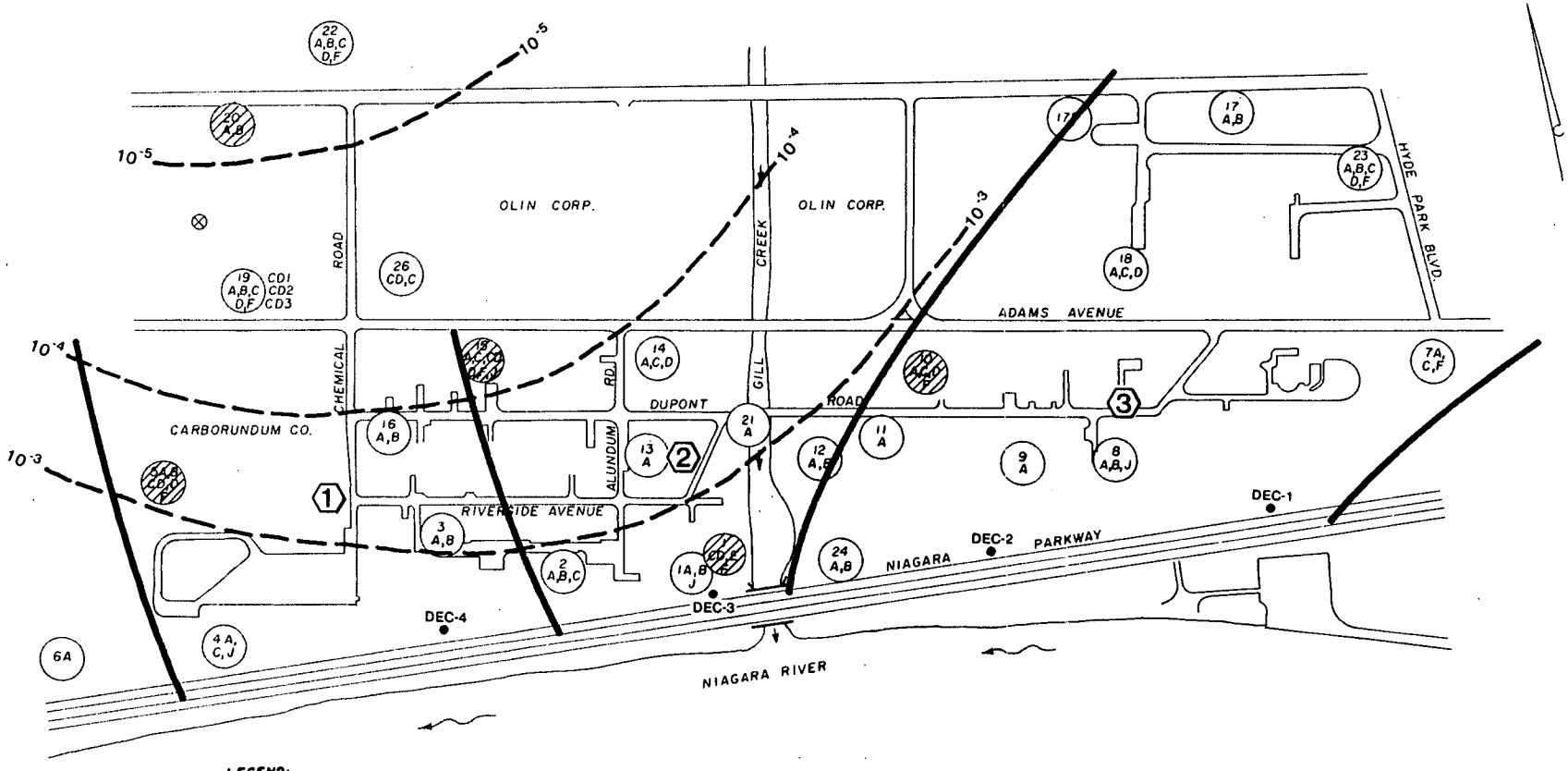
- 17 / A,B — WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 10-3 — TRANSMISSIVITY CONTOUR (ft.²/sec.)
- WELL USED IN STUDY
- 3 — FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

