INDEPENDENCE DRAINAGE SYSTEM

SAPULPA CITYWIDE MASTER DRAINAGE PLAN

JUNE 2010

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CIVIL & WATER RESOURCE ENGINEERING
GEOGRAPHIC INFORMATION SYSTEMS

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SECTION 3. INDEPENDENCE DRAINAGE SYSTEM

3.1. EXISTING CONDITIONS HYDROLOGY

The Independence Drainage System, which includes other small basins in the immediate area, is shown in **FIGURE 3-1**. These small basins include the Cedar-Mound Drainage Area (CED-MND), the North Hickory Street Drainage Area (HCK), the Muskogee Street Drainage Area (MUS) and the Grove Street Drainage Area (GRV). Although studies showed that these basins do not drain into the Independence System, their size and proximity to the Independence Drainage System lent the drainage areas to being modeled together in the hydrologic analysis. In addition, like the Independence System Drainage Basins, these small basins all drain into Rock Creek.

In addition to the inclusion of the smaller basins, the Independence System also includes modeling of the Downtown Drainage Basin. This basin will be discussed later in detail in **SECTION 4**.

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

Subbasins for the Independence Drainage System will be detailed as a part of the studied storm sewer system in **FIGURE 3-4**.

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 3-1** with more detailed data in **APPENDIX 3-A**.

The Independence Drainage System was modeled along with the Downtown Drainage Basin using HEC-HMS. The HEC-HMS schematic used to develop the flow rates for the Independence Drainage System is located in **APPENDIX 3-B**, and a complete list of the flow rates for the existing conditions is available in **APPENDIX 3-C**. **TABLE 3-2** shows the resulting flow rates at major junctions in the Independence Drainage System.

3.2. EXISTING CONDITIONS HYDRAULICS

FIGURE 3-4 shows the storm sewer systems studied in the Independence Drainage System. A StormCAD model was used to analyze the flow through the storm sewer system. The pipe capacities from the StormCAD model were compared with the 1 – 500% HMS flow rates to determine the existing capacities of each pipe in the system. The storm sewer capacities are shown in **FIGURE 3-5**.

As can be seen, only the storm sewers on W. Taft Avenue at S. Independence Street are sized adequately to carry the projected stormwater during a large event. In general, the remaining storm sewers carry less than a 100% annual chance storm frequency although a few are sized for a 10% annual chance storm. Tables with flow rates and capacities are included in **APPENDIX 3-C.**

City of Sapulpa Master Drainage Plan

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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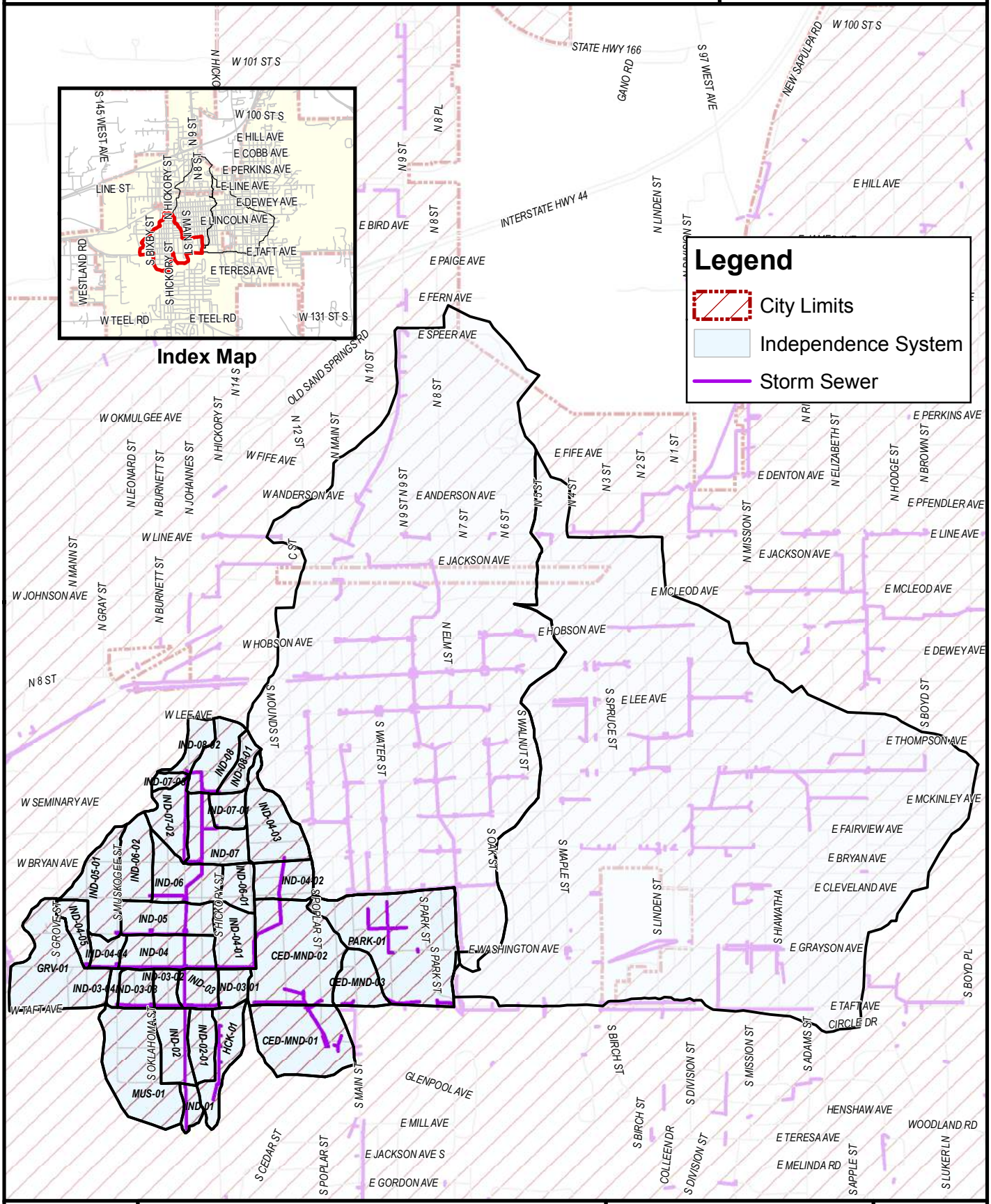

Downtown Systems Independence Drainage System

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Figure 3-1

City of Sapulpa Master Drainage Plan

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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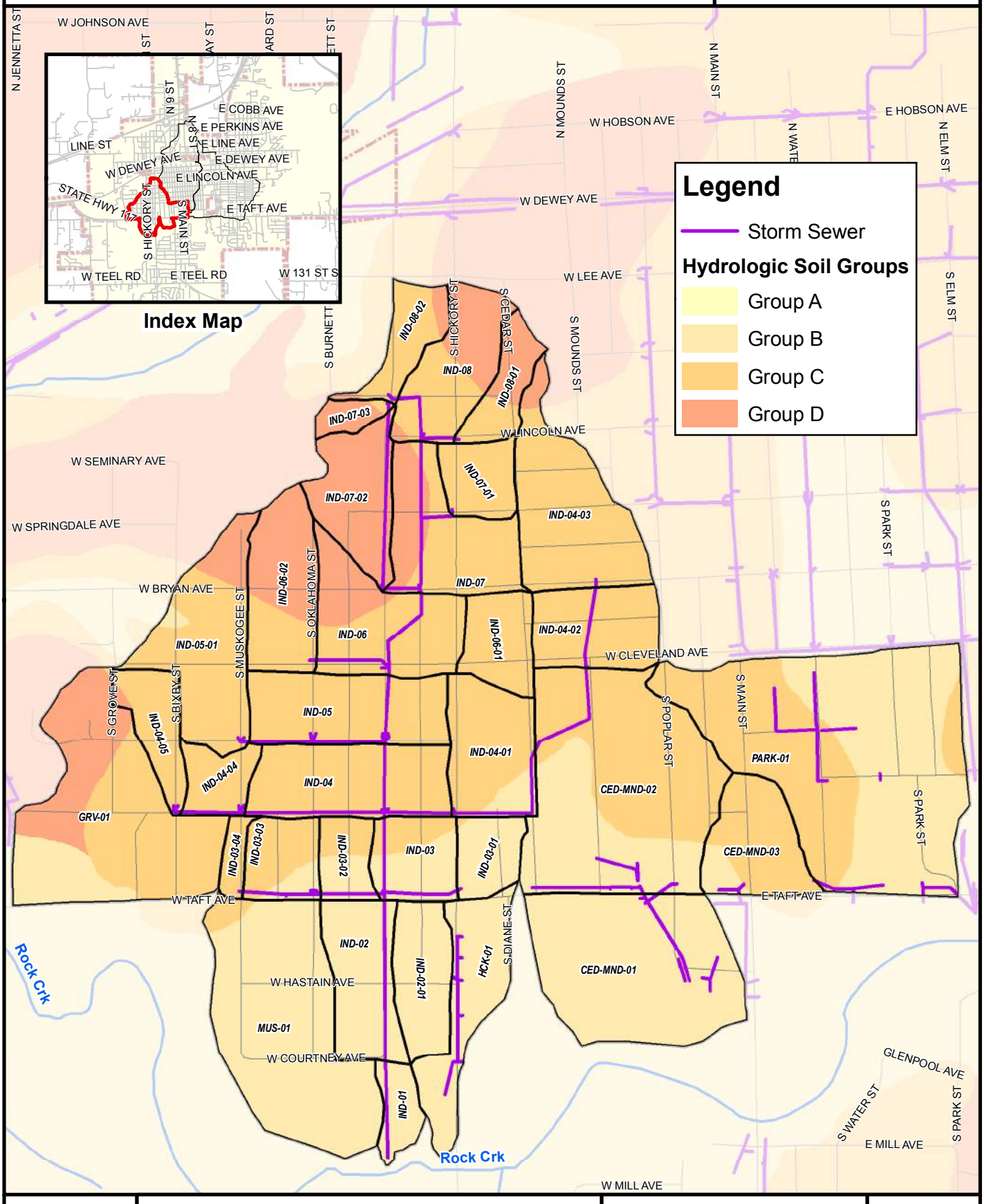

Independence System Hydrologic Soil Groups

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Figure 3-2

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

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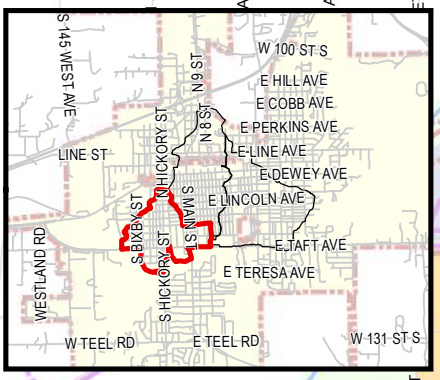

Index Map

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

N JENNETTA ST
N MOUNDS ST
W HOBSON AV
W DEWEY AVE
W LEE AVE
S BURNETT
S HICKORY ST
S CEDAR ST
S MOUNDS ST
W LINCOLN AVE
W SEMINARY AVE
W SPRINGDALE AVE
W BRYAN AVE
S OKLAHOMA ST
S MUSKOGEE ST
S GROVE ST
S BIXBY ST
W CLEVELAND AVE
S POPLAR ST
S MAIN ST
S PARK ST
W TAFT AVE
E TAFT AVE
S DIANE ST
W HASTAIN AVE
W COURTNEY AVE
W MILL AVE
E MILL AVE
S WATER ST
GLENPOOL AVE
Rock Crk

IND-08-02, IND-08, IND-08-01, IND-07-03, IND-07-01, IND-07-02, IND-04-03, IND-07, IND-06-02, IND-06, IND-06-01, IND-04-02, IND-05-01, IND-05-02, IND-05, IND-04-01, IND-04-04, IND-04, CED-MND-02, PARK-01, GRV-01, IND-03-04, IND-03-03, IND-02-02, IND-03, IND-03-01, CED-MND-03, IND-02, IND-02-01, HCK-01, CED-MND-01, MUS-01, IND-01

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Independence System Existing Land Use

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Figure 3-3

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

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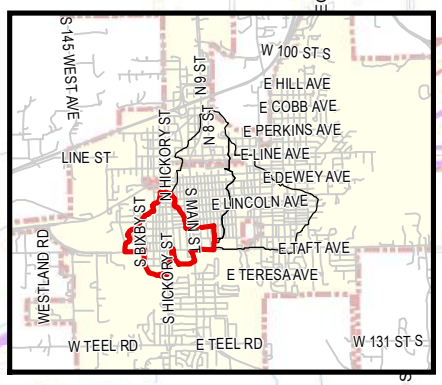

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Legend

- City Limits
- Storm Sewer
- Subbasin Boundaries

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Independence System Studied Systems

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Figure 3-4

TABLE 3-1. INDEPENDENCE DRAINAGE SYSTEM – SUMMARY OF HYDROLOGIC COEFFICIENTS FOR EXISTING CONDITIONS

Sub-Area	Drainage Area, Acres	Lag Time, Minutes	Composite CN
CED-MND-01	18.0	6.5	78
CED-MND-02	24.4	11.7	81
CED-MND-03	6.6	3.1	93
GRV-01	19.5	4.0	78
HCK-01	7.3	5.9	72
IND-01	2.2	1.4	59
IND-02	6.8	5.4	75
IND-02-01	5.3	6.0	75
IND-03	4.5	3.3	78
IND-03-01	3.2	5.6	75
IND-03-02	2.8	3.6	79
IND-03-03	3.9	3.0	81
IND-03-04	1.2	3.7	83
IND-04	9.1	3.4	83
IND-04-01	7.3	2.6	82
IND-04-02	6.5	2.7	83
IND-04-03	11.2	5.0	83
IND-04-04	2.9	2.2	83
IND-04-05	3.8	2.7	83
IND-04-06	4.2	4.1	83
IND-05	8.9	3.8	83
IND-05-01	10.6	3.0	83
IND-06	9.2	3.3	84
IND-06-02	7.5	2.9	84
IND-07	8.7	4.0	84
IND-07-01	3.5	2.8	83
IND-07-02	6.5	3.5	85
IND-07-03	1.3	1.8	80
IND-08	7.1	4.2	85
IND-08-01	3.4	3.7	83
IND-08-02	3.6	5.0	84
MUS-01	19.4	8.2	71
PARK-01	33.4	13.3	80

TABLE 3-2. INDEPENDENCE 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	DownStream Pipe Capacity (cfs)
J-CED-MND-01	Rock Creek & Poplar	54	80	132	166	209	243	276	343	**N/A**
J-CED-MND-02	Taft & b/w Mounds & Poplar	26	40	67	85	107	124	140	175	**N/A**
J-CED-MND-03	Taft & Main	17	27	37	43	51	57	62	73	**N/A**
J-IND-01	Rock Creek & Independence	204	327	522	644	800	916	1031	1261	**N/A**
J-IND-02	Courtney & Independence	203	326	520	642	796	912	1025	1253	**200**
J-IND-03	Taft & Independence	195	311	492	606	750	858	963	1173	**175**
J-IND-04	Garfield & Independence	178	284	447	548	678	774	868	1055	**50**
J-IND-04-01	Garfield & Hickory	41	66	105	129	160	183	206	252	**N/A**
J-IND-04-01-UP	Roosevelt & Cedar	34	54	85	105	130	149	167	204	**14**
J-IND-04-02	Cleveland & Mounds	27	44	69	85	105	120	134	163	**20**
J-IND-04-03	Bryan & Mounds	17	28	44	54	67	77	86	105	**13**
J-IND-04-04	Garfield & Muskogee	11	19	30	37	46	52	58	70	**5**
J-IND-04-05	Garfield & Bixby	7	11	17	21	26	30	33	40	**2**
J-IND-05	Roosevelt & Independence	113	183	284	348	429	489	548	665	**70**
J-IND-06	Cleveland & Independence	83	132	206	251	309	352	395	478	**10**
J-IND-07	Bryan & b/w Hicory & Independence	56	91	141	172	213	242	271	328	**2**
J-IND-07-01	McKinely & Hickory	6	10	16	19	24	27	30	36	**2**
J-IND-07-02	Bryan & Independence	13	22	34	42	51	58	65	79	**2**
J-IND-07-03	South of Thompson at Independence	2	4	6	7	9	10	12	14	**2**
J-IND-07-UP	McKinley & b/w Hicory & Independence	29	46	72	88	109	124	139	168	**N/A**
J-IND-08	Lincoln & b/w Hicory & Independence	23	38	59	71	88	100	112	135	**10**
J-IND-08-01	Lincoln & Hickory	5	9	14	17	22	25	28	33	**4**
J-IND-08-02	Thompson & Independence	6	9	15	18	22	25	28	34	**4**
J-PARK-01	Taft & Park	31	49	84	107	135	157	179	224	**N/A**

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

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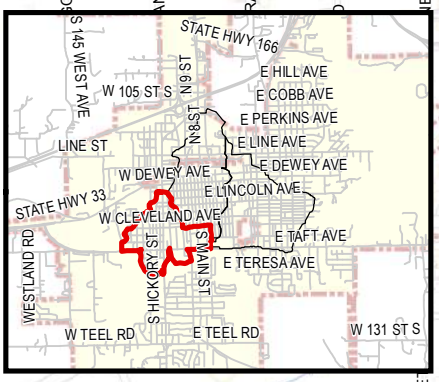

Index Map

Legend

- Subbasin Boundaries

Capacity

- 500YR
- 100YR
- 50YR
- 25YR
- 10YR
- 5YR
- 2YR
- 1YR
- Less Than 1YR

Independence System Capacity of Studied Systems

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Figure 3-5

3.3. PROBLEM AREAS

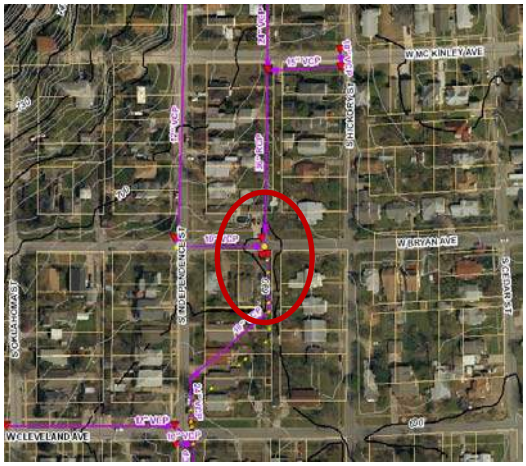
The Independence Drainage System is completely storm sewered to its outlet into Rock Creek. In general, this system is undersized from the intersection at S. Independence Street and W. Thompson Avenue to its discharge point into Rock Creek south of W. Courtney Avenue. Modeling revealed that all storm sewer systems located in this drainage basin are currently surcharged by a 50% to a 100% (or more) frequency storm. In addition to the undersized capacity of the overall Independence storm sewer system, several other localized Problem Areas were identified. A summary of these problem areas, including the Independence storm sewer system, is presented below. Their locations are shown in **FIGURE 3-6**.

