CALIFORNIA CITY OF CALIFORNIA PROUD TO SERVE MISSOURI

# Stormwater Feasibility Study

PGAV PLANNERS

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December 17, 2010

Mr. Patrick Hanlon
Senior Project Manager
PGAV Planners
200 North Broadway, Suite 1000
St. Louis, MO 63102

Re: Stormwater Feasibility Study
California, MO DREAM Community

Dear Mr. Hanlon:

We appreciate the opportunity to partner with PGAV Planners on the DREAM project for the City of California. Attached with this letter is the report summarizing the Stormwater Feasibility Study that was completed to address the flooding problems near the High Street and East Third Street intersection.

Two different options are proposed. Option # 1 addresses the stormwater issues along High Street, East Third Street, and those present along Highway 87. The estimated cost of this option is $442,500. Option # 2 includes the same improvements as Option # 1, but extends the improvements to address a deteriorating system downstream and flooding of Main Street. This extension adds $126,000 to the first option for a total cost of $568,500.

We look forward to working with you and the City to make these improvements, part of the solution that will enhance California's downtown. Please let us know if you have any questions or comments regarding this report.

Sincerely,

Bob Gilbert, P.E.
Project Manager

STATE OF MISSOURI
ROBERT ALAN GILBERT
NUMBER
PE-2004014623
PROFESSIONAL ENGINEER
12-17-10

Attachment

cc: City of California – Brian Scrivner, City Clerk

1719 SOUTHRIDGE DRIVE SUITE 100 ■ JEFFERSON CITY MO 65109-4000
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## Introduction

The City of California has been selected as part of the Downtown Revitalization and Economic Assistance for Missouri (DREAM) Initiative. Improvements are being recommended throughout the downtown area. However, High Street between East Madison Street and East Third Street is plagued by flooding problems, especially the northwest corner of this block that houses the Finke Theater. The intent of this study is to identify the existing stormwater problems in this area and develop conceptual solutions to reduce these problems. Along with conceptual solutions, the study provides an estimate of project cost for each solution to help budget for the improvements.

