QUAIL RUN AND LIBERTY GLASS DRAINAGE SYSTEM

SAPULPA CITYWIDE MASTER DRAINAGE PLAN

JUNE 2010

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MESHEK & ASSOCIATES, PLC
CIVIL & WATER RESOURCE ENGINEERING
GEOGRAPHIC INFORMATION SYSTEMS

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SECTION 13. QUAIL RUN AND LIBERTY GLASS DRAINAGE SYSTEM

13.1. EXISTING CONDITIONS HYDROLOGY

The Quail Run and Liberty Glass Drainage System is composed of two independent basins both of which drain into Polecat Creek. This is shown in **FIGURE 13-1**. This Drainage System generally lies east of N. 9th Street, south of W. 101st Street, west of Polecat Creek and north of Thompson Avenue. Quail Run Drainage Basin drains northwesterly into Polecat Creek while the Liberty Glass Drainage Basin drains southeasterly into Polecat Creek. Though the basins drain separately into Polecat Creek, they were modeled together in the hydrologic analysis.

The hydrologic soil groups and existing land use for this system are shown in **FIGURE 13-2** and **FIGURE 13-3** respectively. More information on the hydrologic soil groups can be found in **SECTION 2.1 HYDROLOGIC ANALYSIS**.

The hydrologic coefficients used for input in the HEC-HMS model include the drainage area, the lag time and the soil complex curve number (CN). A summary of hydrologic coefficients is tabulated in **TABLE 13-1** with more detailed data in **APPENDIX 13-A**.

The drainage basin was modeled using HEC-HMS. The HEC-HMS schematic used to develop the flow rates for the Quail Run and Liberty Glass Drainage System is located in **APPENDIX 13-B** with a complete list of the flow rates for the existing conditions included in **APPENDIX 13-C**. **TABLE 13-2** shows the resulting flow rates at major junctions in the Quail Run and Liberty Glass Drainage System.

13.2. EXISTING CONDITIONS HYDROLOGY

Two storm sewer systems – the Adams and Watchorn System and the Quail Run System - were studied in the Quail Run Drainage Basin using a StormCAD model to analyze the flow through the storm sewer system. The pipe capacities from the StormCAD model were compared with the 1- to 500-year HMS flow rates to determine the pipe capacities of each pipe within each system. No storm sewer systems were studied in the Liberty Glass Drainage Basin.

A. Adams and Watchorn Storm Sewer System

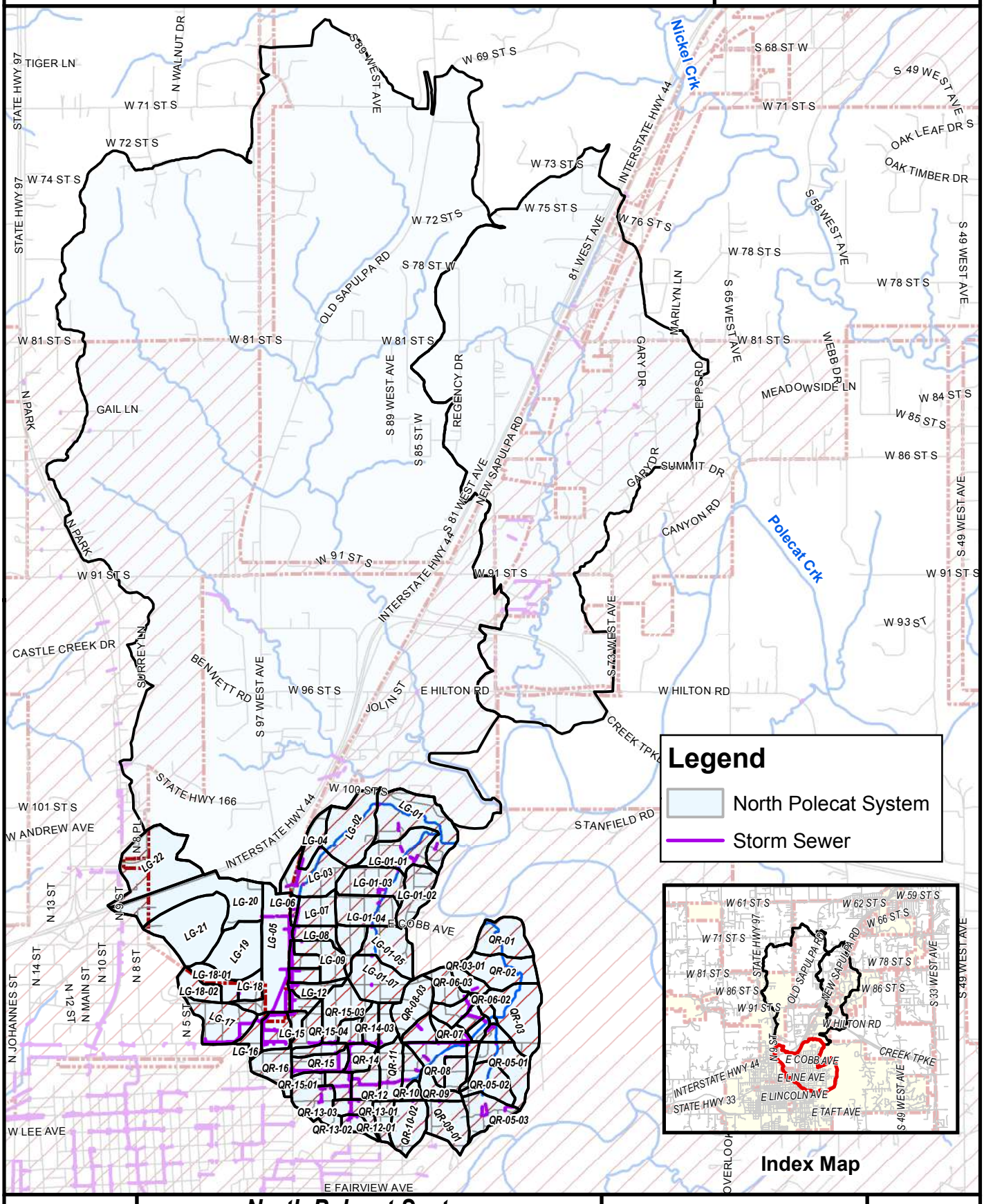
The existing Adams and Watchorn storm sewer system is an elaborate system that, for summary purposes, was broken down into five smaller studied sections. These are: the Main Outfall East, the North Leg, the Northwest Leg, the South Leg, and the West Leg. Each section is discussed below. Their general locations and capacities are shown in **FIGURE 13-4**.

Main Outfall East. From mid- block on N. Watchorn Street south of E. McLeod Avenue, the Main Outfall East generally extends south and east to E. Hobson Avenue and then along E. Hobson Avenue to east of N. Moccasin Place. From N. Watchorn (south of E. McLeod Avenue) to E. Hobson Avenue and N. Boyd Street (if extended), the system is contained in 773 feet of an 8 x 6-foot RCB. From E. Hobson Avenue and N. Boyd Street (if extended), the system continues east through approximately 670 feet of double 6 x 5-foot RCB to the outfall east of

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 1,500 3,000
N



Legend

- North Polecat System
- Storm Sewer

Index Map

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North Polecat Systems
Quail Run & Liberty Glass
Drainage System

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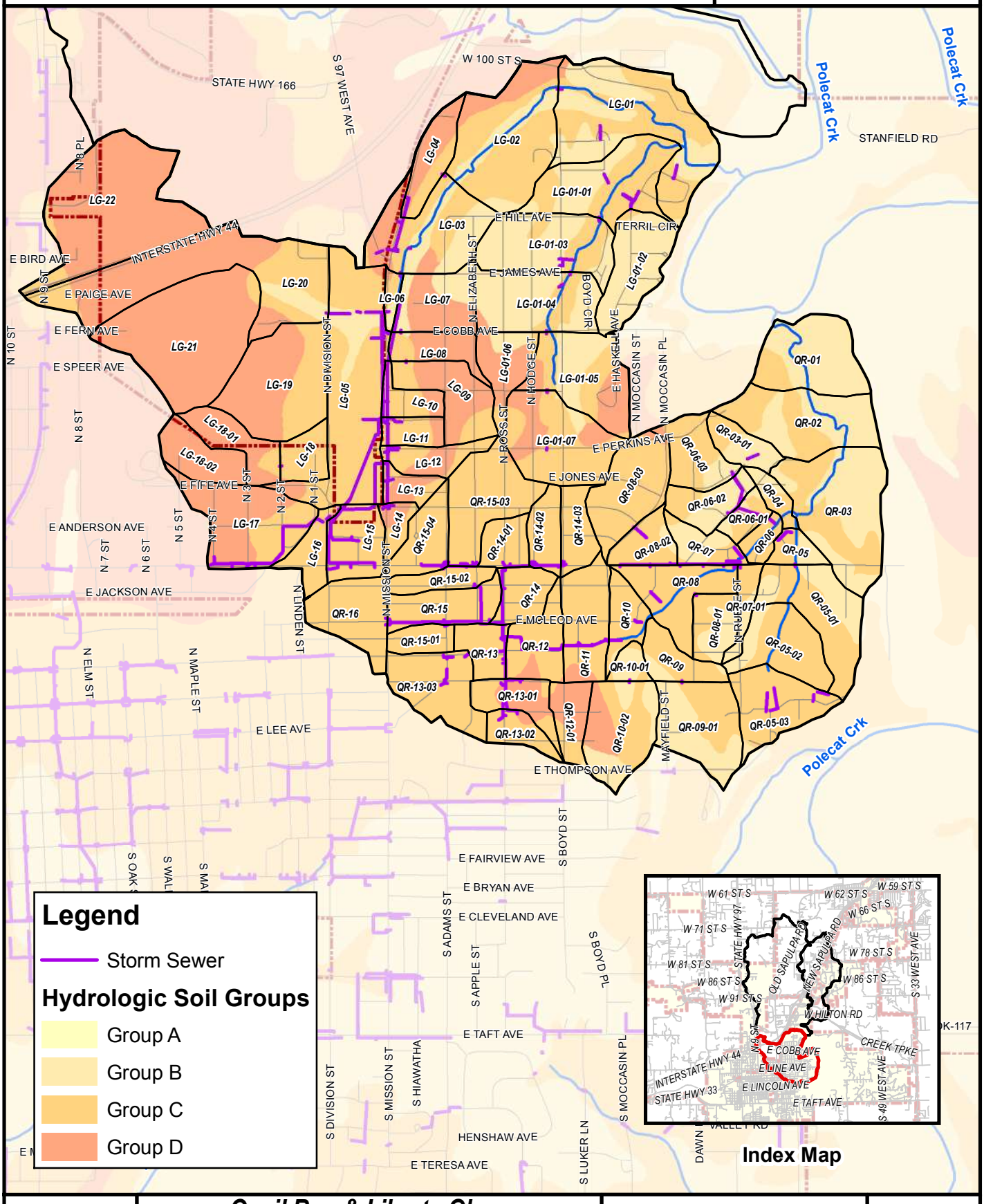
Figure 13-1

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 750 1,500
N



Legend

- Storm Sewer

Hydrologic Soil Groups

- Group A
- Group B
- Group C
- Group D

Index Map

Quail Run & Liberty Glass Drainage System Hydrologic Soil Groups

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Figure 13-2

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
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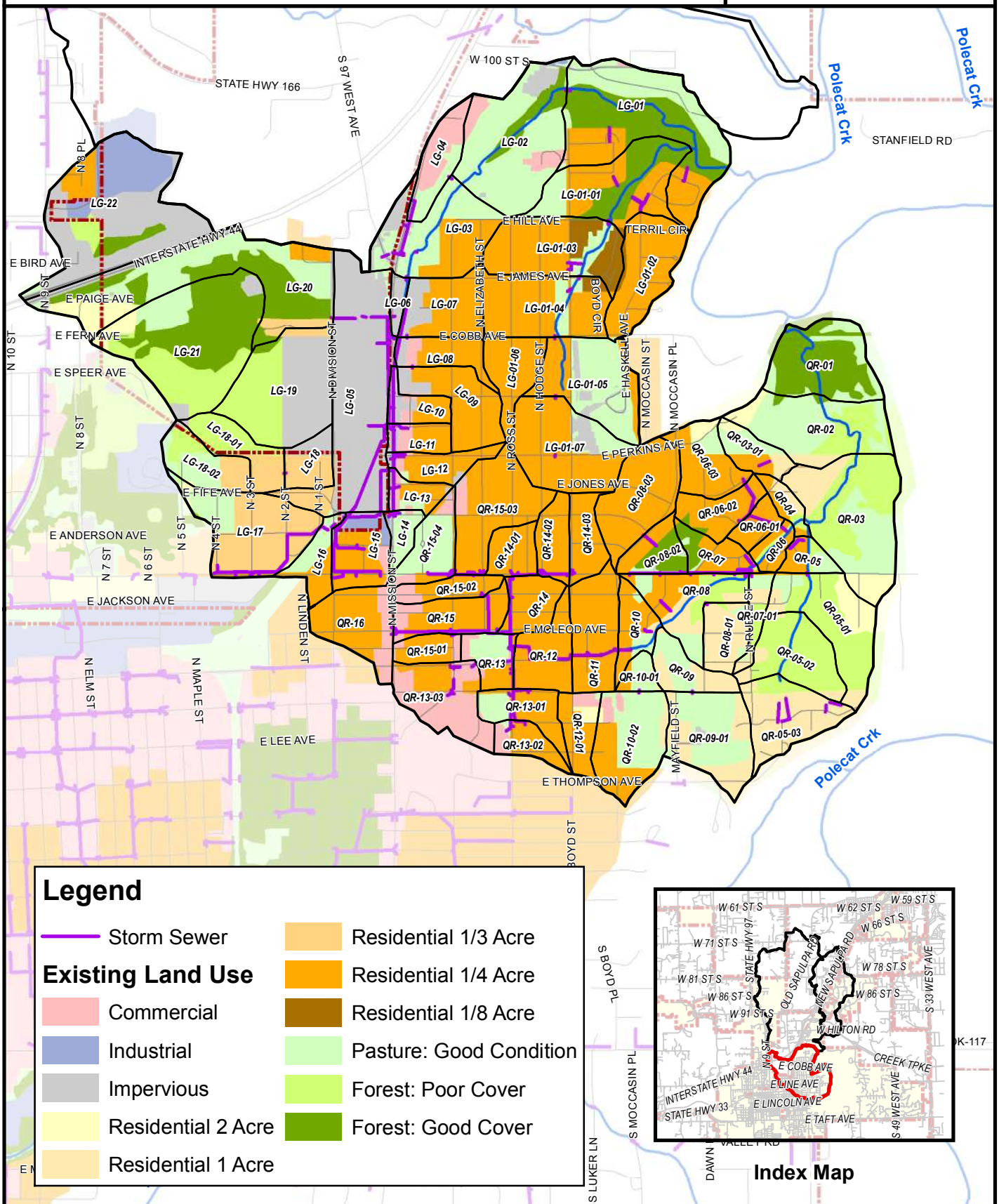

Legend

- Storm Sewer

Existing Land Use

- Commercial
- Industrial
- Impervious
- Residential 2 Acre
- Residential 1 Acre
- Residential 1/3 Acre
- Residential 1/4 Acre
- Residential 1/8 Acre
- Pasture: Good Condition
- Forest: Poor Cover
- Forest: Good Cover

Index Map

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Quail Run & Liberty Glass Drainage System Existing Land Use

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Figure 13-3

TABLE 13-1. QUAIL RUN AND LIBERTY GLASS DRAINAGE SYSTEM SUMMARY OF HYDROLOGIC COEFFICIENTS FOR EXISTING CONDITIONS

Sub-Area	Drainage Area, Acres	Lag Time, Minutes	Composite CN
LG-01	41.9	8.0	69
LG-01-01	24.0	6.0	73
LG-01-02	16.9	4.9	75
LG-01-03	22.3	6.1	78
LG-01-04	21.8	9.6	76
LG-01-05	21.7	5.1	81
LG-01-06	10.2	5.9	84
LG-01-07	24.4	7.6	82
LG-02	34.5	6.2	75
LG-03	24.8	7.5	77
LG-04	9.7	3.2	88
LG-05	43.9	20.3	96
LG-06	2.3	2.0	98
LG-07	13.8	7.4	87
LG-08	8.0	7.9	89
LG-09	14.8	10.5	88
LG-10	5.7	5.6	91
LG-11	5.3	4.0	89
LG-12	7.4	7.0	87
LG-13	5.0	4.2	88
LG-14	4.1	3.0	80
LG-15	11.8	4.7	87
LG-16	7.0	5.8	80
LG-17	24.4	5.4	83
LG-18	6.8	4.2	87
LG-18-01	10.2	3.2	84
LG-18-02	10.4	2.6	83
LG-19	28.8	6.7	91
LG-20	45.3	11.2	78
LG-21	42.2	7.3	80
LG-22	45.2	9.9	94
QR-01	20.8	6.5	59
QR-02	23.8	3.3	68
QR-03	32.1	6.6	69
QR-03-01	6.9	3.4	71
QR-04	3.9	3.7	76

Sub-Area	Drainage Area, Acres	Lag Time, Minutes	Composite CN
QR-05	4.4	1.9	73
QR-05-01	20.4	6.3	72
QR-05-02	15.8	3.8	75
QR-05-03	16.3	6.3	78
QR-06	3.8	2.0	82
QR-06-01	4.4	3.2	81
QR-06-02	8.8	2.7	77
QR-06-03	11.4	5.4	79
QR-07	7.2	5.6	72
QR-07-01	4.4	4.1	72
QR-08	15.3	5.1	79
QR-08-01	8.3	2.8	73
QR-08-02	7.7	2.6	76
QR-08-03	18.3	7.8	83
QR-09	8.3	4.5	75
QR-09-01	19.9	5.6	70
QR-10	7.5	2.4	81
QR-10-01	3.4	2.8	67
QR-10-02	19.0	4.6	76
QR-11	15.6	3.8	83
QR-12	11.4	3.9	83
QR-12-01	7.8	5.2	86
QR-13	6.9	6.0	82
QR-13-01	9.0	5.2	83
QR-13-02	5.9	5.1	85
QR-13-03	16.7	7.3	91
QR-14	8.1	4.8	83
QR-14-01	6.7	5.7	83
QR-14-02	7.3	7.9	83
QR-14-03	7.7	8.8	83
QR-15	11.9	9.3	85
QR-15-01	5.2	3.8	85
QR-15-02	6.1	7.8	85
QR-15-03	20.0	13.4	84
QR-15-04	10.2	4.7	79
QR-16	15.2	4.8	86

TABLE 13-2. QUAIL RUN AND LIBERTY GLASS DRAINAGE SYSTEM EXISTING FLOW RATES AT MAJOR JUNCTIONS (CFS)

HMS Junction	Street Intersection	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
J-LG-01-02	Moccasin St.	16	28	51	66	85	100	114	143
J-LG-01-03	Hill Ave	104	166	286	368	450	535	615	772
J-LG-01-04	James Ave & Brown St.	90	142	239	300	377	437	495	614
J-LG-01-05	Cobb Ave b/w Hodge and Brown St.	74	116	189	235	294	338	382	469
J-LG-01-07	Haskell Ave b/w Hodge and Brown St.	32	50	82	102	127	146	165	202
J-LG-02	Brown St.	500	726	1161	1434	1786	2065	2332	2891
J-LG-05	Mission St. (Near the industrial area)	359	507	777	949	1165	1328	1489	1822
J-LG-06	James Ave to the West of RR	492	709	1096	1341	1653	1887	2115	2582
J-LG-07	RR b/w James and Arch Ave.	145	211	326	399	490	559	626	764
J-LG-08	Cobb Ave. b/w Ridgeway & Mission St.	38	54	81	98	119	134	150	182
J-LG-09	Moman Ave. b/w Ridgeway & Mission St.	24	35	52	63	77	87	97	118
J-LG-10	Moman Ave. & Mission St.	87	130	203	250	308	352	395	483
J-LG-11	Watchorn Ave. & Mission St.	76	117	185	228	282	322	362	442
J-LG-12	Perkins Ave. & Mission St.	67	107	169	209	258	295	332	406
J-LG-13	Jones Ave. & Mission St.	55	89	142	176	218	250	281	344
J-LG-14	Denton Ave. & Mission St.	6	10	16	20	25	29	33	40
J-LG-15	Denton Ave. to the West of Mission	22	35	53	63	77	87	97	116
J-LG-16	Denton Ave. & Division St.	45	73	117	145	180	207	233	284
J-LG-17	RR b/w Denton & Dewey Ave.	37	59	94	115	143	163	183	223
J-QR-03-01	Quail Run Ln.	5	10	19	25	34	40	46	58
J-QR-05	Foxwoods Dr.	38	75	146	189	245	291	332	425
J-QR-06-01	Denton Ave. & Shadow Ln.	29	48	82	103	131	152	173	214
J-QR-06-02	Quail Run Ln. & Denton Ave.	23	38	66	83	106	123	140	173

J-QR-06-03	Jones Ave. & Ruble St.	14	23	39	49	62	72	81	100
J-QR-07	DS of Line Ave. b/w Foxwoods Dr & Shadow Ln	301	454	761	964	1212	1405	1594	1990
J-QR-07-01	Line Ave. to the East of Ruble St.	3	6	12	16	21	24	28	36
J-QR-08	US of Line Ave. to the West of Ruble St.	299	457	749	945	1185	1371	1558	1946
J-QR-08-01	Jackson Ave. & Leathy St.	7	13	25	33	43	51	59	74
J-QR-08-02	Line Ave. b/w Moccasin Pl. & Quail Run Ln.	30	47	77	97	121	140	158	195
J-QR-08-03	Moccasin Pl. & Denton Ave.	25	39	63	78	97	111	125	153
J-QR-09-01	Dewey Ave. b/w Mayfield & Leathy St.	11	22	46	62	82	99	116	148
J-QR-10-02	Dewey Ave. b/w Moccasin Pl. & Mayfield St.	19	33	60	77	99	116	132	165
J-QR-11	Moccasin Pl. b/w McLeod & Dewey Ave.	231	351	554	682	843	965	1085	1331
J-QR-12	Boyd St. b/w Hobson & Dewey Ave	219	331	520	640	790	904	1015	1242
J-QR-12-01	Dewey Ave. & Boyd St.	14	22	33	40	49	55	62	74
J-QR-13	Watchorn St. b/w Hobson & McLeod Ave.	198	300	469	575	709	810	910	1112
J-QR-13-01	Dewey Ave. & Watchorn St.	24	38	60	73	90	103	115	140
J-QR-13-02	Lee Ave. & Watchorn St.	10	16	25	30	37	42	47	57
J-QR-13-03	Hobson Ave. b/w Watchorn & Ridgeway St.	36	51	72	86	103	115	127	152
J-QR-14	McLeod & Watchorn	131	199	318	393	488	560	631	774
J-QR-14-01	Line Ave. & Ross St.	29	45	72	89	110	127	143	175
J-QR-14-02	Line Ave. & Hodge St.	20	31	50	62	77	88	100	122
J-QR-14-03	Line Ave. & Brown St.	10	16	25	31	39	45	51	62
J-QR-15	Adams b/w Watchorn & Ridgeway	92	140	222	274	340	390	439	538
J-QR-15-02	Jackson Ave. & Elizabeth St.	42	62	102	128	160	185	210	260
J-QR-15-03	Line Ave. & Elizabeth St.	32	48	81	101	127	148	167	208
J-QR-15-04	Line Ave. & Ridgeway St.	12	21	36	45	57	66	75	92

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 750 1,500
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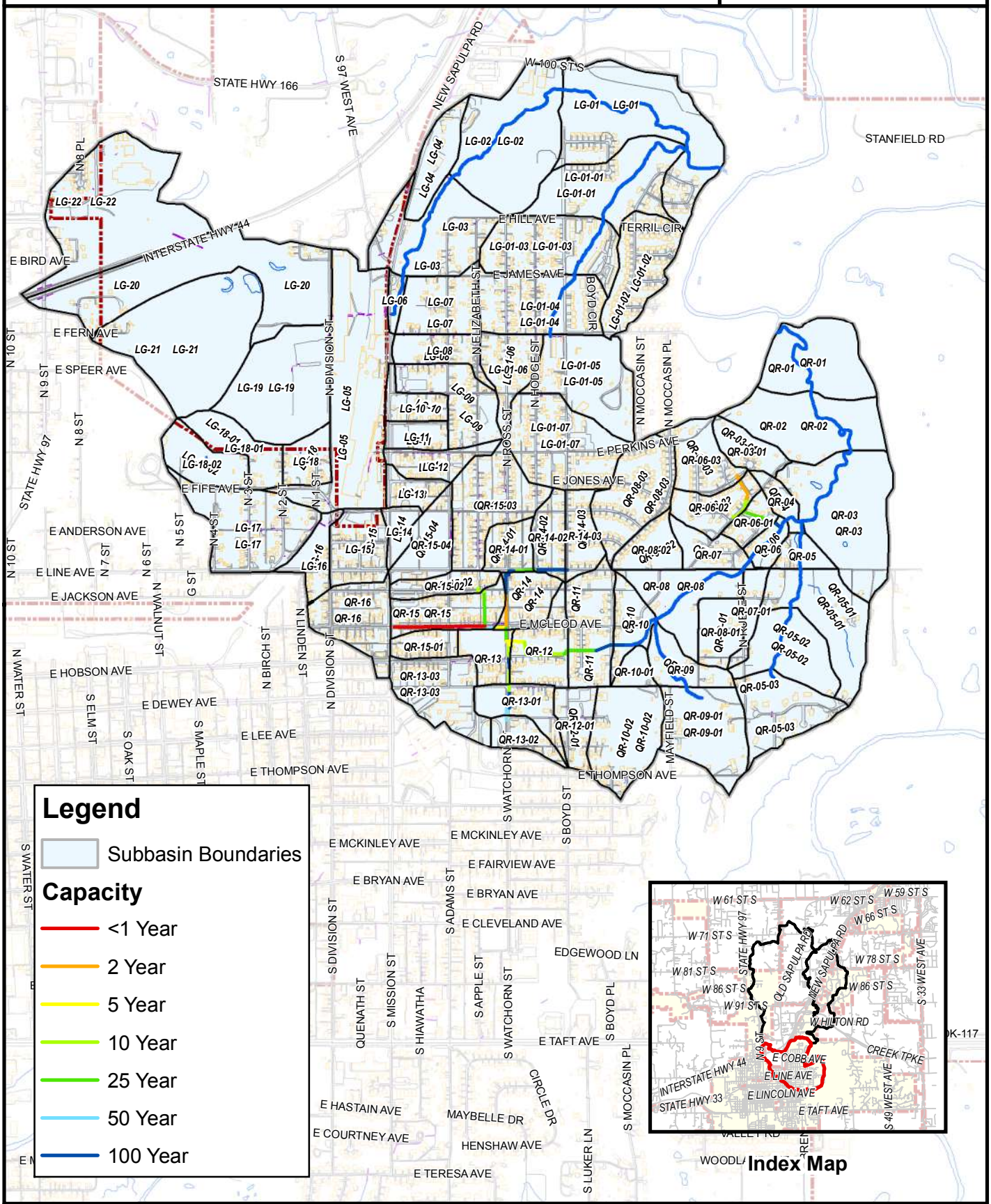

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Quail Run & Liberty Glass Drainage System Studied Systems and Capacity

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Figure 13-4

N. Moccasin Place. The upper leg of this system can handle a 20% annual chance storm event, while the double RCB section at the system's lower end can handle a 4% annual chance storm frequency.

North Leg. The North Leg of the system extends west from the intersection at N. Boyd Street and E. Line Avenue through a 30-inch RCP for 363 feet. The system then continues west through 238 feet of a 36-inch RCP. Just before the intersection at E. Line Avenue and N. Watchorn Street, there is a short stretch of 54 feet of 42-inch RCP. At the intersection, the system extends south through a 48-inch RCP for 666 feet along N. Watchorn Street before connecting with the Main Outfall East system at N. Watchorn Avenue south of E. McLeod Street. The upper end of this leg of the system can handle storm events with a 4% annual chance frequency, while the lower end can handle storm events having a 50% annual chance frequency.

Northwest Leg. From the intersection at N. Elizabeth Street and E. Jackson Avenue, the system's Northwest Leg extends south for 32 feet through double 42-inch RCPs before enlarging and continuing as double 36-inch RCPs for the next 431 feet. At N. Adams Street, the system extends east through approximately 240 feet of 6 x 5-foot RCB and then south at N. Watchorn Street through 158 feet of 6 x 5-foot RCB before intersecting with the Main Outfall East system. This leg of the system has adequate capacity to handle a 20% annual chance storm event.

South Leg. From E. Lee Avenue, the South Leg extends north along N. Watchorn Street to connect with the Main Outfall East between E. Hobson Avenue and E. McLeod Avenue. Beginning at the intersection at N. Watchorn and E. Lee Avenue, a 24-inch RCP extends north 163 feet before becoming 442 feet of 30-inch RCP and finally 300 feet of 36-inch RCP. This leg of the system has a 20% annual chance storm capacity.

