DRAINAGE CALCULATIONS

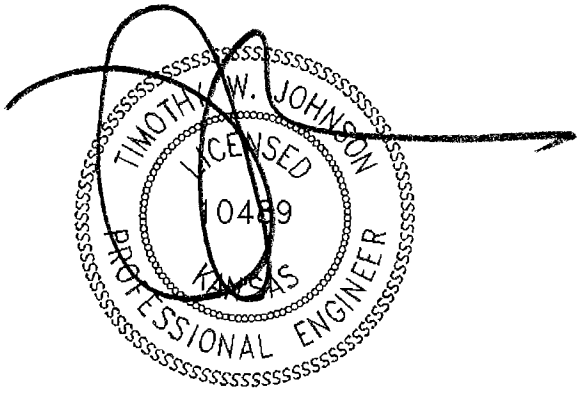
TO SERVE

WATERWALK PHASE 2 ADDITION

South of Waterman Street
West of Main Street

LOCATED IN

Wichita, Kansas



June 12, 2006

Prepared by:

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TABLE OF CONTENTS

REPORT SUMMARY

GENERAL SCOPE

This report will cover the drainage calculations for the proposed Waterwalk Phase 2 Addition. The site is currently a vacant tract of land located at the southwest corner of the intersection of Waterman Street and Main Street in Wichita, KS, a part of the Southeast Quarter (SE/4) of Section Twenty (20), Township Twenty-seven (27), Range One (1) East (Refer to Exhibit A – Location Map). This report presents the supporting calculations and exhibits for the storm sewer improvements.

HISTORIC CONDITIONS

The historic site was an industrial, manufacturing and commercial area of Wichita. Historic street locations appear to be in the same general location as the present street layout. With the close proximity of the Arkansas River, one can assume that storm water runoff flowed directly to the river via sheet flow in the streets and any underground storm sewer systems that were in place at the time.

PRESENT SITE CONDITIONS

Prior to 2004, the site consisted of parking lots, commercial office buildings, vacant lots and apartment buildings (Refer to Exhibit 1 – Site Conditions Pre-2004). The site currently consists of sparsely grassed vacant lots. All structures have been removed by the City of Wichita (Refer to Exhibit 2 – Existing Site Conditions).

Street curb inlets located in Waterman Street intercept runoff from areas north and south of Waterman and discharge into a collector sewer that flows west to the Arkansas River. (Refer to Exhibit 3 – Existing Site Drainage).

Street curb inlets located in Lewis Street, west of Main Street, receive runoff from an area bordered by Broadway to the east and approximately one half block north and south of Lewis Street. This runoff is collected and piped underground to the west, discharging into the river just south of the Lewis Street Bridge. (Refer to Exhibit 3 – Existing Site drainage).

Inlets located in Dewey Street and Wichita capture runoff from the southern part of the site. Pipe flow is directed south to a collector sewer that discharges to the river south of the Gander Mountain building. (Refer to Exhibit 3 – Existing Site Drainage).

SOILS

According to the National Resources Conservation Service (NRCS) soils survey for Sedgwick County, the site is in the Urban land series – Canadian complex, 0 to 3 percent slopes. (Refer to Exhibit B)

Drainage class is "well drained". (Refer to Exhibit C)

Soil is comprised of fine sandy loam, loam, sandy loam, and sandy fine loam. (Refer to Exhibits D & E)

PROPOSED DEVELOPMENT CONDITIONS

The proposed Waterwalk Addition will be comprised of offices, residential, parking, and retail structures. Existing streets will be relocated to accommodate the new layout. Landscaped areas with various water features and walking areas will be constructed to create a pedestrian friendly environment. (Refer to Exhibit 4 – Developed Site Layout)

Due to the urban setting of the development, ground slopes will vary from 1 to 3 percent. Streets will have a minimum slope of 0.3 percent.

The site is in a regulatory flood zone. The area is classified as Zone B per FIRM Panel 25, City of Wichita, Sedgwick County, Kansas, May 15, 1986. Minimum building pad elevation is 1293.00 (NAVD 88 Datum). (Refer to Exhibit F).

Runoff was modeled based on the Rational Method with rainfall intensities derived from data obtained from KDOT 's "Rainfall Intensity Tables for Counties in Kansas, Revised Edition, 1997." (Refer to Exhibit G) Drainage Areas are shown in Exhibit 6 (Developed Site Drainage Areas).

DRAINAGE SUMMARY

The proposed Waterwalk Addition will be constructed so that surface runoff from the building sites will be collected and piped underground to the existing storm water system for eventual discharge to the Arkansas River (Refer to Exhibit 5 – Developed Site Drainage Plan).

The proposed storm sewer improvements will discharge into the existing sewer lines. During preliminary design discussions with the City of Wichita Engineering Department, it was decided that the new system be designed based on the capacity of the existing downstream pipes, with the objective being to meet the requirements of the 10 year storm.

At Lewis Street, the capacity of the existing 48" pipe at a slope of 0.22% is 67.37 cfs. The existing storm sewer line in Lewis Street will be replaced east of Wichita Street. The 48" line will be extended to a junction box at Water Street (Refer to P & P Sheet ST1.1 of 6). A 30" line will extend north and east to allow for drainage from areas inside the site to be handled (Refer to P&P Sheet ST1.4 of 6). The 48" line will continue south on Water Street before transitioning to a 42" line that is routed east through the site to the west side of Main Street to allow runoff from the east (on Lewis Street) to be intercepted (Refer to P&P Sheets ST1.1, 2, 3 of 4). Pipe stub-outs to the right-of-way will be constructed to provide for runoff from internal portions of the development. (Refer to Sheet ST1.5 of 6).

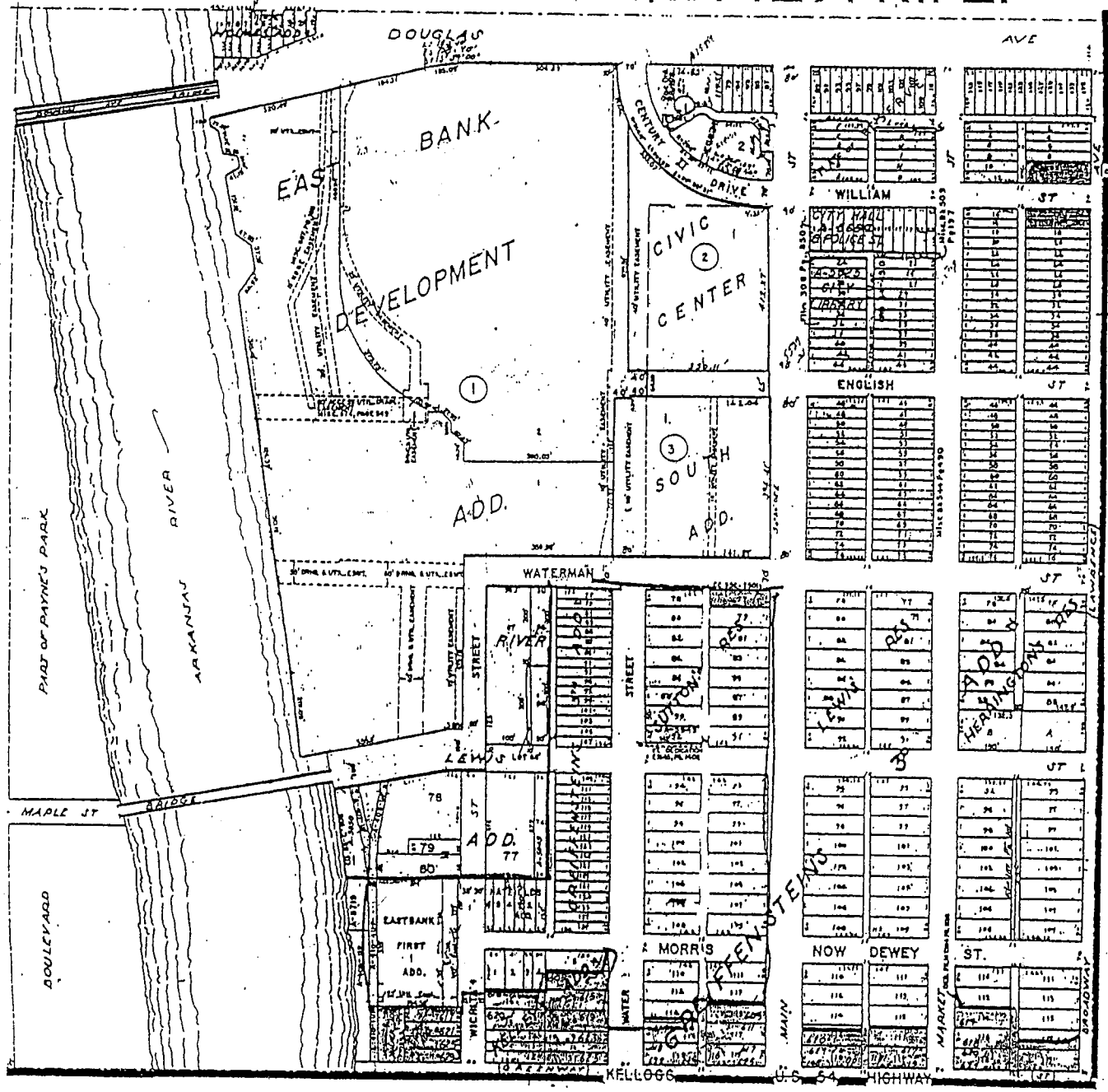
A new 30" storm sewer will be constructed along Wichita Street to handle runoff from the southwest portion of the development, including Waterwalk Commons. This line will discharge to the existing Lewis Street storm sewer (Refer to P&P Sheet ST1.2 of 6).

Runoff from the portion of the development that is adjacent to the south right-of-way of Waterman Street will be piped to the reinforced box culvert that is scheduled for construction. (Refer to P&P Sheet ST1.5, 1.6 of 6)

EXHIBITS

S. E. ¼ SEC. 20. T. WP. 27. R. 1 E.

WI 79



THIS SHEET PREPARED UNDER SUPERVISION OF
SEDGWICK COUNTY CLERK

SOIL SURVEY OF SEDGWICK COUNTY, KANSAS

Waterwalk Development

Waterwalk Development

MAP LEGEND

- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans
- Escarpment, bedrock
- Escarpment, non-bedrock
- Gulley
- Levee
- Slope
- Blowout
- Borrow Pit
- Clay Spot
- Depression, closed
- Eroded Spot
- Gravel Pit
- Gravelly Spot
- Gulley
- Lava Flow
- Landfill
- Marsh or Swamp
- Miscellaneous Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Slide or Slip
- Sinkhole
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Perennial Water
- Wet Spot

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 14

Soil Survey Area: Sedgwick County, Kansas
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

Map comprised of aerial images photographed on these dates:
3/20/1996

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

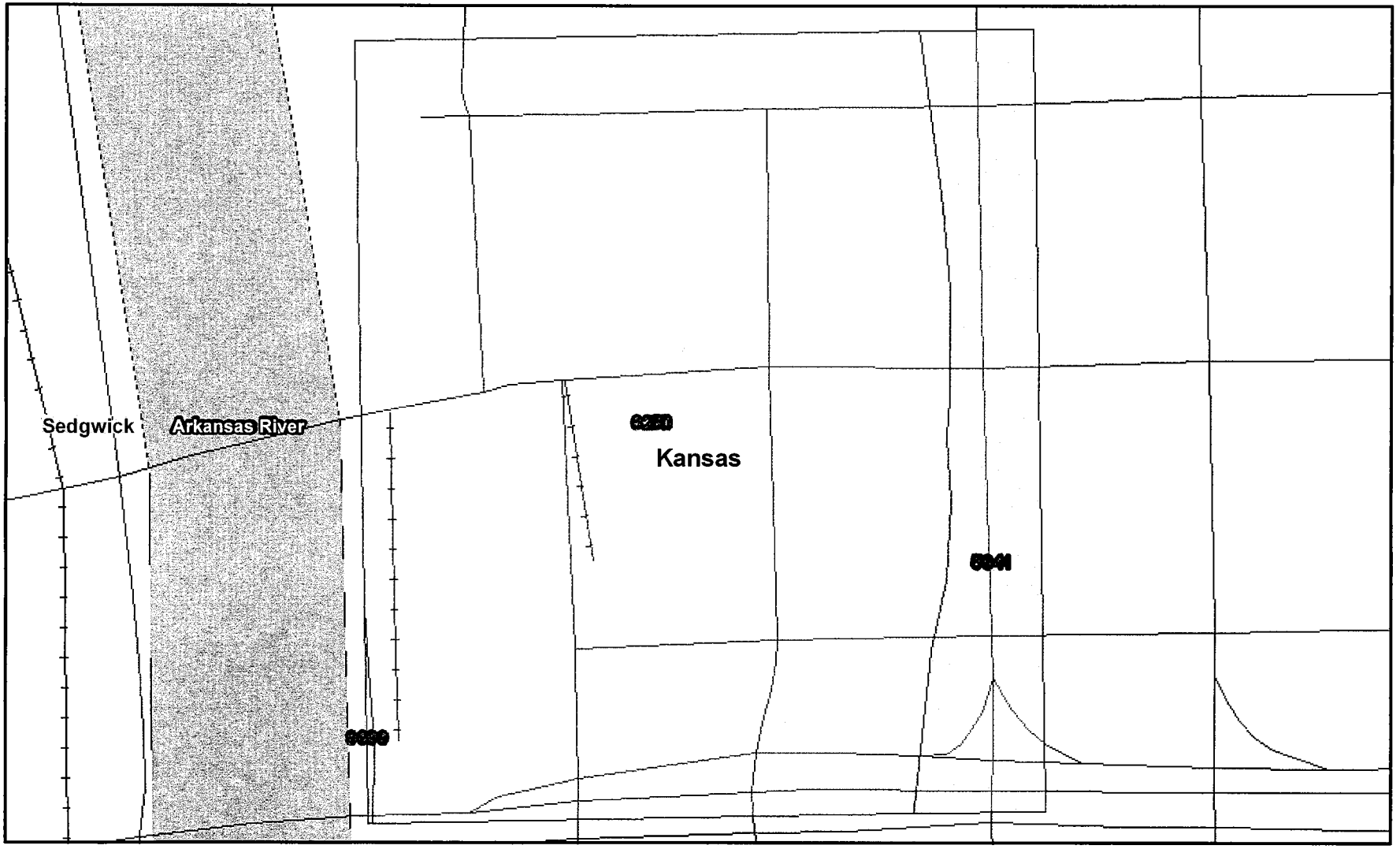
Map Unit Legend Summary

Sedgwick County, Kansas

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5841	Urban land-Tabler complex, 0 to 1 percent slopes	5.7	14.9
6250	Urban land-Canadian complex, 0 to 3 percent slopes	32.5	84.9
9999	Water	0.1	0.2

DRAINAGE CLASS RATING FOR SEDGWICK COUNTY, KANSAS

Waterwalk Development



DRAINAGE CLASS RATING FOR SEDGWICK COUNTY, KANSAS

Waterwalk Development

MAP LEGEND

Drainage Class

{Dominant Condition, >}

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Not rated or not available
- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

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Tables - Drainage Class

Summary by Map Unit - Sedgwick County, Kansas

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
5841	Urban land-Tabler complex, 0 to 1 percent slopes	Null	5.7	14.9
6250	Urban land-Canadian complex, 0 to 3 percent slopes	Well drained	32.5	84.9
9999	Water	Null	0.1	0.2

Description - Drainage Class

Drainage class (natural) refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized — excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Parameter Summary - Drainage Class

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Higher

Taxonomic Classification of the Soils

Sedgwick County, Kansas

Soil name	Family or higher taxonomic classification
Canadian	Coarse-loamy, mixed, thermic Udic Haplustolls
Tabler	Fine, smectitic, thermic Udertic Argiustolls

Engineering Properties

Sedgwick County, Kansas

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
5841:												
Urban land	---	---	---	---	---	---	---	---	---	---	---	---
Tabler	0-9	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	84-92	39-51	19-25
	9-32	Clay, Silty clay	CH	A-7	0	0	100	100	92-100	89-100	50-66	29-40
	32-60	Clay, Silty clay, Silty clay loam	CH, CL	A-7	0	0	97-100	93-100	83-100	79-100	46-65	25-40
6250:												
Urban land	---	---	---	---	---	---	---	---	---	---	---	---
Canadian	0-20	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	98-100	84-98	40-54	18-35	2-12
	20-35	Fine sandy loam, Loam, Sandy loam	SC, SC-SM	A-4	0	0	100	98-100	88-97	38-47	21-31	6-12
	35-60	Fine sandy loam, Loam, Loamy fine sand	CL, ML, SC, SC-SM, SM	A-4	0	0	100	98-100	84-98	40-54	16-30	2-12
9999:												
Water	---	---	---	---	---	---	---	---	---	---	---	---

THIS AREA PROTECTED FROM THE ONE PERCENT ANNUAL CHANCE (100-YEAR) FLOOD BY LEVEE, DIKE, OR OTHER STRUCTURES SUBJECT TO POSSIBLE FAILURE OR OVER-TOPPING DURING LARGER FLOODS.