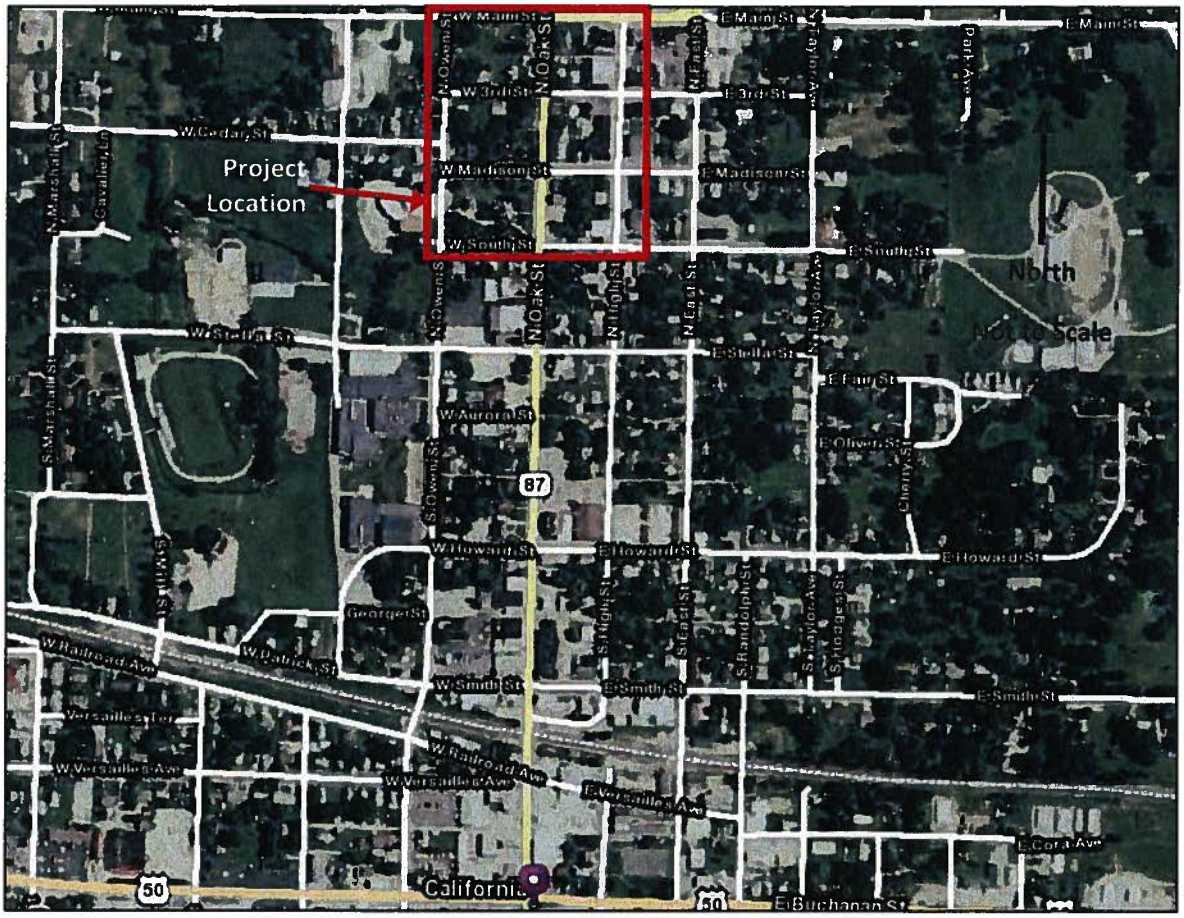



Figure 1: Map showing project location (image taken from MapQuest)

## Conceptual Design Criteria

The conceptual pipe sizes, slopes, and lengths were determined using a digital elevation model created from USGS 10' contour maps and an aerial photo. No field surveying was performed, and no underground utilities were located when determining the conceptual designs, other than a general review of known city utilities from their geographic information system (GIS). The conceptual designs are intended to be used to determine the approximate sizes and lengths of improvements in order to determine a conceptual project cost estimate. The conceptual designs shown in this report should not be used for construction, but they are a starting point for final design.

Hydrologic and hydraulic design criteria was based on Kansas City Metropolitan Chapter, "American Public Works Association Standard Specifications and Design Criteria- Section 5600" (2005) with the following exceptions or clarifications.

### Hydrology

- Hydrologic calculations for 10 and 100 year storm frequencies were determined. The pipes were designed to contain the 100 year storm, and inlets were spaced to meet the requirements of a 10 year storm.
- Design runoff was based on existing conditions.
- Rational Method was used to determine the peak runoff.
- Calculation of the time of concentration (Tc) was calculated assuming the first 100 feet was overland flow and the remaining travel distance was a channelized flow velocity of 7 ft/sec.
- Rainfall intensity was determined using the City of Jefferson's intensity-duration-frequency data.
- The runoff coefficient (C) was determined according to APWA Section 5600.

### Hydraulics

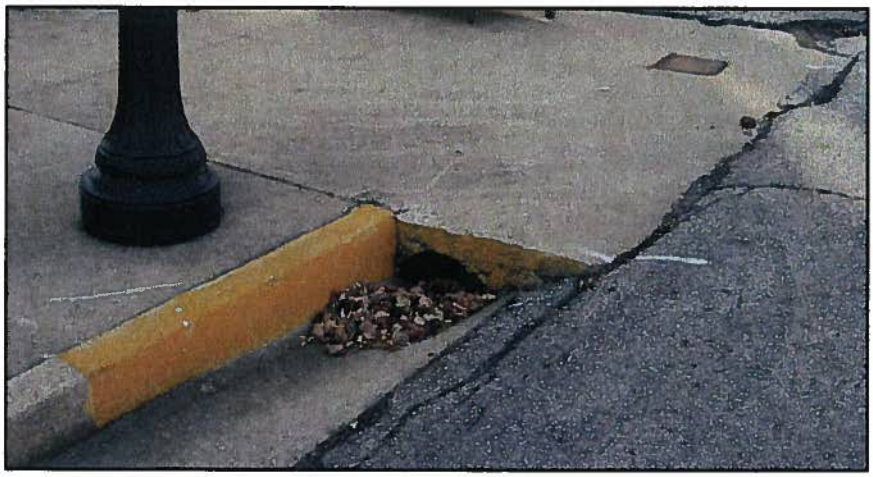
- Manning's equation for open channel flow was used in sizing storm sewers.
- Pipes were assumed to be high-density polyethylene (HDPE) with a roughness coefficient of 0.013 (would also work if reinforced concrete pipe (RCP) was chosen).
- Minimum pipe size is a 15-inch diameter.

