



Memorandum

To: Chuck Soules, Matt Bond (City of Lawrence)

From: Bartlett & West/CDM Smith Team

Date: April 18, 2013

Subject: Maple Street Drainage Improvements – Preliminary Engineering Study

1.0 Introduction

In 2005, the North Lawrence Drainage Study was completed by HNTB for the City of Lawrence, Kansas (City). This study was completed to address repeat flooding concerns reported by the residents of North Lawrence. The major causes of flooding in North Lawrence are an undersized drainage system and very mild slopes. As a part of this drainage study, North Lawrence was divided into several drainage areas. Of particular concern, was the System 6 drainage area. This system is located downstream near the Kansas River and contains the Maple Street pump station (6th and Maple Street). During the North Lawrence Drainage Study, HNTB found that the pump station and force main were undersized for a 10-year design event, and therefore recommended an upgrade to the force main, as well as the pump station.

During the fall of 2012, Bartlett & West in association with CDM Smith was tasked with providing a preliminary engineering report to determine appropriate design flows for a proposed pump station near the intersection of 6th and Maple Street. The purpose of this preliminary engineering report is to focus on refining the proposed concept presented in the HNTB report, which includes replacing the existing pump station with a larger pump station and increasing the capacity of the adjoining drainage system to alleviate flooding in the area.

2.0 Approach and Methodology

The System 6 drainage area is comprised of 70 percent residential land use with some adjacent light industrial, commercial, and open space. Stormwater in this drainage area is conveyed through ditch sections with cross road pipes to a point just north of railroad tracks bisecting the area from east to west. From this point, an existing pump station at 6th and Maple Street conveys stormwater across the railroad tracks to a gravity pipe which discharges to the Kansas River.

The City has developed a detailed Stormwater Management Criteria (SMC) document which gives specific direction on return frequency storm events, hydrologic and hydraulic criteria and methods, and enclosed system design. The SMC document was used as a guide during the hydrologic evaluation.

An XP-SWMM model of System 6 was developed as part of the 2005 study which was provided to CDM Smith by the City. The XP-SWMM model parameters were consistent with those presented in the SMC. However, no information was provided on the model input parameters, such as the method for acquiring pipe and ditch sizes and inverts. In addition, the existing pump station was not modeled. The XP-SWMM model utilized the Rational Method for estimating peak runoff volumes. For the preliminary engineering report, the project team agreed the hydrologic and hydraulic analysis would not include using the XP-SWMM model, but rather a more streamlined approach focused on the Rational Method parameters and their applicability to the System 6 drainage area would be applied.

The Rational Method is commonly used in small urbanized areas to estimate peak flow volumes, and is presented in the SMC as an acceptable method for drainage areas less than 300 acres. The Rational Method is defined as:

$$Q = CiA$$

Q = Peak runoff rate, cubic feet per second (cfs)

C = Runoff coefficient

i = Rainfall intensity, inches/hr

A = Drainage area, acres

According to the SMC, all enclosed and improved open channel conveyance system components maintained by the City should be sized to provide a 10-year level of service (LOS) using specified criteria for land use runoff factors, rainfall, and system time of concentration.

Hydrology

The System 6 drainage area was divided into four subwatersheds based on topographic data. Three of these subwatersheds are upstream of 6th and Maple Street. The Rational Method parameters for these three subwatersheds are as follows:

- **Drainage Area (A).** The drainage area of the three subwatersheds to 6th and Maple Street is approximately 195 acres.
- **Intensity (i).** Intensity is derived from the time of concentration for the subwatersheds. The time of concentration is calculated as the sum of the overland flow time, shallow concentrated flow time, and the system flow time. The time of concentration was estimated using the TR-55 method. For these three subwatersheds, times of concentration ranged from 50 to 65 minutes with an average time of concentration of approximately 58 minutes. The corresponding rainfall intensity is provided in the SMC, Table A. A time of concentration of 60 minutes was used, which is comparable to the TR-55 calculations. The 10-year frequency interval storm intensity for a 60 minute time of concentration from Table A is 2.5 inches per hour.
- **Runoff Coefficient (C).** Runoff coefficients specific to the City are provided in Table B of the SMC. Land use for System 6 was assigned visually to three categories, as shown in Table 1: residential,

open space, and commercial. Average C values, as presented in the Lawrence SMC, were assigned to each of these land use categories. Based on the review of these runoff coefficients, the City suggested that the values did not represent the unique drainage characteristics of the System 6 drainage area. As an alternative, the City directed the project team to apply the American Society of Civil Engineers (ASCE) runoff coefficients which they felt better represented the water shed characteristics, and are widely applied within the engineering field. The runoff coefficients from both sources are provided in Table 2.

Table 1: Drainage Area to 6th & Maple Streets Land Use (visual inspection)

Land Use Type	Drainage Area to 6 th & Maple Street (acres)
Residential	144.2
Open Space	27.3
Commercial	23.3
Total	194.8

Table 2: Runoff Coefficients (C) Assigned to Land Use

Land Use Type	Runoff Coefficients (C)	
	Lawrence SMC	ASCE
Residential Medium	0.60	0.40
Open Space Medium	0.36	0.15
Commercial Medium	0.76	0.70

The 10-year design flow at the Maple Street pump station (195 acres, A) for a 60 minute time of concentration at 2.5 inches per hour (i) using ASCE runoff coefficients (C) is approximately 195 cfs, or 1 cfs per acre. Additional details of the hydrologic analysis are provided in Attachment A.

