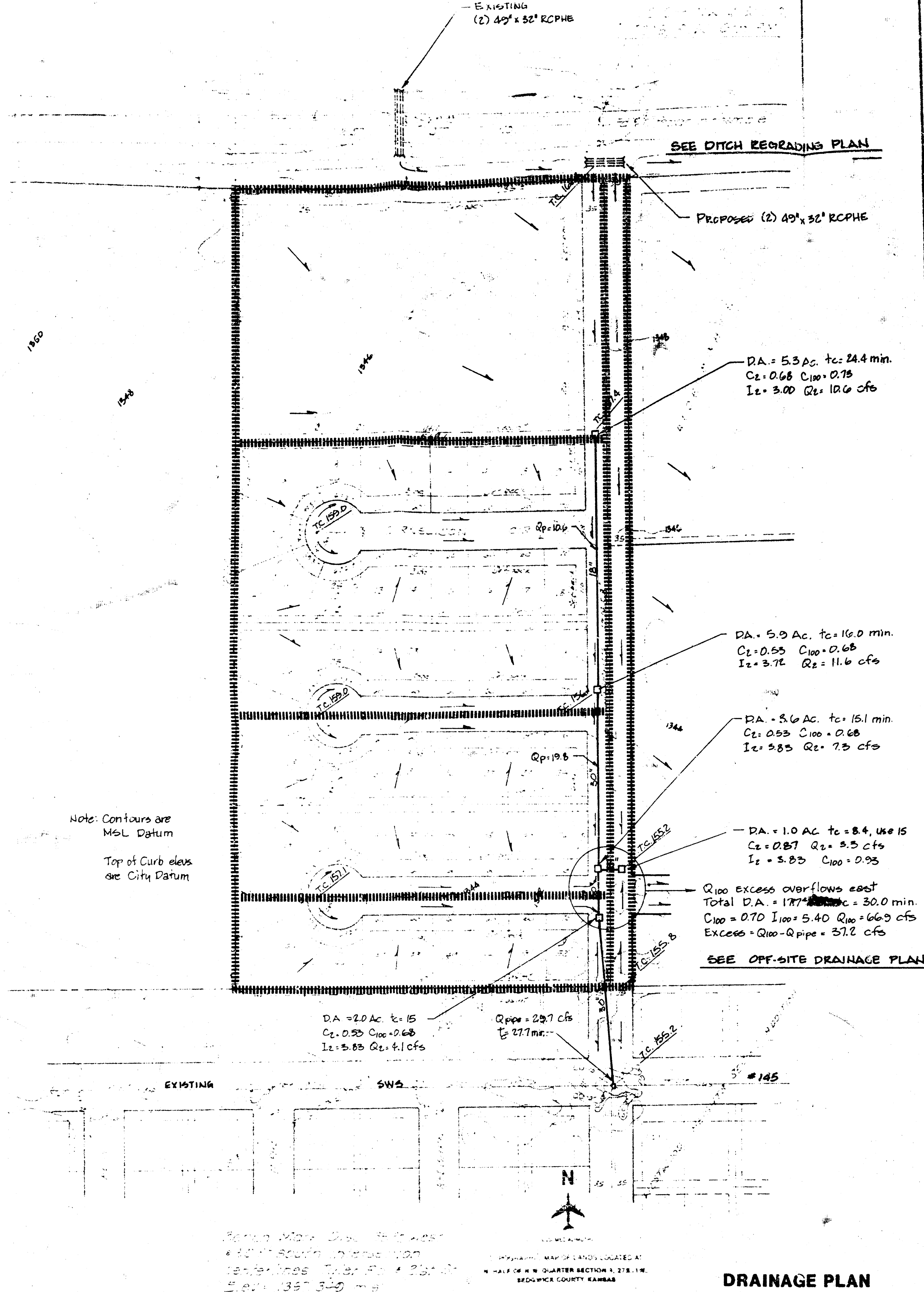


WESTWIND 2ND ADDITION

DRAINAGE PLAN

PART OF THE NW 1/4 OF SEC 3 T 27 N R 1 W SEDGWICK COUNTY KANSAS

WESTWIND ASSOCIATES II



DRAINAGE PLAN
November 21, 1986
Rev. June 25, 1987

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
31625-7271 • 315 ELLIS • WICHITA, KANSAS 67211