## Existing Conditions

There are currently no curb inlets to collect stormwater along High Street through the downtown area. North and south of East Third Street, the only stormwater facilities are small culverts across intersections. These small culverts collect the water in the gutter at one side of the intersection and carry the water under the pavement to the gutter on the other side of the intersection.

Picture 1: Stormwater facilities at the intersection of South Street and High Street, looking east

At the intersection of East Third Street and High Street, there is a pipe in each quadrant of the intersection that connects underneath the pavement and discharges the stormwater to the west, along the south side of East Third Street. Finke Theater is located at the southwest corner of this intersection and has experienced structural flooding multiple times. The flooding at this location is caused by both the capacity of the pipes being inadequate and the inability for the water to flow into the pipes because of the lack of curb inlets. The floodwaters enter the north door to the theater at which point the water is able to flow into the seating area of the theater. Water has also been reported to enter the south door of the theater. The theater is currently undergoing a significant restoration, and any future damage to the theater will be more costly.



Picture 2: Pipe located in front of Finke Theater, looking northwest

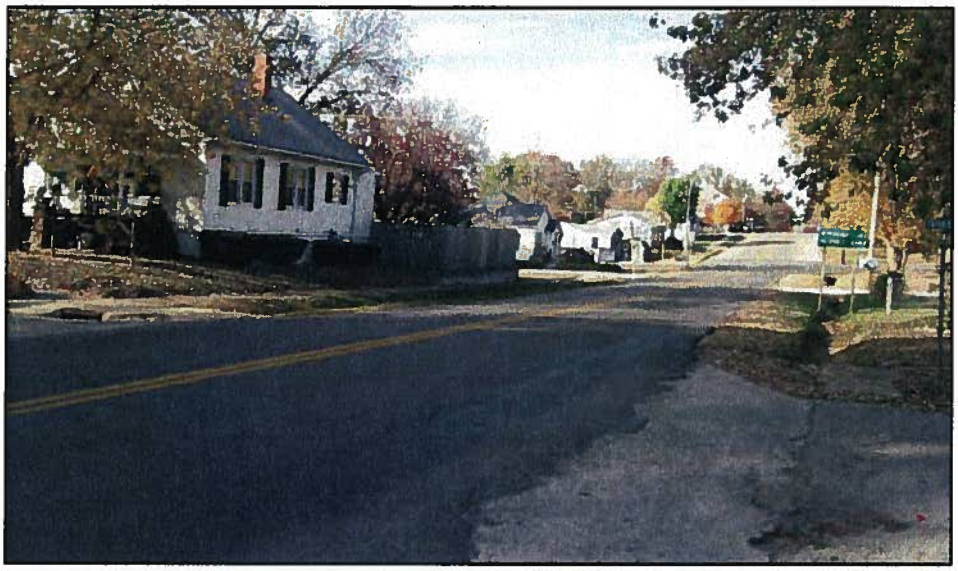
Picture 3: Looking in the north door of the Finke Theater

From the outlet of the High Street system the water travels west along the south side of East Third Street to Highway 87. Two different houses appear to be in danger of flooding along Third Street as noted on Figure 2: Existing Conditions, which can be found at the end of this report. The owners on the north side of the street, 100 East Third Street, were contacted and had not experienced any structural flooding but had experienced water flooding their front yard.

