

**JOE'S CREEK WATERSHED**  
**BEST MANAGEMENT PRACTICES (BMP)**  
**ALTERNATIVES ANALYSIS**  
**(TASK 3.1.8)**

Prepared for:

Pinellas County  
City of St. Petersburg and  
Southwest Florida Water Management District



7650 West Courtney Campbell Causeway, Suite 700  
Tampa, Florida 33607-1462

December 2016

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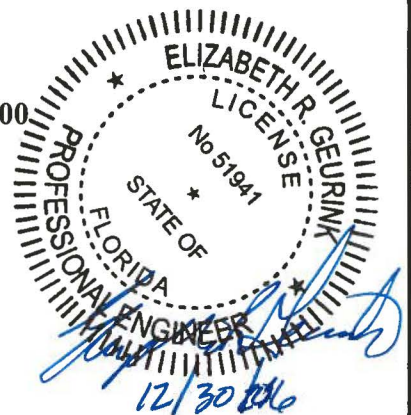
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JOE'S CREEK WATERSHED  
BEST MANAGEMENT PRACTICES (BMP) ALTERNATIVES ANALYSIS  
(TASK 3.1.8)

## 1.0 INTRODUCTION

Pinellas County, in cooperation with the City of St. Petersburg and the Southwest Florida Water Management District (SWFWMD), is preparing a Watershed Management Plan for the Joe's Creek Watershed in Pinellas County. The project is to be executed in general conformance with SWFWMD's Watershed Management Program Guidelines and Specifications (G&S), and will consist of the following major elements: (1) Project Development and Digital Topographic Information, (2) Watershed Evaluation, (3) Watershed Management Plan, (5) Implementation of Best Management Plans (BMPs), and (6) Database Maintenance and Watershed Model Updates.

This BMP alternative analysis is the final component of the Watershed Management Plan element; which comprises a Floodplain Analysis, a Level of Service (LOS) Evaluation, a Surface Water Resource Assessment (SWRA) and a BMP Alternatives Analysis. The watershed boundaries, storage, conveyance, flow paths and parameters have been developed and verified by field reconnaissance. The information from the Floodplain Analysis and LOS Evaluation has been used to create a computer model of the existing watershed conditions. This model was used to evaluate the flood control BMPs considered herein. A subbasin-level non-point runoff average annual pollutant loading model (Joe's Creek PLM), developed as part of the SWRA was utilized to evaluate pollutant load reduction associated with water quality BMPs.

This report is limited to the BMP Alternatives Analysis component of the Watershed Management Plan element for the Joe's Creek Watershed. Separate reports address the other elements associated with the Watershed Management Program.

### 1.1 Authorization

URS Corporation Southern (URS) has been contracted by Pinellas County to conduct the first five elements of the Watershed Management Program for the Joe's Creek (**Figure 1.1**). Tasks conducted under this Work Order are per Contract No. 090-0348-CN under the Scope of Services dated 04/29/2014.

### 1.2 Project Location and General Description

The Joe's Creek Watershed encompasses approximately 9,230 acres (14.6 square miles) in southwestern Pinellas County. Approximately 3,700 acres are within the boundaries of unincorporated Pinellas County, while the remaining areas are located within the City of Pinellas Park (1,300 acres), the City of St. Petersburg (3,815 acres), and Kenneth City (418 acres). The watershed is generally bordered on the east by the CSX Railroad, on the north by 78<sup>th</sup> Ave N, and on the west by Joe's Creek, and extends south to 9<sup>th</sup> Ave N (**Figure 1.2**). The Joe's Creek Watershed comprises largely urban land uses such as commercial and industrial establishments, single-family and multi-family developments.

### 1.3 Purpose

The purpose of this analysis is to provide Pinellas County and the City of St. Petersburg with a list of BMPs that could be implemented to improve the water quality and to increase flood protection in the Joe's Creek Watershed. BMPs are traditionally described in terms of water pollution prevention, reduction, and elimination. Novotny (2003) defined BMPs as "...methods, measures, or practices selected and implemented to meet the needs of nonpoint (diffuse) source control. BMPs include, but are not limited to, structural and nonstructural controls and operations and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants from diffuse sources into receiving waters." This report expands the traditional pollution control definition to include not only water quality measures, but also flood protection and flood control measures. Implementation projects that reduce flooding and improve flood protection in regional or intermediate systems may qualify for SWFWMD funding. Improvement of natural systems and water quality are likely to be eligible for cooperative funding through the SWFWMD Surface Water Improvement and Management (SWIM) program. The BMPs recommended herein may qualify for cooperative funding.

Street and yard flooding has been an issue at several locations within the watershed. Pinellas County, City of St. Petersburg, and SWFWMD's staff provided input on conceptual BMP locations and approaches that could reduce the duration and depth of flooding in and along the Joe's Creek Watershed primary channels. Basin conditions represented in the watershed modeling are based on a 2008 digital elevation model (DEM), 2011 land use/land cover and 2014 aerial imagery, and environmental resource permits (ERPs) from 2008 - 2014.

Section 2.0 of this report contains information about the flood prone areas and areas of potential water quality concern for which conceptual BMPs have been considered. Section 3.0 describes the screening process for selection of modeled and priority BMPs, and the list of the BMPs selected for detailed analysis. Section 4.0 describes the evaluation and the analysis of each of the selected BMPs. Section 5.0 contains a summary of findings and recommendations.



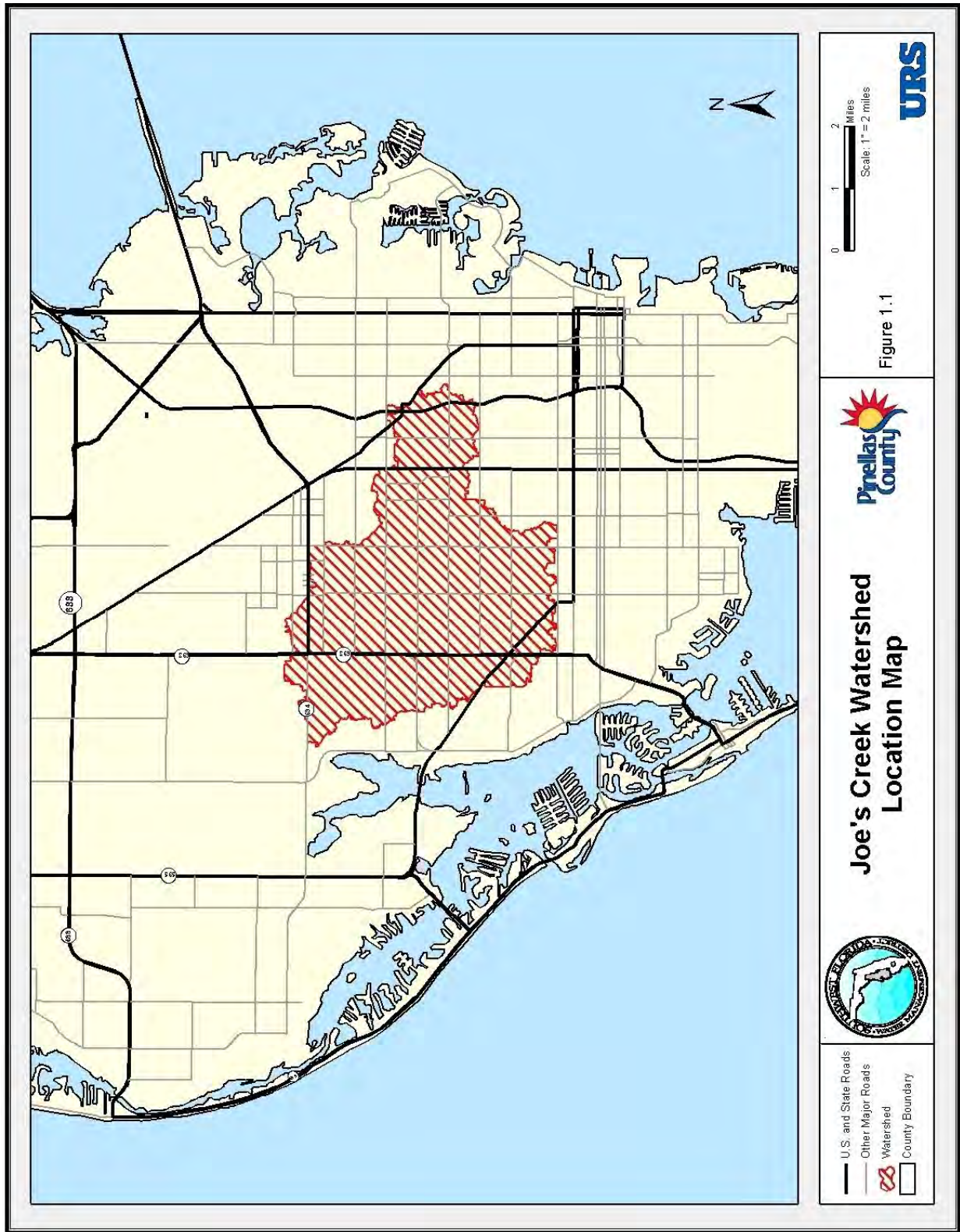


Figure 1.1 Location Map

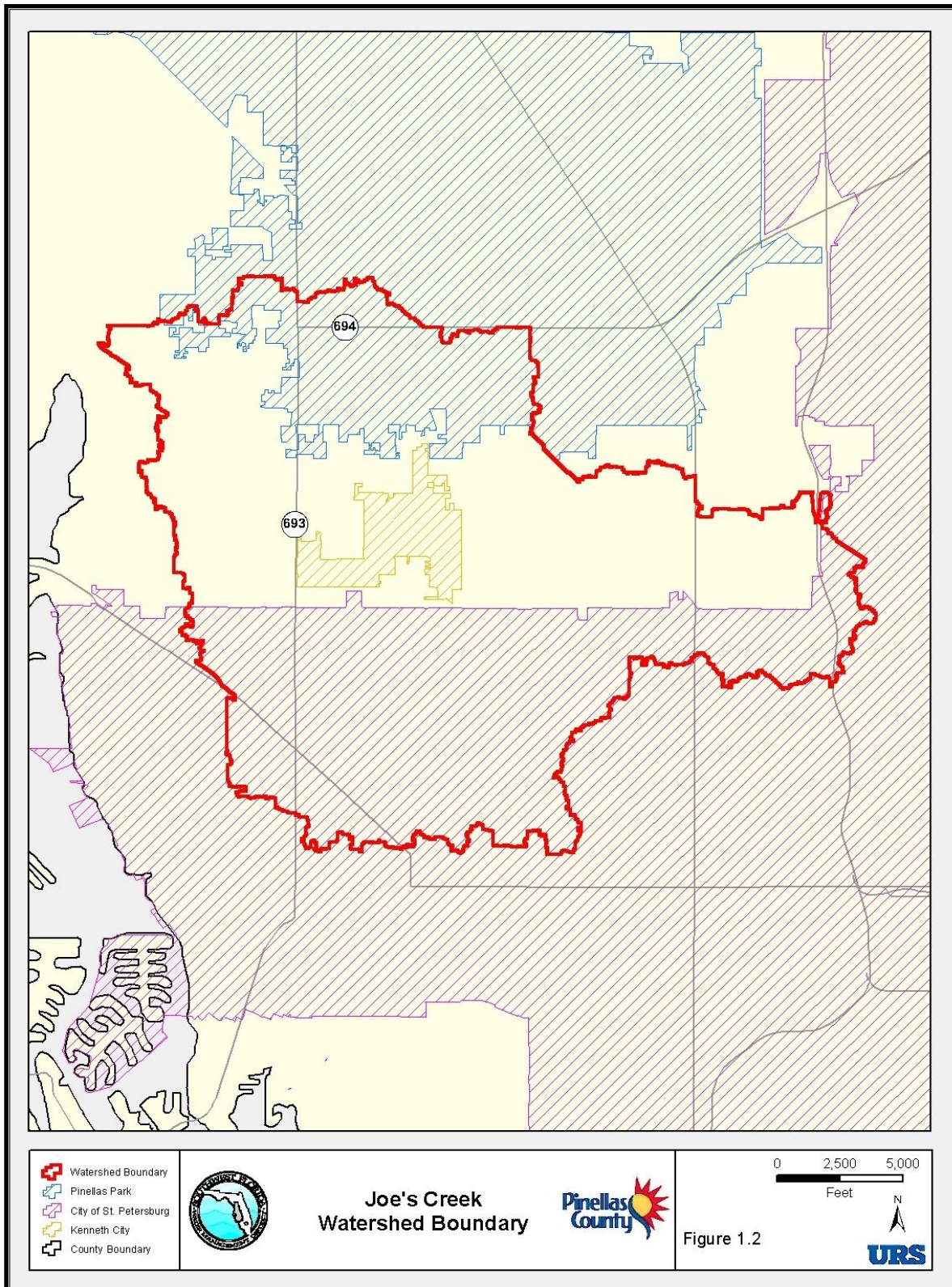


Figure 1.2 Joe's Creek Watershed Boundary

## 2.0 CHARACTERIZATION OF FLOOD PRONE AND TARGET WATER QUALITY AREAS

### 2.1 Flood Prone Areas

Areas of concern for flooding within the Joe's Creek Watershed have been identified using historical complaints and photos combined with the results of model simulations. Pinellas County's LOS criteria were used to determine where surface inundation would be categorized as problematic. The target LOS criteria include:

- 100-year event habitable building protection (no flooding)
- 25-year event municipally-maintained ponds and channel peak stages within banks
- 25-year "passable" conditions for evacuation routes (less than 6 inches over road)
- 10-year "passable" conditions for other public roads (less than 6 inches over road)

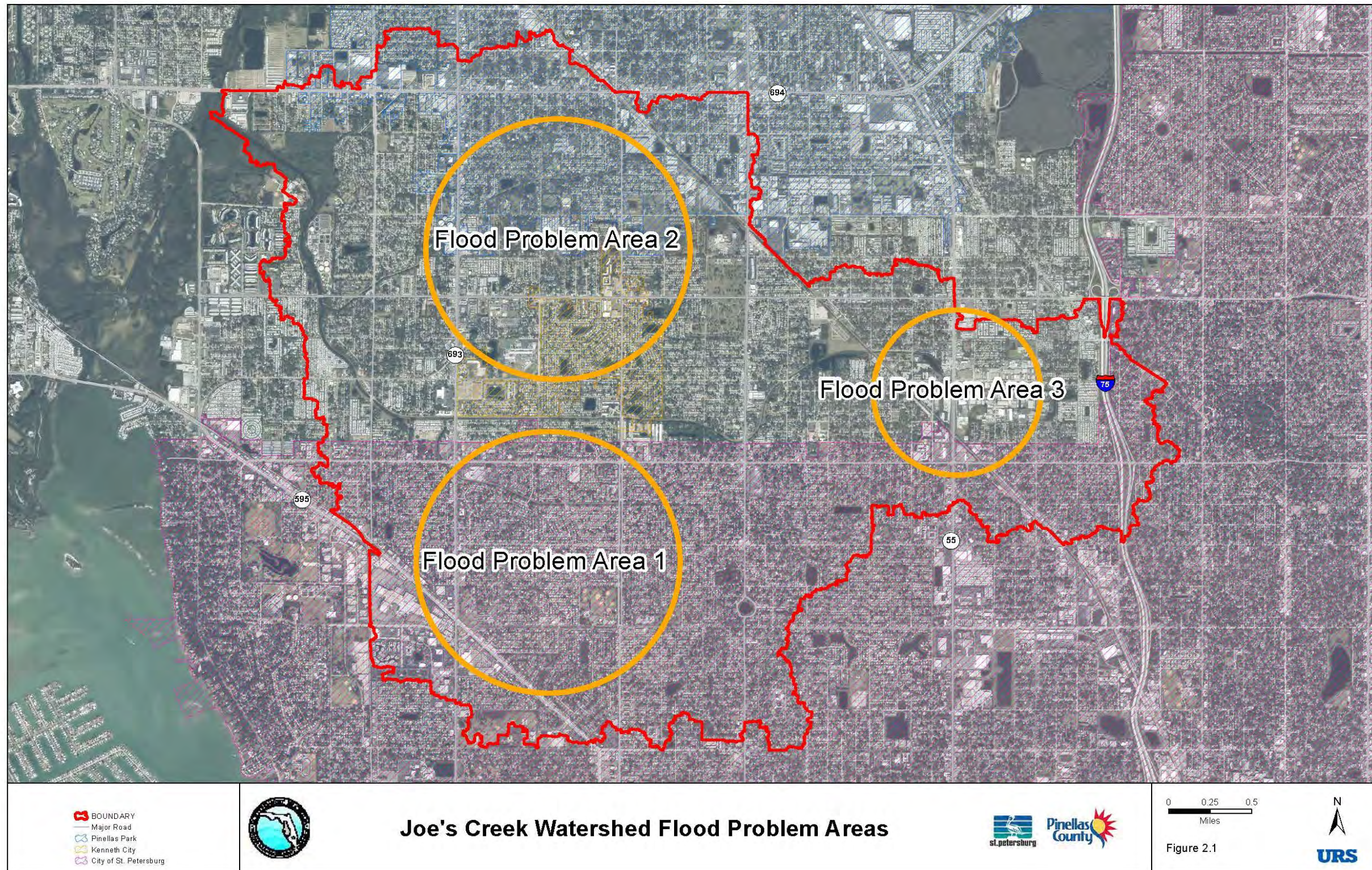
Characterization of flood extent and depth is based on:

- 10-, 25- and 100-year modeled floodplains generated from the existing conditions ICPR model
- Aerial backdrop and DEM which allows identification of top-of-bank, low road and low site elevations (finished floors assumed to be at grade for permanent buildings, although mobile homes are typically raised)

The areas of concern for water quality are based on:

- Water quality data collected as part of the Pinellas County Ambient Water Quality Program
- Land use/land cover data coupled with drain pipe and pond locations to identify older development predating State water quality regulations such as Chapter 62-25, FAC
- Joe's Creek Pollutant Loading Model non-point source basin loading results

The locations of the primary areas of concern identified for flooding and water quality are presented in **Figure 2.1** and **Figure 2.3**, respectively. Flood prone areas use a numeric designation and water quality problem areas use an alpha designation. **Table 2-1** more fully describes the flood prone areas of concern and the issues associated with each. Descriptions of each flood prone area follow, grouped by municipality.



Joe's Creek Watershed Flood Problem Areas

Figure 2.1 Joe's Creek Watershed Flood Problem Areas

**Table 2-1 Joe's Creek Watershed Flooding Problem Areas**

<b>Area</b>	<b>Municipality</b>	<b>Area Description</b>	<b>Problem/Severity</b>
1	City of St. Petersburg	Residential and commercial areas surrounding Tyrone Boulevard that drain through pipes and ditches to Miles Creek.	Undersized drainage systems along 22 <sup>nd</sup> Ave. N south of Tyrone Square mall and undersized systems along 38 <sup>th</sup> Ave. N from 64 <sup>th</sup> St. N. to 58 <sup>th</sup> St. N. result in significant street inundation
2	Unincorporated Pinellas County, City of Pinellas Park and Kenneth City	Mainly residential area from south of 54 <sup>th</sup> Ave N. flows north and discharges into ditch system (Channel 4-D) draining west into Channel 4.	Undersized culvert at 64 <sup>th</sup> St. N. and lack of capacity in Channel 4-D prevents flow from discharging to Channel 4 causing severe flooding upstream
3	Unincorporated Pinellas County	Residential and commercial areas east 38 <sup>th</sup> St. N. to west of I-75 drain through culverts and Channel 1, ultimately draining to Joe's Creek	Undersized culverts at 38 <sup>th</sup> St. N. cause severe flooding upstream

**2.1.1 City of St. Petersburg Flood Prone Area 1**

Three flood areas have been identified for evaluation within the City of St. Petersburg. The channel system on the northeast side of Tyrone Blvd. has little capacity and floods even for the 5 year event, causing large areas southwest of Tyrone Blvd. to flood. Culvert crossings under Tyrone Blvd. from Devonshire Pond, 18<sup>th</sup> Ave N, and 19<sup>th</sup> Ave N. comprise the second area. The outfall area from Tyrone Square Mall at 66<sup>th</sup> St. N. and Tyrone Blvd and drainage systems from 38<sup>th</sup> Ave. N. draining south into Miles Creek, also lack capacity and result in flooding.

**2.1.2 Pinellas County/Pinellas Park Flood Prone Area 2**

Flood areas have been identified within the unincorporated Pinellas County and Pinellas Park area. One area is known as the Lealman area, between 54<sup>th</sup> Ave. N., 60<sup>th</sup> St. N., 62<sup>nd</sup> Ave. N. and 66<sup>th</sup> St. N. Another is located northeast of 66<sup>th</sup> St. N. along Channel 4. In this area, channel flooding occurs at the 10 year event.

**2.1.3 Unincorporated Pinellas County Flood Prone Area 3**

Significant street, structure and yard flooding occurs in unincorporated Pinellas County at 34<sup>th</sup> St. N. and east of 49<sup>th</sup> St. N., respectively. Due to undersized pipes under 34<sup>th</sup> St. N., significant flooding occurs from Channel 1 for the 10 year event, causing many homes and businesses upstream to flood.

## 2.2 Water Quality Target Areas

Determination of potential target areas that could benefit from water quality BMPs has been made by:

1. Reviewing the Pinellas County ambient water quality database and evaluating average annual conditions by parameters along the various stream or ditch segments;
2. Assessing the relative average annual subbasin loads (kg/year) of total suspended solids (TSS), biochemical oxygen demand (BOD), total nitrogen (TN) and total phosphorus (TP) from the Joe's Creek Pollutant Loading Model (PLM) and identifying the top ten contributor basins for each parameter;
3. Assessing the relative average annual unit loads (kg/acre-year) for TSS, BOD, TN and TP and identifying the top 10 contributor basins by intensity for each parameter; and
4. Identifying municipally-owned or potentially acquirable green spaces serving areas of similar land use/loading potential as the top contributing subbasins.

Primary areas of concern identified for flooding and water quality are presented in **Figure 2.3** and listed in **Table 2-4**.

### 2.2.1 Ambient Water Quality Overview

The conclusions from water quality ambient monitoring are as follows:

- TSS and turbidity do not appear to be problematic in any of the monitored channel or ditch segments; however intense storms in 2016 resulted in some significant channel bank erosion in some areas of Joe's Creek, as illustrated in **Figure 2.2**, which must be stabilized to prevent future issues.



**Figure 2.2 Joe's Creek Bank Failure**

- Dissolved oxygen saturation is worst in the Joe's Creek channel between Miles Creek (OF-00) and the South Cross Bayou wastewater reclamation facility (WRF) (OF-07A)
- Total nitrogen values are highest in Miles Creek and only slightly lower near the South Cross Bayou WRF in the tidal segment of Joe's Creek. The next highest total nitrogen values come from the Pinellas Park ditches. However, all segments meet the numeric nutrient criteria (NNC) concentrations for TN.
- Total phosphorus average values are fairly consistent in the freshwater segment of Joe's Creek and its tributaries. Total phosphorus concentrations more than double at the tidal segment adjacent to South Cross Bayou WRF over the average, and may be attributable to point source discharges. The tidal segment of Joe's Creek is the only segment that does not meet the NNC concentrations consistently for TP.

Chlorophyll *a* concentrations are four times higher in the upstream-most Joe's Creek site (35-11) than in the Pinellas Park tributaries but meets the NNC concentration for all years except 2015, where it exceeded the threshold by 0.1 ug/l. Chlorophyll *a* values adjacent to the South Cross Bayou WRF are nearly an order of magnitude higher than those of the Pinellas Park ditches but are, again potentially related to point source contributions.

### **2.2.2 Pollutant Loading Model Ranking**

Assessing average annual load (kg/year) by basin produced the rankings shown in **Table 2-2**. Basin locations within the watershed are highlighted in **Figure 2.3**. The limitation of this assessment criterion is that generally it can skew the ranking by physical basin size.

**Table 2-2 Joe's Creek Watershed Average Annual Load By Basin**

Major Tributary	Basin	TSS kg/yr	Major Tributary	Basin	BOD kg/yr
Joes Creek Fresh	D0020	55,119	Joes Creek Fresh	D0020	8,259
Joes Creek Fresh	D0160	52,645	Joes Creek Fresh	D0160	6,536
Miles Creek	B0010	37,499	Miles Creek	B0010	5,561
Joes Creek Fresh	D0430	34,644	Joes Creek Fresh	D0570	5,139
Joes Creek Fresh	D0570	32,746	Joes Creek Fresh	D0430	5,001
Miles Creek	C0150	27,401	Miles Creek	C0150	4,394
Joes Creek Fresh	D0150	24,835	Pinellas Pk Ditch # 5	J0040	4,190
Pinellas Pk Ditch # 5	J0040	22,888	Miles Creek	C0250	3,264
Miles Creek	C0250	21,258	Joes Creek Fresh	D0150	3,079
Joes Creek Fresh	D0060	20,045	Joes Creek Fresh	D0060	3,033
Major Tributary	Basin	TN kg/yr	Major Tributary	Basin	TP kg/yr
Joes Creek Fresh	D0020	1,887	Joes Creek Fresh	D0020	372
Miles Creek	B0010	1,304	Miles Creek	B0010	257
Joes Creek Fresh	D0430	1,242	Joes Creek Fresh	D0570	224
Joes Creek Fresh	D0160	1,182	Joes Creek Fresh	D0430	214
Joes Creek Fresh	D0570	1,111	Miles Creek	C0150	185
Miles Creek	C0150	899	Joes Creek Fresh	D0160	176
Miles Creek	C0250	783	Pinellas Pk Ditch # 5	J0040	158
Joes Creek Fresh	D0060	761	Miles Creek	C0250	156
Joes Creek Fresh	K0220	659	Joes Creek Fresh	D0060	150
Pinellas Pk Ditch # 5	J0040	641	Joes Creek Fresh	K0220	127

Assessing average annual load per acre (kg/acre-year) by basin produced a different ranking shown in **Table 2-3**, but with some overlap. The limitation of the unit loading criterion is that it often calls out highly impervious basins (dominated by commercial and, industrial land uses) that are of such a small size that a BMP implemented there would not reduce the watershed load by a significant amount.



**Table 2-3 Joe's Creek Watershed Average Annual Load Per Acre**

Major Tributary	Basin	TSS kg/ac-yr	Major Tributary	Basin	BOD kg/ac-yr
Joes Creek Fresh	D0020	1,887	Joes Creek Fresh	B0430	66.1
Miles Creek	B0010	1,304	Miles Creek	C0040	66.0
Joes Creek Fresh	D0430	1,242	Joes Creek Fresh	B0410	66.0
Joes Creek Fresh	D0160	1,182	Joes Creek Fresh	B0030	65.9
Joes Creek Fresh	D0570	1,111	Miles Creek	B0450	65.9
Miles Creek	C0150	899	Joes Creek Fresh	B0460	65.9
Miles Creek	C0250	783	Pinellas Pk Ditch #5	B0470	65.8
Joes Creek Fresh	D0060	761	Miles Creek	B0330	65.3
Joes Creek Fresh	K0220	659	Joes Creek Fresh	B0290	65.0
Pinellas Pk Ditch #5	J0040	641	Joes Creek Fresh	J0050	64.3
Major Tributary	Basin	TN kg/ac-yr	Major Tributary	Basin	TP kg/ac-yr
Miles Creek	B0420	6.8	Miles Creek	B0430	1.7
Joes Creek Fresh	D0600	6.7	Miles Creek	C0040	1.7
Miles Creek	B0430	6.6	Miles Creek	B0410	1.6
Miles Creek	C0040	6.6	Miles Creek	B0030	1.6
Miles Creek	B0410	6.6	Miles Creek	B0450	1.6
Miles Creek	B0030	6.6	Miles Creek	B0460	1.6
Miles Creek	B0450	6.6	Miles Creek	B0470	1.6
Miles Creek	B0460	6.6	Joes Creek Fresh	D0600	1.6
Miles Creek	B0470	6.6	Miles Creek	B0290	1.6
Miles Creek	B0330	6.6	Miles Creek	B0330	1.6

Knowing the limitations of each of the criteria, the high loading areas identified by the Joe's Creek PLM (**Figure 2.3**) have been reviewed along with knowledge of municipally-owned lands in basins of similar development character, to optimize potential structural water quality BMP locations.

**Table 2-4** provides descriptions of the targeted areas presented to the project partners and identifies the reason for their selection.

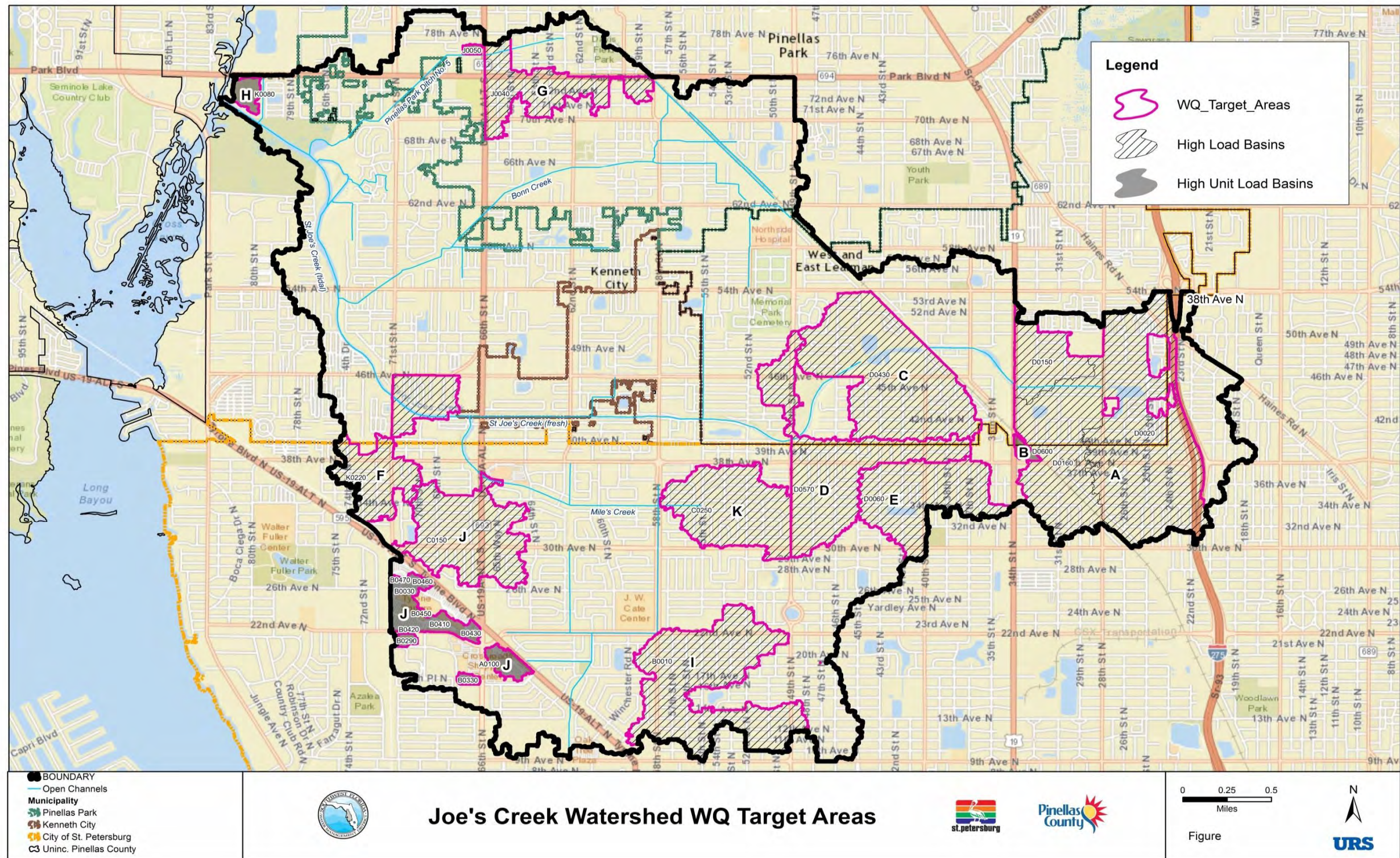


Figure 2.3 Joe's Creek Watershed Water Quality Target Areas

**Table 2-4 Joe's Creek Watershed Identified Water Quality Target Areas**

Area	Municipality	Area Description	Problem/Severity
A	<p>City of St. Petersburg (50%)</p> <p>Unincorporated Pinellas County (50%)</p>	<p>Basins D0150, D0160, D0020 located east of US Hwy 19 (34<sup>th</sup> Street N). Basins drain to upper Joe's Creek.</p> <p>Dominant land uses are high density residential, high intensity commercial and industrial. One large water feature (Silver Lake) is maintained by the County.</p> <p>Basin D0150 is ranked for TSS and BOD only</p>	<p>High total basin loads and very few existing stormwater BMPs.</p> <p>High runoff potential (limited green space) throughout most of the basin and concentrated traffic.</p> <p>The nearest Joe's Creek water quality station (35-11) measures poorer water quality from this contributing area than at the downstream station (35-10).</p>
B	<p>City of St. Petersburg</p>	<p>Basin D0600 abuts Area A and represents a single, privately owned industrial parcel with no stormwater treatment.</p> <p>Basin drains to upper Joe's Creek</p>	<p>Second highest unit TN load in the watershed but over a small area.</p>
C	<p>Unincorporated Pinellas County</p>	<p>Basin D0430 drains to upper Joe's Creek near water quality station 35-11. It is located west of the railroad centered on 46<sup>th</sup> Street N and 46<sup>th</sup> Ave N and includes Greenway Park and its large water feature.</p> <p>Dominant land use is high density residential with some industrial use north of the park.</p> <p>There is significant County-owned green space in this basin for a BMP.</p>	<p>High total basin loads from a large physical area, although approximately 30% of the basin is served by a wet detention pond at Greenway Park.</p>

**Table 2-4 Joe's Creek Watershed Identified Water Quality Target Areas**

Area	Municipality	Area Description	Problem/Severity
D	<p>City of St. Petersburg (80%)</p> <p>Unincorporated Pinellas County (20%)</p>	<p>Basin D0570 drains to Joe's Creek and is located along 38<sup>th</sup> Ave N, east of 49<sup>th</sup> Street N in St. Petersburg.</p> <p>Includes the 49<sup>th</sup> Street N corridor from 50<sup>th</sup> Ave N to 40<sup>th</sup> Ave N in Pinellas County. Comprises high density residential, high intensity commercial and highway uses.</p>	<p>High total basin loads. BMPs serve approximately 8% of the basin area.</p> <p>High runoff potential and high development density results in significant loading to Joe's Creek.</p>
E	City of St. Petersburg	<p>Basin D0060 drains to Joe's Creek and is located between 30<sup>th</sup> Ave and 38<sup>th</sup> Ave N and between 35<sup>th</sup> St and 45<sup>th</sup> St N.</p> <p>Area comprises high density residential use with one large flood detention pond south of 34<sup>th</sup> Ave N. The pond is owned and maintained by the City.</p>	<p>High total basin loads and unit loading values are associated with this basin.</p> <p>Land use has high runoff potential and limited green space, with the exception of the pond site.</p>
F	City of St. Petersburg	<p>Basin K0220 drains to the lower portion of Joe's Creek freshwater segment.</p> <p>It is located in between Tyrone Boulevard and 38<sup>th</sup> Ave N and comprises mostly high density residential land use with some institutional properties.</p>	<p>Ranked in the top 10 basins for total nutrient (TN, TP) loads. No existing BMPs are credited to this basin.</p> <p>Land uses have high runoff potential and limited green space. No municipal lands for structural BMPs in this basin.</p>
G	City of Pinellas Park	<p>Basins J0040 and J0050 drain to Pinellas Park Ditch No. 5. The basins are located along the Park Boulevard and US Hwy 19 Alt (66<sup>th</sup> Street N) corridors and are dominated by high intensity commercial and highway land uses with some high to medium density residential areas also present.</p>	<p>Basin J0040 exhibits a high total basin load for all parameters and the small J0050 basin, in the same vicinity, is a ranked basin for BOD load intensity.</p> <p>Land uses have high runoff potential and high wash-off concentrations. An existing flood detention area is present.</p>

**Table 2-4 Joe's Creek Watershed Identified Water Quality Target Areas**

Area	Municipality	Area Description	Problem/Severity
H	Unincorporated Pinellas County	<p>Basin K0080 is located at the mouth of the Joe's Creek tidal segment at the watershed's northwest extremity. It contains three privately owned industrial parcels south of Park Boulevard.</p> <p>An abandoned mobile home/RV park is located just east of the basin and a County-owned pond with open space is also located to the southeast.</p>	<p>High unit loading is exhibited by this basin and discharges flow to the already nutrient rich tidal segment of Joe's Creek.</p> <p>The basin area is relatively small, such that trade-off treatment area would make good sense.</p>
I	City of St. Petersburg	<p>Basin B0010 is located south of 22<sup>nd</sup> Ave N at the southern extent of the watershed. It mostly comprises high density residential development and drains to Miles Creek through tributary ditch and pipe systems.</p> <p>Stormwater is collected in inlets and pipes without treatment. No water features or open municipal lands are located in the basin.</p>	<p>High total basin loads. No existing BMPs serve the area.</p> <p>High runoff potential and high development density results in significant loading to Miles Creek.</p>
J	City of St. Petersburg	<p>Basin C0150 and Tyrone Square Mall and Cross Roads Shopping Center basins located along Tyrone Boulevard between 22<sup>nd</sup> Ave and 35<sup>th</sup> Ave N drain to Miles Creek through a series of pipes or tributary ditches. Basin C0150 is characterized by high density residential neighborhoods and a high intensity commercial corridor along 66<sup>th</sup> Street N.</p>	<p>High total basin loads are generated in C0150 and high unit loads are generated by the Tyrone Boulevard shopping areas.</p> <p>Very few existing BMPs serve the areas and high runoff potential results in elevated loads.</p> <p>Limited green space exists.</p>

**Table 2-4 Joe's Creek Watershed Identified Water Quality Target Areas**

Area	Municipality	Area Description	Problem/Severity
K	City of St. Petersburg	<p>Basin C0250 drains to Miles Creek and is located south of 38<sup>th</sup> Ave N, between 49<sup>th</sup> and 58<sup>th</sup> Street N.</p> <p>Basin C0250 is characterized by high density residential neighborhoods with a small portion occupied by high intensity commercial along 49<sup>th</sup> Street N.</p> <p>Stormwater is collected in neighborhood inlets and conveyed, untreated, by pipes to ditches tributary to Miles Creek.</p>	<p>High total basin loads are generated in C0250.</p> <p>No existing BMPs serve the residential areas and high runoff potential results in elevated loads.</p> <p>Limited green space exists.</p>

### 3.0 ALTERNATIVE BMP FORMULATION

The types of BMPs considered in this analysis included Flood Control (FC) and Water Quality (WQ) BMPs. The following list, while not exhaustive, shows the variety of available BMPs considered in this analysis.

- Detention ponds (Structural FC)
- Add conveyance structures (Structural FC)
- Re-route flow from overtaxed systems (Structural FC)
- Raise structures/roadways (Structural FC)
- Purchase flood affected areas (Non-Structural FC)
- Improve capacity of channels (Structural FC)
- Dry retention areas\* (Structural WQ)
- Pretreatment retention\* or terraced detention with biofiltration (Structural WQ)
- Green streets right-of-way infiltration trench\* (Structural WQ)
- Street sweeping program frequency or extent modifications (Non-Structural WQ)
- Ordinance controls (Non-Structural WQ)
- Rainwater harvesting and low-impact development (LID)/redevelopment incentives (Non-Structural WQ)

\* with or without biosorption activated media (BAM) enhancements

#### 3.1 Flood Control BMP Development Process

Following completion of the existing conditions model analysis and LOS evaluation, and a review of past flood complaints within the watershed, potential flood problem areas were identified as described in Section 2.0. Representatives from the staff of Pinellas County, the City of St. Petersburg, and the SWFWMD SWIM program worked together to review and comment on a preliminary list of conceptual BMP locations and types that could reduce the duration and depth of flooding throughout the Joe's Creek watershed. Problem areas and potential BMP approaches are summarized in **Table 3-1**. It is recommended that, for problem areas associated with undocumented structural flooding, actual floor elevation be verified before proceeding with design of engineered alternatives. Locations of the flood control BMPs selected for hydraulic modeling and a more detailed evaluation are presented in **Figure 3.1**.

**Table 3-1 Joe's Creek Watershed Flood Problem Areas and BMP Options**

Area ID	Area Description	BMP Options	
1	Outfall from Devonshire Pond north of St. Petersburg High School discharges under Tyrone Blvd in to channel system that ultimately drains to Miles Creek.	(FC-1) Re-route outfall from pond northwest along Tyrone Blvd St N; Re-route pipe under Tyrone Blvd at 17 <sup>th</sup> Ave N northwest along Tyrone Blvd; Re-route pipe under Tyrone Blvd at 19 <sup>th</sup> Ave N northwest along Tyrone Blvd discharging into large CBC that is parallel to 66 <sup>th</sup> St N	(FC-1 and FC-2) Re-route outfall from pond northwest along Tyrone Blvd St N; Re-route pipe under Tyrone Blvd at 17 <sup>th</sup> Ave N northwest along Tyrone Blvd; Re-route pipe under Tyrone Blvd at 19 <sup>th</sup> Ave N northwest along Tyrone Blvd discharging into large CBC that is parallel to 66 <sup>th</sup> St N; Re-Route 38 <sup>th</sup> Ave N west through 5'x10' CBC ultimately discharging into Channel 7 on the west side of 66 <sup>th</sup> St N.
	38 <sup>th</sup> Ave N from 64 <sup>th</sup> St N to 58 <sup>th</sup> St N drains south through small pipes and ditch system to Miles Creek.	(FC-2) Re-route 38 <sup>th</sup> Ave N west through 5'x10' CBC ultimately discharging into Channel 7 on the west side of 66 <sup>th</sup> St N.	
	22 <sup>nd</sup> Ave N south of Tyrone Square Mall has undersized drainage system that flows southeast to 66 <sup>th</sup> St N and through a 5' x 7' CBC under Tyrone Blvd. Under 30 <sup>th</sup> Ave N a 66" pipe drains to Miles Creek	(FC-1A) Replace existing 30" pipe with a 54" RCP; Replace existing 48" and 54" pipe with a 60" RCP, Replace existing 60"x84" CBC with a 72"x120" CBC, Replace 66" pipe with 72"x120" CBC in addition to FC-1.	
2	Flow from south of 54 <sup>th</sup> Ave N flows north and discharges into ditch system (Channel 4-D) draining west into Channel 4.	(FC-5) Re-route 54 <sup>th</sup> Ave N from 55 <sup>th</sup> St N west to 66 <sup>th</sup> St N then running north parallel to 66 <sup>th</sup> St N discharging into Channel 4-D.	(FC-5 and FC-6) Re-route 54 <sup>th</sup> Ave N from 55 <sup>th</sup> St N west to 66 <sup>th</sup> St N then running north parallel to 66 <sup>th</sup> St N discharging into Channel 4-D; remove culvert at 64 <sup>th</sup> St N and improve/excavate ditch system from 62 <sup>nd</sup> St N to 66 <sup>th</sup> St N and from 66 <sup>th</sup> St N to Channel 4
	Culvert at 64 <sup>th</sup> St N and Channel 4-D controls flow and causes flooding upstream in Lealman area.	(FC-6) Remove culvert at 64 <sup>th</sup> St N and improve/excavate ditch system from 62 <sup>nd</sup> St N to 66 <sup>th</sup> St N and from 66 <sup>th</sup> St N to Channel 4	
	Flooding from Channel 4 overtops bank and floods neighborhood north of 62 <sup>nd</sup> Ave N; culvert at 62 <sup>nd</sup> Ave N is undersized and backs up flooding in Channel 4	(FC-7) Excavate 1.8 ac pond to receive areas north and south of 62 <sup>nd</sup> Ave N through proposed inlets and pipes; Berm southeast side of Channel 4; Add additional 8'x10' CBC under 62 <sup>nd</sup> Ave N	



**Table 3-1 Joe's Creek Watershed Flood Problem Areas and BMP Options**

Area ID	Area Description	BMP Options	
3	Undersized culverts at 34 <sup>th</sup> St N prevents flow and causes upstream flooding between I-75 and 34 <sup>th</sup> St N	(FC-3) Add additional 84"x120"CBC (FC-3A) Add 2-84"x120"CBC	(FC-3 and FC-4) Add additional 84"x120"CBC; Add additional 108"x120"CBC
	Undersized culverts at 49 <sup>th</sup> St N prevents flow and causes upstream flooding	(FC-4) Add additional 108"x120"CBC	(FC-3A and FC-4) Add 2-84"x120"CBC; Add additional 108"x120"CBC

### 3.2 Water Quality BMP Development

The best candidates for structural water quality BMPs are those with existing detention facilities that have upland green space or buffer area. Pretreatment swales or terraced filtration basins were considered for these areas to reduce nutrients prior to entry into the existing water feature.

The built-out nature of the watershed presents challenges to traditional stormwater quality treatment techniques. Several basins are entirely built-out and have little or no land area available for stormwater treatment ponds (dry or wet). In these areas the best small-scale structural alternative(s) may be to:

- Redesign neighborhood roadside greenspaces (swales or bio-retention cells) to increase pollutant absorption and infiltration prior to reaching the basin collection point, and use soil amendments or infiltration trenches to reduce nutrient loads.
- Consider future redesign of streets to include “green streets” concepts, such as the use of unpaved boulevard space for bio-retention cells or creation of raingardens/tree gardens between outer edge of pavement and sidewalks.
- Encourage installation of pervious pavement surfaces and stormwater harvesting (the collection and reuse of stormwater) at a parcel level through cistern or rain barrel installation, and offer incentives to private parcels for implementing these practices. Note: Municipal building demonstration projects could provide an example.

Several water quality BMPs were also conceptualized. The final short list of problem areas and associated water quality BMPs (structural and non-structural) is presented as **Table 3-2**. **Figure 3.1** includes the location of proposed structural water quality BMPs selected for computation of pollutant load reduction, using the Joe's Creek PLM basin loading rates and estimated removal efficiencies, modified as appropriate where BAM enhancements are proposed.

### 3.3 Alternative BMP Concepts

Eight (8) structural flood control BMPs and six (6) structural water quality BMPs, as well as two (2) non-structural water quality alternatives, were selected for detailed analysis from the problem areas and conceptual BMPs described in **Tables 3-1** and **3-2**. The list includes additional culvert construction, conveyance improvements, pretreatment facilities and low impact development (LID) water quality improvements. Section 4.0 details the analysis for each selected area. **Appendix A** contains pollutant reduction calculations and concept sketches for various structural and non-structural stormwater flood control and water quality BMPs. Flood control concepts and modeling results are also presented in Section 4.0.

