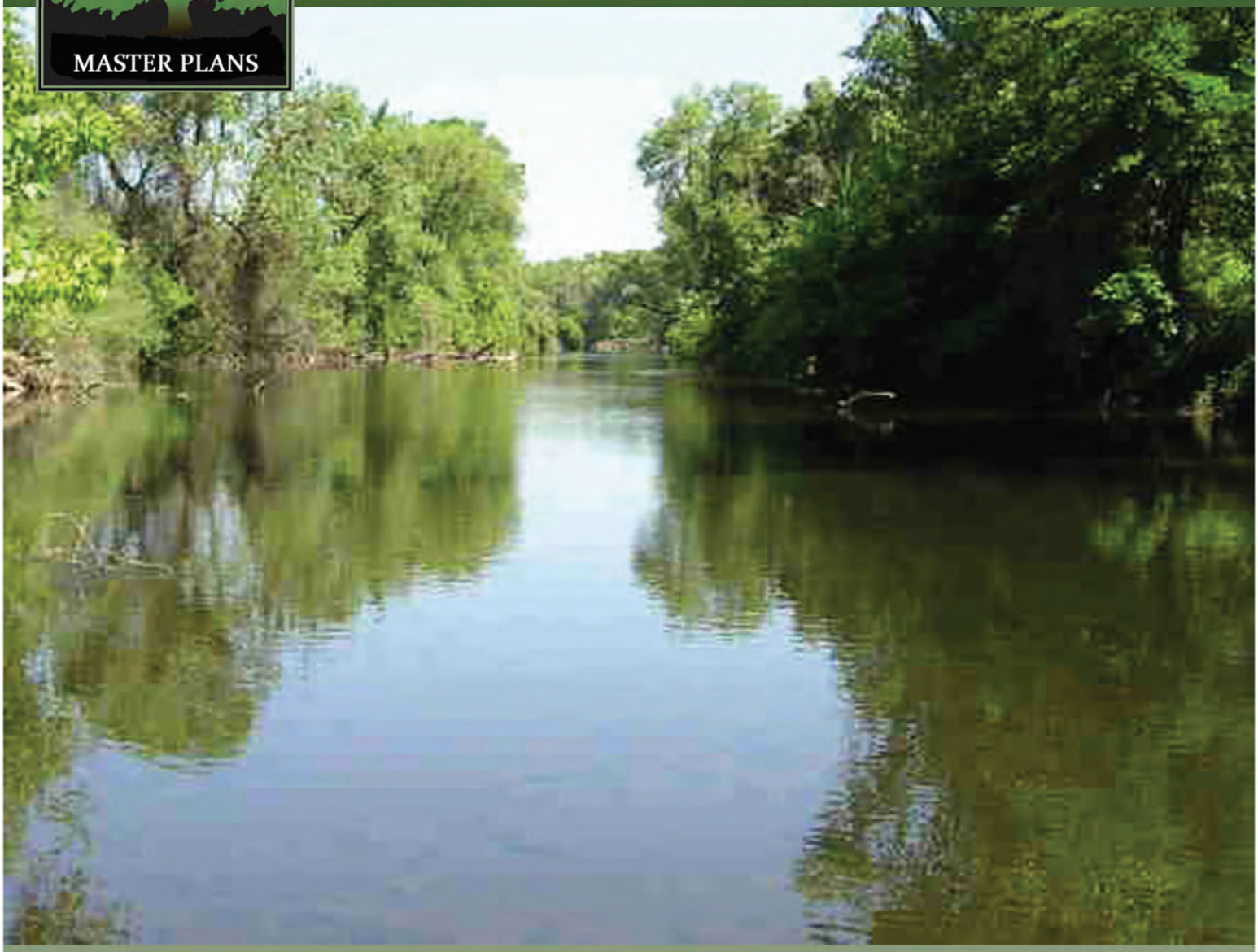
STORM DRAIN MASTER PLAN



City of Oakdale
Public Services Department
455 S. Fifth Street
Oakdale, California 95368

Final
Adopted October 5, 2015

STORM DRAIN MASTER PLAN 2015

CITY OF OAKDALE

DEPARTMENT OF PUBLIC SERVICES

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FINAL

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1. INTRODUCTION

Background:

The City of Oakdale (City) maintains and operates its own storm drain system within the City limits. The storm drain system consists of several discharge locations directly in to the Stanislaus River, multiple discharge locations along Oakdale Irrigation District (OID) facilities, detention basis, dry wells, French drains and cross connections to the sanitary sewer system. The City utilizes an agreement with OID to discharge excess storm runoff into OID facilities during the fall and winter months while the district is not running irrigation water and the pipelines are drained.

The most recent storm drain study performed for the city was completed in March of 1981 by Fredricksen, Delamare & Fultz. On August 8th 2013 the City Council adopted a 2030 General plan which established policies and standards for providing storm drain facilities to serve the existing and future residents and businesses. Included in the General plan are the following policies pertaining to the development of this Storm Drain Master Plan:

> **PF-3.1** ***Adequate Infrastructure.*** *Ensure that the City's storm drainage system is adequately sized, maintained and upgraded to accommodate stormwater runoff and prevent flooding. (MP, EV-IP1)*
>
> **PF-3.2** ***Storm Drainage Planning.*** *Regularly review and update the City's Storm Drainage Study and other storm drainage master planning and capital improvement tools to ensure adequate capacity, infrastructure, treatment, maintenance, rehabilitation, and funding. (MP, PF-IP 1)*
>
> **PF-3.5** ***Deficient Areas.*** *Prioritize the construction of storm drainage infrastructure improvements in areas where deficient services exists (such as older parts of the City prone to street flooding) to minimize flooding. (MP, IGC)*
>
> **PF-3.6** ***Discharge to OID Infrastructure.*** *Consider alternate drainage solutions in areas where stormwater is currently discharged into Oakdale Irrigation District Infrastructure (MP, IGC)*

Purpose and Objective:

The purpose of this Storm Drain Master plan is to act as a guide for planning, development, and financing of both future development in the City and improvements to the existing storm drain facilities. The plan addresses strengths and deficiencies in the existing facilities and presents a comprehensive strategy to enhance the performance of the storm drain system while accommodating future growth and development. The following major tasks are included in the scope of this Storm Drain Master plan.

- Review and evaluation of the existing storm drain system (See **Chapter 2**)
- Determine deficiencies in the existing system & propose improvements to enhance the overall performance of the system and accommodate future growth (See **Chapter 3**)

- Develop cost estimates for proposed improvements identified in Chapter 3 that can be incorporated into a Capital Improvement Program (See **Chapter 4**)

- Identify "next steps" and make recommendations for maintenance of the system to insure long term sustainability (See **Chapter 5**)

Study Area Overview:

The City is located at the base of the foothills of the Sierra Nevada Mountains in the North-Eastern portion of Stanislaus County, approximately 12 miles North East of Modesto and 27 miles South East of Stockton in California's Central Valley. The City is bordered on the North by the Stanislaus River and is surrounded primarily by farmland in all directions. The closest Neighboring Cities South of the Stanislaus River include Riverbank and Modesto to the Southwest and Hughson and Waterford to the South. Major highways include S.R. 120 from the North and S.R. 108 from the West which join in the center of the City and accommodate both regional and cross-City travel.

Climate:

The City's weather, like most of California's Central Valley consists of hot, dry summers and cool winters with moderate spring and fall seasons with a majority of the City's annual precipitation between November and April. Historical climate data for the Oakdale area is shown in table 1.1 below.

Table 1.1 Historical Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Total Precipitation (in.)	2.61	2.14	2.21	1.34	0.45	.012	0.00	0.02	0.18	0.65	1.24	2.37	13.33
Average Max Temperature (F)	52.4	59.0	63.8	70.7	80.5	89.1	95.8	93.9	88.0	78.6	65.7	54.2	74.3
Average Min Temperature (F)	35.1	38.4	40.8	43.5	48.2	54.4	58.4	57.1	54.1	48.0	40.2	36.3	46.2

Source: Western Regional Climate Center: Oakdale Woodward Dam 3/01/1906-12/31/1967

Topography:

The topography of the City is primarily flat with slopes from 0-3% with some rolling hill areas with slopes as high as 15-30% along the Stanislaus River. A high bluff separates the steep northern portion of the city and the river frontage from the southern portion of the city which is generally flat. In general the City slopes from the Southeast to the Northwest towards the Stanislaus River and has elevations ranging from 110 to 220 feet above sea level.

Soils:

Soils throughout the city are a characterized by deep well drained sandy loams. Soils are predominantly Tujunga Loamy Sand, Greenfield Sandy Loam and Hanford Sandy Loam. Tujunga Loamy Sand is described as a pale brown very deep somewhat excessively drained soil with negligible to low runoff that formed in

alluvium from granitic sources. Greenfield loam is described as a pale brown deep well drained soil with slow to medium runoff formed in alluvium from granitic and mixed rock sources. Hanford Sandy Loam is described as a pale brown to light brownish gray very deep somewhat excessively drained soil with negligible to low runoff that formed in alluvium dominantly from granite.

Land Use:

The city limits encompass approximately 6 square miles of residential, commercial, industrial public/semi-public, parkland and agricultural properties with residential being the most prominent. The City's historic residential neighborhoods are located north of West F Street (S.R. 108). A majority of new single family homes are located in the northeast and southwest quadrants of the City. Existing commercial properties are primarily located along West and East F Street (S.R. 108/120) as well as along North Yosemite Avenue (S.R. 120). The southern portion of the City is home to the majority of Oakdale's Industrial properties with the largest industrial park being located east of South Yosemite Avenue. Throughout the City are various Public/semi-public land uses including schools, churches, medical facilities, emergency services, the Oakdale Municipal Airport and the Oakdale Rodeo Grounds. Parkland consists of large community parks, residential parks, mini parks, walking paths and trails and is abundant throughout the City, generally a short walk from most residential neighborhoods. Outside the city limits the predominant land use is agriculture with a diverse combination of row crops, orchards, dairies, livestock and pastureland. Table 1.2 below shows the current land use throughout Oakdale.

Table 1.2 Existing Land Use

Land Use	Code	Acres within City Limits	Percent of total City Acres	Acres within 2030 GP Area[1]	Percent of total 2030 Area Acres[1]
Existing Land Use					
Residential Agricultural	RA	2	<1%	1,797	15
Rural Estate	RE	4	<1%	0	0%
Single Family	SFR	929	24%	68	<1%
Multi Family	MFR	142	4%	1	<1%
Mobile Home Park	MHP	2	<1%	0	0%
Commercial	C	222	6%	0	0%
Office	O	1	<1%	0	0%
Agricultural	AG	0	0%	8,868	73
Industrial	IND	546	14%	0	0%
Public/Semi-Public	P/SP	413	11%	0	0%
Park	P	147	4%	265	2%
Open Space	OS	22	<1%	1	<1%
Golf Course	GC	0	0%	132	1%
Subtotal Existing Land	**Acres**	**2,480**	**64**	**11,144**	**92%**
Vacant		700	18%	211	2%
Right-of-Way/Roads		724	18	729	6%
Total Acres		**3,904**	**100%**	**12,084**	**100%**

SOURCE: City of Oakdale 2030 General Plan.

2. STORM DRAIN SYSTEM ANALYSIS

Existing System Overview:

The City's storm drain system is comprised of a combination of inlets, pipes, detention basins, drywells, French drains, pumping stations and outfall structures. A significant portion of the city (approximately 30 percent) ultimately discharges into the Stanislaus River through one of eight outfall structures maintained by the city, or by discharging into an Oakdale Irrigation District (OID) facility that ultimately discharges to the river. Storm runoff from the balance of the city never reaches the river directly, as it is percolated back into the ground through the use of retention basins, drywells and french drains. During large storm events, some storm runoff is directed to the city's Wastewater Treatment Plant, either through direct overflow connections, or by manual pumping into the sewer collection system.

