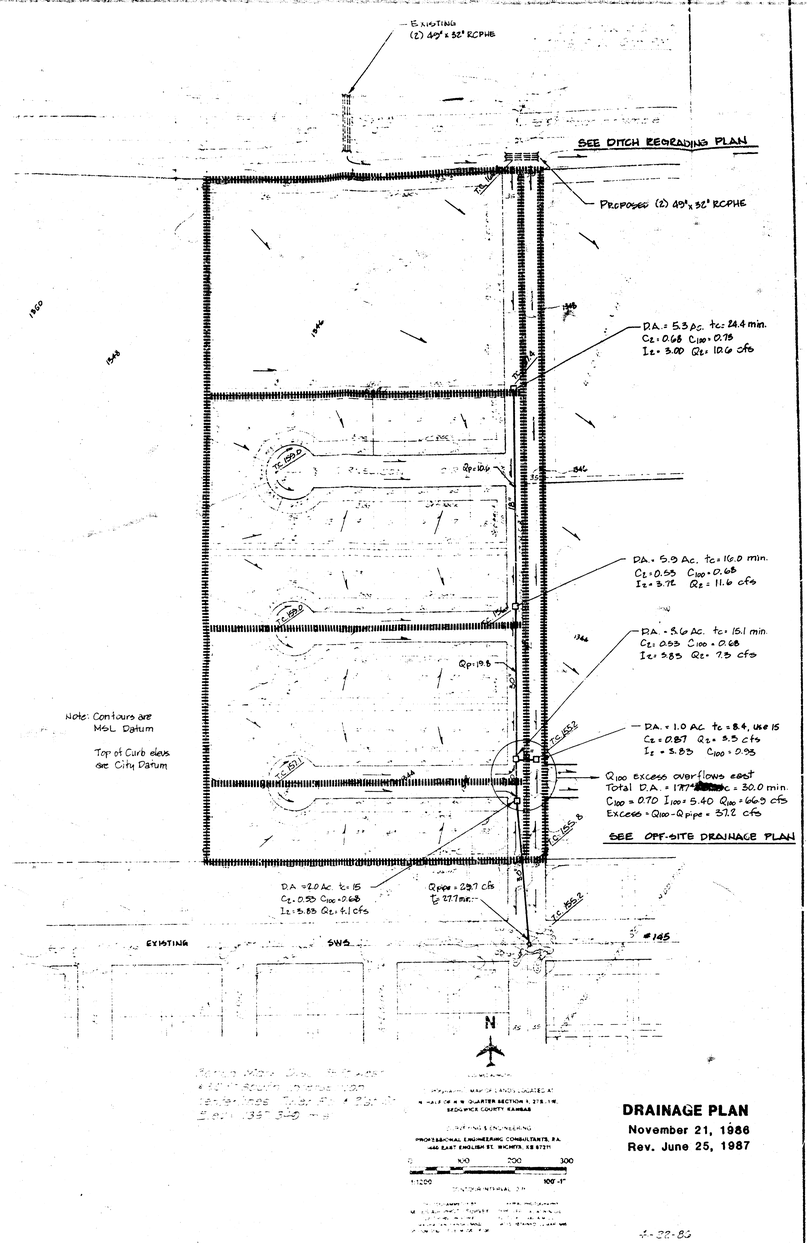
WESTWIND 2ND ADDITION

DRAINAGE PLAN

PART OF THE NW¼ OF SEC 9 T 27 S
R-1-W SEDGWICK COUNTY KANSAS

WESTWIND ASSOCIATES II



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

4-28-86

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
316 262-7271 • 330 LAURA • WICHITA KANSAS 67211

28 MAY 86

DRAINAGE PLAN

FOR

WESTWIND 2nd ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
316/262-7271 • 315 ELLIS • WICHITA, KANSAS 67211

June 1987

JUN 24 1987
DPW - SW DIVISION

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-yr.)

III. Diversion of excess runoff (100-yr.) to the east.

THOMAS CHARLES BUSSER
LICENSED
9021
KANSAS
PROFESSIONAL ENGINEER

1

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 103 cfs (Q100). 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 (SWS 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) 49" x 32" Reinforced Concrete Pipes (H.E.). 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 flows 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 two driveways downstream 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).

2

WESTWIND 2ND ADDITION
Determination of Runoff — TCR 6-24-87
from area N. of 21st Street

Undeveloped Condition
D.A. = 68 Ac. — Soil Group B, 50% pasture, 50% grass waterway
use Rational Method
C_5 = 0.22 C_{100} = 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 ÷ 0.65 ÷ 60 = 59.0 t_c = 59 mins.
I_5 = 2.18"/hr I_{100} = 3.77"/hr (Attach A)
Q_5 = 32.6 cfs Q_{100} = 102.5 cfs (use 103 cfs)

Developed Condition

	Church Sites	Golf Course	Commercial Sites
	D.A. = 28.2 Ac.		
Area =	22.0 Ac.	3.0 Ac.	5.2 Ac.
Impervious =	20%	0%	70%
C_5 =	25% x 0.36 = 0.172 80% x 0.22 = 0.176 0.35		
C_{100} =	20% x 0.50 = 0.150 80% x 0.61 = 0.488 0.64		

{ Developed conditions per PEC development plan for Reflection Ridge 6-10-87 }

t_c: L = 660', V = 0.44 fps t_c = 25 min.
I_5 = 2.57 I_{100} = 5.90 I_5 = 3.57 I_{100} = 5.90 I_5 = 6.52 I_{100} = 7.77
Q_5 = 25.0 cfs Q_5 = 2.4 cfs Q_5 = 14.2 cfs
Q_{100} = 60.2 cfs Q_{100} = 7.3 cfs Q_{100} = 31.2 cfs
Total Q_5 = 43.6 cfs Total Q_{100} = 98.7 (use 99 cfs)

3

WESTWIND 2ND ADDITION — TCR 6-24-87
Ditch flow east (S. side 21st St.)