Picture 4: Flooding at 100 East Third Street (provided by owners), looking north

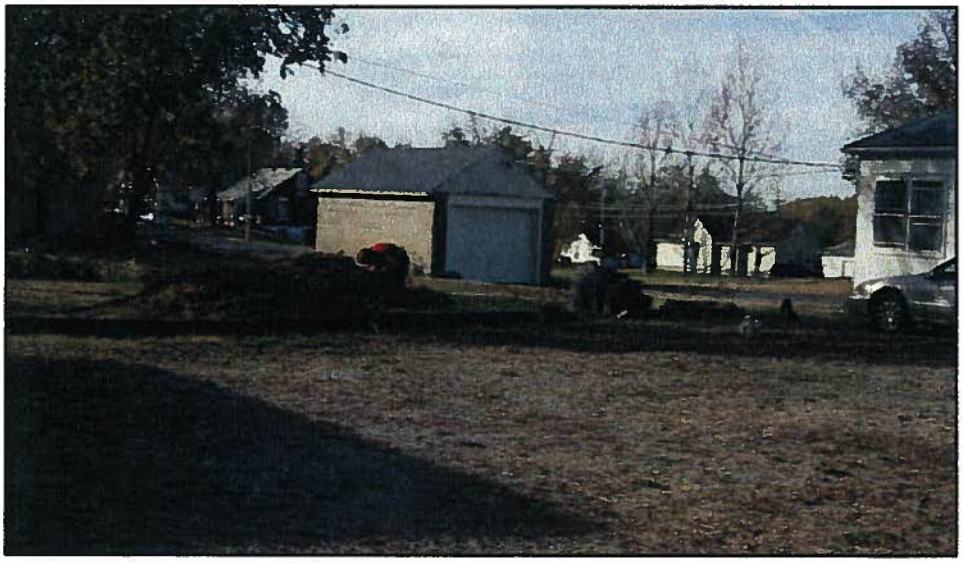
Flow along Highway 87 is conveyed in ditches along the project area. At Third Street there is a culvert on each side of the road that carries the ditched flow. The water flowing along East Third Street from

High Street enters the eastern culvert through openings in the pipe. The water traveling along West Third Street is collected by a curb inlet on the north side of the road and connects to the western culvert.



Picture 5: Looking north along Highway 87

Highway 87 north of Third Street is subject to flooding along with the business, Rorhbach's Massage Therapy, in the southwest quadrant of the Highway 87 and Main Street intersection, 405 North Oak Street. According to the property owner of Rorhbach's Massage Therapy, high flows cross Highway 87, travel through her driveway, and pass between her business and shed. In low flows the water continues north to the intersection before turning to the west, but in a large rain event the water does not follow this intended path. The owner of this property stated that multiple floods have caused damage to her property and structures.



Picture 6: At 405 North Oak Street floodwaters travel between business and shed, Highway 87 looking northwest

From this point the water travels west in a ditch along the south side of Main Street before entering an old stormwater system. It appears that Main Street floods due to the inability for the water to enter the system on the south side of the street. The stormwater system on the north side of Main Street appears to be conduit created by mixture of placed stone and concrete. At Owens Street the stormwater conduit becomes a corrugated metal pipe. This pipe appears to be deteriorating as there are sinkholes located above it. It seems as though the residence located in the southwest quadrant of Owens Street and North Street would flood, but the current resident has not experienced any structural flooding in recent years and stated a relative owns the property and has not reported any flooding of the residence.

Picture 7: Stormwater system north of Main Street

Picture 8: Sinkholes west of Owens Street

## Proposed Project

To help address the flooding issues at the High Street and East Third Street intersection, particularly at the Finke Theater, Option #1 begins by adding curb inlets along High Street as shown in Figure 3: Proposed Alternatives, which can be found at the end of this report. Two inlets would be placed south of Madison Street, and the main trunk line for the sewer would be run down the west side of High Street under the sidewalk and curb. Two more curb inlets would be placed along this trunk line to help collect the water before it reaches the East Third Street Intersection. The improvements would also include the installation of a curb inlet in each quadrant of the High Street and East Third Street intersection. This will replace the existing system of pipes.

The new High Street system would continue down the south side of East Third Street in an enclosed pipe system instead of the existing open channel system. This will also allow for the addition of curb and gutter on the south side of the street. The north side of the street features curb and gutter on the east end but not the west end near Highway 87. Therefore, the curb and gutter will be extended to the intersection with Highway 87 to complete a curb and guttered cross section for this block of East Third Street.