Alternatives

The project team evaluated two options to alleviate flooding for a 10-year design storm:

- Option 1 – Gravity System. This option involves the installation of a pipe by tunneling from 6th & Maple Street to the Kansas River. Future additions to this configuration could include a stormwater pump station at the levee to address stormwater backwater from the Kansas River during flooding conditions.
- Option 2 – Pump Station at 6th and Maple. This option investigated the replacement of the existing pump station at this location with a new pump station, forcemain, and downstream gravity storm sewer system to the Kansas River.

Option 1 – Gravity System

A gravity system between 6th and Maple Street and the Kansas River was identified as a feasible solution during the proposal stage of the project. The gravity pipe plan and profile for this alignment are provided in Attachment B.

The outfall invert of a gravity pipe at the Kansas River controls the remainder of the system layout. An outfall elevation established at or near normal flow for a waterbody provides opportunity for increased slope, and therefore storage, in the pipe system. For this report, the outfall elevation for normal flow conditions was established using historical U.S. Geological Survey (USGS) data upstream and downstream of Lawrence on the Kansas River in conjunction with Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) profiles. This was then compared to the calculated results from a rating curve for a recently installed USGS gage on the Kansas River near the existing System 6 discharge point.

Based on this analysis, an outfall elevation of 802 feet was recommended for the analysis of the gravity pipe system. The available 20-year historical gage data of the Kansas River provide the best estimate of normal flow conditions for the System 6 discharge point.

Manning's equation was used to calculate the required pipe diameter for an all gravity system. Approximately 2,000 feet of 72-inch reinforced concrete pipe (RCP) at a slope of 0.25 percent is required to convey the 10-year design flow of 195 cfs from 6th and Maple Street to an outfall of 802 feet at the Kansas River. The Lawrence SMC requires at least a 0.2 percent slope for a pipe of this size and material.

The advantages and disadvantages of a gravity pipe system are provided in Table 3. One of the disadvantages is the high initial cost of the system. The estimated cost for this option is approximately \$5,624,900. This cost could fluctuate, depending on future geotechnical investigations that would be required prior to design. The detailed cost estimate for this option is included in Attachment D.

Table 3: Option 1 Advantages and Disadvantages

Advantages	Disadvantages
Lower operating and maintenance costs	Higher initial construction cost
Will convey 10-year design storm when river is at the 10-year flood stage	The basin will not drain when Kansas River elevation reaches 817 feet (approximately a 25-year river elevation) and capacity will be reduced when Kansas River elevation exceeds 812 feet (10-year elevation)
6th Street south of railroad will not have to be reconstructed	A coordination effort with USACE-Kansas City District will be required prior to any work at the levee. USACE should be engaged in any decisions regarding the levee, and may have specific requirements to be addressed and incorporated in the design. Tunneling beneath the levee could present permitting challenges.
	A coordination effort with the railroad will be required prior to any work at the railroad right-of-way. The railroad may have specific requirements to be addressed and incorporated in the design. Tunneling in the railroad right-of-way could present permitting challenges with the railroad.
	There are risks associated with tunnel construction which could result in unforeseen delays and costs during implementation.

Option 2 –Pump Station at 6th & Maple Street

The removal and replacement of the existing 6th and Maple Street pump station, downstream force main, and gravity system to the Kansas River to convey the 10-year design flow of 195 cfs was investigated. The plan and profile of this alternative is provided in Attachment C. For this analysis, the existing System 6 outfall elevation to the Kansas River was used.

The advantages and disadvantages of replacing the existing configuration are provided in Table 4. The estimated cost for this option is approximately \$4,921,400. The detailed cost estimate is included in Attachment D.

Table 4: Option 2 Advantages and Disadvantages.

Advantages	Disadvantages
Lower initial construction cost	Portions of 6th Street and storm system south of railroad will need to be reconstructed.
The City is familiar with the operation and maintenance activities associated with stormwater pump stations. In addition, the expectation from the neighborhood residents is that a new pump station will be constructed.	Long-term annual operations and maintenance costs (annual inspection of pump station; electricity cost; continued rehabilitation) will be higher than the gravity system.
The permitting process with the railroad and the United States of America Corps of Engineers (USACE) will be streamlined due to the existing pipeline that is currently in place.	

Recommendation

Based on the analysis of this preliminary engineering report, it is recommended that the City pursue preliminary design of Option 2: Pump Station at 6th & Maple Street based on the advantages listed in Table 4.

Conveyance of stormwater upstream of the 6th and Maple Street pump station site could be improved in the future. This could include routine operation and maintenance activities of existing ditch section roads and cross road pipes. Should additional pipe and/or curb and gutter be installed in the future, it is recommended that the designer re-evaluate the time of concentration associated with this type of installation to assess the impact on the pump station design flows.