(2) 49"x32" RCP-HE x 102' long incl. end sections (existing).
Determine discharge using FHWA HEC. NO.5.
(FHWA Nomo 49"x32" = 50"x31")
WSEL = 159.40 DSPL = 159.26 Elev. E & 21st = 162.71
Max. HW = 162.71 - 159.40 = 3.31' Slope = 0.0016
~~Inlet control~~: HW/D = 3.31 ÷ 2.67 = 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 N. ditch = elev. 162.0 ±. When ponding reaches that elev., it begins to flow east ∴ excess flow drains east.

Recommend installing (2) 49" x 32" RCPHE ± street and driveway locations along south ditch of 21st St. Maintain HW depth of 3.6' @ all inlet ponds.

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 — 6-24-87 TCR
Ditch Sta. 0+00 to 3+00 : S = 0.0043 $S^{1/2}$ = 0.066
try y_2 = 2.0' A = 32.00 ft² wp = 24.49' r = 1.307 $r^{2/3}$ = 1.191 (n = 0.030)
$V = \frac{1.486}{0.030}(1.191)(0.066) = 3.91$ fps $Q = 3.91 \times 32.00 = 125$ cfs > 76

Minimum elev. 161.1 along R/W for rest of 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 $S^{1/2}$ = 0.045
try y_2 = 2.2' A = 33.60 ft² wp = 26.18' r = 1.283 $r^{2/3}$ = 1.183
$V = \frac{1.486}{0.030}(1.183)(0.045) = 2.64$ fps $Q = 2.64 \times 33.60 = 88.6$ cfs > 76 cfs

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

Ditch Sta. 7+00 to SWS inlet @ 23+90 ± :

Slopes 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 approve 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 Westlawn 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 drainage area are Hydrologic Group B, per Sedgwick county Soil Survey. A minimum of time of concentrations of 15 minutes was used for inlets.

The excess capacity in the existing storm water sewer has been determined to be 45 cfs at the point of inflow from this system, at a flow time of approximately 35 minutes in the pipe system (refer to analysis of SWS 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 (Q5) per the Drainage Plan. The Q100 excess of 37.2 cfs (66.9-29.7) will overflow at Westlawn Avenue to the east, as described in Part III.

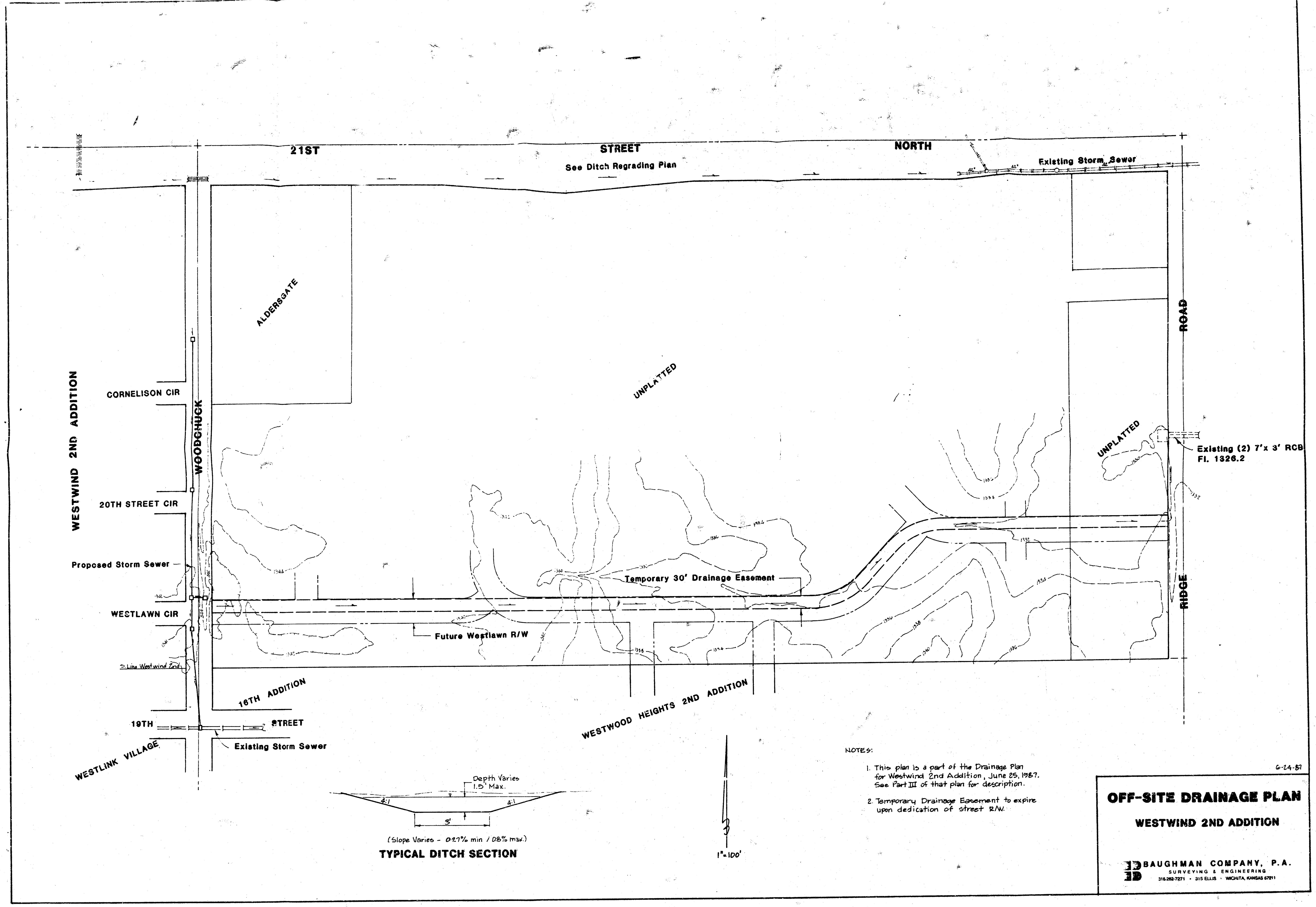
III. DIVERSION OF EXCESS RUNOFF

Runoff in excess of the capacity of the storm sewer will overflow at the intersection of Woodchuck and Westlawn and drain to the east (see plan). This flow will be carried by open ditch through a temporary drainage easement to two existing 7' x 3' RCB'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 areas.