Drainage Areas:

The city's storm drain system can be viewed as a collection of individual drainage areas/systems. These individual drainage areas have been grouped together into major drainage areas as a convenient way of analyzing and evaluating the system. These major drainage areas are identified as Central, West, East and South, as shown below:

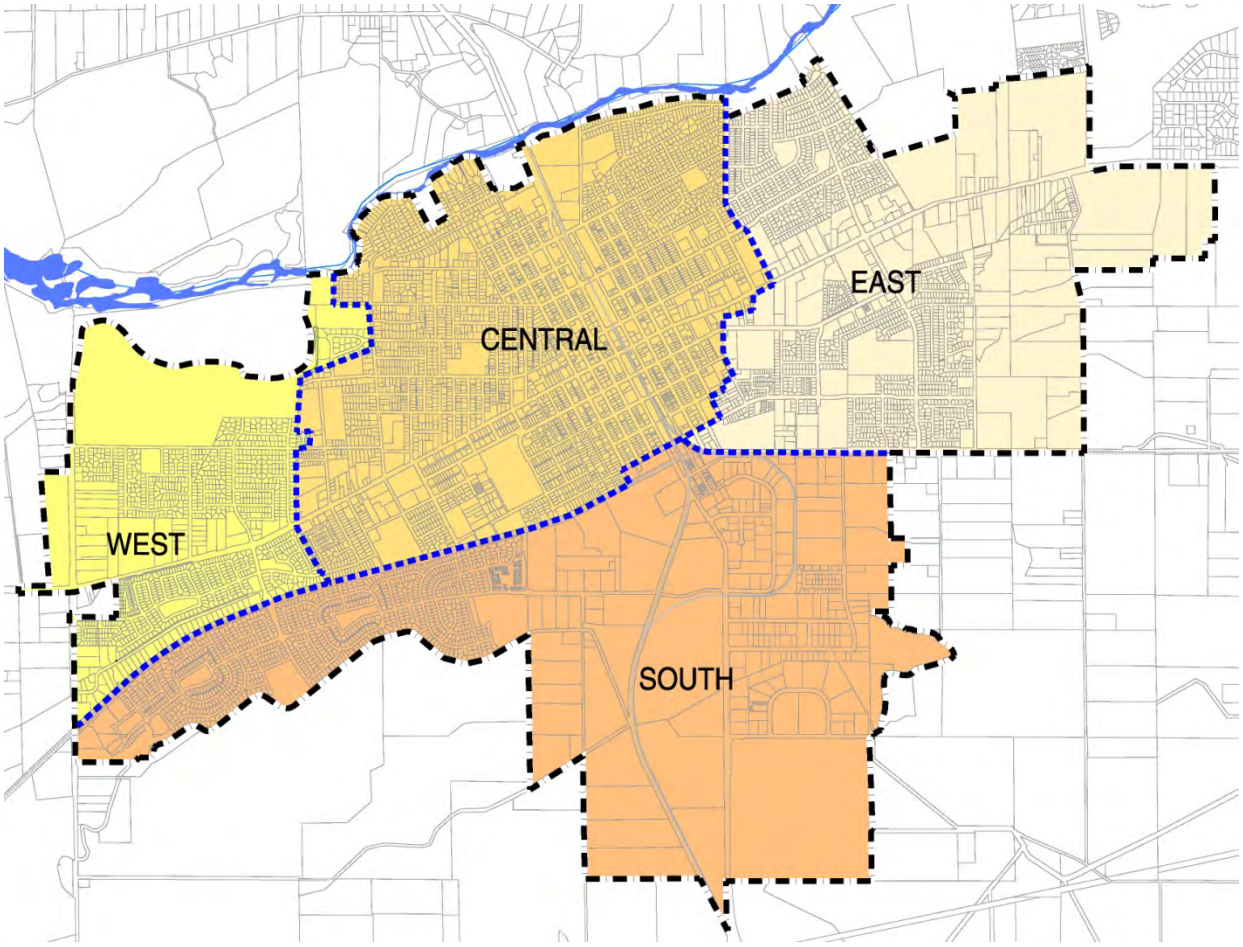
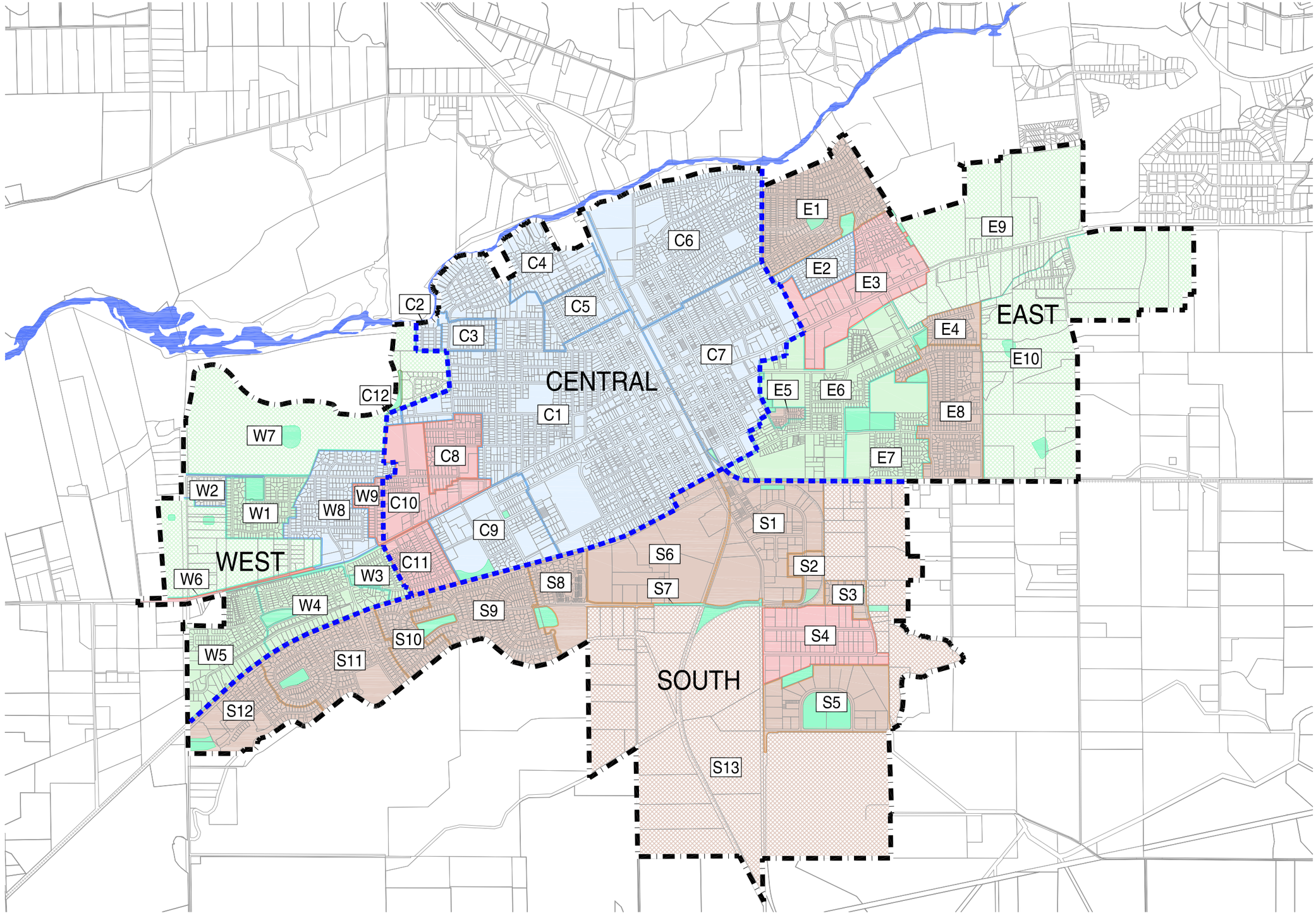


FIGURE 2.1
STORM DRAIN DRAINAGE AREAS



LEGEND

- DISCHARGES DIRECTLY TO RIVER
- DRAINS TO BASIN THEN RIVER
- DRAINS TO PERCOLATION BASIN
- DRAINS TO DRYWELL
- DRAINS TO BASIN THEN TO RIVER (FUTURE)
- DRAINS TO PERCOLATION BASIN (FUTURE)
- A01 DRAIN AREA
- CITY LIMIT
- DRAINAGE AREA LIMITS

NORTH

0 1000 2000

CITY OF OAKDALE

These large "drainage areas" consist of multiple individual sub-areas or watersheds that service anywhere from small residential neighborhoods to large combinations of commercial and residential properties. **Figure 2.1** shows the configuration of these individual drainage sub-areas, or watersheds. The color of each watershed indicates where the runoff from that watershed is discharged, as follows:

Discharges directly into the River (no retention)

Drains into a detention basin, then discharges to River

Discharges into a drywell or french drain

Discharges into a retention basin

Central Drainage Area:

The Central Drainage Area consists of the north-central and oldest part of town, and the majority of this drainage area discharges directly into the Stanislaus River. The conveyance (piping) system in this area was designed for a much smaller storm than today's standards, and with the exception of two small watersheds, detention facilities were not provided. Essentially, the streets are utilized as detention facilities during larger storm events in this drainage area.

Some of the storm drain system components within this area were constructed as early as the 1930's. In these areas, record information is sparse or unavailable. An extensive investigation was performed on record maps and documents to compile and produce a complete storm drain system map. Drainage areas were drawn from a combination of record maps as well as field verification. Drainage areas and their respective storm drain systems were determined to analyze problem areas throughout the City.

Virtually all localized flooding problems occur within this drainage area because of the lack of adequate storage volume and/or conveyance facilities. Fortunately, city crews are adept at managing this system to relieve flooding and protect homes and businesses from being inundated during storm events. Unfortunately, some level of maintenance and management during storms will probably always be a reality in this area, because updating this entire area to today's standards for storm drainage design would be cost-prohibitive. Below is a brief description of each watershed within the Central Drainage Area.

Sub-Area C1 encompasses the oldest parts of the City and is the largest drainage area at approximately 500 acres. C1 is bound on the east by Yosemite Avenue and the railroad tracks which act as a natural barrier, on the south by the bluff and railroad tracks running east and west. The western boundary includes Hinkley Avenue to F Street, east of Stanislaus Avenue to Pontiac Street, north on Oak to midway between Pontiac and Fair Oaks Ct. west to the city limits, then north to DA-38, east to Lee Avenue, north to Walnut Street, East to Barton Parkway Alley, and North to Kimball Street. It is bound on the north by the Stanislaus River, C4, and C5. The storm drain system is a positive drainage system that conveys stormwater gathered at drain inlets along the streets directly to the Stanislaus River.

Sub-Area C2 is a small area bound by the City limits on the south and west, the Stanislaus River on the north and the fence line between Del Rio Circle and N. Oak Avenue. The drainage from this area is picked up by one drain inlet on Walnut Avenue and is directly discharged to the Stanislaus River through a 15" diameter mainline.

Sub-Area C3 is a small drainage area located to the east of C2 and surrounded by C1 on all other sides. Drainage from this area collects in drain inlets along the system mainline and directly discharges to the Stanislaus River. This system is underutilized and should be incorporated into C1 to relieve overloading of the C1 system.

Sub-Area C4 is located west of Yosemite Avenue and north of North Street. It is bound on the west by Laurel Avenue and the east end of Gina Way and on the north by the Stanislaus River. Drainage collects in drain inlets throughout the area and is directly discharged to the Stanislaus River.

Sub-Area C5 is located west of Yosemite Avenue and is bound on the north by North Avenue and on the south by B Street, Laurel, and Walnut. On the west C5 is bound by Eucalyptus Avenue. Drainage from C5 collects in drain inlets throughout the system that discharge to an OID line as well as one dry well.

Sub-Area C6 Is a large drainage area that is bound on the east by Valley View Drive, on the south by C Street, on the west by the railroad tracks east of Yosemite Avenue and on the North by the Stanislaus River. Drainage from C6 collects throughout the system in curb inlets and discharges directly to the Stanislaus River through three outfalls. C6 also receives drainage through a force main from C7.

Sub-Area C7 is bound on the west side by Yosemite Avenue and the railroad tracks, on the north by C Street, on the East by the center line of Valley View Drive southeast to F Street, west along F to the bend in G Street, south to the intersection of H Street and Pedersen Road, south along Pedersen, west to the intersection of I Street and 6th Avenue, south along 6th to J street and west along J to the railroad tracks. Drainage from C7 is collected throughout the system in drain inlets and drains to a pump station at the northern end of the drainage area which discharges into the mainline of C6 which directly discharges into the Stanislaus River. A small portion of the drainage area along the west edge drains first to a percolation basin that when full allows for the water to back up and flow into the mainline which drains to the pump station.

Sub-Area C8 is bound on the north by Poplar Street on the east by Stanislaus Avenue, on the south by Pontiac Street, and on the west by the back of Fair Oaks Elementary. Drainage for this area is collected along N. Oak Avenue and directed to a large French drain located on the east side of Oak.

Sub-Area C9 is bound on the north by F Street, on the east by Hinkley Avenue, on the south by the railroad tracks and the bluff and on the west by Ash Avenue. Drainage occurs through drain inlets throughout the drainage area that are connected to dry wells and a small basin. Excess runoff is discharged through a lift station to an OID Line.

Sub-Area C10 includes N. Lee Avenue, Valmor Court and the area south of C8 and north of F Street. Drainage is collected in drain inlets and discharged into Dry wells.

Sub-Area C11 is bound on the north by F Street, on the east by Ash Avenue, on the south by the railroad tracks and the bluff, and on the west by the back of lots on Odessa Way. Drainage in C11 is collected in drain inlets and discharged to dry wells.

Sub-Area C12 includes the end of Poplar Street west of N. Lee Avenue. Drainage collects in drain inlets on the west end of Poplar and a lift station discharges into an OID line north of Poplar.

East Drainage Area:

The East Drainage Area consists of residential and commercial land east of the Central Drainage Area and north of the railroad. It also includes both the East F Street Specific Plan and the Sierra Pointe Specific Plan.

Sub-Area E1 is bound on the west by Valley View Drive, on the north by Stanislaus River, on the East by the city limits and on the south by the trail between C Street and D Street. The Drainage from this system discharges into two basins with drywells installed in them.

Sub-Area E2 is bound on the north by E1, on the east by the back of lots on Brett Avenue, on the south by the back of the lots on Speer Street, on the west by the back of lots on Appaloosa Avenue, and on the north by trail between C and D. Drainage from E2 collects in drain inlets and drains to a pump station that discharges to an OID mainline.

Sub-Area E3 is bound on the north by E1 and E2, on the east by the city limits, on the south by the back of the commercial properties south of F Street, and on the west by C7. Drainage in E3 is collected along the system in drain inlets which are connected to multiple drywells. Any excess drainage is directed to basins on the eastern boundary of the drainage area.

Sub-Area E4 is bound on the north by the back of lots north of G Street, on the east by the extension of Orsi Road, on the south by Lando Road, and on the west by the basin at the corner of E Street and S. Maag Avenue. Drainage occurs through drain inlets along the system and discharges to the basin on the west boundary.

Sub-Area E5 is a small drainage area which includes Marquez Court, Hallman Lane, and Dominic Street. Drainage collects in Drain inlets along the streets and discharges into a terminal basin north of Dominic Street on Pedersen Road.

