March 2009

Belmont City-wide Storm Drainage Study Submittal

CALIFORNIA
CITY OF BELMONT

BELMONT-WIDE STORM DRAINAGE STUDY

March 2009

BKF

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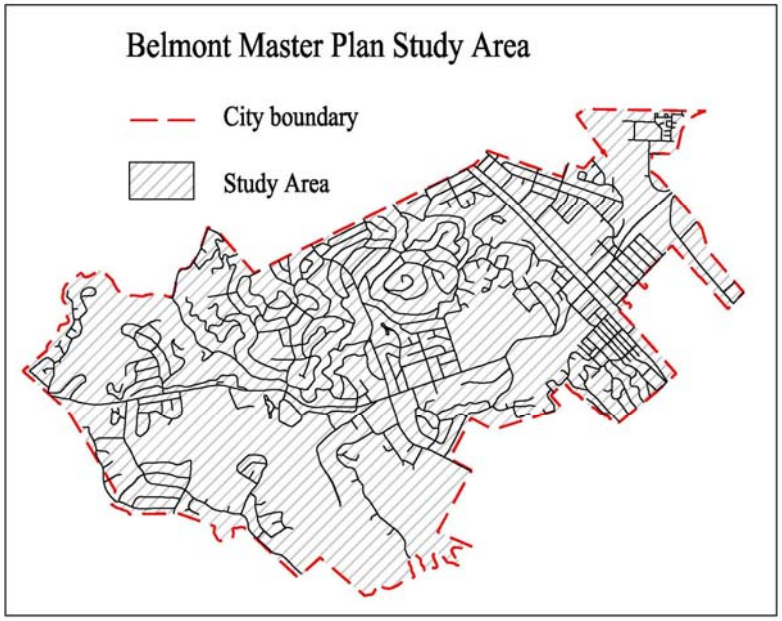
1. INTRODUCTION

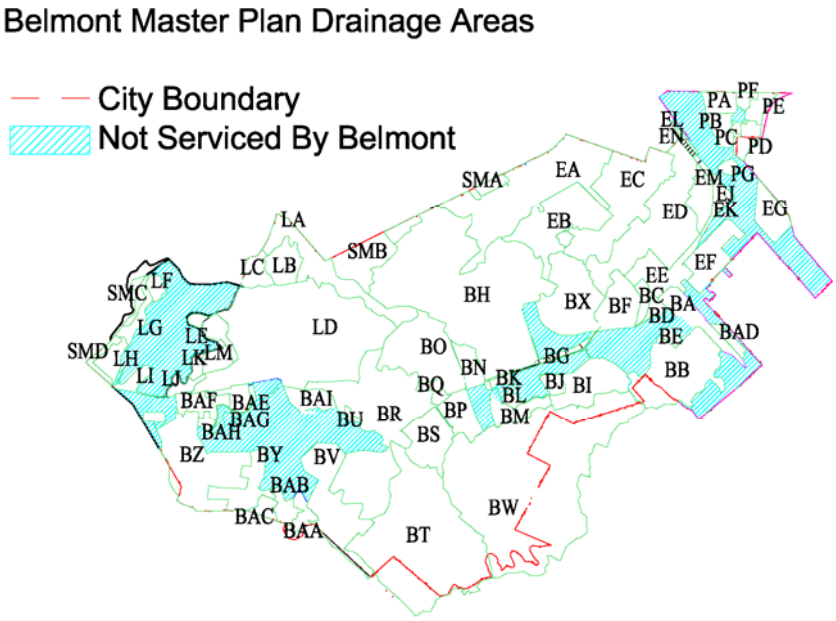
The following Drainage Study documents the existing City of Belmont's (City) stormwater drainage system and identify drainage system deficiencies. The goal of this report is to provide prioritized recommendations for system repairs and additions necessary to reduce storm drain deficiencies in the City of Belmont.



Belmont Storm Drainage Study
Project Area

2. SYSTEM LAYOUT

The City has a total area of 4.6 square miles. The areas not served by City storm drain pipes are shown using cross-hatching on the right. The primary storm drainage conveyance through the City is Belmont Creek. Belmont Creek has a 2.8 square mile drainage area that conveys runoff from about 60 percent of the City. Water Dog Lake is within the upper portion of the drainage area and detains runoff from 22 percent of the Belmont Creek drainage area.



Studied Drainage System
Boundaries

East of the railroad, Belmont Creek flows through a portion of San Carlos, and then enters Belmont again east of Highway 101. There are about 33 local drainage systems

that convey flows to outfalls within Belmont Creek. Figure 1A presents the vicinity map for the City of Belmont. Figures 1B through 1J present various aerial views of Belmont. See Figure 1L for city-wide regional drainage areas.

The eastern branch of Laurel Creek has an 0.78 square mile drainage area in the northwestern portion of the City and conveys runoff from about 17 percent of the City. Laurel Creek discharges to the City of San Mateo. There are 12 City drainage systems that outfall to Laurel Creek.

O'Neill Slough is located east of Highway 101 and is hydraulically connected to San Francisco Bay. Marina Lagoon is located directly east of Highway 101 north of the City. A total of 0.96 square miles, or 21 percent of the City discharges to O'Neill Slough or Marina Lagoon either directly or indirectly through City of San Mateo systems.

Island Park is east of Highway 101. Runoff from Island Park is to a Lagoon that connects to Belmont Creek through triple 48-inch diameter lines with flap gates. The drainage area to the lagoon is about 54 acres, which is about 2 percent of the City.

There are four locations where runoff flows to the City of San Mateo storm drain systems, North Road, Alameda de Las Pulgas, Roberts Avenue/Skyline Drive and Adelaide Way. The total drainage area for these four systems is about 26 acres.

Runoff enters the City storm drain system from the City of San Carlos along the entire southern length of the City. A total of about 183 acres (0.29 square miles) drains from San Carlos into the City.

3. EXECUTIVE SUMMARY

BKF has completed hydrologic and hydraulic analyses of the City System. The City system is comprised of 73 individual systems serving 73 drainage areas within the City. A total of about 33 percent of the storm drain lines are either under-sized, or constructed of pipe material that is aging and in need of replacement. Portions of Belmont Creek and Laurel Creek are undersized. Upgrades are proposed for under-sized storm drain and Creek systems. One regional improvement is proposed to direct a portion of the runoff that currently flows through San Mateo to an outfall under Highway 101 to O'Neill Slough.

3.a Concerns

The Master Plan identifies deficiencies within the City storm drain system. Deficiencies include areas without drainage facilities, failing corrugated metal storm drain lines, and undersized storm drain lines. Deficient storm drainage causes various problems including increased infiltration to the sewer system, flood related damage and roadway deterioration.

Flooding has various impacts including property damage and roadway embankment damage. Uncontrolled runoff causes local scour that can damage roadways and underground utility systems, including washout of sewer systems, causing releases of untreated sewage.

In areas without storm drain systems, runoff is conveyed through the gutters and within the street pavement section. Where there is no storm drain facilities, efforts are made to channel the flow in concrete gutters. The concrete gutters are often effective for new construction. As differential settlement occurs, runoff no longer enters the concrete swale, and, instead, flows along the asphalt. Runoff leaches oils from the asphalt, causing unraveling of the asphalt. When asphalt unravels, the rock within the asphalt is exposed, causing a rougher, less stable surface. Also cracking occurs. Where cracking occurs, runoff has a pathway to enter the roadway subbase, and can saturate the subbase. This

saturation increases the potential for sewer infiltration. In addition, the width of gutter increases in areas without a storm drain system. This increases the potential for storm runoff as inflow through sanitary sewer manhole lids and pick-holes to the sanitary sewer system.

Rusted corrugated metal storm drains develop holes that allow flow to exfiltrate from the pipe. Flow leaving the pipe saturates soils under the roadways. A portion of the exfiltrated runoff flows along the outside surface of the storm drain, washing away adjacent soils. With time, sufficient soil is washed away, allowing soils from above to fills the void created by the washed out material. If not repaired, the soil supporting the roadway will fail, leading to failure of the roadway pavement section. Prior to the road failing, water will exfiltrate from the pipe into the surrounding soils. This water either percolates to groundwater or enters into lower lying pipes. Typically, sewer pipes are deep to prevent contamination of domestic water lines by exfiltration from the sewer line. As a result sewer lines are below storm drain lines. Runoff that exfiltrates from failed storm drain lines can infiltrate into the sewer lines.

3.b Recommendations

Storm drain system failures impact City service for sanitary sewer system and traffic. Sanitary sewer impacts include increased potential for infiltration and inflow, increased flow into the sewer system, and increased chance of sewer system failure caused by washout of existing sanitary sewer lines.

Deficient storm drain lines within the City should be replaced. In addition, there are significant areas that are not served by drainage lines. The total cost to fix deficient pipes, is approximately $25,153,000. It is not feasible to replace all deficient lines and add additional lines in a timely manner. Therefore, a system of prioritization is recommended to gradually upgrade the City drainage system.

The cost to upgrade Belmont Creek to convey a 100-year event flow event is $2,166,000. The City recently made improvements to Laurel Creek that totaled about $400,000.

There are significant portions of the City that are not served by a City drainage system. The cost to extend storm drainage to these areas is about $12,944,000. Extension of drainage to these areas would reduce roadway maintenance and reduce infiltration to the sewer system.

There is a total of about 33,000 feet of roadway that does not have standard curb, gutter and sidewalk. Runoff within the pavement section leaches oils from the asphalt, destabilizing the roadway. There is increased saturation of soils, which further destabilizes the pavement section and increases infiltration potential to the sewer system. The cost for upgrading the roadways to include curb, gutter and sidewalk is about $2,818,000.

3.c Priority of Improvements

The following section provides a brief description for priorities of drainage solutions for the City's Storm Drainage system. Priorities were established as follows:

Priority High – Replacement of undersized, failing corrugated metal pipe lines. Replacement or slip-lining of failing corrugated metal pipes that have adequate flow capacity. Replacement of pipes to reduce the potential for uncontrolled flow of runoff outside the City Right-of-Way.

The three categories of high priority improvements are of equal priority to the City.

Priority Medium – Replacement of pipelines that are in good condition, but are undersized for a 10-year storm event and there is no flow path in streets (missing curb and gutter) for excess flows.

Priority Low – Replacement of pipelines that are in good condition, where overflow is through streets, or correct nuisance ponding in the street.

Many System improvements contain a combination of high, medium and low priority improvements. A detailed list of the priority for each length of storm drain is provided on the Tables in Appendix C.

Table 1 – Summary of Cost for Correcting System Deficiencies And Improvements to Minimize Infiltration and Inflow

System	Total Cost ($)	Uncontrolled Flows Improvements Priority Near-Term ($)	Failing CMP Replacement Priority Near-Term ($)	Failing CMP Slip-lining Priority Near-Term ($)	Undersized for the 10-year Event: No Street Path Pipes Priority Mid-Term ($)	Undersized for the 10-year Event: With Street Path Pipes Priority Long-Term ($)
CMP Repair	$1,660,000		$249,000	$1,412,000		
Un-modeled CMPs	$1,070,000					
Uncontrolled Flows	$4,130,000	$4,133,000				
Undersized Lines	$18,293,000				$5,560,000	$12,733,000
Storm Drain Total	**$25,153,000**	$4,133,000	$249,000	$1,412,000	$5,560,000	$12,733,000
In-stream Belmont Creek	$2,166,000				$2,166,000	
Total Cost With Creek Improvements	**$26,253,000**	$4,133,000	$249,000	$1,412,000	$9,483,000	$12,733,000
Pipe Extensions	$12,944,000	$3,544,000		$727,000	$314,000	$8,359,000
Curb and Gutter	$2,818,000					$2,818,000
Total Cost	**$44,080,000**					

Note Near term = Highest priority, Long term = Lowest priority

3.d Methodology

The Belmont storm drains were modeled using the Haested Method's StormCAD software. The City creeks were modeled using the Hydrologic Engineering Center's HEC-1 program to verify flows published by Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS). The creeks were then modeled using the

Hydrologic Engineering Center's-River Analysis System (HEC-RAS) program to verify water surface elevations and velocities within the channels.

The existing pipes were modeled for the 10-year storm event to prioritize a replacement schedule, using downstream conditions from the results of the HEC-RAS analysis. The results of the 10-year storm analysis are presented for each system in Appendix D. The proposed pipes presented are sized for the 25-year event following city standards. The proposed pipes are replacement pipes where necessary, for the build-out condition and are shown within existing city alignments and easements. Extensions of existing and proposed storm drain systems are recommended to serve those areas not currently served by underground facilities. The proposed drainage system, sized for the 25-year storm event, is presented in Appendix D. The Creeks were analyzed for both the 25 and 100-year storm events. The 25-year event is used to establish tailwater conditions downstream of storm drain systems. The 100-year event is used to develop recommendations for Creek improvements.

4. PREVIOUS REPORTS

The primary storm drainage conveyance through the City is Belmont Creek. Belmont Creek flooding is described in the Federal Emergency Management Agency (FEMA) Flood Insurance Study for the City of Belmont. FEMA has designated portions of the City of Belmont as within FEMA Flood Hazard Zone A, subject to flooding during a 100-yer flow storm event. These designations were made in the 1980's. For the area east of Highway 101, the designation does not account for the construction of the Redwood Shores and Island Park developments.

The most recent study evaluating Creek improvements was Belmont Creek Hydraulics Investigation by Parsons Brinkerhoff dated April 18, 1997. The project investigated the reach of the Creek from 6th Avenue and O'Neill Street to east of Old County Road. The study concludes that Belmont Creek is sized for a 25-year storm event and that railroad improvements should be consistent with this level of protection.

Island Park hydrology and hydraulics are presented in the report, Design Report Stormwater Retention Lagoon by Van Kirk Engineers dated July 1985. This report presents an evaluation of concurrent rainfall and high tide events on water levels within the Island Park Lagoon. The report concludes that a Lagoon water level of elevation 5.0 will occur during a 480-year storm event, with the return frequency developed based on a high tide concurrent with a 100-year rainfall event.

Wilsey Hamm conducted a combined Storm Drain and Sanitary Sewer Master Plan for the City of Belmont, dated May 5th 1980. Wilsey Hamm also conducted a combined Storm Drain and Sanitary Sewer Master Plan for the City of Belmont, December 15th 1965.

5. IMPLEMENTATION PLAN

This Implementation Plan presents recommendations for phasing improvements to upgrade the City's storm drainage system. The Implementation Plan is based on local collection system improvements shown on Figures 2A through 2L and recommended in stream improvements shown on Figures 3A through 3F in Appendix A. Figure 3G shows culverted sections of Belmont Creek.

5.a Purpose

The purpose of the City-wide Storm Drainage Study is to document the existing City stormwater drainage system, identify drainage deficiencies and prioritize system repairs and upgrades to correct the deficiencies.

5.b Existing Capital Improvement Program

Currently, the City does not have a Capital Improvement Program for upgrading their storm drainage system. Upgrades that are made by the City are based on pipe failures and have not addressed the major system deficiencies. Upgrades of major drainage systems have been constructed by site developers as a condition of development, and have not been guided by Master Plan requirements.

5.c Proposed Capital Improvement Program

This Storm Drainage Study presents costs and facility's sizes necessary to provide a consistent level of storm drainage protection throughout the City. Systems with deficient storm drain lines are noted and replacement pipe sizes are determined. Improvements are identified to provide a consistent level of storm drainage protection throughout the City. The estimated total cost for these facilities is $24.1 million. In addition, a total of $2.2 million is necessary to upgrade Belmont Creek to provide a 100-year level of protection, $15.1 million is necessary to extend the storm drain system and $2.8 million is necessary to provide curb, gutter and sidewalk in areas without facilities.

To establish an equitable manner for dealing with flooding complaints, proposed improvements are prioritized. Highest priority is given to projects that improve the level of service to areas where storm water frequently floods properties and there are failing or undersized CMP lines. Lower priority is given to projects that eliminate good condition pipelines that are just undersized and new pipes for eliminating nuisance localized ponding in the gutter.

6. DRAINAGE STUDY SUMMARY

BKF has completed the hydrologic and hydraulic analyses of the City systems. The City system is comprised of about 73 individual systems that serve the City. The drainage boundaries for these systems are shown on Figure 2 in Appendix A.

6.a Drainage Patterns

The City of Belmont extends from the San Francisco Bay southwesterly up into the foothills. The drainage system within the upland portion of the City is through well defined valleys that drain toward Belmont and Laurel Creeks. Systems east of El Camino Real drain toward O'Neill Slough.

Belmont Creek

Belmont Creek originates in the western portion of the City. The upper portion of the drainage area flows to Water Dog Lake. The 1980 FEMA study included flow detention at Notre Dame Reservoir (commonly referred to as Water Dog Lake). Water Dog Lake is owned by Notre Dame de Namur University, and is leased to the City of Belmont. The lease is scheduled to expire in 2012. Belmont Creek flows parallel to Ralston Avenue through the western portion of the City. At Fifth Avenue, the Creek enters an underground storm drain system that conveys flows toward the south, away from Ralston Avenue. The Creek crosses El Camino Real and then day lights. The creek then passes under the Railroad tracks between Harbor Boulevard and Broadway and under Old County Road. East of the Railroad Tracks, the Creek flows through San Carlos in an open channel. The Creek crosses under Highway 101 in a box culvert and reenters the City north of Shoreline Drive. The Creek flows as open channel that is parallel to Twin Dolphin Drive, flows northerly under a bridge at Marine World Parkway and flows to San Francisco Bay through Belmont Slough.

Belmont Creek has an under-sized section where flow capacity can be expanded by construction of a parallel storm drain line. These sections are shown on Figures 3A through 3F. The portion of the Creek that is culverted from 6th Avenue and O'Neill Street to the Creek daylighted near the Caltrain culvert, will be bypassed to allow excess flow around existing constrictions in the culvert. This bypass alignment will follow the City right-of-way down O'neill Street to El Camino Real, and connect with the larger section of culvert downstream. Culverted sections are shown on Figure 3G. The Creek crossing at Old County Road will convey a 10-year storm event. Runoff that cannot be conveyed through the culvert will bubble out of the storm drain line and flow through the Harbor Grade Separation under crossing or overflow Old County Road.

East Branch of Laurel Creek

Laurel Creek conveys flows from the northwestern portion of the City toward the City of San Mateo. The East Branch of Laurel Creek drainage area consists primarily of low density residential areas adjacent to open space areas. There are several apartment complexes within the drainage area. Much of the Creek is in undeveloped areas. A portion of the Creek near San Mateo is adjacent to the Laurel Creek roadway. Laurel Creek is conveyed by multiple culverts under East Laurel Drive. A failing culvert is labeled on Figures 3E and 3F, was repaired to protect the East Laurel Creek roadway.

San Mateo

There are two storm drainage areas along the northern portion of Belmont that discharge directly to City of San Mateo storm drain systems. Two storm drainage systems are along the western portion of Belmont, and discharge indirectly to San Mateo. All but one system have adequate flow capacity during a 10-year event. The deficiency for the one system is minor and upgrades are a low priority. There are other locations where runoff

flows to San Mateo drainage systems as street flow or within swales. These areas appear to have adequate flow capacity.

Discharge to Slough, Laurel Creek, Marina Lagoon

Runoff from much of the downtown and low-lying portions of Belmont is to O'Neill Slough and to non-tidally influenced portions of the City of San Mateo storm drain system. Non-tidally influenced storm drain systems outfall through San Mateo to Marina Lagoon, a lagoon that is pumped to the San Francisco Bay. The starting water level for Marina Lagoon is assumed to be -3.1 feet. There are eleven primary storm drain systems outfalling to the O'Neill slough and Marina Lagoon, all of which are under-sized and susceptible to flooding during minor storm events.

Improvements to City lines connecting to City of San Mateo storm drain lines are not expected to have adverse impacts. Coordination with the City of San Mateo will be necessary for downstream improvements to the Belmont storm drains in this area. If San Mateo coordination is not possible, a regional solution is provided to relieve capacity problems within this area. Flows that are entering San Mateo storm drain lines will continue to enter these lines for all improvements but the regional solution. Figures 4 and 4A show the alignment of the proposed regional solution. Tables R1 through R5 show flows and water levels during design storm events with the regional solution in place.

Island Park

The Island Park development is east of Highway 101 and north of Belmont Slough. Island Park drains to a Lagoon that is hydraulically connected to Belmont Slough through three parallel 48-inch diameter storm drain lines. Lagoon hydraulics are presented in the report "Design Report, Stormwater Retention Lagoon" by Van Kirk Engineers. During a normal dry weather day, the maximum water level in the Lagoon is elevation 2.8. During a 100-year storm event with extreme tides, the water level will be elevation 4.5. Storm drains in the area generally have adequate flow capacity, with minor ponding expected

during a 10-year storm event. Improvements in this area are Low Priority because runoff in excess of the storm drain system flow capacity is conveyed to the Lagoon as overland flow.

Local Collections Systems

The analyses show that most storm drain systems west of El Camino Real have adequate flow capacity during a 10-year storm event. Most under-sized lines are CMP, and are highest priority of replacement. East of El Camino Real, systems are significantly under-sized, with storm drain system flow capacity under Highway 101 a major limitation. The areas within the City with deficient storm drainage based on a 10-year design storm criterion are indicated on Figures 2A, through 2L in Appendix A. The reported deficiencies do not account for overtopping flows from upstream systems. West of El Camino Real, this is not a concern. East of El Camino Real, runoff from adjoining deficient systems worsens flooding in areas with existing under-sized lines. Areas that are not served by an underground storm drainage system are shown as cross hatched in brown on the figures. Existing storm drain systems that have sufficient capacity are shown in teal. The locations of deficient storm drain facilities are shown in various colored lines. Proposed storm drains needed to service areas not presently serviced by existing systems are presented on Figure 5. Where deficiencies were found, the existing pipe size is shown along with the pipe size that would be needed to handle the flow.

As a part of the Drainage Study, BKF evaluated regional solutions. The regional solution consists of the installation of new "interceptor" storm drain lines that collect storm water from the upstream storm drains and divert it into a new pipeline rather than increasing the size of the down stream system. The regional solution was identified that had costs equivalent to replacement of the existing line. The Interceptor lines that were evaluated are shown in orange on Figure 4 in Appendix A. Because there is not a clear advantage to the "interceptor line" BKF recommends that the City base Drainage Study decisions on

the replacement of the existing line. During the project design phase, the option of the interceptor line should be re-evaluated.

6.b Recommendations

Based on our analyses of the City's existing drainage systems, most of the systems west of El Camino Real provide a 10-year storm event level of service. In this area, most under-sized pipes are CMP lines. These under-sized lines are also failing structurally and the City should make replacement of these lines a high priority.

Priorities were established as follows:

High Priority Undersized CMP improvements are necessary where undersized CMP storm drain lines are failing. These locations have the highest risk of failure of the storm drain line leading to the formation of a sinkhole. There is one High Priority Undersized CMP systems east of El Camino Real, two in Belmont Creek and one in the Laurel Creek drainage areas.

High Priority Aging CMP improvements are necessary to replace aging CMP lines that otherwise have adequate flow capacity. Slip-lining a thin walled high density polyethylene (HDPE) line into the pipe and grouting the annular space between the HDPE and the aging CMP is recommended for lines 15-inch and larger. Existing 12-inch diameter CMP lines should be replaced.

Priority High, Private Property Flooding improvements consist of correction of undersized lines where the overland flow path of excess runoff is outside the City right-of-way. There are nine locations where this occurs in the Belmont Creek drainage area, two locations in the Laurel Creek drainage area and six locations east of El Camino Real. The Belmont Creek and Laurel Creek High Priority Property Flooding improvements are

proposed where undersized lines serve sag points where overland release is across private property. The East of El Camino Real improvements are required because there is inadequate flow capacity across Highway 101, leading to flooding of the low-lying areas immediately west of the Highway.

Medium Priority improvements correct existing under-sized lines where the excess flow is not readily conveyed within the street. There are many locations where this occurs throughout the City.

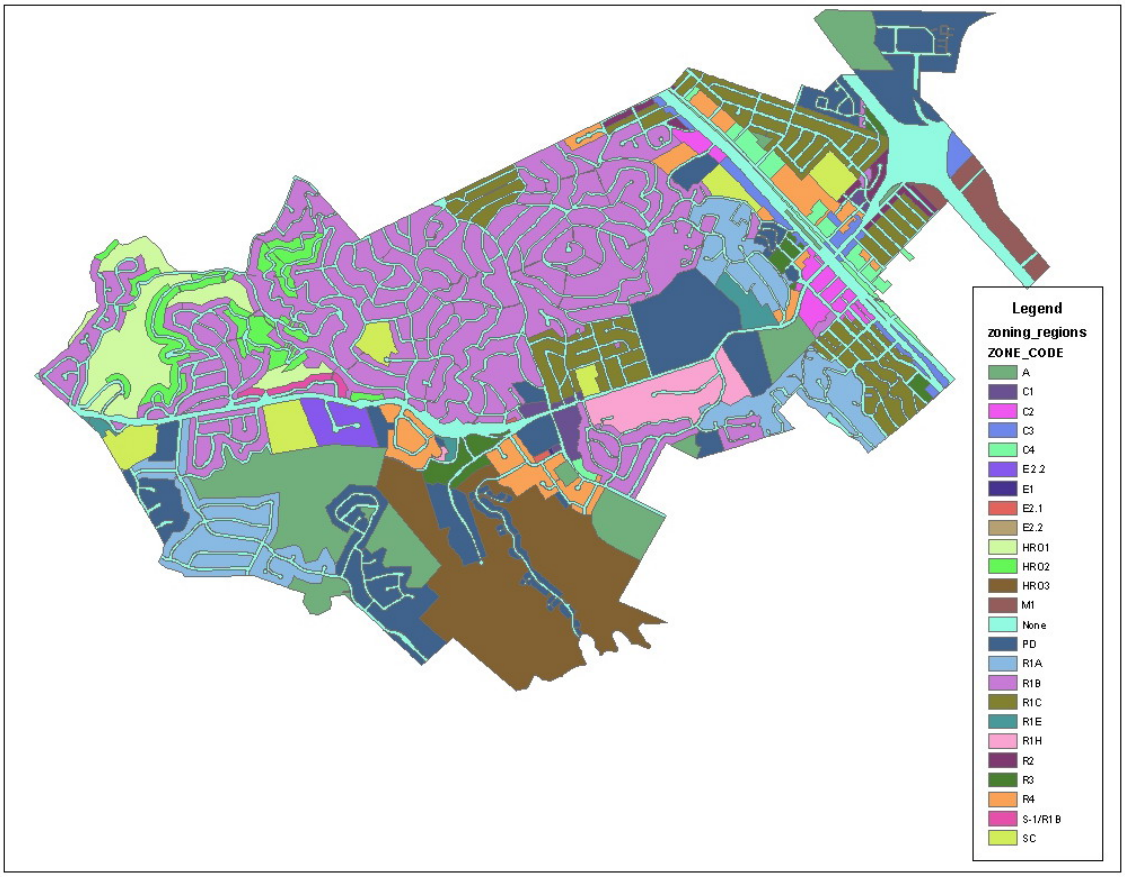
Low Priority improvements correcting existing undersized lines where there is adequate flow capacity within the street to convey the excess runoff. This occurs in many places throughout the City. These lines should be replaced only as required based on lifecycle concerns. At the time of replacement, upsizing should occur to provide a consistent level of storm drain service throughout the City.

7. SYSTEM IDENTIFICATION

The drainage system pipe diameter and line inverts are taken from the GIS mapping conducted by Towill in 1994. The GIS mapping includes an inventory of the existing storm drain system. BKF used the Towill map for the initial system identification. The Towill GIS mapping results were reviewed by BKF and updates made as needed. GIS and survey data was conducted using the NGVD 1929 datum.

Rim elevations are available from the GIS maps. For key lines, BKF has surveyed the distance from the rim elevation to the invert. In areas where video monitoring has occurred, this distance is collected as a part of the pipe evaluation. Where information is available, BKF has used the measured invert. Where information was not found, BKF has approximated the invert elevation based on a depth with three feet of cover on the pipe. The systems are evaluated based on surcharge flow conditions, the analyses are not

highly sensitive to storm drain invert. Proposed improvements are presented on Figure 6. Pipe sizes are as presented on the GIS Maps unless determined to be different from BKF field review or from sizes shown on Improvement Plans.



City land use maps were used to calculate runoff coefficients for City areas. Runoff coefficients are presented in Appendix E.

The methodology and design criteria used for analyzing the City's drainage system are also presented in Appendix E.

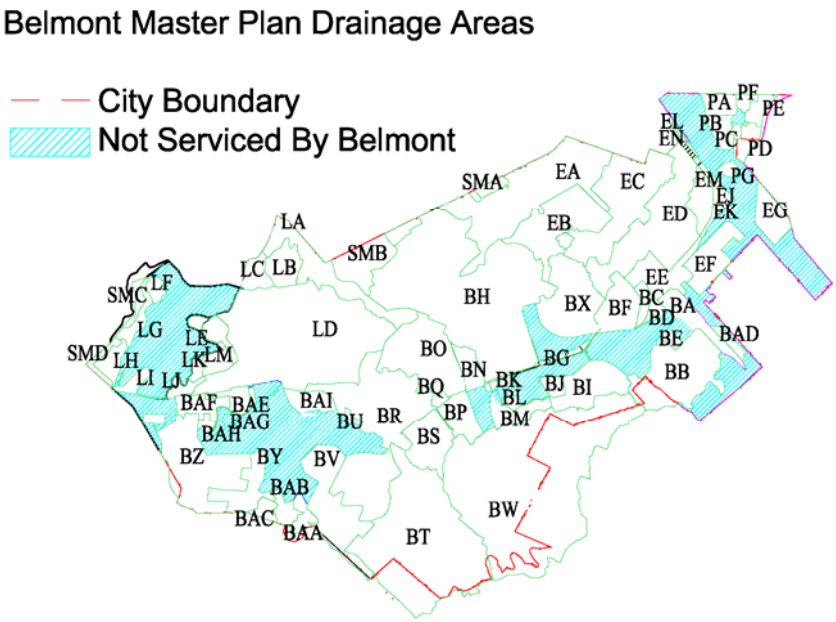
8. DRAINAGE ISSUES

The City of Belmont has drainage issues that affect various regions of the City as well as problems that affect individual properties. The regional problems generally affect many

property owners and usually occur only when there is a significant storm event. These problems occur as a result of deficiencies in the Belmont storm drain system. The problems that are seen by isolated individual property owners occur whenever there is a major storm event. Local drainage problems are summarized in Appendix C and below.

The City provided BKF with a map and list of known problems from service calls and problem reports. These problem locations are shown on Figure 7A. BKF conducted a field review of city during 3 storm events. Field data was collected and City problem locations were verified in most locations. Video monitoring data was reviewed and used where available. Video monitoring problem locations are shown on Figures 7B and 7C. BKF then modeled these observed problem locations as part of the drainage system city-wide model.

There are 73 modeled city-wide drainage systems that serve the City. Drainage boundaries for the individual systems are shown on Figure 2. Detailed drainage boundaries and inlet locations are shown on Figures contained in Appendix D. The following describes each system:



System BA - System BA discharges to the box culvert portion of Belmont Creek near El Camino Real. This is a piped system with 12 and 18-inch diameter RCP lines. This area is subject to flooding from backwater from Belmont Creek. Low Priority improvements are recommended.

System BB - System BB discharges to the box culvert portion of Belmont Creek near El Camino Real and serves Broadway. This is a piped system with 12 to 48-inch diameter RCP lines. This area is in the hill above El Camino Real and is not sensitive to Belmont Creek water levels. Most lines have adequate flow capacity. Several 12-inch lines are slightly under-sized. In most areas where lines are under-sized, there is adequate flow capacity in the street. Along Vine Street, there is a section of undersized line that crosses private property that should be upsized, High Priority. The remaining improvements are Low Priority.

System BC - System BC discharges to the box culvert portion of Belmont Creek near El Camino Real and serves 6th Avenue. This is a piped system with 12 to 30-inch diameter RCP lines. This area is in the hill above El Camino Real and is not sensitive to Belmont Creek water levels. *The line conveys the 10-year storm event.*

System BD - System BD discharges to Belmont Creek near 6th Avenue. *The line conveys the 10-year storm event.*

System BE - System BE discharges to Belmont Creek near Sunnyslope Avenue. *The line conveys the 10-year storm event.*

System BF - System BF discharges to Belmont Creek near South Street. *The line conveys the 10-year storm event.*

System BG - System BG discharges to Notre Dame Creek in the vicinity of Ralston Avenue near the entrance to Notre Dame de Namur University. *The line conveys the 10-year storm event.*

System BH - System BH discharges to Notre Dame Creek at Notre Dame Avenue. There are several under-sized lines within this drainage area. There are

three reaches of under-sized CMP lines near Fairway Drive. Failure of these lines would cause overflow to private property areas. A total of 395 feet of High Priority line improvements that are currently CMP lines. Remaining improvements are Low Priority.

System BI - System BI discharges to Belmont Creek in the vicinity of Chula Vista Drive. There are two slightly undersized lines where street flow is adequate to convey excess flows. *Several Low Priority improvements are recommended.*

System BJ - System BJ discharges to Belmont Creek in the vicinity of Escondido Way. *The line conveys the 10-year storm event.*

System BK - System BK discharges to Belmont Creek in the vicinity of Misty Way. *The line conveys the 10-year storm event.*

System BL - System BL discharges to Belmont Creek in the vicinity of Kittie Lane. *Several Low Priority improvements are recommended.*

System BM - System BM discharges to Belmont Creek in the vicinity of Maywood Drive. The existing 15-inch diameter line is under sized. *Flow in excess of the flow capacity of the line is conveyed to Belmont Creek as surface flow. Low Priority improvements are recommended.*

System BN - System BN discharges to Belmont Creek in the vicinity of Ralston Avenue near the Alameda de las Pulgas Branch. *Low Priority improvements are recommended.*

System BO - System BO discharges to Belmont Creek from the north at Alameda de las Pulgas. There are several significantly undersized 12-inch diameter lines.

Several Medium Priority improvements are recommended. The remainder of improvements are Low Priority improvements.

System BP - System BP discharges to Belmont Creek from the north at Alameda de las Pulgas. *The line conveys the 10-year storm event.*

System BQ - System BQ discharges to Belmont Creek at Coronet Boulevard. The line is CMP, but has adequate flow capacity to convey the 10-year storm event. *The line should be repaired by slip-lining as High Priority.*

System BR - System BR discharges to Belmont Creek at Carlmont Drive. Most of the system has adequate flow capacity. *There are 98-feet of CMP that needs to be upsized (High Priority) and 259-feet of CMP that have adequate flow capacity and should be slip-lined. There is also a section of under-sized CMP that should be slip-lined. Remaining improvements are Low Priority.*

System BS - System BS discharges to Belmont Creek from Hastings Drive near Mulberry Court. *There is a 18-inch diameter line, most of which is CMP, that should be slip-lined as a High Priority, the remaining improvements are also High Priority.*

System BT - System BT discharges to Belmont Creek from the south at Carlmont Drive. *The line conveys the 10-year storm event.*

System BU - System BU discharges to Belmont Creek at Continentals Way. The line is 10-inch diameter and is undersized. Medium *Priority improvements are recommended.*

System BV - System BV discharges to Belmont Creek in the vicinity of Wakefield Drive and Somerset Drive. *Replacement of this portion of the line is a*

High Priority for private property flooding. Remaining improvements are Low Priority.

System BW - System BW discharges to the Alameda de las Pulgas Branch of Belmont Creek in the vicinity of El Verano Way. There are several lengths of line that are slightly under-sized. *Low Priority improvements are recommended.*

System BX - System BX discharges to Belmont Creek in the vicinity of Ralston Village. The outlet pipe for System BX collects runoff from Notre Dame Creek. The entire system is under-sized. System spills would flow down Ralston Avenue. *This system is considered for Medium and Low Priority replacements.*

System BY - System BY discharges to Belmont Creek in the vicinity of Comstock Circle. Much of the line is undersized. *The reach at the outfall to the Creek is undersized with no overland flow path to the Creek (flooding). This system is considered as High Priority. Remaining improvements are Low Priority.*

System BZ - System BZ discharges to Belmont Creek in the vicinity of Hallmark Drive. Much of the line is undersized. *The reach at the outfall to the Creek is undersized with no overland flow path to the Creek (flooding). This improvement is considered as High Priority private property flooding. Other improvements in the system are Medium and Low Priorities.*

System BAA - System BAA discharges to Belmont Creek in the vicinity of Hallmark Drive near Paddington Court. *The line is RCP and conveys the 10-year storm event.*

System BAB - System BAB discharges to Belmont Creek in the vicinity of Soho Circle. *The line is RCP and conveys the 10-year storm event.*

System BAC - System BAC discharges to Belmont Creek in the vicinity of Waterloo Court. There are two lengths of RCP line that are slightly undersized. *Excess flow would be across private property flooding and replacement of these lines is High Priority. Remaining improvements are Low Priority.*

System BAD - System BAD discharges to the box culvert portion of Belmont Creek in the vicinity of Harbor Drive at El Camino Real. *Low Priority improvements for nuisance flooding are recommended.*

System BAE - System BAE discharges to Belmont Creek in the vicinity of Bryce Court. The reach at the outfall to the Creek is undersized with no overland flow path to the Creek. This system conveys the 10-year event.

System BAF - System BAF discharges to Belmont Creek in the vicinity of Muir Way. The system is 12-inch diameter. There is a 186-foot length of CMP that should be replaced. There is an additional 759-foot section of adjacent undersized 12-inch diameter line that should be replaced at the same time, High Priority. *The remaining improvements are Low Priority.*

System BAG - System BAG discharges to Belmont Creek in the vicinity of Bryce Court. The line is 12-inch diameter CMP and should be replaced as High Priority.

System BAH - System BAH discharges to Belmont Creek in the vicinity of Lassen Drive. *The line is RCP and conveys the 10-year storm event.*

System BAI - System BAI discharges to Belmont Creek in the vicinity of Davis Drive. *There is a 426-foot length of 24-inch diameter CMP that should be slip-lined as High Priority.*

Laurel Creek Drainage Systems

System LA - System LA discharges to Laurel Creek in the vicinity of Haskins Drive. *There is a 1,837-foot length of undersized 12 and 15-inch diameter line that crosses private property at a sag point. This portion of the line should be replaced as a High Priority. There is a 222-foot length of 18-inch diameter CMP line that should be slip lined. The remaining line is RCP and conveys the 10-year storm event.*

System LB - System LB discharges to Laurel Creek in the vicinity of Laurel Creek Road and Bay Drive. *The line is RCP and conveys the 10-year storm event.*

System LC - System LC is a culvert on Laurel Creek in the vicinity of Laurel Creek Road and Bay Drive. *The line is RCP and conveys the 10-year storm event.*

System LD - System LD discharges to Laurel Creek in the vicinity of Laurel Creek Road and San Juan Court. *There is one location in the upper drainage area where there is an under-sized line with no street release. There is a significant length of adequately sized CMP line that should be slip-lined as High Priority. Remaining improvements are Low Priority.*

System LE - System LE discharges to Laurel Creek in the vicinity of Hillcrest Drive. *There are several locations with under-sized RCP lines, with Low Priority repairs required.*

System LF - System LF discharges to Laurel Creek in the vicinity of Bishop Road. *The line is RCP and conveys the 10-year storm event.*

System LG - System LG discharges to Laurel Creek in the vicinity of Marsten Avenue. *The line is RCP and conveys the 10-year storm event.*

System LH - System LH discharges to Laurel Creek in the vicinity of Marsten Avenue and Lori Drive. *High Priority slip-lining is recommended for failing CMP lines.*

System LI - System LI discharges to Laurel Creek in the vicinity of Naughton Avenue near Ralston Ranch Road. *There is 191-feet of 18-inch diameter CMP that should be slip-lined as High Priority. The remaining system is RCP and conveys the 10-year storm event.*

System LJ - System LJ discharges to Laurel Creek in the vicinity of Naughton Avenue. *The entire system is CMP line. There is a 298-foot length of 12-inch diameter line that should be replaced and a 347-foot length of 18-inch diameter line that should be slip-lined as High Priority.*

System LK - System LK discharges to Laurel Creek in the vicinity of Naughton Avenue. *The final 256-feet is CMP and should be slip-lined as High Priority. The remaining system is RCP and conveys the 10-year storm event.*

System LL – There is no system LL.

System LM - System LM discharges to Laurel Creek in the vicinity of Hillcrest Drive. *There is an under-sized reach of line where excess flows are conveyed in the street. Low Priority improvements are recommended.*

Drainage Systems to City of San Mateo Local Collection Systems

System SMA - System SMA discharges to a City of San Mateo drainage system at North Road. *The system is RCP and conveys the 10-year storm event.*

System SMB - System SMB discharges to a City of San Mateo drainage system at Alameda de las Pulgas. *The system is undersized with excess flows conveyed in the street, improvements are recommended as Low Priority.*

System SMC - System SMC discharges to a San Mateo County served drainage system near Roberts Avenue and Skymont Drive. *The system is RCP and conveys the 10-year storm event.*

System SMD - System SMD discharges to a San Mateo County served drainage system near Adelaide Way. *The system is RCP and conveys the 10-year storm event.*

Drainage Systems To Island Park Lagoon

System PA - System PA discharges to the Island Park Lagoon near Clipper Court. *There are several under-sized lines to be replaced as Low Priority. There is available flow in the street at locations with under-sized lines and no additional improvements are recommended.*

System PB - System PB discharges to the Island Park Lagoon near Concourse Drive. There are several under-sized 12-inch diameter lines. *There is available flow in the street at locations with under-sized lines with Low Priority improvements recommended.*

System PC - System PC discharges to the Island Park Lagoon near Concourse Drive and Clipper Drive. *The system is RCP and conveys the 10-year storm event.*

System PD - System PD discharges to the Island Park Lagoon near Concourse Drive and Clipper Drive. *There are a significant number of undersized lines with Low Priority improvements recommended.*

System PE - System PE discharges to the Island Park Lagoon near Clipper Drive. *There are a significant number of undersized 12-inch lines with Low Priority improvements recommended.*

System PF - System PF discharges to the Island Park Lagoon near Sotocastle Lane. There are two undersized lengths of 12-inch lines. *There is an overland flow path in the streets and Low Priority improvements are recommended.*

System PG - System PG discharges to the O'Neill Slough near Island Parkway Drive. *The system is RCP and conveys the 10-year storm event.*

Drainage Systems East of El Camino Real That Drain to O'Neill Slough or Marina Lagoon through Laurel Creek

System EA - System EA is the Ruth Avenue / Hillman Avenue system that conveys runoff to a City of San Mateo drainage facility. There is a significant length of undersized 18-inch diameter RCP that flows through a rear lot easement. *This line does not have adequate flow capacity for a 2-year storm event, and overtopping is expected at least once in most years (High Priority – Private Property Flooding). Other portions of the line are also significantly under sized. System EA is primarily RCP line, and pipe failure caused by aging line is not anticipated. A proposed line is recommended along Ruth Avenue, and existing systems along North (Medium Priority) and El Camino Real (Medium Priority) and further downstream along Dale View (Low Priority) are recommended.*

System EB – System EB is the Glen Road system. The system serves the recently developed Ross Woods development. Analyses made as a part of the Ross Woods development show that the system conveys the 100-year storm event. *There is*

significant CMP line in this area that should be slip-lined as High Priority. The remaining improvements are Medium and Low Priorities.

System EC – System EC conveys flows easterly on Marine View Avenue and discharges to a City of San Mateo storm drain system at Seagate Drive. There are CMP lines in the system. *High (CMP replacement) and Low Priority replacements are recommended in this drainage area.*

System ED – System ED conveys flows northeasterly along Briarfield Way. The system conveys flows through lots at Chesterton Avenue. The line is adjacent to Highway 101 through rear lots of Seagate Way. The line flows through the City of San Mateo and enters Laurel Creek immediately upstream of Highway 101. *All priority levels are recommended for this system. (High priority flooding)*

System EE – System EE conveys flows along Ralston Avenue, through the Highway 101 interchange, to a culvert that discharges to O'Neill Slough. There is a flap gate at O'Neill Slough that prevents high tailwater from entering the system. *Low Priority improvements are recommended.*

System EF- System EF is a mid-block system between O'Neill Avenue and Ralston Avenue / Highway 101 on-ramp. The line is between lots except where it crosses City streets. The line discharges to an open ditch at the grade separation. The line crosses through private property and there is no overland release. *The portion through private property (flooding) should be upsized as a High Priority replacement. Remaining improvements are Low Priority.*

System EG – System EG conveys flows along Sem Lane to Belmont Creek east of Highway 101. The line is oversized for the immediate drainage area, but serves to dewater the area in the event that Belmont Creek overtops its banks west of Highway 101.

Systems EH and EI are in San Carlos and are not analyzed as a part of this study.

Systems EJ, EK, EL EM and EN are a part of the Ralston Interchange. These systems are a single system consisting of culverts and open channel reaches through the interchange. The system receives runoff from System EE, the Ralston Avenue system. System EL is the primary Highway 101 crossing for the area east of El Camino Real. *Analyses are based on installation of one additional parallel 48-inch diameter culvert across Highway 101 as a High Priority improvement. Failing CMP lines in this system shall be replaced.*

System EO – System EO serves the southern portion of the Ross Woods development. System EO was evaluated as a part of Ross Woods and conveys the 100-year storm event to a ditch at the Railroad. The Railroad ditch conveys flows to System EA. System EA is undersized and a tailwater occurs at this location. *With the downstream portion of System EA corrected, there will be adequate flow capacity in the railroad ditch, and improvements are recommended as Medium Priority.*

The analyses for the above recommendations are presented in Appendix D. Analyses for each drainage area are placed behind a Figure that shows the drainage area. The letters, indicated by "XY", identifies the system analyzed, where the X is B for Belmont Creek drainage area, L for Laurel Creek drainage area, P for Island Park drainage Area, SM for drainage to a City of San Mateo storm drain system, and E for a system that discharges east of El Camino Real. "Y" is the sub-system within each larger drainage area. For each system, there is, (1) a Figure showing the drainage system, (2) an existing system hydrology for 10-year event Table (XY.1), (3) an existing system hydraulics for 10-year event table (XY.2), (4) a proposed system hydrology for 25-year event table (XY.3), and (5) a proposed system hydraulics for 25-year event table (XY.4). Following system tables are the Belmont and Laurel Creek tables for water surface elevations and velocities.

The regional solution alternative was evaluated and is shown on Figure 4 in Appendix A. This system consists of a line to O'Neill Slough that will collect runoff from Systems east of El Camino Real (the "E" systems.) The line will reduce flow to the existing "E" system outfalls, reducing the need for multiple outfall permits and outside entity coordination. For the Regional Alternative, results are presented in proposed system hydraulics tables D-R1 to D-R5 in Appendix D, with proposed system hydraulics tables. The costs tables are presented in Appendix C, Table C-Regional. The regional solution provides significant benefit by limiting work within the Caltrans right-of-way, limiting environmental permitting to a single outfall, and avoiding the potential for increased flows to storm drain systems within neighboring Cities.
Proposed line sizes are summarized on Figures 2A through 2F. The Regional Solution pipe sizes are shown on Figure 4A.

9. CREEK IMPROVEMENTS

Belmont Creek is the receiving waters for most of the local storm drain systems. Belmont Creek was mapped by FEMA and is included on the City of Belmont Flood Insurance Rate Map. FEMA requires flood insurance for facilities located within the 100-year floodplain of a mapped drainage facility.

There are several bottlenecks within the Belmont Creek system. Primary deficiencies are accumulated sediment at the Railroad crossing, under-sized box culvert O'Neill Avenue and Civic Lane, and an under-sized culvert at El Verano Way. The cost for in stream improvements to provide a 100-year level of protection is $2,160,000.

10. INDIVIDUAL DRAINAGE PROBLEMS

The City keeps records of areas where there are complaints by residents, or problems noted by maintenance crews. These areas are shown on Figure B1. In Appendix B, problem areas are shown and possible solutions are presented. In general there are three types of problems have been found:

Typical nuisance ponding

- The first is the nuisance ponding that is due to the lack of established surface drainage paths. The installation of concrete gutters with continuous slopes would solve most of these problems.
- The second is the minor flooding problems that occur during or immediately after major storm events. These problems are generally caused by insufficient capacity in the underground collection system or overflows from upstream systems that do not have sufficient capacity.

Minor flooding condition

- The third are flooding problems due to overflows of the discharge waterways that are intended to carry water to the Bay. These conditions occur when Belmont Creek overflows its banks.

Making improvements to the existing collection system would be the most cost effective way to reduce the minor flooding problem. Improvements would include 1) the extension of storm drain lines into areas that are not presently served, 2) replacing undersized storm drain pipelines and 3) installing interceptor storm drain lines that divert

storm water before it reaches portions of the existing system that do not have sufficient capacity, 4) retaining water in ponds for future release, and 5) the use of drywells to facilitate infiltration of storm drainage.

The following presents an evaluation of alternative methods for improving drainage within the City. Three options are available for controlling stormwater. The first option is the construction of new or replacement storm drain systems that convey runoff to the receiving water (Belmont Creek, Laurel Creek or San Francisco Bay). The second method is to retain runoff in storage basins for release at later times after the peak of the storm has passed. The third option is to construct facilities that improve infiltration of runoff to the groundwater system. This study focuses on the first option, construction of storm drain facilities. Stormwater detention is effective in areas of proposed development where land is available for storage of stormwater. Currently, the City of Belmont is at or near build-out, and there is insufficient land available in areas where drainage systems are inadequate for effective stormwater storage. Improved infiltration is possible, but is not sufficient to correct the existing drainage deficiencies.

11. ALTERNATIVES FOR UPGRADING STORM DRAIN SYSTEMS

Replace In-Place - Existing lines are replaced with lines sized to convey a 25-year storm event. Line sizes are shown on Figures 2a through 2l in Appendix A. Detailed costs for replacement facilities are presented in Appendix C.

Regional Solutions – Regional Solutions are used to correct drainage deficiencies at multiple drainage areas. The Regional Solution is shown on Figure 4 (shown as orange). The Regional Solution includes upgrading a single outfall to O'Neill Slough instead of multiple minor upgrades, to the two existing outfalls. The Regional solution reduces flows to current undersized outfalls for Systems EA, EC, ED and EM. The Regional solution is equivalent to the costs of the individual

improvements, but the Regional Solution would reduce discharges to the City of San Mateo drainage system, which would allow upstream improvements to proceed with the potential for increasing the discharge to the City of San Mateo's upgraded drainage system later.

Additional Facilities – There are portions of the City where significant flow is allowed to occur through the streets in gutters and swales. These areas are shown on Figure 2 with brown cross-hatching. Flow capacities within the streets are shown on Figures 8 and 8A. In some areas, facilities are recommended to reduce the required flow through street travel way. Locations of extension pipes to non-served areas are shown on Figures 5A through 5L as red lines. The costs for these additional facilities are summarized in Tables C-4 through C-6 in Appendix C.

12. PROPOSED MAINTENANCE PROGRAM

Annual Maintenance and Replacement Schedule

There are a total of about 23 miles of storm drain lines within the City of Belmont. In 1950, the population of the City was 5,567 people, but by 1970, Belmont's population was 23,667 people. The population at the time of the 2000 census was 25,123, or about 2,000 people more than in 1970. Early development within the City was served by open channels, with corrugated metal pipe (CMP) culverts under roadways. As development occurred, the original CMP lines were incorporated into the City system. A portion of the City system consists of CMP lines that are more than 55 year old. The majority of the system was constructed to meet the population increase that occurred between 1950 and 1970, and, therefore, ranges in age from 35 to 55 years old. ((xx age of pipe figure from presentation, 8A))

The City has records for the age of the sanitary sewer system. It is likely that the storm drainage was installed at the same time as the sewer system.

Historically, there have been three pipe materials commonly used within the City, (1) Reinforced Concrete Pipe (RCP), (2) Corrugated Metal Pipe (CMP), and (3) Plastic Pipe (HDPE and PVC). The RCP, HDPE and PVC are generally considered to have an expected life of 100-years. CMP tends to rust, and has a shorter expected life expectancy of about 30 to 50 years. Because of concerns with life span, the City no longer allows the use of CMP. Based on the inspection videos, there is significant failure of the CMP within the City. Much of the CMP was installed prior to 1950, is more than 55 years old, and is failing. Of the total pipe within the City, about 2.5 miles, or 11 percent is CMP. A program is needed to replace the CMP in the near term.

The remaining pipe has an expected remaining life of 45 to 65 years, and therefore immediate replacement because of general pipe condition is not warranted. However, because of the significant pipe placed in the ground over a relatively short 20 year period, some early replacement is warranted such that the City does not encounter a period in which significant replacement is required over a short time period. The replacement of a portion of the RCP and Plastic pipe will be necessary to correct known deficiencies caused by undersized lines in areas with an inadequate street overland flow path.

ANNUAL MAINTENANCE

The present maintenance plan is adequate and should be continued. This plan is as follows:

There are four components to maintenance. The first component is active debris removal from the drainage system during storm events. The second component is removal of sediment, trash and debris from the storm drainage system during dry weather to allow the system to function as designed. The third component is repair of components that fail because of age. The fourth component is a proactive program of repair of systems prior to failure. Sediment removal can be controlled in some areas by soil stabilization measures.

Areas where soil stabilization is needed are presented on Figure 9. A Table D-Erosion presenting Sediment Loads with Annual Volumes of erosion is presented in Appendix D.

Active Maintenance

During storm events, the maintenance crews remove debris from trash racks on Belmont Creek near Carlmont Drive, near Alameda de las Pulgas and Coronet Boulevard and at 6th Avenue near O'Neill Avenue. During these events, crews from other City Departments are used to assist the maintenance crew. During a major storm event, a crew of 10 people is required.

Ongoing Maintenance

The City has an on-going maintenance program that consists of clearing Creeks, removing sediment from drain inlets the system, and clearing debris from catch basins. There are three full time employees responsible for storm drain system maintenance. There is an additional full time employee responsible for street sweeping. The budget provides for an additional 2.8 full time non-maintenance personnel that provide office support and administration.

The current allowance of three full time employees for storm drain system maintenance appears reasonable if the work is limited to system maintenance.

On-going Repair of Failed Facilities

The City has experienced several failures that may be related to storm drain system deficiencies. These include road failures at Merry Moppet near Carlmont Drive and at East Laurel Creek. Maintenance crews assist with repairs at these locations, but do not have primary responsibility for full repairs.

Proactive Repair of Failed CMP Lines

The video inspection program has identified significant rusting of the flow line of CMP lines. There is a significant risk that runoff discharging through a hole in the pipe will scour materials in the pipe trench. When the scour becomes severe, there is potential for resulting sinkholes in the pavement. The total cost for repair of the City's 0.85 miles of aging CMP line is about $1.6 million.

With existing staffing levels, the current maintenance crew does not have adequate available time to provide proactive repairs of failing lines. If the City were to accomplish a portion of this task in house, additional crew would be required. Based on the experience of Mid-peninsula Water District, typical construction including mobilization, street repair, and pipeline replacement is 200 feet per day for a four man crew. Based on construction of 50,000 feet per year, a single crew could complete the Priority High , Medium and Low improvements in about 9.5 miles/years. Approximately 2 years are required to replace priority pipes 36-inch or smaller.

13. FUNDING

The City historically had no dedicated funding source for funding storm drainage system capital improvements or repairs. System upgrades and repairs were funded from the general fund. More recently revenue from the sewer/storm drainage charge has been used to fund the storm drainage system. Revenue from the sewer/storm drainage charge is appropriately used to fund the storm drainage operating and capital expenses because of the close relationship between sanitary and storm drainage facilities: sanitary sewer customers benefit significantly from storm drainage facilities because storm drainage facilities reduce the inflow and infiltration of runoff into the sanitary sewers. By reducing inflow and infiltration to the sanitary sewers, collection systems and wastewater treatment plants are not surcharged during wet weather events and therefore do not need to be sized as large.

The City has implemented or is evaluating the following additional funding mechanisms for funding storm drainage capital improvements:

- **Street sweeping costs** – Street sweeping services were previously included in the storm drainage fund. Beginning in FY 2006-07, the street sweeping program was moved to the solid waste program, the costs of which are now included in solid waste rates. This change reduces the storm drainage budget while increasing the solid waste budget.
- **Development impact fees** – Impact fees are a type of fee paid by at the time of development. Impact fees must be based on reasonable costs of the improvements and are intended to bring new development to the same level of capital participation in the system as existing users. Belmont does not currently levy a storm drainage impact fee. The City could establish a storm drainage impact fee in compliance with the Mitigation Fee Act (California Government Code Section 66000 et seq.). However, because there is very little development in the City, the amount of revenue from a storm drainage impact fee would not make a significant contribution to defraying the capital improvement program.
- **Developer contributions** – Capital contributions from developers for facilities that directly benefit specific developments can be negotiated as a condition of development. A contribution of this type is similar to a connection fee except that the revenue is collected only for local improvements and is paid in advance of the construction of facilities. Alternatively, developers can be required to construct all in-tract storm drainage facilities at their cost, which would then be dedicated to the City upon acceptance. Because the majority of the facilities in the master plan are of broader benefit, this form of funding will do little to fund the master plan facilities.
- **Assessment district financing** – Assessment districts are formed to finance the capital costs of facilities benefiting property owners within the district. A majority vote of the property owners is required to establish the assessment district. Assessment districts are typically formed at the time the improvements

are initially constructed, often for the purpose of funding debt service on bonds that funded the construction. Establishing an assessment district later when the facilities require replacement is uncommon because it is difficult to achieve approval of a majority of property owners. Hence, assessment district financing is not viewed as being as viable a source of funding in Belmont unless the district can be created as a condition of development. Because there is so little development in Belmont, little funding would be generated from assessment districts.

The City is not actively pursuing the creation of a stormwater fee. Such a fee could be based on a variety of factors such as parcel size, surface type (pervious, impervious), and runoff characteristics. A stormwater fee could be used to fund any remaining costs that are not more appropriately funded from the sewer/storm drainage fee or other sources. However, a thorough review of the storm drainage operating and capital costs indicates that these costs are appropriately funded from the sewer/storm drainage fee. Hence, there is no practical need for a new stormwater fee at this time.

Should the City determine in the future that there is a need for a new stormwater fee to cover costs not already covered by the sewer/storm drainage fee, such a stormwater fee would have to comply with Article XIII of the State Constitution (enacted by Proposition 218 in 1996). The most significant requirement under Article XIII is that the creation of or increase in a stormwater fee requires voter approval.

14. CONCLUSIONS

There are major deficiencies in the existing City storm drain systems. Common drainage system concerns are undersized storm drain lines, bubble-up storm drain systems, and areas without storm drain systems. In addition, there is concern with inadequate flow capacity of Belmont Creek.

The purpose of this report is to address storm drainage system and Creek flooding concerns. The City's storm drain system problem areas are identified on Figures 7A, 7B and 7C. Prior repairs of storm drain problems are shown on Figure 7D. Storm drain improvements to areas currently without storm drains are presented on Figure 5A through 5L and Appendix B. Storm drain line sizes presented for serving these areas are shown on Figures 6A through 6D and Figures 3A through 3F. The cost for implementing measures required to provide a minimum 10-year level of storm drain protection throughout the system is about $25.1 Million. The cost for High Priority improvements is about $5.8 Million. Given the high cost of implementing measures for correcting all noted deficiencies, a phased approach is recommended as described in Appendix C.

Solutions to the local drainage problems can potentially increase property values by eliminating public nuisances and traffic hazards associated with water ponding in the street for prolonged time periods. Replacement or sliplining of CMP lines will significantly reduce the risk associated with sinkholes forming at pipe failure locations.

The City should consider gradual replacement of aging RCP storm drain lines. Many of these lines have at least 35 years remaining life. However, in 35 years, a significant portion of the system may be in need of repair. Figure 10 shows relative ages of pipes in the City of Belmont. Storm drain pipes are assumed to be the same age as sewer pipes in City right-of-way. In the near term, replacement of the aging CMP lines and undersized storm drain lines should be highest priority. Once these repairs are completed, gradual replacement of aging RCP lines should be started. City-wide priority maps are shown on Figures 11A through 11E.

