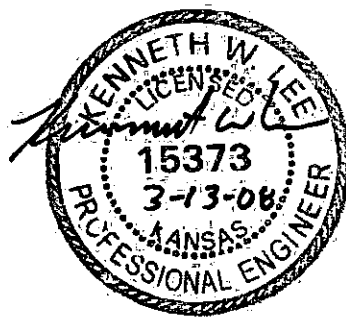


**DRAINAGE REPORT
FOR
SIERRA HILLS 2ND ADDITION
WICHITA, SEDGWICK COUNTY,**

KANSAS

March 13th, 2008



Ruggles & Bohm P.A.

Engineering, Surveying, Land Planning

**SIERRA HILLS 2ND ADDITION
DRAINAGE ANALYSIS
March 13th, 2008**

INTRODUCTION

This report contains supporting documentation and calculations for the proposed Sierra Hills 2nd Addition. The existing site is an L-shaped undeveloped 51.3-acre tract of land located ¼ mile west of 143rd Street East on the north side of Pawnee. The area is currently pasture land and drains generally southeasterly in two drainage basins. The site also has a small portion that drains offsite to the north. The first drainage basin flows to the southeast to a 29"x45" CMP under Pawnee. The CMP drains to an unnamed branch of the Spring Branch of Fourmile Creek. The second basin flows to the southeast corner of the site and thence into the same unnamed tributary. Existing off-site drainage enters the site from Sierra Hills Golf Course in the western basin and at the north of the L from a property owned by USD 259 in the eastern basin.

The unnamed tributary of Spring Branch has an upstream tributary area of approximately 2 square miles with an upstream channel length of approximately 7500 feet. The tributary connects to the Spring Branch approximately one mile downstream. Several exist farm ponds are downstream from the site.

FEMA map 20173C0395E, effective date Feb., 2 2007 shows the proposed project site is located in unshaded Zone X, defined as areas located of the 500 year floodplain. A small portion located at the southeast corner of the site is located in the shaded Zone X, defined as 500-year flood or in the 100-year flood with less than average depth of less than 1 foot. The northeast corners of lots 37 and 38, Block 2 are located in Zone AE and will be placed in a floodplain reserve or drainage easement.

The site will be developed into residential lots with on-site detention provided by the creation of three detention ponds. Site topography is such that most of the site will drain through the detention ponds to limit the opportunities for off-site silt transport. Silt fence with J-hooks and ditch checks will be implemented in areas where the potential for silt transport exists. Ditch checks will be implemented internally to limit silt transport to ponds. A stormwater pollution plan and notice of intent will be filed with KDHE prior to any construction.

HYDROLOGY

Peak flow rates for the tributary areas were determined using HEC-HMS. The times of concentration were calculated using the velocity method and overland flow rates from attachment E of the City of Wichita Drainage Criteria. The parameters and results of the existing and proposed analysis are shown in the tables below. The west offsite area is part of the Sierra Hills Golf course where an 18" pipe has been placed which carries water to another

basin to the west. Therefore the amount of offsite water accepted by the proposed project site is reduced by the capacity of the 18" pipe.

Existing	Area	CN	TC (min.)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
East	43.8 ac.	80	42	34.7	53.1	64.6	84.1	117.8
West	29.0 ac.	80	44	15.2	26.9	34.2	46.6	68.2
North	3.90 ac.	80	15	5.9	8.9	10.7	13.9	19.3
Total Site	76.7 ac.	80	44	51.6	82.6	101.9	134.8	191.6

Proposed	Area	CN	TC (min.)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
East	45.0 ac.	84	42	32.2	47.8	57.4	75.8	111.3
West	30.0 ac.	84	44	12.4	23.4	30.3	42.5	66.2
North	2.15 ac.	84	15	1.5	2.1	2.5	3.2	4.3
Total Site	77.2 ac.	84	44	42.2	64.9	78.9	106.7	157.1

Post-developed flows are lower than pre-developed runoff rates in every storm event. The rational method was used to determine peak flow rates for the basins located within the plat. The attached Drainage Plan shows the on site drainage calculations.

PAWNEE CULVERT

The hydraulic characteristics of the culvert under Pawnee located in the west basin were modeled using HY-8. The rational equation yielded a Q_{100} of 87.0 cfs and a 100-year headwater of Elev. = 1315.98. The culvert will not over top Pawnee because the north ditch has an overtop elevation of 1314.24 and will allow 33 cfs to flow north along the ditch of Pawnee to the unnamed tributary to the Spring Branch of Fourmile Creek. The roadway is approximately 1318 in this area so street overtopping is not an issue. A pipe will be installed underneath the proposed entrance to the subdivision to maintain this existing drainage pattern.

POND ROUTING

Three ponds will provide the detention required for this development. The western drainage basin contains a series of two ponds while the eastern basin is detained by a single pond.

Rainfall Data: The SCS Type II Rainfall Distribution as modeled by the HEC-HMS program is used for analysis, with a total 100 year – 24 hour rainfall event of 7.8 inches (TR-55). This rainfall model is used for all basins.

The schematic hydraulic model indicates the modeling parameters for each of the basins draining to the detention pond area. A summary of the ponds' performance in the various design storms can be found in the tables below.

WEST POND 1

<u>Design Storm</u>	<u>Peak Inflow (cfs)</u>	<u>Peak Outflow (cfs)</u>	<u>Peak Storage (ac-ft.)</u>	<u>Peak Elevation</u>
2-yr	22.5	10.7	1.0	1317.9
5-yr	37.9	22.1	1.5	1318.3
10-yr	47.5	29.4	1.8	1318.6
25-yr	63.8	41.5	2.3	1319.0
100-yr	91.9	63.6	3.1	1319.6

The stage-storage data was calculated by HEC-HMS using the parameters located in the table below.

<u>Stage</u>	<u>Area (ac-ft)</u>
1317.00	1.02
1318.00	1.13
1319.00	1.24
1320.00	1.35
1321.00	1.47

The outlet of this pond shall be controlled by 2 – 36” RCP pipes which will pass under Ironstone Court and keep the pond at a static elevation of 1317.00. Lots 16-25, Block 1 as shown on the preliminary plat shall have a minimum pad elevation of 1321.60.

WEST POND 2

<u>Design Storm</u>	<u>Peak Inflow (cfs)</u>	<u>Peak Outflow (cfs)</u>	<u>Peak Storage (ac-ft.)</u>	<u>Peak Elevation</u>
2-yr	16.4	12.4	0.5	1315.6
5-yr	25.3	23.4	0.8	1316.0
10-yr	33.2	30.3	1.0	1316.2
25-yr	46.5	42.5	1.3	1316.5
100-yr	70.8	66.2	1.8	1317.0

The stage-storage data was calculated by HEC-HMS using the parameters located in the table below.

<u>Stage</u>	<u>Area (ac-ft)</u>
1315.0	0.80
1316.0	0.89
1317.0	0.99
1318.0	1.10

The pond outlet of this pond shall be controlled by a broad crested weir 8’ in length and will set the static elevation of the pond at 1315.00. Lots 29-36, Block 1 as shown on the preliminary plat shall have a minimum pad elevation of 1319.00

EAST POND

<u>Design Storm</u>	<u>Peak Inflow (cfs)</u>	<u>Peak Outflow (cfs)</u>	<u>Peak Storage (ac-ft.)</u>	<u>Peak Elevation</u>
2-yr	28.9	15.5	0.8	1311.5
5-yr	42.0	22.8	1.1	1311.8
10-yr	50.1	27.3	1.4	1311.9
25-yr	63.8	38.4	1.7	1312.2
100-yr	87.1	56.9	2.2	1312.5

The stage-storage data was calculated by HEC-HMS using the parameters located in the table below.

<u>Stage</u>	<u>Area (ac-ft)</u>
1311.0	1.40
1312.0	1.52
1313.0	1.65
1314.0	1.79

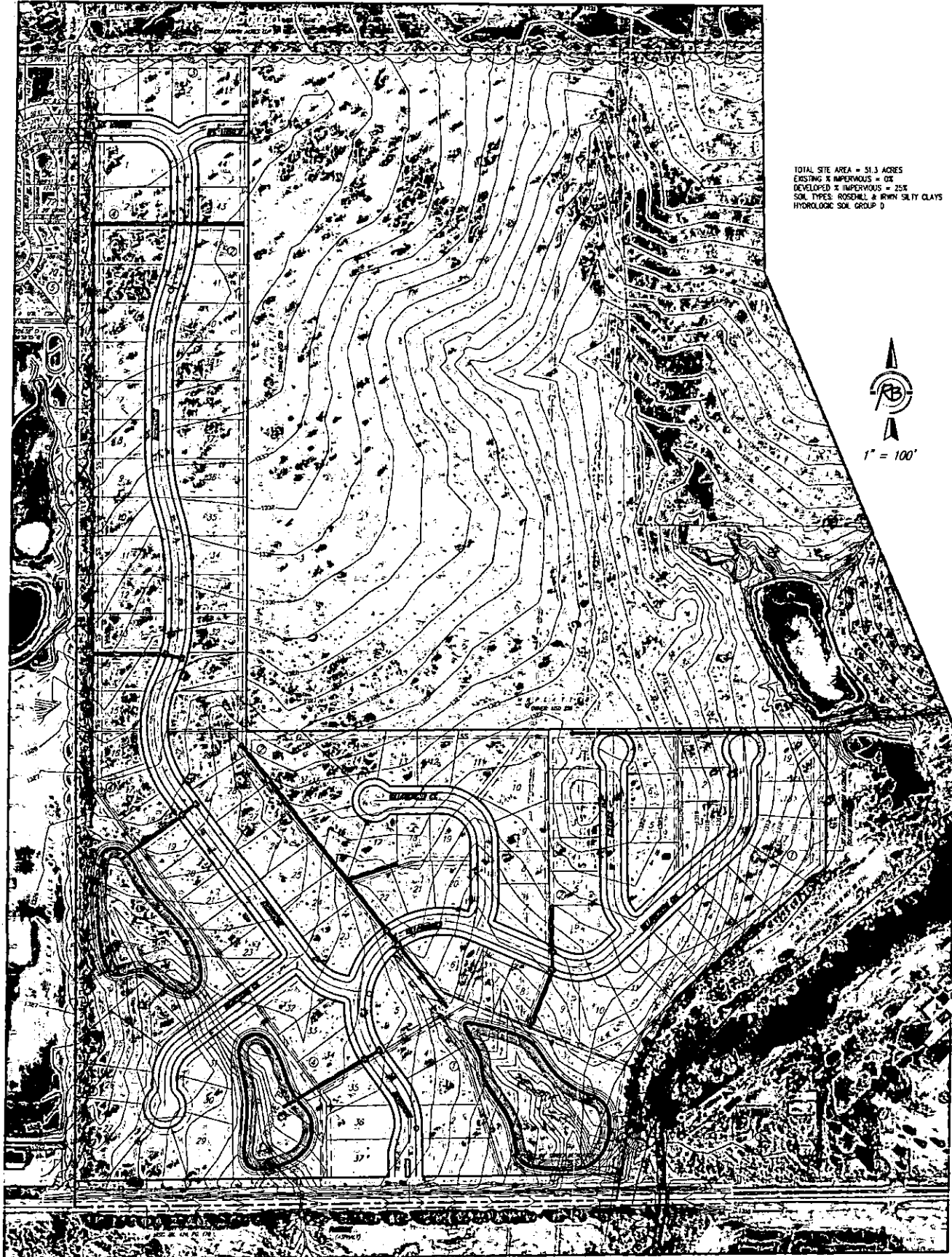
The pond outlet of this pond shall be controlled by a broad crested weir 10' in length and will set the static elevation of the pond at 1311.00. Lots 46-52 and 54-58, Block 2 as shown on the preliminary plat shall have a minimum pad elevation of 1314.50.

CONCLUSIONS

The proposed ponds will provide adequate detention to reduce post-developed flow rates below pre-developed levels. It will be important to include a pipe under the subdivision's entrance onto Pawnee to allow the existing bypass to the east to function properly. The proposed lots are laid out to stay out of the FEMA shaded floodplain and there are no plans to place fill in a floodplain.