DRAINAGE PLAN FOR WESTWIND 2nd ADDITION

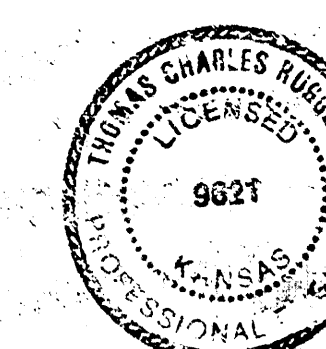
WICHITA, SEDGWICK COUNTY, KANSAS

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
31625-7271 • 315 ELLIS • WICHITA, KANSAS 67211

June 1987

WESTWIND 2ND ADDITION
REVISED DRAINAGE PLAN
JUNE 25, 1987

This plan supersedes two previously submitted plans dated November, 1986, and March, 1987, and consists of three parts:
I. Diversion of off-site drainage from the north, to the east.
II. Storm sewer system for the initial design storm (2-in.)
III. Diversion of excess runoff (100-yr.) to the east.



I. DIVERSION OF OFFSITE DRAINAGE

An area of 68 acres located north of 21st Street naturally drains across the Westwind 2nd Addition site via two culvert pipes under the street. The undeveloped condition runoff from the area is 100 cfs (1000). This area is to be included in a planned development, with a reduced drainage area of 28.3 acres and peak runoff (Q100) of 99 cfs, approximately equal to the existing condition (see page 3). However, no drainage right of way or easement exists south of 21st Street, and this runoff flows across private property (Westwind 2nd Addition). Since this and other drainage areas were excluded from the design of the storm sewer system to the south (SSS 145), sufficient capacity does not exist in that system to accept this runoff. Part I of this Drainage Plan will divert the flow along the south side of 21st Street within existing street right of way to an existing storm sewer at Ridge Road, thereby eliminating the overland flow to the south.

The existing culvert installation across 21st Street (see Plan) includes (2) 48\" x 32\" Reinforced Concrete Pipes (R.C.P.). Although the runoff to the culvert inlet is 99 cfs, the pipes will handle only 76 cfs, due to head limits controlled by the elevation of 21st Street. The excess flow east along the north side of the street (see page 4). The 76 cfs discharged by the pipes will be carried east in the south ditch by removing a ditch plug at Woodchuck and regrading the ditch in some areas to the east. A proposed double culvert at Woodchuck and culverts at the driveway downcross will be sized to pass this flow (see pages 4 and 5). Some filling along the south R/W line will be required to contain the flow within the ditch (see Ditch Regrading Plan).

WESTWIND 2ND ADDITION
Determination of Runoff
from area n. of 21st Street

Undeveloped Condition

D.A. = 68 Ac. Soil Group B, 50% pasture, 50% grass, use Rational Method
C_s = 0.22 C₁₀₀ = 0.40 (Attach D)
Length of Watershed = 2300' H = 1366-1346 S = 0.87%
1150 @ 1.05 fps / 1150 @ 0.26 fps. V_{avg} = 0.65 fps (Attach E)
2300 @ 0.25 = 575.0 tc = 59 min.
I_s = 2.18 in I₁₀₀ = 3.77 in/hr (Attach A)
Q_s = 32.6 cfs Q₁₀₀ = 102.5 cfs (use 103 cfs)

Developed Condition

Church Sites	Golf Course	D.A. = 28.3 Ac.	Commercial Sites
Area = 23.0 Ac.	3.0 Ac.		5.3 Ac.
Impervious = 20%	0%		70%
C _s = 20% x 0.31 = 0.072			
80% x 0.22 = 0.176			
C _s = 0.155			

Developed condition: per P.E.C. development plan for Reflection Ridge L-10-37

C₁₀₀ = 20% x 0.30 = 0.180
50% x 0.41 = 0.205
C₁₀₀ = 0.31
L = 660', V = 0.44 fps tc = 25 min.
I_s = 2.57 I₁₀₀ = 5.90 I_s = 4.56 I₁₀₀ = 7.37
Q_s = 25.0 cfs Q_s = 2.4 cfs Q₁₀₀ = 16.2 cfs
Q₁₀₀ = 60.2 cfs Q₁₀₀ = 7.3 cfs Q₁₀₀ = 31.2 cfs
Total Q_s = 43.6 cfs Total Q₁₀₀ = 38.7 (use 44 cfs)

WESTWIND 2ND ADDITION
Ditch flow east (S. side 21st St.)