APPENDIX A

Figures

Figure 1A	Vicinity Map
Figure 1 B through J	Belmont Aerials
Figure 1K	Four Main Drainage Areas in Belmont
Figure 2	Storm System Drainage Areas
Figure 2 A through L	Existing and Proposed Storm Drain Line Sizes
Figure 2M	Existing Regional Drainage Areas
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Figure 6D	Prior Improvements Made by City
Figure 7	Priority of Improvements – City Wide
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Figure 8A, B	Flow Capacity of Overland Flow Path
Figure 9	Problem Areas of Erosion
Figure 10	Age of Existing Pipes
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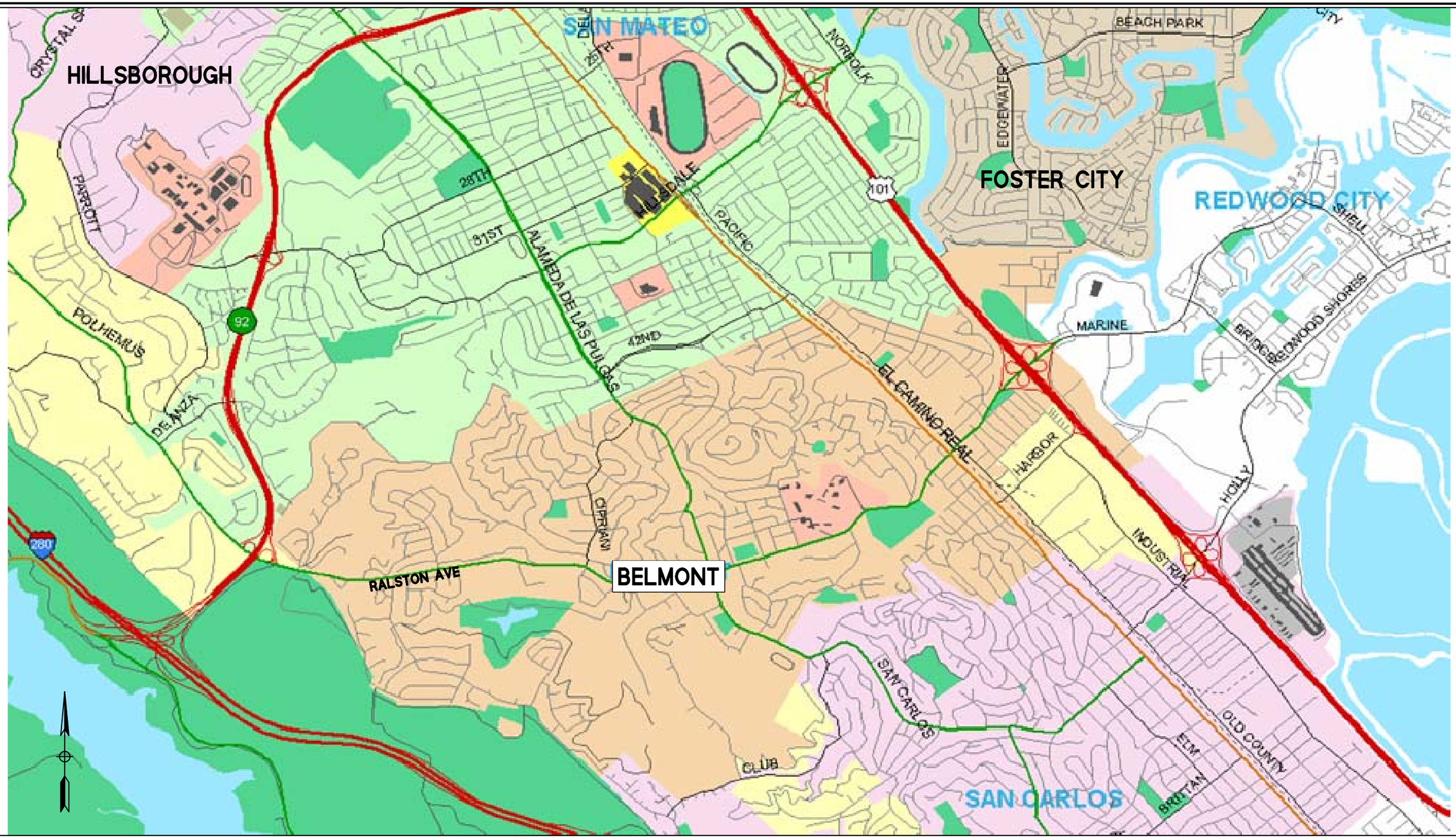
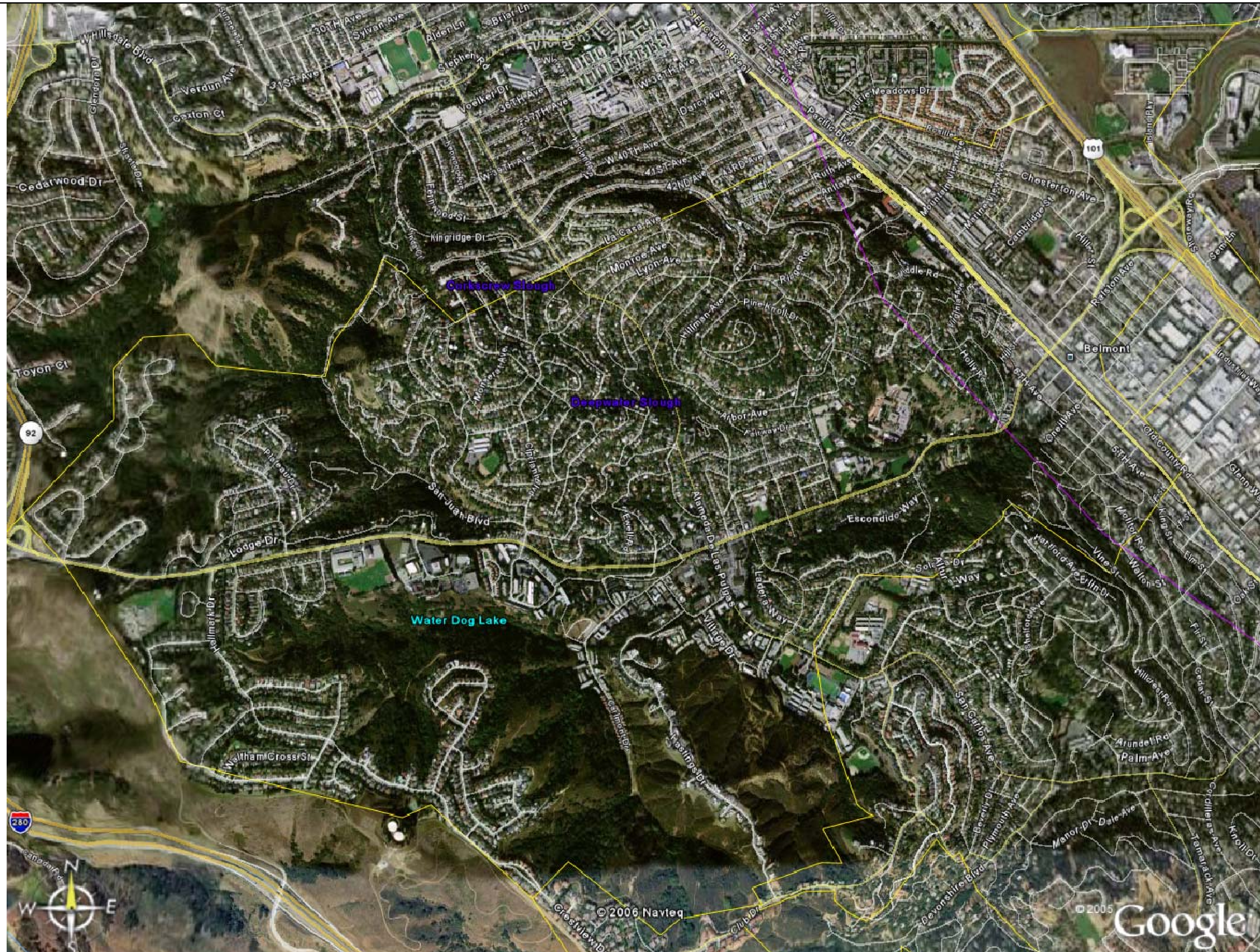


FIGURE 1A
BELMONT STORM DRAIN MASTER PLAN
VICINITY MAP

BKF



NOTE: NOT TO SCALE

FIGURE 1B
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

BKF

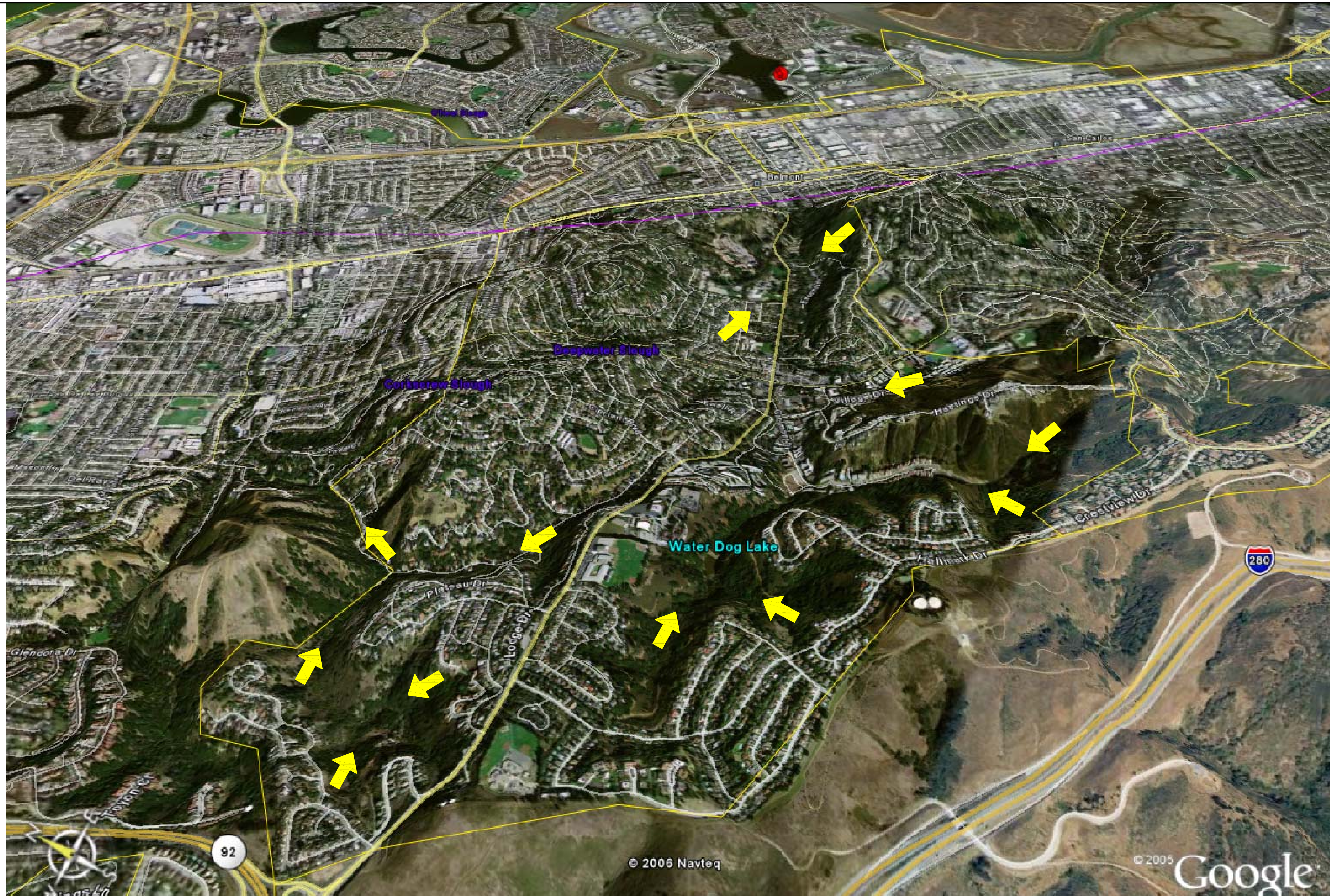


FIGURE 1C
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS - OVERLAND FLOW PATHS

NOTE: NOT TO SCALE

BKF

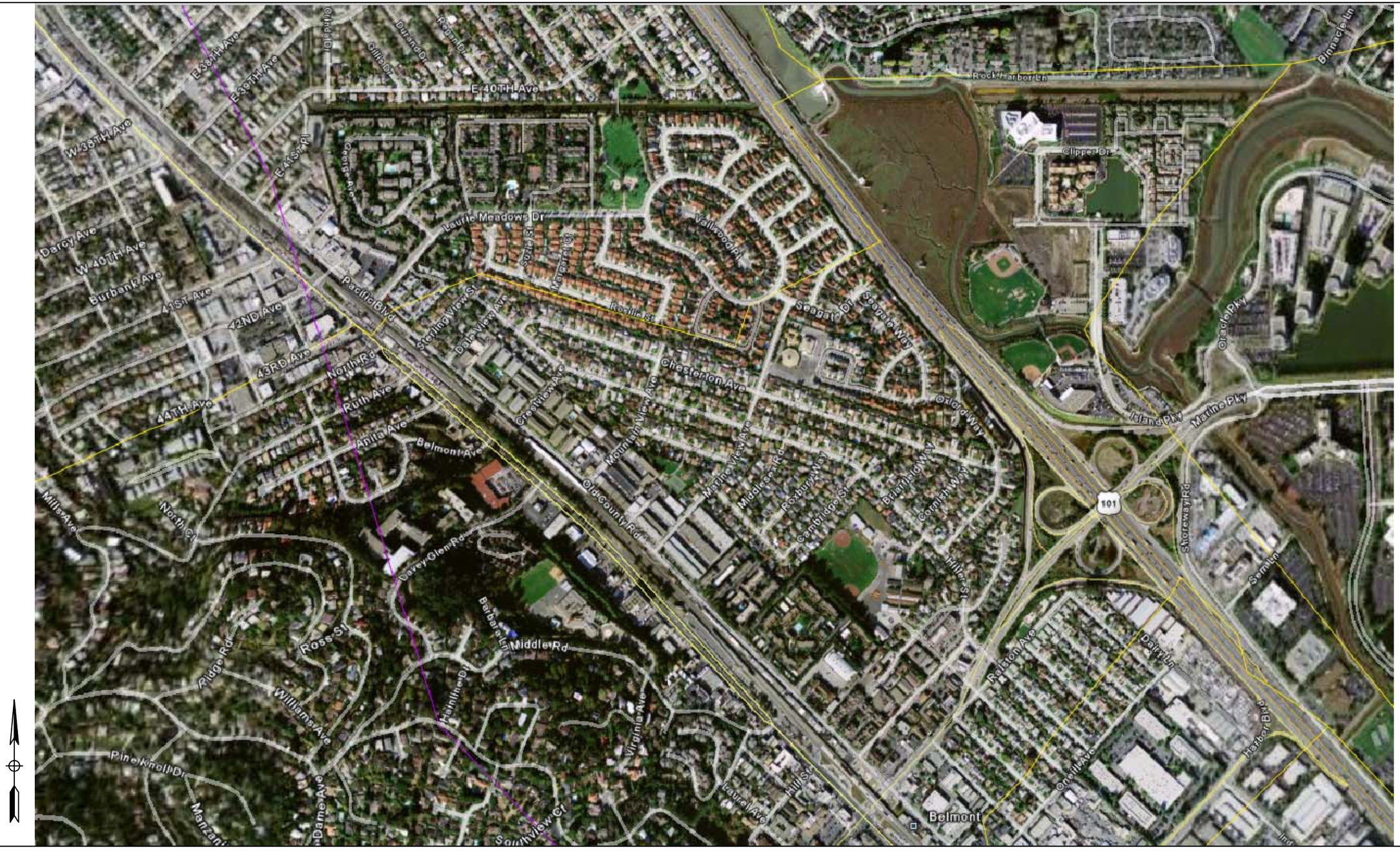


FIGURE 1D
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BKF

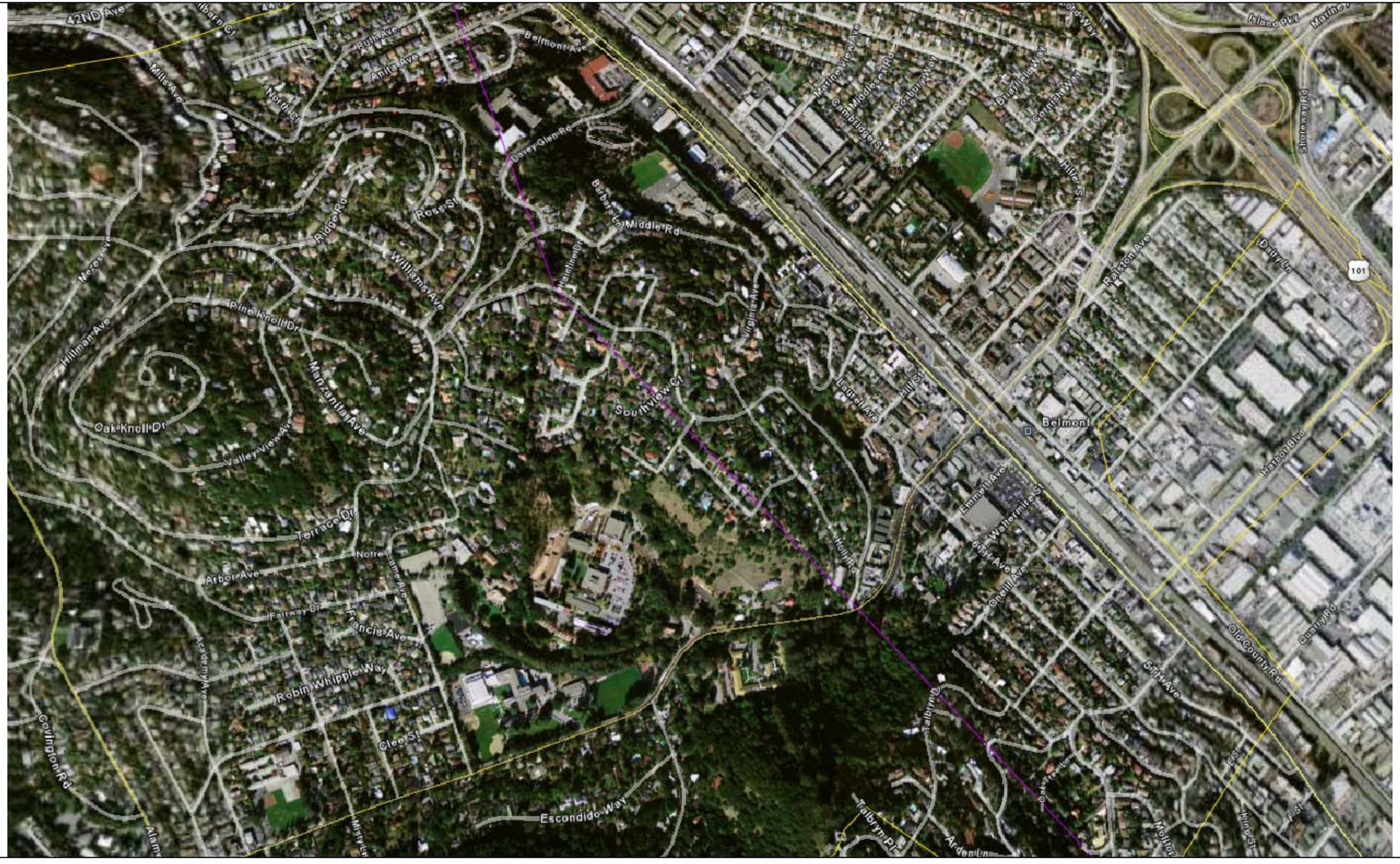


FIGURE 1E
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BKF

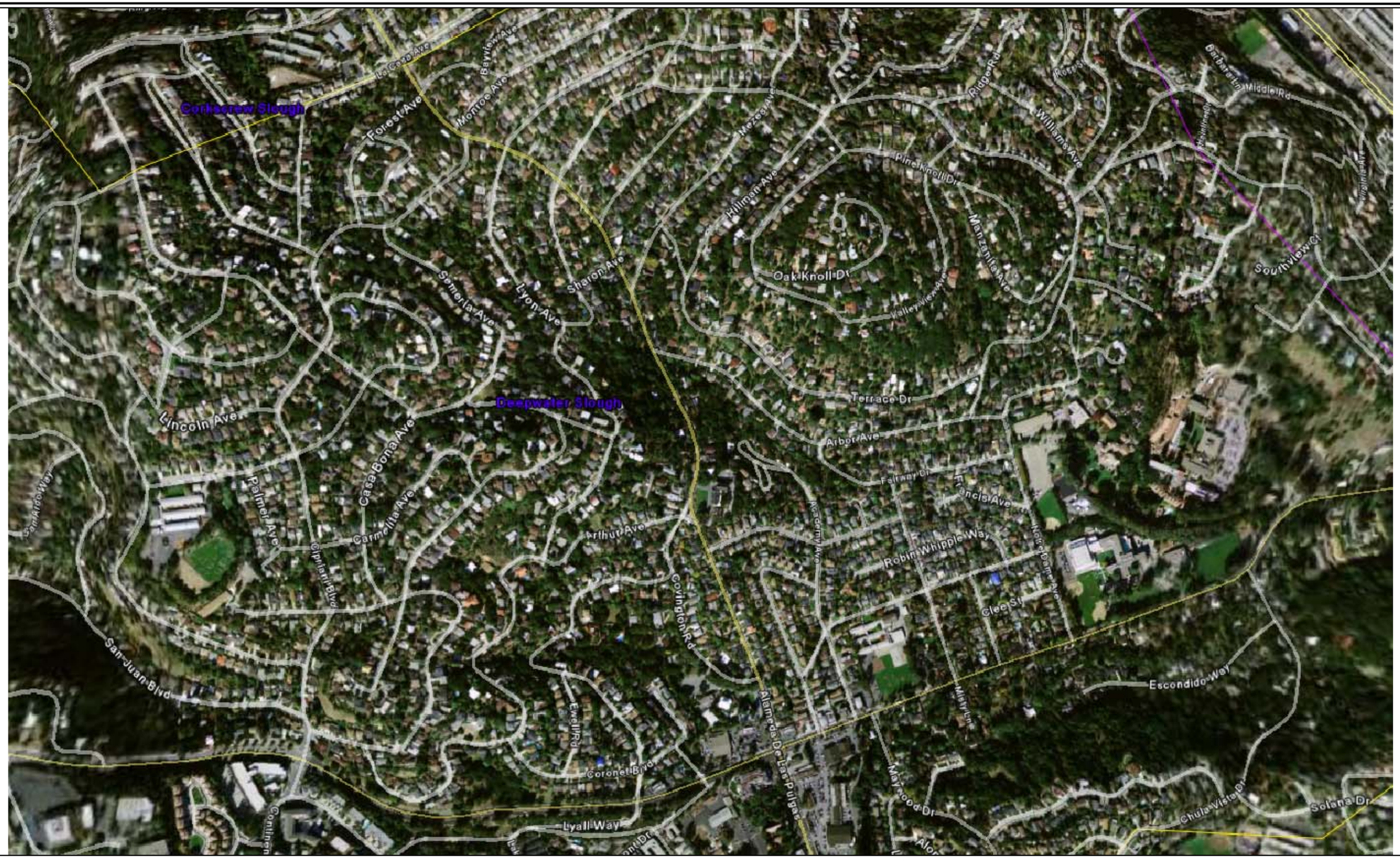


FIGURE 1F
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BKF

FIGURE 1G
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BKF

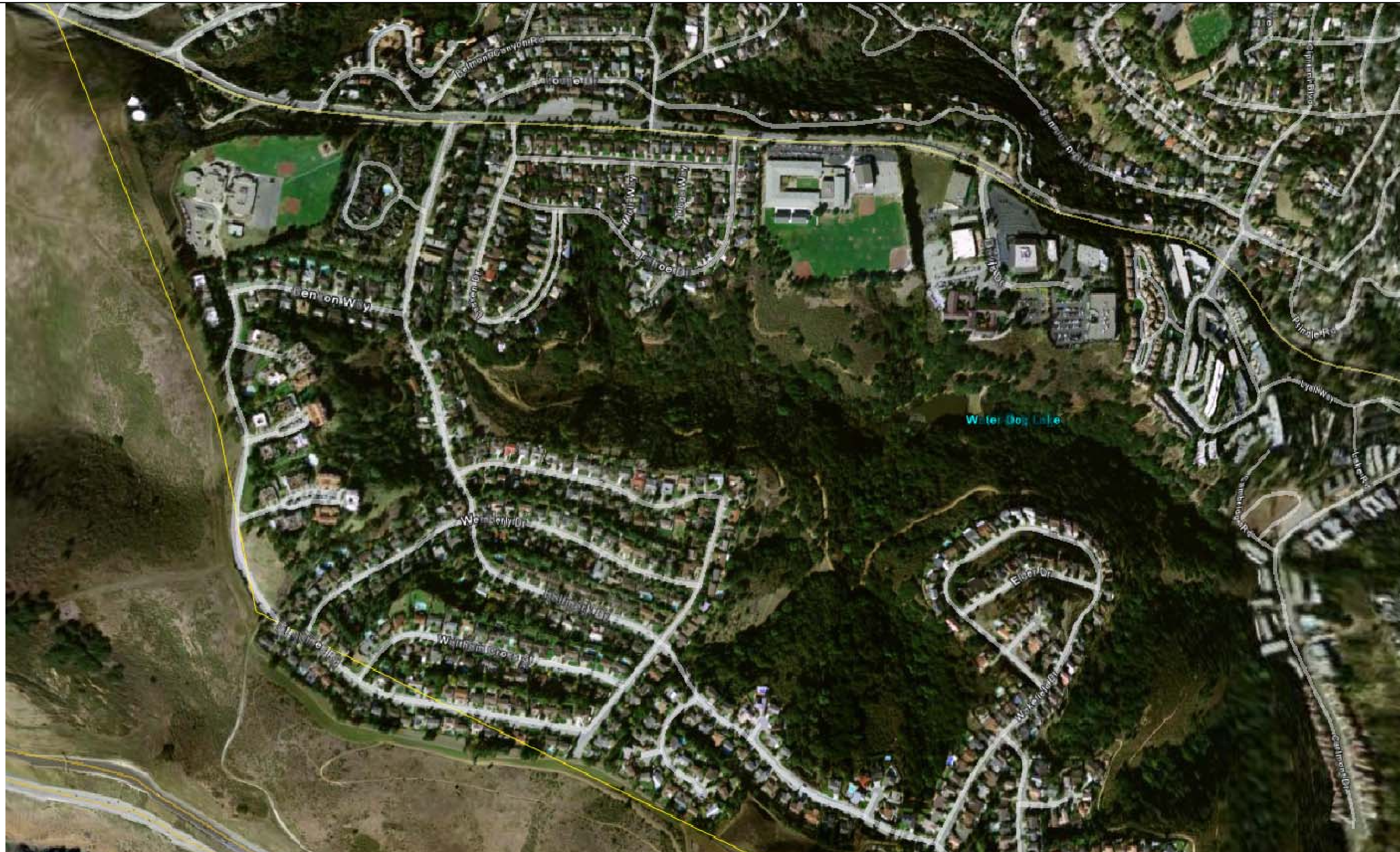


FIGURE 1H
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

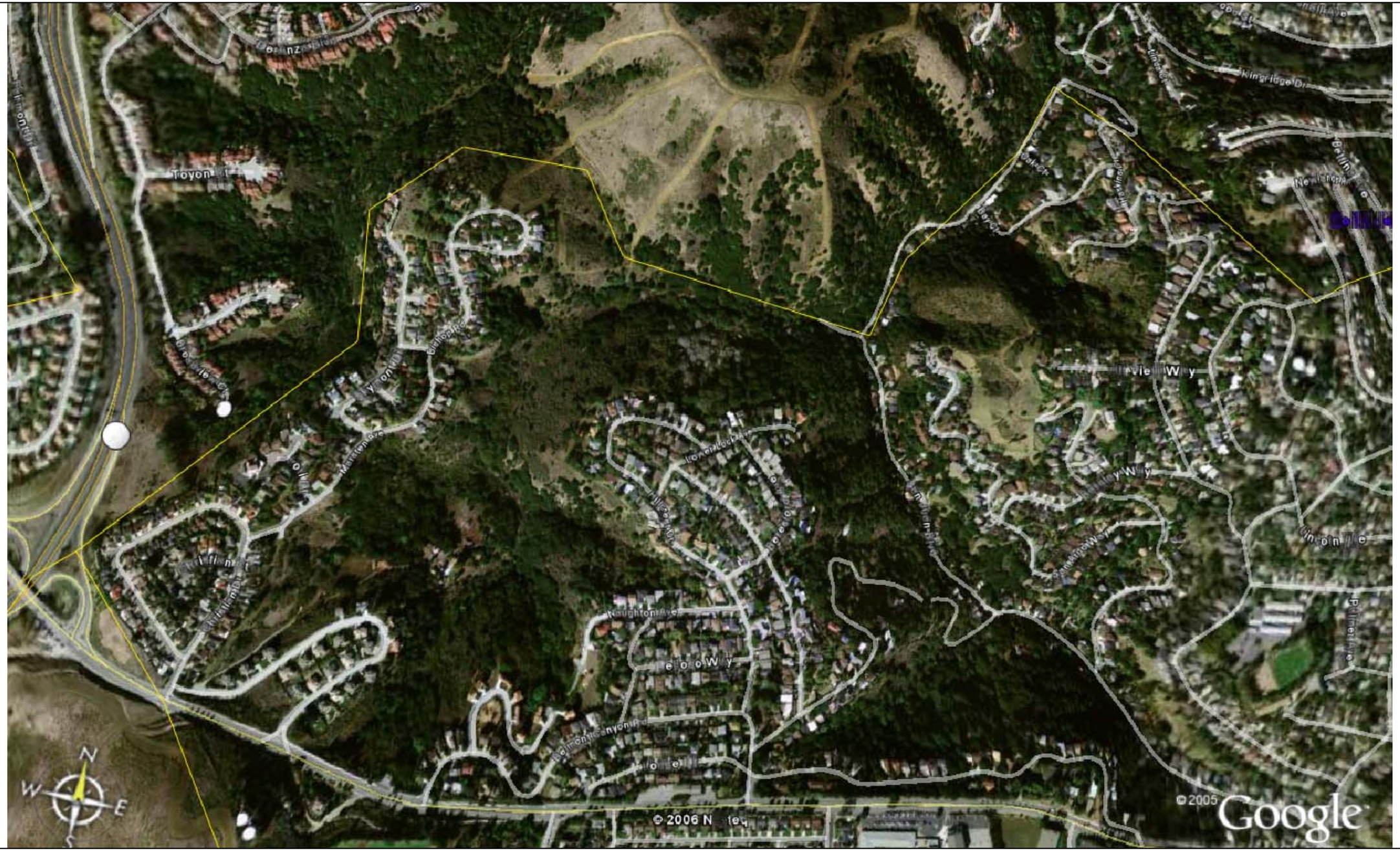


FIGURE 1I
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BkF

FIGURE 1J
BELMONT STORM DRAIN MASTER PLAN
BELMONT AERIALS

NOTE: NOT TO SCALE

BkF

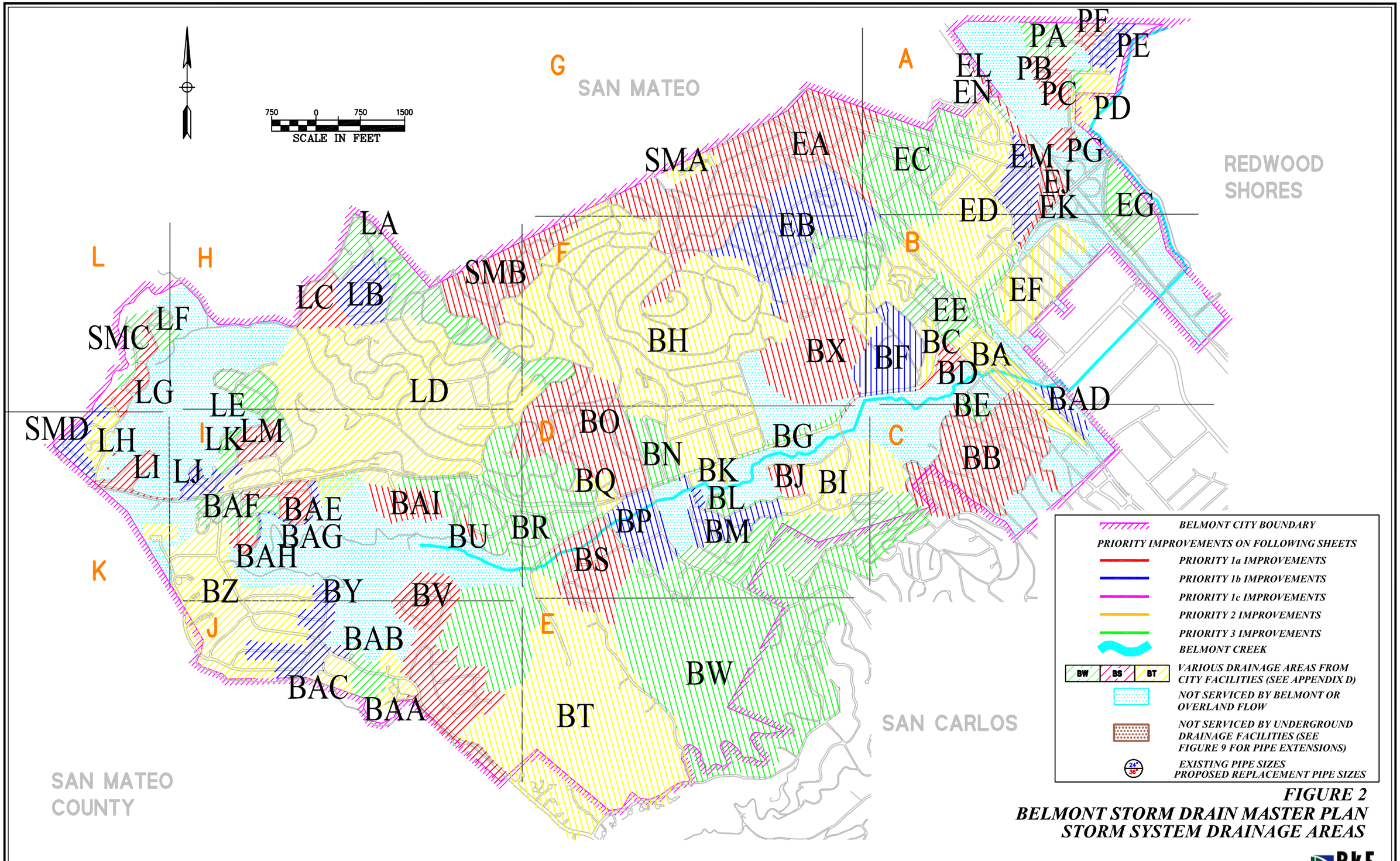


FIGURE 2
BELMONT STORM DRAIN MASTER PLAN
STORM SYSTEM DRAINAGE AREAS

BKF

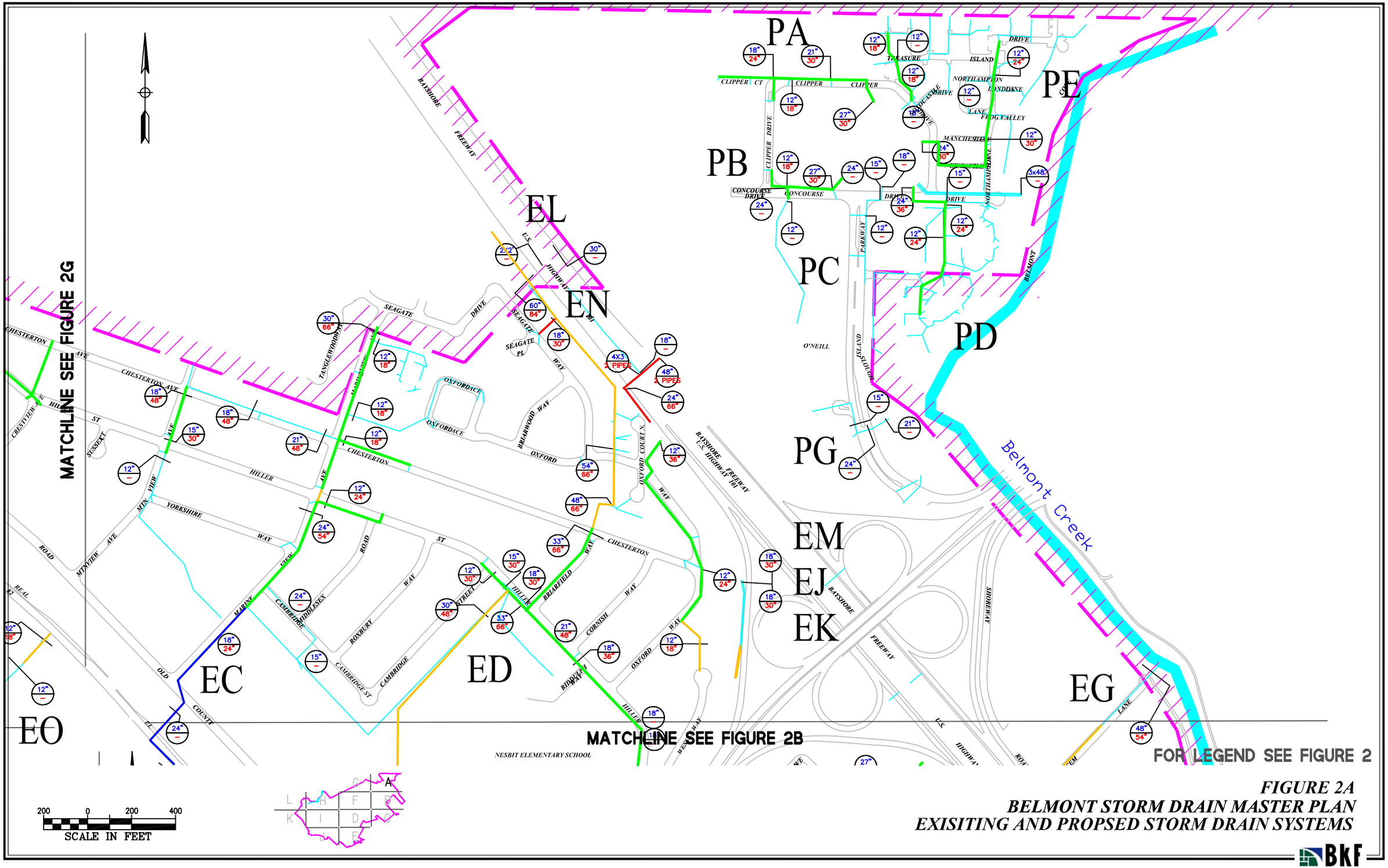


FIGURE 2A
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

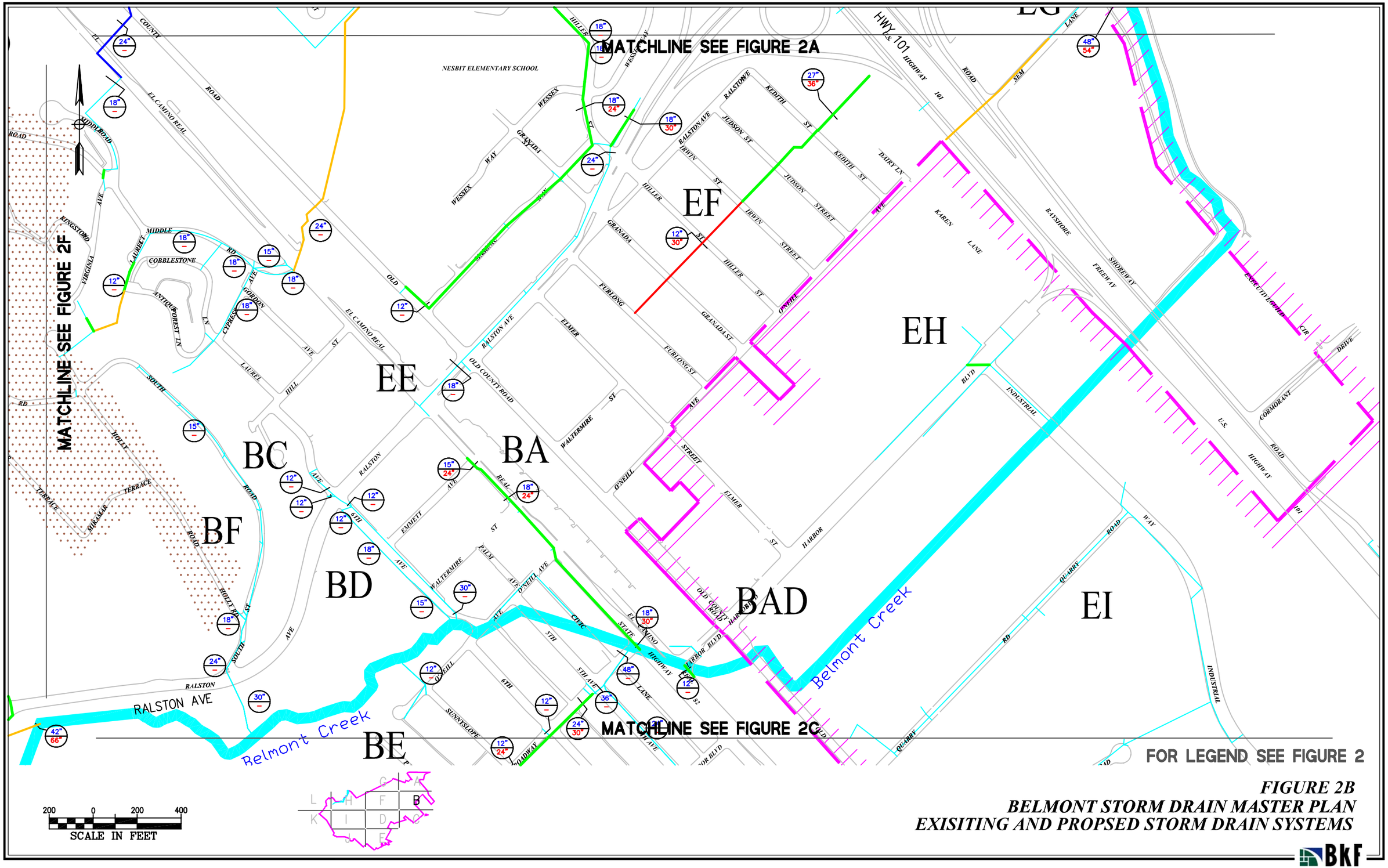


FIGURE 2B
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

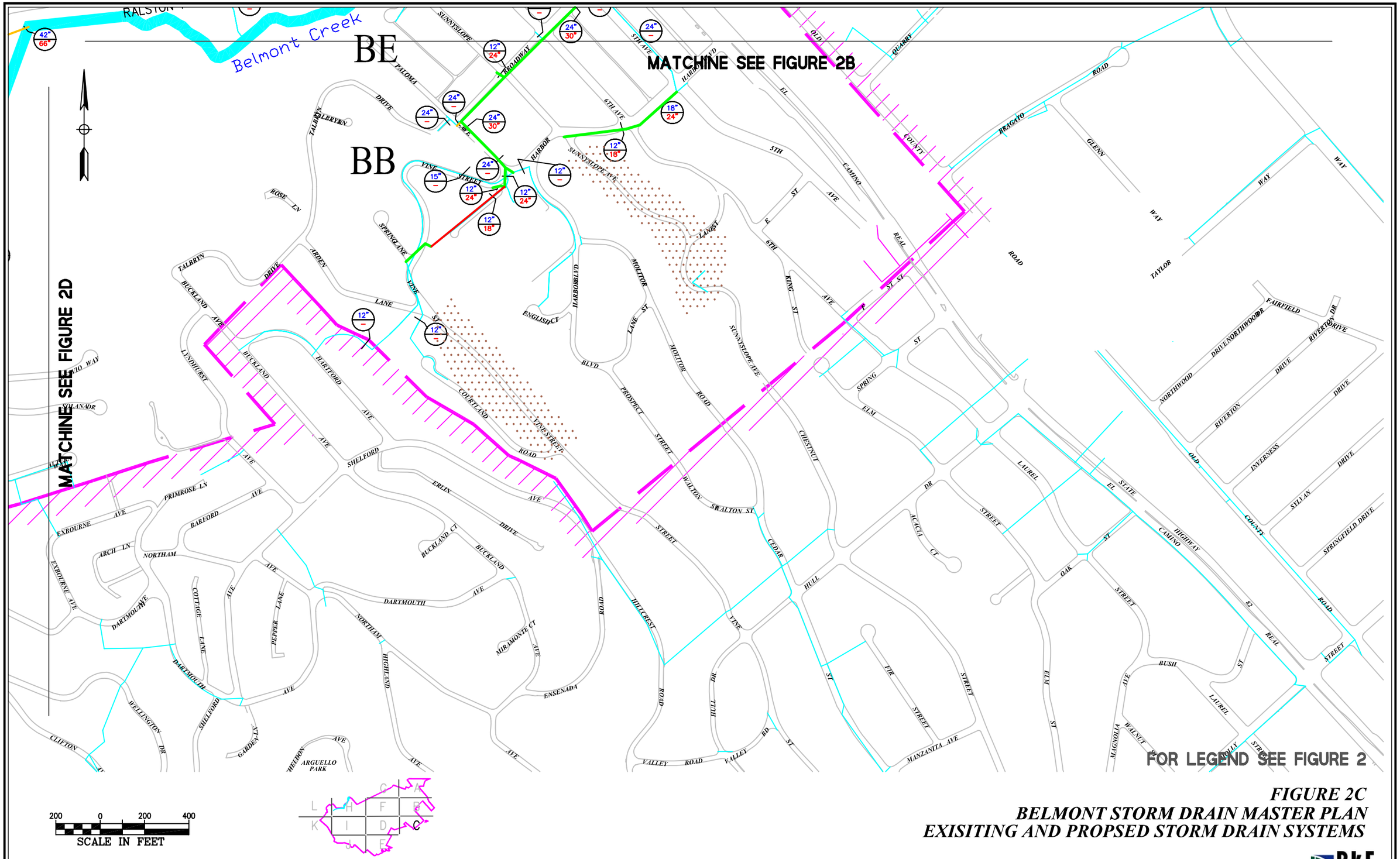


FIGURE 2C
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

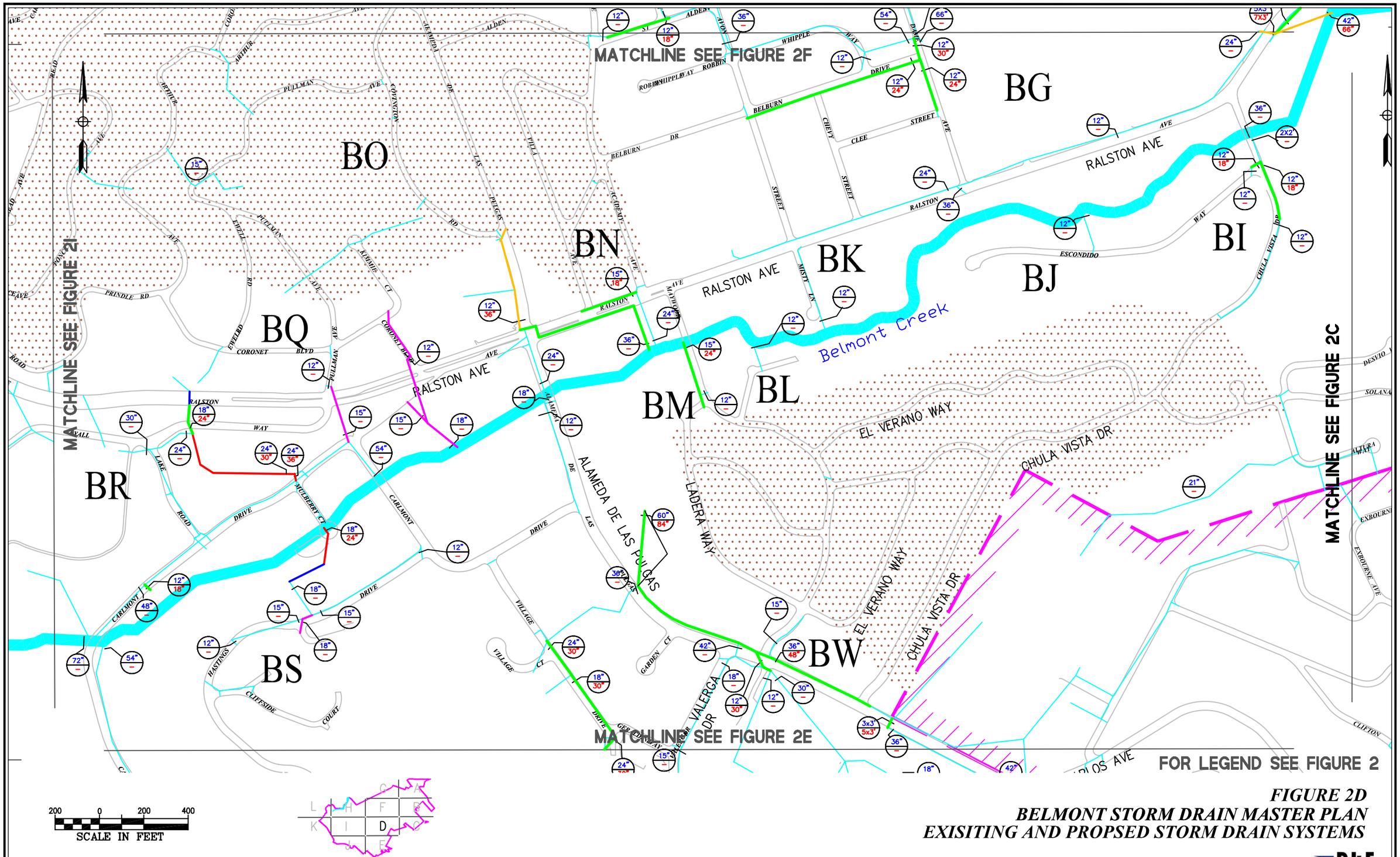


FIGURE 2D
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

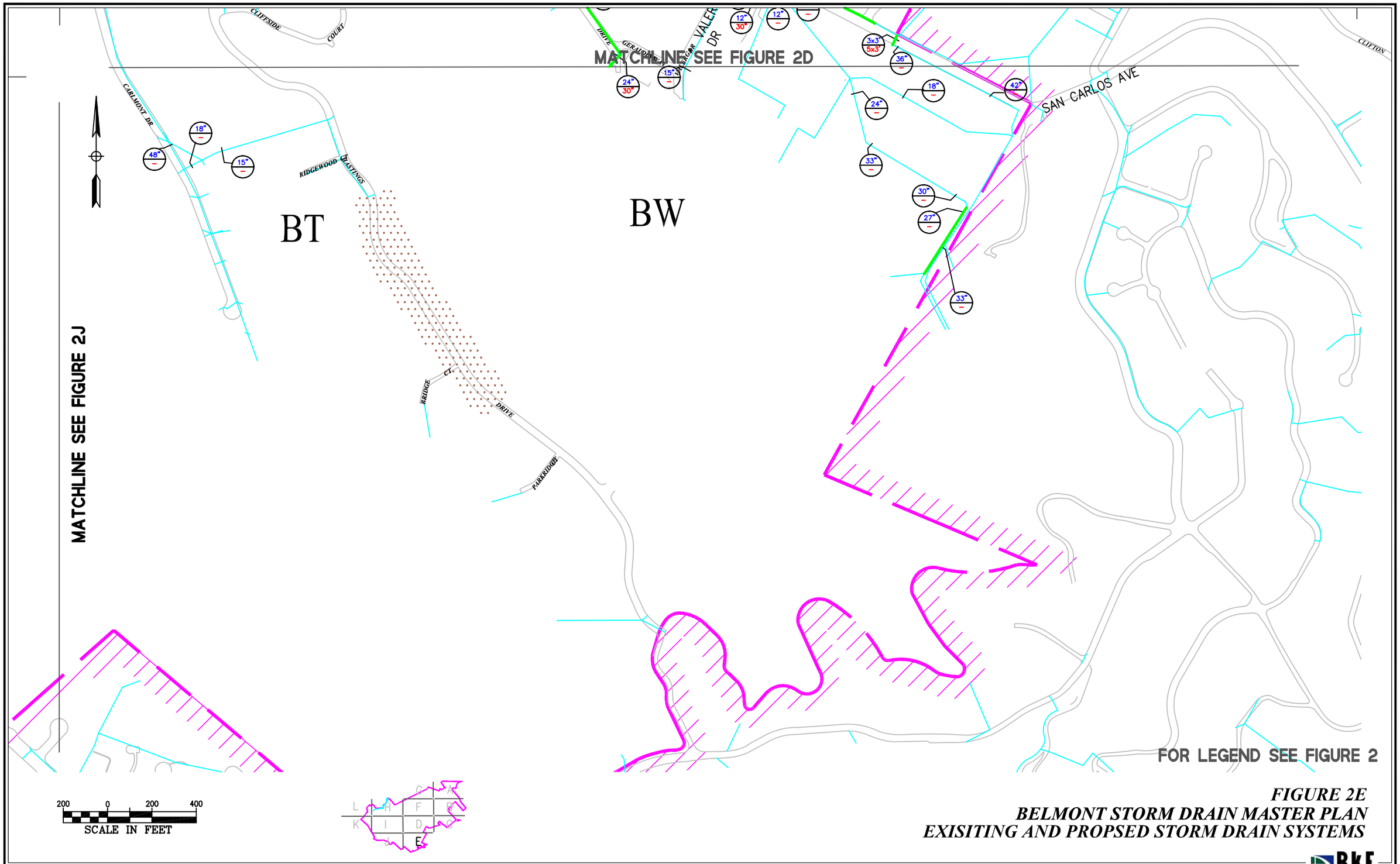


FIGURE 2E
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

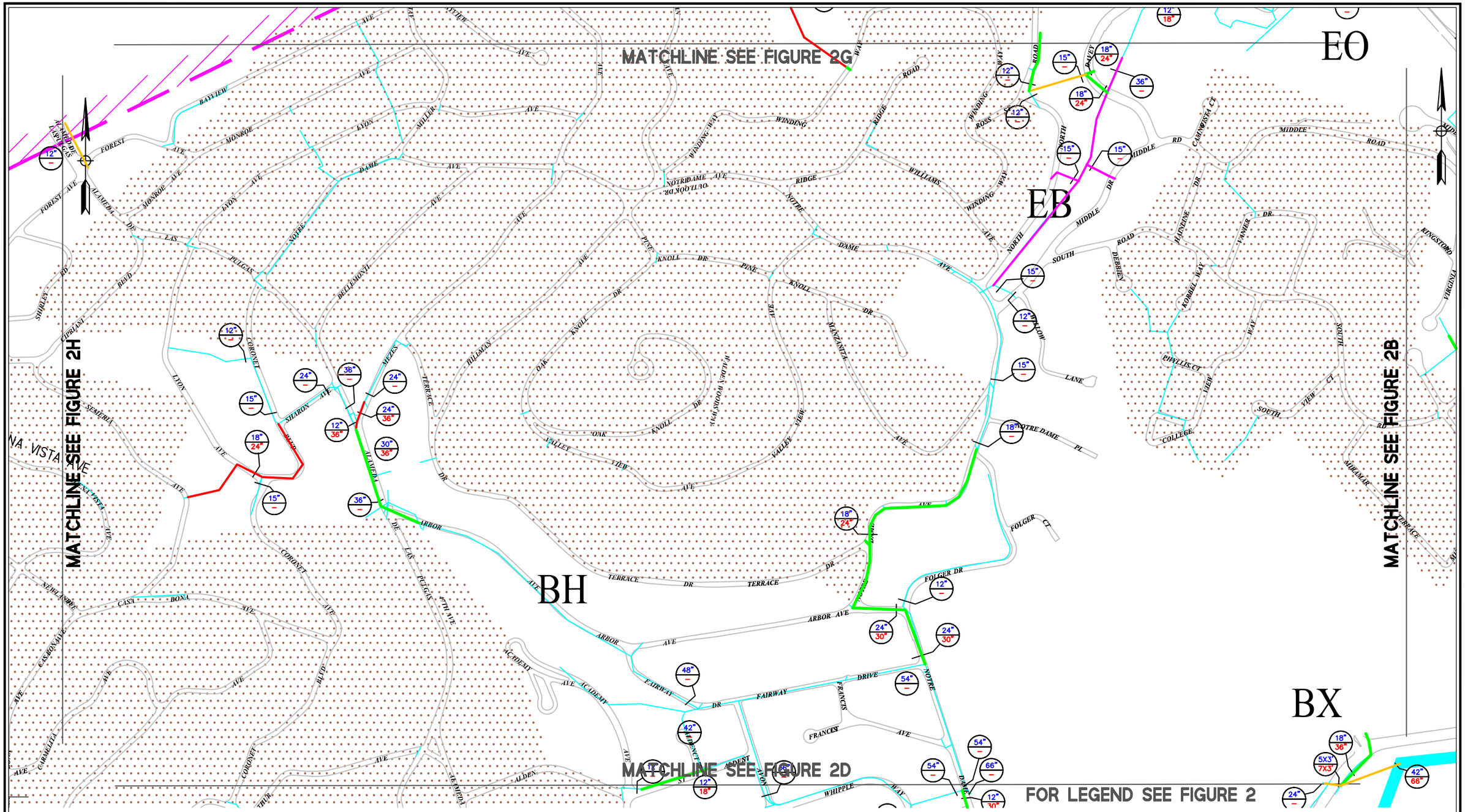


FIGURE 2F
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

FOR LEGEND SEE FIGURE 2

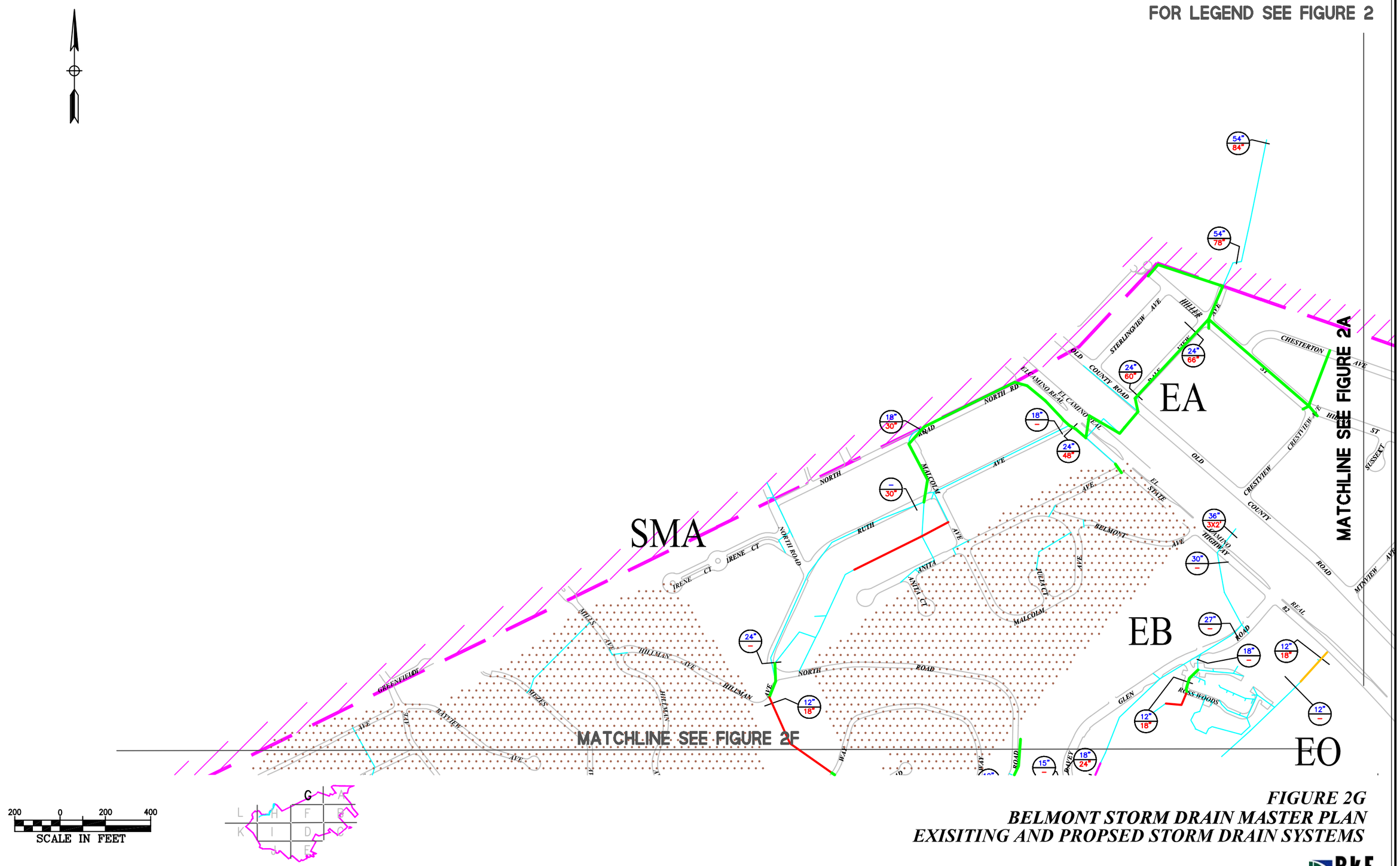


FIGURE 2G
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

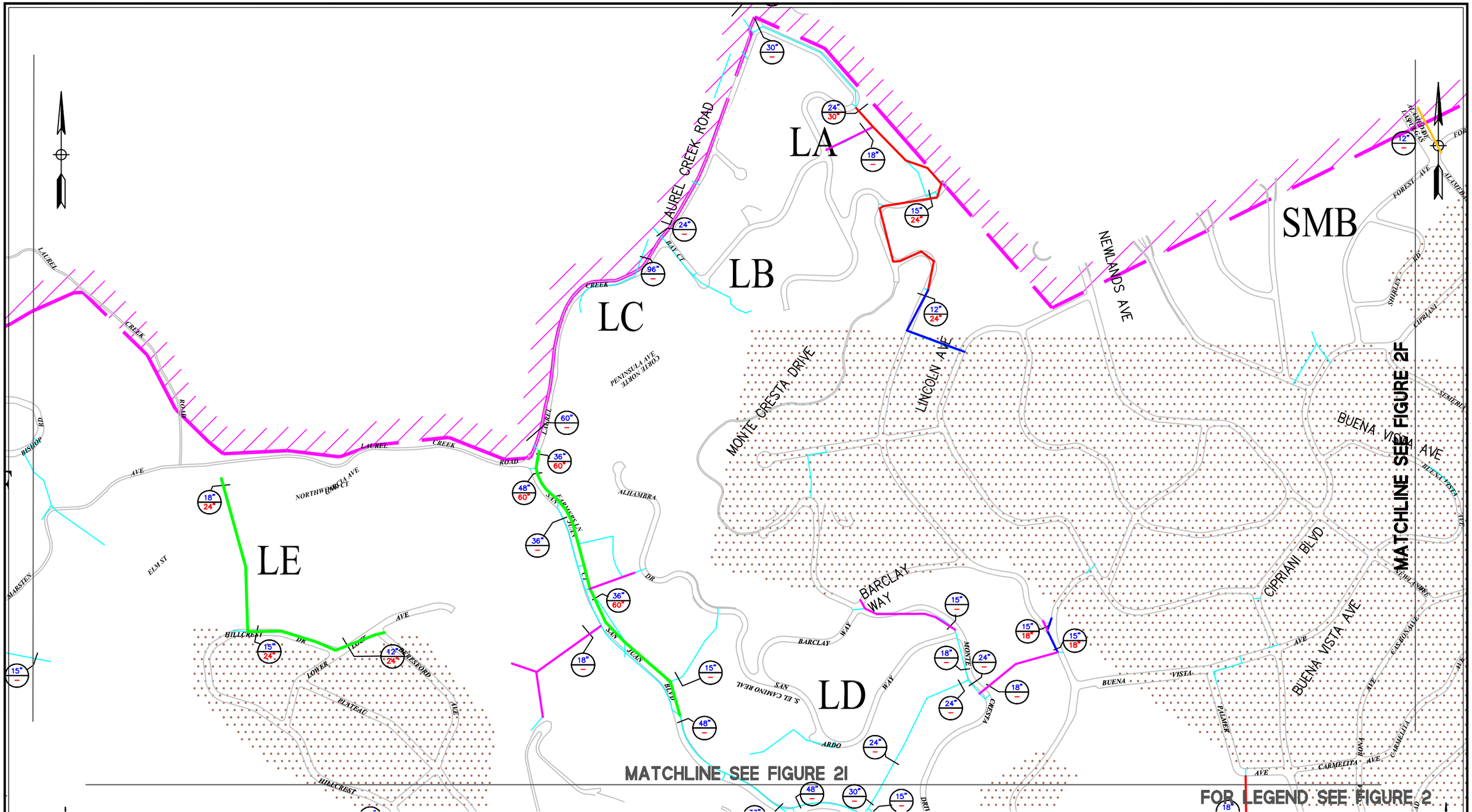


FIGURE 2H
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

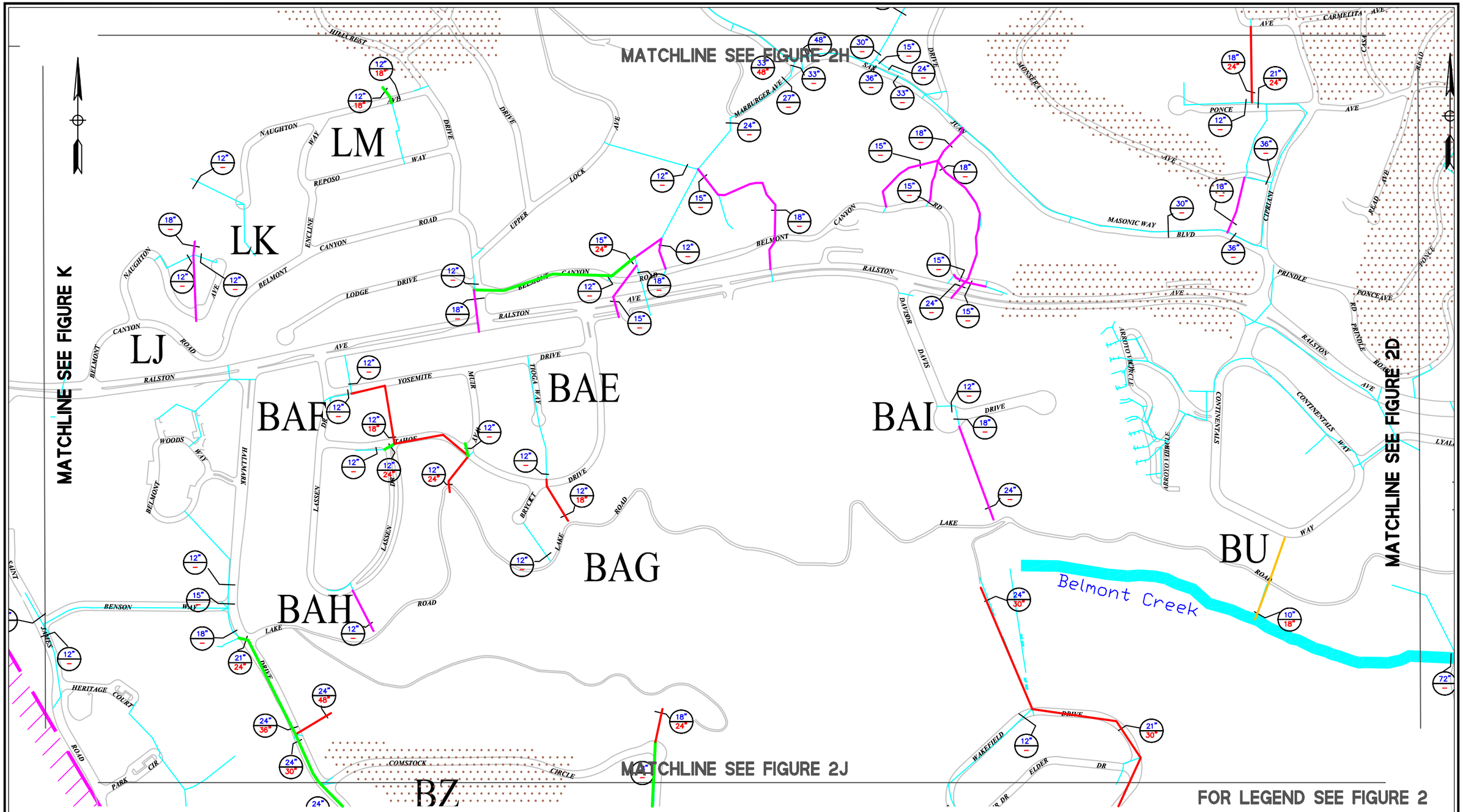


FIGURE 2I
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

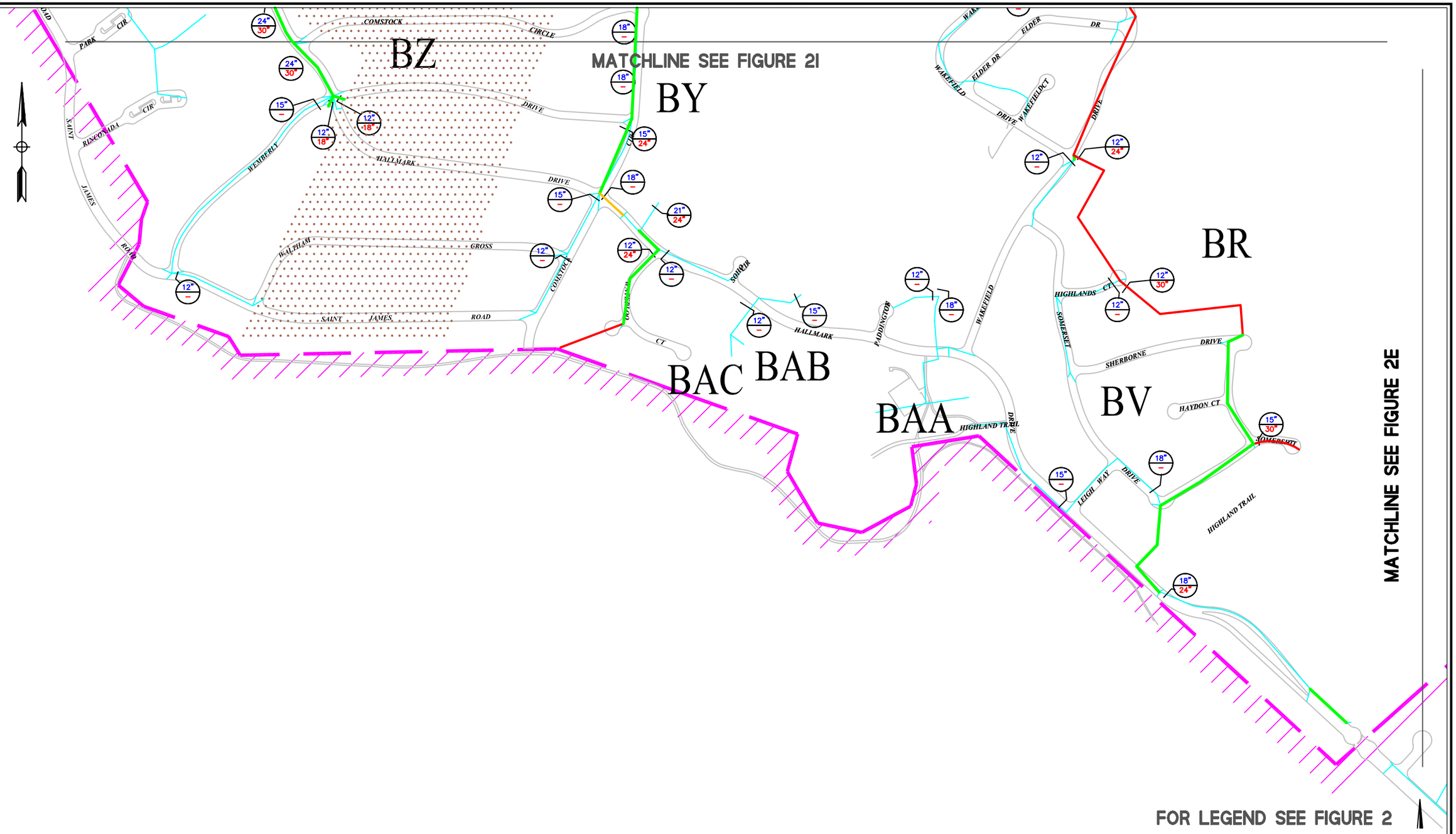
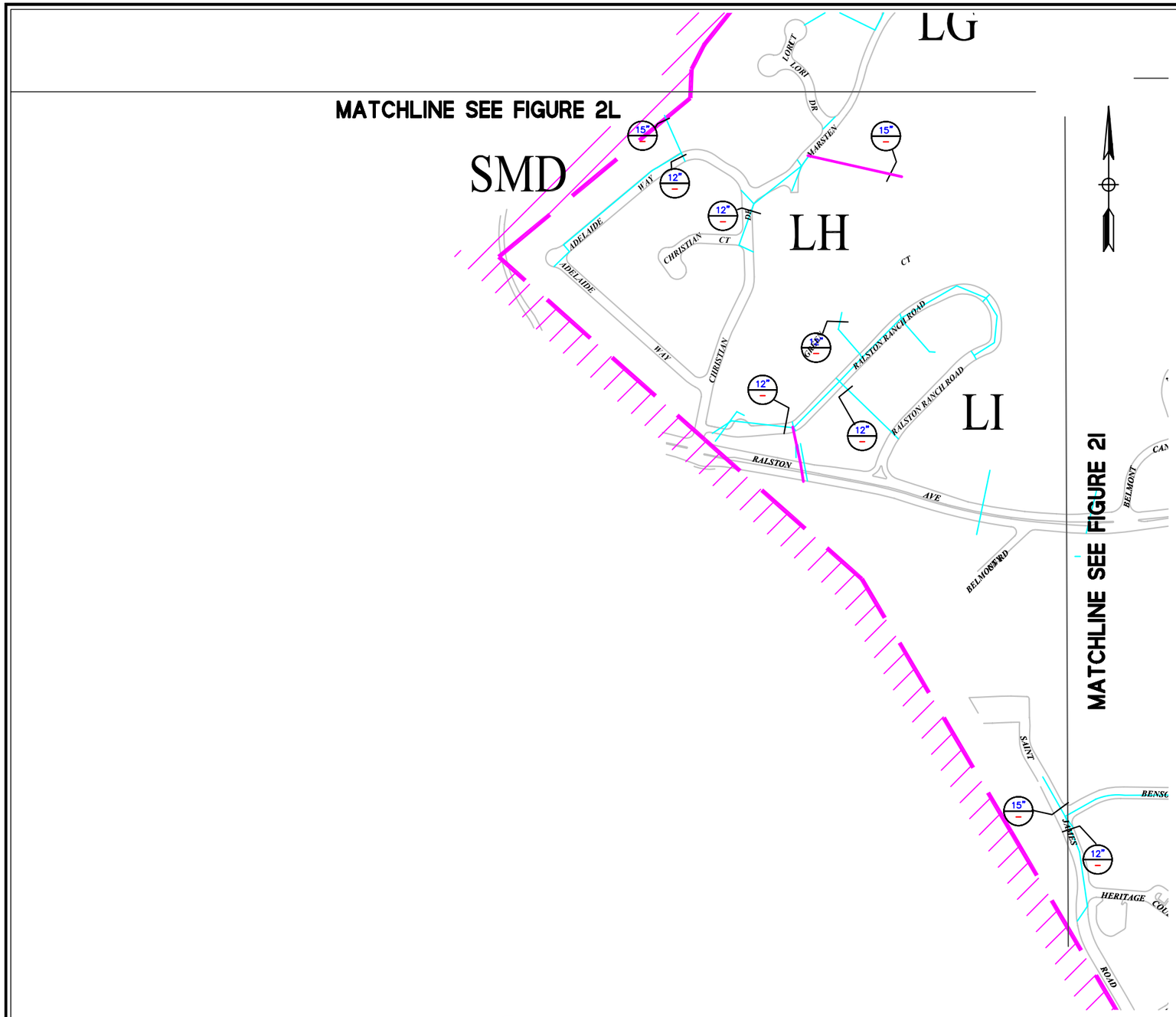