**Table 3-2 Water Quality BMP Options**

Area ID	Area Description	BMP Options		
A	Industrialized eastern lobe of watershed located east of US Hwy 19 (34 <sup>th</sup> Street N). Basins drain through Silver Lake to upper Joe's Creek.	(WQ-1) Intercept and pre-treat inflows to Silver Lake	Industrial Site SWPPP and facility inspections	Low Impact re-Development Incentives
B & H	(B) Private industrial site located at the corner of 38 <sup>th</sup> Ave N and 38 <sup>th</sup> Street N (H) Private industrial sites located south of Park Boulevard at the mouth of Joe's Creek (tidal)	Industrial Site SWPPP and facility inspections	Provide trade-off treatment for similar areas where municipal land is available	Low Impact re-Development Incentives
C	Older high density residential areas between 54 <sup>th</sup> Ave and 40 <sup>th</sup> Ave N and between 49 <sup>th</sup> Street N and the railroad.	(WQ-2) Intercept and pre-treat inflows to the Greenway Park stormwater facility	Use residential ROW to create shallow interception raingardens	Residential incentive programs for private stormwater harvesting and reuse
D	Older residential and commercial corridors located along 38 <sup>th</sup> Ave N, east of 49 <sup>th</sup> Street N in St. Petersburg.  Includes the 49 <sup>th</sup> Street N corridor from 50 <sup>th</sup> Ave N to 40 <sup>th</sup> Ave N in Pinellas County.	Provide trade-off treatment for similar areas where municipal land is available	Use residential ROW to create shallow interception raingardens	Residential incentive programs for private stormwater harvesting and reuse
E	Older residential areas located between 30 <sup>th</sup> Ave and 38 <sup>th</sup> Ave N and between 35 <sup>th</sup> and 45 <sup>th</sup> Streets N.  One large flood detention pond south of 34 <sup>th</sup> Ave N, owned by the City of St. Petersburg, serves the area.	(WQ-3) Intercept and pre-treat inflows to the existing pond.	Use residential ROW to create shallow interception raingardens	Residential incentive programs for private stormwater harvesting and reuse
F	High density residential areas with some institutional properties located between Tyrone Boulevard and 38 <sup>th</sup> Ave N in St. Petersburg and high density residential areas in unincorporated Pinellas County east of 71 <sup>st</sup> Street N between 40 <sup>th</sup> Ave and 46 <sup>th</sup> Ave N	(WQ-5) Provide trade-off treatment for similar areas where municipal land is available	Use residential ROW to create shallow interception raingardens	Residential incentive programs for private stormwater harvesting and reuse

**Table 3-2 Water Quality BMP Options**

Area ID	Area Description	BMP Options		
G	Park Boulevard from US Hwy 19 Alt (66 <sup>th</sup> Street N) to the railroad and the 66 <sup>th</sup> Street N corridor between 68 <sup>th</sup> Ave and 78 <sup>th</sup> Ave N - primarily commercial with some residential areas included.	(WQ-6) Provide trade-off treatment for similar areas where municipal land is available	Residential incentive programs for private stormwater harvesting and reuse	Residential stormwater collection system currently uses drop inlets in ROW greenspace.
I	Older high density residential areas located south of 22 <sup>nd</sup> Ave N and between 59 <sup>th</sup> and 49 <sup>th</sup> Streets N, at the southern extent of the watershed.	Provide trade-off treatment for similar areas where municipal land is available	Use residential ROW to create shallow interception raingardens	Residential incentive programs for private stormwater harvesting and reuse
J	Tyrone Square Mall and Cross Roads Shopping Center areas located along Tyrone Boulevard between 22 <sup>nd</sup> Ave and 35 <sup>th</sup> Ave N and older high density residential neighborhoods plus commercial corridor along 66 <sup>th</sup> Street N between 64 <sup>th</sup> and 70 <sup>th</sup> Streets N.	(WQ-4) Retrofit green median area along 30 <sup>th</sup> Ave N for “green streets”-style biofiltration	Low Impact Re-Development Incentives for commercial properties	Use residential ROW to create shallow interception raingardens and offer private stormwater harvesting incentives
K	Older high density residential neighborhoods with a corridor of commercial properties along 49 <sup>th</sup> Street N. Located south of 38 <sup>th</sup> Ave N, between 49 <sup>th</sup> and 58 <sup>th</sup> Streets N.	Low Impact Re-Development Incentives for commercial properties	Provide trade-off treatment for similar areas where municipal land is available	Use residential ROW to create shallow interception raingardens and offer private stormwater harvesting incentives

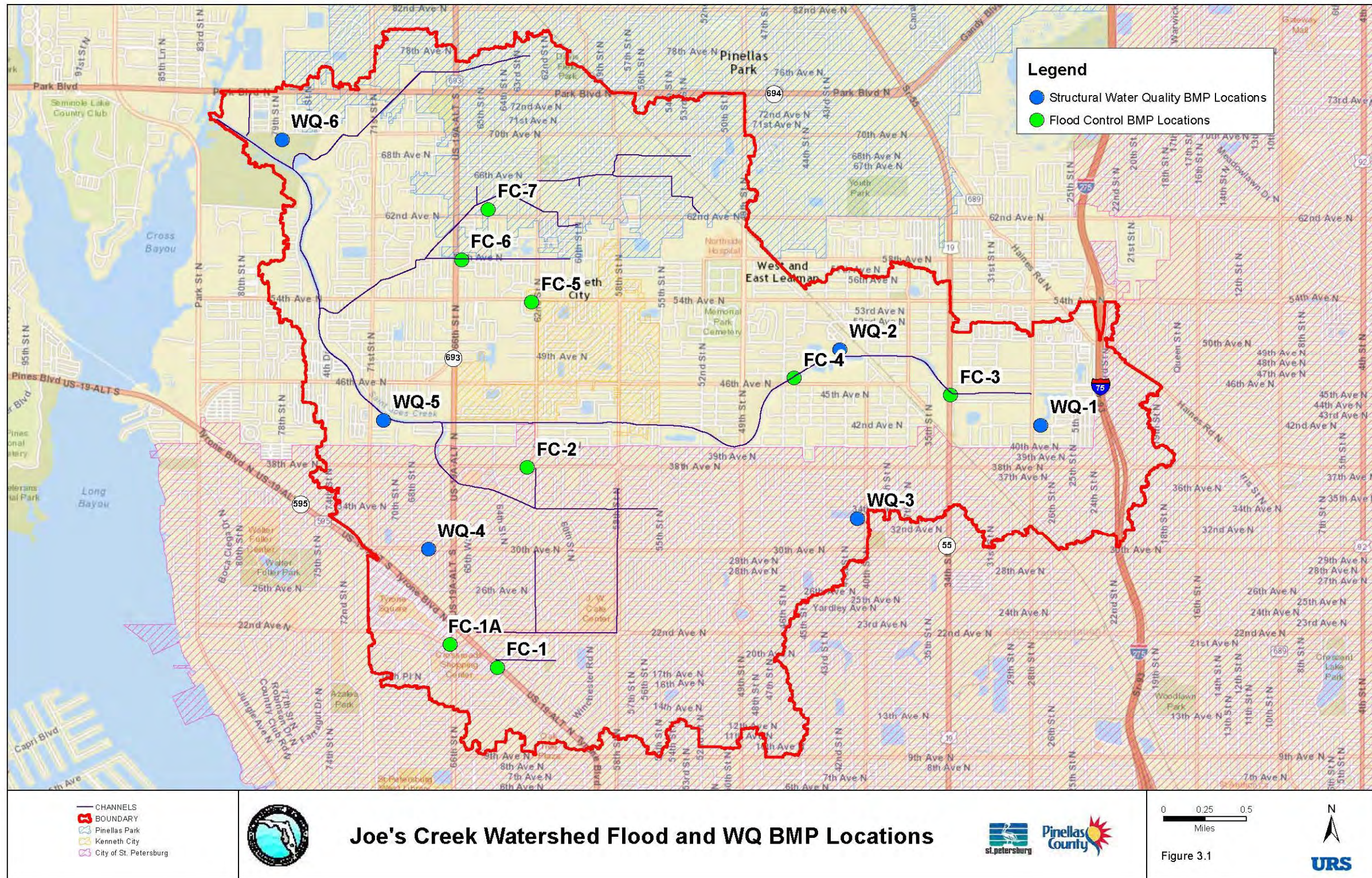


Figure 3.1 Flood and Water Quality BMP Locations

#### 4.0 ANALYSIS OF ALTERNATIVES

The preferred BMPs were evaluated based on cost, environmental benefits/impacts, permitting issues, flood protection benefits and pollutant load reduction (as applicable). Environmental impacts were assessed qualitatively as low, medium, or high depending on the extent of the proposed activity's damage to natural systems (wetlands, lakes, streams, natural transition zones), and whether the damage would be permanent or temporary. Excluding minor impacts during construction, significant impacts would be deemed unacceptable without appropriate mitigation.

Permitting difficulty is designated as low, medium or high based upon the level of effort needed to support project compliance with standard conditions of issuance. A BMP that is difficult to permit is given a lower priority for implementation. The difficulty in obtaining easements or land purchase was also considered in assigning priority for implementation.

The off-site impact of implementing these BMPs was also one of the evaluation criteria. If implementing the BMP would cause off-site impacts, the priority for development was lowered. Off-site impacts have been generally defined as (1) increases in the water surface profile of hydraulically-connected systems that create a new violation of the defined LOS for roads, sites, buildings, water storage areas or conveyances, or (2) increases of existing exceedances of the desired LOS. A rise in peak water surface elevation within open water conveyances of greater than 0.1 foot for the 100-year design event is considered an "impact" unless it occurs at the immediate downstream end of upgraded culverts in municipal systems. These are evaluated on a case-by-case basis to assure that the rise does not create out-of-bank flooding or increased site flooding for connected systems.

URS developed a detailed existing conditions ICPR hydrologic and hydraulic model that estimates flood elevations throughout the watershed for various design storm events. Eight (8) flood control BMP alternatives (FC1, FC-1A and FC-2 through 7) were simulated by modifying the existing conditions model to include replacement structures, re-routing of flows and additional storage. In some cases, combinations of independent BMP alternatives were also tested. For each BMP alternative, model parameters for structural elements were modified based on the proposed alternative and the model was rerun for the following three storm events:

- 10-year, 24-hour
- 25-year, 24-hour
- 100-year, 24-hour

The peak flood elevations for existing and proposed conditions for each of the modeled alternatives were compared to determine relative benefits and potential off-site impacts. Each BMP was initially tested independently from other proposed BMPs in order to assess the importance of BMP sequencing or interdependence in its effectiveness. The final proposed condition model for the Joe's Creek Watershed incorporates all of the recommended BMPs. **Appendix A** includes concept sketches for each modeled alternative described in this section.

Flood inundation comparisons are presented in **Appendix B** for the existing condition and final proposed condition model.

Water quality BMP analysis also included the type and extent of the service area that could be accommodated, as well as the potential reduction in nutrient and TSS loads to natural systems (kg per year) that could be achieved (see **Appendix A** for computations).

Future implementation of BMPs and associated permitting will require more detailed assessment of local conditions and survey of local site and hydraulic structures representative of conditions at the time of final design. Preliminary construction quantities estimates were determined for each alternative following the model evaluation. Cost opinions were then developed using Florida Department of Transportation cost tables (2015-2016) and pay items. Cost analysis sheets are provided in **Appendix C**.

Following discussion of each alternative analyzed, **Table 4-2** summarizes the various alternative service areas, components and costs, and identifies those not being recommended. **Table 4-3** provides a summary of costs and benefits for the alternatives which are recommended for implementation.

## **4.1 Flood Control Alternative Evaluations**

### **4.1.1 BMP FC-1 – Devonshire Pond Outfall/Tyrone Blvd Re-Route**

#### **Existing Conditions:**

- 48' x 72" CBC outfall from pond crossing Tyrone Blvd (RA0010A)
- 30" RCP crossing Tyrone Blvd at 18<sup>th</sup> Ave N (RA0110)
- 36" x 72" CBC crossing Tyrone Blvd at 19<sup>th</sup> Ave N (RA0100)
- 120"x 132" CBC runs parallel to 66<sup>th</sup> St N and outfalls to Miles Creek (RB260A)

#### **Proposed Conditions:**

- Replacement - 72" x 108" CBC outfall from pond diverted northwest under Tyrone Blvd. (RA0010A)
- Replacement - 72" x 108" CBC diverting basin A0110 northwest under Tyrone Blvd (RA0110)
- Replacement - 72" x 108" CBC diverting basin A0100 northwest under Tyrone Blvd (RA0100)
- New - 120" x 60" CBC to run parallel to 66<sup>th</sup> St N and outfall at Miles Creek (RB0260B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Moderately low effort required.

**Land Acquisition Requirements:** No land acquisition required

**Cost Estimates:** \$12,747,000

**Model Results:** This alternative reduces peak flood stages for the 10 year event by several feet for upstream nodes. Approximately 21 structures are removed from the 100-year inundation polygon and one basin LOS is improved from designation "F" to designation "A." (See Appendix B, Figures B-1, B-2 and B-3)



**Table 4-1-1 BMP FC-1**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
A0010	17.82	18.09	18.44	F	12.93	15.05	18.18	F	LOS remains F but flooding for the 10 yr and 25 yr stays in pond. Approximately 15 structures removed from 100 yr
A0100	17.73	17.94	18.27	F	12.82	14.90	18.09	F	Flooding reduced for the 10 yr and 25 yr. Still flooding on Tyrone Blvd. for the 10 year.
A0110	17.64	17.94	18.48	F	12.86	14.95	18.08	A	3 structures removed from 100 yr; no street flooding at the 25 yr.
B0260	13.13	14.88	17.26	F	12.64	14.62	17.29	F	Still flooding on evacuation route 66 <sup>th</sup> St N for the 100 yr; no change in LOS
B0380	17.59	17.96	18.55	F	17.60	17.80	18.23	F	3 structures removed from 100 yr; no LOS change due to street flooding at the 10 yr
B0510	15.78	17.20	18.63	C	15.80	16.96	18.43	C	Evacuation route still floods at 100 yr; no change in LOS

**Recommendations:** This alternative reduces the stages, overall, west of Tyrone Blvd. and removes structures from the 100 year inundation polygon. Although the cost is significant, flood stages are reduced without adverse downstream impacts. This alternative's environmental concerns are low because no wetlands or natural systems will be negatively impacted. Therefore this alternative is recommended.

#### 4.1.2 BMP FC-2 – 38<sup>th</sup> Ave N Re-Route

##### Existing Conditions:

- 38<sup>th</sup> Ave N east of 64<sup>th</sup> St N drains south to Miles Creek (C0070 and C0230)

##### Proposed Conditions:

- Re-route 38<sup>th</sup> Ave N west with 60" x 96" CBC (RC0061) and 60" x 96" CBC (RC0062) and discharge west of 66<sup>th</sup> St. N to Miles Creek

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Low.

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$7,155,000

**Model Results:** This alternative lowered stages appreciably for the 10 year event, but did not result in any significant LOS changes due to 100 year inundation of surrounding structures. (See Appendix B, Figures B-4, B-5 and B-6)

**Table 4-1-2 BMP FC-2**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
C0061	N/A	N/A	N/A	N/A	13.68	15.88	16.98	F	Evacuation route still floods at the 100 yr event
C0062	N/A	N/A	N/A	N/A	12.96	15.81	16.92	F	Evacuation route still floods at the 100 yr event
C0070	14.68	15.75	17.00	F	14.05	15.52	16.91	F	Stage decreases no change in LOS
C0080	14.24	15.68	16.99	F	13.57	15.44	16.90	F	Stage decreases no change in LOS
C0090	14.93	15.86	17.02	F	14.44	15.66	16.94	F	Stage decreases no change in LOS
C0100	15.95	16.48	17.07	F	15.68	16.42	16.99	F	Stage decreases no change in LOS
C0180	12.36	14.35	16.71	F	12.08	14.10	16.63	F	Stage decreases no change in LOS
C0190	13.52	15.36	16.93	F	12.99	15.10	16.84	F	Stage decreases no change in LOS
C0200	13.05	15.19	16.90	F	12.61	14.94	16.81	F	Stage decreases no change in LOS
C0220	15.85	16.27	17.07	F	15.83	16.02	16.98	F	Stage decreases no change in LOS
C0230	13.83	15.52	16.96	F	13.21	15.29	16.88	F	Stage decreases no change in LOS

**Recommendations:** This alternative reduces the stages overall, but the cost is significant. Although this alternative produces good flood stage reductions for the 10 year event, there is no LOS improvement benefit so the alternative is not recommended.

### 4.1.3 BMP FC-1 and FC-2 – Devonshire Pond Outfall/Tyrone Blvd Re-Route and 38<sup>th</sup> Ave N Re-Route

#### Existing Conditions:

- 48' x 72" CBC outfall from pond crossing Tyrone Blvd (RA0010A)
- 30" RCP crossing Tyrone Blvd at 18<sup>th</sup> Ave N (RA0110)
- 36" x 72" CBC crossing Tyrone Blvd at 19<sup>th</sup> Ave N (RA0100)
- 38<sup>th</sup> Ave N east of 64<sup>th</sup> St N drains south to channel (C0070 and C0230)
- 120"x 132" CBC runs parallel to 66<sup>th</sup> St N and outfalls to Miles Creek (RB260A)

#### Proposed Conditions:

- Replacement - 72" X 108" CBC outfall from pond diverted northwest under Tyrone Blvd. (RA0010A)
- Replacement - 72" X 108" CBC diverting basin A0110 northwest under Tyrone Blvd (RA0110)
- Replacement - 72" X 108" CBC diverting basin A0100 northwest under Tyrone Blvd (RA0100)
- Replacement - Re-route 38<sup>th</sup> Ave N west with 60" RCP (RC0061) and 66" RCP (RC0062)
- New 120" x 60" CBC to run parallel to 66<sup>th</sup> St N and outfall at Miles Creek (RB0260B)

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** High difficulty due to adverse off-site impacts.

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$19,902,000

**Model Results:** This alternative reduces peak flood stages substantially for the 10 year and 25 year events for upstream nodes but creates unacceptable rises in the profile at B0260 (66<sup>th</sup> St N north of Tyrone Blvd) and at the mobile home park south of 46<sup>th</sup> Ave N and east of 71<sup>st</sup> St N. Approximately 254 structures are removed from the 100-year inundation polygon, one basin LOS is improved from designation "F" to designation "A" and two basins LOS are improved from designation "F" to designation "B". (See Appendix B, Figures B-7, B-8 and B-9)

**Table 4-1-3 BMP FC-1 And BMP FC-2**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
A0010	17.82	18.09	18.44	F	13.75	16.21	18.23	F	Approximately 11 structures removed from 100 year, LOS remains F but flooding for the 10 yr and 25 yr stays in pond.
A0100	17.73	17.94	18.27	F	13.64	16.10	18.05	F	Flooding reduced for the 10 yr and 25 yr. Still flooding on Tyrone Blvd. for the 10 yr.
A0110	17.64	17.94	18.48	F	13.68	16.13	18.14	A	3 structures removed from 100 yr; no street flooding at the 25 yr.
B0260	13.13	14.88	17.26	F	13.55	16.01	18.04	F	Flooding increases on evacuation route 66 <sup>th</sup> St N for the 100 yr
C0060	11.03	12.81	15.24	F	11.56	13.49	15.66	F	Stage increases and remains in channel for 25 yr, but for the 100 yr causes evacuation route to increase flooded area.
C0061	N/A	N/A	N/A	N/A	14.09	16.19	16.76	N/A	
C0062	N/A	N/A	N/A	N/A	13.40	15.44	16.74	N/A	
C0070	14.68	15.75	17.00	F	14.33	15.46	16.28	F	65 structures removed from 100 yr and no road flooding at the 10 yr
C0090	14.93	15.86	17.02	F	14.65	15.61	16.39	A	2 structures removed from 100 year, channel contains 25 yr and no road flooding at the 10 yr
C0100	15.95	16.48	17.07	F	15.81	16.42	16.74	F	2 structures removed from 100 year, still road flooding at the 10 yr
C0160	11.89	13.88	16.27	F	12.24	14.14	15.94	B	28 structures removed from 100 yr, channel fails at the 100 yr
C0180	12.36	14.35	16.71	F	12.55	14.33	16.01	B	2 structures removed from 100 yr, channel fails at the 100 yr
C0200	13.05	15.19	16.90	F	13.03	14.83	16.08	F	48 structures removed from 100 yr, channel fails the 25 yr, no road flooding at the 10 yr
C0220	15.85	16.27	17.07	F	15.85	16.17	16.75	F	3 structures removed from 100 yr, road still floods at 10 yr
C0230	13.83	15.52	16.96	F	13.60	15.19	16.18	F	100 structures removed from 100 yr, channel still overtops at the 25 yr
C0240	15.93	15.95	17.00	F	15.93	15.95	16.28	B	1 structure removed from 100 yr, yard flooding at the 25 yr
K0200	12.92	13.03	13.21	F	12.92	13.03	13.60	F	100 yr slightly increases; no change in LOS
K0220	9.66	10.93	13.20	F	9.94	11.29	13.60	F	100 yr increases, possibly adding 10 mobile homes to floodplain

**Table 4-1-3 BMP FC-1 And BMP FC-2**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
K0230	9.83	11.11	13.39	F	10.12	11.48	13.80	F	100 yr increases, possibly adding 1 structure to 100 yr
K0240	10.54	10.93	13.20	F	10.54	11.30	13.61	F	100 yr increases; no change in LOS

**Recommendations:** This alternative reduces the upstream flood stages and removes many structures from the simulated 100 year floodplain; however, it causes an increase in flooding on an evacuation road and potentially adds flood risks to eleven structures. Therefore, this alternative is not recommended.

#### 4.1.4 BMP FC-1A – Tyrone Square Mall Culvert Upgrades

##### Existing Conditions:

- 48' x 72" CBC outfall from pond crossing Tyrone Blvd (RA0010A)
- 30" RCP crossing Tyrone Blvd at 18<sup>th</sup> Ave N (RA0110)
- 36" x 72" CBC crossing Tyrone Blvd at 19<sup>th</sup> Ave N (RA0100)
- 30" RCP crossing 22<sup>nd</sup> Ave N (RB0390)
- 48" RCP along 22<sup>nd</sup> Ave N (RB0420)
- 60" x 84" CBC at 66<sup>th</sup> St N crossing Tyrone Blvd (RB0510)
- 66" pipe crossing 30<sup>th</sup> Ave N north to Miles Creek (RB0170A)

##### Proposed Conditions:

- Replacement - 72" X 108" CBC outfall from pond diverted northwest under Tyrone Blvd. (RA0010A)
- Replacement - 72" X 108" CBC diverting basin A0110 northwest under Tyrone Blvd (RA0110)
- Replacement - 72" X 108" CBC diverting basin A0100 northwest under Tyrone Blvd (RA0100)
- Replacement - 54" RCP crossing 22<sup>nd</sup> Ave N (RB0390)
- Replacement - 60" RCP along 22<sup>nd</sup> Ave N (RB0420)
- Replacement - 72" x 120" CBC at 66<sup>th</sup> St N crossing Tyrone Blvd. (RB0510)
- Replacement - 72" x 120" CBC crossing 30<sup>th</sup> Ave N north to Miles Creek (RB0170A)
- New 120" x 60" CBC to run parallel to 66<sup>th</sup> St N and outfall at Miles Creek (RB0260B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Moderately Low.

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$18,732,000

**Model Results:** This alternative reduces peak flood stages by 2 to 4 inches for upstream nodes. Approximately 12 structures are removed from the 100-year inundation polygon and six basins experience significant improvements in LOS designations. Three basin LOS designations are improved by one level. (See Appendix B, Figures B-10, B-11 and B-12)



**Table 4-1-4 BMP FC-1A**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
A0010	17.82	18.09	18.44	F	12.95	15.14	15.77	F	3 structures removed from 100 year, no road flooding at the 10 year
A0100	17.73	17.94	18.27	F	12.82	14.86	18.04	F	Parking lot flooding removed for the 10 yr, but still road flooding on Tyrone Blvd. for all events
A0110	17.64	17.94	18.48	F	12.88	14.91	18.04	A	3 structures removed from 100 year, no road flooding at the 10 year
B0260	13.13	14.88	17.26	F	12.65	14.56	17.30	F	66 <sup>th</sup> St N (evacuation road). Flooding decreases for the 10 and 25 yr
B0330	18.23	18.35	18.64	F	17.90	18.09	18.44	A	25 year contained within pond.
B0380	17.59	17.96	18.55	F	17.30	17.54	18.03	E	3 structure removed from 100 yr, still road flooding at the 10 yr
B0390	18.98	19.27	19.53	E	17.89	18.58	19.37	A	No road flooding at the 10 yr
B0400	17.57	17.95	18.56	F	16.63	17.51	18.02	A	3 structures removed from 100 yr, no road flooding at the 10 yr
B0410	19.07	19.28	19.53	E	18.63	18.96	19.38	C	Stage decreases but still some parking lot flooding at the 10 yr
B0420	18.97	19.26	19.52	E	17.32	18.41	19.37	A	10 year road flooding removed
B0430	16.53	17.64	18.75	B	14.69	15382	18.18	A	Parking lot flooding removed
B0490	17.09	17.88	18.76	B	16.69	17.35	18.44	A	Parking lot flooding removed
B0510	15.78	17.20	18.63	C	12.83	14.75	17.75	C	Evacuation route flooding removed to passable depth
B0520	17.58	17.88	18.76	C	17.58	17.63	18.44	C	Stage decreases no change in LOS

**Recommendations:** This alternative includes part of the St. Petersburg Stormwater Master Plan Basin H improvements. It effectively reduces flood stages, improves basin LOS and is recommended.

### 4.1.5 BMP FC-3 – Channel 1 Culvert Upgrade at 34<sup>th</sup> St N

**Existing Conditions:**

- 2 – 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)

**Proposed Conditions:**

- 3 - 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** High degree of difficulty due to adverse off-site impacts.

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$351,000

**Model Results:** Approximately 81 structures are removed from the 100-year inundation polygon; however, stage increases in the basin D0430 pond, possibly putting two structures in the 100 year floodplain. In addition, one basin LOS is improved from designation “F” to designation “A” and one basin LOS goes from designation “A” to designation “B”. (See Appendix B, Figures B-13, B-14 and B-15)

**Table 4-1-5 BMP FC-3**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0020	42.09	42.62	43.51	F	41.59	42.19	43.06	F	Approximately 59 structures removed from 100 yr
D0150	41.35	41.86	42.71	F	40.33	40.88	41.57	F	Approximately 5 structures removed from 100 yr
D0160	41.70	42.19	43.01	F	41.09	41.63	42.36	F	Approximately 2 structures removed from 100 yr
D0190	30.61	31.55	33.73	A	30.96	32.11	34.62	B	Channel may breach at the 100 yr; further evaluation needed for TOB.
D0200	34.34	35.32	37.39	A	34.73	35.93	38.48	A	Stage increase for proposed no change in LOS
D0220	42.09	42.62	43.51	F	41.59	42.19	43.06	A	Pond does not fail at the 25 yr, change in LOS
D0250	43.03	43.10	43.51	F	43.03	43.10	43.18	F	All structures (15) removed, however pond fails at the 25 yr
D0260	29.03	30.13	32.86	B	29.40	30.79	33.80	B	Proposed stage increases; no change in LOS
D0300	28.42	29.56	32.49	F	28.79	30.26	33.45	F	Proposed stage increases no change in LOS; However possible structure affected for the 100 yr

**Table 4-1-5 BMP FC-3**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0310	25.10	27.05	28.90	A	25.56	27.45	29.24	A	Proposed stage increases and appears to stay within channel banks
D0430	34.18	35.14	37.21	F	34.56	35.74	38.26	F	Proposed stage increases no change in LOS; However 2 structures affected for the 100 yr
D0570	26.49	29.02	32.16	B	27.15	29.76	33.07	B	Proposed stage increases causing parking-lot flooding at the 100 yr; no change in LOS
D0610	35.71	36.27	38.11	A	36.34	37.01	39.29	A	Proposed stage increases; no additional impacts from flooding, no change in LOS

**Recommendations:** This alternative removes a significant number of structures from the simulated 100 year floodplain but causes increased downstream flooding from the basin D0430 pond and may add two structures to the floodplain, depending on their finished floor levels. Unacceptable downstream impacts prevent this alternative from being recommended.

#### 4.1.6 BMP FC-4 – Channel 1 Culvert Upgrade at 49<sup>th</sup> St N

**Existing Conditions:**

- 2 – 108” x 120” at 49<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

**Proposed Conditions:**

- 3 – 108” x 120” CBC at 49<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Low.

**Land Acquisition Requirements:** No land acquisition is required.

**Cost Estimates:** \$458,000.00

**Model Results:** One structure is removed from the 100-year inundation polygon. One basin LOS is improved from designation “F” to designation “A” and the LOS is improved from designation “B” to designation “A” in two basins. (See Appendix B, Figures B-16, B-17 and B-18)

**Table 4-1-6 BMP FC-4**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0190	30.61	31.55	33.73	A	30.58	31.46	32.95	A	Stage increases for the 10 and 25 yr but is contained within the channel
D0200	34.34	35.32	37.39	A	34.31	35.28	37.11	A	Stage increases for all events but is contained within the channel
D0260	29.03	30.13	32.86	B	29.00	29.93	31.53	A	Stage decreases for the 100 yr and is contained within the channel
D0300	28.42	29.56	32.49	F	28.38	29.32	30.93	A	1 structure removed from 100 yr and contained within channel
D0430	34.18	35.14	37.21	F	34.15	35.10	36.91	F	Stage decreases for the 100 yr but does not change LOS
D0570	26.49	29.02	32.16	B	25.55	27.80	30.34	A	100 yr is contained within channel

**Recommendations:** This alternative removes a structure from the simulated 100 year floodplain and improves local basin LOS at a relatively low cost. No land acquisition is required and permitting difficulty is anticipated to be low. This alternative's environmental concerns are low

because no wetlands or natural systems will be negatively impacted. It effectively reduces flood stages, improves basin LOS and is recommended.

#### 4.1.7 BMP FC-3 and FC-4 – Channel 1 Culvert Upgrades at 34<sup>th</sup> St N and 49<sup>th</sup> St N

##### Existing Conditions:

- 2 – 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)
- 2 – 108” x 120” at 46<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

##### Proposed Conditions:

- 3 - 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)
- 3 – 108” x 120” CBC at 46<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** High difficulty due to adverse off-site impacts.

**Land Acquisition Requirements:** None, permitting difficulty is low

**Cost Estimates:** \$793,000

**Model Results:** Approximately 82 structures are removed from the 100-year inundation polygon; however, stage increases in the basin D0430 pond, potentially adding two structures to the simulated 100-year floodplain. One basin LOS is improved from designation “F” to designation “A”, one basin LOS is improved from designation “F” to designation “B”, and two basins LOS are improved from designation “B” to designation “A”. (See Appendix B, Figures B-19, B-20 and B-21)

**Table 4-1-7 BMP FC-3 and FC-4**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0020	42.09	42.62	43.51	F	41.59	42.19	43.07	F	Approximately 59 structures removed from 100 yr
D0150	41.35	41.86	42.71	F	40.33	40.88	41.59	F	Approximately 5 structures removed from 100 yr
D0160	41.70	42.19	43.01	F	41.09	41.63	42.37	F	Approximately 2 structures removed from 100 yr
D0200	34.34	35.32	37.39	A	34.69	35.87	38.10	A	Stage increase for proposed; no change in LOS
D0220	42.09	42.62	43.51	F	41.59	42.19	43.07	A	Pond does not fail at the 25 yr
D0250	43.03	43.10	43.51	F	43.03	43.10	43.18	F	All structures removed (15), however pond fails at the 25 yr
D0260	29.03	30.13	32.86	B	29.36	30.48	32.26	A	Proposed 100 yr contained within channel
D0300	28.42	29.56	32.49	F	28.75	29.87	31.65	B	1 Structure removed from 100 yr, channel fails at the 100 yr

**Table 4-1-7 BMP FC-3 and FC-4**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0310	25.10	27.05	28.90	A	24.56	25.86	28.80	A	Proposed stage decreases no change in LOS
D0430	34.18	35.14	37.21	F	34.52	35.67	37.85	F	Proposed stage increases no change in LOS. 2 structures affected for the 100 yr
D0550	24.81	26.80	28.61	F	24.15	25.46	28.42	F	Proposed stage decreases no change in LOS
D0570	26.49	29.02	32.16	B	25.11	26.76	30.33	A	Channel contains 100 yr.
D0610	35.71	36.27	38.11	A	36.35	37.04	39.03	A	Proposed stage increases no additional impacts from flooding, no change in LOS

**Recommendations:** This alternative removes a significant number of structures from the 100 year floodplain but creates unacceptable downstream impacts by placing two structures in basin D0430 within the 100-year inundation polygon that were not previously at risk. It is, therefore, not recommended.

#### 4.1.8 BMP FC-3A – Channel 1 Culvert Upgrade at 34<sup>th</sup> St N (Option 2)

**Existing Conditions:**

- 2 – 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)

**Proposed Conditions:**

- 4 - 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** High difficulty due to adverse off-site impacts.

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$741,000

**Model Results:** Approximately 146 structures are removed from the 100-year inundation polygon; however, stage increases in the basin D0430 pond, potentially adding two structures to the simulated 100-year floodplain. One basin LOS is improved from designation “F” to designation “A”, one basin LOS is improved from designation “F” to designation “B”, one basin LOS is improved from designation “F” to designation “C”, and two basins LOS are improved from designation “B” to designation “A”. (See Appendix B, Figures B-22, B-23 and B-24)

**Table 4-1-8 BMP FC-3A**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0020	42.09	42.62	43.51	F	41.20	41.89	42.77	F	Approximately 110 structures removed from 100 yr
D0150	41.35	41.86	42.71	F	39.55	40.07	40.64	C	All structures removed (15) from 100 yr; channel possibly still breaches at the 25 yr.
D0160	41.70	42.19	43.01	F	40.62	41.25	41.96	F	Approximately 5 structures removed from 100 yr; however, channel flooding significantly lower for the 10 and 25 yr
D0190	30.61	31.55	33.73	A	31.08	32.15	33.98	A	Stage increase for proposed; no change in LOS
D0200	34.34	35.32	37.39	A	34.86	36.11	38.47	A	Stage increase for proposed; no change in LOS
D0220	42.09	42.62	43.51	F	41.20	41.89	42.77	A	Pond does not fail at 25 yr,
D0250	43.03	43.10	43.51	F	43.03	43.10	43.18	F	All structures removed (15), however, pond fails at the 25 yr
D0260	29.03	30.13	32.86	B	29.53	30.67	32.65	A	Proposed 100 yr contained within channel



**Table 4-1-8 BMP FC-3A**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0300	28.42	29.56	32.49	F	28.92	30.06	32.08	B	1 structure removed from 100 yr, channel fails at the 100 yr
D0310	25.10	27.05	28.90	A	25.73	27.63	29.57	A	Proposed stage increases and appears to stay within channel banks; no change in LOS
D0430	34.18	35.14	37.21	F	34.69	35.90	38.23	F	Proposed stage increases no change in LOS. 2 structures adversely affected for the 100 yr
D0550	24.81	26.80	28.61	F	25.45	27.37	29.29	F	Proposed stage increases; no change in LOS
D0570	26.49	29.02	32.16	B	26.47	28.73	31.52	A	Channel contains 100 yr.
D0610	35.71	36.27	38.11	A	36.63	37.36	39.38	A	Proposed stage increases no additional impacts from flooding; no change in LOS

**Recommendations:** This alternative removes a significant number of structures from the 100 year floodplain but creates unacceptable downstream impacts to two structures within basin D0430 by placing them at flood risk for the 100-year event. It is, therefore, not recommended.

#### 4.1.9 BMP FC-3A and FC-4 – Channel 1 Culvert Upgrades at 34<sup>th</sup> St N and 49<sup>th</sup> St N (Option 2)

##### Existing Conditions:

- 2 – 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)
- 2 – 108” x 120” at 49<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

##### Proposed Conditions:

- 4 - 84” x 120” CBC under 34<sup>th</sup> St N along Channel 1 (RD0150A and RD0150B)
- 3 – 108” x 120” CBC at 49<sup>th</sup> St N and Channel 1 (RD0570A and RD0570B)

**Natural Systems Improvement:** Low

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** High difficulty due to adverse off-site impacts.

**Land Acquisition Requirements:** No land acquisition required.

**Model Results:** Approximately 146 structures are removed from the 100-year inundation polygon; however, stage increases in basin D0430 potentially adding two structures to the simulated 100-year floodplain. One basin LOS is improved from designation “F” to designation “A”, one basin LOS is improved from designation “F” to designation “B”, one basin LOS is improved from designation “F” to designation “C”, and two basins LOS are improved from designation “B” to designation “A”. (See Appendix B, Figures B-25, B-26 and B-27)

**Table 4-1-9 BMP FC-3A and FC-4**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0020	42.09	42.62	43.51	F	41.59	42.19	43.07	F	Approximately 110 structures removed from 100 yr
D0150	41.35	41.86	42.71	F	40.33	40.88	41.59	C	All 15 structures removed from 100 yr; but channel possibly still breaches at the 25 yr.
D0160	41.70	42.19	43.01	F	41.09	41.63	42.37	F	Approximately 5 structures removed from 100 yr, however, channel flooding significantly lower for the 10 and 25 yr
D0220	42.09	42.62	43.51	F	41.59	42.19	43.07	A	Pond does not fail at the 25 yr
D0250	43.03	43.10	43.51	F	43.03	43.10	43.18	F	All structures removed (15), however, pond fails at the 25 yr
D0260	29.03	30.13	32.86	B	29.36	30.48	32.26	A	Proposed 100 yr contained within channel
D0300	28.42	29.56	32.49	F	28.75	29.87	31.65	B	1 structure removed from 100 yr, channel fails at the 100 yr

**Table 4-1-9 BMP FC-3A and FC-4**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
D0430	34.18	35.14	37.21	F	34.52	35.67	37.85	F	Proposed stage increases no change in LOS. 2 structures affected for the 100 yr
D0550	24.81	26.80	28.61	F	24.15	25.46	28.42	F	Proposed stage increases, no change in LOS
D0570	26.49	29.02	32.16	B	25.11	26.76	30.33	A	Channel contains 100 yr.
D0610	35.71	36.27	38.11	A	36.35	37.04	39.03	A	Proposed stage increases; no additional impacts from flooding, no change in LOS

**Recommendations:** This alternative removes a significant number of structures from the 100 year floodplain but causes unacceptable rises in downstream flood stages, threatening structures for the 100-year event. Because of the downstream impacts, this alternative is not recommended.

**4.1.10 BMP FC-5 – 54<sup>th</sup> Ave N Drainage Improvement (from 66<sup>th</sup> St N to 62<sup>nd</sup> St N)**

**Existing Conditions:**

- Portion of 54<sup>th</sup> Ave N drains north to Lealman area causing additional flooding

**Proposed Conditions:**

- Re-route 54<sup>th</sup> Ave N west then north parallel to 66<sup>th</sup> St N discharging into Channel 4-D. (RH0133, RH0132 AND RH0131)

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Moderately Low.

**Land Acquisition Requirements:** No land acquisition is required.

**Cost Estimates:** \$2,556,000

**Model Results:** Approximately 14 structures are removed from the 100-year inundation polygon. (See Appendix B, Figures B-28, B-29 and B-30)

**Table 4-1-10 BMP FC-5**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
G0030	14.84	15.15	15.53	F	14.52	14.90	15.39	F	Floodplain lower no change in LOS
H0010	14.32	15.06	15.52	F	14.04	14.77	15.39	F	Floodplain lower no change in LOS
H0020	14.73	15.14	15.50	F	13.71	14.39	15.36	F	Floodplain lower no change in LOS, no road flooding at the 10 yr, pond fails at the 25 yr
H0040	14.84	15.14	15.52	F	14.51	14.88	15.38	F	Floodplain lower no change in LOS
H0050	14.73	15.13	15.49	F	14.08	14.35	15.35	F	Floodplain lower no change in LOS
H0060	14.83	15.14	15.51	F	14.34	14.85	15.38	F	Floodplain lower no change in LOS
H0065	14.87	15.16	15.54	F	14.51	14.91	15.40	F	Floodplain lower no change in LOS
H0070	14.87	15.16	15.53	F	14.51	14.91	15.40	F	Floodplain lower no change in LOS
H0080	14.85	15.16	15.50	F	14.64	14.67	15.35	F	1 structure removed from 100 yr and pond contains 25 yr
H0090	14.86	15.16	15.50	F	14.26	14.42	15.35	F	Floodplain lower no change in LOS

**Table 4-1-10 BMP FC-5**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
H0130	10.72	11.68	14.68	F	11.39	12.64	14.46	F	8 structures removed from 100 yr, evacuation road now passable
H0131	N/A	N/A	N/A	N/A	13.66	15.89	16.12	A	
H0132	N/A	N/A	N/A	N/A	14.36	16.28	19.11	A	
H0133	N/A	N/A	N/A	N/A	16.41	16.68	19.55	A	
H0200	14.84	15.15	15.52	F	14.54	14.90	15.38	F	Floodplain lower no change in LOS
H0210	14.84	15.15	15.53	F	14.52	14.90	15.40	F	5 structures removed from 100 year
H0220	14.84	15.14	15.52	F	14.47	14.88	15.38	F	Floodplain lower no change in LOS

**Recommendations:** This alternative reduces stages and removes structures from the 100 year floodplain, although basin LOS is unaffected. This alternative's environmental concerns are low because no wetlands or natural systems will be negatively impacted. The cost for this alternative is significant. Permitting difficulty is anticipated to be low, therefore it is recommended.

**4.1.11 BMP FC-6 – Channel 4-D Modifications (from 66<sup>th</sup> St N to 62<sup>nd</sup> St N and from Channel 4 to 66<sup>th</sup> St N)**

**Existing Conditions:**

- Channel draining west from Lealman with pipe crossing at Jasmine St

**Proposed Conditions:**

- Remove pipe crossing at 64<sup>th</sup> St N and improve/excavate ditch system from 62<sup>nd</sup> St N to 66<sup>th</sup> St N and from Channel 4 to 66<sup>th</sup> St N. (RH0050)

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Medium (due to erosion control and potential dewatering aspects).

**Land Acquisition Requirements:** No land acquisition is required.

**Cost Estimates:** \$144,000

**Model Results:** Approximately 33 structures are removed from the 100-year inundation polygon. (See Appendix B, Figures B-31, B-32 and B-33)

**Table 4-1-11 BMP FC-6**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
G0030	14.84	15.15	15.53	F	14.48	14.88	15.27	F	Floodplain lower no change in LOS
G0190	14.32	15.06	15.52	F	14.04	14.75	15.28	F	Floodplain lower no change in LOS
H0010	14.84	15.15	15.53	F	14.48	14.87	15.27	F	Floodplain lower no change in LOS
H0020	14.73	15.14	15.50	F	13.12	13.74	15.09	F	No road flooding at the 10 year and pond contains the 25 year
H0040	14.84	15.14	15.52	F	14.46	14.84	15.24	F	Floodplain lower no change in LOS
H0050	14.73	15.13	15.49	F	13.01	13.55	15.08	F	3 structures removed from 100 year, channel contains the 25 year and no road flooding at the 10 year.
H0060	14.83	15.14	15.51	F	14.03	14.77	15.22	F	No road flooding at the 10 year
H0065	14.87	15.16	15.54	F	14.47	14.90	15.29	F	1 structure removed from 100 year, no street flooding at the 10 year
H0070	14.87	15.16	15.53	F	14.47	14.90	15.29	F	No street flooding at the 10 year

**Table 4-1-11 BMP FC-6**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
H0080	14.85	15.16	15.50	F	14.75	14.85	15.15	F	Floodplain lower no change in LOS
H0090	14.86	15.16	15.50	F	14.76	14.85	15.15	F	9 structures removed from 100 year
H0130	10.72	11.68	14.68	F	11.71	13.06	14.83	F	Channel slightly fails at the 25 year
H0140	15.01	15.14	15.50	F	14.99	15.02	15.13	F	5 structures removed from 100 year
H0190	14.85	15.14	15.51	F	14.81	14.88	15.19	F	1 structure removed from 100 year
H0200	14.84	15.15	15.52	F	14.50	14.88	15.23	F	3 structures removed from 100 year
H0210	14.84	15.15	15.53	F	14.47	14.87	15.27	F	11 structures removed from 100 year, no road flooding at the 10 year
H0220	14.84	15.14	15.52	F	14.30	14.84	15.24	F	Floodplain lower no change in LOS

**Recommendations:** This alternative effectively reduces the peak stages and removes flooding in the Lealman area. The permitting difficulty is anticipated to be moderate. This alternative's environmental concerns are low because no wetlands or natural systems will be negatively impacted. This alternative is recommended.

**4.1.12 BMP FC-5 and FC-6 – 54<sup>th</sup> Ave N Drainage Improvement (from 66<sup>th</sup> St N to 62<sup>nd</sup> St N) and Channel 4-D Modifications (from 66<sup>th</sup> St N to 62<sup>nd</sup> St N and from Channel 4 to 66<sup>th</sup> St N)**

**Existing Conditions:**

- Portion of 54<sup>th</sup> Ave N drains north to Lealman area; Channel draining west from Lealman with pipe crossing at 64<sup>th</sup> St N

**Proposed Conditions:**

- Re-route 54<sup>th</sup> Ave N west then north parallel to 66<sup>th</sup> St N discharging into Channel 4-D. (RH0133, RH0132 AND RH0131)
- Remove pipe crossing at 64<sup>th</sup> St N and improve/excavate ditch system from 62<sup>nd</sup> St N to 66<sup>th</sup> St N and from Channel 4 to 66<sup>th</sup> St N. (RH0050)

**Natural Systems Improvement:** Low.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Medium (due to erosion control and potential dewatering aspects).

**Land Acquisition Requirements:** No land acquisition required.

**Cost Estimates:** \$2,700,000

**Model Results:** Approximately 72 structures are removed from the 100-year inundation polygon and one basin LOS is improved from designation “F” to designation “A”. (See Appendix B, Figures B-34, B-35 and B-36)

**Table 4-1-12 BMP FC-5 and FC-6**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
G0030	14.32	15.06	15.52	F	14.24	14.70	15.21	F	Floodplain lower no change in LOS
G0190	14.84	15.15	15.53	F	14.03	14.66	15.23	F	2 structures removed from 100 yr
H0010	14.73	15.14	15.50	F	14.24	14.70	15.21	F	Floodplain lower no change in LOS
H0020	14.53	14.70	15.52	F	13.09	13.47	14.91	F	3 structures removed from 100 yr, no road flooding at the 10 yr and pond contains the 25 yr
H0030	14.84	15.14	15.52	F	14.53	14.71	15.23	A	2 structures removed from 100 yr, pond contains 25 yr
H0040	14.73	15.13	15.49	F	14.16	14.67	15.18	F	Pond contains 10 yr in banks



**Table 4-1-12 BMP FC-5 and FC-6**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
H0050	14.83	15.14	15.51	F	11.66	12.98	14.88	F	27 structures removed from 100 yr, no road flooding at the 10 yr and pond contains the 25 yr
H0060	14.87	15.16	15.54	F	13.75	14.46	15.15	F	No road flooding at the 10 yr
H0065	14.87	15.16	15.53	F	14.13	14.67	15.22	F	2 structures removed from 100 yr, no road flooding at the 10 yr
H0070	14.85	15.16	15.50	F	14.13	14.67	15.22	F	No road flooding at the 10 yr
H0080	14.86	15.16	15.50	F	14.64	14.67	14.91	F	Pond contains 25 yr in banks
H0090	10.72	11.68	14.68	F	14.23	14.38	14.91	F	12 structures removed from 100 yr
H0130	14.32	15.06	15.52	F	11.49	12.88	14.76	F	Channel slightly fails at 25 yr
H0131	N/A	N/A	N/A	N/A	13.68	15.97	16.13	A	
H0132	N/A	N/A	N/A	N/A	14.32	16.32	19.09	A	
H0133	N/A	N/A	N/A	N/A	16.41	16.68	19.53	A	
H0140	15.01	15.14	15.50	F	14.97	15.01	15.08	F	4 structures removed from 100 yr
H0190	14.85	15.14	15.51	F	14.81	14.85	15.12	F	1 structure removed from 100 yr
H0200	14.84	15.15	15.52	F	14.32	14.71	15.17	F	4 structures removed from 100 yr
H0210	14.84	15.15	15.53	F	14.19	14.70	15.21	F	13 structures removed from 100 yr, no road flooding at the 10 yr
H0220	14.84	15.14	15.52	F	14.04	14.65	15.18	F	2 structures removed from 100 yr

**Recommendations:** This alternative effectively reduces the peak stages and removes flooding in the Lealman area. It is expensive than alternative FC-6, alone, and improves LOS in one basin. The permitting is difficulty is anticipated to be moderate. The project is recommended for consideration.

#### 4.1.13 BMP FC-7 – 62<sup>nd</sup> Ave N Drainage Improvement and Channel 4 Modification

##### Existing Conditions:

- Channel 4 overtops north of 62<sup>nd</sup> Ave and east of 66<sup>th</sup> St flooding into basin I0300. Currently 2 - 96" x 120" CBCs discharges into Channel 4 under 62<sup>nd</sup> Ave.

##### Proposed Conditions:

- Construct 1.81 acre pond with a control structure and grade basin I0300 through ditch system into pond (RG0231A) – concept sketch in Appendix A.
- Re-route part of basin I0310 north under 62<sup>nd</sup> Ave in to pond (RI0311A)
- Berm south side of Channel 4 starting at 62<sup>nd</sup> Ave N and proceeding 870 ft. north east
- Add an additional 8' x 10' CBC under 62<sup>nd</sup> Ave (RI0300A and RI0300B)

**Natural Systems Improvement:** Medium due to reduced pollutant load to Bonn Creek.

**Environmental Concerns:** Low. No wetlands are impacted.

**Permitting Effort:** Moderately low.

**Land Acquisition Requirements:** Pond site is privately owned and would need to be acquired. The site does not appear to be actively in use.