THIS AREA PROTECTED FROM THE ONE PERCENT ANNUAL CHANCE (100-YEAR) FLOOD BY LEVEE, DIKE, OR OTHER STRUCTURES SUBJECT TO POSSIBLE FAILURE OR OVER-TOPPING DURING LARGER FLOODS.

PROJECT LOCATION

APPROXIMATE SCALE
1000 0 1000 F

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
WICHITA,
KANSAS
SEDGWICK COUNTY

PANEL 25 OF 40
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
200328 0025 B

EFFECTIVE DATE:
MAY 15, 1986

Federal Emergency Management Agency

Kansas Department of Transportation

November 3, 1997

ROAD MEMORANDUM NO. 97-5

SUBJECT: Rainfall Intensity Tables

Attached is a copy of the "Rainfall Intensity Tables for Counties in Kansas." These tables were developed from data published in Technical Memorandum NWS HYDRO-35 for the U.S. National Weather Service (Frederick et al. 1977) for durations of five (5) minutes through 60 minutes, and Technical Paper No. 40 (TP-40) of the U.S. Weather Bureau (Hershfield 1961) for longer durations as part of K-TRAN Research Project KU-92-1.

These tables supersede the rainfall intensity tables dated September 1991.

James O. Brewer

James O. Brewer, P.E.
Engineering Manager
State Road Office

JOB:JRR:js

cc: All Active Consultants - w/att. (1 each)
District Engineers - w/att. (2 each)
Chief, Bureau of Construction & Maintenance - w/att. (1)
Chief, Bureau of Traffic Engineering - w/att. (2)
Chief, Bureau of Local Projects - w/att. (25)
Chief, Bureau of Design - w/att. (1)
Kenneth F. Hurst, Engineering Manager-State Bridge Office - w/att. (6)
Road Squad Leaders - w/att. (2 each)

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY KANSAS
(revised June 1997)

This table contains average rainfall intensities in inches per hour.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:05	4.91	5.64	6.64	7.38	8.48	9.34	10.20
0:06	4.62	5.34	6.33	7.07	8.15	9.00	9.84
0:07	4.38	5.09	6.08	6.80	7.86	8.69	9.52
0:08	4.17	4.87	5.85	6.56	7.60	8.41	9.22
0:09	4.00	4.68	5.63	6.33	7.34	8.14	8.93
0:10	3.84	4.50	5.43	6.11	7.10	7.87	8.64
0:11	3.70	4.34	5.25	5.90	6.86	7.61	8.36
0:12	3.56	4.19	5.07	5.71	6.64	7.36	8.09
0:13	3.44	4.05	4.91	5.53	6.43	7.14	7.84
0:14	3.33	3.92	4.76	5.36	6.24	6.92	7.61
0:15	3.22	3.80	4.62	5.21	6.06	6.73	7.40
0:16	3.12	3.69	4.49	5.07	5.91	6.56	7.21
0:17	3.03	3.58	4.37	4.94	5.76	6.40	7.04
0:18	2.94	3.48	4.26	4.82	5.63	6.26	6.88
0:19	2.85	3.39	4.16	4.71	5.50	6.12	6.74
0:20	2.77	3.30	4.06	4.60	5.38	5.99	6.60
0:21	2.70	3.22	3.97	4.50	5.27	5.87	6.47
0:22	2.63	3.14	3.88	4.41	5.17	5.76	6.35
0:23	2.56	3.07	3.80	4.32	5.07	5.65	6.23
0:24	2.50	3.00	3.72	4.23	4.97	5.54	6.12
0:25	2.44	2.93	3.64	4.15	4.88	5.44	6.01
0:26	2.38	2.87	3.57	4.07	4.79	5.35	5.90
0:27	2.33	2.81	3.50	4.00	4.70	5.26	5.80
0:28	2.27	2.75	3.44	3.92	4.62	5.17	5.71
0:29	2.23	2.69	3.37	3.86	4.54	5.08	5.61
0:30	2.18	2.64	3.31	3.79	4.47	4.99	5.52
0:31	2.14	2.59	3.26	3.72	4.39	4.91	5.43
0:32	2.09	2.54	3.20	3.66	4.32	4.83	5.34
0:33	2.05	2.50	3.14	3.60	4.25	4.76	5.26
0:34	2.02	2.45	3.09	3.54	4.18	4.68	5.18
0:35	1.98	2.41	3.04	3.48	4.12	4.61	5.10
0:36	1.94	2.37	2.99	3.43	4.05	4.54	5.02
0:37	1.91	2.33	2.94	3.38	3.99	4.47	4.95
0:38	1.88	2.29	2.90	3.32	3.93	4.40	4.87
0:39	1.85	2.25	2.85	3.27	3.87	4.34	4.80
0:40	1.82	2.22	2.81	3.23	3.82	4.28	4.73
0:41	1.79	2.18	2.77	3.18	3.76	4.22	4.67
0:42	1.76	2.15	2.73	3.13	3.71	4.16	4.60
0:43	1.73	2.12	2.69	3.09	3.66	4.10	4.54
0:44	1.71	2.09	2.65	3.05	3.61	4.04	4.48
0:45	1.68	2.06	2.62	3.01	3.56	3.99	4.42
0:46	1.66	2.03	2.58	2.96	3.51	3.94	4.36
0:47	1.63	2.00	2.55	2.93	3.47	3.89	4.30
0:48	1.61	1.97	2.51	2.89	3.42	3.84	4.25
0:49	1.59	1.95	2.48	2.85	3.38	3.79	4.20
0:50	1.57	1.92	2.45	2.81	3.34	3.74	4.15

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY KANSAS
(revised June 1997)

This table contains average rainfall intensities in inches per hour.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:51	1.55	1.90	2.42	2.78	3.30	3.70	4.10
0:52	1.53	1.87	2.39	2.75	3.26	3.65	4.05
0:53	1.51	1.85	2.36	2.71	3.22	3.61	4.00
0:54	1.49	1.83	2.33	2.68	3.18	3.57	3.95
0:55	1.47	1.80	2.30	2.65	3.14	3.53	3.91
0:56	1.45	1.78	2.28	2.62	3.11	3.49	3.86
0:57	1.43	1.76	2.25	2.59	3.07	3.45	3.82
0:58	1.41	1.74	2.22	2.56	3.04	3.41	3.78
0:59	1.40	1.72	2.20	2.53	3.01	3.37	3.74
1:00	1.38	1.70	2.17	2.50	2.97	3.34	3.70
1:05	1.30	1.61	2.06	2.38	2.82	3.17	3.52
1:10	1.23	1.53	1.96	2.26	2.69	3.02	3.35
1:15	1.17	1.45	1.87	2.16	2.57	2.89	3.20
1:20	1.11	1.38	1.79	2.06	2.46	2.77	3.07
1:25	1.06	1.32	1.71	1.98	2.36	2.65	2.95
1:30	1.01	1.27	1.64	1.90	2.27	2.55	2.83
1:35	0.97	1.21	1.58	1.83	2.18	2.46	2.73
1:40	0.93	1.16	1.52	1.76	2.10	2.37	2.63
1:45	0.89	1.12	1.46	1.70	2.03	2.29	2.54
1:50	0.86	1.08	1.41	1.64	1.96	2.21	2.46
1:55	0.82	1.04	1.36	1.58	1.89	2.13	2.38
2:00	0.79	1.00	1.31	1.53	1.83	2.07	2.30
2:05	0.76	0.97	1.27	1.48	1.77	2.00	2.23
2:10	0.74	0.93	1.23	1.43	1.72	1.94	2.16
2:15	0.71	0.90	1.19	1.39	1.67	1.88	2.10
2:20	0.69	0.87	1.15	1.35	1.62	1.83	2.04
2:25	0.66	0.85	1.12	1.31	1.57	1.78	1.98
2:30	0.64	0.82	1.09	1.27	1.53	1.73	1.93
2:35	0.62	0.80	1.06	1.24	1.49	1.68	1.88
2:40	0.61	0.78	1.03	1.21	1.45	1.64	1.83
2:45	0.59	0.75	1.01	1.18	1.42	1.60	1.79
2:50	0.57	0.74	0.98	1.15	1.38	1.56	1.74
2:55	0.56	0.72	0.96	1.12	1.35	1.53	1.70
3:00	0.55	0.70	0.94	1.10	1.32	1.49	1.67
3:15	0.51	0.66	0.88	1.03	1.24	1.40	1.57
3:30	0.48	0.62	0.83	0.97	1.17	1.32	1.48
3:45	0.45	0.59	0.78	0.92	1.11	1.26	1.40
4:00	0.43	0.56	0.75	0.88	1.06	1.20	1.34
4:15	0.41	0.53	0.71	0.84	1.01	1.14	1.28
4:30	0.40	0.51	0.68	0.80	0.97	1.10	1.22
4:45	0.38	0.49	0.66	0.77	0.93	1.05	1.17
5:00	0.37	0.47	0.63	0.74	0.89	1.01	1.13
5:15	0.36	0.46	0.61	0.72	0.86	0.98	1.09
5:30	0.35	0.44	0.59	0.69	0.83	0.94	1.05
5:45	0.34	0.43	0.57	0.67	0.81	0.91	1.02
6:00	0.33	0.42	0.55	0.65	0.78	0.88	0.98

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY KANSAS
(revised June 1997)

This table contains average rainfall intensities in inches per hour.

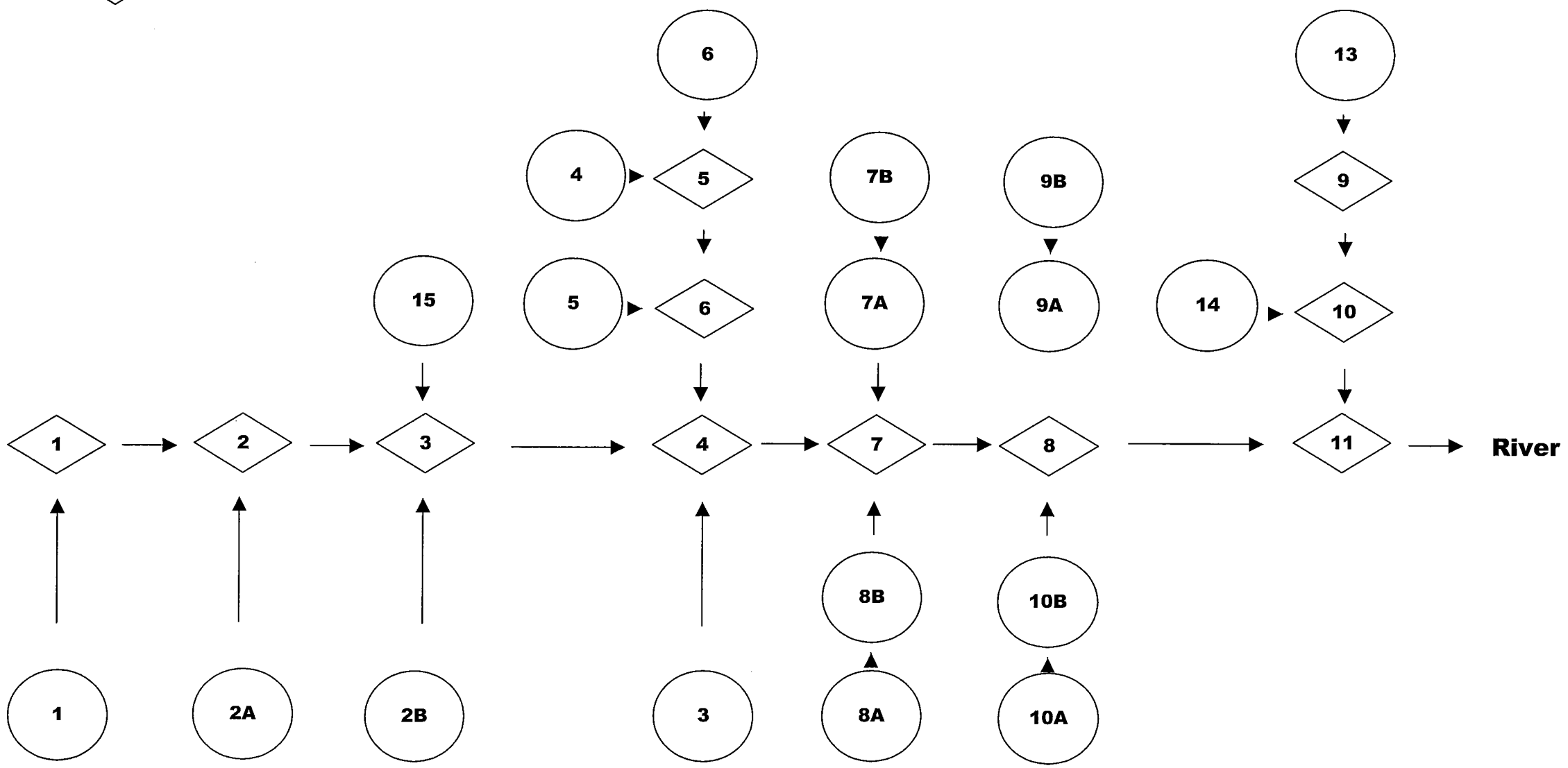
DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
6:30	0.31	0.39	0.52	0.61	0.73	0.83	0.92
7:00	0.29	0.37	0.49	0.58	0.69	0.78	0.87
7:30	0.28	0.35	0.47	0.55	0.66	0.74	0.83
8:00	0.27	0.34	0.45	0.52	0.62	0.70	0.78
8:30	0.26	0.32	0.43	0.50	0.60	0.67	0.75
9:00	0.25	0.31	0.41	0.47	0.57	0.64	0.71
9:30	0.24	0.30	0.39	0.45	0.54	0.61	0.68
10:00	0.23	0.29	0.38	0.44	0.52	0.59	0.66
10:30	0.22	0.28	0.36	0.42	0.50	0.57	0.63
11:00	0.21	0.27	0.35	0.41	0.48	0.55	0.61
11:30	0.21	0.26	0.34	0.39	0.47	0.53	0.59
12:00	0.20	0.25	0.33	0.38	0.45	0.51	0.57
13:00	0.19	0.24	0.31	0.36	0.42	0.48	0.53
14:00	0.18	0.22	0.29	0.33	0.40	0.45	0.50
15:00	0.17	0.21	0.27	0.32	0.38	0.43	0.47
16:00	0.16	0.20	0.26	0.30	0.36	0.40	0.45
17:00	0.15	0.19	0.25	0.29	0.34	0.39	0.43
18:00	0.15	0.18	0.24	0.27	0.33	0.37	0.41
19:00	0.14	0.18	0.23	0.26	0.31	0.35	0.39
20:00	0.14	0.17	0.22	0.25	0.30	0.34	0.38
21:00	0.13	0.16	0.21	0.24	0.29	0.33	0.36
22:00	0.13	0.16	0.20	0.23	0.28	0.31	0.35
23:00	0.12	0.15	0.20	0.23	0.27	0.30	0.34
24:00	0.12	0.15	0.19	0.22	0.26	0.29	0.32

RUNOFF CALCULATIONS

Legand:

Drainage Areas

NODE
(Junction Box)



FLOW SCHEMATIC

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *Drainage Area 1 -East of Main West of Broadway* Revised 6/12/2006
Flow surface type: *Overland Flow to Channel Flow (Street)*
Flow at MH Node 1
D.A.: 8.4 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	8.4
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	8.4

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	235	0.50%	0.4450	9.68
	Length	Velocity (fps)		
Channel Flow	775	1		12.92
	Length	Velocity (fps)		
Pipe Flow	0	0		0.00
			Total	**22.60** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	3.33	Q2=	25.1
i5=	4.01	Q5=	30.3
i10=	4.50	Q10=	34.0
i25=	5.26	Q25=	39.8
i50=	5.84	Q50=	44.2
i100=	6.41	Q100=	48.5

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	42.00	RCP	Diameter (in)=	36.00	RCP
n=	0.013		n=	0.013	
S=	0.22%		S=	0.22%	
A=	9.62	sq.ft.	A=	7.07	sq.ft.
Wet.Per.=	11.00	feet	Wet.Per.=	9.42	feet
Hydr. radius=	0.88	feet	Hydr. radius=	0.75	feet
Velocity=	4.90	fps	Velocity=	4.43	fps
Q=	**47.19**	**cfs**	**Q=**	**31.28**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	4.06	ft	D+1.5*(V^2/2g)=	3.46	ft