Attachments

- A. Hydrologic Parameters and Calculations
- B. Option 1 – Gravity System Outfall Elevation Calculation Plan and Profile
- C. Option 2 – Maple Street Pump Station Plan and Profile
- D. Cost Estimate and Comparison

ATTACHMENT A:
Hydrologic Parameters and Calculations

Rainfall

Rainfall Source	Total Rainfall* (in)		
	2-year	5-year	10-year
City of Lawrence Stormwater Criteria Manual	3.6	4.56	5.28

*24-hour duration

2005 HNTB XP-SWMM Model Parameters

XP-SWMM			
Subcathment ID	Runoff Coefficient	Time of Concentration, min	Hydrology Method
S6-16N	0.61	23	Rational
S6-15N	0.6	20	Rational
S6L3-9N	0.61	23	Rational
S6L3-7N	0.54	23	Rational
S6L3-6N	0.62	28	Rational
S6-13N	0.57	37	Rational
S6-11N	0.57	27	Rational
S6L2-1N	0.58	27	Rational
S6-5N	0.56	25	Rational

TIME OF CONC CALCS

=====								
JBBASIN								

	SHALLOW CONC FLOW CALCULATINS							
	SHALLOW						SHALLOW	SHALLOW
	CONC	UPSTREAM	DOWNSTREAM		SHALLOW	Paved/	CONC	CONC
	LENGTH	ELEVATION	ELEVATION	SLOPE	CONC	Unpaved	VELOCITY	TRAVEL
	(FT)	(FT-NGVD)	(FT-NGVD)	(FT/FT)	LAND USE	Coefficient	(FT/S)	TIME (HR)

	1017.51			0.002	4	20.3282	0.9	0.31
	304.76			0.003	4	20.3282	1.2	0.07
	500.41			0.002	4	20.3282	0.9	0.15
	639.73			0.003	4	20.3282	1.1	0.16

TIME OF CONC CALCS

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	CHANNEL - LATERAL										
		Pipe	CHANNEL	CHANNEL	Flow Area	Wetted Perimeter		HYDRAULIC	CHANNEL	CHANNEL	
		Diameter	MANNING	LENGTH	SQ.FT	FT	SLOPE	RADIUS	VELOCITY	TRAVEL	
			N VALUE	(FT)			(FT/FT)	(FT)	(FT/S)	TIME (HR)	
					0	0		#DIV/0!	#DIV/0!	0.00	
					0	0		#DIV/0!	#DIV/0!	0.00	
					0	0		#DIV/0!	#DIV/0!	0.00	
					0	0		#DIV/0!	#DIV/0!	0.00	

TIME OF CONC CALCS

==						=====	=====				

	CHANNEL - MAJOR TRANSPORT NETWORK										
	FLOW	BOTTOM	TOP	CHANNEL	CHANNEL	UPSTREAM	DOWNSTREAM		HYDRAULIC	CHANNEL	CHANNEL
	DEPTH	WIDTH	WIDTH	MANNING	LENGTH	ELEVATION	ELEVATION	SLOPE	RADIUS	VELOCITY	TRAVEL
	(FT)	(FT)	(FT)	N VALUE	(FT)	(FT-NGVD)	(FT-NGVD)	(FT/FT)	(FT)	(FT/S)	TIME (HR)
	0.5	2.0	4.0	0.030	1997.95			0.003	0.35	1.4	0.41
	0.5	2.0	4.0	0.030	2854.35			0.003	0.35	1.3	0.63
	0.5	2.0	4.0	0.030	2048.90			0.001	0.35	0.8	0.72
	0.5	2.0	4.0	0.030	755.53			0.001	0.35	0.9	0.23

From GIS Delineation (CDM Smith) - visual C based on aerials

ID	NAME	ACRES	LAND_USE
8	S6-001	8.9	COMMERCIAL
11	S6-003	9.0	COMMERCIAL
14	S6-003	5.5	COMMERCIAL
2	S6-002	4.8	OPEN SPACE
7	S6-001	18.5	OPEN SPACE
12	S6-003	4.1	OPEN SPACE
1	S6-002	53.0	RESIDENTIAL
3	S6-002	12.0	RESIDENTIAL
9	S6-001	21.3	RESIDENTIAL
10	S6-001	25.3	RESIDENTIAL
13	S6-003	1.9	RESIDENTIAL
15	S6-003	30.7	RESIDENTIAL
Total Area (acres) to PS (6th and Maple):		194.9	