**Cost Estimates:** \$869,000

**Model Results:** Stage is lowered for the 10 year event in Channel 4. No structures removed from the 100 year floodplain. (See Appendix B, Figures B-37, B-38 and B-39)

**Table 4-1-13 BMP FC-7**

Basin	Existing Conditions				Proposed Conditions				Comment
	10 Year	25 Year	100 Year	LOS	10 Year	25 Year	100 Year	LOS	
G0231	N/A	13.87	14.95	F	11.79	12.99	14.81	F	
G0232	N/A	13.87	14.95	F	11.80	12.96	14.71	F	
G0233	N/A	13.87	14.95	F	12.34	12.98	14.59	F	
I0310	N/A	13.66	14.79	F	12.35	13.04	14.71	F	
I0311	N/A	13.87	14.95	F	11.80	13.00	14.71	F	

**Recommendations:** This alternative reduces peak stages and flooding for the 25 year event along Channel 4. An Environmental Resource Permit would be required but would not involve challenging issues. The land acquisition aspect creates a higher project cost. This alternative is recommended for consideration.

## 4.2 Water Quality Improvement Alternative Evaluations

### 4.2.1 BMP WQ-1 – Silver Lake Pretreatment

Based on the Joe's Creek PLM loading results and the ambient water quality downstream of this stormwater detention facility, benefits may be realized from providing diversion of inflows to a pretreatment detention swale with, or without, enhanced exfiltration provided by biosorption activated media (BAM) for increased nutrient removal efficiency. The Stormwater Academy of the University of Central Florida has done substantial research on various materials and combinations of materials (limestone gravel, mulch, tire chips, clay, etc) that provide a better sorption surface than standard sand filters or in-situ soils.

There is sufficient perimeter greenspace around the south end of the pond to design and install a BMP to accept diverted inflow from nearby pipe systems. This BMP would capture and infiltrate a portion of the contributing watershed runoff prior to release/spillover into the existing pond.

**Proposed BMP:** Excavate approximately 1,600 linear feet of retention swale to a depth of 3.0 feet. The side slopes of the swale have been conceptualized at 3H:1V and the average swale bottom width varies from 6 to 14 feet. The interior (pond-ward) berm is anticipated to spillover one-foot below the outer top of bank (TOB) elevation. Additionally, the conceptual design would divert the southern inflow systems to the pretreatment area (possibly equipping those systems with smart weir structures to bypass high flows).

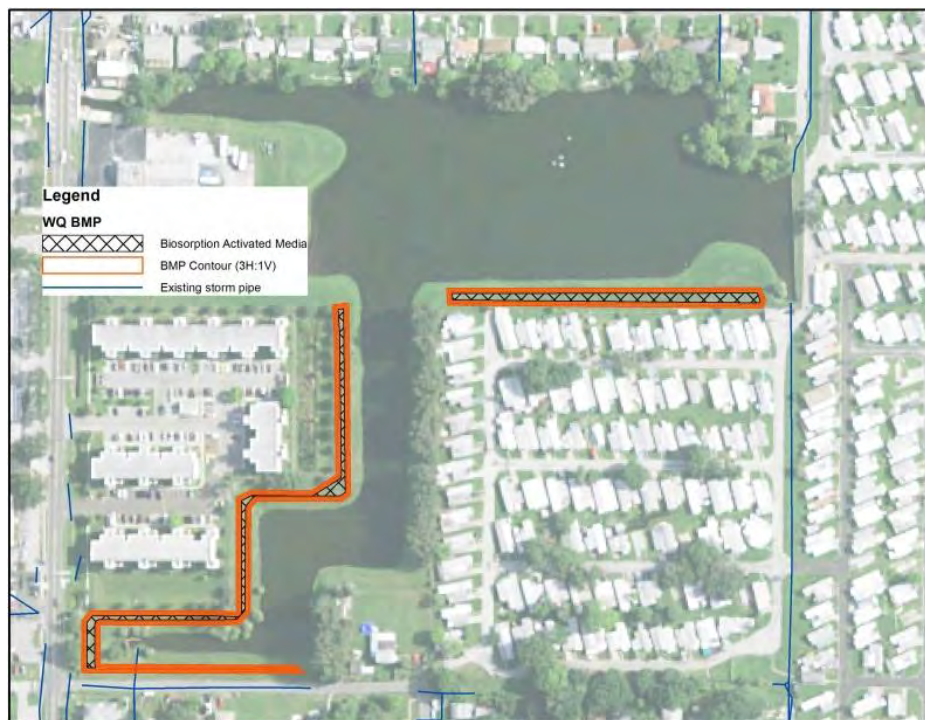


Figure 4.2.1 BMP WQ-1

Option A: Provide a 12-inch thick layer of BAM over a one foot depth of gravel trench, with seed or sod placed over the BAM. The system would then collect water in a perforated pipe and discharge into Silver Lake at several locations along the swale. Conceptually, the spacing of exfiltration trench discharge pipes is estimated to be 150-160 feet.

Option B: Utilize in-situ soils to infiltrate the treatment retention volume while allowing excess inflow to spill over into Silver Lake.

Typical concept sketches for this alternative are provided in **Appendix A**.

**Natural Systems Improvement:** Medium. Pollutant load reduction benefit for upper Joe's Creek but with a limited service area.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Moderately low (once engineering designs are finalized).

**Land Acquisition Requirements:** Land is owned by Pinellas County

**Cost Estimates:** The estimated construction cost of alternative WQ-1A is approximately \$390,000. The less expensive WQ-1B option is estimated to be approximately \$135,000.

**Pollutant Reduction Model Results:** Assuming a two-foot depth of storage before spillover to Silver Lake, the swale should capture and treat the equivalent of 0.5 inch over at least 29.2 acres of contributing watershed.

Option A BAM removal efficiencies for Bold & Gold CTS™ are cited at 60% TN, 90% TP and 90% TSS. Option B traditional on-line retention removal efficiencies are anticipated to be 58% TN, 63% TP and 87% TSS.

Using the Joe's Creek PLM calculated unit loads for the surrounding basin (D0020), the following average annual pollutant reduction is expected:

- TN reduction of 80.4 kg/year (option A) and 77.7 kg/year (option B)
- TP reduction 23.8 kg/year (option A) and 16.6 kg/year (option B)
- TSS reduction of 3,524 kg/year (option A) and 3,407 kg/year (option B)

**Recommendations:** This alternative effectively reduces incoming pollutants from a high loading area. Significant modifications to the existing inflow systems will be required to implement this alternative and overall BMP hydraulic performance will need to be assessed using site specific structure data, survey and geotechnical information. An Environmental Resource Permit would be required.

#### 4.2.2 BMP WQ-2 – Joe's Creek Greenway Park Detention Pond Pretreatment Area

Based on the Joe's Creek PLM load results and the ambient water quality downstream of this stormwater detention and treatment facility, benefits may be realized from providing diversion of inflows to a small dry retention area. The existing wet detention facility was designed with littoral plantings in shallower areas and features conducive to wildlife use that could restore some natural system functions of the altered (channelized) Joe's Creek system. The proposed pretreatment area is intended to further reduce incoming nutrient and sediment loads.

There is a large area of County-owned land north of the wet detention pond, upon which to site a BMP to accept diverted inflow from nearby pipe systems. The BMP would then capture and infiltrate a portion of the contributing watershed runoff prior to release/spillover into the existing pond.

**Proposed BMP:** Excavate a 4.4-acre dry retention area to a depth of 4.0 feet, with embankment side slopes conceptualized as 3H:1V. The southern (waterward) berm is anticipated to have armored spillover saddles at an elevation one-foot below the northern TOB elevation. Water from the northern inflow systems would then be diverted to the pretreatment area.



Figure 4.2.2 BMP WQ-2

**Natural Systems Improvement:** High pollutant load reduction benefit to upper Joe's Creek serving a large contributing area.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Moderately low (modification of an existing permit).

**Land Acquisition Requirements:** Land is owned by Pinellas County

**Cost Estimates:** The estimated construction cost of alternative WQ-2 is approximately \$699,000.

**Pollutant Reduction Model Results:** Assuming a three-foot depth of storage before spillover to Greenway Park pond and PLM BMP removal efficiencies of 58% TN, 63% TP and 87% TSS, the pretreatment area should capture and treat the equivalent of 0.5 inch over at least 285.7 acres of contributing watershed.

Using the Joe's Creek PLM calculated unit loads for the surrounding basin, D0430, the following average annual pollutant reduction is expected:

- TN reduction of 607.5 kg/year
- TP reduction of 113.8 kg/year
- TSS reduction of 25,411 kg/year

**Recommendations:** This alternative effectively reduces incoming pollutants from a high loading area. The modifications to the existing inflow systems and overall BMP hydraulic performance will need to be designed using site specific structure data, survey and geotechnical information. A modification to an existing Environmental Resource Permit (ERP 002259) would be required.

### 4.2.3 BMP WQ-3 – St. Petersburg 33<sup>rd</sup> – 34<sup>th</sup> Ave Pond Pretreatment

Based on the Joe's Creek PLM load results, the high total basin and unit (per acre) loading for this high density residential area may be reduced by providing diversion of inflows to a pretreatment detention swale, with or without enhanced exfiltration provided by BAM for increased nutrient removal efficiency.

There is sufficient perimeter greenspace around the eastern half the of City of St. Petersburg flood detention pond to design and install a BMP to accept diverted inflow from nearby pipe systems. The BMP would then capture and infiltrate a portion of the contributing watershed runoff prior to release/spillover into the existing pond. The City of St. Petersburg also owns a parcel adjacent on the east side to the existing pond, which is managed by the Parks Department.

**Proposed BMP:** Excavate approximately 1,280 linear feet of retention swale (with an expanded storage lobe to the east) to a depth of 3.0 feet with swale side slopes conceptualized to be 3H:1V. The interior (pond-ward) berm is anticipated to spillover one-foot below the outer TOB elevation. Existing inflow systems would then be diverted to the pretreatment area (possibly equipping them with smart weir structures to bypass high flows).

Option A: Construct a BAM-covered exfiltration zone with a bottom width ranging from 8 to 12 feet. Provide a 12-inch layer of BAM over a one foot depth of gravel. The remaining retention area bottom and the BAM would be seeded/sodded to maintain grass cover. Water would then be collected in a perforated pipe within the gravel trench and discharged to the wet detention pond at several locations along the swale. The spacing of exfiltration trench discharge pipes is estimated to be 150-160 feet.

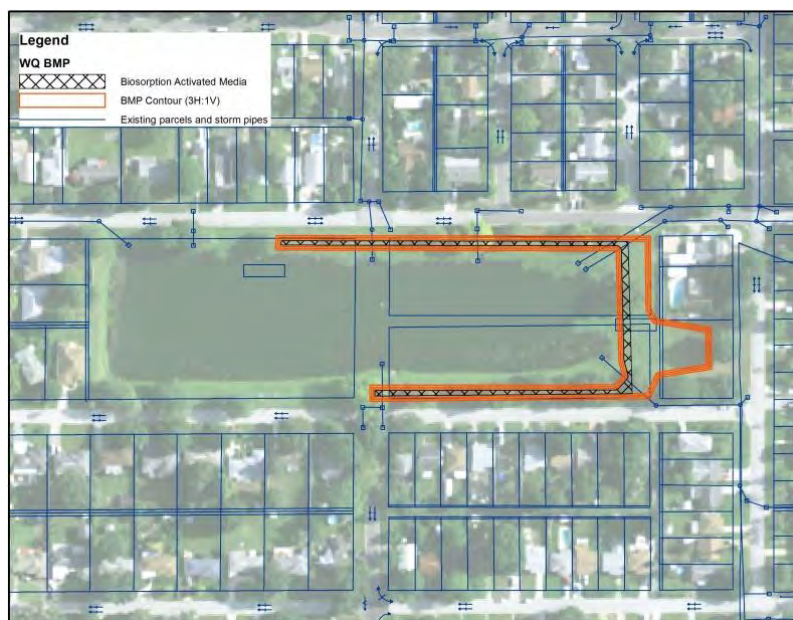


Figure 4.2.3 BMP WQ-3

Option B: Utilize in-situ soils to infiltrate the treatment retention volume allowing excess inflow to spill over into the pond.

Typical concept sketches for this alternative are provided in **Appendix A**.

**Natural Systems Improvement:** Medium. Reduced pollutant load to Joe's Creek, but over a limited service area.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Moderately low (once engineering designs for inflows are finalized).

**Land Acquisition Requirements:** Land is owned by the City of St. Petersburg; however the project may not be consistent with Parks Department goals and objectives.

**Cost Estimates:** The estimated construction cost of alternative WQ-3 option A is approximately \$372,000. The estimated construction cost of alternative WQ-3 using option B is approximately \$183,000.

**Pollutant Reduction Model Results:** Assuming a two-foot depth of storage before spillover to the existing pond, the swale should capture and treat the equivalent of 0.5 inch over at least 38 acres of contributing watershed. Option A BAM removal efficiencies for Bold & Gold CTS™ are cited as 60% TN, 90% TP and 90% TSS. Option B traditional on-line retention removal efficiencies are anticipated to be 58% TN, 63% TP and 87% TSS.

Using the Joe's Creek PLM calculated unit loads for the surrounding basin (D0060), the following average annual pollutant reduction is expected:

- TN reduction of 94.5 kg/year (option A) and 91.4 kg/year (option B)
- TP reduction of 28.0 kg/year (option A) and 19.6 kg/year (option B)
- TSS reduction of 3,736 kg/year (option A) and 3,611 kg/year (option B)

**Recommendations:** Although this alternative effectively reduces incoming pollutants from a high loading, untreated contributing area, the modifications to the existing inflow systems and overall BMP hydraulic performance will need significant redesigned using site specific structure data, survey and geotechnical information. Significant engineering constraints may make this alternative infeasible. An Environmental Resource Permit would be required.



#### 4.2.4 BMP WQ-4 – St. Petersburg 30<sup>th</sup> Ave N Median Filtration Area

Based on the Joe's Creek PLM load results, the high total basin and unit (per acre) loading for this high density residential area may be reduced by providing diversion of inflows to a biofiltration area or traditional effluent filtration area constructed in the planted median of 30<sup>th</sup> Ave N, with or without BAM soil enhancement for increased nutrient removal efficiency.

The BMP would require retrofit of the existing storm pipe collection system to connect to the filtration area, most likely using a “bubble up” design. Alternatively, the treatment area might be limited to street flow through curb cut-outs, which would provide a much lower pollutant reduction potential. Once the capacity of the filtration median is filled, stormwater would bypass to the existing pipe conveyances.

**Proposed BMP:** Excavate approximately 855 linear feet of retention swale to a depth of 1.0 foot, with swale side slopes conceptualized to be 3H:1V. Divert the existing inflow systems to the pretreatment area (possibly equipping them with smart weir structures to bypass high flows). Provide an exfiltration trench with average bottom width of 18 feet and outfitted in a manner outlined in the following two options.



Figure 4.2.4 BMP WQ-4

Option A: Provide a 12-inch layer of BAM over a one foot depth of gravel, which would collect water in a perforated pipe and discharge into the existing stormwater collector system. BAM may be covered with sod.

Option B: Provide an 18-inch clean sand filter over the gravel trench containing the perforated pipe, which may be covered with sod and/or landscape plants.

Typical concept sketches for this alternative are provided in **Appendix A**.

**Natural Systems Improvement:** Low due to very small service area.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Low

**Land Acquisition Requirements:** Right-of way is owned by the City of St. Petersburg.

**Cost Estimates:** The estimated construction cost of alternative WQ-4 using option A is approximately \$277,000. The estimated construction cost of alternative WQ-4 using option B is approximately \$111,000.

**Pollutant Reduction Model Results:** Assuming a one-foot depth of storage before spillover to the existing stormwater system, the biofiltration or sand filtration trench should capture and treat the equivalent of 0.5 inch over at least 9.8 acres of contributing watershed. The option A BAM removal efficiencies for Bold & Gold CTS™ are cited as 60% TN, 90% TP and 90% TSS. Option B traditional exfiltration removal efficiencies are anticipated to be 30% TN, 60% TP and 85% TSS.

Using the Joe's Creek PLM calculated unit loads for the surrounding basin (C0150), the following average annual pollutant reduction is expected:

- TN reduction of 26.9 kg/year (option A) and 13.5 kg/year (option B)
- TP reduction of 8.3 kg/year (option A) and 5.5 kg/year (option B)
- TSS reduction of 1,231 kg/year (option A) and 1,163 kg/year (option B)

**Recommendations:** This alternative reduces incoming pollutants from a high loading, untreated contributing area. The modifications to the existing inflow systems, however, are substantial and would accommodate a relatively small service area. The BMP could be designed as an intermittent swale between existing trees, but would, as a result, lose capture volume. Hydraulic performance will need to be designed using site specific structure data, survey and geotechnical information. An Environmental Resource Permit would be required.

#### 4.2.5 BMP WQ-5 – Joe's Creek Dry Retention Pond

Based on the Joe's Creek PLM load results and the ambient water quality measured downstream of the Miles Creek confluence (station OF-00), benefits to the channelized natural systems and Joe's Creek may be realized from providing diversion of stormwater flows from high density residential areas south of the BMP as well as the 71<sup>st</sup> Street N corridor, which drain commercial and residential areas within the City of St. Petersburg and unincorporated Pinellas County, to a dry retention area on County-owned lands.

The proposed BMP site was formerly used as a dewatering area associated with existing ERP No. 30198.003. It is now a grassed upland space adjacent to the Joe's Creek main channel and would be ideal for capture and infiltration of a portion of the contributing K0220 watershed runoff prior to controlled release into the Joe's Creek main channel.

**Proposed BMP:** Excavate a 1.26-acre dry retention area to a depth of 5.0 feet with conceptualized 3H:1V slopes. The pond is anticipated have a control elevation two to three feet below the TOB elevation. Diverted inflows from 71<sup>st</sup> Street N may require a smart weir or upflow system to bypass higher flows through the existing storm sewer system.



Figure 4.2.5 BMP WQ-5

**Natural Systems Improvement:** Medium. Pollutant load reduction to Joe's Creek over a moderate sized service area. Design could include transition zone planting buffers along the downstream embankment.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Moderately low (existing permit to be modified).

**Land Acquisition Requirements:** Land is owned by Pinellas County

**Cost Estimates:** The estimated construction cost of alternative WQ-5 is approximately \$250,000.

**Pollutant Reduction Model Results:** Assuming a two-foot depth of storage before spillover to Joe's Creek and PLM BMP removal efficiencies of 58% TN, 63% TP and 87% TSS, the traditional infiltration treatment area should capture and treat the equivalent of 0.5 inch over approximately 45.7 acres of contributing watershed. Approximately one-third of the area is within unincorporated Pinellas County and the remaining two-thirds is within the City of St. Petersburg.

Using the Joe's Creek PLM calculated unit loads for basin K0220, the following average annual pollutant reduction is expected:

- TN reduction of 106.6 kg/year
- TP reduction of 22.3 kg/year
- TSS reduction of 4,579 kg/year

**Recommendations:** This alternative effectively reduces incoming pollutants from a high loading area. The modifications to the existing inflow systems and overall BMP hydraulic performance will need to be designed using site specific structure data, survey and geotechnical information. An Environmental Resource Permit modification (ERP No. 30198.003) would be required.

#### 4.2.6 BMP WQ-6 – Joe's Creek (Tidal) 70<sup>th</sup> Ave N Pond Pretreatment

While not located within one of ranked high loading basins, this BMP is situated on County-owned land surrounding an existing stormwater management pond downstream of the ranked water quality target basins J0040 and J0050 in Pinellas Park. The tidal portion of the natural system, Joe's Creek, exhibits elevated nutrient concentrations, making any BMP within its contributory area desirable. The runoff from high load areas is to be diverted to a pretreatment dry detention and biofiltration area with BAM enhancement for increased nutrient removal efficiency. This alternative has also been assessed without the BAM enhancement.

There is sufficient perimeter greenspace at the eastern end of the County-owned pond to design and install a BMP to accept diverted inflow from nearby pipe systems, to capture and infiltrate a portion of the contributing watershed runoff prior to release/spillover into the existing pond.

**Proposed BMP:** Excavate a 1.1-acre dry detention area to a depth of 3.0 feet with conceptualized side slopes of 3H:1V slopes. Divert the existing inflow systems to the pretreatment area. Spillover weirs would be designed with control elevations one foot below TOB.



Figure 4.2.6 BMP WQ-6

Option A: Construct approximately 335 linear feet of BAM-covered exfiltration trench with an average bottom width of 20 feet. Provide a 12-inch layer of BAM over one foot depth of gravel, collecting flow in a perforated pipe and discharging to the wet detention pond. The spacing of exfiltration trench discharge pipes is estimated to be 150-160 feet. The remaining retention area bottom and BAM would be seeded/sodded to maintain grass cover.

Option B: Utilize in-situ soils to infiltrate the treatment retention volume allowing excess inflow to spill over into the wet pond.

Typical concept sketches for this alternative are provided in **Appendix A**.

**Natural Systems Improvement:** Medium. Significant pollutant load reduction would be achieved over a moderate service area prior to discharge into tidal Joe's Creek.

**Environmental Concerns:** Low – No wetland impacts.

**Permitting Effort:** Low

**Land Acquisition Requirements:** Land is owned by Pinellas County

**Cost Estimates:** The estimated construction cost of alternative WQ-6 using option A is approximately \$259,000. The estimated construction cost of alternative WQ-6 using option B is reduced to approximately \$159,000.

**Pollutant Reduction Model Results:**

Assuming a 2.5-foot depth of storage before spillover to the existing pond, the pretreatment BMP should capture and treat the equivalent of 0.5 inch over at least 58.3 acres of contributing watershed.

Option A BAM removal efficiencies for Bold & Gold CTS™ are cited as 60% TN, 90% TP and 90% TSS. Option B traditional on-line retention removal efficiencies are anticipated to be 58% TN, 63% TP and 87% TSS.

Using the Joe's Creek PLM calculated unit loads for nearest contributing basin (K0090), the following average annual pollutant reduction is expected:

- TN reduction of 111.6 kg/year (option A) and 107.9 kg/year (option B)
- TP reduction of 26.9 kg/year (option A) and 18.8 kg/year (option B)
- TSS reduction of 3,590 kg/year (option A) and 3,470 kg/year (option B)

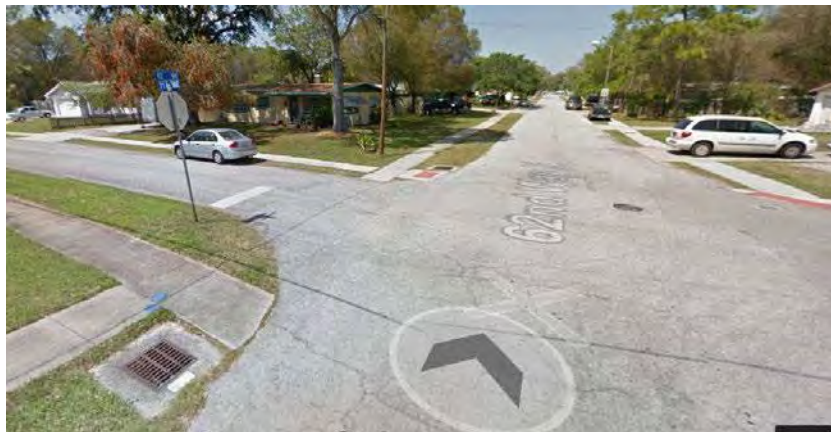
**Recommendations:** This alternative effectively reduces incoming pollutants from a high loading, untreated contributing area using municipally owned lands at a strategic location. The modifications to the existing inflow systems and overall BMP hydraulic performance will need to be designed using site specific structure data, survey and geotechnical information. An Environmental Resource Permit would be required.

#### 4.2.7 BMP WQ-7 – Water Quality Improvements at Older High Density Residential Areas

Large older residential areas (high density) were developed prior to the implementation of rules governing stormwater treatment from areas of new development. These areas include numerous mobile home parks and small subdivision areas. These areas discharge untreated stormwater runoff from large residential areas that have a high amount of impervious surfaces which could contain numerous pollutants directly to the Joe's Creek main channel and its tributary channels and ditches.

Public awareness campaigns for the municipalities in the Joe's Creek watershed currently encourage xeriscaping, responsible pet waste management, and low fertilization landscapes, and both the County and the City of St. Petersburg have fairly aggressive street sweeping programs in place that include residential streets. Pollutant removal efficiencies for street sweeping are estimated at 85% TSS, 85% TP and 50% NO<sub>3</sub>

Pinellas Park residential areas within Joe's Creek watershed typically utilize a stormwater collection design with drop inlets placed within the green space between sidewalk and edge of pavement (**Figure 4.2.7a**).



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**Figure 4.2.7a Pinellas Park Residential Example**

Unincorporated Pinellas County and City of St. Petersburg systems are predominantly designed with shallow concrete gutters at the pavement edge draining to curb inlets, as shown in **Figure 4.2.7b** and **4.2.7c**.



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**Figure 4.2.7b Pinellas County Example 1**



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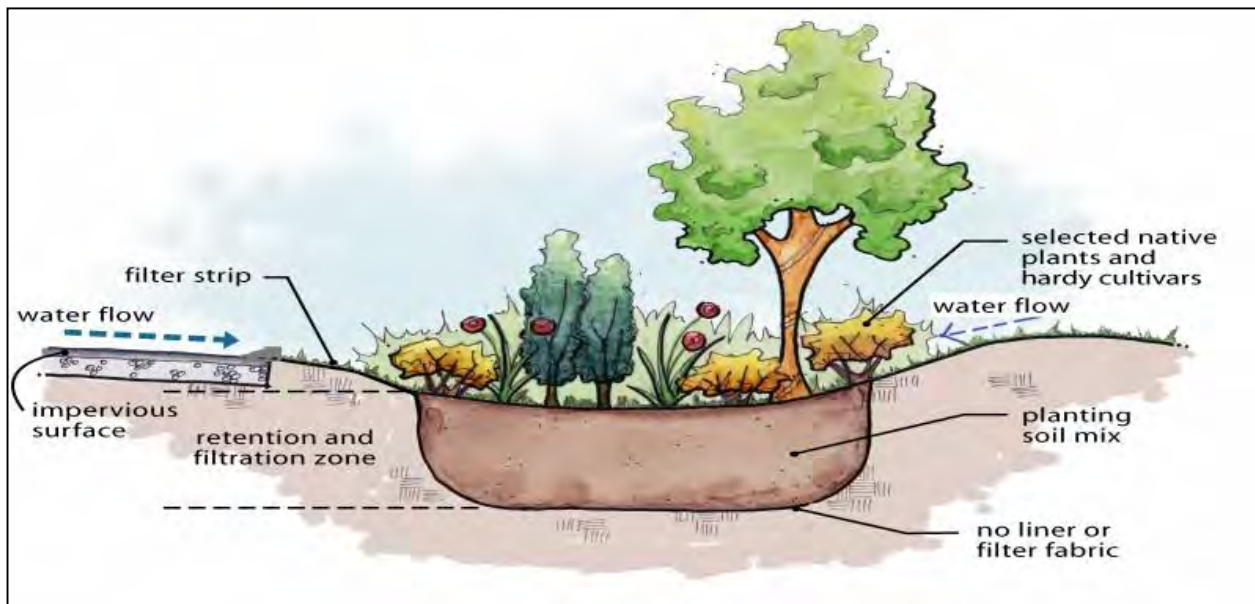
**Figure 4.2.7c City of St. Petersburg Example 2**

**Recommendations:** While it is not feasible to retrofit these large residential areas to provide traditional stormwater treatment detention/retention areas, there are several options that could be implemented to reduce pollutant loads to Joe's Creek and Miles Creek, which are the most impaired conveyances. Implementation of these additional options will improve compliance with NPDES permits and help to address potential FDEP TMDL issues within the watershed. These options could include:

- Promotion of private on-site stormwater harvesting such as pervious pavement for add-on patios and driveways, rain barrel-rainwater collection/reuse, etc.



- Utilize residential street right-of-way for stormwater microbasins and/or small raingardens to capture and infiltrate portions of residential runoff prior to entering the typical shallow gutter and inlet collection systems (**Figure 4.2.7d**).
- Create enforceable ordinances for pet waste disposal in all areas
  - Enforceable ordinances are limited to municipally owned parks and preservation lands in Pinellas County
  - The City of St. Petersburg pet waste ordinance currently applies to rights-of-way citywide and dog parks



**Figure 4.2.7d Raingarden Concept**

#### **4.2.8 BMP WQ-8 – Water Quality Improvements at Older Commercial and Industrial Areas**

Older Commercial and Industrial Areas in unincorporated Pinellas County and St. Petersburg were developed prior to the implementation of rules for stormwater treatment. These area discharge untreated stormwater runoff, from commercial and industrial areas that have a high amount of pollutant laden impervious surface, directly to the Miles Creek and Joe's Creek channel and ditch systems.



**Figure 4.2.8a Industrial Site Example 1**



**Figure 4.2.8b Industrial Site Example 2**

**Recommendations:** While it is not feasible to retrofit these older commercial and industrial areas to provide required stormwater treatment, there are several options that could be implemented during redevelopment to reduce pollutant loads to the Joe's Creek watershed. Implementation of these options will improve compliance with NPDES permits and address potential FDEP TMDL issues within the watershed. These options could include:

- Commercial/Public/Redevelopment: Low Impact development (LID) options, functional landscaping and buffers for runoff infiltration, green-roofing, minimizing directly connected impervious areas, incentives for organic mulching over fertilizers
- Industrial: Site review and periodic inspection of NPDES Industrial Activity stormwater pollutant prevention plans and practices where applicable
- Installation of in-line water quality inlets (Stormceptor, Baffle Box, Vortex, etc.) on outfalls with high TSS loads

Pollutant removal efficiencies will vary depending on the type of stormwater BMP implemented. Pollutant removal efficiencies of various non-structural and structural BMPs are included in **Appendix A**. Pollutant removal efficiencies vary for in-line water quality filters, based on suspended sediment particle size, type of filtration and flow through rates.

Costs for these options will vary depending on what is implemented.

**Table 4-2 Joe's Creek Watershed BMPs Selected for Modeling**

BMP No.	Problem Area ID	Problem Area	Location	Jurisdiction	BMP	Existing Structure Size	Proposed Structure Size	Number	Length (ft.)	Estimated Construction Cost	Comments
FC-1	1	Downstream of Devonshire Pond is backed up by Channel 7 flooding	Devonshire Pond Outfall/Tyrone Blvd. culvert upgrades	City of St. Petersburg	Replace Structure	48"x72" CBC	72"x120" CBC	1	1,500	\$12,747,000	Recommended
					Replace Structure	30" Pipe	72"x120" CBC	1	700		
					Replace Structure	36"x72" CBC	72"x120" CBC	1	1,700		
					New Structure	N/A	120"x 60" CBC	1	3,600		
FC-2	1	Flooding from Miles Creek	38 <sup>th</sup> Ave. N culvert upgrades	City of St. Petersburg	Replace Structure	24" Pipe	60"x120" CBC	1	1,200	\$7,155,000	Not Recommended
					Replace Structure	24"x38" Pipe	60"x120" CBC	1	3,000		
									8		
FC-1 AND FC-2	1	Downstream of Devonshire Pond is backed up by Channel 7 flooding and from Miles Creek	Devonshire Pond Outfall/Tyrone Blvd. culvert upgrades and 38 <sup>th</sup> Ave. N culvert upgrades	City of St. Petersburg	Replace Structure	48"x72" CBC	72"x120" CBC	1	1,500	\$19,908,000	Unacceptable downstream impacts; not recommended
					Replace Structure	30" Pipe	72"x120" CBC	1	700		
					Replace Structure	36"x72" CBC	72"x120" CBC	1	1,700		
					New Structure	N/A	120"x 60" CBC	1	3,600		
					Replace Structure	24" Pipe	60"x120" CBC	1	1,200		
					Replace Structure	24"x38" Pipe	60"x120" CBC	1	3,000		
FC-1A	1	Tyrone Square Mall floods on 22 <sup>nd</sup> Ave. N due to undersized pipes	Devonshire Pond Outfall/Tyrone Blvd. culvert upgrades and Tyrone Square Mall outfall upgrade	City of St. Petersburg	Replace Structure	30" Pipe	54" RCP	1	60	\$18,732,000	Recommended
					Replace Structure	48" Pipe	60" RCP	1	930		
					Replace Structure	60"x84" CBC	72"x120" CBC	1	215		
					Replace Structure	66" Pipe	72"x120" CBC	1	1,410		
					Replace Structure	48"x72 CBC	72"x108" CBC	1	1,500		
					Replace Structure	30" Pipe	72"x108" CBC	1	700		
					Replace Structure	36"x72" CBC	72"x108" CBC	1	1,700		
					New Structure	N/A	120"x 60" CBC	1	3,600		
FC-3	3	Undersized pipe at 34 <sup>th</sup> St. N causes significant flooding upstream	Channel 1 At 34 <sup>th</sup> St. N	Pinellas County	New Structure	N/A	84"x120" CBC	1	157	\$351,000	Unacceptable downstream impacts; not recommended

**Table 4-2 Joe's Creek Watershed BMPs Selected for Modeling**

BMP No.	Problem Area ID	Problem Area	Location	Jurisdiction	BMP	Existing Structure Size	Proposed Structure Size	Number	Length (ft.)	Estimated Construction Cost	Comments
FC-4	3	Undersized pipe at 49 <sup>th</sup> St. N causes slight flooding upstream	Channel 1 at 49 <sup>th</sup> St. N	Pinellas County	New Structure	N/A	108"x120" CBC	1	185	\$458,000	Recommended
FC-3 AND FC-4	3	Undersized pipes at 34 <sup>th</sup> St. N and 49 <sup>th</sup> St. N causes flooding upstream	Channel 1 At 34 <sup>th</sup> St. N and Channel 1 at 49 <sup>th</sup> St. N	Pinellas County	New Structure New Structure	N/A N/A	84"x120" CBC 108"x120" CBC	1 1	157 185	\$793,000	Unacceptable downstream impacts; not recommended
FC-3A	3	Undersized pipe at 34 <sup>th</sup> St. N causes significant flooding upstream	Channel 1 At 34 <sup>th</sup> St. N	Pinellas County	New Structure New Structure	N/A N/A	84"x120" CBC 84"x120" CBC	1 1	157 157	\$741,000	Unacceptable downstream impacts; not recommended
FC-3A AND FC-4	3	Undersized pipes at 34 <sup>th</sup> St. N and 49 <sup>th</sup> St. N causes flooding upstream	Channel 1 At 34 <sup>th</sup> St. N and Channel 1 at 49 <sup>th</sup> St. N	Pinellas County	New Structure New Structure New Structure	N/A N/A N/A	84"x120" CBC 84"x120" CBC 108"x120" CBC	1 1 1	157 157 185	\$871,000	Unacceptable downstream impacts; not recommended
FC-5	2	Excess area draining to the Lealman area causes significant flooding	54 <sup>th</sup> Ave. N from 66 <sup>TH</sup> St. N And 62 <sup>ND</sup> St. N	Pinellas County	Replace Structures Replace Structures Replace Structures	Multiple sizes Multiple sizes Multiple sizes	54" RCP 60" RCP 72" RCP	1 1 1	800 3,600 2,100	\$2,556,000	Recommended

**Table 4-2 Joe's Creek Watershed BMPs Selected for Modeling**

BMP No.	Problem Area ID	Problem Area	Location	Jurisdiction	BMP	Existing Structure Size	Proposed Structure Size	Number	Length (ft.)	Estimated Construction Cost	Comments
FC-6	2	Lack of capacity in the ditch system and undersized pipe causes the Lealman area to back up and flood	Channel 4-D from 66 <sup>th</sup> St. N to 62 <sup>nd</sup> St. N, and from Channel 4 to 66 <sup>th</sup> St. N	Pinellas County	Remove pipe	54" Pipe	None	1	50	\$144,000	Recommended
FC-5 AND FC-6	2	Excess area draining to the Lealman area causes significant flooding and the lack of capacity in the ditch system and undersized pipe causes the Lealman area to back up and flood	54 <sup>th</sup> Ave. N from 66 <sup>th</sup> St. N and 62 <sup>nd</sup> St. N; Channel 4-D from 66 <sup>th</sup> St. N to 62 <sup>nd</sup> St. N, and from Channel 4 to 66 <sup>th</sup> St. N	Pinellas County	Replace Structures Replace Structures Replace Structures Remove pipe	Multiple sizes Multiple sizes Multiple sizes 54" Pipe	54" RCP 60" RCP 72" RCP None	1 1 1 1	800 3,600 2,100 50	\$2,7000,000	Recommended
FC-7	2	Undersized pipe causes channel to overflow and low events	62 <sup>nd</sup> Ave. N Drainage and Channel 4	Pinellas County/Pinellas Park	Replace Structure New Structure New Structure New Structure New Pond Remove pipe 3 Ditch bottom Inlets 1 Type C CS Berm	19"x30" N/A N/A N/A N/A 30" CMP N/A N/A N/A N/A	24" RCP 24" RCP 24" RCP 24" RCP N/A N/A N/A N/A N/A	1 1 1 1 N/A 1 N/A N/A N/A	50 60 40 800  50   870	\$869,000	Recommended
WQ-1	A	Industrial, commercial and high density residential areas east of 34 <sup>th</sup> Street N (US Hwy 19) draining to Silver Lake and thence to Joe's Creek	Silver Lake stormwater detention pond	Unincorporated Pinellas County	Pretreatment BAM-enhanced infiltration swale.  ½ inch capture capacity over 29.2 acres	---	Swale area at TOB=32,284 SF  3H:1V bank slopes  2-foot retention depth	---	Trench Length 1,600	\$390,000	BMP site is on County-owned lands.  Project also provides water quality benefit for City of St. Petersburg contributing areas.
WQ-2	C	Older high density residential areas west of the railroad, draining to Joe's Creek Greenway Park	Site north of Joe's Creek Greenway Park wet detention facility	Unincorporated Pinellas County	Pretreatment dry retention facility.  ½ inch capture capacity over 285.7 acres	---	Area at TOB=191,736 SF  3H:1V bank slopes 3-foot retention depth	---	---	\$699,000	BMP site is on County-owned lands.

**Table 4-2 Joe's Creek Watershed BMPs Selected for Modeling**

BMP No.	Problem Area ID	Problem Area	Location	Jurisdiction	BMP	Existing Structure Size	Proposed Structure Size	Number	Length (ft.)	Estimated Construction Cost	Comments
WQ-3	E	Older high density residential areas in the City of St. Petersburg between 30 <sup>th</sup> Ave and 38 <sup>th</sup> Ave N and between 35 <sup>th</sup> and 45 <sup>th</sup> Streets N draining to Joe's Creek	Existing flood detention pond located between 33 <sup>rd</sup> Ave and 34 <sup>th</sup> Ave N	City of St. Petersburg	Pretreatment BAM-enhanced infiltration swale.  ½ inch capture capacity over 38 acres	---	Swale area at TOB=51,470 SF  3H:1V bank slopes  2-foot retention depth	---	Trench Length 1,250	\$372,000	BMP site is on City-owned lands.
WQ-4	J	Older high density residential areas in the City of St. Petersburg between 64 <sup>th</sup> and 70 <sup>th</sup> Streets N draining to Joe's Creek	30 <sup>th</sup> Ave N green median.	City of St. Petersburg	Pretreatment BAM-enhanced bio-filtration swale.  ½ inch capture capacity over 9.8 acres	---	Swale area at TOB=20,414 SF  3H:1V bank slopes  1-foot retention depth	---	Trench Length 857	\$277,000	BMP site is on City-owned right-of-way.
WQ-5	F	High density residential areas located between Tyrone Boulevard and 38 <sup>th</sup> Ave N in St. Petersburg and similar areas in unincorporated Pinellas County east of 71 <sup>st</sup> Street N between 40 <sup>th</sup> Ave and 46 <sup>th</sup> Ave N, draining to Joe's Creek	County-owned open parcel on south bank of Joe's Creek (east of 71 <sup>st</sup> Street N and north of 41 <sup>st</sup> Terrace N)	Unincorporated Pinellas County	Pretreatment dry retention facility.  ½ inch capture capacity over 45.7 acres	---	Area at TOB=55,108 SF  3H:1V bank slopes  2-foot retention depth	---	---	\$250,000	BMP site is on County-owned lands.  Project also provides water quality benefit for City of St. Petersburg contributing areas.
WQ-6	G	Park Boulevard commercial corridor and surrounding residential areas from 66 <sup>th</sup> Street N to the railroad and 66 <sup>th</sup> Street N between 64 <sup>th</sup> Ave and 70 <sup>th</sup> Ave N in Pinellas Park draining to Joe's Creek (tidal)	County-owned stormwater detention pond located at the corner of 70 <sup>th</sup> Ave N and 78 <sup>th</sup> Street N	Unincorporated Pinellas County	Pretreatment BAM-enhanced infiltration swale.  ½ inch capture capacity over 45.7 acres	---	Swale area at TOB=48,145 SF  3H:1V bank slopes  2-foot retention depth	---	Trench Length 335	\$259,000	BMP site is on County-owned lands.  Project mainly provides water quality benefit for City of Pinellas Park.

**4.3 BMP Alternative Summary of Benefits**

The relative benefit and cost for recommended flood control and water quality alternatives is summarized below in **Table 4-3**. Pollutant reduction in this table is expressed in units of pounds per year (lb/year) per SWFWMD request.

**Table 4-3 Joe's Creek Watershed BMP Summary of Benefits**

BMP	Description	Opinion of Probable Cost	Outfall	TN Load Reduction (lb/year)	TP Load Reduction (lb/year)	TSS Load Reduction (lb/year)	Improvement in Floodplain <sup>(1)</sup>	Number of Structures Removed from 100-Year Floodplain	BMP Drainage Area (acres)	Opinion of Probable Cost/lb of TN Removal	Opinion of Probable Cost/lb of TP Removal	Opinion of Probable Cost/lb of TSS Removal	Opinion of Probable Cost/Acre of Drainage Area
FC-1	Culvert upgrades	\$12,747.00	Miles Creek	0	0	0	Yes	21	135.8	\$0	\$0	\$0	\$94
FC-1A	Culvert upgrades	\$18,732,000	Miles Creek	0	0	0	Yes	12	181.8	\$0	\$0	\$0	\$103,036
FC-4	Proposed new culverts	\$458,000	Channel 1	0	0	0	Yes	1	18.3	\$0	\$0	\$0	\$25,027
FC-5	Culvert upgrades	\$2,556,000	Channel 4-D	0	0	0	Yes	14	59.1	\$0	\$0	\$0	\$43,249
FC-6	Channel improvements	\$144,000	Channel 4-D	0	0	0	Yes	14	86.8	\$0	\$0	\$0	\$1,659
FC-5 AND FC-6	Culvert upgrades and Channel improvements	\$2,700,000	Channel 4-D	0	0	0	Yes	14	153.4	\$0	\$0	\$0	\$17,601
FC-7	Proposed pond and culvert upgrades	\$869,000	Channel 4	17.5	5.9	1,225	Yes	0	24	\$22,571	\$66,949	\$322	\$36,208
WQ-1a	Silver Lake pre-treatment with BAM-enhanced infiltration	\$390,000	Upper Joe's Creek	80.4	23.8	3,524	No	0	29.2	\$2,205	\$7,448	\$50	\$13,356
WQ-1b	Silver Lake pre-treatment with in-situ soils infiltration	\$135,000	Upper Joe's Creek	77.7	16.6	3,407	No	0	29.2	\$790	\$3,697	\$18	\$4,623
WQ-2	Greenway Park dry retention pre-treatment	\$699,000	Upper Joe's Creek	607.5	113.8	25,411	No	0	285.7	\$523	\$2,792	\$13	\$2,447



**Table 4-3 Joe's Creek Watershed BMP Summary of Benefits**

BMP	Description	Opinion of Probable Cost	Outfall	TN Load Reduction (lb/year)	TP Load Reduction (lb/year)	TSS Load Reduction (lb/year)	Improvement in Floodplain <sup>(1)</sup>	Number of Structures Removed from 100-Year Floodplain	BMP Drainage Area (acres)	Opinion of Probable Cost/lb of TN Removal	Opinion of Probable Cost/lb of TP Removal	Opinion of Probable Cost/lb of TSS Removal	Opinion of Probable Cost/Acre of Drainage Area
WQ-3a	St. Petersburg 33rd-34th Ave pond BAM pretreatment	\$372,000	Joe's Creek	94.5	28.0	3,736	No	0	38.0	\$1,789	\$6,039	\$45	94.5
WQ-3b	St. Petersburg 33rd-34th Ave pond pretreatment (no BAM)	\$183,000	Joe's Creek	91.4	19.6	3,611	No	0	38.0	\$910	\$4,244	\$23	91.4
WQ-4a	St Petersburg 30th Ave N biofiltration	\$277,000	Joe's Creek	26.9	8.3	1,231	No	0	9.8	\$4,681	\$15,170	\$102	\$28,265
WQ-4b	St Petersburg 30th Ave N exfiltration	\$111,000	Joe's Creek	13.5	5.5	1,163	No	0	9.8	\$3,737	\$9,174	\$43	\$11,327
WQ-5	Joe's Creek dry retention	\$250,000	Joe's Creek	106.6	22.3	4,579	No	0	45.7	\$1,066	\$5,096	\$25	\$5,470
WQ-6a	70th Ave N pond pre-treatment with BAM-enhanced infiltration	\$259,000	Joe's Creek (tidal)	111.6	26.9	3,590	No	0	58.3	\$1,055	\$4,376	\$33	\$5,667
WQ-6b	70th Ave N pond pre-treatment with in-situ soils infiltration	\$159,000	Joe's Creek (tidal)	107.9	18.8	3,470	No	0	58.3	\$670	\$3,844	\$21	\$2,727

Notes: (1) Floodplain Improvement claimed if BMP creates at least 6 inches of 100-year stage reduction

(2) Existing and Proposed LOS has been reassessed using the ICPR existing condition and BMP model results

## 5.0 SUMMARY OF FINDINGS

A BMP project scoring assessment has been performed to compare the various benefits and costs of the many alternatives evaluated. The project ranking system, originally developed for Hernando County, assigns ranking points based on the following categories:

- Type of outfall or receiving system (wetland/waterbody, springshed, etc)
- Magnitude of stormwater pollutant load reduction for impairment parameters
- Aquifer vulnerability
- Improvement to floodplain level of service designation
- Cost per pound of nutrient removal (nitrogen and phosphorus)
- Number of structures potentially removed from the floodplain
- Type of roadway realizing improved LOS (arterial, evacuation, local, etc)
- Cost per acre of drainage area served

A completed ranking summary for the Joe's Creek watershed flood control and water quality BMPs is provided in **Table 5-1**. The overall project ranking, with higher scores being preferred, is as follows:

### Ranking by Score

1.	WQ-6B	70
2.	WQ-6A	68
3.	FC-1	66
4.	FC-6	63
5.	WQ-2	60
6.	WQ-1B	57
7.	WQ-3B	55
8.	WQ-5	55
9.	WQ-3A	50
10.	FC-5 and FC-6	47
11.	WQ-1A	45
12.	WQ-4B	43
13.	WQ-4A	41
14.	FC-4	34
15.	FC-1A	30
16.	FC-5	15

Other non-structural BMPs generally recommended for water quality protection throughout the watershed include the following:

1. Increase resource allocation for inspection and repair of sanitary utility lines and fittings
2. Perform wastewater facility capacity studies in areas where frequent sanitary sewer overflows or plant releases are occurring
3. Continue public awareness campaigns to encourage xeriscaping, responsible pet waste management, and low fertilization landscapes.