D-ZONE TRANSMISSIVITY CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-9

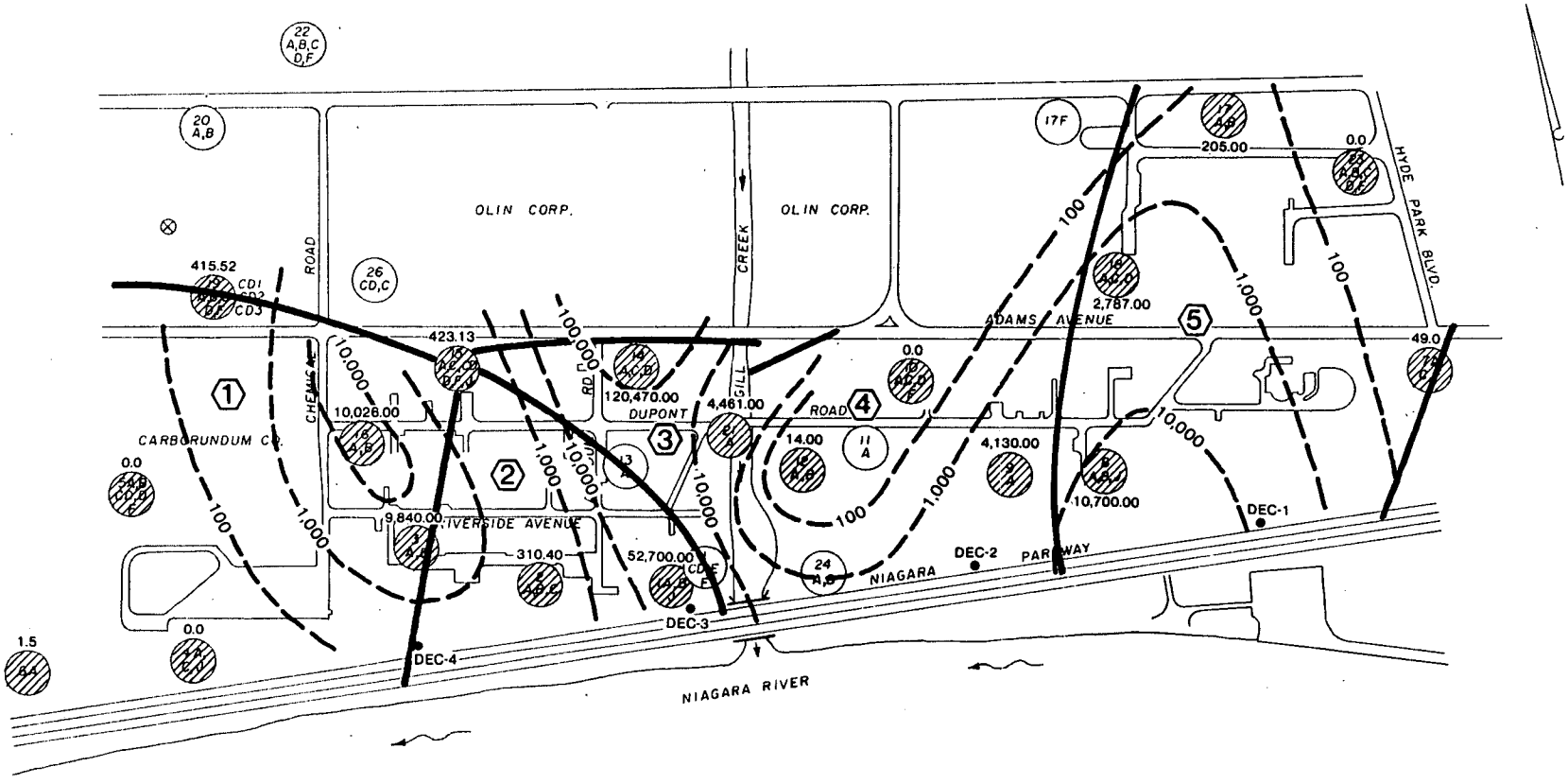


F-ZONE TRANSMISSIVITY CONTOURS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-10



LEGEND:

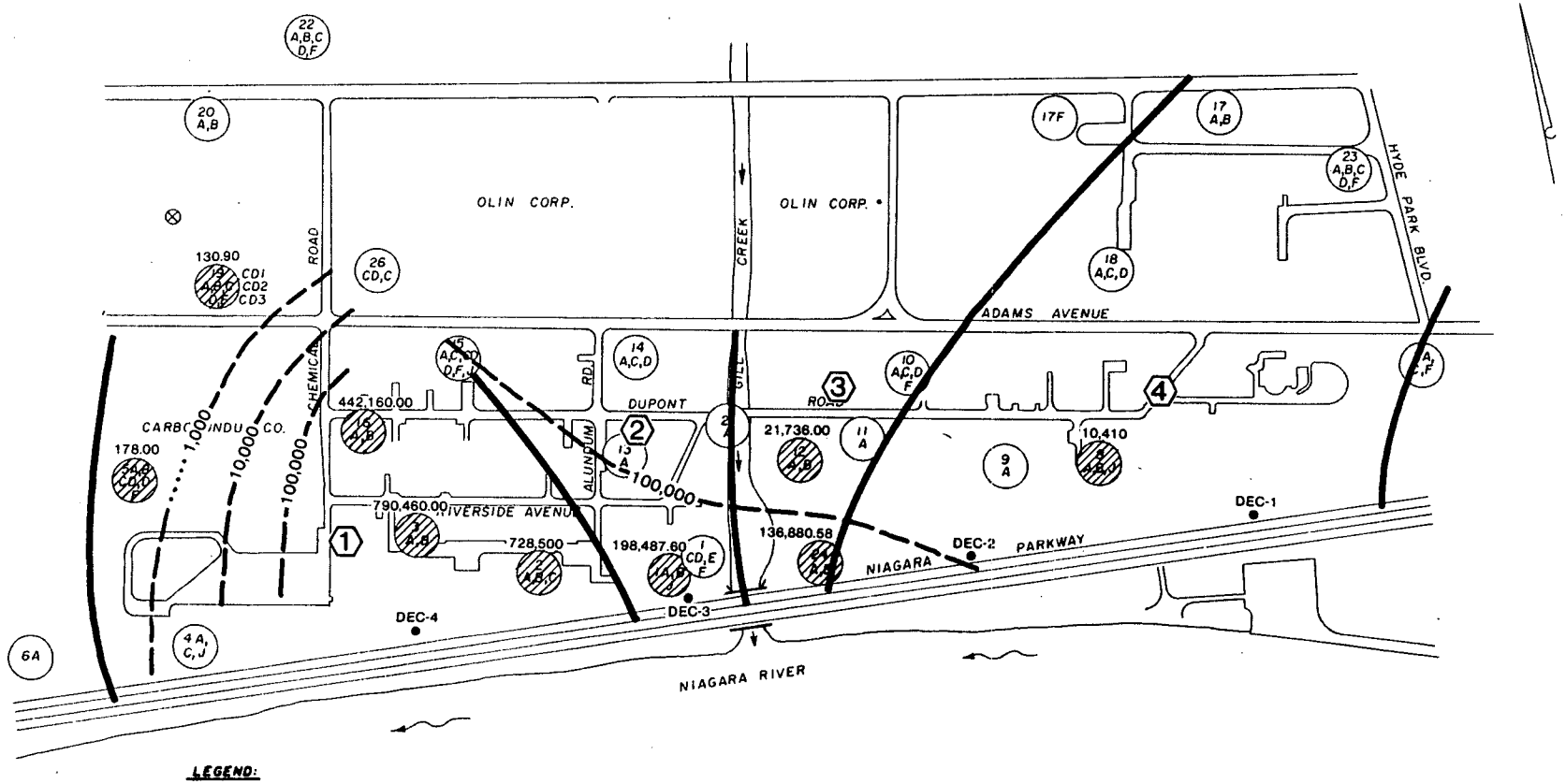
- WELL CLUSTER NUMBER (NO.)
- WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 100 CONCENTRATION CONTOUR (ppb)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

A-ZONE TOTAL INDICATOR ORGANICS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date: 87C2555 D-1
Checked by: M.N.G.		Job: 83C2236