AREA TYPE :	AREA TO PS
RESIDENTIAL	144.2
OPEN SPACE	27.3
COMMERCIAL	23.3
SCHOOL	

C Values

C TYPE	C	
	LAWRENCE SMC	ASCE
RESIDENTIAL MEDIUM	0.60	0.40
OPEN SPACE MEDIUM	0.36	0.15
COMMERCIAL MEDIUM	0.76	0.70

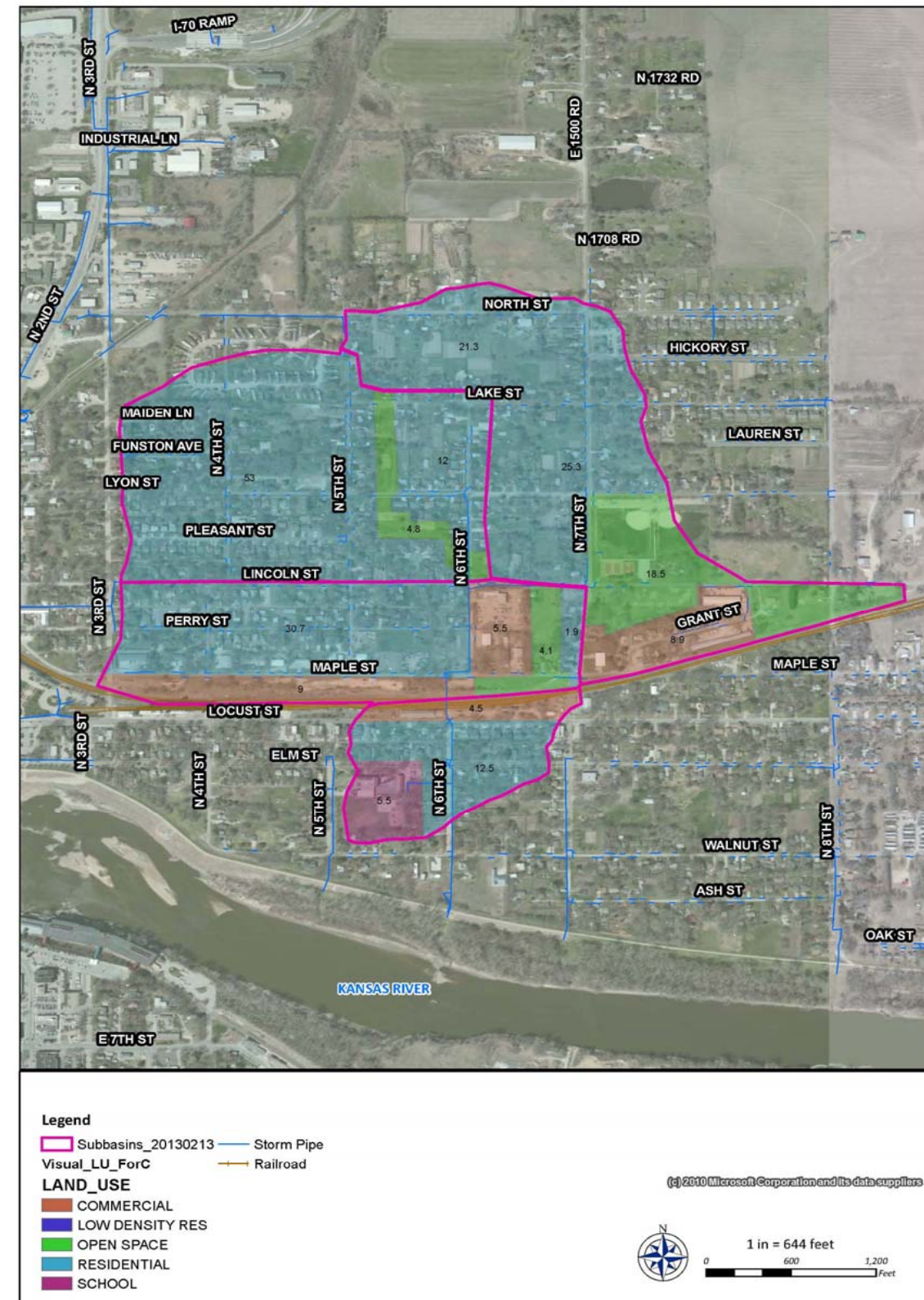
Note: numbers in red are estimated based on high and low values. Values for ASAE and ASCE are between B-C soil groups.

MEDIUM	Weighted C	
	LAWRENCE SMC	ASCE
	0.59	0.40

Rational Calculations - 10-year Event

$i_{10\text{-yr, Low DCM}}$ (in/hr) (60 minute T_c): 2.5
 Area (acres): 194.9

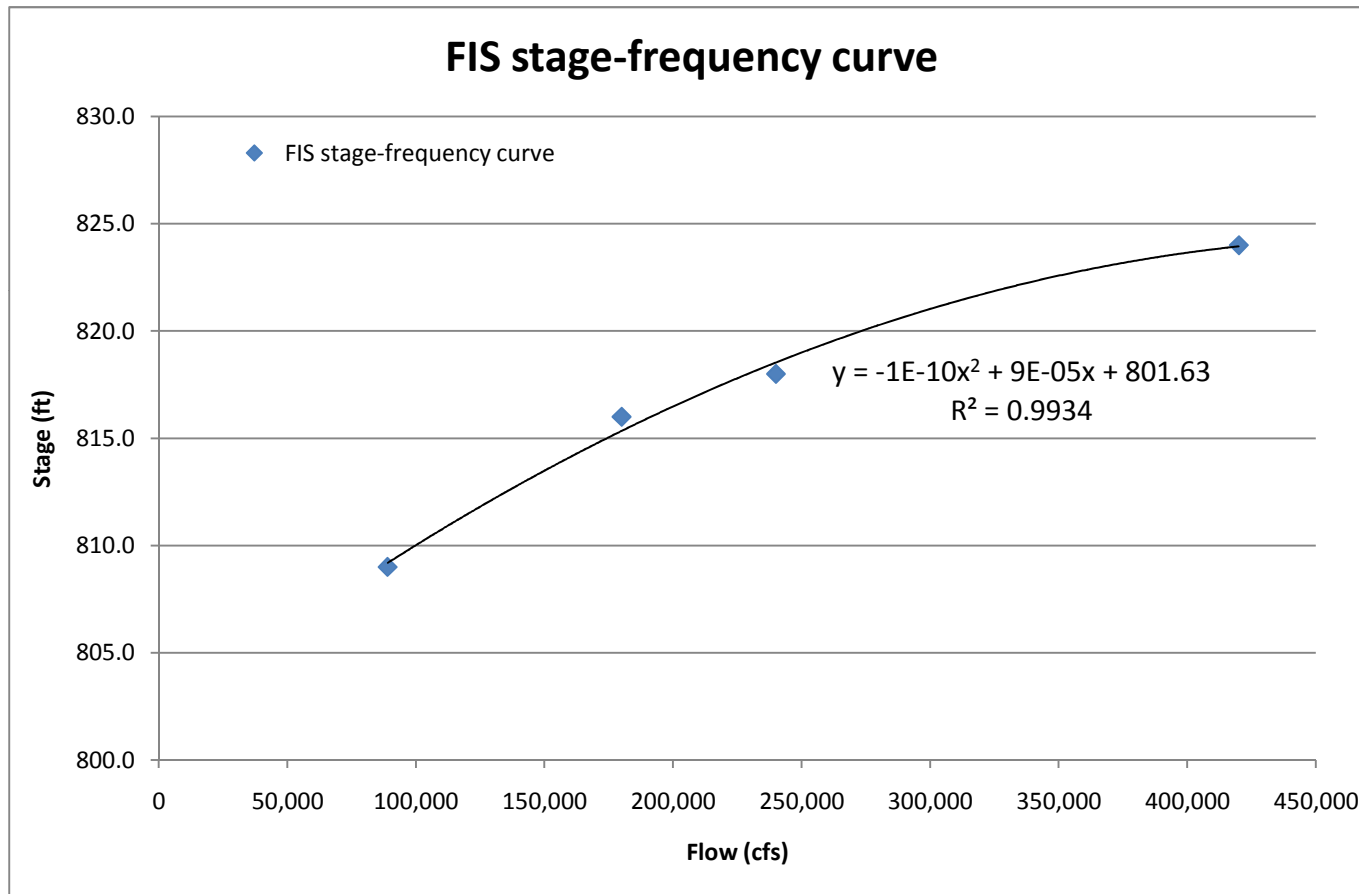
MEDIUM	LAWRENCE SMC		ASCE	
	Q (cfs)	cfs/ac	Q (cfs)	cfs/ac
	285.25	1.46	195.31	1.00