FIGURE 2J
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF



FOR LEGEND SEE FIGURE 2

200 0 200 400
SCALE IN FEET

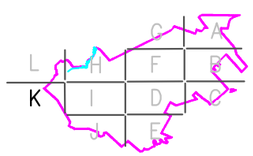
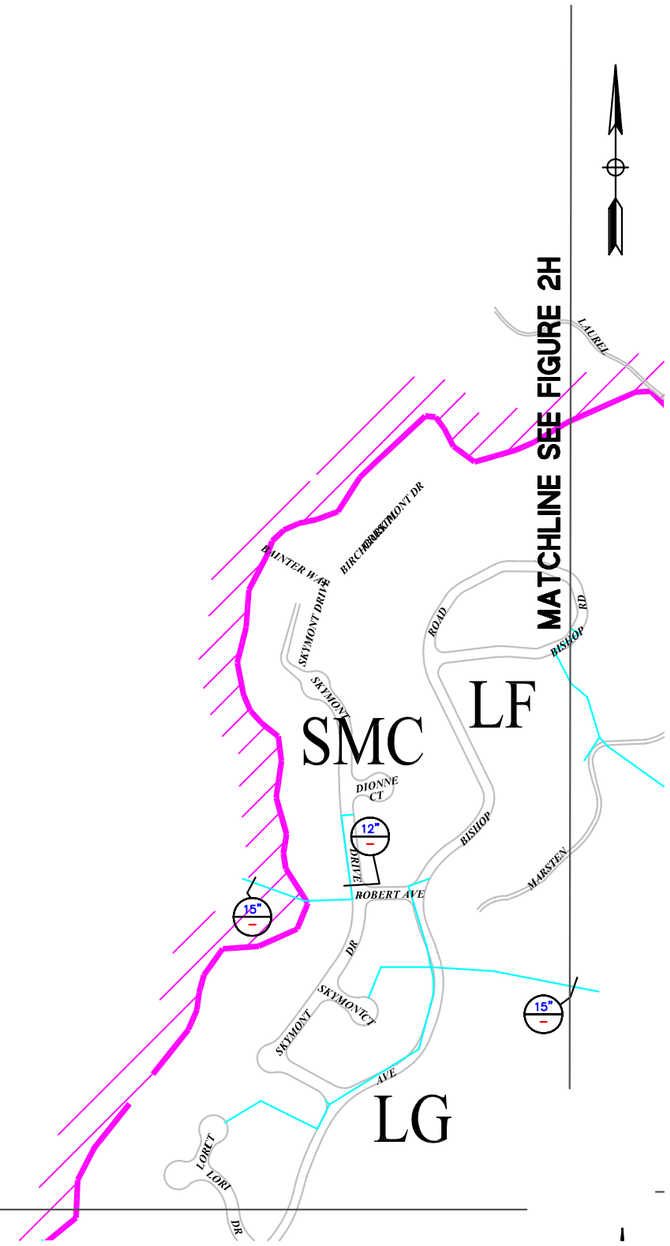


FIGURE 2K
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF



MATCHLINE SEE FIGURE 2K

FOR LEGEND SEE FIGURE 2

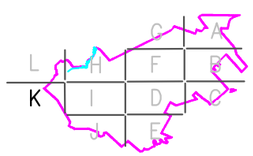


FIGURE 2L
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

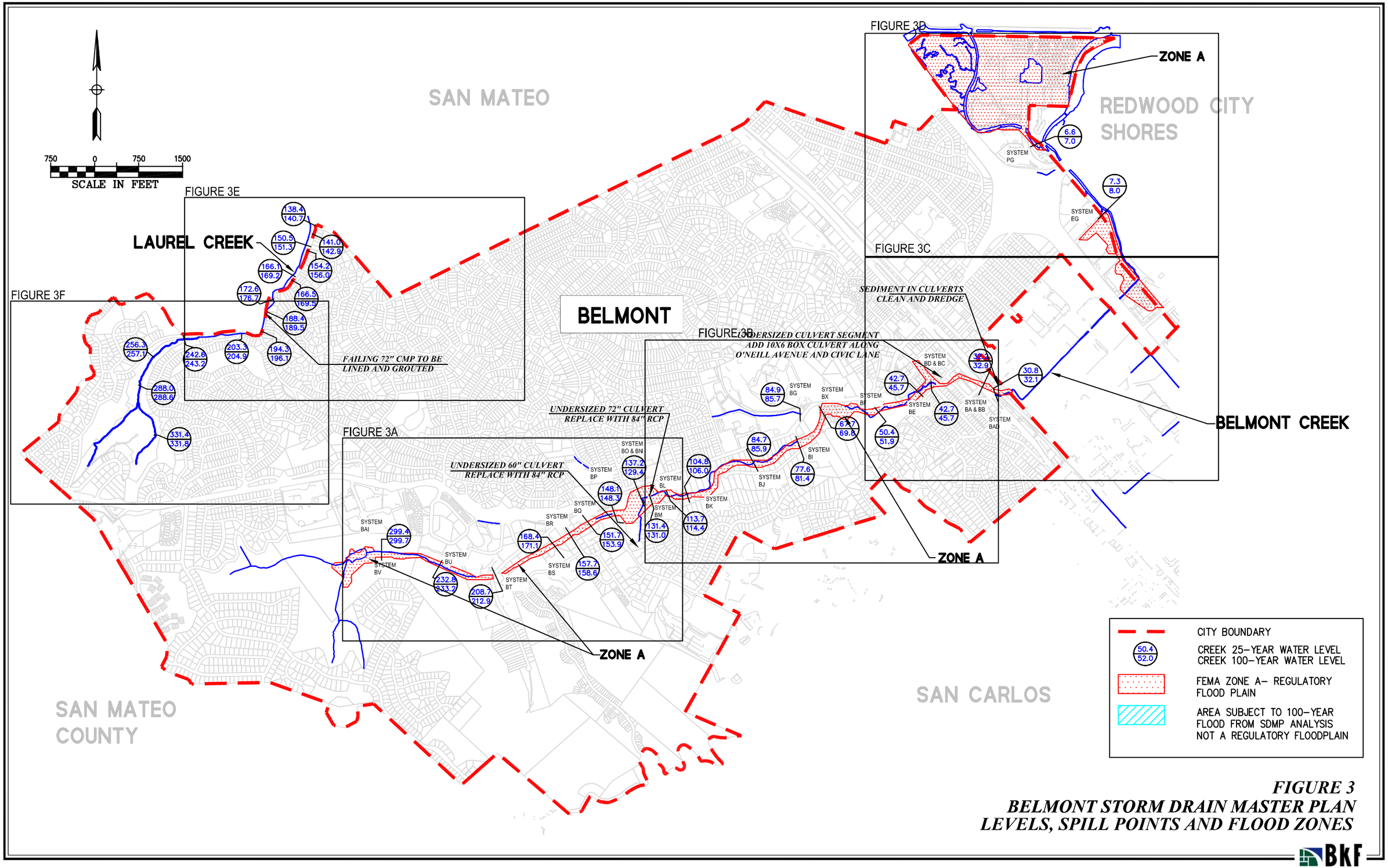


FIGURE 3
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

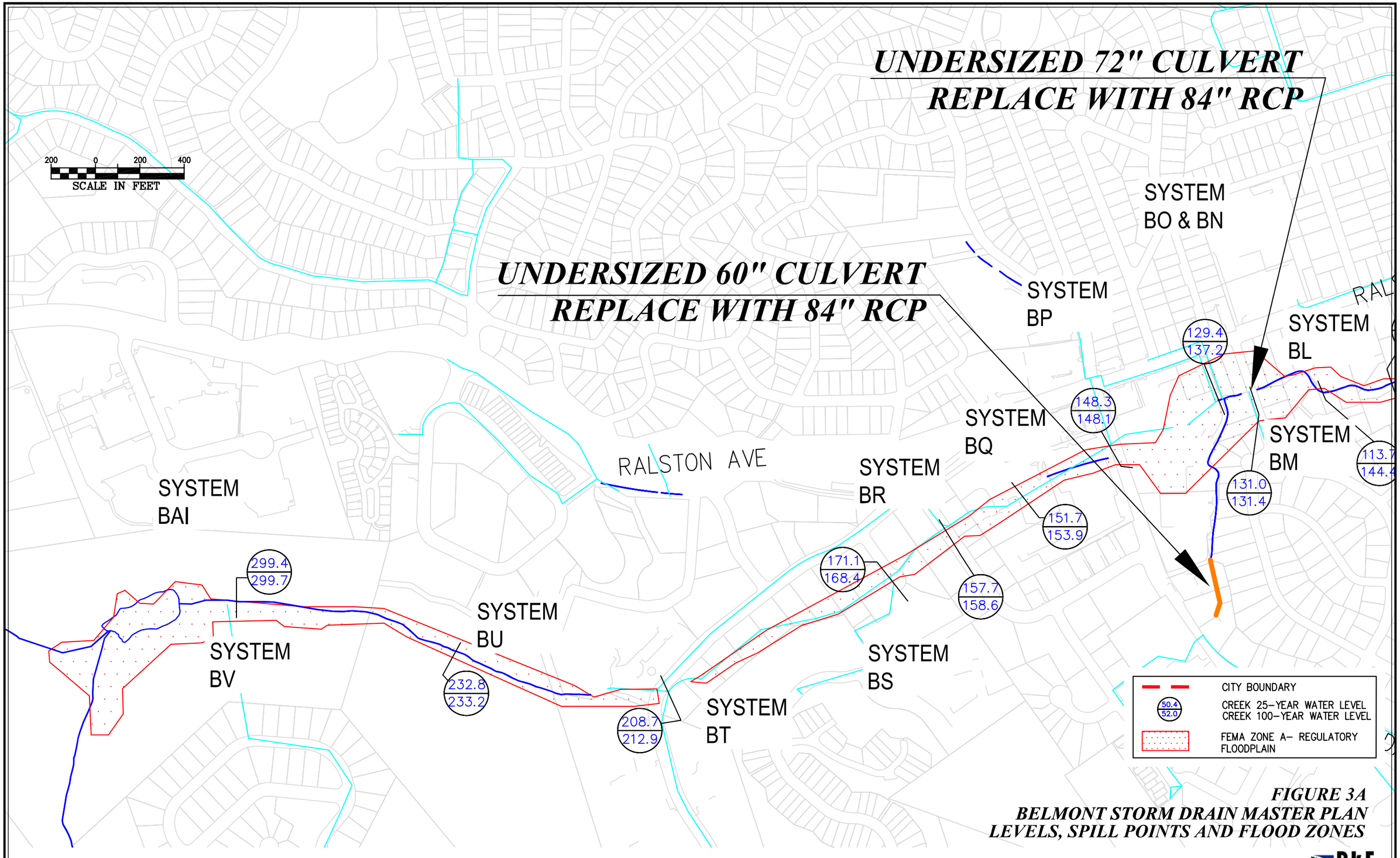


FIGURE 3A
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

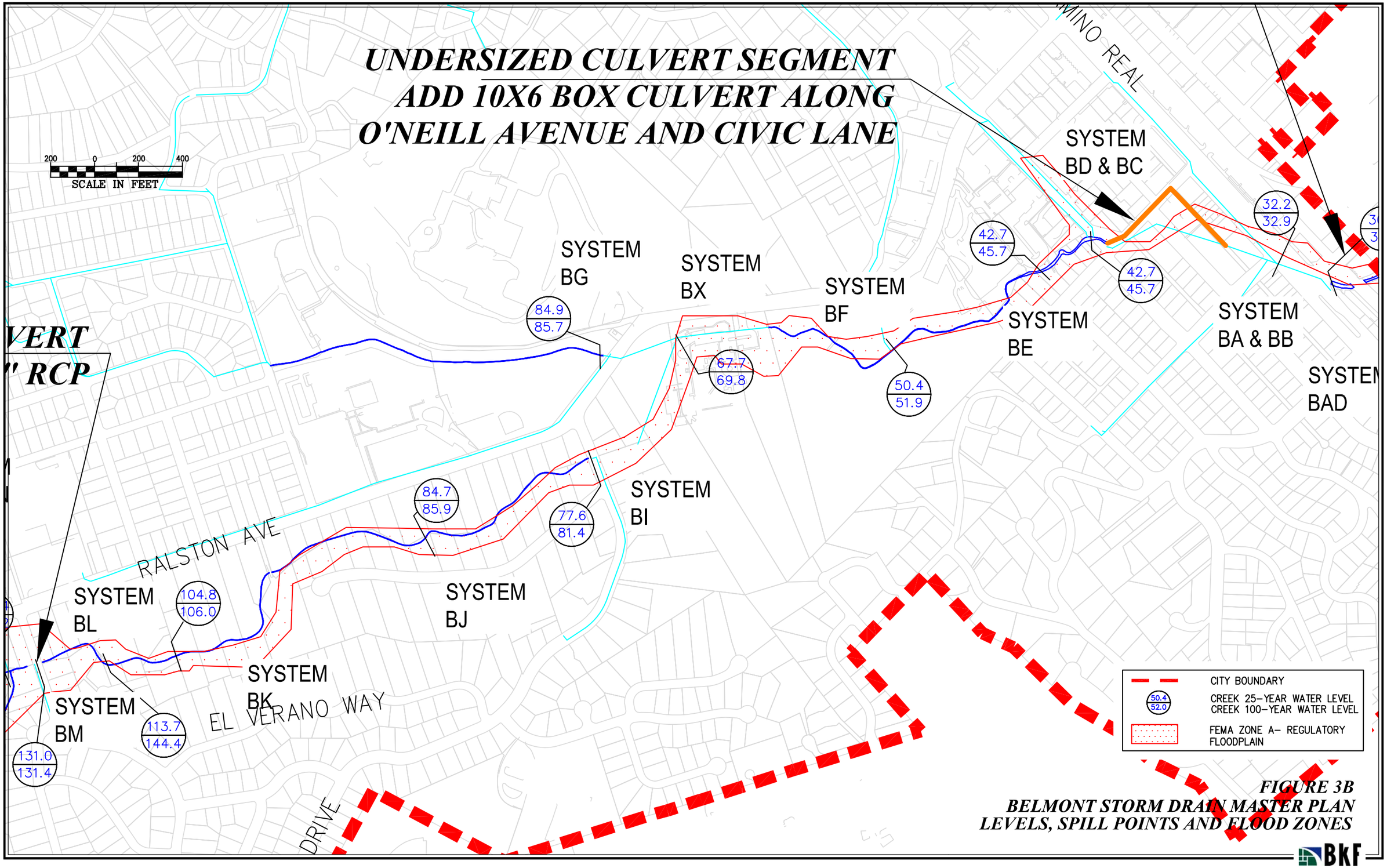


FIGURE 3B
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

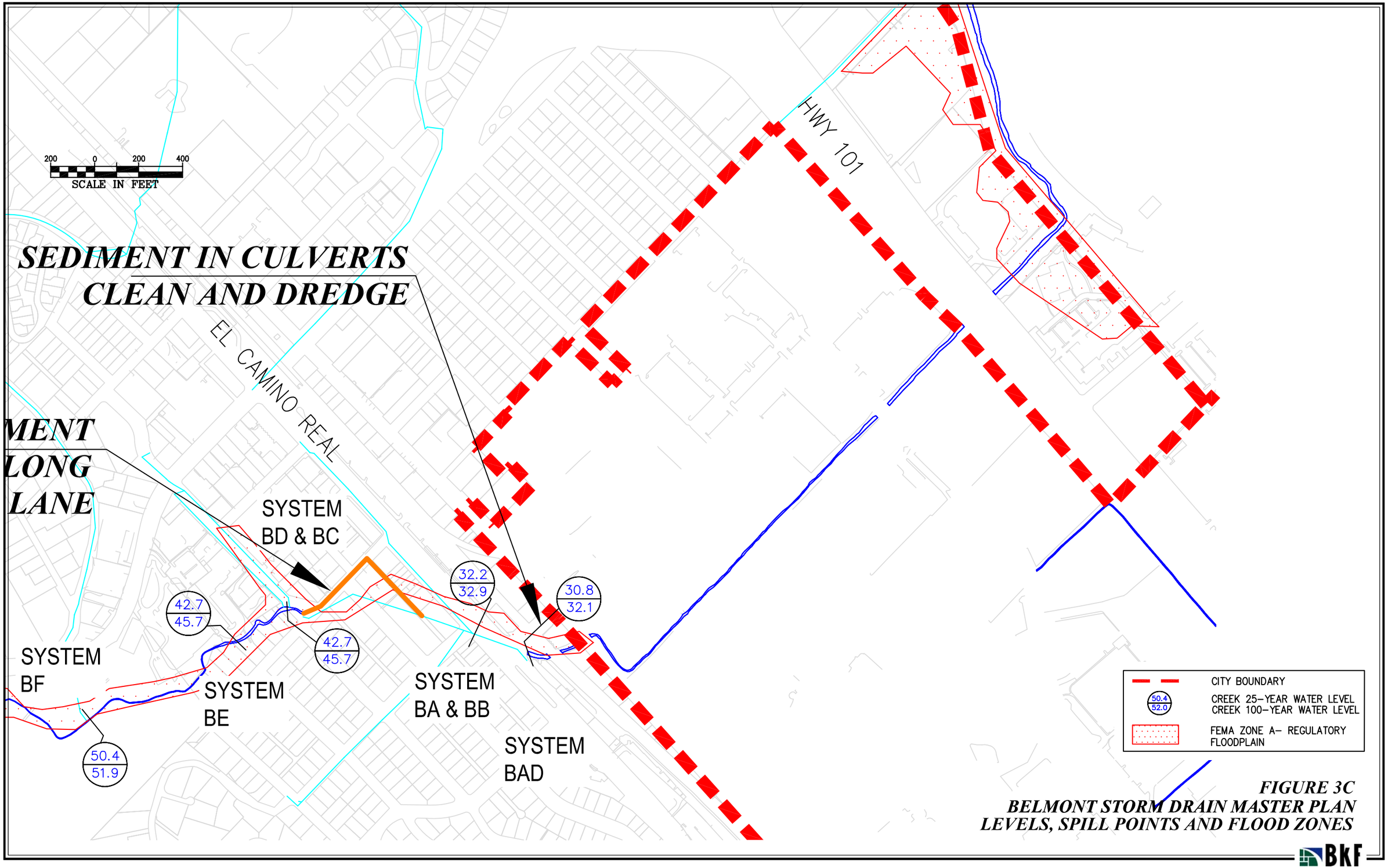


FIGURE 3C
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

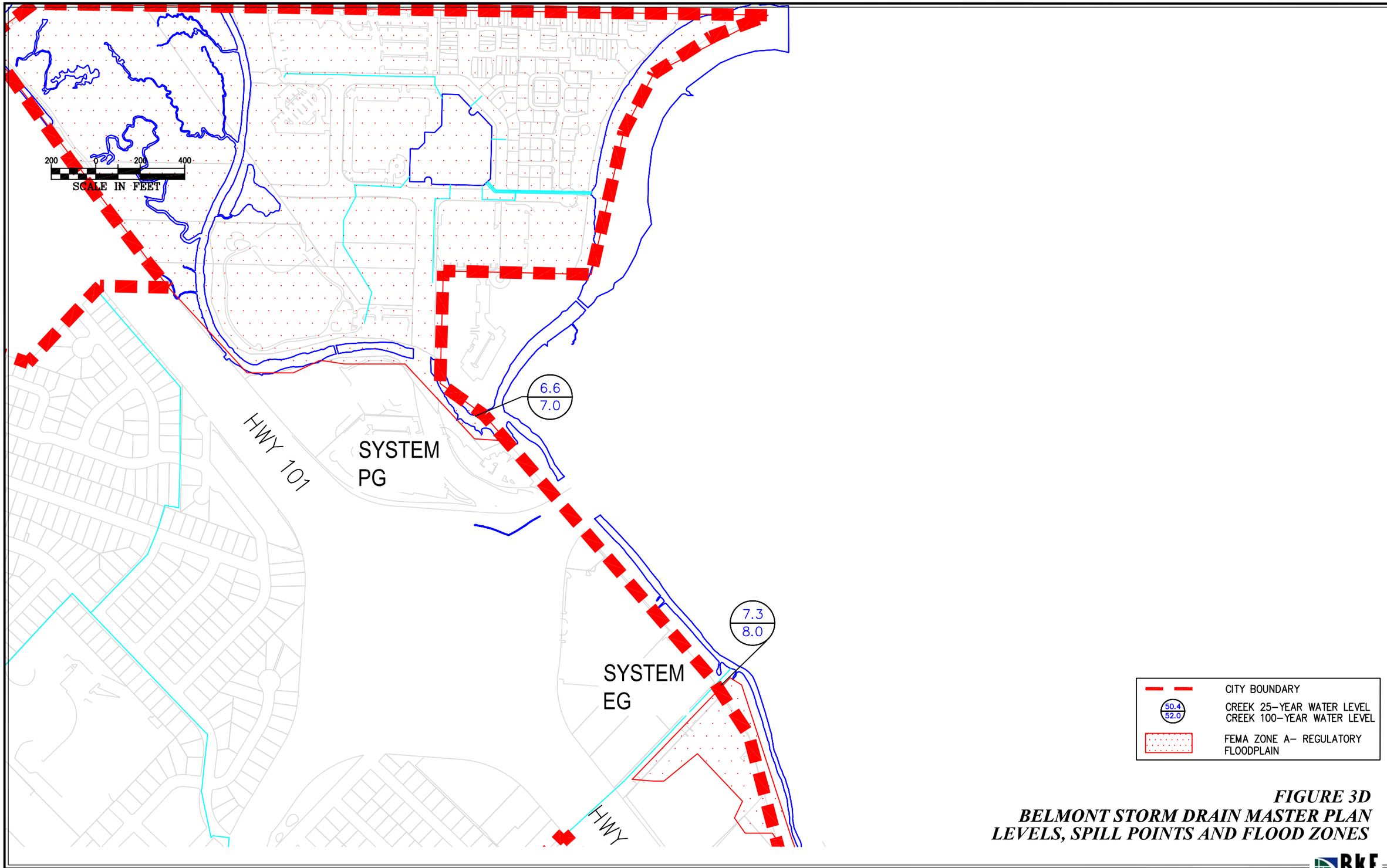


FIGURE 3D
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

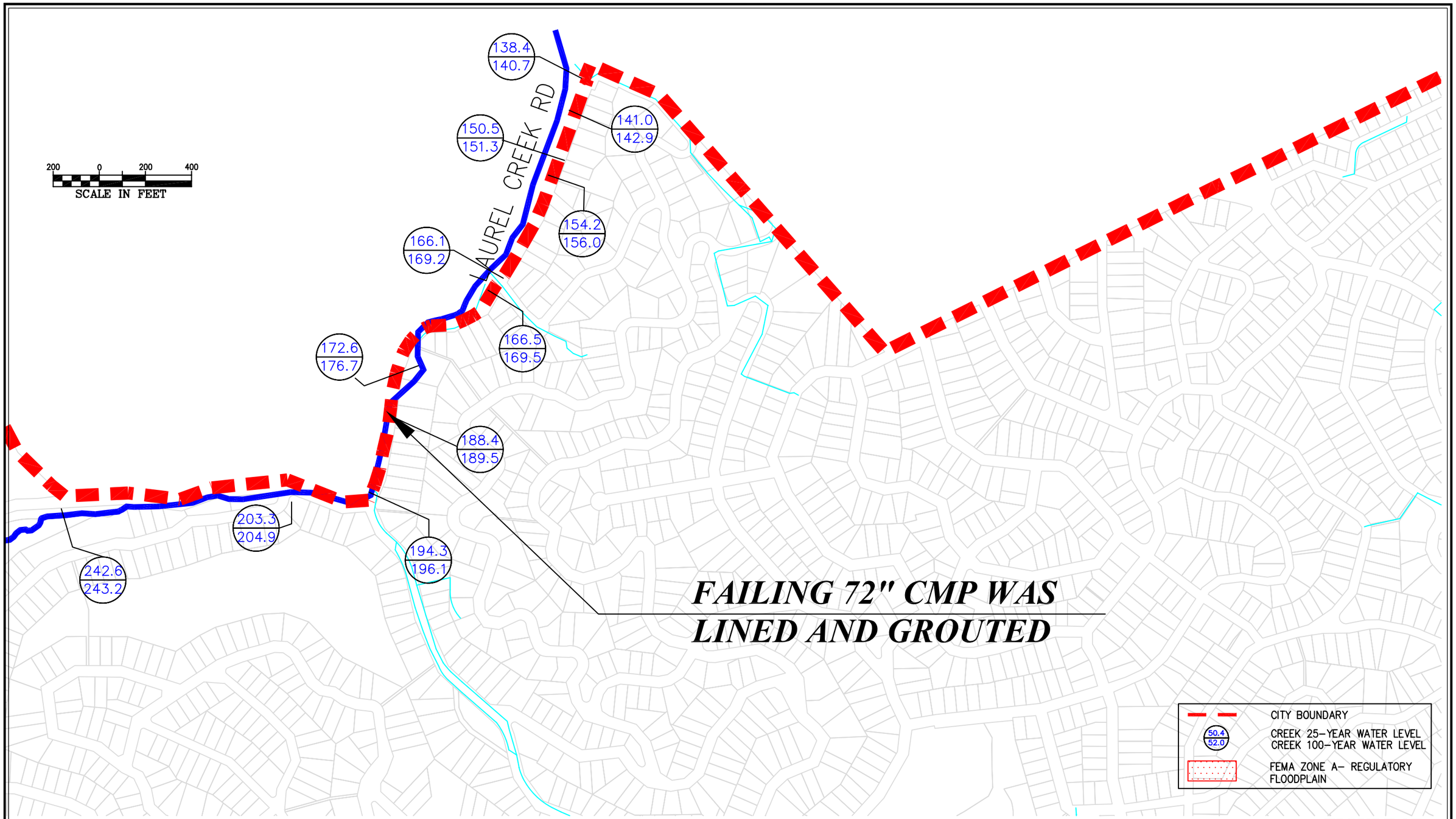


FIGURE 3E
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

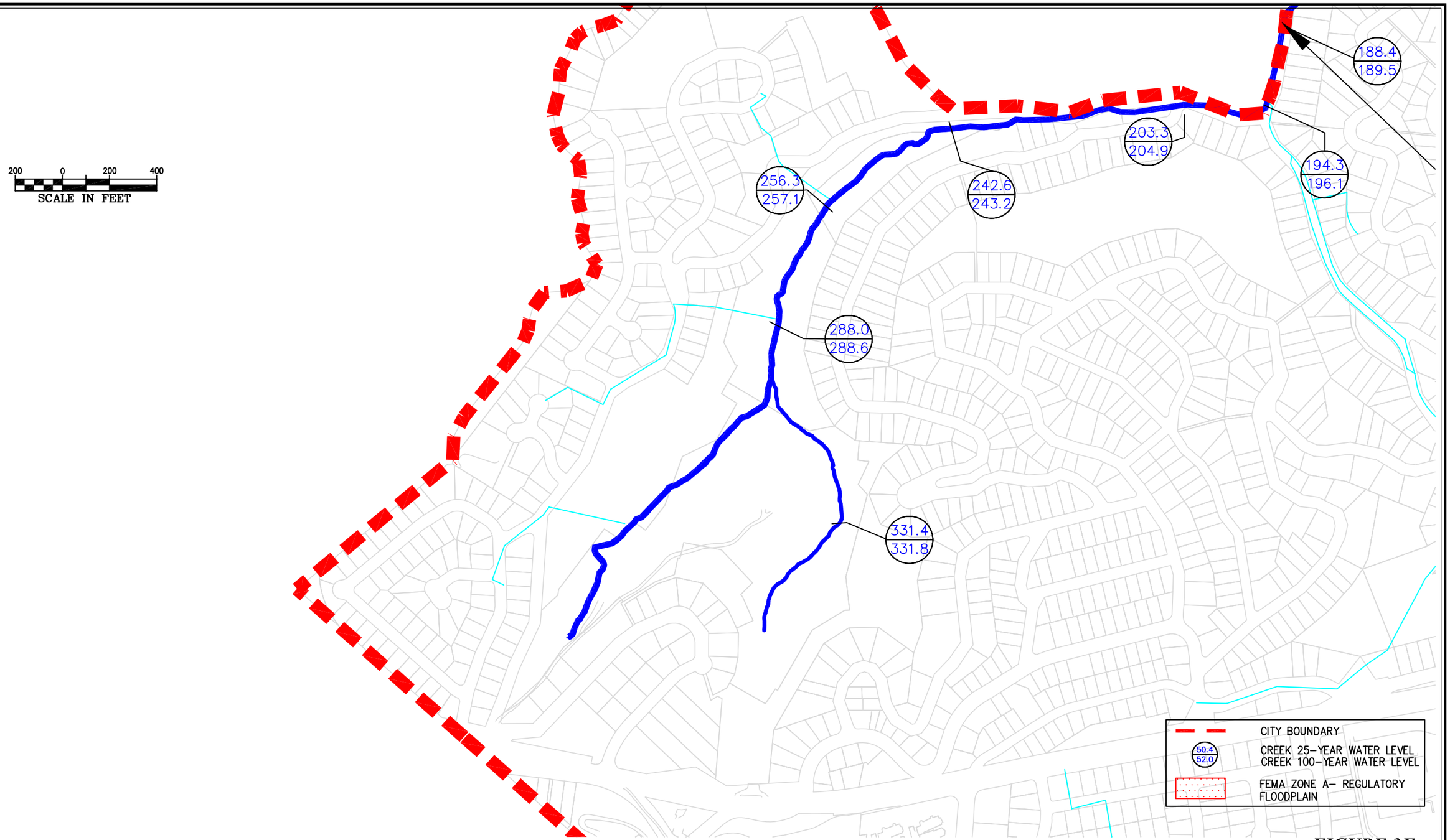


FIGURE 3F
BELMONT STORM DRAIN MASTER PLAN
LEVELS, SPILL POINTS AND FLOOD ZONES

BKF

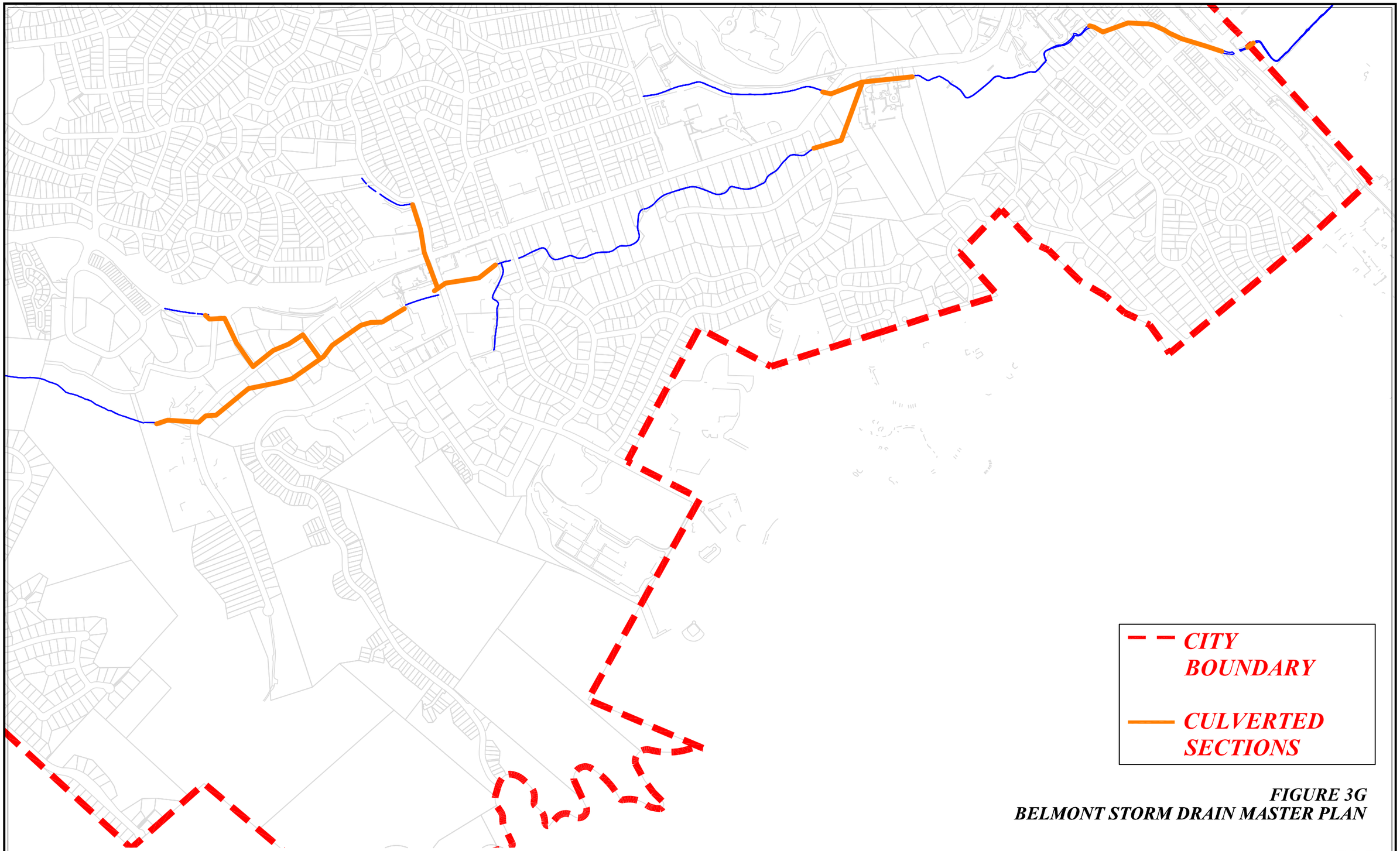


FIGURE 3G
BELMONT STORM DRAIN MASTER PLAN

BKF

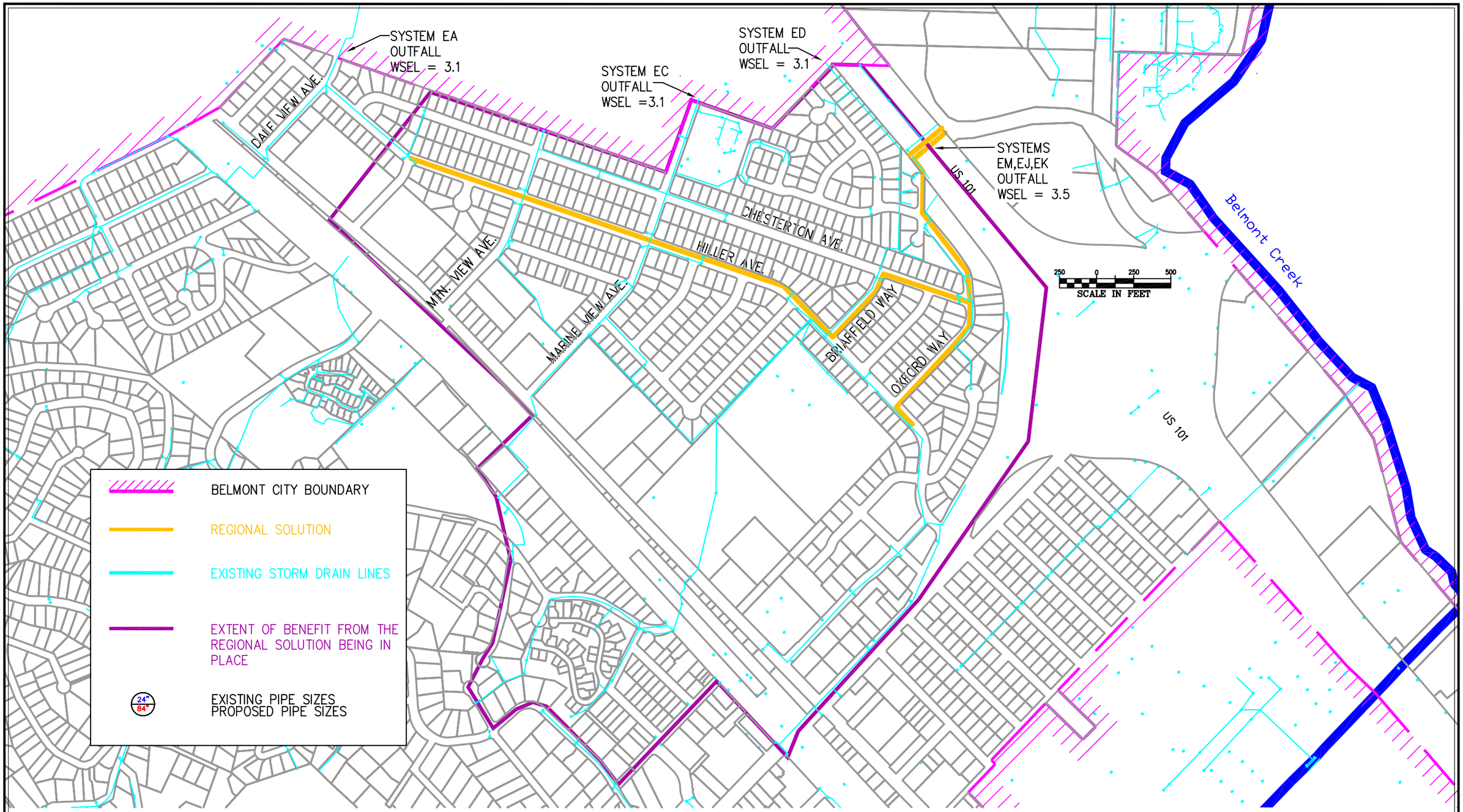


FIGURE 4
BELMONT STORM DRAIN MASTER PLAN
REGIONAL SOLUTION ALTERNATIVE

BKF

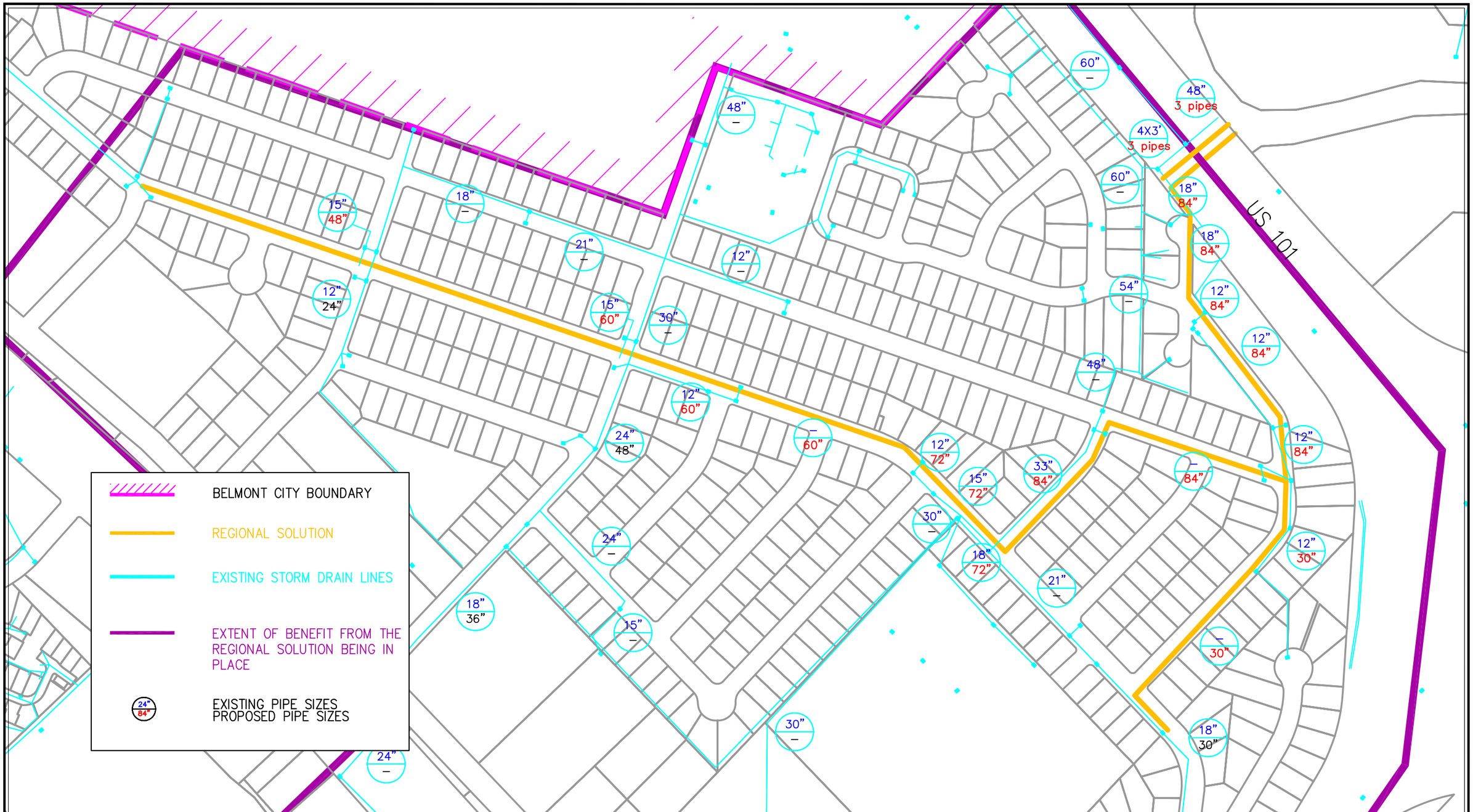


FIGURE 4A
BELMONT STORM DRAIN MASTER PLAN
REGIONAL SOLUTION ALTERNATIVE

BKF

MATCHLINE SEE FIGURE 5G

CHESTERTON AVE

Belmont Creek

U.S. HIGHWAY 101

MATCHLINE SEE FIGURE 5B

EXTENSIONS ARE REQUIRED WHERE RUNOFF TRAVELS IN CITY RIGHT-OF-WAY FOR MORE THAN 500-FEET.

EXTENTION PIPES

I-BH-01 SYSTEM OF CONNECTION

EXT-I-BO-04 PROBLEM AREAS SERVICED BY NEW EXTENTION PIPES

CITY LIMITS

CREEK

200 0 200 400

SCALE IN FEET

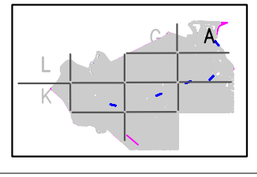
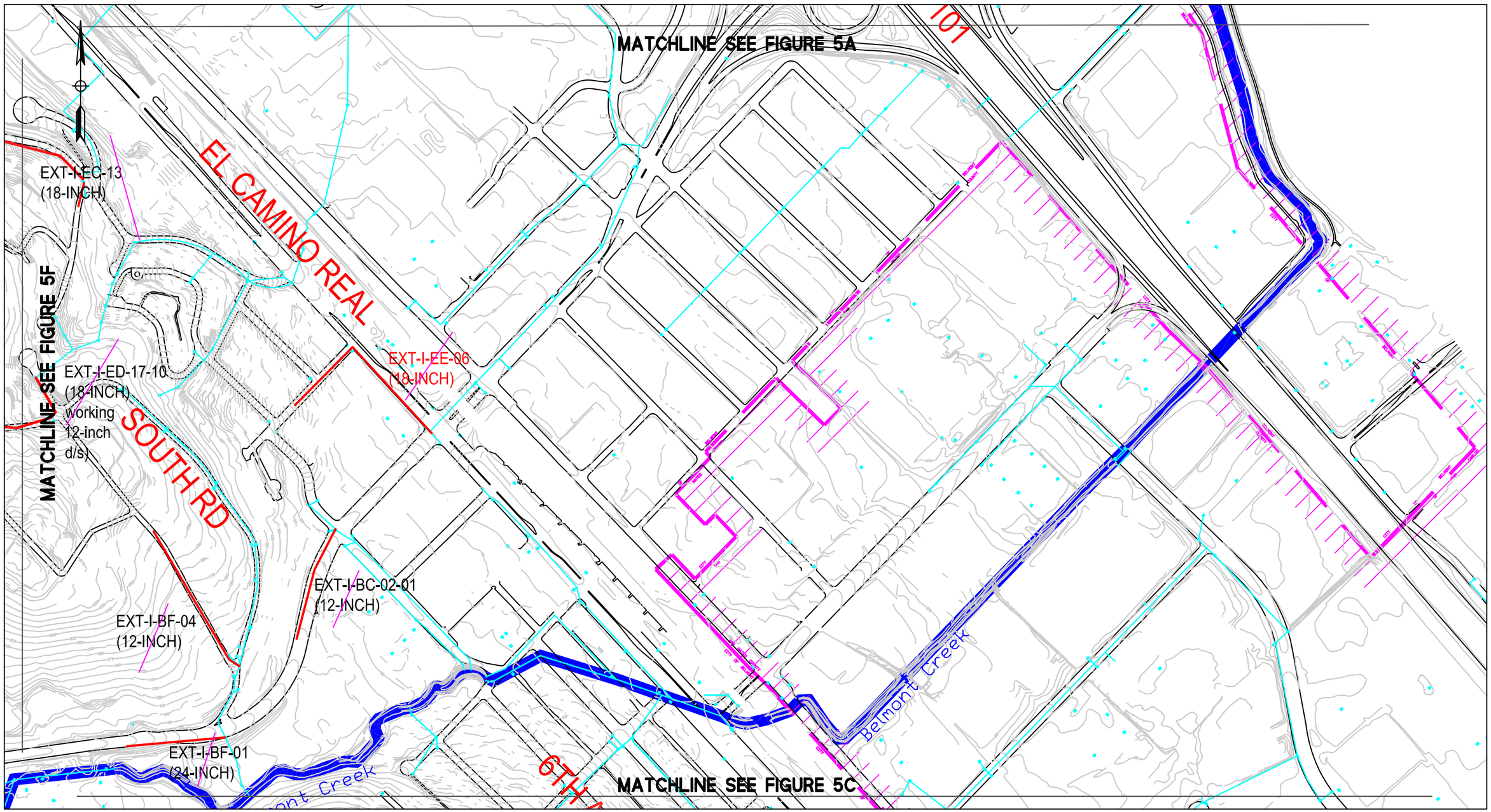
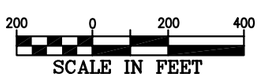


FIGURE 5A
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF





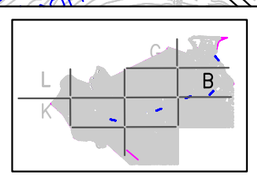


FIGURE 5B
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

EXT-I-BF-01
(24-INCH)

Belmont Creek

6TH AVE

MATCHLINE SEE FIGURE 5B

EXT-I-BB-02-04
(18-INCH)

EXT-I-BB-07-05
(12-INCH)

MATCHLINE SEE FIGURE 5E

200 0 200 400
SCALE IN FEET

L
K
C

FIGURE 5C
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

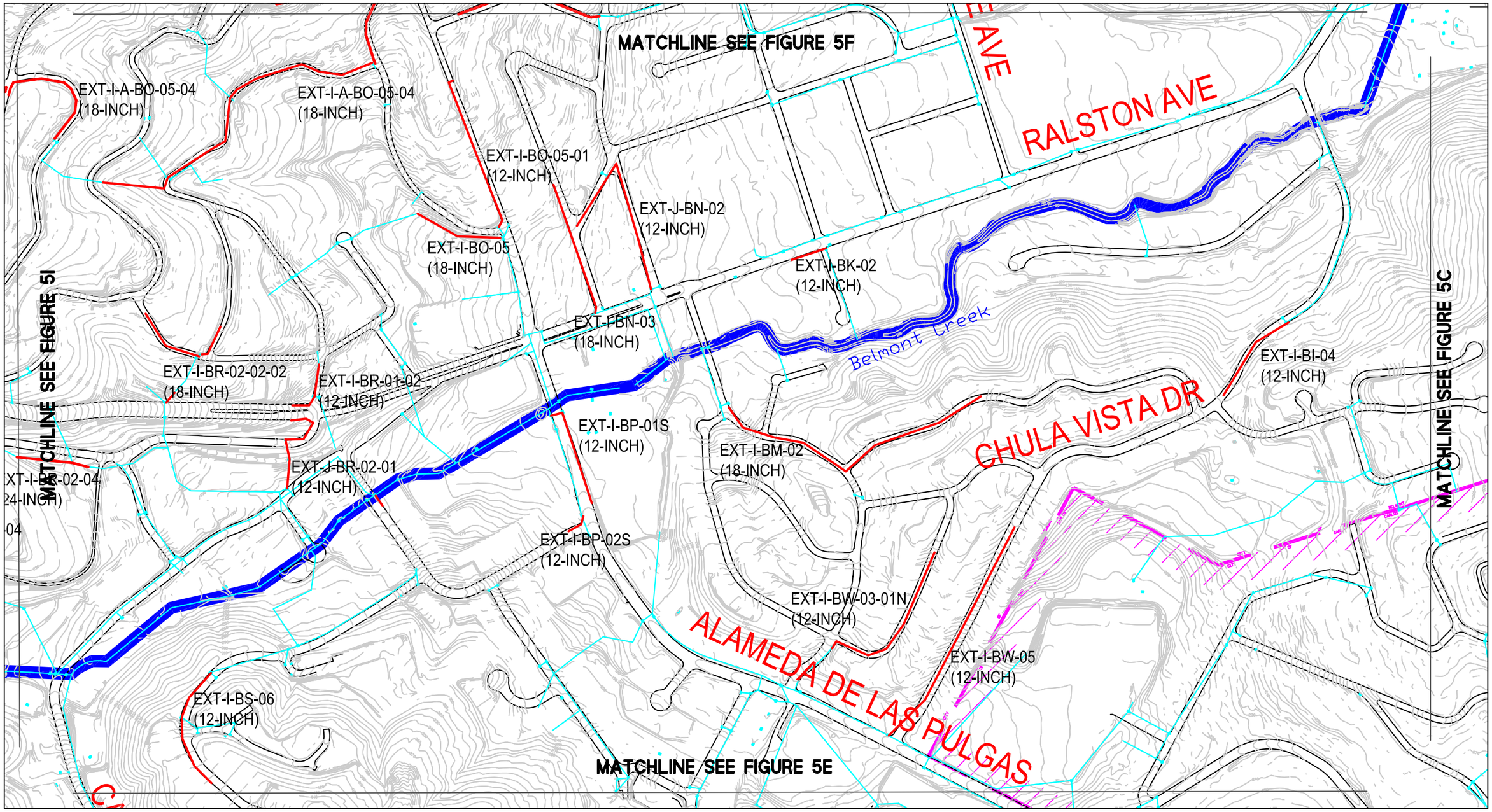


FIGURE 5D
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

MATCHLINE SEE FIGURE 5D

CARLMONT DR

EXT-I-BT-02-04
(12-INCH)

HASTINGS DR

MATCHLINE SEE FIGURE 5J

200 0 200 400
SCALE IN FEET

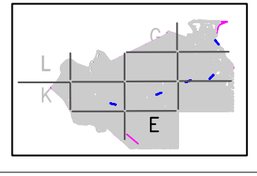


FIGURE 5E
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

MATCHLINE SEE FIGURE 5G

EXT-I-EA-16-15
(18-INCH)

EXT-I-EB-07-02
(3X 12-INCH)

EXT-I-EB-09-01
(12-INCH)

EXT-I-BH-03-09
(18-INCH)

EXT-I-BH-13
(18-INCH)

ALAMEDA DE LAS PULGAS

MATCHLINE SEE FIGURE 5H

EXT-I-BH-03-09
(18-INCH)

EXT-I-BH-03-09
(24-INCH)

EXT-I-BH-03-07-03
(18-INCH)

EXT-I-BH-03-12
(18-INCH)

EXT-I-BH-03-06
(18-INCH)

EXT-I-BH-09
(18-INCH)

EXT-I-BH-06-01
(18-INCH
PIPES)

EXT-I-BH-03-12
(18-INCH)

EXT-I-BH-06-01
(24-INCH)

EXT-I-BH-03-05
(18-INCH)

EXT-I-BH-03-12
(18-INCH)

NORTE DAME

EXT-I-A-BO-05-04
(18-INCH)

EXT-I-BH-01-03-05
(12-INCH)

MATCHLINE SEE FIGURE 5D

MATCHLINE SEE FIGURE 5B

200 0 200 400
SCALE IN FEET

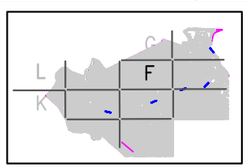
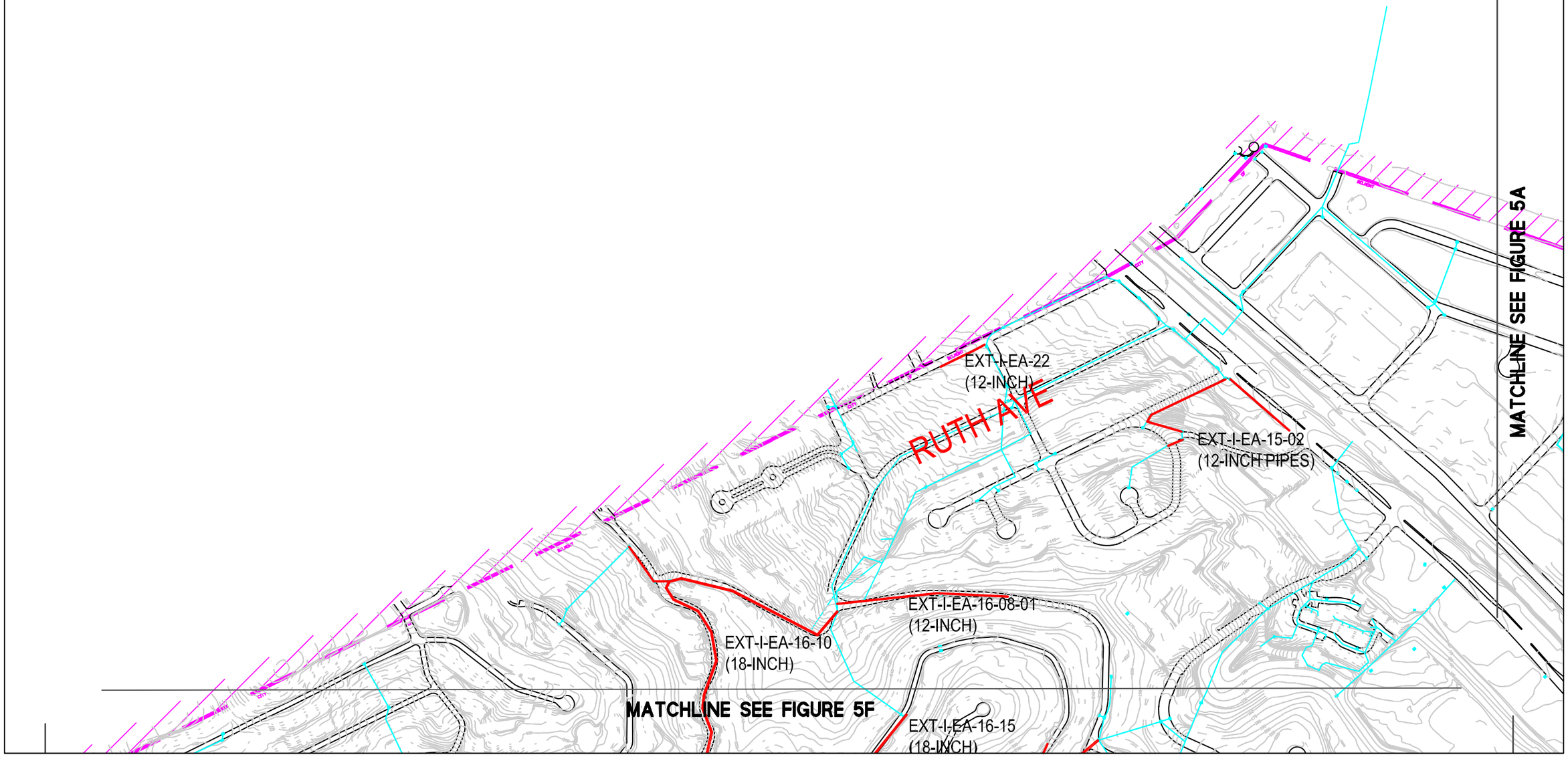
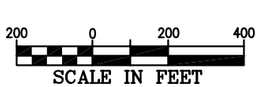


FIGURE 5F
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF





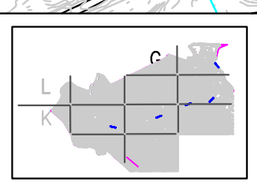


FIGURE 5G
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

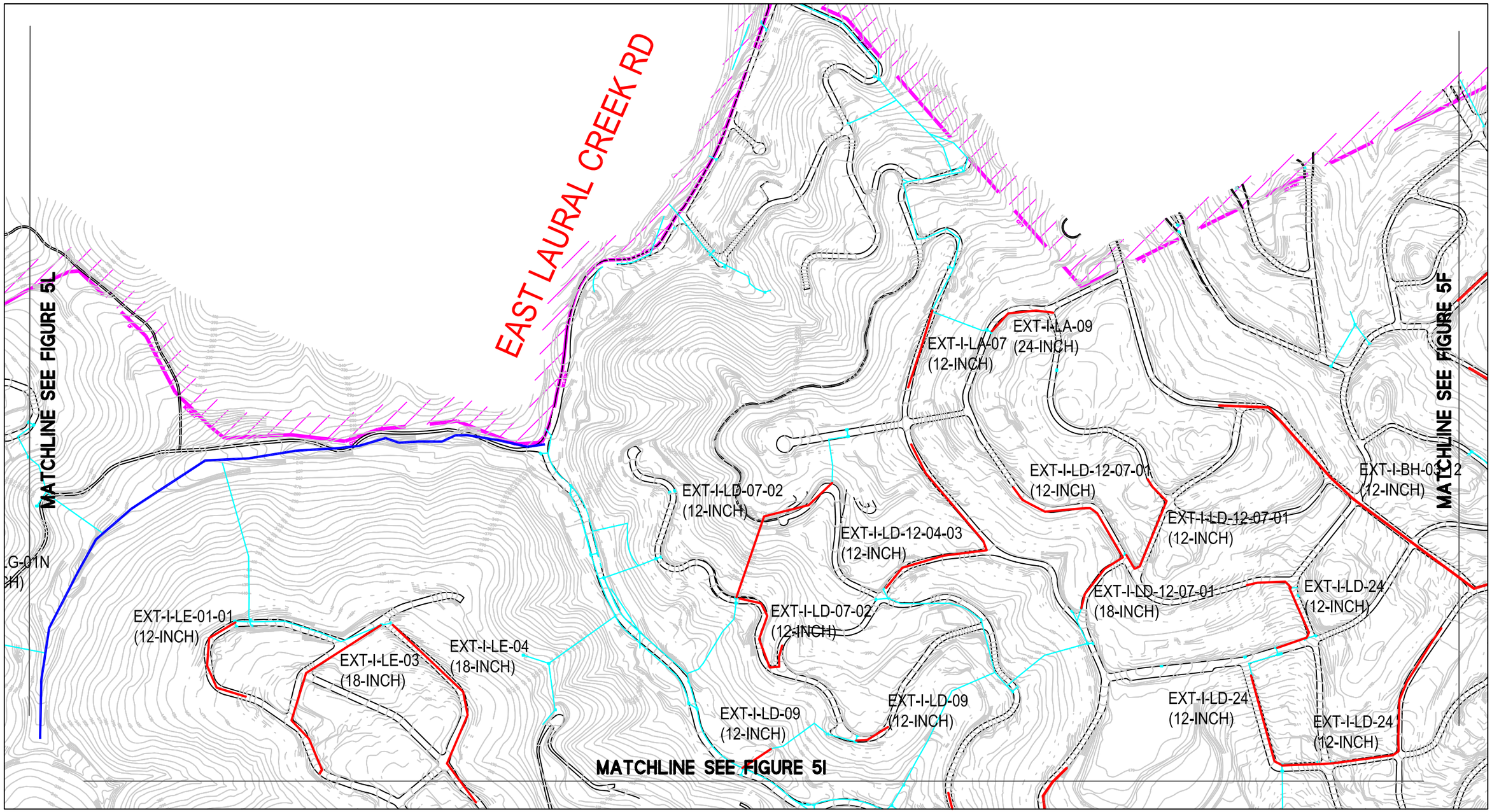


FIGURE 5H
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

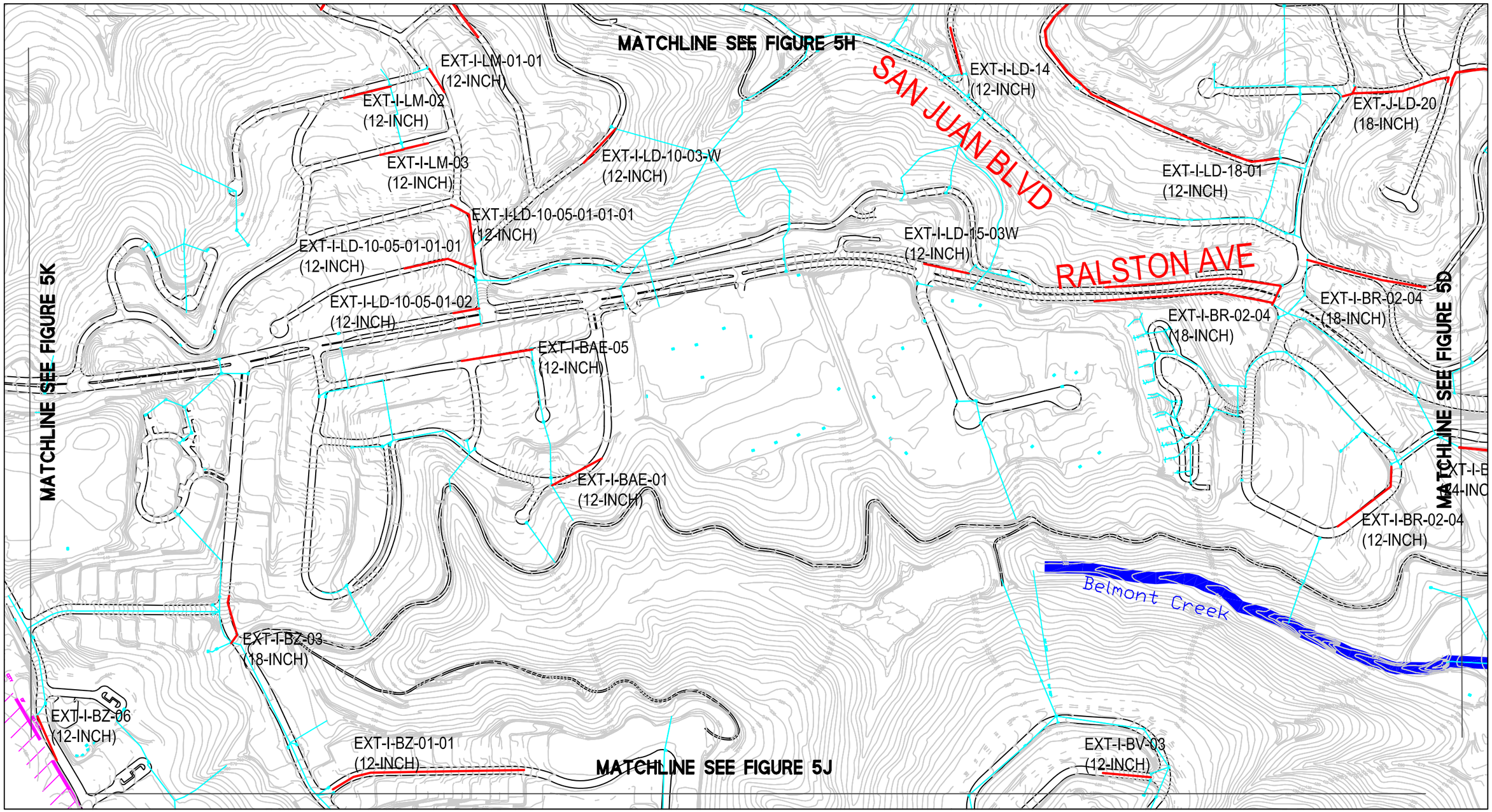
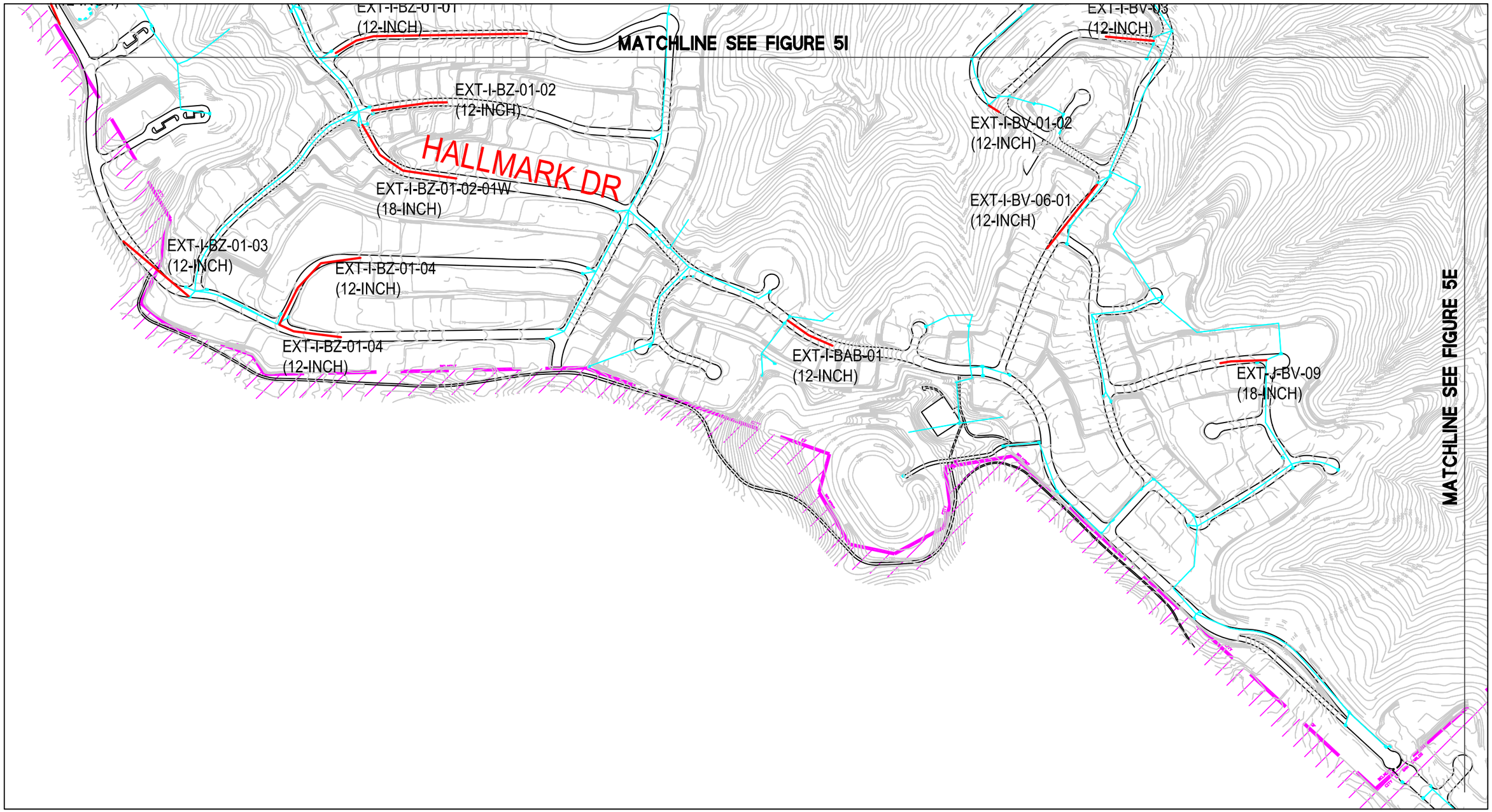