Sub-Area E6 is bound on the east by Maag Avenue south to Jubal Court, the back of lots on Grand Oak Way and Oak Branch Street, south down Ventanas Avenue to Sierra Road, on the south by Sierra Road, on the west by J Street, up 6th Street and over to Dominic Street, Up Pedersen to the intersection at H Street, North up to the bend in G Street and on the north by C7 and E3. Drainage from E6 collects in drain inlets throughout the system and flows to a small basin in the northwest corner of the drainage area. Excess drainage flows to C7 and then to C6 where it is discharged to the Stanislaus River.

Sub-Area E7 is bound on the east by Maag Avenue, on the south by the city limits, on the west by the west edge of Sierra View Elementary School up to Cottle's Woods Park, east on J Street around the park and along the back of the lots on Oak Branch Street, and on the north by the lots on Grand

Oak Way and Jubal Court. Drainage from E7 collects in drain inlets throughout the system and drains to Cottle's Woods Park. Excess drainage flows out of the park into E6 which eventually flows to E5, C7 and C6 where it discharges to the Stanislaus River.

Sub-Area E8 is bound on the east by Orsi Road, on the south by Knox Road, on the west by Maag Avenue, the parcels on Jubal Court, and on the north by E4. Drainage from E8 collects in drain inlets throughout the system and discharges into the basin south of Jubal court as well as the basin at the southeast corner of G and Maag.

Sub-Area E9 includes the North F Street Corridor Specific Plan. Drainage will collect and discharge into percolation basins. Excess drainage will discharge through an outfall to the Stanislaus River.

Sub-Area E10 includes the Sierra Pointe Specific Plan area. Drainage throughout this area will collect in drain inlets and discharge into percolation basins. Excess drainage will discharge into OID lines which eventually discharge into the Stanislaus River.

West Drainage Area:

The West Drainage Area consists of residential and commercial land west of the Central Drainage Area and north of the railroad. It also includes the recently developed Vineyard subdivision and the Crane Crossing Specific Plan.

Sub-Area W1 is bound on the north by Pontiac Street, on the east by C12, on the south by the city limits and on the west by the back of lots on Timberwood Drive. Drainage collects in drain inlets throughout the system then discharges to a retention basin. A lift station in the basin discharges excess water to a storm drain line that leads to the outfall in the Stanislaus River north of Crane Road.

Sub-Area W2 is a small drainage area on the western edge of the city limits. W2 is bound on the north, south, and west by the city limits and on the east by W1. Drainage from W2 collects in drain inlets throughout the system and is directly discharged to the Stanislaus River through the mainline on Crane Road.

Sub-Area W3 is bound on the north by F Street, on the east by C11, on the south by the railroad tracks and the bluff and J Street, and on the west by S. Willowood Drive. Drainage collects in drain inlets throughout the area and discharges to a basin to the west. Excess flows spill out of the basin and drain to the west in the same manner as the drainage areas to the south.

Sub-Area W4 is bound on the north by F Street, on the east by W3 on the south by the railroad tracks and the bluff and on the west by Rivergate Drive. Drainage is collected in drain inlets and discharged to the basin on the west edge of the drainage area which also takes excess drainage from the basin in W3.

Sub-Area W5 is bound on the north by F Street, on the east by W4 on the south by the railroad tracks and the bluff and on the west by the city limits at Crane Road. Drainage from W5 collects in drain inlets and is discharged to the basin between W5 and W4. Currently the basins act as terminal basins and do not discharge to the Stanislaus River. Infrastructure is in place to install a lift station at

Crane and Greger which would tie into the outfall north of Crane Road and discharge into the Stanislaus River.

Sub-Area W6 encompasses the portion of F Street, west of Willowood Drive. Drainage collects in drain inlets along F Street and is discharged into a French drain and dry well system.

Sub-Area W7 includes the Crane Crossing Specific Plan area. Drainage from this area will collect and drain to percolation basins. These basins well be connected and have an outfall to the Stanislaus River.

Sub-Area W8 is bound on the north by the city limits, on the east by C10, on the south by F Street, on the west by the back of lots on Reed Drive and Obsidian Drive. Drainage is collected throughout the area at drain inlets and is directed to a lift station on Willowood Drive where it is discharges into an OID mainline.

Sub-Area W9 includes Willow Glen (from F Street to Pontiac), Foothills Court and Shadyside Court. Drainage is collected in drain inlets and discharged into Dry wells which have been connected to the sanitary sewer to alleviate flooding in the storm drain system when the dry wells are overloaded.

South Drainage Area:

The South Drainage Area consists of residential and commercial/industrial land south of the railroad. It also includes the recently developed Bridle Ridge area and the South Oakdale Industrial Specific Plan.

Sub-Area S1 is bound on the north by the southern railroad spur line south of Sierra Avenue, on the east by the city limits, on the south by Wakefield Drive, and on the west by the railroad tracks west of Yosemite. Drainage collects in drain inlets throughout the system and discharges into a terminal basin at the northern edge of S1.

Sub-Area S2 is a small drainage area that includes the area half way between Delano Drive and Wakefield Drive south along Wakefield. Drainage collects in drain inlets and discharges into the basin with dry wells at the south east corner of Wakefield Drive.

Sub-Area S3 includes Hedberg Way, Zell Lane, Fairfax Drive, Post Road and a portion of Armstrong Way. Drainage collects in drain inlets and discharges to a terminal basin with dry wells on the east side of Post Road.

Sub-Area S4 includes the west half of Armstrong Way, all of High-Tech Parkway and is bound on the west by Yosemite Avenue and on the north by the railroad tracks south of Wakefield Drive. Drainage occurs throughout S4 by collecting in drain inlets that discharge into dry wells located at the catch basins. Excess flow drains to a lift station accessed from Ackley Court that discharges into the OID line running between S4 and S5.

Sub-Area S5 includes all of Ackley Circle, Warnerville Road from Yosemite to the City limits, and a portion of Yosemite Avenue north or Warnerville Road. Drainage collects in drain inlets throughout the system and discharges to a terminal basin in the northwest corner of S5.

Sub-Area S6 is bound on the north by the railroad tracks and the bluff, on the east by the railroad tracks west of Yosemite, on the south by Greger Street and on the west by the property line north of the roundabout on Greger. Drainage from the site collects locally and remains onsite.

Sub-Area S7 is a small portion of Greger Street that is split by the railroad tracks west of Yosemite. Drain inlets on either side of the tracks collect runoff and discharge to the basin south of Greger. A lift station collects excess drainage and pumps it south to and OID mainline.

Sub-Area S8 is bound on the north by the railroad tracks and the bluff, on the east by S6, on the south by the city limits and on the west by the back of lots on Branding Iron Street. S8 is the first of a series of drainage areas that collect drainage at drain inlets throughout the system and discharge into a retention basin which discharges to the subsequent drainage are basin if excess flows are encountered. The basins have a series of dry wells in them and also function as percolation basins once the drywells have reached capacity.

Sub-Area S9 is bound on the north by the railroad tracks and the bluff on the east by S8, on the south by the city limits and on the west by Parkside way, and midway between Saddle court and Gelding Court. S9 is the second of the series of drainage areas including S8 where drainage discharges on the eastern basin and excess runoff runs back west to a basin on the western edge of S9.

Sub-Area S10 is bound on the east by S9 on the south by the city limits, on the west by the back of lots on Jonabel Way, and on the north by the railroad tracks and the bluff. S10 is the third drainage area in the southern series of drainage areas that discharge to the basin to the east and excess flows to the basin to the west.

Sub-Area S11 is bound on the north by the railroad tracks and the bluff, on the east by S10, on the south by the city limits and on the west by the back of lots on Breton Dive and Tori Way. Drainage is collected in drain inlets throughout the system and discharges into the basin surrounded by S-29. S-32 is the fourth in the series of drainage areas that are connected through a series of basins that take the upstream basin's excess drainage.

Sub-Area S12 is bound on the north by the railroad tracks and the bluff, on the east by S11 and on the south and west by the city limits. S12 is the last of the drainage areas that share basins. Drainage collects in drain inlets throughout the system and discharge to a basin on the west edge of the drainage area that also takes excess drainage from the basin in S11. This basin is currently a terminal basin with infrastructure in place to tie into the mainline that discharges to the Stanislaus River in the event that the basins can no longer manage the storm water that is generated from S9, S10, S11 & S12.

Sub-Area S13 includes the South Oakdale Industrial Specific Plan. Drainage will be discharged into several detention basins that will percolate stormwater.

Collection/Conveyance:

The city's collection/conveyance system is depicted in **Figure 2.2** through **Figure 2.5.** Individual components of this system are described below:

Storm Drain Pipes: The conveyance of stormwater throughout the city is primarily accomplished through the use of an underground pipe system. These pipes range in size from 12" to 48" and are typically either concrete or PVC. Drain inlets are connected to these pipes and the individual pipe segments are connected with manholes to provide service and maintenance of the system.

Pump Stations: The city maintains eleven pump station throughout the city that lift storm drainage from an individual collection system into a separate conveyance system or pipe leading to an ultimate discharge location. Pump stations are needed primarily because of the lack of adequate natural slope. Without them, pipe systems would become unmanageably deep as they traverse the watershed to deliver stormwater to a storage or outfall facility.

Oakdale Irrigation District owns and operates a system of pipes through the City. Many of these lines are the main distribution laterals for the district and are used the entire irrigation season. Other lines have been abandoned or are no longer used for irrigation purposes but still serve in the discharge of stormwater from the City. During the storm season when OID lines are no longer in use by the district, the city utilizes them as drain lines. There are several connections and dual use pipelines throughout the city. The OID facilities eventually drain to the Stanislaus River.

Storage:

Detention Basins are common in the more recent development and are used to slow the discharge of stormwater to the river and decrease the overall volume of water discharged by percolation through the soil. Retention basins also help to protect the city from flooding by accumulating water and storing it while discharging stormwater into the downstream facilities at a rate that does not overload them. Retention basins are ideal as they not only enhance the storm drainage system, but they also provide park areas that are beneficial for the community. The dual use characteristic including the multiple benefits to the storm drain system make retention basins a crucial part of an effective storm drain system.

Retention Basins are similar to detention basins, except that instead of "detaining" the runoff, they completely "retain" it. All of the water that enters the retention basin must percolate into the ground through the bottom of the basin or the use of drywells and/or french drains.

While detention basins are clearly the most commonly used storage system in the central valley, retention basins are becoming more desirable for two reasons 1) increased regulatory requirements for discharges into the river, and 2) the need to recharge groundwater. Groundwater levels in the Central Valley have been on a downward trend in recent years due to the increased use of groundwater for both domestic growth and farming operations. Currently, 100% of Oakdale's domestic water supply comes from groundwater. So, protecting this valuable asset through methods of groundwater recharge is important. Consequently, detention basins and other means of groundwater recharge will be encouraged in future development.

FIGURE 2.2
STORM DRAIN SYSTEM CENTRAL

WALNUT AVENUE
TOWN
MAIN
LATERAL
D STREET
F STREET
YOSEMITE AVENUE
CENTRAL
TOWN E
LATERAL
OAK AVENUE
G STREET
J STREET
MAAG AVE
WEST
LATERAL
LANGWORTH
GREGER STREET
GREGER STREET
SOUTH
LATERAL

LEGEND

- DISCHARGES DIRECTLY TO RIVER
- DRAINS TO BASIN THEN RIVER
- DRAINS TO PERCOLATION BASIN
- DRAINS TO DRYWELL
- DRAINS TO BASIN THEN TO RIVER (FUTURE)
- DRAINS TO PERCOLATION BASIN (FUTURE)
- CITY LIMIT
- DRAINAGE AREA LIMITS
- 12"- 18" STORM DRAIN
- 21"- 30" STORM DRAIN
- 36"- 48" STORM DRAIN
- FUTURE STORM DRAIN
- OID IRRIGATION LINE
- FORCE MAIN
- PARK/BASIN
- LIFT STATION
- STORM DRAIN OUTFALL