(2) 48\" x 32\" R.C.P. @ 100' long incl. end sections (existing).
Determine discharge using FHWA HEC-NO.5.
(FHWA 1975 41322 50' x 31')
USFL = 159.40 DSFL = 159.26 Elev. E @ 21st = 162.71
Max. HW = 162.71 - 159.40 = 3.31' Slope = 0.0016
Inlet control: HW/D = 3.31/2.61 = 1.24 (use Chart 3)
Q = 60 cfs / pipe x 2 = 120 cfs
w/ outlet control: K_e = 0.5 H = 3.31 - 2.67 = 0.64' (use Chart 10)
Q = 38 cfs / pipe x 2 = 76 cfs
Outlet control governs: Q = 76 cfs through pipes
Note: High point in ditch = elev 162.03. When ponding reaches that elev., it begins to flow east. Excess flow drains east.

Recommend installing (2) 48\" x 32\" R.C.P. @ street and driveway locations along south ditch of 21st St. Maintain HW depth of 3.4' @ all inlet points.

Check ditch section capacity in south ditch per plan/profile, to prove capacity ≥ 76 cfs. Typical existing finished ditch section has 8' bottom.

DITCH CAPACITIES

Ditch Sta. 0+00 to 3+00: S = 0.0043 S₁ = 0.006
try q = 2.0' A = 32.64 ft² W = 24.14' R = 1.307 r² = 1.110
V = 1.435 (1.485) (0.362) = 3.91 fps Q = 3.91 x 32.64 = 125 cfs > 76

Minimum elev. 161.1 along R/W for rigid HW @ 3+00 culvert exceeds 2.0' depth for this reach. Capacity exceeds 76 cfs.

Ditch Sta. 3+55 to 7+00: S = 0.0020 S₁ = 0.0045
try q = 2.2' A = 35.60 ft² W = 26.14' R = 1.285 r² = 1.183
V = 1.485 (1.485) (0.362) = 3.91 fps Q = 3.91 x 35.60 = 138 cfs > 76 cfs

∴ ditch capacity for this reach exceeds 76 cfs @ 2.2' depth.

Ditch Sta. 7+00 to SW's inlet @ 23+90 ±:

Slope exceed 0.43% (above) with same ditch section, capacity will exceed 76 cfs @ depths < 2.0'.

II. STORM SEWER

An extension of Storm Sewer 145 will be constructed within Woodchuck right of way, and will drain all the area included in Westwind 2nd Addition (see Plan). This system will be designed to accept runoff from the design storm up to the limits of remaining capacity in the existing system, considering contributions from stormwater detention systems on Westwind 3rd and 4th Additions and Golf Park West, located to the west. (See approved Drainage plans for Westwind 3rd and 4th Addition, May 1987, and Golf Park West, June 1986). Inflow to the storm sewer will be limited by curb inlet capacity, controlled by an overflow to the east at the Westline intersection (see Part III).

Runoff from Westwind 2nd Addition was computed using the Rational Method, per City of Wichita Drainage Criteria. The initial design storm was the 2-yr. frequency, and the secondary storm was the 100-yr. frequency. Runoff coefficients used were from Attachment D, and rainfall intensities were from Attachment A of the above Criteria. All soils in the Westwind 2nd Addition are in Hydrologic Group B, per Sedgwick County Soil Survey. A minimum time of concentration of 15 minutes was used for inlets.

The excess capacity in the existing storm sewer has been determined to be 46 cfs at the point of inflow from this system, at a flow time of approximately 30 minutes in the pipe system (refer to analysis of SSS 145 included in the November 1986 plan). The time lag between inflow at the contributing points for the areas mentioned will allow approximately 30 cfs from the proposed storm sewer to enter the system at Woodchuck (see Plan). The contribution from Westwind 2nd Addition will be limited to 29.7 cfs (2) per the Drainage Plan. The Q100 excess of 37.2 cfs (66-29.7) will overflow at Westline Avenue to the east, as described in Part III.