A. Problem Area 1: Independence Storm Sewer System

From the intersection at S. Independence Street and W. Thompson Avenue to the system's discharge point into Rock Creek south of W. Courtney Avenue, the Independence storm sewer system is undersized. This lack of capacity has been a source of drainage complaints from area residents.

B. Problem Area 2: Independence and Thompson

This is a localized flooding problem caused by both inadequate storm sewer capacities and clogged inlets and pipes. In the past, the existing system has been able to convey a 100% or more annual chance storm. However, because of two recent City measures, these problems have been largely resolved by: (1) cleaning the storm inlets and pipes, and (2) installing a 36-inch RCP in the alley between S. Independence Street and S. Hickory Street from W. Bryan Avenue to W. Cleveland Avenue in the summer of 2008. This newly constructed, enlarged pipe replaced an existing undersized pipe in serious disrepair. The 36-inch pipe was constructed in anticipation of future recommended upgrades to the pipe's capacity.



C. Problem Area 3: 420 W. Bryan Avenue

This Problem Area is located at the southwest corner of W. Bryan Avenue and the alley between S. Independence Street and S. McKinley Street. The house is northwest of a storm sewer that angles southwesterly and passes between the house and garage. The existing pipe is undersized, in disrepair,

City of Sapulpa Master Drainage Plan

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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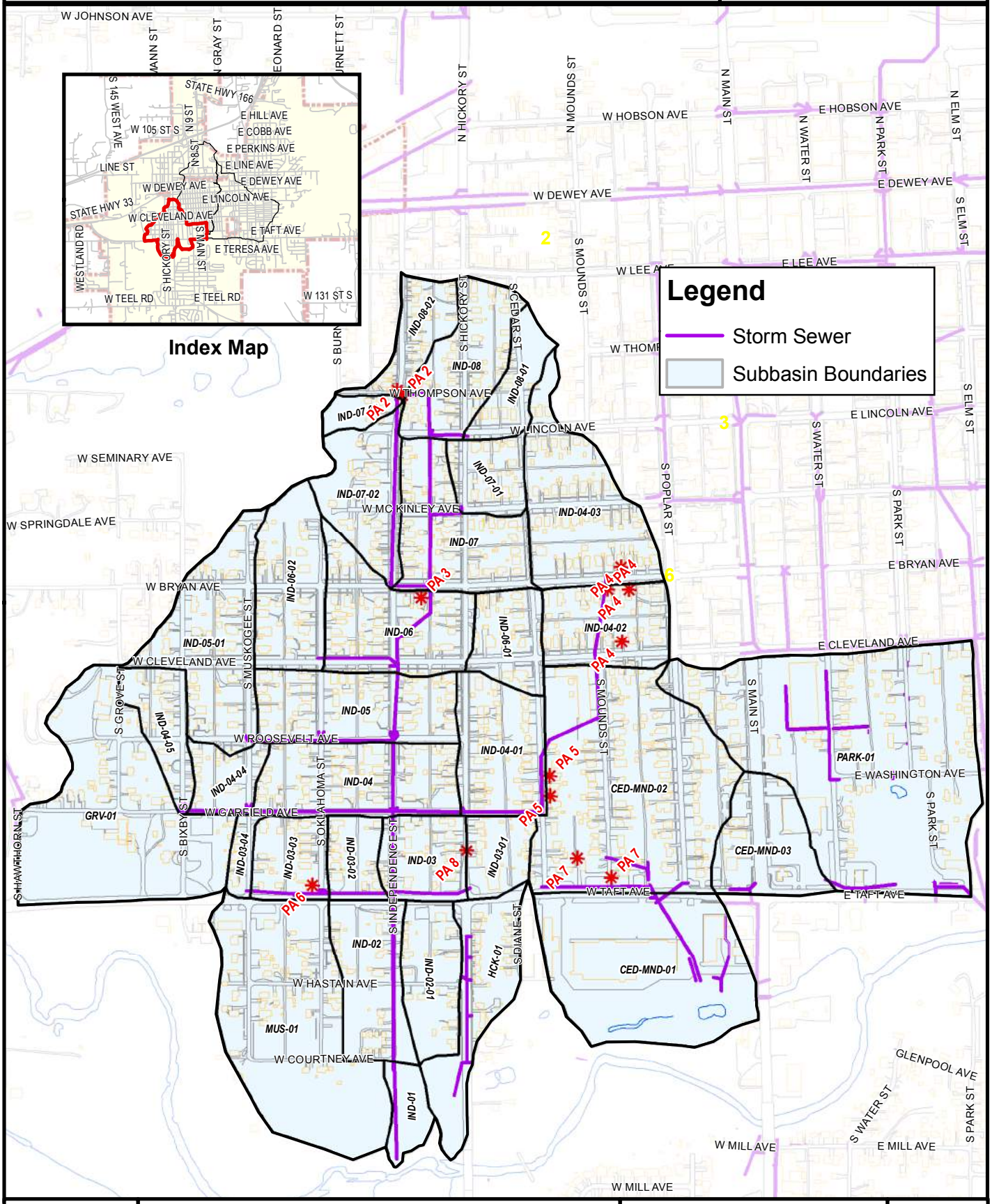

Independence Drainage Problem Areas

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Figure 3-6

and causes flooding. The pipe was videotaped with several deficiencies noted; this information can be viewed in **FIGURE 3-7**. Because of the pipe's current condition and frequent flooding at this location, a plan is underway to replace the pipe with a diversion system that would extend east along W. Bryan Avenue to S. Hickory Street and then continue south along Hickory. This is described in detail in the **SECTION 3.4.A EVALUATION OF ALTERNATIVES**.

D. Problem Area 4: 116, 117 and 120 W. Bryan Avenue and 121 W. Cleveland Avenue

Several problems exist in this area. Video inspection of the pipe in the top circle of the photo below revealed that a smaller pipe segment had been stubbed into the connection between a new inlet and the existing pipe. This reduced the capacity of the downstream pipe.

Either a broken pipe or a pipe with sealing grout intrusion was found in the area of the middle circle of the photo.

Video survey of the pipe in the location of the lowest circle had to be abandoned because of an obstruction in the pipe. City crews have worked in this area to replace inlets and remove any obstructions, but the pipe is still obstructed. Please refer to **FIGURE 3-8** for the location of these inspection problems.

The sump area on Bryan Avenue receives 11 acres of stormwater runoff, which flows overland between the houses at 116 and 120 W. Bryan Avenue and into the alley. A 20% annual chance flow rate at this location is 44 cfs. The adjacent picture shows the street in front of 120 W. Bryan Avenue on May 31, 2008.

The downstream 15-inch VCP has a maximum capacity of 7 to 8 cfs before counting the smaller pipe section stubbed in behind the relatively new inlet on the south side of W. Bryan Avenue.

The inlet in the alley cannot accept all the overland flow. As the water builds up in the alley, it overflows a concrete wall into the backyard of 121 W. Cleveland Avenue. The water then continues to make its way overland to a storm sewer inlet on Cleveland Avenue in front of the house. This occurs frequently.

City of Sapulpa Master Drainage Plan

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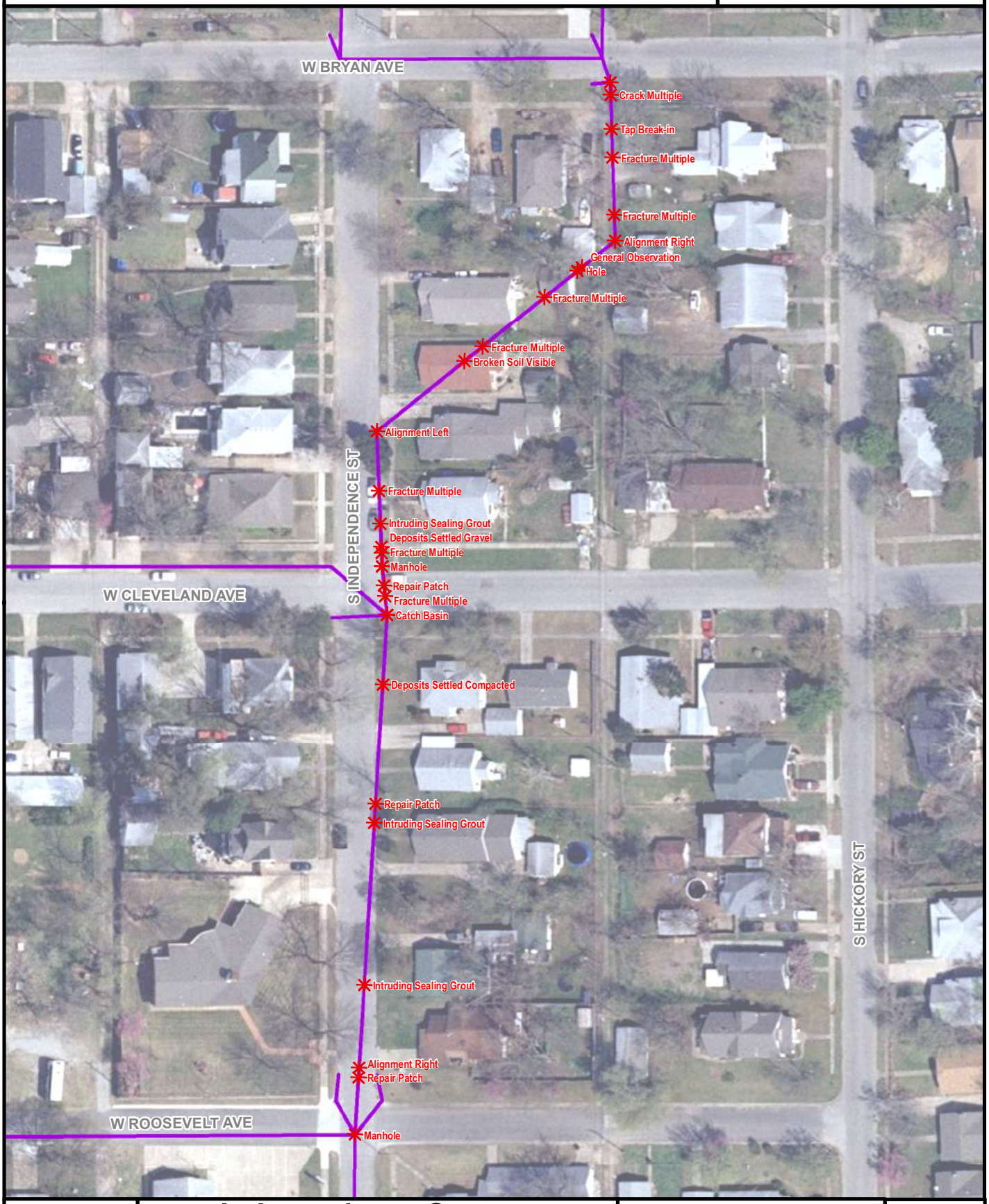

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Independence System Inspection Results S. Independence St.

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Figure 3-7

City of Sapulpa Master Drainage Plan

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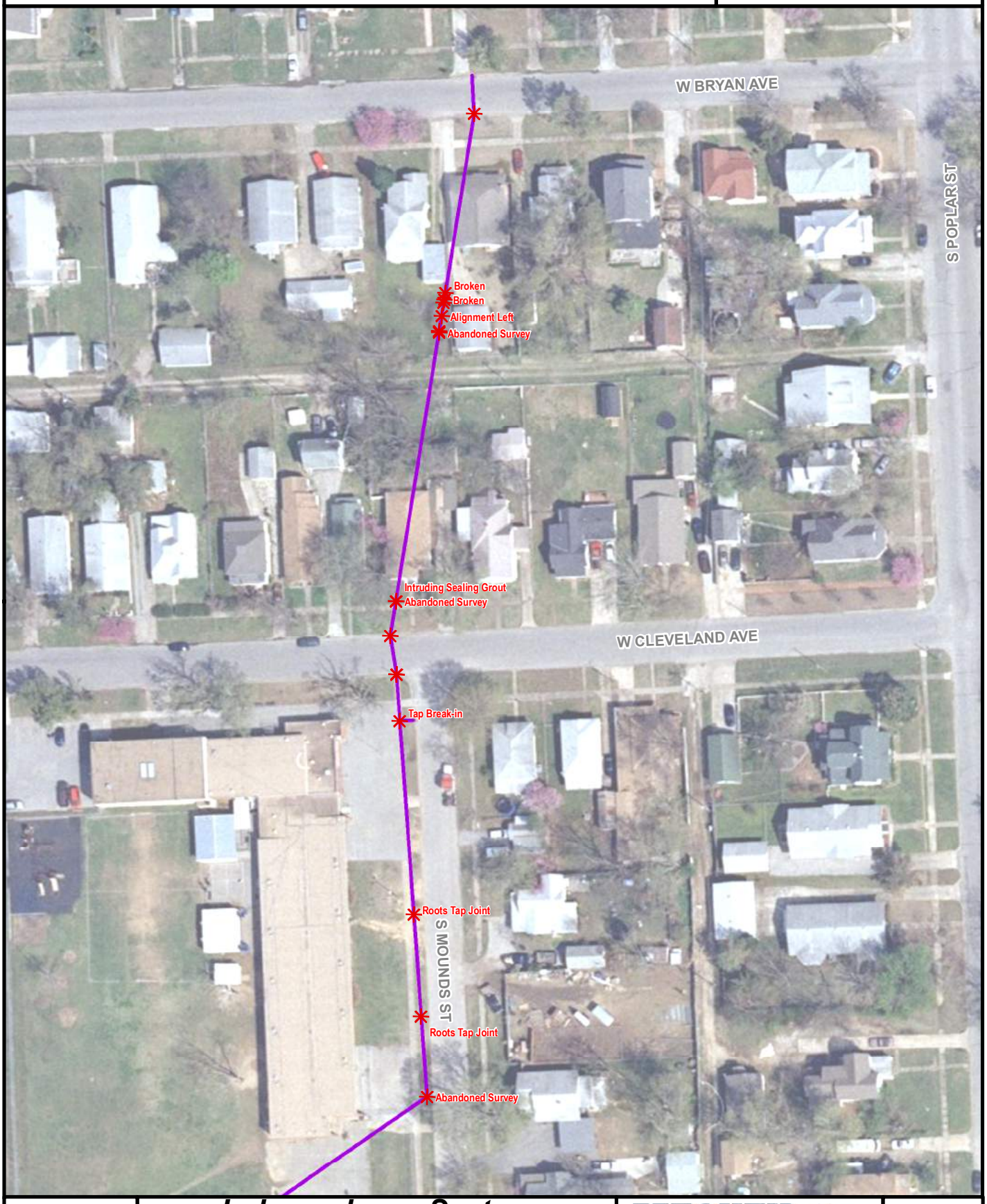

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Independence System Inspection Results W. Bryan Ave

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Figure 3-8

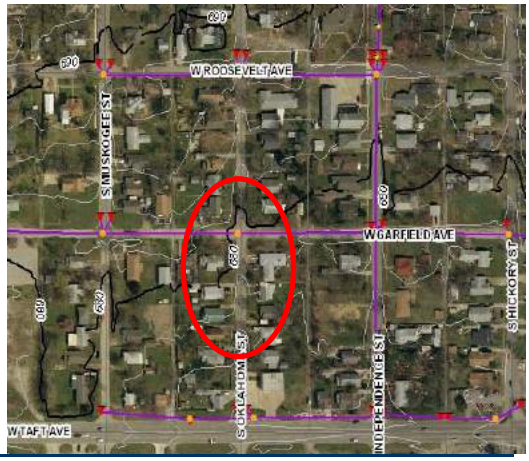
Below are more photographs of the property at 121 W. Cleveland Avenue receiving overflow from the areas to the north.

E. Problem Area 5: 707 and 711 South Cedar Street

South Cedar Street has been overlain several times until the curb depth is minimal. The result is frequent overflows from the street into the yards to the east of the area circled in the picture below.

The 24-inch storm sewer along Cedar was video-inspected for condition. Several points showed root intrusion, cracks and multiple fractures. One location even showed a sanitary sewer line installed through a storm sewer; as a result, the flow through the pipe section was nearly obstructed.

As a part of the inspection process, the obstructions were removed. In addition, the City installed new inlets on the east curb while lowering the gutter line; this allows the water to flow into the new inlets and the existing 24-inch pipe instead of overflowing yards and flowing to the alley east of Cedar Street.



Some of the local residents have indicated that the storm sewers in the schoolyard are not working and/or picking up water. The obstructions appear to be most of the problem. However, the storms sewers are seriously undersized as well.