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 N½ of the NE¼ 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 N½ of the NE¼ of Sec. 9; thence east parallel with the south line of said N½ of the NE¼ of Sec. 9, 1660.0 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 northeasterly along the tangent to said curve, 112.0 feet to the 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; 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.



BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
316/262-7271 • 330 LAURA • WICHITA, KANSAS 67211

CONFIRMATION MEMO

PROJECT West Wind Addition
DATE November 21, 1986
JOB NO.
COPIES TO:
TO Vicky Huang
FROM Tom Ruggles
REFERENCE Plat

Enclosed is the final drainage plan for the above plat. Attached are drainage calculations (3 pages) ditch plan and profile, and an analysis of Storm Sewer 145 checking available capacity (1 print, 3 pages, and computer print-out).

The final plat is being submitted today to MAPD.

PAGE __ OF __

Culvert / Ditch Flow
21st & Woodchuck
By TCR Date 11-20-86 Page 1 Of 2 **MILLCON CORPORATION**

2 - 49"x32" RCPHE Across 21st St. L=102'
(Using HEC. No.5, FHWA)
USFL = 159.40 DSFL = 159.26 S = 0.0014
ELEV. ℄ 21st ST. = 162.71
MAX HW = 162.71 - 159.40 = 3.31'
~~w/ Inlet control~~: HW/D = 3.31 ÷ 2.67' = 1.24 (Chart 3)
Q = 60 cfs / pipe
w/ outlet control (Chart 10) Ke = .05 H = 3.31 - 2.67 = 0.64
Q = 38 cfs/pipe x 2 = 76 cfs
* Note: When HW elev. exceeds 162.71, water will flow east in n. ditch
Total Q through pipes = 76 cfs

D.A. n. of 21st flowing to culverts above = 68 ac.
L = 2300' S = 1366 - 1346 = 0.87% ½ distance pasture, ½ grass waterway
Avg. velocity = (1.05 + 0.26)/2 = 0.65 fps
"C" for soil group B/C, pasture condition, 100 yr. freq. = 0.40
Tc = 2300' ÷ 0.65 cfs = 59 min I100 = 3.77 "/hr.
Q100 = 0.40 (3.77)(68) = 103 cfs * See note above
(try Q50) C50 = 0.35 I50 = 3.41 Q50 = 0.35 (3.41)(68) = 81.
(try Q10) C10 = 0.3 I10 = 2.56 Q10 = 0.3(2.56)(68) = 52
∴ pipes are sized for approx. Q50.

Check ditch capacity - new section.
min. slope = 0.12% n = 0.030
V = 1.486 (1.5)(0.035) / 0.030 = 2.64 fps
A = 69 sf, WP = 36.7, R = 1.88, R⅔ = 1.52
Qditch = 2.64 x 69 = 182 cfs

Check Ditch Inlet capacity (sta. 23+82)
42" RCP, FL = 137.02 top elev. 142.18 HW = 5.16' w/ inlet control
HW/D = 5.16 ÷ 3.5 = 1.47 (ke = 0.2) Q = 90 cfs (Chart 2)

By Date Page 2 Of **MILLCON CORPORATION**

Check driveway culvert / overtop capacity (sta. 9+74)
29"x18" CMPA w/es. x 48' long
USFL = 155.15 DSFL = 154.79 S = 0.0074 Top elev. 157.3
w/ inlet control HW = 157.3 - 155.15 = 2.15 HW/D = 1.43 Q = 15 cfs
w/ outlet control Q = 15 cfs
∴ Flow will overtop driveway at most frequent storms.

The same culvert size exists @ sta. 14+57
(See profile)
The ditch is plugged by a driveway entrance @ sta. 3+37
∴ No flow is being carried to the east under present conditions.

Recommendation: Install 2-58"x31" RCPHE under Woodchuck in south ditch of 21st (location of existing driveway w/ no culvert).

Replace existing driveway culverts @ sta. 9+74 and 14+57. Regrade ditch to lower flowline from 0-50 to 15+00, to pass Q10 @ drives.
(Q10 = 52 cfs)
Sta. 14+57: HW = 150.4 - 146.7 = 3.7' [L = 30']
try 2 - 29"x18" CMPA HW = 3.7' HW/D = 2.46 22 cfs x 2 = 44 cfs } inlet control Chart 6
try 2 - 36"x22" CMPA HW = 3.7' HW/D = 2.02 32 cfs x 2 = 64 cfs
check outlet control H = (150.4 - 147.8) = 2.6' Q = 29 cfs x 2 = 58 OK } outlet control Chart 10-12
try 2 - 30"x19" RCPHE H = 2.6' Q = 29 cfs x 2 = 58 OK
Use [2 - 36"x22" CMPA] or [2 - 30"x19" RCPHE] 30' long

Sta. 9+74: HW = 157.1 - 154.5 = 2.6' [L = 48']
try 2 - 36"x22" CMPA HW = 2.6' HW/D = 1.42 Q = 24 cfs x 2 = 48 cfs no
try 2 - 30"x19" ... Q = 15.5 x 2 = 31 cfs no
check outlet control H = 0.77' Q = 15.5' x 2 = 31 cfs
try 2 - 30" ... dc = 1.57 DSFL = 156.15 tw = 155.72 H = 1.4' Q = 15.5 x 2 = 31 no
try 2 - 30" ... dc = 1.57 DSFL = 157 ... H = 1.7' Q = 24 x 2 = 48 no

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100-yr Analysis SWS 145 (II)
By Date 11-19-86 Page 3 Of 3 **MILLCON CORPORATION**

Line identification same as 2-yr analysis (computer output attached)

Values for Q100 based on current C of (1) drainage design criteria.
See plan worksheet for Q calculations. Storage in sumps ignored.