4. Encourage parcel-based stormwater harvesting such as private raingardens, pervious pavers and rain barrels. Consider demonstration projects on municipal parcels.
5. Continue street sweeping programs at the current frequencies. Continue to add roads to the sweeping programs as staffing and equipment allow.
6. Low impact development (LID) incentives for new and redeveloped commercial/industrial sites encouraging practices such as functional landscaping, green buffers for runoff infiltration, green-roofing, minimizing directly connected impervious areas, and incentives for organic mulching over fertilizers

**Table 5-1 Joe's Creek Watershed Preliminary BMP Project Scoring**

<b>SCORING CRITERION</b>	<b>FC-1</b>	<b>FC-1A</b>	<b>FC-4</b>	<b>FC-5</b>	<b>FC-6</b>	<b>FC-5 and FC-6</b>	<b>WQ-1A</b>	<b>WQ-1B</b>	<b>WQ-2</b>	<b>WQ-3A</b>	<b>WQ-3B</b>	<b>WQ-4A</b>	<b>WQ-4B</b>	<b>WQ-5</b>	<b>WQ-6A</b>	<b>WQ-6B</b>
<b>DISCHARGE OUTFALL</b>																
Direct Discharge to River/Lake/Connect Wetlands (25)															25	25
Direct Discharge Sinkhole/Drainage Well (20)																
Infiltration in Springshed with TMDL (15)	15	15	15	15	15	15	15	15	15	15	15	15	15	15		
Direct Discharge Isolated Wetland > 5 acres (10)																
Direct Discharge Isolated Wetland < 5 acres (5)																
Infiltration (5)																
<b>STORMWATER LOAD REDUCTION - IMPAIRMENT POLLUTANT OF CONCERN</b>																
80-100% (15)	0	0	0	0	0	0	15			15		15			15	
60-79% (12)								12	12		12		12	12		12
40-59%(9)																
20-39% (6)																
6-19% (3)																
<b>AQUIFER VULNERABILITY</b>																
Most Vulnerable (15)																
MoreVulnerable (10)																
Vulnerable (5)																
Less Vulnerable (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>FLOODPLAIN LEVEL OF SERVICE</b>																
Improved LOS by 4 Levels (15)	15	15	15			15										
Improved LOS by 3 Levels (10)																
Improved LOS by 2 Levels (5)																
Improved LOS by 1 Levels (2)																
Improved LOS by 0 Levels (0)				0	0		0	0	0	0	0	0	0	0	0	0
<b>COST PER POUND NOx</b>																
\$0-\$2,000 (10)								10	10	10	10			10	10	10
\$2,001-\$4,000 (8)							8						8			
\$4,001-\$6,000 (6)												6				
\$6,001-\$8,000 (4)																
>\$8,001 (2)	0	0	0	0	0	0										
<b>COST PER POUND TP</b>																
\$0-\$2,000 (10)																
\$2,001-\$4,000 (8)								8	8							8
\$4,001-\$6,000 (6)											6			6	6	
\$6,001-\$8,000 (4)							4			4						
>\$8,001 (2)	0	0	0	0	0	0						2	2			
<b>NUMBER OF STRUCTURES POTENTIALLY REMOVED/IMPACTED</b>																
	21	12	1	14	33	72										

<b>TYPE OF ROAD IMPROVED FOR LOS</b>																
Evacuation (20)																
Arterial (16)																
Collector (12)																
Major Local (8)																
Local (4)																
<b>COST PER ACRE OF DRAINAGE AREA</b>																
\$0-\$3,000 (15)	15				15				15							15
\$3,001-\$6,000 (12)								12			12			12	12	
\$6,001-\$9,000 (9)																
\$9,001-\$12,000 (6)										6			6			
>\$12,001 (3)		3	3	3		3	3					3				
	<b>FC-1</b>	<b>FC-1A</b>	<b>FC-4</b>	<b>FC-5</b>	<b>FC-6</b>	<b>FC-5 and FC-6</b>	<b>WQ-1A</b>	<b>WQ-1B</b>	<b>WQ-2</b>	<b>WQ-3A</b>	<b>WQ-3B</b>	<b>WQ-4A</b>	<b>WQ-4B</b>	<b>WQ-5</b>	<b>WQ-6A</b>	<b>WQ-6B</b>
<b>TOTAL</b>	<b>66</b>	<b>30</b>	<b>34</b>	<b>15</b>	<b>63</b>	<b>47</b>	<b>45</b>	<b>57</b>	<b>60</b>	<b>50</b>	<b>55</b>	<b>41</b>	<b>43</b>	<b>55</b>	<b>68</b>	<b>70</b>

## **6.0 REFERENCES**

Bold and Gold Engineers. Internet Link

<http://www.boldandgoldmedia.com/engineers.html>

Florida Department of Environmental Protection (FDEP). Internet Link

<http://www.fdot.gov/programmanagement/Estimates/BasisofEstimates/BOEManual/BOEOnline.shtm>

## **Appendix A**

# **Pollutant Load Removal for BMPs and Concept Sketches**

## **Removal Estimates for Structural BMPs**



Proposed Removal Efficiencies for PLM Existing Watershed Condition (%)				
	TN	TP	BOD5	TSS
On-line Dry Retention (1/2-inch)	58%	63%	80%	87%
Detention with Filtration (1/2-inch)	30%	60%	50%	85%
Extended Wet Detention (1-inch) td=7 days	30%	60%	50%	60%
WQ INLET - limited capacity < 1 acre service area typically	0%	10%	10%	50%

**Other Tool Efficiencies for Comparison**

EMCTool	TN	TP	BOD5	TSS
On-line Dry Retention	99%	99%	99%	99%
Detention with Underdrain/Sidedrain	80%	92%	93%	98%
Extended Wet Detention	37%	69%	75%	77%

BMPTrains_ver7.71	TN	TP	BOD5	TSS
On-line Dry Retention	61%	61%		
Detention with Underdrain and Sand Filter	30%	60%		85%
Extended Wet Detention	27%	53%		

PTI, Inc. (vendor - see engineering spec)	TN	TP	BOD5	TSS
Bold&Gold ECT	55%	65%		70%
Bold&Gold CTS	60%	90%		90%

**Source Legend**

- "Evaluation of Current Stormwater Design Criteria within the State of Florida"
- "Tampa Bay Reasonable Assurance Plan" Action Plan Database
- UCF Stormwater Academy BMPTrains Version 7.71
- "Pennsylvania Stormwater Best Management Practices Manual – BMP 6.6.4 Water Quality Filters and hydrodynamic Devices" (Pennsylvania DEP, 2006) and BMAP St Lucie Riv

WQ-1 Silver Lake pretreatment west				St Pete and PC Benefit east				indicates treatment volume stage
depth	area, SF	volume, CF	Elev	depth	area, SF	volume, CF	Elev	
3	32284	58471.5	42	3	18169	38860.5	41	
2	23566	30546.5	spillover	2	14655	22448.5	spillover	
1	14943	11292	40	1	11207	9517.5	39	
0	7641	0	39	0	7828	0	38	

Option A

Basin **D0020** Acres treated at 1/2-inch: 29.2

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.6	0.9	134.1	Load kg/acre-yr
134.0	26.4	3915.9	Load kg/year
60.0%	90.0%	90.0%	Efficiency Dry B&G Filtration
80.4	23.8	3524.3	Reduction kg/yr


Option B

Basin **D0020** no BAM- in-situ soils infiltration

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.6	0.9	134.1	Load kg/acre-yr
134.0	26.4	3915.9	Load kg/year
58.0%	63.0%	87.0%	Efficiency Dry Retention
77.7	16.6	3406.8	Reduction kg/yr

WQ-2 Greenway Park Pretreatment -Infiltration				PC benefit			
			No BAM	Basin D0430	Acres treated at 1/2-inch:		285.7
depth	area, SF	volume, CF	Elev	Basin kg/yr-acre (source Joe's Creek PLM)			
				TN	TP	TSS	
4	191736	706513	42				
3	184097	518596.5 spillover		3.7	0.6	102.2	Load kg/acre-yr
2	176555	338270.5	40	1047.5	180.7	29208.6	Load kg/year
1	169111	165437.5	39	58.0%	63.0%	87.0%	Dry Infiltration
0	161764	0	38	607.5	113.8	25411.4	Reduction kg/yr

 indicates treatment  
 volume stage

WQ-3 St Pete 41st St N-34th Ave N Pond Pre-treatment

indicates treatment volume stage

depth	area, SF	volume, CF	Elev
3	51470	116092.5	50
2	42909	68903	spillover
1	34431	30233	48
0	26035	0	47

7-8 pvc outlet drains (20 LF each)

Option A

Basin D0060 Acres treated at 1/2-inch: 38.0

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.1	0.8	109.3	Load kg/acre-yr
157.5	31.1	4150.8	Load kg/year
60.0%	90.0%	90.0%	Efficiency Dry B&G Filtration
94.5	28.0	3735.7	Reduction kg/yr

Option B

Basin D0060 No BAM - in-situ soils infiltration

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.1	0.8	109.3	Load kg/acre-yr
157.5	31.1	4150.8	Load kg/year
58.0%	63.0%	87.0%	Efficiency Dry Retention
91.4	19.6	3611.2	Reduction kg/yr

WQ-4 St. Pete 30th Ave N bioretention in median

  indicates treatment  
 volume stage

depth	area, SF	volume, CF
1	20414	17772
0	15130	0

Option A

Basin **C0150** Acres treated at 1/2-inch: 9.8

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.6	0.9	139.7	Load kg/acre-yr
44.9	9.2	1368.0	Load kg/year
60.0%	90.0%	90.0%	Efficiency B&G Exfiltration Trench w/drain
26.9	8.3	1231.2	Reduction kg/yr

Option B

Basin **C0150** No BAM

Basin kg/yr-acre (source Joe's Creek PLM)

TN	TP	TSS	
4.6	0.9	139.7	Load kg/acre-yr
44.9	9.2	1368.0	Load kg/year
30.0%	60.0%	85.0%	Efficiency Exfiltration Trench w/drain
13.5	5.5	1162.8	Reduction kg/yr

WQ-5 Joe's Creek at 71st Pretreatment -Infiltration

PC 30% and StPete 60% benefit

No BAM

Basin K0220

Acres treated at 1/2-inch: 45.7

depth	area, SF	volume, CF	Elev	Basin kg/yr-acre (source Joe's Creek PLM)			
5	55108	232704	16	TN	TP	TSS	
4	51588	179356	15	4.0	0.8	115.1	Load kg/acre-yr
3	48145	129489.5	14	183.9	35.4	5263.4	Load kg/year
2	44779	83027.5 spillover		58.0%	63.0%	87.0%	Efficiency Dry Retention
1	41491	39892.5	12	106.6	22.3	4579.2	Reduction kg/yr
0	38294	0	11				

indicates treatment volume stage

WQ-6 Joe's Creek at 70th Ave N Pretreatment

PC and Pinellas Park benefit

Option A				Basin K0090	Acres treated at 1/2-inch: 58.3		
depth	area, SF	volume, CF	Elev	Basin kg/yr-acre (source Joe's Creek PLM)			
				TN	TP	TSS	
3	48145	129489.5	8				
2.5	46462	105837.8	7.5 spillover	3.2	0.5	68.4	Load kg/acre-yr
2	44779	83027.5	7	186.0	29.9	3988.9	Load kg/year
1	41491	39892.5	6	60.0%	90.0%	90.0%	Efficiency B&G CTS
0	38294	0	5	111.6	26.9	3590.0	Reduction kg/yr

indicates treatment volume stage

5 pvc outlet drains at L=20ft

Option B

PC and Pinellas Park benefit

Basin K0090

without BAM - in-situ soils infiltration

Basin kg/yr-acre (source Joe's Creek PLM)

	TN	TP	TSS	
	3.2	0.5	68.4	Load kg/acre-yr
	186.0	29.9	3988.9	Load kg/year
	58.0%	63.0%	87.0%	Efficiency online dry retention
	107.9	18.8	3470.3	Reduction kg/yr

FC-7 Bonn Creek Wet Detention with filtration assume SHW at 8.0 feet				Pinellas Park benefit			Note: capacity to treat 126.7 acres 20.0 acres *can capture 4.125 wshed-inches or set low weir at 8.83
depth	area, SF	volume, CF	Elev	Basin I0300	Contributing area approx: Basin kg/yr-acre (source Joe's Creek PLM)		
5	71874	299475	13 spillover	TN	TP	TSS	
4	67082.4	229996.8	12	2.9	0.5	72.1	Load kg/acre-yr
3	62290.8	165310.2	11	58.2	9.9	1441.2	Load kg/year
2	57499.2	105415.2	10	30.0%	60.0%	85.0%	Detention w/effluent filtration
1	52707.6	50311.8	9	17.5	5.9	1225.0	Reduction kg/yr for 1/2 inch over 20 acres
0	47916	0	8 SHW	110.7	37.5	7760.6	Reduction kg/yr over 126.7 acres

indicates treatment  
 volume stage



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Bold and Gold® is distributed by Plastic Tubing Industries, Inc. manufacturers of corrugated plastic pipe used in stormwater, wastewater and drainage applications

**Engineers**

Nutrient loads are a concern in water pollution control and moving to the forefront of conversation at regulatory and design specification levels. Bold & Gold® is an addition to the BMPs already available and is used to remove nutrients in stormwater, wastewater, and agricultural applications. The media is typically installed by a utility contractor and requires little to no site modification from current construction practices.

The information on the following table will provide engineering design parameters used in the sizing of stormwater, wastewater, and agricultural best management practices to remove nutrients and other pollutants in water.

DESCRIPTION OF MEDIA	MATERIAL	PROJECTED TREATMENT PERFORMANCE *			SUSTAINABLE POROSITY	TYPICAL LIMITING FILTRATION RATE (in/hr)
		TSS REMOVAL EFFICIENCY	TN REMOVAL EFFICIENCY	TP REMOVAL** EFFICIENCY		
B&G ECT (REF A) A first BMP, ex. Up-Flow Filter in Baffle box and a constructed wetland <sup>3</sup> (USER DEFINED BMP)	Expanded Clay <sup>2</sup> Tire Chips <sup>1</sup>	70%	55%	65%	0.4	96 in/hr
B&G OTE (REF B) Up-Flow at Wet Pond & Dry Basin Outflow (FILTRATION)	Organics <sup>7</sup> Tire Chips <sup>1</sup> Expanded Clay <sup>3</sup>	60%	45%	45%	0.4	96 in/hr
B&G ECT3 (REF C) Inter-event flow using Up-flow Filter at wet pond and Down-Flow Filter at Dry Basin (FILTRATION)	Expanded Clay <sup>3</sup> Tire Chips <sup>1</sup>	60%	25%	25%	0.4	96 in/hr
B&G CTS (REF D) Sown-Flow Filters 12" depth at wet pond or dry basin <i>pervious pave, tree well, rain garden, swale, and</i>	Clay <sup>5</sup> Tire Crumb <sup>4</sup> Sand & Topsoil <sup>6</sup>	90%	60%	90%	0.3	0.25 in/hr

NOTES \*No generally accepted BMP at this time. Also can be used as a downstream BMP but the removal must be lowered.  
 \*\*All Effectiveness Estimates to nearest 5%. \*\*Phosphorus removal has limited life expectancy. \*\*\*24" depth has TN and TP removals of 75 & 95%  
 acronyms B&G - BOLD & GOLD; ECT- Expanded Clay and Tire; ECT3 Expanded Clay and Tire in Treatment Train  
<sup>1</sup> Tire Chip 3/8" and no measurable metal content (approximate dry density = 730 lbs/CY)  
<sup>2</sup> Expanded Clay 5/8 and 3/8 blend (approximate dry density = 950 lbs/CY)  
<sup>3</sup> Expanded Clay 3/8 in blend (approximate density = 950 lbs/CY)  
<sup>4</sup> Tire Crumb 1-5 mm and no measurable metal content (approximate density = 730 lbs/CY)  
<sup>5</sup> Medium Plasticity typically light colored Clay (approximate density = 2500 lbs/CY)  
<sup>6</sup> Sand with less than 5% passing #200 sieve (approximate density = 2200 lbs/CY)  
<sup>7</sup> Organic Compost (approximate density of 700 lbs/CY) Class 1A Compost or Mix of yard waste  
<sup>8</sup> Local top soil is used over CTS media in dry basins, gardens, swales and strips, is free of roots & debris but is not used in other BMPs.  
 A - Demonstration Bio Media for Ultra-urban Stormwater Treatment, Wanielista, et al. FDOT Project BDK78 977-19, 2014  
 B - Nutrient Reduction in a Stormwater Pond Discharge in Florida, Ryan, et al, Water Air Soil Pollution, 2010  
 C - Up-Flow Filtration for Wet Detention Ponds, Wanielista and Flint, Florida Stormwater Association, June 12, 2014.  
 D - Nitrogen Transport and Transformation in Retention Basins, Marion Co, Fl, Wanielista, et al, State DEP, 2011  
 E - Improving Nitrogen Efficiencies in Dry Ponds, Williams and Wanielista, Florida Stormwater Association, June 18 2015

## **Concept Sketches**



Construct 60"x120" CBC to Miles Creek

Tie into existing 10'x11' CBC

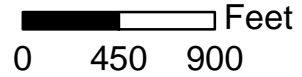
Upgrade 36"x72" CBC to 72"x108"

Upgrade 30" Pipe to 72"x108"

Upgrade 48"x72" CBC to 72"x108"



FC - 1





Upgrade to 60" x 120" CBC

38th Ave N

60th St N

58th St N



FC - 2

0 200 400 Feet



38th Ave N

Upgrade to 60" x 120" CBC

Construct 60"x120" CBC to Miles Creek

Tyrone Blvd

Tie into existing 10'x11' CBC

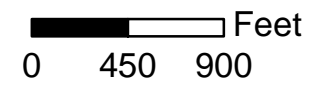
Upgrade 30" Pipe to 72"x108"

Upgrade 36"x72" CBC to 72"x108"

66th St N

Upgrade 48"x72" CBC to 72"x108"

FC - 1 AND FC - 2





Tie into existing 10'x11' CBC

Upgrade 48" pipe to 60" RCP

Upgrade 30" piipe to 54" RCP

Upgrade 60"x84" to 72"x120" CBC

Upgrade 36"x72" CBC to 72"x108"

Upgrade 30" Pipe to 72"x108"

Construct 60"x120" CBC to Miles Creek

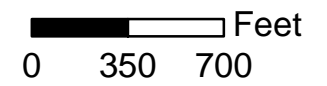
Upgrade 66" pipe to 72"x120" CBC

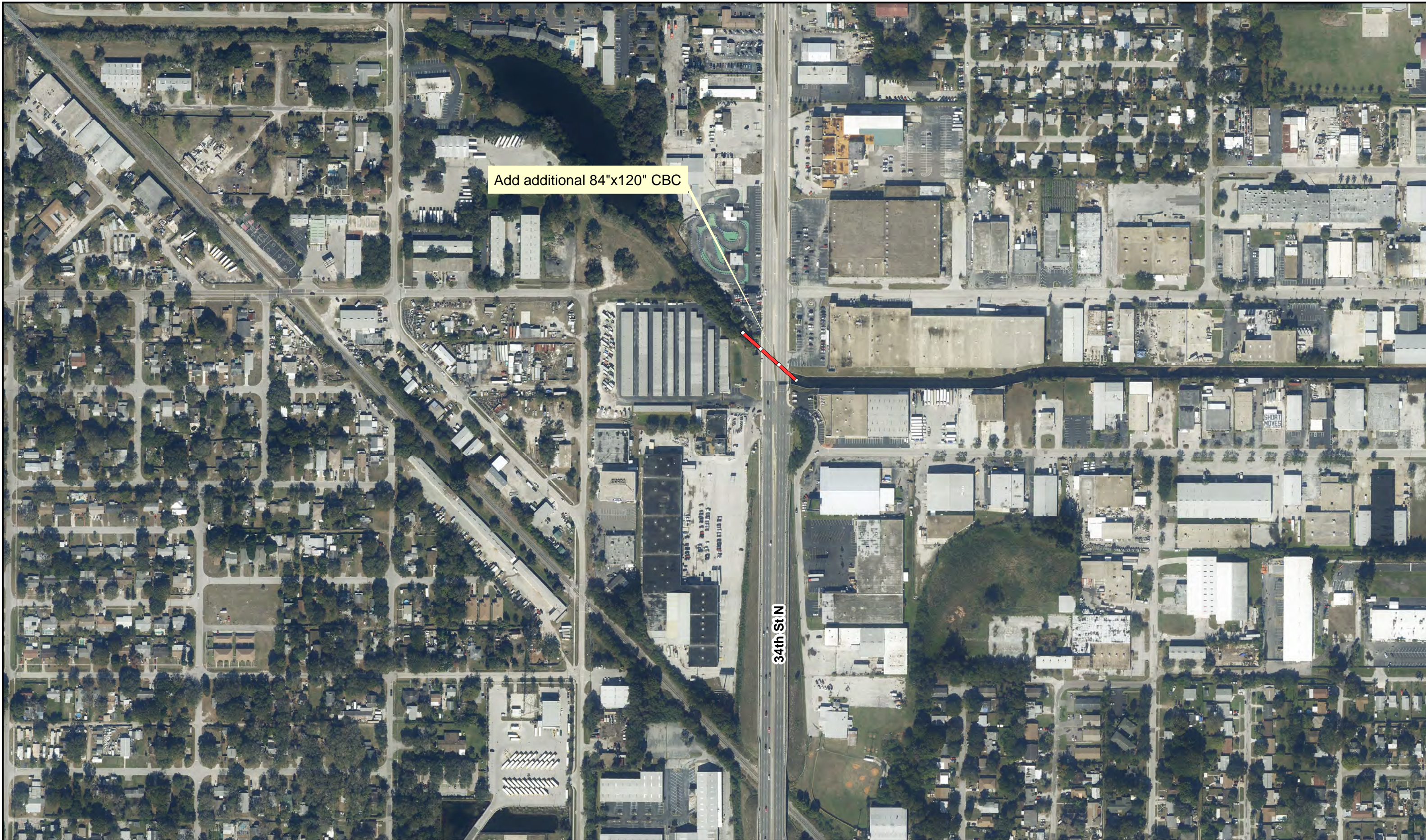
Upgrade 48"x72" CBC to 72"x108"

Tyrone Blvd

66th St N

FC - 1A





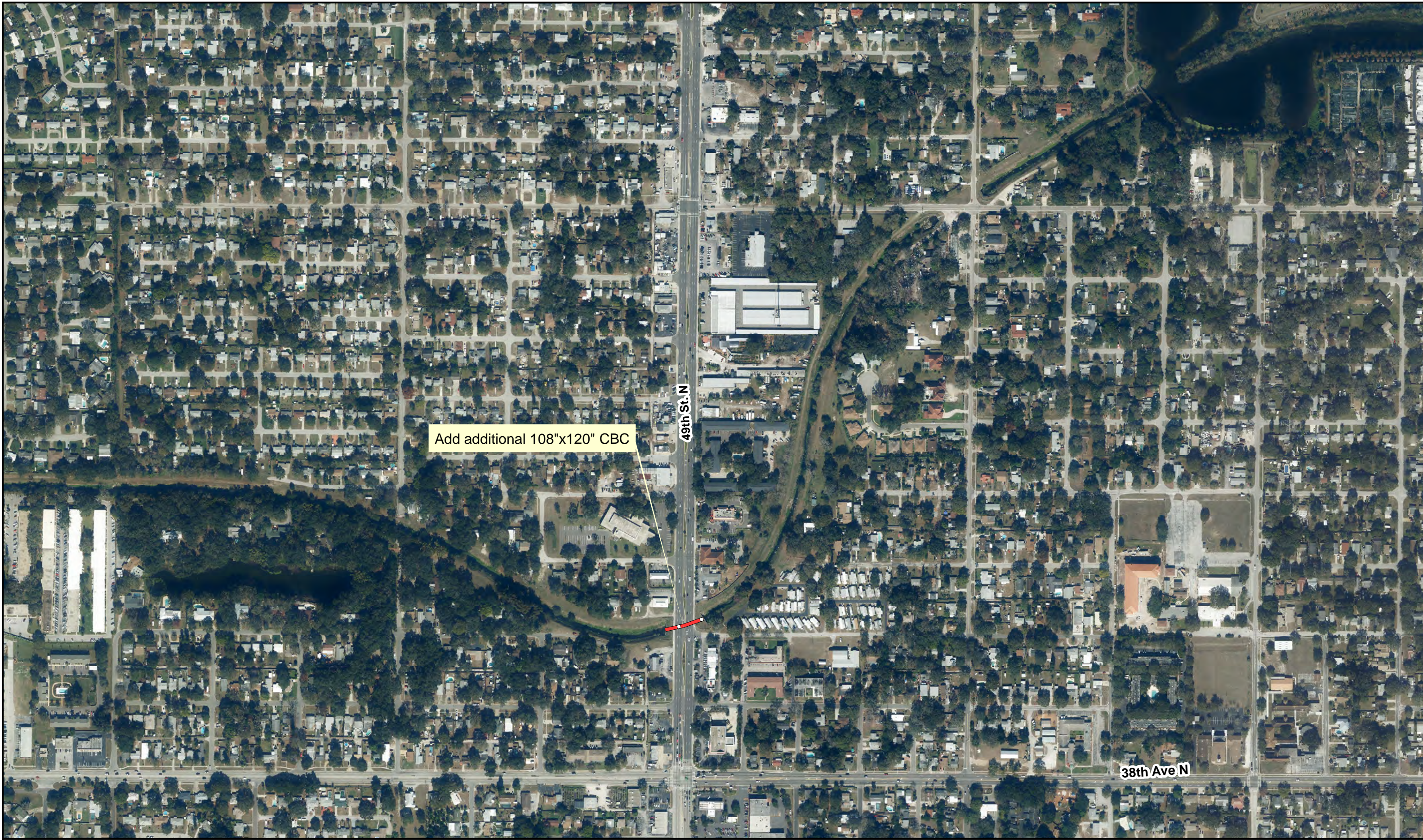
Add additional 84"x120" CBC

34th St N

FC - 3



0 150 300 Feet

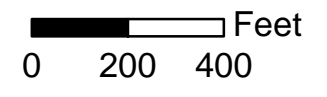


Add additional 108"x120" CBC

49th St. N

38th Ave N

FC - 4







CHANNEL 1

Add additional 84"x120" CBC

Add additional 108"x120" CBC

49th St. N

34th St. N



FC - 3 AND FC - 4

0 250 500 Feet



CHANNEL 50

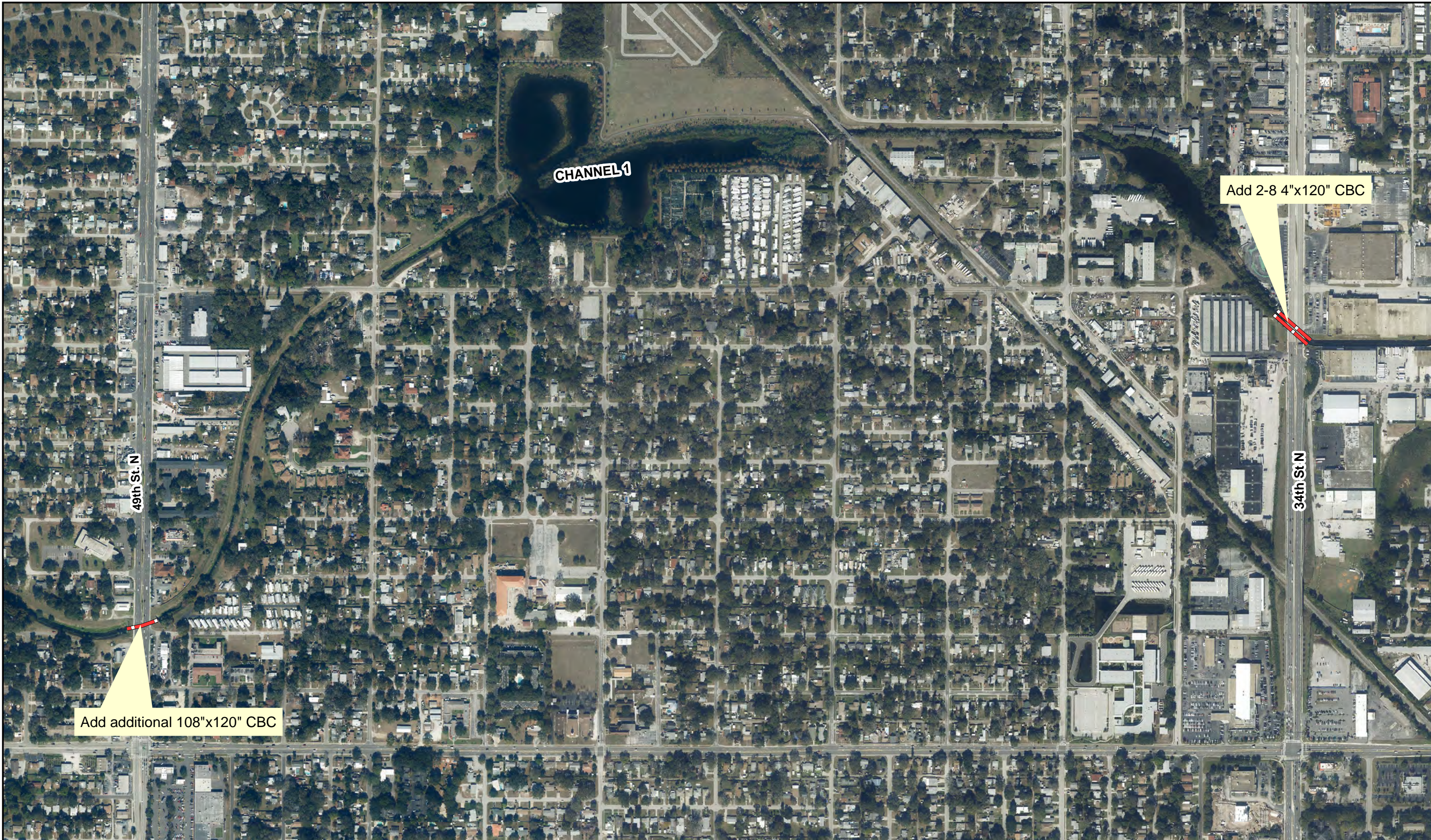
Add 2- 84"x120" CBC

34th St N

FC - 3A



0 100 200 Feet



CHANNEL 1

Add 2-8 4"x120" CBC

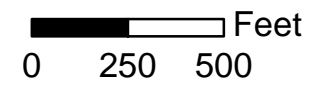
Add additional 108"x120" CBC

49th St. N

34th St. N



FC - 3A AND FC - 4





66th St N

54th Ave N

Upgrade to 60" x 120" CBC

FC - 5



0 200 400 Feet



Excavate/Improve Ditch

Excavate/Improve Ditch

Remove culvert

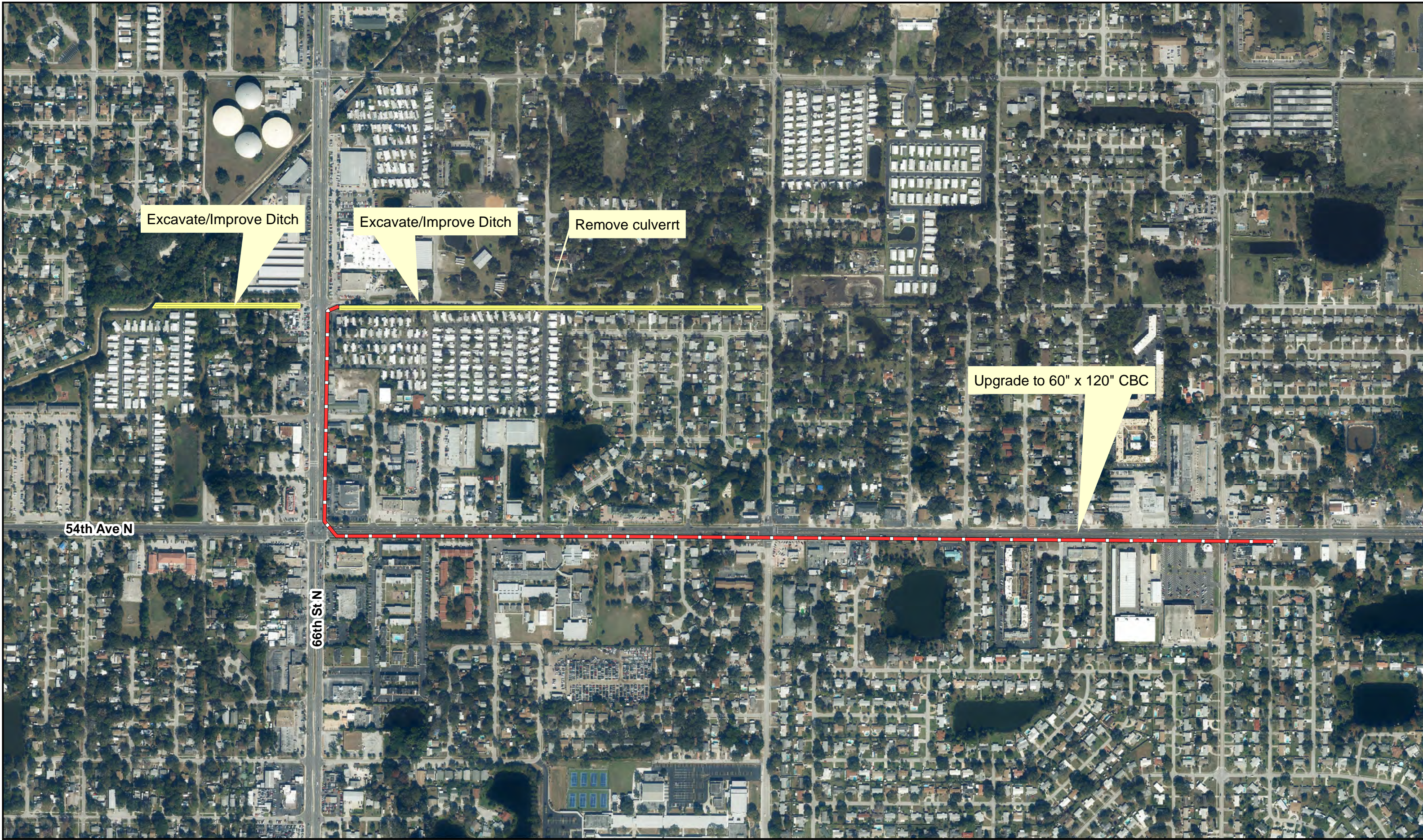
66th St N

54th Ave N

FC - 6



0 150 300 Feet



Excavate/Improve Ditch

Excavate/Improve Ditch

Remove culvert

Upgrade to 60" x 120" CBC

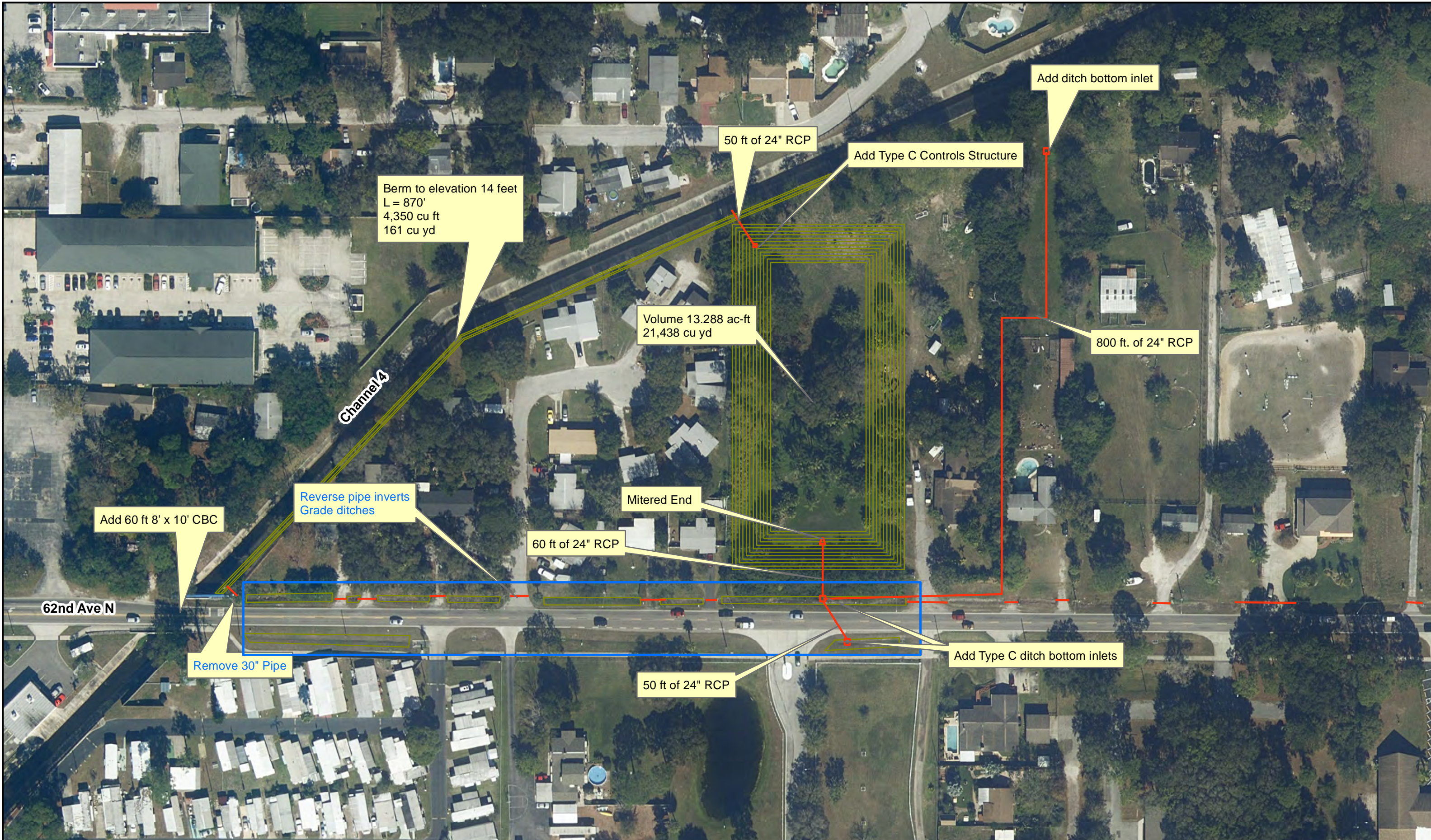
54th Ave N

66th St N

FC - 5 AND FC - 6



0 300 600 Feet



Berm to elevation 14 feet  
 L = 870'  
 4,350 cu ft  
 161 cu yd

Volume 13.288 ac-ft  
 21,438 cu yd

Add ditch bottom inlet

Add Type C Controls Structure

800 ft. of 24" RCP

Reverse pipe inverts  
 Grade ditches

Mitered End

60 ft of 24" RCP

Add 60 ft 8' x 10' CBC

Add Type C ditch bottom inlets

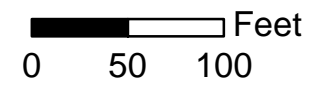
Remove 30" Pipe

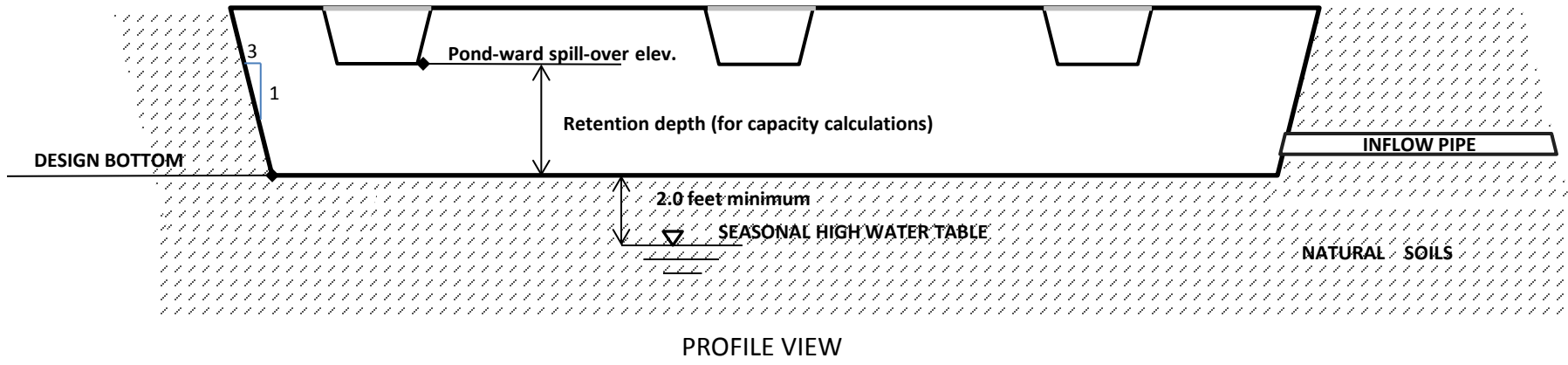
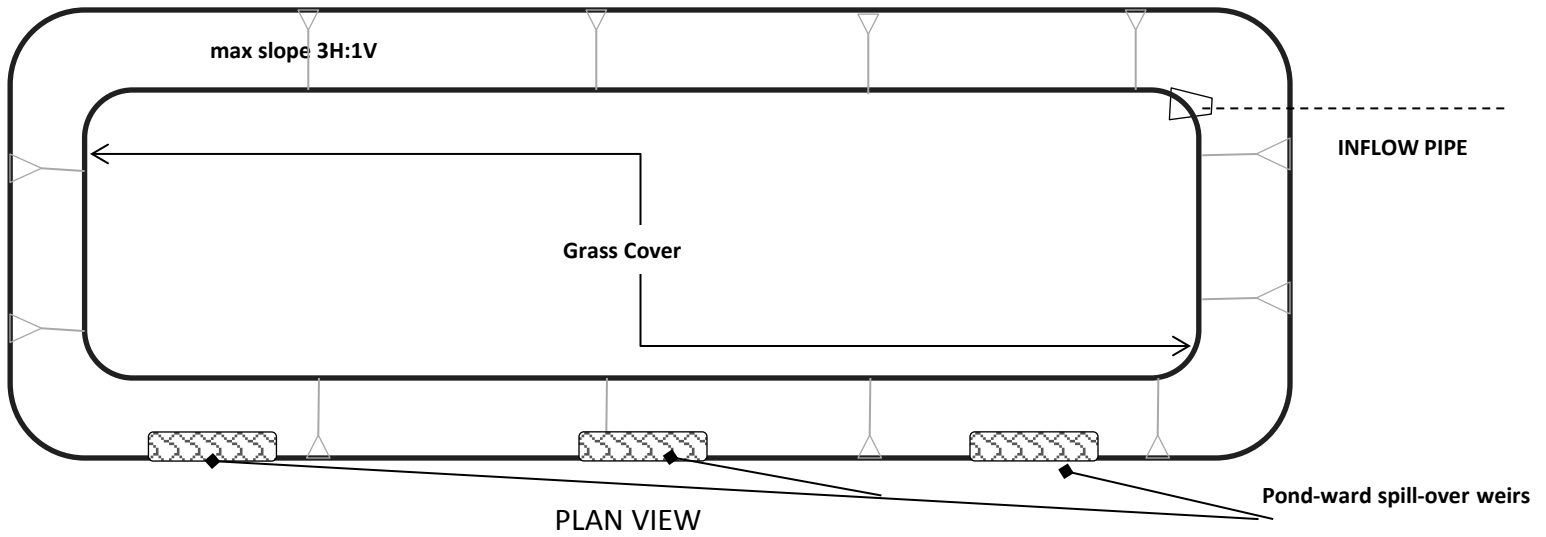
50 ft of 24" RCP

62nd Ave N

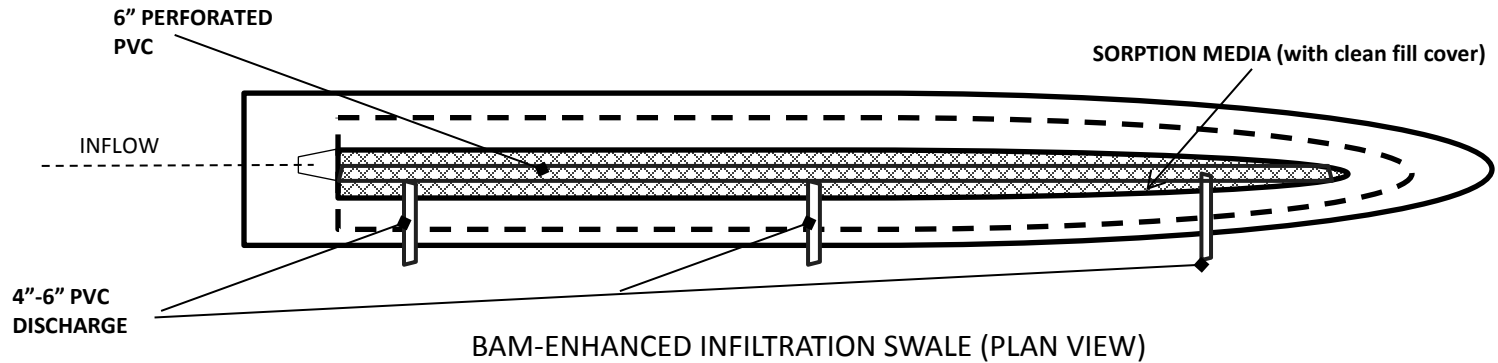
Channel 4

FC - 7

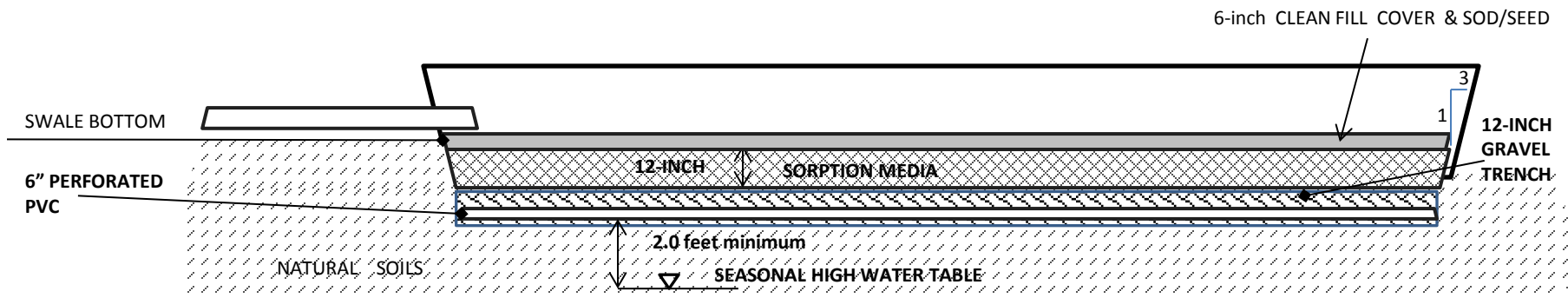








BAM-Enhanced Infiltration Swale (Plan View)



Infiltration Swale Profile View

**NOTES:**

1. EXCAVATE 30" TO INSTALL 12" GRAVEL TRENCH, 12" NUTIRENT SORPTION MEDIA WITH 6" SAND CAP ON SWALE BOTTOM
2. STABILIZE DISTURBED AREAS WITH SOD

4"-6" PERF. PVC IN GRAVEL TRENCH (connect to existing stormpipe)

SORPTION MEDIA (with 6" clean fill cover)  
Grass Cover with Trees/Plantings (opt)

max slope 3H:1V

EXISTING STORM PIPE

Curb cut-outs

PLAN VIEW

6-inch CLEAN FILL COVER & SOD/SEED

DESIGN BOTTOM

Curb cuts

1.0' retention depth (for capacity calculations)