Pipe Capacity

Capacity 42" RCP @ 0.22% = 47.19 cfs > 34.0 cfs (Q10) **OK**

Q100 will be picked up by the storm sewer structure

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006
		Revised 6/12/2006

Drainage Area Designation: *D.A. 1,2A -West Main Street*
Flow surface type: *Overland Flow to Channel Flow (Street, Building)*
Flow at MH Node 2
D.A.: 10.95 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	10.95
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	10.95

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	235	0.50%	0.4450	9.68	
	Length	Velocity (fps)			
Channel Flow	775	1		12.92	
	Length	Velocity (fps)			
Pipe Flow	313.78	4.9		1.07	
			Total	**23.66**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	3.24	Q2=	32.0
i5=	3.92	Q5=	38.6
i10=	4.40	Q10=	43.3
i25=	5.15	Q25=	50.7
i50=	5.72	Q50=	56.3
i100=	6.28	Q100=	61.9

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00 RCP	Diameter (in)=	42.00 RCP
n=	0.013	n=	0.013
S=	0.22%	S=	0.22%
A=	12.57 sq.ft.	A=	9.62 sq.ft.
Wet.Per.=	12.57 feet	Wet.Per.=	11.00 feet
Hydr. radius=	1.00 feet	Hydr. radius=	0.88 feet
Velocity=	5.36 fps	Velocity=	4.90 fps
Q=	**67.37 cfs**	**Q=**	**47.19 cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67 ft	D+1.5*(V^2/2g)=	4.06 ft

Pipe Capacity

Capacity 42" RCP @ 0.22% = 47.19 cfs > 43.30 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 15* Revised 6/12/2006
Flow surface type: *Overland Flow (Street)*
Flow at MH Node 3
D.A.: 0.59 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.59
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.59

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	380	0.30%	0.4450	12.81
	Length	Velocity (fps)		
Channel Flow	0	1		0.00
	Length	Velocity (fps)		
Pipe Flow	0	5		0.00
			Total	**12.81** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	4.33	Q2=	2.3
i5=	5.15	Q5=	2.7
i10=	5.71	Q10=	3.0
i25=	6.62	Q25=	3.5
i50=	7.33	Q50=	3.9
i100=	8.01	Q100=	4.3

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	24.00 RCP	Diameter (in)=	18.00 RCP
n=	0.013	n=	0.013
S=	3.30%	S=	1.00%
A=	3.14 sq.ft.	A=	1.77 sq.ft.
Wet.Per.=	6.28 feet	Wet.Per.=	4.71 feet
Hydr. radius=	0.50 feet	Hydr. radius=	0.38 feet
Velocity=	13.08 fps	Velocity=	5.94 fps
Q=	**41.10 cfs**	**Q=**	**10.50 cfs**

Required Head:

D+1.5*(V^2/2g)=	5.99 ft	D+1.5*(V^2/2g)=	2.32 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 3.00 cfs (Q10) **OK**
Capacity 24" RCP @ 3.30% = 41.10 cfs > 3.0 cfs (Q10) **OK**
Q100 will be picked up by the storm sewer structure

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006
		Revised 6/12/2006

Drainage Area Designation: *D.A. 1, 2A, 2B, 15*
Flow surface type: *Overland to Channel Flow (Street, Building)*
Flow at MH Node 3
D.A.: 12.25 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	12.25
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	12.25

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	235	0.50%	0.4450	9.68	
	Length	Velocity (fps)			
Channel Flow	775	1		12.92	
	Length	Velocity (fps)			
Pipe Flow	313.78	4.9		1.07	
Pipe Flow	562.76	4.9		1.91	
			Total	**25.58**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	3.11	Q2=	34.3
i5=	3.76	Q5=	41.5
i10=	4.23	Q10=	46.7
i25=	4.96	Q25=	54.7
i50=	5.51	Q50=	60.8
i100=	6.06	Q100=	66.8

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00 RCP	Diameter (in)=	42.00 RCP
n=	0.013	n=	0.013
S=	0.22%	S=	0.22%
A=	12.57 sq.ft.	A=	9.62 sq.ft.
Wet.Per.=	12.57 feet	Wet.Per.=	11.00 feet
Hydr. radius=	1.00 feet	Hydr. radius=	0.88 feet
Velocity=	5.36 fps	Velocity=	4.90 fps
Q=	**67.37 cfs**	**Q=**	**47.19 cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67 ft	D+1.5*(V^2/2g)=	4.06 ft

Pipe Capacity

Capacity 48" RCP @ 0.22% = 67.37 cfs > 46.70 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006
		Revised 6/12/2006

Drainage Area Designation: *Node 4*

Flow surface type: *Overland to Channel Flow (Street, Building)*

D.A. 1, 2A, 2B, 15, 3, 4, 5, 6

D.A.: 14.53 acres

Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	14.53
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	14.53

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00

Dnstream Elevation 0.00

	Length	Slope	Velocity (fps)	k	Tc	
Overland	235	0.50%		0.4450	9.68	
Channel Flow	775		1		12.92	
Pipe Flow	313.78		4.9		1.07	
Pipe Flow	562.76		4.9		1.91	
Pipe Flow	249.27		5		0.83	
				Total	**26.41**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	3.05	Q2=	39.9
i5=	3.70	Q5=	48.4
i10=	4.16	Q10=	54.5
i25=	4.88	Q25=	63.9
i50=	5.43	Q50=	71.0
i100=	5.96	Q100=	78.0

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00	RCP	Diameter (in)=	42.00	RCP
n=	0.013		n=	0.013	
S=	0.22%		S=	0.22%	
A=	12.57	sq.ft.	A=	9.62	sq.ft.
Wet.Per.=	12.57	feet	Wet.Per.=	11.00	feet
Hydr. radius=	1.00	feet	Hydr. radius=	0.88	feet
Velocity=	5.36	fps	Velocity=	4.90	fps
Q=	**67.37**	**cfs**	**Q=**	**47.19**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67	ft	D+1.5*(V^2/2g)=	4.06	ft

Pipe Capacity

Capacity 48" RCP @ 0.22% = 67.37 cfs > 54.5 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 3* Revised 6/12/2006
Flow surface type: *Overland Flow (Sidewalk)*
Flow at MH Node 4
D.A.: 1.2 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	1.2
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	1.2

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	1.00%	0.4450	7.94	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	100	5		0.33	
			Total	**8.27**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	5.04	Q2=	5.4
i5=	5.97	Q5=	6.4
i10=	6.57	Q10=	7.1
i25=	7.57	Q25=	8.2
i50=	8.38	Q50=	9.1
i100=	9.13	Q100=	9.9

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	30.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	0.50%	S=	0.50%
A=	4.91 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	7.85 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.63 feet	Hydr. radius=	0.50 feet
Velocity=	5.91 fps	Velocity=	5.09 fps
Q=	**29.00 cfs**	**Q=**	**16.00 cfs**

Required Head:

D+1.5*(V^2/2g)=	3.31 ft	D+1.5*(V^2/2g)=	2.60 ft

Pipe Capacity

Capacity 30" RCP @ 0.50% = 29.00 cfs > 7.10 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 4* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 5
D.A.: 0.49 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.49
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.49

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	140	1.00%	0.4450	6.96	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**6.96**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.30	Q2=	2.3
i5=	6.27	Q5=	2.8
i10=	6.87	Q10=	3.0
i25=	7.91	Q25=	3.5
i50=	8.75	Q50=	3.9
i100=	9.53	Q100=	4.2

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	0.50%	S=	0.50%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	4.20 fps	Velocity=	5.09 fps
Q=	**7.43 cfs**	**Q=**	**16.00 cfs**

Required Head:

D+1.5*(V^2/2g)=	1.91 ft	D+1.5*(V^2/2g)=	2.60 ft

Pipe Capacity

Capacity 24" RCP @ 0.05% = 16.00 cfs > 3.09 cfs (Q10) **OK**
Capacity 18" RCP @ 0.50% = 7.43 cfs > 3.09 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 5* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 6
D.A.: 0.25 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.25
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.25

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	160	1.00%	0.4450	7.31	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	50	5		0.17	
			Total	**7.48**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.19	Q2=	1.2
i5=	6.15	Q5=	1.4
i10=	6.75	Q10=	1.5
i25=	7.77	Q25=	1.7
i50=	8.60	Q50=	1.9
i100=	9.37	Q100=	2.1

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	0.50%		S=	0.50%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	4.20	fps	Velocity=	5.09	fps
Q=	**7.43**	**cfs**	**Q=**	**16.00**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	1.91	ft	D+1.5*(V^2/2g)=	2.60	ft

Pipe Capacity

Capacity 24" RCP @ 0.5% = 16.00 cfs > 1.5 cfs (Q10) **OK**
Capacity 18" RCP @ 0.50% = 7.43 cfs > 1.5 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 6* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 5
D.A.: 0.34 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.34
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.34

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	180	1.00%	0.4450	7.64
	Length	Velocity (fps)		
Channel Flow	0	1		0.00
	Length	Velocity (fps)		
Pipe Flow	0	5		0.00
			Total	**7.64** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.16	Q2=	1.6
i5=	6.11	Q5=	1.9
i10=	6.71	Q10=	2.1
i25=	7.73	Q25=	2.4
i50=	8.56	Q50=	2.6
i100=	9.32	Q100=	2.9

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 24" RCP @ 1.0% = 22.62 cfs > 2.10 cfs (Q10) **OK**
Capacity 18" RCP @ 1.00% = 10.50 cfs > 2.10 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 4, 6* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 5
D.A.: 0.83 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.83
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.83

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	180	1.00%	0.4450	7.64	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	20	5		0.07	
Pipe Flow	55	5		0.18	
			Total	**7.89**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.11	Q2=	3.8
i5=	6.06	Q5=	4.5
i10=	6.65	Q10=	5.0
i25=	7.67	Q25=	5.7
i50=	8.49	Q50=	6.3
i100=	9.25	Q100=	6.9

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	30.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	0.30%	S=	0.30%
A=	4.91 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	7.85 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.63 feet	Hydr. radius=	0.50 feet
Velocity=	4.58 fps	Velocity=	3.94 fps
Q=	**22.47 cfs**	**Q=**	**12.39 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.99 ft	D+1.5*(V^2/2g)=	2.36 ft

Pipe Capacity

Capacity 24" RCP @ 0.30% = 12.39 cfs > 5.0 cfs (Q10) **OK**
Capacity 30" RCP @ 0.30% = 22.47 cfs > 5.0 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006
Drainage Area Designation:	*D.A. 4, 5, 6*	Revised 6/12/2006
Flow surface type:	*Overland Flow (Building)*	
	Flow at MH Node 6	
D.A.:	1.08 acres	
Weighted C:	0.9000	

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	1.08
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	1.08

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation	0.00
Dnstream Elevation	0.00

	Length	Slope	Velocity (fps)	k	Tc	
Overland	180	1.00%		0.4450	7.64	
Channel Flow	0		1		0.00	
Pipe Flow	20		5		0.07	
Pipe Flow	55		5		0.18	
Pipe Flow	16		5		0.05	
				Total	**7.89**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.11	Q2=	5.0
i5=	6.06	Q5=	5.9
i10=	6.65	Q10=	6.5
i25=	7.67	Q25=	7.5
i50=	8.49	Q50=	8.2
i100=	9.25	Q100=	9.0

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	30.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	0.30%		S=	0.30%	
A=	4.91	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	7.85	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.63	feet	Hydr. radius=	0.50	feet
Velocity=	4.58	fps	Velocity=	3.94	fps
Q=	**22.47**	**cfs**	**Q=**	**12.39**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.99	ft	D+1.5*(V^2/2g)=	2.36	ft

Pipe Capacity

Capacity 24" RCP @ 0.30% = 12.39 cfs > 6.5 cfs (Q10) **OK**

Capacity 30" RCP @ 0.30% = 22.47 cfs > 6.5 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007 Printed	6/22/2006

Drainage Area Designation: *D.A. 7A* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 7
D.A.: 0.61 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.61
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.61

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	1.00%	0.4450	7.94	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**7.94**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.10	Q2=	2.8
i5=	6.04	Q5=	3.3
i10=	6.64	Q10=	3.6
i25=	7.66	Q25=	4.2
i50=	8.47	Q50=	4.7
i100=	9.23	Q100=	5.1

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.5 cfs > 3.69 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 3.6 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 7B* Revised 6/12/2006

Flow surface type: *Overland Flow (Sidewalk, Pavement)*

Flow at MH Node 7

D.A.: 0.19 acres

Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.19
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.19

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00

Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	75	1.00%	0.4450	5.52	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**5.52**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.61	Q2=	1.0
i5=	6.63	Q5=	1.1
i10=	7.25	Q10=	1.2
i25=	8.32	Q25=	1.4
i50=	9.21	Q50=	1.6
i100=	10.01	Q100=	1.7

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.5 cfs > 1.2 cfs (Q10) **OK**

Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.2 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007 Printed	6/22/2006
Drainage Area Designation:	*D.A. 8A* Revised	6/12/2006
Flow surface type:	*Overland Flow (Building)*	
	Flow at MH Node 7	
D.A.:	0.23 acres	
Weighted C:	0.9000	

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.23
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.23

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation	0.00
Dnstream Elevation	0.00

	Length	Slope	k	Tc	
Overland	110	1.00%	0.4450	6.36	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	60	5		0.20	
			Total	**6.56**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.38	Q2=	1.1
i5=	6.36	Q5=	1.3
i10=	6.97	Q10=	1.4
i25=	8.02	Q25=	1.7
i50=	8.87	Q50=	1.8
i100=	9.66	Q100=	2.0

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	1.00%		S=	1.00%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	5.94	fps	Velocity=	7.20	fps
Q=	**10.50**	**cfs**	**Q=**	**22.62**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32	ft	D+1.5*(V^2/2g)=	3.21	ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 1.4 cfs (Q10) **OK**

Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.4 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 8B* Revised 6/12/2006
Flow surface type: *Overland Flow (Sidewalk, Pavement)*
Flow at MH Node 7
D.A.: 0.19 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.19
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.19

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	75	1.00%	0.4450	5.52	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**5.52**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.61	Q2=	1.0
i5=	6.63	Q5=	1.1
i10=	7.25	Q10=	1.2
i25=	8.32	Q25=	1.4
i50=	9.21	Q50=	1.6
i100=	10.01	Q100=	1.7

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 1.2 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.2 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006
		Revised 6/12/2006

Drainage Area Designation: *Node 7*
Flow surface type: *Overland to Channel Flow (Street, Building)*
D.A. 1/2A/2B/15/3/4/5/6/7A/7B/8A/8B

D.A.: 15.75 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	15.75
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	15.75

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	235	0.50%	0.4450	9.68	
	Length	Velocity (fps)			
Channel Flow	775	1		12.92	
	Length	Velocity (fps)			
Pipe Flow	313.78	4.9		1.07	
Pipe Flow	562.76	4.9		1.91	
Pipe Flow	249.27	5.36		0.78	
Pipe Flow	103.31	5.36		0.32	
			Total	**26.67**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	3.04	Q2=	43.0
i5=	3.68	Q5=	52.2
i10=	4.14	Q10=	58.7
i25=	4.86	Q25=	68.9
i50=	5.40	Q50=	76.6
i100=	5.94	Q100=	84.2

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00	RCP	Diameter (in)=	42.00	RCP
n=	0.013		n=	0.013	
S=	0.22%		S=	0.22%	
A=	12.57	sq.ft.	A=	9.62	sq.ft.
Wet.Per.=	12.57	feet	Wet.Per.=	11.00	feet
Hydr. radius=	1.00	feet	Hydr. radius=	0.88	feet
Velocity=	5.36	fps	Velocity=	4.90	fps
Q=	**67.37**	**cfs**	**Q=**	**47.19**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67	ft	D+1.5*(V^2/2g)=	4.06	ft

Pipe Capacity

Capacity 48" RCP @ 0.22% = 67.37 cfs > 58.7 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 9A* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 8
D.A.: 0.43 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.43
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.43

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	210	1.00%	0.4450	8.08
	Length	Velocity (fps)		
Channel Flow	0	1		0.00
	Length	Velocity (fps)		
Pipe Flow	0	5		0.00
			Total	**8.08** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.08	Q2=	2.0
i5=	6.01	Q5=	2.3
i10=	6.61	Q10=	2.6
i25=	7.62	Q25=	2.9
i50=	8.43	Q50=	3.3
i100=	9.19	Q100=	3.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 2.6 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 2.6 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007 Printed	6/22/2006
Drainage Area Designation:	*D.A. 9B* Revised	6/12/2006
Flow surface type:	*Overland Flow (Sidewalk, Pavement)*	
	Flow at MH Node 8	
D.A.:	0.2 acres	
Weighted C:	0.9000	

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.2
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.2

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation	0.00
Dnstream Elevation	0.00

	Length	Slope	k	Tc	
Overland	75	1.00%	0.4450	5.52	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**5.52**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.61	Q2=	1.0
i5=	6.63	Q5=	1.2
i10=	7.25	Q10=	1.3
i25=	8.32	Q25=	1.5
i50=	9.21	Q50=	1.7
i100=	10.01	Q100=	1.8