Note: Orig. design of system provided for Q100 of 154.21 cfs in pipe from sump @ Rock & 19th. Current value calculated for Q100 at same point = 136 cfs

Orig. design of system provided for Q100 of 293.04 cfs in pipe from sump @ Woodchuck & 19th. Current value calculated for Q100 at same point = 218 cfs

Line	Q cfs	Size	Slope Hyd. Gr.	Length	V_1	V_2	FL_1	FL_2	HG_1	hf	HG_2	T.curb
1	—	8'x4.5	—	—	—	—	—	—	—	—	136.57	
2	494	↓	.00886	604.61	13.7	13.7	128.64	130.95	136.57	5.36	141.93	
3	494		.00886	213.90	13.7	13.7	130.95	131.80	141.93	1.90	143.83	
4	494		.00886	437.19	13.7	13.7	131.80	133.80	143.83	3.87	147.70	148.70
5	494		.00886	272.50	13.7	13.7	133.80	134.86	147.70	2.41	150.11	
6	410		.00611	100.53	11.6	11.4	134.86	135.25	150.11	0.61	150.72	
7	409		.00607	262.20	11.4	11.4	135.26	136.45	150.72	1.59	152.31	
8	339	↓	.00417	234.31	9.4	9.4	136.45	138.50	152.31	0.98	153.29	
9	234	72"	.00305	549.94	8.3	8.3	138.52	140.93	153.29	1.68	154.97	
10	234		.00305	282.00	8.3	8.3	140.96	142.21	154.97	0.86	155.83	
11	222		.00275	276.64	7.9	7.9	142.23	143.45	155.83	0.76	156.59	
12	218		.00265	137.19	7.7	7.7	143.47	144.07	156.59	0.36	156.95	155.20
13	218	↓	.00265	397.67	7.7	7.7	144.10	144.96	156.95	1.05	158.00	
14	137	60"	.00277	320.98	7.0	7.0	145.09	145.73	158.00	0.89	158.89	
15	137		.00277	269.50	7.0	7.0	148.00	149.84	158.89	0.75	159.64	
16	137		.00277	270.00	7.0	7.0	149.87	151.22	159.64	0.75	160.39	
17	137	↓	.00277	580.63	7.0	7.0	151.24	153.78	160.39	1.61	161.00	

WILLIAM L. KORBER, L.S.
JOHN E. LUNDBLADE, L.S.
N. BRENT WOOTEN, P.E.

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
316/262-7271 • 315 ELLIS • WICHITA, KANSAS 67211

June 25, 1987

Vicki Huang, P.E.
City Engineer's Office
455 North Main
Wichita, KS 67202

Dear Vicki,

Transmitted herewith is a revised Drainage Plan for Westwind 2nd Addition. The plan consists of the written report and (3) additional sheets: Drainage Plan, Off-site Drainage Plan, and Ditch Regrading Plan/Profile. This plan is a revision of the one submitted in November, 1986.

A copy has also been submitted to Jim Weber at Sedgwick County. Since part of the subject property is in the County, I am unsure of whose approval is required.

Please review the plan and notify us of your recommendations.

Respectfully submitted,

Tom

Thomas C. Ruggles, P.E.

File
TCR/ksb

RECEIVED

Westwind Add. - 21st St. Ditch (Revision)
By TCR Date 11-25-86 Page 1 Of 1 **MILLCON CORPORATION**

Minimum ditch section (Sta. 8+00)
Slope = 0.00125 A = 18.1 SF WP = 18.2' R = 0.995 R⅔ = 0.997 n = 0.030
V = 1.486 (R⅔)(S½) = 1.486 (0.997)(.035) / .030 = 1.75 fps
V = 1.75 fps Q = 31.6 cfs no

Lower ditch @ 8+00 to elev. 154.78 y = 2.5' S = 0.00532
S½ = 0.0730 A = 43.75 WP = 25.8' R = 1.695 R⅔ = 1.422
V = 1.486 (1.422)(0.073) / 0.030 = 5.14 fps Q = 5.14(43.8) = 225 cfs >> Q50 ok
Actual depth ≈ 1.5' @ 52 cfs

Recheck culverts @ sta. 9+74 HW = 157.1 - 153.3 = 3.8 ... outlet control
Use try [2 - 30"x19" RCPHE] dc = 1.57 DSFL = 152.59 tw = 154.16 H = 157.1 - 154.16 = 2.9'
Q = 32 cfs x 2 = 64 cfs > 52 cfs (Q10) < 76 cfs (Q50)
Same try 3 - 36"x22" CMPA dc = 1.33 DSFL = 152.59 tw = 153.92 H = 157.1 - 153.9 = 3.2'
?? Q = 34 cfs x 3 = 102 cfs > Q50
or try [2 - 36"x22" CMPA] dc = 1.63 DSFL = 152.59 tw = 154.22 H = 157.1 - 154.2 = 2.9'
Q = 33 cfs x 2 = 66 cfs
?? try 3 - 30"x19" RCPHE dc = 1.50 DSFL = 152.59 tw = 154.1 H = 157.1 - 154.1 = 3.0'
Q = 32 cfs x 3 = 96 cfs > Q50
~~try 3 - 23"x14" RCPHE~~ dc = 1.50 DSFL = 152.59 tw = 154.1 H = 157.1 - 154.1 = 3.0'
Q = 17 cfs x 3 = 51 cfs < Q10 No

Recheck culverts @ sta. 14+57 outlet control
try 2 - 30"x19" RCPHE DSFL = 146.1 dc = 1.62' tw = 147.8 H = 149.6 - 147.78 = 1.8'
Q = 26 cfs x 2 = 52 < 52 cfs (Q10)
Use [2 - 30"x19" RCPHE] ≥ 76 cfs (Q50)

Westwind Add. - SWS Analysis
By TCR Date 11-18-86 Page 1 Of 3 **MILLCON CORPORATION**

Analysis of SWS 145 using current design criteria
(Original design was based on old rainfall frequency-duration-intensity curves)

Per current design standards, initial design storm frequency is 2-yr (use Q2). Runoff coefficients (for Rational Method) are 0.41 for 2-yr and 0.61 for 100-yr, based on ⅓ acre residential lot size, 50% Soil Group B and 50% Soil Group C.