ATTACHMENT B: Option 1 – Gravity System
Outfall Elevation Calculation
Plan and Profile

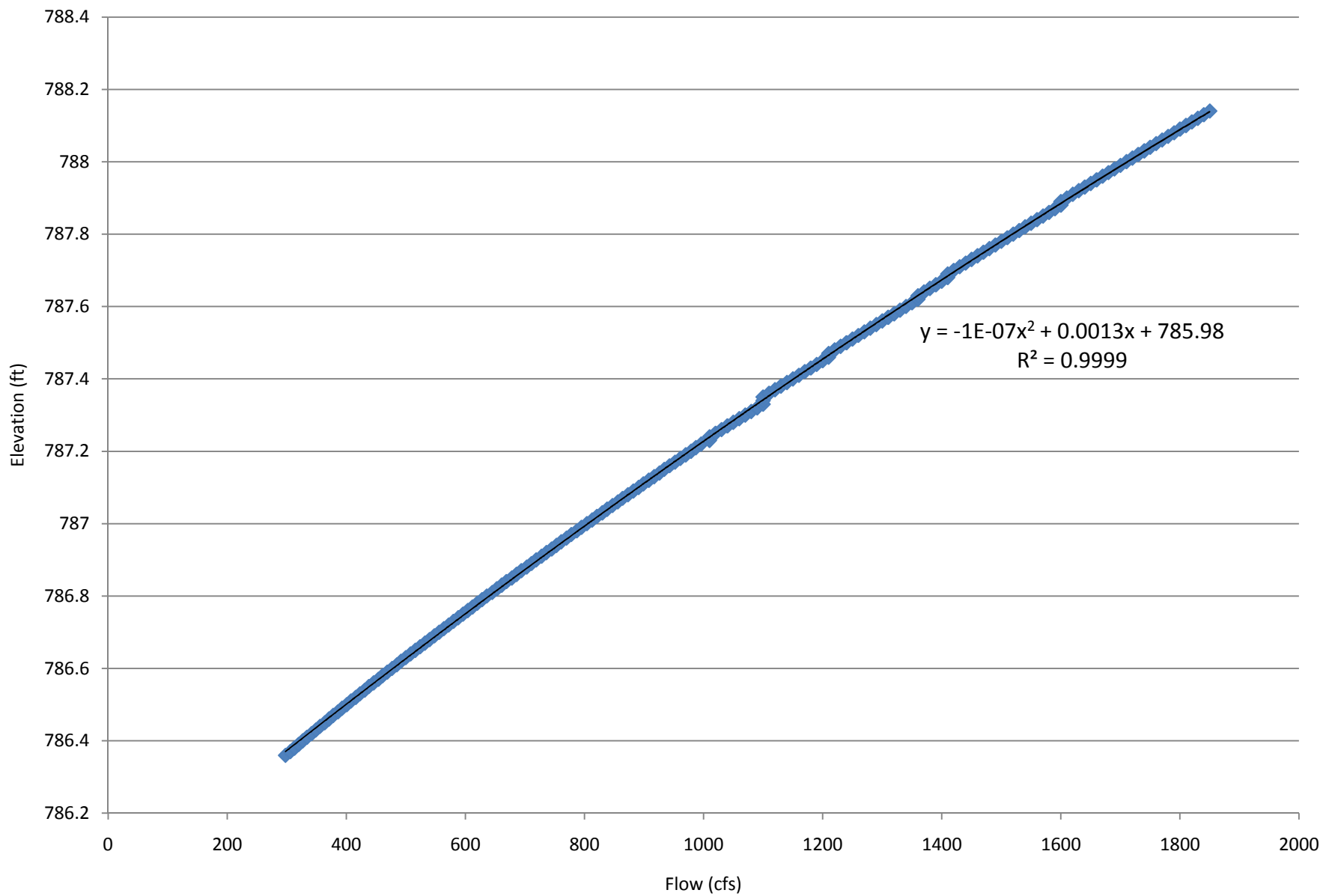
% Annual Chance	FIS flow (cfs, KS River 2400 ft above ATSF Trib)	FIS stage (ft, KS River 2400 ft above ATSF Trib)
Average flow*	7,752	801.6
10	89,000	809.0
2	180,000	816.0
1	240,000	818.0
0.2	420,000	824.0

*Estimated from USGS data at LeCompton and DeSoto, KS.