FIGURE B-11

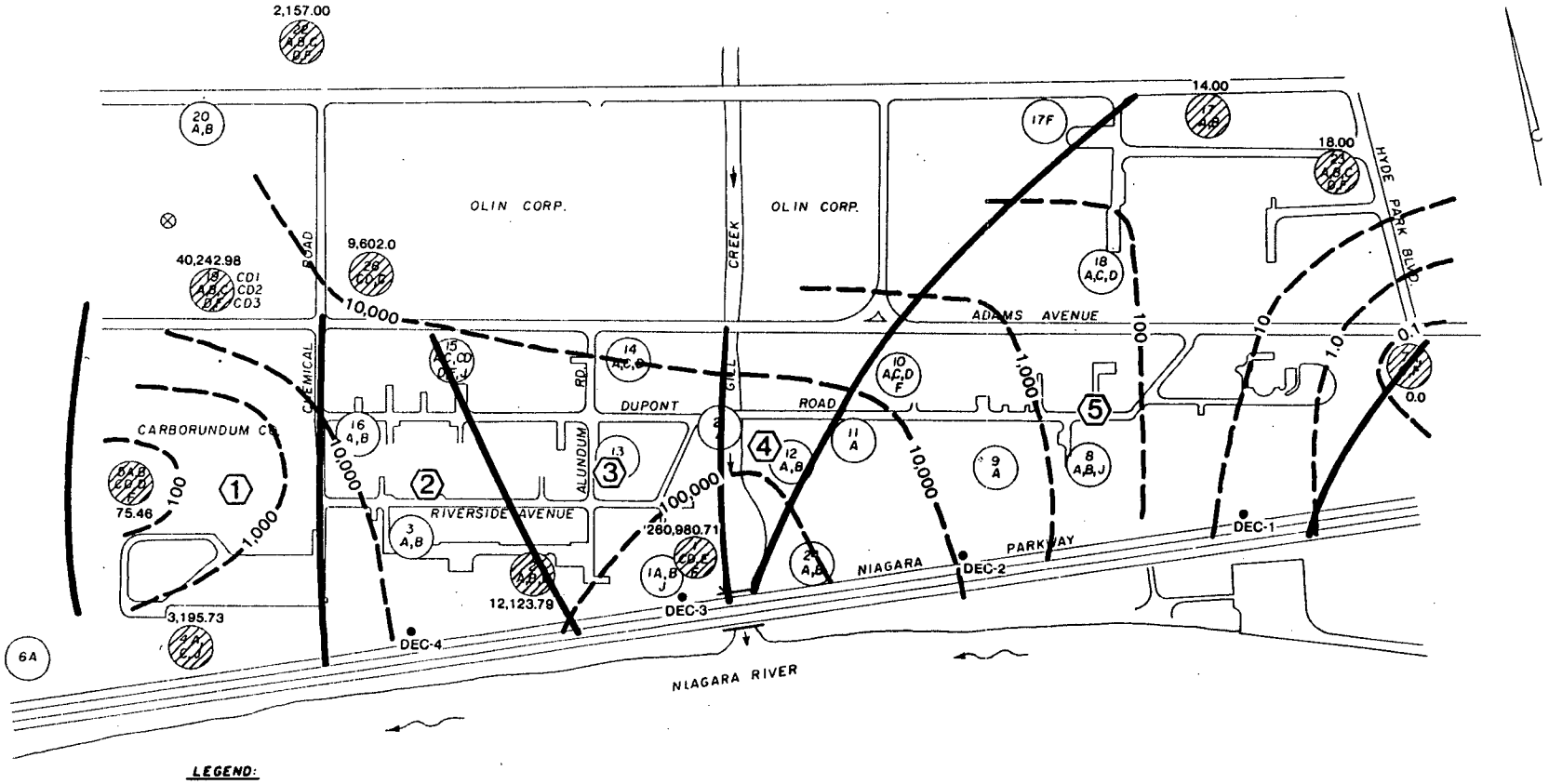


B-ZONE TOTAL INDICATOR ORGANICS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-12



LEGEND:

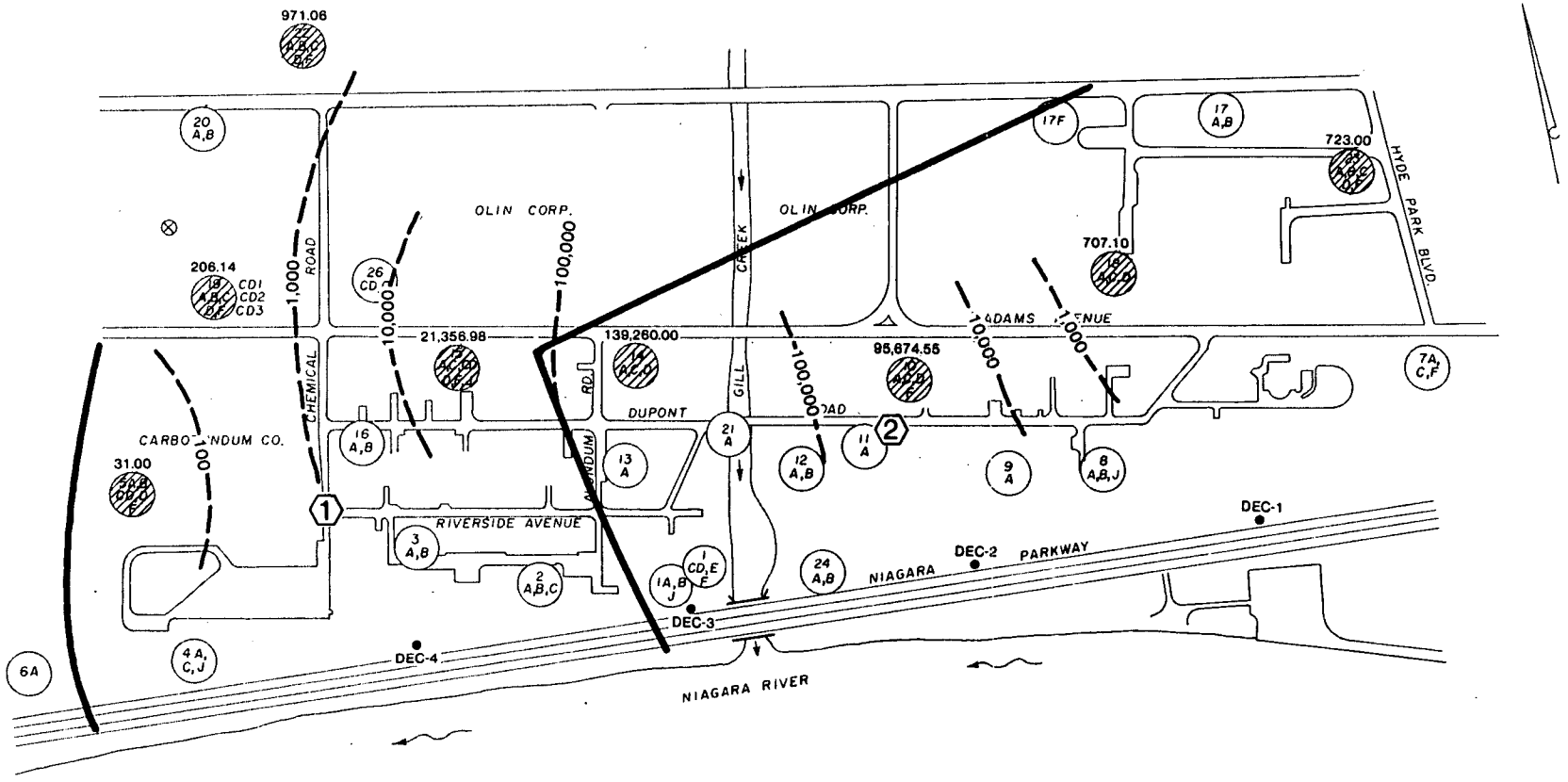
- WELL CLUSTER NUMBER (NO.)
- WELL TYPE (LETTER)
- OLIN PRODUCTION WELL
- 100 — CONCENTRATION CONTOUR (ppb)
- WELL USED IN STUDY
- FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

CD-ZONE TOTAL INDICATOR ORGANICS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-13