12-INCH

SORPTION MEDIA

12-INCH GRAVEL TRENCH  
4"-6" PERF. PIPE

EXISTING STORM PIPE

2.0 feet minimum

SEASONAL HIGH WATER TABLE

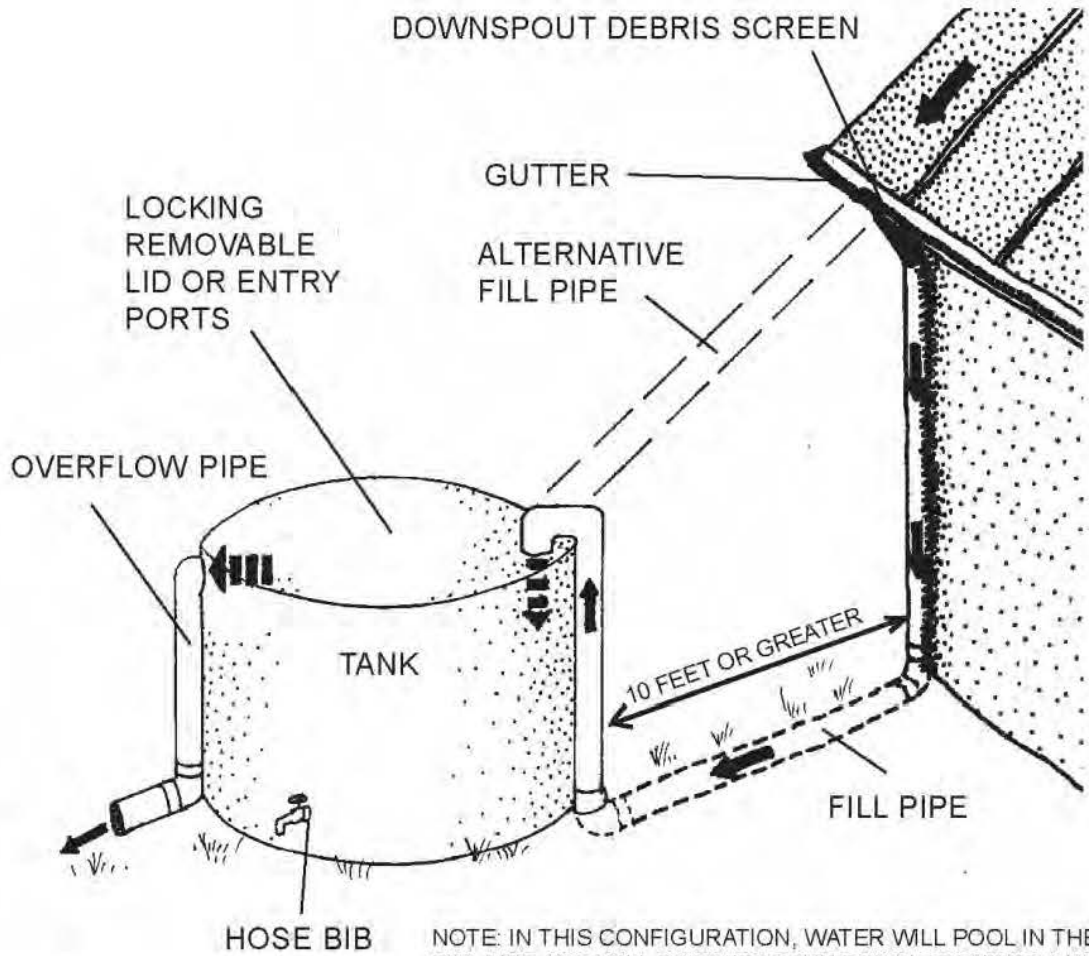
PROFILE VIEW



Joe's Creek Watersheds  
BMP Alternatives Analysis

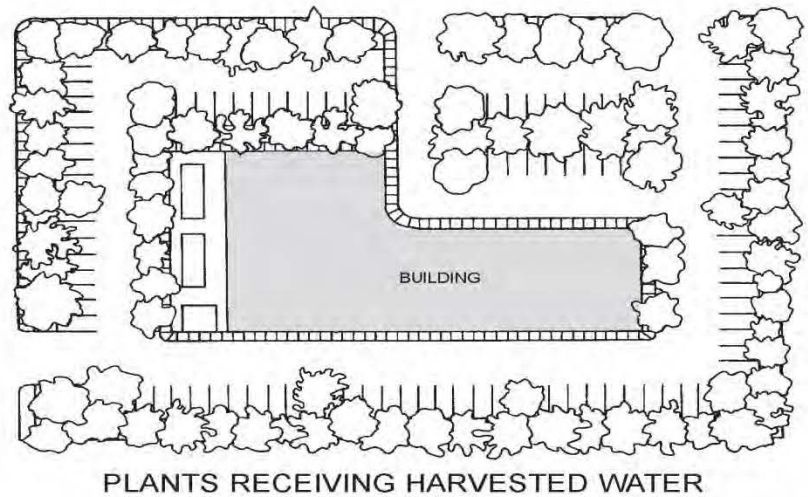
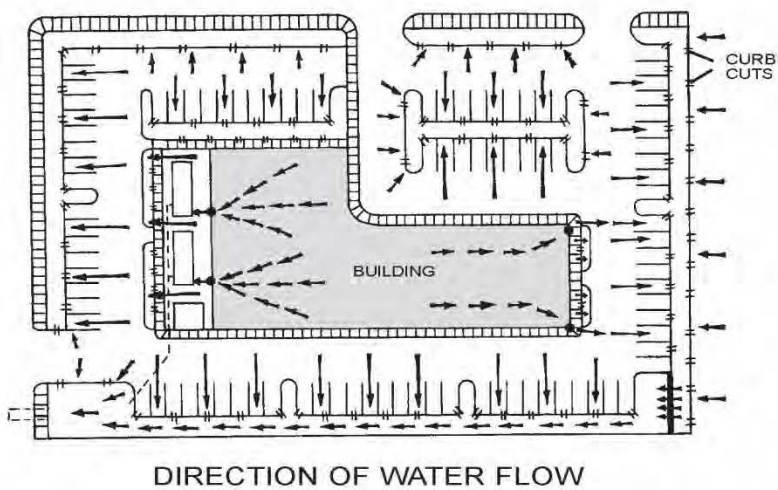
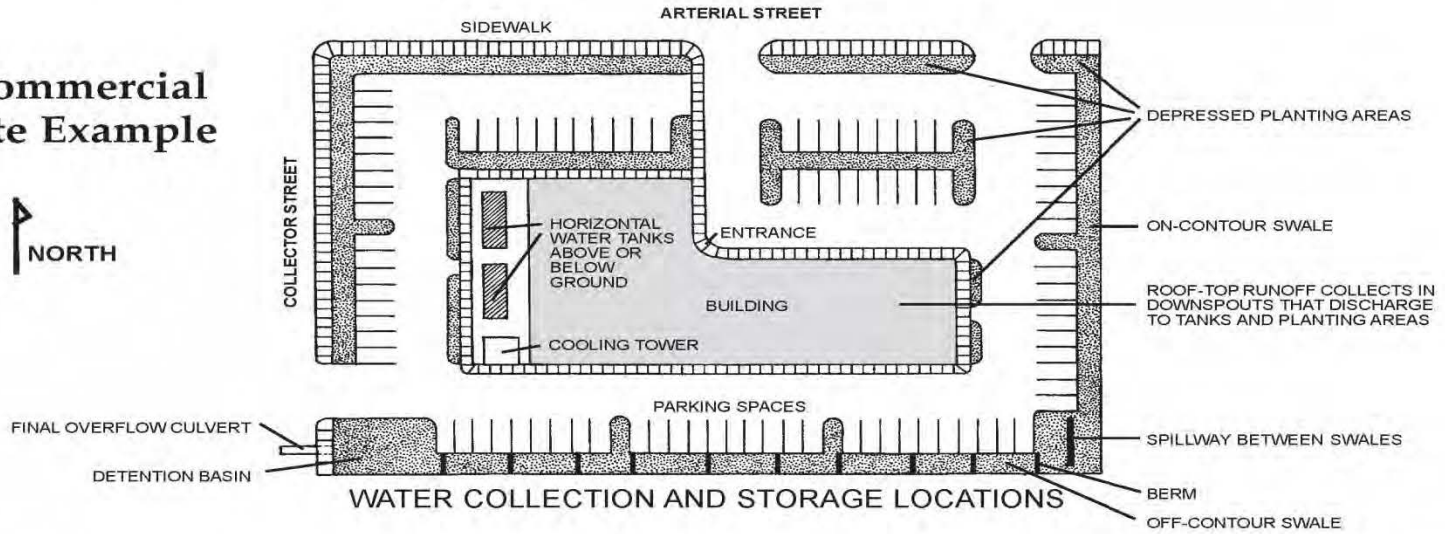
Median Landscaped Bio-filtration

Figure A-3

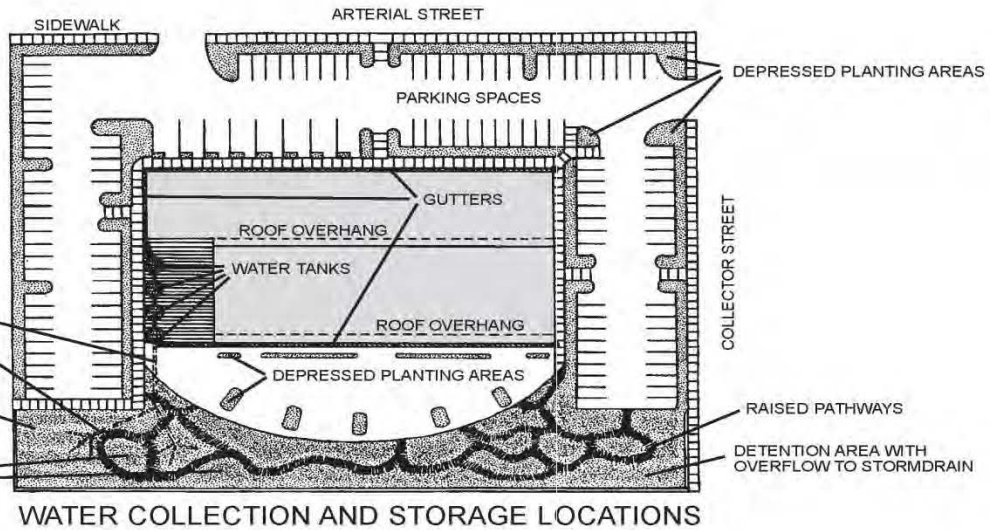


NOTE: IN THIS CONFIGURATION, WATER WILL POOL IN THE U-SHAPED FILL PIPE AND WILL BACKUP IN THE DOWN-SPOUT TO A HEIGHT EQUAL TO THE HEIGHT OF WATER IN THE TANK. INSTALL WATER-TIGHT SEALS TO PREVENT LEAKS.

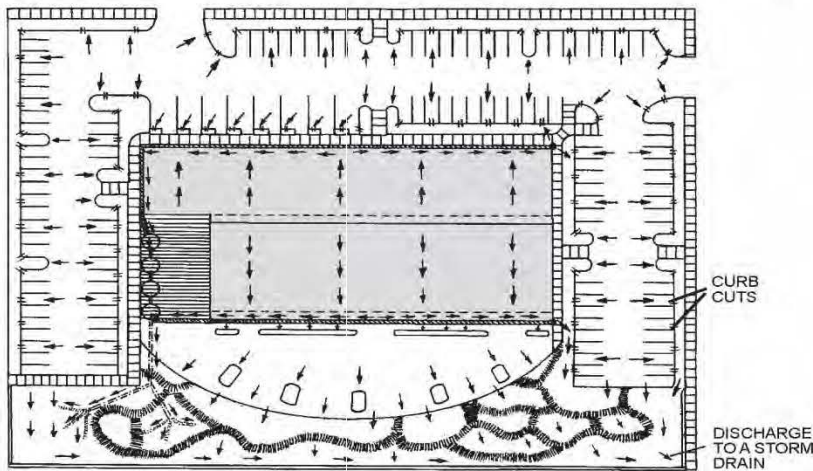
# Commercial Site Example



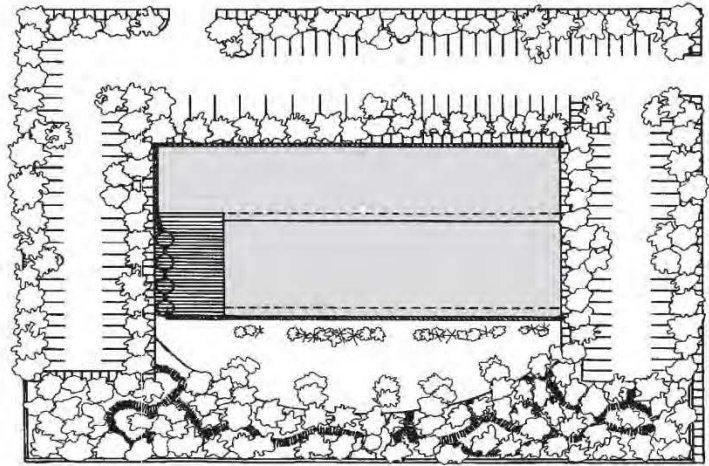
# Public Building Example



WATER COLLECTION AND STORAGE LOCATIONS



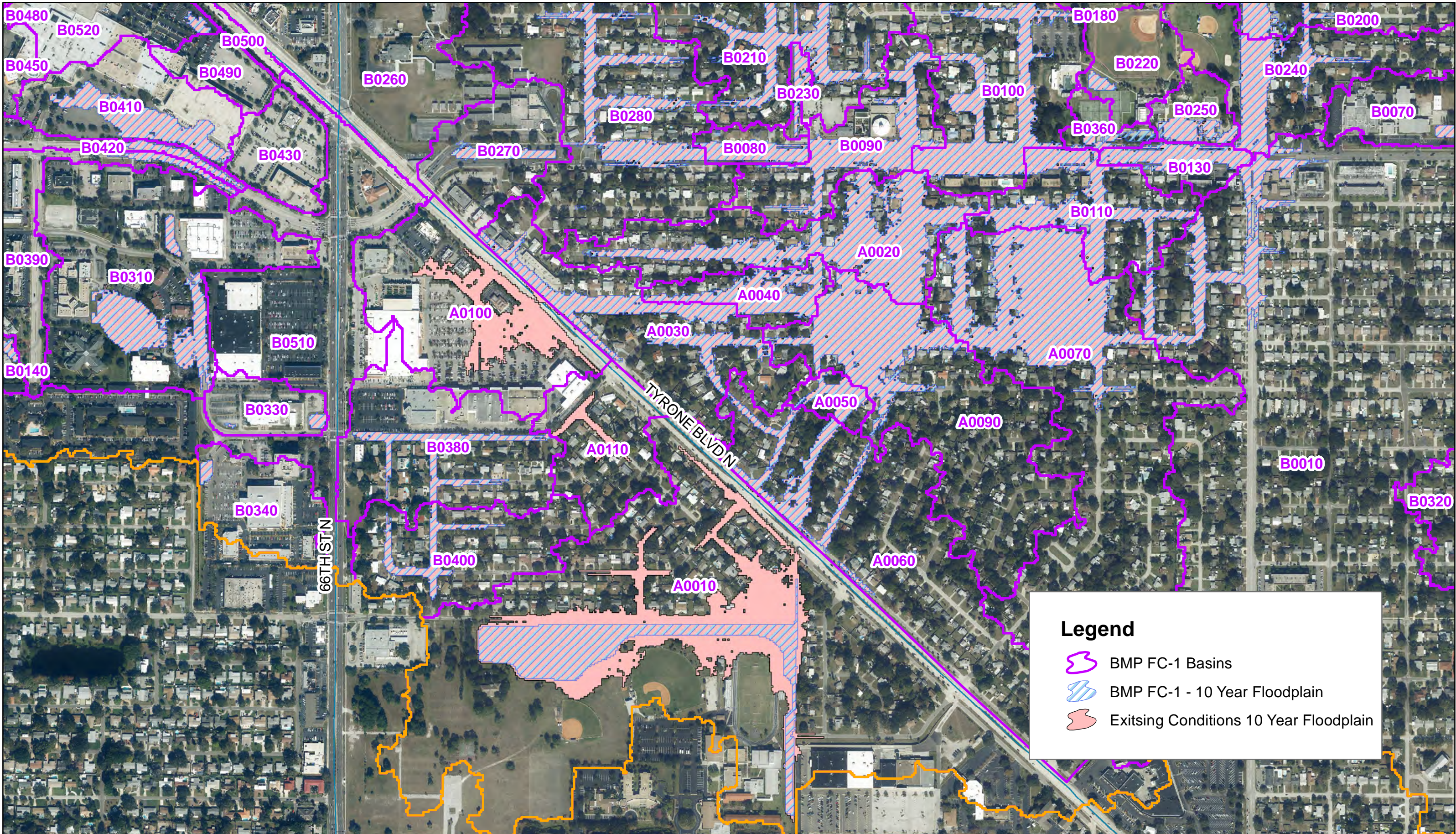
DIRECTION OF WATER FLOW



PLANTS RECEIVING HARVESTED WATER

# **Appendix B**

## **BMP Model Inundation Results**



**Joe's Creek Watershed  
BMP FC-1**

BOUNDARY

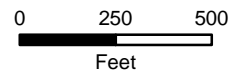
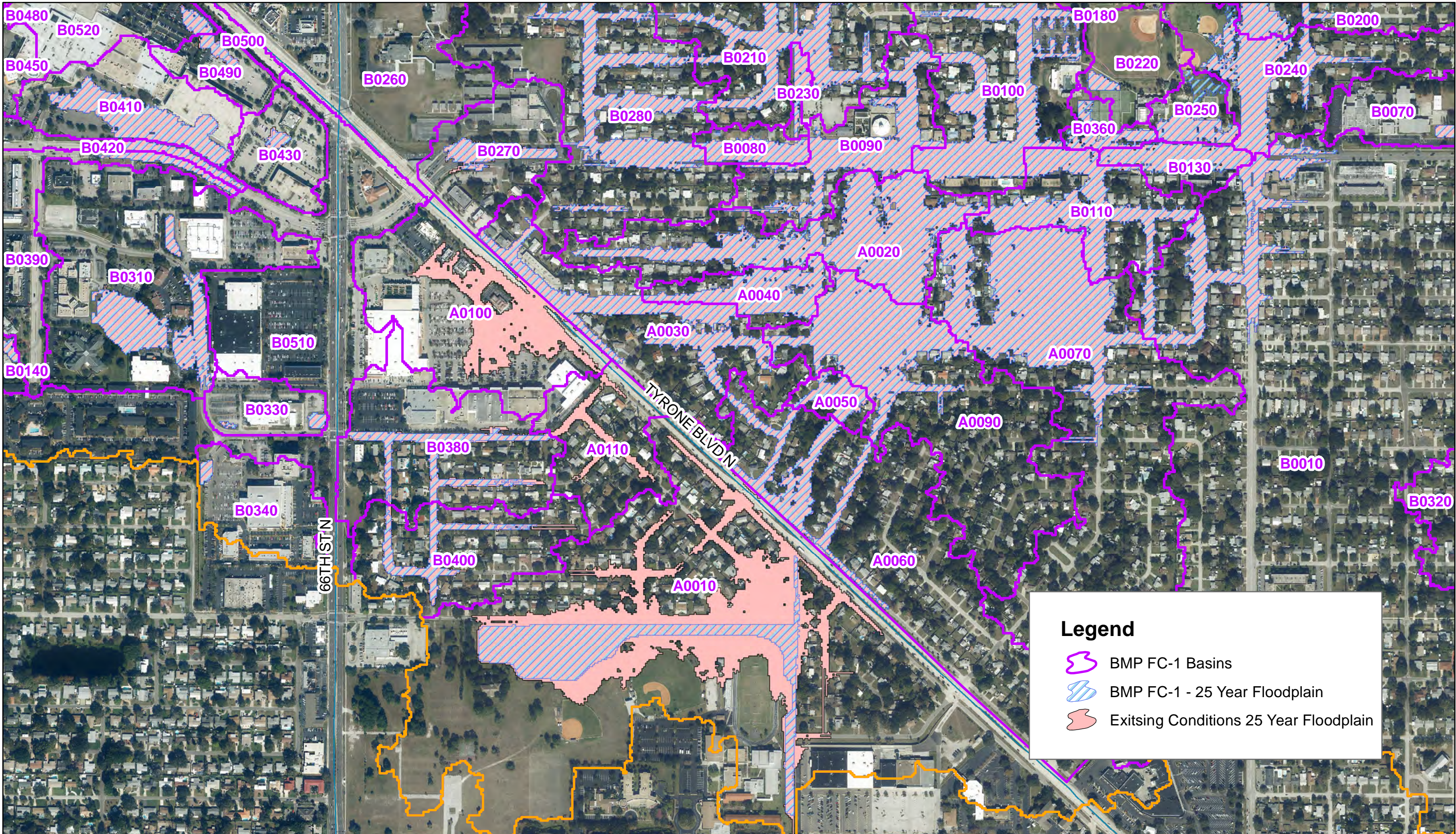


Figure B-1





BOUNDARY



### Joe's Creek Watershed BMP FC-1

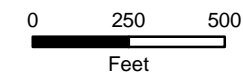
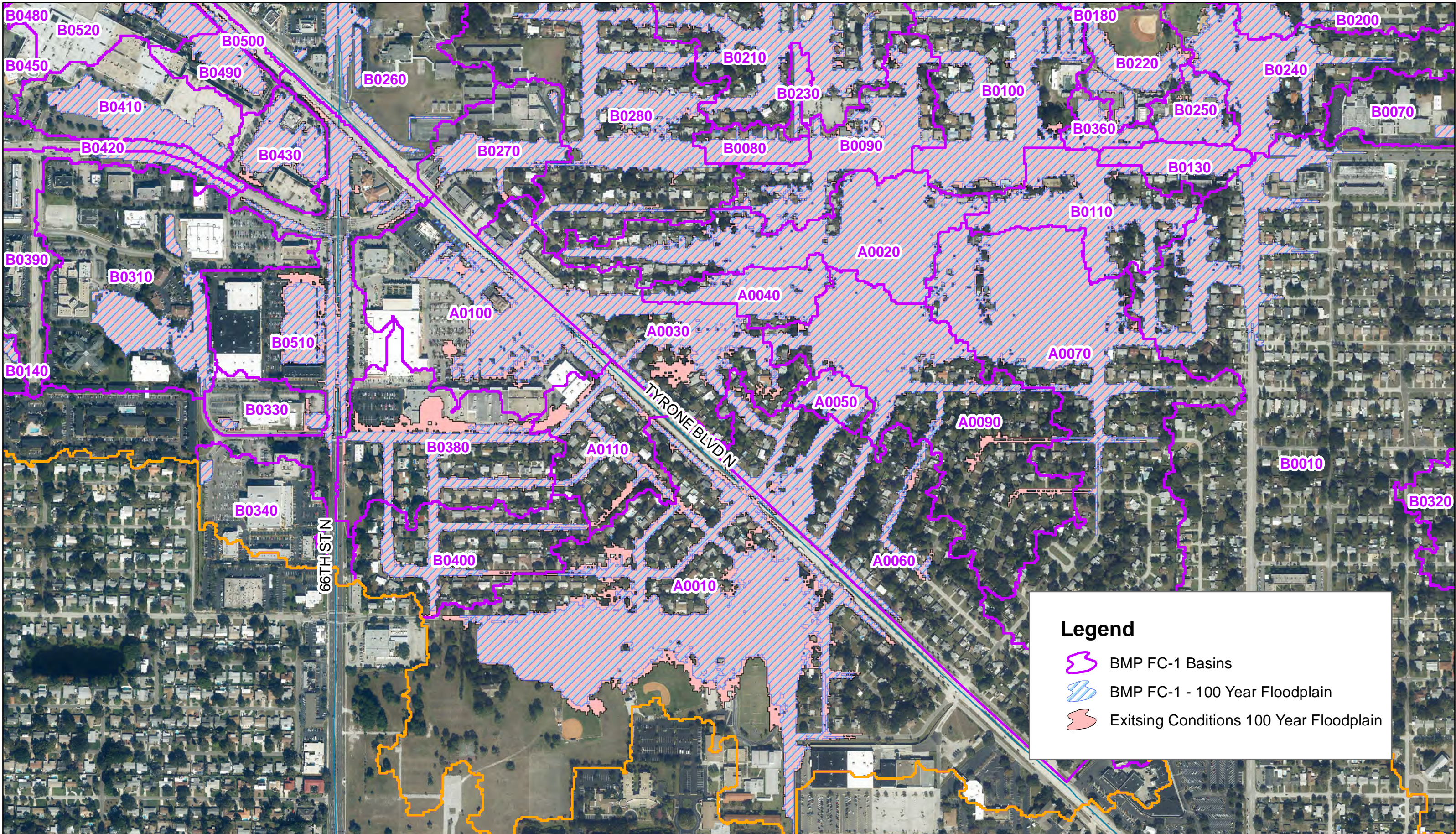


Figure B-2







**Joe's Creek Watershed  
BMP FC-1**

BOUNDARY

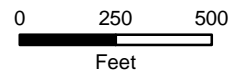
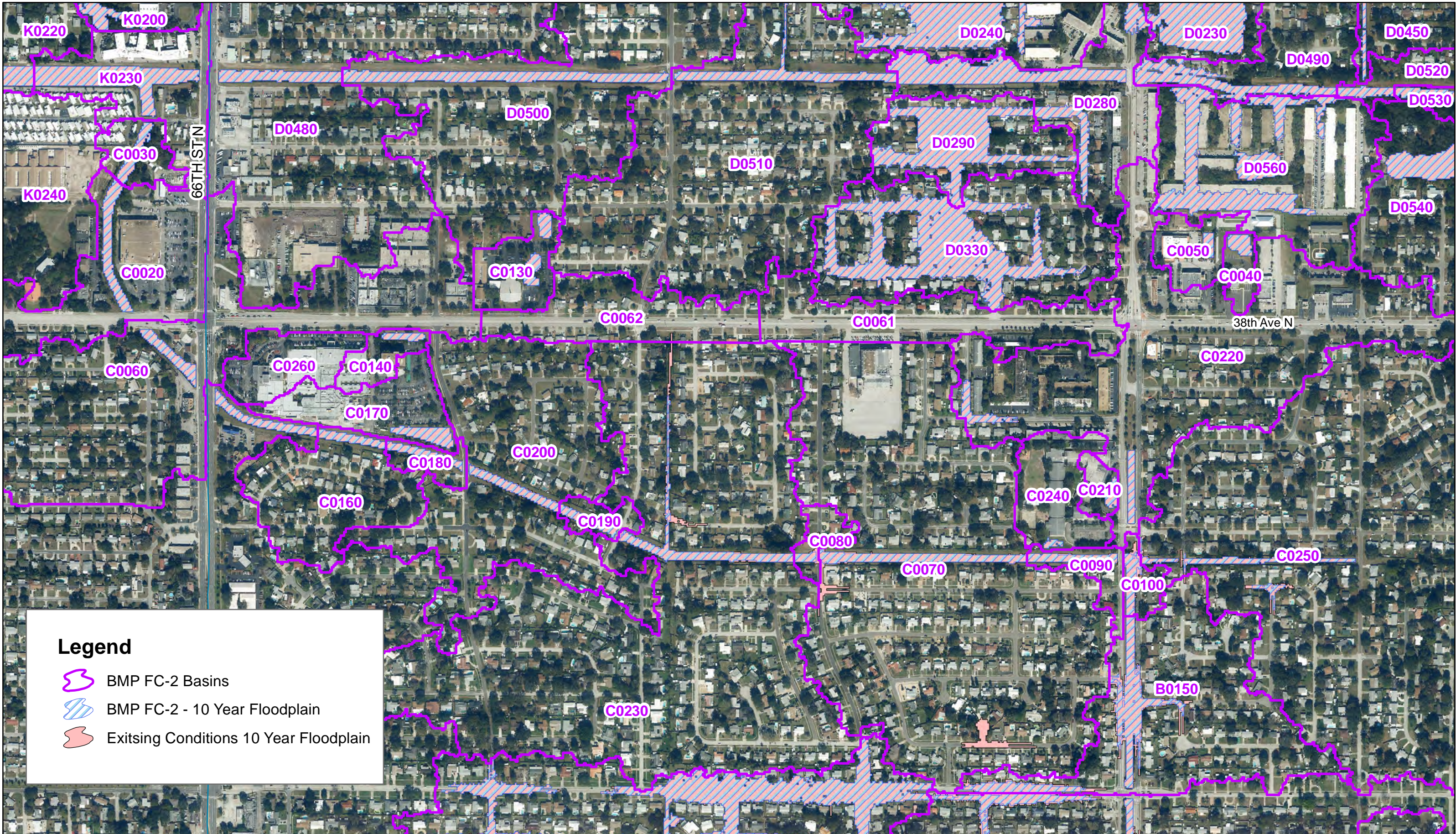





Figure B-3





**Legend**

-  BMP FC-2 Basins
-  BMP FC-2 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-2**

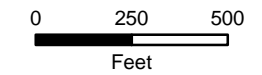
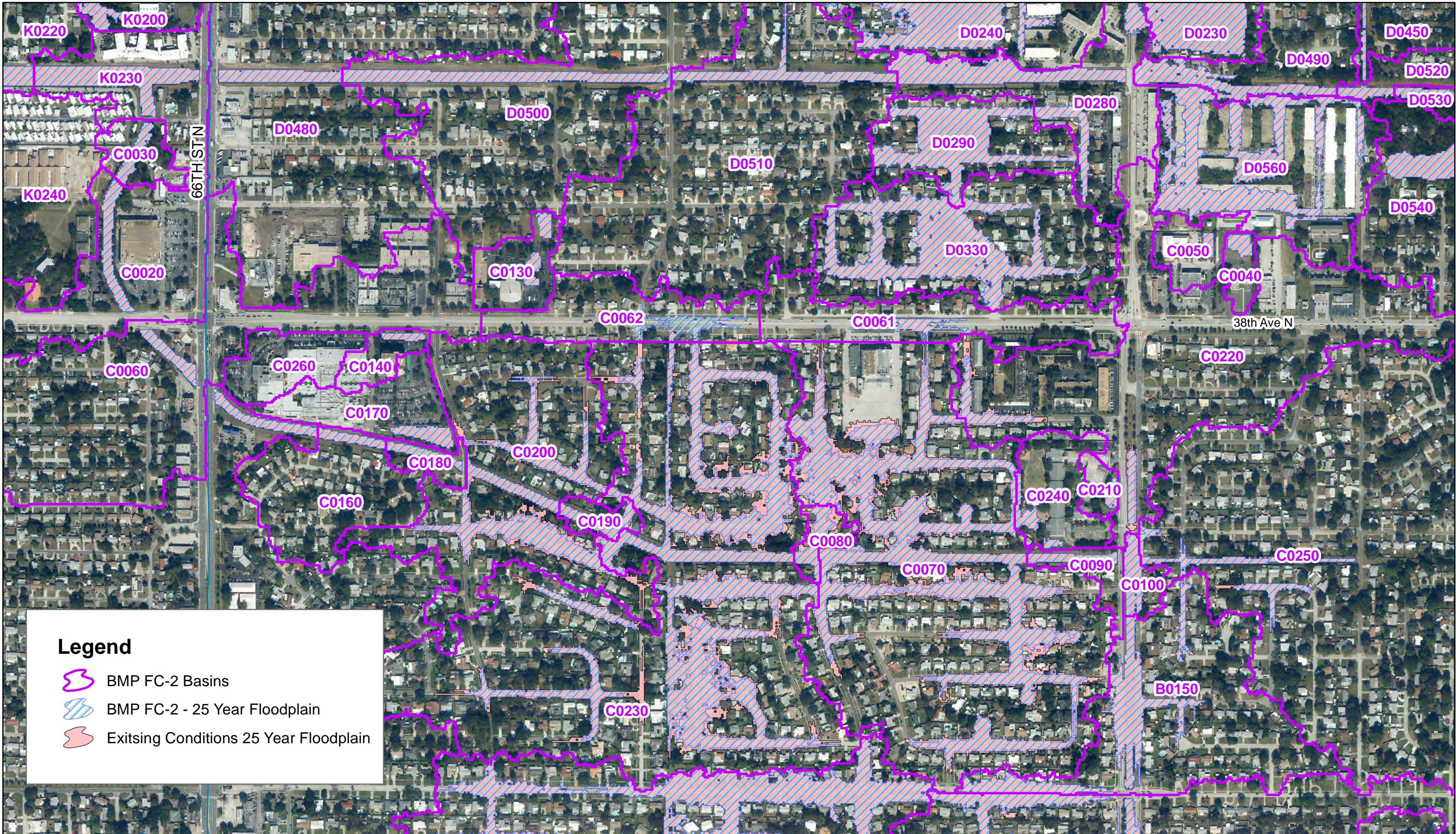





Figure B-4

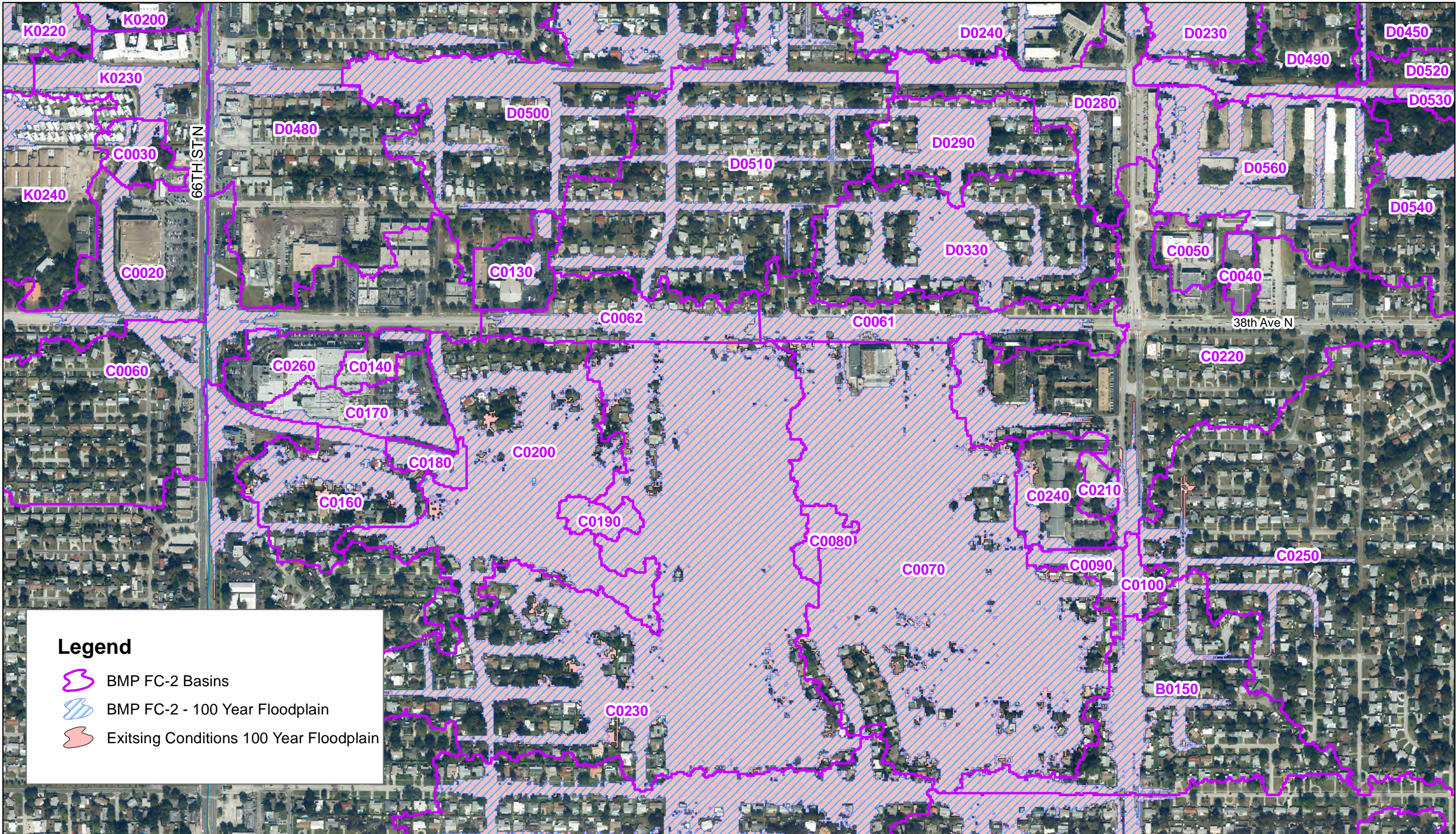







**Legend**

-  BMP FC-2 Basins
-  BMP FC-2 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

**Joe's Creek Watershed  
BMP FC-2**



**Legend**

-  BMP FC-2 Basins
-  BMP FC-2 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-2**

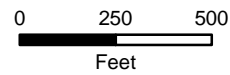
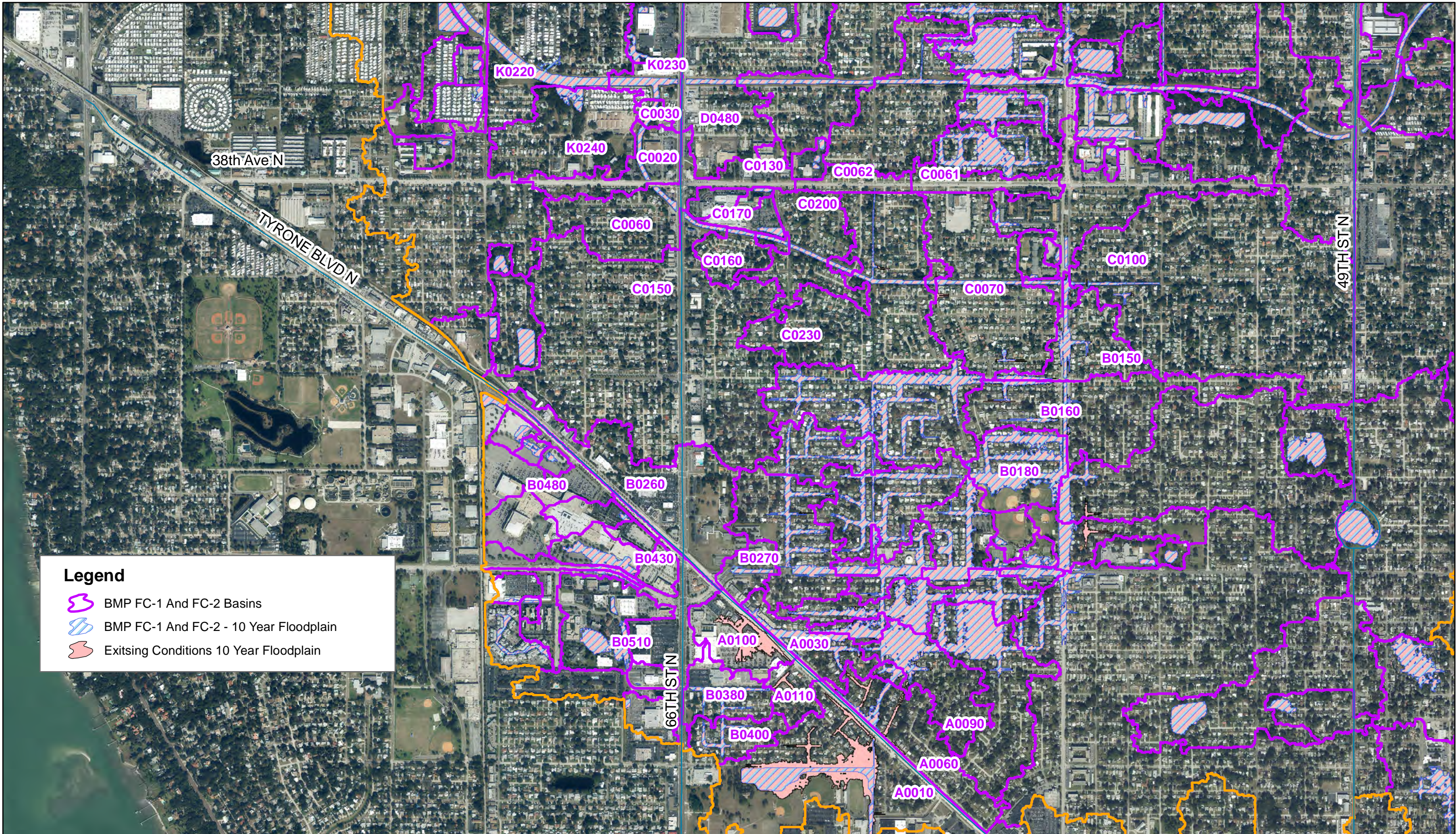





Figure B-6





**Legend**

-  BMP FC-1 And FC-2 Basins
-  BMP FC-1 And FC-2 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-1 And FC-2**

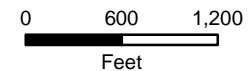
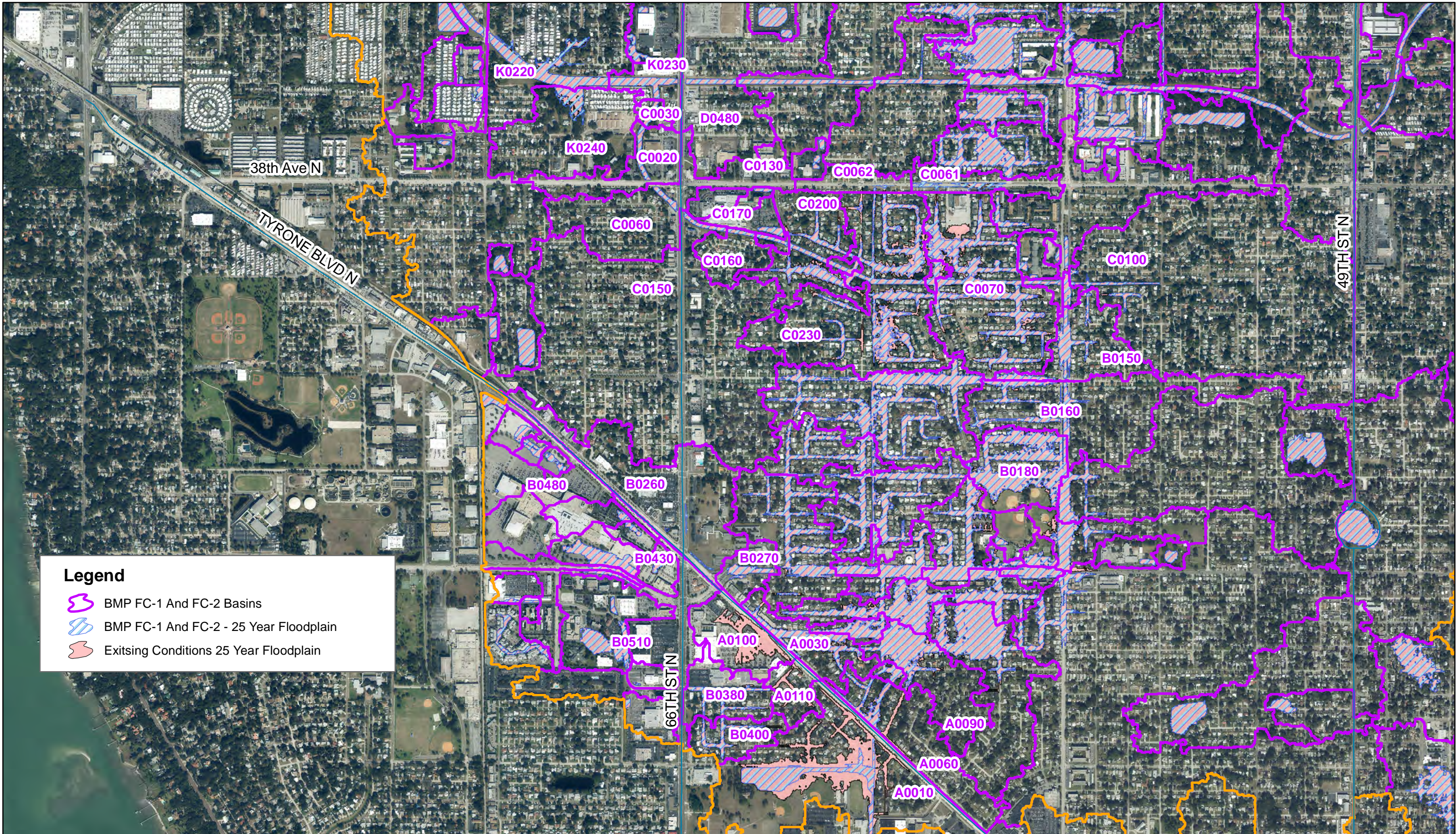





Figure B-7





**Legend**

-  BMP FC-1 And FC-2 Basins
-  BMP FC-1 And FC-2 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-1 And FC-2**

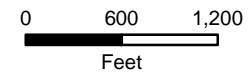
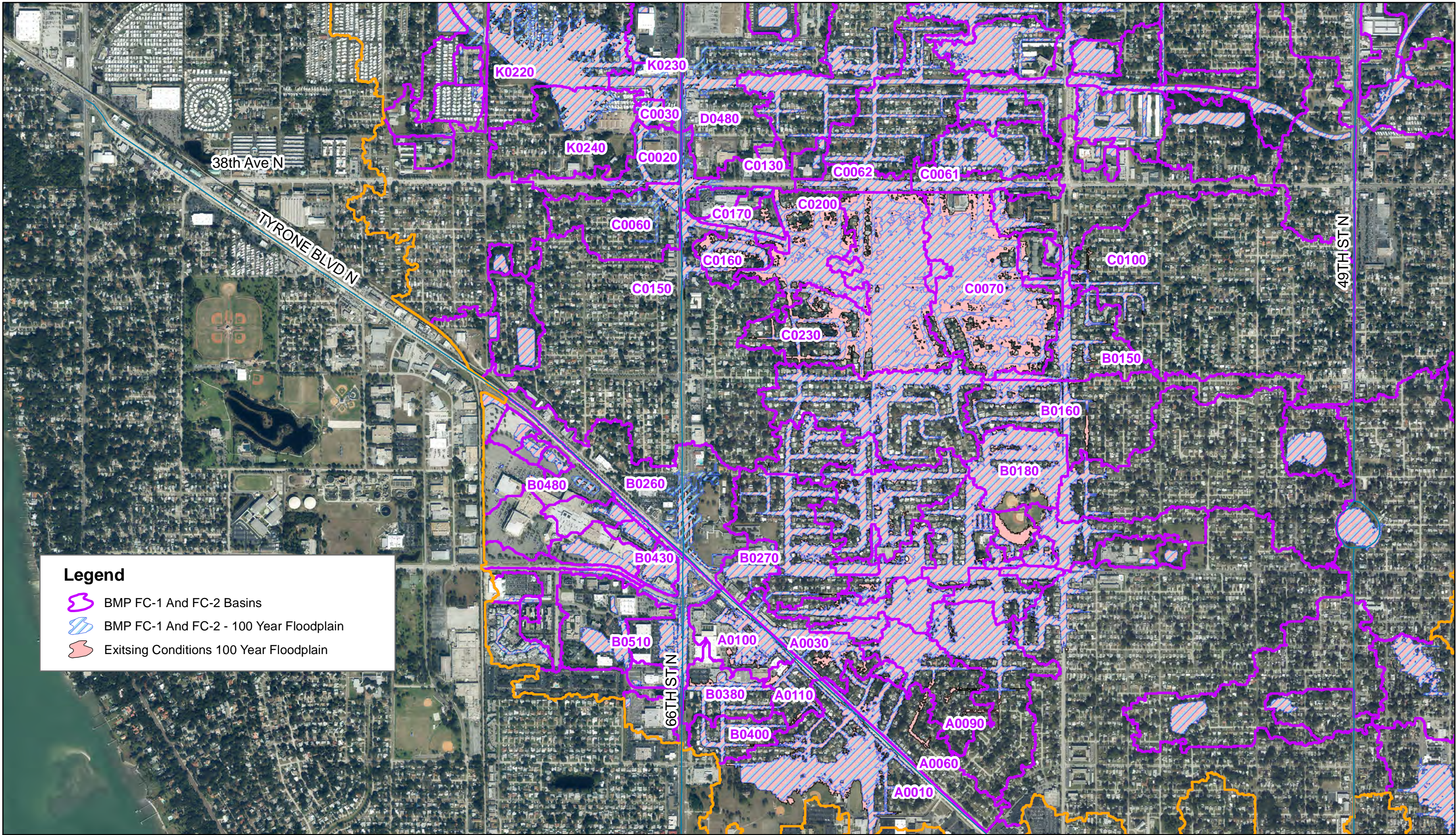





Figure B-8





**Legend**

-  BMP FC-1 And FC-2 Basins
-  BMP FC-1 And FC-2 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-1 And FC-2**