FIGURE 5I
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF



200 0 200 400
SCALE IN FEET

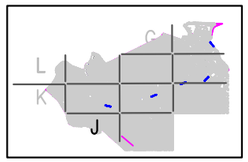
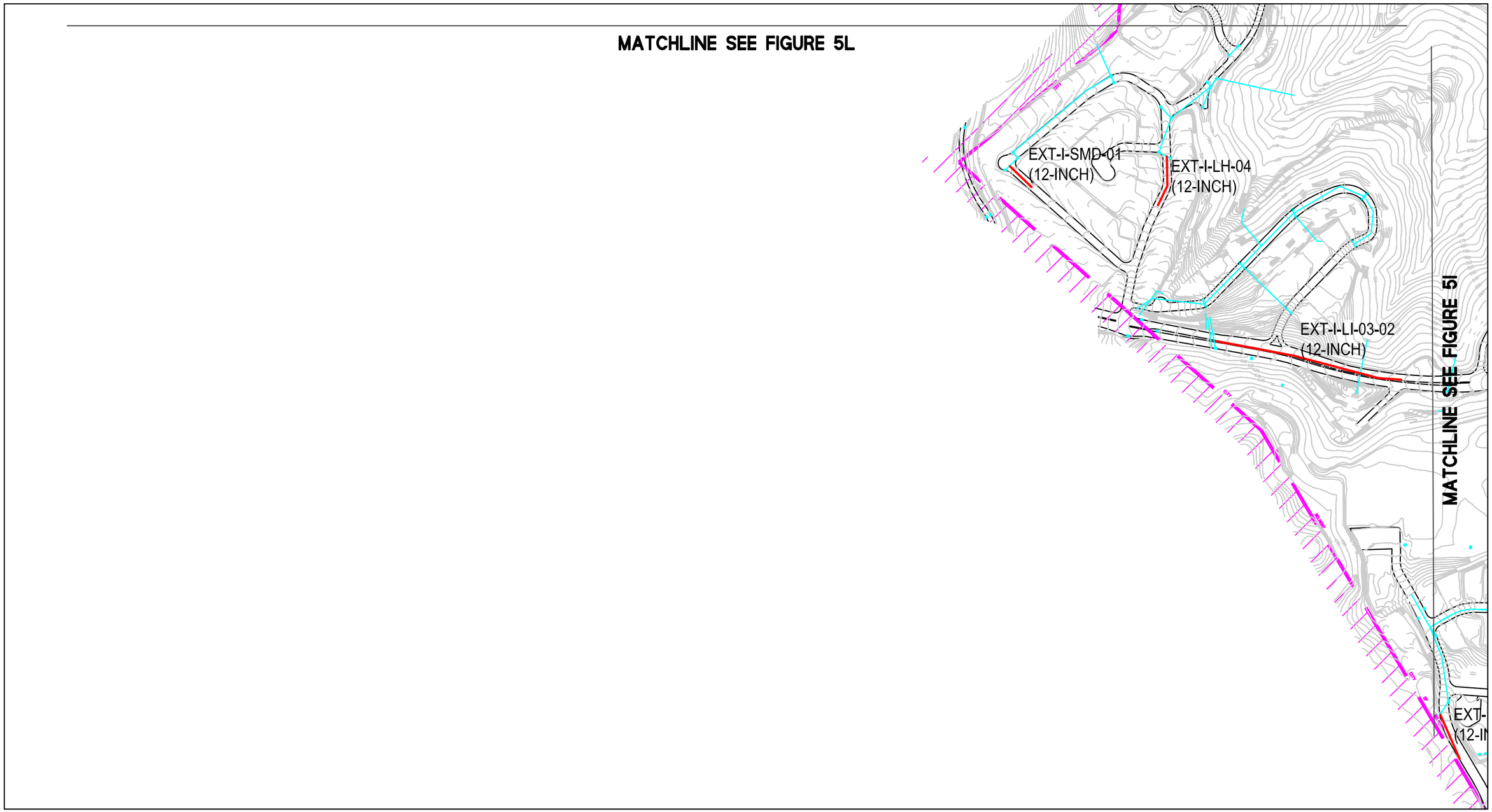


FIGURE 5J
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF



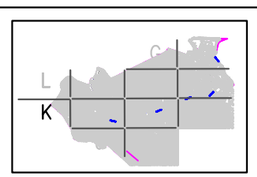
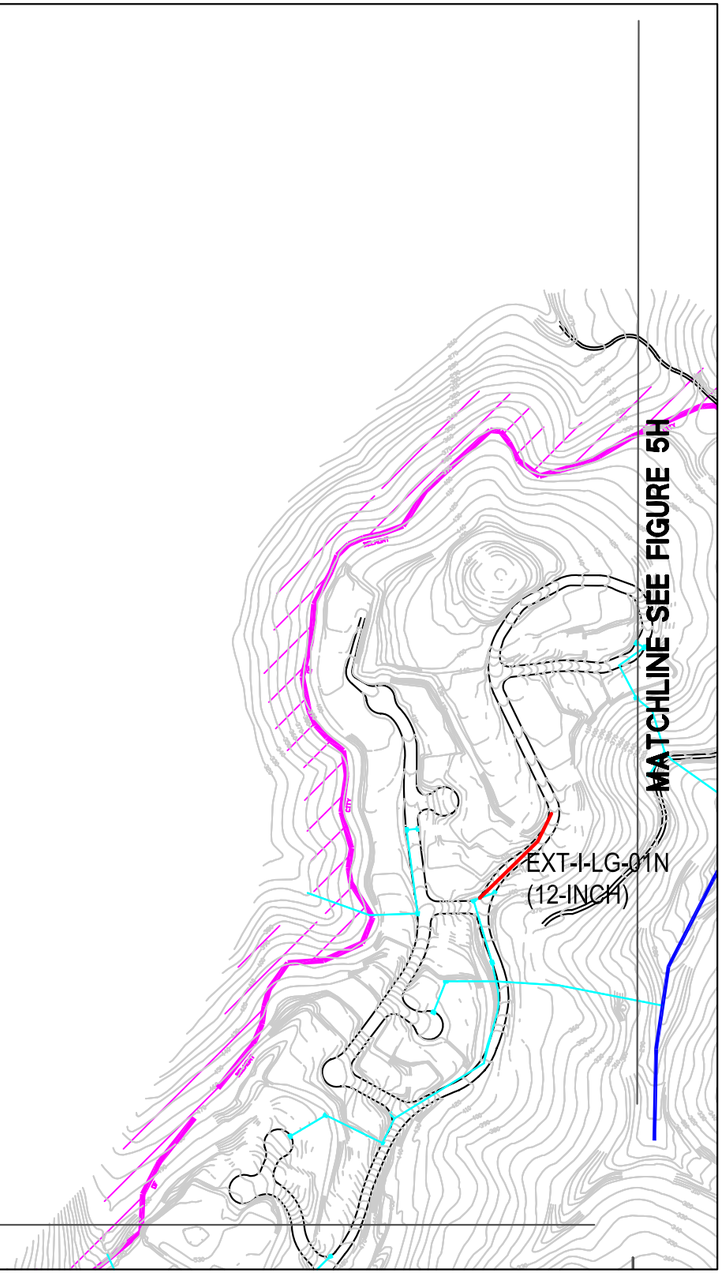


FIGURE 5K
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF



MATCHLINE SEE FIGURE 5K

200 0 200 400
SCALE IN FEET

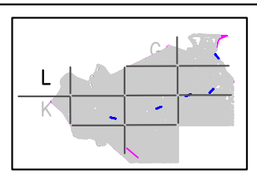


FIGURE 5L
BELMONT STORM DRAIN MASTER PLAN
EXTENSION TO NON-SERVED AREAS

BKF

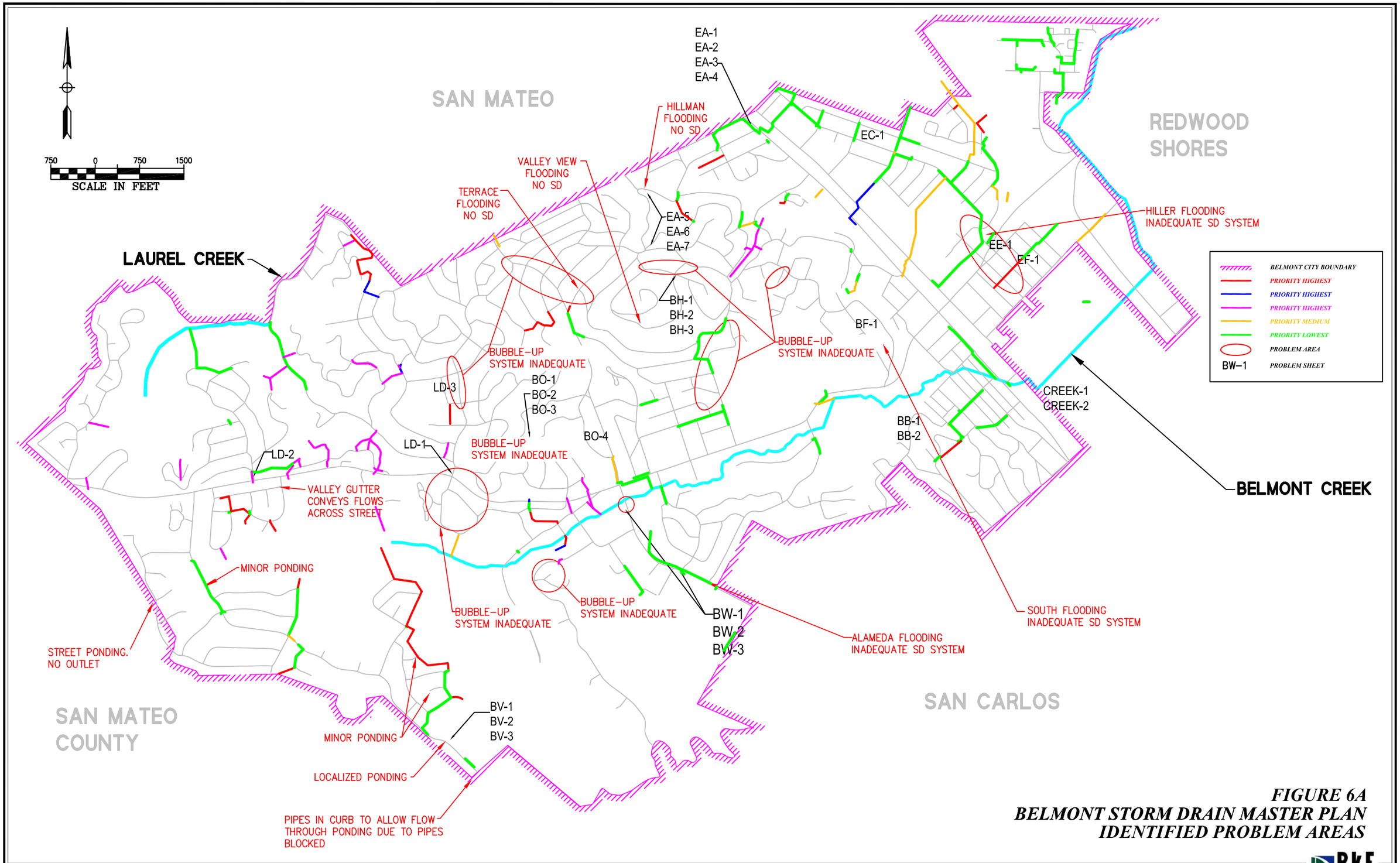


FIGURE 6A
BELMONT STORM DRAIN MASTER PLAN
IDENTIFIED PROBLEM AREAS

BKF

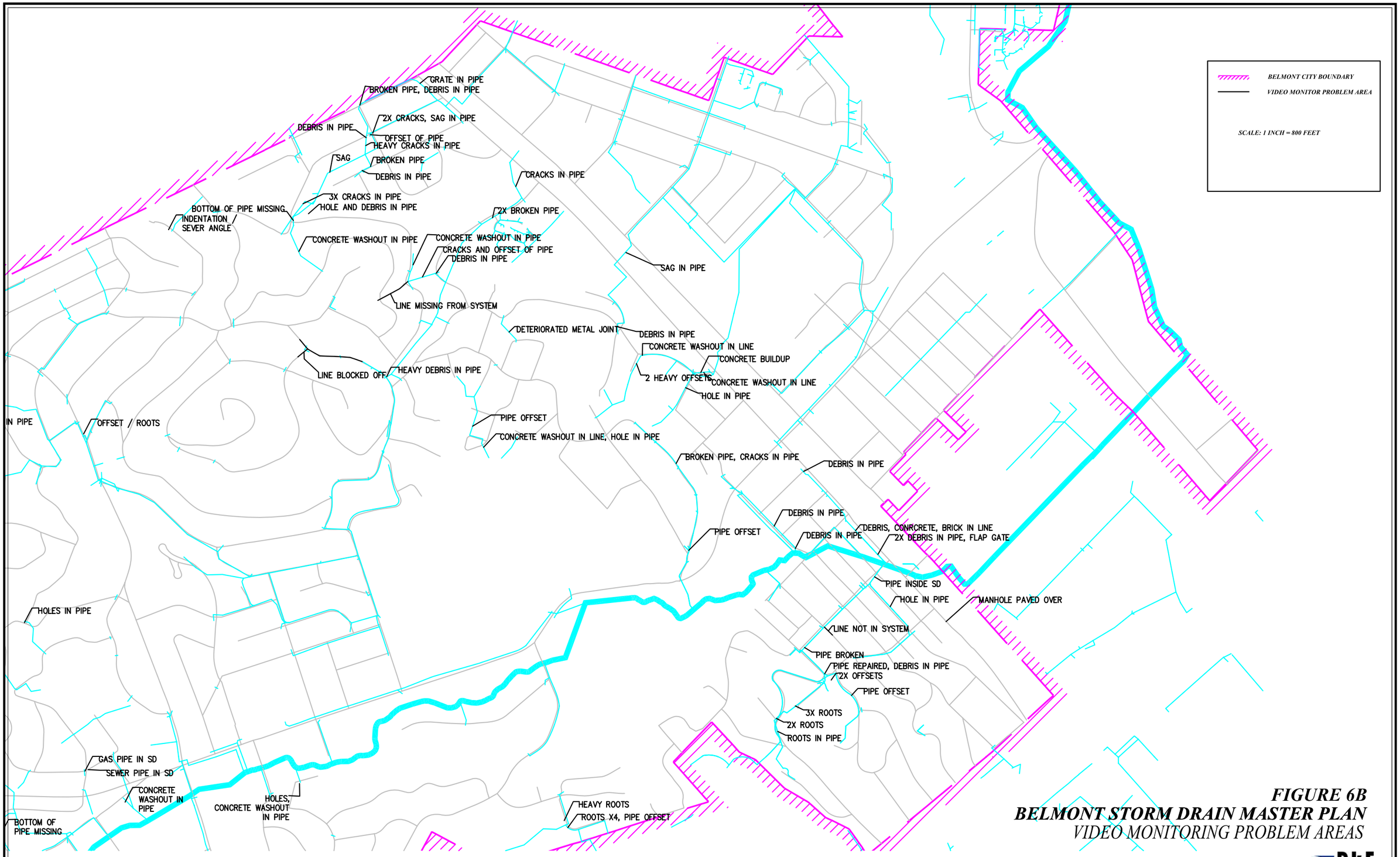


FIGURE 6B
BELMONT STORM DRAIN MASTER PLAN
VIDEO MONITORING PROBLEM AREAS

BKF

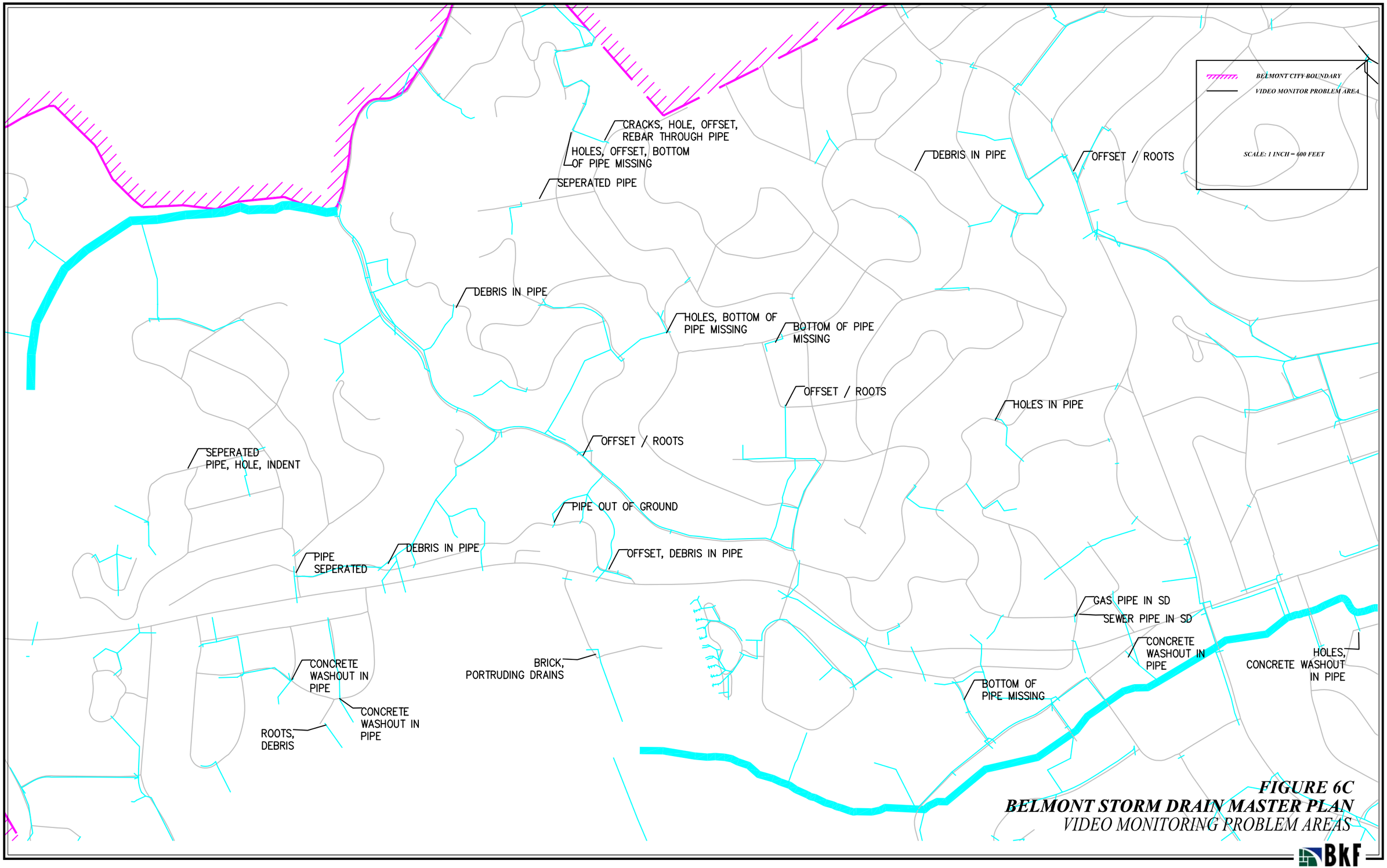


FIGURE 6C
BELMONT STORM DRAIN MASTER PLAN
VIDEO MONITORING PROBLEM AREAS

BKF

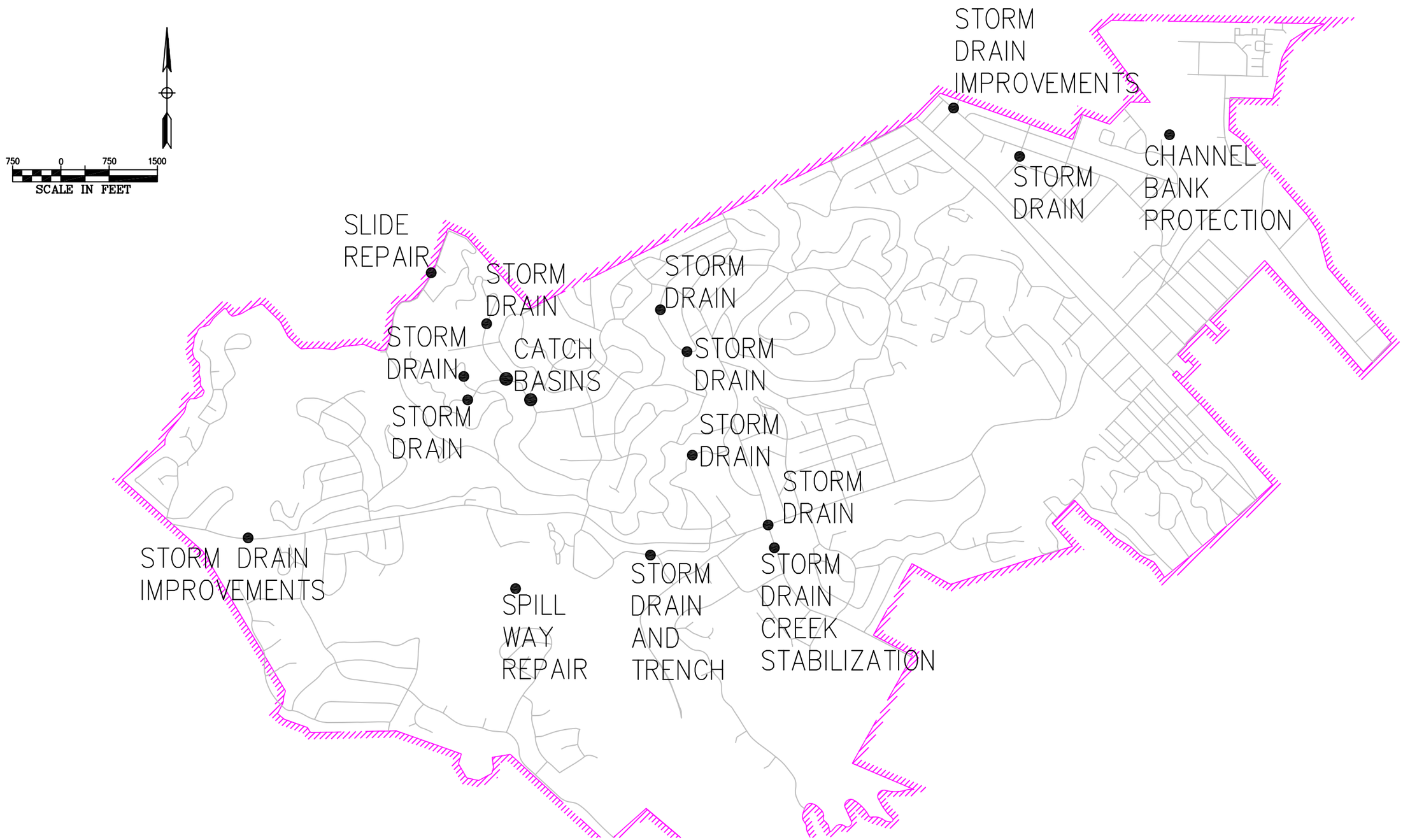


FIGURE 6D
BELMONT STORM DRAIN MASTER PLAN
PRIOR IMPROVEMENT AREAS

BKF

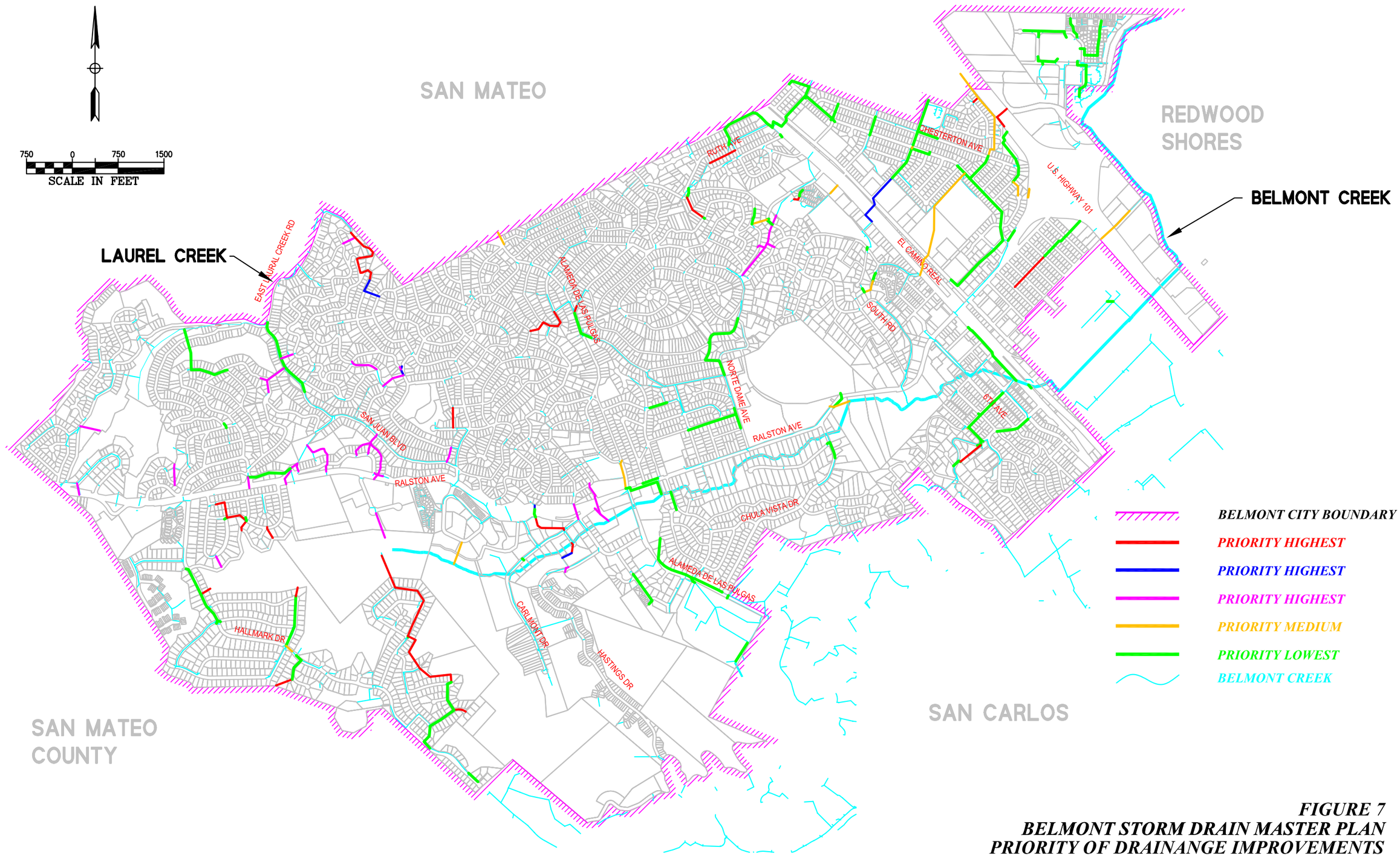


FIGURE 7
BELMONT STORM DRAIN MASTER PLAN
PRIORITY OF DRAINANGE IMPROVEMENTS

BKF

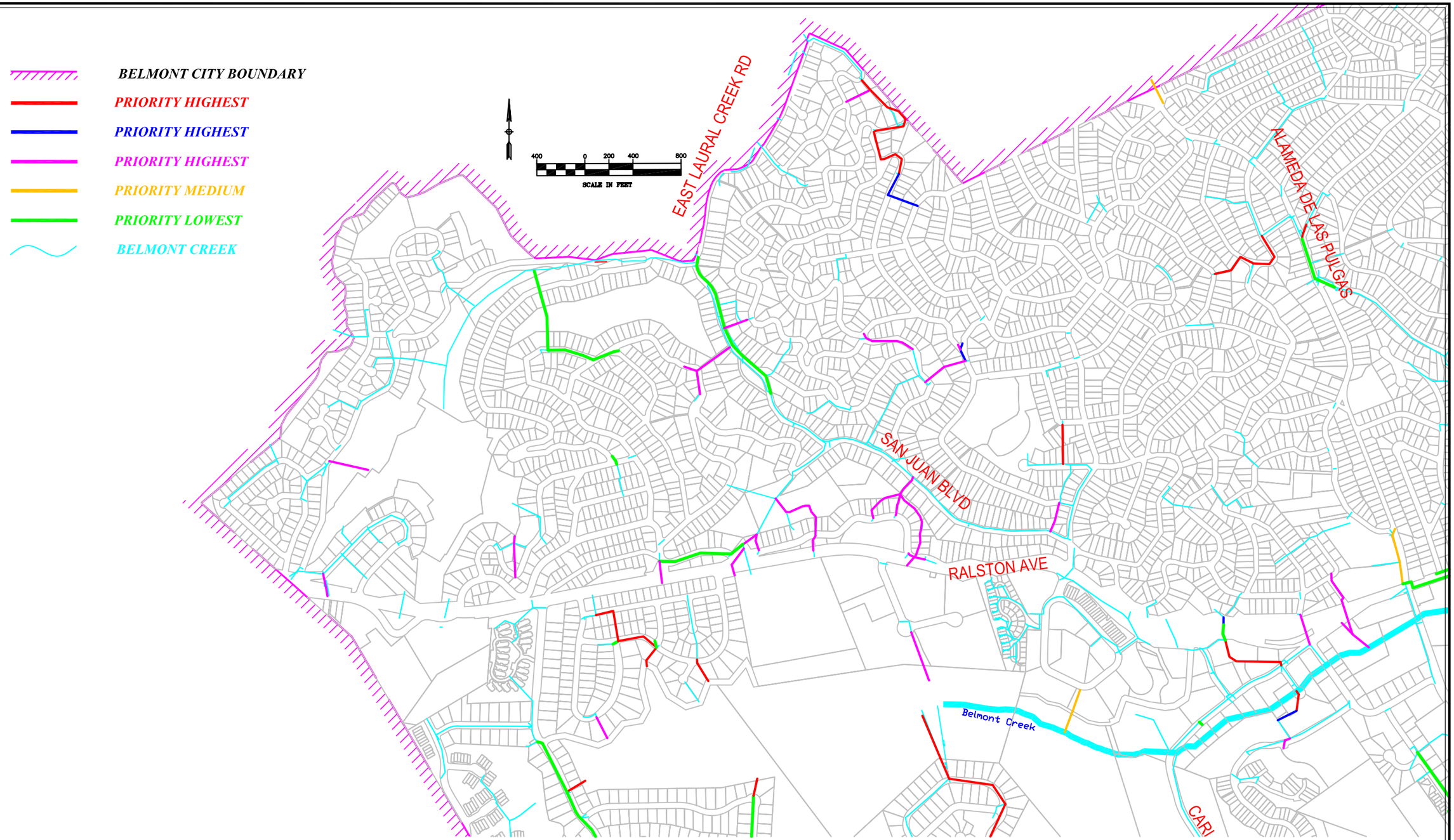


FIGURE 7A
BELMONT STORM DRAIN MASTER PLAN
PRIORITY OF DRAINAGE IMPROVEMENTS

BKF

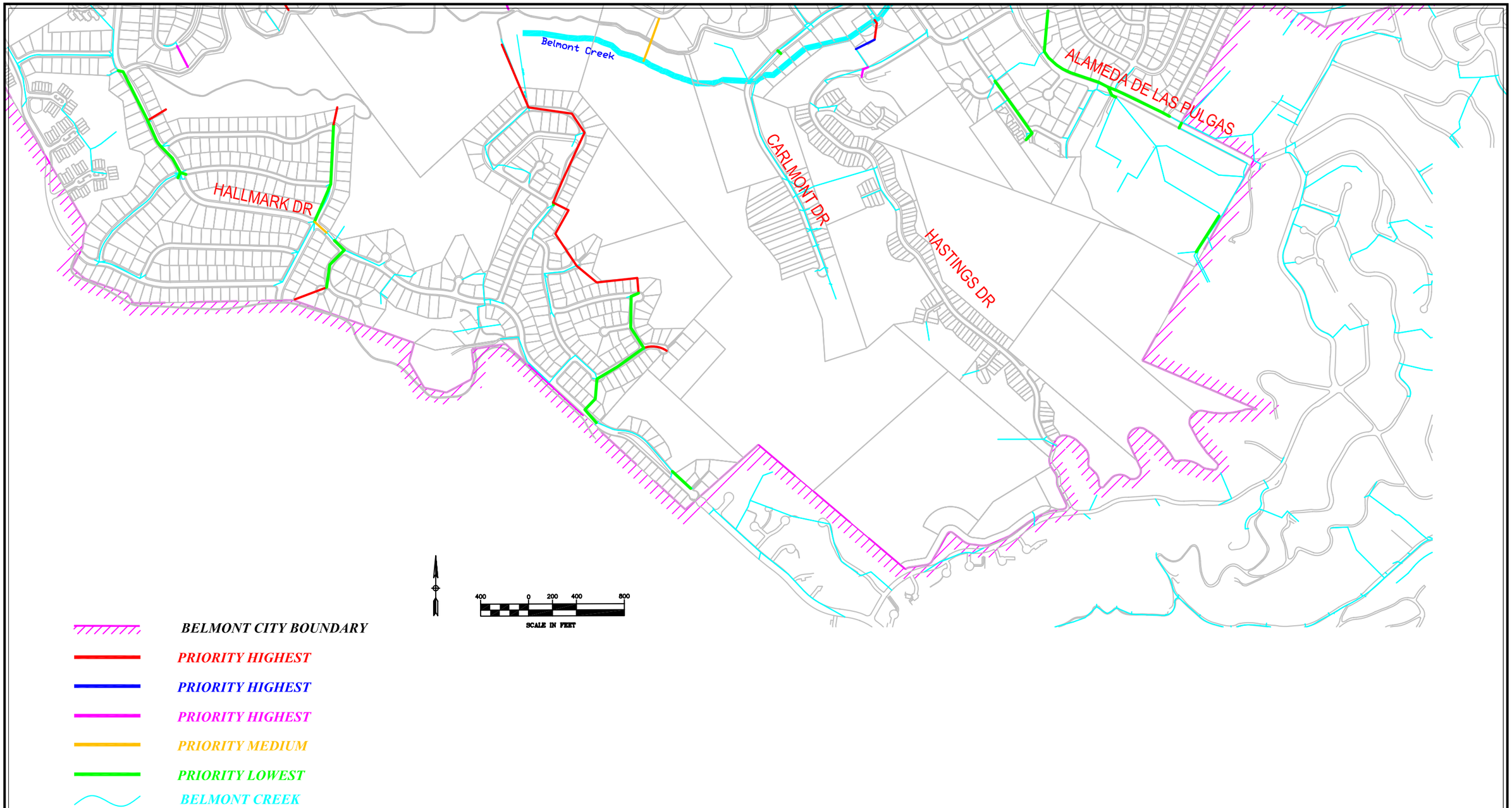


FIGURE 7B
BELMONT STORM DRAIN MASTER PLAN
PRIORITY OF DRAINAGE IMPROVEMENTS

BKF

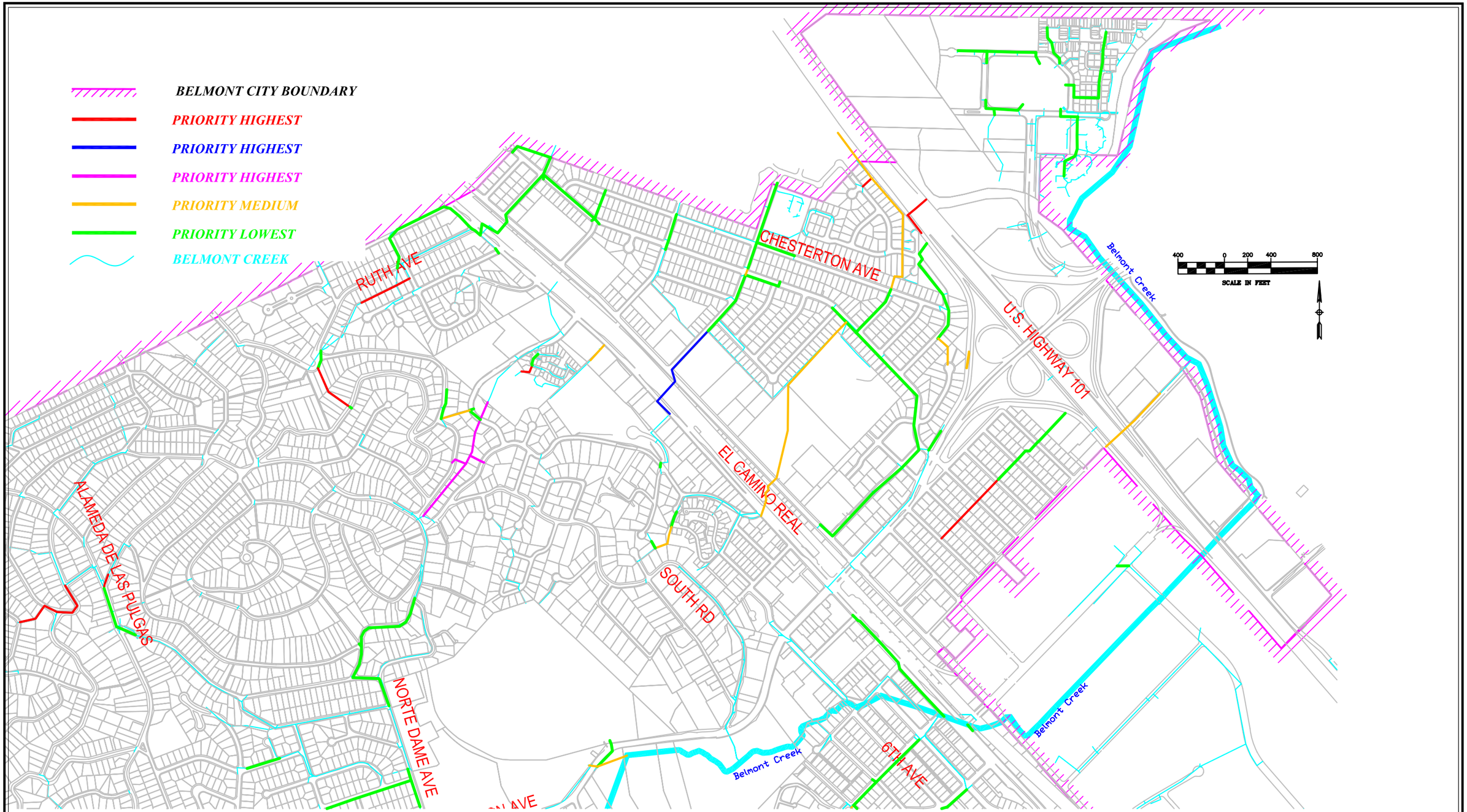


FIGURE 7C
BELMONT STORM DRAIN MASTER PLAN
PRIORITY OF DRAINAGE IMPROVEMENTS

BKF

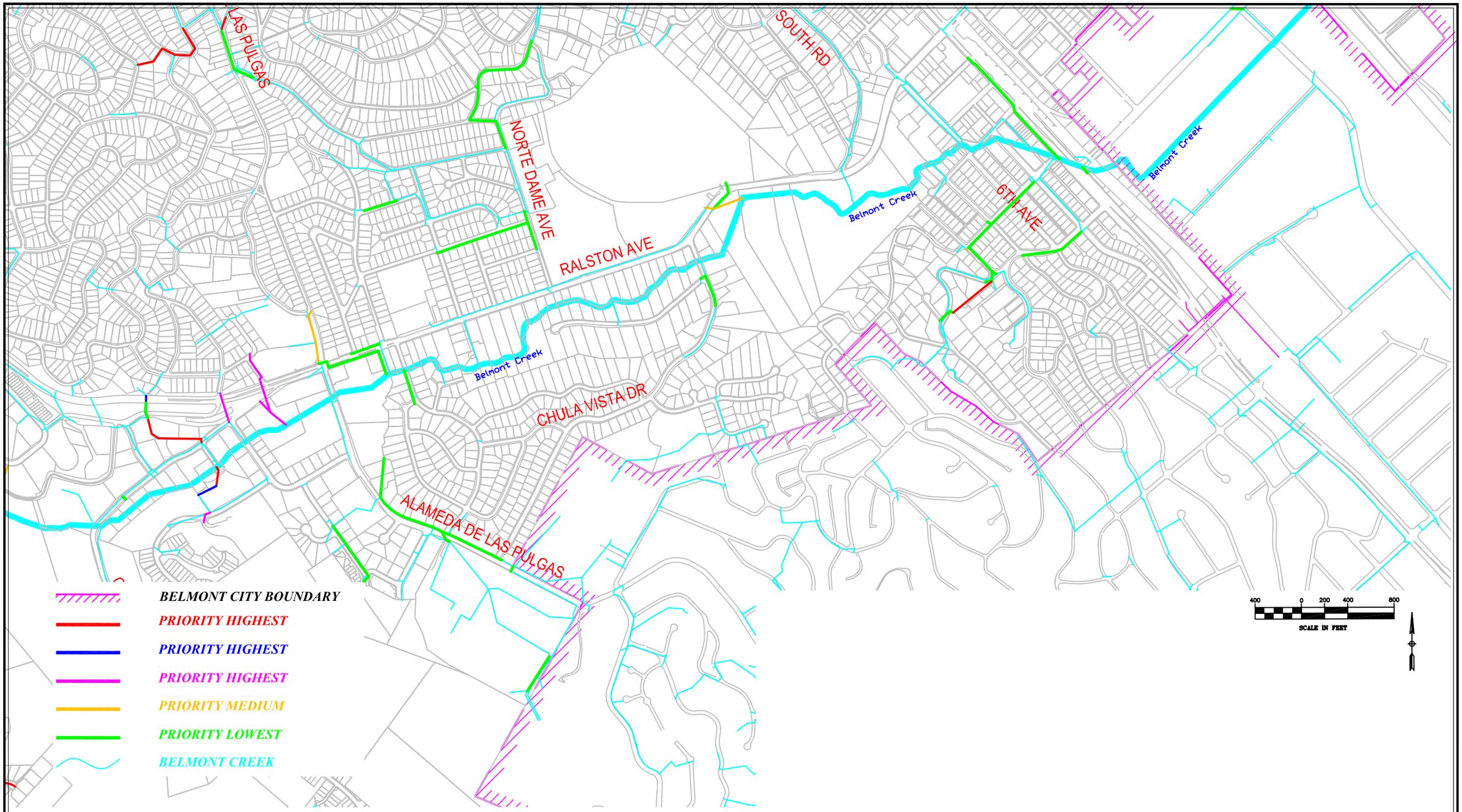
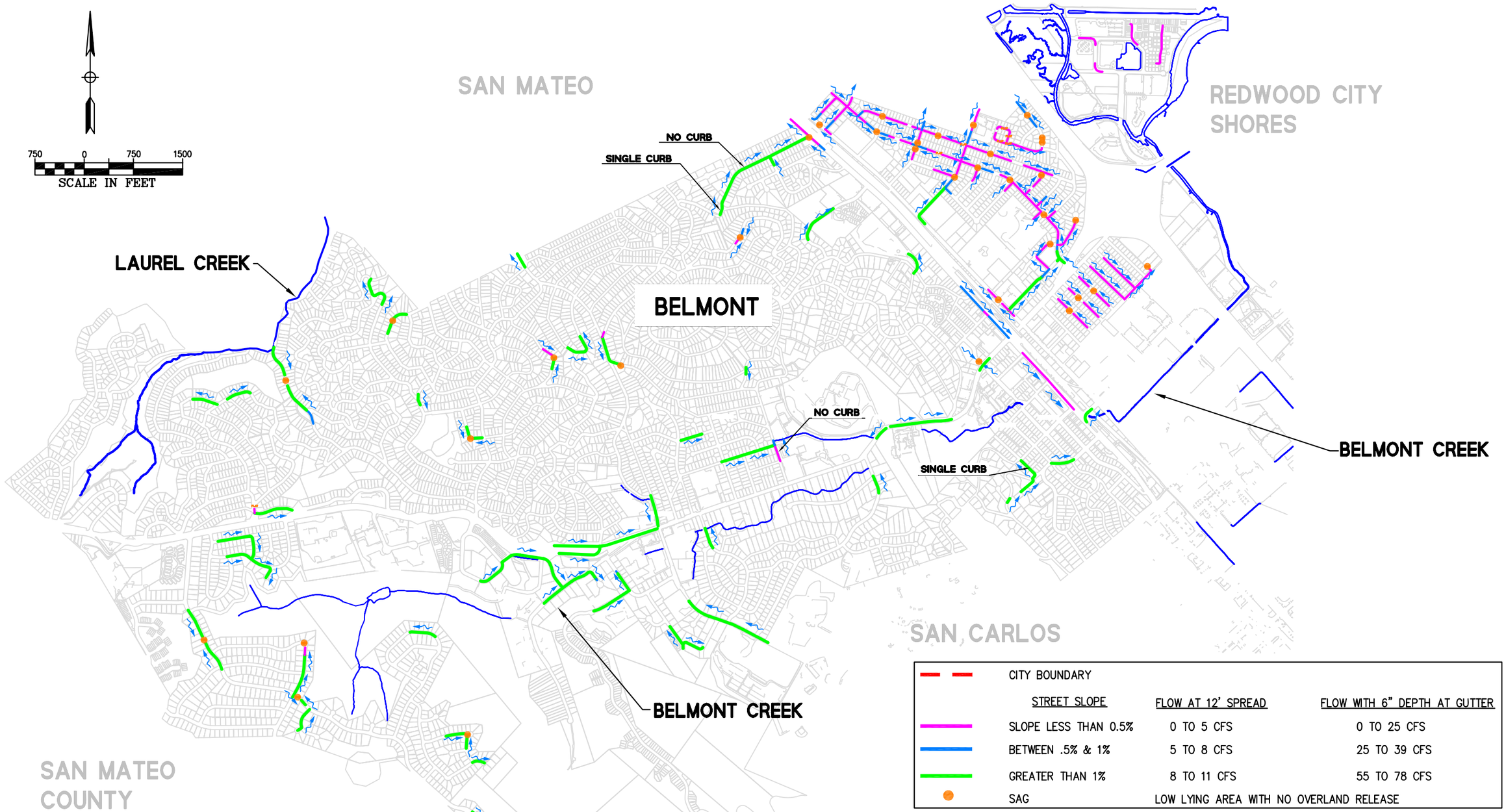


FIGURE 7D
BELMONT STORM DRAIN MASTER PLAN
PRIORITY OF DRAINAGE IMPROVEMENTS

BKF



	STREET SLOPE	FLOW AT 12' SPREAD	FLOW WITH 6" DEPTH AT GUTTER
CITY BOUNDARY			
	SLOPE LESS THAN 0.5%	0 TO 5 CFS	0 TO 25 CFS
	BETWEEN .5% & 1%	5 TO 8 CFS	25 TO 39 CFS
	GREATER THAN 1%	8 TO 11 CFS	55 TO 78 CFS
	SAG	LOW LYING AREA WITH NO OVERLAND RELEASE	

STREET FLOW OCCURS WHEN EXISTING STORM DRAIN SYSTEM IS INADEQUATE CAPACTIY TO CONVEY FLOW. FLOWS CONTINUE DOWNSTREAM IN CITY RIGHT-OF-WAY UNTIL INTERCEPTED BY A SYSTEM WITH CAPACITY.