Kansas River					
At Douglas-Johnson County line	59756.00	89,500	179,500	232,500	428,000
2400 feet above ATSF Tributary	58460.00	89,000	180,000	240,000	420,000

USGS RC



	Outfall Elevation (ft)	Average Flow (cfs)
FIS	801.6	7752
USGS RC	796.1	7752

The outfall elevation was estimated using 2 different methods and sources of information:

1. FIS method. Outfall elevation determined by using the 2010 FIS profiles (elevation) and the information presented within (flow) the FIS to plot the elevation-flow relationship near the location of the outfall (FIS station 271,300).

Elevation-flow relationship: The FIS flows reported and used in this plot are located 2400' above the ATSF Trib, FIS station 264,400. The flows reported at station 264,400 and approximate elevations at this location (based on the FIS profiles for the 10, 2, 1, 0.2 % chance event) were plotted in the analysis and this plot was subsequently used to determine the elevation on the Kansas River at station 271,300 for the average flow of the past 20 years.

Average flow* used to determine the outfall elevation: The USGS gage at Lawrence has only been in service since September 2012, so it is not possible to get a representative average flow for use with the elevation-flow relationship described above. For this reason, USGS flow data was gathered upstream (LeCompton, KS-12 RM upstream Lawrence) and downstream (DeSoto, KS-21 RM downstream Lawrence) for the last 20 water years (October 1, 1992-October 1, 2012). For each of these gages the daily flow data was averaged over the past 20 years, and a weighted distribution (distance from Lawrence) was used to determine the average flow on the Kansas River at Lawrence, KS. This flow was then used in conjunction with the equation fit to the elevation-flow data to determine the appropriate outfall elevation based on the FIS.