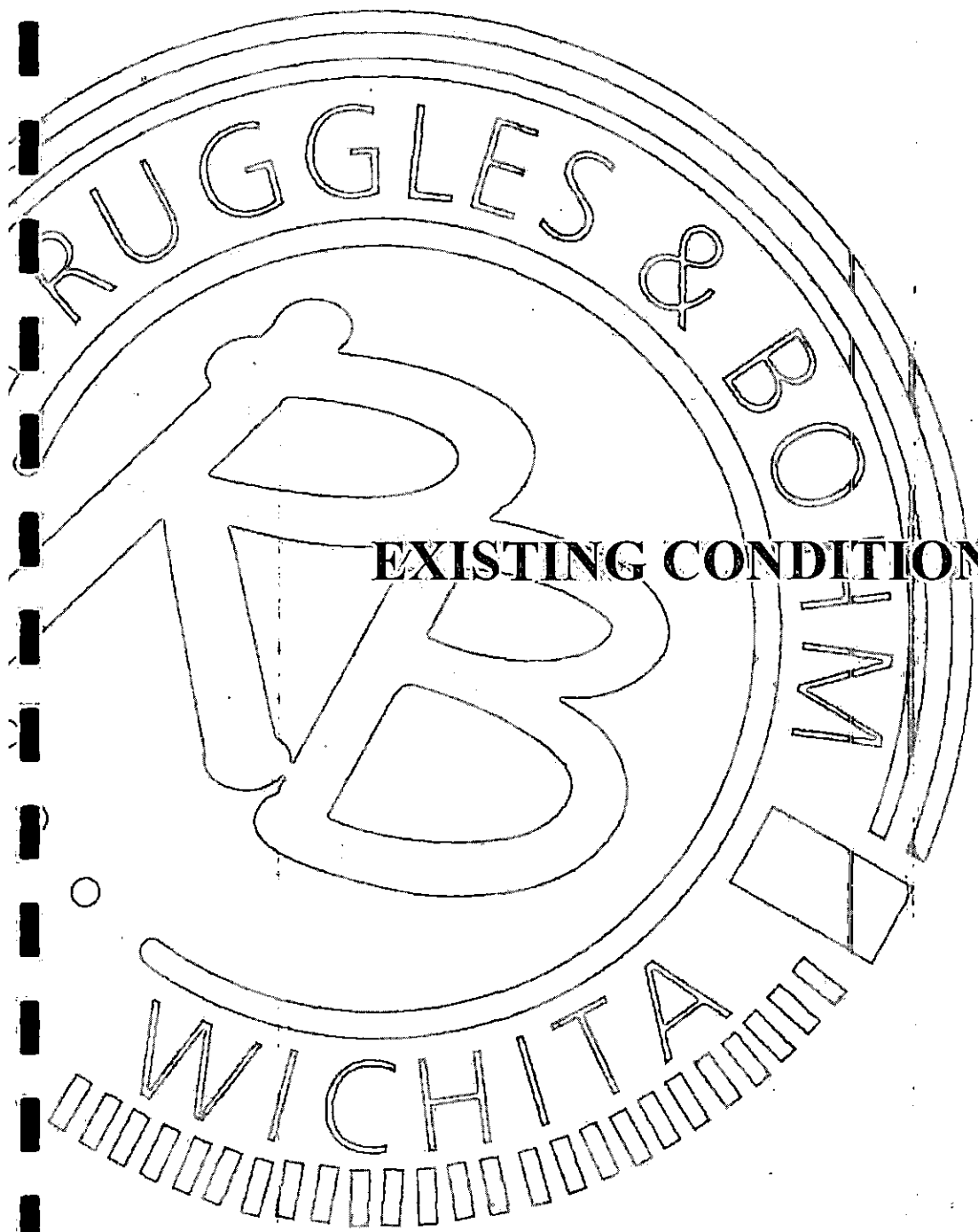
Revised subdivision grading plans will be turned in for review by engineering at the completion of each phase of paving to reflect any minor changes in street grades. All minimum pads have been set to provide a minimum of 2' freeboard above proposed maximum water surface elevations.

Aerial Exhibit
SIERRA HILLS 2ND ADDITION
An Addition to Wichita, Sedgwick County, Kansas



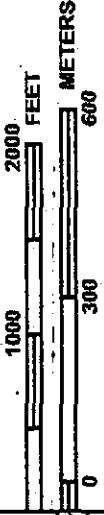
TOTAL SITE AREA = 51.3 ACRES
EXISTING % IMPERVIOUS = 0%
DEVELOPED % IMPERVIOUS = 25%
SOIL TYPES: ROSHILL & IRWIN SILTY CLAYS
HYDROLOGIC SOIL GROUP D





EXISTING CONDITIONS

MAP SCALE 1" = 1000'



PANEL 0395E

FIRM
FLOOD INSURANCE RATE MAP
SEDGWICK COUNTY,
KANSAS
AND INCORPORATED AREAS

PANEL 395 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SEDGWICK COUNTY	200321	0395	E
WICHITA, CITY OF	200328	0395	E

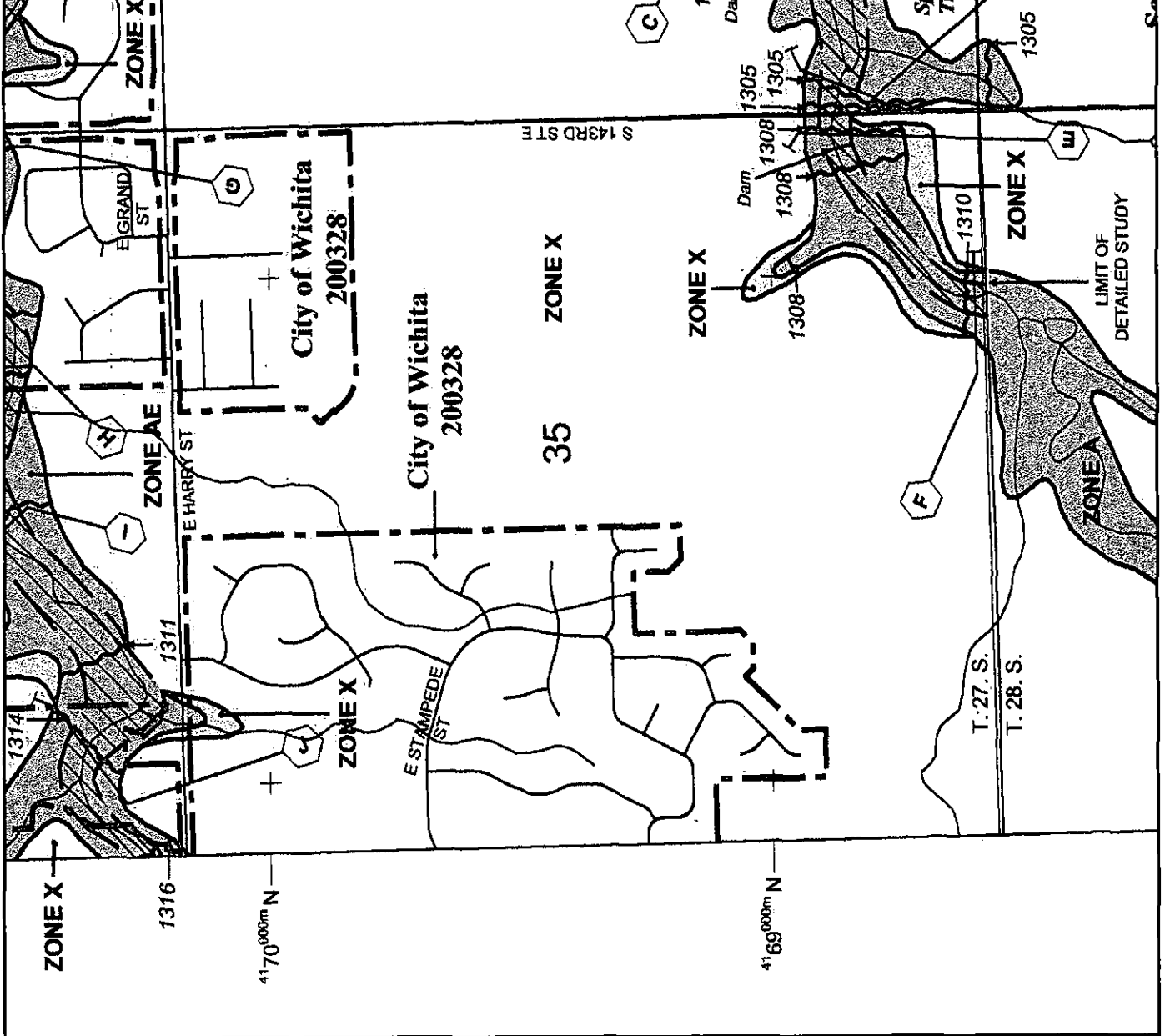
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



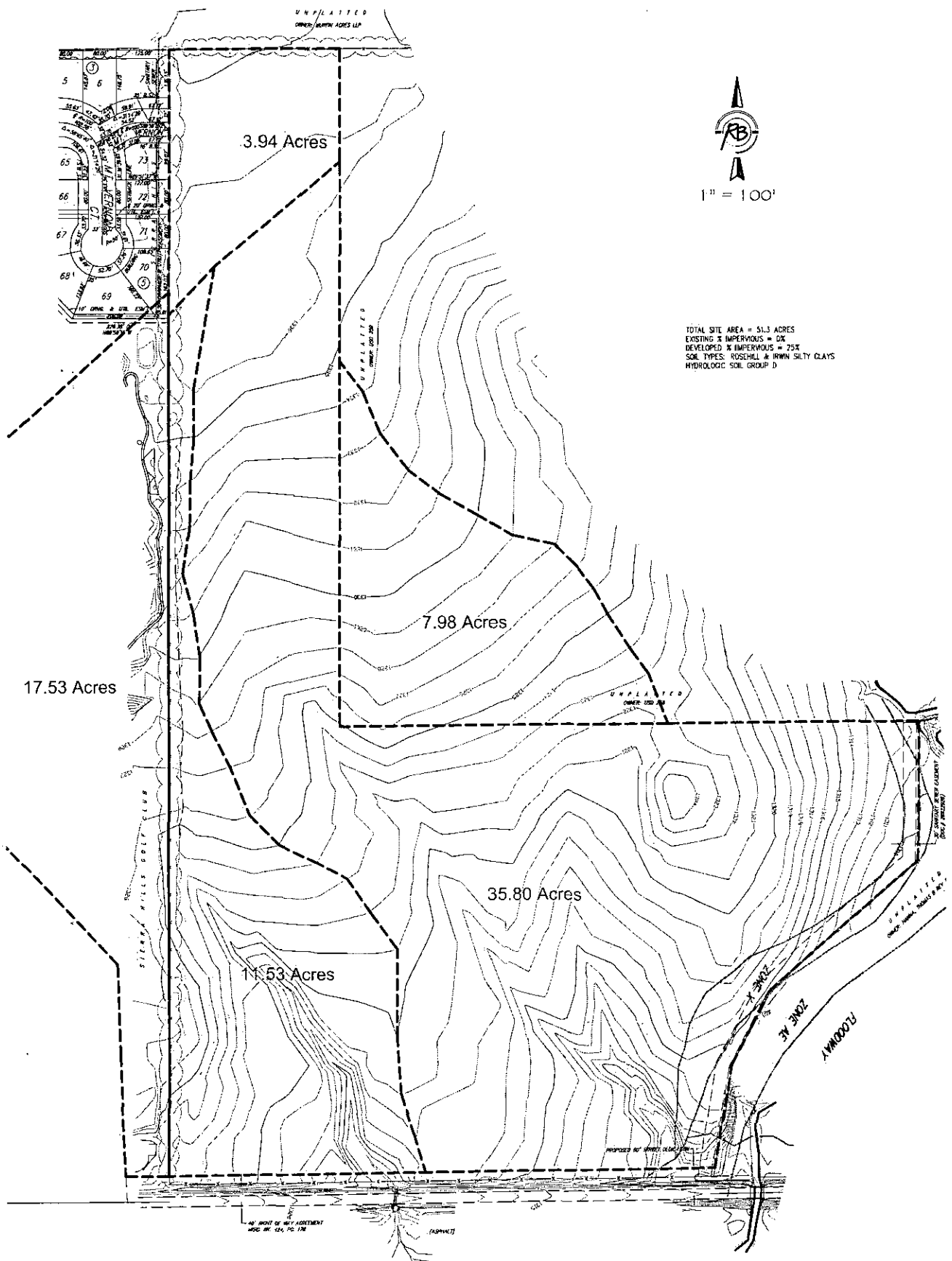
MAP NUMBER
20173C0395E

EFFECTIVE DATE
FEBRUARY 2, 2007
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date of the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov.