FIGURE 8A
BELMONT STORM DRAIN MASTER PLAN
FLOW CAPACITY OF OVERLAND

BKF

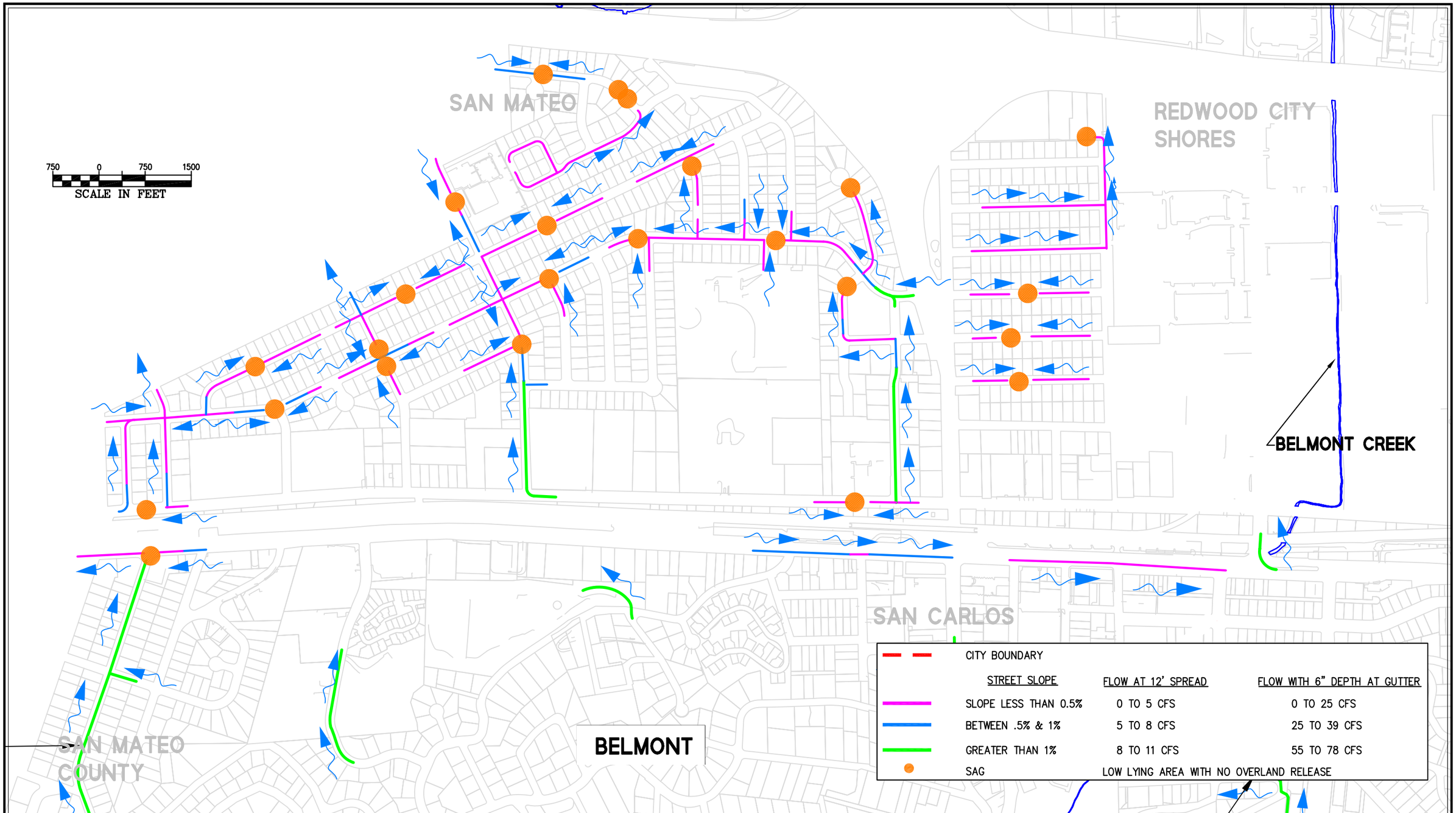


FIGURE 8B
BELMONT STORM DRAIN MASTER PLAN
FLOW CAPACITY OF OVERLAND

BKF

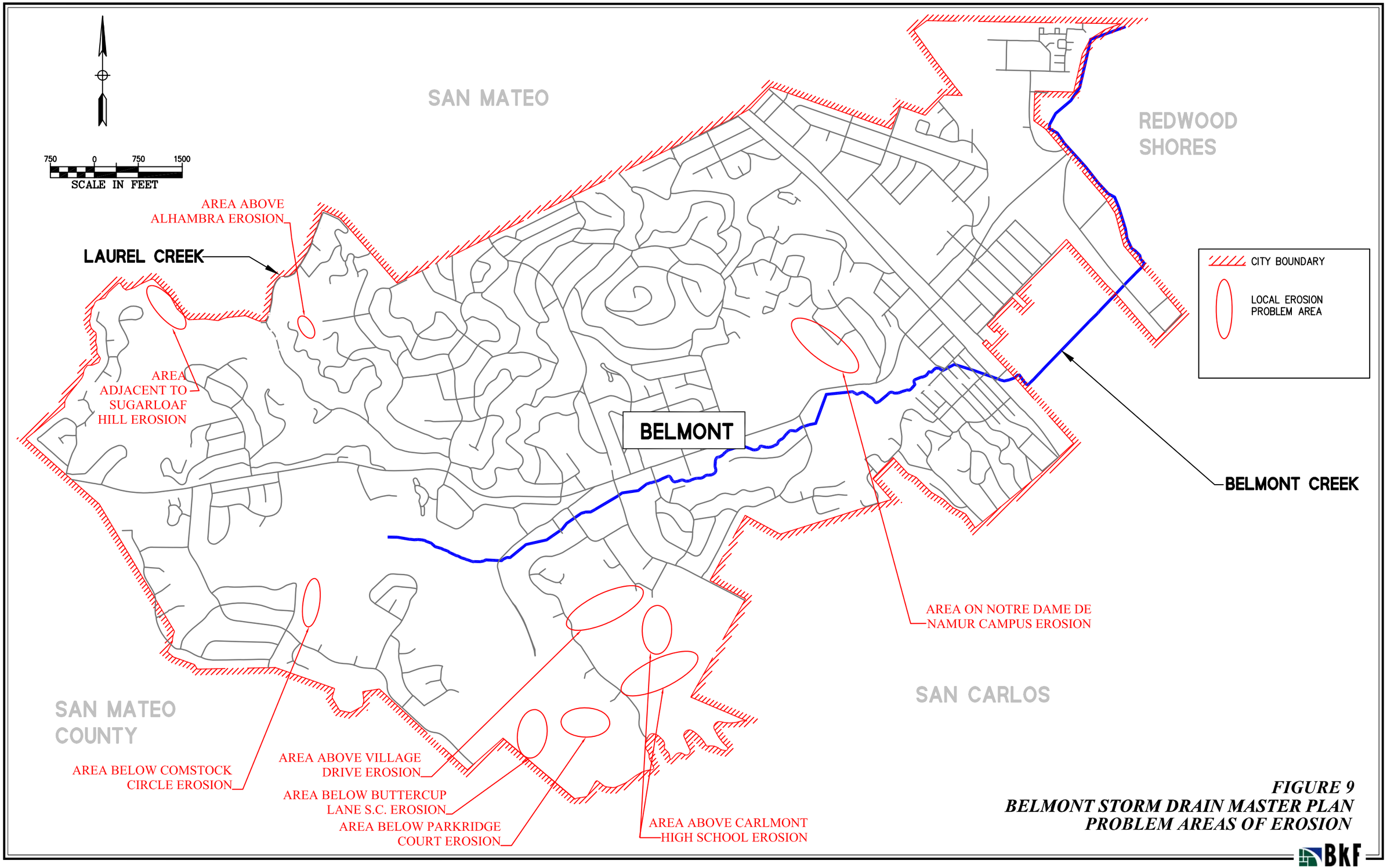


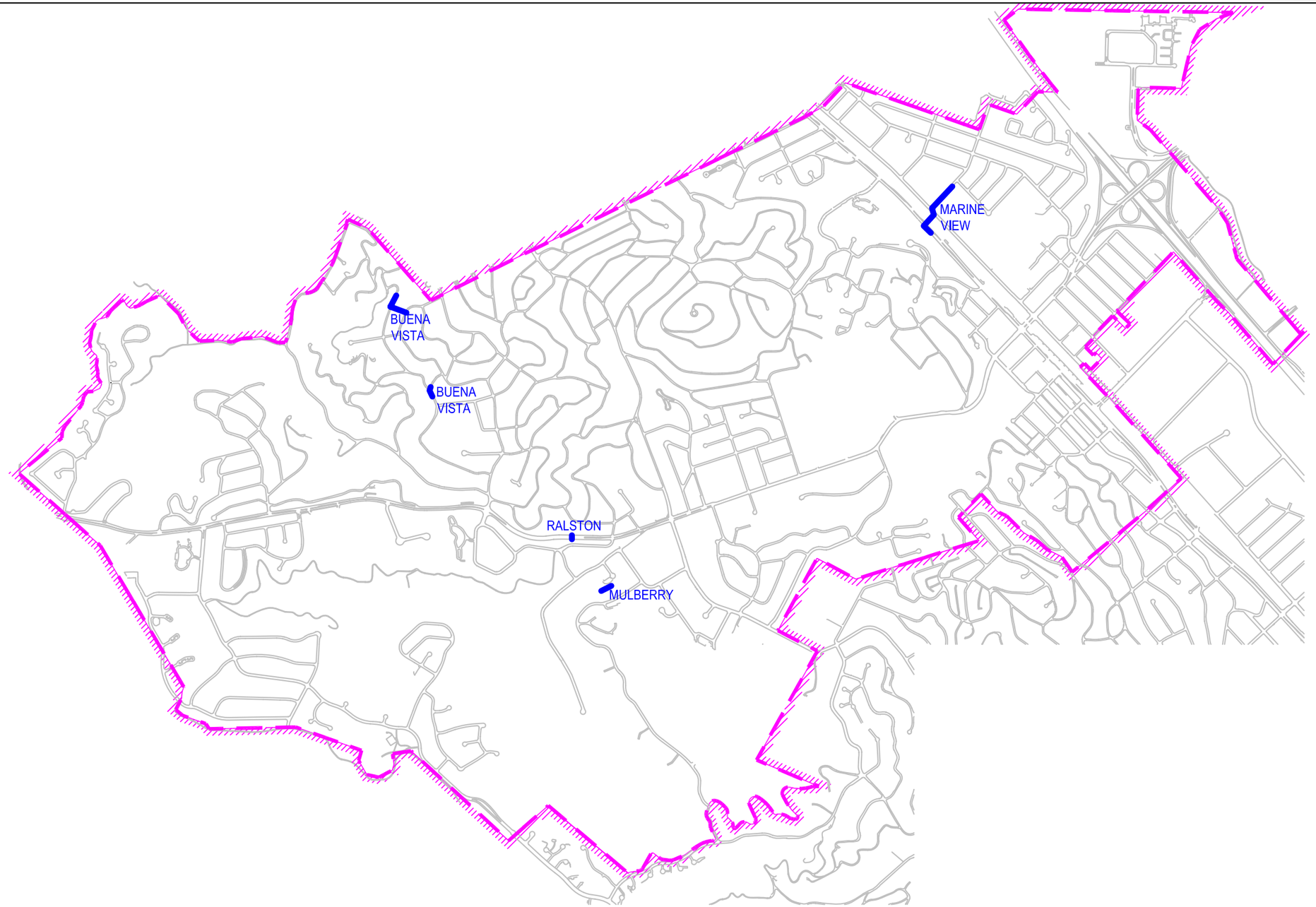
FIGURE 9
BELMONT STORM DRAIN MASTER PLAN
PROBLEM AREAS OF EROSION

BKF

800 0 800 1600
SCALE IN FEET

FIGURE 10
BELMONT STORM DRAIN MASTER PLAN
AGE OF EXISTING PIPES

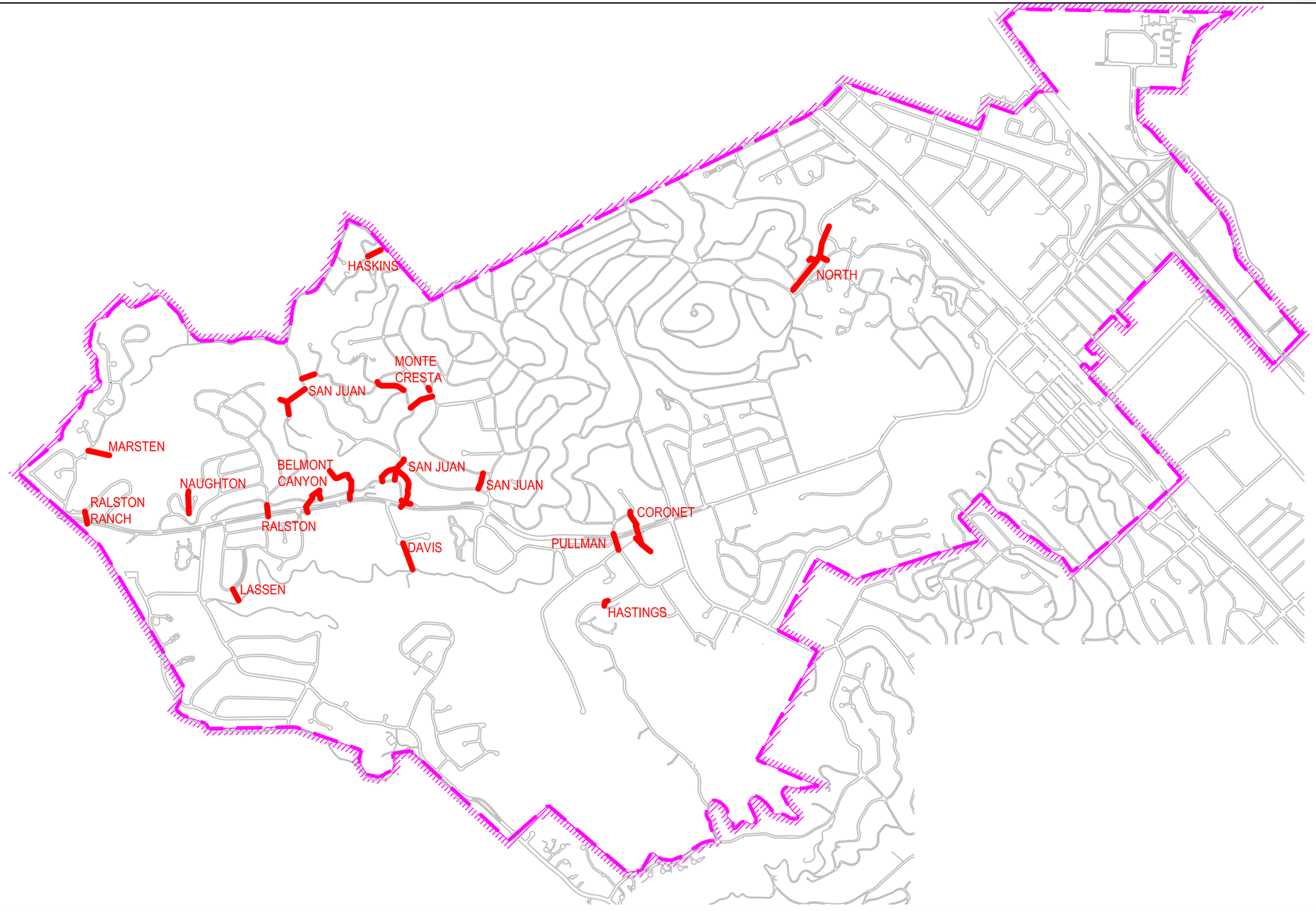
BKF



800 0 800 1600
SCALE IN FEET

FIGURE 11A
BELMONT STORM DRAIN MASTER PLAN
FAILING CMP IMPROVEMENTS

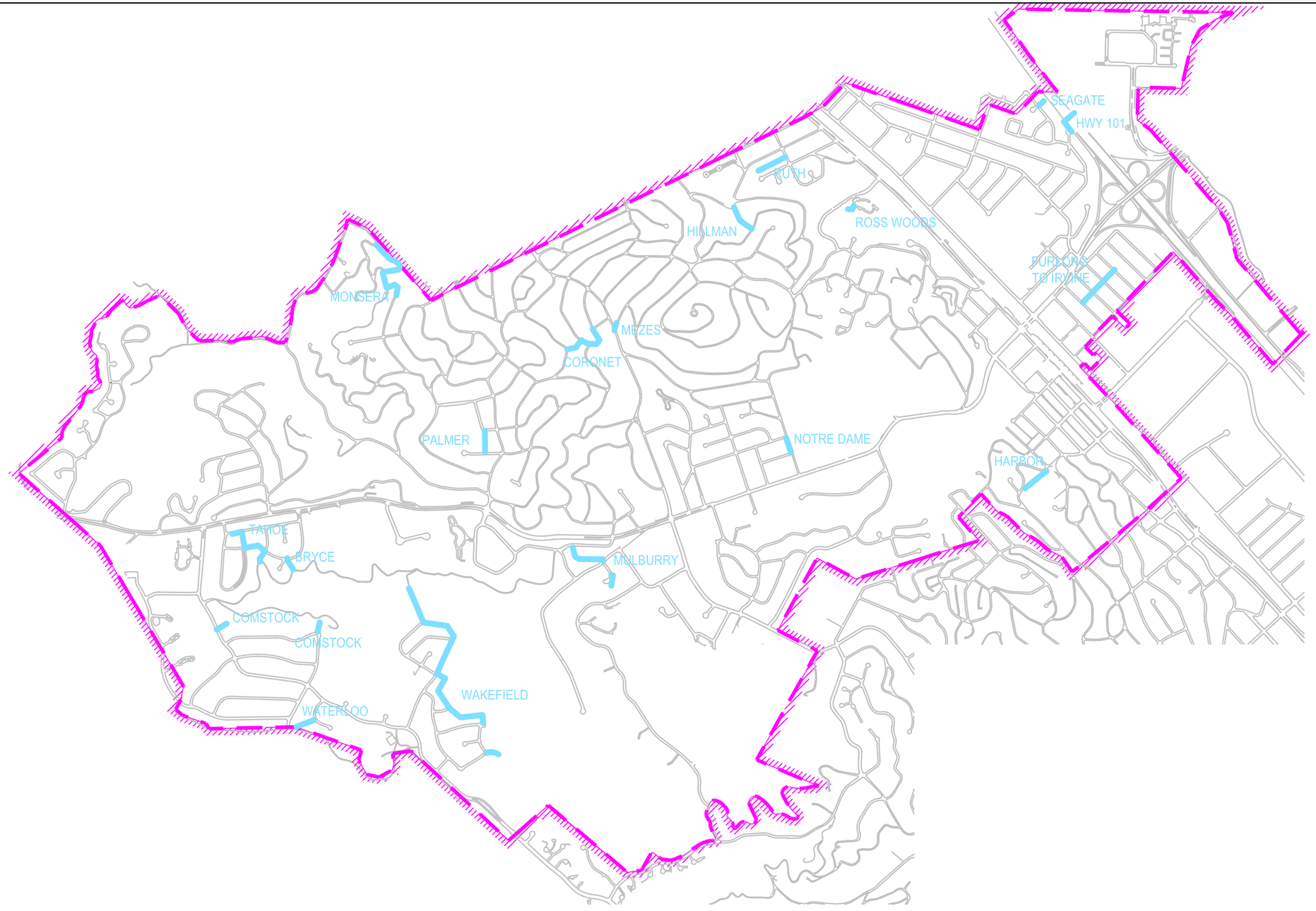
BkF



800 0 800 1600
SCALE IN FEET

FIGURE 11B
BELMONT STORM DRAIN MASTER PLAN
SLIP LINING CMP IMPROVEMENTS

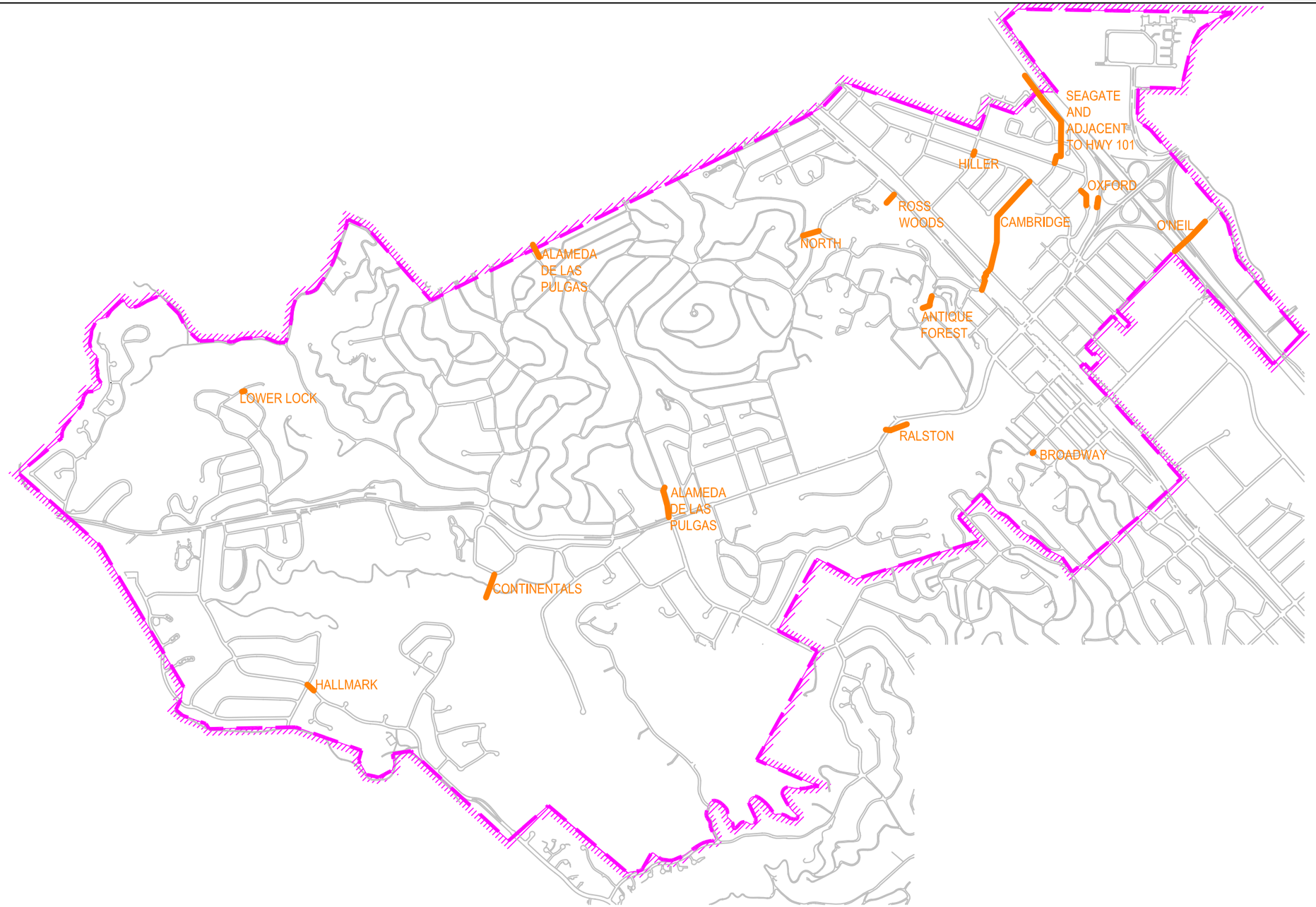
BkF



800 0 800 1600
SCALE IN FEET

FIGURE 11C
BELMONT STORM DRAIN MASTER PLAN
UNCONTROLLED FLOW IMPROVEMENTS

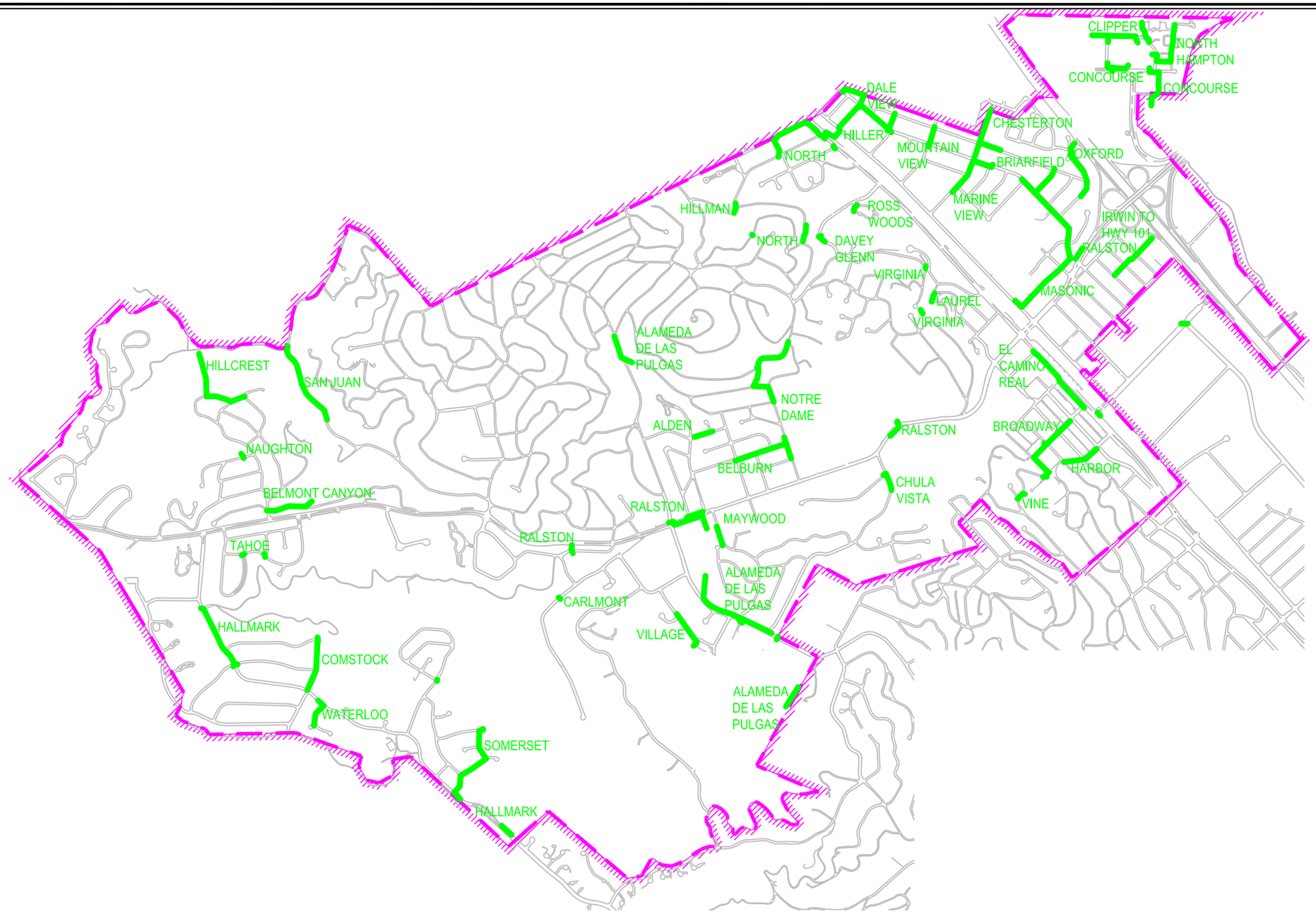
BkF



800 0 800 1600
SCALE IN FEET

FIGURE 11D
BELMONT STORM DRAIN MASTER PLAN
UNDERSIZED GOOD CONDITION PIPE IMPROVEMENTS WITH STREET PATH

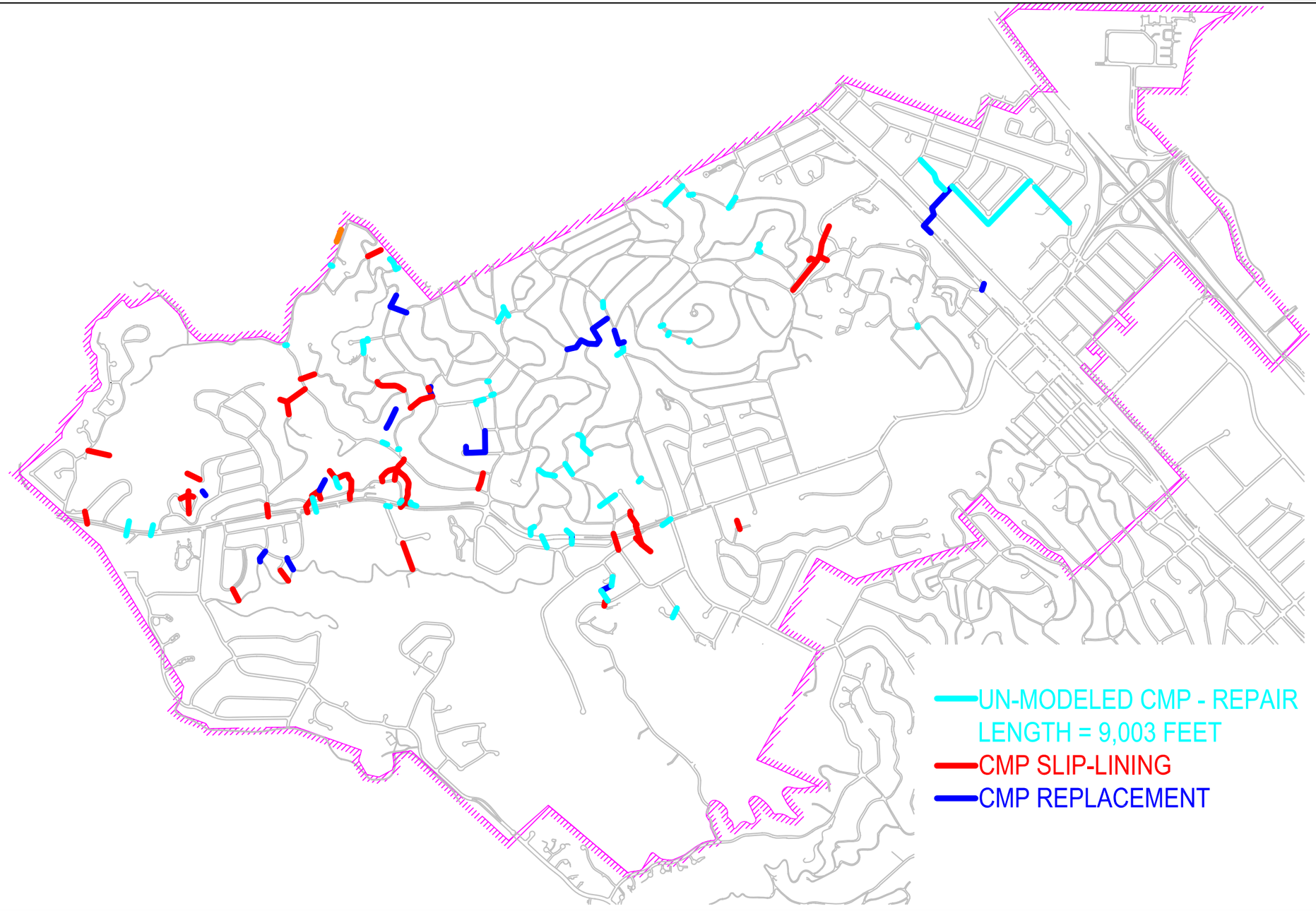
BkF



800 0 800 1600
SCALE IN FEET

FIGURE 11E
BELMONT STORM DRAIN MASTER PLAN
UNDERSIZED GOOD CONDITION PIPE IMPROVEMENTS NO STREET PATH

BKF



800 0 800 1600
SCALE IN FEET

FIGURE 11F
BELMONT STORM DRAIN MASTER PLAN
NON-MODELED CMP IMPROVEMENTS

BKF

APPENDIX B

Description of Problem Areas

The following Appendix presents descriptions of individual problem areas that have been identified by either residents of Belmont or the City staff. The list is based on specific complaints, and is not a list of all expected deficiencies.

Figure B1 shows locations of problem sheets, and prioritized improvements in the vicinity of these problems.

Figure B1.	Problem Areas
Problem Sheets	Creek-1, Creek-2, BB 1-2, BF, BH 1-4, BO 1-4, BV 1-3, BW 1-3, EA 1-7, EC, EE, EF, LD 1-3

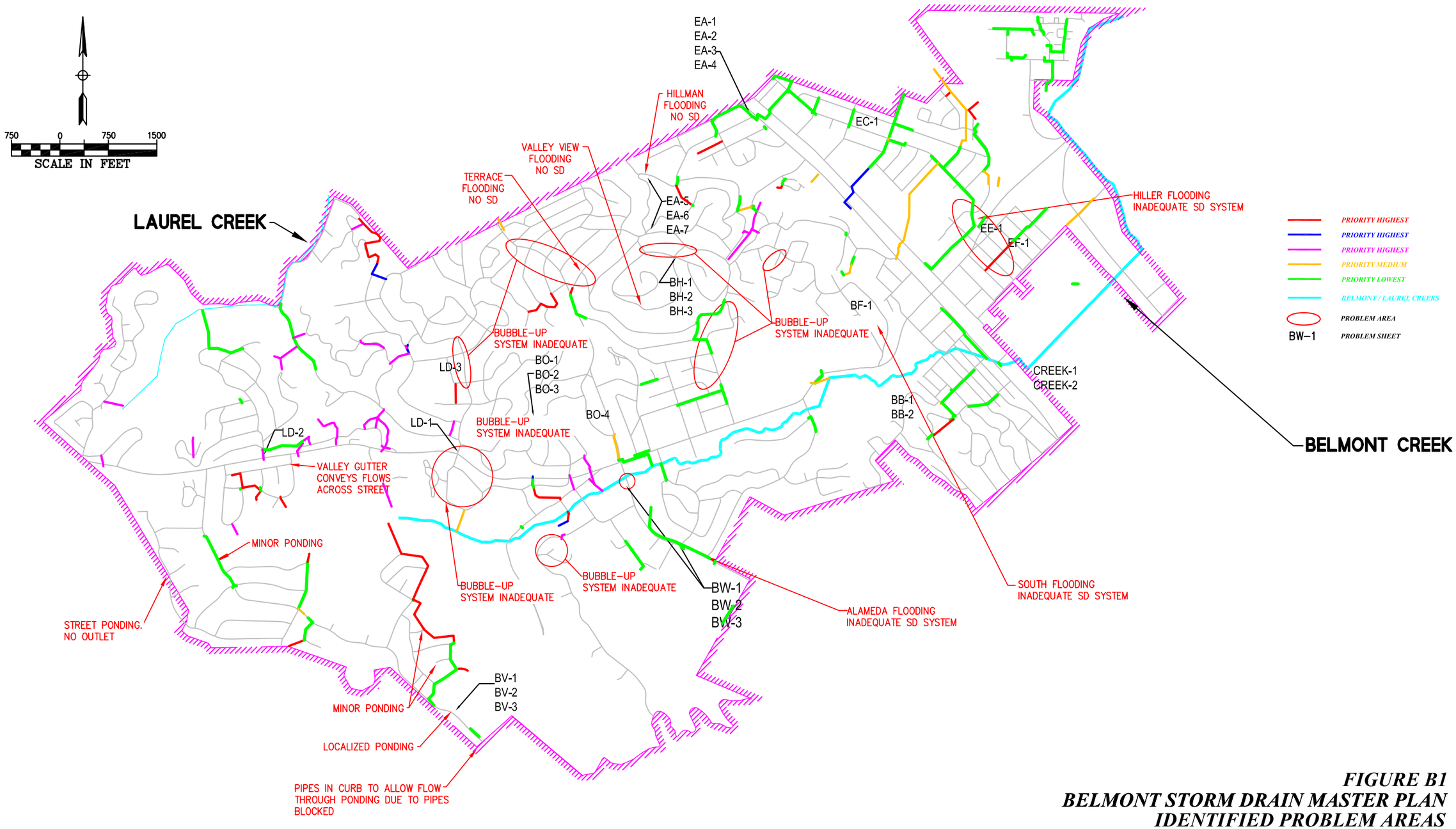


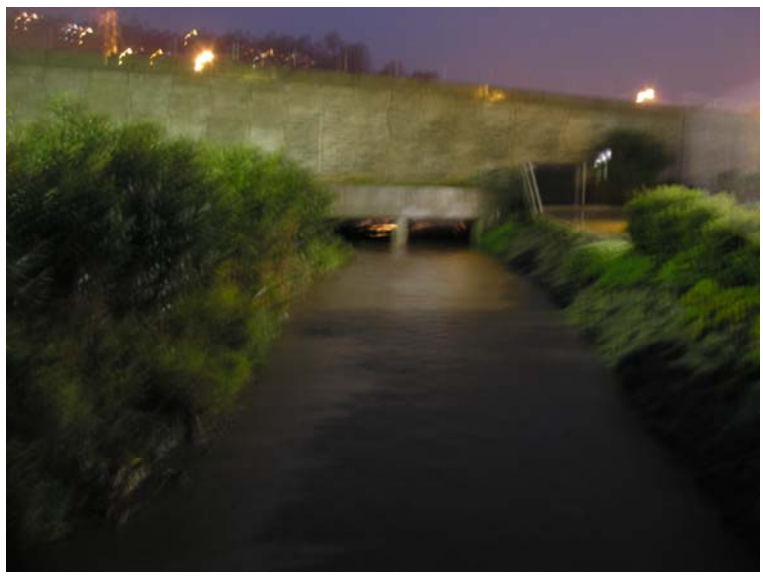
FIGURE B1
BELMONT STORM DRAIN MASTER PLAN
IDENTIFIED PROBLEM AREAS

BKF

OLD COUNTY ROAD

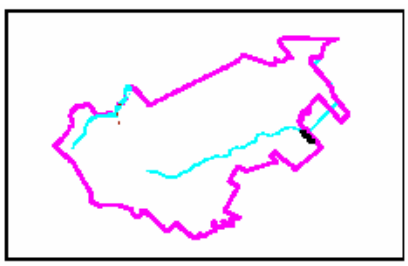
OLD COUNTY ROAD

CALTRAIN OVERPASS



LOCATION: (I-BE-03) Old County Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Work with JPB to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

PRIORITY: LOWEST

FIGURE CREEK-1
BELMONT

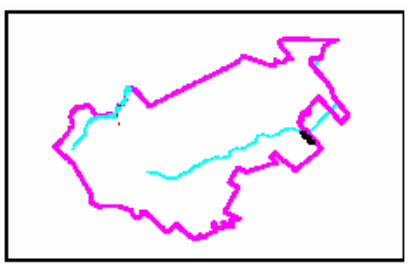
OLD COUNTY ROAD

OLD COUNTY CULVERT DOWNSTREAM

OLD COUNTY CULVERT UPSTREAM

LOCATION: (I-BE-03) Old County Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Work with City of San Carlos to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

FIGURE CREEK-2
BELMONT

PRIORITY: LOWEST

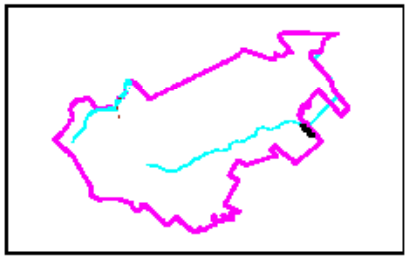
OLD COUNTY ROAD ADDENDUM 01-04-08

OLD COUNTY ROAD AT BELMONT CREEK

CALTRAIN OVERPASS

LOCATION: (I-BE-03) Old County Road

PROBLEM: Business owners report flooding, overtopping culvert onto Old County Road.



POSSIBLE SOLUTIONS: Work with JPB to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

FIGURE CREEK-1A BELMONT

PRIORITY: LOWEST

BkF

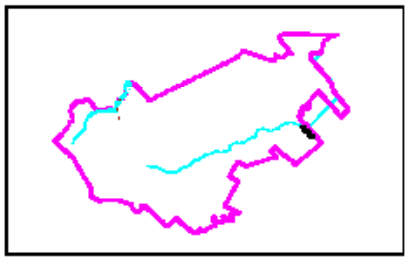
OLD COUNTY ROAD ADDENDUM 01-04-08

OLD COUNTY CULVERT DOWN-STREAM

OLD COUNTY CULVERT UPSTREAM

LOCATION: (I-BE-03) Old County Road

PROBLEM: Business owners report flooding, overtopping culvert onto Old County Road.



POSSIBLE SOLUTIONS: Work with City of San Carlos to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

FIGURE CREEK-2A BELMONT

PRIORITY: LOWEST

BkF

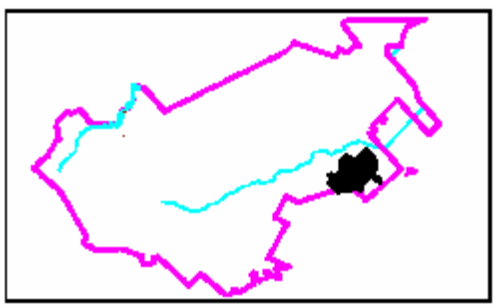
TALBYRN DRIVE

TALBYRN DRIVE

TALBYRN DRIVE

LOCATION: (I-BB-05-02) Talbyrn Drive

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Installation of extension pipe of BB-05-02 to reduce street Flow in street. See Figure 5.

FIGURE BB-1
BELMONT

PRIORITY: LOWEST

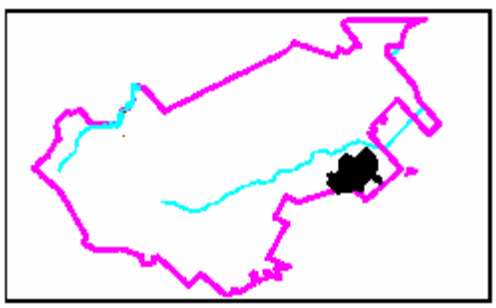
O'NEILL ALLEYWAY

O'NEILL ALLEYWAY

O'NEILL ALLEYWAY

LOCATION: (I-BE-03) O'Neill Alleyway

PROBLEM: Flooding.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Compare cost of curb and gutter improvements with cost of storm drain improvements.

POSSIBLE SOLUTIONS: Install line to existing line on O'Neill.

PRIORITY: HIGHEST- PROPERTY FLOODING

FIGURE BB-2
BELMONT

BkF

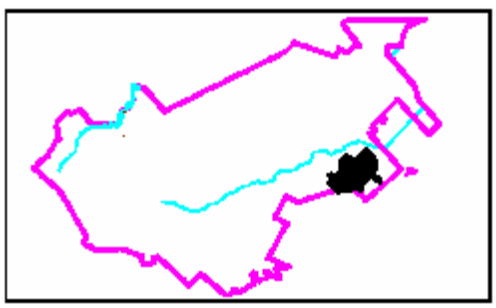
TALBYRN DRIVE

TALBYRN DRIVE

TALBYRN DRIVE

LOCATION: (I-BB-05-02) Talbyrn Drive

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Installation of extension pipe of BB-05-02 to reduce street Flow in street. See Figure 5.

FIGURE BB-1
BELMONT

PRIORITY: LOWEST

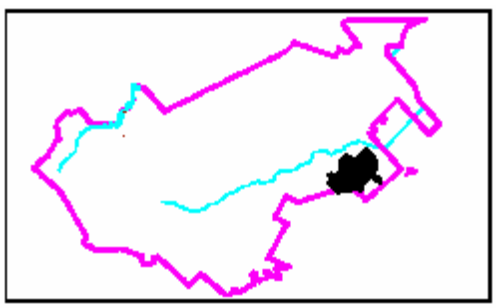
O'NEILL ALLEYWAY

O'NEILL ALLEYWAY

O'NEILL ALLEYWAY

LOCATION: (I-BE-03) O'Neill Alleyway

PROBLEM: Flooding.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Compare cost of curb and gutter improvements with cost of storm drain improvements.

POSSIBLE SOLUTIONS: Install line to existing line on O'Neill.

PRIORITY: HIGHEST- PROPERTY FLOODING

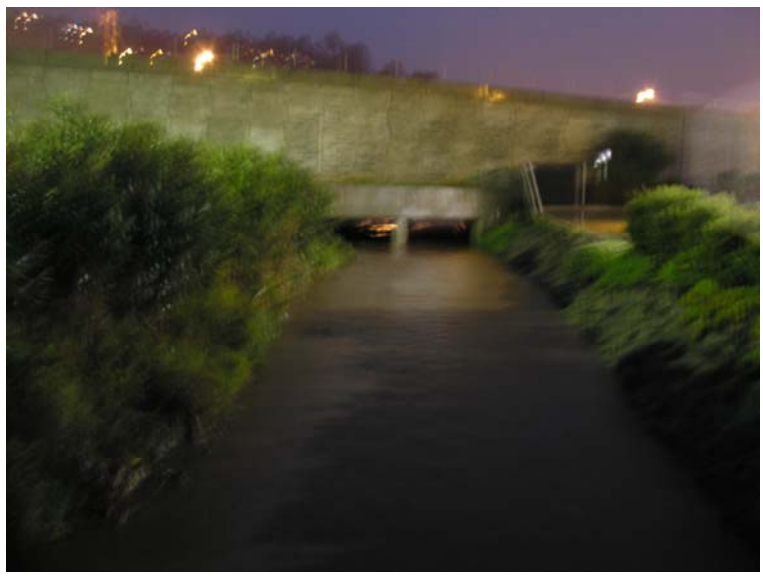
FIGURE BB-2
BELMONT

BkF

OLD COUNTY ROAD

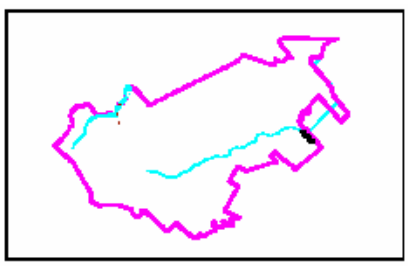
OLD COUNTY ROAD

CALTRAIN OVERPASS



LOCATION: (I-BE-03) Old County Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Work with JPB to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

PRIORITY: LOWEST

FIGURE CREEK-1
BELMONT

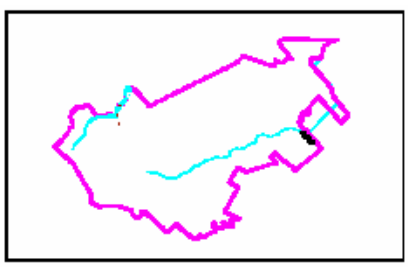
OLD COUNTY ROAD

OLD COUNTY CULVERT DOWNSTREAM

OLD COUNTY CULVERT UPSTREAM

LOCATION: (I-BE-03) Old County Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Work with City of San Carlos to remove sediment from channel at culvert. Sediment should be removed to level shown in the FEMA study.

FIGURE CREEK-2
BELMONT

PRIORITY: LOWEST

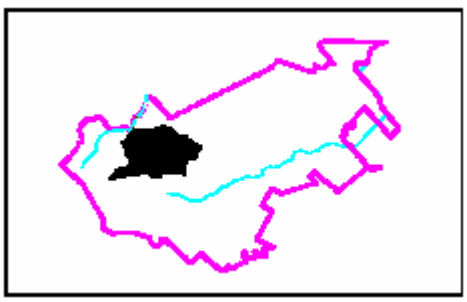
RALSTON AVENUE
BELMONT CANYON ROAD

RALSTON NEAR BELMONT CANYON

BELMONT CANYON NEAR RALSTON

LOCATION: (I-LD-15-04) Ralston Avenue and Belmont Canyon Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

FIGURE LD-1
BELMONT

PRIORITY: LOWEST

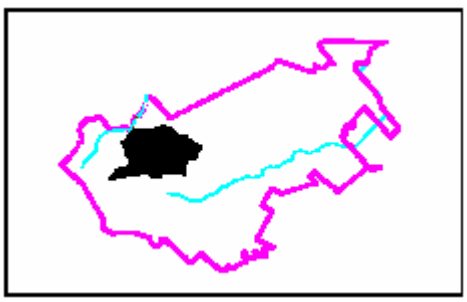
RALSTON AVENUE
HILLCREST DRIVE

RALSTON NEAR HILLCREST

HILLCREST AT LODGE AND BELMONT CANYON

LOCATION: (I-LD-10-05-02) RALSTON AVENUE

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

PRIORITY: LOWEST

FIGURE LD-2
BELMONT

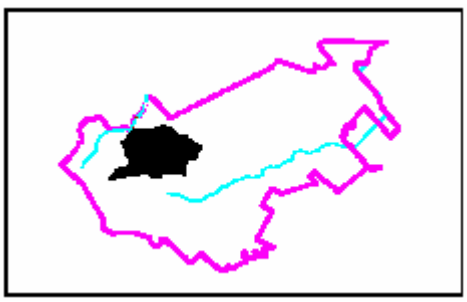
CIPRIANI BOULEVARD
WOOSTER AVENUE

WOOSTER AT CIPRANI

WOOSTER AT CIPRANI

LOCATION: (I-LD-10-05-02) Ciprani Boulevard, Wooster Avenue

PROBLEM: Flooding area, bubble up systems inadequate.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

PRIORITY: LOWEST

FIGURE LD-3
BELMONT

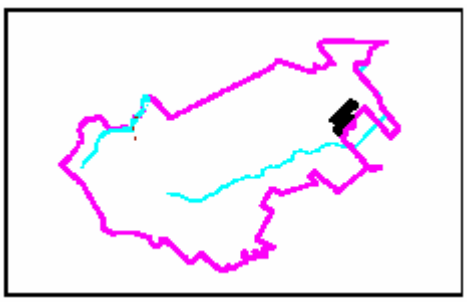
EL CAMINO REAL
RALSTON AVENUE

RALSTON AVENUE AT EL CAMINO

EL CAMINO AT RALSTON AVENUE

LOCATION: (I-) El Camino Real and Ralston Avenue

PROBLEM: Manhole at El Camino Real Floats up.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Check pump station operations.

POSSIBLE SOLUTIONS: Install a bolt-down manhole.

PRIORITY: LOWEST

FIGURE EE-1
BELMONT

BkF

SOUTH ROAD, UPPER HOLLY TO RALSTON

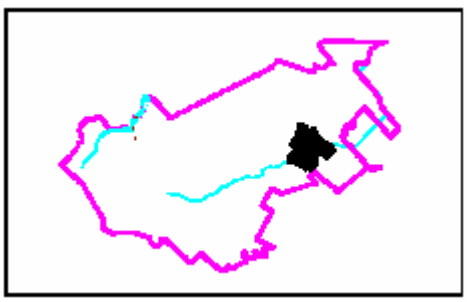
HOLLY AND SOUTH INTERSECTION FROM LOWER HOLLY ROAD

SOURCE OF SEWER INFILTRTION AND INFLOW

HOLLY AND SOUTH INTERSECTION FROM LOWER HOLLY ROAD

LOCATION: (I-BF-10 TO I-BF-02) South Road from upper Holly Road to Ralston Avenue.

PROBLEM: Storm drain system flows across roadways.



POSSIBLE SOLUTIONS: Add inlets to collect runoff.

FIGURE BF-1
BELMONT

PRIORITY: LOWEST

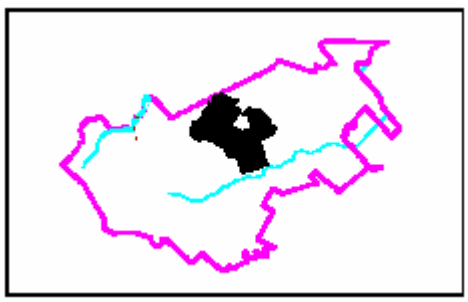
VALLEY VIEW AVENUE
PINE KNOLL DRIVE

VALLEY VIEW AVENUE AT PINE KNOLL ROAD

VALLEY VIEW AVENUE AT PINE KNOLL ROAD

LOCATION: (NO EX SYSTEMS, I-BH-13 DOWNSTREAM) Valley View Avenue and Pine Knoll Road.

PROBLEM: No storm drainage system, flows from curb and gutter system through bubble ups.



RECOMMENDATIONS FOR FURTHER INVESTIGATION:

POSSIBLE SOLUTIONS: Installation of extension pipe to BH-13-S1 to reduce flow in street. See Figure 5.

PRIORITY: LOWEST

FIGURE BH-1
BELMONT

BkF

1608 VALLEY VIEW AVE
1701 PINE KNOLL ROAD

1608 VALLEY VIEW AVENUE

1608 VALLEY VIEW AVENUE

Additional Photos

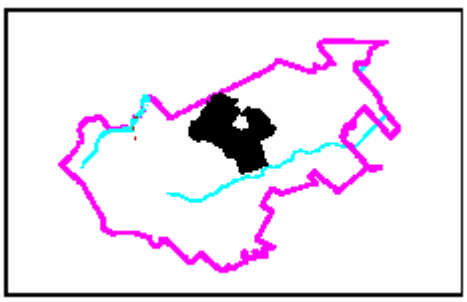


FIGURE BH-2
BELMONT

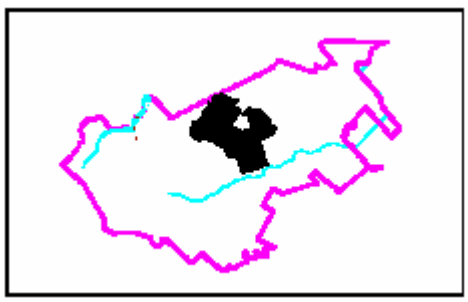
VALLEY VIEW AVENUE
OAK TO PINE NOLL ROADS

VALLEY VIEW AVENUE

VALLEY VIEW AVENUE

LOCATION: (NO EX SYSTEMS, EA-16-12 DOWNSTREAM) Valley View Avenue from Oak Knoll to Pine Knoll Roads.

PROBLEM: Nuisance flooding mid-block.



RECOMMENDATIONS FOR FURTHER INVESTIGATION:

POSSIBLE SOLUTIONS: Installation of extension pipe to BH-13 to reduce flow in street. See Figure 5.

FIGURE BH-3
BELMONT

PRIORITY: LOWEST

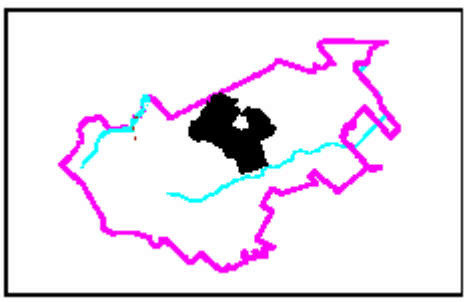
TERRACE DRIVE
MEZES AVENUE

TERRACE DRIVE TO MEZES AVENUE

MEZES TO TERRACE DRIVE

LOCATION: (I-BH-03-07-01) Terrace Drive at Mezes Road.

PROBLEM: Storm drain overtops into street.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Verify pipes are not clogged with video monitoring.

POSSIBLE SOLUTIONS: Install extension pipe upstream to existing system to reduce flow in streets.

FIGURE BH-4
BELMONT

PRIORITY: LOWEST

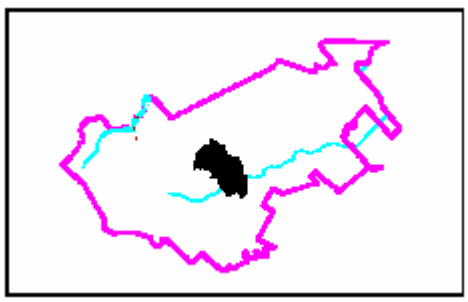
2116 AND 2114 PULLMAN AVENUE

2116 PULLMAN AVENUE

2116 PULLMAN AVENUE

LOCATION: (I-BO-06 downstream) 2114-2116 Pullman Avenue

PROBLEM: CMP pipe is overtopped uphill and overland flows through private property. Garages and yards flooding.



POSSIBLE SOLUTIONS: Replace existing CMP pipes, upsize for higher flow capacity. See Figure 2d.

FIGURE BO-1
BELMONT

PRIORITY: HIGH PRIORITY – PROPERT FLOODING

2116 AND 2114 PULLMAN AVENUE

2116 PULLMAN AVENUE

2114 PULLMAN AVENUE

Additional Photos

FIGURE BO-2
BELMONT

2116 AND 2114 PULLMAN AVENUE

2116 PULLMAN AVENUE

2116 PULLMAN AVENUE

Additional Photos

FIGURE BO-3
BELMONT

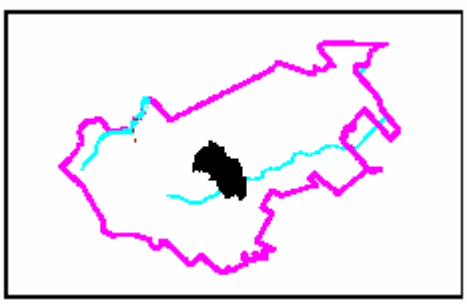
818 AND 824 COVINGTON AVENUE

818-824 COVINGTON AVENUE

818 COVINGTON AVENUE

LOCATION: (upstream of I-BO-05-01) 818-824 Covington Avenue

PROBLEM: CMP pipe was removed by city and replaced, now bubble up at Pullman and Covington Avenues is inundating private property.



POSSIBLE SOLUTIONS: Install extension pipe to new pipe on Covington to convey Pullman Avenue flows as shown in Figure 5.

FIGURE BO-4
BELMONT

PRIORITY: LOWEST

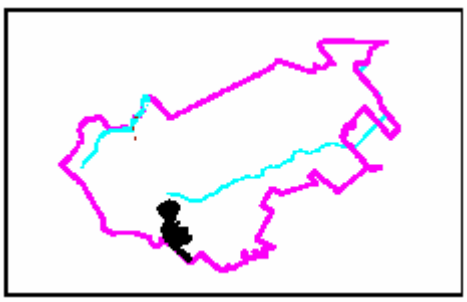
HALLMARK DRIVE
CRESTVIEW DRIVE, S.C.

2450 HALLMARK DRIVE

117 CRESTVIEW DRIVE

LOCATION: (I-BV-15) 2450 Hallmark Drive and 117 Crestview Drive San Carlos.

PROBLEM: Local Flooding



POSSIBLE SOLUTIONS:
Upsize curb drains.

PRIORITY: LOWEST

FIGURE BV-1
BELMONT

BkF

HALLMARK DRIVE
CRESTVIEW DRIVE, S.C.

118 CRESTVIEW DRIVE

2441 HALLMARK DRIVE

Additional photos

FIGURE BV-2
BELMONT

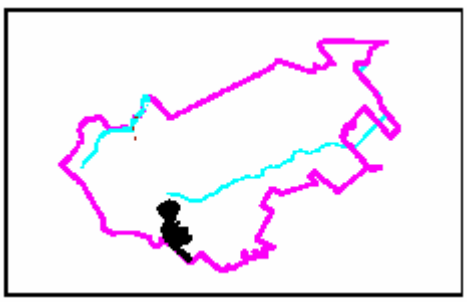
HALLMARK DRIVE NEAR HIGHLAND TRAIL

HALLMARK DRIVE

HALLMARK DRIVE

LOCATION: (I-BV-13) Hallmark Drive Near Highland Trail.

PROBLEM: Local Flooding



POSSIBLE SOLUTIONS: Overlay street to provide sufficient crown to allow drainage to gutter.

PRIORITY: MEDIUM

FIGURE BV-3
BELMONT

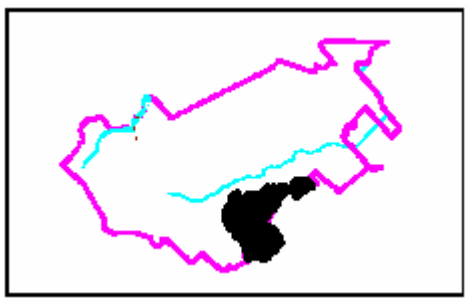
ALAMEDA DE LAS PULGAS

ALAMEDA NEAR CHULA VISTA DRIVE

ALAMEDA NEAR CHULA VISTA DRIVE

LOCATION: (I-BW-07 to I-BW-03-02) Alameda De Las Pulgas

PROBLEM: Inadequate storm drain system on Alameda.



RECOMMENDATIONS FOR FURTHER INVESTIGATION:

POSSIBLE SOLUTIONS: Upsize system with 48 and 60-inch lines. Add or modify inlets to improve inlet efficiency, See Figure 2d.

PRIORITY: LOWEST

FIGURE BW-1
BELMONT

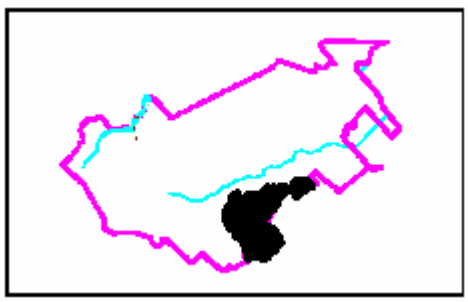
ALAMEDA DE LAS PULGAS

ALAMEDA NEAR CARLMONT AVENUE

ALAMEDA NEAR BELMONT CREEK

LOCATION: (I-BW-05 to I-BW-01) Alameda De Las Pulgas

PROBLEM: Inadequate storm drain system on Alameda.



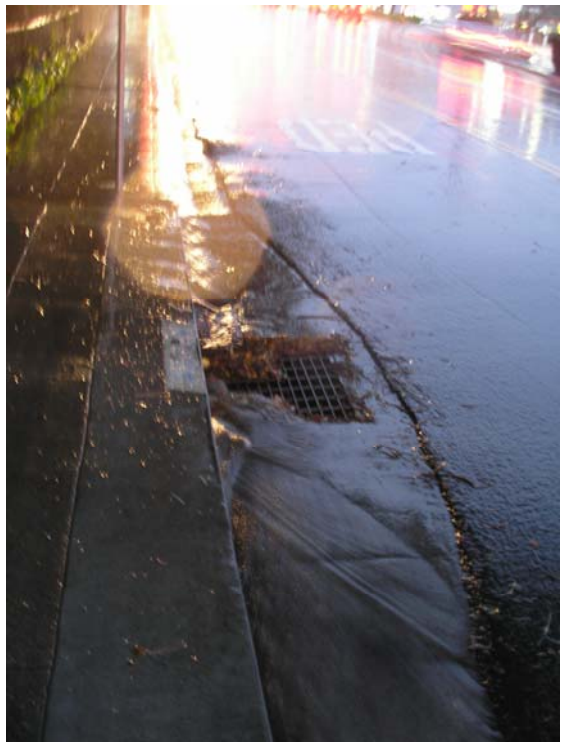
RECOMMENDATIONS FOR FURTHER INVESTIGATION: Investigate further to determine if Belmont Creek needs maintenance in the area.

FIGURE BW-2
BELMONT

PRIORITY: LOWEST

ALAMEDA DE LAS PULGAS

ALAMEDA NEAR BELMONT CREEK



Additional Photo

FIGURE BW-3
BELMONT

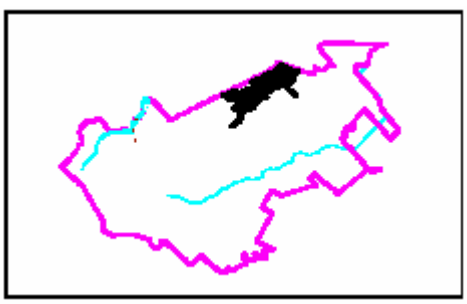
RUTH AVENUE
EL CAMINO REAL

EL CAMINO AS SEEN FROM RUTH AVENUE

APPROACH TO RUTH FROM EL CAMINO

LOCATION: (I-EA-15) Corner of Ruth Avenue and El Camino Real.

PROBLEM: Storm drainage system undersized.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Verify downstream system inadequacy and verify slopes of pipes, and video pipes for blockages.

POSSIBLE SOLUTIONS: Upsize system downstream of the Ruth/ El Camino Intersection. See Figure 2b.

PRIORITY: LOWEST

FIGURE EA-1
BELMONT

BkF

RUTH AVENUE
EL CAMINO REAL

EL CAMINO AS SEEN FROM RUTH AVENUE

APPROACH TO RUTH FROM EL CAMINO

Additional Photos

FIGURE EA-2
BELMONT

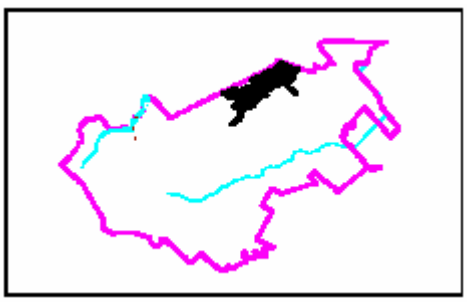
BACKYARD EASEMENT BETWEEN RUTH & ANITA

1117 RUTH AVENUE

1117 RUTH AVENUE

LOCATION: (I-A-EA-04 TO 1-A-EA-01 PR I-EA-16-06 EX) Backyard easement between Ruth and Anita Avenues.

PROBLEM: Storm drainage system flows overland through backyards of houses along Ruth Avenue.



POSSIBLE SOLUTIONS: Upsize system to 25-year protection levels. Install new parallel system in Ruth Avenue. See Figures 2f, 2g and Figure 5.

PRIORITY: HIGHEST

FIGURE EA-3
BELMONT

BACKYARD EASEMENT BETWEEN RUTH & ANITA

904 ANITA AVENUE

210 MALCOLM AVENUE

Additional Photos

FIGURE EA-4
BELMONT

BkF

HILLMAN AVENUE
WINDING WAY

HILLMAN AVENUE AT MILLS AVENUE

HILLMAN AVENUE AT NORTH ROAD

HILLMAN AVENUE AT MILLS AVENUE

HILLMAN AVENUE AT NORTH ROAD

Additional Photos

FIGURE EA-7
BELMONT

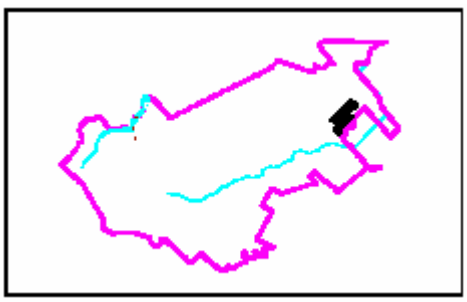
CHESTERTON AVENUE
HILLER STREET

CHESTERTON AVENUE

HILLER STREET

LOCATION: (I-EC-03) Chesterton Avenue and Hiller Street local areas.

PROBLEM: Low land flooding in the area



POSSIBLE SOLUTIONS:
Regional Solution.

FIGURE EC-1
BELMONT

PRIORITY: LOWEST

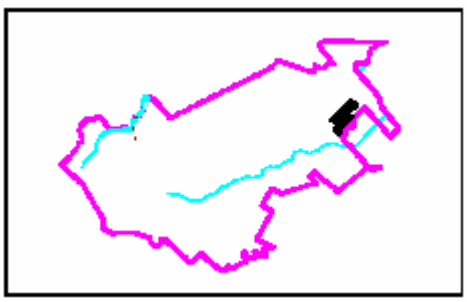
EL CAMINO REAL
RALSTON AVENUE

RALSTON AVENUE AT EL CAMINO

EL CAMINO AT RALSTON AVENUE

LOCATION: (I-) El Camino Real and Ralston Avenue

PROBLEM: Manhole at El Camino Real Floats up.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Check pump station operations.

POSSIBLE SOLUTIONS: Install a bolt-down manhole.

PRIORITY: LOWEST

FIGURE EE-1
BELMONT

BkF

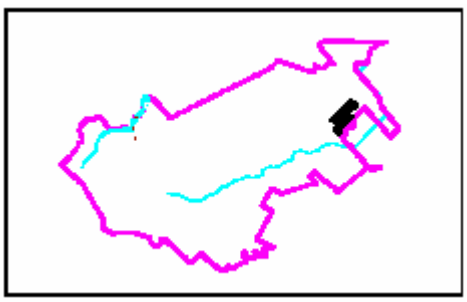
MID-BLOCK SYSTEMS
HILLER, GRANADA

1100 HILLER STREET

1101 HILLER STREET

LOCATION: (I-EF-04) Mid-block of Hiller Street, and Granada Street.

PROBLEM: Storm drainage system undersized.



RECOMMENDATIONS FOR FURTHER INVESTIGATION: Verify downstream system inadequacy and verify slopes of pipes, and video pipes for blockages.

POSSIBLE SOLUTIONS:
Upsize system to 25-year protection levels. See Figure 2b.

PRIORITY: MEDIUM

FIGURE EF-1
BELMONT

BkF

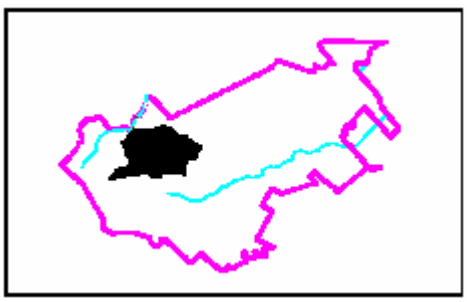
RALSTON AVENUE
BELMONT CANYON ROAD

RALSTON NEAR BELMONT CANYON

BELMONT CANYON NEAR RALSTON

LOCATION: (I-LD-15-04) Ralston Avenue and Belmont Canyon Road

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

FIGURE LD-1
BELMONT

PRIORITY: LOWEST

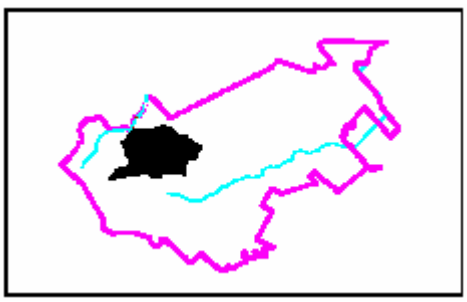
RALSTON AVENUE
HILLCREST DRIVE

RALSTON NEAR HILLCREST

HILLCREST AT LODGE AND BELMONT CANYON

LOCATION: (I-LD-10-05-02) RALSTON AVENUE

PROBLEM: Flooding.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

PRIORITY: LOWEST

FIGURE LD-2
BELMONT

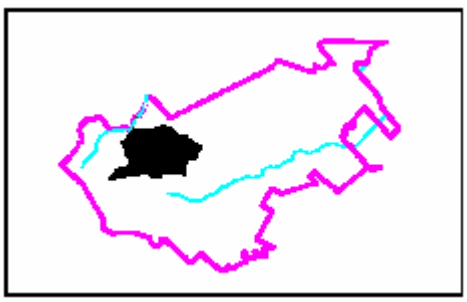
CIPRIANI BOULEVARD
WOOSTER AVENUE

WOOSTER AT CIPRANI

WOOSTER AT CIPRANI

LOCATION: (I-LD-10-05-02) Ciprani Boulevard, Wooster Avenue

PROBLEM: Flooding area, bubble up systems inadequate.



POSSIBLE SOLUTIONS: Install extension line to serve upstream area, reducing surface flow to location. See Figure 5 for location of supplemental lines.

PRIORITY: LOWEST

FIGURE LD-3
BELMONT

APPENDIX C

Cost and Priority of Improvements

The following Appendix contains a priority and costs for the proposed improvements. General locations of laterals and trunk lines are shown on Figures contained in Appendix D. Priority of improvements are shown on Figure 7 in Appendix A. A summarized list of system improvements is provided at the end of the Appendix.

Table C6 summarizes the cost of improvements by System. Table C7 presents costs for the high priority (Priorities High, Medium, and Low) projects. Table C8 summarizes the length of project pipes and installation time by priority for the Systems. Table C-9 summarizes proposed extension pipes to serve non-served areas. Table C-10 summarizes the costs associated with the extension pipe improvements and priority pipe replacements. Table C-11 summarizes the length of project pipes and installation time associated with priority pipe replacements. Table C-12 summarizes the costs for installation of missing curb and gutter facilities. Table C-13 summarizes lengths and ages of various pipe types within the city. Table C-14 summarizes Storm Drain repairs as reported in the text, with break downs for capital costs as well as administration costs for each priority.

The basis for the construction cost is presented in Tables C1 through C5. Detail breakdowns for each system are provided with a priority, a length and a location. Construction costs are presented in Table C-2 storm drain pipe materials unit cost comparison and Table C-4 installation unit costs. Table C-5 is slip-lining unit costs. The cost includes, (1) mobilization, (2) Contractor's overhead and profit, (3) adjustments to the year 2006, and (4) adjustments for work in San Mateo County. The costs do not include work associated with obtaining approval to work in Belmont Creek or Laurel Creek. Project involving work in these facilities will be required to obtain approvals from California Department of Fish and Game and California Regional Water Quality Control Board. Approval would likely be required from the United States Corps of Engineers.

Advantages and disadvantages associated with the different pipe materials is presented in Table C-3.

DESCRIPTION OF PIPELINE UNIT COSTS

The following Appendix presents miscellaneous analyses used in developing the Drainage Study.

1. Unit Costs – Unit costs for pipeline installation are presented in Table C4. Costs are developed based on unit cost information presented in Construction Cost manuals. Costs are increased to account for, (1) mobilization, (2) overhead & profit, (3) typical shoring, and (4) typical dewatering. The costs are adjusted to account for construction in the Bay Area. Two costs are presented. The first cost is for construction on a bare site. This is presented to allow comparison with costs from development projects.

   Factors are then presented that account for the cost for construction in a developed urban area. These costs include repaving, disposal of excess dirt, traffic control and utility relocation. These costs will vary with location, and a single factor is used citywide. During final design, these factors should be adjusted. Costs are based on an ENR Construction Cost index of 7,643 in January of 2006.

   The recommended improvements are generally shallow because of the topography and outfall restrictions. No adjustments are applied for depth of pipeline. In general, the cost will be higher where the cover exceeds 5 feet and will be slightly less where the cover is 3 feet.

   In some areas, it may be necessary to have less than three feet of cover. In these areas, there may be additional cost required to protect the pipe.

Construction costs are based on the use of reinforced concrete pipe. Savings of about 20 percent may occur if High Density Poly-Ethylene (HDPD) pipe is used. This should be considered on a project by project basis.

An additional factor of 60 percent is then included to account for the following:

1. Contingency – 20%
2. Design, survey, geotechnical evaluation and construction monitoring – 30%
3. City Administration – 10%

Costs do not include permitting or mitigation for improvements within Belmont Creek of Laurel Creek.

Open Trench Method

In order to select the most appropriate type of pipe, we contacted various storm drain pipe manufacturers and obtained physical and hydraulic characteristics of the different pipes, as well as unit prices for various pipe types.

We examined the following pipe material:

1. High Density Polyethylene (HDPE) Sure-Loc, corrugated outside and smooth inside.
2. PVC Perma-Loc ribbed outside and smooth inside.
3. Reinforced Concrete Pipe (RCP) class III

The physical and hydraulic characteristics of the various storm water pipe materials are listed in Table 1. A comparison of unit prices for the storm drain pipe materials is shown in Table 2.

Advantages and disadvantages of the various storm drain pipe types are depicted in Table 3.

In order to satisfy hydraulic requirements and physical obstacle (conflict with exiting utilities), it would be best to use a pipe material that provides a lower Manning's roughness

coefficient and a pipe with a thinner wall. Table 1 depicts physical and hydraulic characteristics of various pipe types.

Table 4 depicts unit prices for installation of various storm drain pipes. The prices include compensation for mobilization, material, installation, traffic control in a moderate location, complete in place.

It should be noted that unit prices for installation of RCP pipes are relatively much higher, since the pipe is heavier, requiring greater effort and larger equipments for installation.

Lining.

For failing CMP lines, an alternative to replacement of lines is use of a liner in conjunction with grouting the annular space between the liner and the existing failing line. There are several lining systems that could be used. One type that we would recommend is Pacific Multi-liner. This is lining with Fiberglass and polyester resin. The thickness of the liner depends on the structural integrity of CMP pipe, and also depends on the diameter of the pipe. The thickness varies between 1/8" to 1/4" for pipes up to 21" in diameter and varies between 1/4" and 1/2" for larger pipes. State of California Department of Transportation (CalTrans) has used this lining method on the projects. Unit prices for lining various storm drain pipes are shown in Table 5.

Recommendation, Lining versus Replacement

In general, pipeline replacement is recommended for existing 12-inch diameter CMP lines, regardless of the adequacy of the size. At 12-inch diameter, the savings for slip lining does not justify the lower flow capacity that occurs with the reduction in diameter. For larger diameter pipes, slip-lining is recommended when the existing pipe size is adequate for a 25-year flow rate. Replacement is recommended when the flow capacity of the existing line is not adequate for the 25-year storm event.

Table C1

Storm Drain Pipe Materials
Physical and Hydraulic Characteristics Comparison

Pipe Type	Nominal Pipe Size	Pipe Outside Diameter	Pipe Inside Diameter	Pipe Weight (lb/ft)	Pipe Span (ft)	Manning "n" Coefficient
Closed Profile PVC	21"	22.1"	20.8"	18	13	0.010
	24"	25.1"	23.5"	22		
	27"	28.2"	26.5"	28		
	30"	31.3"	29.5"	33		
	36"	37.8"	35.5"	39		
	42"	44.2"	41.5"	70		
	48"	50.6"	47.5"	52		
	54"	57.0"	53.5"	113		
HDPE Sure-Lok Corrugated Outside & Smooth Inside	24"	28.4"	24"	11	20	0.010
	30"	36"	30"	17		
	36"	41.4"	36"	20		
	42"	48"	42"	25		
	48"	54"	48"			
	54"	60"	54"			
	60"	66"	60"			
PVC Perma-Loc Ribbed Outside & Smooth inside	18"	20.9"	17.7"	8	13	0.010
	21"	24.2"	20.8"	11		
	24"	27.4"	23.5"	14		
	27"	30.8"	26.5"	17		
	30"	34.1"	29.5"	20		
	36"	40.7"	35.5"	28		
	42"	46.2"	41.5"	42		
	48"	52.6"	47.5"	53		
RCP Class III	24"	29"	24"	260	12	0.013
	30"	36"	30"	370	12	
	36"	42"	36"	520	12	
	42"	49"	42"	680	12	
	48"	56"	48"	850	12	
	54"		54"		8	
	60"		60"		8	
	66"		66"		8	
	72"		72"		8	
	78"		78"		8	
	84"		84"		8	
	90"		90"		8	
	96"		96"		8	

Table C2
Storm Drain Pipe Materials
Pipe Material Unit Cost Comparison

Pipe Type	**Type of Joint**	**Manufacture**	**Pipe Size Available**	**Unit Price * $/LF**
HDPE Sure-Lok Corrugated Outside & Smooth Inside	Bell & Spigot	Hancor Or ADS	12”	9.00
			15”	14.00
			18”	17.00
			24”	27.00
			30”	40.00
			36”	50.00
			42”	63.00
			48”	83.00
			54”	94.00
			60”	101.00
PVC Perma- Loc Ribbed Outside & Smooth inside	Bell & Spigot	JM Manufacturing	18”	15.00
			21”	22.00
			24”	26.00
			27”	30.00
			30”	33.00
			36”	45.00
			42”	70.00
			48”	88.00
RCP Class III **	Bell & Spigot	Hanson Pipe Or San Jose Concrete	15”	17.00
			18”	20.00
			24”	24.00
			30”	28.00
			36”	36.00
			42”	46.00
			48”	52.00
			54”	72.00
			60”	99.00
			66”	120.00
			72”	135.00
			78”	202.00
			84”	245.00
			90”	315.00
			96”	350.00

- Notes:
  1. Pipe unit price includes delivery to the jobsite, but does not include installation costs.
  2. Add 5% to unit prices for Class IV RCP.

Table C3
Storm Drain Pipe Materials
Advantages and Disadvantages

Pipe Type	Advantages	Disadvantages
HDPE Sure-Lok Corrugated Outside & Smooth Inside)	1. Relatively higher flow capacity, due to lower friction coefficient. 2. Relatively lightweight, thus less expensive to install. 3. Relatively lower pipe unit price. 4. Relatively flexible, thus easier to miss a potential utility conflict.	1. Relatively lightweight thus need greater effort for dewatering at location where groundwater is high. 2. Not 100% watertight under differential settlement, or over 5-psi pressure.
PVC Perma- Loc Ribbed Outside & Smooth inside	1. Relatively higher flow capacity, due to lower friction coefficient. 2. Relatively lightweight, thus less expensive to install. 3. Relatively lower pipe unit price. 4. Relatively flexible, thus easier to miss a potential utility conflict.	1. Relatively lightweight thus need greater effort for dewatering at location where groundwater is high.
RCP Class III	1. Relatively stronger structurally.	1. Relatively lower flow capacity, due to higher friction coefficient. 2. Relatively heavy thus need greater effort and larger equipments for installation.

Table C4
Storm Drain Installation
Unit Cost

Pipe size (inches)	**Trench Depth (feet)**	**Unit Price * $/LF**
12	Up to 5.0	75.00
	5.1 to 8.0	100.00
	8.1 to 12.0	130.00
15	Up to 5.0	85.00
	5.1 to 8.0	110.00
	8.1 to 12.0	150.00
18	Up to 5.0	110.00
	5.1 to 8.0	150.00
	8.1 to 12.0	200.00
21	Up to 5.0	120.00
	5.1 to 8.0	160.00
	8.1 to 12.0	210.00
24	Up to 5.0	130.00
	5.1 to 8.0	170.00
	8.1 to 12.0	220.00
27	Up to 6.0	145.00
	6.1 to 9.0	190.00
	9.1 to 12.0	240.00
30	Up to 6.0	170.00
	6.1 to 9.0	225.00
	9.1 to 12.0	300.00
33	Up to 6.0	190.00
	6.1 to 9.0	245.00
	9.1 to 12.0	310.00
36	Up to 6.0	200.00
	6.1 to 9.0	255.00
	9.1 to 12.0	320.00
42	Up to 7.0	230.00
	7.1 to 10.0	280.00
	10.1 to 13.0	350.00
48	Up to 7.0	300.00
	7.1 to 10.0	350.00
	10.1 to 13.0	420.00
54	Up to 8.0	350.00
	8.1 to 11.0	410.00
	11.1 to 14.0	470.00
60	Up to 8.0	390.00
	8.1 to 11.0	430.00
	11.1 to 14.0	500.00

66	Up to 9.0 9.1 to 12.0 12.1 to 15.0	440.00 500.00 570.00
96	Up to 11.0 11.1 to 14.0 14.1 to 17.0	800.00 950.00 1200.00

Note: Unit prices include mobilization, trenching, pipe material and installation, backfill, and a moderate traffic control, complete in place. Prices are based on 2006 construction costs.

Table C5
Storm Drain Pipe Lining
Unit Costs

Existing CMP Pipe Size	**HDPE Lining Pipe Size**	**Percent of Flow with Lining**	**Lining Unit Price * $/LF**
12”	10”	80%	60.00
15”	14”	108%	75.00
18”	16”	94%	90.00
24”	22”	103%	120.00
27”	24”	94%	135.00
30”	26”	88%	150.00
36”	32”	94%	180.00

* Note: unit price includes mobilization and all other related works, complete in place. Prices are based on 2006 construction costs.