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 1.3 cfs (Q10) **OK**

Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.3 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 10A* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*
Flow at MH Node 8
D.A.: 0.23 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.23
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.23

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	110	1.00%	0.4450	6.36	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	60	5		0.20	
			Total	**6.56**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.38	Q2=	1.1
i5=	6.36	Q5=	1.3
i10=	6.97	Q10=	1.4
i25=	8.02	Q25=	1.7
i50=	8.87	Q50=	1.8
i100=	9.66	Q100=	2.0

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 1.4 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.4 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 10B* Revised 6/12/2006
Flow surface type: *Overland Flow (Sidewalk, Pavement)*
Flow at MH Node 8
D.A.: 0.17 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.17
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.17

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	75	1.00%	0.4450	5.52
	Length	Velocity (fps)		
Channel Flow	0	1		0.00
	Length	Velocity (fps)		
Pipe Flow	0	5		0.00
			Total	**5.52** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.61	Q2=	0.9
i5=	6.63	Q5=	1.0
i10=	7.25	Q10=	1.1
i25=	8.32	Q25=	1.3
i50=	9.21	Q50=	1.4
i100=	10.01	Q100=	1.5

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 1.1 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.1 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007 Printed	6/22/2006
		Revised 6/12/2006

Drainage Area Designation: *Node 8*
Flow surface type: *Overland to Channel Flow (Street, Building)*
D.A. 1/2A/2B/15/3/4/5/6/7A/7B/8A/8B/9A/9B/10A/10B

D.A.: 16.78 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	16.78
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	16.78

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	Velocity (fps)	k	Tc	
Overland	235	0.50%		0.4450	9.68	
Channel Flow	775		1		12.92	
	Length		Velocity (fps)			
Pipe Flow	313.78		4.9		1.07	
Pipe Flow	562.76		4.9		1.91	
Pipe Flow	249.27		5.36		0.78	
Pipe Flow	103.31		5.36		0.32	
Pipe Flow	122		5.36		0.38	
				Total	**27.05**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	3.01	Q2=	45.5
i5=	3.65	Q5=	55.2
i10=	4.11	Q10=	62.1
i25=	4.82	Q25=	72.9
i50=	5.36	Q50=	81.0
i100=	5.90	Q100=	89.1

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00	RCP	Diameter (in)=	42.00	RCP
n=	0.013		n=	0.013	
S=	0.22%		S=	0.22%	
A=	12.57	sq.ft.	A=	9.62	sq.ft.
Wet.Per.=	12.57	feet	Wet.Per.=	11.00	feet
Hydr. radius=	1.00	feet	Hydr. radius=	0.88	feet
Velocity=	5.36	fps	Velocity=	4.90	fps
Q=	**67.37**	**cfs**	**Q=**	**47.19**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67	ft	D+1.5*(V^2/2g)=	4.06	ft

Pipe Capacity

Capacity 48" RCP @ 0.22% = 67.37 cfs > 62.1 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 13* Revised 6/12/2006
Flow surface type: *Overland Flow (Street, Building)*
Flow at MH Node 9
D.A.: 1.44 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	1.44
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	1.44

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc
Overland	240	0.50%	0.4450	9.76
	Length	Velocity (fps)		
Channel Flow	0	1		0.00
	Length	Velocity (fps)		
Pipe Flow	0	5		0.00
			Total	**9.76** **min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	4.78	Q2=	6.2
i5=	5.67	Q5=	7.4
i10=	6.26	Q10=	8.1
i25=	7.23	Q25=	9.4
i50=	8.00	Q50=	10.4
i100=	8.73	Q100=	11.3

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	0.50%	S=	0.50%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	4.20 fps	Velocity=	5.09 fps
Q=	**7.43 cfs**	**Q=**	**16.00 cfs**

Required Head:

D+1.5*(V^2/2g)=	1.91 ft	D+1.5*(V^2/2g)=	2.60 ft

Pipe Capacity

Capacity 18" RCP @ .05% = 7.43 cfs > 4.05 cfs (Q10) **OK**
Capacity 24" RCP @ 0.50% = 16.00 cfs > 8.1 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 14* Revised 6/12/2006
Flow surface type: *Overland Flow (Street, Building)*
Flow at MH Node 10
D.A.: 2.02 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	2.02
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	2.02

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	240	0.50%	0.4450	9.76	
	Length	Velocity (fps)			
Channel Flow	0	1		0.00	
	Length	Velocity (fps)			
Pipe Flow	110	5		0.37	
Pipe Flow	43	5		0.14	
			Total	**10.27**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	4.70	Q2=	8.5
i5=	5.58	Q5=	10.1
i10=	6.16	Q10=	11.2
i25=	7.12	Q25=	12.9
i50=	7.88	Q50=	14.3
i100=	8.60	Q100=	15.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	24.00 RCP	Diameter (in)=	30.00 RCP
n=	0.013	n=	0.013
S=	0.50%	S=	0.40%
A=	3.14 sq.ft.	A=	4.91 sq.ft.
Wet.Per.=	6.28 feet	Wet.Per.=	7.85 feet
Hydr. radius=	0.50 feet	Hydr. radius=	0.63 feet
Velocity=	5.09 fps	Velocity=	5.28 fps
Q=	**16.00 cfs**	**Q=**	**25.94 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.60 ft	D+1.5*(V^2/2g)=	3.15 ft

Pipe Capacity

Capacity 24" RCP @ 0.50% = 16.00 cfs > 11.2 cfs (Q10) **OK**
Capacity 30" RCP @ 0.40% = 25.94 cfs > 11.20 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007 Printed	6/22/2006
Drainage Area Designation:	*Node 11* Revised	6/12/2006

Flow surface type: *Overland to Channel Flow (Street, Building)*

D.A. 1/2A/2B/15/3/4/5/6/7A/7B/8A/8B/9A/9B/10A/l0B/13/14

D.A.: 18.8 acres

Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	18.8
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	18.8

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00

Dnstream Elevation 0.00

	Length	Slope	Velocity (fps)	k	Tc	
Overland	235	0.50%		0.4450	9.68	
Channel Flow	775	1			12.92	
Pipe Flow	313.78	4.9			1.07	
Pipe Flow	562.76	4.9			1.91	
Pipe Flow	249.27	5.36			0.78	
Pipe Flow	103.31	5.36			0.32	
Pipe Flow	122	5.36			0.38	
Pipe Flow	223	5.36			0.69	
				Total	**27.75**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	2.97	Q2=	50.2
i5=	3.61	Q5=	61.0
i10=	4.06	Q10=	68.7
i25=	4.76	Q25=	80.6
i50=	5.30	Q50=	89.6
i100=	5.83	Q100=	98.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	48.00 RCP	Diameter (in)=	42.00 RCP
n=	0.013	n=	0.013
S=	0.22%	S=	0.22%
A=	12.57 sq.ft.	A=	9.62 sq.ft.
Wet.Per.=	12.57 feet	Wet.Per.=	11.00 feet
Hydr. radius=	1.00 feet	Hydr. radius=	0.88 feet
Velocity=	5.36 fps	Velocity=	4.90 fps
Q=	**67.37 cfs**	**Q=**	**47.19 cfs**

Required Head:

D+1.5*(V^2/2g)=	4.67 ft	D+1.5*(V^2/2g)=	4.06 ft

Pipe Capacity

Capacity 48" RCP @ 0.22% = 67.37 cfs < 68.7 cfs (Q10)

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 17* Revised 6/12/2006
Flow surface type: *Overland Flow (Sidewalk, Pavement)*

D.A.: 0.89 acres
Weighted C: 0.9500

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0.89
Commercial	0
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.89

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	0.50%	0.3720	7.62	
	Length	Velocity (fps)			
Channel Flow	80	2		0.67	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**8.29**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.04	Q2=	4.3
i5=	5.97	Q5=	5.0
i10=	6.56	Q10=	5.5
i25=	7.57	Q25=	6.4
i50=	8.38	Q50=	7.1
i100=	9.13	Q100=	7.7

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	1.00%		S=	1.00%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	5.94	fps	Velocity=	7.20	fps
Q=	**10.50**	**cfs**	**Q=**	**22.62**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32	ft	D+1.5*(V^2/2g)=	3.21	ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 5.5 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 5.5 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 18A* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*

D.A.: 0.3 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.3
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.3

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	1.00%	0.4450	7.94	
	Length	Velocity (fps)			
Channel Flow	0	2		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**7.94**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	5.10	Q2=	1.4
i5=	6.04	Q5=	1.6
i10=	6.64	Q10=	1.8
i25=	7.66	Q25=	2.1
i50=	8.47	Q50=	2.3
i100=	9.23	Q100=	2.5

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	1.00%		S=	1.00%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	5.94	fps	Velocity=	7.20	fps
Q=	**10.50**	**cfs**	**Q=**	**22.62**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32	ft	D+1.5*(V^2/2g)=	3.21	ft

Pipe Capacity

Capacity 24" RCP @ 1.00% = 22.62 cfs > 1.8 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 18B* Revised 6/12/2006

Flow surface type: *Overland Flow (Sidewalk, Pavement)*

D.A.: 0.44 acres

Weighted C: 0.9159

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0.14
Commercial	0.3
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.44

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00

Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	0.50%	0.4218	8.64	
	Length	Velocity (fps)			
Channel Flow	0	2		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**8.64**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	4.97	Q2=	2.0
i5=	5.89	Q5=	2.4
i10=	6.49	Q10=	2.6
i25=	7.48	Q25=	3.0
i50=	8.28	Q50=	3.3
i100=	9.03	Q100=	3.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 24" RCP @ 1.00% = 22.62 cfs > 2.6 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 19A* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*

D.A.: 0.14 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.14
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.14

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	170	1.00%	0.4450	7.48	
	Length	Velocity (fps)			
Channel Flow	0	2		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**7.48**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	5.19	Q2=	0.7
i5=	6.15	Q5=	0.8
i10=	6.75	Q10=	0.9
i25=	7.77	Q25=	1.0
i50=	8.60	Q50=	1.1
i100=	9.37	Q100=	1.2

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	1.00%		S=	1.00%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	5.94	fps	Velocity=	7.20	fps
Q=	**10.50**	**cfs**	**Q=**	**22.62**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32	ft	D+1.5*(V^2/2g)=	3.21	ft

Pipe Capacity

Capacity 24" RCP @ 1.00% = 22.62 cfs > 0.9 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 16* Revised 6/12/2006
Flow surface type: *Overland Flow (Street)*

D.A.: 1.29 acres
Weighted C: 0.9500

DEVELOPMENT TYPE	acres
Concrete/Asphalt	1.29
Commercial	0
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	1.29

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation	0.00
Dnstream Elevation	0.00

	Length	Slope	k	Tc	
Overland	200	0.30%	0.3720	8.44	
	Length	Velocity (fps)			
Channel Flow	200	2		1.67	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**10.11**	**min**

RUNOFF

	Intensity (in/hr)		Q=CiA (cfs)
i2=	4.72	Q2=	5.8
i5=	5.61	Q5=	6.9
i10=	6.19	Q10=	7.6
i25=	7.15	Q25=	8.8
i50=	7.92	Q50=	9.7
i100=	8.64	Q100=	10.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 7.6 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 7.6 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 21* Revised 6/12/2006
Flow surface type: *Overland Flow (Building)*

D.A.: 0.34 acres
Weighted C: 0.9000

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0
Commercial	0.34
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.34

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	180	1.00%	0.4450	7.64	
	Length	Velocity (fps)			
Channel Flow	0	2		0.00	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**7.64**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	5.16	Q2=	1.6
i5=	6.11	Q5=	1.9
i10=	6.71	Q10=	2.1
i25=	7.73	Q25=	2.4
i50=	8.56	Q50=	2.6
i100=	9.32	Q100=	2.9

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.
Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 24" RCP @ 1.00% = 22.62 cfs > 2.1 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 22* Revised 6/12/2006
Flow surface type: *Overland Flow (Street)*

D.A.: 1.34 acres
Weighted C: 0.9500

DEVELOPMENT TYPE	acres
Concrete/Asphalt	1.34
Commercial	0
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	1.34

TIME OF CONCENTRATION

**** OVERLAND ****
Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	0.80%	0.3720	6.94	
	Length	Velocity (fps)			
Channel Flow	200	2		1.67	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**8.61**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	4.98	Q2=	6.3
i5=	5.90	Q5=	7.5
i10=	6.49	Q10=	8.3
i25=	7.49	Q25=	9.5
i50=	8.29	Q50=	10.6
i100=	9.04	Q100=	11.5

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00	RCP	Diameter (in)=	24.00	RCP
n=	0.013		n=	0.013	
S=	1.00%		S=	1.00%	
A=	1.77	sq.ft.	A=	3.14	sq.ft.
Wet.Per.=	4.71	feet	Wet.Per.=	6.28	feet
Hydr. radius=	0.38	feet	Hydr. radius=	0.50	feet
Velocity=	5.94	fps	Velocity=	7.20	fps
Q=	**10.50**	**cfs**	**Q=**	**22.62**	**cfs**

Required Head:

D+1.5*(V^2/2g)=	2.32	ft	D+1.5*(V^2/2g)=	3.21	ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 8.3 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 8.3 cfs (Q10) **OK**

DRAINAGE CALCULATIONS for:	WaterWalk Phase 2 Addition	6/12/2006
Johnson & Associates, Inc.	2215007	Printed 6/22/2006

Drainage Area Designation: *D.A. 23* Revised 6/12/2006
Flow surface type: *Overland Flow (Street)*

D.A.: 0.77 acres
Weighted C: 0.9500

DEVELOPMENT TYPE	acres
Concrete/Asphalt	0.77
Commercial	0
Residential	0
Rocky/Bare Soil	0
Cultivated	0
Avg. Pasture	0
TOTAL SITE ACREAGE	0.77

TIME OF CONCENTRATION

**** OVERLAND ****

Upstream Elevation 0.00
Dnstream Elevation 0.00

	Length	Slope	k	Tc	
Overland	200	0.80%	0.3720	6.94	
	Length	Velocity (fps)			
Channel Flow	200	2		1.67	
	Length	Velocity (fps)			
Pipe Flow	0	5		0.00	
			Total	**8.61**	**min**

RUNOFF

Intensity (in/hr)		Q=CiA (cfs)	
i2=	4.98	Q2=	3.6
i5=	5.90	Q5=	4.3
i10=	6.49	Q10=	4.8
i25=	7.49	Q25=	5.5
i50=	8.29	Q50=	6.1
i100=	9.04	Q100=	6.6

STRUCTURE CAPACITY

Supporting Calculations

Using Manning's equation to determine adequacy of structure.