NORTH

0 600 1200

CITY OF OAKDALE

FIGURE 2.3
STORM DRAIN SYSTEM SOUTH

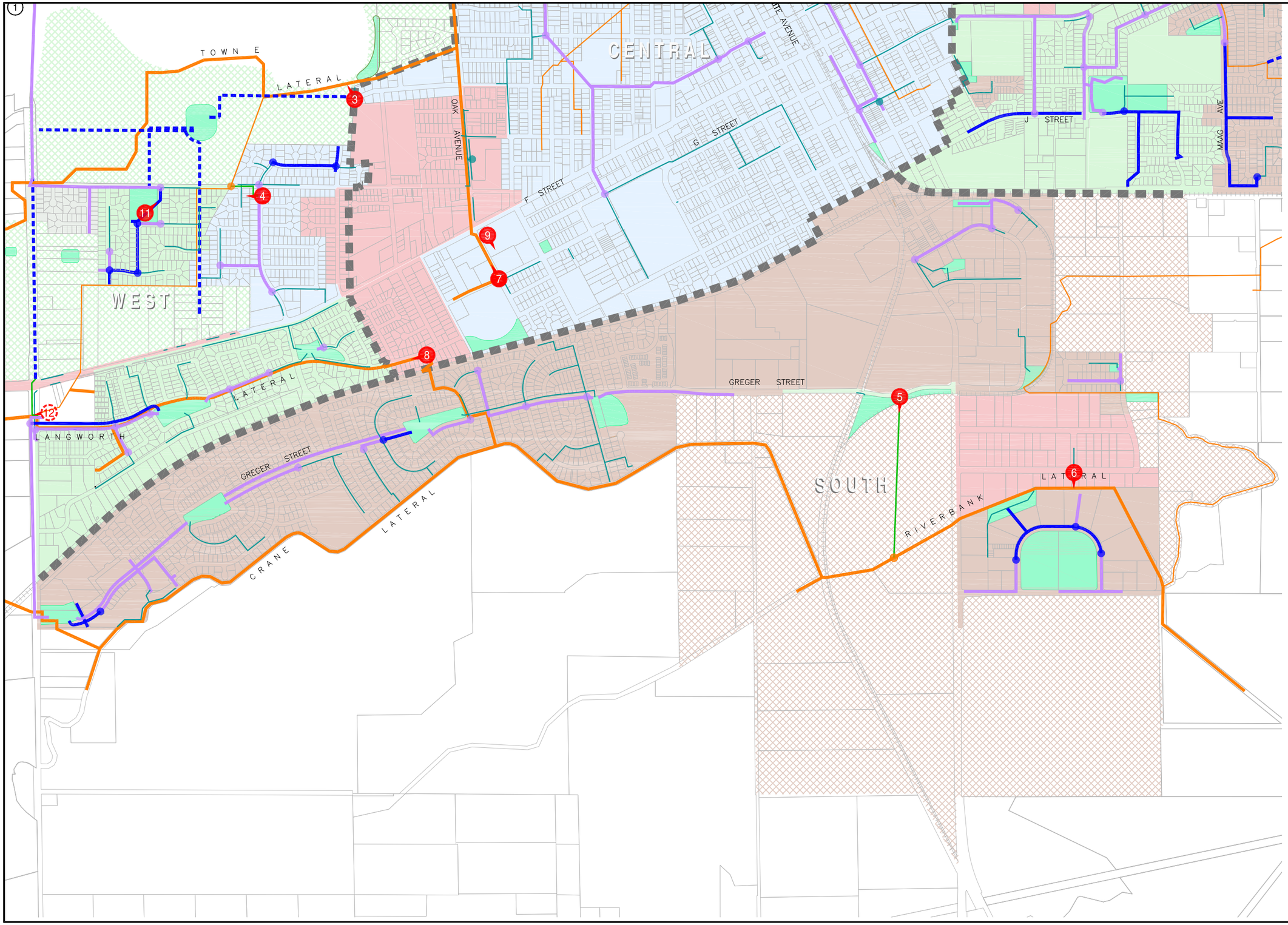
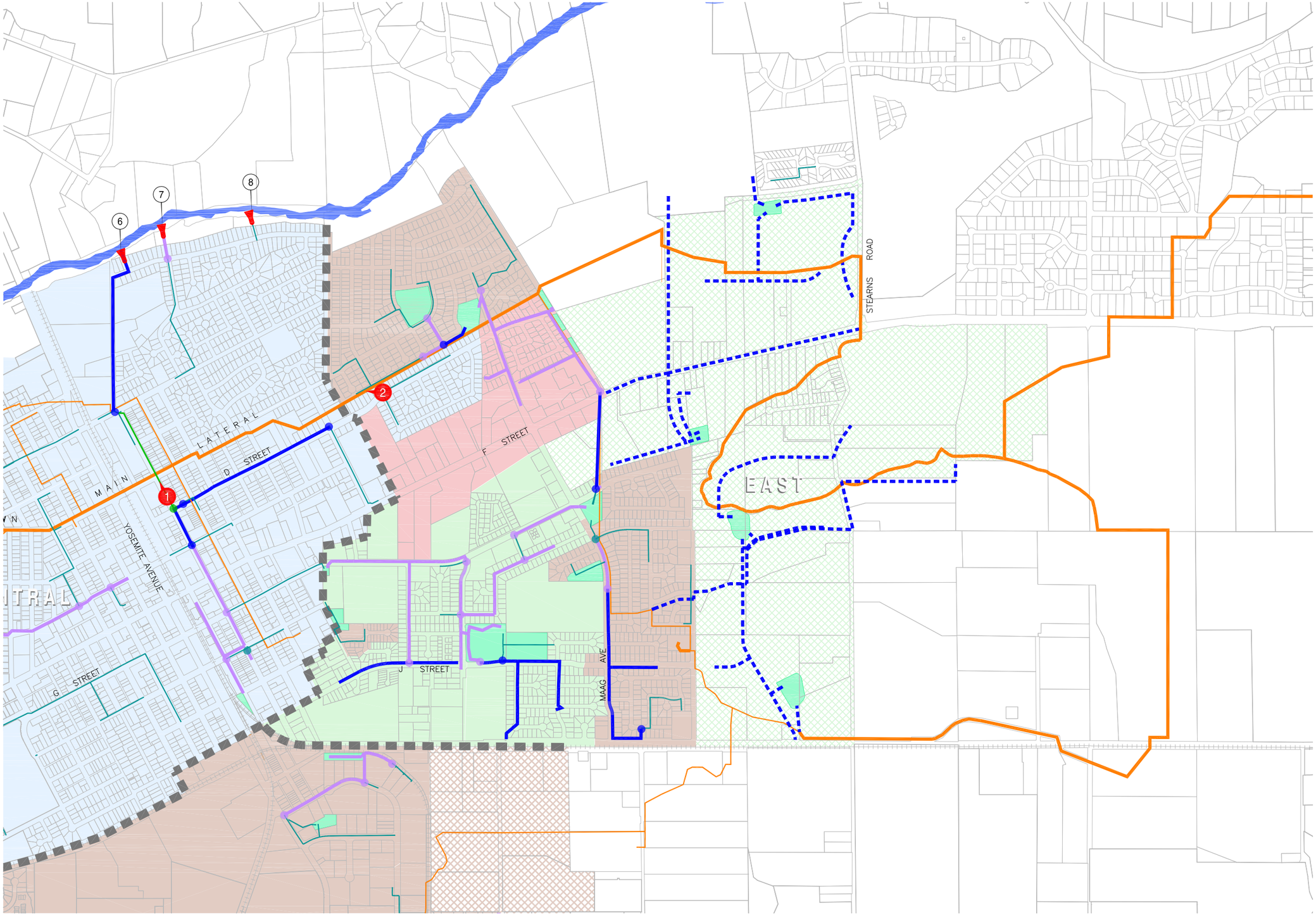


FIGURE 2.4
STORM DRAIN SYSTEM EAST



LEGEND

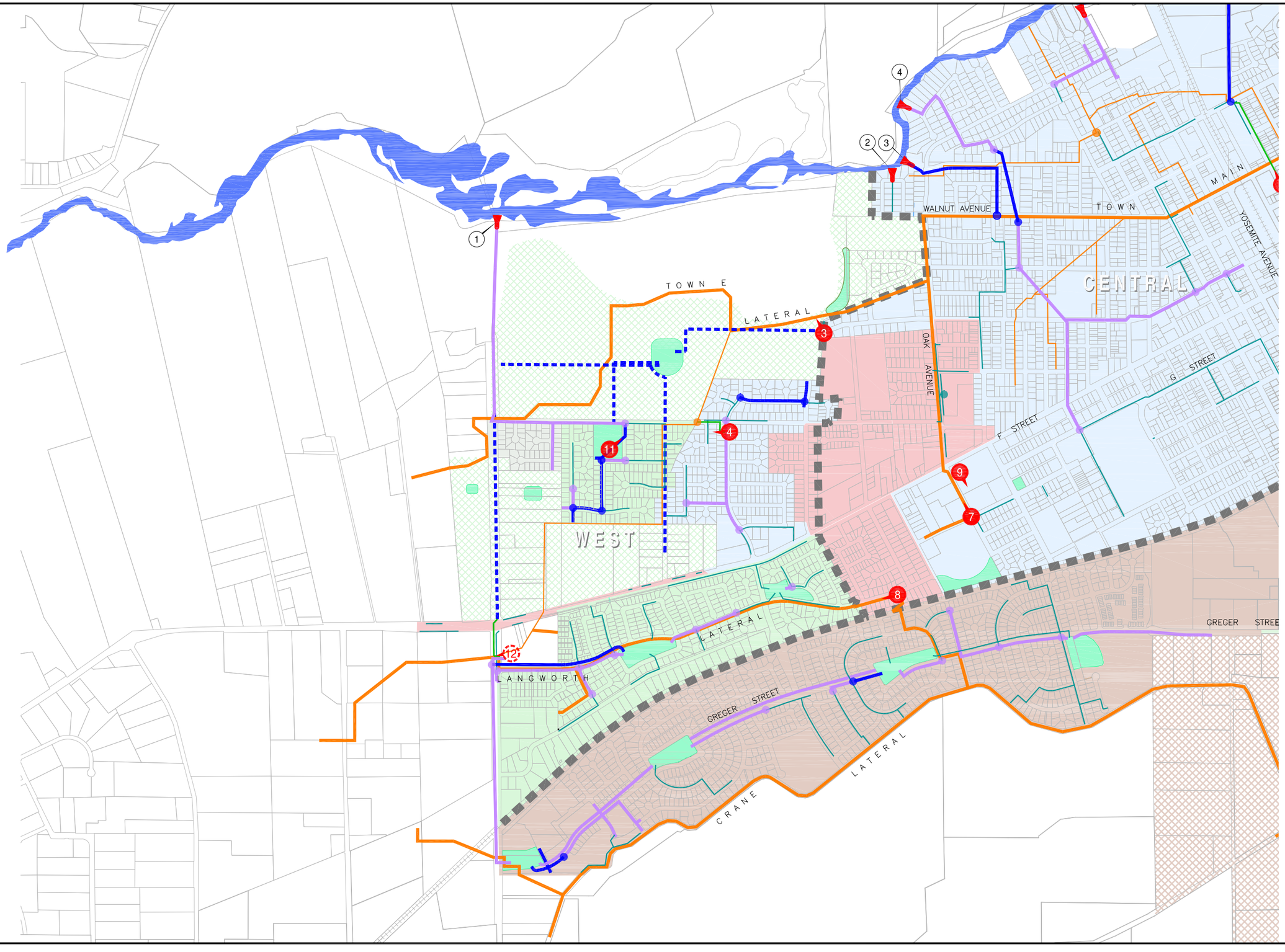
- DISCHARGES DIRECTLY TO RIVER
- DRAINS TO BASIN THEN RIVER
- DRAINS TO PERCOLATION BASIN
- DRAINS TO DRYWELL
- DRAINS TO BASIN THEN TO RIVER (FUTURE)
- DRAINS TO PERCOLATION BASIN (FUTURE)
- CITY LIMIT
- DRAINAGE AREA LIMITS
- 12"- 18" STORM DRAIN
- 21"- 30" STORM DRAIN
- 36"- 48" STORM DRAIN
- FUTURE STORM DRAIN
- OID IRRIGATION LINE
- FORCE MAIN
- PARK/BASIN
- LIFT STATION
- STORM DRAIN OUTFALL

NORTH

0 600 1200

CITY OF OAKDALE

FIGURE 2.5
STORM DRAIN SYSTEM WEST



LEGEND

- DISCHARGES DIRECTLY TO RIVER
- DRAINS TO BASIN THEN RIVER
- DRAINS TO PERCOLATION BASIN
- DRAINS TO DRYWELL
- DRAINS TO BASIN THEN TO RIVER (FUTURE)
- DRAINS TO PERCOLATION BASIN (FUTURE)
- CITY LIMIT
- DRAINAGE AREA LIMITS
- 12"- 18" STORM DRAIN
- 21"- 30" STORM DRAIN
- 36"- 48" STORM DRAIN
- FUTURE STORM DRAIN
- OID IRRIGATION LINE
- FORCE MAIN
- PARK/BASIN
- LIFT STATION
- STORM DRAIN OUTFALL

NORTH

0 600 1200

CITY OF OAKDALE

Discharge:

The Stanislaus River is a natural, historic system that receives stormwater runoff from Oakdale. The city maintains eight outfall pipes that discharge directly into the river. Many of these outfalls take direct discharge from the streets and send it to the river with no treatment. The systems that are from more recent development and include a basin, help to reduce pollutants and the discharge rate into the River.

Dry wells are a common component of the City's storm drain discharge system, located at low points along the curb and gutter throughout the city as well as at the bottom of basins. Dry wells are deep vertical pipes that drain stormwater through percolation into the soil. A deep hole is drilled and lined with a perforated pipe. The pipe is then filled with rock. Water fills the voids between the rock and percolates into the soil through the perforated walls of the dry well casing.