III. DIVERSION OF EXCESS RUNOFF

Runoff in excess of the capacity of the storm sewer will overflow at the intersection of Woodchuck and Westline and drain to the east (see Plan). This flow will be carried by open ditch through a temporary drainage easement to two existing 12\" x 9\" R.C.P.'s at Ridge Road. Upon development of the land east of Woodchuck, this overflow will be carried in the street section and future storm sewer to Ridge Road (See Off-site Drainage Plan).

A temporary drainage easement and an agreement providing for this ditch will be executed by the Westwind developer and the owner of the property between Woodchuck and Ridge Road. This easement will expire at the time that street right of way is dedicated for the ditch area.

LEGAL DESCRIPTION FOR TEMPORARY DRAINAGE EASEMENT

A strip of land 30 feet wide lying 15 feet either side of the following described centerline: Beginning at a point in the west line of the NW of the NE of Sec. 9, Twp. 27-S, R-1-W of the 6th P.M., and 153.0 feet north of the S.W. Corner of said NW of the NE of Sec. 9, thence east parallel with the south line of said NW of the NE of Sec. 9, 1650.0 feet to the P.C. of a curve to the left having a radius of 195 feet; thence along said curve, through a central angle of 45°00', 153.15 feet; thence P.C. of a curve to the right having a radius of 195 feet; thence along said curve, through a central angle of 45°00', 153.15 feet; along said curve, through a central angle of 45°00', 153.15 feet; thence easterly along the tangent to last described curve, 648 feet more or less to a point 40 feet west of the east line of said Sec. 9.

PLAN
SCALE: 1" = 40' H
1" = 5' V

PROFILE
SCALE: 1" = 40' H
1" = 5' V

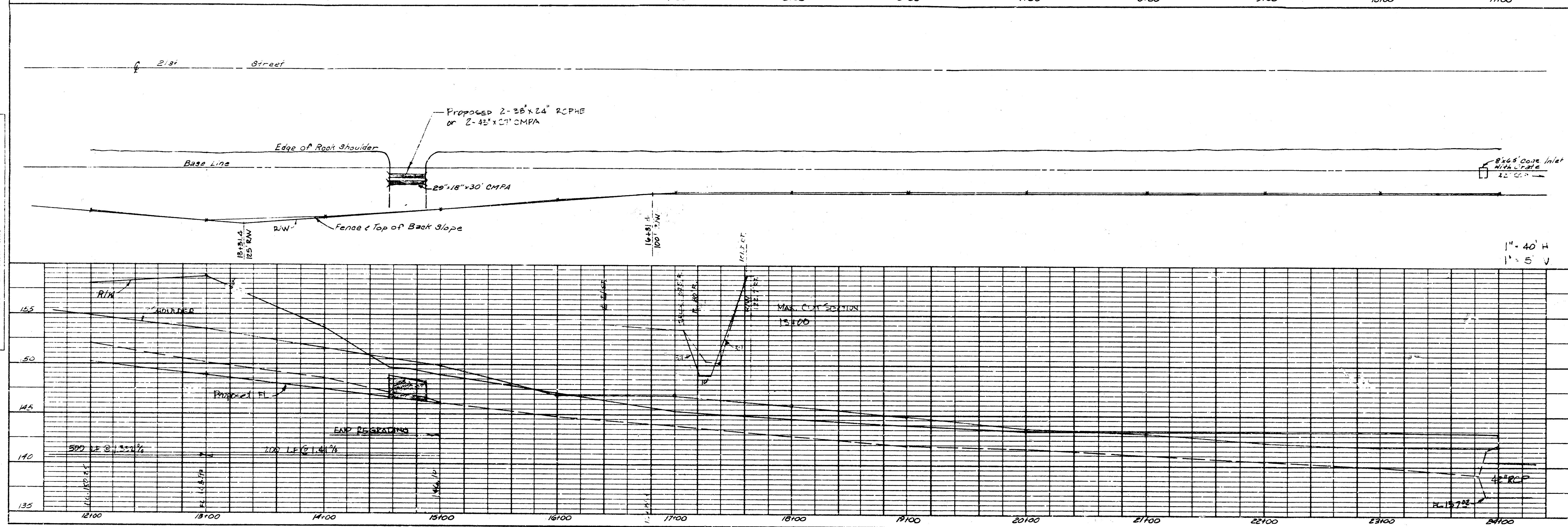
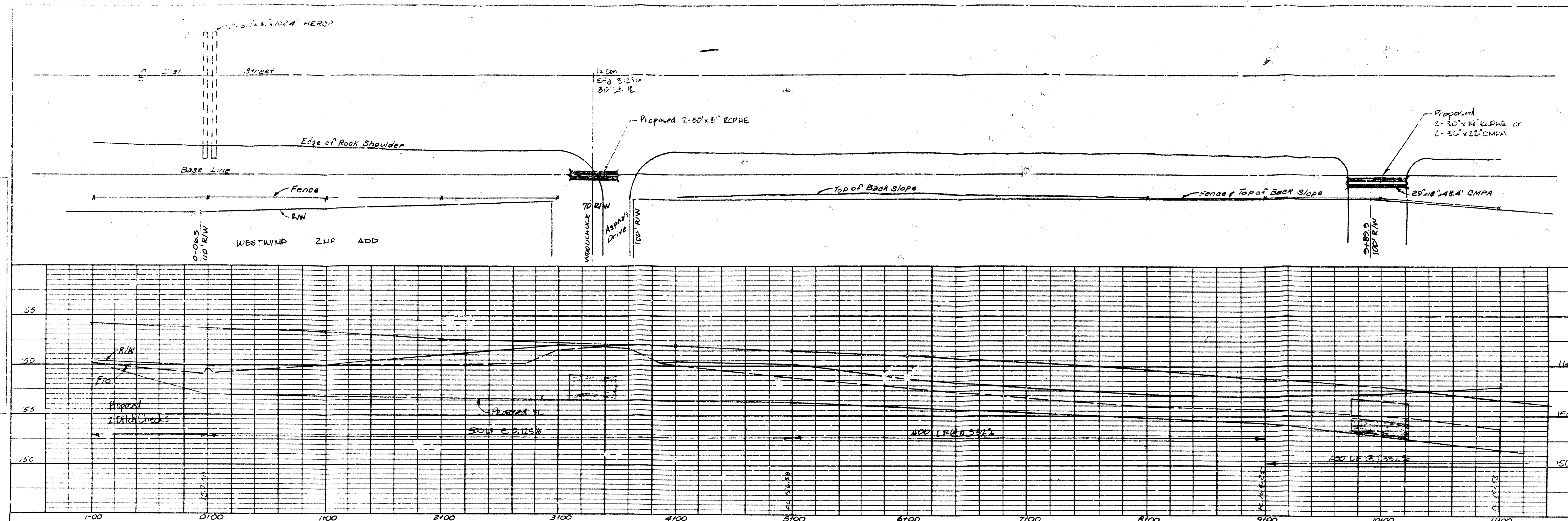