Q = 1.486/n * A * R ^2/3 * S ^1/2

Pipe Conduit:

Diameter (in)=	18.00 RCP	Diameter (in)=	24.00 RCP
n=	0.013	n=	0.013
S=	1.00%	S=	1.00%
A=	1.77 sq.ft.	A=	3.14 sq.ft.
Wet.Per.=	4.71 feet	Wet.Per.=	6.28 feet
Hydr. radius=	0.38 feet	Hydr. radius=	0.50 feet
Velocity=	5.94 fps	Velocity=	7.20 fps
Q=	**10.50 cfs**	**Q=**	**22.62 cfs**

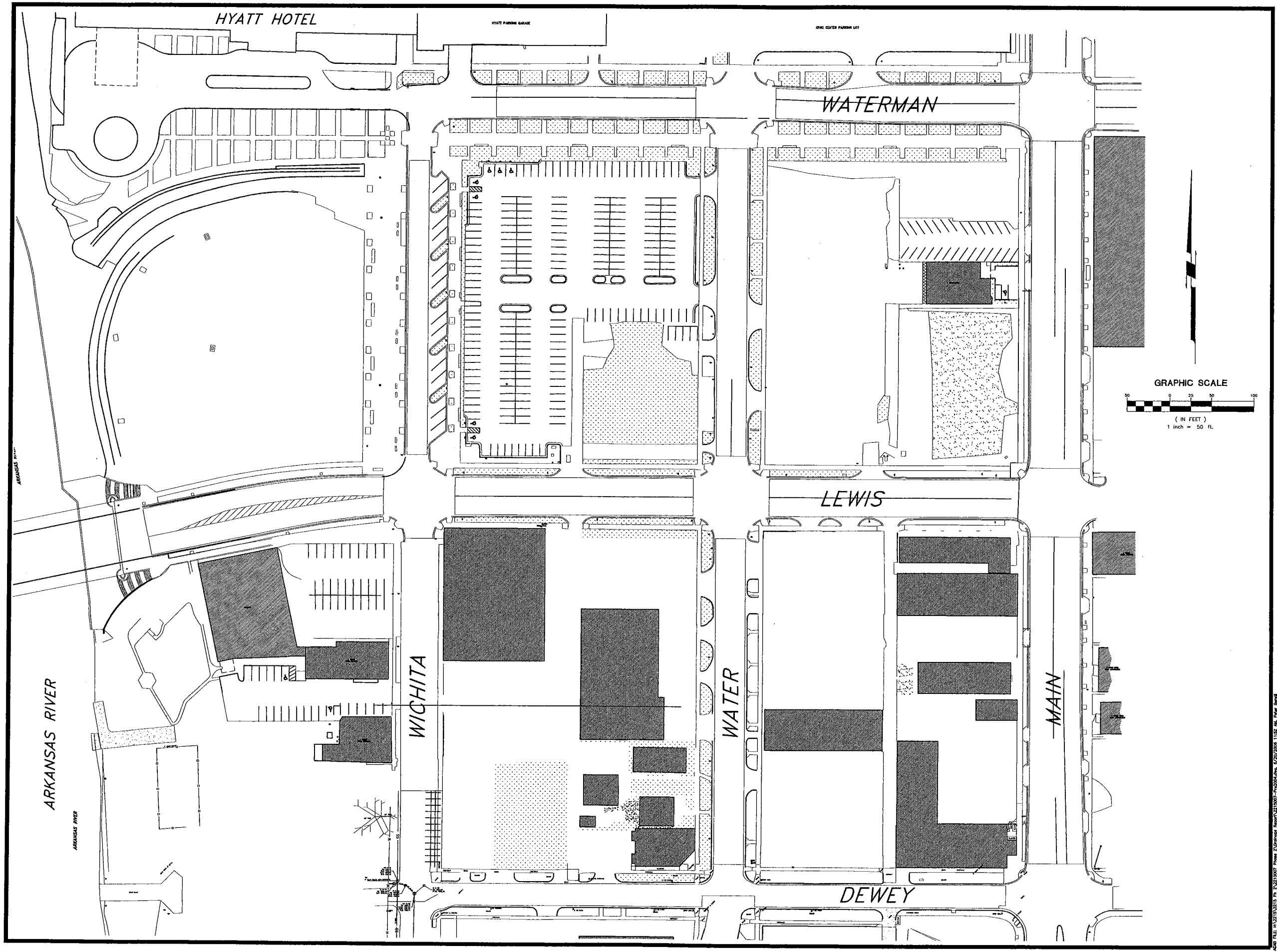
Required Head:

D+1.5*(V^2/2g)=	2.32 ft	D+1.5*(V^2/2g)=	3.21 ft

Pipe Capacity

Capacity 18" RCP @ 1.00% = 10.50 cfs > 4.8 cfs (Q10) **OK**
Capacity 24" RCP @ 1.00% = 22.62 cfs > 8.3 cfs (Q10) **OK**

RUNOFF CALCULATIONS
EXHIBITS



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Certificate of Authorization #E-1128 EXP. DATE: 12-31-2005

WICHITA WATERWALK

WATERWALK PHASE 2 ADDITION

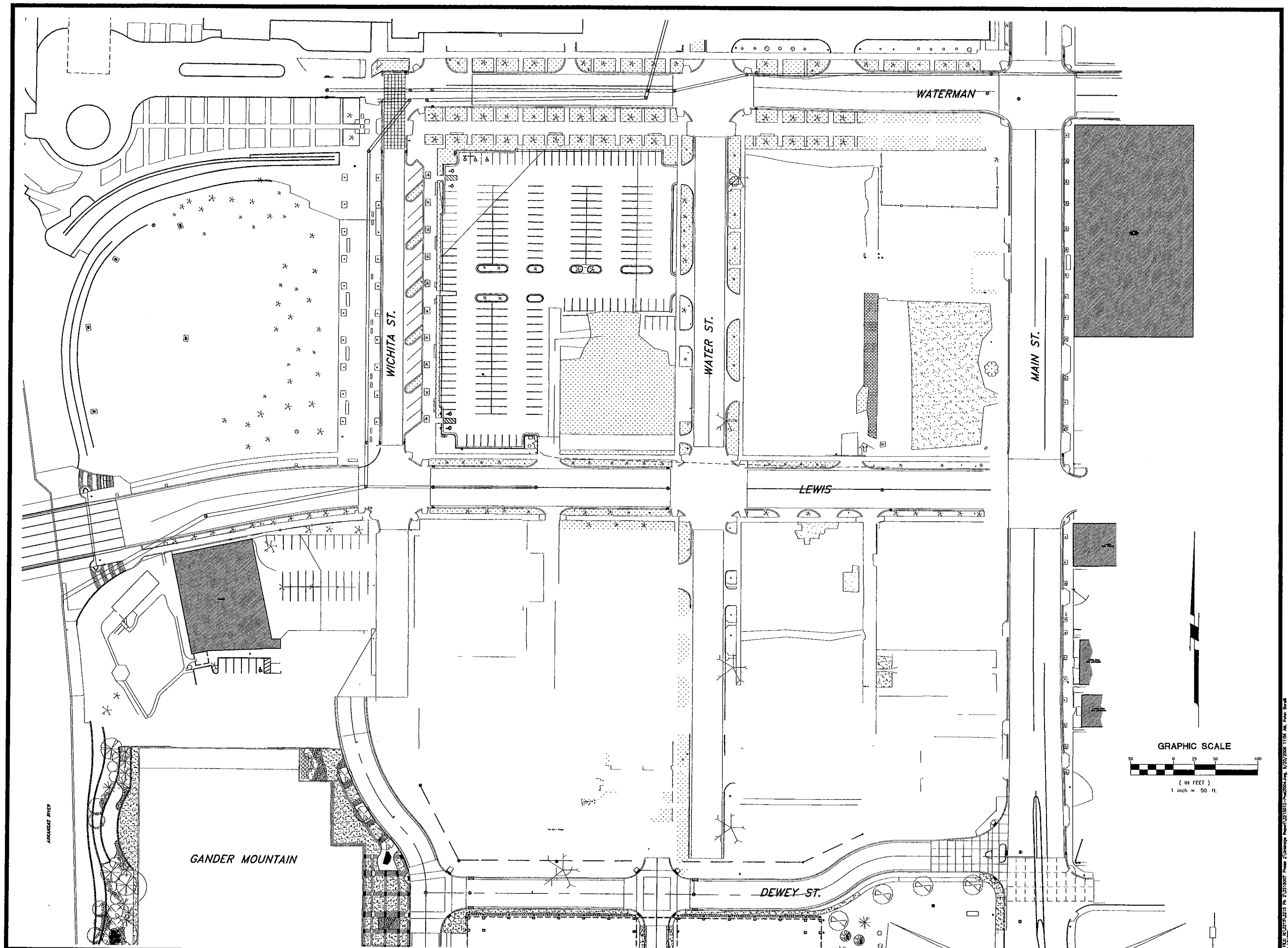
Mark	Date:	Description

EXISTING SITE LAYOUT PRIOR TO 2004

Job No.
Date: 06-14-06
Drawn
Checked

Dwg. 1 of X

ADS File: K:\215\215015 Ph 2\K215007 Phase 2\Drawings\Report\K215007-Ph2004.dwg, 6/20/2006 11:02 AM, Peter Barrett



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WICHITA WATERWALK

WATERWALK PHASE 2 ADDITION

Mark	Date:	Description

EXISTING SITE

Job No.	
Date	06-14-06
Drawn	
Checked	PB

2 OF X Dwg.

ARKANSAS RIVER

WICHITA ST.

WATER ST.

DEWEY ST.

LEWIS

WATERMAIN

MAIN ST.

GRAPHIC SCALE
(IN FEET)
1 inch = 50 ft.

ACAD FILE: H:\2215\2215 Ph 2\2215007 Phase 2\Drainage Report\2215007-Ex Drainage.dwg, 6/20/2006 11:39 AM, Peter Borelli
XREFS LOADED:

EXISTING SITE DRAINAGE

Mark	Date	Description

Job No
Date 06-14-06
Drawn PB
Checked

Dwg. 3 of X of

WICHITA
WATERWALK

WATERWALK PHASE 2 ADDITION

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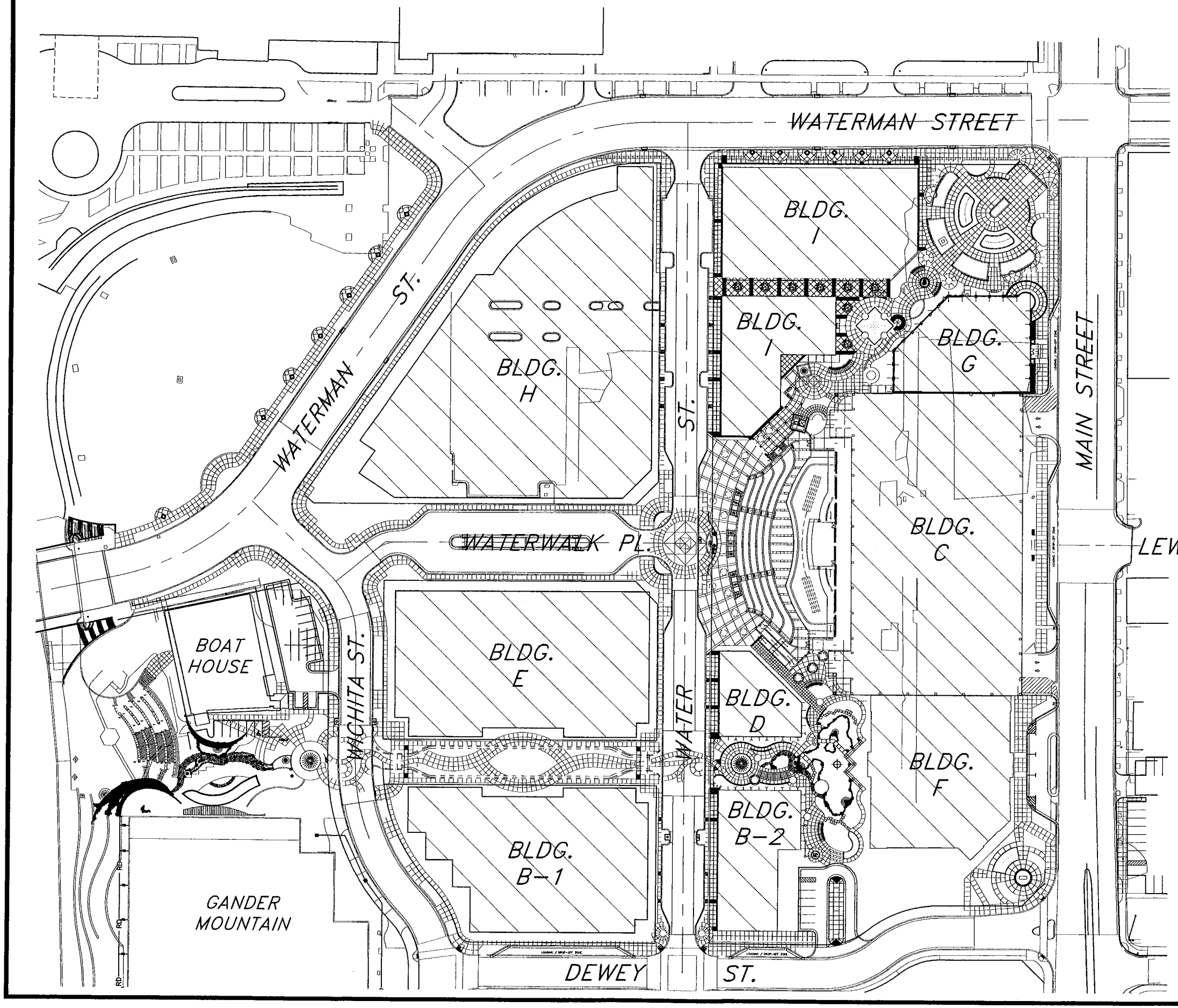

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)
1 inch = 50 ft.

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WICHITA WATERWALK

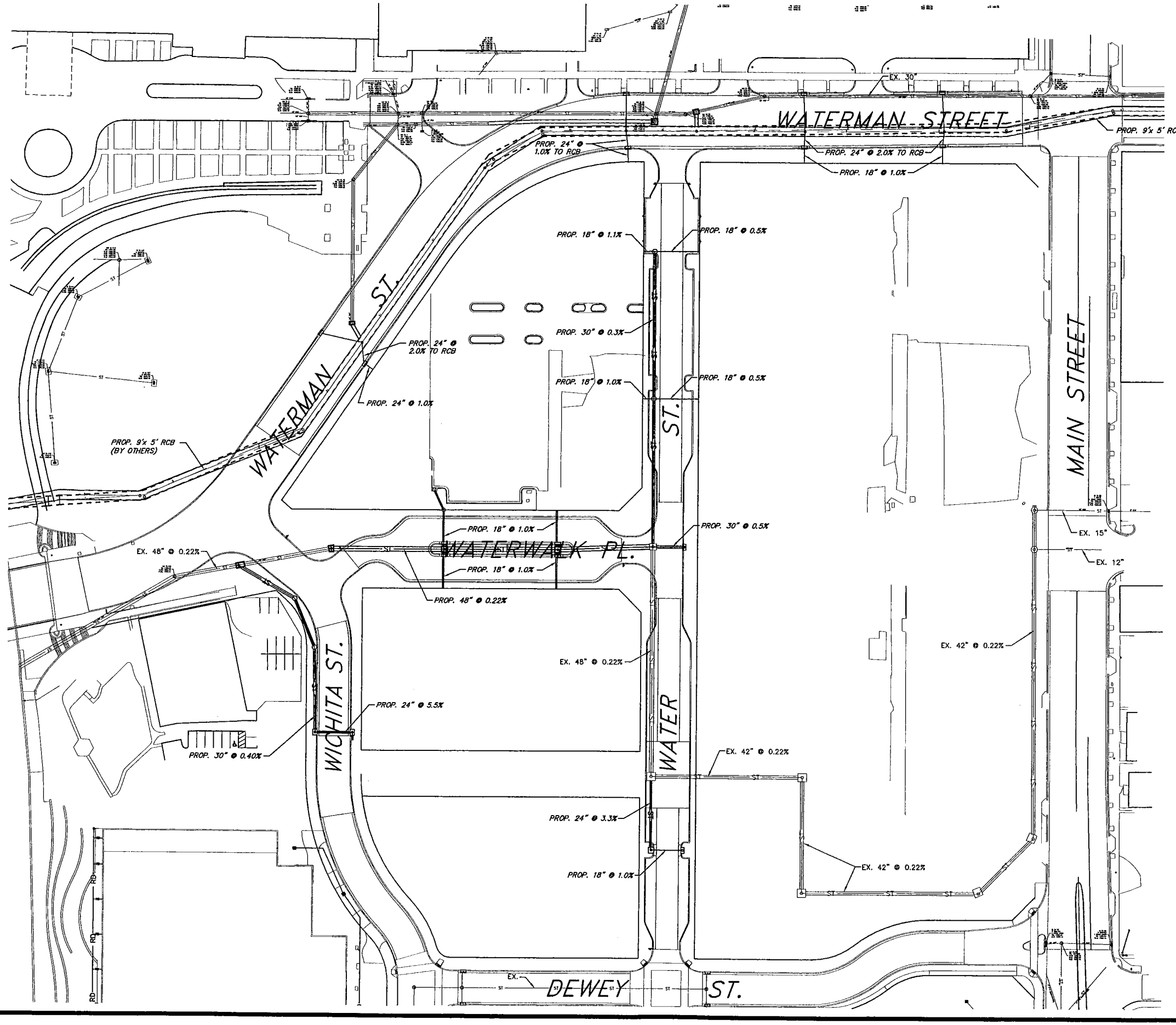
WATERWALK PHASE 2 ADDITION

Mark	Date:	Description

DEVELOPED SITE LAYOUT

Job No.
Date 06-14-06
Drawn
Checked

4 of X Dwg. of



GRAPHIC SCALE

50 0 25 50 100

(IN FEET)

1 inch = 50 ft.