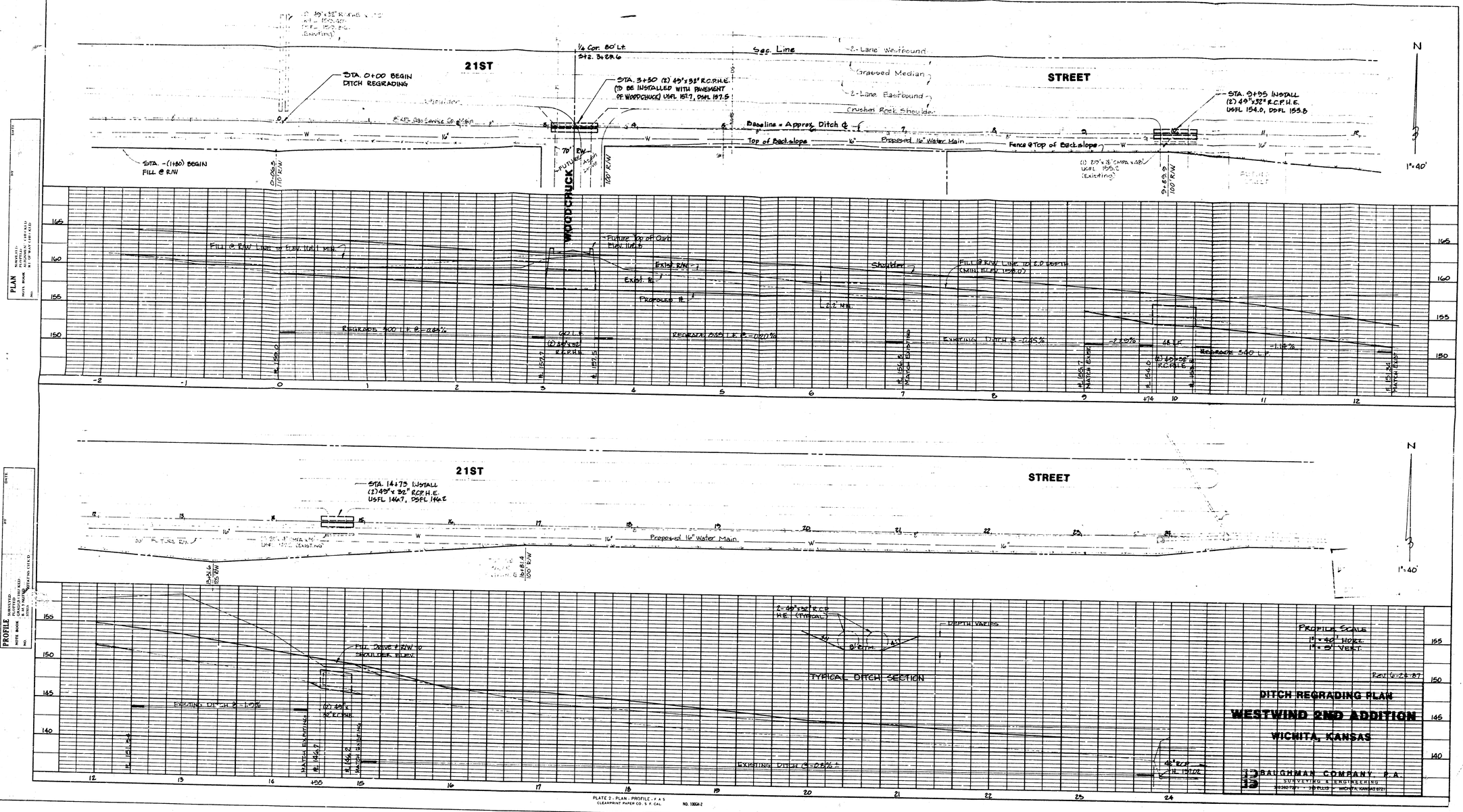
New I and Q values are based on Rainfall Intensity Table for Sedgwick County (April 15, 1986), Drainage Criteria Manual, Att. A.

Times of concentration and drainage areas are per original design by C of W (Kerby).

Analysis used Civilsoft "Storm" program on IBM-PC.
Q values used are for 2-yr frequency (Q2) except that Q100 was routed through street and storm sewer.

Analysis I: existing system under existing conditions (Q2).
Analysis II: existing system with effect of Q100

These analyses considered the flow in laterals for the first section only above their junctions with the main line (points 7, 3, and ...) in the original design, since Q (Max Q) at those points was added to mainline flow as adjusted Q (Adj Q). Laterals were not analyzed



PROFILE
SCALED
PLOTTED
NOTE BOOK
NO.

PLAN
SCALED:
PLOTTED:
NOTE BOOK
NO.

Profile Scale
1" = 40' Horz.
1" = 5' Vert.

Rev. 6-25-87

DITCH REGRADING PLAN
WESTWIND 2ND ADDITION
WICHITA, KANSAS

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
3330 N. 143rd E. - 100 PLUS - WICHITA, KANSAS 67226

PLATE 2 - PLAN, PROFILE, & A S
CLEARPRINT PAPER CO. S. F. CAL. NO. 1000H-2

Drainage Sub Areas - See plan
Westwind
By Date Sheet 2 of 3

MILLCON CORPORATION

Part of Shrunk parcel to drain to 21st St. 150' x 560' = 2.0 Ac.
$C_a = 0.62$ $C_{10} = 5.20$ $C_{100} = 6.75$ $Q_{100} = 10.76$ $T_c = 15$ min.
$I_{10} = 3.83$ $I_{100} = 7.37$
Sm part of shrunk parcel to 21st = 2.9 Ac. $Q_{10} = 7.6$ $C_{100} = 15.6$
(Same runoff factors as above)

Str. Fr. N. 2 places
Sec. Area (1,172 Ac. Lots) $C_{10} = 0.57$ $C_{100} = 0.68$ Lot 3.6 Ac.
Overland flow into entrance @ 0.2 fps = 15 min
400' gutter @ 1.05 fps = 7 min
$T_c = 22.1$
$I_{10} = 3.37$ in/hr. $I_{100} = 6.25$ in/hr.
$Q_{10} = 0.57(2.72)(3.6) + 0.5$ cfs $Q_{100} = 0.68(6.25)(3.6) = 15.3$ cfs

Sub Area - Factors same except Drainage Area = 3.7 Ac.
$Q_{10} = 6.6$ cfs $Q_{100} = 15.7$ cfs

Installed 82" cfs Woodchuck drains east (per MCSS)

Sump @ Woodchuck & West Lawn Circle
Dra. Area: 13.8 Ac. Cw = 0.69 $T_c = 22.1 + 15$ min to sump = 24.0 min.