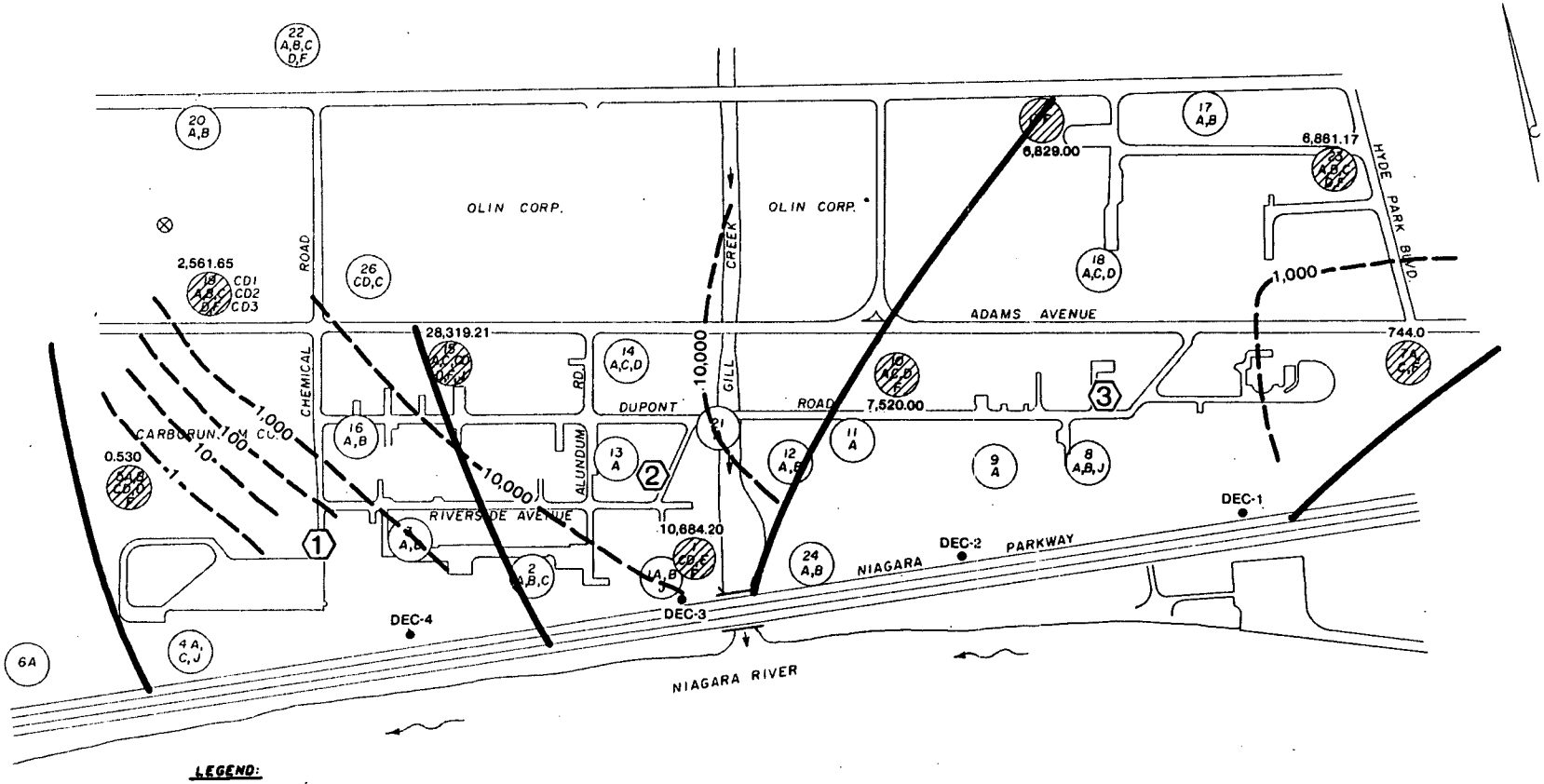


D-ZONE TOTAL INDICATOR ORGANICS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-14



LEGEND:

- 17 A,B — WELL CLUSTER NUMBER (NO.) / WELL TYPE (LETTER)
- ⊗ OLIN PRODUCTION WELL
- ····100—— CONCENTRATION CONTOUR (ppb)
- WELL USED IN STUDY
- (3) FLOW ZONE NO.
- FLOW ZONE DIVIDING LINE

F-ZONE TOTAL INDICATOR ORGANICS
4th QUARTER, 1986
NIAGARA PLANT
E. I. du PONT de NEMOURS & COMPANY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T.P.	SCALE IN FEET 0 300	Date:
Checked by: M.N.G.		Job: 87C2555 D-1

FIGURE B-15

Appendix C

GROUNDWATER FLOW RATES
DUPONT NIAGARA PLANT
A-ZONE : FOURTH QUARTER 1986

FLOW SECT	TRANSMISSIVITY (FT**2/SEC)	GRADIENT (FT/FT)	FLOW SECT WIDTH (FT)	FLOW RATE (GPM)
1	1.0000E-3	6.7000E-3	1200.00	3.61
2	1.0000E-2	1.1000E-2	850.00	41.96
3	5.0000E-4	8.0000E-3	690.00	1.24
4	1.0000E-3	1.7000E-3	660.00	.50
5	5.0000E-4	1.6000E-2	1100.00	3.95
		TOTAL FLOW RATE (GPM):		51.26