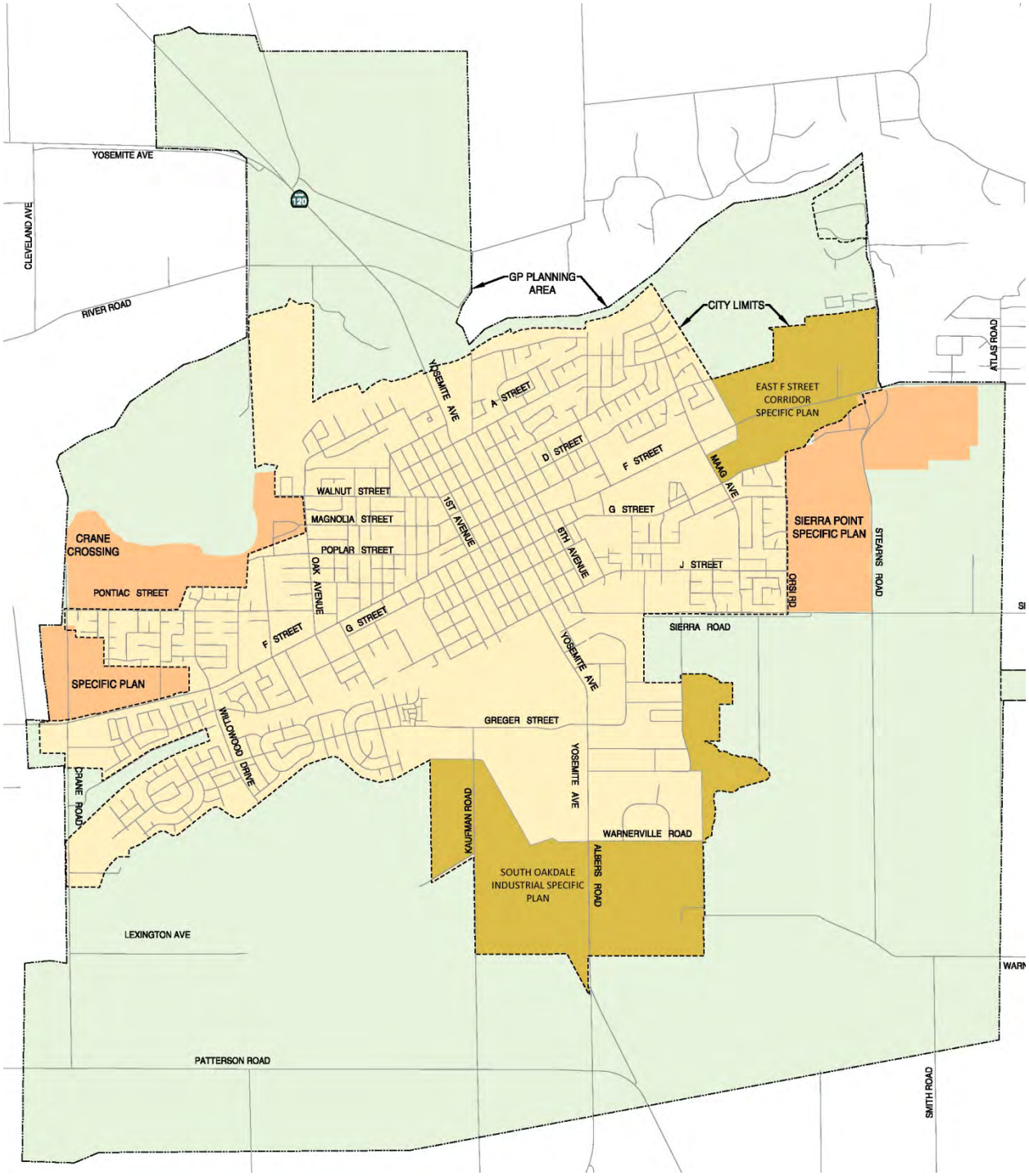
French Drains are another form of percolation device that have been used throughout the city for the discharge of stormwater. Drain inlets are connected to an underground trench that is filled with a large diameter perforated pipe and rock. The French drain allows for a large amount of water to be held until it is percolated into the surrounding soil. Both French Drains and Dry wells require cleaning and routine maintenance to maintain their functionality. If they become plugged up with debris over time they will fail to perform as designed and will cause flooding in the streets.

Retention Basins are used both as a storage facility and a disposal facility through percolation of the water into the ground.

Wastewater Treatment Plant – as mentioned earlier, the City's WWTP is also used as a source for disposal of stormwater during larger storm events.

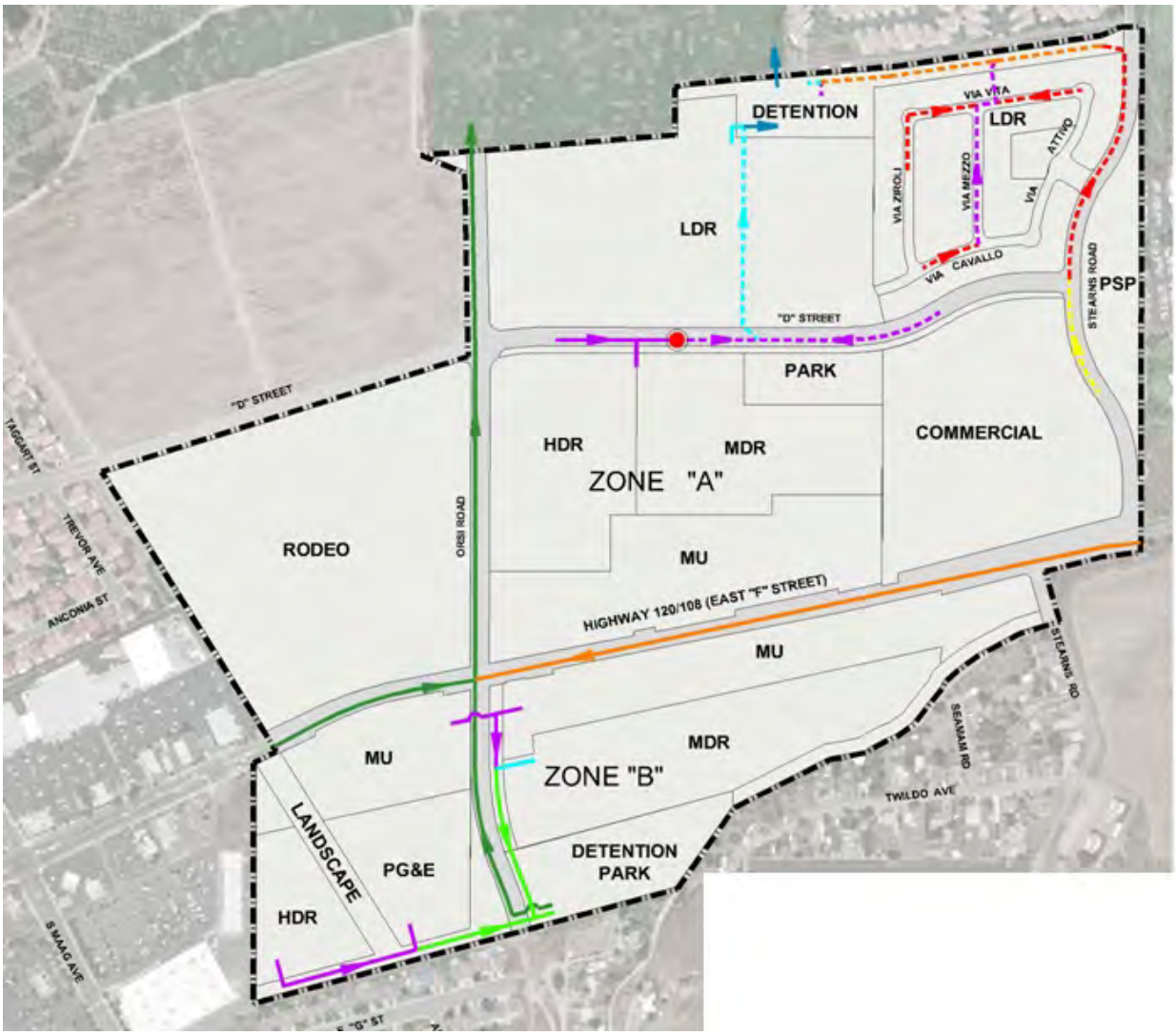
Future Development:

Most of the development that is expected to occur during the 25-year planning horizon of this document will be within the four Specific Plan areas shown below; two that are already approved and annexed into the city (East F Street Corridor SP and South Oakdale Industrial SP), and two that are in the process of approvals (Crane Crossing SP & Sierra Point SP).



EAST F STREET CORRIDOR SPECIFIC PLAN:

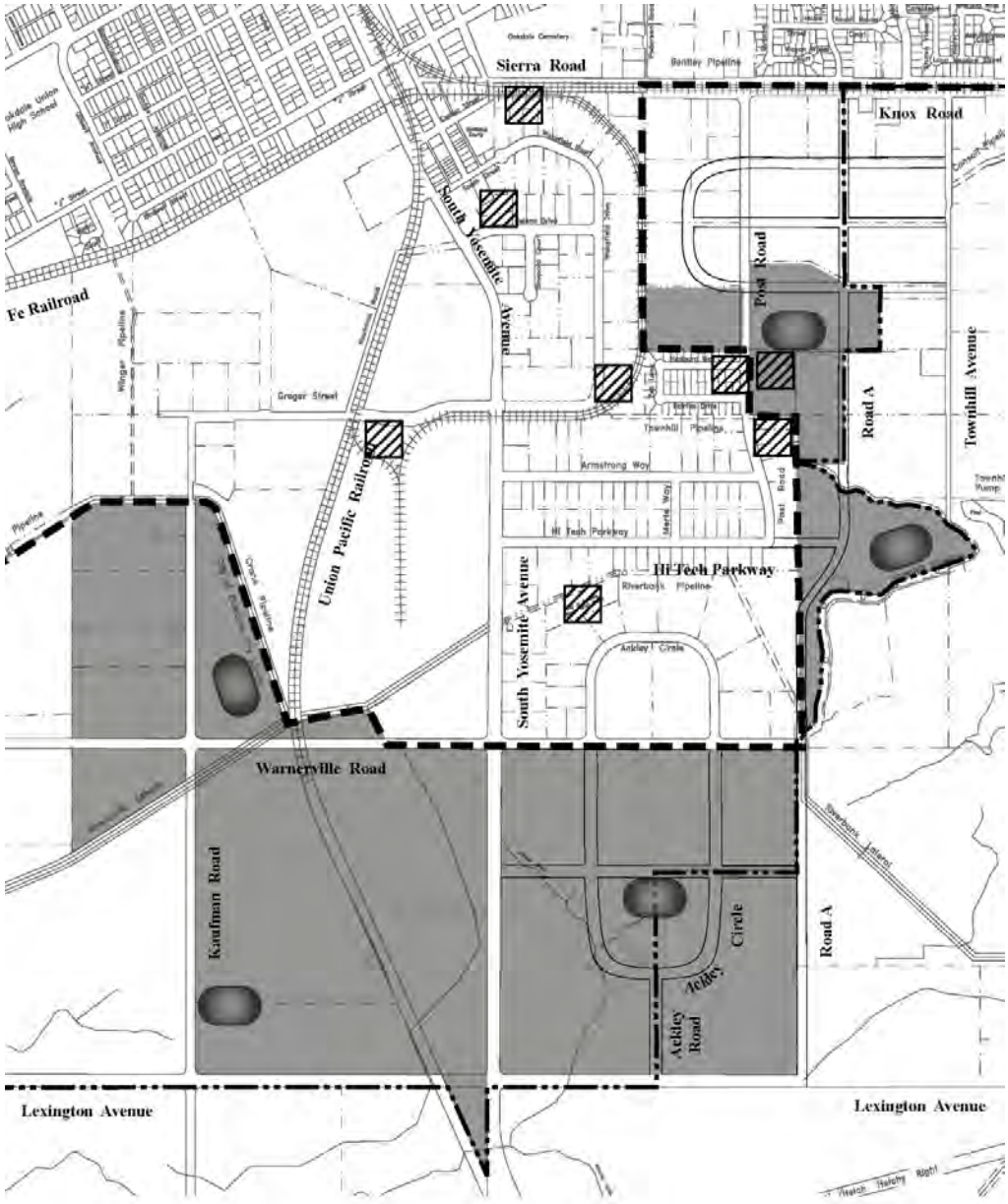
This Specific Plan includes approximately 80 acres of low, medium, and high density residential, 24 acres of mixed use, 33 acres of existing public facilities, and approximately 25 acres of parks, trails, and open space.



The Specific Plan states that drainage from residential development will collect in in-street collection systems and will discharge into stormwater detention basins where stormwater will discharge directly into French drains, and that excess flows will be permitted to release into an outfall system to the Stanislaus River. Two future outfalls to the Stanislaus River are proposed by the Specific Plan. However, recent increases in regulations and monitoring requirements imposed by the state for new storm water discharges into the river have made it impractical for the city to pursue new outfall permits. Consequently, we are requesting that the applicant of this Specific Plan pursue other means for discharging excess flows (infiltration or the use of existing infrastructure).

SOUTH OAKDALE INDUSTRIAL SPECIFIC PLAN (SOISP):

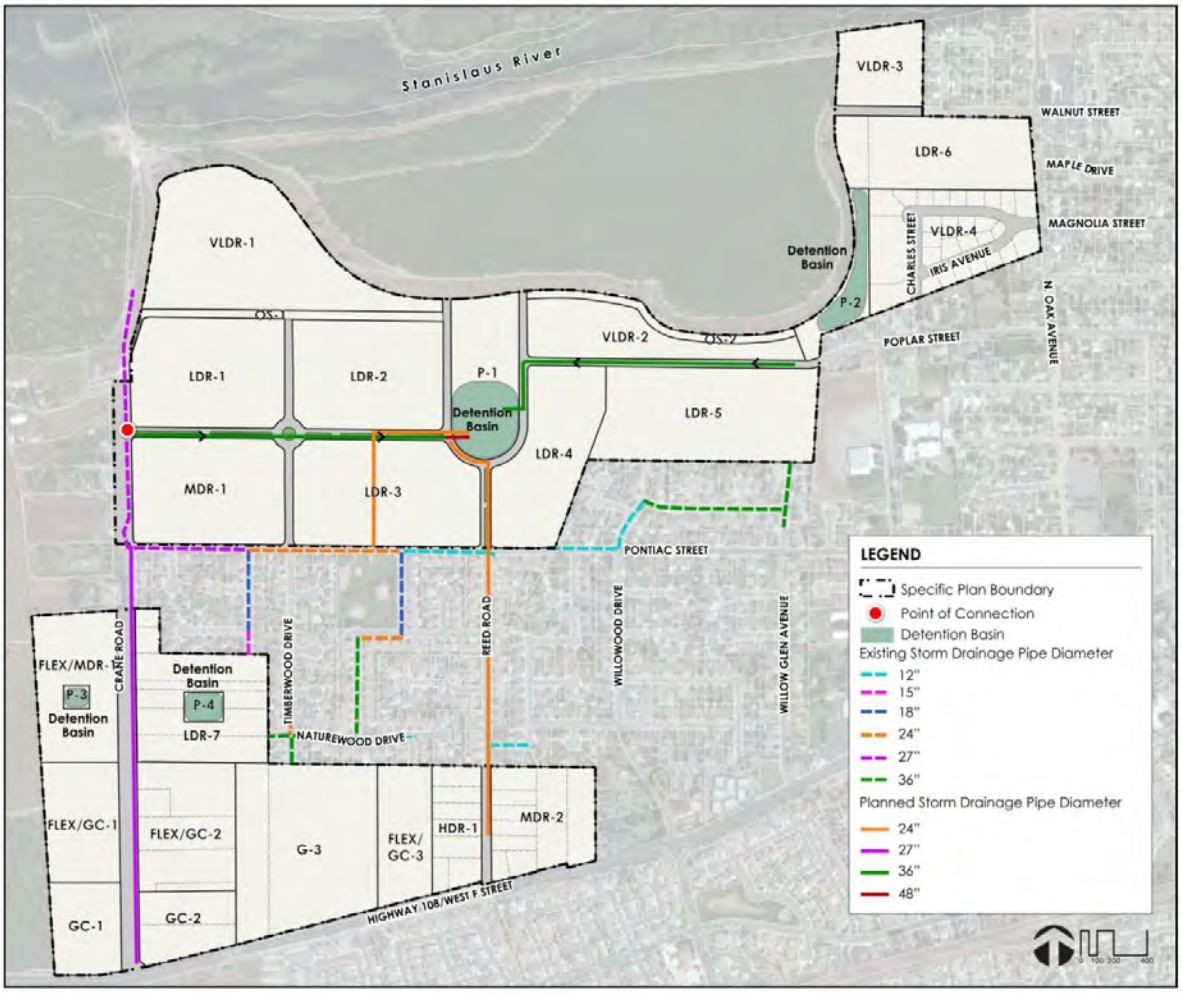
This specific plan includes approximately 500 acres of light industrial, rural estates, and parks and open space.