Existing Drainage
SIERRA HILLS 2ND ADDITION
 An Addition to Wichita, Sedgwick County, Kansas



TOTAL SITE AREA = 51.3 ACRES
 EXISTING % IMPERVIOUS = 0%
 DEVELOPED % IMPERVIOUS = 25%
 SOIL TYPES: ROSSHILL & IRWIN SILTY CLAYS
 HYDROLOGIC SOIL GROUP D



Ruggles & Bohm, P.A.
 Engineering Surveying Land Planning
 524 North Main
 Wichita, Kansas 67203
 www.rtkan.com
 (316) 264-8008
 (316) 264-4621 fax
 E-mail: info@rtkan.com

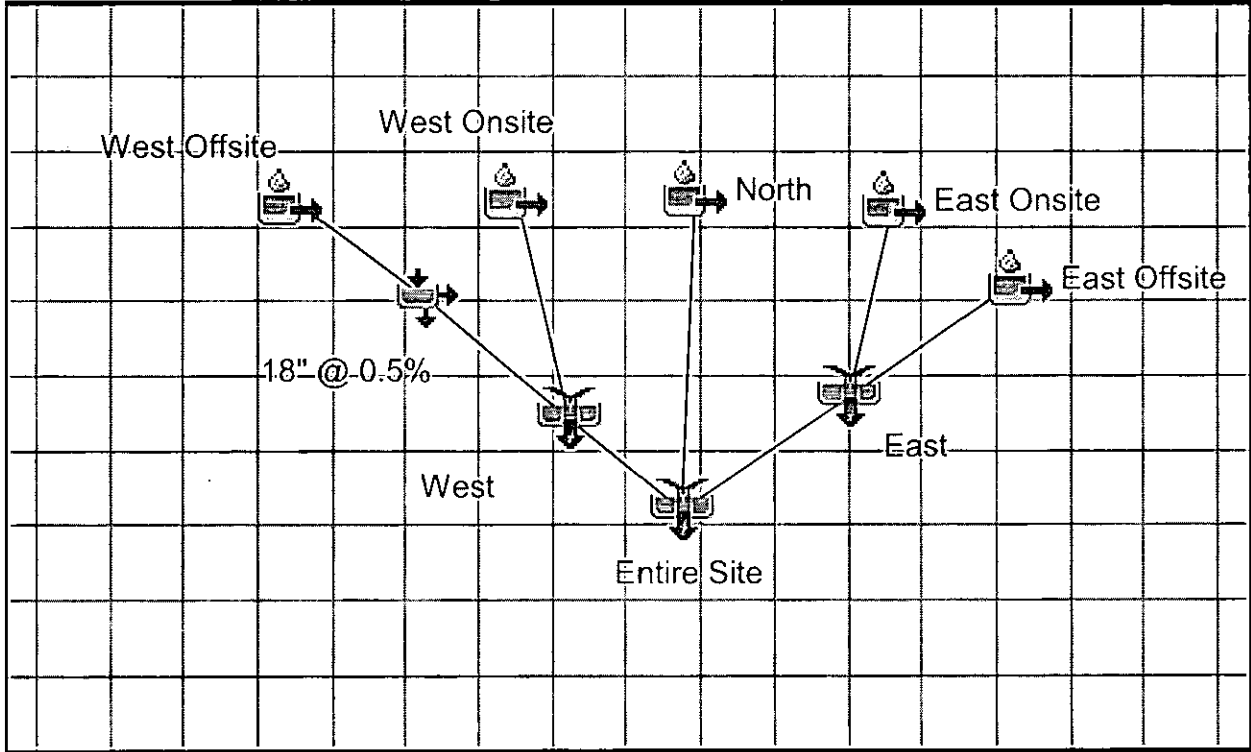


HEC-HMS

Project : Sierra Hills 2nd

Basin Model : Existing

Mar 13 16:43:22 CDT 2008



Project: Sierra Hills 2nd Simulation Run: Ex 2

Start of Run: 01Jan2007, 12:00 Basin Model: Existing
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 2
Compute Time: 11Jul2007, 11:35:07 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.0273	6.3	02Jan2007, 00:40	0.24
East	0.0684	34.7	02Jan2007, 00:35	1.61
East Offsite	0.0125	6.3	02Jan2007, 00:35	1.61
East Onsite	0.0559	28.4	02Jan2007, 00:35	1.61
Entire Site	0.1198	51.6	02Jan2007, 00:35	1.30
North	0.0061	5.9	02Jan2007, 00:10	1.63
West	0.0453	15.2	02Jan2007, 00:40	0.78
West Offsite	0.0273	13.4	02Jan2007, 00:40	1.61
West Onsite	0.0180	8.9	02Jan2007, 00:40	1.61

Project: Sierra Hills 2nd Simulation Run: Ex 5

Start of Run: 01Jan2007, 12:00 Basin Model: Existing
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 5
Compute Time: 11Jul2007, 11:35:17 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.0273	13.4	02Jan2007, 00:40	0.65
East	0.0684	53.1	02Jan2007, 00:35	2.43
East Offsite	0.0125	9.7	02Jan2007, 00:35	2.43
East Onsite	0.0559	43.4	02Jan2007, 00:35	2.43
Entire Site	0.1198	82.6	02Jan2007, 00:35	2.02
North	0.0061	8.9	02Jan2007, 00:10	2.45
West	0.0453	26.9	02Jan2007, 00:40	1.35
West Offsite	0.0273	20.5	02Jan2007, 00:40	2.42
West Onsite	0.0180	13.5	02Jan2007, 00:40	2.42

Project: Sierra Hills 2nd Simulation Run: Ex 10

Start of Run: 01Jan2007, 12:00 Basin Model: Existing
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 10
Compute Time: 13Mar2008, 12:52:38 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.0273	17.8	02Jan2007, 00:40	0.94
East	0.0684	64.6	02Jan2007, 00:35	2.94
East Offsite	0.0125	11.8	02Jan2007, 00:35	2.94
East Onsite	0.0559	52.8	02Jan2007, 00:35	2.94
Entire Site	0.1198	101.9	02Jan2007, 00:35	2.48
North	0.0061	10.7	02Jan2007, 00:10	2.97
West	0.0453	34.2	02Jan2007, 00:40	1.73
West Offsite	0.0273	24.9	02Jan2007, 00:40	2.94
West Onsite	0.0180	16.4	02Jan2007, 00:40	2.94

Project: Sierra Hills 2nd Simulation Run: Ex 25

Start of Run: 01Jan2007, 12:00 Basin Model: Existing
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 25
Compute Time: 11Jul2007, 11:35:33 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.0273	25.2	02Jan2007, 00:35	1.46
East	0.0684	84.1	02Jan2007, 00:35	3.82
East Offsite	0.0125	15.4	02Jan2007, 00:35	3.82
East Onsite	0.0559	68.7	02Jan2007, 00:35	3.82
Entire Site	0.1198	134.8	02Jan2007, 00:35	3.28
North	0.0061	13.9	02Jan2007, 00:10	3.86
West	0.0453	46.6	02Jan2007, 00:35	2.39
West Offsite	0.0273	32.3	02Jan2007, 00:35	3.82
West Onsite	0.0180	21.3	02Jan2007, 00:35	3.82

Project: Sierra Hills 2nd Simulation Run: Existing 100

Start of Run: 01Jan2007, 12:00 Basin Model: Existing
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 100
Compute Time: 13Mar2008, 12:52:50 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.0273	38.3	02Jan2007, 00:35	2.41
East	0.0684	117.8	02Jan2007, 00:35	5.37
East Offsite	0.0125	21.5	02Jan2007, 00:35	5.37
East Onsite	0.0559	96.2	02Jan2007, 00:35	5.37
Entire Site	0.1198	191.6	02Jan2007, 00:35	4.70
North	0.0061	19.3	02Jan2007, 00:05	5.42
West	0.0453	68.2	02Jan2007, 00:35	3.59
West Offsite	0.0273	45.4	02Jan2007, 00:35	5.37
West Onsite	0.0180	29.9	02Jan2007, 00:35	5.37

**PAWNEE RCBC
HY-8 ANALYSIS DATA**

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: Pawnee

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1312.03	0.00	0.00	0.00	1
1313.24	10.00	10.00	0.00	1
1313.83	20.00	20.00	0.00	1
1314.46	30.00	29.84	0.16	5
1314.86	40.00	37.77	2.20	5
1315.19	50.00	43.43	6.53	5
1315.46	60.00	47.42	12.56	6
1315.69	70.00	50.44	19.54	6
1315.86	80.00	52.44	27.53	5
1315.98	87.00	53.93	33.04	5
1316.18	100.00	56.33	43.65	5

Rating Curve Plot for Crossing: Pawnee

Total Rating Curve
Crossing: Pawnee

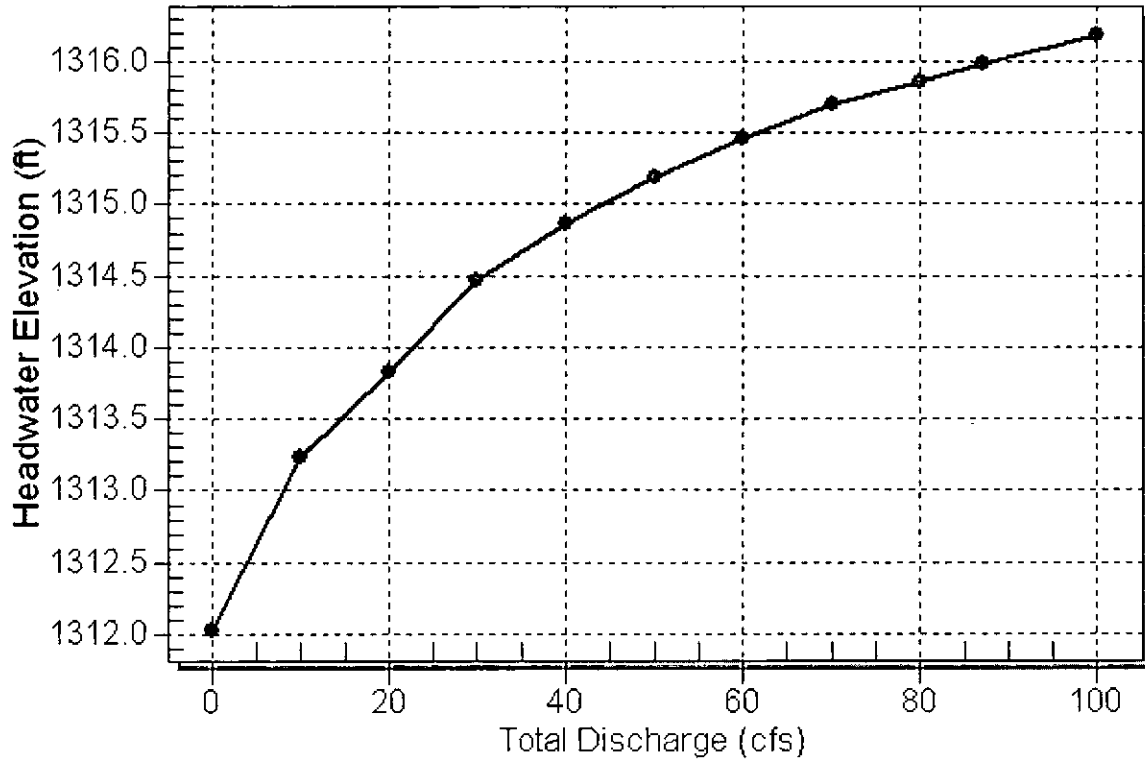


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1312.03	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
10.00	10.00	1313.24	1.131	1.208	2-M2c	0.984	0.798	0.798	0.370	4.245	2.641
20.00	20.00	1313.83	1.712	1.805	2-M2c	1.560	1.139	1.139	0.480	5.075	3.141
30.00	29.84	1314.46	2.228	2.431	2-M2c	2.417	1.583	1.583	0.558	6.085	3.476
40.00	37.77	1314.86	2.662	2.828	2-M2c	2.417	1.742	1.742	0.622	6.776	3.735
50.00	43.43	1315.19	3.003	3.158	2-M2c	2.417	1.844	1.844	0.676	7.290	3.949
60.00	47.42	1315.46	3.266	3.435	7-M2c	2.417	1.915	1.915	0.724	7.614	4.133
70.00	50.44	1315.69	3.477	3.665	7-M2c	2.417	1.959	1.959	0.767	7.887	4.296
80.00	52.44	1315.86	3.625	3.831	7-M2c	2.417	1.985	1.985	0.807	8.128	4.442
87.00	53.93	1315.98	3.738	3.951	7-M2c	2.417	2.004	2.004	0.833	8.285	4.536
100.00	56.33	1316.18	3.928	4.151	7-M2c	2.417	2.036	2.036	0.877	8.532	4.696