F. Problem Area 6: 820 S. Oklahoma Street

The intersection at S. Oklahoma Street and W. Garfield Avenue receives considerable runoff from the streets

to the north and east. In addition, stormwater from two blocks north of this area is not being captured by the small inlets, and instead of flowing easterly, the water tends to flow southerly. Once the water reaches the intersection, there are no storm sewer inlets and no way for the water to enter the existing 15-inch storm sewer. The result is that the water generally continues flowing to the south. The combination results in overland flooding along Oklahoma Street and drainage problems for the residence at 820 S. Oklahoma Street. This house has experienced garage flooding and backup of its sanitary sewers.

G. Problem Area 7: Taft and Mounds

The intersection at Taft and Mounds is sumped at a location approximately 100 feet north of Taft. Additionally, the water in the alley between Cedar and Mounds is collected in another sump location approximately 150 north of W. Taft Avenue; the water is then carried east in an 18-inch RCP to an inlet on S. Mounds Street approximately 150 north of Taft Avenue. Not only is the pipe undersized, but water stands in the roadway because of there are no inlets at the low point.

H. Problem Area 8: 800 Block of S. Hickory Street

Hickory Street has a low area in the 800 Block between W. Garfield Avenue and W. Taft Avenue. As a result, the area does not drain well and is causing pavement damage. In addition, the water gets deep resulting in hazardous driving conditions.

3.4. EVALUATION OF ALTERNATIVES

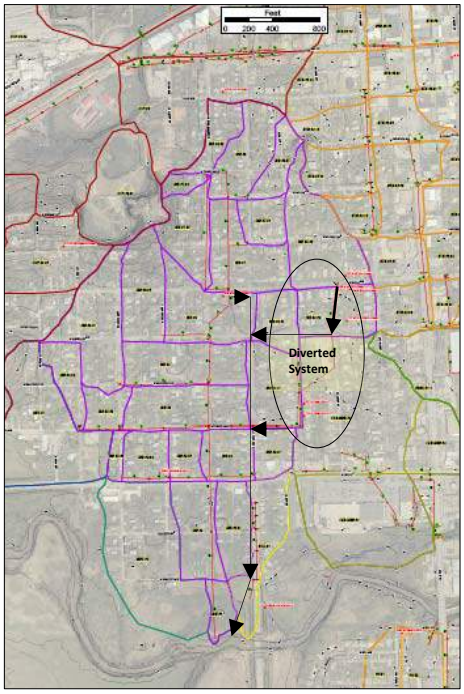
Several alternatives were considered for the identified Problem Areas. Cost estimates can be found in **APPENDIX 3-D**. The alternatives with figures are summarized in the following pages.

A. Problem Areas 1 and 3

The trunk line of the storm sewer system in this drainage system is undersized. Its capacity, as well as that of its tributaries, must be increased in order to mitigate the upstream problems in the Independence Drainage System.

Alternative 1 – Construct a 20% annual chance storm sewer system with a diversion of stormwater from upstream of Cleveland Avenue. This alternative includes two main components. The first component is the construction of a new upgraded trunk line along S. Hickory Street. The second component includes the construction of a diversion system to route stormwater flow from Problem Area 3 (420 W. Bryan Avenue) to the new trunk line.

The first component would construct an entirely new trunk line with an upgraded 20% annual chance, as a single project, along S. Hickory Street from Rock Creek north to W. Cleveland Avenue. This new system is depicted in the drawing below.



A second component to this alternative is the interception and diversion of water from Problem Area 3 (420 W. Bryan Avenue) to the new trunk line at Hickory Street. The upstream storm sewer system north of W. Cleveland Avenue would be replaced with a 48-inch RCP beginning at the alley on the north side of W. Bryan Avenue. It would include 4-foot recessed curb inlets with steel inserts at the alley itself, as well as at those locations upstream from the radius points in the curb and gutter sections, to facilitate the capture of all runoff.

From this point downstream, all flow for the 20% annual chance storm would be diverted east and any overflow from larger storms would be diverted south into the alley. This diversion would greatly improve the drainage problems identified in Problem Area 3.

The cost for the construction of all improvements described in this alternative is estimated to be $2,448,000 and is shown in detail in **FIGURE 3-9**.

Alternative 2 – Construct a two-phase diversion system with a 20% annual chance storm capacity. This alternative is a variation of Alternative 1 and includes project phasing in addition to an alternate diversion route to S. Independence Street. Phase 1 would divert stormwater eastward in a new 48-inch RCP from W. Bryan Avenue to S. Hickory Street and south one block

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

City of Sapulpa Master Drainage Plan

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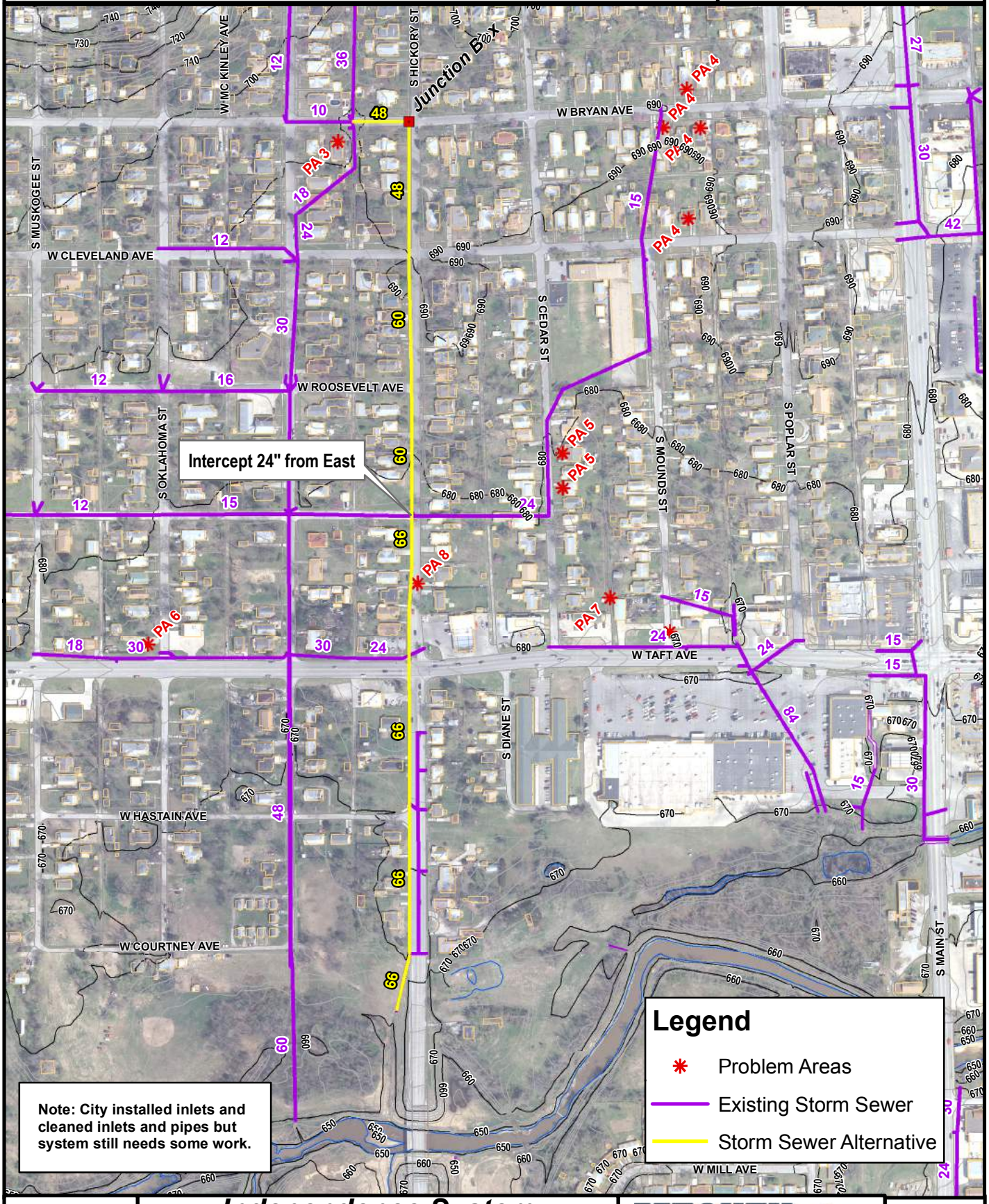

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Independence System Problem Areas 1 and 3 Alternative 1

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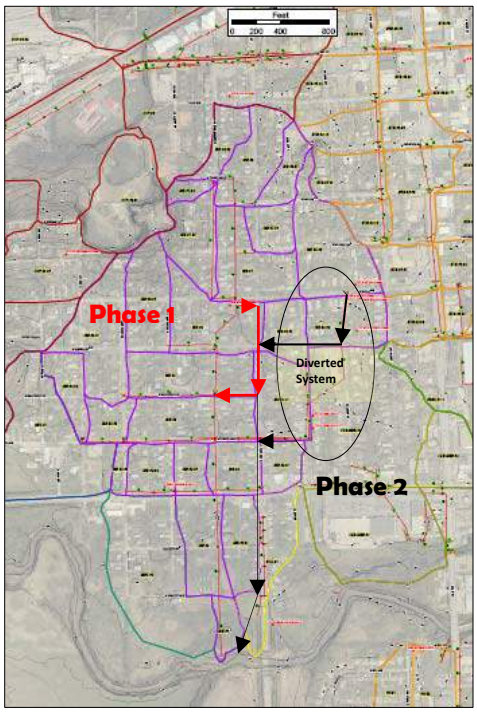
Figure 3-9

to W. Cleveland Avenue. At the intersection of Cleveland Avenue and Hickory Street, the pipe would be enlarged to a 60-inch between W. Cleveland Avenue and W. Roosevelt Avenue. This larger pipe size would be in anticipation of the future Phase 2 construction south from W. Roosevelt Avenue to the current outfall just south of W. Courtney Avenue.

In the interim until Phase 2 can be constructed, stormwater would be piped in a new 48-inch RCP west from W. Roosevelt Avenue to the existing 48-inch masonry/concrete pipe at Independence Street. This would improve localized drainage by replacing the existing pipes immediately upstream and downstream of 420 W. Bryan Avenue with larger 48-inch RCPs that would ultimately flow into the existing 48-inch pipe at Independence. In order to relieve pressure in the street, this interim measure would require the construction of a system of storm sewer inlets in the area.



As stated earlier in Problem Area 2, the City has already replaced the existing pipe in the alley between McKinley and Bryan Avenues with a 36-inch RCP. This upgrade is the first step in implementing the above phased alternative; however, the new 36-inch pipe still connects to a smaller downstream pipe at W. Bryan Avenue. To ensure proper drainage and operation of the system, the pipe upgrade must be continued downstream to W. Roosevelt Avenue and then west to S. Independence Avenue. Design plans are currently being finalized for this portion of the plan so that it can be constructed once funding becomes available.

If this section were constructed prior to the downstream system, the segment between Independence Street and the alley would have to be constructed to drain into the existing system and would serve to equalize flow between the two systems in the future. Inlets used to allow pressure relief would be constructed at the manhole on Independence Street.

Phase 2 would be the construction of the remainder of the new trunk line along S. Hickory Street from W. Roosevelt Avenue south to its outfall south of W. Courtney Avenue. Except for a small stretch of 60-inch RCP from W. Roosevelt Avenue to W. Garfield Avenue along S. Hickory Street, a 66-inch RCP will be constructed for the length of the Phase 2 project.

Phase 1 is estimated to cost $1,000,000 with Phase 2 estimated at $1,684,000. The phased project is shown in **FIGURE 3-10**. This alternative is more expensive than Alternative 1 due to the extra pipe segment along Roosevelt Avenue. However, the increased total cost of this alternative would be offset by the community's ability to fund and construct improvements incrementally over time with smaller amounts of money at any one point in time. This option would also provide immediate relief to a property subject to routine flooding.

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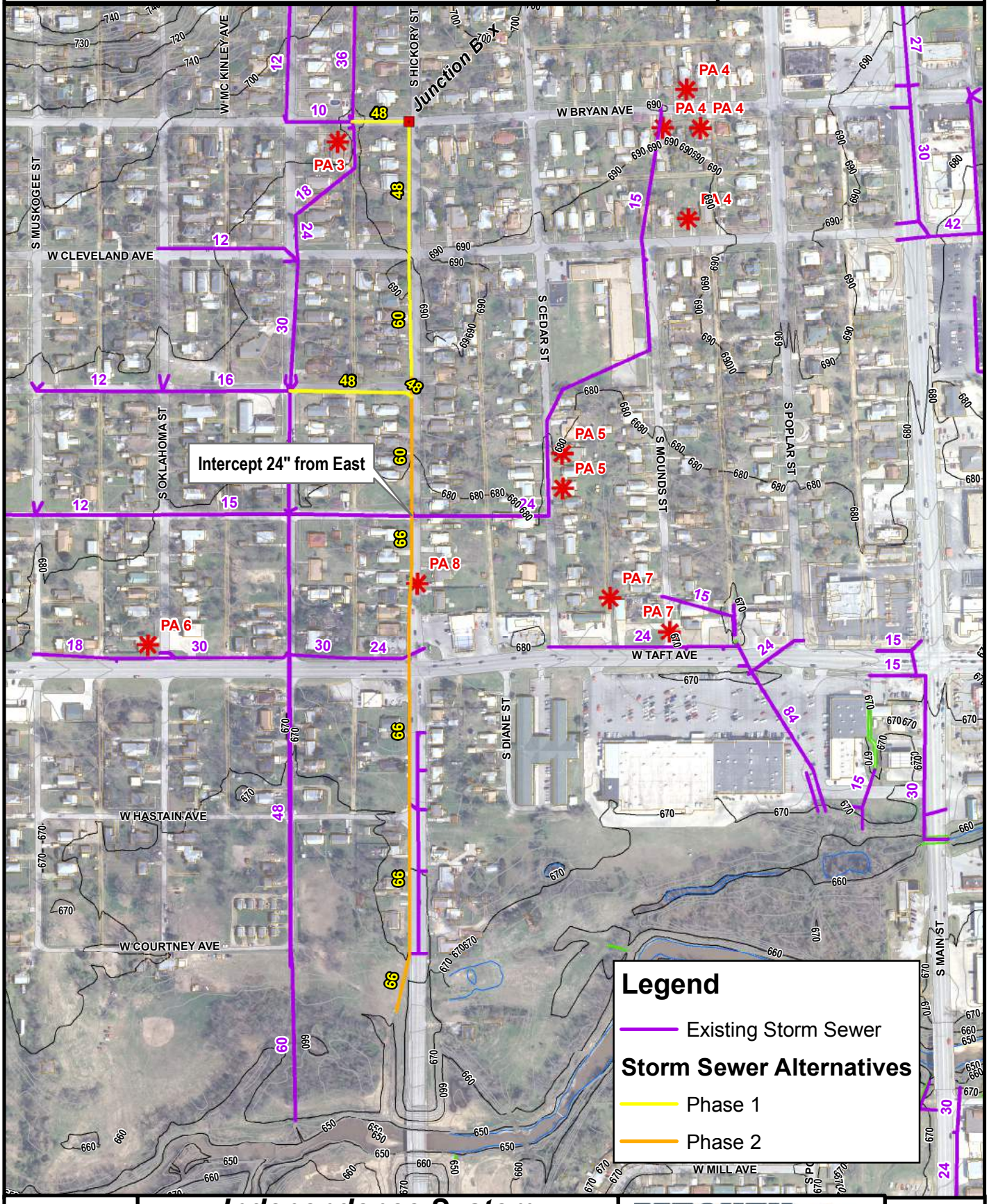

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Independence System Problem Areas 1 and 3 Alternative 2

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Figure 3-10

Alternative 3 – Replace entire trunk line with a 10% annual chance storm sewer system. This alternative is similar to Alternative 1 except that the replacement pipe size would accommodate a 10% annual chance storm instead of the 20% annual chance storm.

Obviously, this alternative's larger capacity storm sewer would cost more than the lesser capacity system described in Alternative 1. It would also provide a higher level of drainage protection for the eastern sections of the watershed. However, it would not allow for increased protection on the westerly portion of the basin, because there is no decrease in the remaining area draining into the existing system. As a result, this alternative was not investigated further.

B. Problem Area 2: Independence and Thompson

As stated previously in **SECTION 3.4.B**, the problems for this location have already been largely resolved by the City due to: (1) cleaning the storm inlets and pipes, and (2) installing a 36-inch RCP in the alley between S. Independence Street and S. Hickory Street from W. Bryan Avenue to W. Cleveland Avenue in the summer of 2008. The newly constructed, enlarged pipe replaced an existing undersized pipe in serious disrepair and was constructed in anticipation of future recommended upgrades to the pipe's capacity, as described in **SECTION 3.4.A PROBLEM AREAS 1 AND 3**.

Alternative 1 – Replace upstream trunk line with a 20% annual chance capacity storm sewer system. This alternative calls for the installation of a 24-inch RCP east from S. Independence Street to the alley along W. Thompson Avenue and a 30-inch RCP from W. Thompson Avenue south to W. McKinley Avenue. A 27-inch RCP would also be constructed along W. Bryan Avenue between the alley and S. Independence Street; this pipe would connect with the new 48-inch RCP, discussed in **SECTION 3.4.A,** along S. Bryan Avenue from the alley east to S. Hickory Street**.**

The existing inlets would be replaced with larger capacity 4-foot recessed curb inlets with steel inserts once the downstream capacity is improved, as follows:

- Thompson and Independence – six 4-foot recessed curb inlets with steel inserts with 15-inch leads.
- Thompson and the alley - four 4-foot recessed curb inlets with steel inserts with 15-inch leads and a trench grate on the north side at the alley.
- Lincoln and the alley - four 4-foot recessed curb inlets with steel inserts with 15-inch leads and a trench grate on the north side at the alley.
- Thompson and the alley - four 4-foot recessed curb inlets with steel inserts with 15-inch leads and a trench grate on the north side at the alley.
- McKinley and the alley - four 4-foot recessed curb inlets with steel inserts with 15-inch leads and a trench grate on the north side at the alley.
- Bryan and the alley - four 4-foot recessed curb inlets with steel inserts with 15-inch leads and a trench grate on the north side at the alley.