The Specific Plan states that stormwater throughout the SOISP will discharge into various detention or retention basins throughout the plan area. Unfortunately, the Specific Plan document did not include much detail regarding the proposed conveyance system or much specificity in regards to the basins and how they will operate. Admittedly, the planning of such facilities must remain fairly loose and flexible in order to accommodate potential industrial developments. The proposed basins and conveyance systems will be sized and located to accommodate drainage as part of individual developments or as part of a master storm drain facility plan for larger developments.

CRANE CROSSING SPECIFIC PLAN (CCSP):

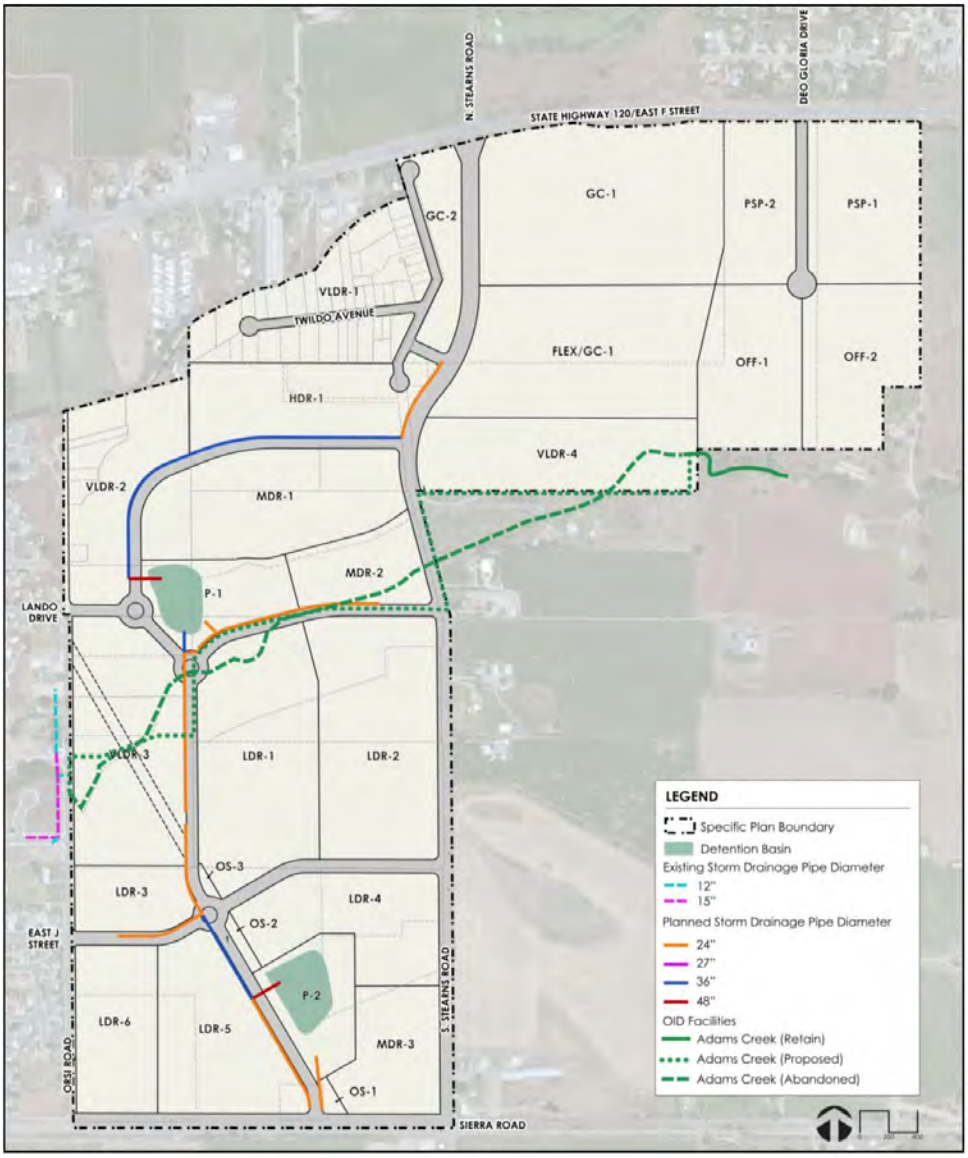
This specific plan is comprised of 272 acres located west of the City in unincorporated Stanislaus County. Proposed land uses include residential, parks, and neighborhood serving commercial and/or office uses. Approximately 1,039 residential units will be constructed.



Storm drainage in the CCSP will utilize dual use on-site storm water detention basins. During small storm events, stormwater will percolate into the ground. During larger storm events, excess drainage will discharge into the existing 27 inch storm drain main line in Crane Road where it ultimately discharges to the Stanislaus River. The northern portion of the CCSP will be served by two 36 inch diameter mainlines and will use a centrally located stormwater detention basin. A 24 inch main will carry excess flows to the main on Crane Road during large storm events. The northeast corner of the CCSP will utilize a linear detention basin and a new 36" outfall to the Stanislaus River. A more decentralized approach will be used in the southern portion where commercial and other non-residential uses will be required to contain storm water on-site and discharge runoff through percolation and infiltration. A storm drain line will be constructed in Crane Road from F Street to Pontiac to convey local drainage to the existing 27 inch storm line outfall in in Crane. It will also carry metered flow from the future Crane Pump Station near J Street.

SIERRA POINTE SPECIFIC PLAN (SPSP):

This specific plan is comprised of 297 acres located on the eastern edge of the city in unincorporated Stanislaus County. Proposed land uses for this development include residential, parks, commercial, office, and educational, providing approximately 901 residential units.



Storm drainage in the SPSP will consist of two dual use storm water detention basins. During small storm events, stormwater will percolate into the ground. During larger storm events, excess drainage will discharge into the Adams Creek Drain and Adams No. 1 pipeline. Adams creek will be relocated and converted from an open channel to a closed pipeline connecting to the existing pipeline to the west of the SPSP. Residential areas will be serviced by 24 to 36 inch main lines which will discharge into the proposed basins. Non-residential use properties will not be connected to the City storm drain system and will be required to contain stormwater on-site.

3. RECOMMENDED IMPROVEMENTS

Recommended Improvements:

This chapter presents the recommended improvements to be made to eliminate existing flooding problems and insure that the city's storm drain system can accommodate future development.

Virtually all future development will rely on the city's existing storm drain infrastructure in one way or another for functionality of their own systems. The city is not likely to pursue any future outfalls to the river, so existing infrastructure and outfalls will be used to convey runoff from new development.

It is noted that none of the proposed projects below occur within the undeveloped Specific Plan areas. Each of the Specific Plan areas will have significant storm drain infrastructure needs, as outlined in their individual Specific Plans. However, the major components (conveyance & storage facilities) of each of these storm drain systems will operate as "stand alone" systems. These systems will utilize existing City storm drain infrastructure to discharge excess runoff from their basins. However, all other proposed improvements within the Specific Plan will only benefit the development that will occur within the Specific Plan. Including such improvements in a city-wide fee program would be inherently inequitable, since the storm drain system within one specific plan area might be much more expensive than the solution in another specific plan area. Consequently, the best way to deal with the funding of major storm drain infrastructure components is to adopt a Specific Plan fee to cover those improvements.

Table 3.1 lists the proposed projects that should be adopted into a Capital Improvement Program (CIP), and the following pages describes each one in detail, and provides exhibits where needed.

Table 3.1: Storm Drain CIP Projects

No.	Description	Purpose
SD-1	Walnut SD	Improve C-1 drainage, eliminate flooding at F/Lambuth
SD-2	Walnut Pump Sta.	Improve C-1 drainage
SD-3	5th & G Connection	Eliminate flooding at 5th & 6th, south of H Street
SD-4	Wood Basin	Improve C-1 drainage near High School
SD-5	H & Oak SD	Connect Wood & J Street Basins, eliminate flooding at Oak & I St.
SD-6	Crane Pump Sta.	New Pump Station
SD-7	Crane Storm Drain	Gravity line in Crane from F Street to Pontiac
SD-8	Pump Stations	Replace pumps and controls
SD-9	Drywells	Rehabilitate Drywells
SD-10	Outfall Treatment	Provide treatment devices at existing outfall structures

Most of the existing flooding problems in the city occur in the Central Drainage Area, which is simply not capable of providing the level of storm drain protection we typically design for under today's standards. Today we design underground conveyance systems to carry a minimum of a 10-year storm event, and provide storage systems (detention or retention basins) to hold the runoff volume generated by a 100-year, 24-hour storm event. Most of the components of the underground conveyance system in the Central Drainage Area, on the other hand, were designed to pass either a 2-year or 5-year storm event,

and no retention facilities (other than for two small sub-areas) were provided. The streets provide the storage volume needed during large storm events.

It would be cost-prohibitive to bring the entire Central Drainage Area up to current standards. However, with the construction of a few improvements, this drainage area can operate at an acceptable level of performance with minimal involvement from city crews during a storm event.

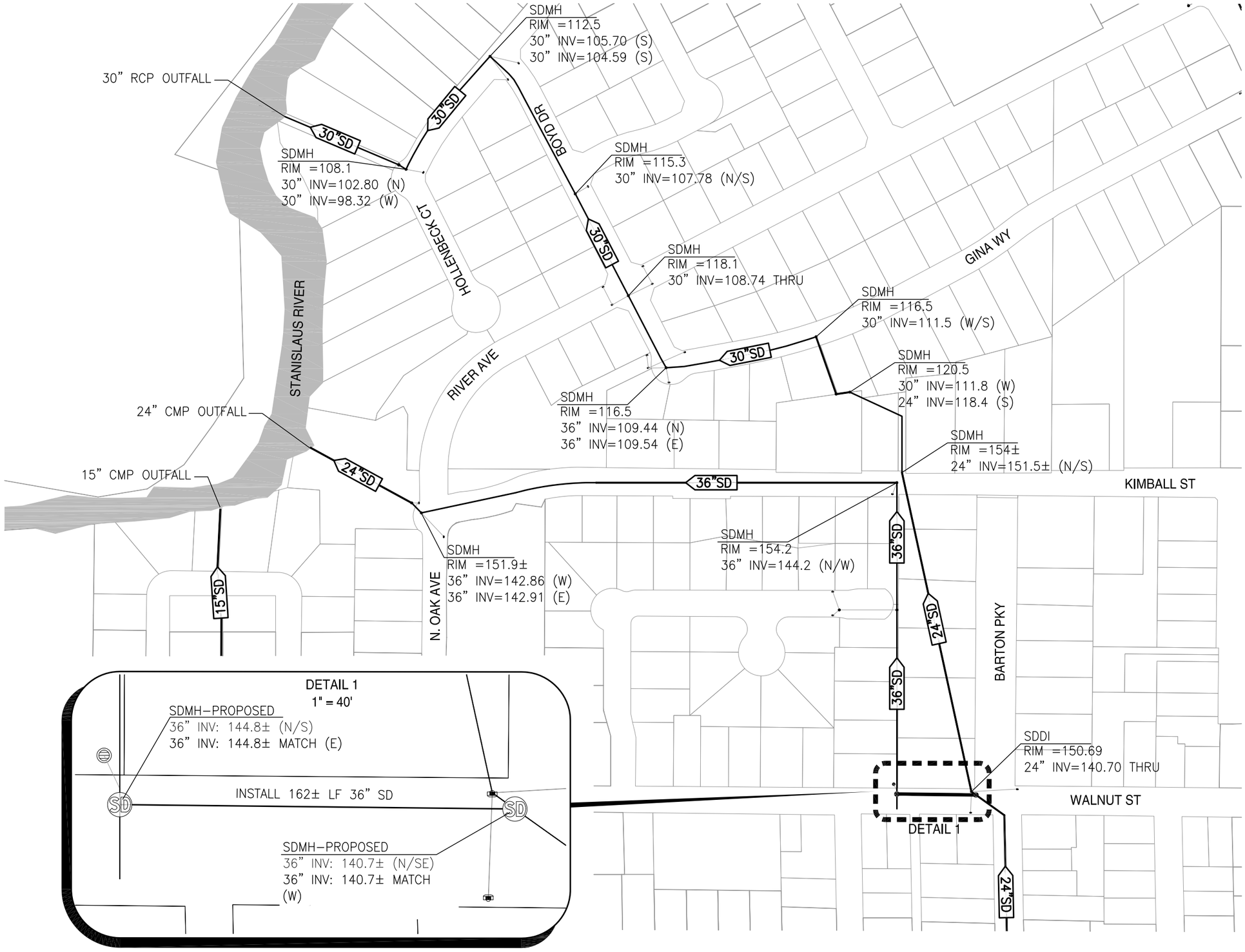
Four of the proposed projects listed above are specifically addressing flooding problems in the C1 sub-area. The C1 sub-area is the largest sub-area in the city, collecting runoff from approximately 500 acres of developed land. The conveyance system includes some pipes with flat and even reverse slopes. The lowest drain inlet in the system is at the intersection of F Street & Bryan Avenue (in front of the Donut Family shopping center), which floods during even small storms and causes great concern for the businesses in the shopping center.