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WICHITA WATERWALK

WATERWALK PHASE 2 ADDITION

Mark	Date:	Description

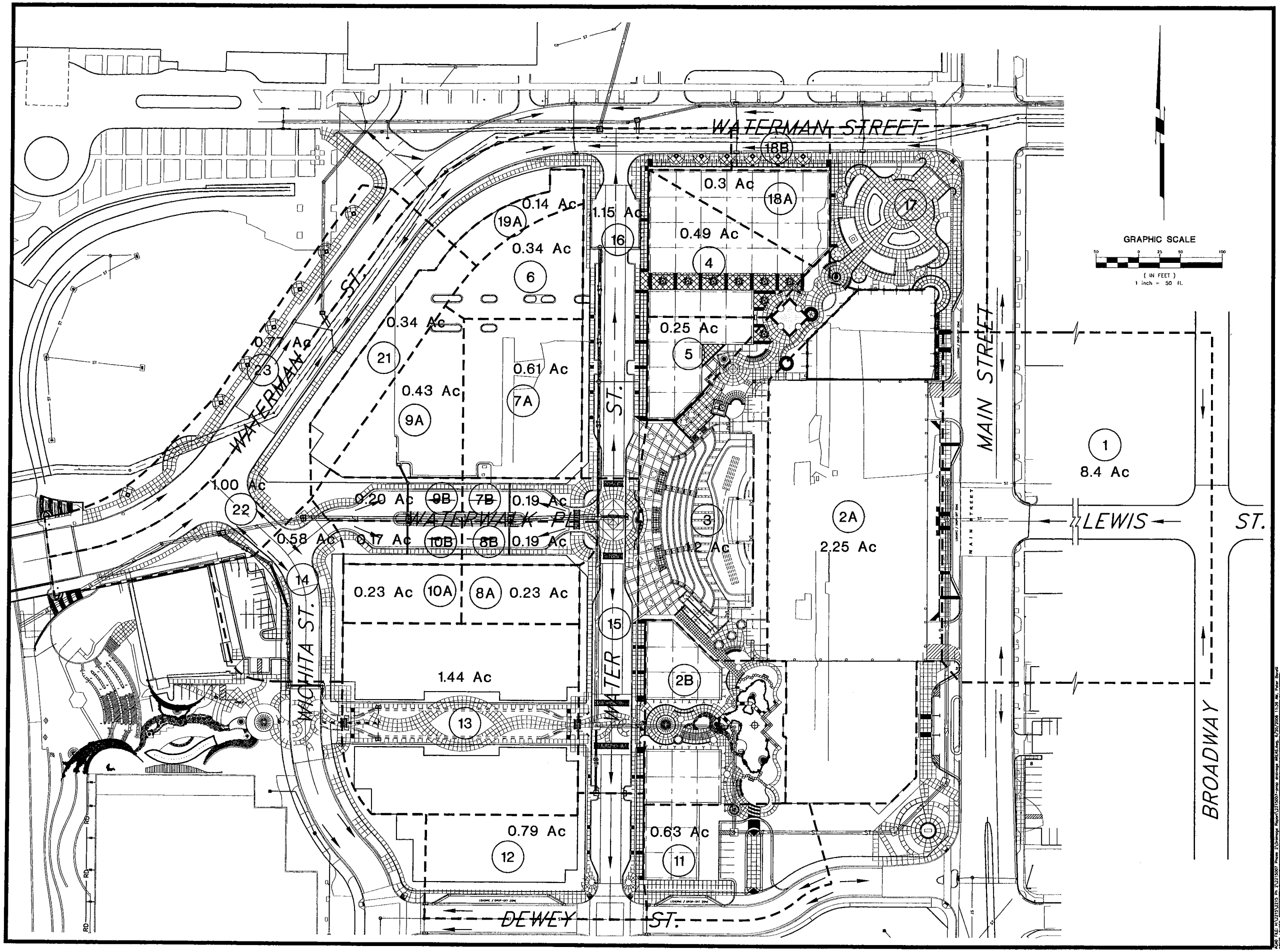
DEVELOPED SITE DRAINAGE PLAN

Job No.	
Date	06-14-06
Drawn	
Checked	

Sheet 5 of X

Dwg. of

K:\07-1\07-1013.Pre 2\07-1007 Phase 2\Drainage Report\07-1007 drainage.dwg, 5/29/2008 12:59 PM, Paul Burak



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WICHITA WATERWALK

WATERWALK PHASE 2 ADDITION

Mark	Date:	Description

DRAINAGE AREAS

Job No.
Date 06-14-06
Drawn
Checked

6 OF X
Dwg. of

REMOVE 189 LF 42" RCP (N)

REMOVE 52 LF 42" RCP (N)

REMOVE MANHOLE, INLETS, PIPE (E)

REMOVE PIPE

LINE 11 RE: SHT. ST1.2

N=9607.72 E=10038.26
STORM SEWER LINE NO. 11 STA. 10+42.50
CONST. 1-STD TYPE P MANHOLE 5' I.D.
TOP RIM=1298.50

REMOVE 20 LF 48" RCP (W)

REMOVE 78.9 LF 30" RCP (E)

REMOVE MANHOLE, INLETS, PIPE (N & S)

REMOVE 121.3 LF 30" RCP (E)

REMOVE MANHOLE, 62 LF PIPE (N & S)

42.5 LF OF 18" RCP @ 1.0 %

42 LF OF 18" RCP @ 1.0 %

REMOVE 128.1 LF 30" RCP (E)

REMOVE MANHOLE, INLETS & PIPE

REMOVE 27.6 LF 30" RCP (E)

REMOVE 251.7 LF 24" RCP (E)

33.83 LF OF 30" RCP @0.5%

123.67 LF 48" RCP @ 0.22%

122 LF 48" RCP @ 0.22%

103.31 LF 48" RCP @ 0.22%

WATERWALK PL.

PROP. R\W

REMOVE MANHOLE, INLET, PIPE (S)

LINE 1

WICHITA ST.

WATER ST.

N=9568.92 E=10264.78
CL WATERWALK PL. STA. 10+17.93, 3.68'LT.=
STORM SEWER LINE NO. 1 STA. 13+48.98
EXISTING MANHOLE
ADJUST RIM TO ELEV. 1298.21

N=9568.92 E=10298.81
CL WATER ST. STA. 14+79.27, 14' RT.=
STORM SEWER LINE NO. 1 STA. 13+82.81
CONST. 1-STD. TYPE I CURB INLET
L=5' OPENING, W=4'-4"
TOP CURB=1298.54

4.64' LT. N=9569.86 E=10039.54
4.64' RT. N=9560.58 E=10039.54
CL WATERWALK PL. STA. 12+43.24, 4.64' RT. & LT.=
STORM SEWER LINE NO. 1 STA. 11+23.67, 4.64' RT. & LT.
CONST. 1-STD. TYPE II DOUBLE CURB INLET
WITH 3 LF 18" PIPE
TOP CURB=1297.07
FL 18" OUT=1293.03

4.64' LT. N=9569.86 E=10161.54
4.64' RT. N=9560.59 E=10161.54
CL WATERWALK PL. STA. 12+21.24, 4.64' RT. & LT.=
STORM SEWER LINE NO. 1 STA. 12+45.67, 4.64' RT. & LT.
CONST. 1-STD. TYPE II DOUBLE CURB INLET
WITH 3 LF 18" PIPE
TOP CURB=1297.07
FL 18" OUT=1293.03

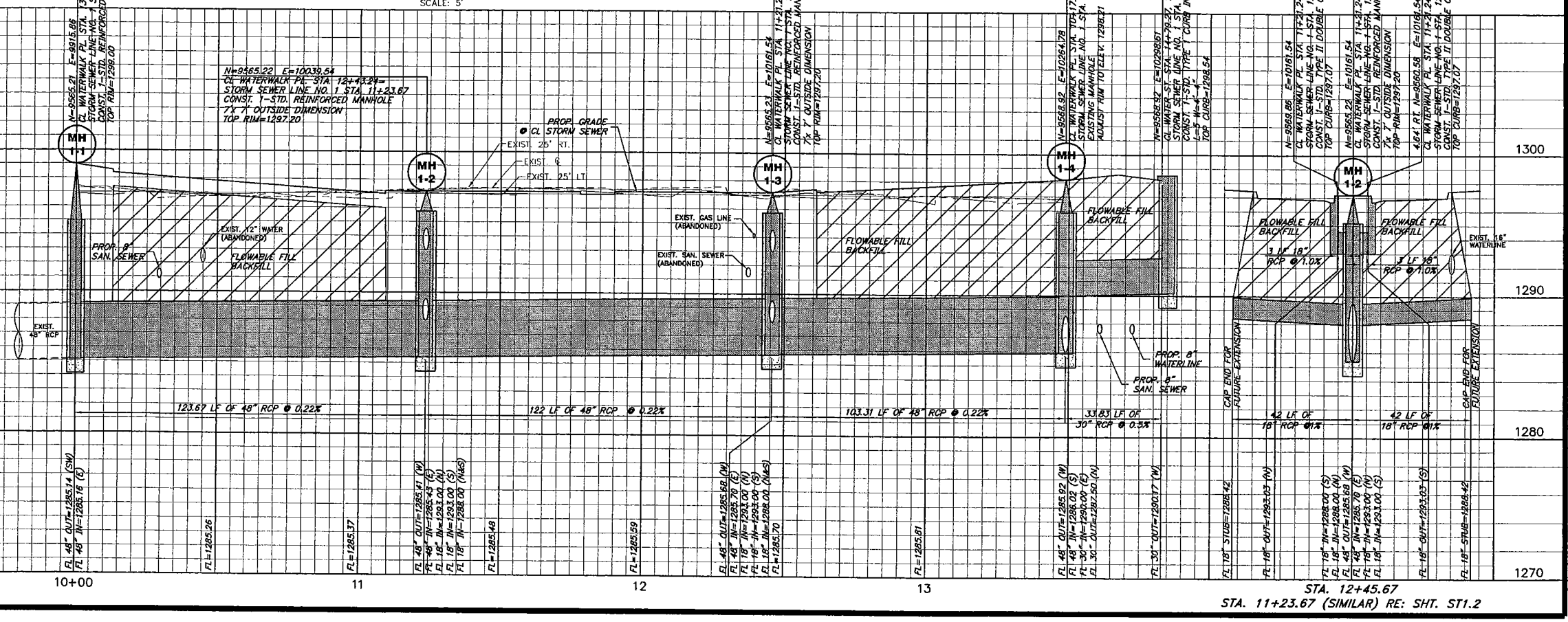
N=9565.22 E=10039.54
CL WATERWALK PL. STA. 12+43.24=
STORM SEWER LINE NO. 1 STA. 11+23.67
CONST. 1-STD. REINFORCED MANHOLE
7'x 7' OUTSIDE DIMENSION
TOP RIM=1297.20

N=9565.23 E=10161.54
CL WATERWALK PL. STA. 11+21.24=
STORM SEWER LINE NO. 1 STA. 12+45.67
CONST. 1-STD. REINFORCED MANHOLE
7'x 7' OUTSIDE DIMENSION
TOP RIM=1297.20

N=9565.21 E=9815.86
CL WATERWALK PL. STA. 13+57.81, 22.47' RT.=
STORM SEWER LINE NO. 1 STA. 10+00
CONST. 1-STD. REINFORCED MANHOLE
TOP RIM=1299.00

MH 1-1 MH 1-2 MH 1-3 MH 1-4

STORM SEWER MANHOLE 1-1
SCALE: 5'



STA. 12+45.67
STA. 11+23.67 (SIMILAR) RE: SHT. ST1.2

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PLAN: SCALE: 1"=20'

PROFILE: SCALE: 1"=20' (HORIZ.) 1"= 4' (VERT.)

WICHITA WATERWALK

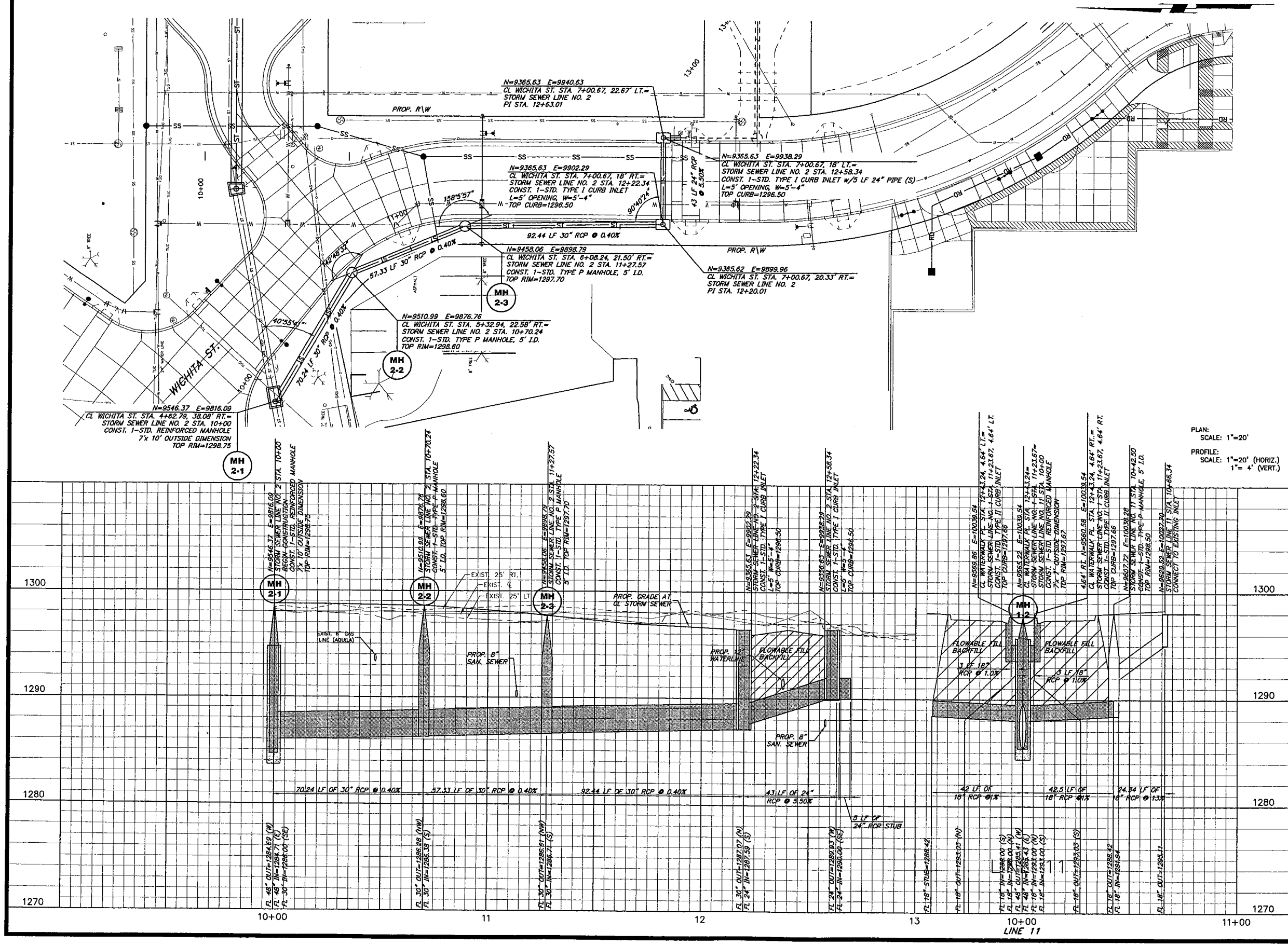
PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

Mark	Date:	Description
	6.07.06	ADDENDUM NO. 1
	5.30.06	BID SET
	4.27.06	FIELD CHECK

STORM SEWER LINE NO. 1

Job No.
Date: 05-30-06
Drawn
Checked

ST1.1 of 6 Dwg 75 of 96



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WICHITA WATERWALK

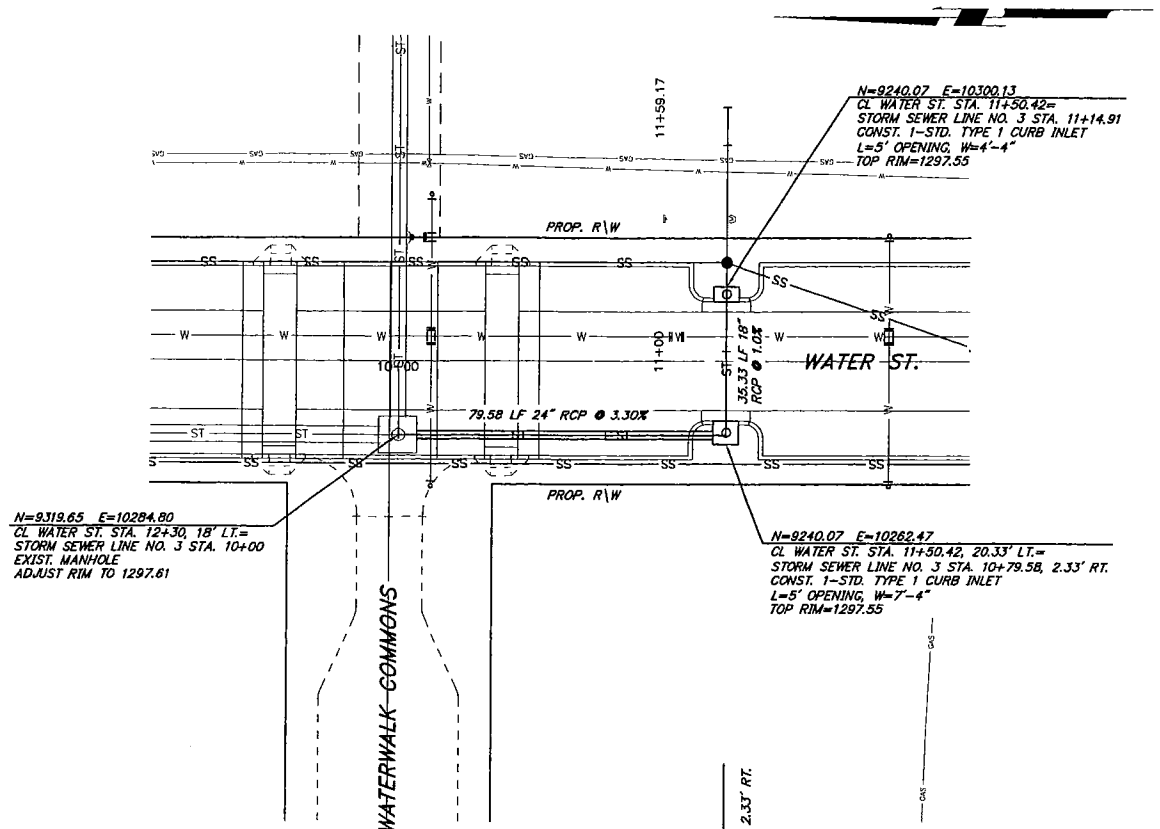
PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