Three new inlets would be installed at the Highway 87 and Third Street intersection. A closed pipe system would be installed on the west side of Highway 87 along with curb and gutter. This new system and the curb and gutter will reduce the flooding at Rorhbach's Massage Therapy. To help prevent floodwaters from cutting through the business's property, the closed system will be taken around the corner of lot and discharge into the existing open channel on the south side of Main Street.

Option #2 includes the improvements proposed above for Option #1, but instead of discharging into the open channel along Main Street, the closed pipe system is continued west. This system would replace the old system that travels northwest across Main Street and Owens Street. The existing system crosses through the middle of a lot between the two streets, but the proposed system would be installed along the roadway to allow the lot to be useable for future development.

Picture 9: Open channel and residence west of Owens Street

The second option would discharge into the existing open channel immediately west of Owens Street as shown in Picture 9 on the previous page. This option was not taken any further because there is no confirmation that the residence along this open channel has flooded. If it is determined that this residence has flooded in the past, or that the channel doesn't have adequate capacity, the option could continue and connect to the existing culvert under North Street.

The table below summarizes the conceptual design calculations. The locations of the design points are shown in Figure 3 and correspond with locations for which drainage areas were developed and calculations were performed. Because the project area does not lend itself well to a combination of overland flow and an enclosed system due to the tight quarters and low opening elevations, each pipe was designed to convey the 100 year storm.

Table 1: Conceptual Design Calculations

| Design Point | Area (ac) | Req'd Design Flow (cfs) | Pipe Size (in) | Pipe Slope | Percent Full at Req'd Design Flow |
|---|---|---|---|---|---|
| P-1 | 0.71 | 7.6 | 18 | 1.56% | 58% |
| P-2 | 2.83 | 38.0 | 30 | 1.32% | 81% |
| P-3 | 1.09 | 11.2 | 15 | 7.07% | 65% |
| P-4 | 1.25 | 13.9 | 15 | 7.61% | 78% |
| P-5 | 0.14 | 15.2 | 18 | 4.91% | 65% |
| P-6 | 0.23 | 66.0 | 36 | 1.92% | 72% |
| P-7 | 3.25 | 30.3 | 30 | N/A | N/A |
| P-8 | 1.04 | 100.7 | 36 | 3.09% | 86% |
| P-9 | 5.81 | 151.5 | 48 | 1.63% | 83% |
| P-10 | 0.13 | 152.0 | 48 | 2.67% | 65% |
| P-11 | 1.41 | 165.6 | 48 | 2.63% | 71% |
| P-12 | 1.41 | 172.4 | 48 | 2.62% | 74% |
| P-13 | 6.02 | 218.7 | 54 | 1.88% | 81% |

## Project Cost

Option #1 is estimated to cost $442,500 in total project cost. The lengthier Option #2 is expected to cost approximately $568,500, an increase of $126,000. A detailed cost estimate is located at the end of this report.

## Recommendations

It is recommended that the improvements be made along High Street, Third Street, and Highway 87. In this area there are two confirmed cases of structural flooding, two more possible cases of structural flooding, and roadway flooding along three major streets. Therefore, Option #1 is recommended as a minimum improvement.

Option #2 increases the length and costs of improvements, but the added benefit is not as significant. This option would reduce the flooding on Main Street and replace a deteriorating storm sewer system. However, it does not reduce any known structural flooding. This option should be considered if funding becomes available and/or the City of California has a desire to replace and upgrade the inadequate, deteriorated system in this area.

It is also recommended that funding sources be explored for these stormwater improvements. Along with typical funding sources for the City such as CDBG funds, funding from MoDOT could be explored. Part of the improvements consist of improvements to Highway 87 and reduce the flooding of this state route. Inquiries could be made to MoDOT's District 5 to determine if cost-share or MoDOT maintenance funds could be used to help the City fund the project.