GROUNDWATER FLOW RATES
DUPONT NIAGARA PLANT
B-ZONE : FOURTH QUARTER 1986

FLOW SECT	TRANSMISSIVITY (FT**2/SEC)	GRADIENT (FT/FT)	FLOW SECT WIDTH (FT)	FLOW RATE (GPM)
1	5.0000E-3	8.0000E-3	900.00	16.16
2	5.0000E-3	2.9000E-3	750.00	4.88
3	1.0000E-3	2.5000E-3	600.00	.67
4	1.0000E-3	1.4000E-2	900.00	5.65
		TOTAL FLOW RATE (GPM):		27.36

GROUNDWATER FLOW RATES
DUPONT NIAGARA PLANT
CD-ZONE : FOURTH QUARTER 1986

FLOW SECT	TRANSMISSIVITY (FT**2/SEC)	GRADIENT (FT/FT)	FLOW SECT WIDTH (FT)	FLOW RATE (GPM)
1	5.0000E-3	1.0000E-2	600.00	13.46
2	1.0000E-2	1.0000E-2	300.00	13.46
3	1.0000E-2	1.3000E-2	750.00	43.76
4	1.0000E-3	8.9000E-3	450.00	1.80
5	1.0000E-3	8.0000E-3	1100.00	3.95
		TOTAL FLOW RATE (GPM):		76.43

GROUNDWATER FLOW RATES
DUPONT NIAGARA PLANT
D-ZONE : FOURTH QUARTER 1986

FLOW SECT	TRANSMISSIVITY (FT**2/SEC)	GRADIENT (FT/FT)	FLOW SECT WIDTH (FT)	FLOW RATE (GPM)
1	1.0000E-3	2.2000E-3	1200.00	1.18
2	1.0000E-3	3.5000E-3	1400.00	2.20
		TOTAL FLOW RATE (GPM):		3.38

GROUNDWATER FLOW RATES
DUPONT NIAGARA PLANT
F-ZONE : FOURTH QUARTER 1986

FLOW SECT	TRANSMISSIVITY (FT**2/SEC)	GRADIENT (FT/FT)	FLOW SECT WIDTH (FT)	FLOW RATE (GPM)
1	5.0000E-5	3.0000E-3	1100.00	.07
2	5.0000E-4	1.0000E-3	1260.00	.28
3	1.0000E-3	8.9000E-3	1300.00	5.19
		TOTAL FLOW RATE (GPM):		5.55

Appendix D

CONTAMINANT LOADING RATES
TOTAL INDICATOR ORGANICS
FOURTH QUARTER 1986
DUPONT NIAGARA PLANT

CONCENTRATION OF INDICATOR ORGANICS (PPB)

FLOW SECTIONS	A ZONE	B-ZONE	CD-ZONE	D-ZONE	F-ZONE
1	100.00	50000.00	40000.00	10000.00	5000.00
2	5000.00	50000.00	10000.00	750.00	10000.00
3	10000.00	10000.00	50000.00		5000.00
4	1000.00	1000.00	10000.00		
5	100.00		10.00		

INDICATOR LOADING RATES (LBS/DAY)

FLOW SECTIONS	A-ZONE	B-ZONE	CD-ZONE	D-ZONE	F-ZONE
1	4.33546E-3	9.703756E0	6.465968E0	1.41713E-1	4.20336E-3
2	2.519614E0	2.930342E0	1.616492E0	1.98158E-2	3.36268E-2
3	1.48919E-1	8.04643E-2	2.627700E1		2.87629E-1
4	6.00480E-3	6.78542E-2	2.16172E-1		
5	4.74379E-3		4.74379E-4		
TOTAL	2.6836	12.7824	34.5761	.1615	.3255

FOURTH QUARTER 1986
GROUNDWATER FLOW RATES
GPM

FLOW SECT	A-ZONE	B-ZONE	CD-ZONE	D-ZONE	F-ZONE
1	3.61	16.16	13.46	1.18	.07
2	41.96	4.88	13.46	2.20	.28
3	1.24	.67	43.76		4.79
4	.50	5.65	1.80		
5	3.95		3.95		
TOTAL	51.26	27.36	76.43	3.38	5.14