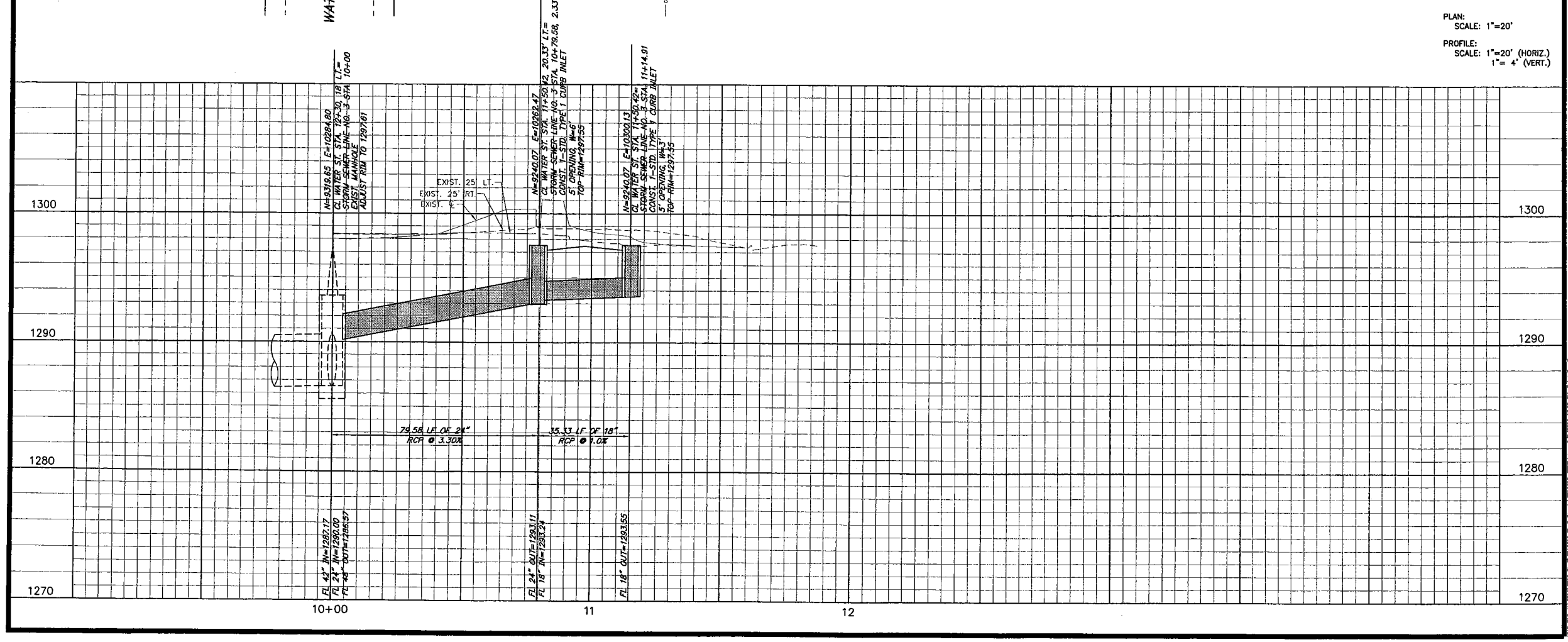
Mark	Date	Description
	6.07.06	ADDENDUM NO. 1
	5.30.06	BID SET
	4.27.06	FIELD CHECK

STORM SEWER LINE 2

Job No.
Date 05-30-06
Drawn
Checked

ST1.2
of
6
Dwg. 76 of 96





PLAN:
SCALE: 1"=20'

PROFILE:
SCALE: 1"=20' (HORIZ.)
1"= 4' (VERT.)

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WICHITA WATERWALK

PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

Mark	Date:	Description
	05.30.06	BID SET
	04.27.06	FIELD CHECK

STORM SEWER LINE 3

Job No.
Date: 05-30-06
Drawn
Checked

ST1.3
OF
6
Dwg. **77** of **96**

WICHITA WATERWALK

PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

Mark	Date	Description
	05.30.06	BID SET
	04.27.06	FIELD CHECK

STORM SEWER LINE 4

Job No. ST1.4
Sht. 6 of 96
Date 05-30-06
Drawn
Checked

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PLAN: SCALE: 1"=20'
PROFILE: SCALE: 1"=20' (HORIZ.) 1"= 4' (VERT.)

10+00 11+00 12+00 13+00 14+00

1270 1280 1290 1300

FL=1287.85 FL=1287.90 FL=1288.80 FL=1288.95 FL=1289.10

FL= 30" IN= 1287.50 (E)
FL= 30" IN= 1287.70 (W)
FL= 48" IN= 1286.02 (S)
FL= 48" OUT=1285.92 (W)

FL=24" IN=1288.08 (E)
FL= 30" IN= 1288.63 (W)
FL= 30" IN= 1288.18 (N)
FL= 30" OUT=1288.08 (S)
FL=1290.45

FL=24" IN=1289.16 (E)
FL=24" IN=1289.18 (W)
FL=30" OUT=1288.68 (S)

160 LF OF 30" STORM SEWER @ 0.3%

160 LF OF 30" STORM SEWER @ 0.3%

FLOWABLE FILL BACKFILL

FLOWABLE FILL BACKFILL

FLOWABLE FILL BACKFILL

PROP. 8" WATERLINE

EXIST. 6" WATERLINE

PROP. 8" SAN. SEWER

PROP. GRADE AT CL STORM SEWER

EXIST. 25' RT.

EXIST. 25' LT.

EXIST. ℄

MH 1-4

MH 4-1

MH 4-2

N=9558.92 E=10264.78
CL WATER ST. STA. 14+39.27, 18.65' LT=
STORM SEWER LINE NO. 4 STA. 10+00

N=9728.92 E=10264.77
CL WATER ST. STA. 16+39.27, 18.00' LT=
STORM SEWER LINE NO. 4 STA. 11+60
CONST. 1-STD. TYPE P MANHOLE, 5' I.D.
TOP RIM=1298.44

N=9888.92 E=10264.76
CL WATER ST. STA. 17+99.27, 18.00' LT=
STORM SEWER LINE NO. 4 STA. 13+20
CONST. 1-STD. TYPE P MANHOLE, 5' I.D.
TOP RIM=1297.97

N=9558.92 E=10264.78
CL WATER ST. STA. 14+79.27, 18.65' LT=
STORM SEWER LINE NO. 4 STA. 10+00
EXISTING MANHOLE

N=9728.92 E=10264.77
CL WATER ST. STA 16+39.27, 18.00' LT=
STORM SEWER LINE NO. 4 STA. 11+60
CONST. 1-STD TYPE P MANHOLE, 5' I.D.
TOP RIM=1298.44

N=9888.92 E=10264.76
CL WATER ST. STA 17+99.27, 18.00' LT=
STORM SEWER LINE NO. 4 STA. 13+20
CONST. 1-STD TYPE P MANHOLE, 5' I.D.
TOP RIM=1297.97

WATER ST.

PROP. R\W

PROP. R\W

160 LF OF 30" RCP @ 0.3%

160 LF OF 30" RCP @ 0.3%

10+00 11+00 12+00 13+20

LINE 1 LINE 5 LINE 6

80' R\W

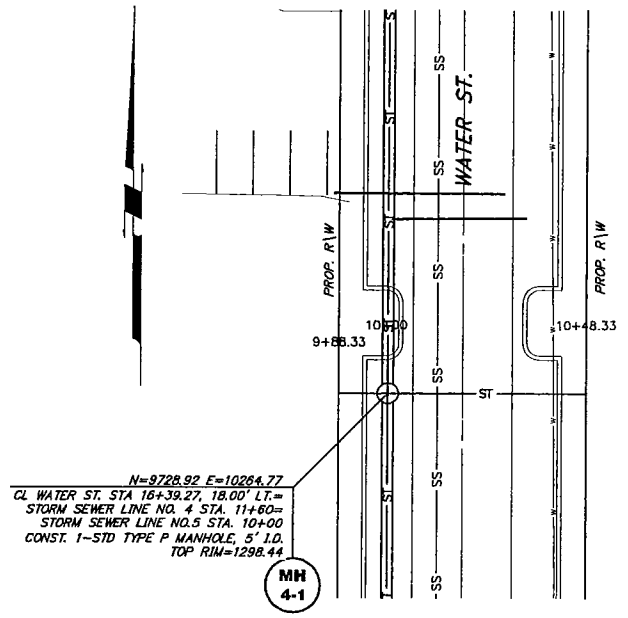
101

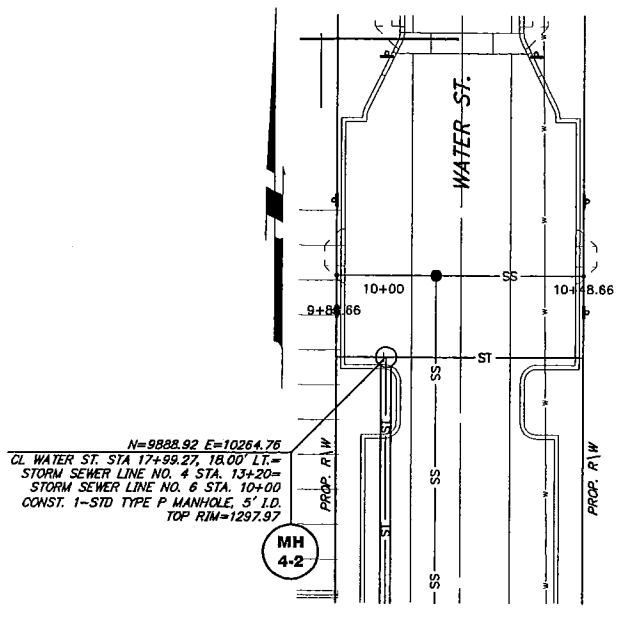
12'

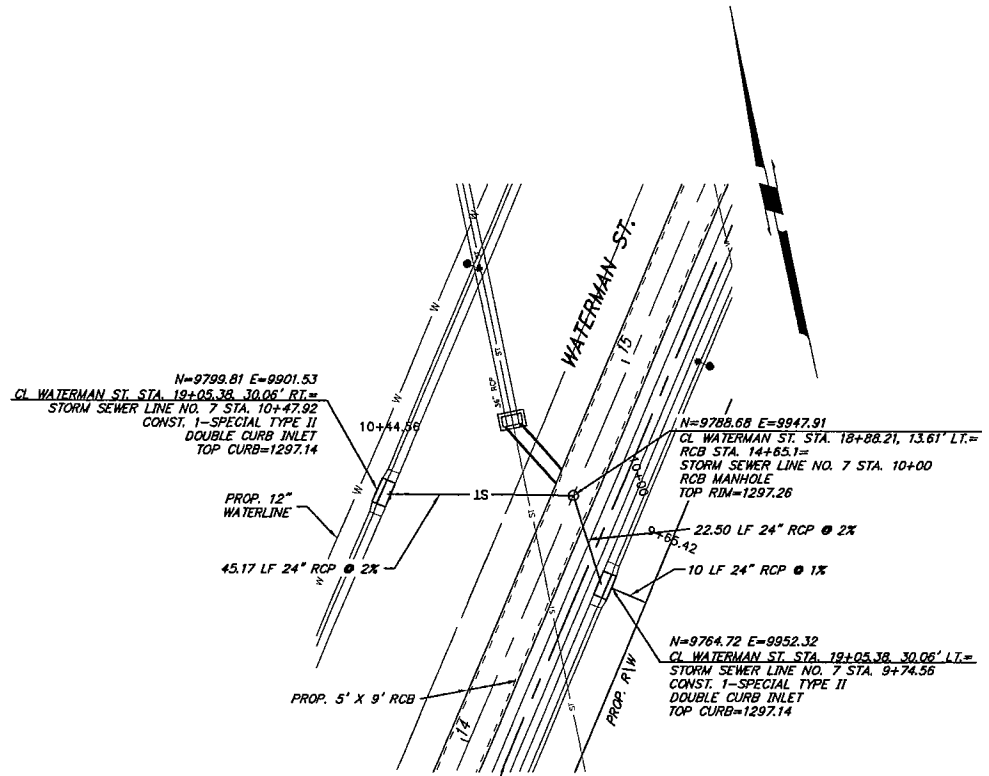
18'

9'

SS CAS W G T

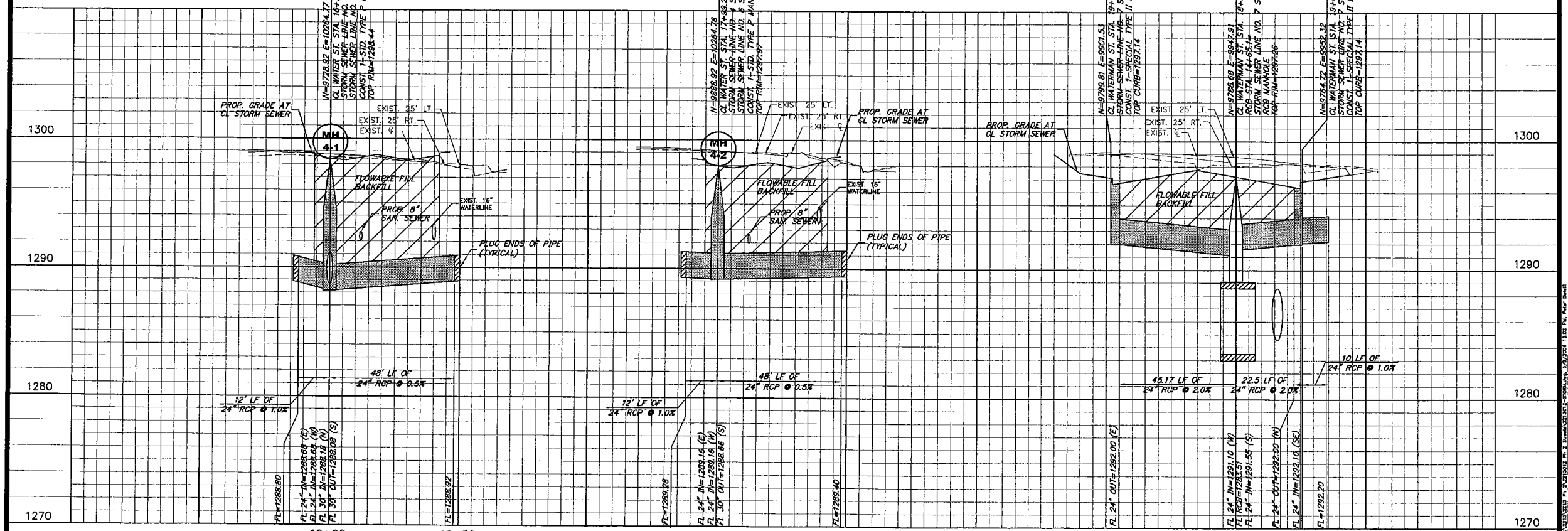






PLAN:
SCALE: 1"=20'

PROFILE:
SCALE: 1"=20' (HORIZ.)
1"= 4' (VERT.)