West Leg. Beginning at the intersection of E. McLeod Street and S. Mission Street, the West Leg extends east through a 15 inch RCP for 1018 feet before intercepting the Northwest Leg at N. Elizabeth (if extended south). This West Leg is incapable of handling even a very frequent event, i.e. a 100% annual chance event.

B. Quail Run Storm Sewer System

This system is a known problem area with frequent residential flooding.

Quail Run Storm Sewer System. The existing system extends from the intersection at E. Jones Avenue and N. Ruble Street southeasterly along N. Ruble Street, north-south on Quail Run Lane and along E. Denton Avenue east to the outfall. From its northwesterly initiation point, a 24-inch RCP extends 446 feet along N. Ruble Street and Quail Run Lane to intercept with 353 feet of 30 inch RCP extending through a neighborhood north of E. Denton Avenue. On the east side of the cul de sac at E. Denton Avenue, the 30-inch RCP continues east to connect with 102 feet of 36-inch RCP which extends to the outfall. This system can contain a 50% annual chance storm event.

The floodplains in the Quail Run and Liberty Glass Drainage System were mapped for the 2-, 10, 100- and 500-year frequency events and are shown in **APPENDIX 13-D**. Buildings located in proximity to the floodplain are also shown. The resulting water surface profiles for each frequency are presented in **APPENDIX 13-E**.

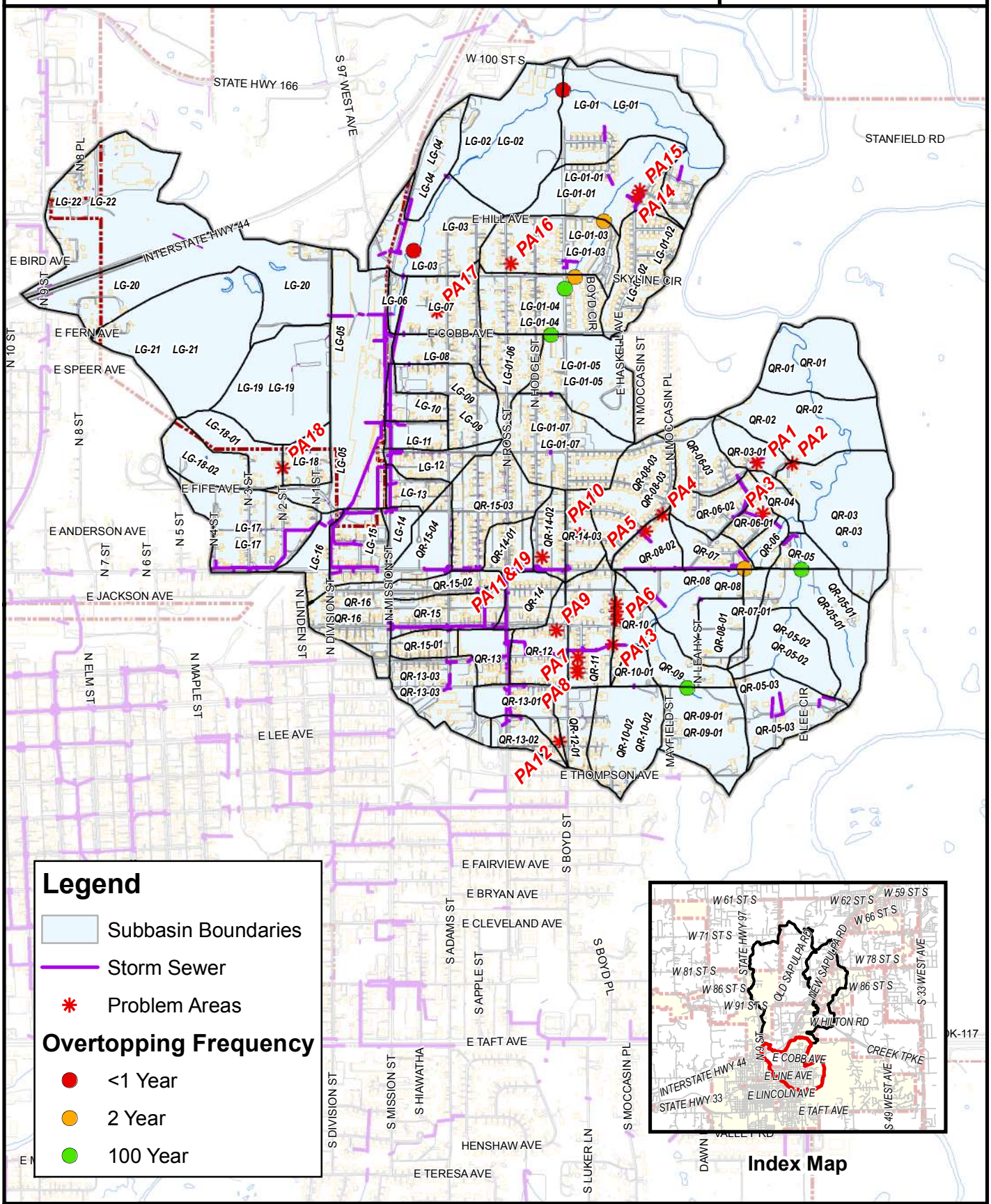
Bridges and culverts were studied to determine the likelihood of overtopping during certain storm frequencies and are depicted in **FIGURE 13-5**. Three structures, one on the main channel and two on the tributaries, were studied in the Quail Run Drainage Basin. The main channel structure at E. Line Avenue and N. Ruble Street would overtop with a 50% annual chance frequency storm event. The structure on Tributary A (on East Line Avenue just east of N. Ruble Street) can handle a 1% annual chance storm event. Like Tributary A, the structure on Tributary B at Dewey Avenue also has the capacity to handle a 1% annual chance storm.

Liberty Glass Basin has two structures on its main channel and four on its tributary. Both structures on the main channel would overtop during storms with a 100% annual chance frequency. The two upstream structures along Tributary A (at E. Cobb Avenue and N. Brown Street) have adequate capacity to handle storm events with a 1% annual chance frequency. The downstream structures at E. James Avenue and E. Hill Avenue have less capacity and would overtop during a storm event with a 50% annual chance occurrence.

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 750 1,500
N



Legend

- Subbasin Boundaries
- Storm Sewer
- Problem Areas

Overtopping Frequency

- <1 Year
- 2 Year
- 100 Year

Index Map

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Quail Run & Liberty Glass Drainage System Problem Areas and Road Overtopping Frequency

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Figure 13-5

13.3. PROBLEM AREAS

Numerous drainage problems in the Quail Run and Liberty Glass Drainage System were identified by City staff and residents attending the public meetings. A discussion of these Problem Areas by basin follows with their locations shown in **FIGURE 13-5**.

In addition, as has been discussed in section, some bridges and structures in both basins would overtop during certain storm frequencies. On the main channel of the Quail Run Drainage Basin (at E. Line Avenue and N. Ruble Street), one structure would overtop during storm events having a 50% annual chance frequency. In the Liberty Glass Basin, two structures on the main channel would overtop during storms events with a 100% annual chance frequency, while two other structures on the downstream tributary (at E. James Avenue and E. Hill Avenue) would overtop during storm events with a 50% annual chance occurrence.

A summary of identified Problem Areas, other than structure overtoppings discussed above, in the **Quail Run Drainage Basin** are discussed below.

A. Problem Area 1: 1722 E. Jones Avenue

At this location, the existing system consists of one inlet with two grates and two hoods connected to approximately 130 feet of 18 inch CMP. The garage at this residence floods when it rains, and the drains "flood" based on comments from the resident.

B. Problem Area 2: 550 Quail Run Lane

Stormwater runoff from the road is washing out this driveway and the foundation causing the house to settle.

C. Problem Area 3: 1809 E. Denton Avenue

This residence flooded four times in 2008, although there had been no prior flooding. The individual believes that the storm pipes above this property are not functioning properly to collect the runoff running through their yard.

D. Problem Area 4: 517 N. Moccasin Place

According to this individual, the storm drains are inadequate on N. Moccasin Place and E. Denton Avenue, and untreated sewage overflows enter the storm drain.

The storm drain at 1445 E. Line is also inadequate and misplaced, i.e. too high for water to enter.

E. Problem Area 5: 437 N. Moccasin Place

Sewage from the sewage line flows into the street and backs up into neighbors tubs.

F. Problem Area 6: 201, 205, 217 N. Moccasin Place

According to this individual, work was not completed on the existing drainage ditch. The drainage ditch needs to be lengthened and repaired around the corner of the property at 201 N. Moccasin Place. A drop off at the intersection also needs to be repaired.

After some waterline repairs, the City repaved the driveway to the residence at 205 N. Moccasin Place. Now the driveway is too low and stormwater flows down the driveway flooding the home.

The east-west drainage ditch on the north side of E. Jackson Avenue needs to be re-established to west of N. Boyd Street. The alley also is "chopped off", so all the water runs into this owner's yard causing flooding at 217 N. Moccasin Place.

G. Problem Area 7: 6 and 10 N. Boyd Place

Drainage ditches need to be re-established on both sides of the 1400 block of East Dewey Avenue by the Episcopal Church.

New pavement in the vicinity of 10 N. Boyd Place causes water to flow across the street into this residential yard.

H. Problem Area 8: 18 N. Boyd Place

The drainage ditch needs to be cleaned, so water will be able to flow into storm drain easier.

I. Problem Area 9: 1338 E. McLeod Avenue

Water stands in the back lot behind this home.

J. Problem Area 10: 1411 E. Pfendler Avenue

Water is rushing across the side of this resident's property.

K. Problem Area 11: 401 N. Hodge Street

This individual believes that the drainage ditch at the intersection of E. Cobb Avenue and N. Hodge Street is dangerous and would like to have culverts installed instead. This area Problem Area is actually located in the Liberty Glass Drainage Basin and will be address as a part of Problem Area 19.

L. Problem Area 12: 1338 E. University Avenue

The culvert behind this residence is damaged and the water does not drain properly.

M. Problem Area 13: N. Moccasin Place and E. Dewey Avenue

Stormwater backs up on N. Moccasin Place in the vicinity of E. Dewey Avenue near the new school site.

The Problem Areas identified in the **Liberty Glass Drainage Basin** are described below.

A. Problem Area 14: 1116 N. Moccasin Place

A large drainage area drains toward this residence. The individual believes there is no existing drainage system, or if there is an existing drainage system, it is plugged. According to this individual, the City has a project designed and ready for construction as soon as the funding becomes available. The storm drains in the area also need to be cleaned.

B. Problem Area 15: 1204 N. Moccasin Place

According to this comment, an additional grate needs to be installed across and further uphill on N. Moccasin Place and then tied into the storm sewer system. (Need to add holding capacity). Existing grates need to be enlarged in order to increase their capacity.

C. Problem Area 16: 903 N. Ross Street

According to this individual, 14 culverts will have to be installed to improve the drainage problems in this area.

D. Problem Area 17: 1132 E. Arch Avenue

The installation of culverts on N. Ridgeway Street supposedly dump into a drainage ditch with phone lines instead of the pond as previously believed. The result is flooding to this resident's structure and those of her neighbors.

E. Problem Area 18: 620 N. 2nd Street

The culvert at the southeast corner of this garage was overtopped during a recent storm. The drainage ditch needs to be re-established north of the county line.

F. Problem Area 19: Intersection at E. Cobb Avenue and N. Hodge Street

The individual at 401 N. Hodge Street has stated that the drainage ditch at the intersection of E. Cobb Avenue and N. Hodge Street is dangerous and would like to have culverts installed.

This Problem Area was moved from the Quail Run Drainage Basin to the Liberty Glass Drainage Basin due to the location of the problem.

13.4 EVALUATION OF ALTERNATIVES

Alternatives were considered for the identified Problem Areas for both basins and cost estimates are located in **APPENDIX 13-F**. Alternatives are summarized, with accompanying exhibits, by basin in the following pages. The City of Sapulpa did not request additional information to size these structures beyond their current capacity.

The **Quail Run Drainage Basin** alternatives follow immediately below.

A. Problem Area 1: 1722 E. Jones Avenue

Alternative 1 – Maintain existing system. At this location, the existing system can handle a 20% annual chance storm event when the existing pipe is cleaned routinely. At the time of this citizen complaint, the existing pipe appeared to be plugged and caused water to backup into the cul-de-sac. The City has since addressed this issue.

It is recommended that the existing system be cleaned and maintained periodically by City staff.

B. Problem Area 2: 550 Quail Run Lane

Alternative 1 – Construct new storm sewer system (10% annual chance) at Quail Run Lane. Alternative 1 would include the construction of a new storm sewer system across Quail Run Lane and south and east to a nearby pond. It would include 20 feet of 18-inch RCP at Quail Run Lane, 182 feet of 24-inch RCP laid north-south, and 155 feet of naturally constructed drainage ditch extending east toward an existing pond. The ditch would be 1-foot wide, 1-foot deep and have 3:1 (horizontal/vertical) slopes. Three 4-foot SMD inlets would also be installed to catch the water along Quail Run Lane. This system could handle a 10% annual chance storm event.

The estimated cost for this alternative is $61,900 and is shown in **FIGURE 13-6.**

Alternative 2 - Construct new storm sewer system (1% annual chance) at Quail Run Lane. This alternative is a variation of Alternative 1 that would construct a 1% annual chance storm sewer and drainage ditch in the same location across Quail Run Lane and then south and east to the existing pond. However, the higher level of protection could be constructed at only a small increase in cost.

This alternative would include 20 feet of 18-inch RCP, 182 feet of 30-inch RCP, and 155 feet of naturally constructed ditch extending east toward the existing pond. The drainage ditch would be 3-foot wide, 1.04 feet deep with 3:1 (horizontal/vertical) slopes. Instead of three SMD inlets as proposed in Alternative 1, four SMD inlets, two on each side of Quail Run Lane, would be installed for collecting stormwater.

The estimated cost for this alternative is $72,900 and can be found in **FIGURE 13-7**.

C. Problem Area 3: 1809 E. Denton Avenue

Alternative 1 – Construct new storm sewer system at Quail Run Lane from N. Ruble Street to E. Denton Street. This alternative would construct a new storm sewer system along Quail Run Lane from N. Ruble Street to E. Denton Avenue to capture and convey the overflow that the

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Feet
0 25 50
N

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Figure 13-6

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

Feet
0 25 50
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Quail Run & Liberty Glass Drainage System
Problem Area 2 - Alternative 2

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Figure 13-7

existing system is unable to handle. This alternative would handle a 10% annual chance storm event. This proposed system would include the installation of 100-feet of 18-inch RCP connected by one 4-foot SMD inlet at its northeast end (at the intersection of N. Ruble Street and Quail Run Lane) and an 8-foot recessed curb inlet with steel insert at its southeast end. From there, 120 feet of 18-inch RCP with a junction box would be constructed along Quail Run Lane to connect with the existing system at the intersection of Quail Run Lane and E. Denton Avenue.

The cost for this alternative is estimated to be $75,900 and can be viewed in more detail in **FIGURE 13-8**.

Alternative 2 – Replace and upgrade existing system (1% annual chance). This alternative would replace and upgrade the existing storm sewer system with pipes and inlets to handle a 1% annual chance storm event. Beginning at the intersection of E. Jones Avenue and N. Ruble Street, 800 feet of 36-inch RCP would be constructed within the existing alignment to connect with the existing system on the southeast side of the E. Denton cul de sac.

This alternative would also include two 8-foot recessed curb inlets with steel inserts, five 4-foot recessed curb inlets with steel inserts, one 4-foot SMD inlet and three junction boxes; the locations of these have been identified on **FIGURE 13-9**. The new SMD inlet (at the intersection of N. Ruble Street and Quail Run Lane) would be connected to the new system with 50 feet of 18-inch RCP.

The cost for this alternative would be approximately $346,500 and is shown in **FIGURE 13-9.**

D. Problem Areas 4 and 5: 437 and 517 N. Moccasin Place

Alternative 1 – Construct new storm sewer system (10% annual chance) along N. Moccasin Place to outfall. This alternative would include the installation of 510 feet of 24-inch RCP along the easterly side of N. Moccasin Place from E. Jones Avenue southwesterly to E. Denton Avenue and then 169 feet of 30-inch RCP southeast to the outfall. This alternative would also include five 4-foot recessed curb inlets with steel inserts, one 8-foot recessed curb inlet with steel insert, and one 6-foot inner diameter manhole. The new steel inlets on the east and west side of N. Moccasin Place would be connected with a total of 80 feet of 18-inch RCP. This alternative would have the capacity to convey a 10% annual chance storm.

It is estimated that this alternative would cost $235,400. It is pictured in **FIGURE 13-10**.

Alternative 2 - Construct new storm sewer system (1% annual chance) along N. Moccasin Place to outfall. This alternative is a variation of Alternative 1 while providing a higher level of protection (1% annual chance storm). It would follow the same general alignment along N. Moccasin Place and to the outfall as Alternative 1 but with enlarged pipe sizes.

In this alternative, pipe lengths and sizes would be changed to 55 feet of 18-inch RCP, 107 feet of 24-inch RCP, 428 feet of 30-inch RCP, and 169 feet of 36-inch RCP. This alternative would also include four 4-foot recessed curb inlets with steel inserts, two 8-foot recessed curb inlets with steel inserts, and one 6-foot inner diameter manhole.

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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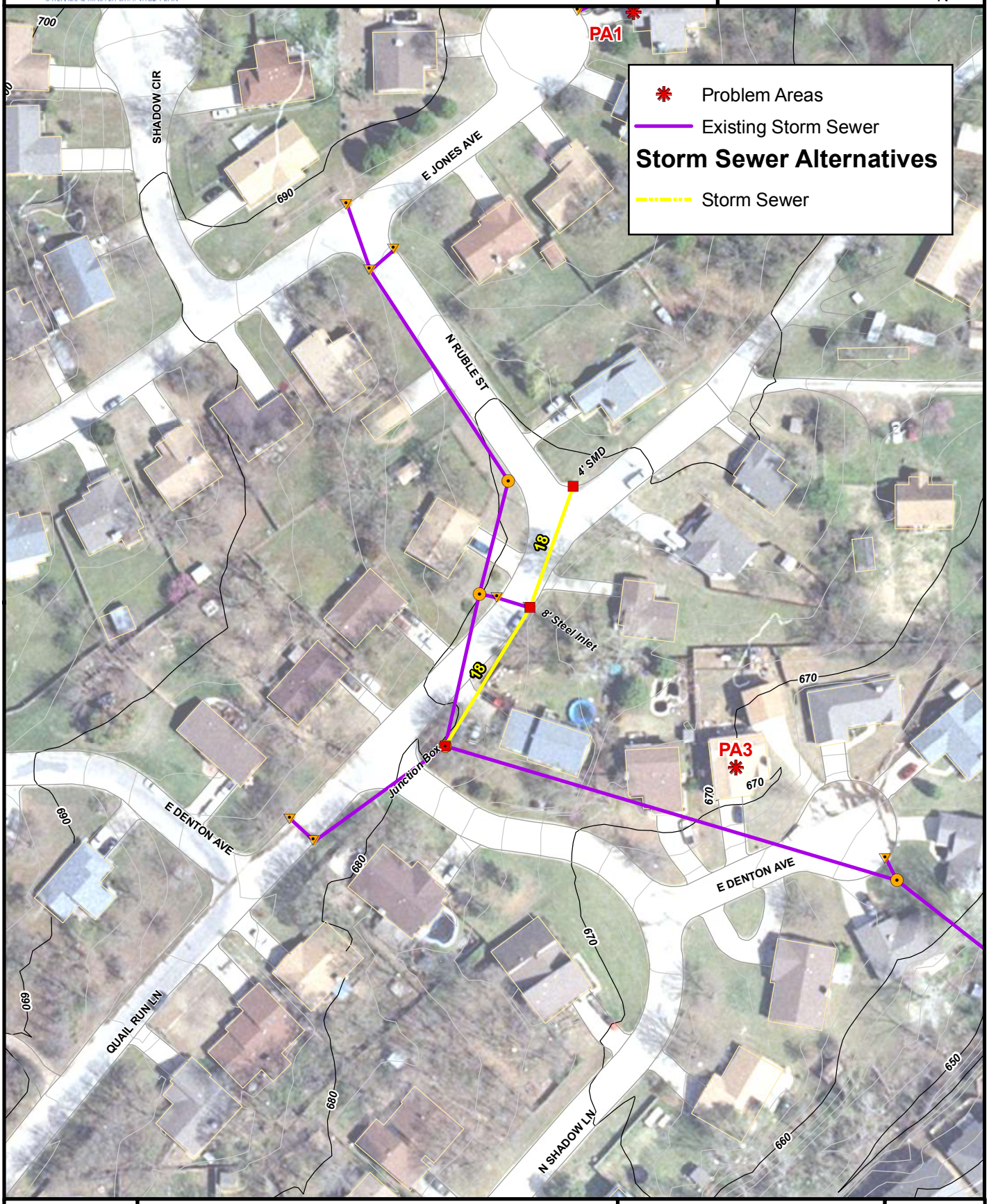

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Figure 13-8

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

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Feet
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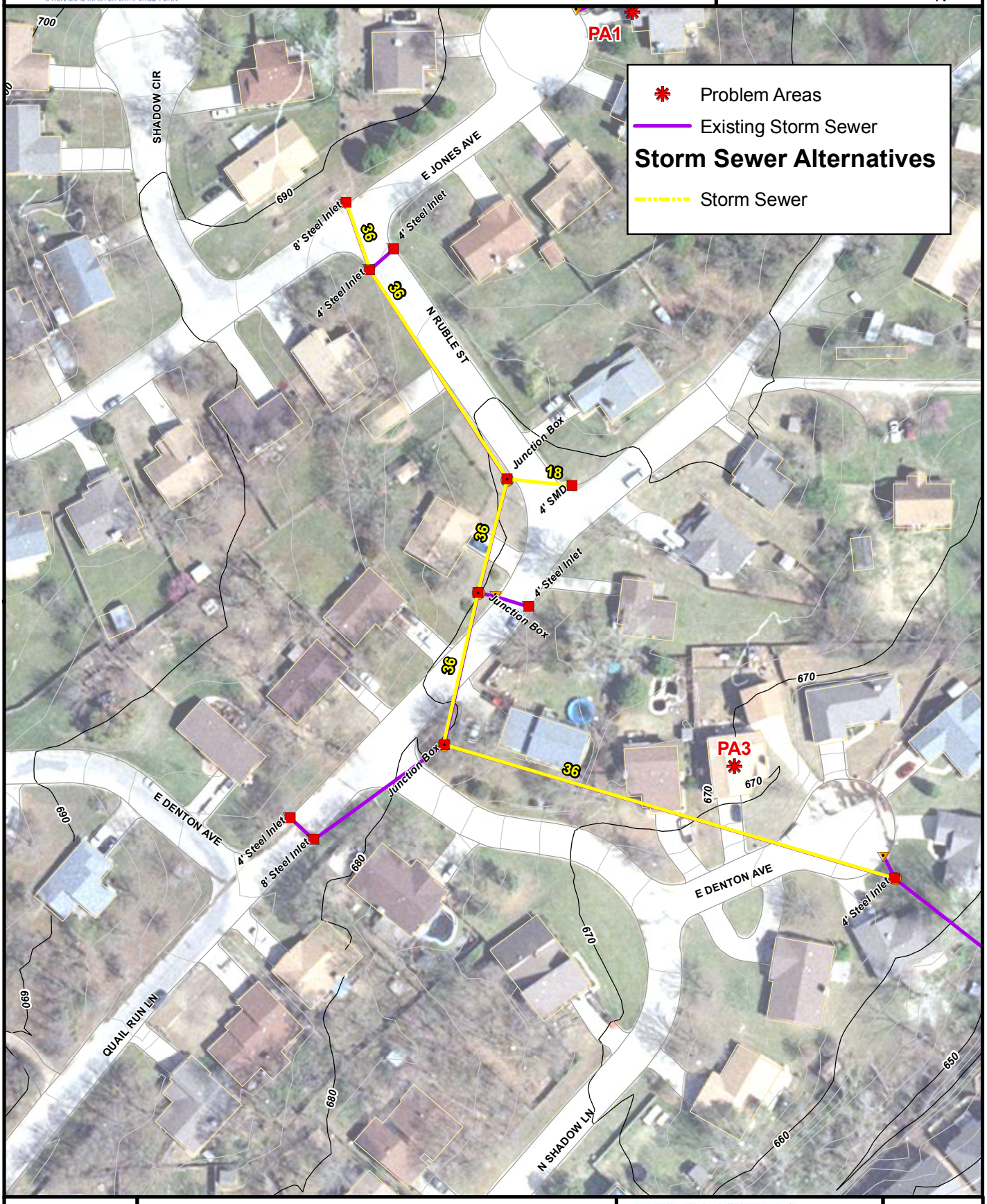

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Figure 13-9

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
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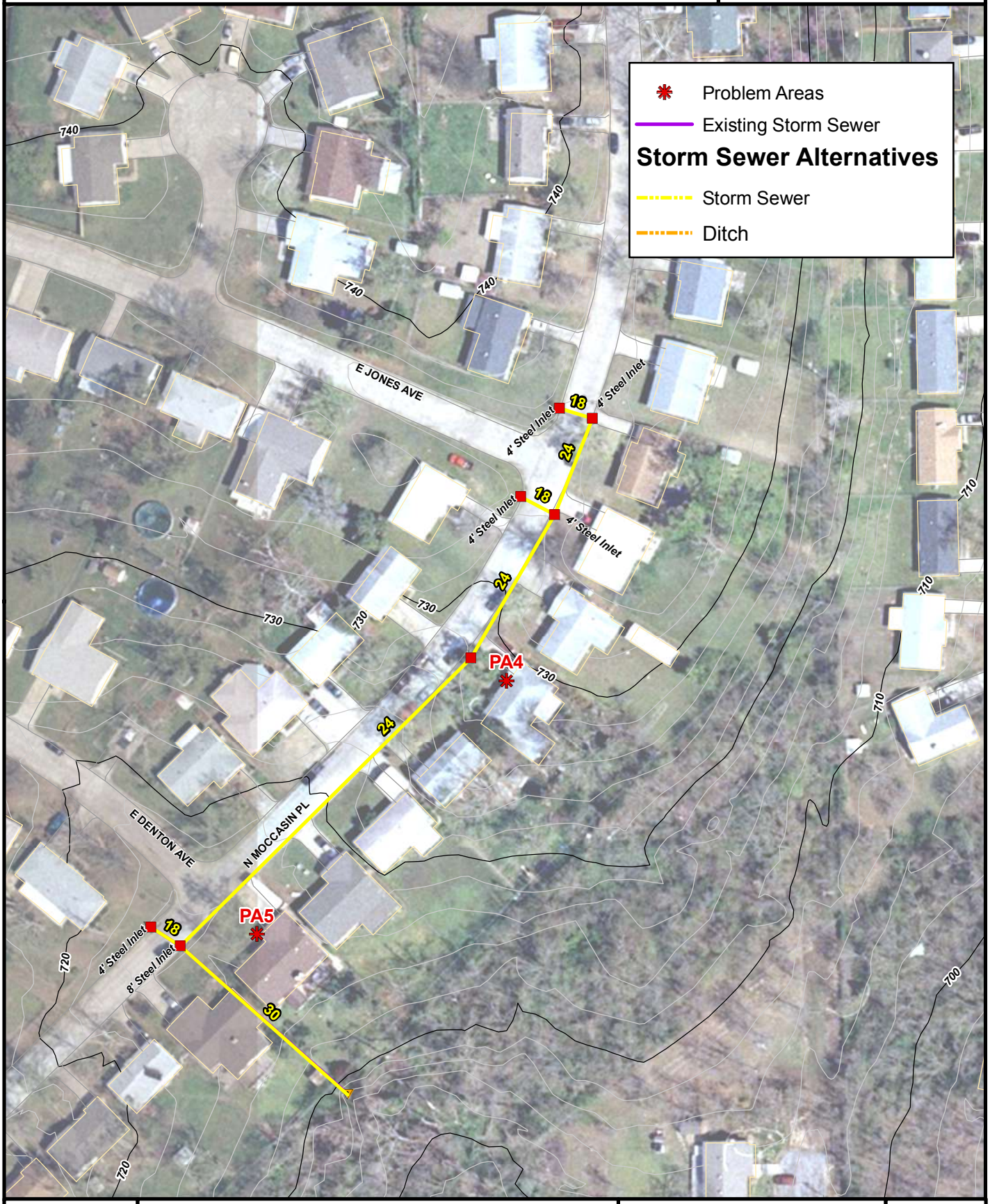

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Figure 13-10

The estimated cost for Problem Areas 4 and 5 Alternative 2 is $260,100; it is detailed in **FIGURE 13-11**.

E. Problem Area 6: 201, 205, 217 N. Moccasin Place

Alternative 1 – Construct new storm sewer south along N. Moccasin Place and east on Woodview Lane. Alternative 1 proposes the construction of a new storm sewer system from the intersection at E. Jackson Avenue and N. Moccasin Place south to Woodview Lane and then east for about one block to tie into the existing system. Starting at E. Jackson Avenue, 408 feet of 12-inch RCP would be installed along N. Moccasin Place south to Woodview Lane at which point the sewer would be upsized to an 18-inch RCP extending east for 320 feet before tying into an existing 24-inch RCP.