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Table C-6

Cost for Priority 1 through 3 Improvements
Local Storm Drainage Collection System Improvements

	Construction Cost ($)	Design & Admin Cost ($)	Total Cost ($)	Priority High Private Property Flooding ($)	Priority High Failing CMP With No Capacity ($)	Priority High Failing CMP With Capacity ($)	Priority Medium Undersized 10-year Pipes ($)	Priority Low Nuisance Ponding ($)
Belmont Creek								
System BA	$ 231,855	$ 139,113	$ 370,968	$ -	$ -	$ -	$ -	$ 370,968
System BB	$ 394,135	$ 236,481	$ 630,616	$ 92,064	$ -	$ -	$ -	$ 538,552
System BC	$	$	$	$ -	$ -	$ -	$ -	$ -
System BH	$ 553,700	$ 332,220	$ 885,920	$ 94,800	$ -	$ -	$ -	$ 791,120
System BI	$ 47,700	$ 28,620	$ 76,320	$ -	$ -	$ -	$ -	$ 76,320
System BL	$ 8,820	$ 5,292	$ 14,112	$ -	$ -	$ -	$ -	$ 14,112
System BM	$ 51,850	$ 31,110	$ 82,960	$ -	$ -	$ -	$ -	$ 82,960
System BN	$ 38,400	$ 23,040	$ 61,440	$ -	$ -	$ -	$ -	$ 61,440
System BO	$ 206,890	$ 124,134	$ 331,024	$ -	$ -	$ -	$ 118,320	$ 212,704
System BQ	$ 67,950	$ 40,770	$ 108,720	$ -	$ -	$ 108,720	$ -	$ -
System BR	$ 196,165	$ 117,699	$ 313,864	$ 221,040	$ 17,952	$ 31,080	$ -	$ 43,792
System BS	$ 58,820	$ 35,292	$ 94,112	$ 85,408	$ 8,704	$ -	$ -	$ -
System BU	$ 37,400	$ 22,440	$ 59,840	$ -	$ -	$ -	$ 59,840	$ -
System BV	$1,029,745	$ 617,847	$1,647,592	$ 1,184,712	$ -	$ -	$ -	$ 462,880
System BW	$ 844,945	$ 506,967	$1,351,912	$ -	$ -	$ -	$ -	$ 1,351,912
System BX	$ 238,685	$ 143,211	$ 381,896	$ -	$ -	$ -	$ 267,248	$ 114,648
System BY	$ 167,790	$ 100,674	$ 268,464	$ 39,712	$ -	$ -	$ -	$ 228,752
System BZ	$ 299,560	$ 179,736	$ 479,296	$ 72,624	$ -	$ -	$ -	$ 406,672
System BAC	$ 114,300	$ 68,580	$ 182,880	$ 68,160	$ -	$ -	$ -	$ 114,720
System BAD	$ 11,390	$ 6,834	$ 18,224	$ -	$ -	$ -	$ -	$ 18,224
System BAF	$ 160,920	$ 96,552	$ 257,472	$ 244,144	$ -	$ -	$ -	$ 13,328
System BAG	$ 12,120	$ 7,272	$ 19,392	$ -	$ -	$ 19,392	$ -	$ -
System BAI	$ 51,120	$ 30,672	$ 81,792	$ -	$ -	$ 81,792	$ -	$ -
Instream Improvements	$1,353,850	$ 812,310	$2,166,160	$ -	$ -	$ -	$ 2,166,160	$ -
Subtotal, Belmont Creek	$6,178,110	$3,706,866	$9,884,976	$ 2,102,664	$ 26,656	$ 240,984	$ 2,611,568	$ 4,903,104
Laurel Creek								
System LA	$ 363,180	$ 217,908	$ 581,088	$ 549,120	$ -	$ 31,968	$ -	$ -
System LD	$1,108,030	$ 664,818	$1,772,848	$ 83,712	$ 69,312	$ 610,896	$ -	$ 1,008,928
System LE	$ 219,300	$ 131,580	$ 350,880	$ -	$ -	$ -	$ -	$ 350,880
System LH	$ 24,600	$ 14,760	$ 39,360	$ -	$ -	$ 39,360	$ -	$ -
System LI	$ 17,190	$ 10,314	$ 27,504	$ -	$ -	$ 27,504	$ -	$ -
System LJ	$ 61,030	$ 36,618	$ 97,648	$ -	$ -	$ 97,648	$ -	$ -
System LK	$ 23,040	$ 13,824	$ 36,864	$ -	$ -	$ 36,864	$ -	$ -
System LM	$ 11,700	$ 7,020	$ 18,720	$ -	$ -	$ -	$ -	$ 18,720
Instream Improvements	$ 250,000	$ 150,000	$ 400,000	$ -	$ -	$ -	$ 400,000	$ -
Subtotal, Laurel Creek	$2,078,070	$1,246,842	$3,324,912	$ 632,832	$ 69,312	$ 844,240	$ 400,000	$ 1,378,528
Island Park								
System PA	$ 175,700	$ 105,420	$ 281,120	$ -	$ -	$ -	$ -	$ 281,120
System PB	$ 90,815	$ 54,489	$ 145,304	$ -	$ -	$ -	$ -	$ 145,304
System PD	$ 152,380	$ 91,428	$ 243,808	$ -	$ -	$ -	$ -	$ 243,808
System PE	$ 145,690	$ 87,414	$ 233,104	$ -	$ -	$ -	$ -	$ 233,104
System PF	$ 51,300	$ 30,780	$ 82,080	$ -	$ -	$ -	$ -	$ 82,080
Subtotal, Island Park	$ 615,885	$ 369,531	$ 985,416	$ -	$ -	$ -	$ -	$ 985,416
East of El Camino Real								
System EA	$1,189,945	$ 713,967	$1,903,912	$ 107,760	$ -	$ -	$ 36,000	$ 1,760,152
System EB	$ 396,110	$ 237,666	$ 633,776	$ 31,440	$ -	$ 326,448	$ 110,880	$ 165,008
System EC	$ 934,090	$ 560,454	$1,494,544	$ -	$ 152,864	$ -	$ -	$ 1,341,680
System ED	$2,305,320	$1,383,192	$3,688,512	$ 37,440	$ -	$ -	$ 2,296,016	$ 1,355,056
System EE	$ 43,875	$ 26,325	$ 70,200	$ -	$ -	$ -	$ -	$ 70,200
System EF	$ 374,805	$ 224,883	$ 599,688	$ 265,128	$ -	$ -	$ -	$ 334,560
System EL	$ 160,235	$ 96,141	$ 256,376	$ 256,376	$ -	$ -	$ -	$ -
Additional Costs for Improvements at Highway 101			$ 700,000	$ 700,000				
System EM	$ 277,650	$ 166,590	$ 444,240	$ -	$ -	$ -	$ 63,120	$ 381,120
System EO	$ 26,250	$ 15,750	$ 42,000	$ -	$ -	$ -	$ 42,000	$ -
Subtotal, East of El Camino Real	$5,708,280	$3,424,968	$9,833,248	$ 1,398,144	$ 152,864	$ 326,448	$ 2,548,016	$ 5,407,776
Direct to San Mateo								
System SMB	$ 36,720	$ 22,032	$ 58,752					$ 58,752
Total Cost, System-wide	$14,617,065	$8,770,239	$24,087,304	$ 4,133,640	$ 248,832	$ 1,411,672	$ 5,559,584	$ 12,733,576

Note: Initial estimates of Jack and Bore for parallel Highway101outfall is $500,000 and other charges such as survey, geotechnical, structural, environmental review, and site constraints is $200,000. The total estimate of new parallel Highway 101 system is $700,000 plus pipe costs.

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STORM DRAIN MASTER PLAN

Table C-7

Cost for Improvements by Priority
Local Storm Drainage Collection System Improvements

System	Construction Cost ($)	Design & Admin Cost ($)	Total Cost ($)	Priority High Private Property Flooding ($)	Priority High Failing CMP With No Capacity ($)	Priority High Failing CMP With Capacity ($)	Priority Medium Undersized 10-year Pipes ($)	Priority Low Nuisence Ponding ($)
Belmont Creek	$6,178,110	$3,706,866	$9,884,976	$2,102,664	$ 26,656	$ 240,984	$2,611,568	$4,903,104
Laurel Creek	$2,078,070	$1,246,842	$3,324,912	$ 632,832	$ 69,312	$ 844,240	$ 400,000	$1,378,528
Island Park	$ 615,885	$ 369,531	$ 985,416	$	$	$	$	$ 985,416
East of El Camino Real	$5,708,280	$3,424,968	$9,133,248	$1,398,144	$ 152,864	$ 326,448	$2,548,016	$5,407,776
Direct to San Mateo	$ 36,720	$ 22,032	$ 58,752	$	$	$	$	$ 58,752
Total Priority Pipe Cost, System-wide	$14,617,065	$8,770,239	$23,387,304	$4,133,640	$ 248,832	$1,411,672	$5,559,584	$12,733,576
Non-priority Pipe Replacement	$ 16,500,289	$9,900,173	$26,400,462					
Cost to Replace All Pipe	$ 31,117,354	$18,670,412	$49,787,766					

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STORM DRAIN MASTER PLAN

Table C-8

Length of Improvements by Priority
Local Storm Drainage Collection System Improvements

System	Total Length (feet)	Priority High Private Property Flooding (feet)	Priority High Failing CMP With No Capacity (feet)	Priority High Failing CMP With Capacity (feet)	Priority Medium Undersized 10-year Pipes (feet)	Priority Low Nuisence Ponding (feet)
Belmont Creek	23,242	6,398	98	1,122	1,153	14,471
Laurel Creek	4,208	-	-	1,420	-	2,788
Island Park	3,409	-	-	-	-	3,409
East of El Camino Real	18,622	694	562	1,277	4,513	11,575
Direct to San Mateo	216					216
Total Length Priority Replacement, System-wi	49,697	7,092	660	3,819	5,666	32,459
Non-priority Pipe Replacement	101,150					
Total Pipe, System-wide	150,847					
	(days)	(days)	(days)	(days)	(days)	(days)
Days to Replace @ 200'/day						
Priority Pipe	248	35	3	19	28	162
Non-Priority Pipe	506					
	754					

Based on 200 construction days per year, Priority Piping less than 36-inch diameter can be replaced in about two years.
Total storm drain line in the City (excluding laterals from catch basins) is about 29 miles.

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STORM DRAIN MASTER PLAN

Table C-9

Cost for High Through Low Priority Improvements
Extension Storm Drainage Collection System Improvements as Part of Other Downstream Improvements

	Construction Cost ($)	Design & Admin Cost ($)	Total Cost ($)	Priority High Private Property Flooding ($)	Priority High Failing CMP With No Capacity ($)	Priority High Failing CMP With Capacity ($)	Priority Medium Undersized 10-year Pipes ($)	Priority Low Nuisence Ponding ($)
Belmont Creek								
System BB	$ 235,000	$ 141,000	$ 376,000	$ -	$ -	$ -	$ -	$ 235,000
System BC	$ 48,600	$ 29,160	$ 77,760	$ -	$ -	$ -	$ -	$ 48,600
System BF	$ 134,830	$ 80,898	$ 215,728	$ -	$ -	$ -	$ -	$ 134,830
System BH	$ 2,548,360	$ 1,529,016	$ 4,077,376	$ 1,235,910	$ -	$ 270,150	$ -	$ 1,042,300
System BI	$ 41,500	$ 24,900	$ 66,400	$ -	$ -	$ -	$ -	$ 41,500
System BK	$ 15,100	$ 9,060	$ 24,160	$ -	$ -	$ -	$ -	$ 15,100
System BM	$ 183,450	$ 110,070	$ 293,520	$ -	$ -	$ -	$ -	$ 183,450
System BN	$ 168,750	$ 101,250	$ 270,000	$ -	$ -	$ -	$ -	$ 168,750
System BO	$ 535,800	$ 321,480	$ 857,280	$ -	$ -	$ -	$ 55,200	$ 480,600
System BP	$ 48,100	$ 28,860	$ 76,960	$ -	$ -	$ -	$ -	$ 48,100
System BR	$ 541,200	$ 324,720	$ 865,920	$ 45,600	$ -	$ -	$ -	$ 495,600
System BS	$ 53,600	$ 32,160	$ 85,760	$ -	$ -	$ -	$ -	$ 53,600
System BT	$ 60,000	$ 36,000	$ 96,000	$ -	$ -	$ -	$ -	$ 60,000
System BV	$ 87,300	$ 52,380	$ 139,680	$ -	$ -	$ -	$ -	$ 87,300
System BW	$ 172,300	$ 103,380	$ 275,680	$ -	$ -	$ -	$ -	$ 172,300
System BZ	$ 345,450	$ 207,270	$ 552,720	$ -	$ -	$ -	$ -	$ 345,450
System BAE	$ 53,100	$ 31,860	$ 84,960	$ 23,400	$ -	$ -	$ -	$ 29,700
System BAB	$ 21,400	$ 12,840	$ 34,240	$ -	$ -	$ -	$ -	$ 21,400
Subtotal, Belmont Creek	$5,293,840	$3,176,304	$8,470,144	$1,304,910	$	$ 270,150	$ 55,200	$3,663,580
Laurel Creek								
System LA	$ 82,860	$ 49,716	$ 132,576	$ 82,860	$ -	$ -	$ -	$ -
System LD	$ 940,150	$ 564,090	$1,504,240	$ 356,150	$ -	$ 119,900	$ -	$ 464,100
System LE	$ 300,500	$ 180,300	$ 480,800	$ -	$ -	$ -	$ -	$ 300,500
System LG	$ 29,500	$ 17,700	$ 47,200	$ -	$ -	$ -	$ -	$ 29,500
System LH	$ 21,200	$ 12,720	$ 33,920	$ -	$ -	$ -	$ -	$ 21,200
System LI	$ 78,300	$ 46,980	$ 125,280	$ -	$ -	$ -	$ -	$ 78,300
System LM	$ 51,600	$ 30,960	$ 82,560	$ -	$ -	$ -	$ -	$ 51,600
Subtotal, Laurel Creek	$1,504,110	$ 902,466	$2,406,576	$ 439,010	$	$ 119,900	$	$ 945,200
East of El Camino Real								
System EA	$ 644,550	$ 386,730	$1,031,280	$ 470,850	$ -	$ -	$ -	$ 173,700
System EB	$ 205,500	$ 123,300	$ 328,800	$ -	$ -	$ 64,500	$ 141,000	$ -
System EC	$ 187,650	$ 112,590	$ 300,240	$ -	$ -	$ -	$ -	$ 187,650
System ED	$ 118,200	$ 70,920	$ 189,120	$ -	$ -	$ -	$ -	$ 118,200
System EE	$ 123,600	$ 74,160	$ 197,760	$ -	$ -	$ -	$ -	$ 123,600
Subtotal, East of El Camino Real	$1,279,500	$ 767,700	$2,047,200	$ 470,850	$	$ 64,500	$ 141,000	$ 603,150
Direct to San Mateo								
System SMD	$ 12,500	$ 7,500	$ 20,000	$ -	$ -	$ -	$ -	$ 12,500
Subtotal, SM	$ 12,500	$ 7,500	$ 20,000	$	$	$	$	$ 12,500
Total Extension Pipe Cost, System wide	$8,089,950	$4,853,970	$12,943,920	$2,214,770	$	$ 454,550	$ 196,200	$5,224,430

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Table C-10

Cost for Improvements by Priority
Extension Storm Drainage Collection System Improvements

System	Construction Cost ($)	Design & Admin Cost ($)	Total Cost ($)	Priority High Private Property Flooding ($)	Priority High Failing CMP With No Capacity ($)	Priority High Failing CMP With Capacity ($)	Priority Medium Undersized 10-year Pipes ($)	Priority Low Nuisence Ponding ($)
Belmont Creek	$5,293,840	$3,176,304	$8,470,144	$1,304,910	$	$ 270,150	$ 55,200	$3,663,580
Laurel Creek	$1,504,110	$ 902,466	$2,406,576	$ 439,010	$	$ 119,900	$	$ 945,200
Island Park	$	$	$	$	$	$	$	$
East of El Camino Real	$1,279,500	$ 767,700	$2,047,200	$ 470,850	$	$ 64,500	$ 141,000	$ 603,150
Direct to San Mateo	$ 12,500	$ 7,500	$ 20,000	$	$	$	$	$ 12,500
Total Extension Pipe Cost, System-wide	$ 8,089,950	$4,853,970	$12,943,920	$2,214,770	$	$ 454,550	$ 196,200	$5,224,430

(1) Costs of $12,000 for storm drain inlets (2 laterals and catch basins) at each intersection was not included in the costs above.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-11

Length of Improvements by Priority
Extension Storm Drainage Collection System Improvements

System	Total Length (feet)	Priority High Private Property Flooding (feet)	Priority High Failing CMP With No Capacity (feet)	Priority High Failing CMP With Capacity (feet)	Priority Medium Undersized 10-year Pipes (feet)	Priority Low Nuisence Ponding (feet)
Belmont Creek	39,757	9,423	-	1,801	368	28,165
Laurel Creek	13,598	4,038	-	1,199	-	8,361
Island Park	-	-	-	-	-	-
East of El Camino Real	9,794	3,139	-	645	1,410	4,600
Direct to San Mateo	125	-	-	-	-	125
Total Length Extension Pipe, Systemwide	63,274	16,600	-	3,645	1,778	41,251
	(days)	(days)	(days)	(days)	(days)	(days)
Days to Replace @ 200'/day						
Priority Pipe	316	83	0	18	9	206
Non-Priority Pipe	0					
	316					

Based on 200 construction days per year, Supplemental Piping could be installed in about 1.5 years.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-12

Length and Costs of Improvements Not Previously Modeled
CMP Storm Drainage Collection System Improvements

System	Total Length (feet)	Un-modeled Priority Low CMP Replacement ($)
Belmont Creek	2,759	$330,430
Laurel Creek	1,936	$248,180
Island Park	0	$0
East of El Camino Real	3,951	$452,800
Direct to San Mateo	357	$35,700
Total Length Extension Pipe, Systemwide	9,003	$1,067,110
Non-priority Pipe Replacement		
Total Pipe, System-wide		
	(days)	(days)
Days to Replace @ 200'/day		
Priority Pipe	45	5,336
Non-Priority Pipe	0	
	45	

Based on 200 construction days per year, remaining CMP replacement could be installed in about 0.2 years.

City of Belmont
Storm Drain Master Plan

Table C-13
Storm Drain Pipe Lengths and Ages

Average Year Installed (year)	Average Age in 2007 (years)	CMP Length (feet)	CMP Percentage Install at Time (%)	RCP Length (feet)	RCP Percentage Install at Time (%)	HDPE Length (feet)	HDPE Percentage Install at Time (%)	PVC Length (feet)	PVC Percentage Install at Time (%)	Steel Length (feet)	Steel Percentage Install at Time (%)	Total Pipes (feet)
1910	97	2,305	24%	7,720	10%	4,620	8%	321	6%	0	0%	
1940	67	628	6%	10,073	13%	9,547	17%	3,662	66%	260	25%	
1970	37	3,836	40%	31,783	42%	18,040	32%	761	14%	0	0%	
1995	12	2,942	30%	25,401	34%	23,762	42%	813	15%	763	75%	
	Totals	9,711		74,977		55,969		5,557		1,023		147,237

Note:
CMP = Corrugated Metal Pipe
HDPE = High-Density Polyethylene Pipe
PVC = Polyvinyl Chloride Pipe
RCP = Reinforced Concreete Pipe
Laterals and pipes less than 12-inches in diameter not part of total.
Storm Drain ages are estimated using sanitary sewer installation dates. We assume sanitary and storm drains are installed at same time in street.
A detailed storm drain survey should be conducted if a more acurate age assesment is required.

City of Belmont
Storm Drain Master Plan

Table C-14
Summary of Storm Drain Repair for Inflow and Infiltration Improvement Costs

	CMP Repairs		Uncontrolled Flow Repairs		Undersized Pipes for 10-YR Event		Upsize Pipes to Eliminate Ponding		Extension Pipes		Curb and Gutter Installation		Grand Total
	Hard Costs	Soft Costs	Hard Costs	Soft Costs	Hard Costs	Soft Costs	Hard Costs	Soft Costs	Hard Costs	Soft Costs	Hard Costs	Soft Costs	
Pipe Replacement	$100,000	$149,000	$1,653,000	$2,480,000	$2,224,000	$3,336,000	$5,093,000	$7,640,000	$9,468,000	$5,681,000	$1,761,000	$1,057,000	
Slip Lining	$847,000	$565,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Sub-Total	$947,000	$714,000	$1,653,000	$2,480,000	$2,224,000	$3,336,000	$5,093,000	$7,640,000	$9,468,000	$5,681,000	$1,761,000	$1,057,000	
Item Total		$1,661,000		$4,133,000		$5,560,000		$12,733,000		$15,149,000		$2,818,000	$42,054,000
In stream Belmont Creek Improvements												$2,166,000	$44,220,000

Notes:
Hard costs are capital costs for construction activities.
Soft costs are capital costs for design and administration, approxiamately 60% of construction costs.
Nuisance ponding repairs are not included in the above table.
CMP = Corrugated Metal Pipe

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-B1

Proposed Storm Drain Line Replacement and Priority, Systems BA, BB & BC

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	Unit Cost ($)	Total Construction ($)	Priority 1,2,3
Belmont Creek Drainage									
P-BA-07	I-BA-07	I-BA-06	24 inch	65	0.003		170	$ 11,050	3
P-BA-06	I-BA-06	I-BA-05	24 inch	214	0.001		170	$ 36,380	3
P-BA-05	I-BA-05	I-BA-04	24 inch	61	0.002		170	$ 10,370	3
P-BA-04	I-BA-04	I-BA-02	24 inch	228	0.004		170	$ 38,760	3
P-BA-03	I-BA-02	J-BA-02	24 inch	56	0.002		170	$ 9,520	3
P-BA-02	J-BA-02	I-BA-01	30 inch	281	0.006		225	$ 63,225	3
P-BA-01	I-BA-01	O-BA	30 inch	278	0.002		225	$ 62,550	3
P-BB-07-01-01	I-BB-07-01-01	J-BB-07-01	24 inch	56	0.136		170	$ 9,520	3
P-BB-07-02	I-BB-07-02	J-BB-07-01	18 inch	285	0.149		150	$ 42,750	1a
P-BB-07-01	J-BB-07-01	J-BB-07	24 inch	87	0.039		170	$ 14,790	1a
P-BB-02-04	I-BB-02-04	I-BB-02-03	18 inch	281	0.099		150	$ 42,150	3
P-BB-02-03	I-BB-02-03	I-BB-02-02	24 inch	65	0.040		170	$ 11,050	3
P-BB-02-02	I-BB-02-02	I-BB-02-01	24 inch	223	0.111		170	$ 37,910	3
P-BB-08	I-BB-08	J-BB-07	24 inch	42	0.024		170	$ 7,140	3
P-BB-06	I-BB-06	I-BB-05	30 inch	220	0.027		225	$ 49,500	3
P-BB-05	I-BB-05	I-BB-04	30 inch	280	0.081		225	$ 63,000	3
P-BB-04	I-BB-04	I-BB-03	30 inch	244	0.063		225	$ 54,900	3
P-BB-03	I-BB-03	I-BB-02	30 inch	273	0.074		225	$ 61,425	3
System BA								$231,855	
System BB								$394,135	
System BC								$ 0	
Priority 1a								$57,540	
Priority 1b								$	
Priority 1c								$	
Priority 2								$	
Priority 3								$568,450	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-B2

Proposed Storm Drain Line Replacement and Priority, System BH

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Belmont Creek Drainage									
Mean Annual Precipitation 24"									
P-BH-06-01	I-BH-06-01	J-BH-06	36 inch	28	0.0429		255	$ 7,140	**3**
P-BH-03-12	I-BH-03-12	I-BH-03-11	18 inch	395	0.2258		150	$ 59,250	**1a**
P-BH-01-03-04	I-BH-01-03-04	J-BH-01-03-03	18 inch	293	0.0560		150	$ 43,950	**3**
P-BH-01-01-01-01	I-BH-01-01-01-01	I-BH-01-01-01	24 inch	239	0.0017		170	$ 40,630	**3**
P-BH-01-01-03	I-BH-01-01-03	I-BH-01-01-02	24 inch	305	0.0151		170	$ 51,850	**3**
P-BH-01-01-02	I-BH-01-01-02	I-BH-01-01-01	24 inch	519	0.0133		170	$ 88,230	**3**
P-BH-01-01-01	I-BH-01-01-01	I-BH-01-01	30 inch	101	0.0396		225	$ 22,725	**3**
P-BH-09	I-BH-09	J-BH-08	24 inch	285	0.0351		170	$ 48,450	**3**
P-BH-08	J-BH-08	J-BH-07	24 inch	265	0.0351		170	$ 45,050	**3**
P-BH-07	J-BH-07	J-BH-06	24 inch	185	0.0708		170	$ 31,450	**3**
P-BH-06	J-BH-06	J-BH-04	30 inch	284	0.1116		225	$ 63,900	**3**
P-BH-04	I-BH-04	I-BH-03	30 inch	227	0.0727		225	$ 51,075	**3**
P-BI-02-01	I-BI-02-01	J-BI-02	18 inch	46	0.0217		150	$ 6,900	**3**
P-BI-03	I-BI-03	J-BI-02	18 inch	272	0.1397		150	$ 40,800	**3**
P-BL-01	I-BL-01	O-BL	12 inch	147	0.1224	slipline	60	$ 8,820	**3**
P-BM-02	I-BM-02	I-BM-01	24 inch	56	0.0179		170	$ 9,520	**3**
P-BM-01	I-BM-01	O-BM	24 inch	249	0.0562		170	$ 42,330	**3**
System BH								$553,700	
System BI								$ 47,700	
System BL								$ 8,820	
System BM								$ 51,850	
Priority 1a								$59,250	
Priority 1b								$	
Priority 1c								$	
Priority 2								$	
Priority 3								$602,820	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-B3

Proposed Storm Drain Line Replacement and Priority, Systems BN, BO, BQ, BR, BS & BU

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Belmont Creek Drainage									
Mean Annual Precipitation 24"									
P-BN-03	I-BN-03	J-BN-02	18 inch	256	0.039		150	38400.0	3
P-BO-05	I-BO-05	I-BO-04	24 inch	234	0.038		170	39780.0	2
P-BO-04	I-BO-04	I-BO-03	24 inch	182	0.021		170	30940.0	2
P-BO-03	I-BO-03	J-BO-02	24 inch	19	0.005		170	3230.0	2
P-BO-02	J-BO-02	I-BO-01	24 inch	53	0.019		170	9010.0	3
P-BO-01	I-BO-01	O-BO	24 inch	729	0.028		170	123930.0	3
P-BQ-01-01	I-BQ-01-01	J-BQ-01	15 inch	132	0.091	**slipline**	75	9900.0	1c
P-BQ-05	I-BQ-05	I-BQ-04	12 inch	62	0.169	**slipline**	60	3720.0	1c
P-BQ-04	I-BQ-04	I-BQ-03	12 inch	172	0.081	**slipline**	60	10320.0	1c
P-BQ-03	I-BQ-03	I-BQ-02	12 inch	24	0.025	**slipline**	60	1440.0	1c
P-BQ-02	I-BQ-02	J-BQ-01	18 inch	302	0.078	**slipline**	90	27180.0	1c
P-BQ-01	J-BQ-01	O-BQ	18 inch	171	0.064	**slipline**	90	15390.0	1c
P-BR-03-01	I-BR-03-01	J-BR-03	18 inch	34	0.088		150	5100.0	3
P-BR-02-02-02	I-BR-02-02-02	I-BR-02-02-01	24 inch	66	0.027	**replace**	170	11220.0	1b
P-BR-02-02-01	I-BR-02-02-01	J-BR-02-02	24 inch	131	0.374		170	22270.0	3
P-BR-02-02	J-BR-02-02	J-BR-02-01	30 inch	580	0.067		225	130500.0	1a
P-BR-02-01	J-BR-02-01	J-BR-02	36 inch	30	0.050		255	7650.0	1a
P-BR-01-01	I-BR-01-01	J-BR-01	15 inch	259	0.161	**slipline**	75	19425.0	1c
P-BS-03	J-BS-03	J-BS-02	24 inch	176	0.085		170	29920.0	1a
P-BS-02	J-BS-02	J-BS-01	24 inch	138	0.192		170	23460.0	1a
P-BS-01	J-BS-01	O-BS	24 inch	32	0.003	**replace**	170	5440.0	1b
P-BU-02	I-BU-02	I-BU-01	12 inch	192	0.262		100	19200.0	2
P-BU-01	I-BU-01	O-BU	12 inch	182	0.637		100	18200.0	2
System BN								$ 38,400	
System BO								$206,890	
System BQ								$ 67,950	
System BR								$196,165	
System BS								$ 58,820	
System BU								$ 37,400	
Priority 1a								$191,530	
Priority 1b								$16,660	
Priority 1c								$87,375	
Priority 2								$111,350	
Priority 3								$198,710	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-B4

Proposed Storm Drain Line Replacement and Priority, Systems BV, BW, BX & BY

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Belmont Creek Drainage									
Mean Annual Precipitation 26"									
P-BV-11-01	I-BV-11-01	I-BV-11	24 inch	201	0.003		170	$ 34,170	1a
P-BV-06-01	I-BV-06-01	J-BV-06	24 inch	20	0.090		170	$ 3,400	3
P-BV-15	I-BV-15	I-BV-14	18 inch	208	0.005		150	$ 31,200	3
P-BV-13	I-BV-13	J-BV-12	18 inch	434	0.012		150	$ 65,100	3
P-BV-12	J-BV-12	I-BV-11	18 inch	469	0.032		150	$ 70,350	3
P-BV-11	I-BV-11	J-BV-10	30 inch	204	0.005		225	$ 45,900	3
P-BV-10	J-BV-10	J-BV-09	30 inch	260	0.004		225	$ 58,500	3
P-BV-09	J-BV-09	I-BV-08	30 inch	66	0.008		225	$ 14,850	3
P-BV-08	I-BV-08	I-BV-07	30 inch	689	0.008		225	$155,025	1a
P-BV-07	I-BV-07	J-BV-06	30 inch	688	0.019		225	$154,800	1a
P-BV-06	J-BV-06	J-BV-05	30 inch	188	0.207		225	$ 42,300	1a
P-BV-05	J-BV-05	I-BV-04	30 inch	314	0.092		225	$ 70,650	1a
P-BV-04	I-BV-04	I-BV-03	30 inch	135	0.163		225	$ 30,375	1a
P-BV-03	I-BV-03	J-BV-02	30 inch	189	0.079		225	$ 42,525	1a
P-BV-02	J-BV-02	I-BV-01	30 inch	366	0.020		225	$ 82,350	1a
P-BV-01	I-BV-01	O-BV	30 inch	570	0.342		225	$128,250	1a
P-BW-03-02	I-BW-03-02	J-BW-03-01	30 inch	36	0.042		225	$ 8,100	3
P-BW-03-01	J-BW-03-01	I-BW-03	42 inch	76	0.020		280	$ 21,280	3
P-BW-01-05	I-BW-01-05	I-BW-01-04	30 inch	75	0.027		225	$ 16,875	3
P-BW-01-04	I-BW-01-04	J-BW-01-03	30 inch	345	0.075		225	$ 77,625	3
P-BW-01-03	J-BW-01-03	J-BW-01-02	30 inch	187	0.071		225	$ 42,075	3
P-BW-08	I-BW-07	J-BW-07	5 x 3 ft	46	0.011		410	$ 18,860	3
P-BW-07	J-BW-07	I-BW-06	48 inch	114	0.026		350	$ 39,900	3
P-BW-06	I-BW-06	I-BW-05	48 inch	81	0.025		350	$ 28,350	3
P-BW-05	I-BW-05	I-BW-04	48 inch	406	0.023		350	$142,100	3
P-BW-04	I-BW-04	I-BW-03	60 inch	83	0.008		430	$ 35,690	3
P-BW-03	I-BW-03	J-BW-02	60 inch	89	0.034		430	$ 38,270	3
P-BW-02	J-BW-02	I-BW-01	60 inch	522	0.010		430	$224,460	3
P-BW-01	I-BW-01	O-BW	60 inch	352	0.059		430	$151,360	**3**
P-BX-01-01	I-BX-01-01	J-BX-01	7 x 3 ft	71	0.042		430	$ 30,530	2
P-BX-03	I-BX-03	I-BX-02	36 inch	94	0.040		255	$ 23,970	3
P-BX-02	I-BX-02	J-BX-01	36 inch	187	0.052		255	$ 47,685	3
P-BX-01	**J-BX-01**	**O-BX**	**66 inch**	**273**	**0.028**		**500**	**$136,500**	2
P-BY-03	I-BY-03	I-BY-02	24 inch	341	0.035		170	$ 57,970	3
P-BY-02	I-BY-02	I-BY-01	24 inch	500	0.039		170	$ 85,000	3
P-BY-01	I-BY-01	O-BY	24 inch	146	0.099		170	$ 24,820	1a
System BV								$1,029,745	
System BW								$844,945	
System BX								$238,685	
System BY								$167,790	
Priority 1a								$765,265	
Priority 1b								$	
Priority 1c								$	
Priority 2								$167,030	
Priority 3								$1,348,870	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-B5

Proposed Storm Drain Line Replacement and Priority, Systems BZ, BAC, BAE, BAF & BAI

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Belmont Creek Drainage									
Mean Annual Precipitation 26"									
P-BZ-01-02-01W	I-BZ-01-02-01W	J-BZ-01-02	18 inch	47	0.0596		150	$ 7,050	3
P-BZ-01-02-01E	I-BZ-01-02-01E	J-BZ-01-02	18 inch	49	0.0980		150	$ 7,350	3
P-BZ-01-02	J-BZ-01-02	J-BZ-01-01	30 inch	273	0.0487		225	$ 61,425	3
P-BZ-01-01	J-BZ-01-01	J-BZ-01	30 inch	246	0.0285		225	$ 55,350	3
P-BZ-03	I-BZ-03	J-BZ-02	24 inch	41	0.0341		170	$ 6,970	3
P-BZ-02	J-BZ-02	J-BZ-01	36 inch	455	0.0147		255	$116,025	3
P-BZ-01	J-BZ-01	O-BZ	36 inch	178	0.0163		255	$ 45,390	1a
P-BAC-02-02	I-BAC-02-02	I-BAC-02-01	18 inch	284	0.0018		150	$ 42,600	1a
P-BAC-02-01	I-BAC-02-01	J-BAC-02	18 inch	363	0.0722		150	$ 54,450	3
P-BAC-02	J-BAC-02	J-BAC-01	18 inch	115	0.1157		150	$ 17,250	3
P-BAD-01	I-BAD-01	O-BAD	24 inch	67	0.0149		170	$ 11,390	3
P-BAF-02-01	I-BAF-02-01	J-BAF-02	24 inch	49	0.0000		170	$ 8,330	3
P-BAF-03	I-BAF-03	J-BAF-02	18 inch	403	0.0479		150	$ 60,450	1a
P-BAF-02	J-BAF-02	J-BAF-01	24 inch	356	0.0216		170	$ 60,520	1a
P-BAF-01	J-BAF-01	O-BAF	24 inch	186	0.3548		170	$ 31,620	1a
P-BAG-01	I-BAG-01	O-BAG	12 inch	202	0.2847	**slipline**	60	$ 12,120	1c
P-BAI-01	I-BAI-01	O-BAI	24 inch	426	0.2265	**slipline**	120	$ 51,120	1c
System BZ								$299,560	
System BAC								$114,300	
System BAD								$ 11,390	
System BAE									
System BAF								$160,920	
System BAG								$ 12,120	
System BAI								$ 51,120	
Priority 1a								$240,580	
Priority 1b								$	
Priority 1c								$63,240	
Priority 2								$	
Priority 3								$345,590	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-E1

Proposed Storm Drain Line Replacement and Priority, System EA

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Ruth Avenue, Backyard Easement									
P-EA-16-15	I-EA-16-15	I-EA-16-14	18 inch	17	0.0182		150	$ 2,550	3
P-EA-16-14	I-EA-16-14	J-EA-16-13	18 inch	226	0.3289		150	$ 33,900	1a
P-EA-16-13	J-EA-16-13	J-EA-16-12	18 inch	223	0.2312		150	$ 33,450	1a
P-EA-16-12	J-EA-16-12	I-EA-16-11	18 inch	74	0.0649		150	$ 11,100	3
P-EA-16-11	I-EA-16-11	I-A-EA-04	24 inch	106	0.0953		170	$ 18,020	3
El Camino Real									
P-EA-15-02	I-EA-15-02	I-EA-15-01	18 inch	48	0.0408		150	$ 7,200	3
Hiller Street									
P-EA-07-02-03	I-EA-07-02-03	J-EA-07-02	18 inch	58	0.011552		150	$ 8,700	3
P-EA-07-02-02	I-EA-07-02-02	J-EA-07-02	18 inch	30	0.012		150	$ 4,500	3
P-EA-07-02-01	I-EA-07-02-01	J-EA-07-02	18 inch	12	0.0475		150	$ 1,800	3
P-EA-07-04	I-EA-07-04	I-EA-07-03	12 inch	33	0.00303		100	$ 3,300	3
P-EA-07-03	I-EA-07-03	J-EA-07-02	24 inch	231	0.003766		170	$ 39,270	3
P-EA-07-02	J-EA-07-02	I-EA-07-01	36 inch	460	0.001152		255	$117,300	3
P-EA-07-01S	I-EA-07S	J-EA-07	18 inch	40	0.054075		150	$ 6,000	3
P-EA-07-01	I-EA-07-01	J-EA-07	36 inch	126	0.012563		255	$ 32,130	3
P-EA-06-02	I-EA-06-02	I-EA-06-01	24 inch	66	0.000152		170	$ 11,220	3
P-EA-06-01	I-EA-06-01	I-EA-06	24 inch	301	0.012625		170	$ 51,170	3
Ruth Avenue / Dale View Avenue									
P-EA-24	I-EA-06-08	I-EA-23	30 inch	100	0.042		225	$ 22,500	2
P-EA-23	I-EA-23	I-EA-22	30 inch	177	0.029661		225	$ 39,825	3
P-EA-22	I-EA-22	I-EA-21	30 inch	104	0.065385		225	$ 23,400	
P-EA-21	I-EA-21	I-EA-20	30 inch	445	0.03236		225	$100,125	3
P-EA-20	I-EA-20	I-EA-19	30 inch	57	0.010526		225	$ 12,825	3
P-EA-19	I-EA-19	I-EA-18	48 inch	103	0.001942		350	$ 36,050	3
P-EA-18	I-EA-18	I-EA-17	48 inch	112	0.001339		350	$ 39,200	3
P-EA-17	I-EA-17	J-EA-16	48 inch	41	0.002683		350	$ 14,350	3
P-EA-16	J-EA-16	I-EA-15	48 inch	33	0.00697		350	$ 11,550	3
P-EA-15	I-EA-15	I-EA-14	48 inch	59	0.020847		350	$ 20,650	3
P-EA-14	I-EA-14	I-EA-13	48 inch	99	0.02		350	$ 34,650	3
P-EA-13	I-EA-13	I-EA-12	48 inch	189	0.018413		350	$ 66,150	3
P-EA-12	I-EA-12	I-EA-11	60 inch	92	0.012935		430	$ 39,560	3
P-EA-11	I-EA-11	I-EA-10	66 inch	61	0.00541		500	$ 30,500	**3**
P-EA-10	I-EA-10	I-EA-09	66 inch	23	0.107826		500	$ 11,500	3
P-EA-09	I-EA-09	I-EA-08	66 inch	216	0.009352		500	$108,000	3
P-EA-08	I-EA-08	J-EA-07	66 inch	236	0.007131		500	$118,000	3
P-EA-07	J-EA-07	I-EA-06	78 inch	159	0.000484		500	$ 79,500	3
City Limits									
System EA								$1,189,945	
Priority 1a								$67,350	
Priority 1b								$	
Priority 1c								$	
Priority 2								$22,500	
Priority 3								$1,100,095	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-E2

Proposed Storm Drain Line Replacement and Priority, Systems EB & EC

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Ruth Avenue, Backyard Easement									
P-EB-09-02	I-EB-09-02	I-EB-09-01	15 inch	38	0.0789	**slipline**	75	$ 2,850.00	1c
P-EB-09-01	I-EB-09-01	J-EB-09	15 inch	99	0.3636	**slipline**	75	$ 7,425.00	1c
P-EB-08-01	I-EB-08-01	J-EB-08	15 inch	109	0.4404	**slipline**	75	$ 8,175.00	1c
P-EB-07-01-01	I-EB-07-01-01	I-EB-07-01	18 inch	40	0.0200		150	$ 6,000.00	3
P-EB-07-04	I-EB-07-01	J-EB-07	18 inch	124	0.0661		150	$ 18,600.00	3
P-EB-07-03	J-EB-07	I-EB-06	18 inch	165	0.0788		150	$ 24,750.00	3
P-EB-07-02	I-EB-06	I-EB-05	18 inch	462	0.0942		150	$ 69,300.00	2
P-EB-07-01	I-EB-05	J-EB-04	24 inch	214	0.1472		170	$ 36,380.00	3
P-EB-04-03	I-EB-04-03	J-EB-04-02	18 inch	131	0.0382		150	$ 19,650.00	1a
P-EB-04-02	J-EB-04-02	J-EB-04-01	18 inch	116	0.0431		150	$ 17,400.00	3
P-EB-09	J-EB-09	J-EB-08	36 inch	79	0.1266	**slipline**	180	$ 14,220.00	1c
P-EB-08	J-EB-08	J-EB-07	36 inch	325	0.0708	**slipline**	180	$ 58,500.00	1c
P-EB-07	J-EB-07	I-EB-06	36 inch	165	0.0788	**slipline**	180	$ 29,700.00	1c
P-EB-06	I-EB-06	I-EB-05	36 inch	462	0.0942	**slipline**	180	$ 83,160.00	1c
Chesterton Avenue									
P-EC-05-02	I-EC-05-02	I-EC-05-01	24 inch	40	0.0000		170	$ 6,800.00	3
P-EC-05-01	I-EC-05-01	J-EC-05	24 inch	300	0.0070		170	$ 51,000.00	3
P-EC-03-04W	I-EC-03-04W	I-EC-03-03W	36 inch	80	0.0013		255	$ 20,400.00	3
P-EC-03-03W	I-EC-03-03W	J-EC-03-02W	36 inch	236	0.0055		255	$ 60,180.00	3
P-EC-03-02W	J-EC-03-02W	I-EC-03-01W	48 inch	354	0.0003		350	$ 123,900.00	3
P-EC-03-01W	I-EC-03-01W	J-EC-03	48 inch	377	0.0003		350	$ 131,950.00	3
P-EC-03-01E	I-EC-03-01E	J-EC-03	18 inch	344	0.0067		150	$ 51,600.00	3
Marine View Avenue									
P-EC-09	I-EC-09	I-EC-08	24 inch	562	0.0413		170	$ 95,540.00	1b
P-EC-08	I-EC-08	J-EC-07	36 inch	130	0.0169		255	$ 33,150.00	3
P-EC-07	J-EC-07	I-EC-06	54 inch	219	0.0037		410	$ 89,790.00	3
P-EC-06	I-EC-06	J-EC-05	54 inch	240	0.0004		410	$ 98,400.00	3
P-EC-05	J-EC-05	I-EC-04	54 inch	63	0.0024		410	$ 25,830.00	3
P-EC-04	I-EC-04	J-EC-03	54 inch	233	0.0006		410	$ 95,530.00	3
P-EC-03	J-EC-03	J-EC-02	54 inch	122	0.0057		410	$ 50,020.00	3
P-EC-02	J-EC-02	J-EC-01	54 inch	355	0.0034		410	$ 145,550.00	3
P-EC-01	J-EC-01	O-EC	54 inch	66	0.0008		410	$ 27,060.00	3
System EB								$396,110	
System EC								$934,090	
Priority 1a								$19,650	
Priority 1b								$95,540	
Priority 1c								$204,030	
Priority 2								$69,300	
Priority 3								$941,680	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-E3

Proposed Storm Drain Line Replacement and Priority, System ED

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
P-ED-17-08-01	I-ED-17-08-01	I-ED-17-08	12 inch	65.0000	0.0154		100	$ 6,500	3
P-ED-17-08	I-ED-17-08	I-ED-17-07	18 inch	113.0000	0.0089		150	$ 16,950	2
P-ED-17-07	I-ED-17-07	I-ED-17-06	18 inch	76.0000	0.2895		150	$ 11,400	2
P-ED-17-06	I-ED-17-06	I-ED-17-05	18 inch	72.0000	0.2222		150	$ 10,800	2
P-ED-17-05	I-ED-17-05	I-ED-17-04	18 inch	93.0000	0.0215		150	$ 13,950	2
P-ED-17-04	I-ED-17-04	I-ED-17-03	18 inch	46.0000	0.4587		150	$ 6,900	3
P-ED-17-03	I-ED-17-03	I-ED-17-02	18 inch	147.0000	0.1286		150	$ 22,050	3
P-ED-09-01	I-ED-09-01	I-ED-09	42 inch	172	0.0006		280	$ 48,160	3
P-ED-08-09	I-ED-08-09	J-ED-08-08	24 inch	657.0000	0.0134		170	$111,690	3
P-ED-08-08	J-ED-08-08	J-ED-08-07	24 inch	327.0000	0.0193		170	$ 55,590	3
P-ED-08-07	J-ED-08-07	I-ED-08-06	24 inch	211.0000	0.0085		170	$ 35,870	3
P-ED-08-06	I-ED-08-06	I-ED-08-05	24 inch	213.0000	0.0150		170	$ 36,210	3
P-ED-08-05	I-ED-08-05	I-ED-08-04	30 inch	81.0000	0.0074		225	$ 18,225	3
P-ED-08-04	I-ED-08-04	I-ED-08-03	30 inch	272.0000	0.0040		225	$ 61,200	3
P-ED-08-03	I-ED-08-03	I-ED-08-02	36 inch	251.0000	0.0008		255	$ 64,005	3
P-ED-08-02	I-ED-08-02	I-ED-08-01	36 inch	104.0000	0.0010		255	$ 26,520	3
P-ED-08-01	I-ED-08-01	I-ED-08	36 inch	308.0000	0.0071		255	$ 78,540	3
Seagate Place									
P-ED-01-01	I-ED-01-01	J-ED-01	30 inch	104.0000	0.0024		225	$ 23,400	1a
Cypruss Road									
P-ED-15	I-ED-15	I-ED-14	24 inch	100.0000	0.1000		170	$ 17,000	2
P-ED-14	I-ED-14	I-ED-13	24 inch	48.0000	0.0208		170	$ 8,160	2
P-ED-12	J-ED-12	I-ED-11	48 inch	80.0000	0.0013		350	$ 28,000	2
P-ED-11	I-ED-11	J-ED-10	48 inch	1485.0000	0.0156		350	$519,750	2
P-ED-10	J-ED-10	I-ED-09	48 inch	117.0000	0.0205		350	$ 40,950	3
P-ED-08	I-ED-08	J-ED-07	72 inch	14.0000	0.0000		500	$ 7,000	3
P-ED-07	J-ED-07	I-ED-06	72 inch	414.0000	0.0019		500	$207,000	3
P-ED-06	I-ED-06	I-ED-05	72 inch	54.0000	0.0000		500	$ 27,000	3
Briarfield Way									
P-ED-05	I-ED-05	J-ED-04	72 inch	181.0000	0.0028		500	$ 90,500	2
P-ED-04	J-ED-04	J-ED-03	72 inch	304.0000	0.0016		500	$152,000	2
P-ED-03	J-ED-03	J-ED-02	84 inch	116.0000	0.0022		500	$ 58,000	2
P-ED-02	J-ED-02	J-ED-01	84 inch	530.0000	0.0005		500	$265,000	2
P-ED-01	J-ED-01	O-ED	84 inch	487.0000	0.0005		500	$243,500	2
System ED								$2,305,320	
Priority 1a								$23,400	
Priority 1b								$	
Priority 1c								$	
Priority 2								$1,435,010	
Priority 3								$846,910	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-E4

Proposed Storm Drain Line Replacement and Priority, Systems EE, EF, EL, EM & EO

Pipe #	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Number Parallel Pipes	Constructed Slope (ft/ft)	CMP?	Unit Cost ($)	Total Construction ($)	Priority 1,2,3
Ralston Avenue										
P-EE-01	J-EE-01	O-EE	30 inch	195	1	0.008		225	$ 43,875	3
Furlong Street to Dairy Lane										
P-EF-06	I-EF-06	I-EF-05	30 inch	233	1	0.012		225	$ 52,425	1a
P-EF-05	I-EF-05	I-EF-04	30 inch	236	1	0.019		225	$ 53,100	1a
P-EF-04	I-EF-04	I-EF-03	36 inch	236	1	0.009		255	$ 60,180	1a
P-EF-03	I-EF-03	I-EF-02	36 inch	234	1	0.017		255	$ 59,670	3
P-EF-02	I-EF-02	I-EF-01	36 inch	248	1	0.008		255	$ 63,240	3
P-EF-01	I-EF-01	O-EF	36 inch	338	1	0.008		255	$ 86,190	3
P-EL-03	I-EL-03	I-EL-02	66 inch	194	1	0.001		500	$ 97,000	1a
P-EL-02	I-EL-02	I-EL-01	4 x 3 ft	97	2	0.003		255	$ 24,735	1a
P-EL-01	I-EL-01	O-EL	48 inch	110	2	0.002		350	$ 38,500	1a
P-EM-09	I-EM-09	I-EM-08	18 inch	152	1	0.005		150	$ 22,800	2
P-EM-08	I-EM-08	I-EM-07	18 inch	111	1	0.009		150	$ 16,650	2
P-EM-07	I-EM-07	I-EM-06	30 inch	145	1	0.001		225	$ 32,625	3
P-EM-06	I-EM-06	I-EM-05	30 inch	125	1	0.001		225	$ 28,125	3
P-EM-05	I-EM-05	I-EM-04	36 inch	146	1	0.000		255	$ 37,230	3
P-EM-04	I-EM-04	I-EM-03	36 inch	336	1	0.001		255	$ 85,680	3
P-EM-03	I-EM-03	I-EM-02	36 inch	53	1	0.005		255	$ 13,515	3
P-EM-02	I-EM-02	I-EM-01	30 inch	52	1	0.005		225	$ 11,700	3
P-EM-01	I-EM-01	O-EM	36 inch	115	1	0.002		255	$ 29,325	3
P-EO-01	I-EO-01	O-EO	18 inch	175	1	0.0171		150	$ 26,250	2
System EE									$43,875	
System EF									$374,805	
System EL									$160,235	
System EM									$277,650	
System EO									$26,250	
Priority 1a									$325,940	
Priority 1b									$	
Priority 1c									$	
Priority 2									$65,700	
Priority 3									$491,175	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-L1

Proposed Storm Drain Line Replacement and Priority, Systems LA & LD

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	Unit Cost ($)	Total Construction ($)	Priority 1,2,3
Laurel Creek Drainage									
P-LA-03-01	I-LA-03-01	J-LA-03	18 inch	222	0.079	slip line	90	$ 19,980	1c
P-LA-09	I-LA-09	I-LA-08	24 inch	22	0.443	replace	170	$ 3,740	1a
P-LA-08	I-LA-08	I-LA-07	24 inch	437	0.151	replace	170	$ 74,290	1a
P-LA-07	I-LA-07	I-LA-06	24 inch	581	0.196		170	$ 98,770	1a
P-LA-06	I-LA-06	I-LA-05	24 inch	235	0.026		170	$ 39,950	1a
P-LA-05	I-LA-05	J-LA-04	30 inch	252	0.099		225	$ 56,700	1a
P-LA-04	J-LA-04	J-LA-03	30 inch	196	0.255		225	$ 44,100	1a
P-LA-03	J-LA-03	I-LA-02	30 inch	114	0.279		225	$ 25,650	1a
P-LD-18-01	I-LD-18-01	I-LD-18	18 inch	249	0.051	slip line	90	$ 22,410	1c
P-LD-15-04	I-LD-15-04	J-LD-15-03	24 inch	90	0.167	slip line	120	$ 10,800	1c
P-LD-15-03E	I-LD-15-03E	J-LD-15-03	15 inch	91	0.005	slip line	75	$ 6,825	1c
P-LD-15-03	J-LD-15-03	I-LD-15-02	18 inch	21	0.071	slip line	90	$ 1,890	1c
P-LD-15-02	I-LD-15-02	J-LD-15-01	18 inch	586	0.132	slip line	90	$ 52,740	1c
P-LD-15-01W	I-LD-15-01W	J-LD-15-01	15 inch	349	0.321	slip line	75	$ 26,175	1c
P-LD-15-01S	I-LD-15-01S	J-LD-15-01	15 inch	181	0.568	slip line	75	$ 13,575	1c
P-LD-15-01	J-LD-15-01	I-LD-15	15 inch	179	0.447	slip line	75	$ 13,425	1c
P-LD-12-07-01	I-LD-12-07-01	J-LD-12-07	18 inch	56	0.027	replace	150	$ 8,400	1b
P-LD-12-04-03	I-LD-12-04-03	I-LD-12-04-02	15 inch	43.0000	0.0465	slipline	75	$ 3,225	1c
P-LD-12-04-02	I-LD-12-04-02	I-LD-12-04-01	15 inch	408.0000	0.0828	slipline	75	$ 30,600	1c
P-LD-12-07	J-LD-12-07	I-LD-12-06	18 inch	103	0.073		90	$ 9,270	1c
P-LD-12-06	I-LD-12-06	J-LD-12-05	18 inch	388	0.277	replace	90	$ 34,920	1b
P-LD-10-05-01-02	I-LD-10-05-01-02	I-LD-10-05-01-01	18 inch	182	0.110	slip line	90	$ 16,380	1c
P-LD-10-05-01-01	I-LD-10-05-01-01	I-LD-10-05-01	18 inch	609	0.045		90	$ 54,810	3
P-LD-10-05-01	I-LD-10-05-01	J-LD-10-05	18 inch	124	0.3185	slipline	90	$ 11,160	1c
P-LD-10-04-02	I-LD-10-04-02	J-LD-10-04-01	12 inch	84	0.524	slip line	60	$ 5,040	1c
P-LD-10-04-01	J-LD-10-04-01	J-LD-10-04	12 inch	55	0.364	slip line	60	$ 3,300	1c
P-LD-10-03-05E	I-LD-10-03-05E	I-LD-10-03-04E	18 inch	128	0.188	slip line	90	$ 11,520	1c
P-LD-10-03-04E	I-LD-10-03-04E	I-LD-10-03-03E	18 inch	28	0.029	slip line	90	$ 2,520	1c
P-LD-10-03-03E	I-LD-10-03-03E	I-LD-10-03-02E	18 inch	130	0.240	slip line	90	$ 11,700	1c
P-LD-10-03-02E	I-LD-10-03-02E	J-LD-10-03-01E	15 inch	312	0.240	slip line	75	$ 23,400	1c
P-LD-10-03-01E	J-LD-10-03-01E	J-LD-10-03	15 inch	141	0.355	slip line	75	$ 10,575	1c
P-LD-10-05	J-LD-10-05	J-LD-10-04	18 inch	145	0.207	slip line	90	$ 13,050	1c
P-LD-05-01	J-LD-05-01	I-LD-05	24 inch	203.0000	0.4852	slipline	120	$ 24,360	1c
P-LD-03-03-01-01	I-LD-03-03-01-01	I-LD-03-03-01	18 inch	193	0.067	slip line	90	$ 17,370	1c
P-LD-03-03-02	I-LD-03-03-02	I-LD-03-03-01	18 inch	111	0.045	slip line	90	$ 9,990	1c
P-LD-03-03-01	I-LD-03-03-01	I-LD-03-03	18 inch	339	0.528	slip line	90	$ 30,510	1c
P-LD-23	I-LD-23	J-LD-22	21 inch	327	0.055		160	$ 52,320	1a
P-LD-08	I-LD-08	I-LD-07	60 inch	151	0.033		430	$ 64,930	3
P-LD-07	I-LD-07	I-LD-06	60 inch	261	0.009		430	$ 112,230	3
P-LD-06	I-LD-06	I-LD-05	60 inch	274	0.022		430	$ 117,820	3
P-LD-05	I-LD-05	I-LD-04	60 inch	105	0.001		430	$ 45,150	3
P-LD-04	I-LD-04	I-LD-03	60 inch	304	0.047		430	$ 130,720	3
P-LD-03	I-LD-03	J-LD-02	60 inch	171	0.022		430	$ 73,530	3
P-LD-02	J-LD-02	J-LD-01	60 inch	73	0.032		430	$ 31,390	3
System LA								$363,180	
System LD								$1,108,030	
Priority 1a								$395,520	
Priority 1b								$43,320	
Priority 1c								$401,790	
Priority 2								$	
Priority 3								$630,580	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-L2

Proposed Storm Drain Line Replacement and Priority, Systems LE, LH, LI, LJ & LM

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	Unit Cost ($)	Total Construction ($)	Priority 1,2,3
Laurel Creek Drainage									
P-LE-04	I-LE-04	I-LE-03	24 inch	41	0.010		170	$ 6,970	3
P-LE-03	I-LE-03	J-LE-02	24 inch	183	0.009		170	$ 31,110	3
P-LE-02	J-LE-02	I-LE-01	24 inch	393	0.056		170	$ 66,810	3
P-LE-01	I-LE-01	O-LE	24 inch	673	0.318		170	$ 114,410	3
P-LH-01	I-LH-01	O-LH	15 inch	328	0.300	slip line	75	$ 24,600	1c
P-LI-03-02	I-LI-03-02	I-LI-03-01	18 inch	59	0.008	slip line	90	$ 5,310	1c
P-LI-03-01	I-LI-03-01	I-LI-03	18 inch	132	0.295	slip line	90	$ 11,880	1c
P-LJ-01-W	I-LJ-01W	J-LJ-01	12 inch	196	0.250		100	$ 19,600	1c
P-LJ-01-E	I-LJ-01E	J-LJ-01	12 inch	102	0.461		100	$ 10,200	1c
P-LJ-03	I-LJ-03	I-LJ-02	18 inch	149		slip line	90	$ 13,410	1c
P-LJ-02	I-LJ-02	J-LJ-01	18 inch	137		slip line	90	$ 12,330	1c
P-LJ-01	J-LJ-01	O-LJ	18 inch	61		slip line	90	$ 5,490	1c
P-LK-01	J-LK-01	O-LK	18 inch	256	0.301	slip line	90	$ 23,040	1c
P-LM-02	I-LM-02	J-LM-01	18 inch	26	0.008		150	$ 3,900	3
P-LM-01	J-LM-01	O-LM	18 inch	52	0.154		150	$ 7,800	3
System LE								$219,300	
System LH								$ 24,600	
System LI								$ 17,190	
System LJ								$ 61,030	
System LK								$ 23,040	
System LM								$ 11,700	
Priority 1a								$	
Priority 1b								$	
Priority 1c								$125,860	
Priority 2								$	
Priority 3								$231,000	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-P1

Proposed Storm Drain Line Replacement and Priority, Systems PA, PB, P, & PF

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
Island Park									
Mean Annual Precipitation 20 inches									
P-PA-05-01	I-PA-05-01	I-PA-05	18 inch	99	0.001		150	$14,850	3
P-PA-07	I-PA-07	I-PA-06	24 inch	141	0.009		170	$23,970	3
P-PA-06	I-PA-06	I-PA-05	24 inch	109	0.002		170	$18,530	3
P-PA-05	I-PA-05	I-PA-04	30 inch	72	0.003		225	$16,200	3
P-PA-04	I-PA-04	I-PA-03	30 inch	189	0.001		225	$42,525	3
P-PA-03	I-PA-03	I-PA-02	30 inch	160	0.002		225	$36,000	3
P-PA-02	I-PA-02	I-PA-01	30 inch	35	0.000		225	$7,875	3
P-PA-01	I-PA-01	O-PA	30 inch	70	0.007		225	$15,750	3
P-PB-02-01	I-PB-02-01	I-PB-02	24 inch	52	0.002		170	$8,840	3
P-PB-03	I-PB-03	I-PB-02	18 inch	140	0.025		150	$21,000	3
P-PB-02	I-PB-02	I-PB-01	30 inch	209	0.004		225	$47,025	3
P-PB-01	I-PB-01	O-PB	30 inch	62	0.004		225	$13,950	3
P-PD-08	I-PD-08	I-PD-07	24 inch	128	0.006		170	$21,760	3
P-PD-07	I-PD-07	I-PD-06	24 inch	99	0.003		170	$16,830	3
P-PD-06	I-PD-06	I-PD-05	24 inch	64	0.004		170	$10,880	3
P-PD-05	I-PD-05	I-PD-04	24 inch	117	0.002		170	$19,890	3
P-PD-04	I-PD-04	I-PD-03	24 inch	128	0.010		170	$21,760	3
P-PD-03	I-PD-03	I-PD-02	30 inch	32	0.008		225	$7,200	3
P-PD-02	I-PD-02	I-PD-01	36 inch	149	0.001		255	$37,995	3
P-PD-01	I-PD-01	O-PD	36 inch	63	0.013		255	$16,065	3
P-PE-07	I-PE-07	I-PE-06	18 inch	159	0.002		150	$23,850	3
P-PE-06	I-PE-06	I-PE-05	18 inch	179	0.001		150	$26,850	3
P-PE-05	I-PE-05	I-PE-04	18 inch	102	0.005		150	$15,300	3
P-PE-04	I-PE-04	J-PE-03	24 inch	132	0.002		170	$22,440	3
P-PE-03	J-PE-03	I-PE-02	24 inch	35	0.007		170	$5,950	3
P-PF-02-01	I-PF-02-01	I-PF-02	18 inch	141	0.002		150	$21,150	3
P-PF-02	I-PF-02	I-PF-01	18 inch	201	0.006		150	$30,150	3
P-PF-02-01	I-PF-02-01	I-PF-02	18 inch	141	0.002		150	$21,150	3
P-PF-02	I-PF-02	I-PF-01	18 inch	201	0.006		150	$30,150	3
System PA								$175,700	
System PB								$ 90,815	
System PD								$152,380	
System PE								$145,690	
System PF								$ 51,300	
Priority 1a								$	
Priority 1b								$	
Priority 1c								$	
Priority 2								$	
Priority 3								$615,885	

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-SM1

Proposed Storm Drain Line Replacement and Priority, System SMB

Pipe #	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	CMP?	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
to San Mateo Storm Drain System Mean Annual Precipitation = 24"									
P-SMB-01	I-SMB-01	O-SMB	24 inch	216	0.005		170	$36,720	3

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-Regional

Proposed Storm Drain Line Replacement and Priority, Systems EB, EC, ED, EF, EG, EL & EM with Reigional Facilities

Pipe # (1)	Upstream Node	Downstream Node	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	# Sections	**Unit Cost ($)**	Total Construction **($)**	Priority 1,2,3
P-R07-04	I-ED-08-03	I-R07-03	36 inch	130	0.001	1	255	$ 33,150	1
P-R07-03	I-R07-03	I-R07-02	36 inch	461	0.003	1	255	$117,555	1
P-R07-02	I-R07-02	I-R07-01	36 inch	145	0.003	1	255	$ 36,975	1
P-R07-01	I-R07-01	I-R07	36 inch	125	0.039	1	255	$ 31,875	1
P-R17	J-R17	I-R16	48 inch	660	0.002	1	350	$231,000	1
P-R16	I-R16	I-R15	60 inch	725	0.000	1	430	$311,750	1
P-R15	I-R15	I-R14	72 inch	305	0.000	1	500	$152,500	1
P-R14	I-R14	I-R13	72 inch	499	0.000	1	500	$249,500	1
P-R13	I-R13	I-R12	72 inch	172	0.000	1	500	$ 86,000	1
P-R12	I-R12	I-R11	72 inch	119	0.000	1	500	$ 59,500	1
P-R10	J-R-10	I-R09	84 inch	414	0.000	1	500	$207,000	1
P-R09	I-R09	I-R08	84 inch	54	0.001	1	500	$ 27,000	1
P-R08	I-R08	I-R07	84 inch	531	0.000	1	500	$265,500	1
P-R07	I-R07	I-R-06	84 inch	146	0.000	1	500	$ 73,000	1
P-R06	I-R-06	I-R05	84 inch	336	0.000	1	500	$168,000	1
P-R05	I-R05	I-R04	84 inch	53	0.001	1	500	$ 26,500	1
P-R04	I-R04	I-R03	84 inch	52	0.004	1	500	$ 26,000	1
P-R03	I-R03	I-R02	84 inch	180	0.001	1	500	$ 90,000	1
P-R02	I-R02	I-R01	84 inch	181	0.005	1	500	$ 90,500	1
P-R01	I-R01	O-R	48 inch	205	0.002	1	350	$ 71,750	1
P-EA-07-03	I-EA-07-03	J-R17	24 inch	231	0.014	1	170	$ 39,270	1
P-EA-07-02-03	I-EA-07-02-03	J-R17	18 inch	58	0.054	1	150	$ 8,700	1
P-EA-07-02-02	I-EA-07-02-02	J-R17	18 inch	30	0.094	1	150	$ 4,500	1
P-EA-07-02-01	I-EA-07-02-01	J-R17	18 inch	12	0.252	1	150	$ 1,800	1
P-EC-05-02	I-EC-05-02	I-R14	18 inch	40	0.114	1	150	$ 6,000	1
P-EC-03-04W	I-EC-03-04W	I-R16	24 inch	80	0.046	1	170	$ 13,600	1
P-EC-03-02W	J-EC-03-02W	I-EC-03-01W	24 inch	354	0.000	1	170	$ 60,180	1
P-EC-03-01W	I-EC-03-01W	J-EC-03	24 inch	377	0.000	1	170	$ 64,090	1
P-EC-03-01E	I-EC-03-01E	J-EC-03	18 inch	344	0.007	1	150	$ 51,600	1
P-EC-02-01	J-EC-02-01	J-EC-02	18 inch	390	0.007	1	150	$ 58,500	1
P-EC-01-01	I-EC-01-01	J-EC-01	24 inch	148	0.018	1	170	$ 25,160	1
P-EC-09	I-EC-09	I-EC-08	24 inch	562	0.041	1	170	$ 95,540	1
P-EC-08	I-EC-08	J-EC-07	36 inch	130	0.017	1	255	$ 33,150	1
P-EC-07	J-EC-07	I-EC-06	48 inch	219	0.006	1	350	$ 76,650	1
P-EC-06	I-EC-06	J-EC-05	48 inch	240	0.002	1	350	$ 84,000	1
P-EC-05	J-EC-05	I-R15	48 inch	63	0.024	1	350	$ 22,050	1
P-ED-08-09	I-ED-08-09	J-ED-08-08	24 inch	657	0.013	1	170	$111,690	1
P-ED-08-08	J-ED-08-08	J-ED-08-07	24 inch	327	0.019	1	170	$ 55,590	1
P-ED-08-07	J-ED-08-07	I-ED-08-06	24 inch	211	0.009	1	170	$ 35,870	1
P-ED-08-06	I-ED-08-06	I-ED-08-05	24 inch	213	0.015	1	170	$ 36,210	1
P-ED-08-05	I-ED-08-05	I-ED-08-04	30 inch	81	0.007	1	225	$ 18,225	1
P-ED-08-04	I-ED-08-04	I-ED-08-03	30 inch	272	0.004	1	225	$ 61,200	1
P-ED-08-01	I-ED-08-01	I-R11	21 inch	308	0.020	1	160	$ 49,280	1
P-ED-17	I-ED-17	I-ED-16	24 inch	28	0.043	1	170	$ 4,760	1
P-ED-16	I-ED-16	I-ED-15	24 inch	164	0.098	1	170	$ 27,880	1
P-ED-15	I-ED-15	I-ED-14	24 inch	100	0.070	1	170	$ 17,000	1
P-ED-14	I-ED-14	I-ED-13	24 inch	48	0.021	1	170	$ 8,160	1
P-ED-10	J-ED-10	I-R12	30 inch	117	0.055	1	225	$ 26,325	1
P-EL-02	I-EL-02	I-EL-01	4 x 3 ft	97	0.003	2	350	$ 67,900	1
P-EL-01	I-EL-01	O-EL	48 inch	110	0.002	2	350	$ 77,000	1
System EA								$ 54,270	
System EC								$590,520	
System ED								$452,190	
System EL									
System Regional								$2,355,055	
Priority 1								$2,954,835	

Note: Initial estimates of Jack and Bore for parallel highway 101 outfall is $650,000 and other charges such as survey, geotechnical, structural, environmental review, and site constraints is $250,000. The total estimate of new parallel Highway 101 system is $900,000 plus pipe costs.