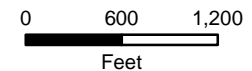
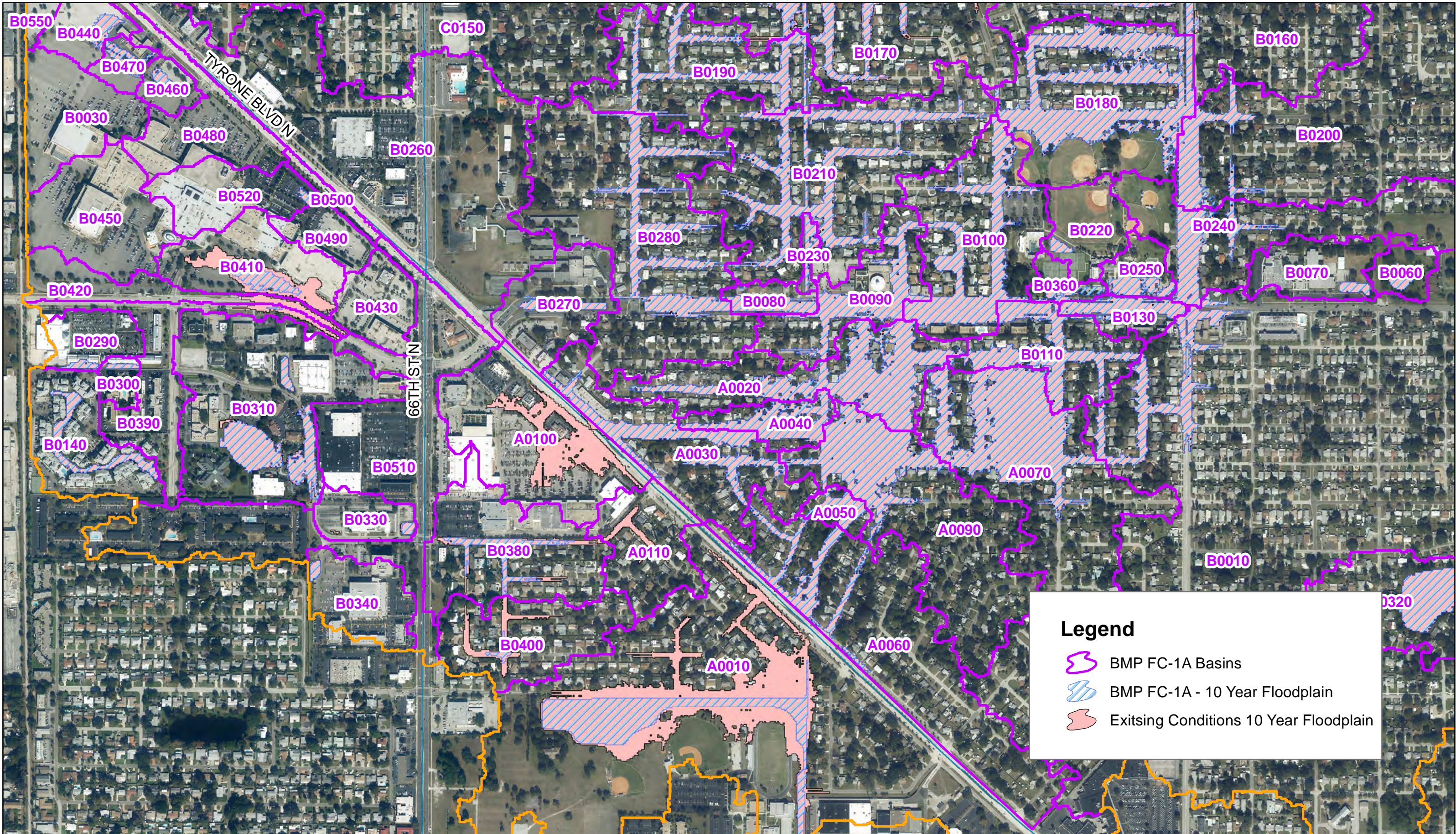





Figure B-9





**Legend**

-  BMP FC-1A Basins
-  BMP FC-1A - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-1A**

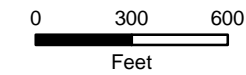
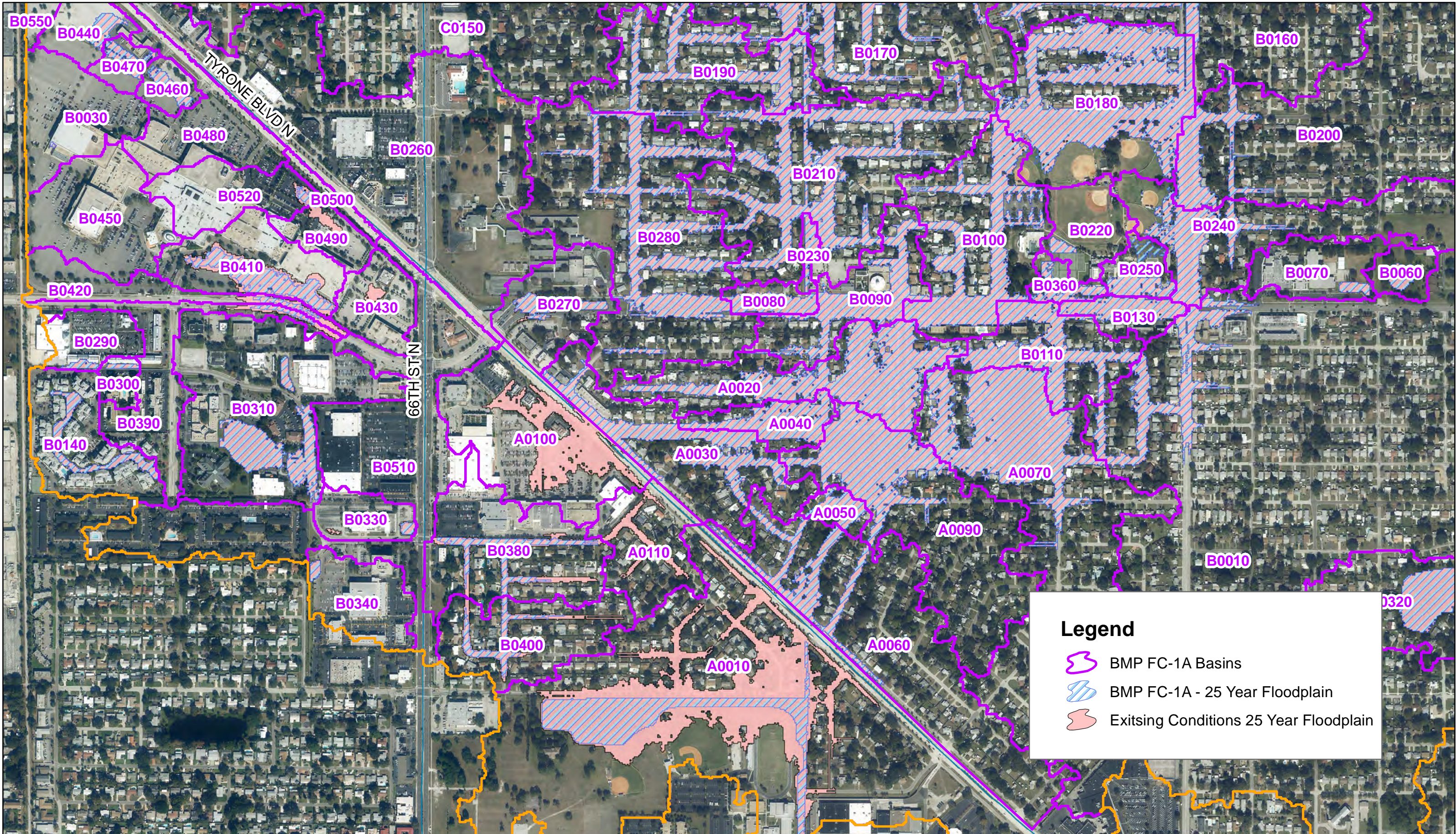


Figure B-10







**Joe's Creek Watershed  
BMP FC-1A**

BOUNDARY

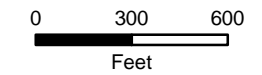
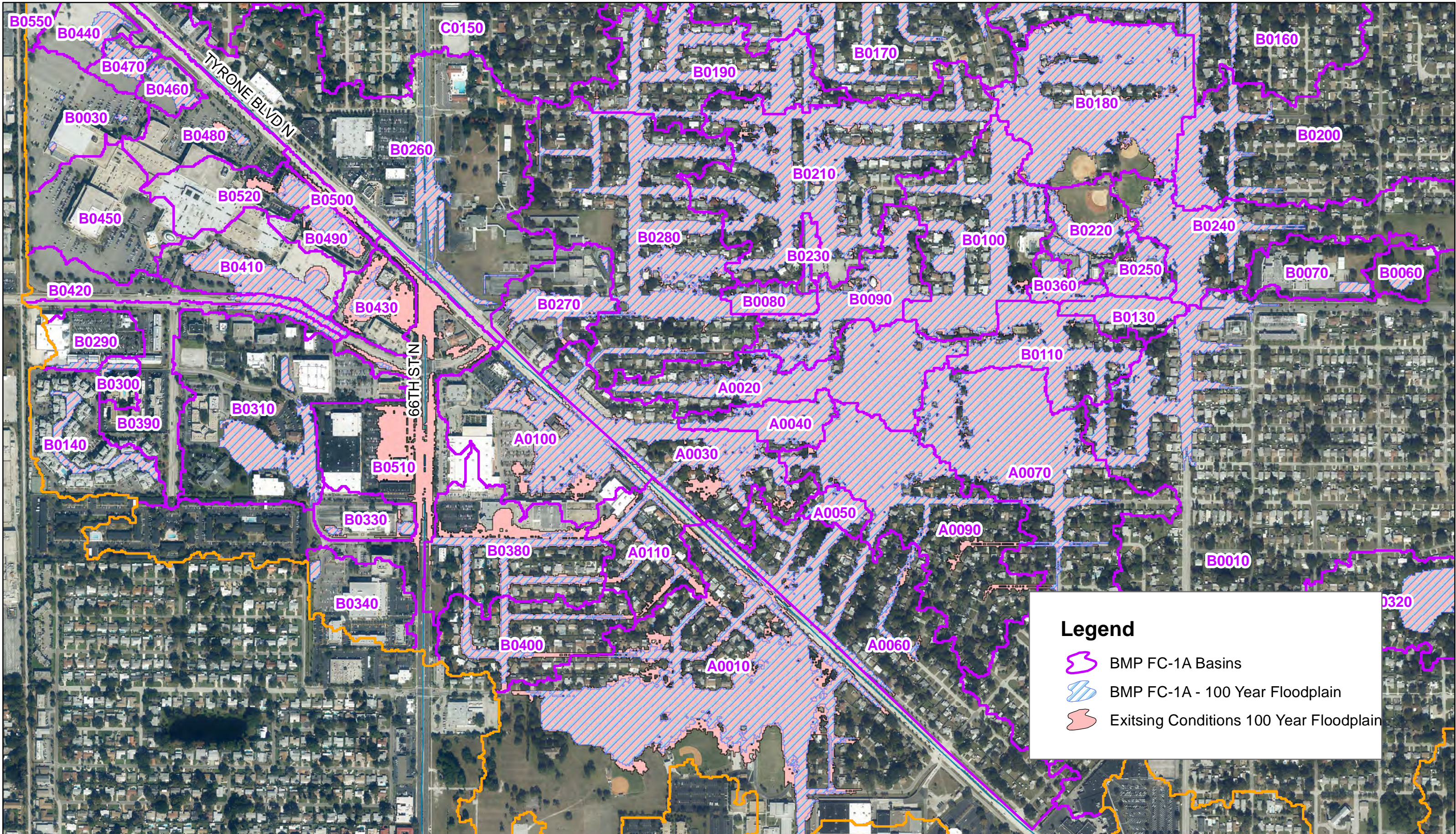





Figure B-11





**Legend**

-  BMP FC-1A Basins
-  BMP FC-1A - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



## Joe's Creek Watershed BMP FC-1A

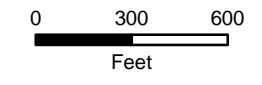
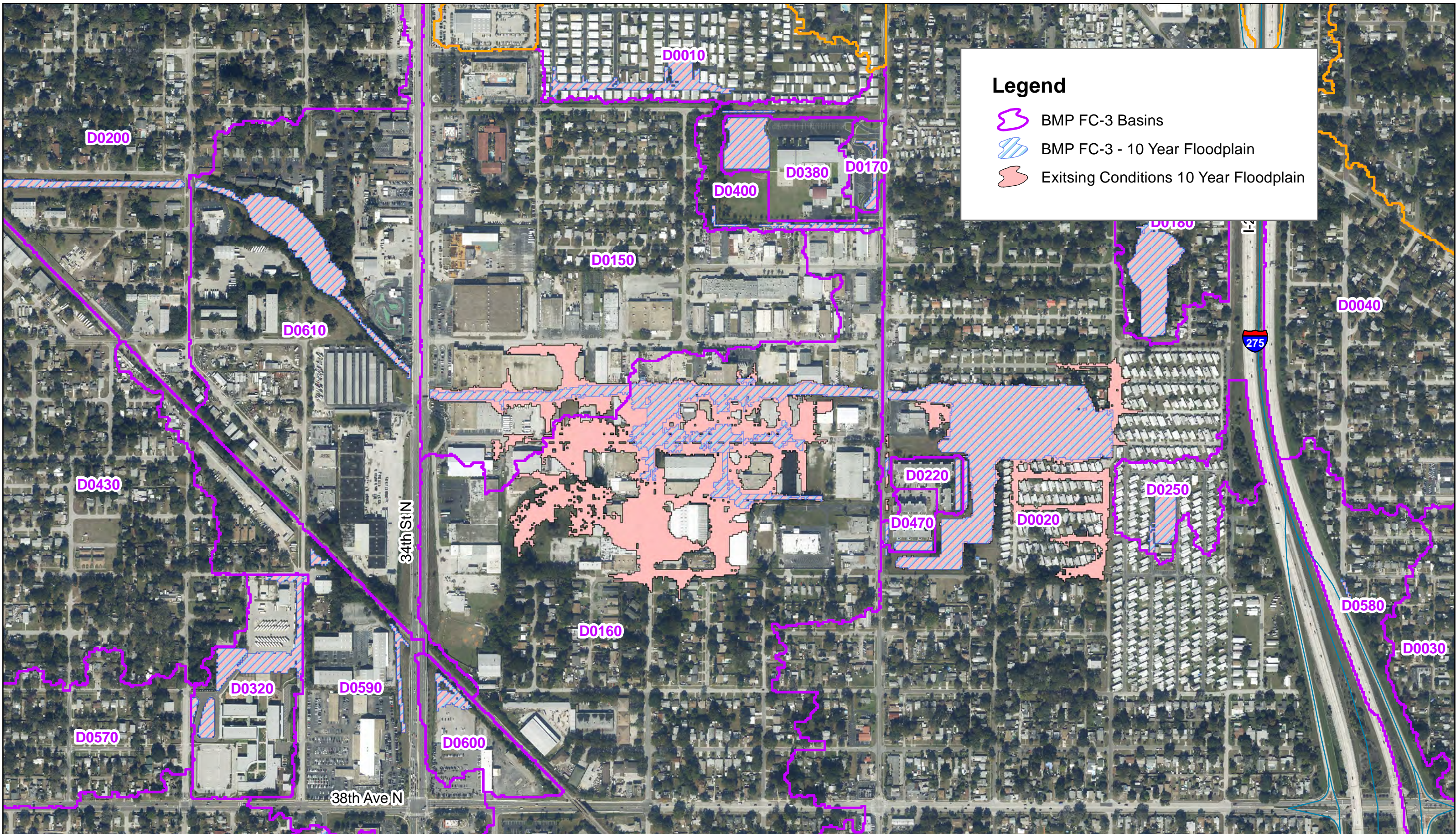





Figure B-12





**Legend**

-  BMP FC-3 Basins
-  BMP FC-3 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3**

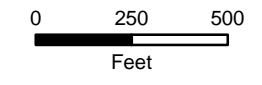
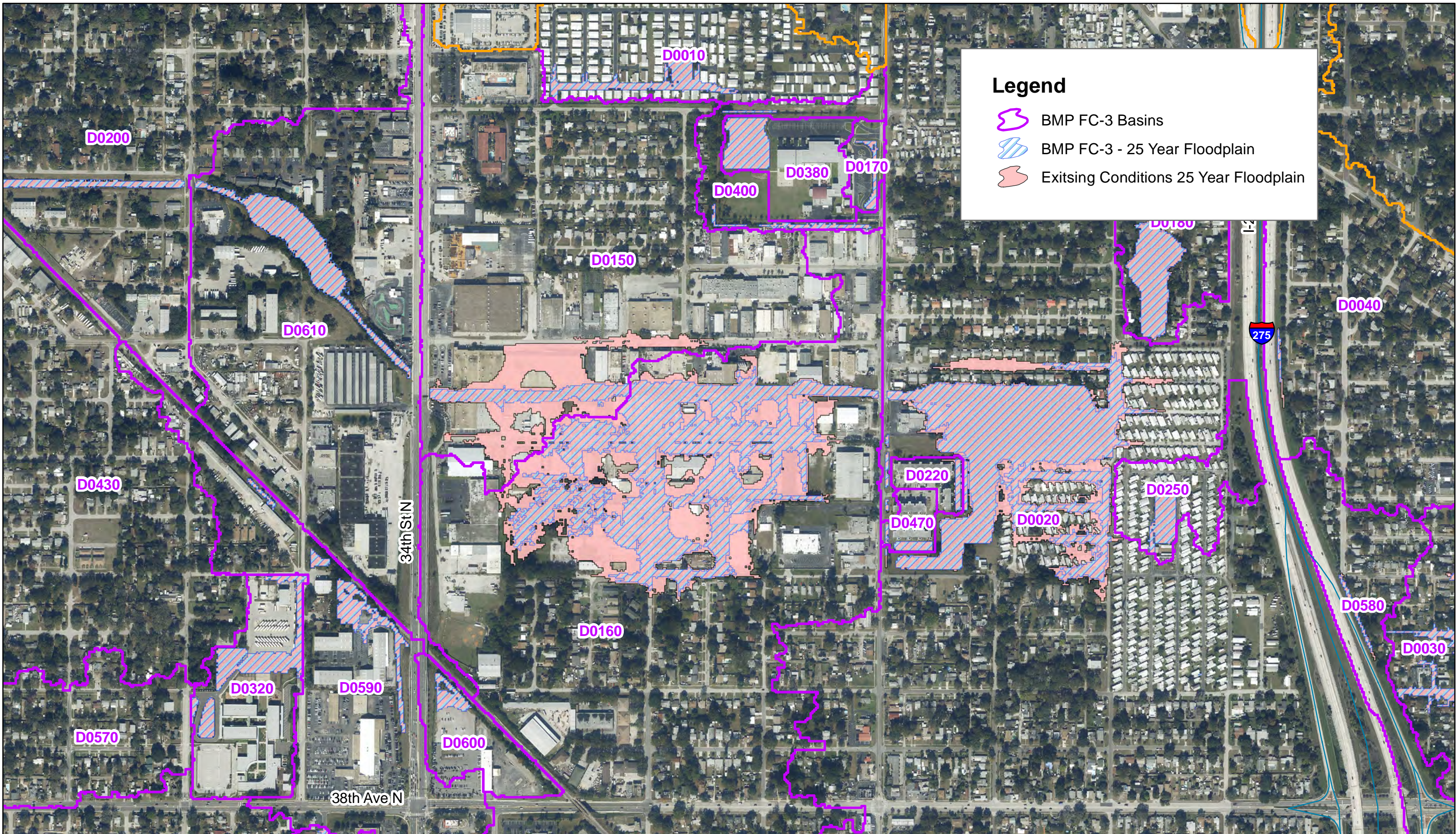




Figure B-13





**Legend**

-  BMP FC-3 Basins
-  BMP FC-3 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3**

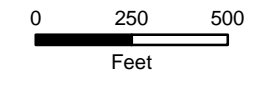
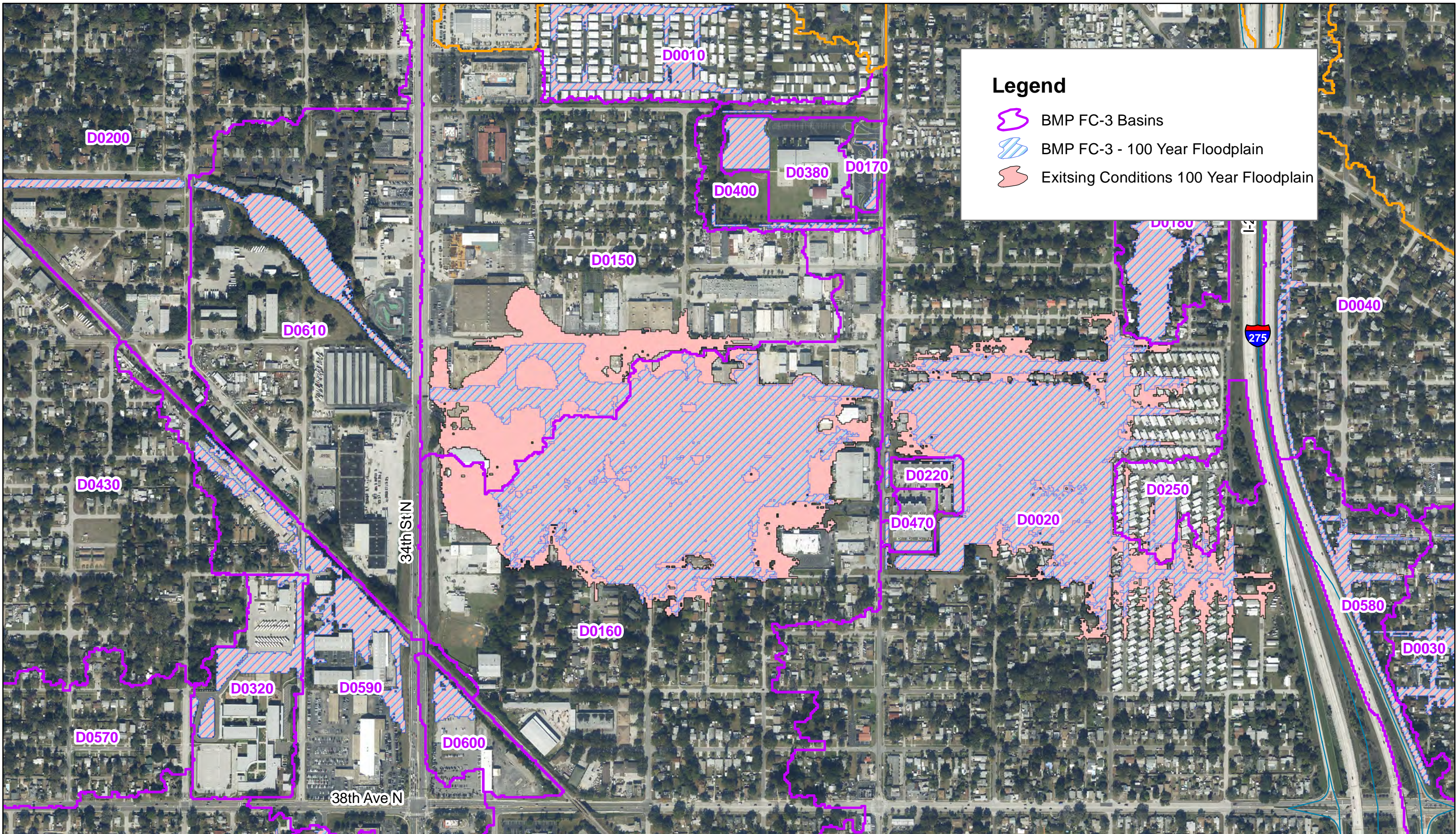





Figure B-14





**Legend**

-  BMP FC-3 Basins
-  BMP FC-3 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3**

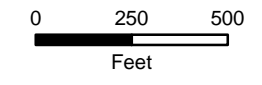
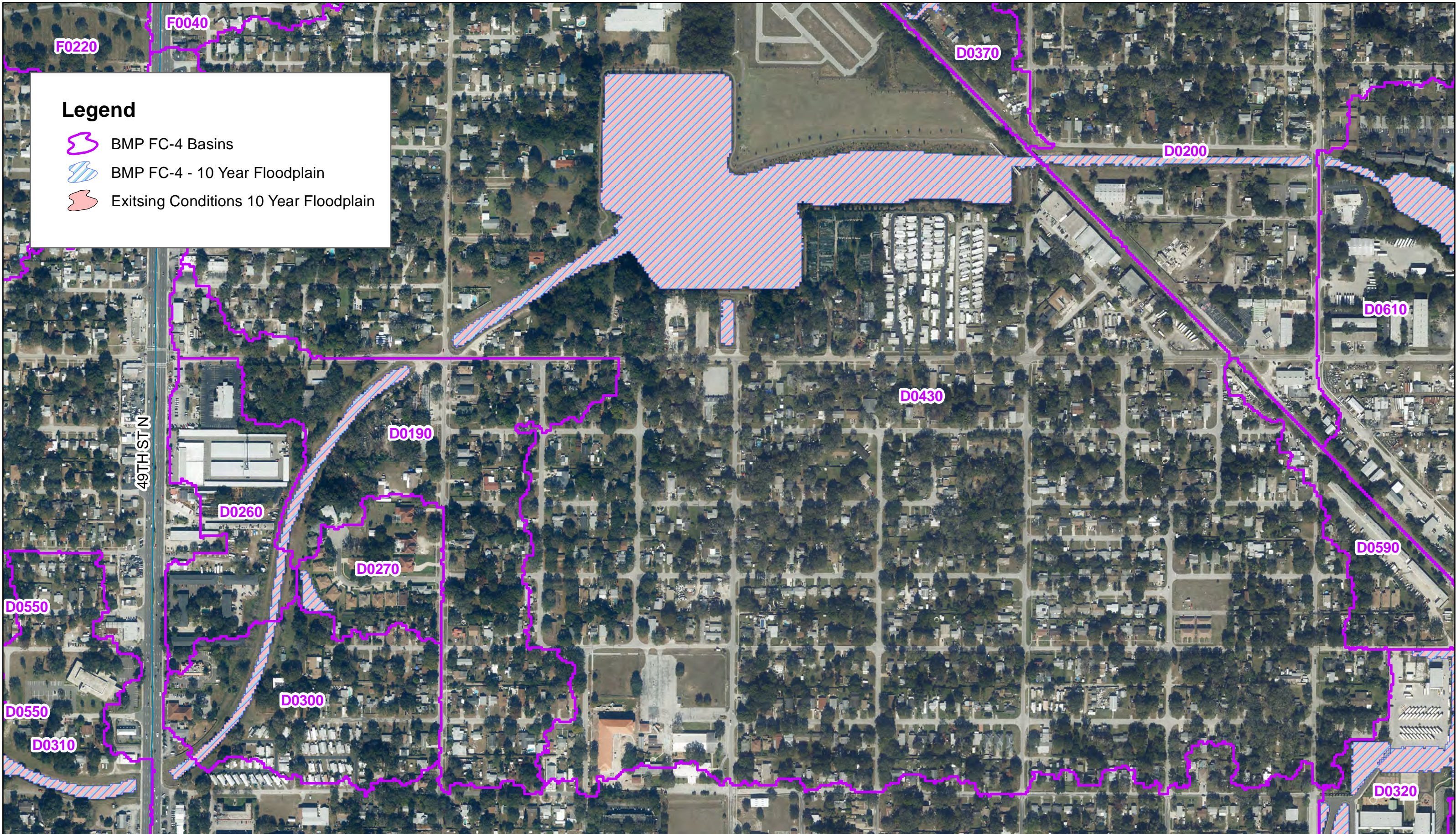





Figure B-15





**Legend**

-  BMP FC-4 Basins
-  BMP FC-4 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-4**

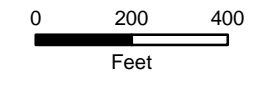
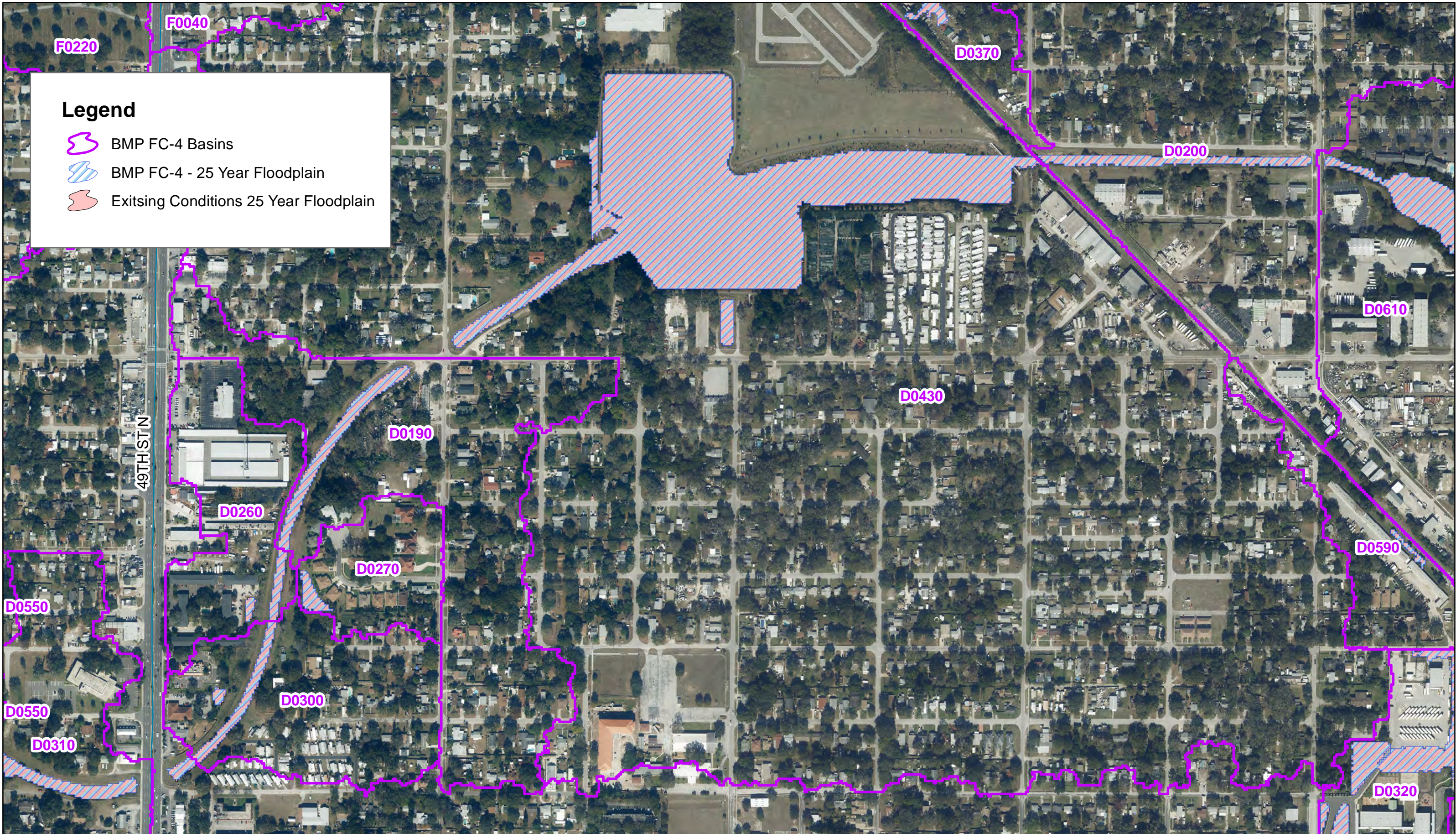





Figure B-16





**Legend**

-  BMP FC-4 Basins
-  BMP FC-4 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

**Joe's Creek Watershed  
BMP FC-4**

 BOUNDARY

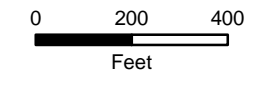
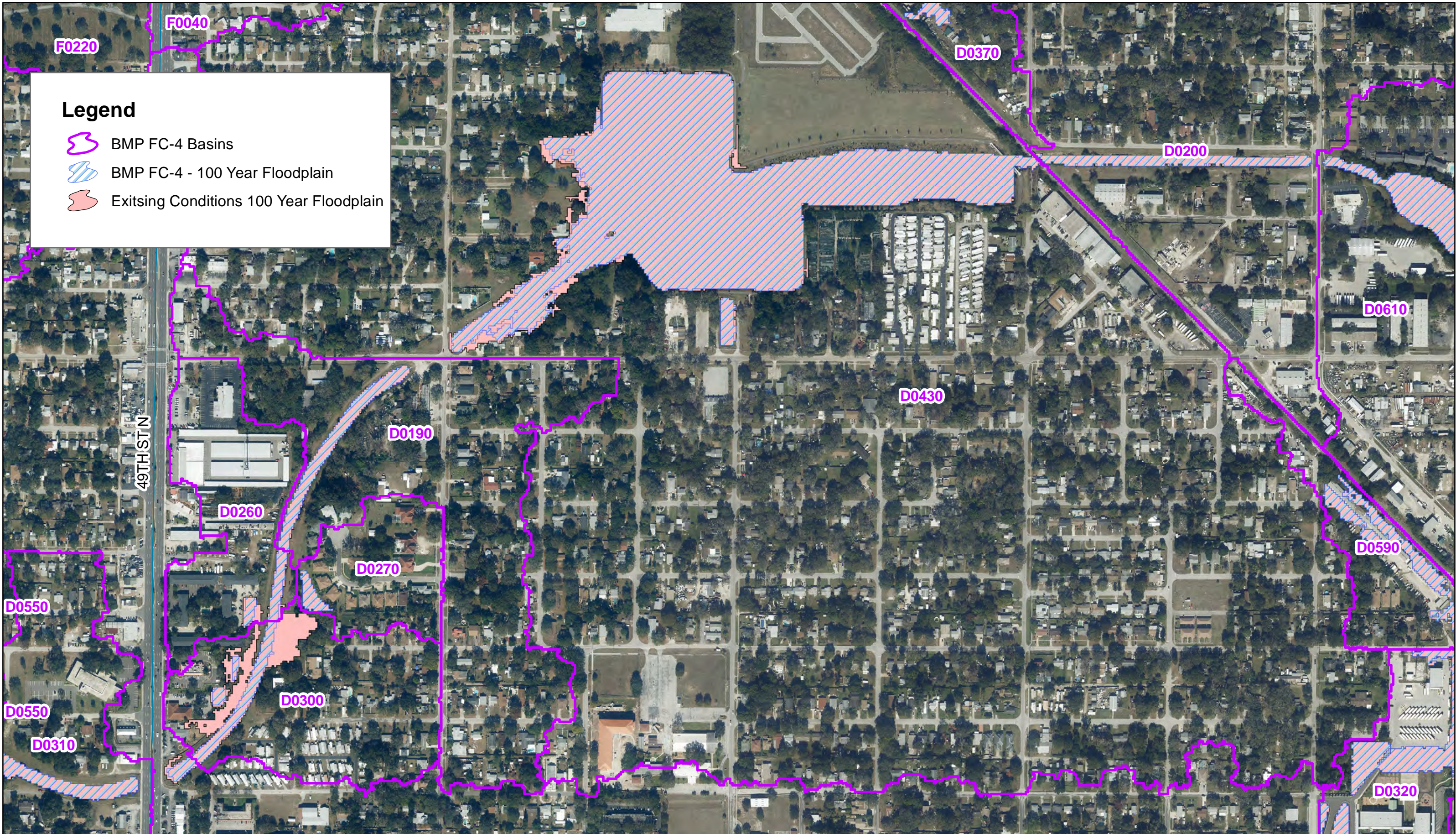





Figure B-17





**Legend**

-  BMP FC-4 Basins
-  BMP FC-4 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-4**

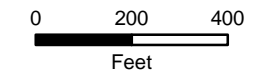
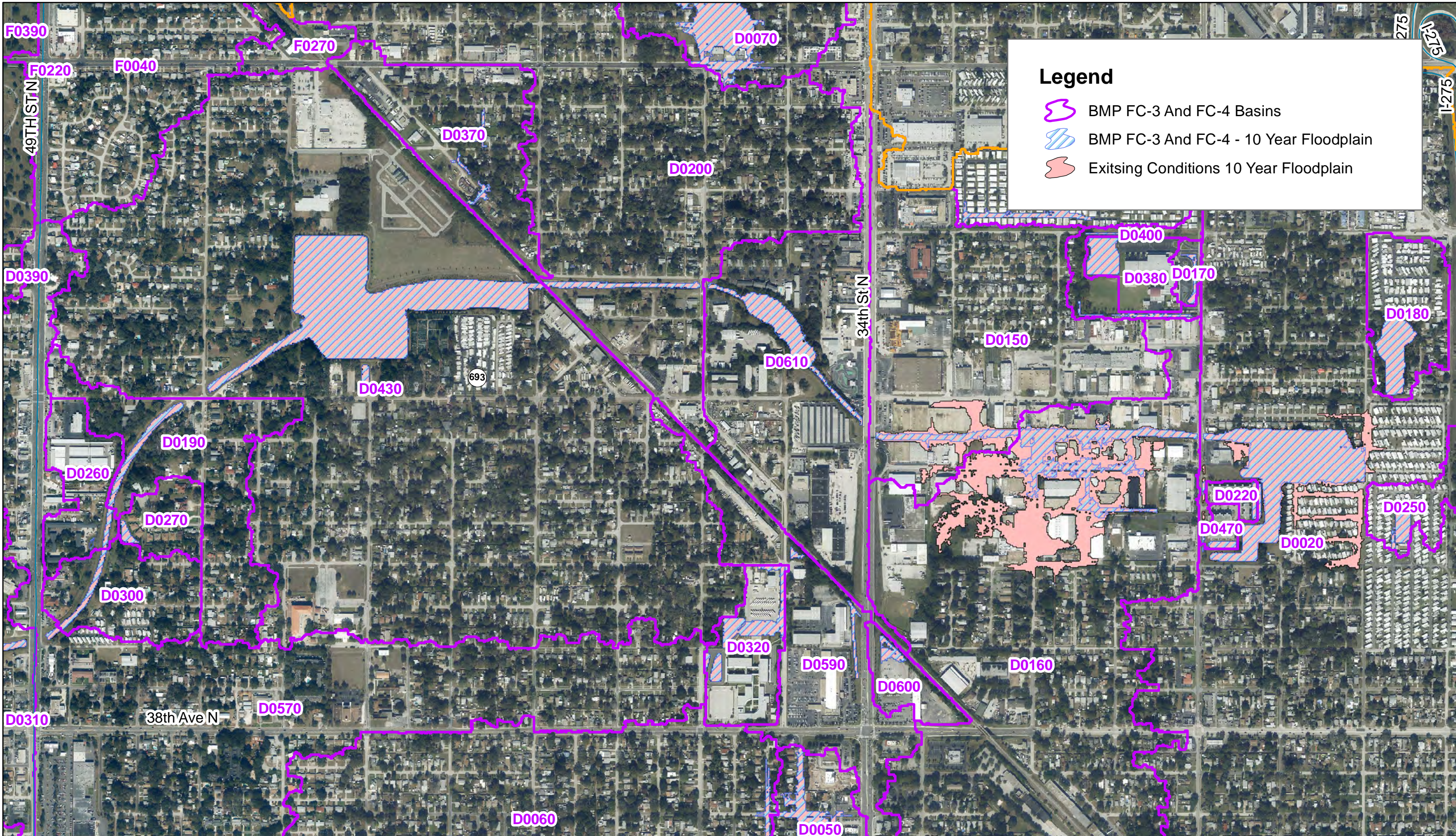





Figure B-18







**Legend**

-  BMP FC-3 And FC-4 Basins
-  BMP FC-3 And FC-4 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3 And FC-4**

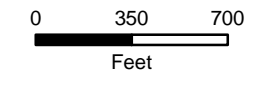
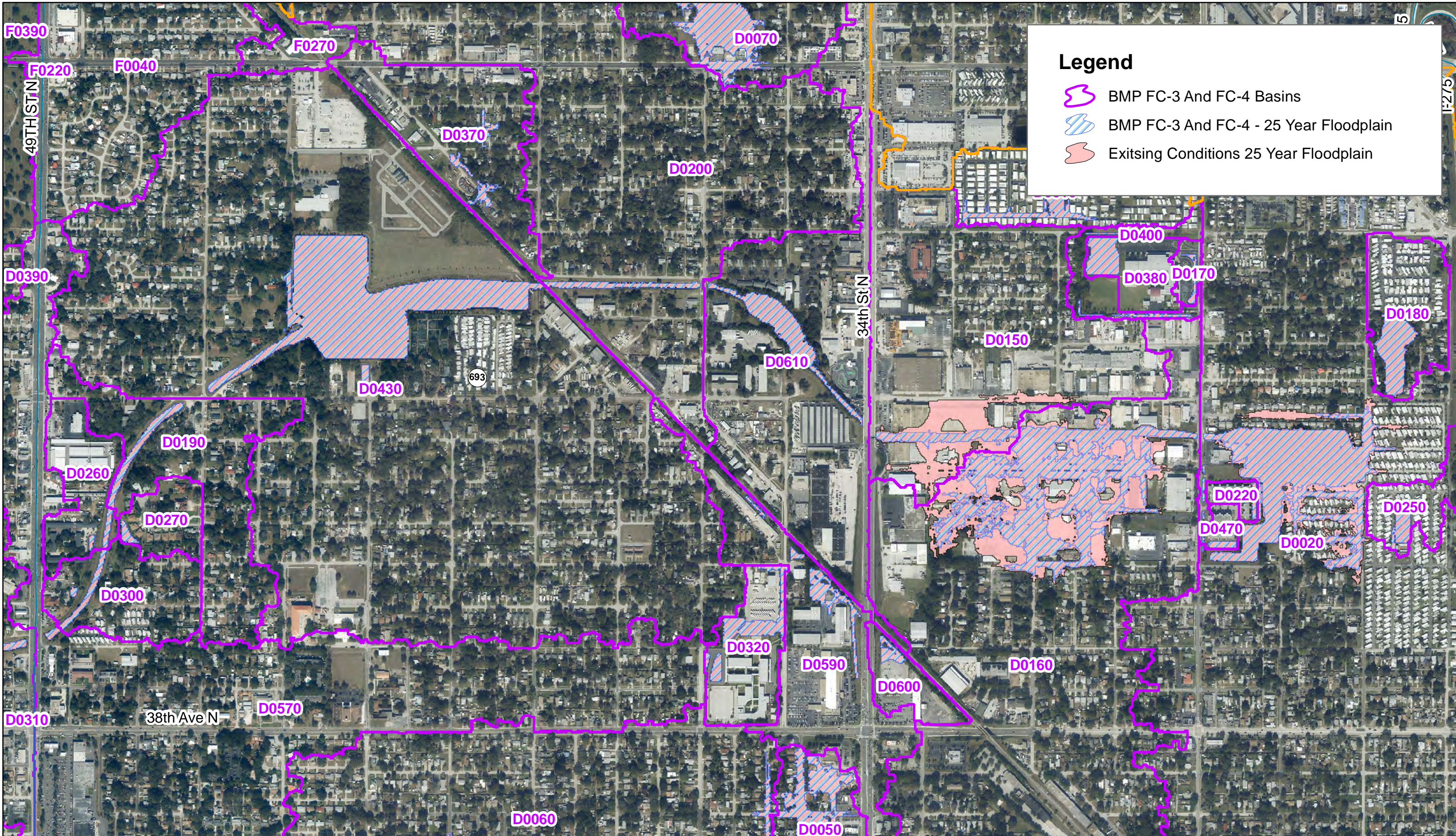





Figure B-19





**Legend**

-  BMP FC-3 And FC-4 Basins
-  BMP FC-3 And FC-4 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3 And FC-4**

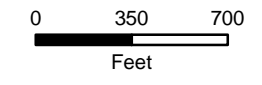
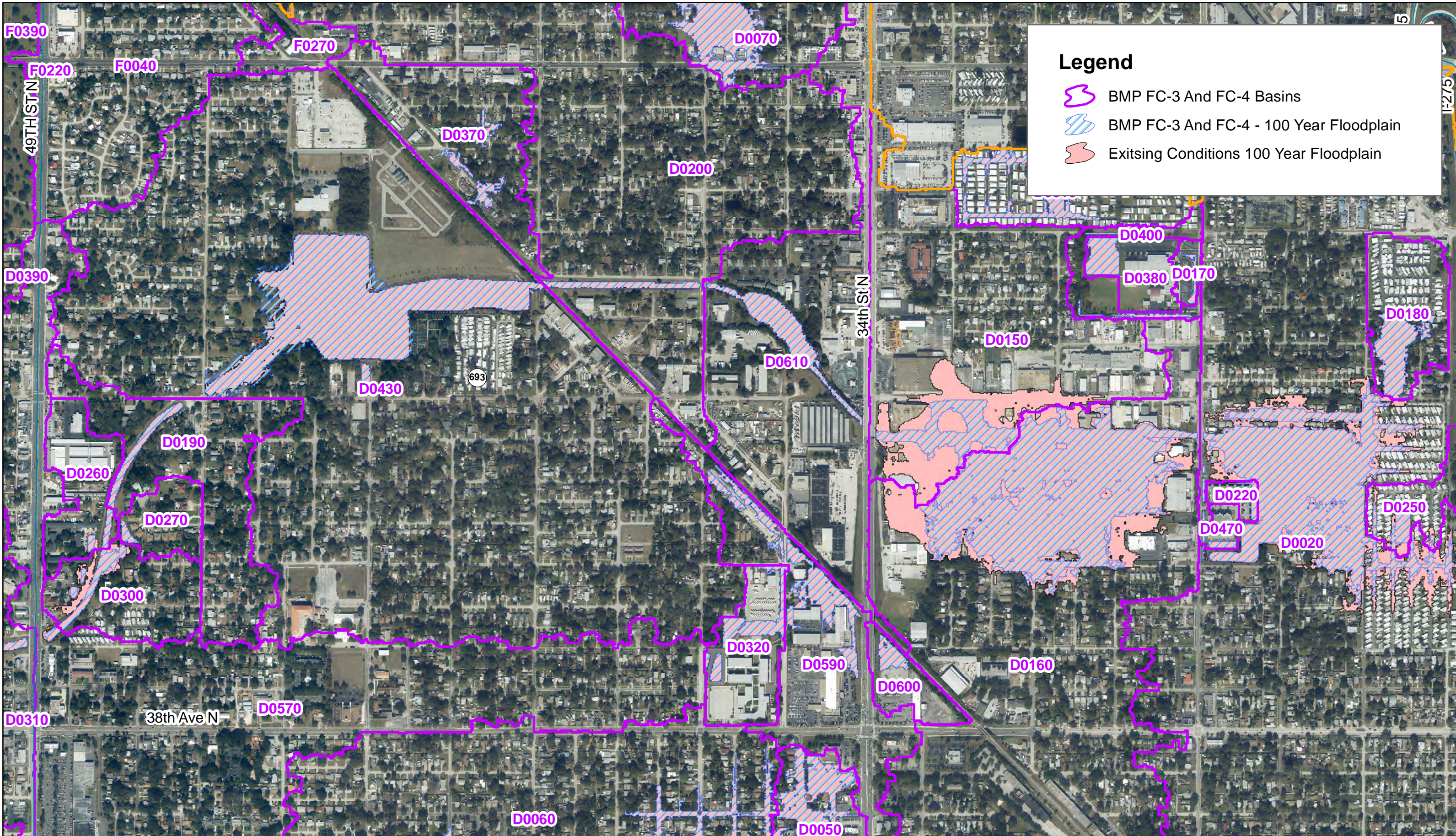





Figure B-20





**Legend**

-  BMP FC-3 And FC-4 Basins
-  BMP FC-3 And FC-4 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3 And FC-4**