- Independence and Bryan – four 4-foot recessed curb inlets with steel inserts with 15-inch leads.

To prevent any adverse downstream impact, this alternative is contingent upon the construction of the new trunk line along Hickory Street, described in **SECTION 3.4.A**. This system would be compatible with a 20% annual chance storm as well as the 36-inch pipe recently constructed by the City in the alley between W. Bryan Avenue and W. McKinley Avenue.

The cost for Problem Area 2 Alternative 1 is approximately $387,000 and is shown in **FIGURE 3-11**.

C. Problem Area 4: 116, 117 and 120 West Bryan Avenue and 121 West Cleveland Avenue

Alternative 1: Construct a 36-inch storm sewer from W. Bryan Avenue south to W. Cleveland Avenue with a diversion from S. Mounds Street west to S. Hickory Street. This alternative proposes the construction of a 48-inch RCP from the intersection at S. Hickory Street and W. Cleveland Avenue to the intersection at S. Mounds Street and W. Cleveland Avenue. From the intersection at S. Mounds Street and W. Cleveland Avenue, a 36-inch RCP would continue, along property lines or in driveways, in a northeasterly direction to S. Bryan Avenue.

The inlets would be replaced with larger capacity 4-foot or 8-foot recessed curb inlets with steel inserts, as follows:

- Cedar and Cleveland – two 4-foot recessed curb inlets with steel inserts with 15-inch leads.
- Mounds and Cleveland – two 8-foot recessed curb inlets with steel inserts with 18-inch leads.
- The alley between Cleveland and Bryan – two area inlets with 36-inch inflow and outflow pipes.
- Bryan at approximately Mounds - four 4-foot recessed curb inlets with steel inserts or two 8-foot recessed curb inlets with steel inserts with 18-inch leads.

Like Alternative 1 above, this alternative is also contingent upon the construction of the alternatives identified in **SECTION 3.4.A** and is compatible with the 20% annual chance storm for the system south along Hickory Street.

The cost for this alternative is approximately $620,000 and is depicted in **FIGURE 3-12**.

D. Problem Area 5: 707 and 711 South Cedar Street

Alternative 1: Upgrade the storm sewer system from southeast corner of the school property to the diversion at S. Hickory Street and W. Garfield Avenue. Because of the numerous problems identified for this segment of storm sewer, total replacement is recommended in the future. The entire system, extending from the southeast corner of the school property at S. Mounds Street to S. Cedar Street and W. Garfield Avenue, if Garfield were extended, would be replaced with a new 24-inch RCP.

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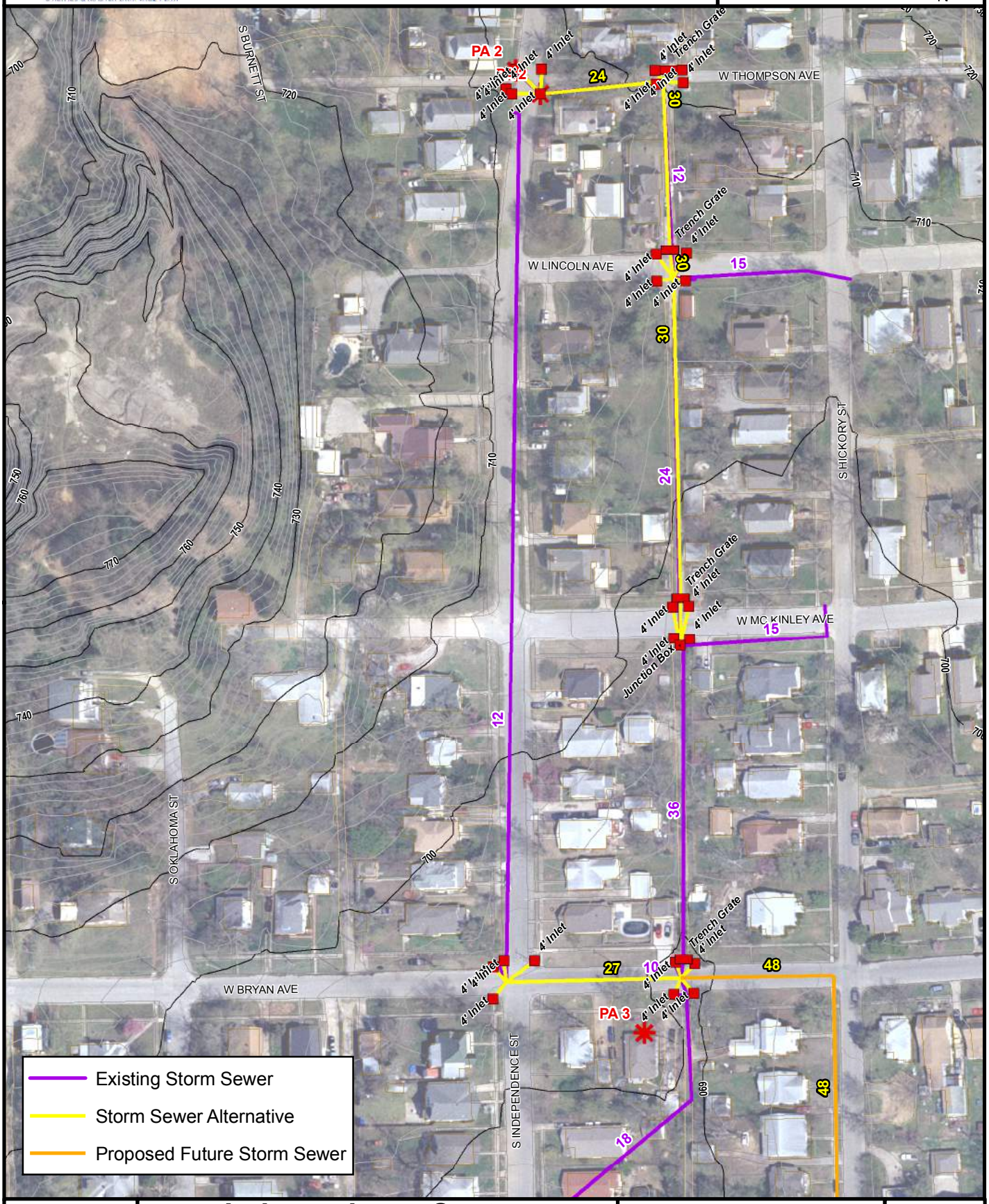

Independence System Problem Area 2 Alternative 1

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Figure 3-11

STORMWATER
UTILITIES & MASTER DRAINAGE PLAN

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Feet
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Independence System Problem Area 4 Alternative 1

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Figure 3-12

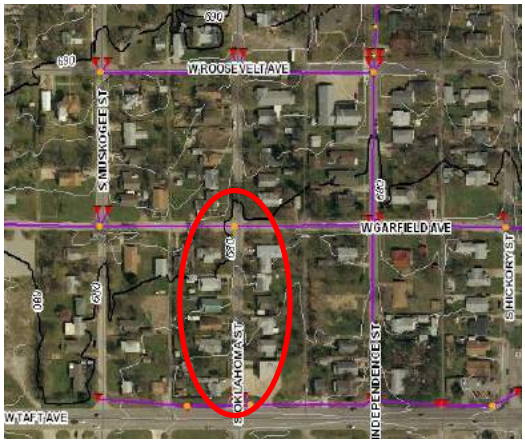
At S. Cedar Street and W. Garfield Avenue, if extended, two additional 4-foot recessed curb inlets with steel inserts would be required. The flow to these new inlets would capture water from the eastern half of the block bounded by Hickory Street on the east, Cleveland Avenue on the north, Cedar Street on the east and Garfield Avenue on the south. From Cedar Street west to the new diversion at the intersection of S. Hickory Street and W. Garfield Avenue, a 30-inch RCP would be required.

However, in the interim until the entire system can be replaced, the diversion proposed in **SECTION 3.4.C** would divert 18 acres of stormwater from the existing 24-inch VCP. This upstream diversion would provide some relief to the yard flooding being experienced at 707 and 711 S. Cedar Street.

In addition, as a part of the inspection process, the City has already removed the obstructions in the existing pipe and installed new inlets on the east curb while lowering the gutter line along S. Cedar Street. By getting the stormwater into the existing 24-inch pipe, these improvements have provided some immediate relief to the existing conditions.

The cost for Problem Area 5 Alternative 1 is approximately $265,000 and is shown in **FIGURE 3-13**.

F. Problem Area 6: 820 S. Oklahoma Street



The intersection at S. Oklahoma Street and W. Garfield Avenue does not have any existing storm sewer inlets to receive the considerable runoff from the streets to the north and east. In addition, stormwater from two blocks north of this location is not being captured by the existing small street inlets and tends to flow to the south instead of the east as designed. As a result, all alternatives for this Problem Area call for the installation of new 4-foot recessed curb inlets with steel inserts where S. Oklahoma Street intersects W. Roosevelt Avenue and W. Garfield Avenue and W. Taft Avenue.

Alternative 1 – Divert stormwater south from W. Roosevelt Avenue with a 50% annual chance storm sewer system and inlets. This alternative would collect stormwater at the intersection of W. Roosevelt Avenue and S. Oklahoma Street and divert it south through a new 24-inch RCP to W. Garfield Avenue. At Garfield Avenue, the stormwater would again be collected and continue south through a new 36-inch RCP.

At S. Oklahoma Street and W. Taft Avenue, the proposed 36-inch RCP would intersect with an existing 30-inch RCP which flows eastward to the Independence trunk line. Because this pipe is inadequate to carry the proposed 50% annual chance flow being diverted south from Roosevelt Avenue and the additional stormwater being collected at W. Taft Avenue, it would have to be

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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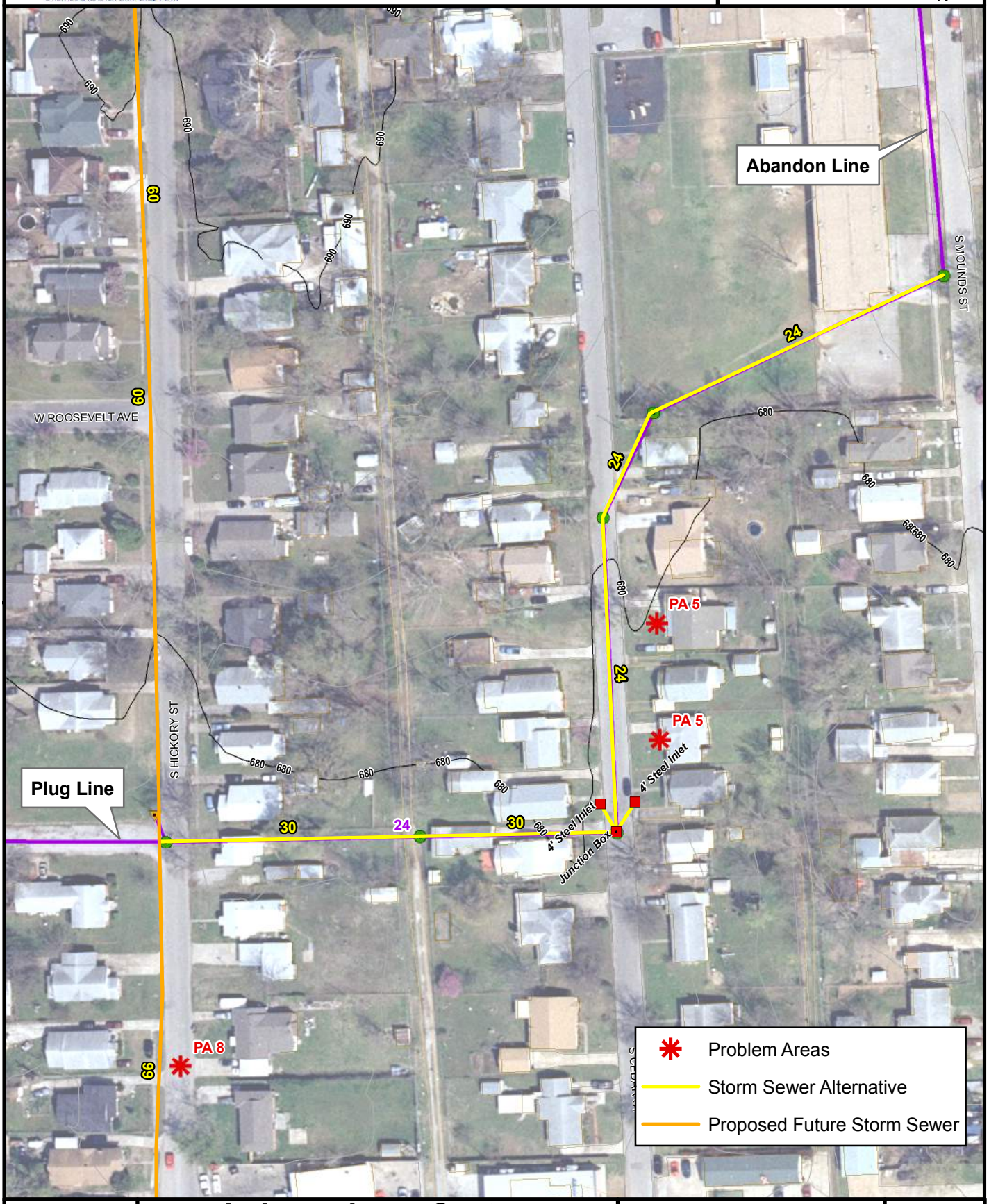

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Independence System Problem Area 5 Alternative 1

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Figure 3-13

upgraded to a 36-inch RCP from S. Oklahoma Street east to the inlet on the west side of Independence Street.

At its juncture with Taft Avenue, the Independence storm sewer system has been upgraded by the Oklahoma Department of Transportation (ODOT) to a 48-inch masonry/concrete pipe for overflow. This existing additional pipe capacity makes the diversion of stormwater south from Roosevelt Avenue along S. Oklahoma Street and east to S. Independence Street a feasible option.

The cost for Alternative 1 is approximately $410,000 and is shown on **FIGURE 3-14.**

Alternative 2 – Divert stormwater south from W. Roosevelt Avenue with a 20% annual chance storm sewer system and inlets. This alternative is a variation of Alternative 1 and would divert the stormwater from a 20% annual chance event at W. Roosevelt Avenue and S. Oklahoma Street into a new 36-inch RCP along Oklahoma Street to W. Garfield Avenue. From Garfield Avenue south to the intersection at Taft Avenue and Oklahoma Street, the pipe size would change to a 42-inch RCP. At Taft Avenue, the pipe size would be upgraded to a 48-inch RCP and continue east to intersect with the existing 48-inch trunk line at Independence Street.

The cost for this alternative is estimated to be $545,000 and is detailed in **FIGURE 3-15**.

Alternative 3 – Divert stormwater south from W. Roosevelt Avenue with a 10% annual chance storm sewer system and inlets. This alternative is similar to Alternatives 1 and 2 with the exception that it would divert the 10% annual chance storm event at W. Roosevelt Avenue and S. Oklahoma Street into a new 36-inch RCP south to W. Garfield Avenue. From W. Garfield and S. Oklahoma Street south to W. Taft Avenue, the pipe size would be enlarged to a 48-inch RCP.

At the intersection of S. Oklahoma Street and W. Taft Avenue, the pipe would become a 60-inch RCP and continue east to connect with the Independence trunk line. Since this pipe would then connect with a 48-inch at the Independence trunk line, the Independence pipe would have to be enlarged as a part of future trunk line improvement and was not considered further.

This alternative is estimated to cost $705,000 and is shown on **FIGURE 3-16**.

Alternative 4 – Upgrade the existing Roosevelt System from Oklahoma Street to Independence Street to a 10% annual chance storm sewer system and along S. Oklahoma Street between Garfield Avenue and Taft Avenue to a new 50% annual chance storm sewer system. This alternative would intercept the water at the intersection of Roosevelt Avenue and Oklahoma Street and convey it in a 10% annual chance storm sewer east to the trunk line at S. Independence Street. This alternative also includes the construction of a new 30-inch RCP to intercept the water at S. Oklahoma Street and W. Garfield Avenue and convey it south to the existing 30-inch RCP at W. Taft Avenue.