The main restriction in this system that causes water to backup to the F Street/Bryan intersection is a downstream connection at Kimball Street, just west of Barton Parkway. At this location, the C1 conveyance system connects into a 30" pipeline that runs down the bluff to Gina Way through the sideyards and backyards of homes that backup up to the bluff. Field crews no longer have access to the manhole on Kimball where these lines connect, so we were unable to verify the invert elevation of the 30-inch pipe. However, field records indicate an invert of 151.5. That elevation corresponds very closely to the water level at F Street & Bryan during a storm event (which is approximately 2 feet higher than the lowest drain inlet at that location. During a storm event the water will not spill over into the 30" pipe at Kimball until it reaches an elevation of 151.5, which causes the flooding at F Street & Bryan, as well as several other places within the C1 conveyance system.

SD-1: Walnut Storm Drain

This project will provide a new primary outfall location for the C-1 system by connecting the system to an existing 36" storm drain pipe in Walnut, just west of Barton Parkway (See **Figure 3.1**). Approximately 162 lineal feet of 36" pipe would need to be installed within Walnut Avenue (and a manhole at each end) to connect these two systems. The existing invert of the 36" pipe at our proposed point of connection is approximately 144.8, more than 6 feet lower than the existing connection point to the 30" pipe in Kimball. This will drastically lower the hydraulic grade line (HGL) in the C1 system and relieve the flooding upstream. While this 36" line appears to be significantly underutilized; serving a very small sub-drainage area, we cannot confirm the operating HGL in that pipe during a storm event. Using a conservative estimate that the HGL is at the top of the 36" pipe, this system will pass a two year storm event without flooding the F Street/Bryan intersection. Assuming the HGL is at the bottom of the 36" pipe, a five year storm event could be accommodated by the system without flooding. This is a relatively inexpensive project that will produce immediate relief to the flooding problems in the C1 conveyance system. We recommend that this project be designed and constructed immediately (before winter rains). Then we can study the system and measure water depths during storm events to better predict what level of storm it can accommodate. This data will also give us information needed to properly design the Phase 2 improvements.

FIGURE 3.1
WALNUT STORM DRAIN (SD-1)



SD-2: Walnut Pump Station

This project will consist of installing a pump station just upstream of the connection point to the 36" storm drain installed as part of Project SD-1 to increase the capacity of this system. The upstream invert of the C1 system as it connects to the 36" storm drain is approximately 140.7 (four feet lower than the 36" invert). Installing a pump station to lift the stormwater into the 36" line will lower our HGL another four feet, providing additional relief to the upstream system and addition capacity.

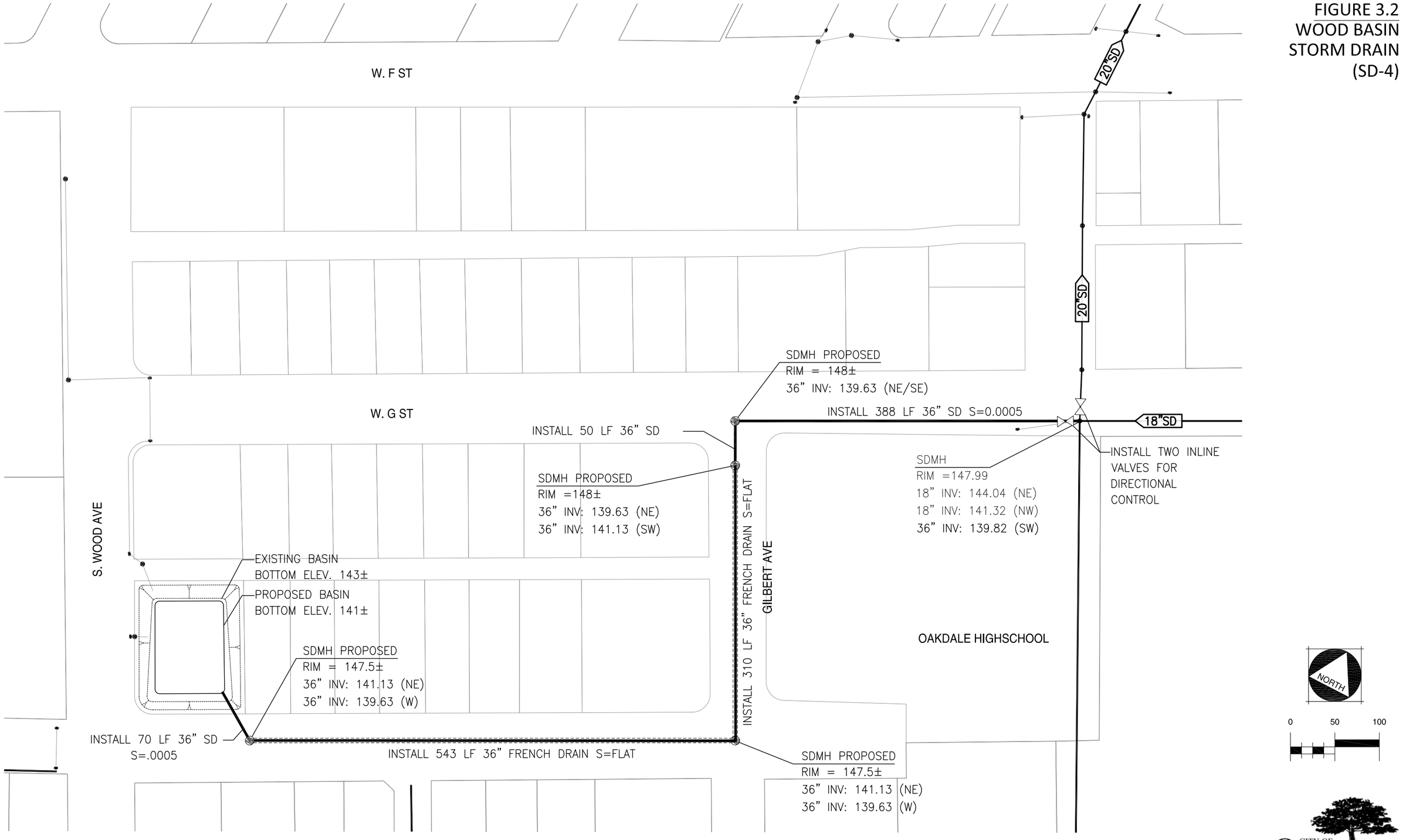
SD-3: 5th & G Street Connection

Flooding occurs at 5th and 6th Street south of H Street where drain inlets are connected to an abandoned OID line. Based on conversations with City staff, this line has been capped by OID when it was abandoned and currently acts as underground storage. During large storm events this line becomes inundated with runoff at which point excess stormwater floods the streets. Stormwater infiltrates out of the line through cracks over time emptying the line. This line needs to be connected into the storm drain system of C7. A connection can be made at the intersection of G Street and 5th Avenue where the abandoned OID line and the storm drain line cross. Two manholes with a connecting pipe should be installed at a convenient location to connect the abandoned line to the storm drain system allowing the abandoned line to drain out during storm events.

SD-4: Wood Basin Improvements

This project consists of connecting the C1 system to the basin at Wood Avenue & H Street as shown in **Figure 3.2**. A new storm drain line would be connected to the existing main at G Street and Bryan Avenue. The line would head west on G and then south on Hinkley Avenue where it would turn into a French Drain system that acts as a conveyance line as well. The French drain runs the length of Hinkley and also runs west on H Street and bubbles up in the basin at Wood Avenue and H. This basin would need to be excavated to accommodate the maximum amount of storm drain runoff possible. The French Drain systems would be designed so that the springline of the drain pipe is located at approximately the invert of the existing line so that in the event of a large storm they would have a large storage capacity but would still drain a large portion of the stormwater as the system drained. Two valves shall also be installed. One valve will shut off the flow to the new storm system. This valve would be used in the event that the existing downstream system can handle the flows and the new system is not needed or if the new system is overloaded. The second valve would be to shut off or slow down the release of the water to the existing downstream pipe in the event that the new system can handle more than it is taking and the downstream side on the existing system is being overloaded. Both of these valves should be installed at the new point of connection. Both valves would be designed to be in the normally open position.

FIGURE 3.2
WOOD BASIN
STORM DRAIN
(SD-4)



CITY OF OAKDALE

SD-5: H Street & Oak Avenue

This project is depicted in **Figure 3.3**. This project will connect the Wood and H Street Basin with the existing basin south of J Street and west of Oak. This basin would also need to be excavated to increase its capacity. Both basins include dry wells in the bottom which would need to be adjusted to match the new basin bottom. More dry wells could potentially be installed into the basins as well to dispose of stormwater faster. In addition, the lift station (PS-7) at H Street and Oak will be upgraded to handle the additional flows from these connections.

Currently the 21" drain line does not have a check valve installed at the connection to the OID mainline. During the irrigation season, irrigation water backs up into the storm drain line causing the line to fill up and drain into the streets. A check valve should be installed at the intersection so water does not fill the line during the irrigation season.

While relieving the drainage issues in Watershed C1, this project also serves to alleviate flooding in Watershed C9. C9 has several areas that lack the capacity to drain during larger storms and the basin fills up relatively quickly.

SD-6: Crane Road Pump Station

This project includes the installation of a pump station at Crane Road, just south of J Street. This pump station will receive outflow from the basins in the Bridle Ridge and Vineyards subdivisions. The conveyance system to and from the pump station was installed as part of the Crane Road improvements (south of F Street). A 30 inch gravity line leaves the west storm drain basin in Bridle Ridge, and travels south on Crane and is stubbed out to the future pump station site. A 24" gravity line from the Vineyards joins this line at J Street. A 12" force main leaves the pump station site, travels north on Crane and is stubbed out on the north side of F Street. This force main will deliver runoff from the pump station into a future gravity line in Crane Road (Project SD-7).

SD-7: Crane Road Storm Drain

When North Crane Road is developed as part of the Crane Crossing Specific Plan, a new storm drain line will be constructed from F Street to Pontiac. It will convey storm water runoff from the street and subdivision to the existing gravity line in Crane that travels north to the river. This line will also be used to convey metered flow from the future Crane Road pump station (Project SD-6).

SD-8: Pump Stations

The city's storm drain system includes 11 pump stations that either lift storm water into an adjacent gravity system, or deliver the storm water to another conveyance system through a force main. These pumps are a vital part of the conveyance system. In addition to the regular maintenance and repairs that are required from time to time, the pumps and electrical components within each of these pump stations will likely reach the end of their useful life during the planning horizon of this document. Consequently, funds need to be set aside to replace each of these pump stations.

FIGURE 3.3
H STREET & OAK
STORM DRAIN
(SD-5)

EXISTING 21" DRAIN LINE

21"SD

UPGRADE STORM DRAIN
LIFT STATION

P

SDMH PROPOSED
RIM = 147.5±
24" INV: 144.0 (E)
24" INV: 140.0 (W)

W. H ST

INSTALL 120 LF 36" SD S=FLAT

INSTALL 48 LF 36" SD S=FLAT

INSTALL 578 LF 36" SD S=FLAT

SDMH PROPOSED
RIM =147.5±
36" INV: 137.0 (NE)
36" INV: 137.0 (SE)

SDMH PROPOSED
RIM = 147.5±
36" INV: 137.0 (NE)
24" INV: 144.0 (W)
12" INV: MATCH (SE)

SDMH PROPOSED
RIM = 147.5±
36" INV: 137.0 (NW)
36" INV: 137.0 (SW)

W. I ST

S.OAK AVE

INSTALL 521 LF 36" SD S=FLAT

S. WOOD AVE

INSTALL 80 LF 36" SD S=FLAT

EXISTING BASIN
BOTTOM ELEV. 143±

PROPOSED BASIN
BOTTOM ELEV. 141±

PROPOSED BASIN
EXPANSION

SDMH PROPOSED
RIM = 147.0±
36" INV: 137.0 (NW)
36" INV: 137.0 (S)

OLSON CT

KING CT

NORTH

0 50 100

CITY OF OAKDALE

SD-9: Drywells

Flooding occurs throughout the city at multiple drywell locations. Many of these dry wells have been in use for many years and have received little maintenance. Through conversations with City staff and field investigations we have identified multiple locations that need immediate service. Many of these dry wells are filled with debris that are blocking the inlet screen. These dry wells should have a thorough cleaning and can be brought into working order with minimal effort. Others have been neglected over the course of many years and that debris has filled the voids within the rock in the drywell effectively plugging off the drywell all together. Dry wells in this case need to be reestablished by removing the rock and cleaning the sediment that has plugged it up. The severity of the plugging should be evaluated on a case by case basis and a solution prescribed as necessary to get each drywell back in working order. The assessment and reestablishment of functional drywells should commence immediately and should be part of a continuing maintenance plan.