This alternative would also include the construction of new curb and gutter for 405 feet along N. Moccasin Place and 175 feet along Woodview Lane until tying into the existing curb and gutter at Woodview Estates. Along this newly constructed curb and gutter road, four new 4-foot recessed curb inlets with steel inserts would be added and the existing inlets at the end of the block at Woodview Lane would be replaced with two new 4-foot recessed curb inlets with steel inserts. This alternative would convey a 10% annual chance storm event.

The estimated cost for Alternative 1 is $256,150 and can be viewed in **FIGURE 13-12**.

Alternative 2 - Construct new storm sewer south along N. Moccasin Place and east on Woodview Lane. Alternative 2 is a variation of Alternative 1 but would handle a 1% annual chance storm event instead of a 10% annual storm event. It would construct a new storm sewer system along the same alignment as Alternative 1 with enlarged pipe sizes. Pipe lengths and sizes would be modified to 183 feet of 18-inch RCP and 225 feet of 24-inch RCP south on N. Moccasin Place and 390 feet of 30-inch RCP to the end of the block on Woodview Lane.

In addition to the new curb and gutter as proposed in Alternative 1, this alternative would have a total of six proposed 4-foot recessed curb inlets with steel inserts. The existing inlets located at the bend of Woodview Lane would also be replaced with two 4-foot recessed curb inlets with steel inserts.

Alternative 2 is estimated to cost $318,600 and is shown in **FIGURE 13-13.**

F. Problem Areas 7 and 8: 6, 10 and 18 N. Boyd Place

Alternative 1 – Construct new storm sewer north of E. Dewey Avenue and re-establish drainage ditch west of S. Boyd Street. Along Dewey Avenue west from S. Boyd Street, this alternative would re-establish the existing drainage ditch and would construct a new storm sewer north of Dewey Avenue and connect with the existing system.

Along the north side of the church and west of S. Boyd Street, 320 feet of existing drainage ditch would be re-established as a 4-foot wide concrete-lined ditch with 3:1 side slopes and a critical depth of 1.2 feet for conveying 40 cfs. From S. Boyd Street, 415 feet of 24-inch RCP would be constructed north to tie into the existing system. Two 4-foot SMD inlets would be

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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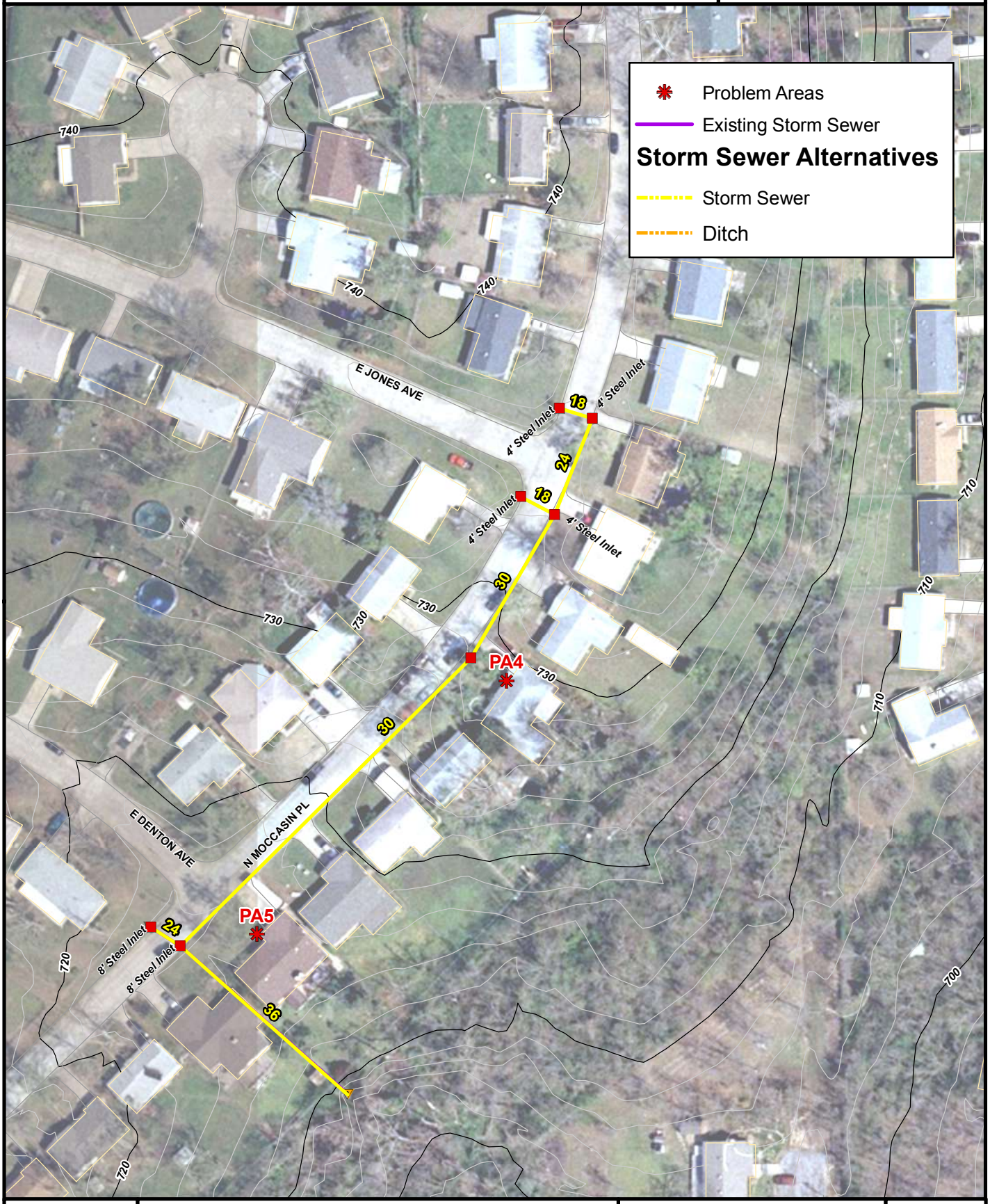

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Figure 13-11

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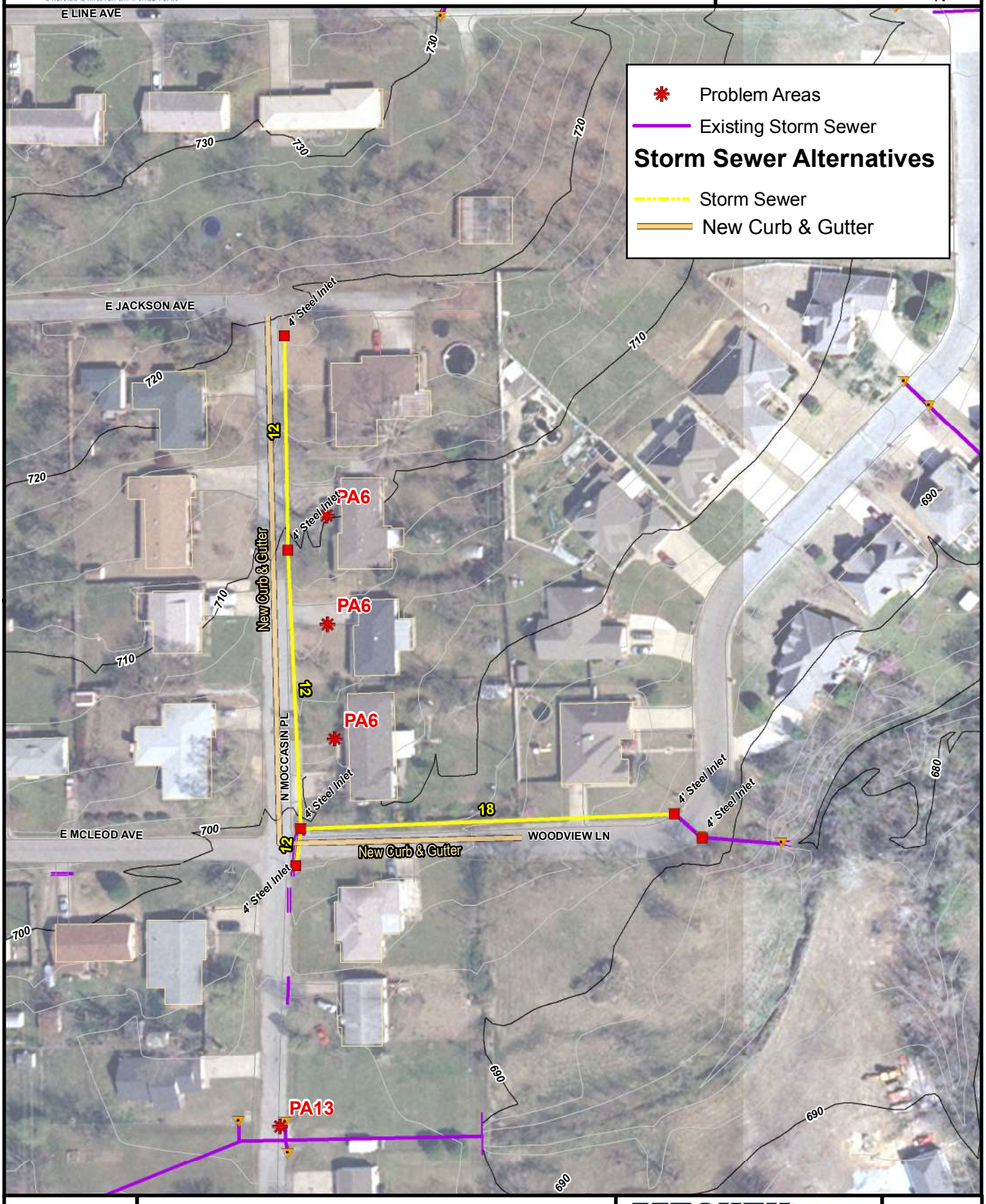

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Problem Area 6 - Alternative 1

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Figure 13-12

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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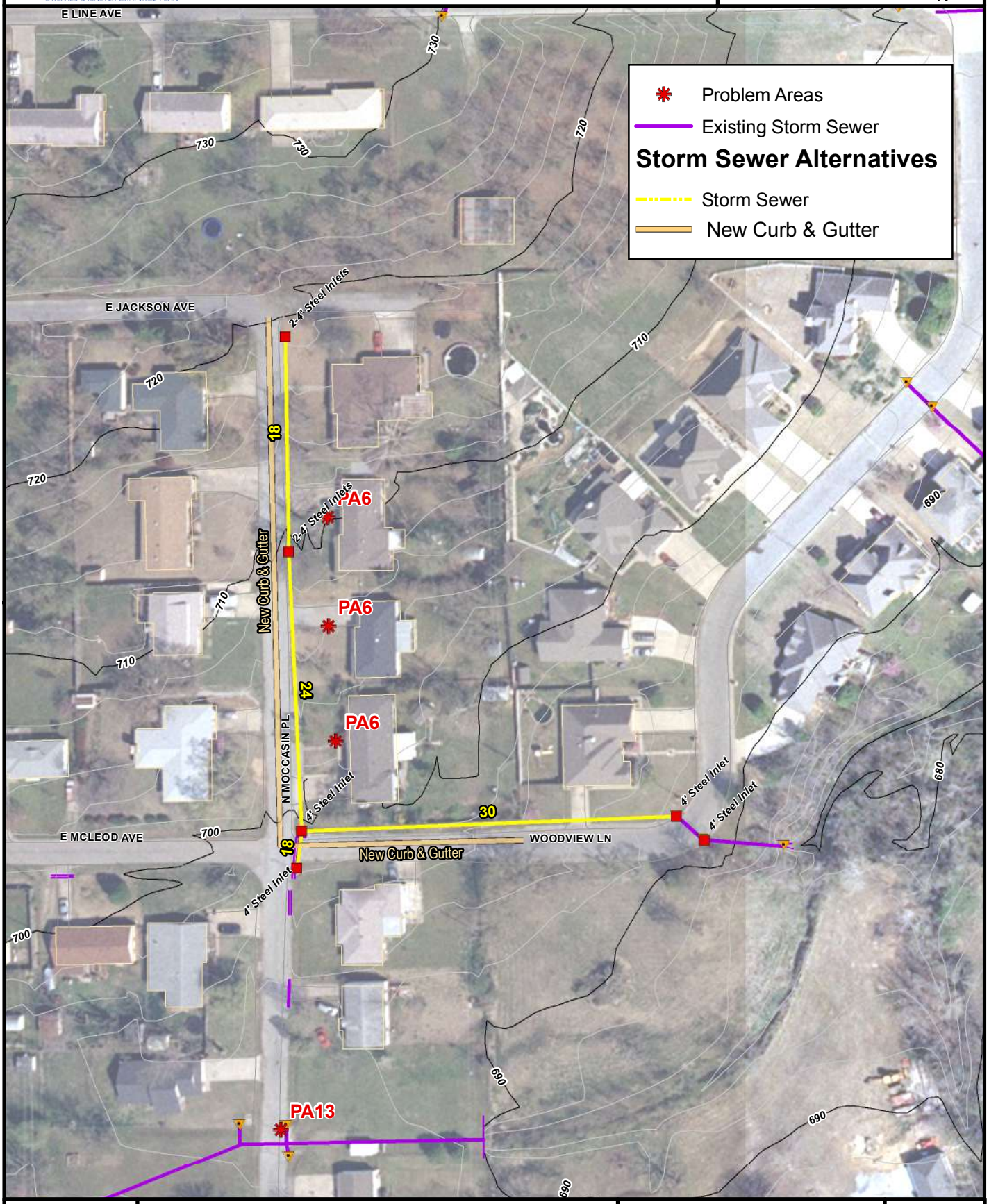

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Figure 13-13

installed on each side of S. Boyd Place with an 18-inch RCP connecting them. New culverts (approximately 40 feet of 18-inch RCP) would be installed under S. Boyd Place and the church's north driveway. This alternative would handle a 10% annual chance storm.

The estimated cost for this alternative is $107,900; it can be viewed in **FIGURE 13-14**.

Alternative 2 - Construct new storm sewer north of E. Dewey Avenue and re-establish drainage ditch west of S. Boyd Street. Alternative 2 is a variation of Alternative 1 but with a higher level of protection, i.e. a 1% annual chance storm event. Overall, the alignment would remain the same, and it would still include improvements to the drainage ditch on the north side of the church as well as the installation of a new storm sewer.

Specifically, this alternative would improve 320 feet of the existing drainage ditch on the north side of the church by lining it with concrete, laying the side slopes back to 3 to 1, and increasing its width to 4 feet with a critical depth of 1.5 feet for conveying 62cfs. Instead of the 24-inch RCP, 415 feet of 30 inch RCP would be installed north of S. Boyd Street and tie into the existing system. All other improvements would remain the same as Alternative 1.

It is estimated that this alternative would cost $121,800 and is depicted in **FIGURE 13-15**.

G. Problem Area 9: 1338 E. McLeod Avenue

Alternative 1 – Construct new storm sewer system (10% annual chance) along E. McLeod to N. Boyd Street. This alternative would construct a new storm sewer system to provide protection for storm events with a 10% annual chance frequency. Along E. McLeod to N. Boyd Street, 200 feet of 18-inch RCP would be installed along with a 4-foot SMD at each end of the 200 feet of 18-inch pipe. From N. Boyd Street, an additional 50 feet of 18-inch RCP would continue southeasterly across McLeod Street and into a concrete-lined ditch 280 feet long with a 4- foot bottom width and 3:1 side slopes. This ditch would drain to an existing storm sewer north of where E. Hobson Avenue dead ends.

Alternate 1 is estimated to cost $92,900 and is shown in **FIGURE 13-16**.

H. Problem Area 10: 1411 E. Pfendler Avenue

Alternative 1 – Construct a natural drainage ditch south from the existing ditch to E. Pfendler Avenue. This alternative proposes that the City construct a grass-lined drainage ditch along the east side of the property at 1411 E. Pfendler Avenue to connect with an existing ditch located between the houses fronting E. Pfendler Avenue and E. Denton Avenue. This natural ditch would be located immediately north of E. Pfendler Avenue and 80 feet east of N. Brown Street and would drain north to south.

Grading and work on private property prohibit the City from implementing this alternative.

Alternative 2 – Construct storm sewer south to E. Pfendler Avenue and along N. Brown Street. Alternative 2 would construct a new storm sewer south from the existing ditch (north of the homes fronting E. Pfendler Avenue) to E. Pfendler Avenue, west on Pfendler and south on N. Brown Street to E. Line Street. At the location of the existing drainage ditch between the

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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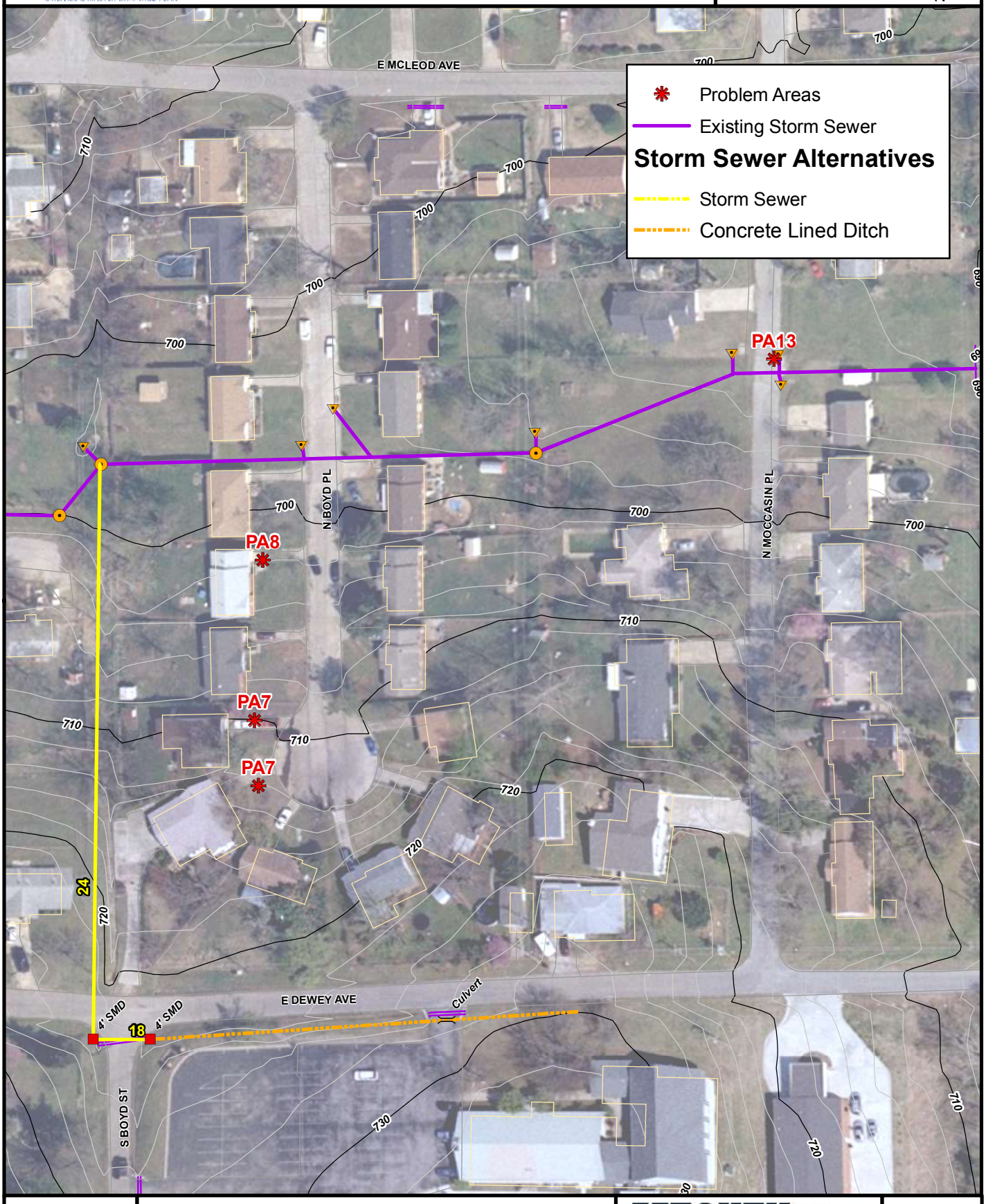

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Figure 13-14

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

Feet
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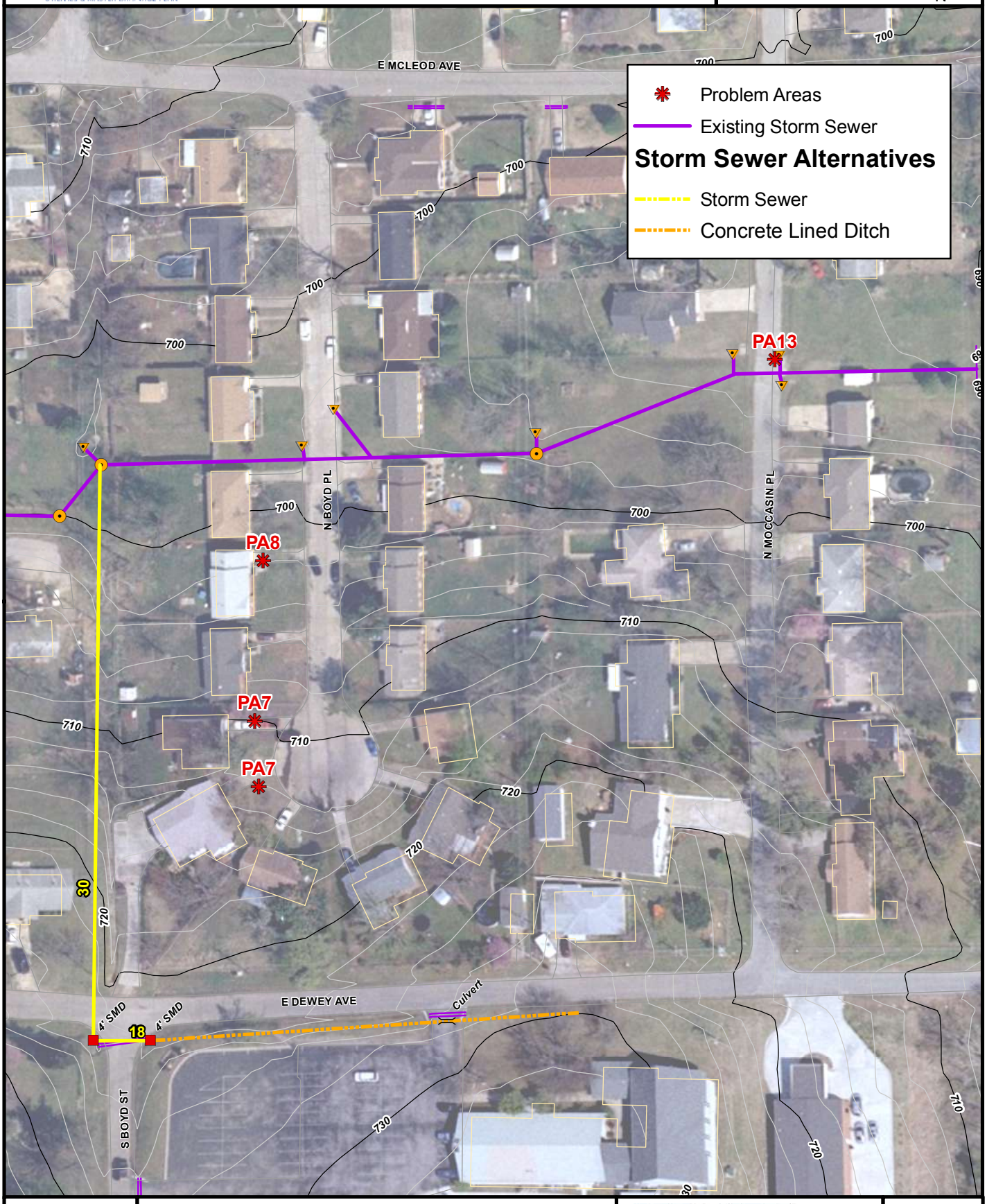

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Problem Areas 7 & 8 - Alternative 2

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Figure 13-15

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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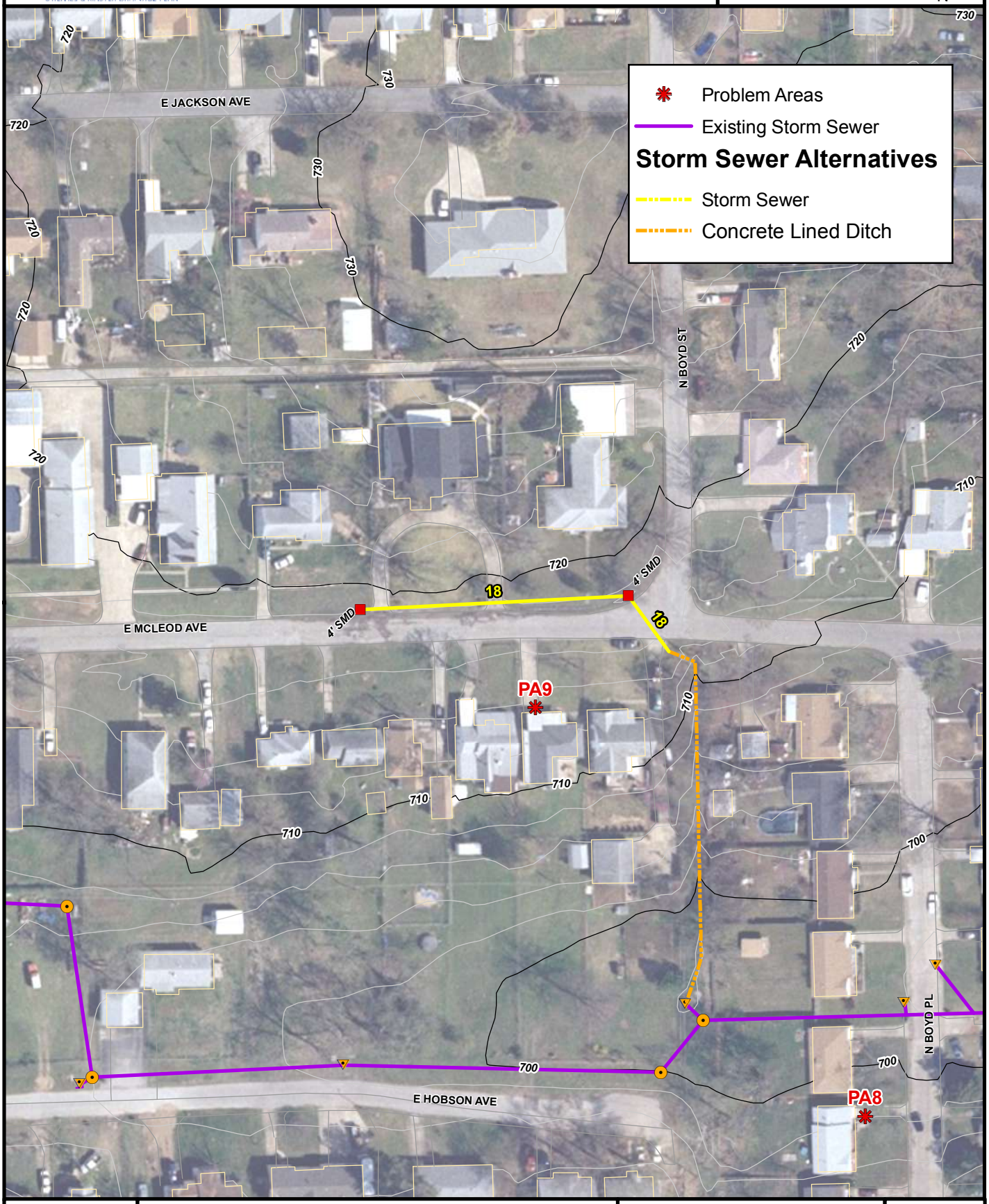

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Figure 13-16

backyards (approximately 80 feet east of N. Brown Street), 160 feet of 18-inch RCP would be constructed south to E. Pfendler Avenue. At its origin point, a 4-foot SMD inlet would also be installed. At E. Pfendler Avenue, a manhole and 80 feet of 18-inch RCP would be constructed east to N. Brown Street. At that point, a 4-foot recessed curb inlet with steel insert would be installed. From there, 310 feet of 18-inch RCP would be constructed south to connect with the existing storm sewer system just north of the intersection at E. Line Avenue and N. Brown Street. This alternative would handle a 10% annual chance storm event.

The cost for this alternative is $124,800 and is shown in **FIGURE 13-17.**

I. Problem Area 11: 401 N Hodge Street

Although the property owner's address is in the Quail Run Basin, the problem itself is located in the Liberty Glass Drainage Basin. As a result, this Problem Area was moved to the Liberty Glass Drainage Basin and will be addressed under Problem Area 19.

J. Problem Area 12: 1338 E. University Avenue

The culvert behind this residence is damaged and the water does not drain properly. This is a City maintenance issue.

K. Problem Area 13: Between Moccasin and Dewey Avenue

Stormwater backs up on N. Moccasin Place in the vicinity of E. Dewey Avenue near the new school site. The ditches need to be re-established in this area. This is a City maintenance issue.

Alternatives, with accompanying exhibits and costs, **Liberty Glass Drainage Basin** are described below.