It must be noted, that even with the additional flow from Oklahoma Street, the existing 30-inch pipe along W. Taft Avenue is sized adequately to convey the 50% annual chance event. However, to convey a 20% annual chance event, as discussed in some of the alternatives above,

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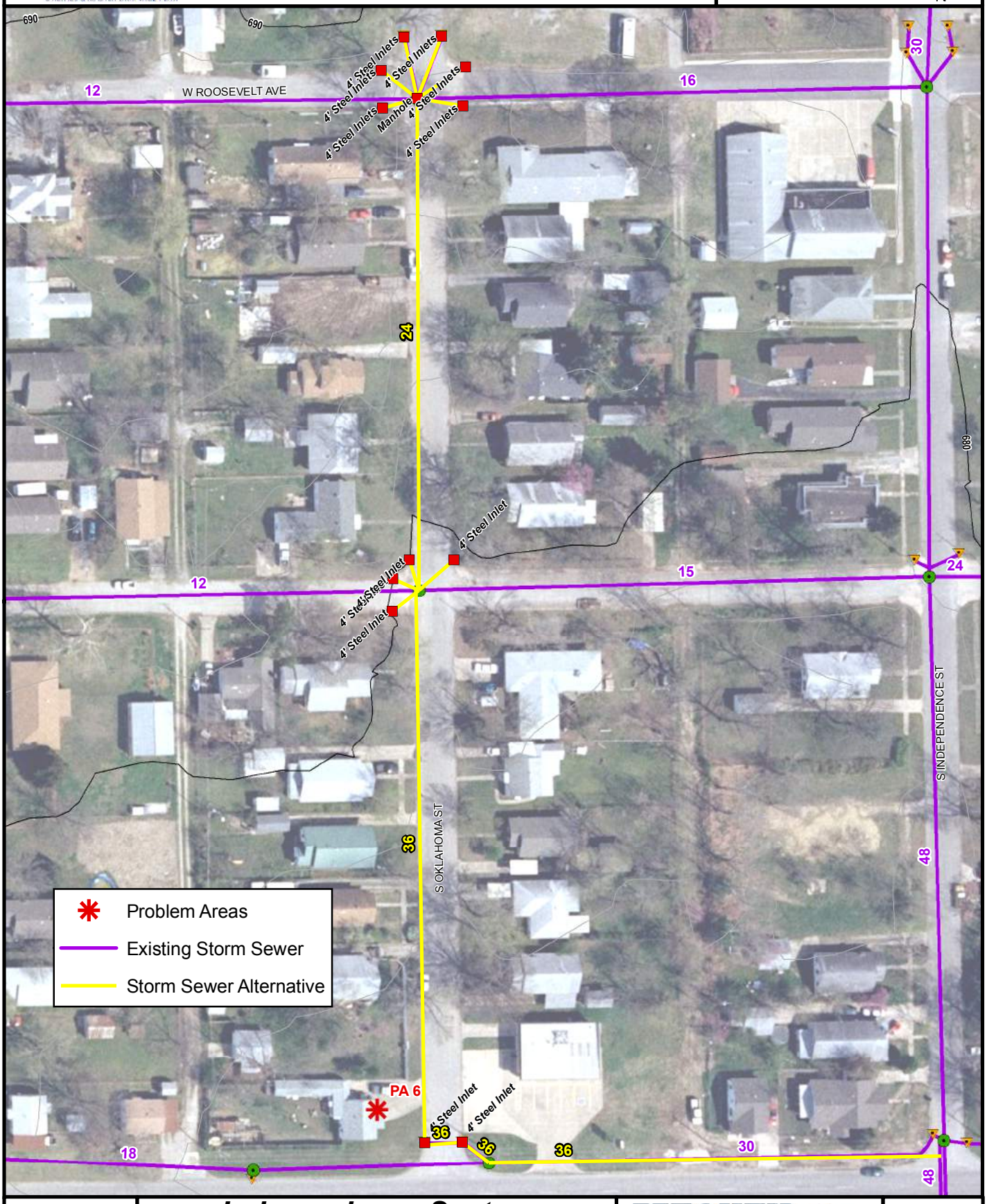

Independence System
Problem Area 6
Alternative 1

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Figure 3-14

City of Sapulpa Master Drainage Plan

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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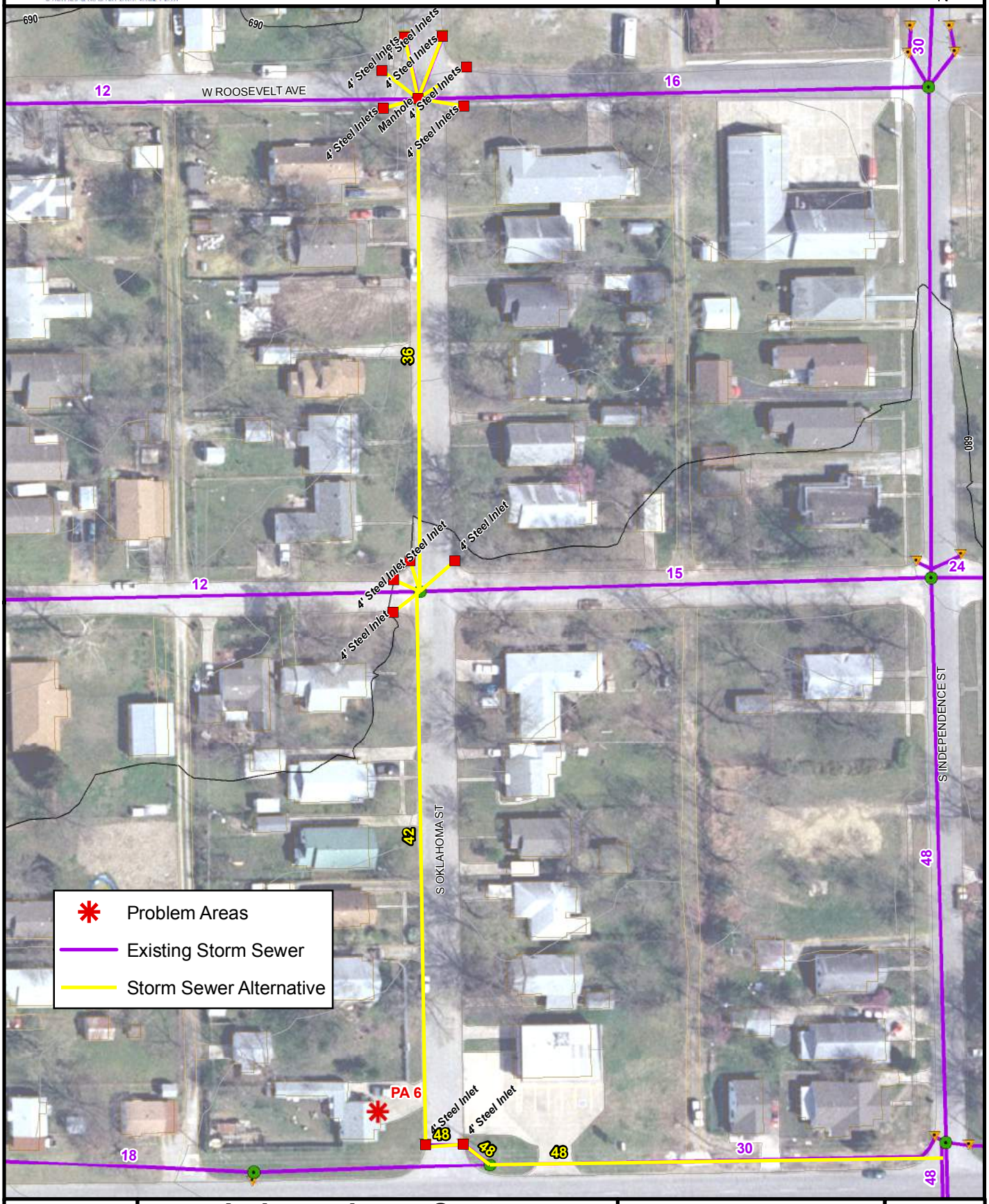

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Figure 3-15

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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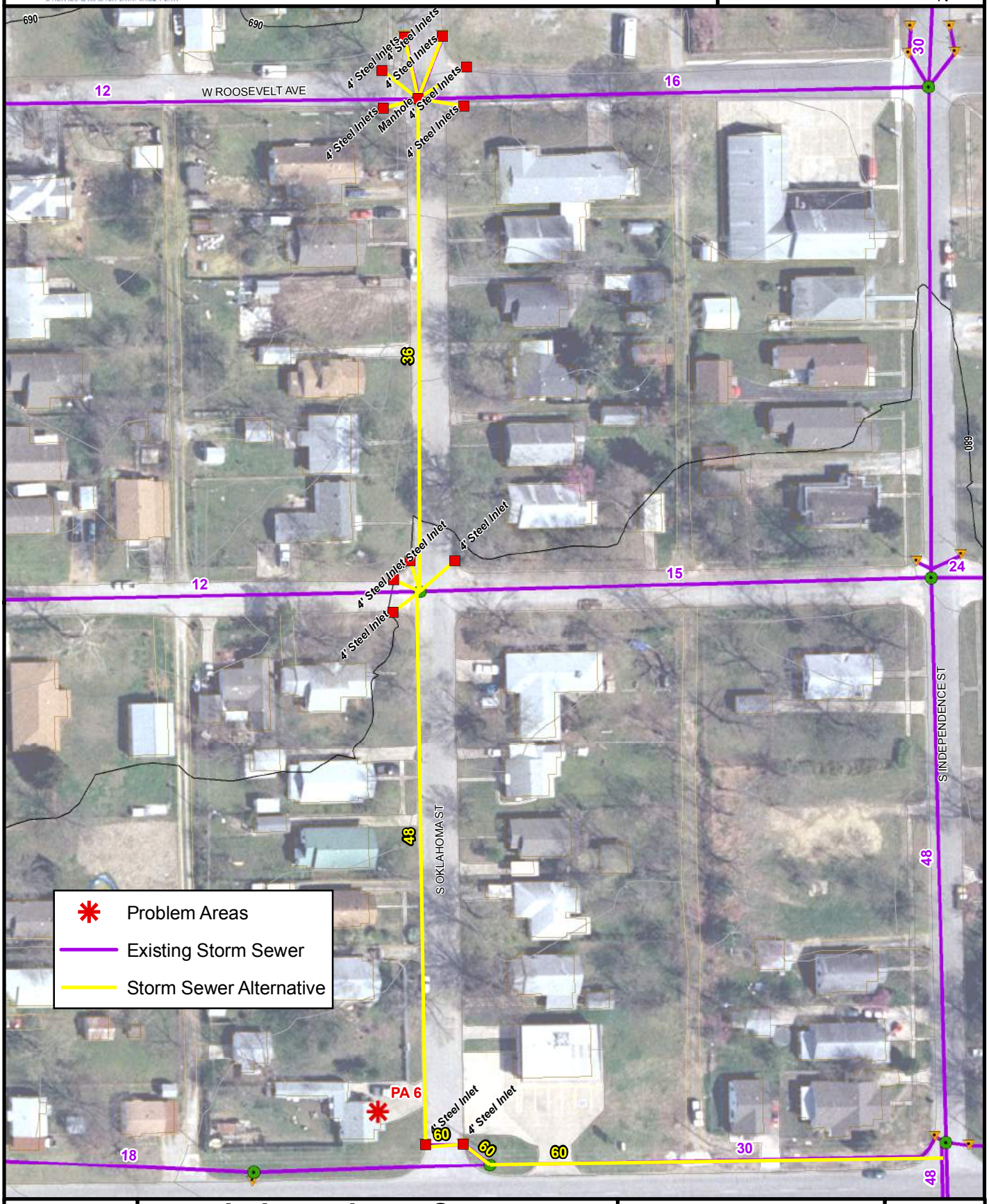

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Independence System Problem Area 6 Alternative 3

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Figure 3-16

the existing 30-inch pipe would have to be upgraded and additional inlets would have to be constructed.

This alternative costs approximately $320,000 and is depicted in **FIGURE 3-17**.

A. Problem Area 7: Taft and Mounds

Alternative 1: Construct storm sewer with inlets to connect with the 48-inch RCP under Taft Avenue. This alternative would capture water from the alley, west of Mounds Street, in an area inlet for conveyance of the 10% annual chance flow through a 30-inch RCP east to Mounds Street. The pipe would then extend south along Mounds Street and then east to connect with the existing 48-inch RCP at the alley east of Mounds Street that crosses under Taft Avenue. This alternative would require the acquisition of easements for some of the new storm sewer line. At the low point in S. Mounds Street, two 4-foot recessed curb inlets with steel inserts would be installed with an 18-inch pipe joining to the new 30-inch RCP.

This alternative is estimated to cost $212,300 and is shown in **FIGURE 3-18**.

B. Problem Area 8: 800 Block of S. Hickory Street

Alternate 1: Construct a 20% annual chance storm sewer system along Hickory Street. This alternative is actually a variation of **SECTION 3.4.A ALTERNATIVE 1 (AND 2)** and would include the construction of three blocks of the new Hickory trunk line, from W. Cleveland Avenue south to W. Taft Avenue. Like the alternatives in **SECTION 3.4.A,** it would include the construction of a 66-inch RCP from W. Garfield Avenue to W. Taft Avenue. New 4-foot recessed curb inlets with steel inserts would also be added the length of the project.

The cost for this alternative is estimated at $1,500,000 and can be viewed in **FIGURE 3-19**.

Alternate 2: Construct a 24-inch storm sewer with inlets on the west side of Hickory Street north of Taft Avenue. In the interim, i.e. until the new Hickory trunk line improvements can be funded and constructed, this alternative would provide some immediate relief for this Problem Area and could be constructed in phases.

Phase 1 of this alternative would consist of the replacement of an existing inlet on the northwest corner of W. Garfield Avenue and S. Hickory Street with a new 4-foot recessed curb inlet with steel insert. Its junction box would be sized for the future 66-inch RCP described in **SECTION 3.4.A**. A new 24-inch RCP would join the replaced inlet with a new manhole constructed above the location of the existing 24-inch pipe south of the new inlet.

A new 4-foot recessed curb inlet with steel insert would also be constructed above the existing 24-inch pipe, just east of the intersection, to allow stormwater access into the system. Its junction box would be sized for a new 30-inch RCP which would also be constructed from the new inlet west to the new manhole described above.

Phase 2 would consist of approximately 420 feet of new 24-inch RCP, starting at the northwest corner of W. Taft Avenue, and continuing north along the west side of S. Hickory Street. At Taft

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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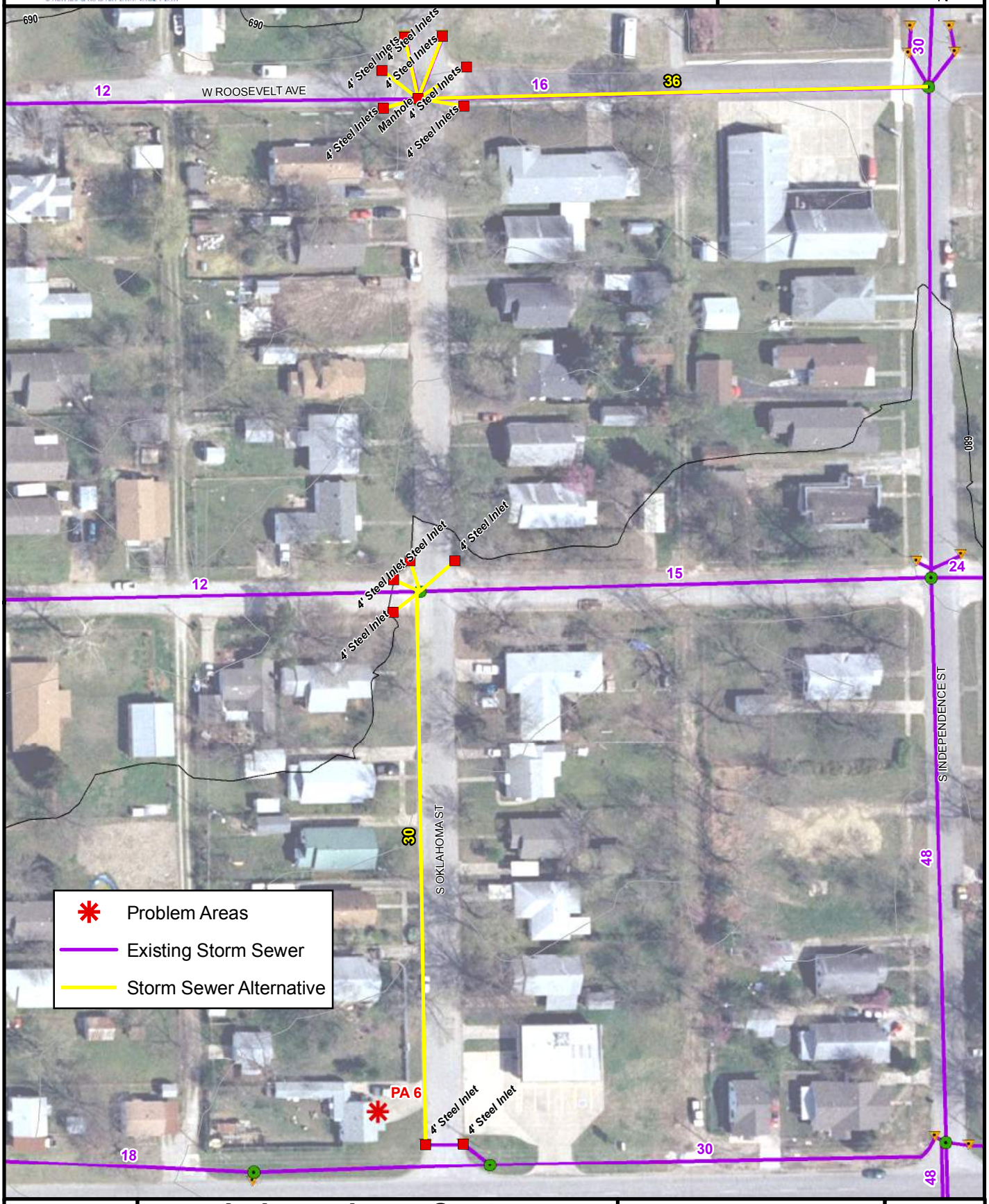