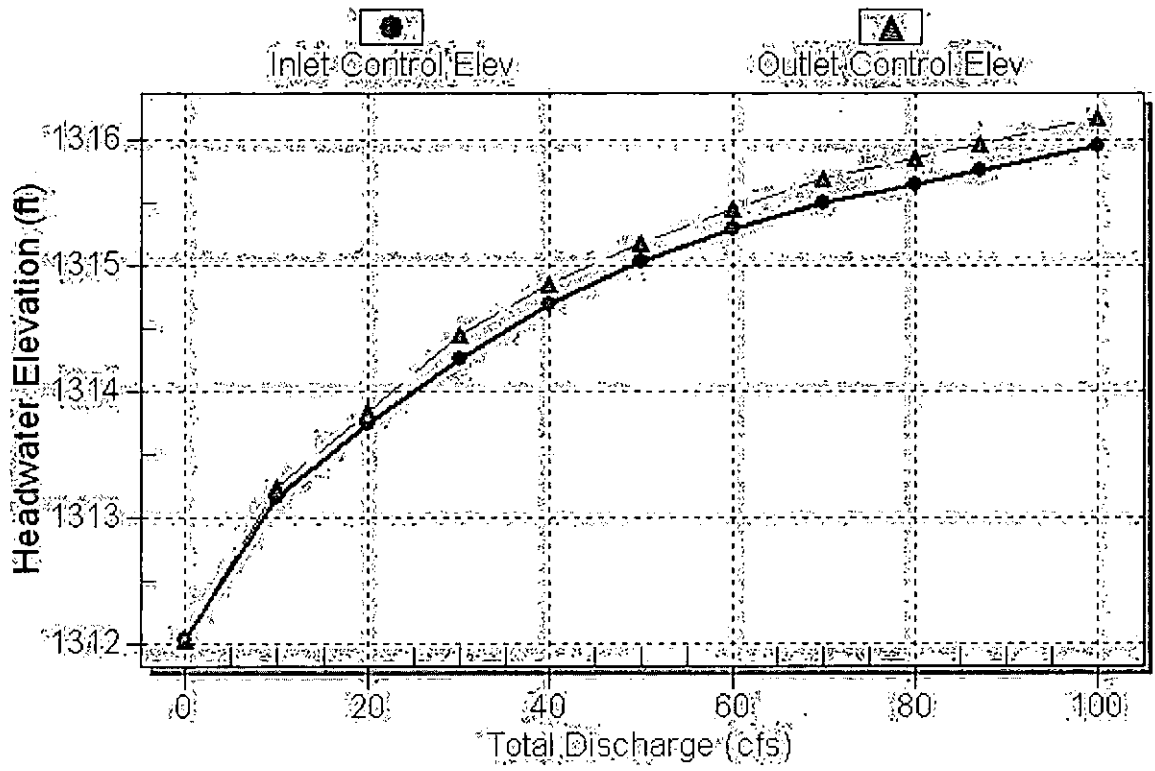
.....
 Inlet Elevation (invert): 1312.03 ft, Outlet Elevation (invert): 1311.87 ft

Culvert Length: 32.40 ft, Culvert Slope: 0.0049

.....

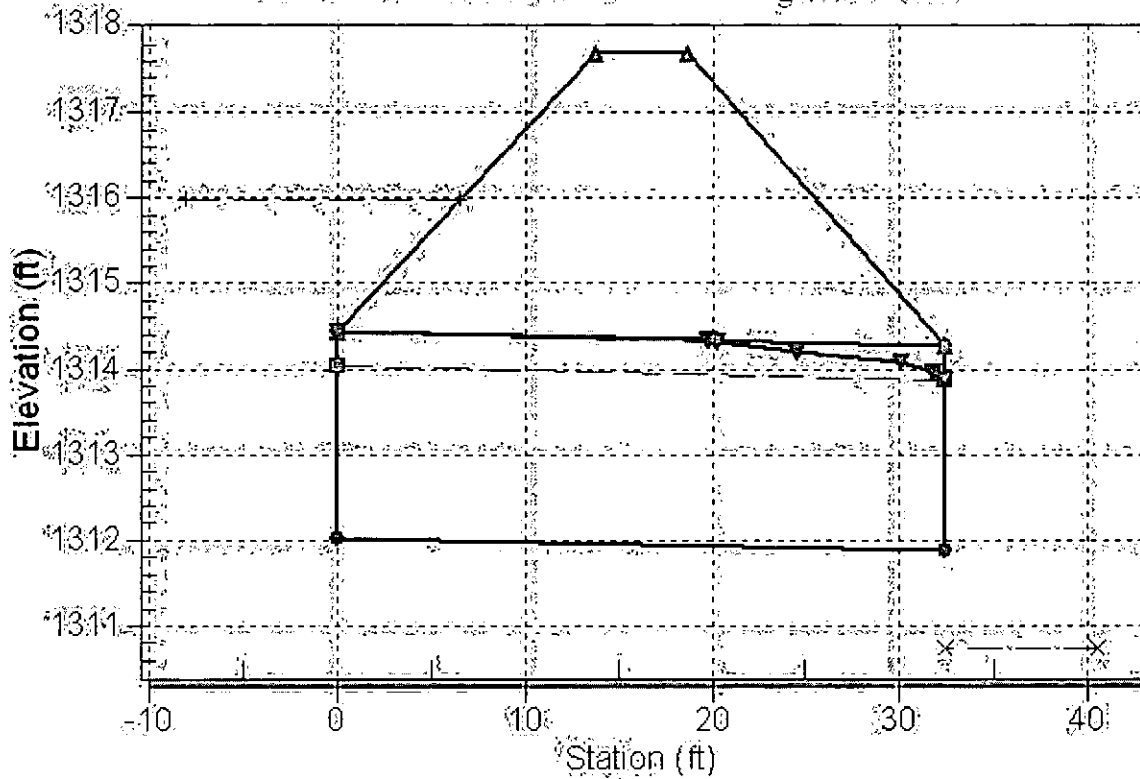
Culvert Performance Curve Plot: Culvert 1

Performance Curve Culvert: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1

Crossing - Pawnee, Design Discharge - 87.0 cfs
Culvert - Culvert 1, Culvert Discharge - 53.9 cfs



Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 1312.03 ft
Outlet Station: 32.40 ft
Outlet Elevation: 1311.87 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Elliptical
Barrel Span: 45.00 in
Barrel Rise: 29.00 in
Barrel Material: Concrete
Barrel Manning's n: 0.0240
Inlet Type: Conventional

Table 3 - Downstream Channel Rating Curve (Crossing: Pawnee)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	1309.91	0.00	0.00	0.00	0.00
10.00	1310.28	0.37	2.64	0.62	1.08
20.00	1310.39	0.48	3.14	0.81	1.13
30.00	1310.47	0.56	3.48	0.94	1.16
40.00	1310.53	0.62	3.73	1.05	1.18
50.00	1310.59	0.68	3.95	1.14	1.20
60.00	1310.63	0.72	4.13	1.22	1.21
70.00	1310.68	0.77	4.30	1.29	1.22
80.00	1310.72	0.81	4.44	1.36	1.23
87.00	1310.74	0.83	4.54	1.40	1.24
100.00	1310.79	0.88	4.70	1.48	1.25

Tailwater Channel Data - Pawnee

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0270

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	1311.50	0.0300
2	35.00	1309.91	0.0300
3	80.00	1311.26	0.0000

Roadway Data for Crossing: Pawnee

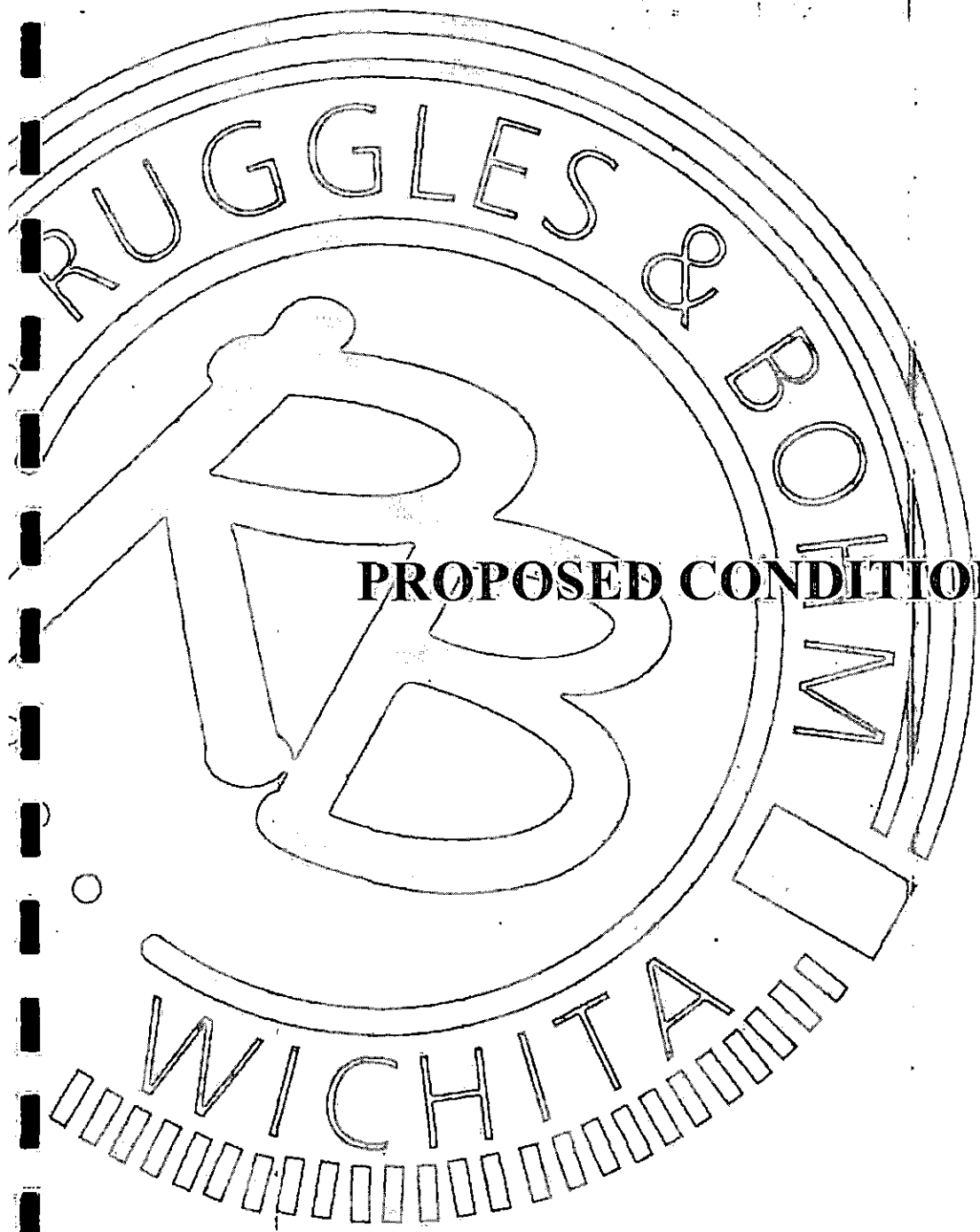
Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	1317.69
2	12.00	1314.24
3	25.13	1317.43