(To in main line @ Woodchuck = 37.0 min)
Hydraulic Gradient from sump @ 19th & Woodchuck = .003 (0.3%)
Use 82" RCP (@ 0.013, Q = 52.1 cfs)

Time of concentration in Sub's 145 @ Woodchuck & 19th = 35.0 min.
during peak Q in 82" by proportion of T_c,
$Q = \frac{20}{35} = 39.2$ cfs

Inlet in Intersection - II
Sumps 19th & West Lawn & Woodchuck
By Date 11-10-86 Page 2 of 3

MILLCON CORPORATION

Ignoring storage in sumps,
Pipe $Q = Q_{100}$ = overflow in street

(Westport / NW Parkway)

Street section: (70' E/W)

Inlet Width for 66" Gtr.
$A = 26.20$ $W = 67.4$ $E = 0.030$ $E^{2/3} = 0.44$
$V = \frac{1.49}{0.015}(0.44)S^{\frac{1}{2}}$ $V = \frac{Q}{A} = \frac{Q}{26.2}$
$Q = 43.7\ TS$ $Q = 1101.2\ TS$

Sumps (2 ea.)
for $S = 0.0064$, $Q = 22.0$
for $S = 0.0107$, $Q = 114.1$
for $S = 0.0070$, $Q = 97.28$
for $S = 0.0122$, $Q = 120.8$
Sump @ Woodchuck:
for $S = 0.0077$, $Q = 94.6$
.0070 $Q = 0.62$
0.0110 56.3
0.0111 56.6
0.0115 118.1
0.0116 47.6
0.0122 62.3

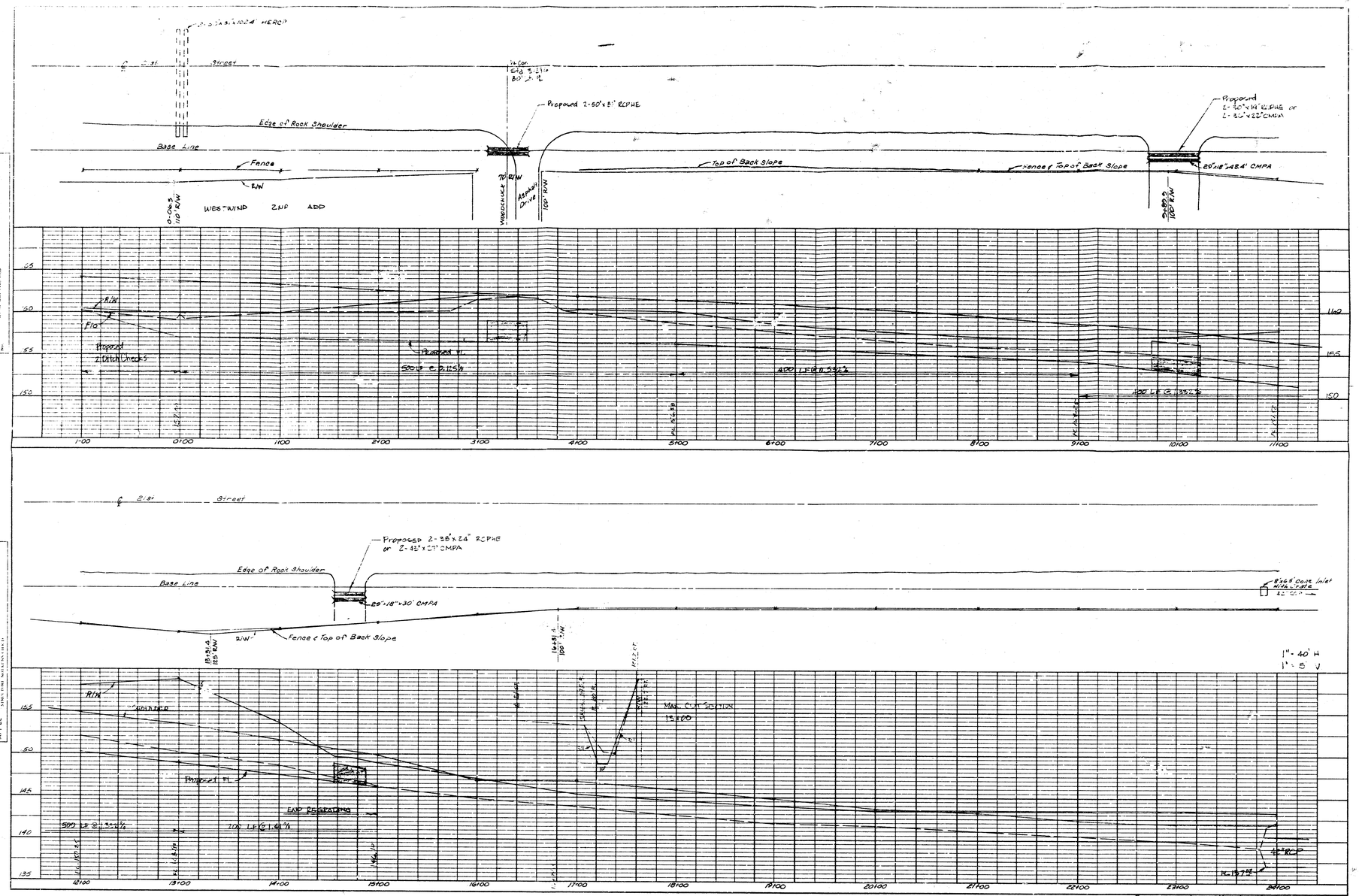
(Cramer)
$A = 6.5$ $WP = 61.2'$ $R = 0.030$ $R^{2/3} = 0.45$
$Q = \frac{1.49}{0.015}(6.45)(18)^{\frac{1}{2}}$
$Q = 827.6\ TS$

(I)

Project : STORM WATER SEWER NO. 145 (Westwind 2nd Add.)