PLATE 2: PLAN, PROFILE, & S
CLEARANCE: 10' MIN. OVER
NO. 10006-2

PRELIMINARY DITCH PROFILES
21st St Ditch - Westwind Addition 11/18/1986

PROJECT: STORM WATER SEWER NO. 145
DATE: 11/18/1986
TIME: 9:35:4

STORM DRAIN ANALYSIS RESULTS

Line No	D (in)	U (in)	Dn (in)	Dc (in)	Flow Type	SI-full (ft/ft)	V.1 (fps)	V.2 (fps)	FL 1 (ft)	FL 2 (ft)	HG 1 Calc	HG 2 Calc	D.1 (ft)	D.2 (ft)	TU Calc	TU CK	
1	Hydraulic grade line control = 136.57																
2	173.0	54	96	2.35	2.44	Full	.00109	4.8	4.8	128.64	130.95	136.57	137.23	7.93	6.28	.00	.00
3	171.0	54	96	2.30	2.42	Full	.00106	4.8	4.8	130.95	131.80	137.28	137.50	6.33	5.70	.00	.00
4	163.0	54	96	2.12	2.34	Seal	.00097	4.5	5.0	131.80	133.80	137.59	137.91	5.78	4.11	.00	.00
	X =	353.57	X(N) =														
5	157.0	54	96	2.18	2.28	Seal	.00090	4.4	5.0	133.90	134.86	138.64	138.75	4.84	3.89	.00	.00
	X =	112.85	X(N) =														
6	151.0	54	96	2.13	2.23	Part	.00083	4.7	5.2	134.86	135.25	138.88	138.88	4.02	3.63	.00	.00
7	151.0	54	96	2.01	2.23	Part	.00083	5.1	10.3	135.25	136.45	138.96	138.20	3.71	1.83	.00	.00
	X =	.00	X(N) =	.00	X(J) =	214.91	F(J) =		61.02	D(BJ) =	138.96	138.20		2.59		.00	HJ
											1.70	D(AJ) =					
8	147.0	54	96	1.98	2.19	Part	.00078	11.5	8.4	136.45	138.50	138.05	140.49	1.60	2.19	.00	.00
9	81.3	72	0	2.21	2.41	Part	.00037	4.3	7.6	138.52	140.94	142.35	143.35	3.83	2.41	.00	.00
	X =	.00	X(N) =	409.98	X(J) =	239.52	F(J) =		30.43	D(BJ) =	2.21	D(AJ) =		2.62		.00	HJ
10	76.1	72	0	2.13	2.33	Part	.00032	5.4	7.5	140.94	142.21	143.85	144.54	2.89	2.33	.00	.00
	X =	.00	X(N) =	190.01	X(J) =	56.85	F(J) =		27.77	D(BJ) =	2.13	D(AJ) =		2.54		.00	HJ
11	72.2	72	0	2.07	2.27	Part	.00029	5.8	7.4	142.23	143.45	144.96	145.72	2.73	2.27	.00	.00
	X =	.00	X(N) =	171.16	X(J) =	40.70	F(J) =		26.15	D(BJ) =	2.07	D(AJ) =		2.47		.00	HJ
12	72.2	72	0	2.08	2.27	Part	.00029	5.8	7.4	143.47	144.07	146.19	146.34	2.72	2.27	.00	.00
	X =	.00	X(N) =	.00	X(J) =	40.09	F(J) =		26.14	D(BJ) =	2.08	D(AJ) =		2.47		.00	HJ
13	71.5	72	0	2.48	2.26	Part	.00028	6.1	6.5	144.10	144.98	146.70	147.46	2.60	2.48	.00	.00
	X =	.00	X(N) =	165.53													
14	58.1	60	0	2.49	2.13	Part	.00050	5.0	15.9	145.09	145.73	147.93	146.93	2.84	1.20	.00	.00
	X =	.00	X(N) =	.00	X(J) =	187.59	F(J) =		22.01	D(BJ) =	1.67	D(AJ) =		2.67		.00	HJ
15	54.4	60	0	1.71	2.07	Part	.00044	9.1	7.1	148.00	149.84	149.71	151.90	1.71	2.07	.00	.00
	X =	.00	X(N) =	66.34													
16	51.2	50	0	1.80	2.01	Part	.00039	5.4	7.0	149.87	151.22	152.30	153.23	2.43	2.01	.00	.00
	X =	.00	X(N) =	66.34													