A. Problem Area 14: 1116 N. Moccasin Place

Alternative 1 –Clean storm drains. The City has a project designed and ready for construction as soon as the funding becomes available. The storm drains in the area also need to be cleaned. This is a routine maintenance item and can be done by staff.

B. Problem Area 15: 1204 N. Moccasin Place

The City has addressed this Problem Area, and no alternatives were therefore considered.

C. Problem Area 16: 903 N Ross Street

Alternative 1 – Construct new drainage ditch along N. Ross Street and clean and line the existing drainage ditch along E. James Avenue and N. Hodge Street. This alternative would construct approximately 250 feet of new concrete-lined drainage ditch along the east side of Ross Street to drain water from this location into an existing ditch at E. James Avenue. In addition, this alternative would include cleaning and lining with concrete approximately 380 feet of the existing ditch along E. James Avenue and north on Hodge Street (until it crosses under Hodge Street through an existing culvert). The new Ross Street ditch would also include three 18-inch driveway culverts approximately 15 feet in length.

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

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Feet
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Problem Area 10 - Alternative 2

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Figure 13-17

The estimated cost for Problem Area 16 Alternative 1 is $67,500 and is shown in **FIGURE 13-18**.

D. Problem Area 17: 1132 E. Arch Avenue

Alternative 1 – Construct new drainage ditch along E. Arch Avenue and clean and line existing drainage ditch along N. Ridgeway Street. Alternative 1 would construct a new drainage ditch along the north side of E. Arch Avenue (west of N. Ridgeway Street) 370 feet long with 3:1 side slopes and a 2-foot concrete liner in its bottom. Along the existing driveways, 40 feet of 18-inch RCP would be installed.

In addition, this alternative would clean and line approximately 275 feet of existing ditch along both sides of N. Ridgeway Street from E. James Avenue to E. Arch Avenue. Along both sides, the bottom would be lined with 2 feet of concrete. To drain the water from the east side to the west side, an 18-inch RCP, 40 feet long, would be installed under Ridgeway Street.

It is estimated that this alternative would cost $39,200 and is depicted in **FIGURE 13-19**.

E. Problem Area 18: 620 N. 2nd Street

Alternative 1 – Construct detention pond, berm and lined drainage ditch. This alternative would consist of the construction of a small detention pond, berm and concrete-lined drainage ditch to address this drainage problem. A berm, 465 feet long and 3 feet high, would be constructed along the 770-foot contour upstream of the neighborhood west of N. 3rd Street and north of E. Fife Avenue. This berm would divert stormwater, flowing west to east, around this neighborhood and north into a 4-foot wide concrete-lined drainage ditch, approximately 1,000 feet long with 3:1 side slopes. The initial 215 feet of channel would have a bottom slope of 8%, while the remaining 791 feet would have a bottom slope of 5%.

A small detention pond would also be constructed upstream of the property at 620 N. 2nd Street. This pond would have a surface area of 0.17 acres, a water surface elevation of 744 feet, and would store 0.4 acre-feet of stormwater. Its outlet structure would be 18-inch RCP, 50 feet long, with a flow line elevation of 740 feet.

This alternative is estimated to cost $101,000 and is detailed in **FIGURE 13-20**. However, this estimate could be reduced by approximately $5,500 if the "Unclassified Excavation", **APPENDIX 13-F PROBLEM AREA 18 ALTERNATIVE 1**, is determined to be suitable material for use in the construction of the berm.

F. Problem Area 19: Intersection at E. Cobb Avenue and N. Hodge Street

Alternative 1 – Construct storm sewer with inlets and new drainage ditches and clean existing drainage ditches and channel (10% annual chance). From E. Perkins Avenue between N. Brown and N. Hodge Streets, Alternative 1 would generally construct a new storm sewer north to E. Cobb Avenue, clean the existing ditches along E. Cobb Avenue and north to E. Hill Avenue and construct a new drainage ditch along E. Cobb Street.

A new storm sewer system would be installed between the houses aligned along N. Hodge and N. Brown Streets north from E. Perkins Avenue to E. Cobb Avenue. From Perkins Avenue north

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Feet
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Figure 13-18

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

Feet
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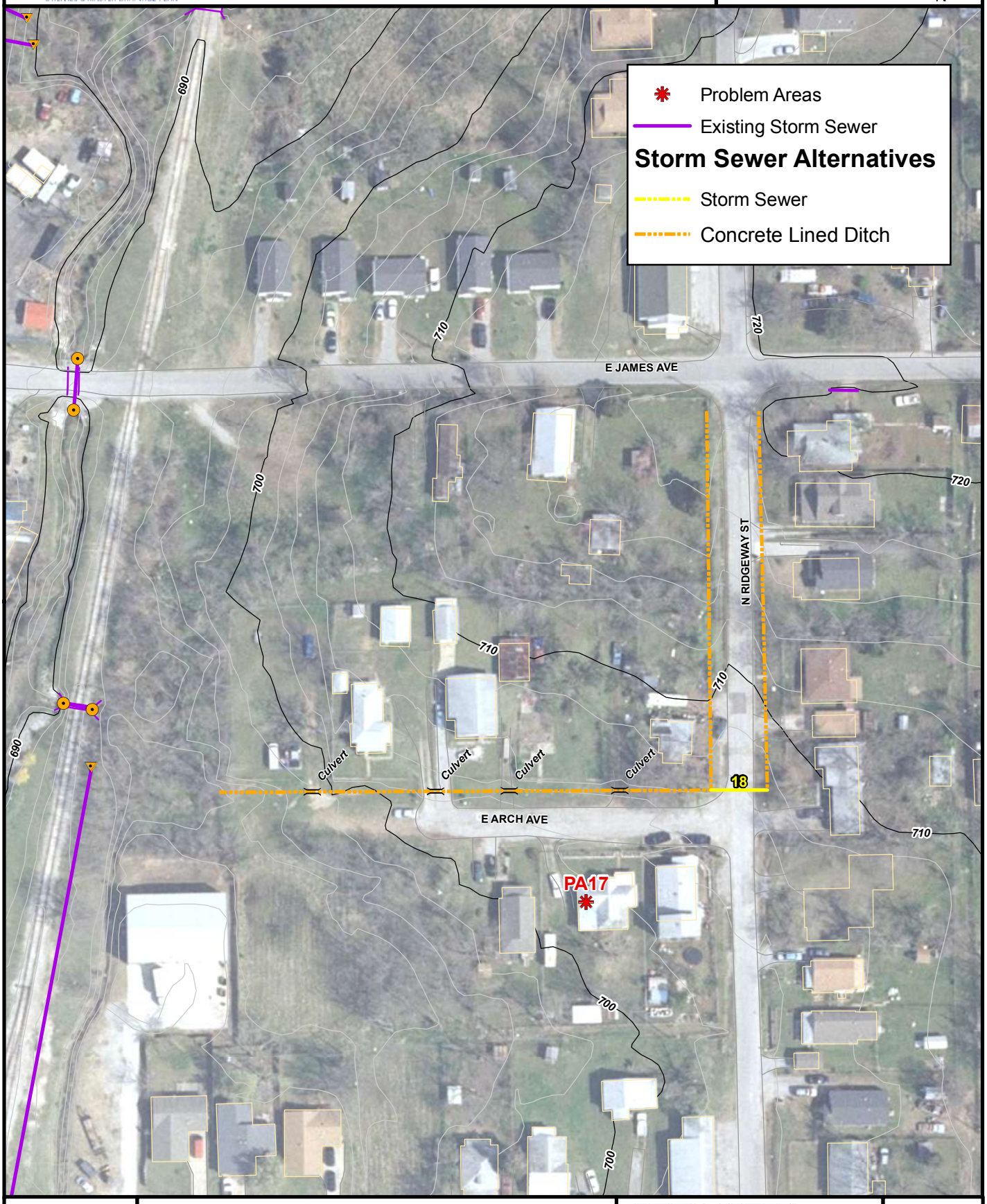

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Figure 13-19

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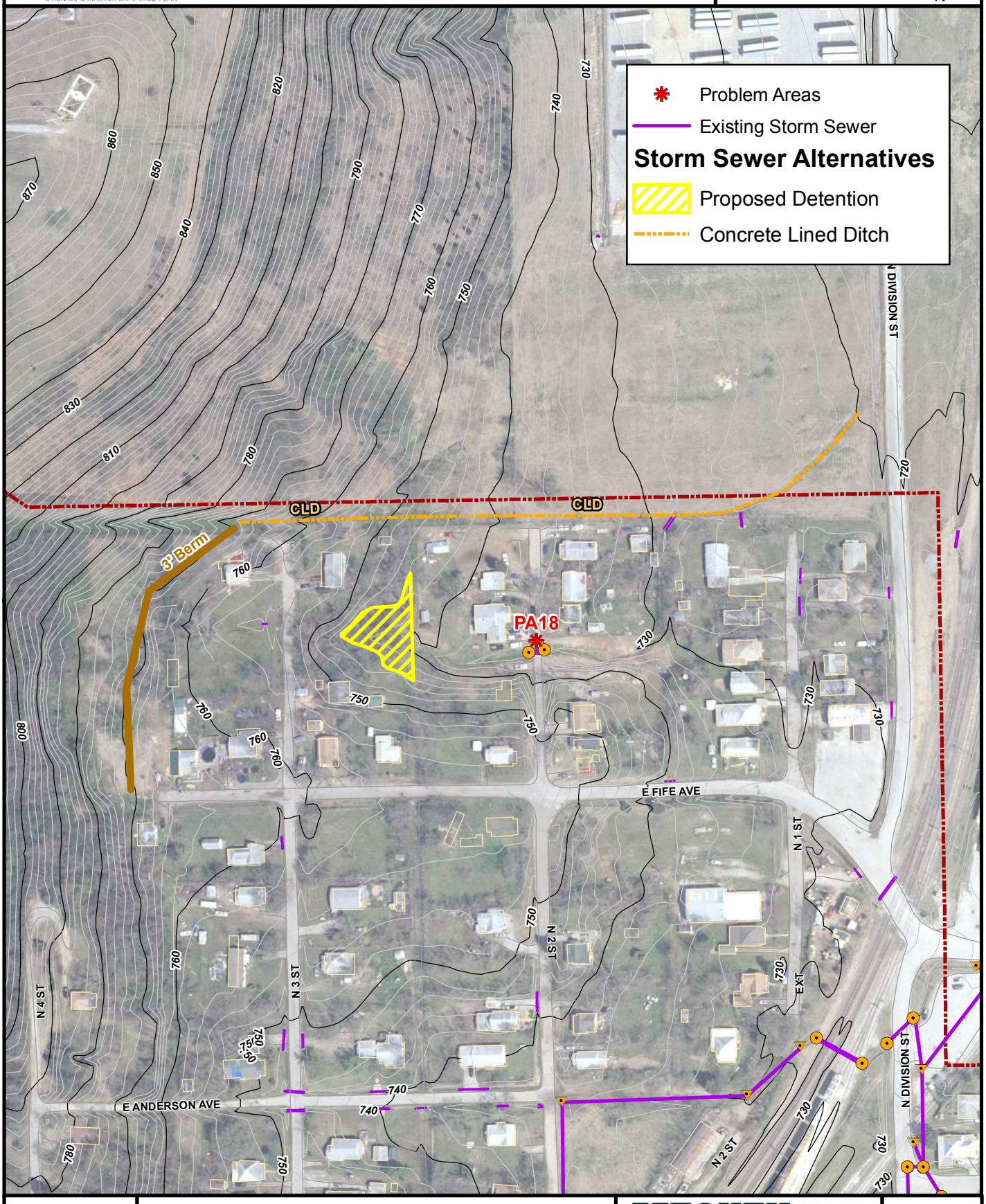

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Figure 13-20

to Haskell Avenue, 656 feet of 30-inch RCP would be installed. From there to Cobb Avenue, approximately 660 feet of 36-inch RCP would be installed. A total of five GPI area inlets, two at Perkins Avenue and three at E. Haskell Avenue, would also be constructed as a part of this new system. From N. Ross Street east to the creek, this alternative would construct 487 feet of drainage ditch, with a concrete-lined bottom, along the south side of E. Cobb Avenue. From Brown Street west to the creek, another 130 feet of concrete-lined ditch would be constructed along the north side of E. Cobb Avenue.

In addition, this alternative would clean the existing ditches along both sides of E. Cobb Avenue to the creek east from N. Ross Street and west from N. Brown Street.

The existing creek from E. Cobb Avenue north to E. Hill Avenue would be cleaned. All along this part of the channel, the existing culverts would be replaced with structures designed to handle a 10% annual chance storm frequency. Culvert sizes would be as follows:

- E. Cobb Avenue - 12 x 3 - foot RCB
- N. Brown Street - Double 9 x 3.5 - foot RCBs
- E. James Avenue - Double 8 x 4 – foot RCBs
- E. Hill Avenue - Double 6 x 5 – foot RCBs.

The cost estimate for Alternative 1 is $779,000 and can be viewed in **FIGURE 13-21**.

Alternative 2 - Construct concrete channel and new drainage ditches and clean existing drainage ditches and channel (10% annual chance). Alternative 2 is a variation of Alternative 1 and follows the same alignment. However, Alternative 2 would construct a concrete channel with vertical walls from E. Perkins Avenue to E. Cobb Avenue instead of the storm sewer system proposed in Alternative 1. This vertical wall channel would be approximately 1320 feet long, 3.5 feet deep and have a 3-foot bottom width.

Like Alternative 1, Alternative 2 would construct new drainage ditches with concrete-lined bottoms east and west of the creek along E. Cobb Street, clean the existing channel downstream of E. Cobb Avenue, and upgrade all culverts (consistent with the box sizes provided in Alternative 1) along the downstream channel to handle a 10% annual chance storm event. Both existing drainage ditches (on the north and south sides of Cobb Avenue) would be cleaned as well.

Alternative 2 is estimated to cost $618,700 and is shown in **FIGURE 13-22**.

Alternative 3 – Construct storm sewer with inlets and new drainage ditches and clean existing drainage ditches and channel (1% annual chance). Alternative 3 is a variation of Alternative 1 except improvements would be sized to handle a 1% annual chance storm. This alternative would include a total of six GPI area inlets, four at E. Perkins Avenue and two at E. Haskell Avenue. A new storm sewer system, 656 feet of 36-inch RCP, would be installed between the backyards of the houses on Hodge and Brown Streets from Perkins to Haskell Avenues. From

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 150 300
N

The City of Sapulpa
Oklahoma's Most Connected City

Quail Run & Liberty Glass Drainage System
Problem Area 19 - Alternative 1

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1437 S Boulder Ave, Suite 1080 Tulsa, OK 74119
Ph:(918) 392-5620 Web:www.meshekengr.com

Figure 13-21

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 150 300
N

The City of Sapulpa
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Quail Run & Liberty Glass Drainage System
Problem Area 19 - Alternative 2

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Figure 13-22

Haskell Avenue north to Cobb Avenue, 660 feet of 4 x 3-foot RCB would be constructed between the houses along Hodge and Brown Streets.

Like the other alternatives, the existing ditches would be cleaned along both sides of E. Cobb Avenue east and west of the creek and new drainage ditches would be added along both sides of Cobb Avenue, east and west, to the creek.

The channel downstream Cobb Avenue would be cleaned and the culverts replaced as flows:

E. Cobb Avenue - Double 10 x 3 - foot RCBs

N. Brown Street - Double 14 x 3.5 - foot RCBs

E. James Avenue - Double 12 x 4 – foot RCBs

E. Hill Avenue - Double 10 x 4 – foot RCBs.

This alternative would handle a 1% annual chance storm event.

The cost estimate for this alternative is $1,148,900 and is detailed in **FIGURE 13-23**.

Alternative 4 - Construct concrete channel and new drainage ditches and clean existing drainage ditches and channel (1% annual chance). Alternative 4 is a variation of Alternative 2 except providing a greater level of protection. It, too, would include a new concrete channel with vertical walls from Perkins to Cobb Avenues. This channel would be approximately 1320 feet long, 3.2 feet deep and 5 feet wide. The existing channel downstream of Cobb Avenue would be cleaned and the culverts replaced with the same size pipes as Alternative 3. The ditches along Cobb Avenue from Ross Street east and from Brown Street west would be cleaned to the creek. New drainage ditches would also be constructed along Cobb Avenue east and west to the creek.

The cost for this alternative would be $865,300 and is shown in **FIGURE 13-24**.

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 150 300
N

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Quail Run & Liberty Glass Drainage System
Problem Area 19 - Alternative 3

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Figure 13-23

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 150 300
N

The City of Sapulpa
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Quail Run & Liberty Glass Drainage System
Problem Area 19 - Alternative 4

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Figure 13-24

13.5. RECOMMENDED PLAN

Based on the prioritization criteria identified in the **INTRODUCTION SECTION 1** and discussions with City staff, the following alternatives were selected as the Recommended Plan for the Quail Run and Liberty Glass Drainage System. More detailed information for each selected alternative with an exhibit is presented in **SECTION 13-4 EVALUATION OF ALTERNATIVES**. Cost estimates can be found in **APPENDIX 13-F**.

The Recommended Plan for the Quail Run and Liberty Glass Drainage System is:

PROBLEM AREA	RECOMMENDED ALTERNATIVE	RATIONALE FOR SELECTION	ESTIMATED COST
Problem Area 1	No Action	The existing system can handle a 20% annual chance storm event when it is maintained routinely by staff.	-0-
Problem Area 2	Alternative 2	Alternative 2 is a variation of Alternative 1 except it provides a greater level of protection at a small increase in cost.	$72,900
Problem Area 3	Alternative 2	A major advantage of this alternative is that, in addition to the stormwater utility fee, it can be combined with other funding sources to improve access for a large number of people during a 1% annual chance storm.	$346,500
Problem Areas 4 and 5	Alternative 2	This alternative is a variation of Alternative 1 while providing a higher level of protection (1% annual chance) at a very modest increase in cost. It alternative also would have a positive impact on the environment.	$260,100
Problem Area 6	Alternative 1	This alternative could be funded through the stormwater utility fee in combination with other funding sources to add to an existing system and provide protection for a 10% annual chance event.	$256,150
Problem Areas 7 and 8	Alternative 2	This Problem Area received numerous drainage complaints. Alternative 2 is a variation of Alternative 1; its major advantage is that it resolves a long-standing problem at a greater level of protection (1% annual chance) with only a	$121,800

		modest increase in cost that could be funded solely through the stormwater utility fee.	
Problem Area 9	Alternative 1	Alternative 1 could be funded solely through the through the stormwater utility fee to address a long-term problem.	$92,900
Problem Area 10	No Action	Grading on private property prohibits the City's implementation of this alternative.	-0-
Problem Area 11	Refer to Problem Area 19	This Problem Area is located in the Liberty Glass Drainage Basin.	-0-
Problem Area 12	No Action	This will be addressed as a City maintenance issue.	-0-
Problem Area 13	No Action	This is a City maintenance issue.	-0-
Problem Area 14	Pending Funding	A solution to this Problem Area has been designed and is pending funding.	-0-
Problem Area 15	No Action	No alternatives were considered. The City has addressed this Problem Area.	-0-
Problem Area 16	No Action	This alternative was not selected due to easements needed for the project.	-0-
Problem Area 17	Alternative 1	This low-cost solution could be funded through the stormwater fee to alleviate a long time drainage problem.	$39,200
Problem Area 18	Alternative 1	Alternative 1 would alleviate a long-standing flood problem for several houses during a 10% annual chance event, would have a positive impact on the environment and could be funded with stormwater fees.	$101,000
Problem Area 19	Alternative 2	Alternative 2 would provide a high level of protection (10% annual chance) to alleviate a long time drainage problem at the least public cost.	$618,700
		TOTAL COST	**$1,909,250**

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		3048																		
LG-01	Overland	134	6.96	1.86	1.21			Commercial	0	89	92	94	95	0.0	0.4	0.0	0.0	69.5	41.9	0.06547
	Channel (ditch)	494	7.91	4.25	1.94			Forest (good cover)	42	25	55	70	77	0.0	18.4	23.2	0.0			
	Paved	633	3.82	3.91	2.70			Impervious	1	98	98	98	98	0.0	0.9	0.1	0.1			
	Pipe			0.00	0.00			Pasture: Good Condition	31	39	61	74	80	0.0	14.5	15.3	0.8			
	Stream	1786	0.65	4.00	7.44	8.0	0.13	Residential 1/4 acre	26	61	75	83	87	0.0	11.9	14.3	0.0			
		2188																		
LG-01-01	Overland	114	5.73	1.68	1.13			Forest (good cover)	39	25	55	70	77	0.0	8.6	30.4	0.0	73.0	24.0	0.03749
	Channel (ditch)	702	5.77	3.62	3.23			Pasture: Good Condition	14	39	61	74	80	0.0	3.9	10.0	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	46	61	75	83	87	0.0	23.5	22.9	0.0			
	Pipe			0.00	0.00			Residential 1/8 acre	1	77	85	90	92	0.0	0.2	0.5	0.0			
	Stream	1372	2.33	4.00	5.72	6.0	0.10													
		1406																		
LG-01-02	Overland	181	5.15	1.60	1.89			Pasture: Good Condition	0	39	61	74	80	0.0	0.4	0.0	0.0	75.4	16.9	0.02634
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	97	61	75	83	87	0.0	94.1	2.9	0.0			
	Paved	1224	2.67	3.26	6.25			Residential 1/8 acre	3	77	85	90	92	0.0	2.6	0.0	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	4.9	0.08													
		1952																		
LG-01-03	Overland	136	4.41	1.48	1.54			Forest (good cover)	1	25	55	70	77	0.0	0.5	0.1	0.0	78.3	22.3	0.03478
	Channel (ditch)	634	4.46	3.17	3.34			Pasture: Good Condition	14	39	61	74	80	0.0	1.8	11.9	0.0			
	Paved	366	2.51	3.16	1.93			Residential 1/4 acre	57	61	75	83	87	0.0	52.9	4.5	0.0			
	Pipe	255	3.33	4.00	1.06			Residential 1/8 acre	28	77	85	90	92	0.0	16.7	11.5	0.0			
	Stream	560	2.23	4.00	2.33	6.1	0.10													
		2135																		
LG-01-04	Overland	205	2.15	1.03	3.32			Pasture: Good Condition	12	39	61	74	80	0.0	3.6	8.4	0.0	75.9	21.8	0.03410
	Channel (ditch)	1193	1.92	2.06	9.64			Residential 1/4 acre	83	61	75	83	87	0.0	72.3	8.9	2.3			
	Paved			0.00	0.00			Residential 1/8 acre	5	77	85	90	92	0.0	3.0	1.5	0.0			
	Pipe			0.00	0.00															
	Stream	737	1.56	4.00	3.07	9.6	0.16													
		1088																		
LG-01-05	Overland	295	2.76	1.17	4.21			Impervious	14	98	98	98	98	0.0	6.1	1.6	6.1	80.8	21.7	0.03395
	Channel (ditch)	793	4.07	3.03	4.37			Pasture: Good Condition	55	39	61	74	80	0.0	22.5	17.0	15.2			
	Paved			0.00	0.00			Residential 1/4 acre	34	61	75	83	87	0.0	5.7	14.4	14.4			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	5.1	0.09													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		1551																		
LG-01-06	Overland	95	1.40	0.83	1.92			Residential 1/4 acre	100	61	75	83	87	0.0	20.0	13.4	66.6	84.1	10.2	0.01601
	Channel (ditch)	399	2.07	2.14	3.11															
	Paved	1056	3.27	3.61	4.87															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	5.9	0.10													
		1594																		
LG-01-07	Overland	166	2.41	1.09	2.54			Pasture: Good Condition	20	39	61	74	80	0.0	3.5	9.0	7.1	82.0	24.4	0.03807
	Channel (ditch)	651	1.64	1.90	5.70			Residential 1/4 acre	80	61	75	83	87	0.0	0.3	60.0	20.0			
	Paved	778	2.17	2.94	4.41															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.6	0.13													
		2054																		
LG-02	Overland	268	7.07	1.87	2.39			Commercial	10	89	92	94	95	0.0	0.5	5.5	3.6	74.8	34.5	0.05392
	Channel (ditch)	801	5.51	3.53	3.78			Forest (good cover)	13	25	55	70	77	0.0	8.9	3.6	0.8			
	Paved			0.00	0.00			Impervious	7	98	98	98	98	0.0	0.0	0.5	6.0			
	Pipe			0.00	0.00			Industrial	0	81	88	91	93	0.0	0.0	0.0	0.5			
	Stream	985	1.76	4.00	4.10	6.2	0.10	Pasture: Good Condition	70	39	61	74	80	0.0	10.7	52.7	6.6			
		1562																		
LG-03	Overland	344	1.16	0.75	7.60			Commercial	1	89	92	94	95	0.0	0.0	0.0	0.6	77.3	24.8	0.03872
	Channel (ditch)	510	8.45	4.40	1.93			Impervious	13	98	98	98	98	0.0	0.2	2.0	11.1			
	Paved			0.00	0.00			Pasture: Good Condition	51	39	61	74	80	0.0	17.1	23.2	10.6			
	Pipe			0.00	0.00			Residential 1/4 acre	35	61	75	83	87	0.0	21.5	10.1	3.4			
	Stream	708	1.47	4.00	2.95	7.5	0.12													
		860																		
LG-04	Overland			0.00	0.00			Commercial	62	89	92	94	95	0.0	0.0	6.0	56.0	87.9	9.7	0.01523
	Channel (ditch)	401	4.93	3.34	2.00			Impervious	3	98	98	98	98	0.0	0.0	0.0	2.5			
	Paved	459	1.31	2.28	3.36			Pasture: Good Condition	35	39	61	74	80	0.0	0.0	29.8	5.7			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	3.2	0.05													
		3313																		
LG-05	Overland	229	0.81	0.63	6.05			Impervious	91	98	98	98	98	0.0	11.5	78.9	0.5	96.3	43.9	0.06860
	Channel (ditch)	3084	1.55	1.85	27.79			Pasture: Good Condition	1	39	61	74	80	0.0	0.2	0.8	0.3			
	Paved			0.00	0.00			Residential 1/3 acre	8	57	72	81	86	0.0	0.0	4.3	3.3			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	20.3	0.34													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		695																		
LG-06	Overland			0.00	0.00			Impervious	100	98	98	98	98	0.0	48.3	44.3	7.2	98.0	2.3	0.00358
	Channel (ditch)	244	3.55	2.82	1.44			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.2			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream	451	1.00	4.00	1.88	2.0	0.03													
		1543																		
LG-07	Overland	182	2.20	1.04	2.92			Commercial	0	89	92	94	95	0.0	0.2	0.0	0.1	86.7	13.8	0.02151
	Channel (ditch)	1008	2.34	2.28	7.37			Impervious	25	98	98	98	98	0.0	12.7	0.1	12.6			
	Paved	352	2.21	2.97	1.98			Residential 1/4 acre	75	61	75	83	87	0.0	27.5	0.0	47.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.4	0.12													
		1538																		
LG-08	Overland	248	2.58	1.13	3.66			Commercial	13	89	92	94	95	0.0	1.1	9.8	2.3	89.1	8.0	0.01248
	Channel (ditch)	915	2.07	2.14	7.12			Impervious	11	98	98	98	98	0.0	0.2	11.0	0.0			
	Paved	376	1.76	2.64	2.37			Residential 1/4 acre	76	61	75	83	87	0.0	0.0	1.9	73.6			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.9	0.13													
		1974																		
LG-09	Overland	263	1.52	0.86	5.07			Commercial	3	89	92	94	95	0.0	0.0	2.5	0.3	87.9	14.8	0.02306
	Channel (ditch)	1711	2.36	2.29	12.45			Impervious	11	98	98	98	98	0.0	0.0	9.9	1.4			
	Paved			0.00	0.00			Residential 1/4 acre	86	61	75	83	87	0.0	0.0	19.3	66.9			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	10.5	0.18													
		1386																		
LG-10	Overland	130	2.47	1.10	1.96			Commercial	18	89	92	94	95	0.0	0.0	17.8	0.0	90.9	5.7	0.00892
	Channel (ditch)	650	2.19	2.21	4.91			Impervious	32	98	98	98	98	0.0	0.0	32.0	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	50	61	75	83	87	0.0	0.0	24.1	26.1			
	Pipe	319	0.31	4.00	1.33															
	Stream	286	1.75	4.00	1.19	5.6	0.09													
		825																		
LG-11	Overland	139	5.57	1.66	1.39			Commercial	21	89	92	94	95	0.0	0.0	20.9	0.0	88.7	5.3	0.00829
	Channel (ditch)	501	1.57	1.86	4.49			Impervious	17	98	98	98	98	0.0	0.0	16.7	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	62	61	75	83	87	0.0	0.0	40.6	21.8			
	Pipe	186	0.65	4.00	0.77															
	Stream			0.00	0.00	4.0	0.07													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		1326																		
LG-12	Overland	228	1.29	0.79	4.79			Commercial	7	89	92	94	95	0.0	0.0	6.9	0.0	86.6	7.4	0.01162
	Channel (ditch)	667	2.56	2.39	4.65			Impervious	10	98	98	98	98	0.0	0.0	8.8	0.7			
	Paved	279	2.15	2.92	1.59			Pasture: Good Condition	2	39	61	74	80	0.0	0.0	2.1	0.1			
	Pipe	152	0.40	4.00	0.63			Residential 1/4 acre	81	61	75	83	87	0.0	0.0	41.6	39.9			
	Stream			0.00	0.00	7.0	0.12													
		902																		
LG-13	Overland	141	1.42	0.84	2.80			Commercial	16	89	92	94	95	0.0	0.0	7.2	9.1	87.6	5.0	0.00774
	Channel (ditch)	466	2.92	2.55	3.04			Impervious	14	98	98	98	98	0.0	0.0	12.8	1.3			
	Paved			0.00	0.00			Pasture: Good Condition	15	39	61	74	80	0.0	0.0	4.1	10.8			
	Pipe	296	1.45	4.00	1.23			Residential 1/4 acre	55	61	75	83	87	0.0	0.0	21.1	33.5			
	Stream			0.00	0.00	4.2	0.07													
		708																		
LG-14	Overland			0.00	0.00			Commercial	4	89	92	94	95	0.0	0.0	0.0	4.5	79.8	4.1	0.00639
	Channel (ditch)			0.00	0.00			Impervious	12	98	98	98	98	0.0	0.0	5.2	6.7			
	Paved	708	1.41	2.37	4.98			Industrial	2	81	88	91	93	0.0	0.0	1.0	0.8			
	Pipe			0.00	0.00			Pasture: Good Condition	82	39	61	74	80	0.0	0.0	53.6	28.2			
	Stream			0.00	0.00	3.0	0.05	Residential 1/4 acre	0	61	75	83	87	0.0	0.0	0.0	0.0			
		1436																		
LG-15	Overland	129	1.55	0.87	2.46			Commercial	9	89	92	94	95	0.0	0.0	8.6	0.0	86.7	11.8	0.01843
	Channel (ditch)			0.00	0.00			Impervious	9	98	98	98	98	0.0	0.0	8.5	0.2			
	Paved			0.00	0.00			Industrial	18	81	88	91	93	0.0	0.0	17.2	0.4			
	Pipe	1307	0.56	4.00	5.45			Pasture: Good Condition	1	39	61	74	80	0.0	0.0	0.7	0.0			
	Stream			0.00	0.00	4.7	0.08	Residential 1/4 acre	65	61	75	83	87	0.0	0.0	64.7	0.0			
		1230																		
LG-16	Overland	167	3.43	1.30	2.14			Forest (good cover)	0	25	55	70	77	0.0	0.0	0.0	0.0	79.7	7.0	0.01093
	Channel (ditch)	1063	2.52	2.37	7.47			Pasture: Good Condition	44	39	61	74	80	0.0	0.0	43.8	0.0			
	Paved			0.00	0.00			Impervious	4	98	98	98	98	0.0	0.0	4.3	0.0			
	Pipe			0.00	0.00			Residential 1/4 acre	52	61	75	83	87	0.0	0.0	51.7	0.0			
	Stream			0.00	0.00	5.8	0.10	Residential 1/3 acre	0	57	72	81	86	0.0	0.0	0.2	0.0			
		2060																		
LG-17	Overland	177	10.32	2.26	1.30			Forest (good cover)	0	25	55	70	77	0.0	0.0	0.0	0.3	83.0	24.4	0.03807
	Channel (ditch)	1883	7.41	4.11	7.64			Forest (poor cover)	0	45	66	77	83	0.0	0.0	0.0	0.2			
	Paved			0.00	0.00			Impervious	0	98	98	98	98	0.0	0.0	0.0	0.3			
	Pipe			0.00	0.00			Industrial	0	81	88	91	93	0.0	0.0	0.0	0.2			
	Stream			0.00	0.00	5.4	0.09	Pasture: Good Condition	21	39	61	74	80	0.0	0.0	1.8	19.5			
								Residential 1/3 acre	73	57	72	81	86	0.0	0.0	30.5	42.6			
								Residential 1/4 acre	3	61	75	83	87	0.0	0.0	0.8	2.3			
								Residential 2 acre	2	46	65	77	82	0.0	0.0	0.0	1.6			