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Figure 3-17

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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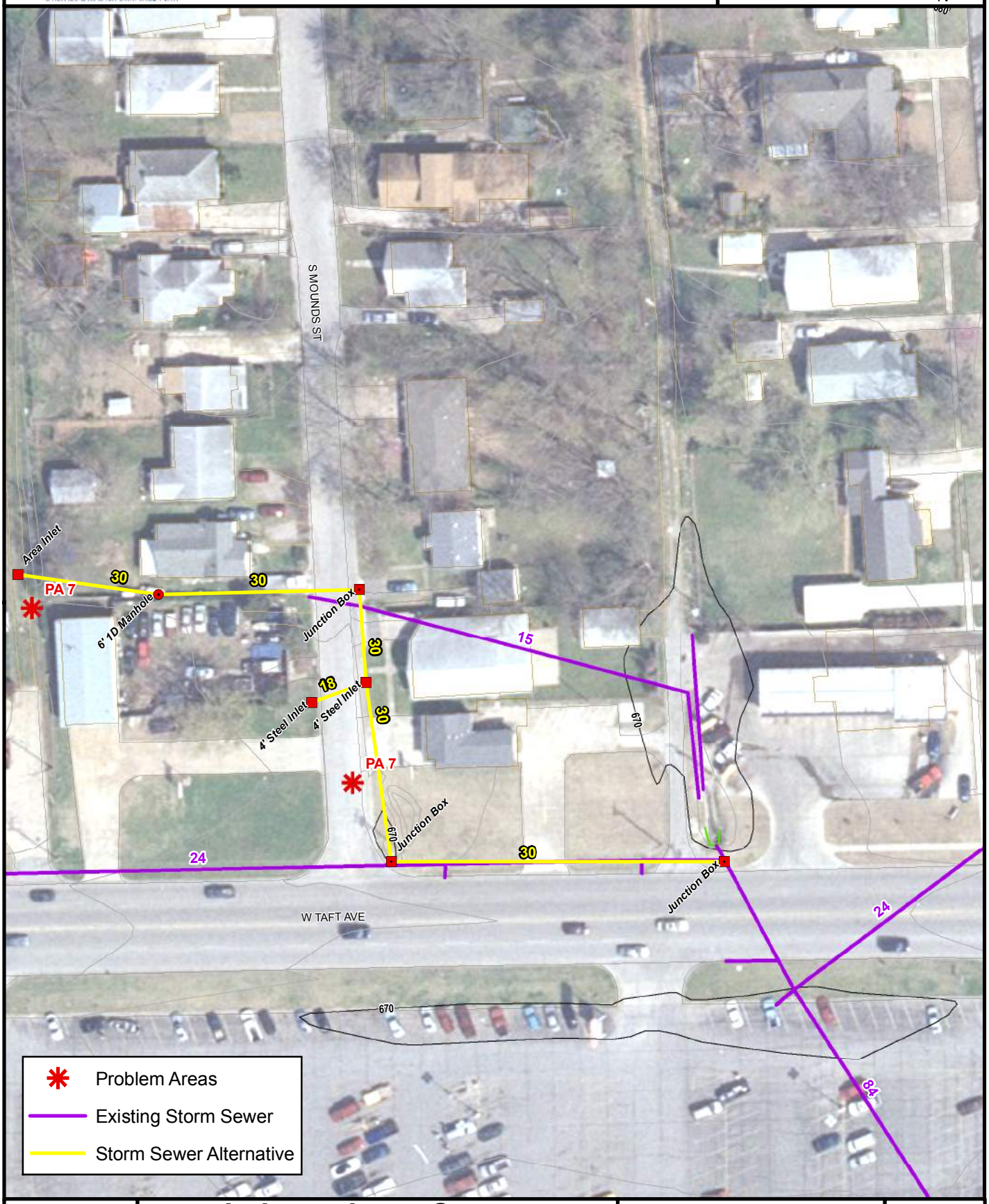

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Independence System Problem Area 7 Alternative 1

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Figure 3-18

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STORMWATER UTILITIES & MASTER DRAINAGE PLAN

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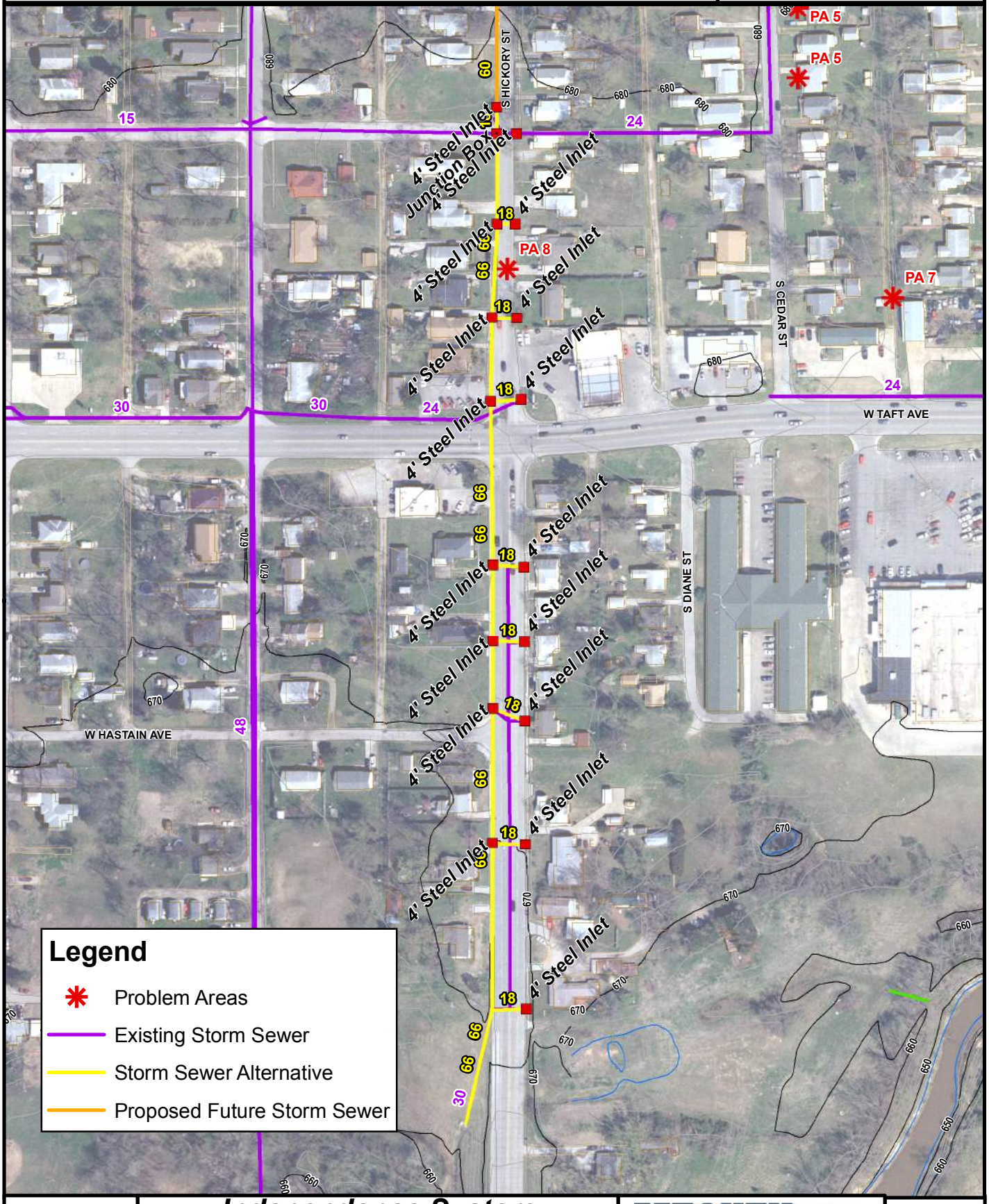

Legend

- Problem Areas
- Existing Storm Sewer
- Storm Sewer Alternative
- Proposed Future Storm Sewer

Independence System
Problem Area 8
Alternative 1

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Figure 3-19

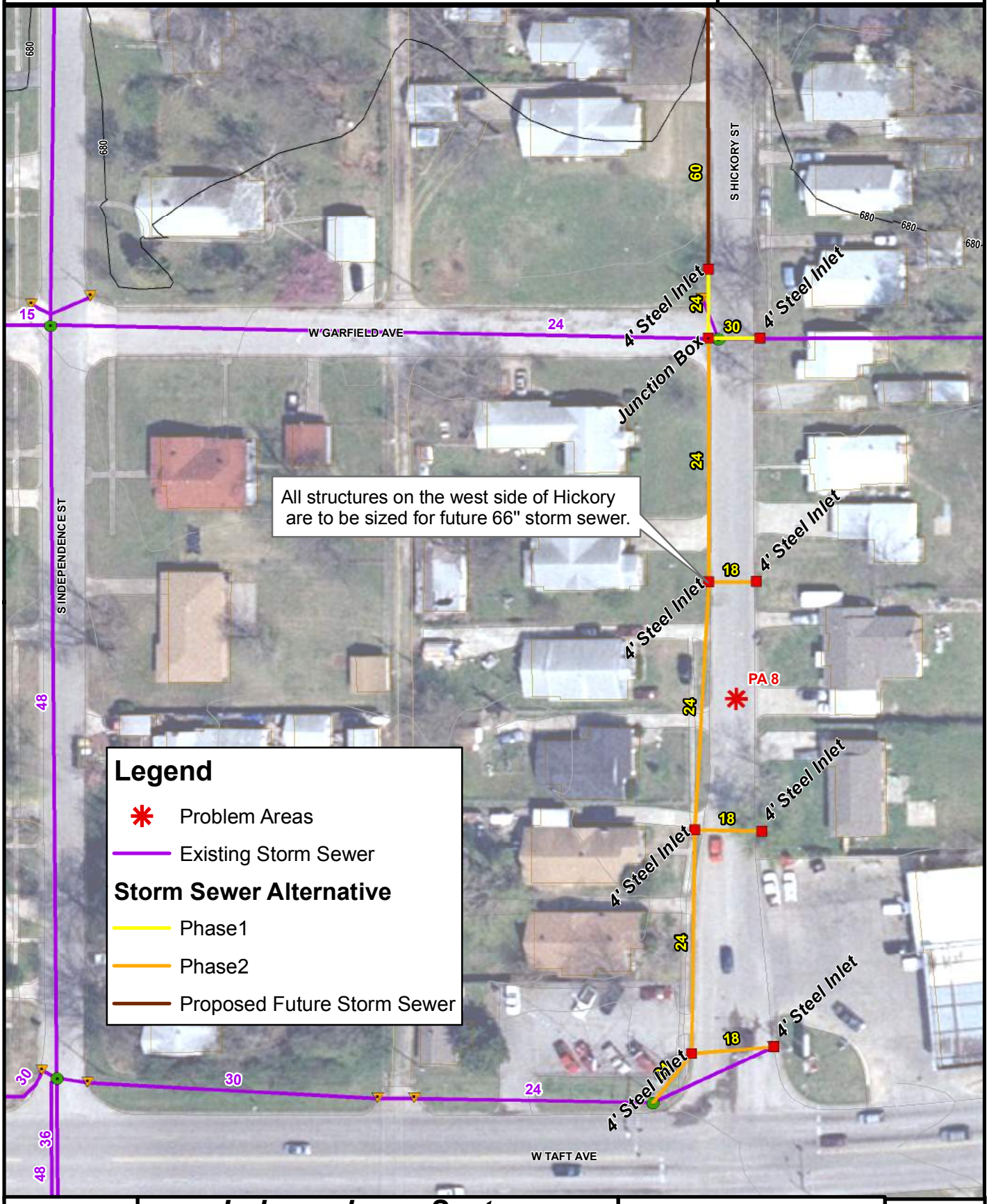
Avenue, the new 24-inch pipe would connect to an existing 24-inch RCP draining west into the Independence trunk line.

Starting with the first set of 4-foot recessed curb inlets with steel inserts immediately north of the northwest corner of W. Taft Avenue and S. Hickory Street, three sets of 4-foot inlets would be installed at 140-foot intervals on both sides of S. Hickory Street. Although a 24-inch RCP would connect the three parallel sets of inlets, the junction boxes on the west side of S. Hickory Street would be sized to handle the ultimate 66-inch RCP described in **SECTION 3.4.A**.

In addition, this phase would include 420 feet of street overlay north from W. Taft Avenue. The cost of Phase 1 of this interim solution is $52,000. Phase 2 is estimated to cost $237,000. Both phases are shown in **FIGURE 3-20**.

Alternative 3: Construct a 24-inch storm sewer on the west side of Hickory Street from Garfield Avenue to Taft Avenue with inlets. This is a variation of Alternative 2. The major difference is that the existing 24-inch pipe at S. Cedar Street and W. Taft Avenue would be extended west to connect with the new 24-inch at Hickory Street and Taft Avenue. Not only would this alternative be more expensive than Alternative 2 (due to an additional block of new 24-inch RCP), but grade changes of up to 1.5 feet differences along Taft Avenue in this area make this alternative unfeasible. As a result, this alternative was explored no further.

City of Sapulpa Master Drainage Plan



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Independence System Problem Area 8 Alternative 2

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Figure 3-20

3.5. RECOMMENDED PLAN

Based on the prioritization criteria presented in **INTRODUCTION SECTION 1** and discussions with City staff, the following alternatives were selected as the Recommended Plan for the Independence Drainage System. Detailed information and exhibits for each of these alternatives can be found in **SECTION 3-4 EVALUATION OF ALTERNATIVES**. Cost estimates can be found in **APPENDIX 3-D**.

The Recommended Plan for the Independence Drainage System is:

PROBLEM AREA	RECOMMENDED ALTERNATIVE	RATIONALE FOR SELECTION	ESTIMATED COST
Problem Areas 1 and 3	Alternative 2-Phased	Alternative 2 is a variation of Alternative 1 and provides similar protection. However, Alternative 2 has the important advantage of "phasing", i.e. allowing the construction and funding to be done in increments.	$2,684,000
Problem Area 2	Alternative 1	In combination with previous work done by the City, this alternative provides a 20% annual chance protection for the public at a reasonable cost.	$387,000
Problem Area 4	Alternative 1	This alternative would provide protection from a 20% annual chance storm event. This solution would correct a long-term problem with City liability, improve emergency access, and eliminate flooding in houses.	$620,000
Problem Area 5	Alternative 1	Ultimately, this entire system will have to be replaced. However, in the interim, Alternative 1 is a cost-effective solution to provide relief from yard flooding.	$265,000
Problem Area 6	Alternative 4	This alternative would upgrade the existing Roosevelt System to provide protection during frequent storm events, i.e. a 10% annual chance frequency. It would also upgrade the existing Oklahoma System to a protection level of that of a 50% annual chance event.	$320,000
Problem Area 7	Alternative 1	This alternative proposes the construction of a new storm sewer with additional inlets to capture the water from a 10% annual storm event. This water would then be conveyed into an existing system.	$212,300

Problem Area 8	Alternative 2 – Phased	This alternative provides immediate relief to an area with hazardous driving conditions and can be constructed and funded in phases – an important advantage.	$289,000
		TOTAL COST	**$4,777,300**

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		1648																		
CED-MND-01	Overland			0.00	0.00			Commercial	60	89	92	94	95	0.0	59.6	0.0	0.0	78.1	18.0	0.02811
	Channel (ditch)	832	1.60	1.88	7.37			Forest (good cover)	27	25	55	70	77	0.0	26.7	0.0	0.0			
	Paved			0.00	0.00			Industrial	1	81	88	91	93	0.0	0.8	0.0	0.0			
	Pipe			0.00	0.00			Pasture: Good Condition	13	39	61	74	80	0.0	12.9	0.0	0.0			
	Stream	816	0.52	4.00	3.40	6.5	0.11													
		1598																		
CED-MND-02	Overland	179	1.19	0.76	3.91			Commercial	9	89	92	94	95	0.0	7.9	0.7	0.0	81.1	24.4	0.03816
	Channel (ditch)	994	0.67	1.20	13.75			Residential 1/4 acre	91	61	75	83	87	0.0	33.4	57.9	0.0			
	Paved			0.00	0.00															
	Pipe	425	1.25	4.00	1.77															
	Stream			0.00	0.00	11.7	0.19													
		661																		
CED-MND-03	Overland			0.00	0.00			Commercial	97	89	92	94	95	0.0	15.9	81.2	0.0	93.4	6.6	0.01031
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	3	61	75	83	87	0.0	0.0	3.0	0.0			
	Paved	591	1.03	2.02	4.87															
	Pipe	70	0.71	4.00	0.29															
	Stream			0.00	0.00	3.1	0.05													
		1444																		
GRV-01	Overland			0.00	0.00			Forest (poor cover)	9	45	66	77	83	0.0	0.0	0.0	9.0	78.3	19.5	0.03053
	Channel (ditch)	1444	5.63	3.57	6.73			Residential 1/4 acre	54	61	75	83	87	0.0	0.0	36.5	17.8			
	Paved			0.00	0.00			Pasture: Good Condition	37	39	61	74	80	0.0	19.0	11.6	6.1			
	Pipe			0.00	0.00															
	Stream			0.00	0.00	4.0	0.07													
		1710																		
HCK-01	Overland			0.00	0.00			Commercial	1	89	92	94	95	0.0	1.5	0.0	0.0	72.1	7.3	0.01147
	Channel (ditch)	479	1.31	1.69	4.72			Forest (good cover)	4	25	55	70	77	0.0	4.4	0.0	0.0			
	Paved			0.00	0.00			Impervious	4	98	98	98	98	0.0	4.5	0.0	0.0			
	Pipe	893	1.38	4.00	3.72			Pasture: Good Condition	23	39	61	74	80	0.0	23.4	0.0	0.0			
	Stream	337	3.56	4.00	1.41	5.9	0.10	Residential 1/4 acre	66	61	75	83	87	0.0	66.3	0.0	0.0			
		544																		
IND-01	Overland			0.00	0.00			Forest (good cover)	68	25	55	70	77	0.0	67.8	0.0	0.0	59.4	2.2	0.00350
	Channel (ditch)			0.00	0.00			Pasture: Good Condition	15	39	61	74	80	0.0	14.9	0.0	0.0			
	Paved			0.00	0.00			Residential 1/4 acre	17	61	75	83	87	0.0	17.3	0.0	0.0			
	Pipe	544	3.31	4.00	2.27															
	Stream			0.00	0.00	1.4	0.02													