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WICHITA WATERWALK

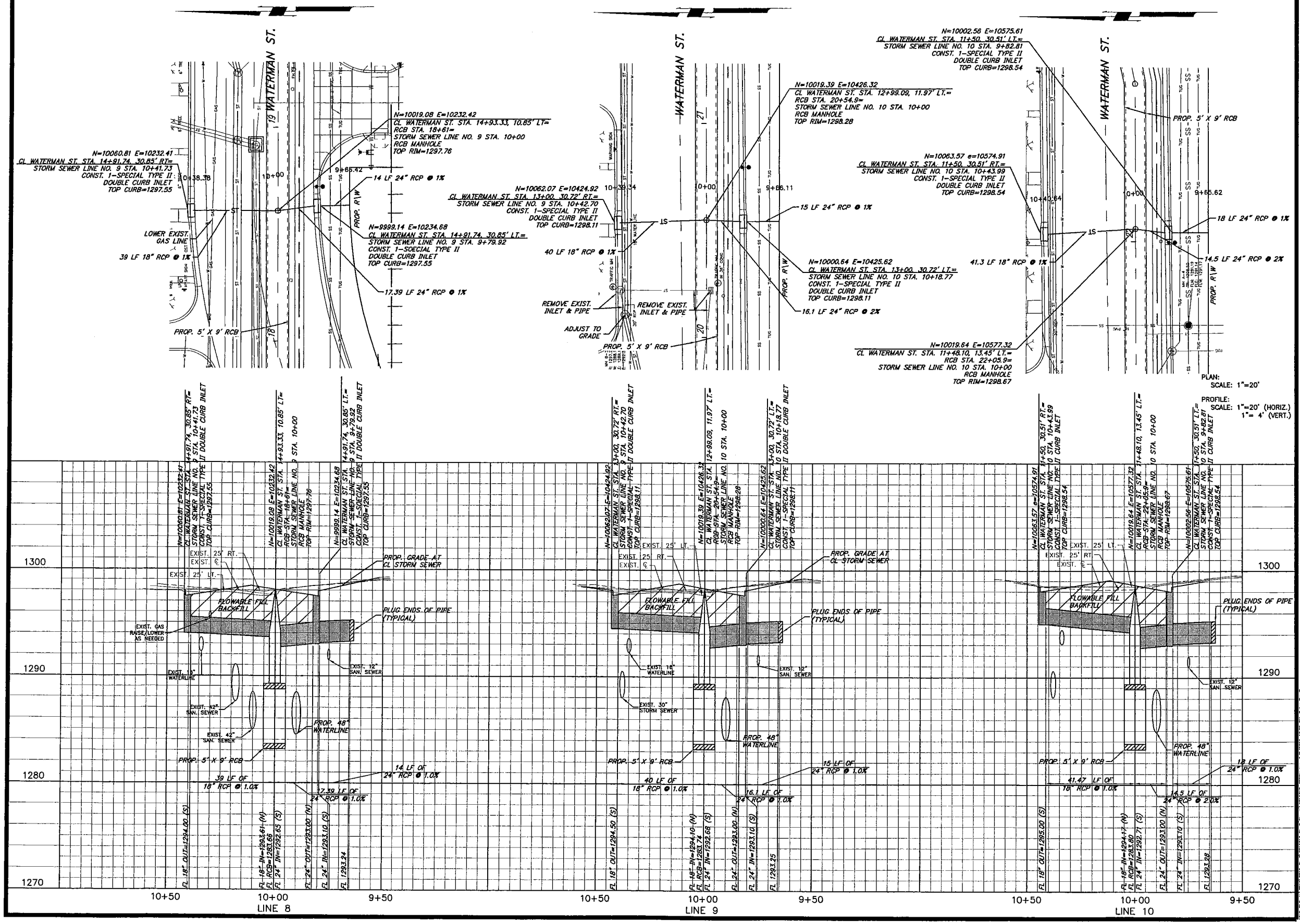
PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

Mark	Date:	Description
	05.30.06	BID SET
	04.27.06	FIELD CHECK

STORM SEWER LINES 5, 6, 7

Job No.
Date 05-30-06
Drawn
Checked

ST1.5
OF
6
Dwg. 79 of 96



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WICHITA WATERWALK

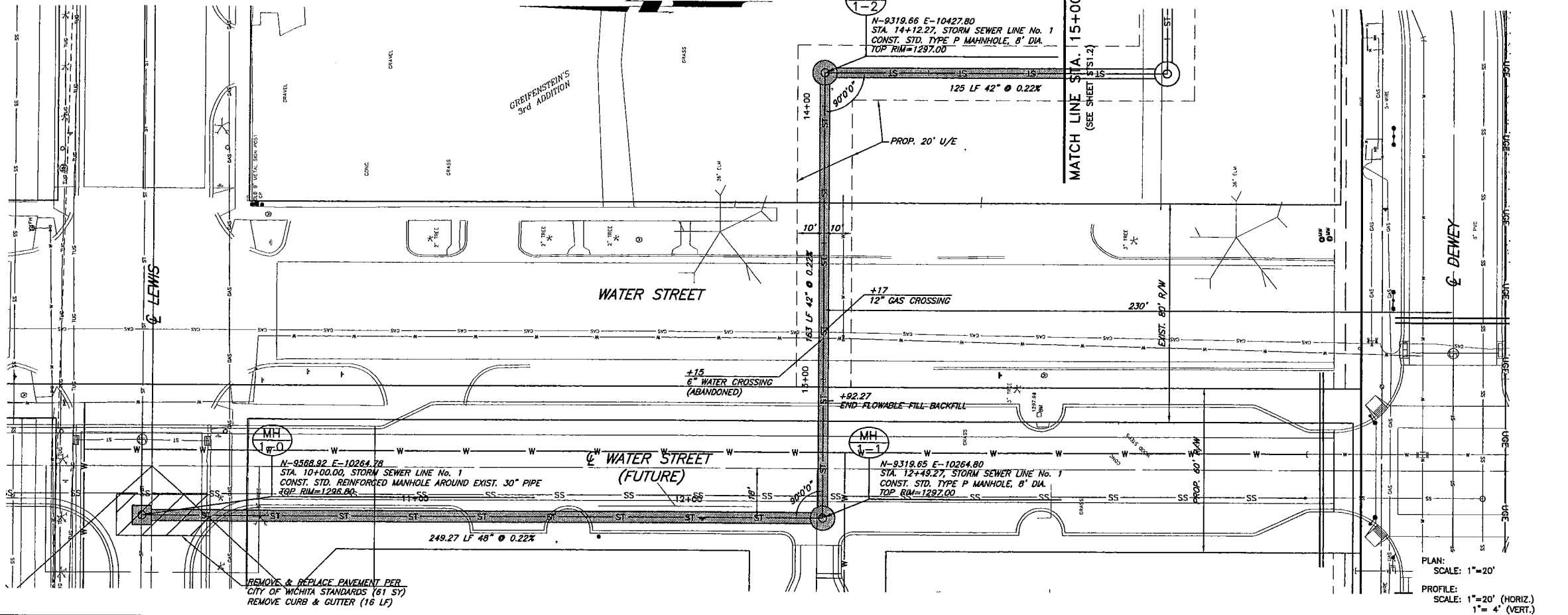
PUBLIC IMPROVEMENTS PACKAGE 2 PHASE 2

Mark	Date:	Description
	05.30.06	BID SET
	04.27.06	FIELD CHECK

STORM SEWER LINES 8, 9, 10

Job No.
Date 05-30-06
Drawn
Checked

ST1.6
OF
6
Dwg. **80** of **96**



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TIMOTHY W. JOHNSON LICENSED 10489 KANSAS PROFESSIONAL ENGINEER

WICHITA WATERWALK

PUBLIC IMPROVEMENTS PHASE 2 PACKAGE 1

Mark	Date:	Description

STORM SEWER No. 1

Job No.	
Date	12-30-05
Drawn	SE
Checked	PB

ST1.1 of 4 Drwg 20 of 24

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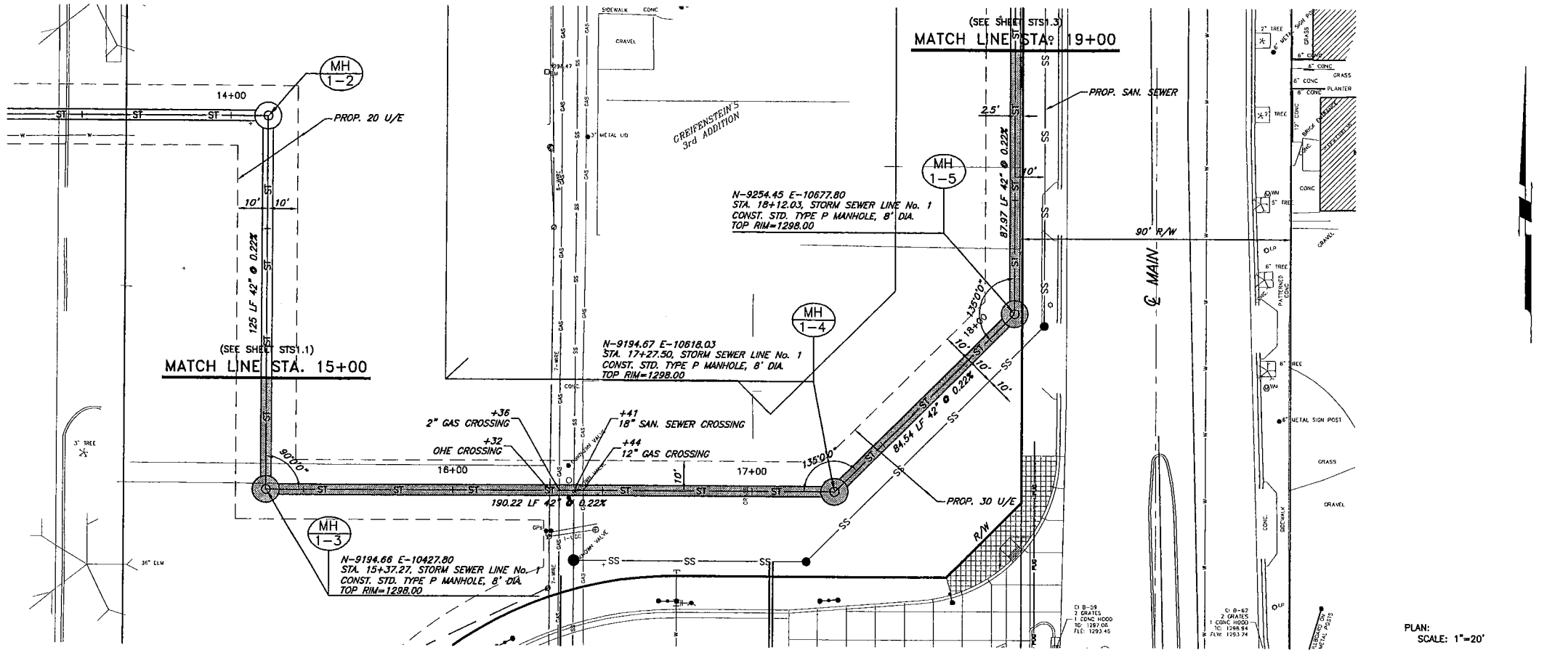

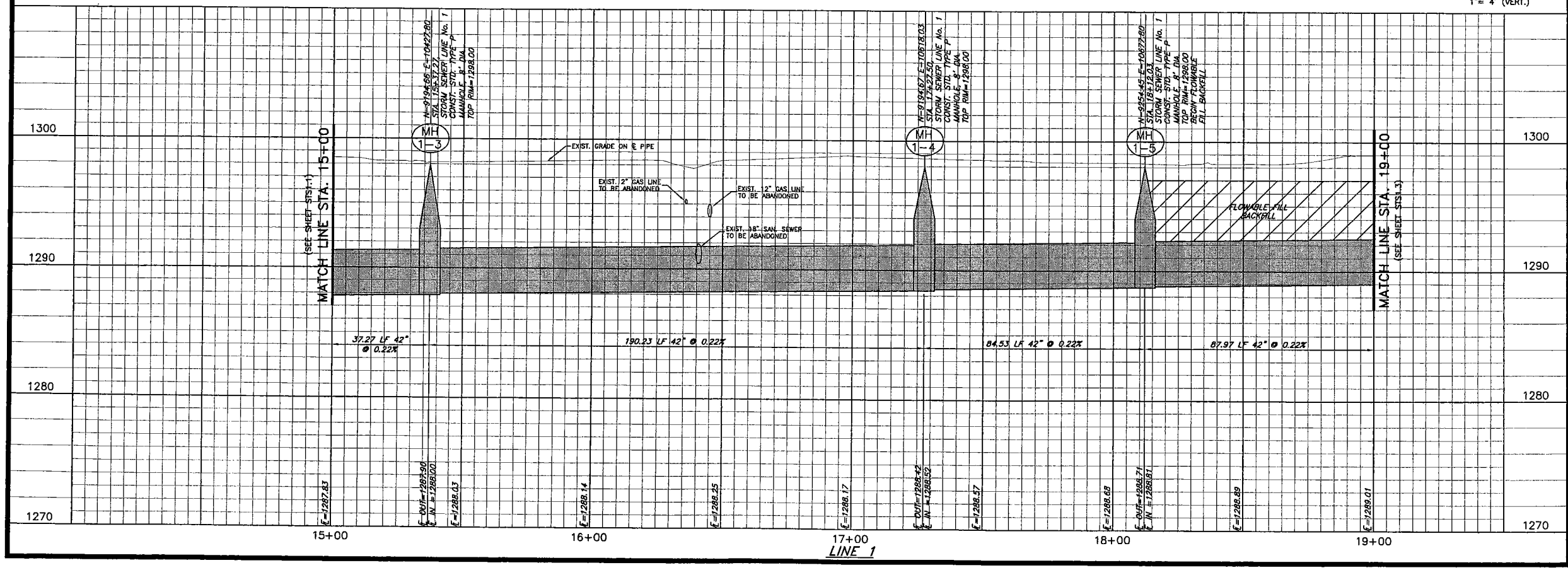

PLAN:
SCALE: 1"=20'

PROFILE:
SCALE: 1"=20' (HORIZ.)
1"= 4' (VERT.)

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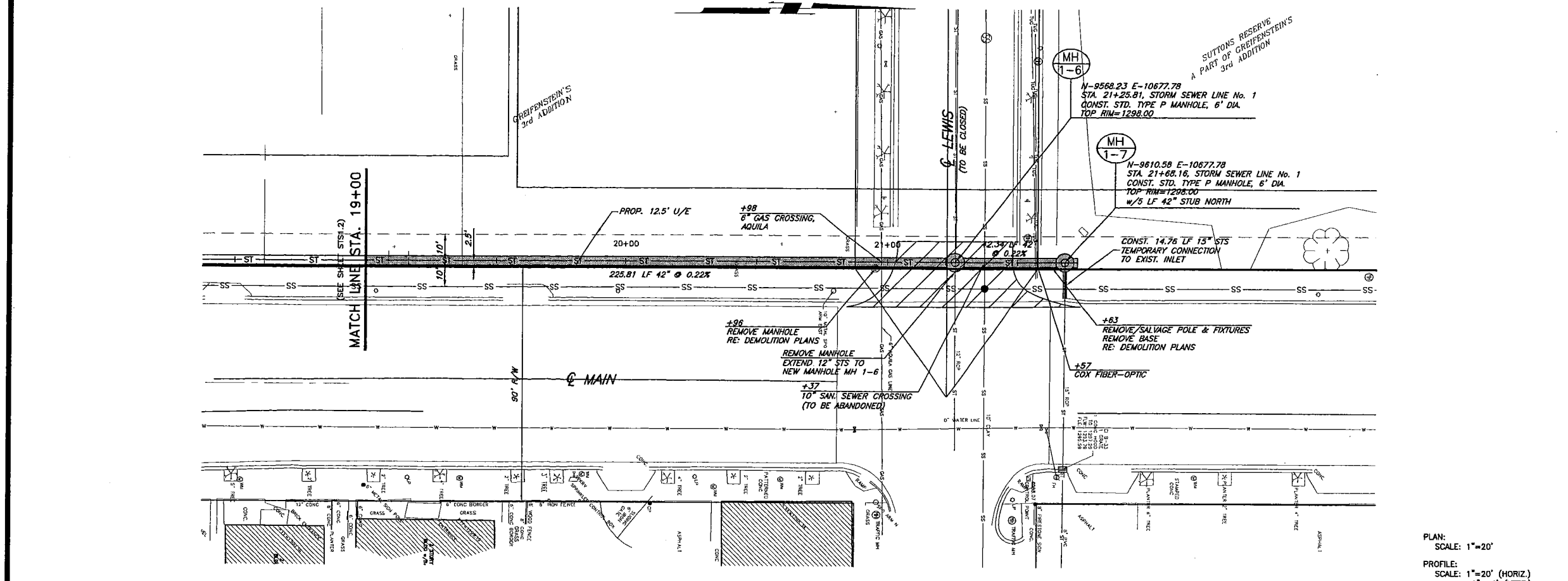
STORM SEWER No. 1

Job No.	
Date	12-30-05
Drawn	SE
Checked	PB

ST1.2
OF
4
Dwg. 21 of 24



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Job No.	
Date	12-30-05
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Checked	PB

ST1.3
of
4
Dwg. 22 of 24