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		1011																		
LG-18	Overland	143	7.46	1.92	1.24			Forest (poor cover)	0	45	66	77	83	0.0	0.0	0.0	0.0	86.9	6.8	0.01063
	Channel (ditch)	868	2.84	2.52	5.74			Impervious	34	98	98	98	98	0.0	0.0	34.2	0.1			
	Paved			0.00	0.00			Industrial	0	81	88	91	93	0.0	0.0	0.0	0.0			
	Pipe			0.00	0.00			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.0			
	Stream			0.00	0.00	4.2	0.07	Residential 1/3 acre	66	57	72	81	86	0.0	0.0	64.2	1.5			
								Residential 2 acre	0	46	65	77	82	0.0	0.0	0.0	0.0			
		0																		
LG-18-01	Overland	184	11.60	2.40	1.28			Forest (poor cover)	61	45	66	77	83	0.0	0.0	0.1	60.9	83.7	10.2	0.01598
	Channel (ditch)	1239	10.84	4.99	4.14			Impervious	2	98	98	98	98	0.0	0.0	0.2	1.5			
	Paved			0.00	0.00			Industrial	0	81	88	91	93	0.0	0.0	0.0	0.0			
	Pipe			0.00	0.00			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.4			
	Stream			0.00	0.00	3.2	0.05	Residential 1/3 acre	37	57	72	81	86	0.0	0.0	12.6	24.3			
								Residential 2 acre	0	46	65	77	82	0.0	0.0	0.0	0.0			
		0																		
LG-18-02	Overland	125	3.09	1.23	1.69			Forest (poor cover)	24	45	66	77	83	0.0	0.0	0.0	24.3	82.9	10.4	0.01627
	Channel (ditch)	936	14.69	5.83	2.67			Impervious	1	98	98	98	98	0.0	0.0	0.0	1.3			
	Paved			0.00	0.00			Industrial	1	81	88	91	93	0.0	0.0	0.0	1.3			
	Pipe			0.00	0.00			Pasture: Good Condition	44	39	61	74	80	0.0	0.0	0.0	43.8			
	Stream			0.00	0.00	2.6	0.04	Residential 1/3 acre	29	57	72	81	86	0.0	0.0	0.0	28.8			
								Residential 2 acre	0	46	65	77	82	0.0	0.0	0.0	0.4			
		2338																		
LG-19	Overland	127	5.34	1.62	1.31			Forest (good cover)	2	25	55	70	77	0.0	0.0	0.0	1.9	90.5	28.8	0.04504
	Channel (ditch)	2211	6.16	3.74	9.85			Forest (poor cover)	43	45	66	77	83	0.0	0.0	0.0	43.0			
	Paved			0.00	0.00			Impervious	51	98	98	98	98	0.0	0.0	35.5	15.3			
	Pipe			0.00	0.00			Residential 1/3 acre	4	57	72	81	86	0.0	0.0	2.6	1.5			
	Stream			0.00	0.00	6.7	0.11													
		3491																		
LG-20	Overland	292	1.37	0.82	5.93			Forest (good cover)	34	25	55	70	77	0.0	6.4	10.1	17.9	78.5	45.3	0.07086
	Channel (ditch)	2417	7.93	4.25	9.47			Forest (poor cover)	0	45	66	77	83	0.0	0.0	0.0	0.0			
	Paved			0.00	0.00			Impervious	10	98	98	98	98	0.0	0.3	3.7	6.2			
	Pipe			0.00	0.00			Pasture: Good Condition	35	39	61	74	80	0.0	0.0	9.5	25.2			
	Stream	782	1.28	4.00	3.26	11.2	0.19	Residential 1/3 acre	5	57	72	81	86	0.0	0.6	1.7	3.0			
								Residential 1/4 acre	4	61	75	83	87	0.0	0.0	3.8	0.0			
								Residential 2 acre	12	46	65	77	82	0.0	0.0	2.7	8.9			

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		1975																		
LG-21	Overland	265	1.16	0.75	5.85			Forest (good cover)	49	25	55	70	77	0.0	0.0	1.2	47.8	80.2	42.2	0.06592
	Channel (ditch)	1711	8.76	4.48	6.37			Forest (poor cover)	31	45	66	77	83	0.0	0.0	0.0	30.8			
	Paved			0.00	0.00			Impervious	4	98	98	98	98	0.0	0.0	1.2	2.9			
	Pipe			0.00	0.00			Pasture: Good Condition	11	39	61	74	80	0.0	0.0	0.0	11.3			
	Stream			0.00	0.00	7.3	0.12	Residential 1/3 acre	0	57	72	81	86	0.0	0.0	0.0	0.2			
								Residential 2 acre	5	46	65	77	82	0.0	0.0	0.0	4.6			
		2017																		
LG-22	Overland	268	0.50	0.49	9.06			Forest (good cover)	5	25	55	70	77	0.0	0.0	0.0	5.1	93.8	45.2	0.07059
	Channel (ditch)	1232	7.63	4.17	4.92			Forest (poor cover)	5	45	66	77	83	0.0	0.0	0.0	4.8			
	Paved	517	2.94	3.43	2.51			Impervious	55	98	98	98	98	0.0	0.0	5.3	49.7			
	Pipe			0.00	0.00			Industrial	27	81	88	91	93	0.0	0.0	0.0	26.6			
	Stream			0.00	0.00	9.9	0.17	Pasture: Good Condition	1	39	61	74	80	0.0	0.0	1.3	0.0			
								Residential 1/4 acre	7	61	75	83	87	0.0	0.0	0.0	7.3			
		1993																		
QR-01	Overland	176	4.02	1.41	2.08			Forest (good cover)	74	25	55	70	77	0.0	62.1	12.4	0.0	58.9	20.8	0.03255
	Channel (ditch)	613	3.31	2.72	3.75			Pasture: Good Condition	25	39	61	74	80	0.0	21.6	3.7	0.0			
	Paved			0.00	0.00			Residential 2 acre	0	46	65	77	82	0.0	0.0	0.3	0.0			
	Pipe			0.00	0.00															
	Stream	1204	0.51	4.00	5.02	6.5	0.11													
		1294																		
QR-02	Overland	97	6.31	1.77	0.92			Forest (good cover)	2	25	55	70	77	0.0	1.2	1.0	0.0	68.2	23.8	0.03722
	Channel (ditch)	1079	8.35	4.37	4.12			Forest (poor cover)	30	45	66	77	83	0.0	25.5	4.9	0.0			
	Paved			0.00	0.00			Pasture: Good Condition	55	39	61	74	80	0.0	30.0	24.8	0.0			
	Pipe			0.00	0.00			Residential 1 acre	6	51	68	79	84	0.0	2.0	4.1	0.0			
	Stream	118	0.34	4.00	0.49	3.3	0.06	Residential 2 acre	7	46	65	77	82	0.0	0.0	6.5	0.0			
		2217																		
QR-03	Overland	202	4.81	1.54	2.19			Forest (poor cover)	44	45	66	77	83	0.0	30.1	14.4	0.0	69.1	32.1	0.05011
	Channel (ditch)	1098	6.01	3.69	4.95			Pasture: Good Condition	30	39	61	74	80	0.0	21.2	9.2	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	0	61	75	83	87	0.0	0.0	0.0	0.0			
	Pipe			0.00	0.00			Residential 1 acre	16	51	68	79	84	0.0	3.4	12.3	0.0			
	Stream	917	0.65	4.00	3.82	6.6	0.11	Residential 2 acre	9	46	65	77	82	0.0	7.3	2.0	0.0			
		1115																		
QR-03-01	Overland	126	4.77	1.53	1.37			Pasture: Good Condition	45	39	61	74	80	0.0	18.2	26.8	0.0	71.2	6.9	0.01081
	Channel (ditch)	989	6.39	3.81	4.33			Residential 1/4 acre	29	61	75	83	87	0.0	27.4	1.4	0.0			
	Paved			0.00	0.00			Residential 1 acre	18	51	68	79	84	0.0	18.2	0.0	0.0			
	Pipe			0.00	0.00			Residential 2 acre	8	46	65	77	82	0.0	0.0	8.0	0.0			
	Stream			0.00	0.00	3.4	0.06													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		888																		
QR-04	Overland	234	3.08	1.23	3.16			Forest (poor cover)	18	45	66	77	83	0.0	0.0	17.8	0.0	76.1	3.9	0.00603
	Channel (ditch)	522	5.82	3.63	2.39			Residential 1/4 acre	44	61	75	83	87	0.0	25.2	18.4	0.0			
	Paved			0.00	0.00			Residential 1 acre	39	51	68	79	84	0.0	20.9	17.6	0.0			
	Pipe			0.00	0.00															
	Stream	132	1.06	4.00	0.55	3.7	0.06													
		709																		
QR-05	Overland	46	4.20	1.44	0.53			Forest (poor cover)	19	45	66	77	83	0.0	16.2	3.2	0.0	73.0	4.4	0.00688
	Channel (ditch)	296	7.93	4.26	1.16			Pasture: Good Condition	31	39	61	74	80	0.0	31.4	0.0	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	49	61	75	83	87	0.0	1.8	47.4	0.0			
	Pipe			0.00	0.00															
	Stream	367	0.54	4.00	1.53	1.9	0.03													
		1922																		
QR-05-01	Overland	193	5.38	1.63	1.98			Forest (poor cover)	62	45	66	77	83	0.0	12.8	49.4	0.0	72.4	20.4	0.03190
	Channel (ditch)	1557	4.92	3.34	7.78			Pasture: Good Condition	7	39	61	74	80	0.0	3.0	4.4	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	1	61	75	83	87	0.0	0.0	0.8	0.0			
	Pipe			0.00	0.00			Residential 1 acre	10	51	68	79	84	0.0	4.9	5.0	0.0			
	Stream	172	1.39	4.00	0.72	6.3	0.10	Residential 2 acre	20	46	65	77	82	0.0	19.2	0.5	0.0			
		1345																		
QR-05-02	Overland	143	7.38	1.91	1.24			Forest (poor cover)	88	45	66	77	83	0.0	10.3	77.7	0.0	75.3	15.8	0.02474
	Channel (ditch)	681	6.43	3.82	2.97			Residential 1 acre	12	51	68	79	84	0.0	7.5	4.5	0.0			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream	522	3.14	4.00	2.18	3.8	0.06													
		1306																		
QR-05-03	Overland	309	1.85	0.95	5.40			Forest (poor cover)	12	45	66	77	83	0.0	0.0	12.0	0.0	78.4	16.3	0.02546
	Channel (ditch)	850	4.33	3.12	4.54			Residential 1 acre	88	51	68	79	84	0.0	3.0	85.0	0.0			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream	146	4.92	4.00	0.61	6.3	0.11													
		760																		
QR-06	Overland	104	7.83	1.97	0.88			Forest (poor cover)	20	45	66	77	83	0.0	0.0	19.8	0.0	81.8	3.8	0.00596
	Channel (ditch)	137	20.27	6.87	0.33			Residential 1/4 acre	80	61	75	83	87	0.0	0.0	80.2	0.0			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream	518	2.08	4.00	2.16	2.0	0.03													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		797																		
QR-06-01	Overland	173	3.62	1.34	2.16			Residential 1/4 acre	100	61	75	83	87	0.0	30.6	69.4	0.0	80.6	4.4	0.00682
	Channel (ditch)	124	3.99	3.00	0.69															
	Paved	420	2.47	3.14	2.23															
	Pipe	80	2.00	4.00	0.33															
	Stream			0.00	0.00	3.2	0.05													
		1010																		
QR-06-02	Overland	102	6.28	1.76	0.96			Forest (good cover)	5	25	55	70	77	0.0	2.0	2.6	0.0	76.7	8.8	0.01371
	Channel (ditch)	174	13.76	5.64	0.52			Residential 1/4 acre	95	61	75	83	87	0.0	67.8	27.6	0.0			
	Paved	586	4.10	4.05	2.41															
	Pipe	148	1.29	4.00	0.62															
	Stream			0.00	0.00	2.7	0.05													
		1586																		
QR-06-03	Overland	193	2.49	1.11	2.91			Pasture: Good Condition	15	39	61	74	80	0.0	0.0	14.7	0.0	79.5	11.4	0.01776
	Channel (ditch)	440	5.51	3.53	2.08			Residential 1/4 acre	75	61	75	83	87	0.0	20.6	51.2	2.7			
	Paved			0.00	0.00			Residential 2 acre	11	46	65	77	82	0.0	0.0	10.8	0.0			
	Pipe			0.00	0.00															
	Stream	952	3.35	4.00	3.97	5.4	0.09													
		2096																		
QR-07	Overland	106	6.42	1.78	0.99			Forest (good cover)	27	25	55	70	77	0.0	22.1	5.3	0.0	72.2	7.2	0.01123
	Channel (ditch)	510	5.83	3.64	2.34			Forest (poor cover)	3	45	66	77	83	0.0	0.0	2.6	0.0			
	Paved	442	4.53	4.26	1.73			Impervious	0	98	98	98	98	0.0	0.3	0.2	0.0			
	Pipe	150	7.15	4.00	0.62			Pasture: Good Condition	4	39	61	74	80	0.0	3.7	0.7	0.0			
	Stream	889	0.17	4.00	3.70	5.6	0.09	Residential 1/4 acre	65	61	75	83	87	0.0	37.7	27.5	0.0			
		1213																		
QR-07-01	Overland	140	3.24	1.26	1.85			Forest (poor cover)	35	45	66	77	83	0.0	30.4	4.7	0.0	71.5	4.4	0.00683
	Channel (ditch)	822	5.32	3.47	3.95			Impervious	1	98	98	98	98	0.0	0.0	1.0	0.0			
	Paved	251	4.62	4.30	0.97			Pasture: Good Condition	24	39	61	74	80	0.0	3.4	20.8	0.0			
	Pipe			0.00	0.00			Residential 1/4 acre	3	61	75	83	87	0.0	0.0	2.8	0.0			
	Stream			0.00	0.00	4.1	0.07	Residential 1 acre	37	51	68	79	84	0.0	19.2	17.7	0.0			
		1747																		
QR-08	Overland	192	6.10	1.74	1.84			Forest (poor cover)	26	45	66	77	83	0.0	0.0	26.1	0.0	78.9	15.3	0.02398
	Channel (ditch)	474	6.39	3.81	2.07			Impervious	1	98	98	98	98	0.0	0.0	0.8	0.0			
	Paved			0.00	0.00			Pasture: Good Condition	17	39	61	74	80	0.0	0.0	17.4	0.0			
	Pipe			0.00	0.00			Residential 1/4 acre	29	61	75	83	87	0.0	0.0	28.9	0.0			
	Stream	1081	1.68	4.00	4.50	5.1	0.08	Residential 1 acre	27	51	68	79	84	0.0	0.0	26.7	0.0			

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		847																		
QR-08-01	Overland	156	4.70	1.52	1.71			Forest (poor cover)	2	45	66	77	83	0.0	0.0	1.6	0.0	72.6	8.3	0.01290
	Channel (ditch)	691	6.46	3.83	3.01			Pasture: Good Condition	10	39	61	74	80	0.0	3.8	6.2	0.0			
	Paved			0.00	0.00			Residential 1 acre	88	51	68	79	84	0.0	48.7	39.7	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	2.8	0.05													
		804																		
QR-08-02	Overland	129	5.49	1.65	1.30			Forest (good cover)	43	25	55	70	77	0.0	6.0	36.6	0.0	75.7	7.7	0.01197
	Channel (ditch)	676	6.32	3.79	2.97			Impervious	4	98	98	98	98	0.0	1.5	2.2	0.0			
	Paved			0.00	0.00			Pasture: Good Condition	11	39	61	74	80	0.0	3.2	7.8	0.0			
	Pipe			0.00	0.00			Residential 1/4 acre	43	61	75	83	87	0.0	0.0	42.7	0.0			
	Stream			0.00	0.00	2.6	0.04													
		1515																		
QR-08-03	Overland	261	1.02	0.71	6.16			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.3	0.0	83.1	18.3	0.02863
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	97.1	2.6			
	Paved	1254	2.40	3.09	6.76															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.8	0.13													
		1413																		
QR-09	Overland	168	4.04	1.41	1.99			Pasture: Good Condition	48	39	61	74	80	0.0	3.5	44.2	0.0	74.6	8.3	0.01295
	Channel (ditch)	362	4.68	3.25	1.85			Residential 1 acre	52	51	68	79	84	0.0	13.9	38.4	0.0			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream	883	3.31	4.00	3.68	4.5	0.08													
		1386																		
QR-09-01	Overland	290	4.68	1.52	3.18			Impervious	3	98	98	98	98	0.0	2.6	0.0	0.0	70.0	19.9	0.03106
	Channel (ditch)	870	3.56	2.83	5.13			Pasture: Good Condition	55	39	61	74	80	0.0	25.2	29.8	0.0			
	Paved			0.00	0.00			Residential 1 acre	42	51	68	79	84	0.0	31.4	11.0	0.0			
	Pipe			0.00	0.00															
	Stream	226	1.72	4.00	0.94	5.6	0.09													
		726																		
QR-10	Overland	139	4.69	1.52	1.53			Pasture: Good Condition	22	39	61	74	80	0.0	0.0	21.7	0.0	80.6	7.5	0.01164
	Channel (ditch)	334	7.15	4.04	1.38			Residential 1/4 acre	73	61	75	83	87	0.0	3.2	69.9	0.0			
	Paved			0.00	0.00			Residential 1 acre	5	51	68	79	84	0.0	0.0	5.1	0.0			
	Pipe	112	9.96	4.00	0.47															
	Stream	140	1.57	4.00	0.58	2.4	0.04													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		656																		
QR-10-01	Overland	135	3.86	1.38	1.63			Commercial	0	89	92	94	95	0.0	0.0	0.0	0.0	66.9	3.4	0.00532
	Channel (ditch)	521	3.69	2.88	3.02			Pasture: Good Condition	72	39	61	74	80	0.0	56.4	15.8	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	22	61	75	83	87	0.0	17.9	3.7	0.0			
	Pipe			0.00	0.00			Residential 1 acre	6	51	68	79	84	0.0	5.3	0.8	0.0			
	Stream			0.00	0.00	2.8	0.05													
		1360																		
QR-10-02	Overland	221	3.69	1.35	2.73			Commercial	6	89	92	94	95	0.0	0.0	2.5	3.7	76.0	19.0	0.02966
	Channel (ditch)	1140	6.55	3.86	4.92			Pasture: Good Condition	52	39	61	74	80	0.0	12.3	34.3	5.7			
	Paved			0.00	0.00			Residential 1/4 acre	35	61	75	83	87	0.0	18.2	4.0	13.1			
	Pipe			0.00	0.00			Residential 1 acre	5	51	68	79	84	0.0	4.9	0.3	0.0			
	Stream			0.00	0.00	4.6	0.08	Residential 2 acre	1	46	65	77	82	0.0	0.0	0.0	1.0			
		1200																		
QR-11	Overland	112	3.91	1.39	1.35			Commercial	0	89	92	94	95	0.0	0.0	0.0	0.2	83.4	15.6	0.02445
	Channel (ditch)	368	4.24	3.09	1.98			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.0			
	Paved	349	4.01	4.01	1.45			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	91.5	8.3			
	Pipe	371	1.27	4.00	1.55															
	Stream			0.00	0.00	3.8	0.06													
		825																		
QR-12	Overland	106	4.39	1.47	1.21			Commercial	0	89	92	94	95	0.0	0.0	0.0	0.0	83.4	11.4	0.01777
	Channel (ditch)	252	3.81	2.93	1.43			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	90.3	9.7			
	Paved	467	1.05	2.04	3.82															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	3.9	0.06													
		1152																		
QR-12-01	Overland	312	2.35	1.08	4.83			Commercial	13	89	92	94	95	0.0	0.0	0.0	13.3	85.8	7.8	0.01219
	Channel (ditch)	840	5.73	3.60	3.89			Pasture: Good Condition	2	39	61	74	80	0.0	0.0	0.0	1.8			
	Paved			0.00	0.00			Residential 1/4 acre	73	61	75	83	87	0.0	2.7	30.2	40.3			
	Pipe			0.00	0.00			Residential 2 acre	12	46	65	77	82	0.0	0.0	0.0	11.8			
	Stream			0.00	0.00	5.2	0.09													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		700																		
QR-13	Overland	92	5.39	1.63	0.93			Commercial	21	89	92	94	95	0.0	0.0	20.9	0.0	81.5	6.9	0.01085
	Channel (ditch)	608	0.57	1.11	9.14			Pasture: Good Condition	42	39	61	74	80	0.0	0.0	42.1	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	37	61	75	83	87	0.0	0.0	37.0	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	6.0	0.10													
		1248																		
QR-13-01	Overland	279	2.87	1.19	3.92			Commercial	1	89	92	94	95	0.0	0.0	1.2	0.0	82.9	9.0	0.01410
	Channel (ditch)	768	4.60	3.22	3.97			Pasture: Good Condition	26	39	61	74	80	0.0	0.0	22.9	3.5			
	Paved			0.00	0.00			Residential 1/4 acre	72	61	75	83	87	0.0	0.0	23.9	48.6			
	Pipe	201	0.40	4.00	0.84															
	Stream			0.00	0.00	5.2	0.09													
		1140																		
QR-13-02	Overland	301	2.97	1.21	4.14			Commercial	21	89	92	94	95	0.0	0.0	20.7	0.0	85.3	5.9	0.00928
	Channel (ditch)			0.00	0.00			Pasture: Good Condition	4	39	61	74	80	0.0	0.0	4.1	0.0			
	Paved	754	2.45	3.13	4.02			Residential 1/4 acre	75	61	75	83	87	0.0	0.0	66.6	8.6			
	Pipe	86	1.75	4.00	0.36															
	Stream			0.00	0.00	5.1	0.09													
		1451																		
QR-13-03	Overland	267	2.75	1.16	3.82			Commercial	75	89	92	94	95	0.0	0.0	75.1	0.0	91.2	16.7	0.02604
	Channel (ditch)	587	2.00	2.10	4.65			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.3	0.0			
	Paved	597	1.81	2.68	3.71			Residential 1/4 acre	25	61	75	83	87	0.0	0.0	24.6	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.3	0.12													
		1132																		
QR-14	Overland	220	1.88	0.96	3.82			Commercial	1	89	92	94	95	0.0	0.0	1.3	0.0	83.1	8.1	0.01268
	Channel (ditch)			0.00	0.00			Pasture: Good Condition	1	39	61	74	80	0.0	0.0	0.6	0.0			
	Paved	469	2.96	3.44	2.28			Residential 1/4 acre	98	61	75	83	87	0.0	0.0	98.0	0.0			
	Pipe	443	1.40	4.00	1.84															
	Stream			0.00	0.00	4.8	0.08													
		758																		
QR-14-01	Overland	230	0.93	0.67	5.68			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	6.7	0.01040
	Channel (ditch)			0.00	0.00															
	Paved	528	1.36	2.33	3.79															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	5.7	0.09													

Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		1094																		
QR-14-02	Overland	279	1.39	0.83	5.63			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	7.3	0.01147
	Channel (ditch)	664	1.40	1.76	6.30															
	Paved	151	1.00	1.98	1.27															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.9	0.13													
		1105																		
QR-14-03	Overland	320	1.37	0.82	6.49			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	7.7	0.01209
	Channel (ditch)			0.00	0.00															
	Paved	785	0.64	1.59	8.25															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	8.8	0.15													
		1431																		
QR-15	Overland	288	0.74	0.60	7.96			Commercial	19	89	92	94	95	0.0	0.0	18.8	0.0	85.0	11.9	0.01860
	Channel (ditch)			0.00	0.00			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.3	0.0			
	Paved	1143	1.58	2.50	7.62			Residential 1/4 acre	81	61	75	83	87	0.0	0.0	80.9	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	9.3	0.16													
		751																		
QR-15-01	Overland	100	1.74	0.92	1.79			Commercial	20	89	92	94	95	0.0	0.0	19.9	0.0	85.2	5.2	0.00817
	Channel (ditch)	280	1.48	1.80	2.58			Residential 1/4 acre	80	61	75	83	87	0.0	0.0	80.1	0.0			
	Paved	372	2.47	3.14	1.97															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	3.8	0.06													
		1121																		
QR-15-02	Overland	259	0.72	0.59	7.29			Commercial	22	89	92	94	95	0.0	0.0	22.3	0.0	85.5	6.1	0.00950
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	78	61	75	83	87	0.0	0.0	77.7	0.0			
	Paved	862	1.62	2.54	5.66															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	7.8	0.13													
		1797																		
QR-15-03	Overland	207	2.13	1.02	3.37			Commercial	5	89	92	94	95	0.0	0.0	5.3	0.0	83.7	20.0	0.03131
	Channel (ditch)	1590	0.90	1.40	18.96			Impervious	1	98	98	98	98	0.0	0.0	0.5	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	94	61	75	83	87	0.0	0.0	93.5	0.7			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	13.4	0.22													