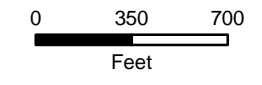
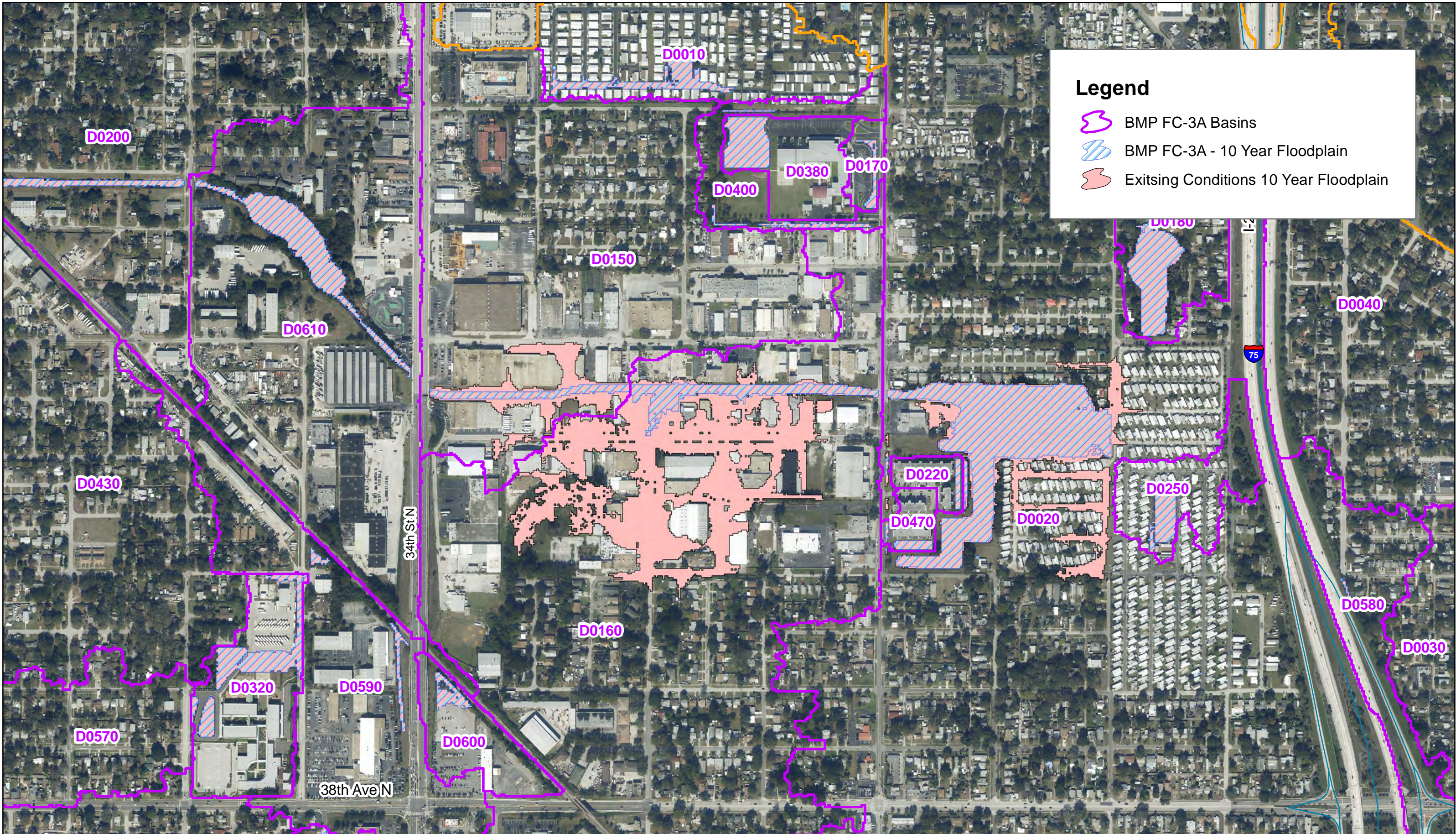





Figure B-21





**Legend**

-  BMP FC-3A Basins
-  BMP FC-3A - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3A**

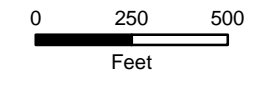
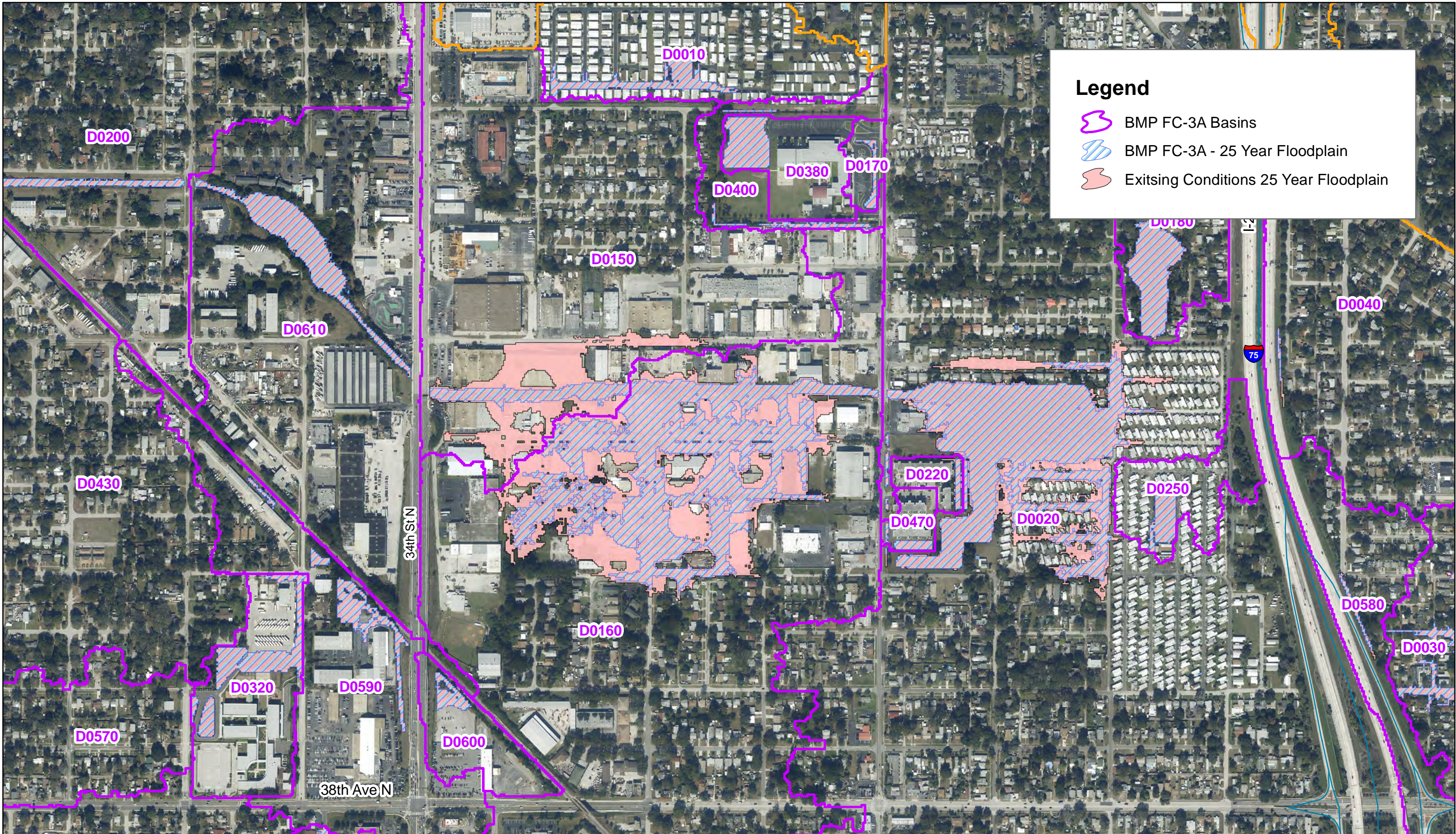





Figure B-22





**Legend**

-  BMP FC-3A Basins
-  BMP FC-3A - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3A**

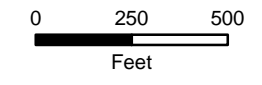
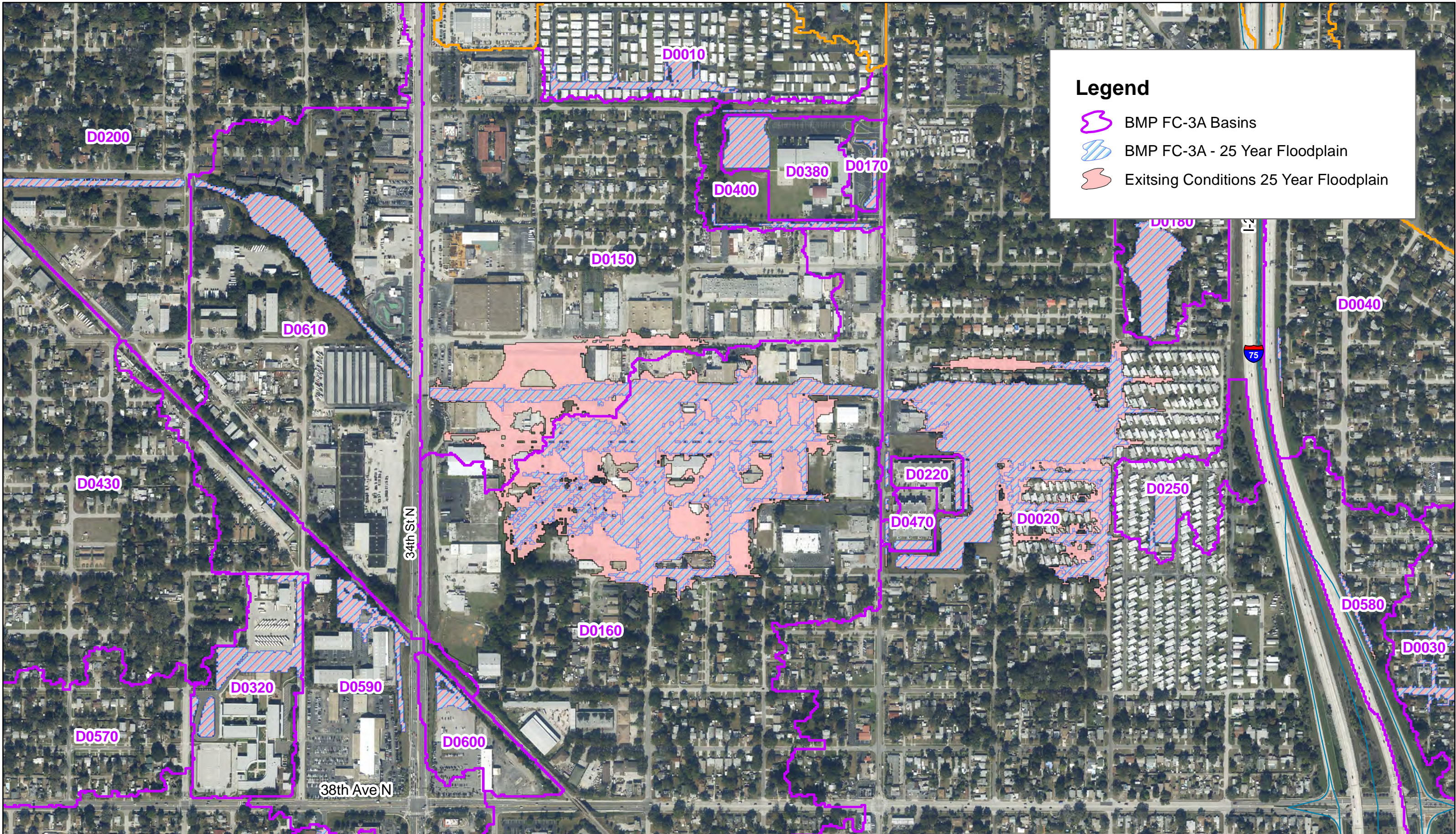





Figure B-23





**Legend**

-  BMP FC-3A Basins
-  BMP FC-3A - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3A**

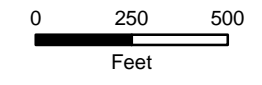
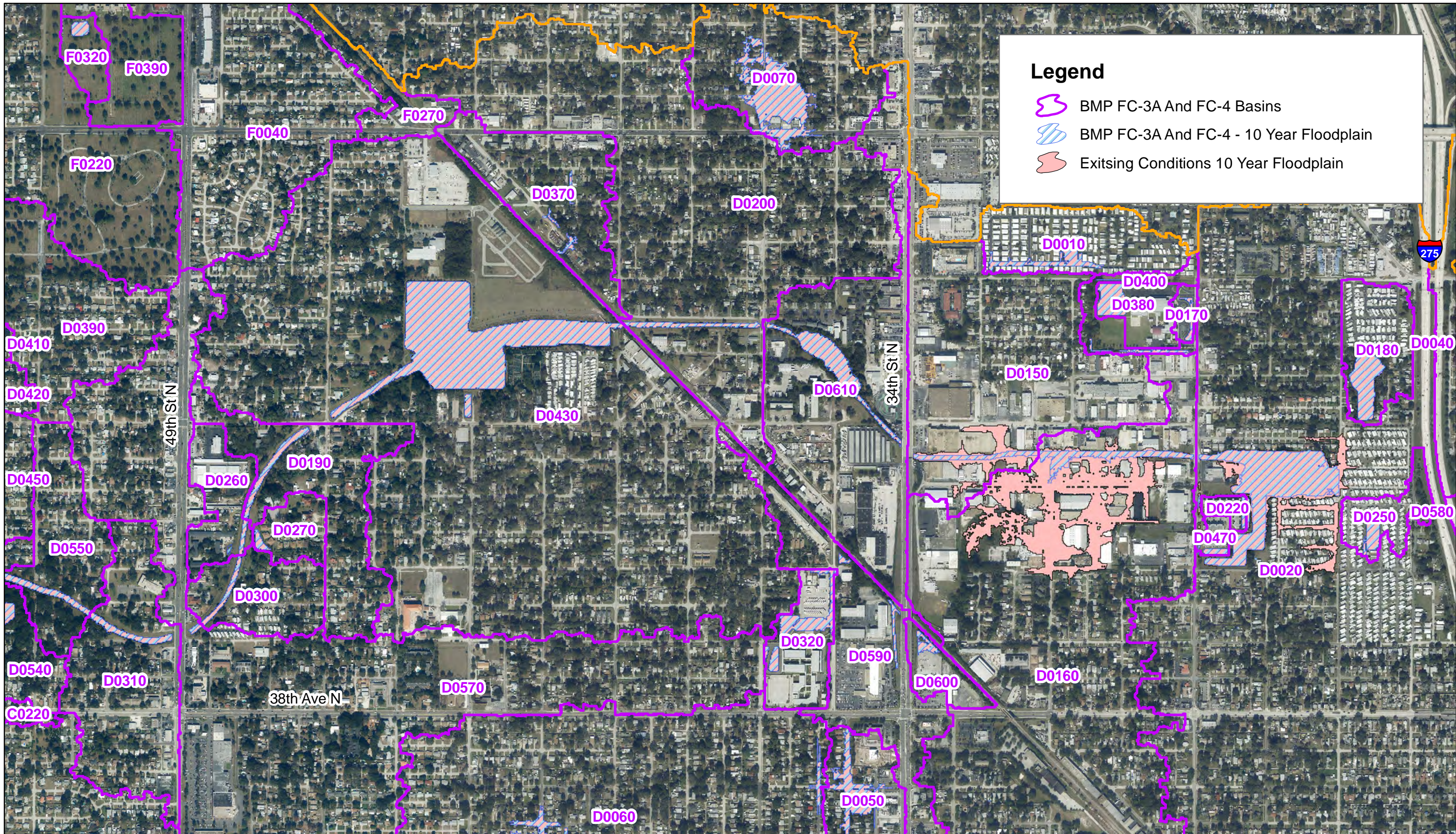


Figure B-24





**Legend**

-  BMP FC-3A And FC-4 Basins
-  BMP FC-3A And FC-4 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY

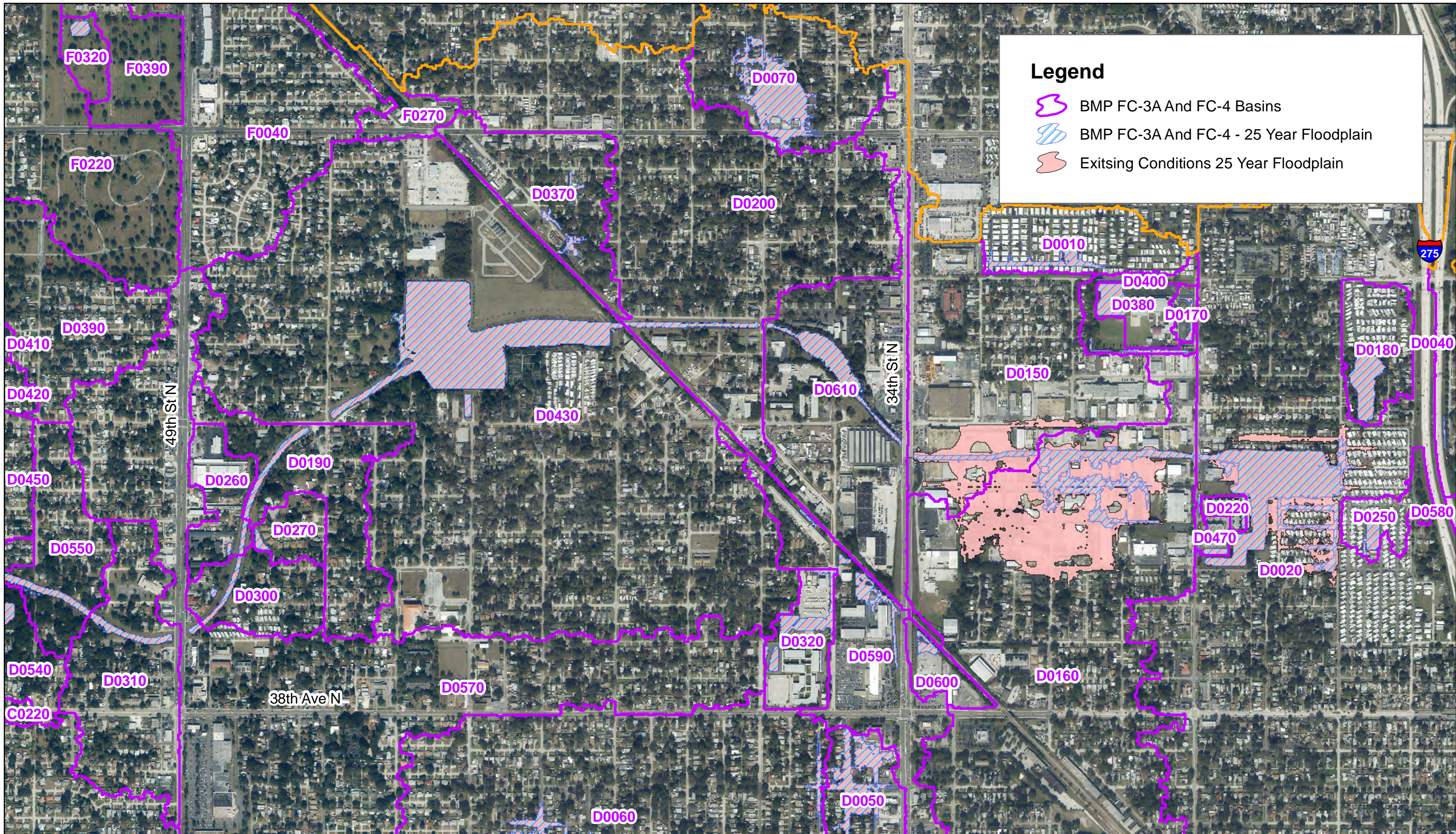


**Joe's Creek Watershed  
BMP FC-3A And FC-4**



Figure B-25





**Legend**

-  BMP FC-3A And FC-4 Basins
-  BMP FC-3A And FC-4 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

 BOUNDARY



**Joe's Creek Watershed  
BMP FC-3A And FC-4**

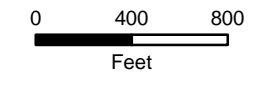
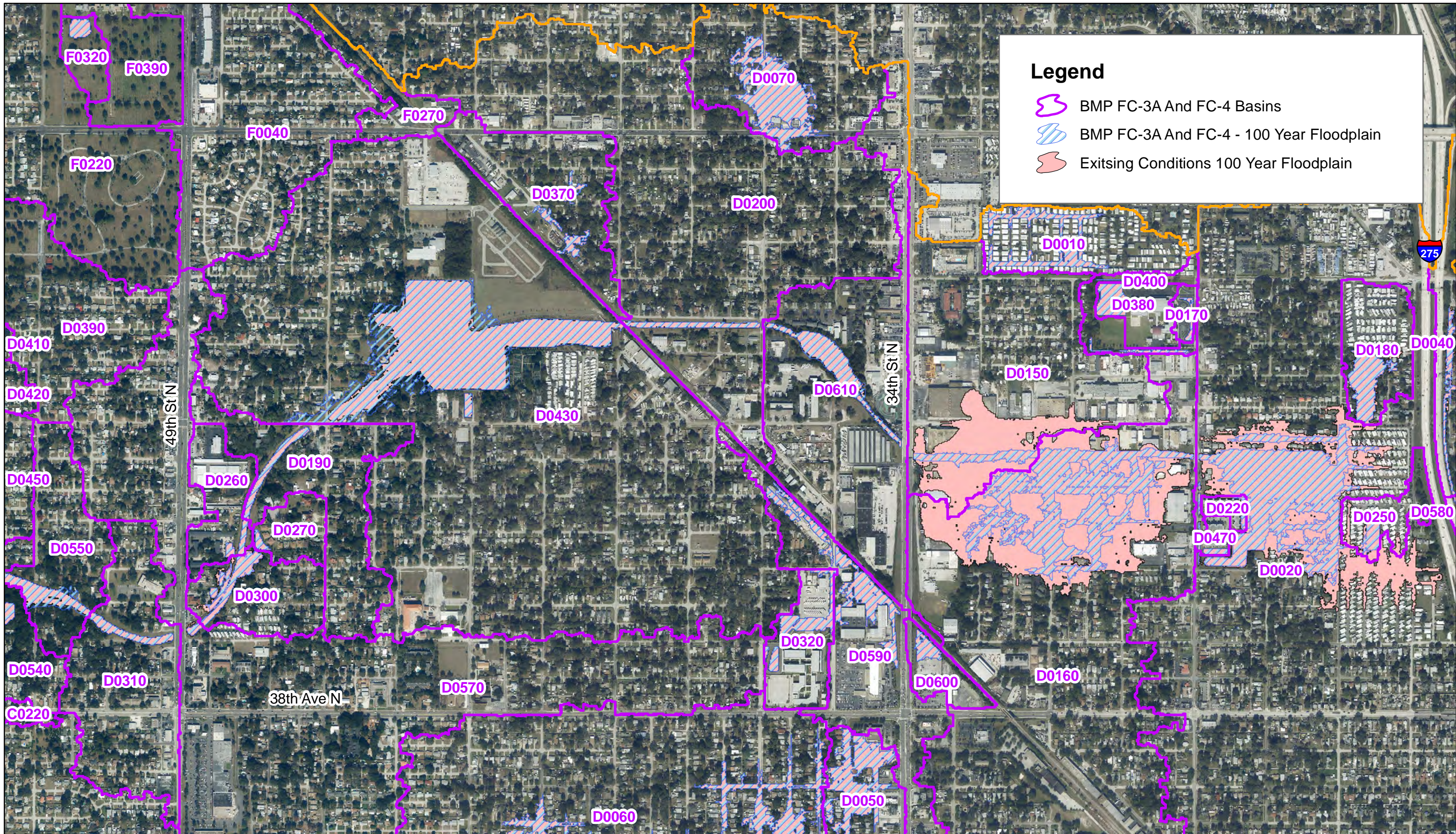


Figure B-26







**Legend**

-  BMP FC-3A And FC-4 Basins
-  BMP FC-3A And FC-4 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY

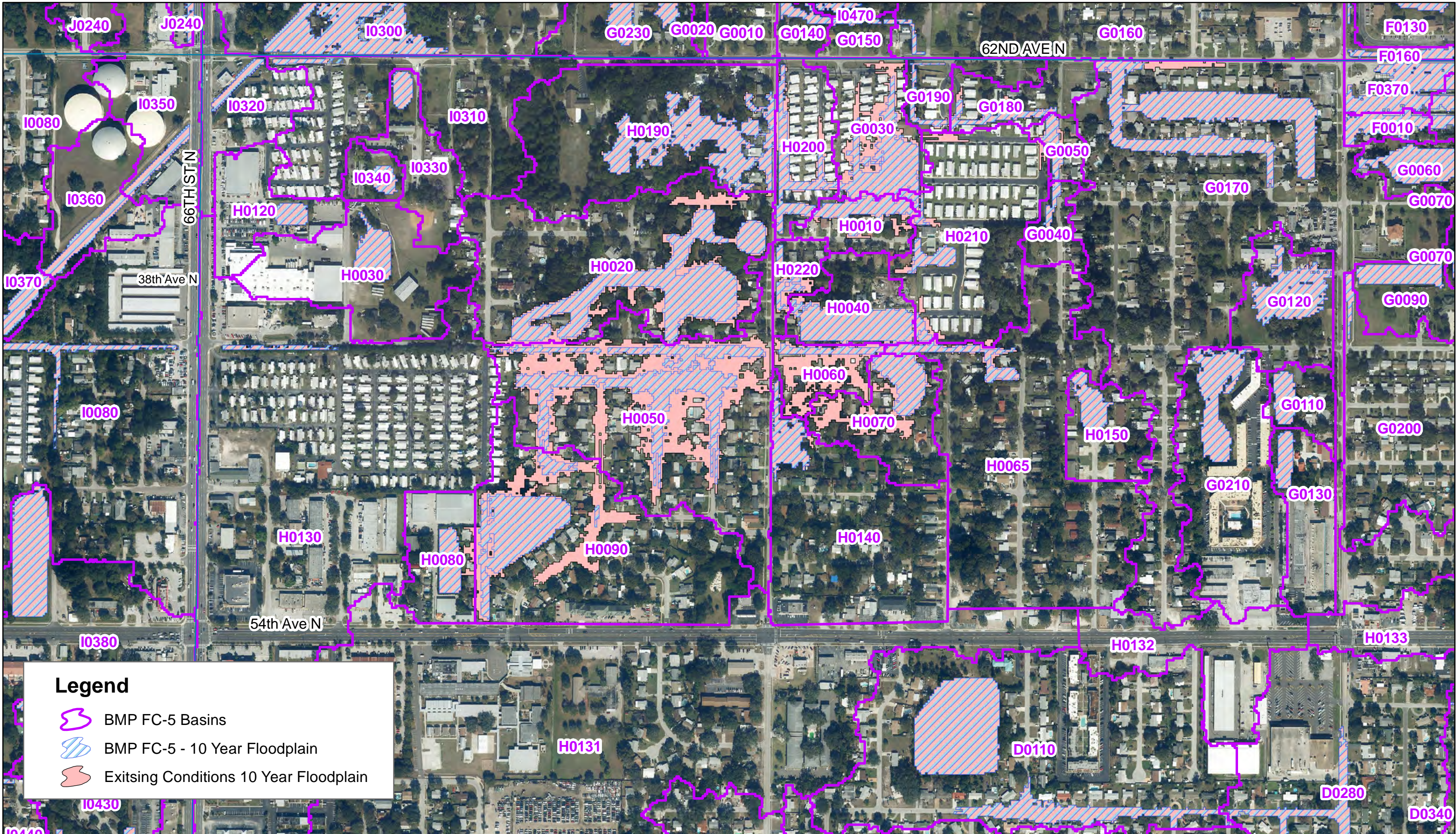


**Joe's Creek Watershed  
BMP FC-3A And FC-4**






Figure B-27





**Legend**

-  BMP FC-5 Basins
-  BMP FC-5 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain

 BOUNDARY



## Joe's Creek Watershed BMP FC-5

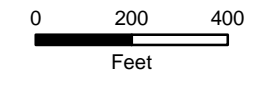
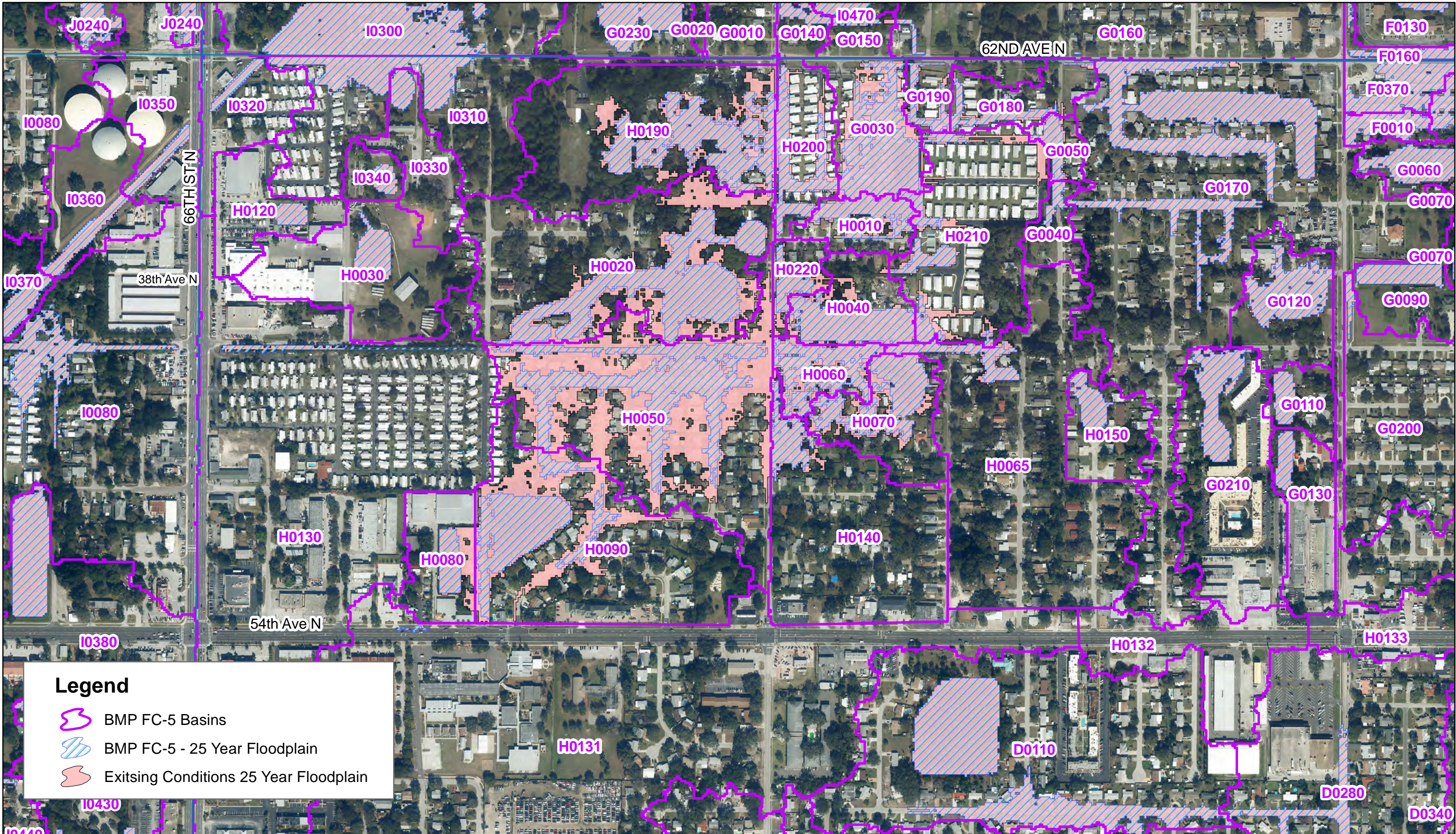





Figure B-28

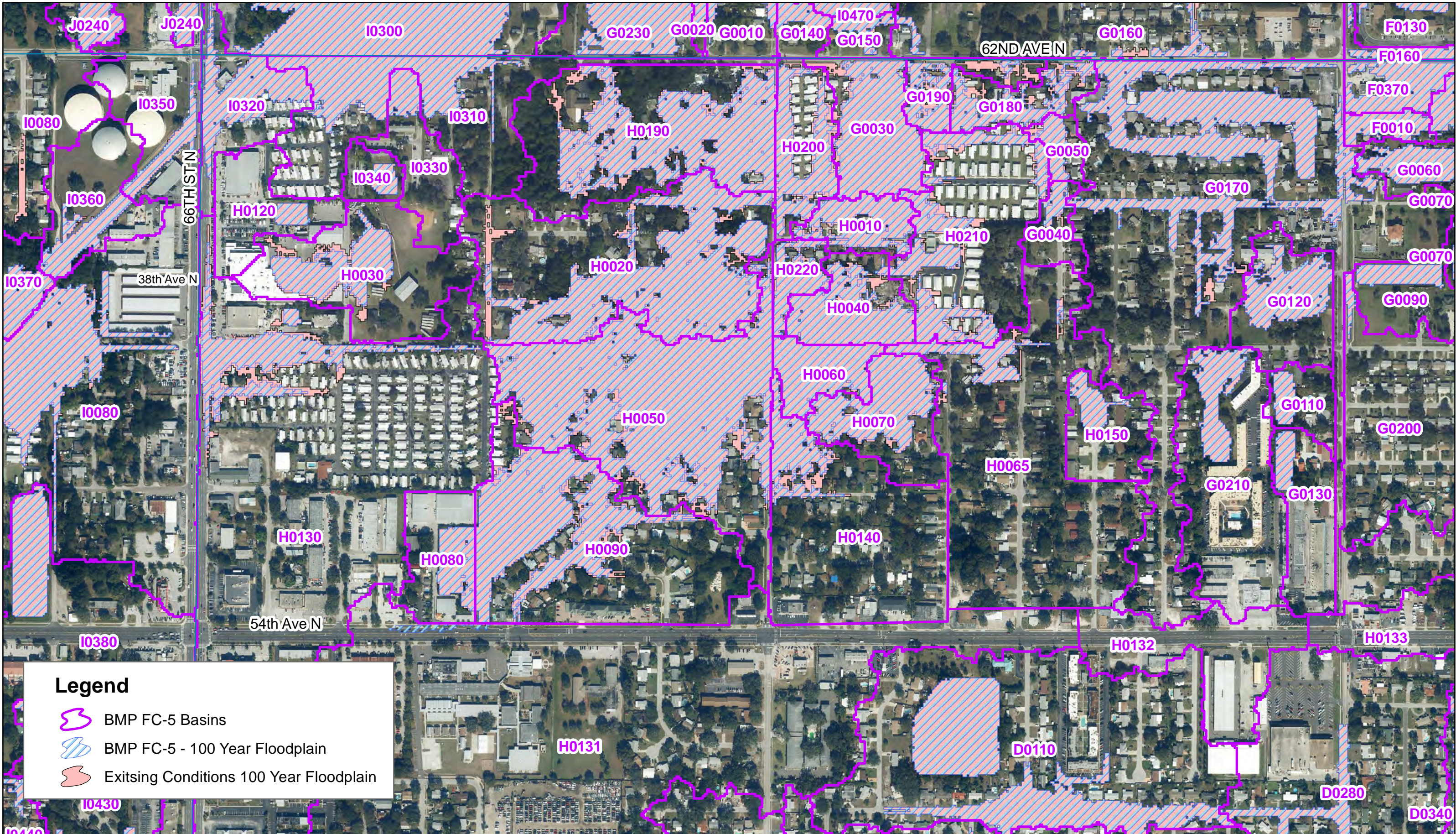







**Legend**

-  BMP FC-5 Basins
-  BMP FC-5 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain

**Joe's Creek Watershed  
BMP FC-5**



**Legend**

-  BMP FC-5 Basins
-  BMP FC-5 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain

 BOUNDARY



## Joe's Creek Watershed BMP FC-5

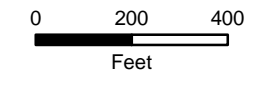



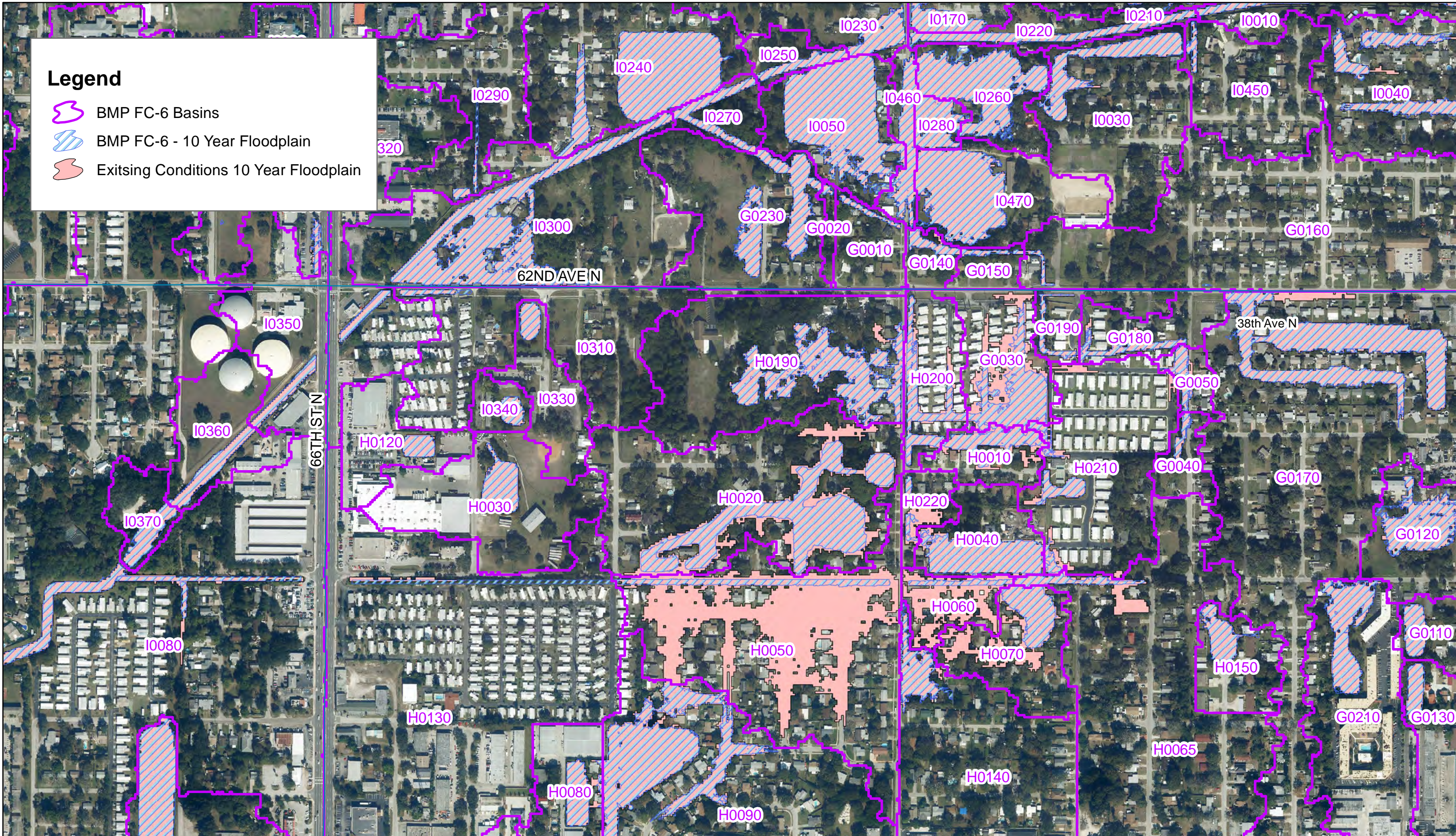


Figure B-30



# Legend

-  BMP FC-6 Basins
-  BMP FC-6 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain



 BOUNDARY



## Joe's Creek Watershed BMP FC-6

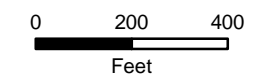



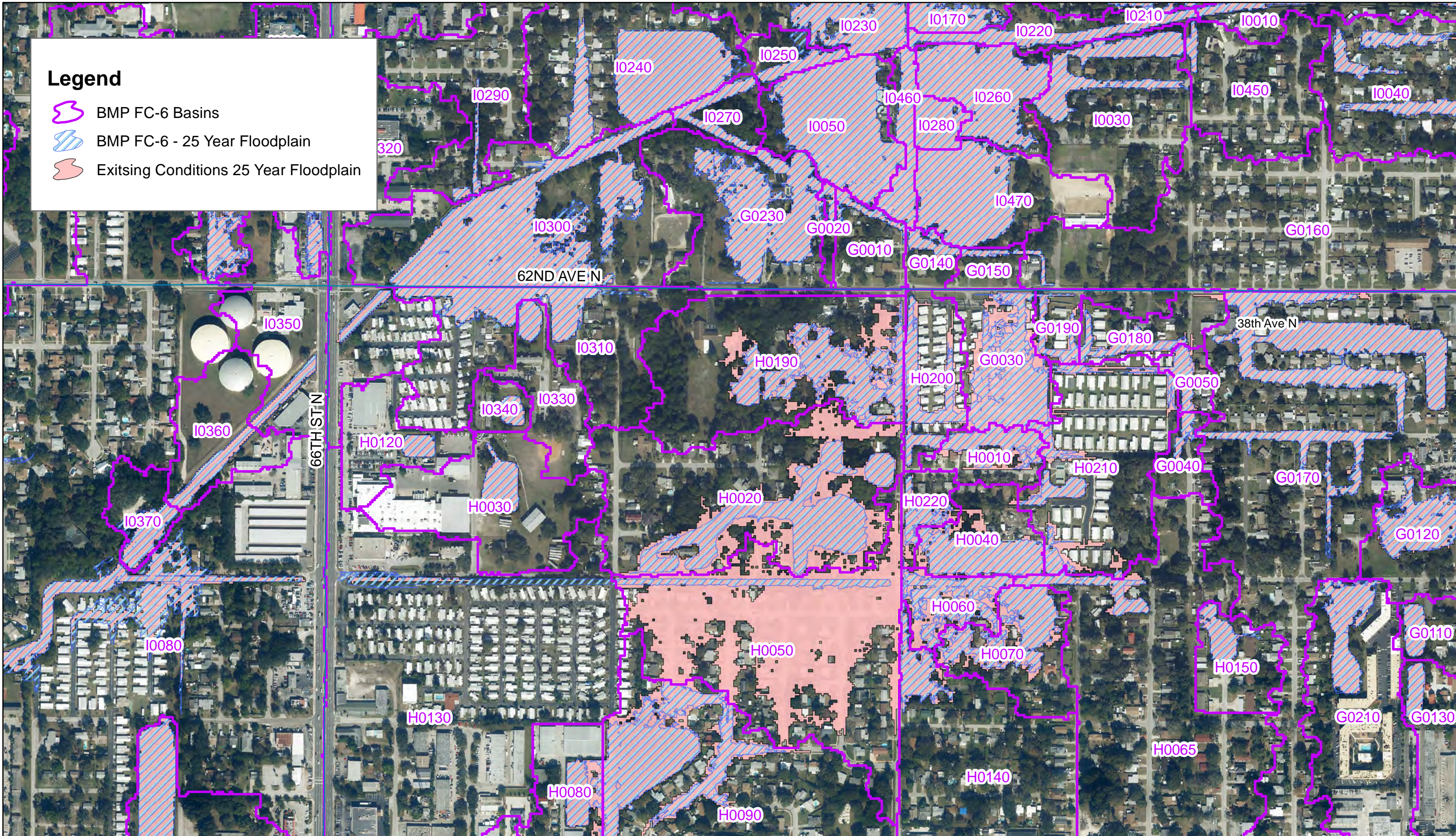


Figure B-31



**Legend**

-  BMP FC-6 Basins
-  BMP FC-6 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain



 BOUNDARY



**Joe's Creek Watershed  
BMP FC-6**






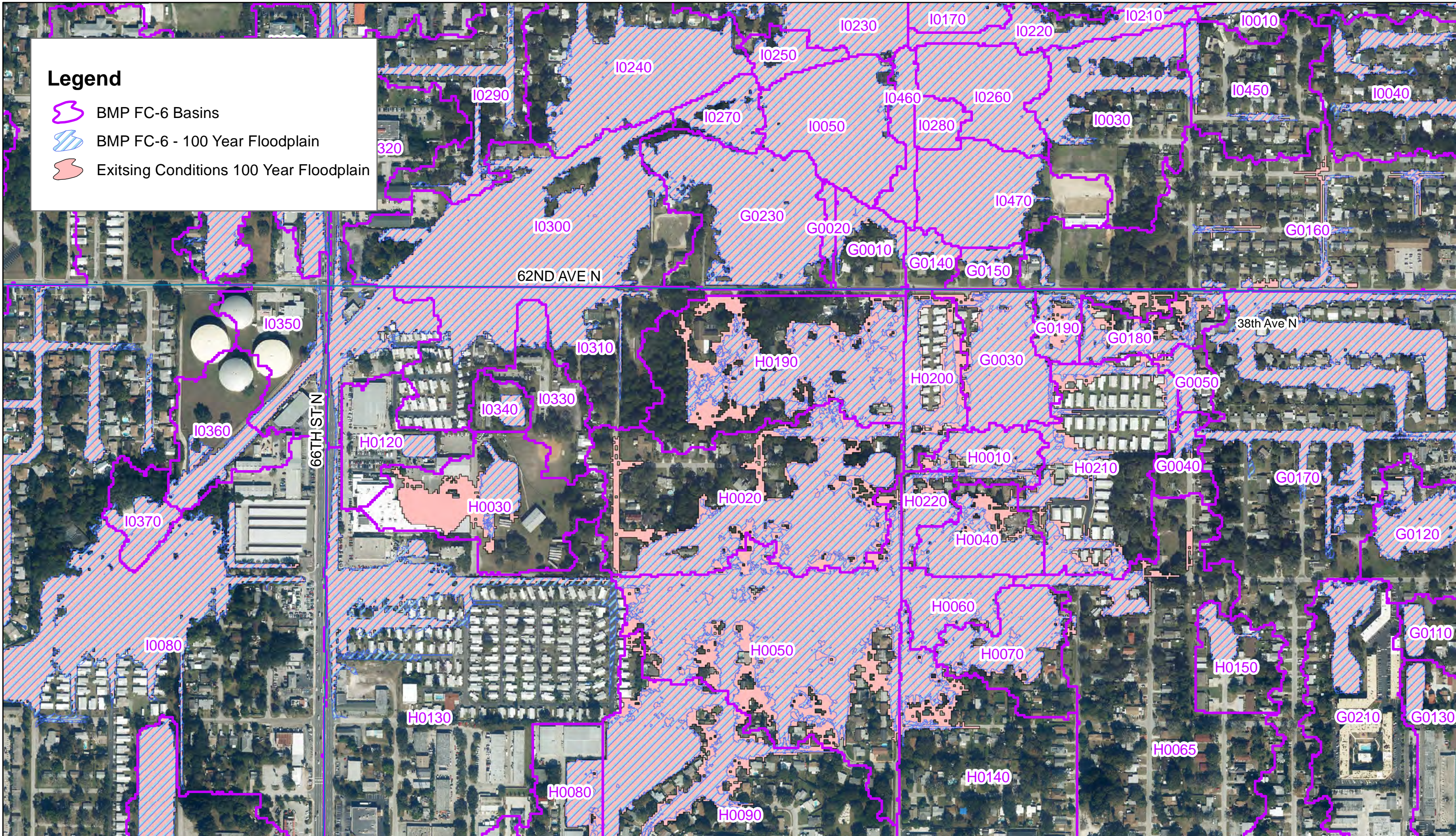
Figure B-32



**URS**

**Legend**

-  BMP FC-6 Basins
-  BMP FC-6 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain