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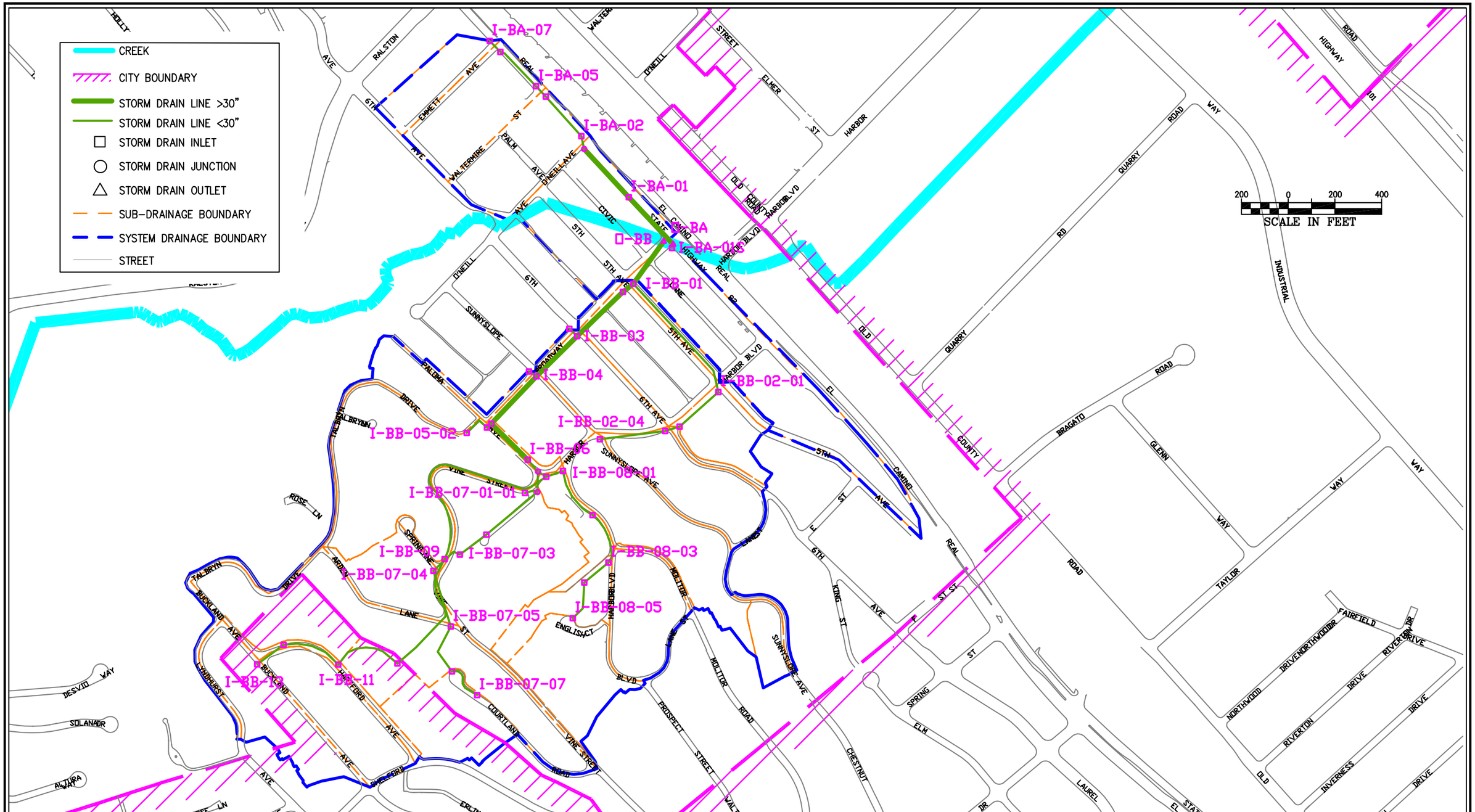

SEE FOLLOWING
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BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B1a

Existing Hydrology, 10-Year Event, Systems BA & BB

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 22"														
El Camino Real														
I-BA-07	36.70	33.70	36.70	36.70	1.90		0.80	1.52	1.90	1.5	10.0	10.0	2.12	3.3
I-BA-06	36.70	32.70	36.74	36.70	0.00		0.00	0.00	1.90	1.5	10.0	10.4	2.08	3.2
I-BA-05	36.70	32.20	36.80	36.70	3.74		0.80	2.99	5.64	4.5	10.0	12.4	1.91	8.7
I-BA-04	36.70	31.70	36.80	36.70	0.00		0.00	0.00	5.64	4.5	10.0	12.6	1.89	8.6
I-BA-02	35.70	31.20	36.34	35.70	3.75		0.50	1.87	9.39	6.4	10.0	13.4	1.84	11.8
I-BA-01S	32.50	29.50	31.88	31.88	7.34		0.50	3.67	16.73	3.7	10.0	10.0	2.12	7.9
I-BA-01	35.40	27.40	35.74	35.40	5.49		0.50	2.75	22.22	9.1	10.0	14.2	1.78	16.4
O-BA	33.00	27.00	31.10	31.10	0.00		0.00	0.00	22.22	12.8	0.0	14.7	1.75	22.6
Vine Street														
I-BB-08-05	184.00	180.00	180.85	180.85	3.71		0.50	1.85	3.71	1.85	10.00	10.00	2.12	3.97
I-BB-08-04	161.30	157.30	158.44	158.14	0.00		0.00	0.00	3.71	1.85	10.00	10.20	2.10	3.93
I-BB-08-03	166.00	152.00	153.30	152.95	1.82		0.50	0.91	5.53	2.77	10.00	10.44	2.08	5.79
I-BB-08-02	146.20	140.70	141.90	141.65	0.00		0.00	0.00	5.53	2.77	10.00	10.79	2.04	5.70
I-BB-08-01	126.70	121.20	122.83	122.14	0.00		0.00	0.00	5.53	2.77	10.00	11.08	2.02	5.62
I-BB-07-01-01	125.00	121.00	125.00	125.00	7.38		0.80	5.90	7.38	5.90	10.00	10.00	2.12	12.64
I-BB-07-07	332.00	328.00	328.80	328.80	3.29		0.50	1.65	3.29	1.65	10.00	10.00	2.12	3.52
I-BB-07-06	325.10	322.60	323.67	323.40	0.00		0.00	0.00	3.29	1.65	10.00	10.34	2.09	3.46
I-BB-07-05	271.80	266.30	274.06	268.58	9.07		0.50	4.54	12.36	6.18	10.00	10.55	2.07	12.88
I-BB-07-04	235.90	230.90	243.88	234.55	2.55		0.50	1.27	14.91	7.46	10.00	10.81	2.04	15.35
I-BB-07-03	210.00	201.50	207.06	202.50	0.00		0.00	0.00	14.91	7.46	10.00	10.93	2.03	15.27
I-BB-07-02	160.00	156.00	162.54	160.00	0.00		0.00	0.00	14.91	7.46	10.00	11.02	2.02	15.21
J-BB-07-01	118.40	113.40	130.63	118.40	0.00	7.38	0.00	0.00	22.29	13.36	0.00	11.26	2.00	26.95
Paloma Avenue														
I-BB-05-02	131.00	128.00	129.07	129.07	8.37		0.50	4.18	8.37	4.18	10.00	10.00	2.12	8.96
I-BB-05-01	106.50	101.50	104.76	104.53	2.77		0.50	1.39	11.14	5.57	10.00	10.10	2.11	11.87
Sunnyslope														
I-BB-04-01	78.80	74.30	75.68	75.68	0.38		0.50	0.19	0.38	0.19	10.00	10.00	2.12	0.41
6th Avenue														
I-BB-03-01	63.00	59.00	60.00	60.00	0.12		0.50	0.06	0.12	0.06	10.00	10.00	2.12	0.13
5th Avenue														
I-BB-02-04	113.00	108.50	113.00	113.00	8.87		0.80	7.10	8.87	7.10	10.00	10.00	2.12	15.19
I-BB-02-03	84.60	80.60	90.70	84.60	4.94		0.50	2.47	13.81	9.57	10.00	10.24	2.10	20.24
I-BB-02-02	83.00	78.00	80.33	79.47	0.27		0.50	0.14	14.08	9.70	10.00	10.28	2.09	20.48
I-BB-02-01	58.70	53.20	55.52	54.90	2.28		0.50	1.14	16.36	10.84	10.00	10.46	2.08	22.69
Broadway														
I-BB-13	458.40	454.40	455.27	455.27	3.96		0.50	1.98	3.96	1.98	10.00	10.00	2.12	4.24
I-BB-12	441.00	437.00	438.55	438.23	0.18		0.50	0.09	4.14	2.07	10.00	10.16	2.11	4.40
I-BB-11	435.70	431.70	434.24	432.69	4.19		0.50	2.10	8.33	4.17	10.00	10.94	2.03	8.53
I-BB-10	405.00	401.00	402.95	402.17	1.12		0.50	0.56	9.45	4.73	10.00	11.26	2.00	9.53
I-BB-09	234.00	230.00	231.38	231.18	0.19		0.80	0.15	9.64	4.88	10.00	11.64	1.97	9.68
I-BB-08	116.00	111.00	118.31	116.00	1.35	5.53	0.50	0.68	16.52	8.32	10.00	12.50	1.90	15.93
J-BB-07	115.00	110.00	113.50	112.25	0.00	22.29	0.00	0.00	38.81	21.68	0.00	12.56	1.90	41.42
I-BB-06	110.00	102.00	110.76	110.00	0.13		0.50	0.07	38.94	21.74	10.00	12.64	1.89	41.40
I-BB-05	106.50	101.50	104.46	103.48	0.14	11.14	0.00	0.00	50.22	27.31	10.00	12.92	1.87	51.45
I-BB-04	78.80	73.30	75.68	75.28	2.18	0.38	0.50	1.09	52.78	28.59	10.00	13.11	1.86	53.47
I-BB-03	63.20	58.00	60.00	59.98	2.84	0.12	0.50	1.42	55.74	30.07	10.00	14.69	1.75	53.12
I-BB-02	46.70	37.70	40.04	39.96	4.02	16.36	0.50	2.01	76.12	32.08	10.00	14.89	1.74	56.28
I-BB-01	46.70	35.00	37.78	37.63	0.46		0.50	0.23	76.58	43.15	10.00	14.94	1.74	75.58
O-BB	33.00	29.00	31.10	31.10	0.00		0.00	0.00	76.58	43.15	0.00	15.16	1.73	75.05

(1) Nodes are presented in Figure D-BA-BB in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B1b

Existing Hydraulics, 10-Year Event, Systems BA & BB

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 22"																	
El Camino Real																	
P-BA-01S	I-BA-01S	O-BA	7.9	14.1	12 inch	16	0.156	0.013	29.5	27.0	32.5	33.0	31.2	30.4	**1.3**	2.0	10.0
P-BA-07	I-BA-07	I-BA-06	7.6	8.0	15 inch	65	0.015	0.013	33.7	32.7	36.7	36.7	37.6	36.7	**ABOVE RIM**	1.8	6.2
P-BA-06	I-BA-06	I-BA-05	7.5	5.1	18 inch	214	0.002	0.013	32.7	32.2	36.7	36.7	37.8	36.7	**ABOVE RIM**	2.5	4.3
P-BA-05	I-BA-05	I-BA-04	13.4	9.5	18 inch	61	0.008	0.013	32.2	31.7	36.7	36.7	37.7	36.7	**ABOVE RIM**	3.0	7.6
P-BA-04	I-BA-04	I-BA-02	13.3	4.9	18 inch	228	0.002	0.013	31.7	31.2	36.7	35.7	39.3	35.7	**ABOVE RIM**	3.5	7.5
P-BA-03	I-BA-02	J-BA-02	16.2	0.0	18 inch	56	0.000	0.013	31.2	31.2	35.7	35.7	37.0	35.7	**ABOVE RIM**	3.0	9.2
P-BA-02	J-BA-02	I-BA-01	16.1	12.2	18 inch	281	0.014	0.013	31.2	27.4	35.7	35.4	42.0	35.4	**ABOVE RIM**	3.0	9.1
P-BA-01	I-BA-01	O-BA	21.1	4.0	18 inch	278	0.001	0.013	27.4	27.0	35.4	33.0	41.6	30.4	**ABOVE RIM**	6.5	11.9
Vine Street																	
P-BB-08-05	I-BB-08-05	I-BB-08-04	4.0	13.0	12 inch	171	0.133	0.013	180.0	157.3	184.0	161.3	180.9	158.4	**3.2**	3.0	14.5
P-BB-08-04	I-BB-08-04	I-BB-08-03	3.9	7.1	12 inch	134	0.040	0.013	157.3	152.0	161.3	166.0	158.1	153.3	**3.2**	3.0	9.3
P-BB-08-03	I-BB-08-03	I-BB-08-02	5.8	7.9	12 inch	232	0.049	0.013	152.0	140.7	166.0	146.2	153.0	141.9	**13.1**	13.0	11.0
P-BB-08-02	I-BB-08-02	I-BB-08-01	5.7	10.2	12 inch	236	0.083	0.013	140.7	121.2	146.2	126.7	141.7	122.8	**4.5**	4.5	13.4
P-BB-08-01	I-BB-08-01	I-BB-08	5.6	13.1	12 inch	76	0.134	0.013	121.2	111.0	126.7	116.0	122.1	116.0	**4.6**	4.5	16.0
P-BB-07-01-01	I-BB-07-01-01	J-BB-07-01	12.6	13.1	12 inch	56	0.136	0.013	121.0	113.4	125.0	118.4	125.5	118.4	**ABOVE RIM**	3.0	16.1
P-BB-07-07	I-BB-07-07	I-BB-07-06	3.5	6.4	12 inch	169	0.032	0.013	328.0	322.6	332.0	325.1	328.8	323.7	**3.2**	3.0	8.3
P-BB-07-06	I-BB-07-06	I-BB-07-05	3.5	17.8	12 inch	225	0.250	0.013	322.6	266.3	325.1	271.8	323.4	271.8	**1.7**	1.5	17.6
P-BB-07-05	I-BB-07-05	I-BB-07-04	12.9	13.4	12 inch	250	0.142	0.013	266.3	230.9	271.8	235.9	268.6	235.9	**3.2**	4.5	16.4
P-BB-07-04	I-BB-07-04	I-BB-07-03	15.4	15.9	12 inch	148	0.199	0.013	230.9	201.5	235.9	210.0	234.6	207.1	**1.3**	4.0	19.6
P-BB-07-03	I-BB-07-03	I-BB-07-02	15.3	20.2	12 inch	142	0.320	0.013	201.5	156.0	210.0	160.0	202.5	160.0	**7.5**	7.5	28.2
P-BB-07-02	I-BB-07-02	J-BB-07-01	15.2	13.8	12 inch	285	0.149	0.013	156.0	113.4	160.0	118.4	170.3	118.4	**ABOVE RIM**	3.0	19.4
P-BB-07-01	J-BB-07-01	J-BB-07	27.0	7.0	12 inch	87	0.039	0.013	113.4	110.0	118.4	115.0	163.6	113.8	**ABOVE RIM**	4.0	34.3
Paloma Avenue																	
P-BB-05-02	I-BB-05-02	I-BB-05-01	5.8	105.9	24 inch	121	0.219	0.013	128.0	101.5	131.0	106.5	128.9	104.7	**2.2**	1.0	18.1
P-BB-05-01	I-BB-05-01	I-BB-05	11.1	0.0	24 inch	25	0.000	0.013	101.5	101.5	106.5	106.5	104.5	104.4	**2.0**	3.0	3.5
Sunnyslope																	
P-BB-04-01	I-BB-04-01	I-BB-04	0.4	36.7	24 inch	38	0.026	0.013	74.3	73.3	78.8	78.8	75.7	75.7	**3.1**	2.5	3.9
6th Avenue																	
P-BB-03-01	I-BB-03-01	I-BB-03	0.1	5.3	12 inch	46	0.022	0.013	59.0	58.0	63.0	63.2	60.0	60.0	**3.0**	3.0	2.8
5th Avenue																	
P-BB-02-04	I-BB-02-04	I-BB-02-03	15.2	14.6	12 inch	281	0.099	0.010	108.5	80.6	113.0	84.6	114.8	84.6	**ABOVE RIM**	3.5	19.3
P-BB-02-03	I-BB-02-03	I-BB-02-02	24.1	7.1	12 inch	65	0.040	0.013	80.6	78.0	84.6	83.0	110.4	80.7	**ABOVE RIM**	3.0	30.7
P-BB-02-02	I-BB-02-02	I-BB-02-01	24.3	35.0	18 inch	223	0.111	0.013	78.0	53.2	83.0	58.7	79.5	55.8	**3.5**	3.5	21.4
P-BB-02-01	I-BB-02-01	I-BB-01	26.5	51.3	24 inch	599	0.030	0.010	53.2	35.0	58.7	46.7	55.0	37.9	**3.7**	3.5	16.5
Broadway																	
P-BB-13	I-BB-13	I-BB-12	4.2	12.6	12 inch	140	0.124	0.013	454.4	437.0	458.4	441.0	455.3	438.6	**3.1**	3.0	14.4
P-BB-12	I-BB-12	I-BB-11	4.4	5.1	12 inch	262	0.020	0.013	437.0	431.7	441.0	435.7	438.2	434.2	**2.8**	3.0	5.6
P-BB-11	I-BB-11	I-BB-10	8.5	11.3	12 inch	304	0.101	0.013	431.7	401.0	435.7	405.0	432.7	403.0	**3.0**	3.0	15.8
P-BB-10	I-BB-10	I-BB-09	9.5	35.9	15 inch	554	0.309	0.013	401.0	230.0	405.0	234.0	402.2	231.4	**2.8**	2.8	24.7
P-BB-09	I-BB-09	I-BB-08	9.7	23.1	15 inch	934	0.127	0.013	230.0	111.0	234.0	116.0	231.2	116.0	**2.8**	2.8	18.0
P-BB-08	I-BB-08	J-BB-07	15.9	10.0	15 inch	42	0.024	0.013	111.0	110.0	116.0	115.0	116.1	113.5	**ABOVE RIM**	3.8	13.0
P-BB-07	J-BB-07	I-BB-06	41.4	78.2	24 inch	67	0.119	0.013	110.0	102.0	115.0	110.0	112.3	110.0	**2.8**	3.0	13.2
P-BB-06	I-BB-06	I-BB-05	41.4	10.8	24 inch	220	0.002	0.013	102.0	101.5	110.0	106.5	113.1	105.7	**ABOVE RIM**	6.0	13.2
P-BB-05	I-BB-05	I-BB-04	50.8	71.8	24 inch	280	0.101	0.013	101.5	73.3	106.5	78.8	103.5	76.4	**3.0**	3.0	24.8
P-BB-04	I-BB-04	I-BB-03	52.8	56.7	24 inch	244	0.063	0.013	73.3	58.0	78.8	63.2	75.3	60.7	**3.5**	3.5	20.5
P-BB-03	I-BB-03	I-BB-02	55.2	61.7	24 inch	273	0.074	0.013	58.0	37.7	63.2	46.7	60.0	40.0	**3.2**	3.2	22.1
P-BB-02	I-BB-02	I-BB-01	58.4	312.6	48 inch	57	0.047	0.013	37.7	35.0	46.7	46.7	39.9	38.0	**6.8**	5.0	18.8
P-BB-01	I-BB-01	O-BB	82.0	254.7	48 inch	224	0.027	0.012	35.0	29.0	46.7	33.0	37.7	30.6	**9.0**	7.7	17.8

(1) Pipes are presented in Figure 2 and Figure D-BA-BB in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B1c

Proposed Hydrology, 25-Year Event, Systems BA & BB

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 22"														
I-BA-07	36.70	32.70	34.35	34.35	1.90		0.88	1.67	1.90	1.7	10.0	10.0	2.54	**4.3**
I-BA-06	36.70	32.50	34.34	34.33	0.00		0.00	0.00	1.90	1.7	10.0	10.3	2.50	**4.2**
I-BA-05	36.70	32.20	34.27	34.25	3.74		0.88	3.29	5.64	5.0	10.0	11.5	2.37	**11.8**
I-BA-04	36.70	32.10	34.10	34.07	0.00		0.00	0.00	5.64	5.0	10.0	11.8	2.34	**11.7**
I-BA-02	35.70	31.30	33.61	33.42	3.75		0.55	2.06	9.39	7.0	10.0	12.6	2.27	**16.1**
I-BA-01S	32.50	29.50	32.50	32.50	7.34		0.55	4.04	16.73	4.0	10.0	10.0	2.54	**10.3**
I-BA-01	35.40	29.50	32.85	32.82	5.49		0.55	3.02	22.22	10.1	10.0	13.5	2.19	**22.2**
O-BA	33.00	29.00	32.20	32.20	0.00		0.00	0.00	22.22	14.1	0.0	14.5	2.11	**29.9**
I-BB-08-05	184.00	180.00	180.93	180.93	3.71		0.55	2.04	3.71	2.04	10.00	10.00	2.54	**5.22**
I-BB-08-04	161.30	157.30	158.69	158.23	0.00		0.00	0.00	3.71	2.04	10.00	10.18	2.52	**5.18**
I-BB-08-03	166.00	152.00	153.67	152.98	1.82		0.55	1.00	5.53	3.04	10.00	10.41	2.49	**7.63**
I-BB-08-02	146.20	140.70	142.12	141.68	0.00		0.00	0.00	5.53	3.04	10.00	10.75	2.45	**7.51**
I-BB-08-01	126.70	121.20	123.35	122.18	0.00		0.00	0.00	5.53	3.04	10.00	11.02	2.42	**7.42**
I-BB-07-01-01	125.00	121.00	122.47	122.47	7.38		0.88	6.49	7.38	6.49	10.00	10.00	2.54	**16.63**
I-BB-07-07	332.00	328.00	328.90	328.90	3.29		0.55	1.81	3.29	1.81	10.00	10.00	2.54	**4.63**
I-BB-07-06	325.10	322.60	323.90	323.49	0.00		0.00	0.00	3.29	1.81	10.00	10.32	2.50	**4.56**
I-BB-07-05	271.80	266.30	281.32	271.80	9.07		0.55	4.99	12.36	6.80	10.00	10.52	2.48	**16.97**
I-BB-07-04	235.90	230.90	252.18	235.90	2.55		0.55	1.40	14.91	8.20	10.00	10.71	2.45	**20.29**
I-BB-07-03	210.00	201.50	219.42	203.43	0.00		0.00	0.00	14.91	8.20	10.00	10.80	2.44	**20.20**
I-BB-07-02	160.00	156.00	157.78	157.47	0.00		0.00	0.00	14.91	8.20	10.00	10.90	2.43	**20.11**
J-BB-07-01	118.40	113.40	117.22	116.35	0.00	7.38	0.00	0.00	22.29	14.69	0.00	11.09	2.41	**35.72**
I-BB-05-02	130.00	127.00	128.23	128.23	8.37		0.55	4.60	8.37	4.60	10.00	10.00	2.54	**11.79**
I-BB-05-01	106.50	101.50	103.34	102.92	2.77		0.55	1.52	11.14	6.13	10.00	10.09	2.53	**15.62**
I-BB-04-01	78.30	74.30	75.87	75.87	0.38		0.55	0.21	0.38	0.21	10.00	10.00	2.54	**0.54**
I-BB-03-01	63.00	59.00	60.46	60.46	0.12		0.55	0.07	0.12	0.07	10.00	10.00	2.54	**0.17**
I-BB-02-04	113.00	108.50	109.97	109.97	8.87		0.88	7.81	8.87	7.81	10.00	10.00	2.54	**19.98**
I-BB-02-03	84.60	80.60	82.64	82.40	4.94		0.55	2.72	13.81	10.52	10.00	10.22	2.51	**26.64**
I-BB-02-02	83.00	78.00	80.26	79.81	0.27		0.55	0.15	14.08	10.67	10.00	10.30	2.50	**26.92**
I-BB-02-01	58.70	53.20	56.04	55.06	2.28		0.55	1.25	16.36	11.93	10.00	10.47	2.48	**29.84**
I-BB-13	458.40	454.40	455.34	455.34	3.96		0.55	2.18	3.96	2.18	10.00	10.00	2.54	**5.58**
I-BB-12	441.00	437.00	441.89	441.00	0.18		0.55	0.10	4.14	2.28	10.00	10.15	2.52	**5.79**
I-BB-11	435.70	431.70	439.71	434.24	4.19		0.55	2.30	8.33	4.58	10.00	10.74	2.45	**11.32**
I-BB-10	405.00	401.00	403.56	402.22	1.12		0.55	0.62	9.45	5.20	10.00	11.09	2.41	**12.63**
I-BB-09	234.00	230.00	231.57	231.22	0.19		0.88	0.17	9.64	5.36	10.00	11.44	2.37	**12.84**
I-BB-08	116.00	111.00	114.52	114.15	1.35	5.53	0.55	0.74	16.52	9.15	10.00	12.25	2.30	**21.17**
J-BB-07	115.00	110.00	113.78	111.99	0.00	22.29	0.00	0.00	38.81	23.84	0.00	12.35	2.29	**54.93**
I-BB-06	110.00	102.00	104.61	104.35	0.13		0.55	0.07	38.94	23.92	10.00	12.39	2.28	**55.00**
I-BB-05	106.50	96.00	99.05	98.44	0.00	11.14	0.00	0.00	50.08	30.04	10.00	12.62	2.26	**68.48**
I-BB-04	78.80	73.30	75.87	75.74	2.18	0.38	0.55	1.20	52.64	31.45	10.00	12.79	2.25	**71.19**
I-BB-03	63.20	58.00	60.46	60.45	2.84	0.12	0.55	1.56	55.60	33.08	10.00	13.56	2.18	**72.72**
I-BB-02	46.70	37.70	40.47	40.36	4.02	16.36	0.55	2.21	75.98	35.29	10.00	13.74	2.17	**77.08**
I-BB-01	46.70	36.00	39.30	39.08	0.46		0.55	0.25	76.44	47.47	10.00	13.79	2.16	**103.47**
O-BB	33.00	29.00	32.20	32.20	0.00		0.00	0.00	76.44	47.47	0.00	13.98	2.15	**102.79**

(1) Nodes are presented in Figure D-BA-BB in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B1d

Proposed Hydraulics, 25-Year Event, Systems BA & BB

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
Belmont Creek Drainage																		
Mean Annual Precipitation 22"																		
El Camino Real																		
P-BA-01S	I-BA-01S	O-BA	10.3	6.3	12 inch	16	0.031	0.013	29.5	29.0	32.5	33.0	33.6	32.2	**ABOVE RIM**	**2.0**	13.2	no change
P-BA-07	I-BA-07	I-BA-06	4.3	13.6	24 inch	65	0.003	0.012	32.7	32.5	36.7	36.7	34.4	34.3	**2.4**	**2.0**	3.8	upsized
P-BA-06	I-BA-06	I-BA-05	4.2	9.2	24 inch	214	0.001	0.012	32.5	32.2	36.7	36.7	34.3	34.3	**2.4**	**2.2**	2.9	upsized
P-BA-05	I-BA-05	I-BA-04	11.8	9.2	24 inch	61	0.002	0.013	32.2	32.1	36.7	36.7	34.3	34.1	**2.5**	**2.5**	3.6	upsized
P-BA-04	I-BA-04	I-BA-02	11.7	14.5	24 inch	228	0.004	0.012	32.1	31.3	36.7	35.7	34.1	33.6	**2.6**	**2.6**	5.1	upsized
P-BA-03	I-BA-02	J-BA-02	16.1	9.6	24 inch	56	0.002	0.013	31.3	31.2	35.7	35.7	33.4	33.2	**2.3**	**2.4**	4.8	upsized
P-BA-02	J-BA-02	I-BA-01	15.9	34.6	30 inch	281	0.006	0.012	31.2	29.5	35.7	35.4	33.1	32.9	**2.6**	**2.0**	6.8	upsized
P-BA-01	I-BA-01	O-BA	22.2	18.8	30 inch	278	0.002	0.012	29.5	29.0	35.4	33.0	32.8	32.2	**2.6**	**3.4**	4.3	upsized
Vine Street																		
P-BB-08-05	I-BB-08-05	I-BB-08-04	5.2	13.0	12 inch	171	0.133	0.013	180.0	157.3	184.0	161.3	180.9	158.7	**3.1**	**3.0**	15.6	no change
P-BB-08-04	I-BB-08-04	I-BB-08-03	5.2	7.1	12 inch	134	0.040	0.013	157.3	152.0	161.3	166.0	158.2	153.7	**3.1**	**3.0**	9.9	no change
P-BB-08-03	I-BB-08-03	I-BB-08-02	7.6	7.9	12 inch	232	0.049	0.013	152.0	140.7	166.0	146.2	153.0	142.1	**13.0**	**13.0**	11.4	no change
P-BB-08-02	I-BB-08-02	I-BB-08-01	7.5	10.2	12 inch	236	0.083	0.013	140.7	121.2	146.2	126.7	141.7	123.4	**4.5**	**4.5**	14.3	no change
P-BB-08-01	I-BB-08-01	I-BB-08	7.4	13.1	12 inch	76	0.134	0.013	121.2	111.0	126.7	116.0	122.2	114.5	**4.5**	**4.5**	17.2	no change
P-BB-07-01-01	I-BB-07-01-01	J-BB-07-01	16.6	83.3	24 inch	56	0.136	0.013	121.0	113.4	125.0	118.4	122.5	117.2	**2.5**	**2.0**	20.7	upsized
P-BB-07-07	I-BB-07-07	I-BB-07-06	4.6	6.4	12 inch	169	0.032	0.013	328.0	322.6	332.0	325.1	328.9	323.9	**3.1**	**3.0**	8.8	no change
P-BB-07-06	I-BB-07-06	I-BB-07-05	4.6	17.8	12 inch	225	0.250	0.013	322.6	266.3	325.1	271.8	323.5	271.8	**1.6**	**1.5**	19.0	no change
P-BB-07-05	I-BB-07-05	I-BB-07-04	17.0	13.4	12 inch	250	0.142	0.013	266.3	230.9	271.8	235.9	292.6	235.9	**ABOVE RIM**	**4.5**	21.6	no change
P-BB-07-04	I-BB-07-04	I-BB-07-03	20.3	15.9	12 inch	148	0.199	0.013	230.9	201.5	235.9	210.0	258.0	210.0	**ABOVE RIM**	**4.0**	25.8	no change
P-BB-07-03	I-BB-07-03	I-BB-07-02	20.2	20.2	12 inch	142	0.320	0.013	201.5	156.0	210.0	160.0	203.4	157.8	**6.6**	**7.5**	25.7	no change
P-BB-07-02	I-BB-07-02	J-BB-07-01	20.1	44.0	18 inch	285	0.149	0.012	156.0	113.4	160.0	118.4	157.5	117.6	**2.5**	**2.5**	24.3	upsized
P-BB-07-01	J-BB-07-01	J-BB-07	35.7	44.7	24 inch	87	0.039	0.013	113.4	110.0	118.4	115.0	116.4	114.2	**2.1**	**3.0**	11.4	upsized
Paloma Avenue																		
P-BB-05-02	I-BB-05-02	I-BB-05-01	11.8	103.9	24 inch	121	0.211	0.013	127.0	101.5	130.0	106.5	128.2	103.3	**1.8**	**1.0**	21.9	no change
P-BB-05-01	I-BB-05-01	I-BB-05	15.6	106.1	24 inch	25	0.220	0.013	101.5	96.0	106.5	106.5	102.9	99.1	**3.6**	**3.0**	24.2	no change
Sunnyslope																		
P-BB-04-01	I-BB-04-01	I-BB-04	0.5	36.7	24 inch	38	0.026	0.013	74.3	73.3	78.3	78.8	75.9	75.9	**2.4**	**2.0**	4.2	no change
6th Avenue																		
P-BB-03-01	I-BB-03-01	I-BB-03	0.2	5.3	12 inch	46	0.022	0.013	59.0	58.0	63.0	63.2	60.5	60.5	**2.5**	**3.0**	0.2	no change
5th Avenue																		
P-BB-02-04	I-BB-02-04	I-BB-02-03	20.0	35.9	18 inch	281	0.099	0.012	108.5	80.6	113.0	84.6	110.0	82.6	**3.0**	**3.0**	20.8	upsized
P-BB-02-03	I-BB-02-03	I-BB-02-02	26.6	45.2	24 inch	65	0.040	0.013	80.6	78.0	84.6	83.0	82.4	80.3	**2.2**	**2.0**	15.0	upsized
P-BB-02-02	I-BB-02-02	I-BB-02-01	26.9	75.4	24 inch	223	0.111	0.013	78.0	53.2	83.0	58.7	79.8	56.0	**3.2**	**3.0**	22.0	upsized
P-BB-02-01	I-BB-02-01	I-BB-01	29.8	49.8	24 inch	599	0.029	0.010	53.2	36.0	58.7	46.7	55.1	39.3	**3.6**	**3.5**	16.6	no change
Broadway																		
P-BB-13	I-BB-13	I-BB-12	5.6	12.6	12 inch	140	0.124	0.013	454.4	437.0	458.4	441.0	455.3	441.0	**3.1**	**3.0**	15.5	no change
P-BB-12	I-BB-12	I-BB-11	5.8	5.1	12 inch	262	0.020	0.013	437.0	431.7	441.0	435.7	442.6	435.7	**ABOVE RIM**	**3.0**	7.4	no change
P-BB-11	I-BB-11	I-BB-10	11.3	11.3	12 inch	304	0.101	0.013	431.7	401.0	435.7	405.0	434.2	403.6	**1.5**	**3.0**	14.4	no change
P-BB-10	I-BB-10	I-BB-09	12.6	35.9	15 inch	554	0.309	0.013	401.0	230.0	405.0	234.0	402.2	231.6	**2.8**	**2.8**	26.7	no change
P-BB-09	I-BB-09	I-BB-08	12.8	23.1	15 inch	934	0.127	0.013	230.0	111.0	234.0	116.0	231.2	114.6	**2.8**	**2.8**	19.3	no change
P-BB-08	I-BB-08	J-BB-07	21.2	34.9	24 inch	42	0.024	0.013	111.0	110.0	116.0	115.0	114.2	113.8	**1.8**	**3.0**	6.7	upsized
P-BB-07	J-BB-07	I-BB-06	54.9	78.2	24 inch	67	0.119	0.013	110.0	102.0	115.0	110.0	112.0	104.6	**3.0**	**3.0**	26.9	no change
P-BB-06	I-BB-06	I-BB-05	55.0	73.4	30 inch	220	0.027	0.012	102.0	96.0	110.0	106.5	104.4	100.0	**5.7**	**5.5**	16.4	upsized
P-BB-05	I-BB-05	I-BB-04	68.5	126.5	30 inch	280	0.081	0.012	96.0	73.3	106.5	78.8	98.4	76.1	**8.1**	**8.0**	26.3	upsized
P-BB-04	I-BB-04	I-BB-03	71.2	111.3	30 inch	244	0.063	0.012	73.3	58.0	78.8	63.2	75.7	60.8	**3.1**	**3.0**	24.0	upsized
P-BB-03	I-BB-03	I-BB-02	72.7	121.2	30 inch	273	0.074	0.012	58.0	37.7	63.2	46.7	60.5	40.5	**2.8**	**2.7**	25.8	upsized
P-BB-02	I-BB-02	I-BB-01	77.1	248.1	48 inch	57	0.030	0.013	37.7	36.0	46.7	46.7	40.4	39.5	**6.3**	**5.0**	17.4	no change
P-BB-01	I-BB-01	O-BB	103.5	275.1	48 inch	224	0.031	0.012	36.0	29.0	46.7	33.0	39.1	32.2	**7.6**	**6.7**	20.3	no change

(1) Pipes are presented in Figure 2 and Figure D-BA-BB in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.

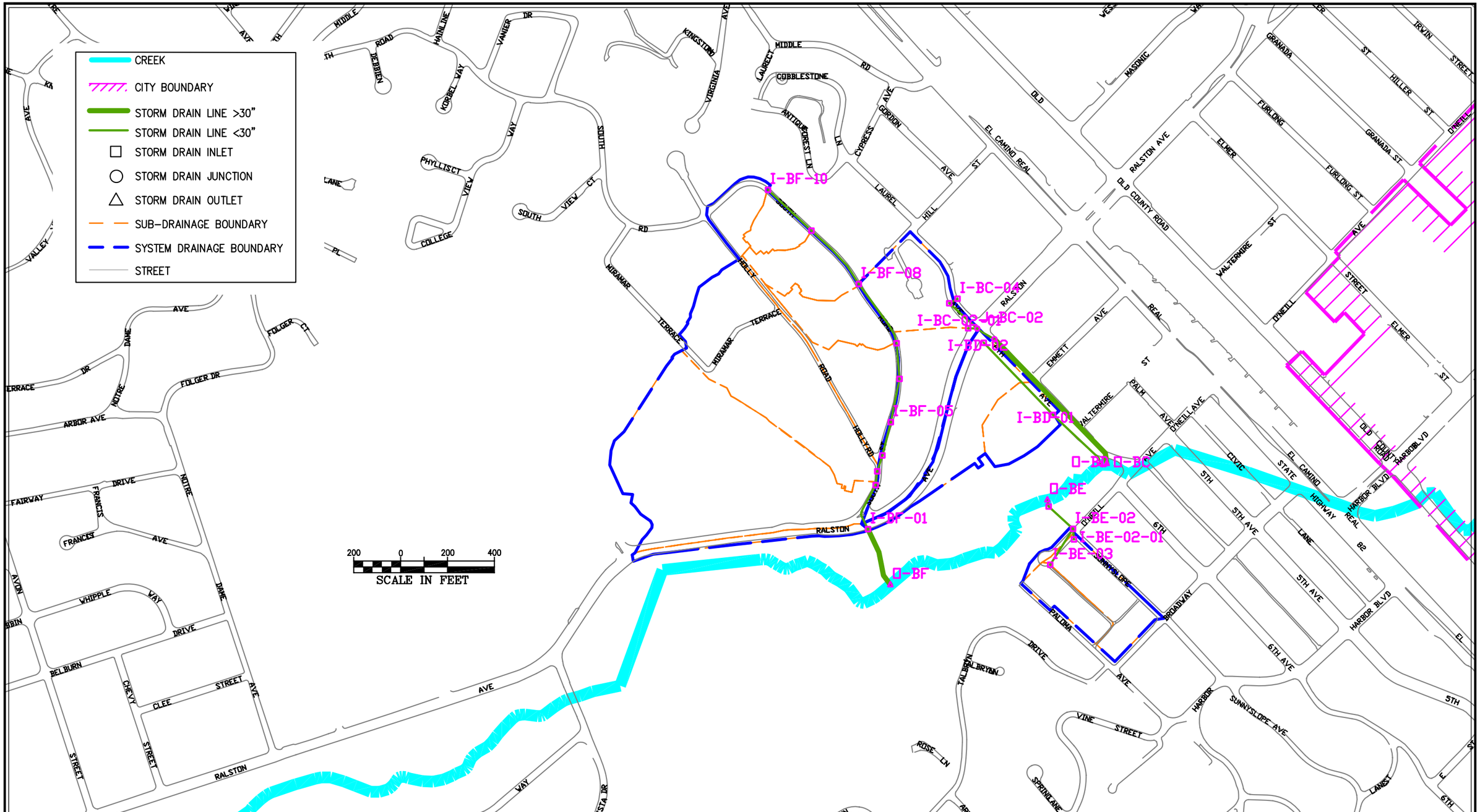

FIGURE D-BC-BF
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B2a

Existing Hydrology, 10-Year Event, Systems BC, BD, BE & BF

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 22"														
6th Avenue														
I-BC-02-01	46.00	42.00	43.07	43.07	4.20		0.80	3.36	4.20	3.4	10.0	10.0	2.12	**7.2**
I-BC-04	45.00	41.00	43.68	43.68	2.65		0.50	1.32	2.65	1.3	10.0	10.0	2.12	**2.8**
I-BC-03	44.60	40.60	43.43	43.14	0.00		0.50	0.00	2.65	1.3	10.0	10.2	2.10	**2.8**
J-BC-02	45.60	40.60	42.14	41.77	0.00	4.20	0.00	0.00	6.85	4.7	0.0	10.9	2.03	**9.6**
J-BC-01	45.60	38.60	39.69	39.63	0.00		0.00	0.00	6.85	4.7	0.0	11.1	2.02	**9.5**
O-BC	40.00	28.00	38.97	38.97	0.00		0.00	0.00	6.85	4.7	0.0	12.6	1.89	**8.9**
6th Avenue														
I-BD-02	46.00	41.00	41.77	41.77	3.11		0.50	1.55	3.11	1.6	10.0	10.0	2.12	**3.3**
I-BD-01	46.40	39.40	40.61	40.56	1.78		0.50	0.89	4.89	2.4	10.0	11.9	1.94	**4.8**
O-BD	40.00	28.00	38.97	38.97	0.00		0.00	0.00	4.89	2.4	0.0	12.4	1.90	**4.7**
Sunnyslope														
I-BE-02-01	56.00	52.00	52.66	52.66	2.22		0.50	1.11	2.22	1.1	10.0	10.0	2.12	**2.4**
I-BE-03	60.00	56.00	56.48	56.48	1.20		0.50	0.60	1.20	0.6	10.0	10.0	2.12	**1.3**
I-BE-02	55.50	51.50	52.43	52.33	0.20	2.22	0.50	0.10	3.62	1.8	10.0	10.5	2.07	**3.8**
I-BE-01	45.00	41.00	42.06	41.82	0.00		0.00	0.00	3.62	1.8	10.0	10.7	2.05	**3.7**
O-BE	40.00	30.00	39.00	39.00	0.00		0.00	0.00	3.62	1.8	0.0	10.8	2.05	**3.7**
South Street														
I-BF-10	205.00	201.00	201.44	201.44	1.15		0.50	0.57	1.15	0.6	10.0	10.0	2.12	**1.2**
I-BF-09	180.00	172.00	172.62	172.60	0.98		0.50	0.49	2.13	1.1	10.0	10.4	2.08	**2.2**
I-BF-08	155.00	146.00	146.87	146.82	1.84		0.50	0.92	3.97	2.0	10.0	10.9	2.04	**4.1**
I-BF-07	129.00	125.00	126.11	125.98	1.89		0.50	0.95	5.86	2.9	10.0	11.2	2.01	**5.9**
I-BF-06	122.00	118.00	119.13	118.98	0.00		0.00	0.00	5.86	2.9	10.0	11.4	1.99	**5.9**
I-BF-05	94.00	90.00	91.06	90.98	0.00		0.00	0.00	5.86	2.9	10.0	11.6	1.97	**5.8**
I-BF-04	90.00	86.00	87.28	87.13	2.64		0.50	1.32	8.50	4.3	10.0	11.8	1.96	**8.4**
I-BF-03	88.00	79.00	80.75	80.42	7.61		0.50	3.81	16.11	8.1	10.0	11.9	1.95	**15.8**
I-BF-02	80.00	75.00	76.63	76.43	0.00		0.00	0.00	16.11	8.1	10.0	11.9	1.95	**15.8**
I-BF-01	71.00	65.00	67.10	67.02	12.82		0.80	10.26	28.93	18.3	10.0	12.2	1.93	**35.5**
O-BF	50.00	40.00	48.80	48.80	0.00		0.00	0.00	28.93	18.3	0.0	12.4	1.91	**35.3**

(1) Nodes are presented in Figure D-BC-BF in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
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Table D-B2b

Existing Hydraulics, 10-Year Event, Systems BC, BD, BE & BF

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 22"																	
6th Avenue																	
P-BC-2-1	I-BC-02-01	J-BC-02	28.2	12.2	15 inch	39	0.036	0.013	42.0	40.6	46.0	45.6	53.0	45.6	**ABOVE RIM**	2.8	23.0
P-BC-04	I-BC-04	I-BC-03	2.8	3.6	12 inch	40	0.010	0.013	41.0	40.6	45.0	44.6	44.9	44.6	**0.1**	3.0	3.6
P-BC-03	I-BC-03	J-BC-02	2.8	0.0	12 inch	161	0.000	0.013	40.6	40.6	44.6	45.6	46.6	45.6	**ABOVE RIM**	3.0	3.6
P-BC-02	J-BC-02	J-BC-01	29.7	9.9	15 inch	86	0.023	0.013	40.6	38.6	45.6	45.6	61.3	43.2	**ABOVE RIM**	3.8	24.2
P-BC-01	J-BC-01	O-BC	29.6	49.7	30 inch	723	0.015	0.013	38.6	28.0	45.6	40.0	43.0	39.2	**2.6**	4.5	6.0
6th Avenue																	
P-BD-02	I-BD-02	I-BD-01	3.3	6.4	18 inch	427	0.004	0.013	41.0	39.4	46.0	46.4	41.8	41.1	**4.2**	3.5	3.7
P-BD-01	I-BD-01	O-BD	4.8	12.8	15 inch	292	0.039	0.013	39.4	28.0	46.4	40.0	41.0	39.4	**5.4**	5.8	3.9
Sunnyslope																	
P-BE-2-1	I-BE-02-01	I-BE-02	2.4	3.8	12 inch	45	0.011	0.013	52.0	51.5	56.0	55.5	52.7	52.5	**3.3**	3.0	5.1
P-BE-03	I-BE-03	I-BE-02	1.3	5.6	12 inch	181	0.025	0.013	56.0	51.5	60.0	55.5	56.5	52.4	**3.5**	3.0	5.8
P-BE-02	I-BE-02	I-BE-01	3.8	9.7	12 inch	141	0.074	0.013	51.5	41.0	55.5	45.0	52.3	42.1	**3.2**	3.0	11.6
P-BE-01	I-BE-01	O-BE	3.7	21.9	12 inch	29	0.379	0.013	41.0	30.0	45.0	40.0	41.8	39.7	**3.2**	3.0	20.9
South Street																	
P-BF-10	I-BF-10	I-BF-09	1.2	21.8	15 inch	254	0.114	0.013	201.0	172.0	205.0	180.0	201.4	172.6	**3.6**	2.8	9.6
P-BF-09	I-BF-09	I-BF-08	2.2	24.5	15 inch	306	0.085	0.010	172.0	146.0	180.0	155.0	172.6	147.0	**7.4**	6.8	12.4
P-BF-08	I-BF-08	I-BF-07	4.8	22.1	15 inch	302	0.070	0.010	146.0	125.0	155.0	129.0	146.9	126.2	**8.1**	7.8	14.4
P-BF-07	I-BF-07	I-BF-06	6.6	18.0	15 inch	153	0.046	0.010	125.0	118.0	129.0	122.0	126.0	119.2	**3.0**	2.8	13.5
P-BF-06	I-BF-06	I-BF-05	6.5	32.4	15 inch	188	0.149	0.010	118.0	90.0	122.0	94.0	119.0	91.1	**3.0**	2.8	20.7
P-BF-05	I-BF-05	I-BF-04	6.5	13.9	15 inch	147	0.027	0.010	90.0	86.0	94.0	90.0	91.0	87.3	**3.0**	2.8	11.1
P-BF-04	I-BF-04	I-BF-03	9.0	26.4	15 inch	71	0.099	0.010	86.0	79.0	90.0	88.0	87.2	80.8	**2.8**	2.8	19.5
P-BF-03	I-BF-03	I-BF-02	16.7	27.4	18 inch	59	0.068	0.013	79.0	75.0	88.0	80.0	80.4	76.7	**7.6**	7.5	16.2
P-BF-02	I-BF-02	I-BF-01	16.7	49.4	24 inch	210	0.048	0.013	75.0	65.0	80.0	71.0	76.5	65.8	**3.5**	3.0	14.2
P-BF-01	I-BF-01	O-BF	17.6	127.4	30 inch	259	0.097	0.013	65.0	40.0	71.0	50.0	66.4	48.8	**4.6**	3.5	18.2

(1) Pipes are presented in Figure 2 and Figure D-BC-BF in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B2c

Proposed Hydrology, 25-Year Event, Systems BC, BD, BE & BF

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 22"														
I-BC-02-01	46.00	42.00	46.00	46.00	4.02		0.88	3.54	4.02	3.5	10.0	10.0	2.54	**9.1**
I-BC-04	46.00	41.00	46.00	46.00	1.65		0.55	0.91	1.65	0.9	10.0	10.0	2.54	**2.3**
I-BC-03	46.00	39.80	46.56	46.00	1.00		0.55	0.55	2.65	1.5	10.0	10.2	2.51	**3.7**
J-BC-02	45.60	39.60	47.20	45.60	0.00	4.02	0.00	0.00	6.67	5.0	0.0	10.8	2.44	**12.3**
J-BC-01	45.60	38.60	43.38	43.34	0.00		0.00	0.00	6.67	5.0	0.0	10.9	2.43	**12.2**
O-BC	40.00	28.00	42.70	42.70	0.00		0.00	0.00	6.67	5.0	0.0	15.8	2.02	**10.2**
I-BD-02	46.00	41.00	46.00	46.00	4.11		0.55	2.26	4.11	2.3	10.0	10.0	2.54	**5.8**
I-BD-01	46.40	39.40	46.52	46.40	1.78		0.55	0.98	5.89	3.2	10.0	12.2	2.30	**7.5**
O-BD	40.00	28.00	42.70	42.70	0.00		0.00	0.00	5.89	3.2	0.0	13.0	2.23	**7.3**
I-BE-02-01	56.00	52.00	53.10	53.10	2.22		0.55	1.22	2.22	1.2	10.0	10.0	2.54	**3.1**
I-BE-03	60.00	56.00	56.55	56.55	1.20		0.55	0.66	1.20	0.7	10.0	10.0	2.54	**1.7**
I-BE-02	55.50	51.50	52.57	52.42	0.20	2.22	0.55	0.11	3.62	2.0	10.0	10.5	2.48	**5.0**
I-BE-01	45.00	41.00	43.85	43.26	0.00		0.00	0.00	3.62	2.0	10.0	10.7	2.46	**4.9**
O-BE	40.00	30.00	42.70	42.70	0.00		0.00	0.00	3.62	2.0	0.0	10.8	2.45	**4.9**
I-BF-10	205.00	201.00	201.50	201.50	1.15		0.55	0.63	1.15	0.6	10.0	10.0	2.54	**1.6**
I-BF-09	180.00	172.00	172.72	172.69	0.98		0.55	0.54	2.13	1.2	10.0	10.4	2.49	**2.9**
I-BF-08	155.00	146.00	147.02	146.94	1.84		0.55	1.01	3.97	2.2	10.0	10.8	2.45	**5.4**
I-BF-07	129.00	125.00	126.29	126.11	1.89		0.55	1.04	5.86	3.2	10.0	11.1	2.41	**7.8**
I-BF-06	122.00	118.00	119.33	119.10	0.00		0.00	0.00	5.86	3.2	10.0	11.3	2.39	**7.8**
I-BF-05	94.00	90.00	91.22	91.10	0.00		0.00	0.00	5.86	3.2	10.0	11.5	2.37	**7.7**
I-BF-04	90.00	86.00	87.45	87.20	2.64		0.55	1.45	8.50	4.7	10.0	11.7	2.35	**11.1**
I-BF-03	88.00	79.00	81.06	80.47	7.81		0.55	4.30	16.31	9.0	10.0	11.7	2.35	**21.2**
I-BF-02	80.00	75.00	76.94	76.65	0.00		0.00	0.00	16.31	9.0	10.0	11.8	2.34	**21.2**
I-BF-01	71.00	65.00	67.38	67.26	12.82		0.88	11.28	29.13	20.3	10.0	12.0	2.32	**47.3**
O-BF	50.00	40.00	50.40	50.40	0.00		0.00	0.00	29.13	20.3	0.0	12.2	2.30	**47.0**

(1) Nodes are presented in Figure D-BC-BF in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

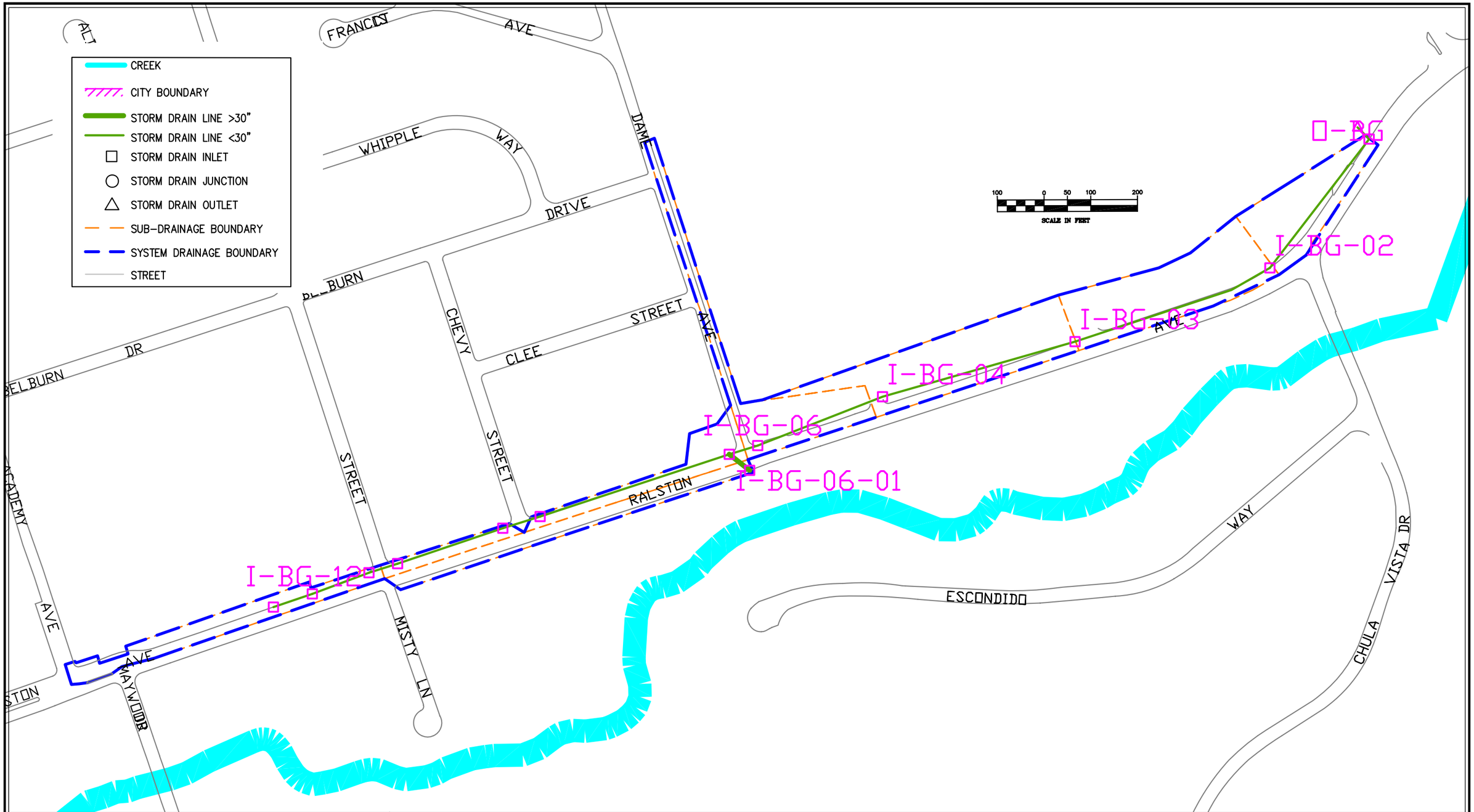
Table D-B2d

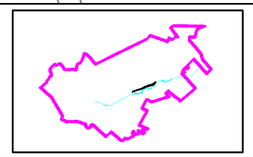
Proposed Hydraulics, 25-Year Event, Systems BC, BD, BE & BF

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 22"																		
6th Avenue																		
P-BC-02-01	I-BC-02-01	J-BC-02	9.1	16.0	15 inch	39	0.062	0.013	42.0	39.6	46.0	45.6	46.4	45.6	**ABOVE RIM**	2.8	7.4	no change
P-BC-04	I-BC-04	I-BC-03	2.3	6.2	12 inch	40	0.030	0.013	41.0	39.8	46.0	46.0	46.2	46.0	**ABOVE RIM**	4.0	3.0	no change
P-BC-03	I-BC-03	J-BC-02	3.7	1.3	12 inch	161	0.001	0.013	39.8	39.6	46.0	45.6	47.3	45.6	**ABOVE RIM**	5.2	4.7	no change
P-BC-02	J-BC-02	J-BC-01	12.3	7.0	15 inch	86	0.012	0.013	39.6	38.6	45.6	45.6	46.5	43.4	**ABOVE RIM**	4.8	10.0	no change
P-BC-01	J-BC-01	O-BC	12.2	49.7	30 inch	723	0.015	0.013	38.6	28.0	45.6	40.0	43.3	42.7	**2.3**	4.5	2.5	no change
6th Avenue																		
P-BD-02	I-BD-02	I-BD-01	5.8	6.4	18 inch	427	0.004	0.013	41.0	39.4	46.0	46.4	47.7	46.4	**ABOVE RIM**	3.5	3.3	no change
P-BD-01	I-BD-01	O-BD	7.5	12.8	15 inch	292	0.039	0.013	39.4	28.0	46.4	40.0	46.7	42.7	**ABOVE RIM**	5.8	6.1	no change
Sunnyslope																		
P-BE-2-1	I-BE-02-01	I-BE-02	3.1	3.8	12 inch	45	0.011	0.013	52.0	51.5	56.0	55.5	53.1	52.8	**2.9**	3.0	4.0	no change
P-BE-03	I-BE-03	I-BE-02	1.7	5.6	12 inch	181	0.025	0.013	56.0	51.5	60.0	55.5	56.6	52.6	**3.5**	3.0	6.3	no change
P-BE-02	I-BE-02	I-BE-01	5.0	9.7	12 inch	141	0.074	0.013	51.5	41.0	55.5	45.0	52.4	43.9	**3.1**	3.0	12.5	no change
P-BE-01	I-BE-01	O-BE	4.9	21.9	12 inch	29	0.379	0.013	41.0	30.0	45.0	40.0	43.3	42.7	**1.7**	3.0	6.3	no change
South Street																		
P-BF-10	I-BF-10	I-BF-09	1.6	21.8	15 inch	254	0.114	0.013	201.0	172.0	205.0	180.0	201.5	172.7	**3.5**	2.8	10.4	no change
P-BF-09	I-BF-09	I-BF-08	2.9	24.5	15 inch	306	0.085	0.010	172.0	146.0	180.0	155.0	172.7	147.0	**7.3**	6.8	13.5	no change
P-BF-08	I-BF-08	I-BF-07	5.4	22.1	15 inch	302	0.070	0.010	146.0	125.0	155.0	129.0	146.9	126.3	**8.1**	7.8	14.9	no change
P-BF-07	I-BF-07	I-BF-06	7.8	18.0	15 inch	153	0.046	0.010	125.0	118.0	129.0	122.0	126.1	119.3	**2.9**	2.8	14.1	no change
P-BF-06	I-BF-06	I-BF-05	7.8	32.4	15 inch	188	0.149	0.010	118.0	90.0	122.0	94.0	119.1	91.2	**2.9**	2.8	21.7	no change
P-BF-05	I-BF-05	I-BF-04	7.7	13.9	15 inch	147	0.027	0.010	90.0	86.0	94.0	90.0	91.1	87.5	**2.9**	2.8	11.6	no change
P-BF-04	I-BF-04	I-BF-03	11.1	26.4	15 inch	71	0.099	0.010	86.0	79.0	90.0	88.0	87.2	81.1	**2.8**	2.8	20.6	no change
P-BF-03	I-BF-03	I-BF-02	21.2	27.4	18 inch	59	0.068	0.013	79.0	75.0	88.0	80.0	80.5	76.9	**7.5**	7.5	17.1	no change
P-BF-02	I-BF-02	I-BF-01	21.2	49.4	24 inch	210	0.048	0.013	75.0	65.0	80.0	71.0	76.7	67.4	**3.3**	3.0	15.1	no change
P-BF-01	I-BF-01	O-BF	47.3	127.4	30 inch	259	0.097	0.013	65.0	40.0	71.0	50.0	67.3	50.4	**3.7**	3.5	24.0	no change

(1) Pipes are presented in Figure 2 and Figure D-BC-BF in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.