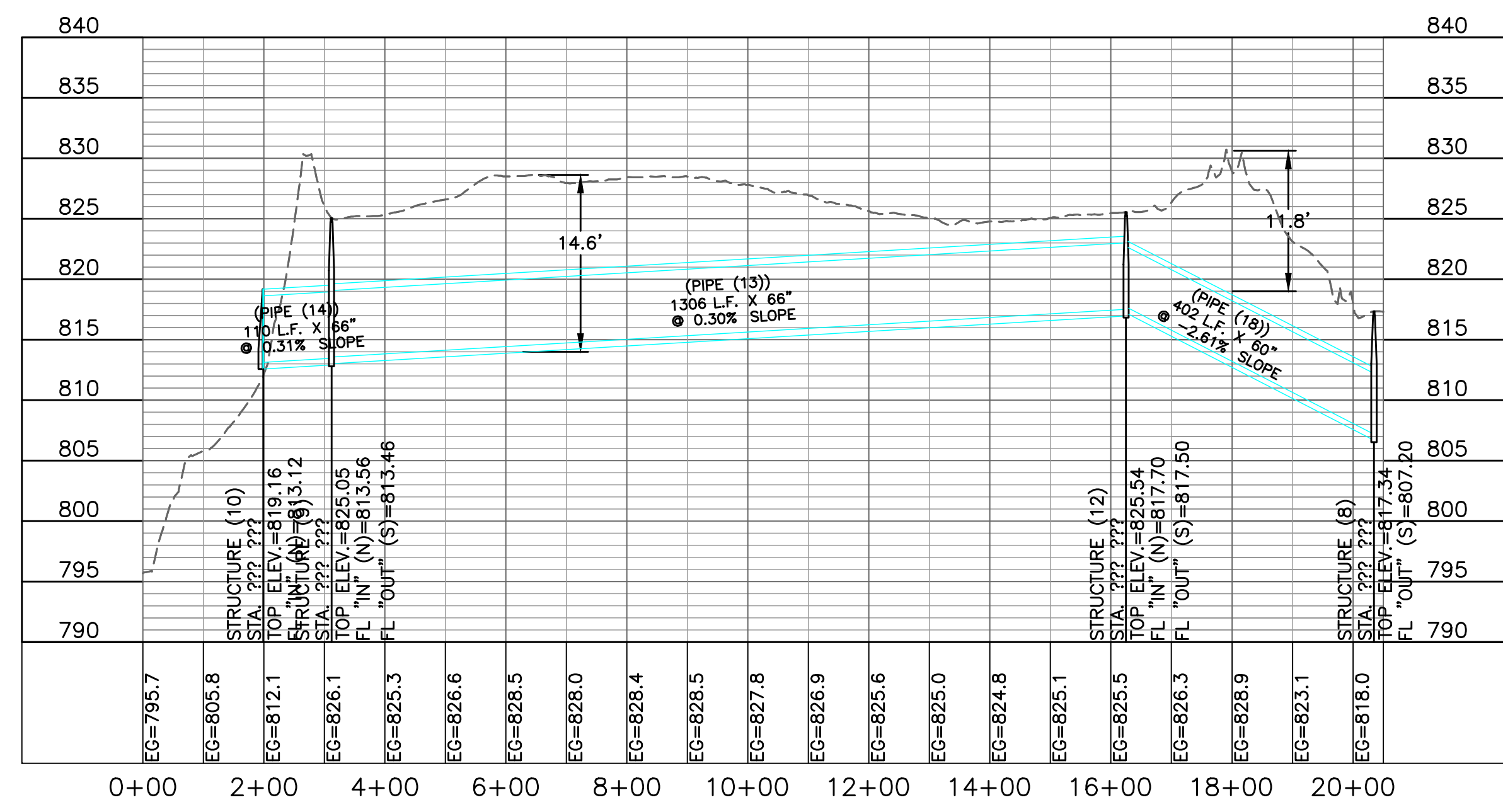
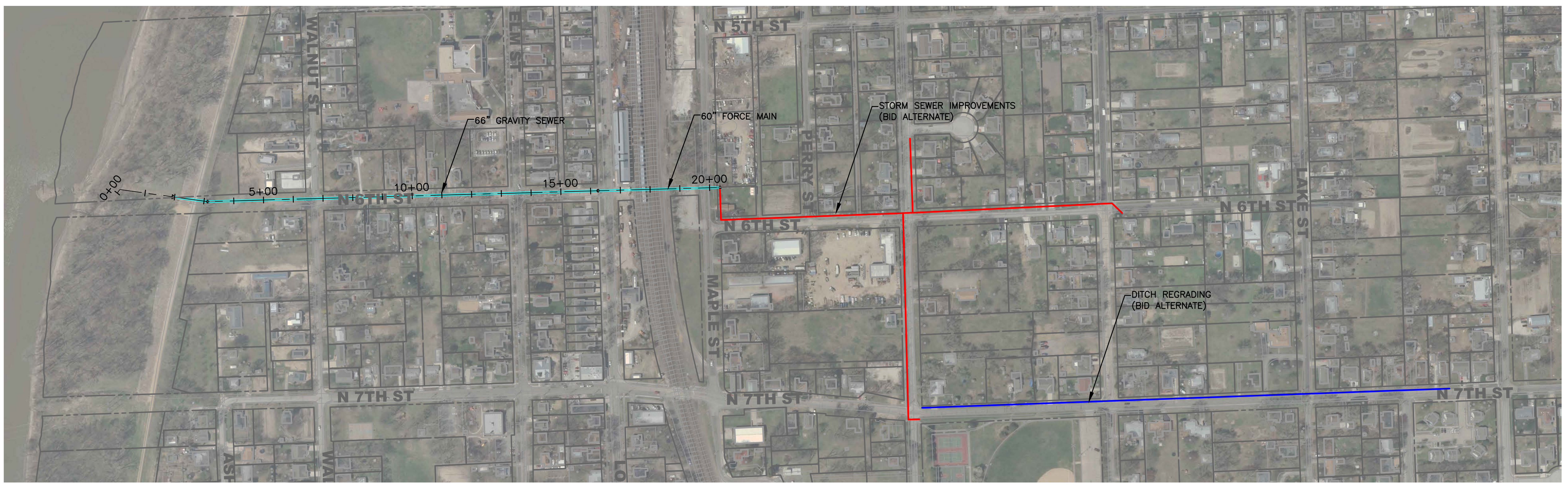
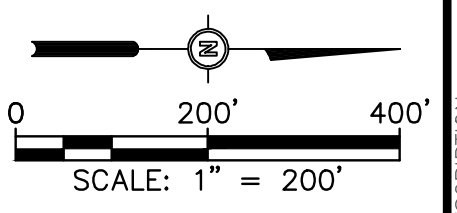
2. USGS method. A rating curve (RC) is provided on the USGS website for the Lawrence gage on the Kansas River downstream of Bowersock Dam. However, that gage has only been in place since September 2012, so the development of the RC is limited. That being said, the RC was plotted and a trendline was used to fit the data. The average flow* was used in conjunction with the fit equation to determine the outfall elevation based on the USGS RC.

3. Both elevations (802 feet and 796 feet) were compared with 2-foot contour information and aerial photography. In comparison with the 2009 aerial for this area, the Kansas River bank appeared relatively bare up to elevation 800 feet. This visual inspection indicated that the normal flow condition elevation of the Kansas River at this location appears to fluctuate between elevation 794 and 800 feet for any given year.

*average flow used for both methods was the same.

ATTACHMENT C: Option 2 – Maple Street Pump Station
Plan and Profile

Last edit on: 00/00/00 Drawing Name: W:\Proj\18000\18016\AutoCad\Strk& Maple_Plan_Sat\18016.000C_PlanProf(Pump).dwg Layout Name: PlanProf-200scale (Pump) Plotted By: JDM06688 Plotted on: 3/15/2013 8:06:47 AM



<h2 style="margin: 0;">PUMP STATION OPTION PLAN & PROFILE</h2> <p style="margin: 0;">MAPLE STREET DRAINAGE IMPROVEMENTS 5TH & MAPLE ST. TO KANSAS RIVER LAWRENCE, KANSAS</p>	<p style="font-size: small; margin: 0;">DESIGNED BY: JDM DRAWN BY: JDM APPROVED BY: BTA DESIGN PROJ: 18016.000 CONST PROJ: PW1133 SCALE: 1" = 20' DATE: JAN, 2013 DRAWING NO: <b style="font-size: large;">2 SHEET NO: 2 of 2</p>
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ATTACHMENT D:
Option 1 and Option 2
Cost Estimate and Comparison

NORTH LAWRENCE STORM WATER PROJECT
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