PROJECT: STORM WATER SEWER NO. 145
DATE: 11/18/1986
TIME: 9:35:4

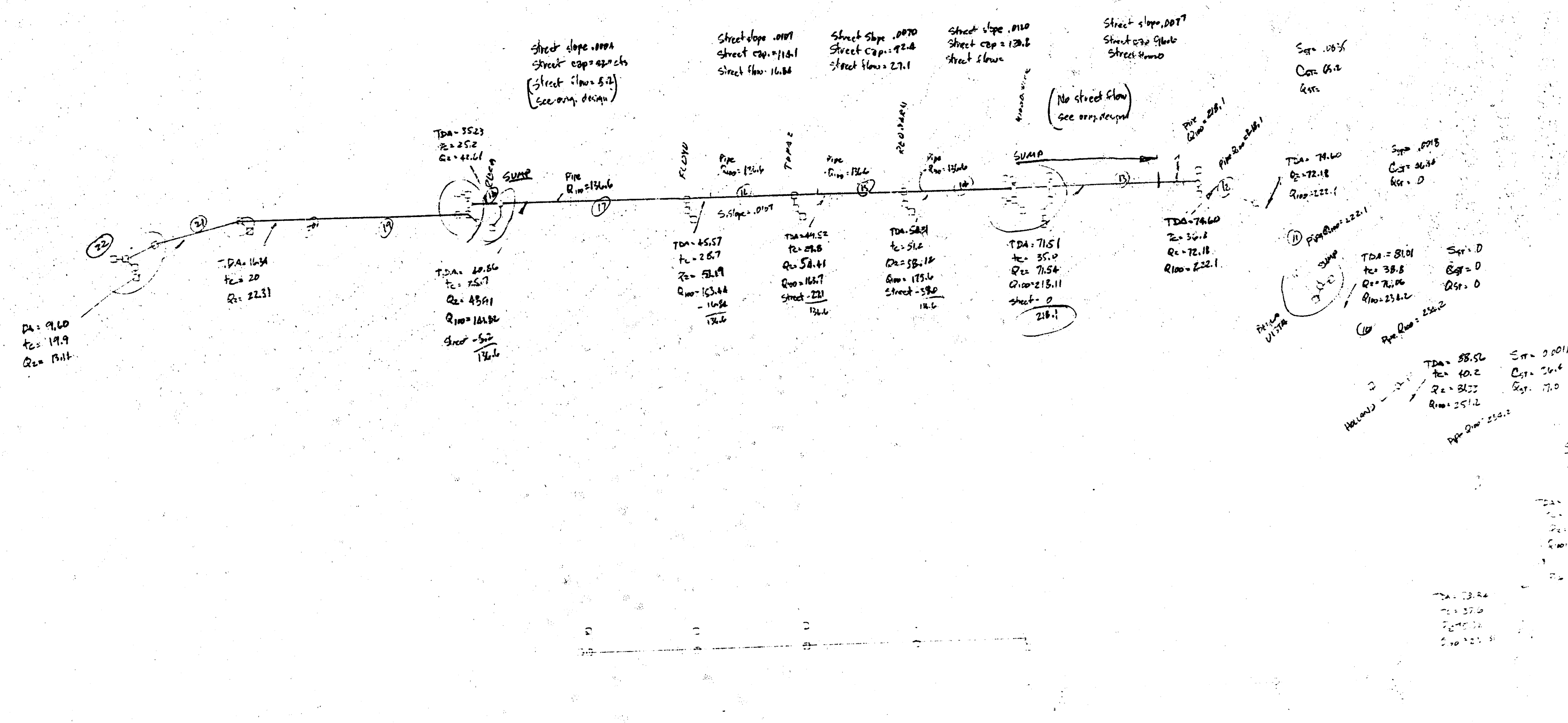
STORM DRAIN ANALYSIS RESULTS (cont)

Line No	D (cfs)	D (in)	U (in)	Dn (ft)	Dc (ft)	Flow Type	SI-full (ft/ft)	V.1 (fps)	V.2 (fps)	FL 1 (ft)	FL 2 (ft)	HG 1 Calc	HG 2 Calc	D.1 (ft)	D.2 (ft)	TU Calc	TU CX
4	Hydraulic grade line control = 137.54																
24	15.4	18	0	1.50	1.41	Seal	.02149	8.9	8.7	141.86	143.50	143.27	146.85	1.41	3.35	148.03	.00
	X =	3.29	X(N) =	.00													
7	Hydraulic grade line control = 138.16																
25	75.3	54	0	1.71	2.53	Part	.00147	13.4	8.2	140.00	143.92	141.73	146.45	1.73	2.53	147.49	.00

LIST OF ABBREVIATIONS

V.1, FL 1, D.1 and HG 1 refer to upstream end
 V.2, FL 2, D.2 and HG 2 refer to downstream end
 X(N) - Distance in feet from downstream end to point where water surface reaches normal depth by either drawdown or backwater
 X(J) - Distance in feet from downstream end to point where hydraulic jump occurs in line
 F(J) - The computed force at the hydraulic jump
 D(BJ) - Depth of water before the hydraulic jump (upstream side)
 D(AJ) - Depth of water after the hydraulic jump (downstream side)
 SEAL indicates flow changes from part to full or from full to part
 HJ indicates that flow changes from supercritical to subcritical through a hydraulic jump
 HJ1 indicates that hydraulic jump occurs at the junction at the upstream end of the line
 HJ2 indicates that hydraulic jump occurs at the junction at the downstream end of the line

WESTTIND 2ND ADDITION
(Drainage)



Analysis I: Input: 2/15/80 2005145.DAT
 Output: 2/15/80 2005145.DAT
 II Input: 2/15/80 2005145.DAT
 Output: 2/15/80 2005145.DAT
 III Input: 2/15/80 2005145.DAT
 Output: 2/15/80 2005145.DAT
 All reports on Eng. Projects I disk
 STORM, 10/11 10:11:00