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		1024																		
IND-02	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	100.0	0.0	0.0	75.0	6.8	0.01070
	Channel (ditch)	607	0.88	1.38	7.32															
	Paved			0.00	0.00															
	Pipe	417	0.19	4.00	1.74															
	Stream			0.00	0.00	5.4	0.09													
		900																		
IND-02-01	Overland			0.00	0.00			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.0	75.0	5.3	0.00830
	Channel (ditch)	900	1.04	1.50	9.97			Residential 1/4 acre	100	61	75	83	87	0.0	100.0	0.0	0.0			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	6.0	0.10													
		649																		
IND-03	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	65.5	34.5	0.0	77.8	4.5	0.00711
	Channel (ditch)	409	1.04	1.51	4.51															
	Paved			0.00	0.00															
	Pipe	240	0.25	4.00	1.00															
	Stream			0.00	0.00	3.3	0.06													
		532																		
IND-03-01	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	98.2	1.8	0.0	75.1	3.2	0.00499
	Channel (ditch)	532	0.43	0.96	9.28															
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	5.6	0.09													
		606																		
IND-03-02	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	53.1	46.9	0.0	78.7	2.8	0.00442
	Channel (ditch)	443	0.90	1.40	5.27															
	Paved			0.00	0.00															
	Pipe	162	0.12	4.00	0.68															
	Stream			0.00	0.00	3.6	0.06													
		665																		
IND-03-03	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	24.4	75.6	0.0	81.0	3.9	0.00609
	Channel (ditch)	433	1.42	1.76	4.09															
	Paved			0.00	0.00															
	Pipe	231	0.78	4.00	0.96															
	Stream			0.00	0.00	3.0	0.05													

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		441																		
IND-03-04	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	1.2	0.00187
	Channel (ditch)	441	0.66	1.20	6.13															
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	3.7	0.06													
		950																		
IND-04	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	9.1	0.01422
	Channel (ditch)	364	1.54	1.84	3.29															
	Paved			0.00	0.00															
	Pipe	586	0.85	4.00	2.44															
	Stream			0.00	0.00	3.4	0.06													
		1050																		
IND-04-01	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	15.3	84.7	0.0	81.8	7.3	0.01139
	Channel (ditch)			0.00	0.00															
	Paved			0.00	0.00															
	Pipe	1050	0.67	4.00	4.37															
	Stream			0.00	0.00	2.6	0.04													
		629																		
IND-04-02	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	6.5	0.01017
	Channel (ditch)	359	1.41	1.76	3.39															
	Paved			0.00	0.00															
	Pipe	270	0.81	4.00	1.13															
	Stream			0.00	0.00	2.7	0.05													
		1467																		
IND-04-03	Overland			0.00	0.00			Residential 1/4 acre	99	61	75	83	87	0.0	0.0	94.9	4.2	83.1	11.2	0.01744
	Channel (ditch)	1467	3.80	2.92	8.37			Pasture: Good Condition	1	39	61	74	80	0.0	0.0	0.0	0.9			
	Paved			0.00	0.00															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	5.0	0.08													
		592																		
IND-04-04	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	2.9	0.00454
	Channel (ditch)	354	2.26	2.24	2.63															
	Paved			0.00	0.00															
	Pipe	238	0.08	4.00	0.99															
	Stream			0.00	0.00	2.2	0.04													

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		974																		
IND-04-05	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	94.8	5.2	83.2	3.8	0.00602
	Channel (ditch)	331	5.92	3.66	1.51															
	Paved	557	3.05	3.49	2.66															
	Pipe	86	1.17	4.00	0.36															
	Stream			0.00	0.00	2.7	0.05													
		711																		
IND-04-06	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	4.2	0.00653
	Channel (ditch)	325	0.74	1.26	4.29															
	Paved	386	1.63	2.55	2.52															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	4.1	0.07													
		922																		
IND-05	Overland			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	8.9	0.01390
	Channel (ditch)	523	1.61	1.88	4.63															
	Paved			0.00	0.00															
	Pipe	399	1.00	4.00	1.66															
	Stream			0.00	0.00	3.8	0.06													
		1315																		
IND-05-01	Overland			0.00	0.00			Forest (good cover)	2	25	55	70	77	0.0	0.0	0.0	1.6	83.3	10.6	0.01658
	Channel (ditch)	111	30.19	8.43	0.22			Residential 1/4 acre	98	61	75	83	87	0.0	2.7	81.6	14.1			
	Paved	1122	4.54	4.27	4.38															
	Pipe	82	0.49	4.00	0.34															
	Stream			0.00	0.00	3.0	0.05													
		1053																		
IND-06	Overland			0.00	0.00			Forest (good cover)	0	25	55	70	77	0.0	0.0	0.0	0.0	84.2	9.2	0.01443
	Channel (ditch)	414	9.51	4.67	1.48			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	70.3	29.7			
	Paved	559	1.66	2.57	3.62															
	Pipe	80	0.50	4.00	0.33															
	Stream			0.00	0.00	3.3	0.05													
		995																		
IND-06-02	Overland			0.00	0.00			Forest (good cover)	12	25	55	70	77	0.0	0.0	0.0	12.1	84.3	7.5	0.01166
	Channel (ditch)	776	8.25	4.34	2.98			Residential 1/4 acre	88	61	75	83	87	0.0	0.0	36.6	51.3			
	Paved	219	0.91	1.90	1.92															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	2.9	0.05													

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		891																		
IND-07	Overland	166	4.26	1.45	1.91			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	66.5	33.5	84.3	8.7	0.01361
	Channel (ditch)	326	1.47	1.80	3.02															
	Paved			0.00	0.00															
	Pipe	399	1.75	4.00	1.66															
	Stream			0.00	0.00	4.0	0.07													
		552																		
IND-07-01	Overland	199	3.61	1.34	2.49			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	100.0	0.0	83.0	3.5	0.00548
	Channel (ditch)	140	4.39	3.14	0.74															
	Paved	213	1.41	2.37	1.50															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	2.8	0.05													
		1197																		
IND-07-02	Overland	299	10.51	2.28	2.18			Residential 1/4 acre	77	61	75	83	87	0.0	0.0	0.7	76.6	84.7	6.5	0.01010
	Channel (ditch)	91	7.72	4.20	0.36			Forest (good cover)	23	25	55	70	77	0.0	0.0	0.0	22.7			
	Paved			0.00	0.00															
	Pipe	806	2.16	4.00	3.36															
	Stream			0.00	0.00	3.5	0.06													
		539																		
IND-07-03	Overland	220	14.49	2.68	1.37			Residential 1/4 acre	37	61	75	83	87	0.0	0.0	10.8	26.6	80.3	1.3	0.00209
	Channel (ditch)	273	4.60	3.22	1.41			Forest (good cover)	63	25	55	70	77	0.0	0.0	0.0	62.6			
	Paved			0.00	0.00															
	Pipe	47	0.00	4.00	0.19															
	Stream			0.00	0.00	1.8	0.03													
		1182																		
IND-08	Overland	301	6.19	1.75	2.87			Pasture: Good Condition	0	39	61	74	80	0.0	0.0	0.0	0.4	84.9	7.1	0.01106
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	100	61	75	83	87	0.0	0.0	52.0	47.6			
	Paved	702	3.13	3.54	3.31															
	Pipe	178	0.45	4.00	0.74															
	Stream			0.00	0.00	4.2	0.07													
		932																		
IND-08-01	Overland	282	3.17	1.25	3.77			Pasture: Good Condition	31	39	61	74	80	0.0	0.0	0.0	31.2	83.1	3.4	0.00524
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	69	61	75	83	87	0.0	0.0	42.1	26.7			
	Paved	650	5.23	4.58	2.36															
	Pipe			0.00	0.00															
	Stream			0.00	0.00	3.7	0.06													

Appendix 3-A. Independence 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.)
										A	B	C	D	A	B	C	D		42.4	
		883																		
IND-08-02	Overland	265	4.02	1.41	3.14			Forest (good cover)	2	25	55	70	77	0.0	0.0	0.0	1.6	83.5	3.6	0.00567
	Channel (ditch)			0.00	0.00			Residential 1/4 acre	98	61	75	83	87	0.0	0.0	83.4	15.1			
	Paved	550	0.87	1.86	4.94															
	Pipe	67	0.45	4.00	0.28															
	Stream			0.00	0.00	5.0	0.08													
		1720																		
MUS-01	Overland			0.00	0.00			Forest (good cover)	10	25	55	70	77	0.0	10.2	0.0	0.0	70.9	19.4	0.03031
	Channel (ditch)	752	1.68	1.93	6.50			Pasture: Good Condition	17	39	61	74	80	0.0	16.6	0.0	0.0			
	Paved	859	1.02	2.01	7.10			Residential 1/4 acre	73	61	75	83	87	0.0	69.4	3.8	0.0			
	Pipe			0.00	0.00															
	Stream	110	0.73	0.00	0.00	8.2	0.14													
		2440																		
PARK-01	Overland			0.00	0.00			Commercial	31	89	92	94	95	0.0	7.2	23.6	0.0	80.2	33.2	0.05188
	Channel (ditch)	793	0.50	1.04	12.70			Forest (good cover)	4	25	55	70	77	0.0	3.5	0.2	0.0			
	Paved	1403	1.89	2.74	8.53			Pasture: Good Condition	10	39	61	74	80	0.0	10.0	0.0	0.0			
	Pipe	243	0.82	4.00	1.01			Residential 1/4 acre	55	61	75	83	87	0.0	35.6	19.8	0.0			
	Stream			0.00	0.00	13.3	0.22													

City of Sapulpa Master Drainage Plan

STORMWATER UTILITIES & MASTER DRAINAGE PLAN

Feet
0 275 550 1,100
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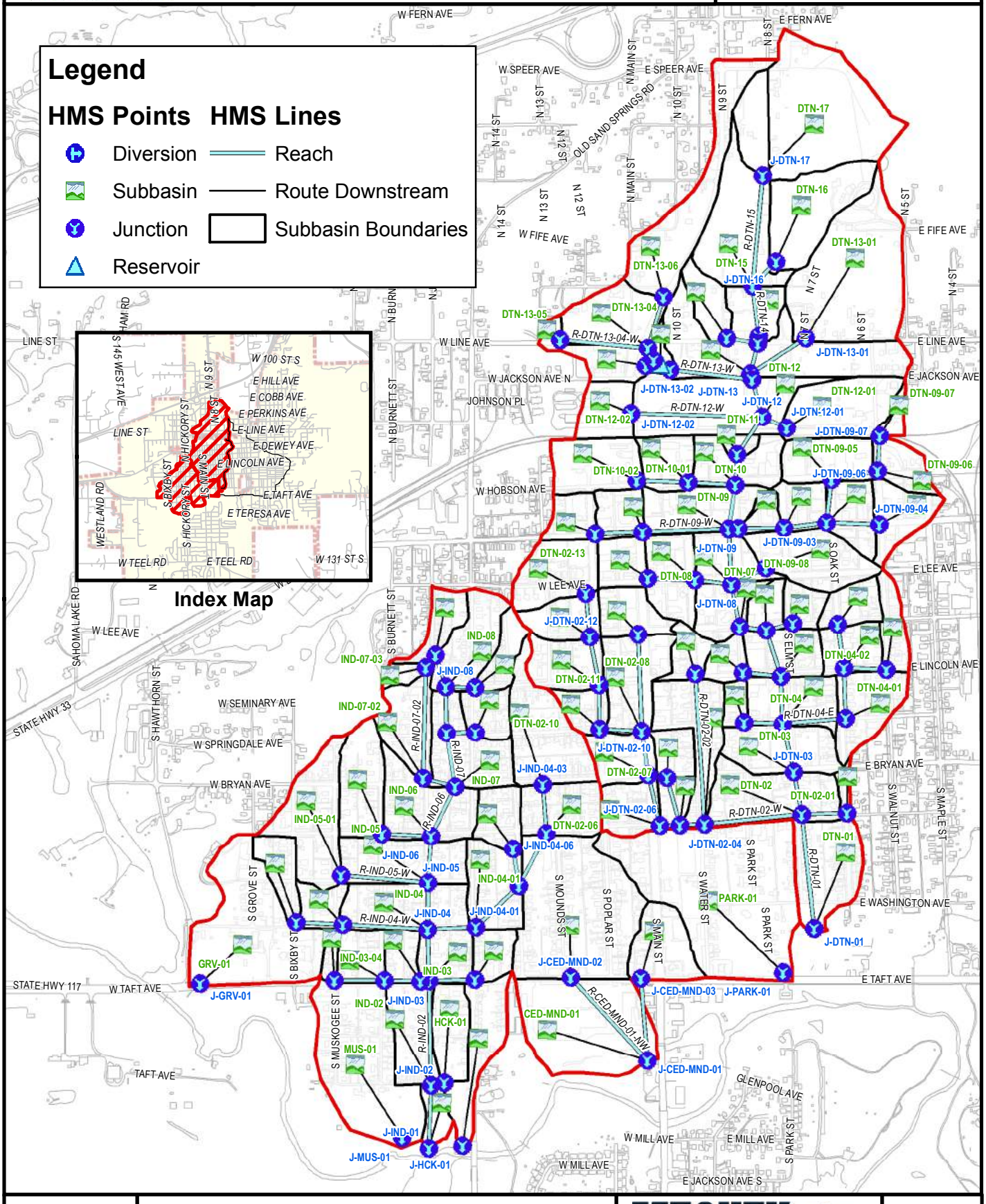

The City of Sapulpa — Oklahoma's Most Connected City

Independence-Downtown System HMS Schematic

MESHEK & ASSOCIATES, PLC
1437 S Boulder Ave, Suite 1080 Tulsa, OK 74119
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Appendix 3-B

Appendix 3-C. Independence 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
CED-MND-01	19	32	56	71	90	105	119	148	0.028
CED-MND-02	26	40	67	85	107	124	140	175	0.038
CED-MND-03	17	27	37	43	51	57	62	73	0.010
GRV-01	23	41	69	88	111	129	146	180	0.031
HCK-01	5	9	18	24	32	38	44	56	0.011
IND-01	0	1	4	5	8	10	12	16	0.004
IND-02	6	11	20	26	33	39	45	56	0.011
IND-02-01	5	8	15	19	25	30	34	43	0.008
IND-03	5	10	17	21	27	31	35	43	0.007
IND-03-01	3	5	9	12	15	18	21	26	0.005
IND-03-02	4	6	11	13	17	19	22	27	0.004
IND-03-03	6	10	16	20	25	29	32	39	0.006
IND-03-04	2	3	5	6	8	9	10	12	0.002
IND-04	15	25	39	48	59	67	76	91	0.014
IND-04-01	11	20	32	39	48	55	62	75	0.011
IND-04-02	11	19	29	36	44	50	56	68	0.010
IND-04-03	17	28	44	54	67	77	86	105	0.017
IND-04-04	5	9	13	16	20	23	26	31	0.005
IND-04-05	7	11	17	21	26	30	33	40	0.006
IND-04-06	7	11	17	21	26	30	34	41	0.007
IND-05	14	24	37	46	57	65	73	88	0.014
IND-05-01	18	30	47	57	71	81	90	109	0.017
IND-06	16	27	41	50	62	70	78	94	0.014
IND-06-02	13	22	34	42	51	58	65	78	0.012
IND-07	15	24	38	46	56	64	72	87	0.014
IND-07-01	6	10	16	19	24	27	30	36	0.005
IND-07-02	11	19	29	35	43	49	55	66	0.010
IND-07-03	2	4	6	7	9	10	12	14	0.002
IND-08	12	20	31	37	46	52	58	70	0.011
IND-08-01	5	9	14	17	22	25	28	33	0.005
IND-08-02	6	9	15	18	22	25	28	34	0.006
J-CED-MND-01	54	80	132	166	209	243	276	343	0.077
J-CED-MND-02	26	40	67	85	107	124	140	175	0.038
J-CED-MND-03	17	27	37	43	51	57	62	73	0.010
J-GRV-01	23	41	69	88	111	129	146	180	0.031
J-HCK-01	5	9	18	24	32	38	44	56	0.011
J-IND-01	204	327	522	644	800	916	1031	1261	0.227
J-IND-02	203	326	520	642	796	912	1025	1253	0.224
J-IND-02-01	5	8	15	19	25	30	34	43	0.008
J-IND-03	195	311	492	606	750	858	963	1173	0.205

Appendix 3-C. Independence 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-IND-03-01	3	5	9	12	15	18	21	26	0.005
J-IND-03-02	11	19	31	39	49	56	63	77	0.012
J-IND-03-03	8	13	21	26	32	37	41	50	0.008
J-IND-03-04	2	3	5	6	8	9	10	12	0.002
J-IND-04	178	284	447	548	678	774	868	1055	0.180
J-IND-04-01	41	66	105	129	160	183	206	252	0.046
J-IND-04-01-UP	34	54	85	105	130	149	167	204	0.034
J-IND-04-02	27	44	69	85	105	120	134	163	0.028
J-IND-04-03	17	28	44	54	67	77	86	105	0.017
J-IND-04-04	11	19	30	37	46	52	58	70	0.011
J-IND-04-05	7	11	17	21	26	30	33	40	0.006
J-IND-04-06	7	11	17	21	26	30	34	41	0.007
J-IND-05	113	183	284	348	429	489	548	665	0.110
J-IND-05-01	18	30	47	57	71	81	90	109	0.017
J-IND-06	83	132	206	251	309	352	395	478	0.079
J-IND-06-02	13	22	34	42	51	58	65	78	0.012
J-IND-07	56	91	141	172	213	242	271	328	0.053
J-IND-07-01	6	10	16	19	24	27	30	36	0.005
J-IND-07-02	13	22	34	42	51	58	65	79	0.012
J-IND-07-03	2	4	6	7	9	10	12	14	0.002
J-IND-07-UP	29	46	72	88	109	124	139	168	0.027
J-IND-08	23	38	59	71	88	100	112	135	0.022
J-IND-08-01	5	9	14	17	22	25	28	33	0.005
J-IND-08-02	6	9	15	18	22	25	28	34	0.006
J-MUS-01	11	20	41	55	73	88	103	132	0.030
J-PARK-01	31	49	84	107	135	157	179	224	0.052
MUS-01	11	20	41	55	73	88	103	132	0.030
PARK-01	31	49	84	107	135	157	179	224	0.052
R-CED-MND-01	17	27	37	43	51	57	62	73	0.010
R-CED-MND-01-NW	26	40	67	85	107	124	140	175	0.038
R-IND-01	203	326	520	642	796	912	1025	1253	0.224
R-IND-02	195	311	492	606	750	858	963	1173	0.205
R-IND-03	178	284	447	548	678	774	868	1055	0.180
R-IND-03-02	8	13	21	26	32	37	41	50	0.008
R-IND-03-03	2	3	5	6	8	9	10	12	0.002
R-IND-03-E	3	5	9	12	15	18	21	26	0.005
R-IND-04	113	183	284	348	429	489	548	665	0.110
R-IND-04-01	34	54	85	105	130	149	167	204	0.034
R-IND-04-01-UP	27	44	69	85	105	120	134	163	0.028
R-IND-04-02	17	28	44	54	67	77	86	105	0.017