COUNTY COURTHOUSE

HIGH STREET

ALLEY

NORTH STREET

THIRD STREET

FINKE THEATER

SOUTH STREET

Highway 87

MADISON STREET

OWENS STREET

OWEN STREET

MAIN STREET

CEDAR STREET

0 50 100 200 Feet

## Legend

- Confirmed Stucture Flooding
- Possible Stucture Flooding
- Roadway Flooding
- Storm Inlet/Structure
- Storm Sewer
- Sanitary Manhole
- Sanitary Sewer Pipe
- Water Lines

**Figure 2 - Existing Conditions**
**California DREAM Stormwater Feasibility Study**

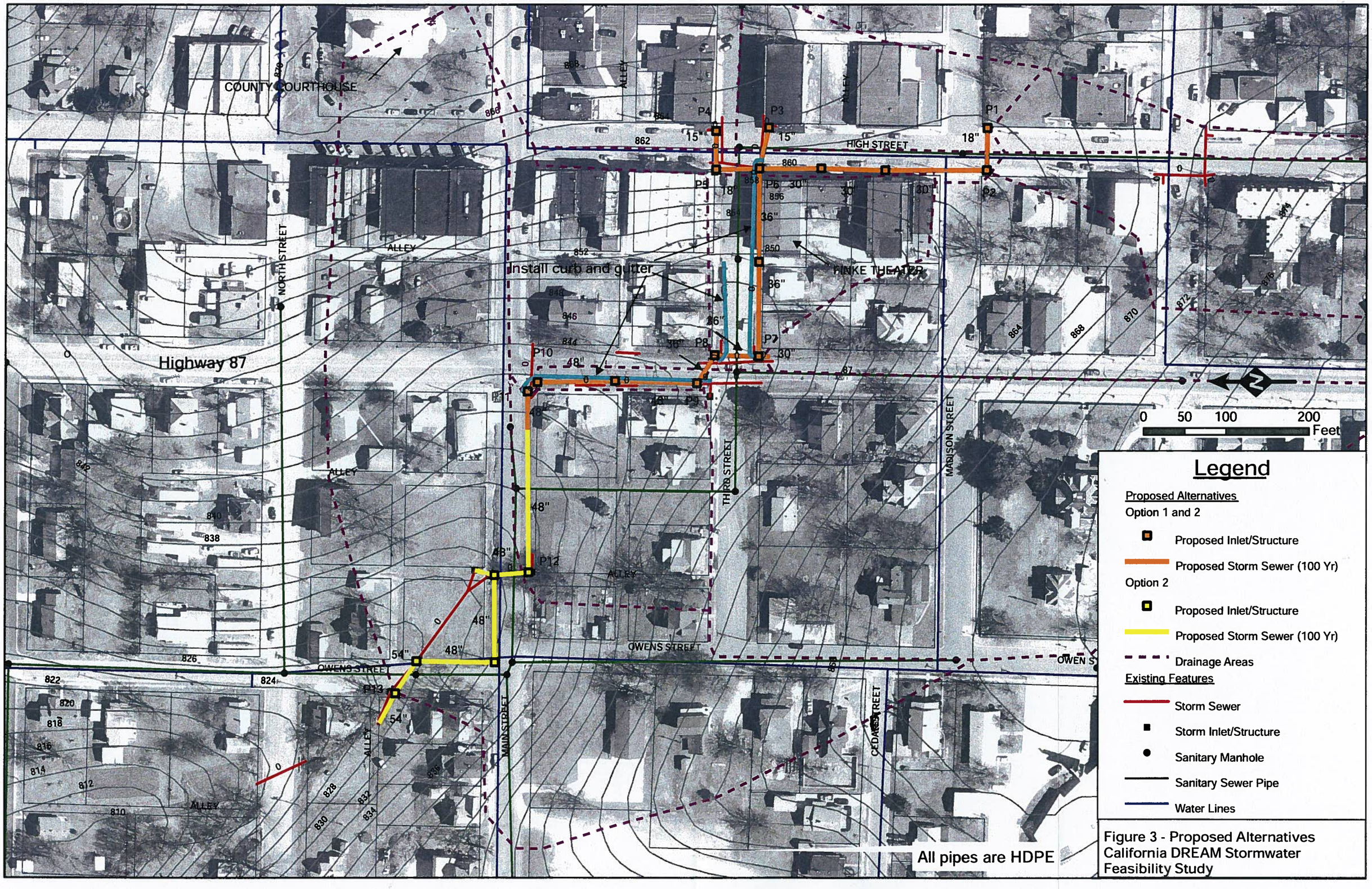



Figure 3 - Proposed Alternatives
California DREAM Stormwater
Feasibility Study

**City of California DREAM- Stormwater Feasibility Study**
**Conceptual Project Costs**
**December 8, 2010**

**Option #1**

**Conceptual Construction Costs:**

| Item Description | Unit | Quantity | Unit Price | Total |
|---|---|---|---|---|
| 15" HDPE Storm Sewer | LF | 100 | $40 | $4,000 |
| 18" HDPE Storm Sewer | LF | 110 | $45 | $4,950 |
| 30" HDPE Storm Sewer | LF | 320 | $65 | $20,800 |
| 36" HDPE Storm Sewer | LF | 310 | $70 | $21,700 |
| 48" HDPE Storm Sewer | LF | 250 | $85 | $21,250 |
| Street Inlet / Manhole | EA | 15 | $3,500 | $52,500 |
| End Section | EA | 3 | $1,500 | $4,500 |
| Connect to Ex. Storm Sewer | EA | 2 | $1,500 | $3,000 |
| Concrete Sidewalk | LF | 600 | $60 | $36,000 |
| Concrete Pavement | SY | 700 | $60 | $42,000 |
| Concrete Curb & Gutter | LF | 1000 | $20 | $20,000 |
| Concrete Drive | SY | 80 | $60 | $4,800 |
| Mobilization | 7% | | | $16,500 |
| Traffic Control | LS | | | $25,000 |
| Erosion Control | LS | | | $5,000 |
| Site Restoration | LS | | | $4,000 |
| Utility Relocation | LS | | | $25,000 |
| Construction Contingencies | 10% | | | $29,000 |
| **Subtotal - Construction Cost** | | | | **$340,000** |

**Conceptual Non-Construction Costs:**

| | | | | |
|---|---|---|---|---|
| Easements | EA | 7 | $500 | $3,500 |