Roadway Surface: Gravel

Roadway Top Width: 5.00 ft

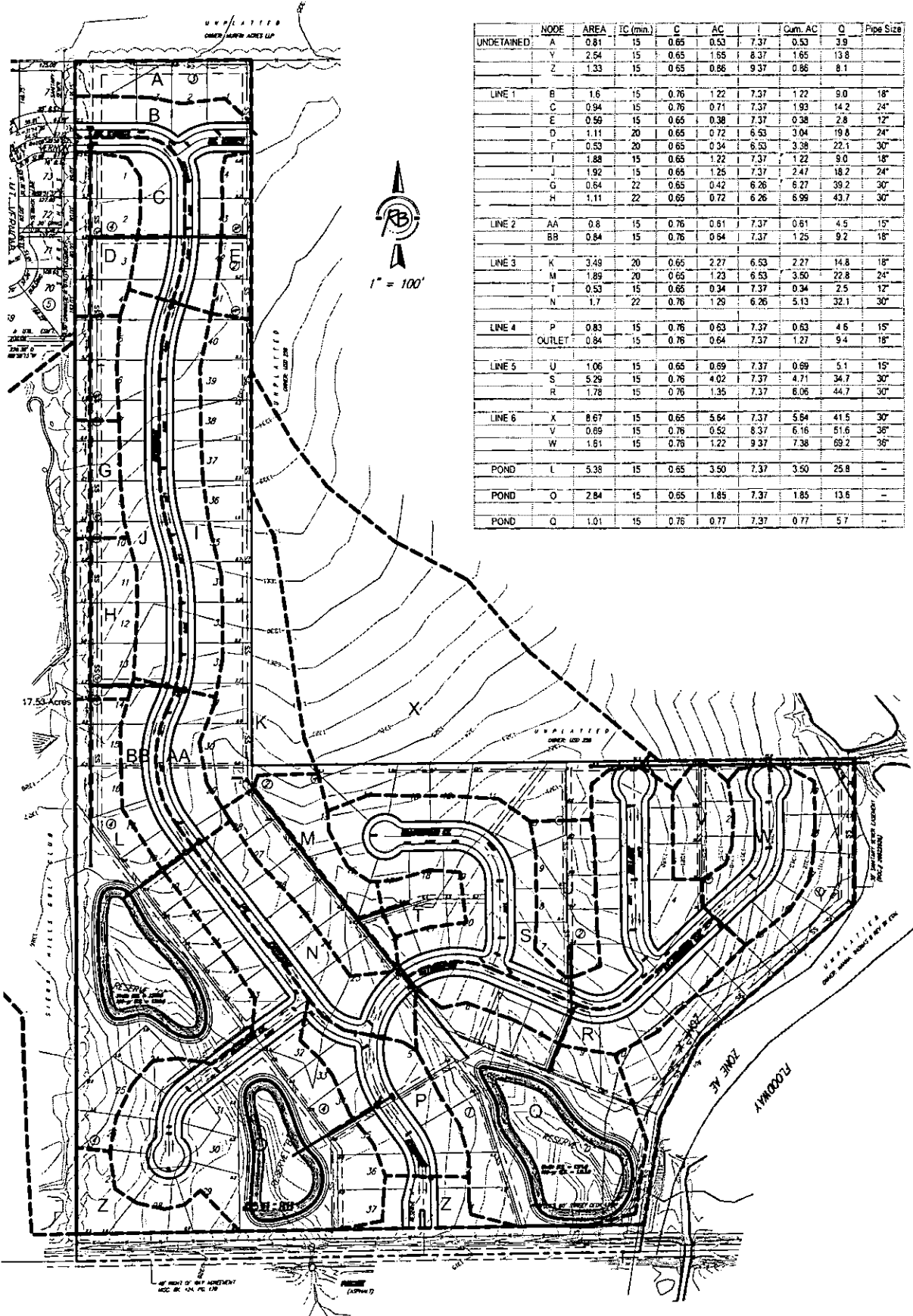


PROPOSED CONDITIONS

Drainage Plan

SIERRA HILLS 2ND ADDITION

An Addition to Wichita, Sedgwick County, Kansas



	NODE	AREA	TC (min)	G	AC	Q	Cum. AC	Q	Pipe Size
UNDRAINED	A	0.81	15	0.65	0.53	7.37	0.53	3.9	
	Y	2.54	15	0.65	1.65	8.37	1.65	13.8	
	Z	1.33	15	0.65	0.86	9.37	0.86	8.1	
LINE 1	B	1.6	15	0.76	1.22	7.37	1.22	9.0	18"
	C	0.94	15	0.76	0.71	7.37	1.93	14.2	24"
	E	0.99	15	0.65	0.38	7.37	0.38	2.8	12"
	D	1.11	20	0.65	0.72	6.93	3.04	19.8	24"
	F	0.53	20	0.65	0.34	6.53	3.38	22.1	30"
	I	1.88	15	0.65	1.22	7.37	1.22	9.0	18"
	J	1.92	15	0.65	1.25	7.37	2.47	18.2	24"
	G	0.64	22	0.65	0.42	6.26	6.27	39.2	30"
LINE 2	H	1.11	22	0.65	0.72	6.26	6.99	43.7	30"
	AA	0.8	15	0.76	0.61	7.37	0.61	4.5	15"
LINE 3	BB	0.84	15	0.76	0.64	7.37	1.25	9.2	18"
	K	3.49	20	0.65	2.27	6.53	2.27	14.8	18"
LINE 4	M	1.89	20	0.65	1.23	6.53	3.50	22.8	24"
	T	0.53	15	0.65	0.34	7.37	0.34	2.5	12"
	N	1.7	22	0.76	1.29	6.26	5.13	32.1	30"
LINE 5	P	0.83	15	0.76	0.63	7.37	0.63	4.6	15"
	OUTLET	0.84	15	0.76	0.64	7.37	1.27	9.4	18"
LINE 6	U	1.06	15	0.65	0.69	7.37	0.69	5.1	15"
	S	5.29	15	0.76	4.02	7.37	4.71	34.7	30"
	R	1.78	15	0.76	1.35	7.37	6.06	44.7	30"
POND	X	8.67	15	0.65	5.64	7.37	5.64	41.5	30"
	V	0.69	15	0.76	0.52	8.37	6.16	51.6	36"
	W	1.61	15	0.76	1.22	9.37	7.38	69.2	36"
POND	L	5.38	15	0.65	3.50	7.37	3.50	25.8	-
POND	O	2.84	15	0.65	1.85	7.37	1.85	13.6	-
POND	Q	1.01	15	0.76	0.77	7.37	0.77	5.7	-



Ruggles & Bohm, P.A.
 Engineering, Surveying, Land Planning
 127 South Main
 Wichita, Kansas 67203
 www.rba.com
 (316) 264-8008
 (316) 264-6211 fax
 E-mail: rba@rba.com

THIS FILE (SHEET) BASE
 PROJECT NO. 2525P
 APRIL 11, 2007

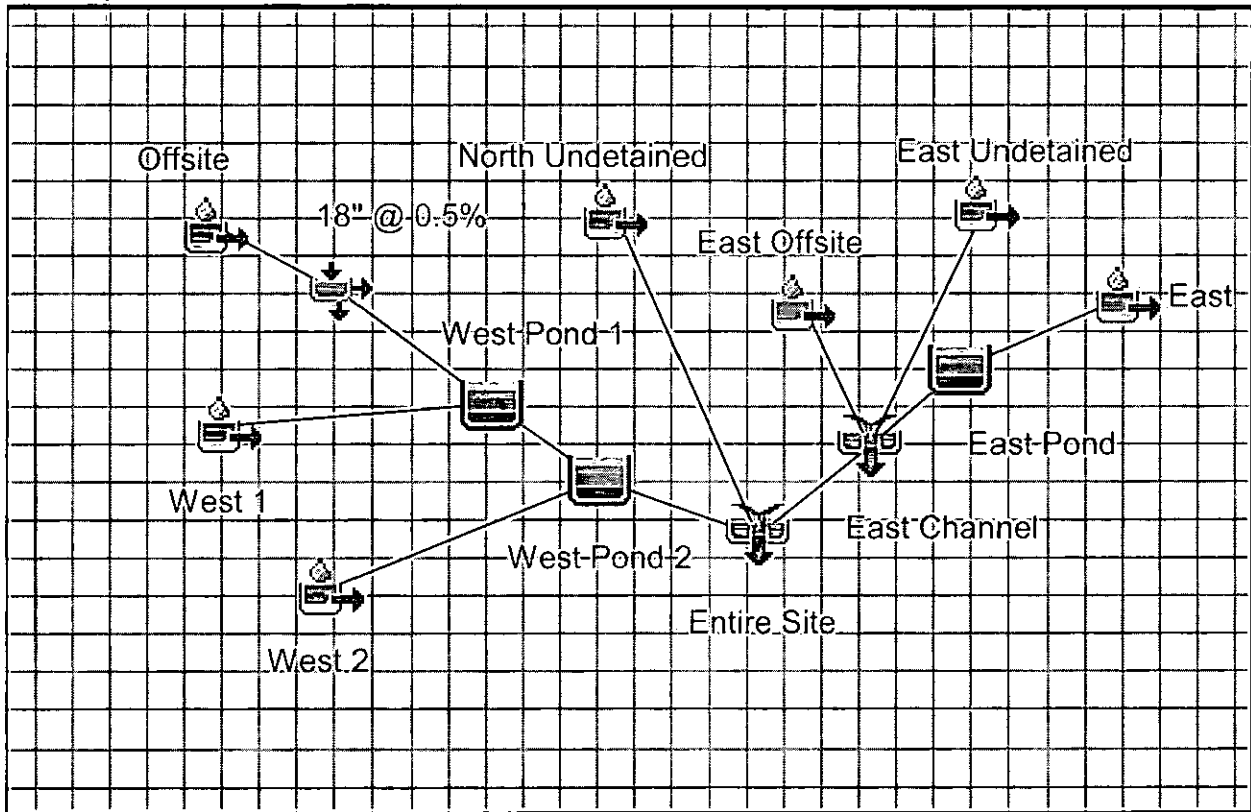


HEC-HMS

Project : Sierra Hills 2nd

Basin Model : Proposed

Mar 13 16:49:28 CDT 2008



Project: Sierra Hills 2nd Simulation Run: Prop 2

Start of Run: 01Jan2007, 12:00 Basin Model: Proposed
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 2
Compute Time: 14Mar2008, 10:29:01 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.02730	3.5	02Jan2007, 00:40	0.10
East	0.02950	28.9	02Jan2007, 00:15	1.92
East Channel	0.05430	32.2	02Jan2007, 00:20	1.84
East Offsite	0.01310	8.4	02Jan2007, 00:25	1.62
East Pond	0.02950	15.5	02Jan2007, 00:35	1.90
East Undetained	0.01170	11.5	02Jan2007, 00:15	1.92
Entire Site	0.12057	42.2	02Jan2007, 00:25	1.46
North Undetained	0.00127	1.5	02Jan2007, 00:10	1.93
Offsite	0.02730	11.5	02Jan2007, 00:40	1.40
West 1	0.02630	21.1	02Jan2007, 00:20	1.92
West 2	0.01140	13.0	02Jan2007, 00:10	1.93
West Pond 1	0.05360	10.7	02Jan2007, 00:55	0.98
West Pond 2	0.06500	12.4	02Jan2007, 01:00	1.13

Project: Sierra Hills 2nd Simulation Run: Prop 5

Start of Run: 01Jan2007, 12:00 Basin Model: Proposed
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 5
Compute Time: 14Mar2008, 10:29:07 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.02730	10.2	02Jan2007, 00:40	0.44
East	0.02950	42.0	02Jan2007, 00:10	2.80
East Channel	0.05430	47.8	02Jan2007, 00:20	2.70
East Offsite	0.01310	12.7	02Jan2007, 00:25	2.44
East Pond	0.02950	22.8	02Jan2007, 00:30	2.77
East Undetained	0.01170	16.7	02Jan2007, 00:10	2.80
Entire Site	0.12057	64.9	02Jan2007, 00:25	2.20
North Undetained	0.00127	2.1	02Jan2007, 00:10	2.81
Offsite	0.02730	18.2	02Jan2007, 00:40	2.17
West 1	0.02630	30.9	02Jan2007, 00:20	2.79
West 2	0.01140	18.9	02Jan2007, 00:10	2.81
West Pond 1	0.05360	22.1	02Jan2007, 00:50	1.57
West Pond 2	0.06500	23.4	02Jan2007, 01:05	1.77

Project: Sierra Hills 2nd Simulation Run: Prop 10

Start of Run: 01Jan2007, 12:00 Basin Model: Proposed
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 10
Compute Time: 14Mar2008, 10:28:55 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.02730	14.5	02Jan2007, 00:40	0.69
East	0.02950	50.1	02Jan2007, 00:10	3.34
East Channel	0.05430	57.4	02Jan2007, 00:20	3.23
East Offsite	0.01310	15.5	02Jan2007, 00:25	2.95
East Pond	0.02950	27.3	02Jan2007, 00:30	3.31
East Undetained	0.01170	19.9	02Jan2007, 00:10	3.34
Entire Site	0.12057	78.9	02Jan2007, 00:25	2.67
North Undetained	0.00127	2.5	02Jan2007, 00:10	3.35
Offsite	0.02730	22.5	02Jan2007, 00:40	2.66
West 1	0.02630	36.8	02Jan2007, 00:20	3.33
West 2	0.01140	22.4	02Jan2007, 00:10	3.35
West Pond 1	0.05360	29.4	02Jan2007, 00:50	1.96
West Pond 2	0.06500	30.3	02Jan2007, 01:05	2.18