Appendix 3-C. Independence 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-IND-04-04	7	11	17	21	26	30	33	40	0.006
R-IND-04-06	7	11	17	21	26	30	34	41	0.007
R-IND-04-E	41	66	105	129	160	183	206	252	0.046
R-IND-04-W	11	19	30	37	46	52	58	70	0.011
R-IND-05	83	132	206	251	309	352	395	478	0.079
R-IND-05-W	18	30	47	57	71	81	90	109	0.017
R-IND-06	56	91	141	172	213	242	271	328	0.053
R-IND-06-W	13	22	34	42	51	58	65	78	0.012
R-IND-07	29	46	72	88	109	124	139	168	0.027
R-IND-07-02	2	4	6	7	9	10	12	14	0.002
R-IND-07-E	6	10	16	19	24	27	30	36	0.005
R-IND-07-UP	23	38	59	71	88	100	112	135	0.022
R-IND-07-W	13	22	34	42	51	58	65	79	0.012
R-IND-08	6	9	15	18	22	25	28	34	0.006
R-IND-08-E	5	9	14	17	22	25	28	33	0.005

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates -Problem Areas 1 & 3 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	5800	$ 2.00	$ 11,600.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	600	$ 2.50	$ 1,500.00
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	3267	$ 45.00	$ 147,000.00
4	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	2	$ 3,500.00	$ 7,000.00
5	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	8	$ 10,000.00	$ 80,000.00
6	**611.06(K)**	**4'x4' CURB INLET**	**EA**	48	$ 3,500.00	$ 168,000.00
7	**613.06(B)**	**48" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	600	$ 220.00	$ 132,000.00
8	**613.06(B)**	**60" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	800	$ 350.00	$ 280,000.00
9	**613.06(B)**	**66" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	1500	$ 430.00	$ 645,000.00
10	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	8595	$ 8.00	$ 68,759.70
11	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	4459	$ 20.00	$ 89,174.00
12	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 50,000.00	$ 50,000.00
13	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	3267	$ 7.00	$ 22,866.67
					Subtotal	**$ 1,702,900.37**
					15% Contingency	**$ 255,435.06**
					Subtotal	**$ 1,958,335.43**
					25% Utility Relocation Contingency	**$ 489,583.86**
					Total	***$ 2,447,919.28***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Areas 1 & 3 Alternate 2 Phase 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	2750	$ 2.00	$ 5,500.00
2	411.06(A)	PAVEMENT REPLACEMENT	SY	1833	$ 45.00	$ 82,500.00
3	611.06(A)	STORM SEWER JUNCTION BOX	EA	3	$ 10,000.00	$ 30,000.00
4	611.06(K)	4'x4' CURB INLET	EA	30	$ 3,500.00	$ 105,000.00
5	613.06(B)	48" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	975	$ 220.00	$ 214,500.00
6	613.06(B)	60" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	400	$ 350.00	$ 140,000.00
7	613.06(S)	TRENCH EXCAVATION	CY	3243	$ 8.00	$ 25,947.85
8	613.06(T)	STANDARD BEDDING MATERIAL	CY	1584	$ 20.00	$ 31,678.00
9	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 50,000.00	$ 50,000.00
10	619.06(B)	PAVEMENT REMOVAL	SY	1833	$ 7.00	$ 12,833.33
					Subtotal	**$ 697,959.19**
					15% Contingency	**$ 104,693.88**
					Subtotal	**$ 802,653.06**
					25% Utility Relocation Contingency	**$ 200,663.27**
					Total	***$ 1,003,316.33***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Areas 1 & 3 Alternate 2 Phase 2						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	3750	$ 2.00	$ 7,500.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	750	$ 2.50	$ 1,875.00
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1900	$ 45.00	$ 85,500.00
4	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	4	$ 10,000.00	$ 40,000.00
5	**611.06(K)**	**4'x4' CURB INLET**	**EA**	24	$ 3,500.00	$ 84,000.00
6	**613.06(B)**	**60" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	375	$ 350.00	$ 131,250.00
7	**613.06(B)**	**66" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	1500	$ 430.00	$ 645,000.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	6096	$ 8.00	$ 48,764.44
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	3210	$ 20.00	$ 64,200.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 50,000.00	$ 50,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1900	$ 7.00	$ 13,300.00
					Subtotal	**$ 1,171,389.44**
					15% Contingency	**$ 175,708.42**
					Subtotal	**$ 1,347,097.86**
					25% Utility Relocation Contingency	**$ 336,774.47**
					Total	***$ 1,683,872.33***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 2 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	1500	$ 2.00	$ 3,000.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	800	$ 2.50	$ 2,000.00
3	411.06(A)	PAVEMENT REPLACEMENT	SY	200	$ 45.00	$ 9,000.00
4	611.06(A)	6' I.D. MANHOLE W/ FRAME AND LID	EA	6	$ 3,500.00	$ 21,000.00
5	611.06(K)	TRENCH GRATE INLET	EA	4	$ 10,000.00	$ 40,000.00
6	611.06(K)	4'x4' CURB INLET	EA	26	$ 3,500.00	$ 91,000.00
7	613.06(B)	24" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	75	$ 75.00	$ 5,625.00
8	613.06(B)	27" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	75	$ 84.00	$ 6,300.00
9	613.06(B)	30" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	600	$ 92.00	$ 55,200.00
10	613.06(S)	TRENCH EXCAVATION	CY	632	$ 8.00	$ 5,052.22
11	613.06(T)	STANDARD BEDDING MATERIAL	CY	384	$ 20.00	$ 7,677.00
12	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 25,000.00	$ 25,000.00
13	619.06(B)	PAVEMENT REMOVAL	SY	200	$ 7.00	$ 1,400.00
					Subtotal	**$ 269,254.22**
					15% Contingency	**$ 40,388.13**
					Subtotal	**$ 309,642.36**
					25% Utility Relocation Contingency	**$ 77,410.59**
					Total	***$ 387,052.94***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 4 Alternate 1						
ITEM	ITEM NO.	DESCRIPTION	UNIT	TOTAL	UNIT PRICE	TOTAL COST
1	223.06	TEMPORARY SILT FENCE	LF	2440	$ 2.00	$ 4,880.00
2	230.06(A)	SOLID SLAB BERMUDA SODDING	SY	660	$ 2.50	$ 1,650.00
3	411.06(A)	PAVEMENT REPLACEMENT	SY	967	$ 45.00	$ 43,500.00
4	611.06(A)	STORM SEWER JUNCTION BOX	EA	5	$ 10,000.00	$ 50,000.00
5	611.06(K)	TRENCH GRATE INLET	EA	2	$ 10,000.00	$ 20,000.00
6	611.06(K)	4'x4' CURB INLET	EA	8	$ 3,500.00	$ 28,000.00
7	613.06(B)	36" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	520	$ 120.00	$ 62,400.00
8	613.06(B)	48" C76 CL IV RCP W/ OMNIFLEX GASKETS	LF	700	$ 220.00	$ 154,000.00
9	613.06(S)	TRENCH EXCAVATION	CY	2043	$ 8.00	$ 16,345.90
10	613.06(T)	STANDARD BEDDING MATERIAL	CY	1088	$ 20.00	$ 21,754.40
11	619.06(B)	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$ 25,000.00	$ 25,000.00
12	619.06(B)	PAVEMENT REMOVAL	SY	967	$ 7.00	$ 6,766.67
					Subtotal	**$ 429,416.96**
					15% Contingency	**$ 64,412.54**
					Subtotal	**$ 493,829.51**
					25% Utility Relocation Contingency	**$ 123,457.38**
					Total	***$ 617,286.88***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 5 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	2150	$ 2.00	$ 4,300.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	900	$ 2.50	$ 2,250.00
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	400	$ 45.00	$ 18,000.00
4	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	5	$ 3,500.00	$ 17,500.00
5	**611.06(K)**	**4'x4' CURB INLET**	**EA**	4	$ 3,500.00	$ 14,000.00
5	**613.06(B)**	**15" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	48	$ 40.00	$ 1,920.00
6	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	675	$ 75.00	$ 50,625.00
7	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 92.00	$ 36,800.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	871	$ 8.00	$ 6,964.07
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	412	$ 20.00	$ 8,247.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 25,000.00	$ 25,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	400	$ 7.00	$ 2,800.00
					Subtotal	**$ 184,106.07**
					15% Contingency	**$ 27,615.91**
					Subtotal	**$ 211,721.99**
					25% Utility Relocation Contingency	**$ 52,930.50**
					Total	***$ 264,652.48***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 6 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	2300	$ 2.00	$ 4,600.00
2	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1533	$ 45.00	$ 69,000.00
3	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	4	$ 3,500.00	$ 14,000.00
4	**611.06(K)**	**4'x4' CURB INLET**	**EA**	12	$ 3,500.00	$ 42,000.00
5	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 70.00	$ 28,000.00
6	**613.06(B)**	**36" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	750	$ 120.00	$ 90,000.00
7	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	1555	$ 8.00	$ 12,442.22
8	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	718	$ 20.00	$ 14,353.00
9	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1533	$ 7.00	$ 10,733.33
					Subtotal	**$ 284,395.22**
					15% Contingency	**$ 42,659.28**
					Subtotal	**$ 327,054.51**
					25% Utility Relocation Contingency	**$ 81,763.63**
					Total	***$ 408,818.13***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 6 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	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1567	$ 45.00	$ 70,500.00
3	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	4	$ 3,500.00	$ 14,000.00
4	**611.06(K)**	**4'x4' CURB INLET**	**EA**	12	$ 3,500.00	$ 42,000.00
5	**613.06(B)**	**36" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 120.00	$ 48,000.00
6	**613.06(B)**	**42" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 162.00	$ 64,800.00
7	**613.06(B)**	**48" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	375	$ 220.00	$ 82,500.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	1961	$ 8.00	$ 15,688.67
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	1022	$ 20.00	$ 20,438.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1567	$ 7.00	$ 10,966.67
					Subtotal	**$ 378,893.33**
					15% Contingency	**$ 56,834.00**
					Subtotal	**$ 435,727.33**
					25% Utility Relocation Contingency	**$ 108,931.83**
					Total	***$ 544,659.17***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 6 Alternate 3						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	2350	$ 2.00	$ 4,700.00
2	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1567	$ 45.00	$ 70,500.00
3	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	4	$ 10,000.00	$ 40,000.00
4	**611.06(K)**	**4'x4' CURB INLET**	**EA**	12	$ 3,500.00	$ 42,000.00
5	**613.06(B)**	**36" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 120.00	$ 48,000.00
6	**613.06(B)**	**48" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 220.00	$ 88,000.00
7	**613.06(B)**	**60" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	375	$ 350.00	$ 131,250.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	2381	$ 8.00	$ 19,050.67
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	1273	$ 20.00	$ 25,466.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1567	$ 7.00	$ 10,966.67
					Subtotal	**$ 489,933.33**
					15% Contingency	**$ 73,490.00**
					Subtotal	**$ 563,423.33**
					25% Utility Relocation Contingency	**$ 140,855.83**
					Total	***$ 704,279.17***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Probem Area 6 Alternate 4						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1550	$ 2.00	$ 3,100.00
2	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1033	$ 45.00	$ 46,500.00
3	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	4	$ 3,500.00	$ 14,000.00
4	**611.06(K)**	**4'x4' CURB INLET**	**EA**	12	$ 3,500.00	$ 42,000.00
5	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	400	$ 90.00	$ 36,000.00
6	**613.06(B)**	**36" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	375	$ 120.00	$ 45,000.00
7	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	1143	$ 8.00	$ 9,141.41
8	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	471	$ 20.00	$ 9,424.50
9	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1033	$ 7.00	$ 7,233.33
					Subtotal	**$ 222,399.24**
					15% Contingency	**$ 33,359.89**
					Subtotal	**$ 255,759.13**
					25% Utility Relocation Contingency	**$ 63,939.78**
					Total	***$ 319,698.91***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 7 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1200	$ 2.00	$ 2,400.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	273	$ 2.50	$ 683.33
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	527	$ 45.00	$ 23,700.00
4	**611.06(A)**	**6' I.D. MANHOLE W/ FRAME AND LID**	**EA**	1	$ 3,500.00	$ 3,500.00
5	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	3	$ 10,000.00	$ 30,000.00
6	**611.06(K)**	**4'x4' CURB INLET**	**EA**	2	$ 3,500.00	$ 7,000.00
7	**611.06(K)**	**AREA INLET**	**EA**	1	$ 3,500.00	$ 3,500.00
8	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	35	$ 46.00	$ 1,610.00
9	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	565	$ 92.00	$ 51,980.00
10	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	507	$ 8.00	$ 4,054.00
11	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	279	$ 20.00	$ 5,587.20
12	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 10,000.00	$ 10,000.00
13	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	527	$ 7.00	$ 3,686.67
					Subtotal	**$ 147,701.20**
					15% Contingency	**$ 22,155.18**
					Subtotal	**$ 169,856.38**
					25% Utility Relocation Contingency	**$ 42,464.10**
					Total	***$ 212,320.48***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 8 Alternate 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	3880	$ 2.00	$ 7,760.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	233	$ 2.50	$ 583.33
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1833	$ 45.00	$ 82,500.00
4	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	3	$ 10,000.00	$ 30,000.00
5	**611.06(K)**	**4'x4' CURB INLET**	**EA**	17	$ 3,500.00	$ 59,500.00
6	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	390	$ 46.00	$ 17,940.00
7	**613.06(B)**	**66" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	1550	$ 430.00	$ 666,500.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	5574	$ 8.00	$ 44,594.49
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	2830	$ 20.00	$ 56,604.20
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 50,000.00	$ 50,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1833	$ 7.00	$ 12,833.33
					Subtotal	**$ 1,028,815.36**
					15% Contingency	**$ 154,322.30**
					Subtotal	**$ 1,183,137.66**
					25% Utility Relocation Contingency	**$ 295,784.41**
					Total	***$ 1,478,922.07***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 8 Alternate 2 Phase 1						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	152	$ 2.00	$ 304.00
2	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	203	$ 45.00	$ 9,120.00
3	**611.06(A)**	**STORM SEWER JUNCTION BOX**	**EA**	1	$ 10,000.00	$ 10,000.00
4	**611.06(K)**	**4'x4' CURB INLET**	**EA**	2	$ 3,500.00	$ 7,000.00
5	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	40	$ 75.00	$ 3,000.00
6	**613.06(B)**	**30" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	36	$ 92.00	$ 3,312.00
7	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	62	$ 8.00	$ 496.12
8	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	30	$ 20.00	$ 605.28
9	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 1,000.00	$ 1,000.00
10	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	203	$ 7.00	$ 1,418.67
					Subtotal	**$ 35,952.07**
					15% Contingency	**$ 5,392.81**
					Subtotal	**$ 41,344.87**
					25% Utility Relocation Contingency	**$ 10,336.22**
					Total	***$ 51,681.09***

City of Sapulpa						
Appendix 3-D. Independence Drainage System Alternative Cost Estimates - Problem Area 8 Alternate 2 Phase 2						
ITEM	**ITEM NO.**	**DESCRIPTION**	**UNIT**	**TOTAL**	**UNIT PRICE**	**TOTAL COST**
1	**223.06**	**TEMPORARY SILT FENCE**	**LF**	1180	$ 2.00	$ 2,360.00
2	**230.06(A)**	**SOLID SLAB BERMUDA SODDING**	**SY**	627	$ 2.50	$ 1,566.67
3	**411.06(A)**	**PAVEMENT REPLACEMENT**	**SY**	1253	$ 45.00	$ 56,400.00
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' CURB INLET**	**EA**	6	$ 3,500.00	$ 21,000.00
6	**613.06(B)**	**18" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	120	$ 46.00	$ 5,520.00
7	**613.06(B)**	**24" C76 CL IV RCP W/ OMNIFLEX GASKETS**	**LF**	470	$ 75.00	$ 35,250.00
8	**613.06(S)**	**TRENCH EXCAVATION**	**CY**	464	$ 8.00	$ 3,714.81
9	**613.06(T)**	**STANDARD BEDDING MATERIAL**	**CY**	195	$ 20.00	$ 3,894.00
10	**619.06(B)**	**REMOVAL OF STRUCTURES AND OBSTRUCTIONS**	**LS**	1	$ 25,000.00	$ 25,000.00
11	**619.06(B)**	**PAVEMENT REMOVAL**	**SY**	1253	$ 7.00	$ 8,773.33
					Subtotal	**$ 164,618.81**
					15% Contingency	**$ 24,692.82**
					Subtotal	**$ 189,311.64**
					25% Utility Relocation Contingency	**$ 47,327.91**
					Total	***$ 236,639.55***