Known locations of dry wells that currently do not provide sufficient drainage are shown in **Figure 3.4.** These should be a priority for rehabilitation in the near future, but ultimately, all of the nearly 200 drywells in the system will need to be rehabilitated over the life of this master plan document.

SD-10: Treatment at Outfalls:

Storm drain outfalls to the Stanislaus River are areas of concern due to the nature of the storm drain systems that are connected to them. Many of the systems have no form of stormwater treatment and directly discharge from the streets to the river. While current regulations do not require agencies to retrofit existing outfalls to current treatment standards, it is anticipated that future regulations will require some form of treatment on these outfalls that directly discharge to the river. **Figure 3.5** shows the existing storm drain outfalls. The changes may require significant infrastructure and space that will be costly.

Storm drain outfall treatment will consist of a mechanical filtration or separation device that removes large debris as well as small particles and sediment. A mechanical treatment device will provide the most effective and economical treatment of the storm water. During a small common storm event a mechanical filter will treat all of the runoff and collect the debris. During a larger storm event when the capacity exceeds the filtration capabilities of the unit, an overflow system allows the large storm to bypass the treatment. A majority of the debris and sediment will be collected during the first part of the storm event when the debris get flushed from the streets and the rest of the cleaner water or excess will bypass during a large storm event.

Mechanical storm water treatment devices could be installed in line with the conveyance system, just downstream of the last drain inlet in the system. The unit could be placed in the street in most locations. In the event a drain inlet is in the curb at the most downstream point that is accessible, a treatment device that includes a drain inlet top should be used. This is a common option for most treatment devices.

Storm drain treatment at the storm drain outfalls should be installed as soon as state regulations require them and funding is available. Priority should be given to storm drain outfalls with the largest drainage areas and in areas those that have no retention facilities upstream of the outfall.

FIGURE 3.4
DRY WELL
REHAB LOCATIONS
(SD-9)

LEGEND

CITY LIMIT

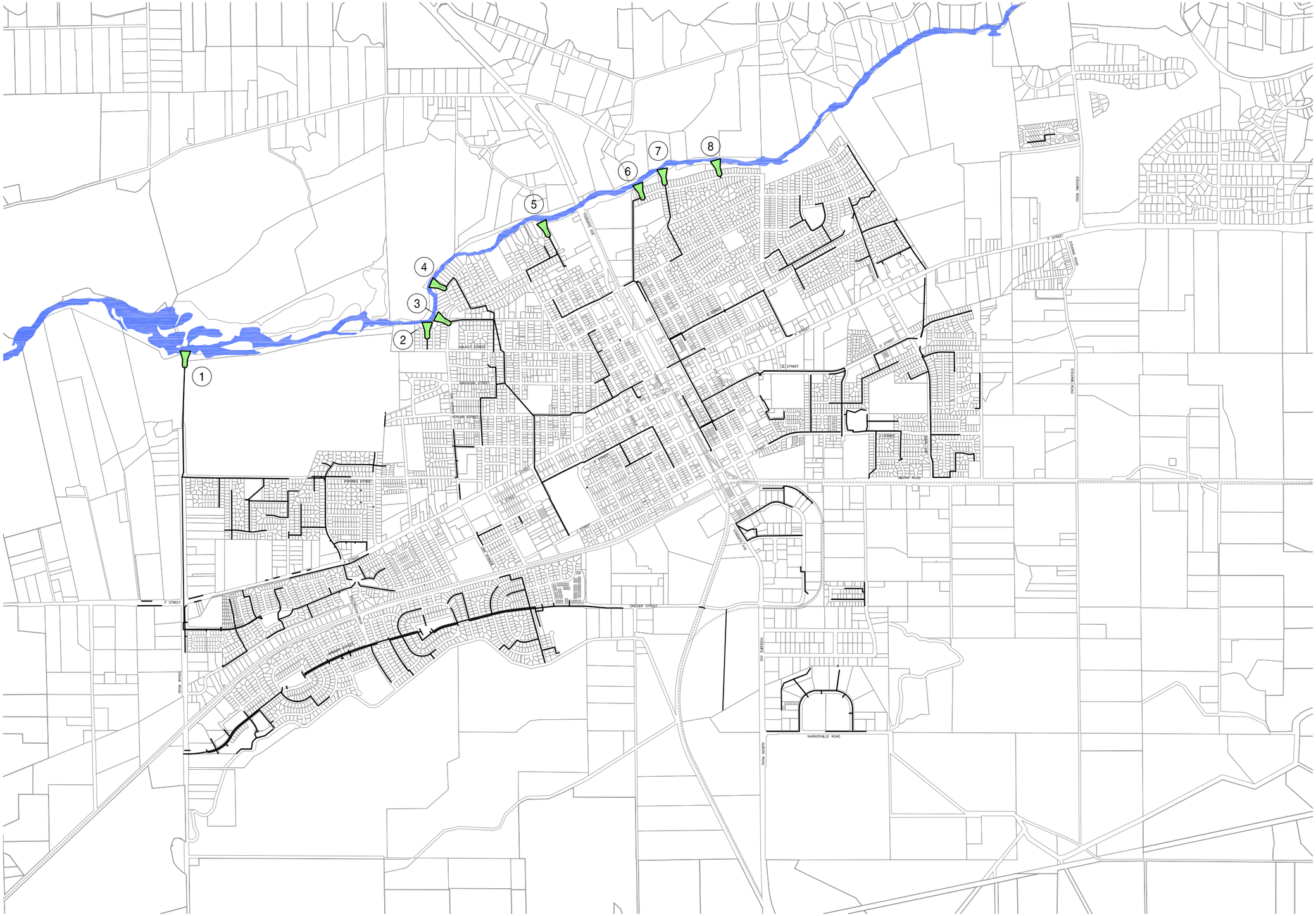
DRY WELL
FLOOD AREA

NORTH

0 1000 2000

CITY OF
OAKDALE

FIGURE 3.5
EXISTING STORM DRAIN OUTFALLS (SD-10)



1: 30" RCP WITH BOX AND SCREEN

2: 15" CMP DIRECT

3: 24" CMP DIRECT

4: 30" RCP WITH BOX AND SCREEN

5: 21" RCP CIRCULAR VAULT

6: 24" RCP WITH BOX AND SCREEN

7: 24" RCP WITH BOX AND SCREEN

8: 21" CMP WITH BOX

LEGEND

- STORM DRAIN LINE
- STORM DRAIN OUTFALL

NORTH

0 1000 2000

CITY OF OAKDALE

4. COST ESTIMATES

This section presents the anticipated costs associated with the recommended projects identified in Section 3 of this report. Table 4-1 below lists the projects and their associated cost by number as they correspond to figure 3.4. More detailed information about each project can be found in section 3. Figure 4.1 through 4.4 present detailed cost estimates for some of the projects.

Table 4-1: Project Costs

No.	Project	Improvements
SD-1	Walnut Storm Drain Connection	$ 189,000.00
SD-2	Walnut Pump Station	$ 150,000.00
SD-3	5th & G Street Storm Drain Connection	$ 94,500.00
SD-4	Wood Basin Connection & Expansion	$ 1,031,100.00
SD-5	H Street & Oak Avenue Storm Drain	$ 1,036,200.00
SD-6	Crane Road Pump Station	$ 420,000.00
SD-7	Crane Road Storm Drain	$ 320,000.00
SD-8	Pump Stations – Pump & Controls (11 total)	$ 550,000.00
SD-9	Rehabilitate Drywells (200 total)	$ 1,000,000.00
SD-10	Outfall Treatment Devices (8 total)	$ 840,000.00
		Total $ 5,630,800.00

Figure 4.1

SD-1 Walnut Storm Drain

Cost Estimate:

NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
1	MOBILIZATION/DEMOLITION	1	LS	$10,000.00	$10,000.00
2	36" STORM DRAIN	175	LF	$200.00	$35,000.00
3	STORM DRAIN MANHOLES	2	EA	$10,000.00	$20,000.00
4	PAVEMENT	2,400	SF	$15.00	$36,000.00
5	STRIPING	1	LS	$10,000.00	$10,000.00
6	TRAFFIC & EROSION CONTROL	1	LS	$15,000.00	$15,000.00
				SUBTOTAL	$126,000.00
				CONTINGENCY & SOFT COSTS (50%)	$63,000.00
				TOTAL:	**$189,000.00**

Figure 4.2

SD-3 5th & 6th STREET CONNECTION

Cost Estimate:

NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
1	MOBILIZATION/DEMOLITION	1	LS	$5,000.00	$5,000.00
2	36" STORM DRAIN	20	LF	$200.00	$4,000.00
3	MANHOLE	2	EA	$10,000.00	$20,000.00
4	PAVEMENT	600	SF	$15.00	$9,000.00
5	STRIPING	1	LS	$10,000.00	$10,000.00
6	TRAFFIC & EROSION CONTROL	1	LS	$15,000.00	$15,000.00
				SUBTOTAL	$63,000.00
				CONTINGENCY & SOFT COSTS (50%)	$31,500.00
				TOTAL:	**$94,500.00**

Figure 4.3

SD-4 Wood Basin Connection & Expansion

Cost Estimate:

NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
1	SAWCUT	2,800	LF	$2.00	$5,600.00
2	REMOVE EXISTING ASPHALT	14,000	SF	$3.00	$42,000.00
3	PAVEMENT	14,000	SF	$12.00	$168,000.00
4	MANHOLE	6	EA	$8,000.00	$48,000.00
5	BUBBLER	1	EA	$3,000.00	$3,000.00
6	36" RCP	520	LF	$180.00	$93,600.00
7	36" PERFORATED CMP	860	LF	$250.00	$215,000.00
8	TRENCH OFFHAUL	650	CY	$12.00	$7,800.00
9	1-1/2" CRUSHED ROCK	340	CY	$70.00	$23,800.00
10	GEOTEXTILE FABRIC	20,000	SF	$1.50	$30,000.00
11	BASIN EXCAVATION	800	CY	$25.00	$20,000.00
12	CURB, GUTTER, & SIDEWALK	10	LF	$60.00	$600.00
13	CONTROL VALVES	1	LS	$15,000.00	$15,000.00
14	ADJUST DRY WELLS IN BASIN	1	LS	$15,000.00	$15,000.00
				SUBTOTAL	$687,400.00
				CONTINGENCY & SOFT COSTS (50%)	$343,700.00
				TOTAL:	**$1,031,100.00**

Figure 4.4

SD-5 H Street & Oak Avenue Storm Drain

WALNUT STORM DRAIN

NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL COST
1	SAWCUT	2,800	LF	$2.00	$5,600.00
2	REMOVE EXISTING ASPHALT	13,500	SF	$3.00	$40,500.00
3	PAVEMENT	13,500	SF	$12.00	$162,000.00
4	MANHOLE	8	EA	$8,000.00	$64,000.00
5	BUBBLER	2	EA	$3,000.00	$6,000.00
6	36" RCP	1,352	LF	$200.00	$270,400.00
7	TRENCH OFFHAUL	740	CY	$15.00	$11,100.00
8	BASIN EXCAVATION	3,000	CY	$25.00	$75,000.00
9	CURB, GUTTER, & SIDEWALK	20	LF	$60.00	$1,200.00
10	ADJUST DRY WELLS IN BASIN	1	LS	$15,000.00	$15,000.00
11	LIFT STATION UPGRADE	1	LS	$30,000.00	$30,000.00
12	CHECK VALVE	1	LS	$10,000.00	$10,000.00
				SUBTOTAL	$690,800.00
				CONTINGENCY & SOFT COSTS (50%)	$345,400.00
				TOTAL:	**$1,036,200.00**

5. IMPLEMENTATION & MAINTENANCE

This section discusses the "next steps" for implementation of this Master Plan.

Implementation:

The preceding chapter of this report identified a list of capital improvement projects (and their associated costs) to insure that the system will operate properly and accommodate anticipated growth. It is recommended that these projects be included in a Capital Improvement Program. The city's Capital Facility Fee program (CFF) should be update to include theses costs, since all these improvements are necessary to insure a healthy storm drain system that is capable of serving future development demands.

The CIP should also include additional project costs for replacement of system components when they have reached their useful life, as well as routine maintenance to ensure the proper function of the system.

System Maintenance:

Overall the storm drain system's performance is largely influenced by the maintenance performed. A comprehensive maintenance plan needs to be part of a properly functioning storm drain system. Currently the City performs street sweeping on a once a month basis or bi-weekly in some parts of town. This simply is not sufficient during storm season to keep the storm drain system operating properly. At a minimum the streets should be swept once a week during the storm season and preferably year around particularly in the older parts of town that have insufficient drainage and an abundance of dry wells. Any debris that is left in the streets eventually makes its way into the gutter and into the storm drain system. Even nuisance flows from small rain events or landscape runoff can cause the debris that is in the gutters to enter the storm drain system. When this happens, drain inlets become plugged, dry wells become inundated with debris, pipelines become filled with sediment, and the storm drain system becomes compromised. Along with the additional street sweeping, routine inspections and maintenance on dry wells needs to be performed to keep them operating at optimum levels. When maintenance is lacking, the storm drain slowly deteriorates and becomes costly to repair. A routine maintenance plan will protect the infrastructure and keep it operating effectively. These recommendations are particularly important in the Central Drainage Area, since this area relies heavily on an under-designed conveyance system and has a lack of storage facilities.