Project: Sierra Hills 2nd Simulation Run: Prop 25

Start of Run: 01Jan2007, 12:00 Basin Model: Proposed
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 25
Compute Time: 14Mar2008, 10:29:03 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.02730	21.8	02Jan2007, 00:40	1.17
East	0.02950	63.8	02Jan2007, 00:10	4.27
East Channel	0.05430	75.8	02Jan2007, 00:25	4.14
East Offsite	0.01310	20.1	02Jan2007, 00:25	3.84
East Pond	0.02950	38.4	02Jan2007, 00:30	4.23
East Undetained	0.01170	25.3	02Jan2007, 00:10	4.27
Entire Site	0.12057	106.7	02Jan2007, 00:25	3.48
North Undetained	0.00127	3.2	02Jan2007, 00:05	4.27
Offsite	0.02730	29.8	02Jan2007, 00:40	3.51
West 1	0.02630	46.8	02Jan2007, 00:20	4.26
West 2	0.01140	28.4	02Jan2007, 00:05	4.27
West Pond 1	0.05360	41.5	02Jan2007, 00:50	2.65
West Pond 2	0.06500	42.5	02Jan2007, 01:00	2.91

Project: Sierra Hills 2nd Simulation Run: Prop 100

Start of Run: 01Jan2007, 12:00 Basin Model: Proposed
End of Run: 02Jan2007, 12:05 Meteorologic Model: Wichita 100
Compute Time: 14Mar2008, 10:28:57 Control Specifications: Control 1

Volume Units: IN

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
18" @ 0.5%	0.02730	34.5	02Jan2007, 00:35	2.08
East	0.02950	87.1	02Jan2007, 00:10	5.87
East Channel	0.05430	111.3	02Jan2007, 00:20	5.73
East Offsite	0.01310	28.1	02Jan2007, 00:20	5.39
East Pond	0.02950	56.9	02Jan2007, 00:25	5.82
East Undetained	0.01170	34.5	02Jan2007, 00:10	5.87
Entire Site	0.12057	157.1	02Jan2007, 00:25	4.91
North Undetained	0.00127	4.3	02Jan2007, 00:05	5.88
Offsite	0.02730	42.5	02Jan2007, 00:35	5.02
West 1	0.02630	63.9	02Jan2007, 00:20	5.86
West 2	0.01140	38.8	02Jan2007, 00:05	5.88
West Pond 1	0.05360	63.6	02Jan2007, 00:50	3.89
West Pond 2	0.06500	66.2	02Jan2007, 01:00	4.21

DETENTION POND

Project : Sierra Hills 2nd Simulation Run : Prop 100 Reservoir: West Pond 1
Start of Run : 01Jan2007, 12:00 Basin Model : Proposed
End of Run : 02Jan2007, 12:05 Meteorologic Model : Wichita 100
Compute Time : 14Mar2008, 10:28:57 Control Specifications : Control 1

Volume Units : IN

Computed Results

Peak Inflow :	91.9 (CFS)	Date/Time of Peak Inflow :	02Jan2007, 00:25
Peak Outflow :	63.6 (CFS)	Date/Time of Peak Outflow :	02Jan2007, 00:50
Total Inflow :	3.94 (IN)	Peak Storage :	3.1 (AC-FT)
Total Outflow :	3.89 (IN)	Peak Elevation :	1319.6 (FT)

Project : Sierra Hills 2nd Simulation Run : Prop 100 Reservoir: West Pond 2

Start of Run : 01Jan2007, 12:00 Basin Model : Proposed
End of Run : 02Jan2007, 12:05 Meteorologic Model : Wichita 100
Compute Time : 14Mar2008, 10:28:57 Control Specifications : Control 1

Volume Units : IN

Computed Results

Peak Inflow :	70.8 (CFS)	Date/Time of Peak Inflow :	02Jan2007, 00:45
Peak Outflow :	66.2 (CFS)	Date/Time of Peak Outflow :	02Jan2007, 01:00
Total Inflow :	4.24 (IN)	Peak Storage :	1.8 (AC-FT)
Total Outflow :	4.21 (IN)	Peak Elevation :	1317.0 (FT)

Project : Sierra Hills 2nd Simulation Run : Prop 100 Reservoir: East Pond
Start of Run : 01Jan2007, 12:00 Basin Model : Proposed
End of Run : 02Jan2007, 12:05 Meteorologic Model : Wichita 100
Compute Time : 14Mar2008, 10:28:57 Control Specifications : Control 1

Volume Units : IN

Computed Results

Peak Inflow :	87.1 (CFS)	Date/Time of Peak Inflow :	02Jan2007, 00:10
Peak Outflow :	56.9 (CFS)	Date/Time of Peak Outflow :	02Jan2007, 00:25
Total Inflow :	5.87 (IN)	Peak Storage :	2.2 (AC-FT)
Total Outflow :	5.82 (IN)	Peak Elevation :	1312.5 (FT)

west pond 36 inch rcp.txt
Culvert Calculator

All calculator output should be verified prior to design use

Entered Data:

Shape Circular
 Number of Barrels 2
 Solving for Headwater
 Chart Number 1
 Scale Number 3
 Chart Description CONCRETE PIPE CULVERT; NO BEVELED RING

ENTRANCE

Scale Description GROOVE END ENTRANCE, PIPE PROJECTING

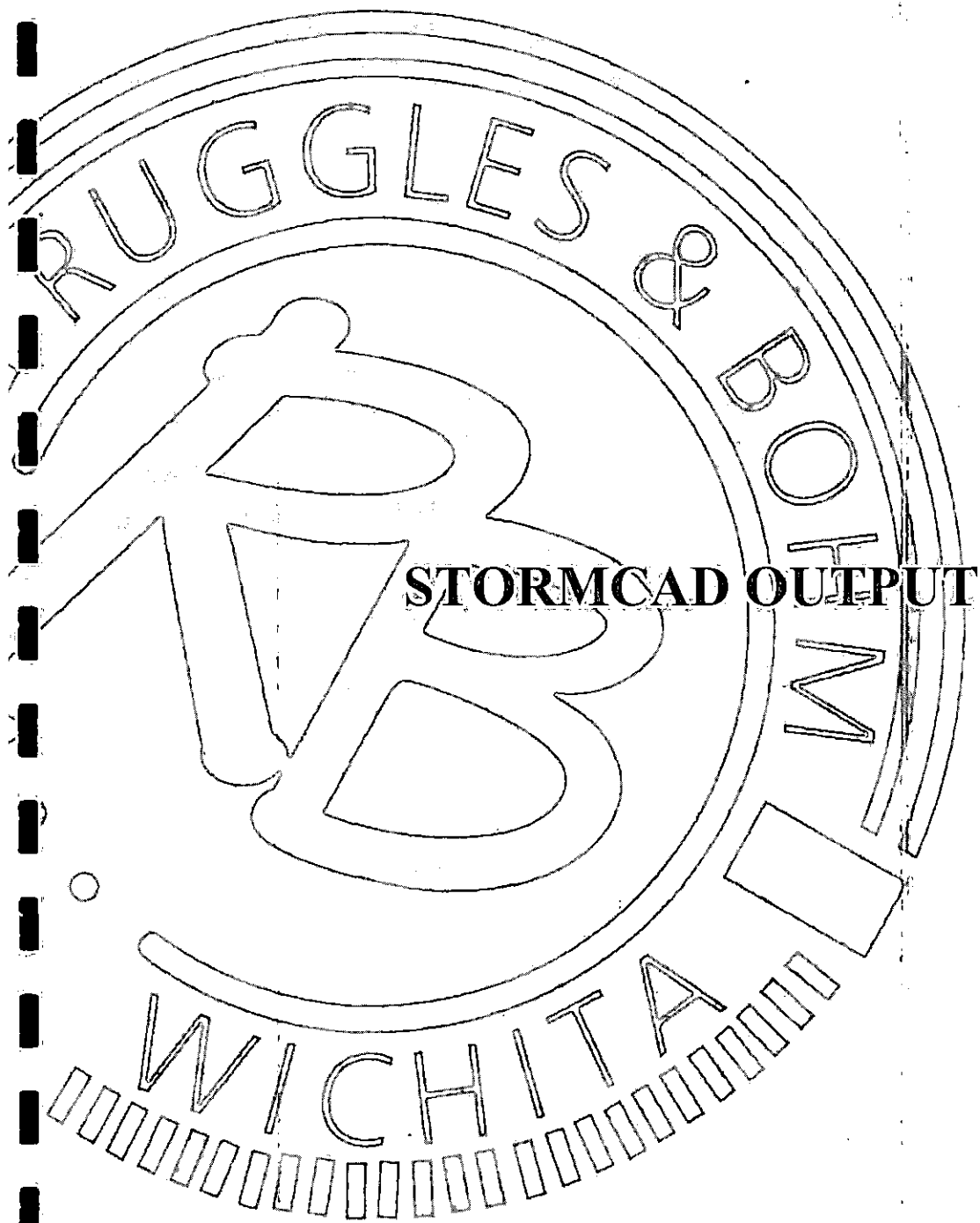
FROM FILL

Overtopping off
 Flowrate 112.0000 cfs
 Manning's n 0.0130
 Roadway Elevation 1322.0000 ft
 Inlet Elevation 1317.0000 ft
 Outlet Elevation 1315.0000 ft
 Diameter 3.0000 ft
 Length 80.0000 ft
 Entrance Loss 0.0000
 Tailwater 0.6000 ft

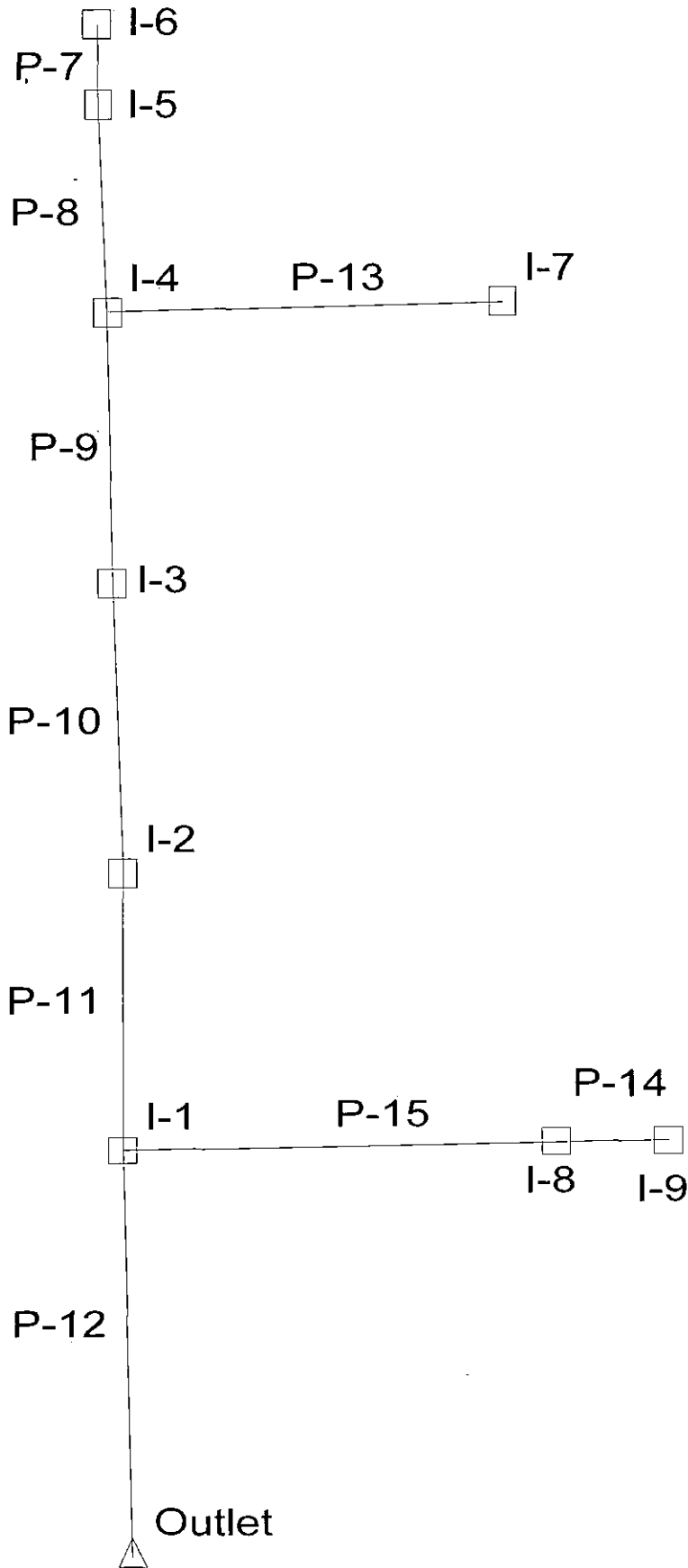
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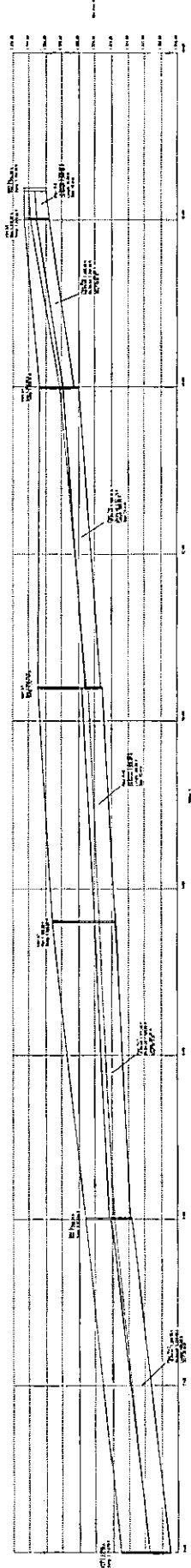
Headwater 1321.0221 ft Inlet Control
 Slope 0.0250 ft/ft
 Velocity 15.1513 fps