Appendix E

A-ZONE
TIO CONCENTRATION
AVERAGES TO DATE (PPB)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	427.00	439.17	390.71	354.38	326.11
2	3960.00	4966.67	4971.43	4475.00	4533.33
3	38000.00	33333.33	30000.00	26875.00	25000.00
4	580.00	650.00	700.00	675.00	711.11
5	138.00	116.67	101.43	90.00	91.11

TIO LOADING RATES
AVERAGES TO DATE (LBS/DAY)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	3.4523E-2	3.1992E-2	2.7712E-2	2.4566E-2	2.2318E-2
2	2.66446E0	2.90754E0	2.87768E0	2.58245E0	2.57546E0
3	3.9480E-1	3.4061E-1	2.9984E-1	2.6589E-1	2.5289E-1
4	5.9929E-3	1.0838E-2	1.4677E-2	1.4351E-2	1.3424E-2
5	4.4743E-3	3.7898E-3	3.3050E-3	2.9312E-3	3.1326E-3
TOTALS	3.1043	3.2948	3.2232	2.8902	2.8672

B-ZONE
TIO CONCENTRATION
AVERAGES TO DATE (PPB)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	10640.00	9033.33	22600.00	7493.75	12216.67
2	92000.00	85000.00	81428.57	77500.00	21875.00
3	18000.00	19166.67	23571.43	21875.00	20555.56
4	62.40	85.33	76.71	73.38	176.33

LOADING RATES
AVERAGES TO DATE (LBS/DAY)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	1.00977E0	8.5749E-1	8.0336E-1	7.1111E-1	1.71030E0
2	1.30457E1	1.15550E1	1.15060E1	1.16418E1	1.06738E1
3	4.5653E-1	4.8552E-1	7.3356E-1	6.7639E-1	6.1018E-1
4	4.5896E-3	6.1145E-3	5.3988E-3	5.0467E-3	1.3528E-2
TOTALS	3.0998	12.9042	13.0484	13.0344	13.01

CD-ZONE
TIO CONCENTRATION
AVERAGES TO DATE (PPB)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	32000.00	30833.33	32500.00	33750.00	34444.44
2	210000.00	187500.00	171428.57	168750.00	151111.11
3	80000.00	75000.00	78571.43	81250.00	77777.78
4	64000.00	55000.00	61428.57	66250.00	60000.00
5	168.00	148.33	137.86	139.38	125.00

LOADING RATES
AVERAGES TO DATE (LBS/DAY)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	4.09263E0	4.58946E0	5.28542E0	5.41437E0	5.53122E0
2	3.64731E1	3.21732E1	2.88715E1	2.92032E1	2.61380E1
3	2.46917E1	2.46056E1	2.88865E1	3.05314E1	3.00586E1
4	1.88862E0	1.62549E0	1.90111E0	1.94420E0	1.75220E0
5	6.7950E-2	5.7097E-2	4.9467E-2	4.4270E-2	3.9404E-2
TOTALS	67.2141	63.0510	64.9940	67.1375	63.52

D-ZONE
TIO CONCENTRATION
AVERAGES TO DATE (PPB)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	29000.00	24333.33	22285.71	20125.00	19000.00
2	1070.00	893.33	780.00	720.00	723.33

LOADING RATES
AVERAGES TO DATE (LBS/DAY)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	6.1290E-1	5.1426E-1	4.7768E-1	4.3200E-1	3.9975E-1
2	8.9457E-3	7.5130E-3	6.4911E-3	8.9539E-3	1.0160E-2
TOTALS	.6218	.5218	.4842	.4410	.4099

F-ZONE
TIO CONCENTRATION
AVERAGES TO DATE (PPB)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	8800.00	8166.67	7714.28	7375.00	7111.11
2	13000.00	14166.67	14285.71	13750.00	13333.33
3	8522.00	8268.33	8087.14	8013.75	7678.89

LOADING RATES
AVERAGES TO DATE (LBS/DAY)

FLOW SECT	4/84-4/85	4/84-1/86	4/84-2/86	4/84-3/86	4/84-4/86
1	3.0526E-2	2.6640E-2	2.3434E-2	2.1631E-2	1.9694E-2
2	2.1497E-1	2.0636E-1	1.9618E-1	1.8066E-1	1.6106E-1
3	3.8153E-1	3.7371E-1	3.5022E-1	3.5126E-1	3.4419E-1
TOTALS	.6270	.6067	.5698	.5536	.5249

#75