INPUT DATA LISTING

CO	L2	MAX Q	ADJ Q	LENGTH	FL 1	FL 2	CTL/TW	D	W	S	KJ	KE	KM	LC	L1	L3	L4	A1	A3	A4	J	N
							136.57															
8	1																					
2	2	173.0	173.0	604.61	128.64	130.95		.00	54.	96.	3	.00	.00	.00	1	3	0	0	16.	0.	0.	4.00	.013
2	3	171.0	171.0	213.90	130.95	131.80		.00	54.	96.	3	.00	.00	.00	0	4	23	0	8.	20.	0.	4.00	.013
2	4	163.0	163.0	437.19	131.80	133.80		.00	54.	96.	3	.00	.00	.00	0	5	24	0	90.	90.	0.	4.00	.013
2	5	157.0	157.0	272.50	133.80	134.86		.00	54.	96.	3	.00	.00	.00	0	6	0	0	21.	0.	0.	4.00	.013
2	6	151.0	151.0	100.53	134.86	135.25		.00	54.	96.	3	.00	.00	.00	0	7	0	0	23.	0.	0.	4.00	.013
2	7	151.0	151.0	262.20	135.25	136.45		.00	54.	96.	3	.00	.00	.00	0	8	0	0	11.	0.	0.	4.00	.013
2	8	147.0	147.0	234.31	136.45	138.50		.00	54.	96.	3	.00	.00	.00	0	9	25	0	43.	90.	0.	4.00	.013
2	9	81.3	81.3	549.94	138.52	140.94		.00	72.	0.	3	.00	.00	.00	0	10	0	0	2.	0.	0.	4.00	.013
2	10	76.1	76.1	283.00	140.96	142.21		.00	72.	0.	3	.00	.00	.00	0	11	0	0	0.	0.	0.	4.00	.013
2	11	72.2	72.2	276.64	142.23	143.45		.00	72.	0.	3	.00	.00	.00	0	12	0	0	30.	0.	0.	4.00	.013
2	12	72.2	72.2	137.19	143.47	144.07		.00	72.	0.	3	.00	.00	.00	0	13	0	0	21.	0.	0.	4.00	.013
2	13	71.5	71.5	397.67	144.10	144.98		.00	72.	0.	3	.00	.00	.00	0	14	0	0	0.	0.	0.	4.00	.013
2	14	58.1	58.1	320.98	145.09	145.73		.00	60.	0.	3	.00	.00	.00	0	15	0	0	0.	0.	0.	4.00	.013
2	15	54.4	54.4	269.50	148.00	149.84		.00	60.	0.	3	.00	.00	.00	0	16	0	0	0.	0.	0.	4.00	.013
2	16	51.2	51.2	270.00	149.87	151.22		.00	60.	0.	3	.00	.00	.00	0	17	0	0	0.	0.	0.	4.00	.013
2	17	48.9	48.9	508.63	151.24	153.78		.00	60.	0.	3	.00	.00	.00	0	18	0	0	0.	0.	0.	4.00	.013
2	18	42.6	42.6	36.84	155.28	155.49		.00	42.	0.	3	.00	.00	.00	0	19	0	0	26.	0.	0.	4.00	.013
2	19	22.3	22.3	163.00	156.00	157.14		.00	36.	0.	3	.00	.00	.00	0	20	0	0	0.	0.	0.	4.00	.013
2	20	22.3	22.3	274.00	157.71	158.75		.00	30.	0.	3	.00	.00	.00	0	21	0	0	13.	0.	0.	4.00	.013
2	21	13.1	13.1	234.40	159.25	161.23		.00	24.	0.	3	.00	.00	.00	0	22	0	0	0.	0.	0.	4.00	.013
2	22	13.1	13.1	68.50	161.48	162.67		.00	21.	0.	1	.00	.00	.00	0	0	0	0	0.	0.	0.	4.00	.013



PRELIMINARY DITCH PROFILES Rev. 11-25-86

21st St Ditch - Westwind Addition 11-21-86

1Project : STORM WATER SEWER NO. 145 Date: 11/18/1986 Time: 9:35: 4

STORM DRAIN ANALYSIS RESULTS

Line No	Q (cfs)	D (in)	W (in)	Dn (ft)	Dc (ft)	Flow Type	Sf-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)	TW Calc	TW 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	137.58	137.91	5.78	4.11	.00	.00	
	X = 353.57			X(N) =	.00													
5	157.0	54	96	2.18	2.28	Seal	.00090	4.4	5.0	133.80	134.86	138.64	138.75	4.84	3.89	.00	.00	
	X = 112.85			X(N) =	.00													
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	HJ
	X = .00			X(N) =	.00	X(J) =	214.91	F(J) =	61.02	D(BJ) =	1.90	D(AJ) =	2.59					
8	147.0	54	96	1.58	2.19	Part	.00078	11.5	8.4	136.45	138.50	138.05	140.69	1.60	2.19	.00	.00	
9	81.3	72	0	2.21	2.41	Part	.00037	6.3	7.6	138.52	140.94	142.35	143.35	3.83	2.41	.00	.00	HJ
	X = .00			X(N) =	409.98	X(J) =	239.52	F(J) =	30.43	D(BJ) =	2.21	D(AJ) =	2.62					
10	76.1	72	0	2.13	2.33	Part	.00032	5.6	7.5	140.96	142.21	143.85	144.54	2.89	2.33	.00	.00	HJ
	X = .00			X(N) =	190.01	X(J) =	56.85	F(J) =	27.97	D(BJ) =	2.13	D(AJ) =	2.54					
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	HJ
	X = .00			X(N) =	171.16	X(J) =	40.70	F(J) =	26.15	D(BJ) =	2.07	D(AJ) =	2.47					
12	72.2	72	0	2.08	2.27	Part	.00029	5.8	7.4	143.47	144.07	146.19	146.36	2.72	2.27	.00	.00	HJ
	X = .00			X(N) =	.00	X(J) =	40.09	F(J) =	26.14	D(BJ) =	2.08	D(AJ) =	2.47					
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) =	368.53													
14	58.1	60	0	2.49	2.13	Part	.00050	5.0	15.9	145.09	145.73	147.73	146.93	2.84	1.20	.00	.00	HJ
	X = .00			X(N) =	.00	X(J) =	187.59	F(J) =	22.01	D(BJ) =	1.67	D(AJ) =	2.67					
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) =	86.34													
16	51.2	60	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	HJ
	X = .00			X(N) =	174.24	X(J) =	29.48	F(J) =	12.54	D(BJ) =	1.80	D(AJ) =	2.01					
17	51.2	60	0	1.80	2.01	Part	.00039	5.4	7.0	151.22	152.62	153.23	153.63	2.01	2.01	.00	.00	
	X = .00			X(N) =	174.24													
18	51.2	60	0	1.80	2.01	Part	.00039	5.4	7.0	152.62	154.02	153.63	154.03	2.01	2.01	.00	.00	
	X = .00			X(N) =	174.24													
19	51.2	60	0	1.80	2.01	Part	.00039	5.4	7.0	154.02	155.42	154.03	154.43	2.01	2.01	.00	.00	
	X = .00			X(N) =	174.24													
20	51.2	60	0	1.80	2.01	Part	.00039	5.4	7.0	155.42	156.82	154.43	154.83	2.01	2.01	.00	.00	
	X = .00			X(N) =	174.24													
21	13.1	24	0	1.15	1.30	Seal	.02329	4.2	10.4	139.25	181.22	151.65	142.08	2.00	.35	.00	.00	HJ
	X = .86			X(N) =	130.93	X(J) =	70.55	F(J) =	3.77	D(BJ) =	1.15	D(AJ) =	1.46					
22	13.1	21	0	1.00	1.35	Part	.00684	8.9	6.6	161.48	162.67	162.51	164.02	1.03	1.35	164.69	.00	
3	Hydraulic grade line control = 137.25																	
23	15.3	27	0	1.12	1.36	Part	.00244	7.4	6.1	143.23	143.50	144.39	144.86	1.16	1.36	145.44	.00	