DIS-CHARGE TAILWATER Flow DEPTH cfs ft	HEAD- WATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	OUTLET VEL. fps
10.00 0.60	1317.91	0.91	0.05	NA	0.44	0.70	7.66	0.44	0.00
20.00 0.60	1318.34	1.34	0.05	NA	0.62	1.00	9.40	0.62	0.00
30.00 0.60	1318.68	1.68	0.05	NA	0.76	1.24	10.57	0.76	0.00
40.00 0.60	1318.99	1.99	0.05	NA	0.88	1.44	11.48	0.88	0.00
50.00 0.60	1319.28	2.28	0.05	NA	0.99	1.61	12.23	0.99	0.00
60.00 0.60	1319.56	2.56	0.05	NA	1.09	1.77	12.86	1.09	0.00
70.00 0.60	1319.83	2.83	0.05	NA	1.19	1.92	13.41	1.19	0.00
80.00 0.60	1320.10	3.10	0.05	NA	1.28	2.06	13.90	1.28	0.00
90.00 0.60	1320.42	3.42	0.05	NA	1.37	2.19	14.34	1.37	0.00
100.00 0.60	1320.62	3.62	0.05	NA	1.45	2.30	14.73	1.45	0.00



STORMCAD OUTPUT





Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-14	I-9	I-8	35.00	18 inch	7.43	4.41	1,328.30	1,328.13	0.005000		7.63
P-15	I-8	I-1	171.00	24 inch	32.71	6.93	1,328.13	1,324.55	0.020906		15.26
P-13	I-7	I-4	350.00	15 inch	4.57	2.41	1,331.80	1,330.05	0.005000		2.80
P-7	I-6	I-5	35.00	18 inch	8.88	5.09	1,333.90	1,333.65	0.007143		9.00
P-8	I-5	I-4	201.00	18 inch	13.04	8.04	1,333.55	1,330.45	0.015423		14.20
P-9	I-4	I-3	360.00	24 inch	19.59	7.33	1,329.95	1,327.25	0.007500		21.70
P-10	I-3	I-2	280.00	30 inch	29.00	6.32	1,327.00	1,325.60	0.005000		23.92
P-11	I-2	I-1	360.00	30 inch	29.00	6.51	1,325.60	1,323.80	0.005000		26.55
P-12	I-1	Outlet	400.00	30 inch	43.74	9.70	1,323.55	1,319.00	0.011375		46.32

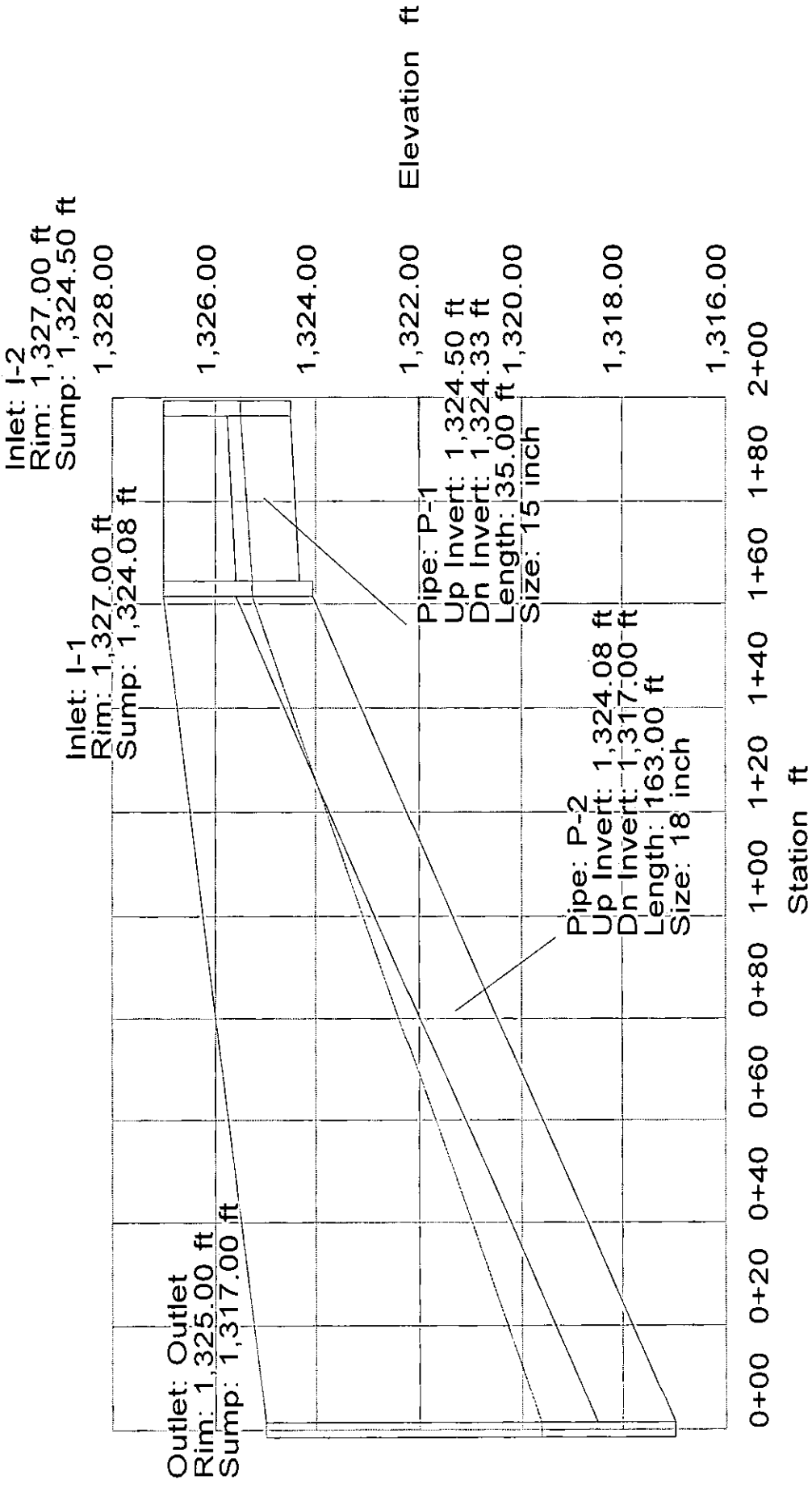
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Outlet

P-2

□
I-1

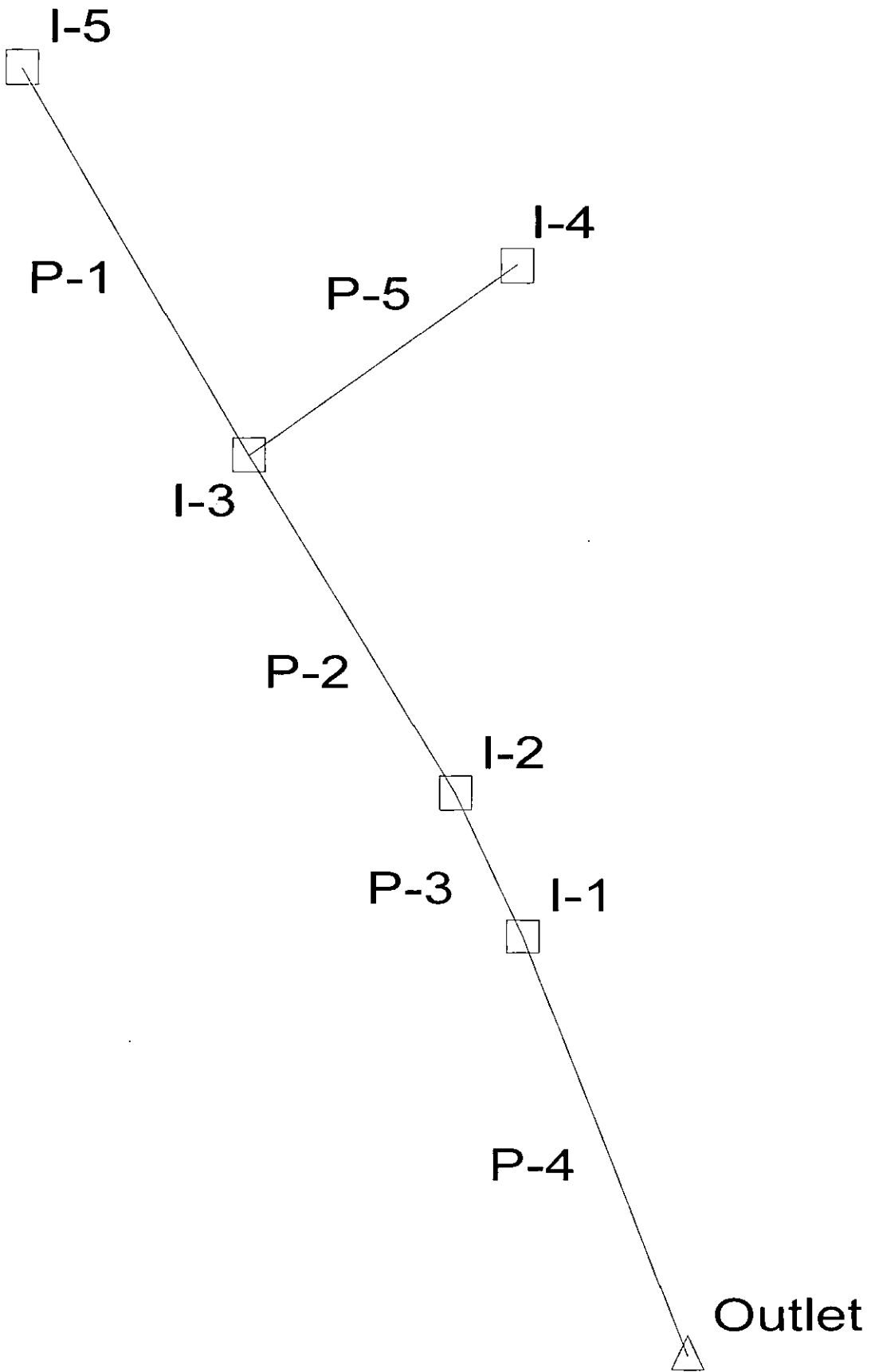
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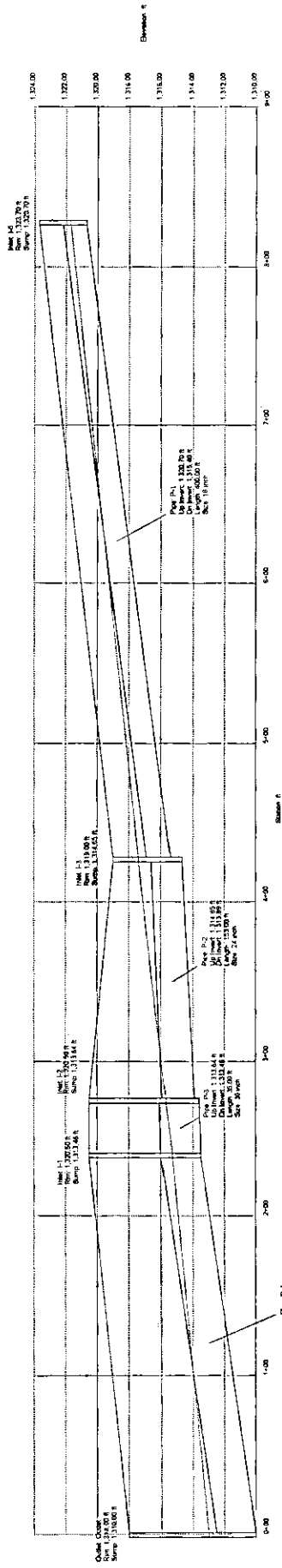
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Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-1	I-2	I-1	35.00	15 inch	4.57	4.48	1,324.50	1,324.33	0.005000		4.50
P-2	I-1.	Outlet	163.00	18 inch	21.89	5.71	1,324.08	1,317.00	0.043436		9.20





Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-5	I-4	I-3	120.00	12 inch	2.52	3.18	1,316.75	1,316.15	0.005000		2.50
P-1	I-5	I-3	400.00	18 inch	12.09	5.06	1,320.70	1,315.40	0.013250		7.80
P-2	I-3	I-2	153.00	24 inch	16.00	7.66	1,314.65	1,313.89	0.005000		23.30
P-3	I-2	I-1	35.00	30 inch	29.00	7.28	1,313.64	1,313.46	0.005000		29.80
P-4	I-1	Outlet	239.00	30 inch	49.35	6.89	1,313.46	1,310.00	0.014477		30.10

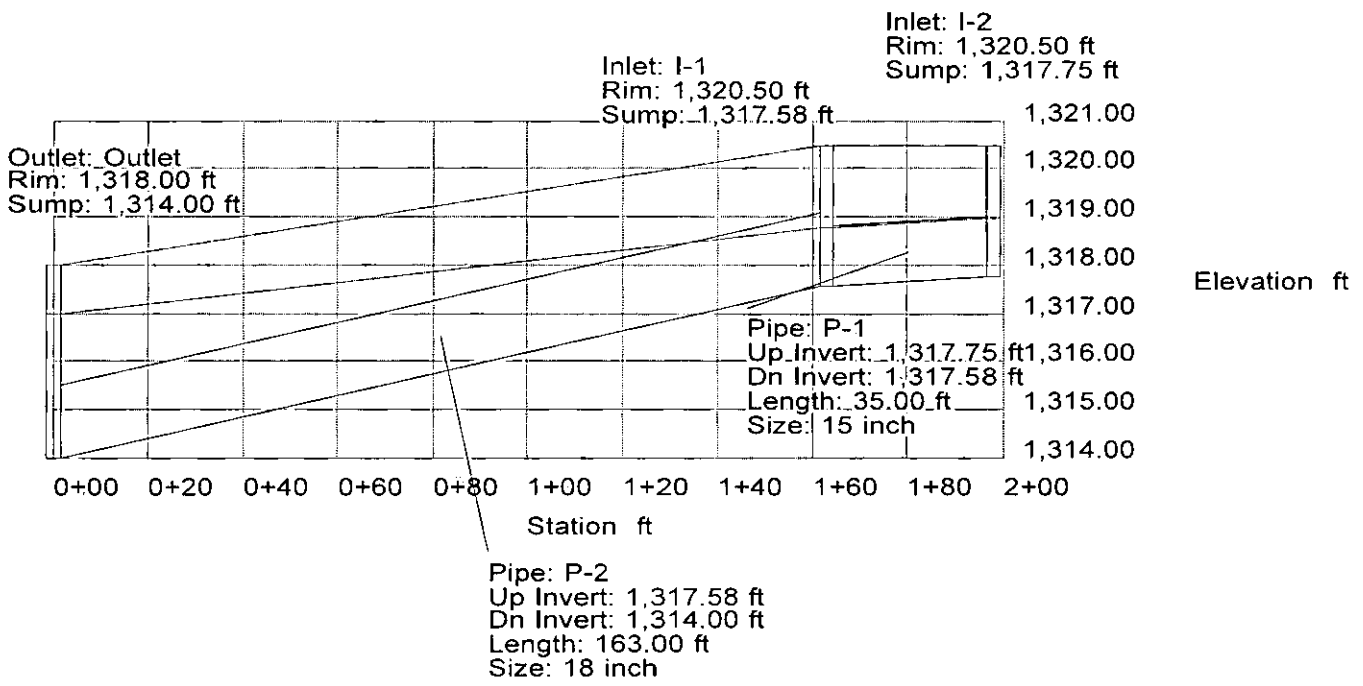
△
Outlet

P-2

□
I-1

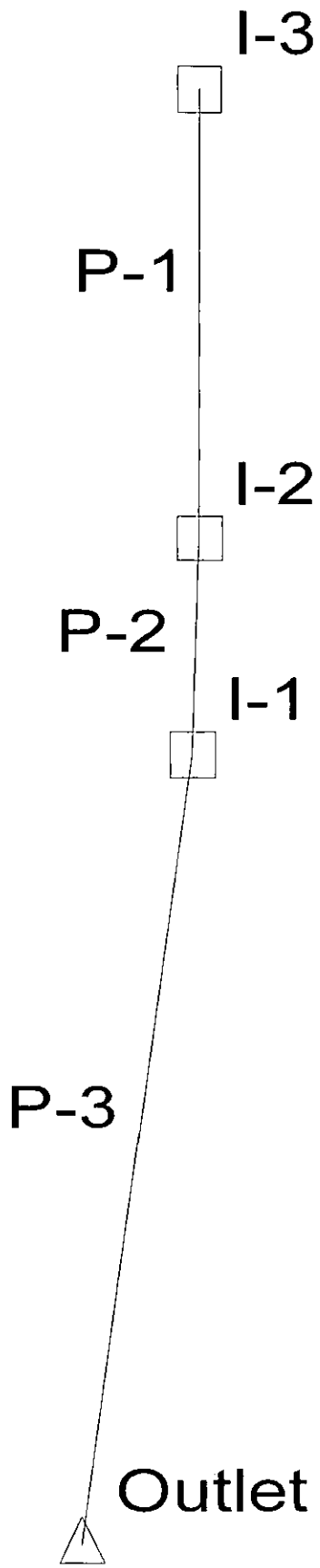
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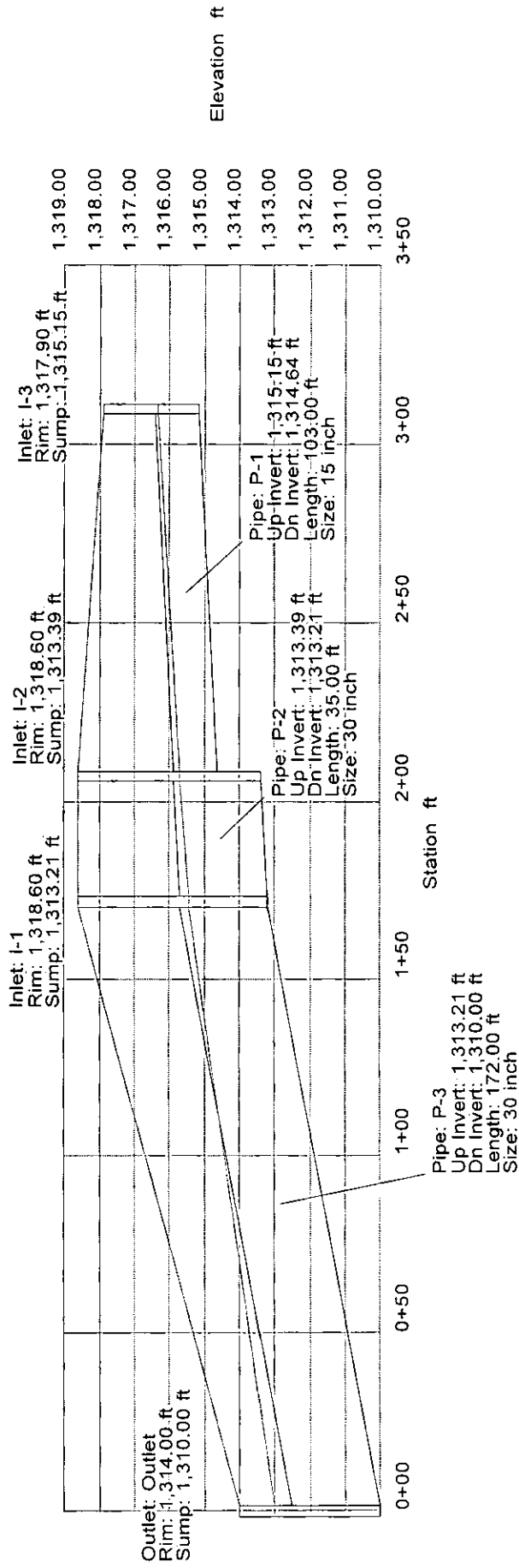
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Combined Pipe/Node Report

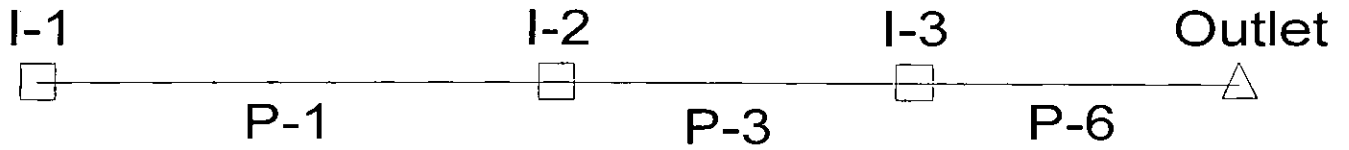
Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-1	I-2	I-1	35.00	15 inch	4.57	3.81	1,317.75	1,317.58	0.005000		4.60
P-2	I-1	Outlet	163.00	18 inch	15.56	5.80	1,317.58	1,314.00	0.021933		9.40

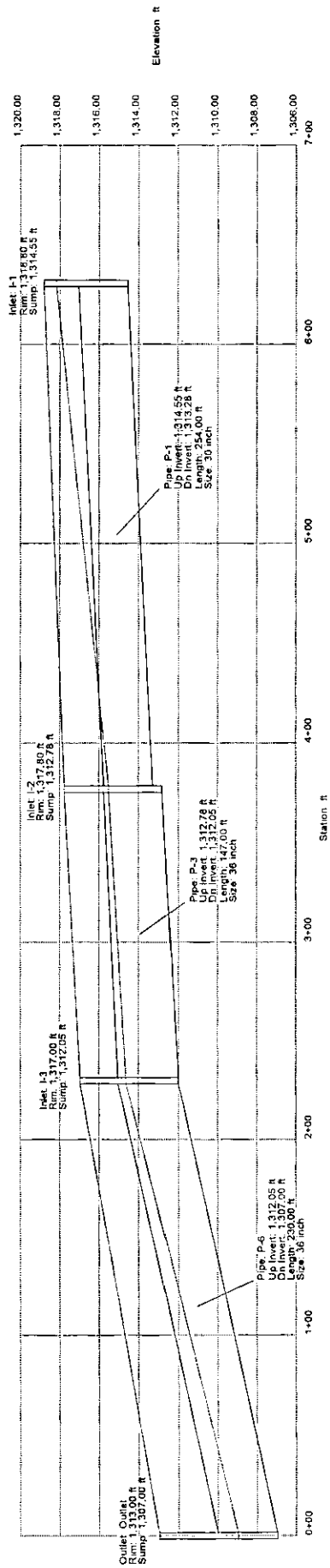




Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-1	I-3	I-2	103.00	15 inch	4.57	4.44	1,315.15	1,314.64	0.005000		5.10
P-2	I-2	I-1	35.00	30 inch	29.00	7.42	1,313.39	1,313.21	0.005000		34.70
P-3	I-1	Outlet	172.00	30 inch	56.03	9.40	1,313.21	1,310.00	0.018663		44.70





Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-1	I-1	I-2	254.00	30 inch	29.00	8.71	1,314.55	1,313.28	0.005000		41.50
P-3	I-2	I-3	147.00	36 inch	47.16	7.73	1,312.78	1,312.05	0.005000		51.60
P-6	I-3	Outlet	230.00	36 inch	98.78	12.15	1,312.05	1,307.00	0.021935		69.20