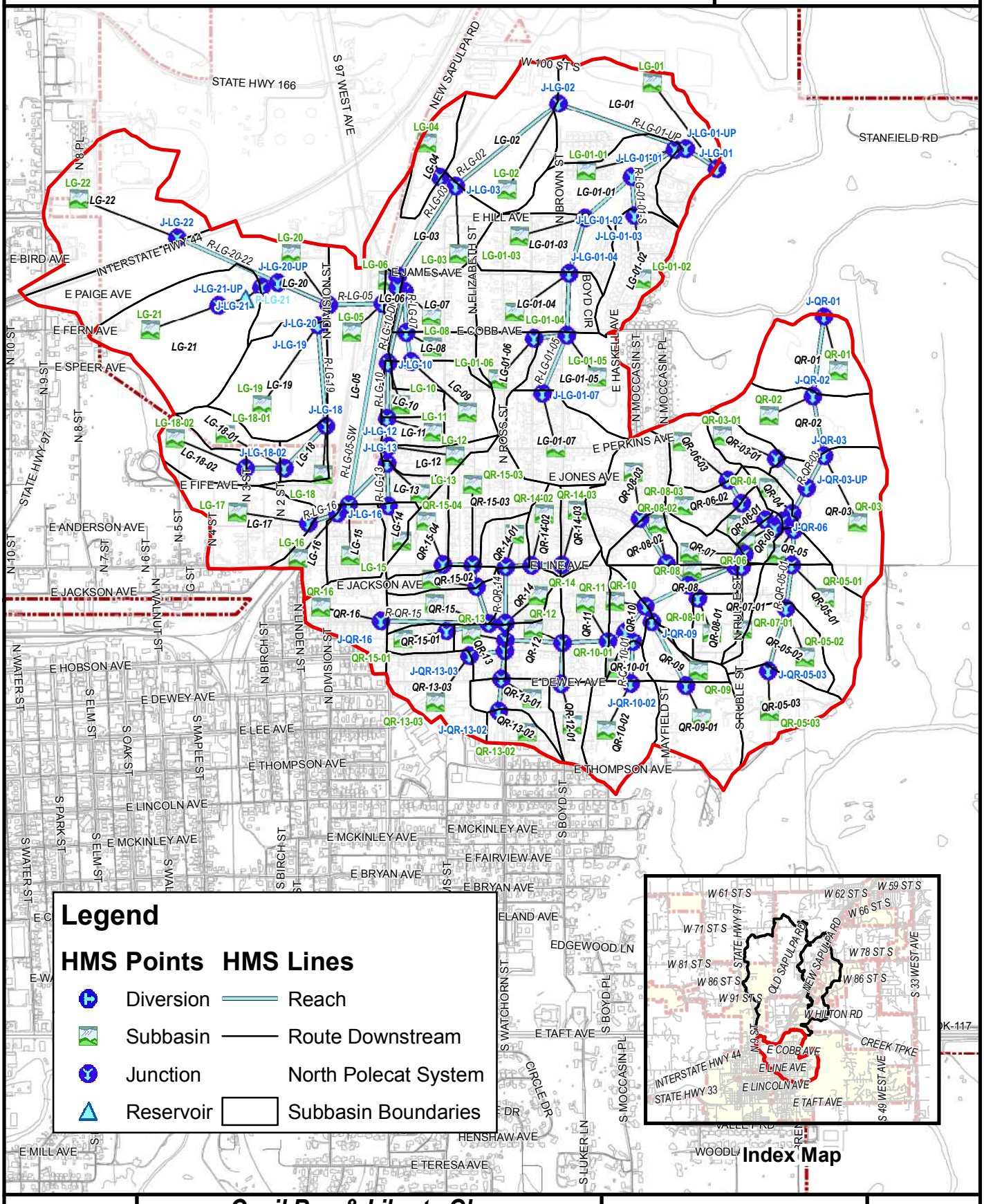
Appendix 13-A. North Polecat Systems - Quail Run and Liberty Glass Drainage System - Hydrologic Coefficients for Existing Conditions

Tributary Subarea	Flow Type	Length (ft)	Weighted Slope (%)	Velocity (ft./sec.)	Tc (min.)	Lag (min.)	Lag (hr.)	Land Use:	% of Use	CN value for each Hydrologic Soil Group				Hydrologic Soil Groups and %				Composite CN	Drainage Area (acres)	Drainage Area (sq. mi.)
									1803	A	B	C	D	A	B	C	D		65.9	
		957																		
QR-15-04	Overland			0.00	0.00			Commercial	15	89	92	94	95	0.0	0.0	14.6	0.0	78.8	10.2	0.01596
	Channel (ditch)			0.00	0.00			Impervious	1	98	98	98	98	0.0	0.0	1.1	0.0			
	Paved	957	1.03	2.02	7.89			Pasture: Good Condition	67	39	61	74	80	0.0	0.0	66.7	0.0			
	Pipe			0.00	0.00			Residential 1/4 acre	18	61	75	83	87	0.0	0.0	17.6	0.0			
	Stream			0.00	0.00	4.7	0.08													
		1082																		
QR-16	Overland	268	4.98	1.57	2.84			Commercial	28	89	92	94	95	0.0	0.0	27.9	0.0	86.1	15.2	0.02371
	Channel (ditch)			0.00	0.00			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.0			
	Paved	814	1.78	2.66	5.10			Residential 1/4 acre	72	61	75	83	87	0.0	0.0	72.1	0.0			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	4.8	0.08													

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 750 1,500
N



Legend

HMS Points		HMS Lines	
Diversion		Reach	
Subbasin		Route Downstream	
Junction		North Polecat System	
Reservoir		Subbasin Boundaries	

The City of Sapulpa
Oklahoma's Most Connected City

Quail Run & Liberty Glass Drainage System HMS Schematic

MESHEK & ASSOCIATES, PLC
1437 S Boulder Ave, Suite 1080 Tulsa, OK 74119
Ph:(918) 392-5620 www.meshekengr.com

Appendix 13-B

Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
J-LG-01	563	844	1414	1785	2265	2639	2991	3712	0.929
J-LG-01-01	124	199	352	460	571	669	776	990	0.221
J-LG-01-01-UP	114	182	315	414	508	603	701	885	0.183
J-LG-01-02	16	28	51	66	85	100	114	143	0.026
J-LG-01-03	104	166	286	368	450	535	615	772	0.157
J-LG-01-04	90	142	239	300	377	437	495	614	0.122
J-LG-01-05	74	116	189	235	294	338	382	469	0.088
J-LG-01-06	16	25	40	49	60	69	77	93	0.016
J-LG-01-07	32	50	82	102	127	146	165	202	0.038
J-LG-01-UP	558	831	1381	1736	2196	2555	2893	3572	0.864
J-LG-02	500	726	1161	1434	1786	2065	2332	2891	0.643
J-LG-03	502	726	1139	1392	1719	1980	2228	2741	0.589
J-LG-04	20	33	48	58	70	78	87	104	0.015
J-LG-05	359	507	777	949	1165	1328	1489	1822	0.382
J-LG-06	492	709	1096	1341	1653	1887	2115	2582	0.535
J-LG-06-UP	492	709	1094	1338	1647	1879	2107	2573	0.531
J-LG-07	145	211	326	399	490	559	626	764	0.149
J-LG-08	38	54	81	98	119	134	150	182	0.036
J-LG-09	24	35	52	63	77	87	97	118	0.023
J-LG-10	87	130	203	250	308	352	395	483	0.092
J-LG-11	76	117	185	228	282	322	362	442	0.083
J-LG-12	67	107	169	209	258	295	332	406	0.075
J-LG-13	55	89	142	176	218	250	281	344	0.063
J-LG-14	6	10	16	20	25	29	33	40	0.006
J-LG-15	22	35	53	63	77	87	97	116	0.018
J-LG-16	45	73	117	145	180	207	233	284	0.049
J-LG-17	37	59	94	115	143	163	183	223	0.038
J-LG-18	47	78	120	146	180	205	229	276	0.043
J-LG-18-01	35	59	92	112	138	157	176	212	0.032
J-LG-18-02	17	30	47	57	71	80	90	108	0.016
J-LG-19	103	159	237	285	347	392	436	525	0.088
J-LG-20	267	386	604	744	920	1054	1185	1447	0.295
J-LG-20-UP	139	195	291	353	430	488	546	683	0.137
J-LG-21	50	80	135	170	213	247	280	340	0.066
J-LG-21-UP	50	81	135	170	213	247	280	345	0.066
J-LG-22	98	134	185	218	260	290	320	383	0.071
J-QR-01	357	555	992	1294	1657	1962	2253	2847	0.725
J-QR-02	359	555	985	1285	1651	1943	2222	2786	0.692
J-QR-03	362	553	975	1264	1613	1889	2155	2688	0.655
J-QR-03-01	5	10	19	25	34	40	46	58	0.011
J-QR-03-UP	355	538	934	1204	1526	1780	2023	2525	0.605

Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
J-QR-04	353	534	925	1190	1508	1757	1997	2493	0.594
J-QR-05	38	75	146	189	245	291	332	425	0.089
J-QR-05-01	40	77	144	185	240	284	327	411	0.082
J-QR-05-02	31	53	94	120	154	181	208	260	0.050
J-QR-05-03	18	30	51	65	83	96	109	136	0.025
J-QR-06	314	474	805	1026	1293	1501	1703	2129	0.499
J-QR-06-01	29	48	82	103	131	152	173	214	0.038
J-QR-06-02	23	38	66	83	106	123	140	173	0.031
J-QR-06-03	14	23	39	49	62	72	81	100	0.018
J-QR-06-UP	313	472	800	1019	1284	1489	1691	2113	0.493
J-QR-07	301	454	761	964	1212	1405	1594	1990	0.455
J-QR-07-01	3	6	12	16	21	24	28	36	0.007
J-QR-08	299	457	749	945	1185	1371	1558	1946	0.437
J-QR-08-01	7	13	25	33	43	51	59	74	0.013
J-QR-08-02	30	47	77	97	121	140	158	195	0.041
J-QR-08-03	25	39	63	78	97	111	125	153	0.029
J-QR-08-UP	289	445	725	909	1140	1316	1496	1869	0.413
J-QR-09	17	31	66	88	113	135	153	189	0.044
J-QR-09-01	11	22	46	62	82	99	116	148	0.031
J-QR-10	260	400	649	810	1014	1170	1328	1657	0.359
J-QR-10-01	20	37	67	86	111	131	150	188	0.035
J-QR-10-02	19	33	60	77	99	116	132	165	0.030
J-QR-10-UP	243	372	593	734	911	1045	1178	1451	0.304
J-QR-11	231	351	554	682	843	965	1085	1331	0.269
J-QR-12	219	331	520	640	790	904	1015	1242	0.244
J-QR-12-01	14	22	33	40	49	55	62	74	0.012
J-QR-13	198	300	469	575	709	810	910	1112	0.214
J-QR-13-01	24	38	60	73	90	103	115	140	0.023
J-QR-13-02	10	16	25	30	37	42	47	57	0.009
J-QR-13-03	36	51	72	86	103	115	127	152	0.026
J-QR-13-UP	59	89	131	157	191	216	240	290	0.049
J-QR-14	131	199	318	393	488	560	631	774	0.154
J-QR-14-01	29	45	72	89	110	127	143	175	0.034
J-QR-14-02	20	31	50	62	77	88	100	122	0.024
J-QR-14-03	10	16	25	31	39	45	51	62	0.012
J-QR-15	92	140	222	274	340	390	439	538	0.107
J-QR-15-01	9	15	24	28	35	40	44	53	0.008
J-QR-15-02	42	62	102	128	160	185	210	260	0.057
J-QR-15-03	32	48	81	101	127	148	167	208	0.047
J-QR-15-04	12	21	36	45	57	66	75	92	0.016
J-QR-16	28	44	66	80	98	110	123	148	0.024

Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
LG-01	20	39	84	114	152	184	216	279	0.065
LG-01-01	18	32	62	82	107	127	147	186	0.037
LG-01-02	16	28	51	66	85	100	114	143	0.026
LG-01-03	24	41	71	89	114	132	151	187	0.035
LG-01-04	17	29	54	70	90	106	123	155	0.034
LG-01-05	29	48	79	99	124	142	161	197	0.034
LG-01-06	16	25	40	49	60	69	77	93	0.016
LG-01-07	32	50	82	102	127	146	165	202	0.038
LG-02	29	51	95	124	160	189	217	273	0.054
LG-03	24	40	71	91	116	136	155	193	0.039
LG-04	20	33	48	58	70	78	87	104	0.015
LG-05	76	98	136	162	193	216	239	290	0.069
LG-06	7	11	14	16	19	21	23	27	0.004
LG-07	24	35	54	65	79	90	100	121	0.022
LG-08	15	22	32	39	47	53	58	70	0.012
LG-09	24	35	52	63	77	87	97	118	0.023
LG-10	13	19	27	32	38	42	47	56	0.009
LG-11	11	18	26	31	37	42	46	55	0.008
LG-12	13	19	29	36	43	49	55	66	0.012
LG-13	10	16	23	28	34	38	42	50	0.008
LG-14	6	10	16	20	25	29	33	40	0.006
LG-15	22	35	53	63	77	87	97	116	0.018
LG-16	9	14	24	30	38	43	49	61	0.011
LG-17	37	59	94	115	143	163	183	223	0.038
LG-18	13	21	31	38	46	52	57	69	0.011
LG-18-01	17	29	45	55	68	77	87	104	0.016
LG-18-02	17	30	47	57	71	80	90	108	0.016
LG-19	61	89	127	151	181	203	224	268	0.045
LG-20	41	66	116	149	189	222	253	317	0.071
LG-21	50	81	135	170	213	247	280	345	0.066
LG-22	98	134	185	218	260	290	320	383	0.071
P-LG-21	50	80	135	170	213	247	280	340	0.066
QR-01	2	6	23	36	53	68	83	114	0.033
QR-02	13	26	58	78	105	127	149	191	0.037
QR-03	16	31	67	91	123	149	174	225	0.050
QR-03-01	5	10	19	25	34	40	46	58	0.011
QR-04	4	7	13	17	21	25	28	35	0.006
QR-05	4	8	14	19	24	29	33	41	0.007
QR-05-01	14	26	51	67	88	105	122	154	0.032
QR-05-02	16	28	51	65	84	99	113	141	0.025
QR-05-03	18	30	51	65	83	96	109	136	0.025

Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
QR-06	6	11	17	21	26	30	33	40	0.006
QR-06-01	6	11	18	22	27	31	35	43	0.007
QR-06-02	10	18	32	40	51	60	68	84	0.014
QR-06-03	14	23	39	49	62	72	81	100	0.018
QR-07	5	9	18	24	32	38	44	56	0.011
QR-07-01	3	6	12	16	21	24	28	36	0.007
QR-08	18	31	52	66	84	97	110	136	0.024
QR-08-01	7	13	25	33	43	51	59	74	0.013
QR-08-02	8	15	27	34	44	51	59	73	0.012
QR-08-03	25	39	63	78	97	111	125	153	0.029
QR-09	8	14	25	32	42	49	57	71	0.013
QR-09-01	11	22	46	62	82	99	116	148	0.031
QR-10	11	19	31	39	49	56	63	76	0.012
QR-10-01	2	4	8	11	15	18	21	27	0.005
QR-10-02	19	33	60	77	99	116	132	165	0.030
QR-11	26	43	67	82	101	115	129	155	0.024
QR-12	19	31	48	59	73	83	93	112	0.018
QR-12-01	14	22	33	40	49	55	62	74	0.012
QR-13	9	15	25	31	38	44	50	61	0.011
QR-13-01	14	22	35	43	53	61	69	84	0.014
QR-13-02	10	16	25	30	37	42	47	57	0.009
QR-13-03	36	51	72	86	103	115	127	152	0.026
QR-14	13	21	32	40	49	56	63	77	0.013
QR-14-01	10	16	25	31	39	44	50	60	0.010
QR-14-02	10	16	25	31	38	44	50	61	0.011
QR-14-03	10	16	25	31	39	45	51	62	0.012
QR-15	17	26	41	50	61	70	79	96	0.019
QR-15-01	9	15	24	28	35	40	44	53	0.008
QR-15-02	10	15	22	27	34	38	43	52	0.010
QR-15-03	23	35	57	70	88	101	114	141	0.031
QR-15-04	12	21	36	45	57	66	75	92	0.016
QR-16	28	44	66	80	98	110	123	148	0.024
R-LG-01-01-DN	113	180	313	407	503	588	681	862	0.183
R-LG-01-01-S	16	28	51	66	85	100	114	143	0.026
R-LG-01-01-UP	104	165	283	367	449	532	613	771	0.157
R-LG-01-03	86	136	231	294	364	427	489	608	0.122
R-LG-01-04	73	114	186	232	288	334	374	464	0.088
R-LG-01-05	32	50	82	102	127	146	165	202	0.038
R-LG-01-06	16	25	40	49	60	69	77	93	0.016
R-LG-01-DN	555	828	1376	1730	2186	2543	2878	3558	0.864
R-LG-01-UP	486	709	1137	1410	1749	2013	2276	2808	0.643

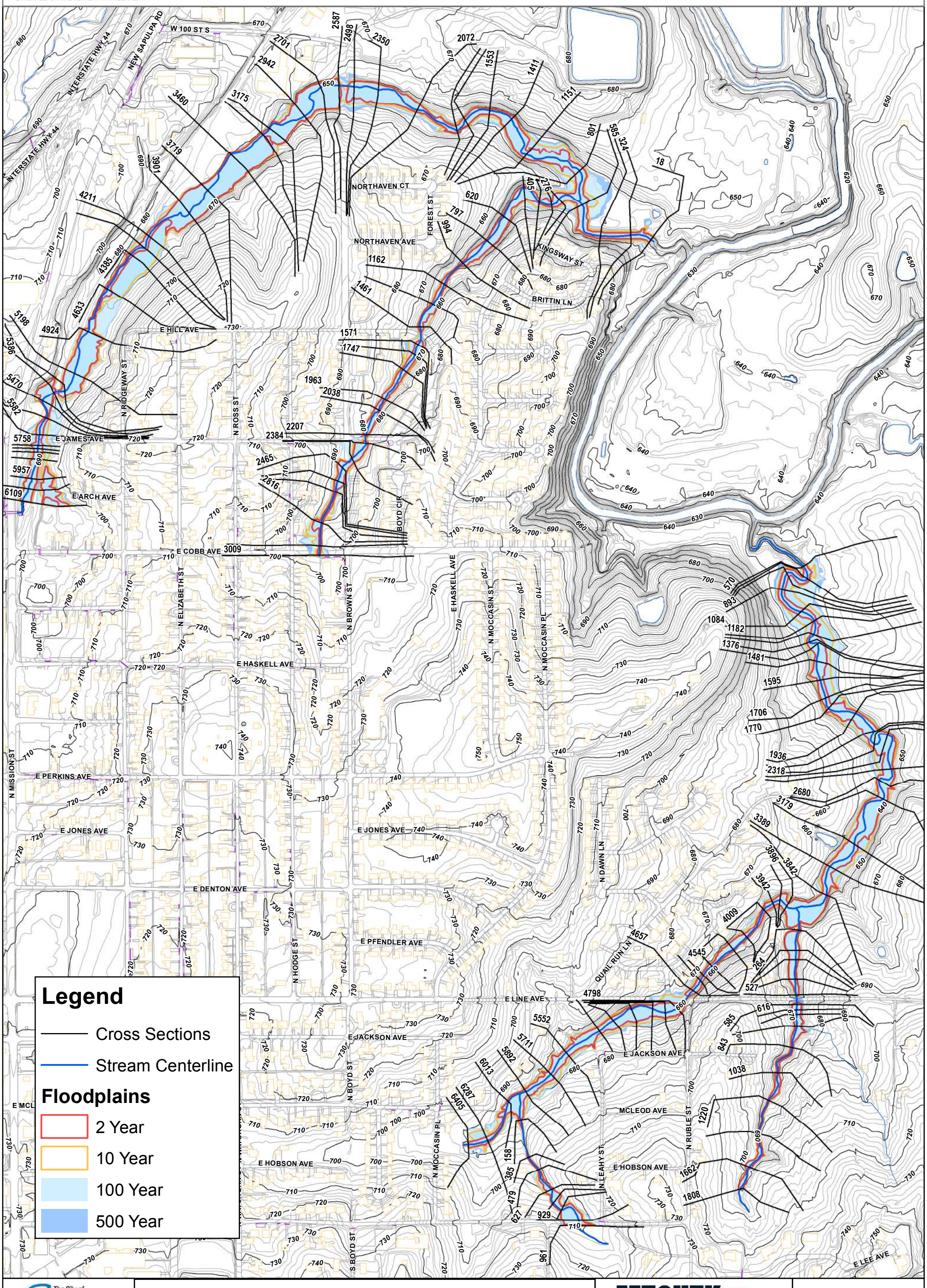
Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
R-LG-02	489	706	1118	1376	1705	1962	2212	2728	0.589
R-LG-03	483	694	1078	1314	1617	1856	2085	2557	0.535
R-LG-05	267	386	604	744	920	1054	1185	1447	0.295
R-LG-05-SW	22	35	53	63	77	87	97	116	0.018
R-LG-06-DN	490	706	1092	1335	1645	1878	2105	2569	0.531
R-LG-06-UP	358	504	773	945	1162	1326	1487	1816	0.382
R-LG-07	38	54	81	98	119	134	150	182	0.036
R-LG-08	24	35	52	63	77	87	97	118	0.023
R-LG-10	76	117	185	228	282	322	362	442	0.083
R-LG-10-DN	87	130	203	250	308	352	395	483	0.092
R-LG-11	67	107	169	209	258	295	332	406	0.075
R-LG-12	55	89	142	176	218	250	281	344	0.063
R-LG-13	6	10	16	20	25	29	33	40	0.006
R-LG-15	45	73	117	145	180	207	233	284	0.049
R-LG-16	37	59	94	115	143	163	183	223	0.038
R-LG-18	35	59	92	112	138	157	176	212	0.032
R-LG-18-01	17	30	47	57	71	80	90	108	0.016
R-LG-19	47	78	120	146	180	205	229	276	0.043
R-LG-20	139	195	291	353	430	488	546	683	0.137
R-LG-20-22	98	134	185	218	260	290	320	383	0.071
R-QR-01	356	551	979	1274	1629	1924	2203	2773	0.692
R-QR-02	356	548	967	1257	1607	1884	2150	2686	0.655
R-QR-03	352	535	931	1201	1524	1778	2022	2523	0.605
R-QR-03-01	5	10	19	25	34	40	46	58	0.011
R-QR-03-UP	353	534	924	1190	1507	1757	1997	2492	0.594
R-QR-04	315	474	805	1026	1293	1500	1704	2129	0.499
R-QR-04-S	38	75	146	189	245	291	332	425	0.089
R-QR-05	37	72	139	180	233	276	315	403	0.082
R-QR-05-01	28	52	93	118	152	180	206	257	0.050
R-QR-05-02	17	29	50	64	81	95	107	134	0.025
R-QR-06	300	452	759	962	1210	1403	1592	1985	0.455
R-QR-06-01	23	38	66	83	106	123	140	173	0.031
R-QR-06-02	14	23	39	49	62	72	81	100	0.018
R-QR-06-DN	313	472	800	1019	1284	1489	1691	2113	0.493
R-QR-06-NW	29	48	82	103	131	152	173	214	0.038
R-QR-07	297	447	745	941	1181	1367	1551	1934	0.437
R-QR-08	259	399	646	808	1012	1167	1324	1653	0.359
R-QR-08-02	25	39	63	78	97	111	125	153	0.029
R-QR-08-DN	289	442	721	907	1137	1314	1492	1862	0.413
R-QR-08-NW	30	47	77	97	121	140	158	195	0.041
R-QR-08-SE	7	13	25	33	43	51	59	74	0.013

Appendix 13-C. North Polecat Systems - Quail Run and Liberty Glass Drainage System Existing Flow Rates (CFS)									
HMS Junction	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year	Drainage Area, mi^2
R-QR-09	11	21	45	60	79	94	108	134	0.031
R-QR-10	231	351	554	682	843	965	1085	1331	0.269
R-QR-10-01	19	33	60	77	99	116	132	165	0.030
R-QR-10-DN	242	370	588	729	905	1038	1170	1445	0.304
R-QR-10-SE	17	31	66	88	113	135	153	189	0.044
R-QR-11	219	331	520	640	790	904	1015	1242	0.244
R-QR-12	198	300	469	575	709	810	910	1112	0.214
R-QR-12-S	14	22	33	40	49	55	62	74	0.012
R-QR-13-01	10	16	25	30	37	42	47	57	0.009
R-QR-13-DN	59	89	131	157	191	216	240	290	0.049
R-QR-13-N	131	199	318	393	488	560	631	774	0.154
R-QR-13-S	24	38	60	73	90	103	115	140	0.023
R-QR-13-W	36	51	72	86	103	115	127	152	0.026
R-QR-14	29	45	72	89	110	127	143	175	0.034
R-QR-14-01	20	31	50	62	77	88	100	122	0.024
R-QR-14-02	10	16	25	31	39	45	51	62	0.012
R-QR-14-W	92	140	222	274	340	390	439	538	0.107
R-QR-15	28	44	66	80	98	110	123	148	0.024
R-QR-15-02	32	48	81	101	127	148	167	208	0.047
R-QR-15-03	12	21	36	45	57	66	75	92	0.016
R-QR-15-N	42	62	102	128	160	185	210	260	0.057
R-QR-15-W	9	15	24	28	35	40	44	53	0.008

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

Feet
0 250 500
N

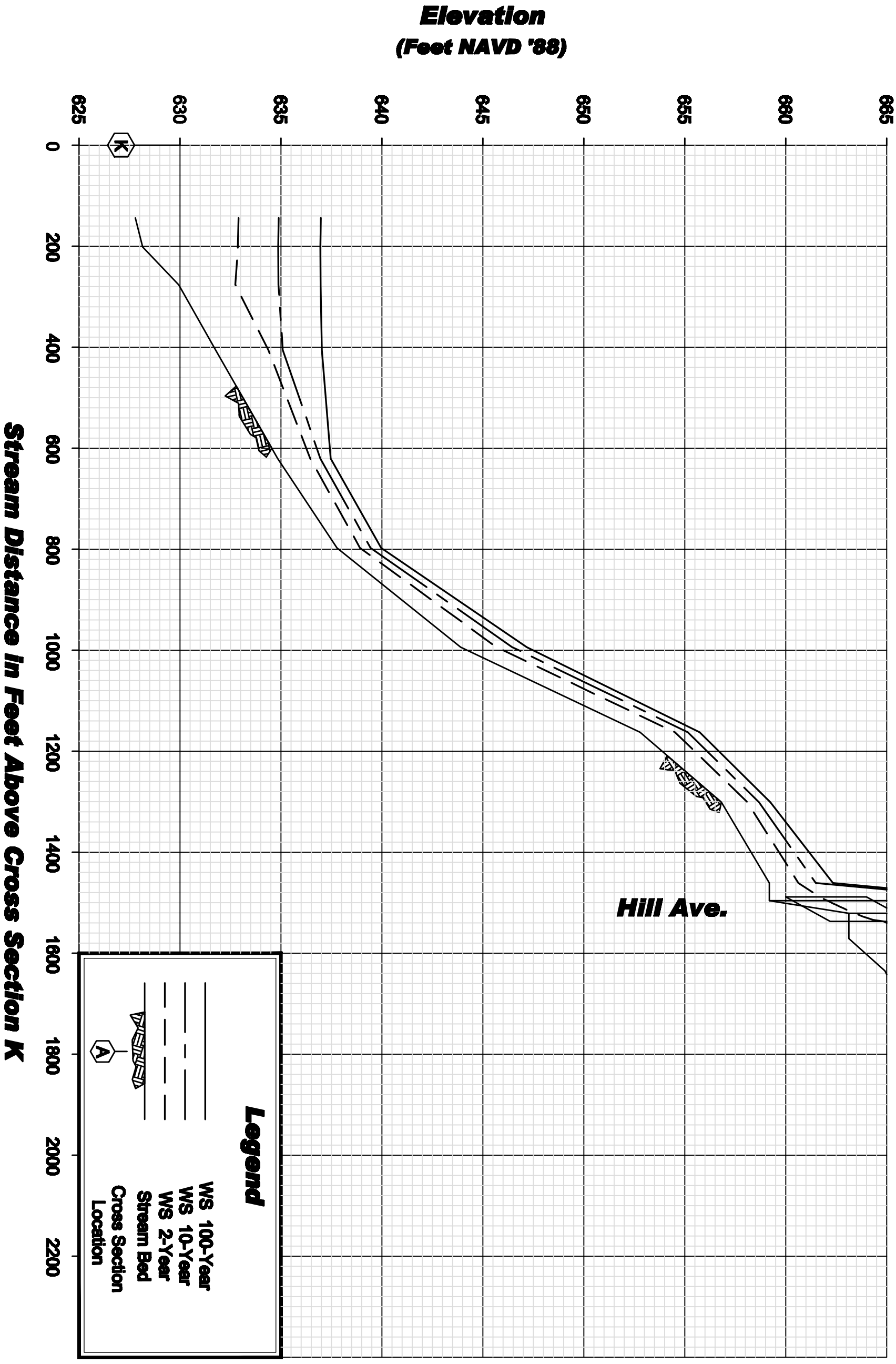


The City of Sapulpa
Oklahoma's Most Connected City

Quail Run & Liberty Glass Drainage Basin Floodplains

MESHEK & ASSOCIATES, PLC
1437 S Boulder Ave, Suite 1080 Tulsa, OK 74119
Ph:(918) 392-5620 www.meshekengr.com