 BOUNDARY



**Joe's Creek Watershed  
BMP FC-6**

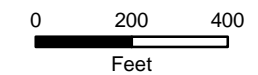



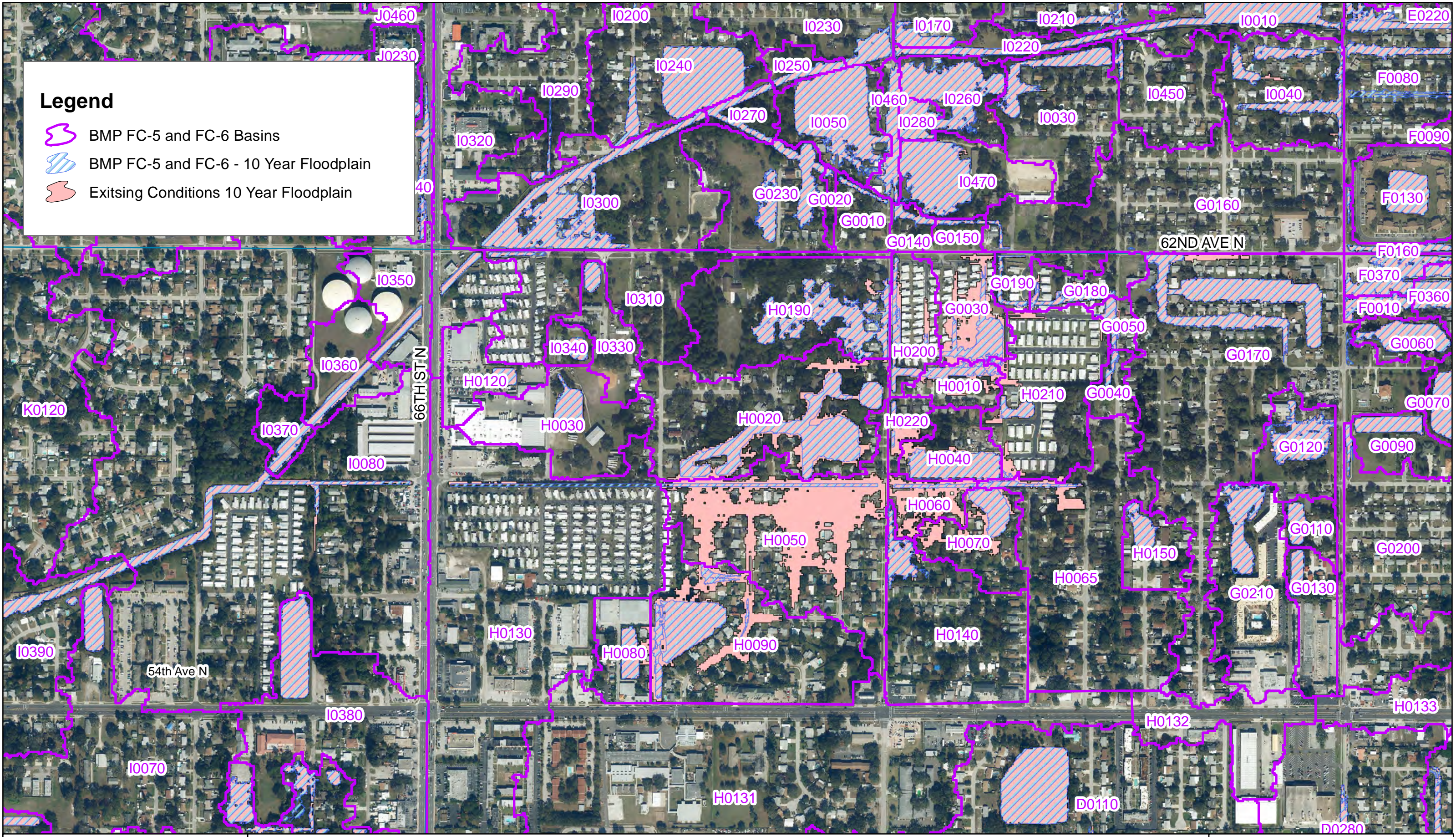


Figure B-33



**Legend**

-  BMP FC-5 and FC-6 Basins
-  BMP FC-5 and FC-6 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain



 BOUNDARY



**Joe's Creek Watershed  
BMP FC-5 And FC-6**






Figure B-34

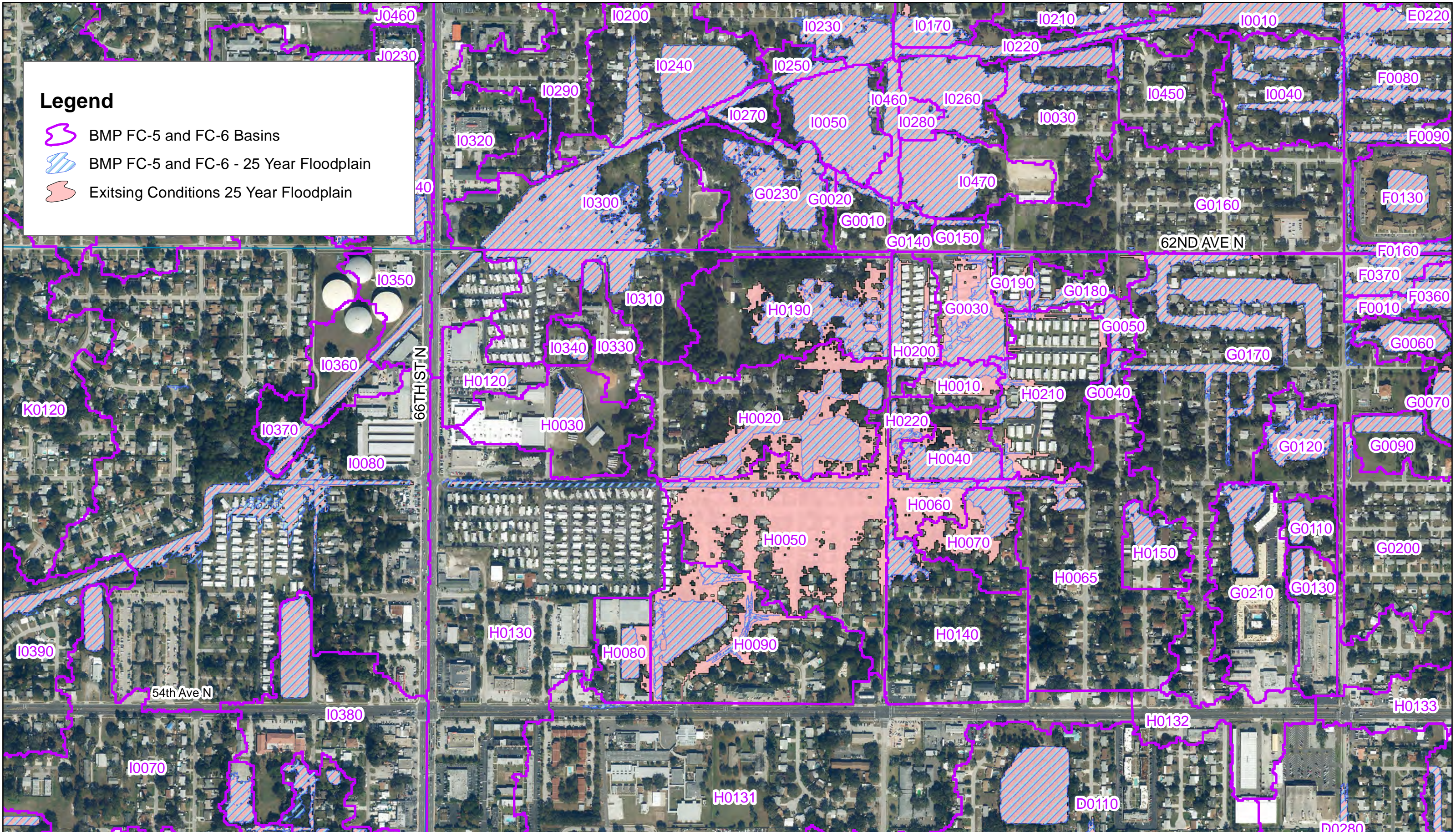


**URS**



### Legend

-  BMP FC-5 and FC-6 Basins
-  BMP FC-5 and FC-6 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain



 BOUNDARY



## Joe's Creek Watershed BMP FC-5 And FC-6

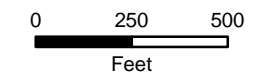

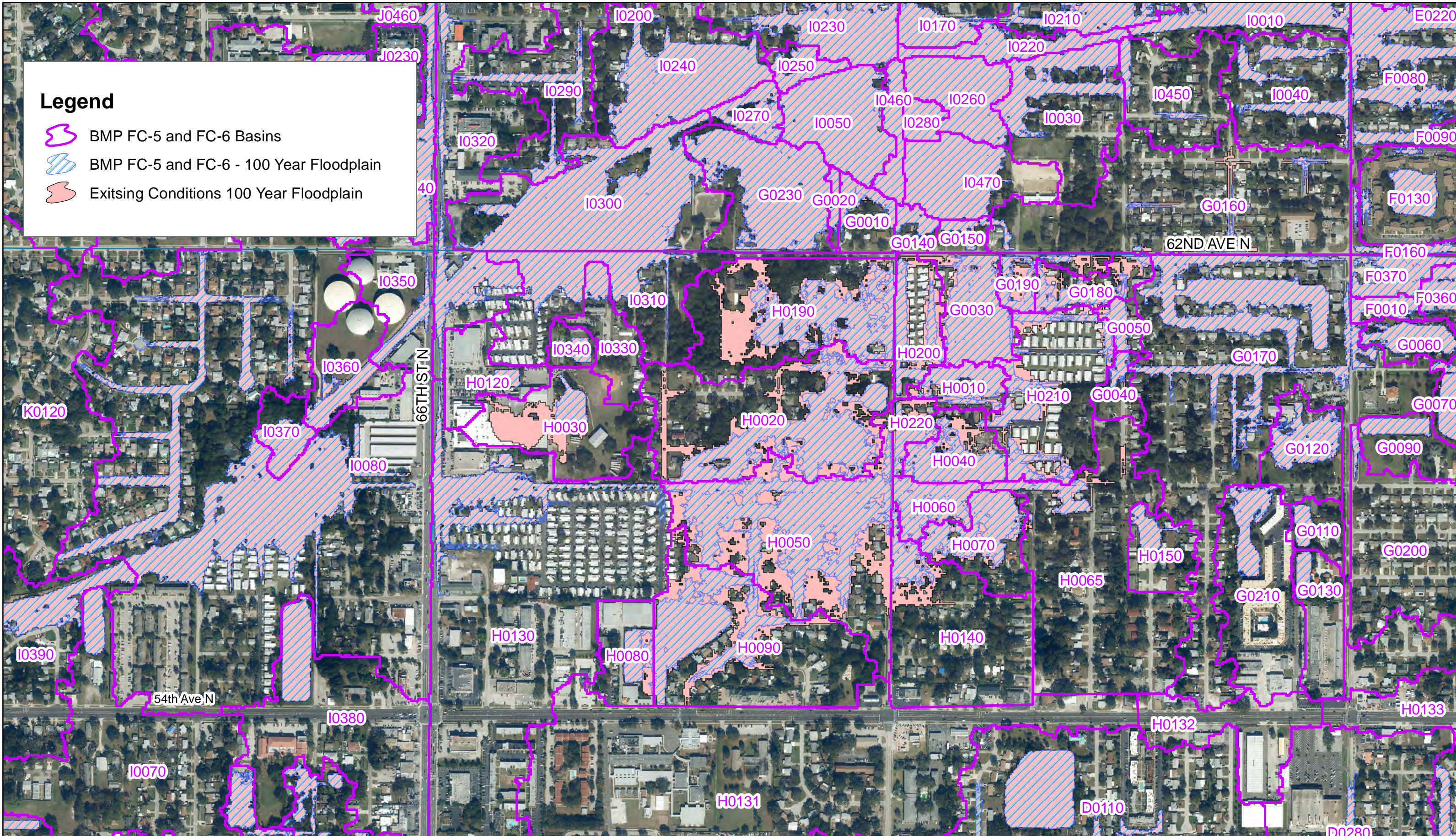


Figure B-35






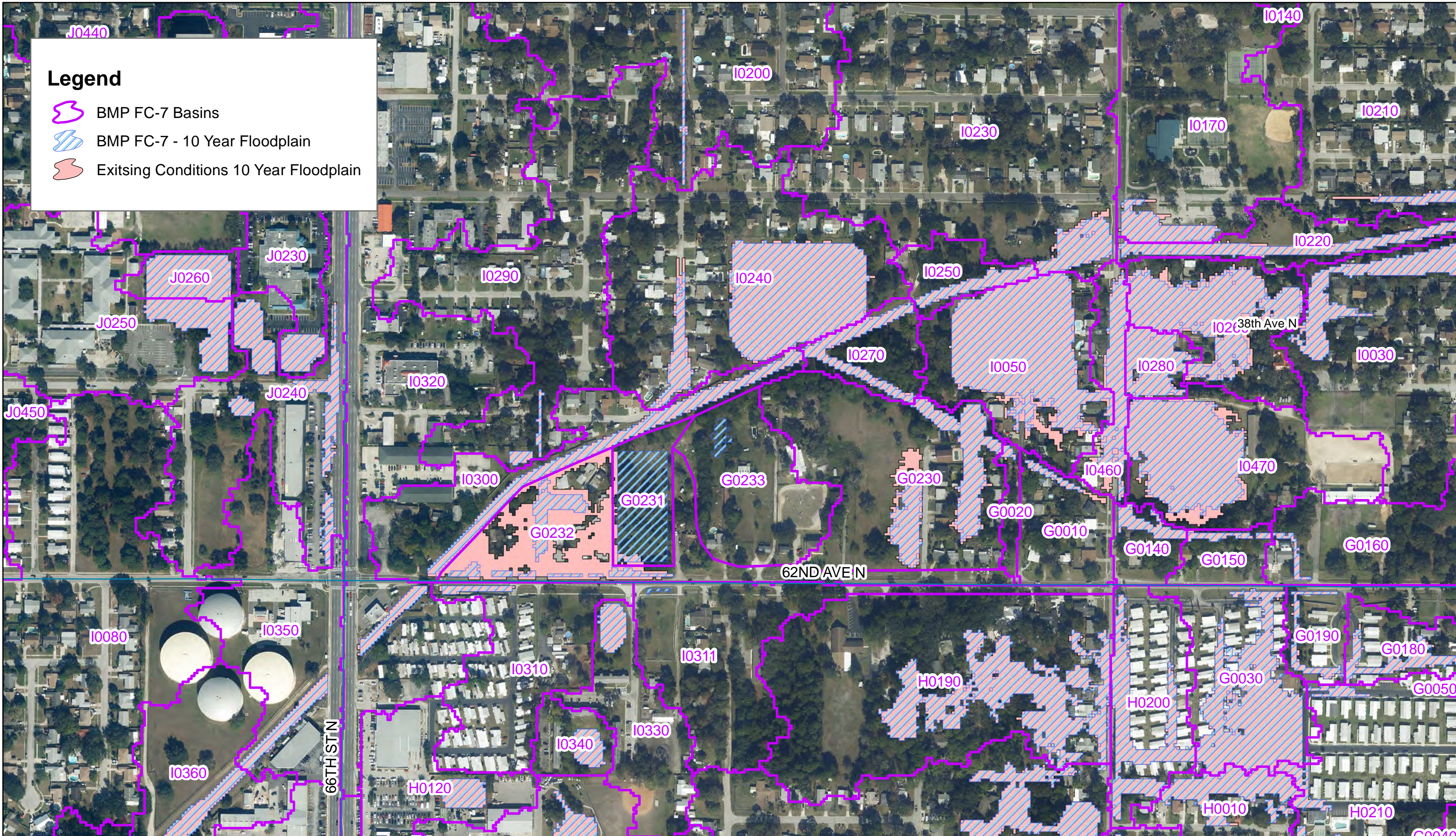
### Legend

-  BMP FC-5 and FC-6 Basins
-  BMP FC-5 and FC-6 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain






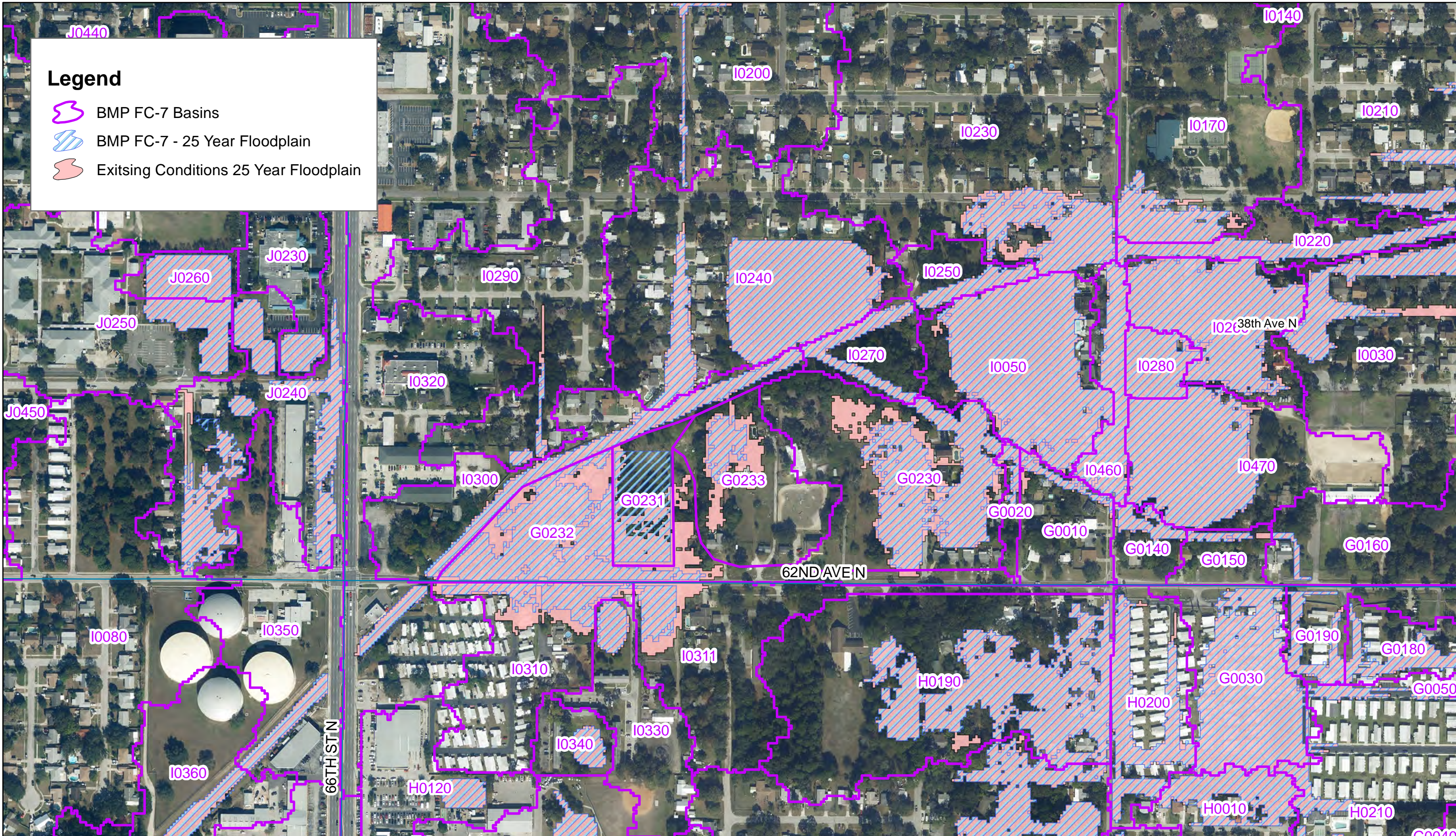
**Legend**

-  BMP FC-7 Basins
-  BMP FC-7 - 10 Year Floodplain
-  Existing Conditions 10 Year Floodplain



**Legend**

-  BMP FC-7 Basins
-  BMP FC-7 - 25 Year Floodplain
-  Existing Conditions 25 Year Floodplain



 BOUNDARY



**Joe's Creek Watershed  
BMP FC-7**

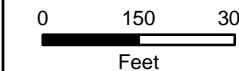





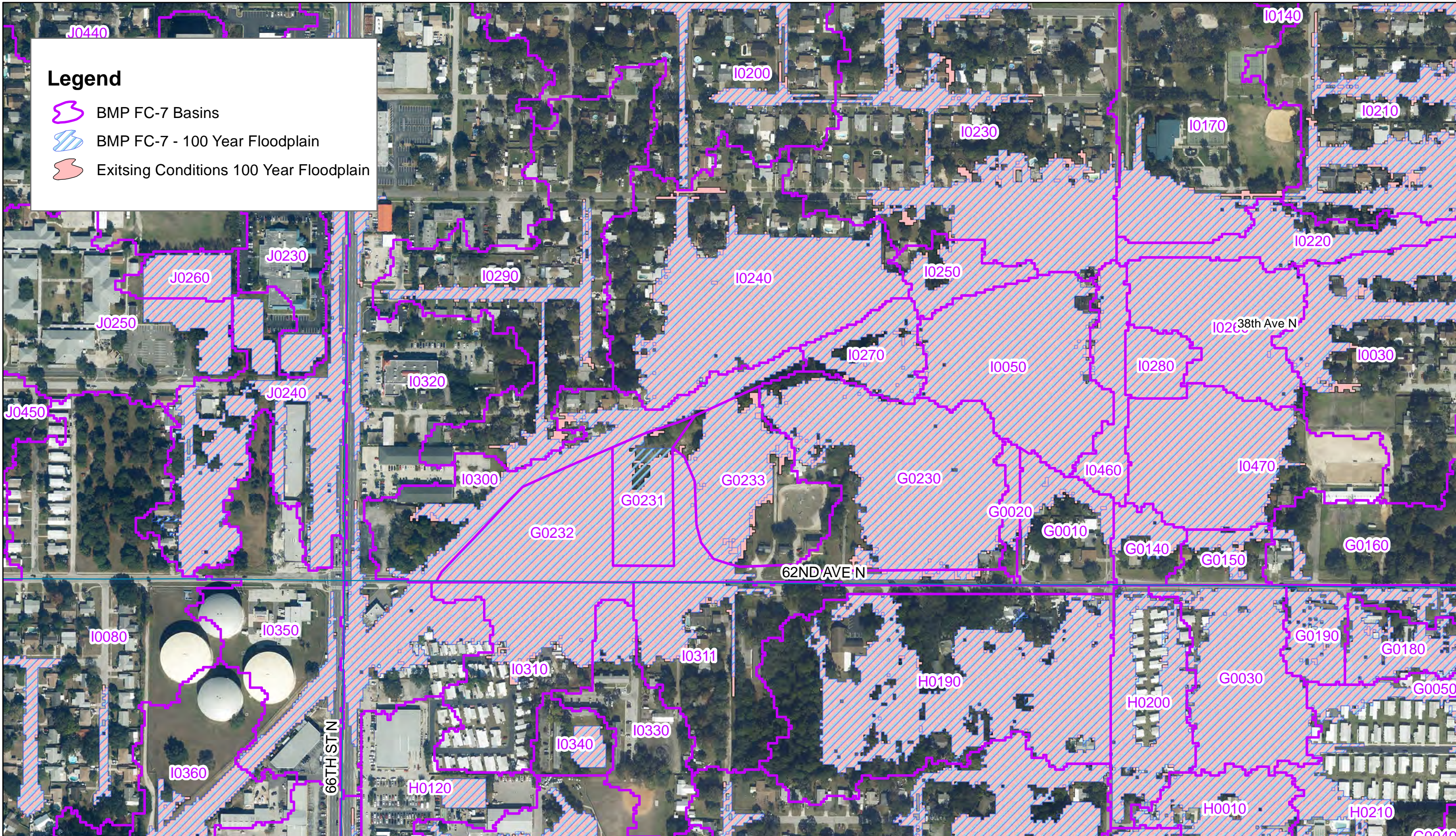
Figure B-38



**URS**

**Legend**

-  BMP FC-7 Basins
-  BMP FC-7 - 100 Year Floodplain
-  Existing Conditions 100 Year Floodplain



 BOUNDARY



**Joe's Creek Watershed  
BMP FC-7**

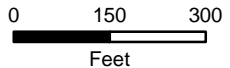


Figure B-39



# **Appendix C**

## **Cost Estimates**

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Devonshire Pond Outfall/Tyrone Blvd Re-Route  
 FC-1**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$639,175.00	\$639,175.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$191,752.50	\$191,752.50
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$319,587.50	\$319,587.50
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	50	\$65.00	\$3,250.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (60 X 120)*	LF	3600	\$850.00	\$3,060,000.00
8	CONCRETE BOX CULVERT (72 X 108)*	LF	3900	\$850.00	\$3,315,000.00
9	SODDING	SY	4500	\$3.00	\$13,500.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$2,262,679.50	\$2,262,679.50
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$9,805,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$490,250.00	\$490,250.00
	DESIGN (15%)	LS	1.0	\$1,470,750.00	\$1,470,750.00
	PERMITTING (5%)	LS	1.0	\$490,250.00	\$490,250.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$490,250.00	\$490,250.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$2,942,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$12,747,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



38<sup>th</sup> Ave N Re-Route  
 FC-2

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$358,825.00	\$358,825.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$107,647.50	\$107,647.50
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$179,412.50	\$179,412.50
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	50	\$65.00	\$3,250.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
8	CONCRETE BOX CULVERT (72 X 108)*	LF	0	\$850.00	\$0.00
9	CONCRETE BOX CULVERT (60 X 120)*	LF	4200	\$850.00	\$3,570,000.00
10	SODDING	SY	5000	\$3.00	\$15,000.00
11	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
12	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
13	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
14	CONTINGENCY AMOUNT (30%)	LS	1	\$1,270,240.50	\$1,270,240.50
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$5,504,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$275,200.00	\$275,200.00
	DESIGN (15%)	LS	1.0	\$825,600.00	\$825,600.00
	PERMITTING (5%)	LS	1.0	\$275,200.00	\$275,200.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$275,200.00	\$275,200.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$1,651,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$7,155,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs



PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Devonshire Pond Outfall/Tyrone Blvd Re-Route and 38<sup>th</sup> Ave N Re-Route  
 FC-1 AND FC-2**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$998,000.00	\$998,000.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$299,400.00	\$299,400.00
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$499,000.00	\$499,000.00
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	100	\$65.00	\$6,500.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (60 X 120)*	LF	3600	\$850.00	\$3,060,000.00
8	CONCRETE BOX CULVERT (72 X 108)*	LF	3900	\$850.00	\$3,315,000.00
9	CONCRETE BOX CULVERT (60 X 120)*	LF	4200	\$850.00	\$3,570,000.00
10	SODDING	SY	9500	\$3.00	\$28,500.00
11	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
12	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
13	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
14	CONTINGENCY AMOUNT (30%)	LS	1	\$3,532,920.00	\$3,532,920.00
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$15,309,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$765,450.00	\$765,450.00
	DESIGN (15%)	LS	1.0	\$2,296,350.00	\$2,296,350.00
	PERMITTING (5%)	LS	1.0	\$765,450.00	\$765,450.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$765,450.00	\$765,450.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$4,593,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$19,902,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Tyrone Square Mall Culvert Upgrades  
 FC-1A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$939,320.00	\$939,320.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$281,796.00	\$281,796.00
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$469,660.00	\$469,660.00
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	200	\$65.00	\$13,000.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (60 X 120)*	LF	3600	\$1,200.00	\$4,320,000.00
8	CONCRETE BOX CULVERT (72 X 108)*	LF	3900	\$850.00	\$3,315,000.00
9	CONCRETE BOX CULVERT (72 X 120)*	LF	1625	\$950.00	\$1,543,750.00
10	SODDING	SY	6500	\$3.00	\$19,500.00
11	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
12	REINFORCED CONCRETE PIPE SECTION (60" SD)	LF	930	\$185.00	\$172,050.00
13	REINFORCED CONCRETE PIPE SECTION (54" SD)	LF	60	\$165.00	\$9,900.00
14	CONTINGENCY AMOUNT (30%)	LS	1	\$3,325,192.80	\$3,325,192.80
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$14,409,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$720,450.00	\$720,450.00
	DESIGN (15%)	LS	1.0	\$2,161,350.00	\$2,161,350.00
	PERMITTING (5%)	LS	1.0	\$720,450.00	\$720,450.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$720,450.00	\$720,450.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$4,323,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$18,732,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 1 Culvert Upgrade At 34<sup>th</sup> St N  
 FC-3**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$17,570.00	\$17,570.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$5,271.00	\$5,271.00
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$8,785.00	\$8,785.00
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	100	\$65.00	\$6,500.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	160	\$1,050.00	\$168,000.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
8	DRA POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	400	\$3.00	\$1,200.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$62,197.80	\$62,197.80
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$270,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$13,500.00	\$13,500.00
	DESIGN (15%)	LS	1.0	\$40,500.00	\$40,500.00
	PERMITTING (5%)	LS	1.0	\$13,500.00	\$13,500.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$13,500.00	\$13,500.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$81,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$351,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 1 Culvert Upgrade At 49<sup>th</sup> St N  
 FC-4**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$22,970.00	\$22,970.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$6,891.00	\$6,891.00
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$11,485.00	\$11,485.00
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	100	\$65.00	\$6,500.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	185	\$1,200.00	\$222,000.00
8	DRA POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	400	\$3.00	\$1,200.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$81,313.80	\$81,313.80
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$352,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$17,600.00	\$17,600.00
	DESIGN (15%)	LS	1.0	\$52,800.00	\$52,800.00
	PERMITTING (5%)	LS	1.0	\$17,600.00	\$17,600.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$17,600.00	\$17,600.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$106,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$458,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 1 Culvert Upgrades At 34<sup>th</sup> St N and 49<sup>th</sup> St N  
 FC-3 AND FC-4**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$39,770.00	\$39,770.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$11,931.00	\$11,931.00
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$19,885.00	\$19,885.00
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	100	\$65.00	\$6,500.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	160	\$1,050.00	\$168,000.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	185	\$1,200.00	\$222,000.00
8	DRA POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	400	\$3.00	\$1,200.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$140,785.80	\$140,785.80
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$610,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$30,500.00	\$30,500.00
	DESIGN (15%)	LS	1.0	\$91,500.00	\$91,500.00
	PERMITTING (5%)	LS	1.0	\$30,500.00	\$30,500.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$30,500.00	\$30,500.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$183,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$793,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 1 Culvert Upgrade At 34<sup>th</sup> St N (Option 2)  
 FC-3A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$37,135.00	\$37,135.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$11,140.50	\$11,140.50
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$18,567.50	\$18,567.50
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	50	\$65.00	\$3,250.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	350	\$1,050.00	\$367,500.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
8	DRA POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	200	\$3.00	\$600.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$131,457.90	\$131,457.90
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$570,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$28,500.00	\$28,500.00
	DESIGN (15%)	LS	1.0	\$85,500.00	\$85,500.00
	PERMITTING (5%)	LS	1.0	\$28,500.00	\$28,500.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$28,500.00	\$28,500.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$171,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$741,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 1 Culvert Upgrades At 34<sup>th</sup> St N and 49<sup>th</sup> St N (Option 2)  
 FC-3A AND FC-4**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$43,685.00	\$43,685.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$13,105.50	\$13,105.50
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$21,842.50	\$21,842.50
4	CONCRETE WEIR (50 FEET LONG)*	LS	1	\$60,000.00	\$60,000.00
5	RIPRAP - RUBBLE	TN	130	\$65.00	\$8,450.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	350	\$1,050.00	\$367,500.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
8	DRA POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	300	\$3.00	\$900.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$154,644.90	\$154,644.90
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$670,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$33,500.00	\$33,500.00
	DESIGN (15%)	LS	1.0	\$100,500.00	\$100,500.00
	PERMITTING (5%)	LS	1.0	\$33,500.00	\$33,500.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$33,500.00	\$33,500.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$201,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$871,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**54<sup>th</sup> Ave N Drainage Improvement (From 66<sup>th</sup> St N to 62<sup>nd</sup> St N)  
 FC-5**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$128,175.00	\$128,175.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$38,452.50	\$38,452.50
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$64,087.50	\$64,087.50
4	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
5	RIPRAP - RUBBLE	TN	150	\$65.00	\$9,750.00
6	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
7	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
8	CONCRETE BOX CULVERT (72 X 108)*	LF	0	\$850.00	\$0.00
9	CONCRETE BOX CULVERT (72 X 120)*	LF	0	\$950.00	\$0.00
10	SODDING	SY	7500	\$3.00	\$22,500.00
11	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
12	REINFORCED CONCRETE PIPE SECTION (72" SD)	LF	2100	\$215.00	\$451,500.00
13	REINFORCED CONCRETE PIPE SECTION (60" SD)	LF	3600	\$185.00	\$666,000.00
14	REINFORCED CONCRETE PIPE SECTION (54" SD)	LF	800	\$165.00	\$132,000.00
15	CONTINGENCY AMOUNT (30%)	LS	1	\$453,739.50	\$453,739.50
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$1,966,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$98,300.00	\$98,300.00
	DESIGN (15%)	LS	1.0	\$294,900.00	\$294,900.00
	PERMITTING (5%)	LS	1.0	\$98,300.00	\$98,300.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$98,300.00	\$98,300.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$590,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$2,556,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs



PROJECT NAME: Joe's Creek  
 DATE: December 16, 2016  
 PREPARED BY: RJE CHECKED BY: ERG

**OPINION OF PROBABLE COST**



**Channel 4-D Modifications (From 66<sup>th</sup> St N to 62<sup>nd</sup> St N And From Channel 4 to 66<sup>th</sup> St N)  
 FC-6**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$7,252.50	\$7,252.50
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$2,175.75	\$2,175.75
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$3,626.25	\$3,626.25
4	EXCAVATION	CY	9050	\$5.50	\$49,775.00
5	PIPE REMOVAL	LF	50	\$35.00	\$1,750.00
6	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
7	RIPRAP - RUBBLE	TN	0	\$65.00	\$0.00
8	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
9	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
10	CONCRETE BOX CULVERT (72 X 108)*	LF	0	\$850.00	\$0.00
11	CONCRETE BOX CULVERT (72 X 120)*	LF	0	\$950.00	\$0.00
12	SODDING	SY	7000	\$3.00	\$21,000.00
13	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
14	REINFORCED CONCRETE PIPE SECTION (72" SD)	LF	0	\$215.00	\$0.00
15	REINFORCED CONCRETE PIPE SECTION (60" SD)	LF	0	\$185.00	\$0.00
16	REINFORCED CONCRETE PIPE SECTION (54" SD)	LF	0	\$165.00	\$0.00
17	CONTINGENCY AMOUNT (30%)	LS	1	\$25,673.85	\$25,673.85
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$111,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$5,550.00	\$5,550.00
	DESIGN (15%)	LS	1.0	\$16,650.00	\$16,650.00
	PERMITTING (5%)	LS	1.0	\$5,550.00	\$5,550.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$5,550.00	\$5,550.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$33,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$144,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

**OPINION OF PROBABLE COST**



**54<sup>th</sup> Ave N Drainage Improvement (From 66<sup>th</sup> St N to 62<sup>nd</sup> St N) And  
 Channel 4-D Modifications  
 (From 66<sup>th</sup> St N to 62<sup>nd</sup> St N And From Channel 4 to 66<sup>th</sup> St N)  
 FC-5 AND FC-6**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$135,427.50	\$135,427.50
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$40,628.25	\$40,628.25
3	EROSION, SEDIMENT, AND TURBITY CONTROL (5%)	LS	1	\$67,713.75	\$67,713.75
4	EXCAVATION	CY	9050	\$5.50	\$49,775.00
5	PIPE REMOVAL	LF	50	\$35.00	\$1,750.00
6	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
7	RIPRAP - RUBBLE	TN	150	\$65.00	\$9,750.00
8	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
9	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
10	CONCRETE BOX CULVERT (72 X 108)*	LF	0	\$850.00	\$0.00
11	CONCRETE BOX CULVERT (72 X 120)*	LF	0	\$950.00	\$0.00
12	SODDING	SY	14500	\$3.00	\$43,500.00
13	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	0	\$3,750.00	\$0.00
14	REINFORCED CONCRETE PIPE SECTION (72" SD)	LF	2100	\$215.00	\$451,500.00
15	REINFORCED CONCRETE PIPE SECTION (60" SD)	LF	3600	\$185.00	\$666,000.00
16	REINFORCED CONCRETE PIPE SECTION (54" SD)	LF	800	\$165.00	\$132,000.00
17	CONTINGENCY AMOUNT (30%)	LS	1	\$479,413.35	\$479,413.35
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$2,077,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$103,850.00	\$103,850.00
	DESIGN (15%)	LS	1.0	\$311,550.00	\$311,550.00
	PERMITTING (5%)	LS	1.0	\$103,850.00	\$103,850.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$103,850.00	\$103,850.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$623,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$2,700,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

**OPINION OF PROBABLE COST**



**62<sup>nd</sup> Ave N Drainage Improvement And Channel 4 Modification  
 FC-7**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$30,245.00	\$30,245.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$9,073.50	\$9,073.50
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$15,122.50	\$15,122.50
4	CLEARING & GRUBBING	AC	2	\$5,500.00	\$11,000.00
5	EXCAVATION	CY	21450	\$5.50	\$117,975.00
6	PIPE REMOVAL	LF	50	\$35.00	\$1,750.00
7	EMBANKMENT	CY	4350	\$4.50	\$19,575.00
8	CONCRETE WEIR (50 FEET LONG)*	LS	0	\$60,000.00	\$0.00
9	RIPRAP - RUBBLE	TN	50	\$65.00	\$3,250.00
10	CONCRETE BOX CULVERT (84 X 120)*	LF	0	\$1,050.00	\$0.00
11	CONCRETE BOX CULVERT (108 X 120)*	LF	0	\$1,200.00	\$0.00
12	CONCRETE BOX CULVERT (72 X 108)*	LF	0	\$850.00	\$0.00
13	CONCRETE BOX CULVERT (72 X 120)*	LF	0	\$950.00	\$0.00
14	CONCRETE BOX CULVERT (96 X 120)*	LF	40	\$1,175.00	\$47,000.00
15	SODDING	SY	8000	\$3.00	\$24,000.00
16	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$8,500.00	\$17,000.00
17	TYPE "C" INLET, MODIFIED (OUTFALL)	EA	1	\$4,500.00	\$4,500.00
18	TYPE "C" INLET, DITCH BOTTOM	EA	1	\$2,500.00	\$2,500.00
19	REINFORCED CONCRETE PIPE SECTION (72" SD)	LF	0	\$215.00	\$0.00
20	REINFORCED CONCRETE PIPE SECTION (60" SD)	LF	0	\$185.00	\$0.00
21	REINFORCED CONCRETE PIPE SECTION (54" SD)	LF	0	\$165.00	\$0.00
22	REINFORCED CONCRETE PIPE SECTION (24" SD)	LF	980	\$55.00	\$53,900.00
23	MITERED END SECTION, OPTIONAL ROUND (24" SD)	EA	2	\$1,250.00	\$2,500.00
24	CONTINGENCY AMOUNT (30%)	LS	1	\$107,817.30	\$107,817.30
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$467,000.00</b>
	Parcel Number 32-30-16-69930-222-0402 (2016 Assessed Value)	LS	1	\$262,179.00	\$262,179.00
<b>PROPERTY ACQUISITION SUBTOTAL</b>					<b>\$262,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$23,350.00	\$23,350.00
	DESIGN (15%)	LS	1.0	\$70,050.00	\$70,050.00
	PERMITTING (5%)	LS	1.0	\$23,350.00	\$23,350.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$23,350.00	\$23,350.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$140,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$869,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

\* Costs shall include footing, coffer dam, de-watering, and water transfer costs

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for Silver Lake Pretreatment  
 WQ-1B**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$6,769.30	\$6,769.30
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$2,030.79	\$2,030.79
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$3,384.65	\$3,384.65
4	BMP EXCAVATION	CY	3650	\$5.50	\$20,075.00
5	HAULING	CY	3650	\$5.00	\$18,250.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	0	\$20.00	\$0.00
7	TRENCH GRAVEL	CY	0	\$15.00	\$0.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	5606	\$3.00	\$16,818.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	50	\$55.00	\$2,750.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$23,963.32	\$23,963.32
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$104,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$5,200.00	\$5,200.00
	DESIGN (15%)	LS	1.0	\$15,600.00	\$15,600.00
	PERMITTING (5%)	LS	1.0	\$5,200.00	\$5,200.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$5,200.00	\$5,200.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$31,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$135,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for Silver Lake Pretreatment  
 WQ-1A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$19,556.80	\$19,556.80
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$5,867.04	\$5,867.04
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$9,778.40	\$9,778.40
4	BMP EXCAVATION	CY	3650	\$5.50	\$20,075.00
5	HAULING	CY	3650	\$5.00	\$18,250.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	1700	\$20.00	\$34,000.00
7	TRENCH GRAVEL	CY	575	\$15.00	\$8,625.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	15500	\$5.50	\$85,250.00
9	SODDING	SY	5606	\$3.00	\$16,818.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	50	\$55.00	\$2,750.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$69,231.07	\$69,231.07
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$300,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$15,000.00	\$15,000.00
	DESIGN (15%)	LS	1.0	\$45,000.00	\$45,000.00
	PERMITTING (5%)	LS	1.0	\$15,000.00	\$15,000.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$15,000.00	\$15,000.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$90,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$390,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for Joe's Creek Greenway Park Detention Pond Pretreatment Area  
 WQ-2**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$35,073.70	\$35,073.70
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$10,522.11	\$10,522.11
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$17,536.85	\$17,536.85
4	BMP EXCAVATION	CY	26200	\$5.50	\$144,100.00
5	HAULING	CY	26200	\$5.00	\$131,000.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	0	\$20.00	\$0.00
7	TRENCH GRAVEL	CY	0	\$15.00	\$0.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	21304	\$3.00	\$63,912.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	35	\$55.00	\$1,925.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$124,160.90	\$124,160.90
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$538,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$26,900.00	\$26,900.00
	DESIGN (15%)	LS	1.0	\$80,700.00	\$80,700.00
	PERMITTING (5%)	LS	1.0	\$26,900.00	\$26,900.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$26,900.00	\$26,900.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$161,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$699,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for St. Petersburg 33rd-34th Ave. Pond Pretreatment  
 WQ-3A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$18,652.50	\$18,652.50
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$5,595.75	\$5,595.75
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$9,326.25	\$9,326.25
4	BMP EXCAVATION	CY	4300	\$5.50	\$23,650.00
5	HAULING	CY	4300	\$5.00	\$21,500.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	1400	\$20.00	\$28,000.00
7	TRENCH GRAVEL	CY	420	\$15.00	\$6,300.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	11000	\$5.50	\$60,500.00
9	SODDING	SY	5725	\$3.00	\$17,175.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	6	\$3,750.00	\$22,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	6	\$1,150.00	\$6,900.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$66,029.85	\$66,029.85
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$286,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$14,300.00	\$14,300.00
	DESIGN (15%)	LS	1.0	\$42,900.00	\$42,900.00
	PERMITTING (5%)	LS	1.0	\$14,300.00	\$14,300.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$14,300.00	\$14,300.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$86,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$372,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for St. Petersburg 33rd-34th Ave. Pond Pretreatment  
 WQ-3B**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$9,172.50	\$9,172.50
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$2,751.75	\$2,751.75
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$4,586.25	\$4,586.25
4	BMP EXCAVATION	CY	4300	\$5.50	\$23,650.00
5	HAULING	CY	4300	\$5.00	\$21,500.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	0	\$20.00	\$0.00
7	TRENCH GRAVEL	CY	0	\$15.00	\$0.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	5725	\$3.00	\$17,175.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	6	\$3,750.00	\$22,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	6	\$1,150.00	\$6,900.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$32,470.65	\$32,470.65
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$141,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$7,050.00	\$7,050.00
	DESIGN (15%)	LS	1.0	\$21,150.00	\$21,150.00
	PERMITTING (5%)	LS	1.0	\$7,050.00	\$7,050.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$7,050.00	\$7,050.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$42,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$183,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design



PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for St. Petersburg 30th Ave. North Median Filtration Area  
 WQ-4A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$13,871.25	\$13,871.25
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$4,161.38	\$4,161.38
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$6,935.63	\$6,935.63
4	BMP EXCAVATION	CY	675	\$5.50	\$3,712.50
5	HAULING	CY	675	\$5.00	\$3,375.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	875	\$20.00	\$17,500.00
7	TRENCH GRAVEL	CY	575	\$15.00	\$8,625.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	15200	\$5.50	\$83,600.00
9	SODDING	SY	2300	\$3.00	\$6,900.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	4	\$3,750.00	\$15,000.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$49,104.23	\$49,104.23
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$213,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$10,650.00	\$10,650.00
	DESIGN (15%)	LS	1.0	\$31,950.00	\$31,950.00
	PERMITTING (5%)	LS	1.0	\$10,650.00	\$10,650.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$10,650.00	\$10,650.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$64,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$277,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for St. Petersburg 30th Ave. North Median Filtration Area  
 WQ-4B**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$5,511.25	\$5,511.25
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$1,653.38	\$1,653.38
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$2,755.63	\$2,755.63
4	BMP EXCAVATION	CY	675	\$5.50	\$3,712.50
5	HAULING	CY	675	\$5.00	\$3,375.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	875	\$20.00	\$17,500.00
7	TRENCH GRAVEL	CY	575	\$15.00	\$8,625.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	2300	\$3.00	\$6,900.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	4	\$3,750.00	\$15,000.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	0	\$55.00	\$0.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	0	\$1,150.00	\$0.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$19,509.83	\$19,509.83
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$85,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$4,250.00	\$4,250.00
	DESIGN (15%)	LS	1.0	\$12,750.00	\$12,750.00
	PERMITTING (5%)	LS	1.0	\$4,250.00	\$4,250.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$4,250.00	\$4,250.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$26,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$111,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**  
**BMP - Joe's Creek Dry Retention Pond**  
**WQ-5**



ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$12,525.00	\$12,525.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$3,757.50	\$3,757.50
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$6,262.50	\$6,262.50
4	BMP EXCAVATION	CY	8700	\$5.50	\$47,850.00
5	HAULING	CY	8700	\$5.00	\$43,500.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	0	\$20.00	\$0.00
7	TRENCH GRAVEL	CY	0	\$15.00	\$0.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	6200	\$3.00	\$18,600.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	100	\$55.00	\$5,500.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$44,338.50	\$44,338.50
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$192,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$9,600.00	\$9,600.00
	DESIGN (15%)	LS	1.0	\$28,800.00	\$28,800.00
	PERMITTING (5%)	LS	1.0	\$9,600.00	\$9,600.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$9,600.00	\$9,600.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$58,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$250,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for Joe's Creek (Tidal) 70th Ave. North Pond Pretreatment  
 WQ-6A**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$12,995.00	\$12,995.00
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$3,898.50	\$3,898.50
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$6,497.50	\$6,497.50
4	BMP EXCAVATION	CY	4850	\$5.50	\$26,675.00
5	HAULING	CY	4850	\$5.00	\$24,250.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	450	\$20.00	\$9,000.00
7	TRENCH GRAVEL	CY	275	\$15.00	\$4,125.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	6800	\$5.50	\$37,400.00
9	SODDING	SY	5500	\$3.00	\$16,500.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	40	\$55.00	\$2,200.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$46,002.30	\$46,002.30
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$199,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$9,950.00	\$9,950.00
	DESIGN (15%)	LS	1.0	\$29,850.00	\$29,850.00
	PERMITTING (5%)	LS	1.0	\$9,950.00	\$9,950.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$9,950.00	\$9,950.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$60,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$259,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design

PROJECT NAME: Joe's Creek  
 DATE: December 8, 2016  
 PREPARED BY: RJE CHECKED BY: RJD

**OPINION OF PROBABLE COST**



**BMP for Joe's Creek (Tidal) 70th Ave. North Pond Pretreatment  
 WQ-6B**

ITEM NUMBER	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	COST
1	MOBILIZATION (10%)	LS	1	\$7,942.50	\$7,942.50
2	MAINTENANCE OF TRAFFIC (3%)	LS	1	\$2,382.75	\$2,382.75
3	EROSION, SEDIMENT, AND TURBIDITY CONTROL (5%)	LS	1	\$3,971.25	\$3,971.25
4	BMP EXCAVATION	CY	4850	\$5.50	\$26,675.00
5	HAULING	CY	4850	\$5.00	\$24,250.00
6	UNDERDRAIN PERFORATED PIPE (12-INCH TRENCH, 4"-6" PERF PIPE)	LF	0	\$20.00	\$0.00
7	TRENCH GRAVEL	CY	0	\$15.00	\$0.00
8	BAM POLLUTANT ABSORPTION MEDIA (ASSUME 12" DEPTH)	SF	0	\$5.50	\$0.00
9	SODDING	SY	5500	\$3.00	\$16,500.00
10	NEW JUNCTION/MH/DIVERSION STRUCTURE/CONTROL STRUCTURE	EA	2	\$3,750.00	\$7,500.00
11	REINFORCED CONCRETE PIPE SECTION (18" SD)	LF	40	\$55.00	\$2,200.00
12	MITERED END SECTION, OPTIONAL ROUND (18" SD)	EA	2	\$1,150.00	\$2,300.00
13	CONTINGENCY AMOUNT (30%)	LS	1	\$28,116.45	\$28,116.45
<b>CONSTRUCTION SUBTOTAL</b>					<b>\$122,000.00</b>
	SURVEYING AND TESTING (5%)	LS	1.0	\$6,100.00	\$6,100.00
	DESIGN (15%)	LS	1.0	\$18,300.00	\$18,300.00
	PERMITTING (5%)	LS	1.0	\$6,100.00	\$6,100.00
	CONSTRUCTION ADMINISTRATION & OVERSIGHT (5%)	LS	1.0	\$6,100.00	\$6,100.00
<b>PROFESSIONAL SERVICES SUBTOTAL</b>					<b>\$37,000.00</b>
<b>TOTAL COST ESTIMATE</b>					<b>\$159,000.00</b>

Note: Unit prices are based on FDOT Area 1 - 12-month moving average costs (11/01/2015 - 10/31/2016), as available.  
 A contingency of 30% was used to account for uncertainties in conceptual level design