| Legal & Financial Consultation | 4% | | | $14,000 |
| Engineering | 15% | | | $51,000 |
| Project Administration & Inspection | 10% | | | $34,000 |
| **Subtotal - Non-Construction Cost** | | | | **$102,500** |

**Total - Conceptual Project Cost** **$442,500**

**City of California DREAM- Stormwater Feasibility Study**
**Conceptual Project Costs**
**December 8, 2010**

**Option #2**

**Conceptual Construction Costs:**

| Item Description | Unit | Quantity | Unit Price | Total |
|---|---|---|---|---|
| 15" HDPE Storm Sewer | LF | 130 | $40 | $5,200 |
| 18" HDPE Storm Sewer | LF | 110 | $45 | $4,950 |
| 30" HDPE Storm Sewer | LF | 320 | $65 | $20,800 |
| 36" HDPE Storm Sewer | LF | 310 | $70 | $21,700 |
| 48" HDPE Storm Sewer | LF | 650 | $85 | $55,250 |
| 54" HDPE Storm Sewer | LF | 100 | $95 | $9,500 |
| Street Inlet / Manhole | EA | 20 | $3,500 | $70,000 |
| End Section | EA | 3 | $1,500 | $4,500 |
| Connect to Ex. Storm Sewer | EA | 3 | $1,500 | $4,500 |
| Concrete Sidewalk | LF | 600 | $60 | $36,000 |
| Concrete Pavement | SY | 900 | $60 | $54,000 |
| Concrete Curb & Gutter | LF | 1000 | $20 | $20,000 |
| Concrete Drive | SY | 80 | $60 | $4,800 |
| Mobilization | 7% | | | $21,800 |
| Traffic Control | LS | | | $25,000 |
| Erosion Control | LS | | | $6,000 |
| Site Restoration | LS | | | $5,000 |
| Utility Relocation | LS | | | $30,000 |
| Construction Contingencies | 10% | | | $37,000 |
| **Subtotal - Construction Cost** | | | | **$436,000** |

**Conceptual Non-Construction Costs:**

| | | | | |
|---|---|---|---|---|
| Easements | EA | 11 | $500 | $5,500 |
| Legal & Financial Consultation | 4% | | | $17,500 |
| Engineering | 15% | | | $65,500 |
| Project Administration & Inspection | 10% | | | $44,000 |
| **Subtotal - Non-Construction Cost** | | | | **$132,500** |

**Total - Conceptual Project Cost** **$568,500**