Appendix 13-D



City of Sapulpa, OK

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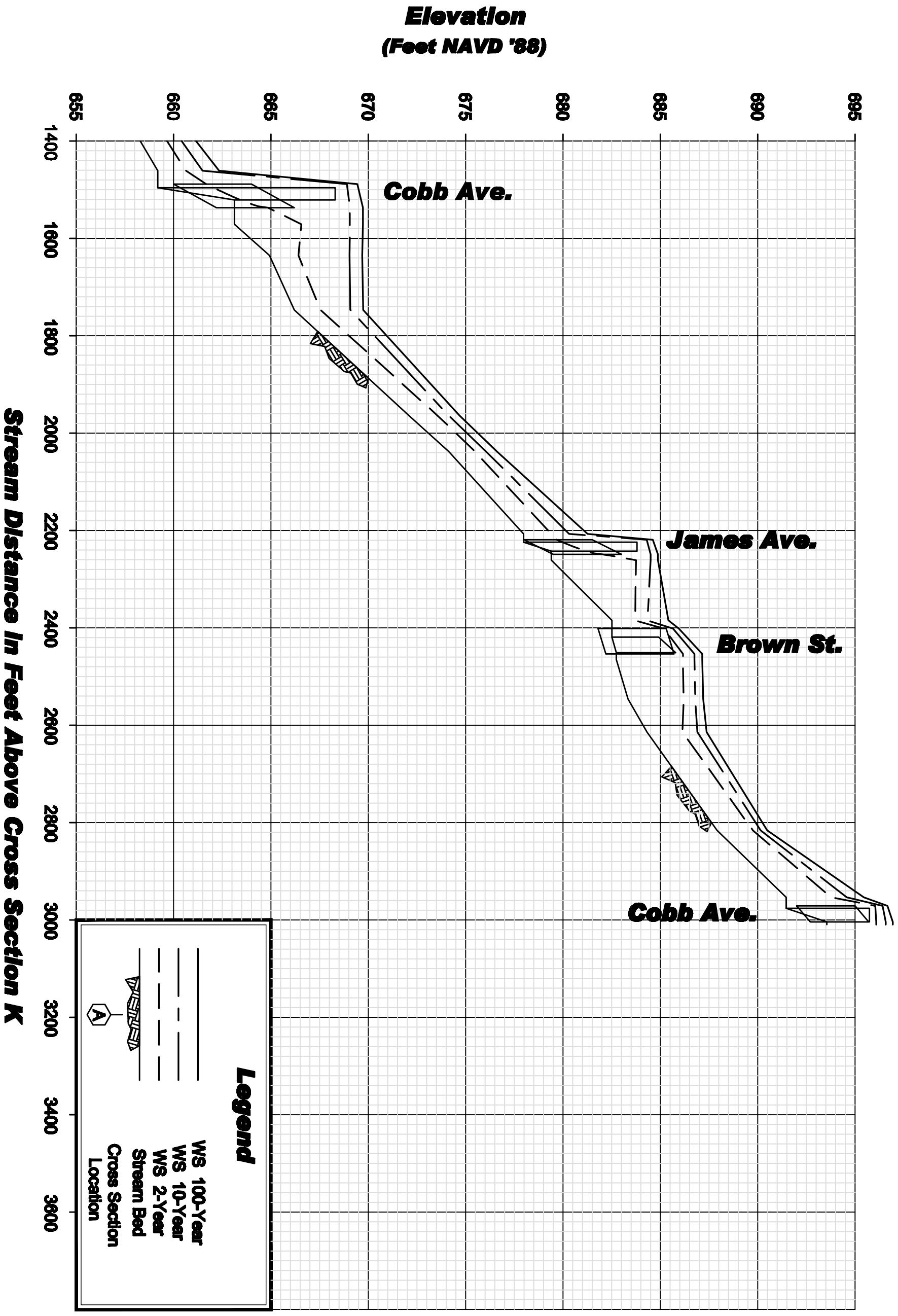
Appendix 13-E-1
Existing Flood Profiles
North Polecat Creek
Liberty Glass Reach 1



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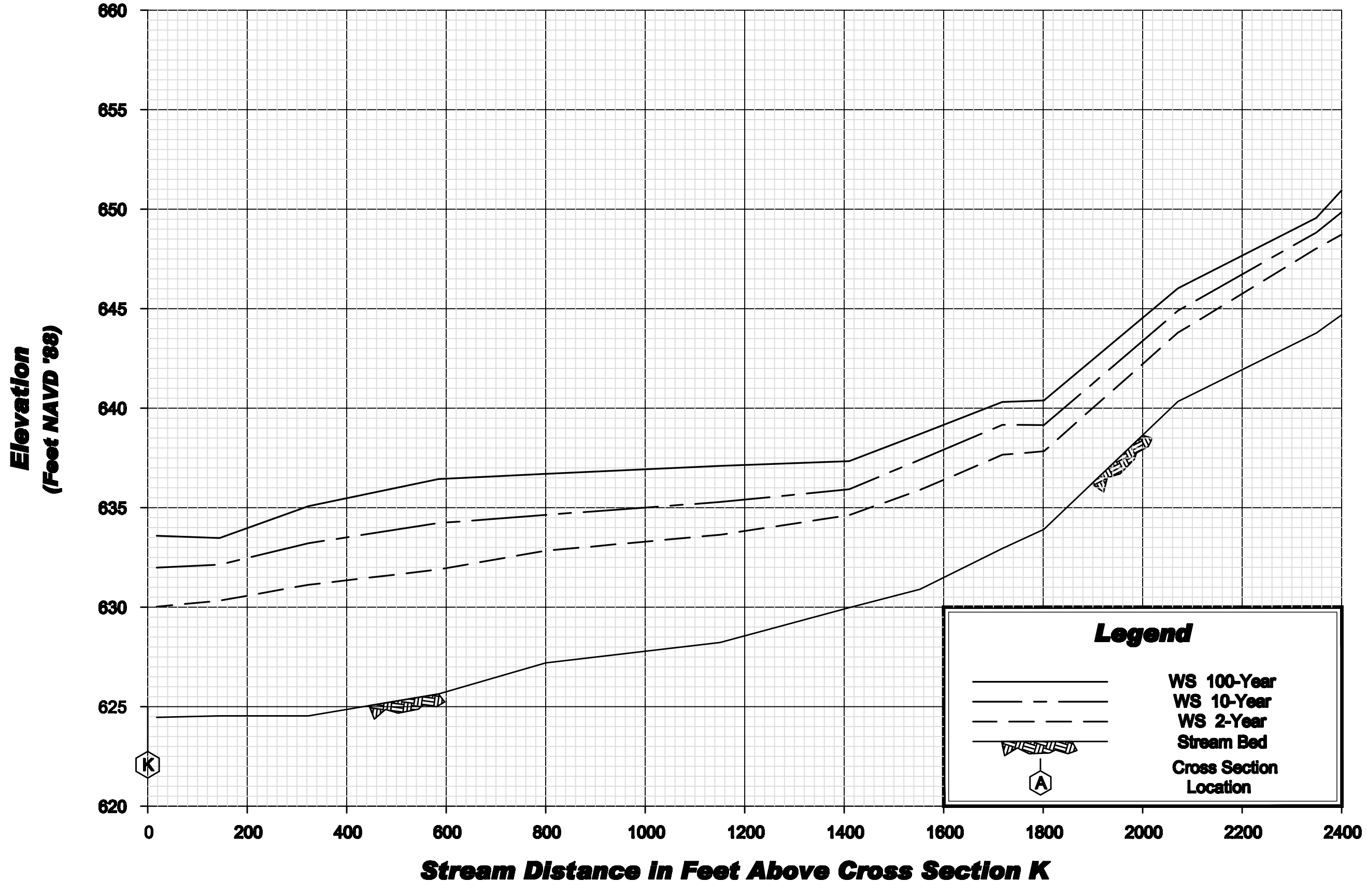
Appendix 13-E-2
Existing Flood Profiles
North Polecat Creek
Liberty Glass Reach 1



Appendix 13-E-3
Existing Flood Profiles
North Polecat Creek
Liberty Glass

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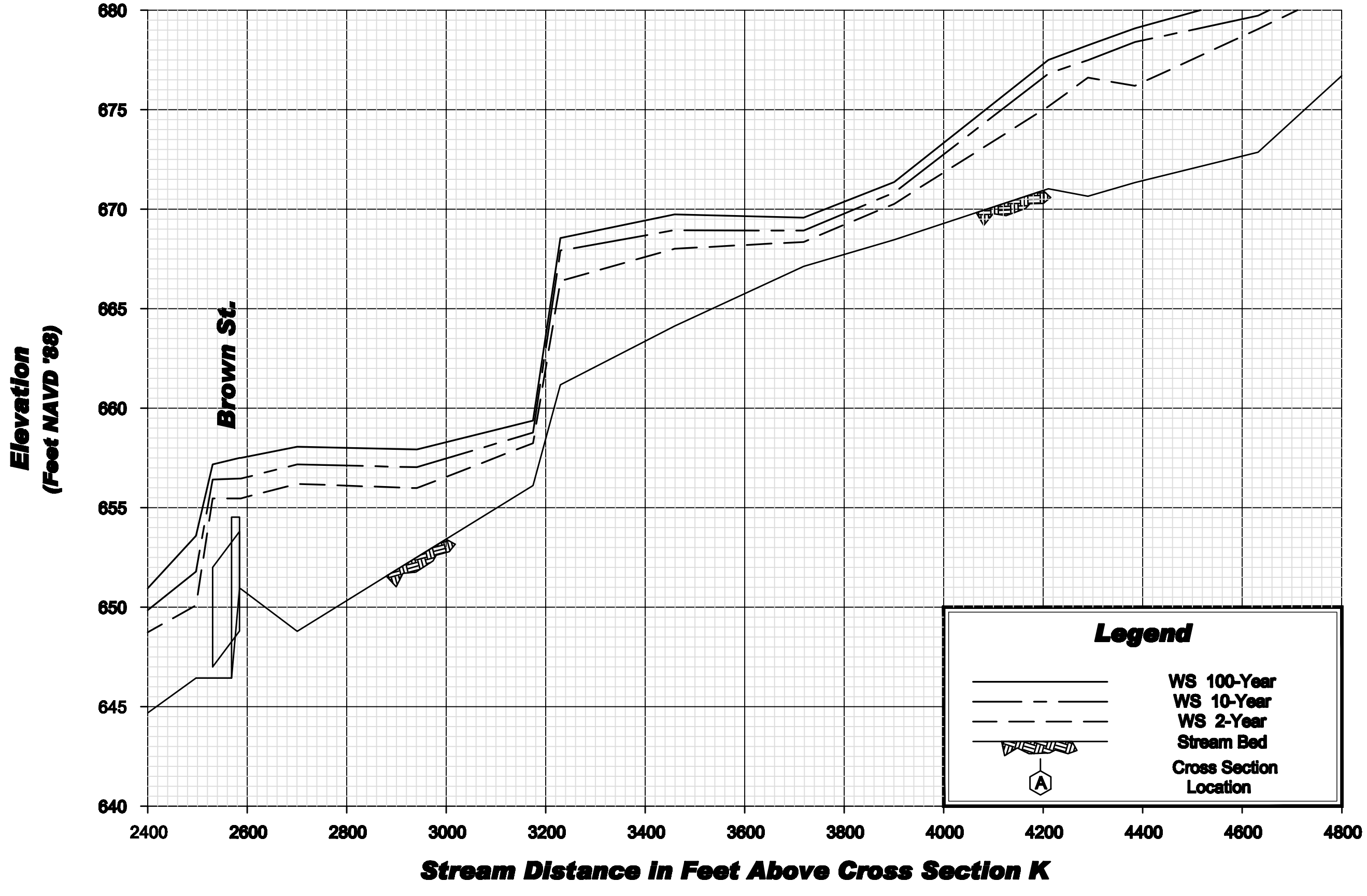

Appendix 13-E-4
Existing Flood Profiles
North Polecat Creek
Liberty Glass

City of Sapulpa, OK

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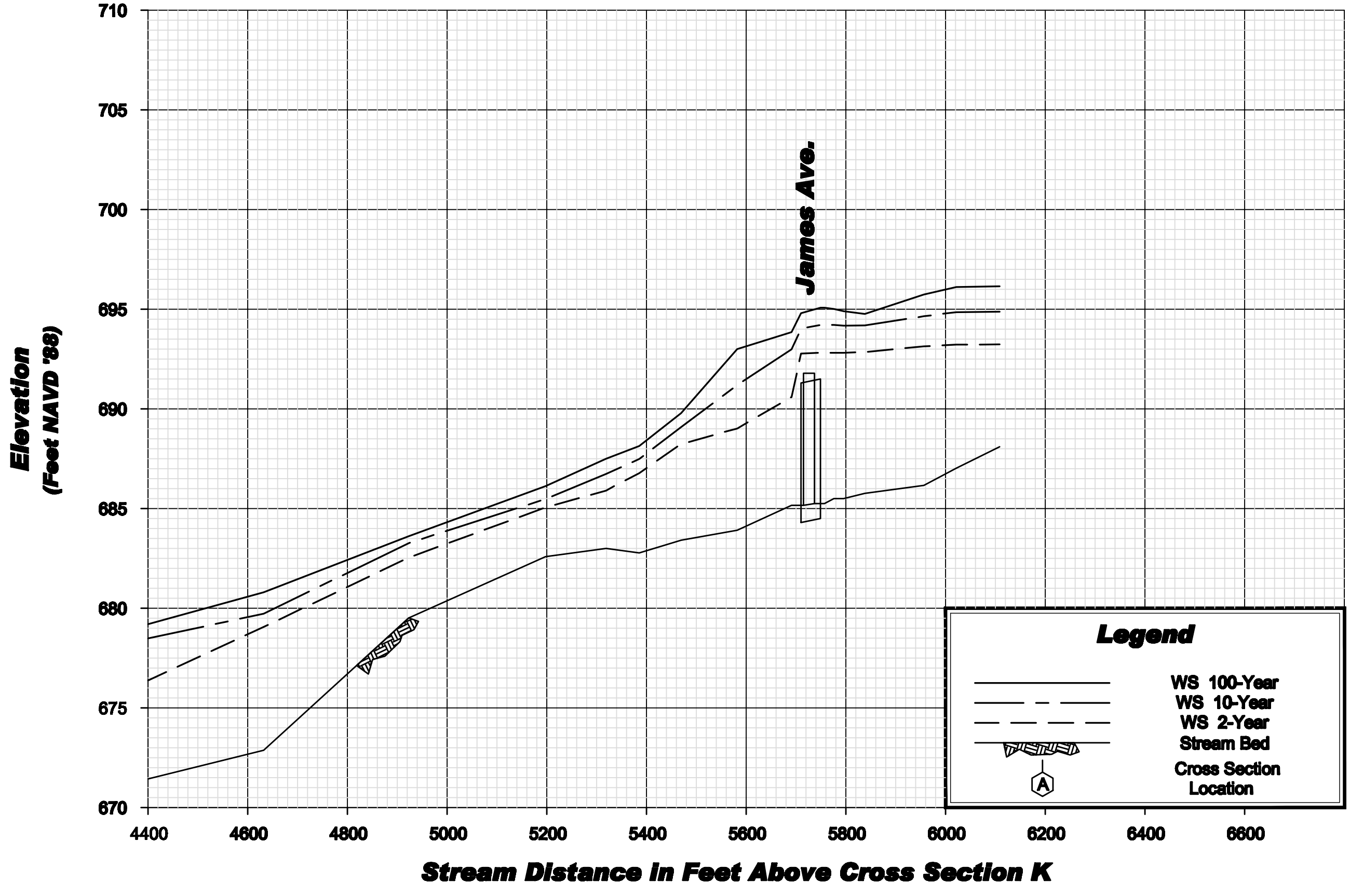

Appendix 13-E-5
Existing Flood Profiles
North Polecat Creek
Liberty Glass

City of Sapulpa, OK

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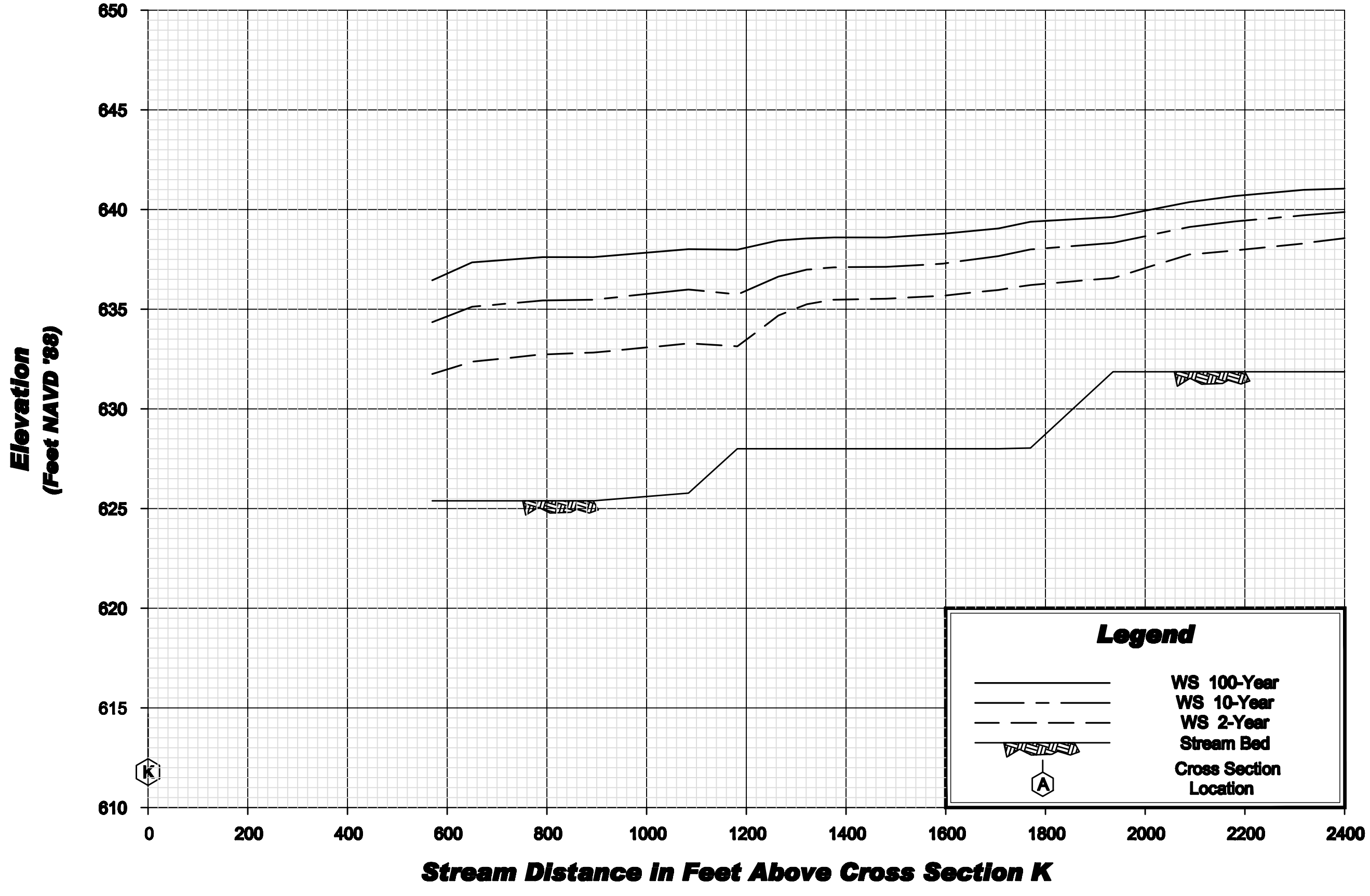

Elevation (Feet NAVD '88)

Stream Distance in Feet Above Cross Section K

Appendix 13-E-6
Existing Flood Profiles
North Polecat Creek
Quail Run

City of Sapulpa, OK

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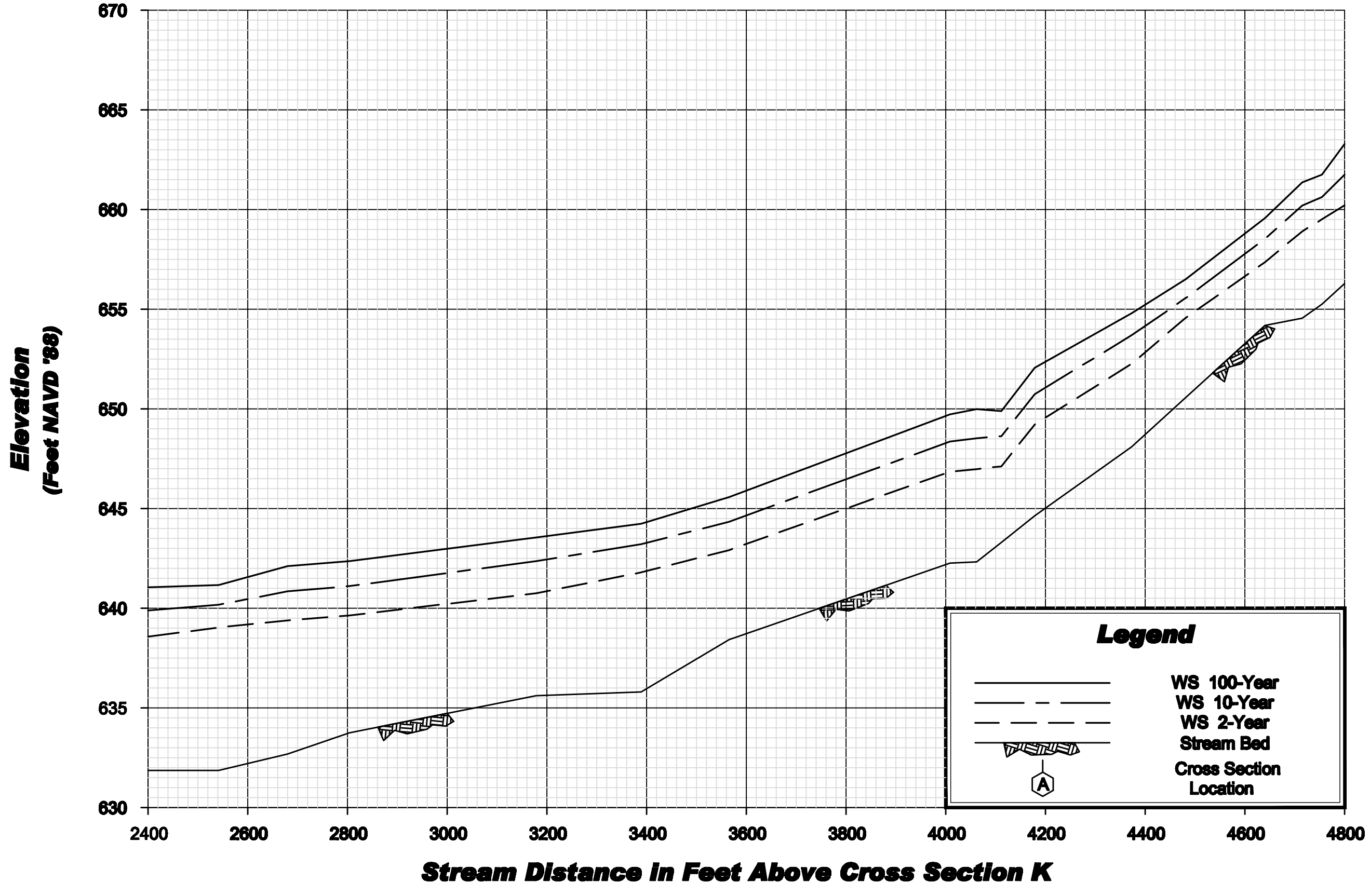

Appendix 13-E-7
Existing Flood Profiles
North Polecat Creek
Quail Run

City of Sapulpa, OK

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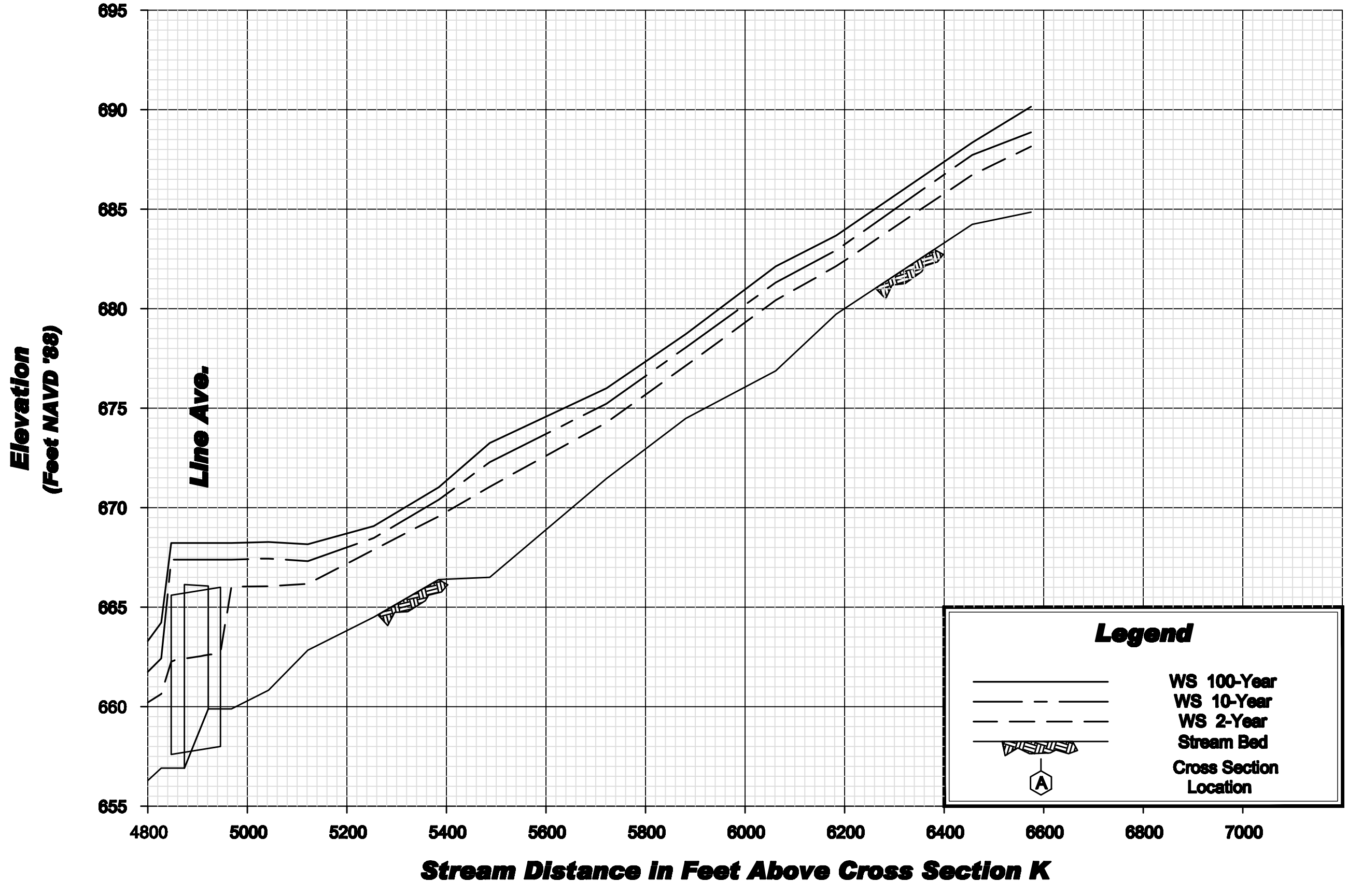