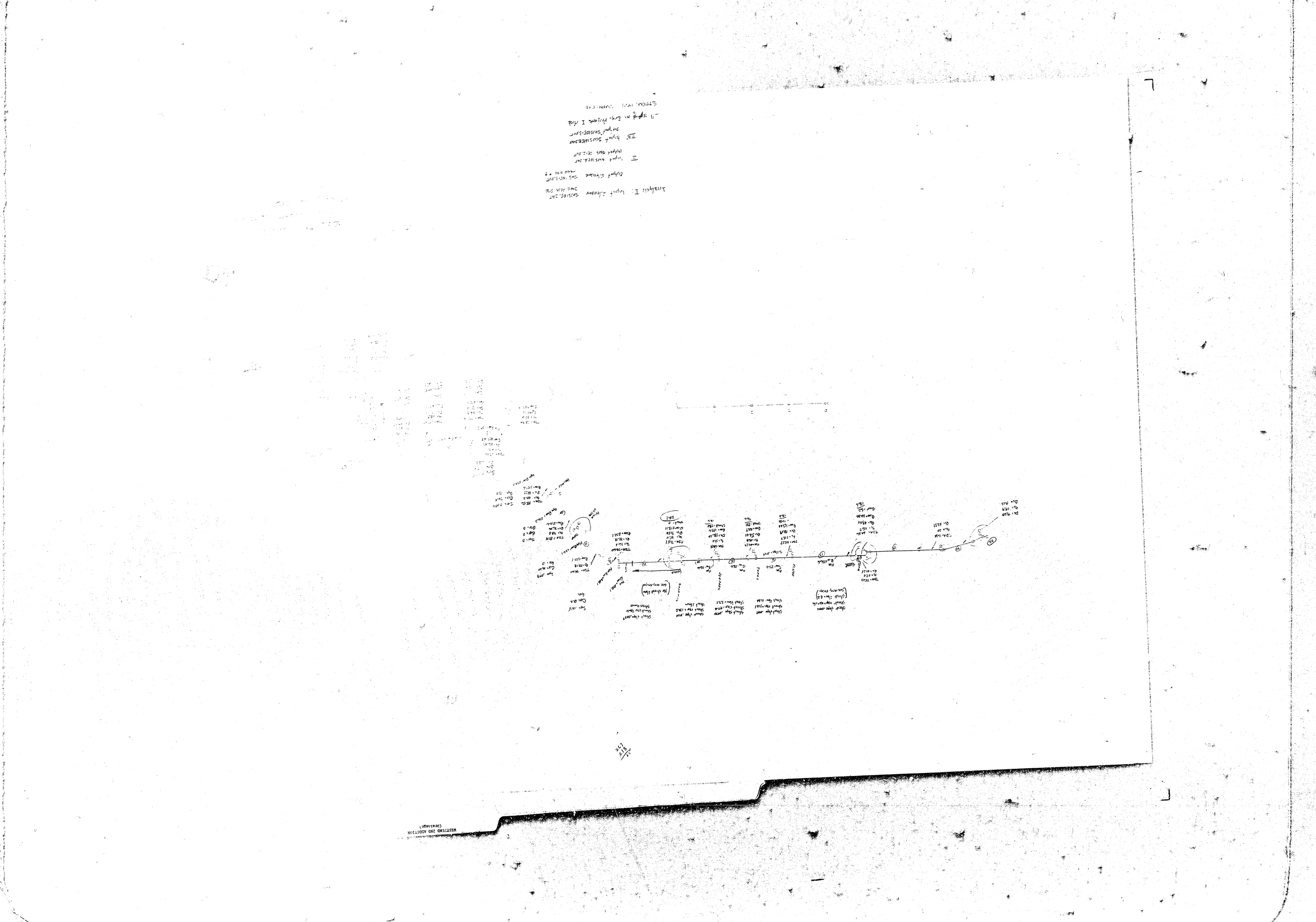
1Project : STORM WATER SEWER NO. 145 Date: 11/18/1986 Time: 9:35: 4

STORM DRAIN ANALYSIS RESULTS (cont.)

Line No	Q (cfs)	D (in)	W (in)	Dn (ft)	Dc (ft)	Flow Type	Sf-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)	TW Calc	TW CK	
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	

1 LIST OF ABBREVIATIONS

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


WESTLAND 2ND ADDITION
(Detached)