<i>Option 1- Gravity Option from 6th & Maple</i>					<i>Option 2 - Pump Station at 6th & Maple</i>						
ITEM NO.	DESCRIPTION	QUANTITY	UNIT	ENGINEER'S ESTIMATE		ITEM NO.	DESCRIPTION	QUANTITY	UNIT	ENGINEER'S ESTIMATE	
				Unit Price	Extension					Unit Price	Extension
1	MOBILIZATION	1	LSUM	500,000.00	500,000.00	1	CONTRACTOR CONSTRUCTION STAKING	1	LSUM	10,000.00	10,000.00
2	CLEARING/GRUBBING SITE PREP	2	ACRE	2,900.00	5,800.00	2	DEMOLITION AND REMOVAL	1	LSUM	30,000.00	30,000.00
3	TRENCH EXCAVATION SAFETY PROTECTION SYSTEMS (ALL DEPTHS)	280	LNFT	150.00	42,000.00	3	CLEARING & GRUBBING	1	LSUM	20,000.00	20,000.00
4	EROSION CONTROL	2,000	LNFT	5.00	10,000.00	4	9" FLYASH TREATED SUBGRADE STABILIZATION	2,003	SQYD	8.00	16,024.00
5	TEMPORARY FENCE, 8' CHAIN LINK	2,000	LNFT	48.50	97,000.00	5	4" DRAINABLE BASE (AB-1)	2,153	SQYD	8.00	17,222.98
6	CHAIN LINK DOUBLE SWING GATE, 8' x 20'	3	EACH	3,525.00	10,575.00	6	CURB & GUTTER, COMBINED (AE)	1,240	LNFT	20.00	24,798.20
7	TEMPORARY DRIVEWAY, INCLUDING REMOVAL AND SITE RESTORATION	2	EACH	6,000.00	12,000.00	7	CONCRETE PAVEMENT (8" UNIFORM)(AE)(NRDJ)	2,003	SQYD	50.00	100,150.00
8	FURNISH 72" DIA. RCP	2,050	LNFT	350.00	717,500.00	8	6" CONCRETE DRIVEWAY	350	SQYD	50.00	17,500.00
9	SHORING (LAUNCHING SHAFT 35x35)	15	VF	3,500.00	52,500.00	9	6" SIDEWALK RAMP	50	SQYD	135.00	6,750.00
10	SHORING (RECEIVING SHAFT 35x35)	15	VF	3,500.00	52,500.00	10	STANDARD CURB INLET (6"x8')	8	EACH	5,500.00	44,000.00
11	FLOOD PROTECTION (RECEIVING SHAFT TO ELEVATION 830)	1	LSUM	187,500.00	187,500.00	11	STANDARD AREA INLET (4'x4')	1	EACH	3,500.00	3,500.00
12	PORTAL/SHAFT EXCAVATION	1,361	CUYD	6.00	8,166.00	12	STANDARD JUNCTION BOX (8'x7')	6	EACH	6,000.00	36,000.00
13	TUNNEL EXCAVATION	2,050	LNFT	1,299.96	2,664,918.00	13	STORM SEWER (15") (RCP)	256	LNFT	45.00	11,502.00
14	HAUL SPOILS	4,559	CUYD	6.00	27,354.00	14	STORM SEWER (66") (RCP)	1,414	LNFT	250.00	353,430.00
15	CONDITION SURVEY	1	LSUM	5,000.00	5,000.00	15	STORM SEWER (60") (RCP) (FORCE MAIN)	414	LNFT	1,300.00	538,720.00
16	SURFACE MONITORING POINT ARRAYS AND INSTRUMENTATION	19	EACH	2,500.00	47,500.00	16	END SECTION (66")(RC)	1	EACH	2,500.00	2,500.00
17	SURFACE MONITORING POINT ARRAYS, READING	1	LSUM	50,000.00	50,000.00	17	TEMPORARY EROSION CONTROL	1	LSUM	15,000.00	15,000.00
18	SEEDING AND SITE RESTORATION	2	ACRE	4,800.00	9,600.00	18	FLOWABLE FILL (LOW STRENGTH)	1,000	CUYD	100.00	100,000.00
	SUBTOTAL				4,499,913.00	19	SEEDING (PERMANENT)	2.0	ACRE	2,500.00	5,000.00
	25% CONTINGENCY				1,124,978.25	20	SEEDING (TEMPORARY)	2.0	ACRE	2,500.00	5,000.00
						21	TEMPORARY TRAFFIC CONTROL	1	LSUM	20,000.00	20,000.00
						22	PUMP STATION	1	LSUM	2,520,000.00	2,520,000.00
						23	LEEVEE RECONSTRUCTION	1	LSUM	40,000.00	40,000.00
							SUBTOTAL				3,937,097.18
							25% CONTINGENCY				984,274.29
	TOTAL ESTIMATE (Average)				\$5,624,891.25		TOTAL ESTIMATE (Average)				\$4,921,371.47
	TOTAL ESTIMATE (Low)				\$4,218,668.44		TOTAL ESTIMATE (Low)				\$4,577,313.43
	TOTAL ESTIMATE (High)				\$7,031,114.06		TOTAL ESTIMATE (High)				\$5,294,698.11

<p>Notes:</p> <ol style="list-style-type: none"> Estimate does not include cost for temporary pump at levee. Estimate assumes rock is not present for tunneling. Estimate assumes existing storm water infrastructure south of railroad will remain in place. Estimate does not include storm water improvements north of 6th & Maple. 	<p>Notes:</p> <ol style="list-style-type: none"> Estimate assumes east half of 6th Street south of railroad will be replaced with concrete. Existing storm water infrastructure south of railroad on 6th St will be replaced and connected with new system. Estimate does not include storm water improvements north of 6th & Maple.
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