Appendix 13-E-8
Existing Flood Profiles
North Polecat Creek
Quail Run

City of Sapulpa, OK

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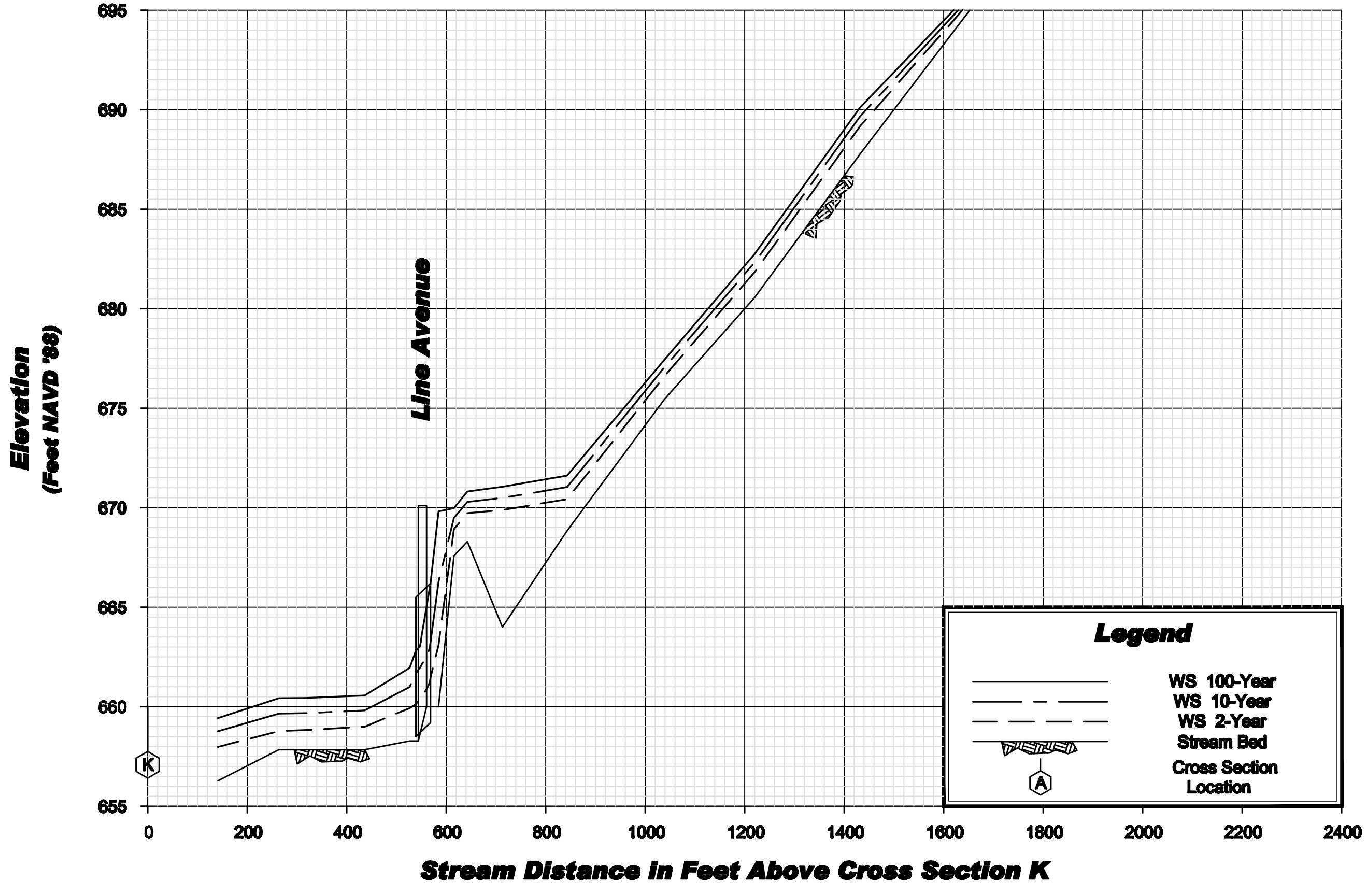

Appendix 13-E-9
Existing Flood Profiles
North Polecat Creek
Qual Run Tributary A

City of Sapulpa, OK

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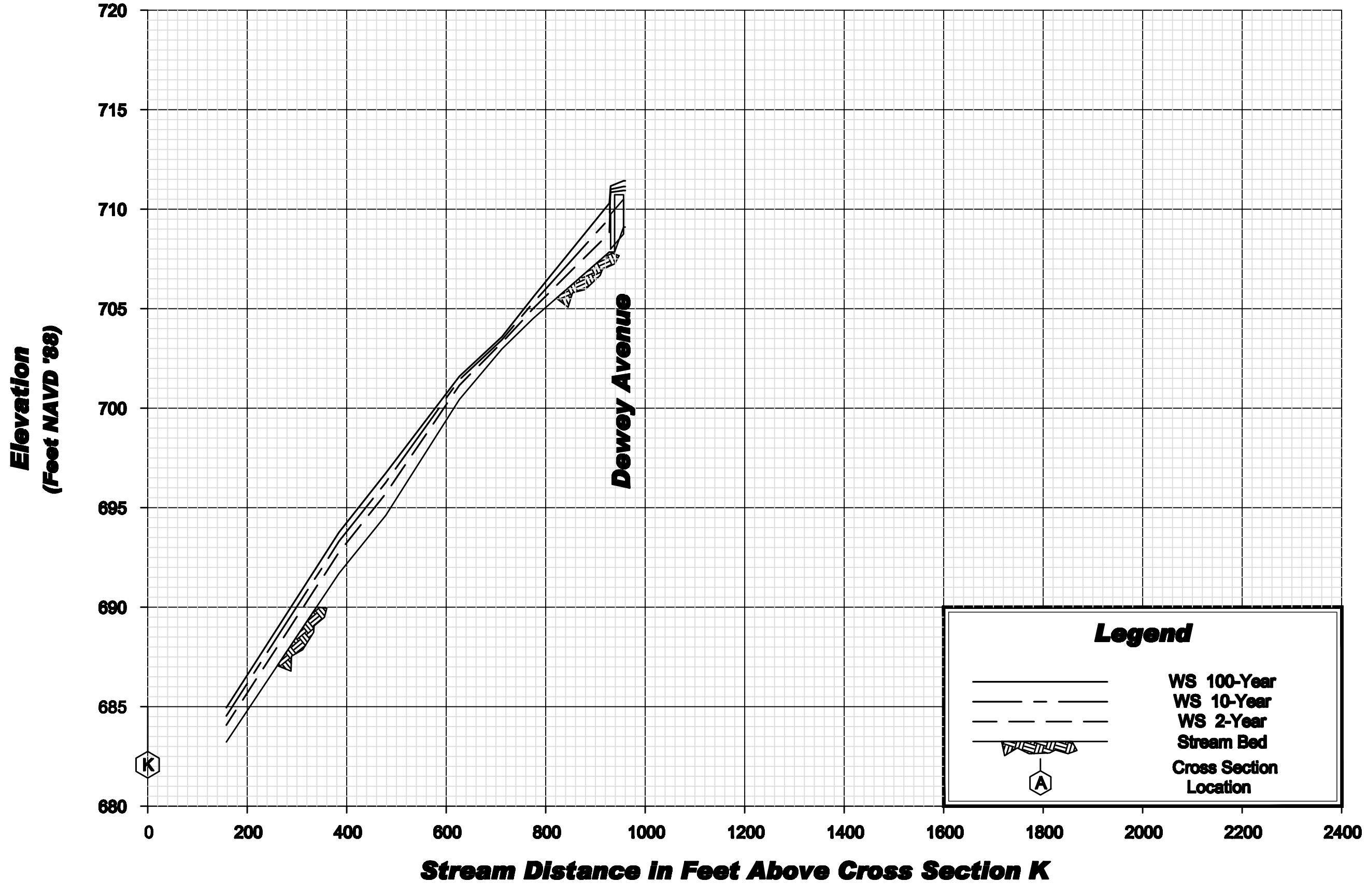

Appendix 13-E-10
Existing Flood Profiles
North Polecat Creek
Qual Run Tributary B

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City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 2 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	23	$ 12.00	$ 275.56
2	**223.06**	**TEMPORARY SILT FENCE**	**LF**	714	$ 2.00	$ 1,428.00
3	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	317	$ 2.50	$ 793.33
4	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	269	$ 50.00	$ 3,466.67
5	**611.06(K)**	**SMD INLET**	**EA**	3	$ 3,500.00	$ 10,500.00
6	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	20	$ 48.00	$ 960.00
7	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	182	$ 70.00	$ 12,740.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	145	$ 8.00	$ 1,163.05
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	76	$ 20.00	$ 1,514.64
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	269	$ 7.00	$ 485.33
11	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 43,051.03**
					15% Contingency	**$ 6,457.65**
					Subtotal	**$ 49,508.68**
					25% Utility Relocation Contingency	**$ 12,377.17**
					Total	***$ 61,885.85***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 2 Alternate 2						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	34	$ 12.00	$ 413.33
2	**223.06**	**TEMPORARY SILT FENCE**	**LF**	714	$ 2.00	$ 1,428.00
3	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	317	$ 2.50	$ 793.33
4	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	269	$ 50.00	$ 3,466.67
5	**611.06(K)**	**SMD INLET**	**EA**	4	$ 3,500.00	$ 14,000.00
6	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	20	$ 48.00	$ 960.00
7	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	182	$ 90.00	$ 16,380.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	165	$ 8.00	$ 1,319.44
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	92	$ 20.00	$ 1,834.96
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	269	$ 7.00	$ 485.33
11	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 50,667.73**
					15% Contingency	**$ 7,600.16**
					Subtotal	**$ 58,267.89**
					25% Utility Relocation Contingency	**$ 14,566.97**
					Total	***$ 72,834.86***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 3 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	440	$ 2.00	$ 880.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	196	$ 2.50	$ 488.89
3	411.06(A)	PAVEMENT REPLACEMENT	SY	293	$ 50.00	$ 14,666.67
4	611.06(A)	6' I.D. MANHOLE W/ FRAME AND LID	EA	1	$ 3,500.00	$ 3,500.00
5	611.06(K)	8'x 4' STEEL INLET	EA	1	$ 5,000.00	$ 5,000.00
6	611.06(K)	SMD INLET	EA	1	$ 3,500.00	$ 3,500.00
7	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	220	$ 48.00	$ 10,560.00
8	613.06(S)	TRENCH EXCAVATION	CY	116	$ 8.00	$ 929.87
9	613.06(T)	STANDARD BEDDING MATERIAL	CY	60	$ 20.00	$ 1,205.60
10	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
11	619.06(B)	PAVEMENT REMOVAL	SY	293	$ 7.00	$ 2,053.33
					Subtotal	**$ 52,784.36**
					15% Contingency	**$ 7,917.65**
					Subtotal	**$ 60,702.01**
					25% Utility Relocation Contingency	**$ 15,175.50**
					Total	***$ 75,877.51***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 3 Alternate 2						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1700	$ 2.00	$ 3,400.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	756	$ 2.50	$ 1,888.89
3	411.06(A)	PAVEMENT REPLACEMENT	SY	1133	$ 50.00	$ 56,666.67
4	611.06(A)	6' I.D. MANHOLE W/ FRAME AND LID	EA	3	$ 3,500.00	$ 10,500.00
5	611.06(K)	SMD INLET	EA	1	$ 3,500.00	$ 3,500.00
6	611.06(K)	4'x4' STEEL INLET	EA	5	$ 3,500.00	$ 17,500.00
7	611.06(K)	8'x4' STEEL INLET	EA	2	$ 5,000.00	$ 10,000.00
8	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	50	$ 48.00	$ 2,400.00
9	613.06(B)	36" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	800	$ 120.00	$ 96,000.00
10	613.06(S)	TRENCH EXCAVATION	CY	1123	$ 8.00	$ 8,986.44
11	613.06(T)	STANDARD BEDDING MATERIAL	CY	615	$ 20.00	$ 12,290.00
12	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
13	619.06(B)	PAVEMENT REMOVAL	SY	1133	$ 7.00	$ 7,933.33
					Subtotal	**$ 241,065.33**
					15% Contingency	**$ 36,159.80**
					Subtotal	**$ 277,225.13**
					25% Utility Relocation Contingency	**$ 69,306.28**
					Total	***$ 346,531.42***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Areas 4 & 5 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1518	$ 2.00	$ 3,036.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	675	$ 2.50	$ 1,686.67
3	411.06(A)	PAVEMENT REPLACEMENT	SY	1012	$ 50.00	$ 50,600.00
4	611.06(A)	6' I.D. MANHOLE W/ FRAME AND LID	EA	1	$ 3,500.00	$ 3,500.00
5	611.06(K)	4'x4' STEEL INLET	EA	5	$ 3,500.00	$ 17,500.00
6	611.06(K)	8'x4' STEEL INLET	EA	1	$ 5,000.00	$ 5,000.00
7	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	80	$ 48.00	$ 3,840.00
8	613.06(B)	24" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	510	$ 70.00	$ 35,700.00
9	613.06(B)	30" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	169	$ 90.00	$ 15,210.00
10	613.06(S)	TRENCH EXCAVATION	CY	578	$ 8.00	$ 4,621.72
11	613.06(T)	STANDARD BEDDING MATERIAL	CY	299	$ 20.00	$ 5,977.72
12	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
13	619.06(B)	PAVEMENT REMOVAL	SY	1012	$ 7.00	$ 7,084.00
					Subtotal	**$ 163,756.11**
					15% Contingency	**$ 24,563.42**
					Subtotal	**$ 188,319.52**
					25% Utility Relocation Contingency	**$ 47,079.88**
					Total	***$ 235,399.41***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Areas 4 & 5 Alternate 2						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1518	$ 2.00	$ 3,036.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	675	$ 2.50	$ 1,686.67
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1012	$ 50.00	$ 50,600.00
4	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	1	$ 3,500.00	$ 3,500.00
5	**611.06(K)**	**4'x4' STEEL INLET**	**EA**	4	$ 3,500.00	$ 14,000.00
6	**611.06(K)**	**8'x4' STEEL INLET**	**EA**	2	$ 5,000.00	$ 10,000.00
7	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	55	$ 48.00	$ 2,640.00
8	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	107	$ 70.00	$ 7,490.00
9	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	428	$ 90.00	$ 38,520.00
10	**613.06(B)**	**36" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	169	$ 120.00	$ 20,280.00
11	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	546	$ 8.00	$ 4,369.96
12	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	386	$ 20.00	$ 7,723.26
13	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
14	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1012	$ 7.00	$ 7,084.00
					Subtotal	**$ 180,929.89**
					15% Contingency	**$ 27,139.48**
					Subtotal	**$ 208,069.37**
					25% Utility Relocation Contingency	**$ 52,017.34**
					Total	***$ 260,086.72***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 6 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1456	$ 2.00	$ 2,912.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	647	$ 2.50	$ 1,617.78
3	411.06(A)	PAVEMENT REPLACEMENT	SY	1353	$ 50.00	$ 67,666.67
4	609 (B)	COMBINED CURB & GUTTER (6" BARRIER)	LF	1160	$ 27.00	$ 31,320.00
5	611.06(K)	4'x4' STEEL INLET	EA	6	$ 3,500.00	$ 21,000.00
6	613.06(B)	12" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	408	$ 30.00	$ 12,240.00
7	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	320	$ 48.00	$ 15,360.00
8	613.06(S)	TRENCH EXCAVATION	CY	350	$ 8.00	$ 2,803.20
9	613.06(T)	STANDARD BEDDING MATERIAL	CY	190	$ 20.00	$ 3,793.60
10	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
11	619.06(B)	PAVEMENT REMOVAL	SY	1353	$ 7.00	$ 9,473.33
					Subtotal	**$ 178,186.58**
					15% Contingency	**$ 26,727.99**
					Subtotal	**$ 204,914.56**
					25% Utility Relocation Contingency	**$ 51,228.64**
					Total	***$ 256,143.21***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 6 Alternate 2						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1596	$ 2.00	$ 3,192.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	363	$ 2.50	$ 906.67
3	411.06(A)	PAVEMENT REPLACEMENT	SY	1353	$ 50.00	$ 67,666.67
4	609 (B)	COMBINED CURB & GUTTER (6" BARRIER)	LF	1160	$ 27.00	$ 31,320.00
5	611.06(K)	4'x4' STEEL INLET	EA	8	$ 3,500.00	$ 28,000.00
6	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	183	$ 48.00	$ 8,784.00
7	613.06(B)	24" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	225	$ 70.00	$ 15,750.00
8	613.06(B)	30" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	390	$ 90.00	$ 35,100.00
9	613.06(S)	TRENCH EXCAVATION	CY	627	$ 8.00	$ 5,017.66
10	613.06(T)	STANDARD BEDDING MATERIAL	CY	322	$ 20.00	$ 6,437.04
11	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
12	619.06(B)	PAVEMENT REMOVAL	SY	1353	$ 7.00	$ 9,473.33
					Subtotal	**$ 221,647.36**
					15% Contingency	**$ 33,247.10**
					Subtotal	**$ 254,894.47**
					25% Utility Relocation Contingency	**$ 63,723.62**
					Total	***$ 318,618.09***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Areas 7 & 8 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1550	$ 2.00	$ 3,100.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	689	$ 2.50	$ 1,722.22
3	411.06(A)	PAVEMENT REPLACEMENT	SY	35	$ 50.00	$ 3,466.67
4	509.06(E)	CLASS C CONCRETE	CY	41	$ 300.00	$ 12,230.40
5	611.06(K)	SMD INLET	EA	2	$ 3,500.00	$ 7,000.00
6	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	40	$ 48.00	$ 1,920.00
7	613.06(B)	24" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	415	$ 70.00	$ 29,050.00
8	613.06(S)	TRENCH EXCAVATION	CY	329	$ 8.00	$ 2,628.33
9	613.06(T)	STANDARD BEDDING MATERIAL	CY	171	$ 20.00	$ 3,423.00
10	619.06(B)	PAVEMENT REMOVAL	SY	35	$ 7.00	$ 485.33
11	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 75,025.95**
					15% Contingency	**$ 11,253.89**
					Subtotal	**$ 86,279.84**
					25% Utility Relocation Contingency	**$ 21,569.96**
					Total	***$ 107,849.80***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Areas 7 & 8 Alternate 2						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1550	$ 2.00	$ 3,100.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	689	$ 2.50	$ 1,722.22
3	411.06(A)	PAVEMENT REPLACEMENT	SY	35	$ 50.00	$ 3,466.67
4	509.06(E)	CLASS C CONCRETE	CY	41	$ 300.00	$ 12,230.40
5	611.06(K)	SMD INLET	EA	2	$ 3,500.00	$ 7,000.00
6	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	40	$ 48.00	$ 1,920.00
7	613.06(B)	30" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	415	$ 90.00	$ 37,350.00
8	613.06(S)	TRENCH EXCAVATION	CY	408	$ 8.00	$ 3,266.50
9	613.06(T)	STANDARD BEDDING MATERIAL	CY	208	$ 20.00	$ 4,153.40
10	619.06(B)	PAVEMENT REMOVAL	SY	35	$ 7.00	$ 485.33
11	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 84,694.53**
					15% Contingency	**$ 12,704.18**
					Subtotal	**$ 97,398.70**
					25% Utility Relocation Contingency	**$ 24,349.68**
					Total	***$ 121,748.38***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 9 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1060	$ 2.00	$ 2,120.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	471	$ 2.50	$ 1,177.78
3	411.06(A)	PAVEMENT REPLACEMENT	SY	333	$ 50.00	$ 16,666.67
4	509.06(E)	CLASS C CONCRETE	CY	36	$ 300.00	$ 10,862.70
5	611.06(K)	SMD INLET	EA	2	$ 3,500.00	$ 7,000.00
6	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	250	$ 48.00	$ 12,000.00
7	613.06(S)	TRENCH EXCAVATION	CY	132	$ 8.00	$ 1,056.67
8	613.06(T)	STANDARD BEDDING MATERIAL	CY	69	$ 20.00	$ 1,370.00
9	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
10	619.06(B)	PAVEMENT REMOVAL	SY	333	$ 7.00	$ 2,333.33
					Subtotal	**$ 64,587.14**
					15% Contingency	**$ 9,688.07**
					Subtotal	**$ 74,275.22**
					25% Utility Relocation Contingency	**$ 18,568.80**
					Total	***$ 92,844.02***

City of Sapulpa						
Appendix 13-F. Quail Run Drainage Basin - Problem Area 10 Alternate 2						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1100	$ 2.00	$ 2,200.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	489	$ 2.50	$ 1,222.22
3	411.06(A)	PAVEMENT REPLACEMENT	SY	520	$ 50.00	$ 26,000.00
4	611.06(A)	6' I.D. MANHOLE W/ FRAME AND LID	EA	1	$ 3,500.00	$ 3,500.00
5	611.06(K)	8'x4' STEEL INLET	EA	1	$ 5,000.00	$ 5,000.00
6	611.06(K)	SMD INLET	EA	1	$ 3,500.00	$ 3,500.00
7	613.06(B)	18" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	550	$ 48.00	$ 26,400.00
8	613.06(S)	TRENCH EXCAVATION	CY	291	$ 8.00	$ 2,324.67
9	613.06(T)	STANDARD BEDDING MATERIAL	CY	151	$ 20.00	$ 3,014.00
10	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 10,000.00	$ 10,000.00
11	619.06(B)	PAVEMENT REMOVAL	SY	520	$ 7.00	$ 3,640.00
					Subtotal	**$ 86,800.89**
					15% Contingency	**$ 13,020.13**
					Subtotal	**$ 99,821.02**
					25% Utility Relocation Contingency	**$ 24,955.26**
					Total	***$ 124,776.28***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 16 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	148	$ 12.00	$ 1,777.78
2	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1350	$ 2.00	$ 2,700.00
3	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	600	$ 2.50	$ 1,500.00
4	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	60	$ 50.00	$ 3,466.67
5	**509.06(E)**	**CLASS C CONCRETE**	**CY**	82	$ 300.00	$ 24,454.50
6	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	45	$ 48.00	$ 2,160.00
7	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	24	$ 8.00	$ 190.20
8	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	12	$ 20.00	$ 246.60
9	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	60	$ 7.00	$ 485.33
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 46,981.08**
					15% Contingency	**$ 7,047.16**
					Subtotal	**$ 54,028.24**
					25% Utility Relocation Contingency	**$ 13,507.06**
					Total	***$ 67,535.30***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 17 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	900	$ 2.00	$ 1,800.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	400	$ 2.50	$ 1,000.00
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	107	$ 50.00	$ 3,466.67
4	**509.06(E)**	**CLASS C CONCRETE**	**CY**	20	$ 300.00	$ 5,864.52
5	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	80	$ 48.00	$ 3,840.00
6	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	42	$ 8.00	$ 338.13
7	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	22	$ 20.00	$ 438.40
8	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	107	$ 7.00	$ 485.33
9	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 27,233.05**
					15% Contingency	**$ 4,084.96**
					Subtotal	**$ 31,318.01**
					25% Utility Relocation Contingency	**$ 7,829.50**
					Total	***$ 39,147.51***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 18 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	645	$ 12.00	$ 7,744.00
2	**202.06(C)**	**UNCLASSIFIED BORROW**	**CY**	465	$ 12.00	$ 5,580.00
3	**223.06**	**TEMPORARY SILT FENCE**	**LF**	840	$ 2.00	$ 1,680.00
4	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	1294	$ 2.50	$ 3,235.56
5	**232(B)**	**HYDROMULCH SEEDING**	**AC**	0.17	$ 700.00	$ 119.00
6	**509.06(E)**	**CLASS C CONCRETE**	**CY**	130	$ 300.00	$ 39,040.02
7	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	50	$ 48.00	$ 2,400.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	26	$ 8.00	$ 211.33
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	14	$ 20.00	$ 274.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
					Subtotal	**$ 70,283.91**
					15% Contingency	**$ 10,542.59**
					Subtotal	**$ 80,826.50**
					25% Utility Relocation Contingency	**$ 20,206.62**
					Total	***$ 101,033.12***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 19 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	202.06(A)	UNCLASSIFIED EXCAVATION	CY	1410	$ 12.00	$ 16,920.44
2	223.06	TEMPORARY SILT FENCE	LF	4208	$ 2.00	$ 8,416.00
3	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	1988	$ 2.50	$ 4,971.11
4	411.06(A)	PAVEMENT REPLACEMENT	SY	474	$ 50.00	$ 3,466.67
5	509.06(E)	CLASS C CONCRETE	CY	80	$ 300.00	$ 24,072.30
6	611.06(K)	SMD INLET	EA	5	$ 3,500.00	$ 17,500.00
7	613.06(B)	30" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	656	$ 90.00	$ 59,040.00
8	613.06(B)	36" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	660	$ 120.00	$ 79,200.00
9	613.06(X)	6'x5' C850 REINFORCED CONCRETE BOX	LF	100	$ 615.00	$ 61,500.00
10	613.06(X)	8'x4' C850 REINFORCED CONCRETE BOX	LF	60	$ 810.00	$ 48,600.00
11	613.06(X)	9'x3.5' C850 REINFORCED CONCRETE BOX	LF	106	$ 920.00	$ 97,520.00
12	613.06(X)	12'x3' C850 REINFORCED CONCRETE BOX	LF	35	$ 1,200.00	$ 42,000.00
13	613.06(S)	TRENCH EXCAVATION	CY	1517	$ 8.00	$ 12,135.66
14	613.06(T)	STANDARD BEDDING MATERIAL	CY	807	$ 20.00	$ 16,132.08
15	619.06(B)	PAVEMENT REMOVAL	SY	474	$ 7.00	$ 485.33
16	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 50,000.00	$ 50,000.00
					Subtotal	**$ 541,959.59**
					15% Contingency	**$ 81,293.94**
					Subtotal	**$ 623,253.53**
					25% Utility Relocation Contingency	**$ 155,813.38**
					Total	***$ 779,066.91***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 19 Alternate 2						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	1410	$ 12.00	$ 16,920.44
2	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1576	$ 2.00	$ 3,152.00
3	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	819	$ 2.50	$ 2,046.67
4	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	474	$ 50.00	$ 3,466.67
5	**509.06(E)**	**CLASS C CONCRETE**	**CY**	349	$ 300.00	$ 104,738.97
6	**613.06(X)**	**6'x5' C850 REINFORCED CONCRETE BOX**	**LF**	100	$ 615.00	$ 61,500.00
7	**613.06(X)**	**8'x4' C850 REINFORCED CONCRETE BOX**	**LF**	60	$ 810.00	$ 48,600.00
8	**613.06(X)**	**9'x3.5' C850 REINFORCED CONCRETE BOX**	**LF**	106	$ 920.00	$ 97,520.00
9	**613.06(X)**	**12'x3' C850 REINFORCED CONCRETE BOX**	**LF**	35	$ 1,200.00	$ 42,000.00
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	474	$ 7.00	$ 485.33
11	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 50,000.00	$ 50,000.00
					Subtotal	**$ 430,430.08**
					15% Contingency	**$ 64,564.51**
					Subtotal	**$ 494,994.59**
					25% Utility Relocation Contingency	**$ 123,748.65**
					Total	***$ 618,743.24***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 19 Alternate 3						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	202.06(A)	UNCLASSIFIED EXCAVATION	CY	3912	$ 12.00	$ 46,940.44
2	223.06	TEMPORARY SILT FENCE	LF	4208	$ 2.00	$ 8,416.00
3	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	2020	$ 2.50	$ 5,048.89
4	411.06(A)	PAVEMENT REPLACEMENT	SY	559	$ 50.00	$ 3,466.67
5	509.06(E)	CLASS C CONCRETE	CY	80	$ 300.00	$ 24,072.30
6	611.06(K)	SMD INLET	EA	6	$ 3,500.00	$ 21,000.00
7	613.06(B)	36" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	656	$ 120.00	$ 78,720.00
8	613.06(B)	4'x3' C850 REINFORCED CONCRETE BOX	LF	660	$ 210.00	$ 138,600.00
9	613.06(X)	10'x4' C850 REINFORCED CONCRETE BOX	LF	100	$ 1,050.00	$ 105,000.00
10	613.06(X)	12'x4' C850 REINFORCED CONCRETE BOX	LF	60	$ 1,320.00	$ 79,200.00
11	613.06(X)	14'x3.5' C850 REINFORCED CONCRETE BOX	LF	106	$ 1,400.00	$ 148,400.00
12	613.06(X)	10'x3' C850 REINFORCED CONCRETE BOX	LF	70	$ 1,040.00	$ 72,800.00
13	613.06(S)	TRENCH EXCAVATION	CY	899	$ 8.00	$ 7,195.59
14	613.06(T)	STANDARD BEDDING MATERIAL	CY	493	$ 20.00	$ 9,853.12
15	619.06(B)	PAVEMENT REMOVAL	SY	559	$ 7.00	$ 485.33
16	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 50,000.00	$ 50,000.00
					Subtotal	**$ 799,198.34**
					15% Contingency	**$ 119,879.75**
					Subtotal	**$ 919,078.10**
					25% Utility Relocation Contingency	**$ 229,769.52**
					Total	***$ 1,148,847.62***

City of Sapulpa						
Appendix 13-F. Liberty Glass Drainage Basin - Problem Area 19 Alternate 3						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**202.06(A)**	**UNCLASSIFIED EXCAVATION**	**CY**	1858	$ 12.00	$ 22,300.44
2	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1576	$ 2.00	$ 3,152.00
3	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	850	$ 2.50	$ 2,124.44
4	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	559	$ 50.00	$ 3,466.67
5	**509.06(E)**	**CLASS C CONCRETE**	**CY**	383	$ 300.00	$ 115,005.63
6	**613.06(X)**	**10'x4' C850 REINFORCED CONCRETE BOX**	**LF**	100	$ 1,050.00	$ 105,000.00
7	**613.06(X)**	**12'x4' C850 REINFORCED CONCRETE BOX**	**LF**	60	$ 1,320.00	$ 79,200.00
8	**613.06(X)**	**14'x3.5' C850 REINFORCED CONCRETE BOX**	**LF**	106	$ 1,400.00	$ 148,400.00
9	**613.06(X)**	**10'x3' C850 REINFORCED CONCRETE BOX**	**LF**	70	$ 1,040.00	$ 72,800.00
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	559	$ 7.00	$ 485.33
11	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 50,000.00	$ 50,000.00
					Subtotal	**$ 601,934.52**
					15% Contingency	**$ 90,290.18**
					Subtotal	**$ 692,224.70**
					25% Utility Relocation Contingency	**$ 173,056.18**
					Total	***$ 865,280.88***