Note: BC and BD are parallel systems connected near Belmont Creek, Drainage Areas modified to balance HGLs





SEE FOLLOWING
TABLES D-B3A TO D-B3D

FIGURE D-BG
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B3a

Existing Hydrology, 10-Year Event, Systems BG

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Ralston Avenue near Notre Dame														
I-BG-06-01	107.7	103.7	104.54	104.54	0.59		0.5	0.3	0.59	0.3	10	10	2.21	**0.7**
Ralston Avenue near Notre Dame														
I-BG-10	122	117	117.37	117.37	0		0	0	0	0.53	10	10.79	2.13	**1.1**
I-BG-09	121	116	116.37	116.36	0		0	0	0	0.53	10	11.04	2.1	**1.1**
I-BG-08	117.1	112.1	112.5	112.49	0.2		0.5	0.1	0.2	0.63	10	11.93	2.02	**1.3**
I-BG-07	116	111	111.39	111.39	0		0	0	0.2	0.63	10	12.25	2	**1.3**
I-BG-06	108.8	103.5	104.53	104.49	0.51		0.5	0.26	0.71	1.18	10	13.76	1.88	**2.2**
I-BG-05	108	103.4	104.23	104.15	0.94		0.5	0.47	1.65	1.65	10	14.13	1.86	**3.1**
I-BG-04	104	99	99.82	99.74	0	0.59	0	0	2.24	1.65	10	14.92	1.81	**3.0**
I-BG-03	98	93	93.73	93.71	1.39		0.5	0.7	3.63	2.34	10	16.14	1.74	**4.1**
I-BG-02	89.5	84.5	85.36	85.29	1.28		0.5	0.64	4.91	2.98	10	17.23	1.68	**5.1**
I-BG-01	86	81	82.03	81.86	0.79		0.8	0.63	5.7	3.62	10	18.23	1.64	**6.0**
I-BF-10	205	201	201.45	201.45	1.15		0.5	0.57	6.85	0.57	10	10	2.21	**1.3**
I-BF-09	180	172	172.63	172.61	0.98		0.5	0.49	7.83	1.06	10	10.44	2.16	**2.3**
O-BG	82	78	80	80	0		0	0	7.83	3.62	0	18.27	1.63	**6.0**

(1) Nodes are presented in Figure D-BG in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B3b

Existing Hydraulics, 10-Year Event, Systems BG

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Ralston Avenue near Notre Dame																	
P-BG-06-01	I-BG-06-01	I-BG-06	0.7	39.9	36 inch	56	0.004	0.013	103.7	103.5	107.7	108.8	104.5	104.5	**3.2**	1.0	2.1
Ralston Avenue near Notre Dame																	
P-BG-12	I-BG-12	I-BG-11	1.2	24.1	24 inch	88	0.011	0.013	121.0	120.0	126.0	125.0	121.4	120.4	**4.6**	3.0	4.0
P-BG-11	I-BG-11	I-BG-10	1.2	34.5	24 inch	129	0.023	0.013	120.0	117.0	125.0	122.0	120.4	117.4	**4.6**	3.0	5.1
P-BG-10	I-BG-10	I-BG-09	1.1	28.3	24 inch	64	0.016	0.013	117.0	116.0	122.0	121.0	117.4	116.4	**4.6**	3.0	4.4
P-BG-09	I-BG-09	I-BG-08	1.1	29.0	24 inch	238	0.016	0.013	116.0	112.1	121.0	117.1	116.4	112.5	**4.6**	3.0	4.5
P-BG-08	I-BG-08	I-BG-07	1.3	25.9	24 inch	84	0.013	0.013	112.1	111.0	117.1	116.0	112.5	111.4	**4.6**	3.0	4.3
P-BG-07	I-BG-07	I-BG-06	1.3	30.0	24 inch	426	0.018	0.013	111.0	103.5	116.0	108.8	111.4	104.5	**4.6**	3.0	4.7
P-BG-06	I-BG-06	I-BG-05	2.2	1.4	12 inch	64	0.002	0.013	103.5	103.4	108.8	108.0	104.5	104.2	**4.3**	4.3	2.9
P-BG-05	I-BG-05	I-BG-04	3.1	4.4	12 inch	287	0.015	0.013	103.4	99.0	108.0	104.0	104.2	99.8	**3.8**	3.6	6.1
P-BG-04	I-BG-04	I-BG-03	3.0	4.2	12 inch	429	0.014	0.013	99.0	93.0	104.0	98.0	99.7	93.6	**4.3**	4.0	5.8
P-BG-03	I-BG-03	I-BG-02	4.1	31.2	24 inch	448	0.019	0.013	93.0	84.5	98.0	89.5	93.7	85.4	**4.3**	3.0	6.9
P-BG-02	I-BG-02	I-BG-01	5.1	22.7	24 inch	348	0.010	0.013	84.5	81.0	89.5	86.0	85.3	82.0	**4.2**	3.0	5.8
P-BG-01	I-BG-01	O-BG	6.0	66.2	24 inch	35	0.086	0.013	81.0	78.0	86.0	82.0	81.9	80.0	**4.1**	3.0	13.1

(1) Pipes are presented in Figure 2 and Figure D-BG in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B3c

Proposed Hydrology, 25-Year Event, System BG

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage Mean Annual Precipitation 24"														
I-BG-06-01	107.7	103.7	105.18	105.18	0.59		0.55	0.32	0.59	0.32	10	10	2.64	**0.9**
I-BG-12	126	121	121.43	121.43	0.66		0.88	0.58	0.66	0.58	10	10	2.64	**1.6**
I-BG-11	125	120	120.43	120.43	0		0	0	0.66	0.58	10	10.34	2.6	**1.5**
I-BG-10	122	117	117.43	117.42	0		0	0	0.66	0.58	10	10.73	2.55	**1.5**
I-BG-09	121	116	116.43	116.42	0		0	0	0.66	0.58	10	10.95	2.52	**1.5**
I-BG-08	117.1	112.1	112.56	112.55	0.2		0.55	0.11	0.86	0.69	10	11.77	2.43	**1.7**
I-BG-07	116	111	111.45	111.45	0		0	0	0.86	0.69	10	12.08	2.4	**1.7**
I-BG-06	108.8	103.5	105.15	104.98	0.51	0.59	0.55	0.28	1.96	1.3	10	13.46	2.28	**3.0**
I-BG-05	108	103.4	104.53	104.26	0.94		0.55	0.52	2.9	1.81	10	13.74	2.25	**4.1**
I-BG-04	104	99	100.08	99.85	0		0	0	2.9	1.81	10	14.49	2.2	**4.0**
I-BG-03	98	93	93.85	93.83	1.39		0.55	0.76	4.29	2.58	10	15.66	2.11	**5.5**
I-BG-02	89.5	84.5	85.51	85.42	1.28		0.55	0.7	5.57	3.28	10	16.66	2.05	**6.8**
I-BG-01	86	81	85.06	84.94	0.79		0.88	0.7	6.36	3.98	10	17.58	1.99	**8.0**
O-BG	86	78	84.9	84.9	0		0	0	6.36	3.98	0	17.81	1.98	**7.9**

(1) Nodes are presented in Figure D-BG in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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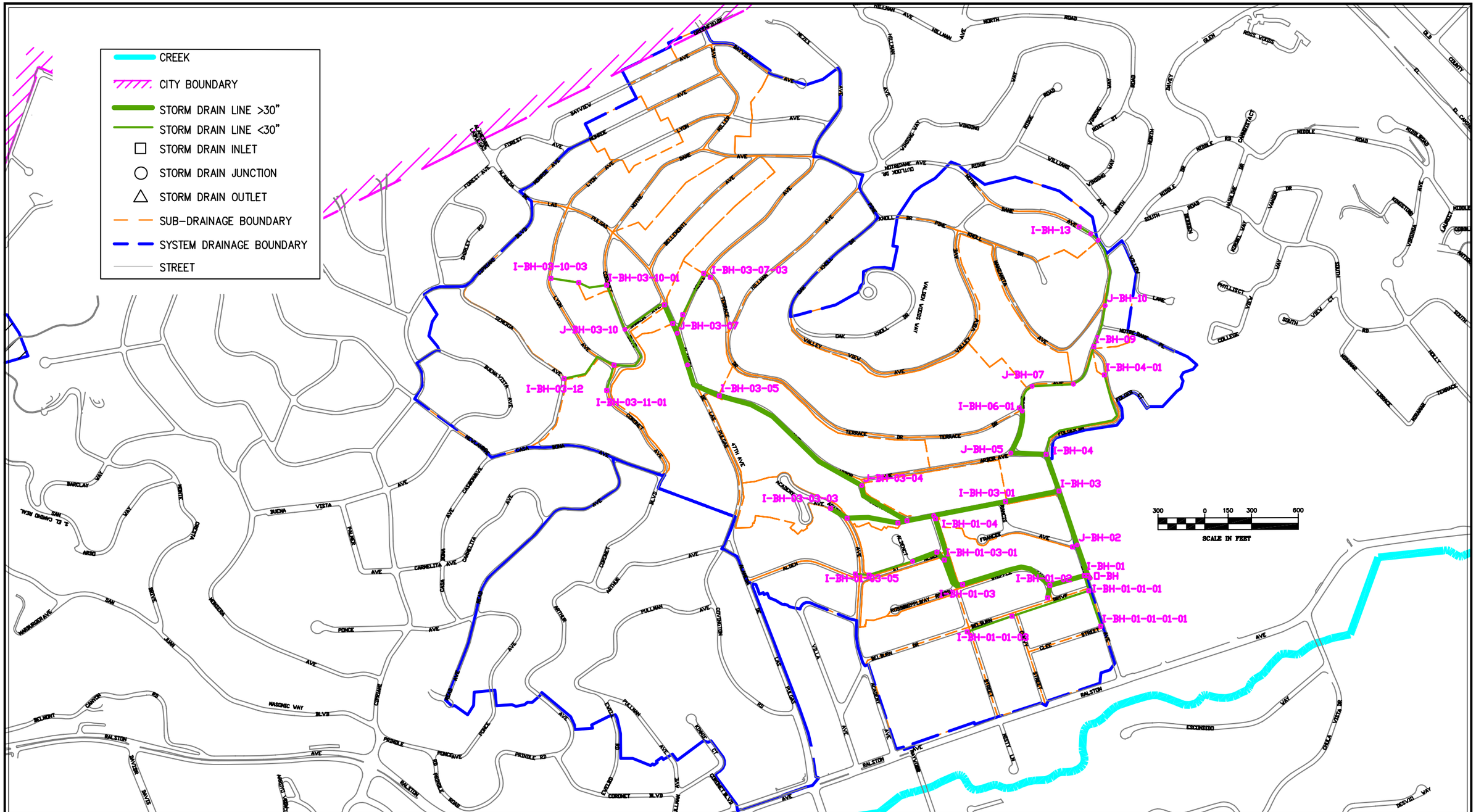
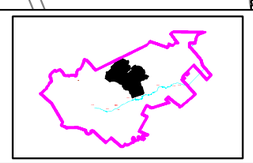
Table D-B3d

Proposed Hydraulics, 25-Year Event, System BG

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Ralston Avenue near Notre Dame																		
P-BG-06-01	I-BG-06-01	I-BG-06	0.9	39.9	36 inch	56	0.004	0.013	103.7	103.5	107.7	108.8	105.2	105.2	**2.5**	1.0	2.3	no change
Ralston Avenue near Notre Dame																		
P-BG-12	I-BG-12	I-BG-11	1.6	24.1	24 inch	88	0.011	0.013	121.0	120.0	126.0	125.0	121.4	120.4	**4.6**	3.0	4.3	no change
P-BG-11	I-BG-11	I-BG-10	1.5	34.5	24 inch	129	0.023	0.013	120.0	117.0	125.0	122.0	120.4	117.4	**4.6**	3.0	5.5	no change
P-BG-10	I-BG-10	I-BG-09	1.5	28.3	24 inch	64	0.016	0.013	117.0	116.0	122.0	121.0	117.4	116.4	**4.6**	3.0	4.8	no change
P-BG-09	I-BG-09	I-BG-08	1.5	29.0	24 inch	238	0.016	0.013	116.0	112.1	121.0	117.1	116.4	112.6	**4.6**	3.0	4.8	no change
P-BG-08	I-BG-08	I-BG-07	1.7	25.9	24 inch	84	0.013	0.013	112.1	111.0	117.1	116.0	112.6	111.5	**4.6**	3.0	4.7	no change
P-BG-07	I-BG-07	I-BG-06	1.7	30.0	24 inch	426	0.018	0.013	111.0	103.5	116.0	108.8	111.5	105.2	**4.6**	3.0	5.1	no change
P-BG-06	I-BG-06	I-BG-05	3.0	1.4	12 inch	64	0.002	0.013	103.5	103.4	108.8	108.0	105.0	104.5	**3.8**	4.3	3.8	no change
P-BG-05	I-BG-05	I-BG-04	4.1	4.4	12 inch	287	0.015	0.013	103.4	99.0	108.0	104.0	104.3	100.1	**3.7**	3.6	6.4	no change
P-BG-04	I-BG-04	I-BG-03	4.0	4.2	12 inch	429	0.014	0.013	99.0	93.0	104.0	98.0	99.9	93.9	**4.2**	4.0	6.1	no change
P-BG-03	I-BG-03	I-BG-02	5.5	31.2	24 inch	448	0.019	0.013	93.0	84.5	98.0	89.5	93.8	85.5	**4.2**	3.0	7.5	no change
P-BG-02	I-BG-02	I-BG-01	6.8	22.7	24 inch	348	0.010	0.013	84.5	81.0	89.5	86.0	85.4	85.1	**4.1**	3.0	6.3	no change
P-BG-01	I-BG-01	O-BG	8.0	66.2	24 inch	35	0.086	0.013	81.0	78.0	86.0	86.0	84.9	84.9	**1.1**	3.0	2.5	no change

(1) Pipes are presented in Figure 2 and Figure D-BG in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE TABLE D-B4b

FIGURE D-BH
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B4a

Existing Hydrology, 10-Year Event, Systems BH

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Notre Dame Avenue														
I-BH-06-01	208.9	204.9	208.9	208.9	44.45		0.5	22.23	44.45	22.23	10	10	2.21	**49.5**
I-BH-04-01	221	217	217.18	217.18	0.18		0.5	0.09	0.18	0.09	10	10	2.21	**0.2**
Fairway Drive														
I-BH-03-11-01	349	346	347.2	347.2	5.93		0.8	4.74	5.93	4.74	10	10	2.21	**10.6**
I-BH-03-10-03	362	358	358.85	358.85	3.57		0.5	1.78	3.57	1.78	10	10	2.21	**4.0**
I-BH-03-10-02	340	336	337	336.84	0.00		0	0	3.57	1.78	10	10.21	2.19	**3.9**
I-BH-03-10-01	318	314	315.01	314.8	0.00		0	0	3.57	1.78	10	10.44	2.16	**3.9**
I-BH-03-07-03	277.5	272.5	274.15	274.15	19.10		0.5	9.55	19.1	9.55	10	10	2.21	**21.3**
I-BH-03-07-02	277.2	270.6	272.87	272.25	0.00		0.5	0	19.1	9.55	10	10.05	2.2	**21.2**
I-BH-03-07-01	269	264	266.85	266.7	0.00		0.8	0	19.1	9.55	10	10.41	2.17	**20.9**
I-BH-03-03-03	168	160	160	160	0.00		0.5	0	0	0	10	10	0	**0.0**
I-BH-03-03-02	164.5	157.5	158.08	158.05	3.06		0.5	1.53	3.06	1.53	10	10	2.21	**3.4**
I-BH-03-03-01	145	139	142.46	142.46	0.00		0	0	3.06	1.53	10	10.62	2.14	**3.3**
I-BH-03-12	421	417.7	421	421	15.08		0.5	7.54	15.08	7.54	10	10	2.21	**16.8**
I-BH-03-11	333.5	328.5	337.47	333.5	13.12	5.93	0.5	6.56	34.13	18.84	10	10.31	2.18	**41.3**
J-BH-03-10	305.2	300.2	302.43	302.17	0.00	3.57	0	0	37.7	20.63	0	10.97	2.11	**43.9**
I-BH-03-09	280	274	278.14	276.77	34.81		0.5	17.41	72.51	38.03	10	11.2	2.09	**80.1**
I-BH-03-08	272	266	268.9	268.77	0.56		0.5	0.28	73.07	38.31	10	11.29	2.08	**80.3**
J-BH-03-07	268	260.5	264.18	262.99	0.00	19.1	0	0	92.17	47.86	0	11.33	2.08	**100.1**
J-BH-03-06	254	239.25	245.65	244.55	0.00		0	0	92.17	47.86	0	11.43	2.07	**99.7**
I-BH-03-05	232.4	225.4	228.84	228.63	15.69		0.5	7.85	107.86	55.71	10	11.69	2.04	**114.8**
J-BH-03-04	177	170	174.03	173.19	0.00		0	0	107.86	55.71	0	12.43	1.98	**111.3**
I-BH-03-03	146.6	138.6	142.45	142.29	14.93	3.06	0.5	7.47	125.85	64.7	10	12.65	1.96	**128.1**
J-BH-03-02	149.4	141.37	141.31	141.31	0.00		0	0	125.85	64.7	10	12.97	1.94	**126.5**
I-BH-03-01	140.2	132.2	136.12	136.06	4.96		0.5	2.48	130.81	67.18	10	13.49	1.9	**128.8**
I-BH-02-01	115.5	111.5	112.53	112.53	4.10		0.8	3.28	4.1	3.28	10	10	2.21	**7.3**
Belburn Drive														
I-BH-01-03-05	160.8	156.8	160.27	160.27	9.62		0.5	4.81	9.62	4.81	10	10	2.21	**10.7**
I-BH-01-03-04	152.4	148.4	154.95	152.4	0.25		0.5	0.13	9.87	4.93	10	10.11	2.2	**10.9**
J-BH-01-03-03	138	132	133.06	133.04	0.00		0	0	9.87	4.93	0	10.46	2.16	**10.8**
I-BH-01-03-02	132.9	126.9	128.27	128.1	3.23		0.5	1.61	13.1	6.55	10	10.73	2.13	**14.1**
I-BH-01-03-01	131	125	126.3	126.21	0.48		0.5	0.24	13.58	6.79	10	10.84	2.12	**14.5**
I-BH-01-02-01	111.2	107.2	108	108	3.16		0.5	1.58	3.16	1.58	10	10	2.21	**3.5**
I-BH-01-01-01-01	108.9	104.9	108.9	108.9	3.70		0.5	1.85	3.7	1.85	10	10	2.21	**4.1**
I-BH-01-01-03	120	116	120	120	13.19		0.5	6.6	13.19	6.6	10	10	2.21	**14.7**
I-BH-01-01-02	115.4	111.4	119.14	115.4	4.37		0.5	2.19	17.56	8.78	10	10.27	2.18	**19.3**
I-BH-01-01-01	108.5	104.5	121.58	108.5	3.11	3.7	0.5	1.55	24.37	12.19	10	10.76	2.13	**26.2**
I-BH-01-04	149.4	141.4	141.4	141.4	0.00		0.8	0	0	0	10	10	0	**0.0**
I-BH-01-03	124	118	119.24	119.21	3.77	13.58	0.5	1.89	17.35	8.68	10	11.17	2.09	**18.3**
I-BH-01-02	112	104	105.35	105.3	0.00	3.16	0	0	20.51	10.26	10	12.11	2.01	**20.8**
I-BH-01-01	108.5	100.5	105.54	105.5	5.52	24.37	0.5	2.76	50.40	25.2	10	12.5	1.98	**50.2**
Notre Creek at Notre Dame Avenue														
I-BH-13	288.5	286	287.21	287.21	10.17		0.5	5.09	10.17	5.09	10	10	2.21	**11.3**
J-BH-12	280	275	278.74	278.17	0.00		0	0	10.17	5.09	0	10.08	2.2	**11.3**
J-BH-11	278	273	276.25	275.6	0.00		0	0	10.17	5.09	0	10.19	2.19	**11.2**
J-BH-10	266.5	261	262.36	262.26	0.00		0	0	10.17	5.09	0	10.99	2.11	**10.8**
I-BH-09	241.3	236.3	242.27	241.3	12.60		0.5	6.3	22.77	11.39	10	11.27	2.08	**23.9**
J-BH-08	231.3	226.8	233.96	231.3	0.00		0	0	22.77	11.39	0	11.63	2.05	**23.5**
J-BH-07	222	217	220.38	218.48	0.00		0	0	22.77	11.39	0	11.96	2.02	**23.2**
J-BH-06	208.9	203.9	208.74	205.89	0.00	44.45	0	0	67.22	33.61	0	12.13	2.01	**68.0**
J-BH-05	177.2	172.2	187.53	177.2	0.00		0	0	67.22	33.61	0	12.31	1.99	**67.5**
I-BH-04	160.7	155.7	171.7	160.7	13.17	0.18	0.5	6.59	80.57	40.29	10	12.89	1.95	**79.0**
I-BH-03	138	130	134.31	134.07	2.52	130.81	0.5	1.26	213.9	108.73	10	13.99	1.87	**204.7**
J-BH-02	115	107	111.15	111.1	0.00	4.1	0	0	218	112.01	0	14.18	1.86	**209.5**
I-BH-01	108	100	105.49	104.92	0.00	50.4	0	0	268.4	137.21	10	14.32	1.85	**255.4**
O-BH	106.5	100	101.8	101.8	0.00		0	0	268.40	137.21	0	14.35	1.84	**255.1**

(1) Nodes are presented in Figure D-BH in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B4b

Existing Hydraulics, 10-Year Event, Systems BH

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Notre Dame Avenue																	
P-BH-06-01	I-BH-06-01	J-BH-06	49.5	12.2	15 inch	28	0.036	0.013	204.9	203.9	208.9	208.9	225.3	208.9	**ABOVE RIM**	3.8	40.3
P-BH-04-01	I-BH-04-01	I-BH-04	0.2	9.6	12 inch	849	0.072	0.013	217.0	155.7	221.0	160.7	217.2	160.7	**3.8**	4.0	4.9
Fairway Drive																	
P-BH-03-11-01	I-BH-03-11-01	I-BH-03-11	10.6	20.8	15 inch	169	0.104	0.013	346.0	328.5	349.0	333.5	347.2	333.5	**1.8**	3.8	17.0
P-BH-03-10-03	I-BH-03-10-03	I-BH-03-10-02	4.0	12.4	12 inch	181	0.122	0.013	358.0	336.0	362.0	340.0	358.9	337.0	**3.1**	3.0	14.1
P-BH-03-10-02	I-BH-03-10-02	I-BH-03-10-01	3.9	12.2	12 inch	187	0.118	0.013	336.0	314.0	340.0	318.0	336.8	315.0	**3.2**	3.0	13.9
P-BH-03-10-01	I-BH-03-10-01	J-BH-03-10	3.9	13.7	15 inch	307	0.045	0.013	314.0	300.2	318.0	305.2	314.8	302.4	**3.2**	3.8	9.6
P-BH-03-07-03	I-BH-03-07-03	I-BH-03-07-02	21.3	57.9	24 inch	49	0.039	0.010	272.5	270.6	277.5	277.2	274.2	272.9	**3.4**	4.6	17.0
P-BH-03-07-02	I-BH-03-07-02	I-BH-03-07-01	21.2	43.8	24 inch	298	0.022	0.010	270.6	264.0	277.2	269.0	272.3	266.9	**4.9**	3.0	13.8
P-BH-03-07-01	I-BH-03-07-01	J-BH-03-07	20.9	37.9	24 inch	125	0.028	0.013	264.0	260.5	269.0	268.0	266.7	265.6	**2.3**	5.5	6.6
P-BH-03-03-03	I-BH-03-03-03	I-BH-03-03-02	0.0	142.9	42 inch	124	0.020	0.013	160.0	157.5	168.0	164.5	160.0	158.1	**8.0**	3.5	0.0
P-BH-03-03-02	I-BH-03-03-02	I-BH-03-03-01	3.4	238.2	42 inch	330	0.056	0.013	157.5	139.0	164.5	145.0	158.1	142.5	**6.4**	2.5	8.9
P-BH-03-03-01	I-BH-03-03-01	I-BH-03-03	3.3	82.8	42 inch	59	0.007	0.013	139.0	138.6	145.0	146.6	142.5	142.5	**2.5**	4.5	4.2
P-BH-03-12	I-BH-03-12	I-BH-03-11	16.8	16.9	12 inch	395	0.226	0.013	417.7	328.5	421.0	333.5	421.3	333.5	**ABOVE RIM**	4.0	21.4
P-BH-03-11	I-BH-03-11	J-BH-03-10	41.3	32.2	24 inch	411	0.069	0.024	328.5	300.2	333.5	305.2	350.9	304.1	**ABOVE RIM**	3.0	13.2
P-BH-03-10	J-BH-03-10	I-BH-03-09	43.9	66.4	24 inch	304	0.086	0.013	300.2	274.0	305.2	280.0	302.2	278.1	**3.0**	4.0	22.6
P-BH-03-09	I-BH-03-09	I-BH-03-08	80.1	165.5	36 inch	130	0.062	0.013	274.0	266.0	280.0	272.0	276.8	268.9	**3.2**	3.0	23.2
P-BH-03-08	I-BH-03-08	J-BH-03-07	80.3	188.3	36 inch	69	0.080	0.013	266.0	260.5	272.0	268.0	268.8	264.2	**3.2**	4.5	25.6
P-BH-03-07	J-BH-03-07	J-BH-03-06	100.1	168.0	30 inch	214	0.099	0.010	260.5	239.3	268.0	254.0	263.0	245.7	**5.0**	12.3	35.7
P-BH-03-06	J-BH-03-06	I-BH-03-05	99.7	93.6	30 inch	312	0.044	0.012	239.3	225.4	254.0	232.4	244.6	228.8	**9.4**	4.5	20.3
P-BH-03-05	I-BH-03-05	J-BH-03-04	114.8	349.4	48 inch	1,099	0.050	0.012	225.4	170.0	232.4	177.0	228.6	174.0	**3.8**	3.0	24.9
P-BH-03-04	J-BH-03-04	I-BH-03-03	111.3	442.7	48 inch	388	0.081	0.012	170.0	138.6	177.0	146.6	173.2	142.8	**3.8**	4.0	29.3
P-BH-03-03	I-BH-03-03	J-BH-03-02	128.1	124.7	54 inch	175	0.003	0.012	138.6	138.0	146.6	149.4	142.3	141.4	**4.3**	6.9	8.9
P-BH-03-02	J-BH-03-02	I-BH-03-01	126.5	236.9	54 inch	469	0.012	0.012	138.0	132.2	149.4	140.2	141.3	136.1	**8.1**	3.5	15.1
P-BH-03-01	I-BH-03-01	I-BH-03	128.8	168.9	54 inch	350	0.006	0.012	132.2	130.0	140.2	138.0	136.1	135.0	**4.1**	3.5	11.7
P-BH-02-01	I-BH-02-01	J-BH-02	7.3	13.2	12 inch	33	0.136	0.013	111.5	107.0	115.5	115.0	112.5	111.2	**3.0**	7.0	9.3
Belburn Drive																	
P-BH-01-03-05	I-BH-01-03-05	I-BH-01-03-04	10.7	11.1	12 inch	87	0.097	0.013	156.8	148.4	160.8	152.4	160.3	152.4	**0.5**	3.0	13.6
P-BH-01-03-04	I-BH-01-03-04	J-BH-01-03-03	10.9	8.4	12 inch	293	0.056	0.013	148.4	132.0	152.4	138.0	160.7	133.1	**ABOVE RIM**	5.0	13.9
P-BH-01-03-03	J-BH-01-03-03	I-BH-01-03-02	10.8	116.6	36 inch	167	0.031	0.013	132.0	126.9	138.0	132.9	133.0	128.3	**5.0**	3.0	10.3
P-BH-01-03-02	I-BH-01-03-02	I-BH-01-03-01	14.1	109.9	36 inch	70	0.027	0.013	126.9	125.0	132.9	131.0	128.1	126.3	**4.8**	3.0	10.7
P-BH-01-03-01	I-BH-01-03-01	I-BH-01-03	14.5	117.4	36 inch	226	0.031	0.013	125.0	118.0	131.0	124.0	126.2	119.2	**4.8**	3.0	11.3
P-BH-01-02-01	I-BH-01-02-01	I-BH-01-02	3.5	7.1	12 inch	81	0.040	0.013	107.2	104.0	111.2	112.0	108.0	105.4	**3.2**	7.0	9.0
P-BH-01-01-01-01	I-BH-01-01-01-01	I-BH-01-01-01	4.1	1.5	12 inch	239	0.002	0.013	104.9	104.5	108.9	108.5	111.7	108.5	**ABOVE RIM**	3.0	5.3
P-BH-01-01-03	I-BH-01-01-03	I-BH-01-01-02	14.7	4.4	12 inch	305	0.015	0.013	116.0	111.4	120.0	115.4	167.2	115.4	**ABOVE RIM**	3.0	18.7
P-BH-01-01-02	I-BH-01-01-02	I-BH-01-01-01	19.3	4.1	12 inch	519	0.013	0.013	111.4	104.5	115.4	108.5	260.7	108.5	**ABOVE RIM**	3.0	24.6
P-BH-01-01-01	I-BH-01-01-01	I-BH-01-01	26.2	7.1	12 inch	101	0.040	0.013	104.5	100.5	108.5	108.5	160.0	105.6	**ABOVE RIM**	7.0	33.3
P-BH-01-04	I-BH-01-04	I-BH-01-03	0.0	469.9	54 inch	481	0.049	0.012	141.4	118.0	149.4	124.0	141.4	119.3	**8.0**	1.5	0.0
P-BH-01-03	I-BH-01-03	I-BH-01-02	18.3	320.9	54 inch	617	0.023	0.012	118.0	104.0	124.0	112.0	119.2	105.4	**4.8**	3.5	10.9
P-BH-01-02	I-BH-01-02	I-BH-01-01	20.8	262.8	54 inch	230	0.015	0.012	104.0	100.5	112.0	108.5	105.3	105.5	**6.7**	3.5	9.9
P-BH-01-01	I-BH-01-01	I-BH-01	50.2	321.2	54 inch	22	0.023	0.012	100.5	100.0	108.5	108.0	105.5	105.5	**3.0**	3.5	3.2
Notre Dame Creek at Notre Dame Avenue																	
P-BH-13	I-BH-13	J-BH-12	11.3	23.1	15 inch	86	0.128	0.013	286.0	275.0	288.5	280.0	287.2	278.7	**1.3**	3.8	18.7
P-BH-12	J-BH-12	J-BH-11	11.3	11.5	15 inch	63	0.032	0.013	275.0	273.0	280.0	278.0	278.2	276.3	**1.8**	3.8	9.2
P-BH-11	J-BH-11	J-BH-10	11.2	10.7	15 inch	439	0.027	0.013	273.0	261.0	278.0	266.5	275.6	262.4	**2.4**	4.3	9.1
P-BH-10	J-BH-10	I-BH-09	10.8	31.5	18 inch	274	0.090	0.013	261.0	236.3	266.5	241.3	262.3	241.3	**4.2**	3.5	16.2
P-BH-09	I-BH-09	J-BH-08	23.9	19.2	18 inch	285	0.033	0.013	236.3	226.8	241.3	231.3	246.0	231.3	**ABOVE RIM**	3.0	13.5
P-BH-08	J-BH-08	J-BH-07	23.5	20.2	18 inch	265	0.037	0.013	226.8	217.0	231.3	222.0	233.7	220.4	**ABOVE RIM**	3.5	13.3
P-BH-07	J-BH-07	J-BH-06	23.2	28.0	18 inch	185	0.071	0.013	217.0	203.9	222.0	208.9	218.5	208.7	**3.5**	3.5	17.7
P-BH-06	J-BH-06	J-BH-05	68.0	75.6	24 inch	284	0.112	0.013	203.9	172.2	208.9	177.2	205.9	177.2	**3.0**	3.0	27.2
P-BH-05	J-BH-05	I-BH-04	67.5	61.0	24 inch	227	0.073	0.013	172.2	155.7	177.2	160.7	180.9	160.7	**ABOVE RIM**	3.0	21.5
P-BH-04	I-BH-04	I-BH-03	79.0	72.7	24 inch	249	0.103	0.013	155.7	130.0	160.7	138.0	164.7	134.3	**ABOVE RIM**	6.0	25.2
P-BH-03	I-BH-03	J-BH-02	204.7	534.8	54 inch	365	0.063	0.012	130.0	107.0	138.0	115.0	134.1	111.3	**3.9**	3.5	31.4
P-BH-02	J-BH-02	I-BH-01	209.5	390.8	54 inch	208	0.034	0.012	107.0	100.0	115.0	108.0	111.1	105.5	**3.9**	3.5	25.0
P-BH-01	I-BH-01	O-BH	255.4	0.0	66 inch	21	0.000	0.012	100.0	100.0	108.0	106.5	104.9	104.5	**3.1**	1.0	10.8

(1) Pipes are presented in Figure 2 and Figure D-BH in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B4c

Proposed Hydrology, 25-Year Event, System BH

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
I-BH-06-01	210.5	205.1	208.99	208.99	44.45		0.55	24.45	44.45	24.45	10	10	2.64	**65.1**
I-BH-04-01	221	217	217.21	217.21	0.18		0.55	0.1	0.18	0.1	10	10	2.64	**0.3**
I-BH-03-11-01	349	346	347.23	347.23	5.93		0.88	5.22	5.93	5.22	10	10	2.64	**13.9**
I-BH-03-10-03	362	358	358.93	358.93	3.57		0.55	1.96	3.57	1.96	10	10	2.64	**5.2**
I-BH-03-10-02	340	336	337.18	336.93	0		0	0	3.57	1.96	10	10.2	2.62	**5.2**
I-BH-03-10-01	318	314	315.21	314.92	0		0	0	3.57	1.96	10	10.41	2.59	**5.1**
I-BH-03-07-03	277.5	272.5	274.33	274.33	19.1		0.55	10.51	19.1	10.51	10	10	2.64	**28.0**
I-BH-03-07-02	277.2	270.6	273.4	272.43	0		0.55	0	19.1	10.51	10	10.04	2.64	**27.9**
I-BH-03-07-01	269	264	269.39	269	0		0.88	0	19.1	10.51	10	10.38	2.59	**27.5**
I-BH-03-03-03	168	160	160	160	0		0.55	0	0	0	10	10	0	**0.0**
I-BH-03-03-02	164.5	157.5	157.5	157.5	3.06		0	0	3.06	0	10	10	0	**0.0**
I-BH-03-03-01	145	139	143.42	143.42	0		0	0	3.06	0	10	10	0	**0.0**
I-BH-03-12	421	417.7	419.18	419.18	15.08		0.55	8.29	15.08	8.29	10	10	2.64	**22.1**
I-BH-03-11	333.5	328.5	331.33	330.49	13.12	5.93	0.55	7.22	34.13	20.73	10	10.23	2.61	**54.6**
J-BH-03-10	305.2	300.2	302.64	302.19	0	3.57	0	0	37.7	22.69	0	10.9	2.53	**57.9**
I-BH-03-09	280	274	279.23	276.92	34.81		0.55	19.15	72.51	41.84	10	11.12	2.51	**105.7**
I-BH-03-08	272	266	270	269.74	0.56		0.55	0.31	73.07	42.15	10	11.2	2.5	**106.1**
J-BH-03-07	268	260.5	269.53	267.12	0	19.1	0	0	92.17	52.65	0	11.28	2.49	**132.0**
J-BH-03-06	254	239.25	255.95	254	0		0	0	92.17	52.65	0	11.41	2.47	**131.3**
I-BH-03-05	232.4	225.4	229.33	229.01	15.69		0.55	8.63	107.86	61.28	10	11.61	2.45	**151.5**
J-BH-03-04	177	177	174.85	173.57	0			0	107.86	107.86	0	12.29	2.38	**147.2**
I-BH-03-03	146.6	138.6	143.42	143.16	14.93	3.06	0.55	8.21	125.85	69.49	10	12.49	2.36	**165.6**
J-BH-03-02	149.4	138	141.84	141.74	0		0	0	125.85	69.49	0	12.77	2.34	**163.8**
I-BH-03-01	140.2	132.2	138.12	138.03	4.96		0.55	2.73	130.81	72.22	10	13.26	2.29	**167.0**
I-BH-02-01	115.5	111.5	113.82	113.82	4.1		0.88	3.61	4.1	3.61	10	10	2.64	**9.6**
I-BH-01-03-05	160.8	156.8	160.8	160.8	9.62		0.55	5.29	9.62	5.29	10	10	2.64	**14.1**
I-BH-01-03-04	152.4	148.4	150.18	149.79	0.25		0.55	0.14	9.87	5.43	10	10.08	2.63	**14.4**
J-BH-01-03-03	138	132	133.23	133.2	0		0	0	9.87	5.43	0	10.42	2.59	**14.2**
I-BH-01-03-02	132.9	126.9	128.51	128.28	3.23		0.55	1.78	13.1	7.21	10	10.67	2.56	**18.6**
I-BH-01-03-01	131	125	126.52	126.4	0.48		0.55	0.26	13.58	7.47	10	10.77	2.55	**19.2**
I-BH-01-02-01	111.2	107.2	108.09	108.09	3.16		0.55	1.74	3.16	1.74	10	10	2.64	**4.6**
I-BH-01-01-01-01	108.9	104.9	106.79	106.79	3.7		0.55	2.04	3.7	2.04	10	10	2.64	**5.4**
I-BH-01-01-03	120	116	117.58	117.58	13.19		0.55	7.25	13.19	7.25	10	10	2.64	**19.3**
I-BH-01-01-02	115.4	111.4	113.32	113.16	4.37		0.55	2.4	17.56	9.66	10	10.53	2.57	**25.1**
I-BH-01-01-01	108.5	104.5	106.66	106.47	3.11	3.7	0.55	1.71	24.37	13.4	10	11.45	2.47	**33.4**
I-BH-01-04	149.4	141.4	141.4	141.4	0		0.88	0	0	0	10	10	0	**0.0**
I-BH-01-03	124	118	119.25	119.24	3.77	13.58	0	0	17.35	7.47	10	11.07	2.51	**18.9**
I-BH-01-02	112	104	105.84	105.81	0	3.16	0	0	20.51	9.21	10	12.01	2.41	**22.4**
I-BH-01-01	108.5	100.5	105.95	105.87	5.52	24.37	0.55	3.04	50.4	25.65	10	12.39	2.37	**61.4**
I-BH-13	288.5	286	287.24	287.24	10.17		0.55	5.59	10.17	5.59	10	10	2.64	**14.9**
J-BH-12	280	275	281.07	280	0		0	0	10.17	5.59	0	10.07	2.63	**14.8**
J-BH-11	278	273	279.36	278	0		0	0	10.17	5.59	0	10.16	2.62	**14.8**
J-BH-10	266.5	261.5	263.04	262.89	0		0	0	10.17	5.59	0	10.77	2.55	**14.4**
I-BH-09	241.3	236.3	238.41	238.19	12.6		0.55	6.93	22.77	12.52	10	11.03	2.52	**31.8**
J-BH-08	231.3	226.3	228.89	228.18	0		0	0	22.77	12.52	0	11.35	2.48	**31.3**
J-BH-07	222	217	219.59	218.88	0		0	0	22.77	12.52	0	11.65	2.45	**30.9**
J-BH-06	208.9	203.9	207.49	206.38	0	44.45	0	0	67.22	36.97	0	11.81	2.43	**90.6**
J-BH-04	177.2	172.2	178.31	174.68	0		0	0	67.22	36.97	0	11.96	2.42	**90.0**
I-BH-04	160.7	155.7	161.07	158.19	13.17	0.18	0.55	7.24	80.57	44.31	10	12.66	2.35	**104.9**
I-BH-03	138	130	134.71	134.32	2.52	130.81	0.55	1.39	213.9	117.92	10	13.82	2.25	**267.2**
J-BH-02	115	107	111.42	111.34	0	4.1	0	0	218	121.53	0	14	2.23	**273.6**
I-BH-01	108	100	105.85	104.93	0	50.4	0	0	268.4	147.17	10	14.13	2.22	**329.8**
O-BH	106	99	102.6	102.6	0		0	0	268.4	147.17	0	14.14	2.22	**329.7**

(1) Nodes are presented in Figure D-BH in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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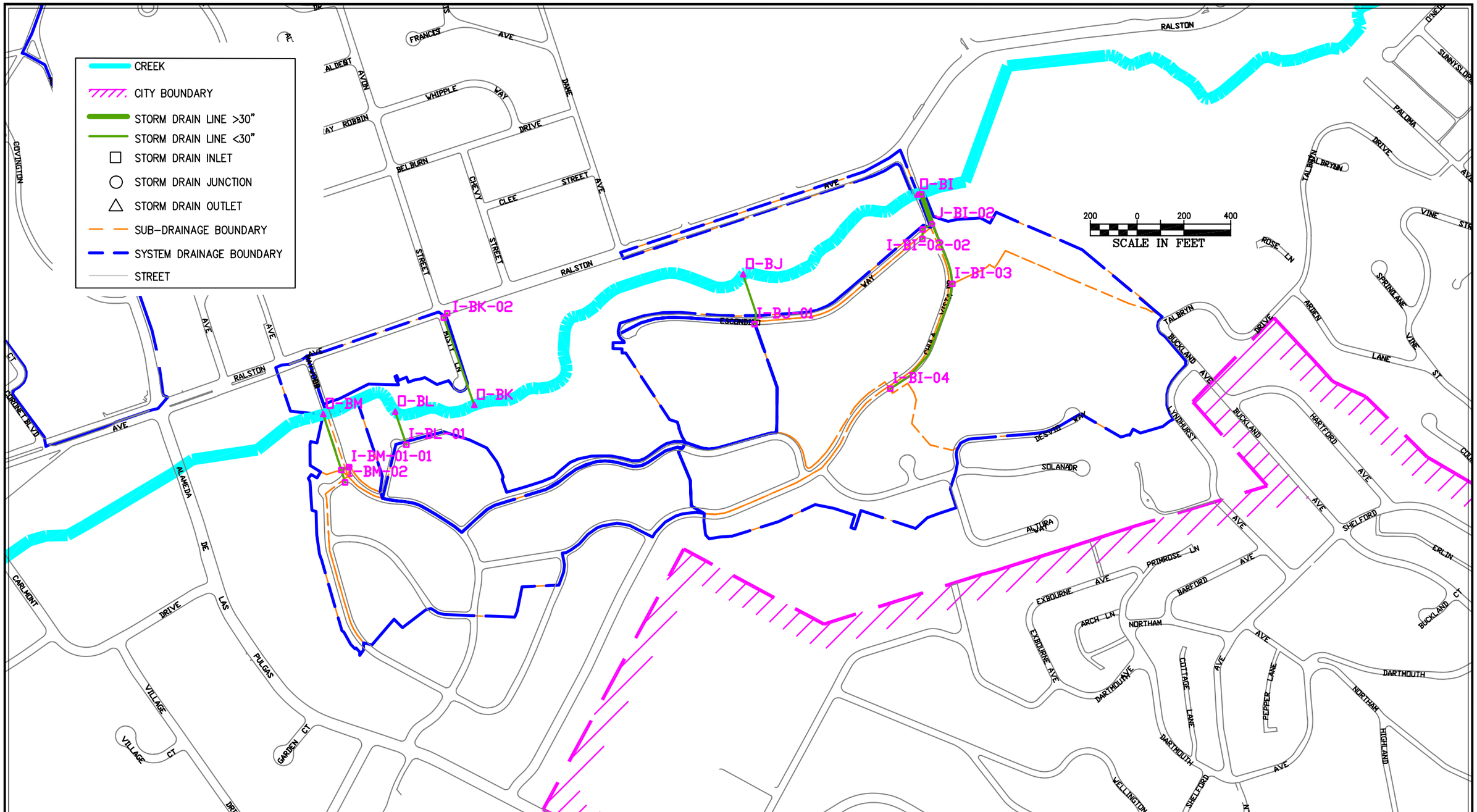
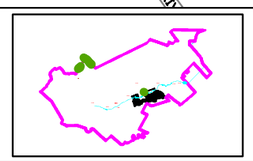
Table D-B4d

Proposed Hydraulics, 25-Year Event, System BH

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Notre Dame Avenue																		
P-BH-06-01	I-BH-06-01	J-BH-06	65.1	138.1	36 inch	28	0.043	0.013	205.1	203.9	210.5	208.9	209.0	208.7	**1.5**	2.0	9.2	upsized
P-BH-04-01	I-BH-04-01	I-BH-04	0.3	9.6	12 inch	849	0.072	0.013	217.0	155.7	221.0	160.7	217.2	160.7	**3.8**	4.0	5.3	no change
Fairway Drive																		
P-BH-03-11-01	I-BH-03-11-01	I-BH-03-11	13.9	20.8	15 inch	169	0.104	0.013	346.0	328.5	349.0	333.5	347.2	331.3	**1.8**	3.8	18.2	no change
P-BH-03-10-03	I-BH-03-10-03	I-BH-03-10-02	5.2	12.4	12 inch	181	0.122	0.013	358.0	336.0	362.0	340.0	358.9	337.2	**3.1**	3.0	15.1	no change
P-BH-03-10-02	I-BH-03-10-02	I-BH-03-10-01	5.2	12.2	12 inch	187	0.118	0.013	336.0	314.0	340.0	318.0	336.9	315.2	**3.1**	3.0	14.9	no change
P-BH-03-10-01	I-BH-03-10-01	J-BH-03-10	5.1	13.7	15 inch	307	0.045	0.013	314.0	300.2	318.0	305.2	314.9	302.6	**3.1**	3.8	10.4	no change
P-BH-03-07-03	I-BH-03-07-03	I-BH-03-07-02	28.0	57.9	24 inch	49	0.039	0.010	272.5	270.6	277.5	277.2	274.3	273.4	**3.2**	4.6	18.3	no change
P-BH-03-07-02	I-BH-03-07-02	I-BH-03-07-01	27.9	43.8	24 inch	298	0.022	0.010	270.6	264.0	277.2	269.0	272.4	269.0	**4.8**	3.0	14.8	no change
P-BH-03-07-01	I-BH-03-07-01	J-BH-03-07	27.5	37.9	24 inch	125	0.028	0.013	264.0	260.5	269.0	268.0	269.8	268.0	**ABOVE RIM**	5.5	8.7	no change
P-BH-03-03-03	I-BH-03-03-03	I-BH-03-03-02	0.0	142.9	42 inch	124	0.020	0.013	160.0	157.5	168.0	164.5	160.0	157.5	**8.0**	3.5	0.0	no change
P-BH-03-03-02	I-BH-03-03-02	I-BH-03-03-01	0.0	238.2	42 inch	330	0.056	0.013	157.5	139.0	164.5	145.0	157.5	143.4	**7.0**	2.5	0.0	no change
P-BH-03-03-01	I-BH-03-03-01	I-BH-03-03	0.0	82.8	42 inch	59	0.007	0.013	139.0	138.6	145.0	146.6	143.4	143.4	**1.6**	4.5	0.0	no change
P-BH-03-12	I-BH-03-12	I-BH-03-11	22.1	54.1	18 inch	395	0.226	0.012	417.7	328.5	421.0	333.5	419.2	332.4	**1.8**	3.5	29.1	upsized
P-BH-03-11	I-BH-03-11	J-BH-03-10	54.6	59.4	24 inch	411	0.069	0.013	328.5	300.2	333.5	305.2	330.5	305.2	**3.0**	3.0	21.4	no change
P-BH-03-10	J-BH-03-10	I-BH-03-09	57.9	66.4	24 inch	304	0.086	0.013	300.2	274.0	305.2	280.0	302.2	279.2	**3.0**	4.0	23.8	no change
P-BH-03-09	I-BH-03-09	I-BH-03-08	105.7	165.5	36 inch	130	0.062	0.013	274.0	266.0	280.0	272.0	276.9	270.0	**3.1**	3.0	24.8	no change
P-BH-03-08	I-BH-03-08	J-BH-03-07	106.1	188.3	36 inch	69	0.080	0.013	266.0	260.5	272.0	268.0	269.7	268.0	**2.3**	4.5	15.0	no change
P-BH-03-07	J-BH-03-07	J-BH-03-06	132.0	168.0	30 inch	214	0.099	0.010	260.5	239.3	268.0	254.0	267.1	254.0	**0.9**	12.3	26.9	no change
P-BH-03-06	J-BH-03-06	I-BH-03-05	131.3	93.6	30 inch	312	0.044	0.012	239.3	225.4	254.0	232.4	256.6	229.3	**ABOVE RIM**	4.5	26.7	no change
P-BH-03-05	I-BH-03-05	J-BH-03-04	151.5	349.4	48 inch	1,099	0.050	0.012	225.4	170.0	232.4	177.0	229.0	174.9	**3.4**	3.0	26.8	no change
P-BH-03-04	J-BH-03-04	I-BH-03-03	147.2	442.7	48 inch	388	0.081	0.012	170.0	138.6	177.0	146.6	173.6	144.0	**3.4**	4.0	31.7	no change
P-BH-03-03	I-BH-03-03	J-BH-03-02	165.6	124.7	54 inch	175	0.003	0.012	138.6	138.0	146.6	149.4	143.2	141.8	**3.4**	6.9	10.4	no change
P-BH-03-02	J-BH-03-02	I-BH-03-01	163.8	236.9	54 inch	469	0.012	0.012	138.0	132.2	149.4	140.2	141.7	138.1	**7.7**	3.5	16.1	no change
P-BH-03-01	I-BH-03-01	I-BH-03	167.0	168.9	54 inch	350	0.006	0.012	132.2	130.0	140.2	138.0	138.0	135.9	**2.2**	3.5	10.5	no change
P-BH-02-01	I-BH-02-01	J-BH-02	9.6	13.2	12 inch	33	0.136	0.013	111.5	107.0	115.5	115.0	113.8	111.4	**1.7**	7.0	12.2	no change
Belburn Drive																		
P-BH-01-03-05	I-BH-01-03-05	I-BH-01-03-04	14.1	11.1	12 inch	87	0.097	0.013	156.8	148.4	160.8	152.4	163.8	150.2	**ABOVE RIM**	3.0	17.9	no change
P-BH-01-03-04	I-BH-01-03-04	J-BH-01-03-03	14.4	24.9	18 inch	293	0.056	0.013	148.4	132.0	152.4	138.0	149.8	132.8	**2.6**	4.5	14.6	upsized
P-BH-01-03-03	J-BH-01-03-03	I-BH-01-03-02	14.2	116.6	36 inch	167	0.031	0.013	132.0	126.9	138.0	132.9	133.2	128.5	**4.8**	3.0	11.2	no change
P-BH-01-03-02	I-BH-01-03-02	I-BH-01-03-01	18.6	109.9	36 inch	70	0.027	0.013	126.9	125.0	132.9	131.0	128.3	126.5	**4.6**	3.0	11.6	no change
P-BH-01-03-01	I-BH-01-03-01	I-BH-01-03	19.2	117.4	36 inch	226	0.031	0.013	125.0	118.0	131.0	124.0	126.4	118.8	**4.6**	3.0	12.2	no change
P-BH-01-02-01	I-BH-01-02-01	I-BH-01-02	4.6	7.1	12 inch	81	0.040	0.013	107.2	104.0	111.2	112.0	108.1	105.8	**3.1**	7.0	9.6	no change
P-BH-01-01-01-01	I-BH-01-01-01-01	I-BH-01-01-01	5.4	9.3	24 inch	239	0.002	0.013	104.9	104.5	108.9	108.5	106.8	106.7	**2.1**	2.0	3.1	upsized
P-BH-01-01-03	I-BH-01-01-03	I-BH-01-01-02	19.3	27.8	24 inch	305	0.015	0.013	116.0	111.4	120.0	115.4	117.6	113.3	**2.4**	2.0	9.6	upsized
P-BH-01-01-02	I-BH-01-01-02	I-BH-01-01-01	25.1	26.1	24 inch	519	0.013	0.013	111.4	104.5	115.4	108.5	113.2	107.0	**2.2**	2.0	9.5	upsized
P-BH-01-01-01	I-BH-01-01-01	I-BH-01-01	33.4	81.6	30 inch	101	0.040	0.013	104.5	100.5	108.5	108.5	106.5	106.0	**2.0**	5.5	15.8	upsized
P-BH-01-04	I-BH-01-04	I-BH-01-03	0.0	469.9	54 inch	481	0.049	0.012	141.4	118.0	149.4	124.0	141.4	119.3	**8.0**	1.5	0.0	no change
P-BH-01-03	I-BH-01-03	I-BH-01-02	18.9	320.9	54 inch	617	0.023	0.012	118.0	104.0	124.0	112.0	119.2	105.9	**4.8**	3.5	11.0	no change
P-BH-01-02	I-BH-01-02	I-BH-01-01	22.4	262.8	54 inch	230	0.015	0.012	104.0	100.5	112.0	108.5	105.8	106.0	**6.2**	3.5	10.1	no change
P-BH-01-01	I-BH-01-01	I-BH-01	61.4	321.2	54 inch	22	0.023	0.012	100.5	100.0	108.5	108.0	105.9	105.9	**2.6**	3.5	3.9	no change
Notre Dame Creek at Notre Dame Avenue																		
P-BH-13	I-BH-13	J-BH-12	14.9	23.1	15 inch	86	0.128	0.013	286.0	275.0	288.5	280.0	287.2	280.0	**1.3**	3.8	20.0	no change
P-BH-12	J-BH-12	J-BH-11	14.8	11.5	15 inch	63	0.032	0.013	275.0	273.0	280.0	278.0	281.3	278.0	**ABOVE RIM**	3.8	12.1	no change
P-BH-11	J-BH-11	J-BH-10	14.8	10.5	15 inch	439	0.026	0.013	273.0	261.5	278.0	266.5	286.0	263.0	**ABOVE RIM**	3.8	12.0	no change
P-BH-10	J-BH-10	I-BH-09	14.4	31.9	18 inch	274	0.092	0.013	261.5	236.3	266.5	241.3	262.9	238.4	**3.6**	3.5	17.6	no change
P-BH-09	I-BH-09	J-BH-08	31.8	42.4	24 inch	285	0.035	0.013	236.3	226.3	241.3	231.3	238.2	228.9	**3.1**	3.0	14.8	upsized
P-BH-08	J-BH-08	J-BH-07	31.3	42.4	24 inch	265	0.035	0.013	226.3	217.0	231.3	222.0	228.2	219.6	**3.1**	3.0	14.8	upsized
P-BH-07	J-BH-07	J-BH-06	30.9	60.2	24 inch	185	0.071	0.013	217.0	203.9	222.0	208.9	218.9	207.5	**3.1**	3.0	19.3	upsized
P-BH-06	J-BH-06	J-BH-04	90.6	137.0	30 inch	284	0.112	0.013	203.9	172.2	208.9	177.2	206.4	177.2	**2.5**	2.5	29.8	upsized
P-BH-05	J-BH-04	I-BH-04	90.0	110.6	30 inch	227	0.073	0.013	172.2	155.7	177.2	160.7	174.7	160.7	**2.5**	2.5	25.1	upsized
P-BH-04	I-BH-04	I-BH-03	104.9	142.8	30 inch	249	0.103	0.012	155.7	130.0	160.7	138.0	158.2	134.7	**2.5**	5.5	31.8	upsized
P-BH-03	I-BH-03	J-BH-02	267.2	534.8	54 inch	365	0.063	0.012	130.0	107.0	138.0	115.0	134.3	111.6	**3.7**	3.5	33.6	no change
P-BH-02	J-BH-02	I-BH-01	273.6	390.8	54 inch	208	0.034	0.012	107.0	100.0	115.0	108.0	111.3	105.9	**3.7**	3.5	26.6	no change
P-BH-01	I-BH-01	O-BH	329.8	793.8	66 inch	21	0.048	0.012	100.0	99.0	108.0	106.0	104.9	102.9	**3.1**	1.5	31.9	no change

(1) Pipes are presented in Figure 2 and Figure D-BH in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B5A TO D-B5D

FIGURE D-BI-BM
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B5a

Existing Hydrology, 10-Year Event, Systems BI, BJ, BK, BL & BM

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Chula Vista Drive														
I-BI-02-02	92	88	90.19	90.19	8.93		0.5	4.46	8.93	4.46	10	10	2.21	**9.9**
I-BI-02-01	87	83	94.89	87	4.05		0.5	2.02	12.98	6.49	10	10.05	2.2	**14.4**
I-BI-04	210	205	206	206	9.95		0.5	4.97	9.95	4.97	10	10	2.21	**11.1**
I-BI-03	125	120	135.87	125	15.54		0.5	7.77	25.49	12.75	10	10.45	2.16	**27.8**
J-BI-02	90	82	87.61	87.1	0	12.98	0	0	38.47	19.23	0	10.65	2.14	**41.5**
I-BI-01	90	81	84.29	83	0.94		0.5	0.47	39.41	19.7	10	10.87	2.12	**42.1**
O-BI	86.3	80	74	74	0.00		0	0	39.41	19.7	0	10.89	2.12	**42.1**
Escondido Way														
I-BJ-01	100.9	96.9	97.88	97.88	6.34		0.5	3.17	6.34	3.17	10	10	2.21	**7.1**
O-BJ	89	84	83.49	83.49	0		0	0	6.34	3.17	0	10.3	2.18	**7.0**
Misty Way														
I-BK-02	121.6	118.6	119.91	119.91	3.39		0.5	1.7	3.39	1.7	10	10	2.21	**3.8**
I-BK-01	121.5	118.5	119.63	119.33	0		0	0	3.39	1.7	10	10.09	2.2	**3.8**
O-BK	105	101	102	102	0		0	0	3.39	1.7	0	10.78	2.13	**3.6**
Kittie Lane														
I-BL-01	133.5	129	129.88	129.88	3.95		0.5	1.98	3.95	1.98	10	10	2.21	**4.4**
O-BL	118	111	112	112	0		0	0	3.95	1.98	0	10.27	2.18	**4.3**
Maywood Drive														
I-BM-01-01	133.1	129.1	133	133	0.1		0.5	0.05	0.1	0.05	10	10	2.21	**0.1**
I-BM-02	134	130	134	134	15.13		0.5	7.57	15.13	7.57	10	10	2.21	**16.9**
I-BM-01	133	129	133.06	133	1.53	0.1	0.5	0.77	16.76	8.38	10	14.11	1.86	**15.7**
O-BM	125	115	125.69	125.69	0		0	0	16.76	8.38	0	14.44	1.84	**15.5**

(1) Nodes are presented in Figure D-BI-BM in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B5b

Existing Hydraulics, 10-Year Event, Systems BI, BJ, BK, BL & BM

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Chula Vista Drive																	
P-BI-02-02	I-BI-02-02	I-BI-02-01	9.9	12.4	12 inch	41	0.122	0.013	88.0	83.0	92.0	87.0	90.2	87.0	**1.8**	3.0	12.7
P-BI-02-01	I-BI-02-01	J-BI-02	14.4	5.3	12 inch	46	0.022	0.013	83.0	82.0	87.0	90.0	95.3	87.8	**ABOVE RIM**	3.0	18.4
P-BI-04	I-BI-04	I-BI-03	11.1	14.1	12 inch	541	0.157	0.013	205.0	120.0	210.0	125.0	206.0	125.0	**4.0**	4.0	19.9
P-BI-03	I-BI-03	J-BI-02	27.8	24.1	15 inch	272	0.140	0.013	120.0	82.0	125.0	90.0	137.9	87.6	**ABOVE RIM**	3.8	22.6
P-BI-02	J-BI-02	I-BI-01	41.5	24.8	2 x 2 ft	135	0.007	0.013	82.0	81.0	90.0	90.0	87.1	84.3	**2.9**	6.0	10.4
P-BI-01	I-BI-01	O-BI	42.1	69.9	2 x 2 ft	17	0.059	0.013	81.0	80.0	90.0	86.3	83.0	81.6	**7.0**	7.0	18.3
Escondido Way																	
P-BJ-01	I-BJ-01	O-BJ	7.1	8.6	12 inch	220	0.059	0.013	96.9	84.0	100.9	89.0	97.9	84.7	**3.0**	3.0	12.3
Misty Way																	
P-BK-02	I-BK-02	I-BK-01	3.8	2.3	12 inch	25	0.004	0.013	118.6	118.5	121.6	121.5	119.9	119.6	**1.7**	2.0	4.8
P-BK-01	I-BK-01	O-BK	3.8	7.5	12 inch	397	0.044	0.013	118.5	101.0	121.5	105.0	119.3	102.0	**2.2**	2.0	9.5
Kittie Lane																	
P-BL-01	I-BL-01	O-BL	4.4	6.8	12 inch	147	0.122	0.024	129.0	111.0	133.5	118.0	129.9	112.0	**3.6**	3.5	9.2
Maywood Drive																	
P-BM-01-01	I-BM-01-01	I-BM-01	0.1	1.9	12 inch	35	0.003	0.013	129.1	129.0	133.1	133.0	133.0	133.0	**0.1**	3.0	0.1
P-BM-02	I-BM-02	I-BM-01	16.9	8.6	15 inch	56	0.018	0.013	130.0	129.0	134.0	133.0	136.8	133.0	**ABOVE RIM**	2.8	13.7
P-BM-01	I-BM-01	O-BM	15.7	15.3	15 inch	249	0.056	0.013	129.0	115.0	133.0	125.0	140.4	125.7	**ABOVE RIM**	2.8	12.8

(1) Pipes are presented in Figure 2 and Figure D-BI-BM in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B5c

Proposed Hydrology, 25-Year Event, Systems BI, BJ, BK, BL & BM

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
I-BI-02-02	92	88	92	92	8.93		0.55	4.91	8.93	4.91	10	10	2.64	**13.1**
I-BI-02-01	91.5	83	99.76	91.28	4.05		0.55	2.23	12.98	7.14	10	10.04	2.64	**19.0**
I-BI-04	210	205	210	210	9.95		0.55	5.47	9.95	5.47	10	10	2.64	**14.6**
I-BI-03	125	120	123.65	121.5	15.54		0.55	8.55	25.49	14.02	10	10.49	2.58	**36.5**
J-BI-02	90	82	93.31	90	0	12.98	0	0	38.47	21.16	0	10.65	2.56	**54.6**
I-BI-01	90	81	85.25	83	0.94		0.55	0.52	39.41	21.68	10	10.82	2.54	**55.5**
O-BI	86.3	80	78.3	78.3	0		0	0	39.41	21.68	0	10.83	2.54	**55.5**
I-BI-04	210	205	210	210	9.95		0.55	5.47	9.95	5.47	10	10	2.64	**14.6**
O-BJ	89	84	85.57	85.57	0		0	0	0	3.49	0	10.31	2.6	**9.2**
I-BK-01	121.5	118.5	119.89	119.41	0		0	0	0	1.86	10	10.07	2.63	**5.0**
I-BJ-01	100.9	96.9	100.52	100.52	6.34		0.55	3.49	6.34	3.49	10	10	2.64	**9.3**
O-BK	105	101	104.8	104.8	0		0	0	6.34	1.86	0	10.72	2.55	**4.8**
I-BL-01	133.5	129	129.95	129.95	3.95		0.55	2.17	3.95	2.17	10	10	2.64	**5.8**
O-BL	118	111	113.7	113.7	0		0	0	3.95	2.17	0	10.25	2.61	**5.7**
I-BM-02	134	130	133.54	133.54	15.13		0.55	8.32	15.13	8.32	10	10	2.64	**22.2**
I-BM-01-01	133.1	129.1	133	133	0.1		0.55	0.06	15.23	0.06	10	10	2.64	**0.2**
I-BM-01	133	129	133.07	133	1.53		0.55	0.84	16.76	9.22	10	13.13	2.31	**21.4**
O-BM	125	115	134.3	134.3	0		0	0	16.76	9.22	0	13.74	2.25	**21.0**

(1) Nodes are presented in Figure D-BI-BM in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

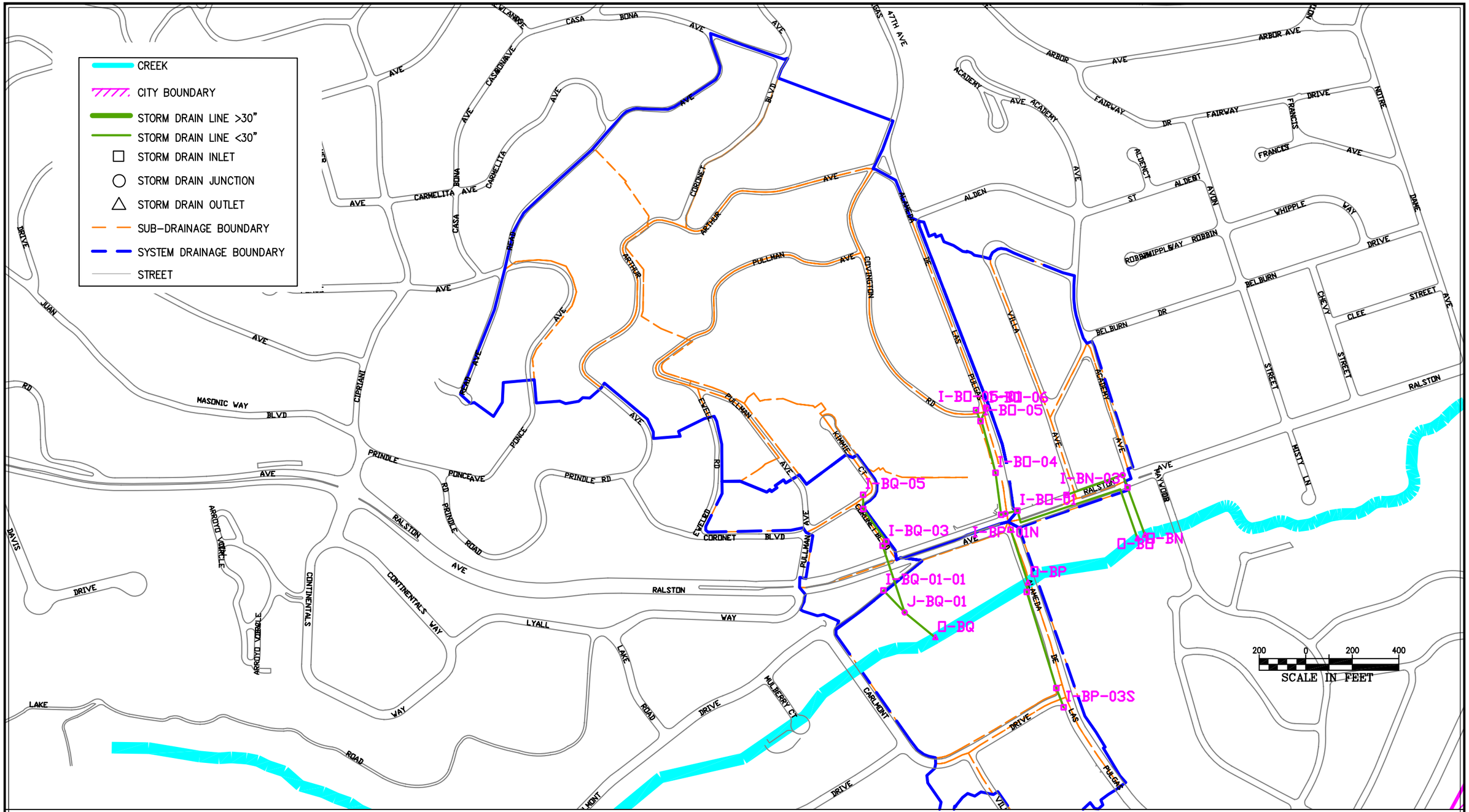
CITY OF BELMONT
STORM DRAIN MASTER PLAN

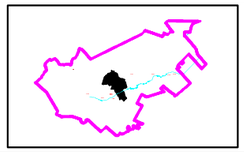
Table D-B5d

Proposed Hydraulics, 25-Year Event, Systems BI, BJ, BK, BL & BM

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Chula Vista Drive																		
P-BI-02-02	I-BI-02-02	I-BI-02-01	13.1	12.4	12 inch	41	0.122	0.013	88.0	83.0	92.0	91.5	97.0	91.5	**ABOVE RIM**	3.0	16.7	no change
P-BI-02-01	I-BI-02-01	J-BI-02	19.0	16.8	18 inch	46	0.022	0.012	83.0	82.0	91.5	90.0	91.3	90.0	**0.2**	7.0	10.7	upsized
P-BI-04	I-BI-04	I-BI-03	14.6	14.1	12 inch	541	0.157	0.013	205.0	120.0	210.0	125.0	214.2	123.7	**ABOVE RIM**	4.0	18.6	no change
P-BI-03	I-BI-03	J-BI-02	36.5	42.5	18 inch	272	0.140	0.012	120.0	82.0	125.0	90.0	121.5	90.0	**3.5**	3.5	27.1	upsized
P-BI-02	J-BI-02	I-BI-01	54.6	24.8	2 x 2 ft	135	0.007	0.013	82.0	81.0	90.0	90.0	90.1	85.3	**ABOVE RIM**	6.0	13.7	no change
P-BI-01	I-BI-01	O-BI	55.5	69.9	2 x 2 ft	17	0.059	0.013	81.0	80.0	90.0	86.3	83.0	81.8	**7.0**	7.0	19.5	no change
Escondido Way																		
P-BJ-01	I-BJ-01	O-BJ	9.3	8.6	12 inch	220	0.059	0.013	96.9	84.0	100.9	89.0	100.5	85.6	**0.4**	3.0	11.8	no change
Misty Way																		
P-BK-02	I-BK-02	I-BK-01	5.0	2.3	12 inch	25	0.004	0.013	118.6	118.5	121.6	121.5	120.4	119.9	**1.2**	2.0	6.3	no change
P-BK-01	I-BK-01	O-BK	5.0	7.5	12 inch	397	0.044	0.013	118.5	101.0	121.5	105.0	119.4	104.8	**2.1**	2.0	10.2	no change
Kittie Lane																		
P-BL-01	I-BL-01	O-BL	5.8	6.8	12 inch	147	0.122	0.024	129.0	111.0	133.5	118.0	130.0	113.7	**3.6**	3.5	9.7	no change
Maywood Drive																		
P-BM-01-01	I-BM-01-01	I-BM-01	0.2	1.9	12 inch	35	0.003	0.013	129.1	129.0	133.1	133.0	133.0	133.0	**0.1**	3.0	0.2	no change
P-BM-02	I-BM-02	I-BM-01	22.2	30.2	24 inch	56	0.018	0.013	130.0	129.0	134.0	133.0	133.5	133.0	**0.5**	2.0	7.1	upsized
P-BM-01	I-BM-01	O-BM	21.4	53.6	24 inch	249	0.056	0.013	129.0	115.0	133.0	125.0	136.5	134.3	**ABOVE RIM**	2.0	6.8	no change

(1) Pipes are presented in Figure 2 and Figure D-BI-BM in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B6A TO D-B6D

FIGURE D-BN-BQ
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B6a

Existing Hydrology, 10-Year Event, Systems BN, BO, BP & BQ

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Ralston Avenue nr Alameda de las Pulgas Branch														
I-BN-03	146	142	143.21	143.21	10.04		0.5	5.02	10.04	5.02	10	10	2.21	**11.2**
J-BN-02	137.1	132.1	133.83	133.65	0		0	0	10.04	5.02	0	10.37	2.17	**11.0**
I-BN-01	137	132	133.44	133.38	3.57		0.5	1.78	13.61	6.81	10	10.64	2.14	**14.7**
O-BN	133.8	129.8	124.1	124.1	0		0	0	13.61	6.81	0	11.12	2.1	**14.4**
Alameda de las Pulgas (north)														
I-BO-05-01	173	169	170.12	170.12	6.52		0.5	3.26	6.52	3.26	10	10	2.21	**7.3**
I-BO-06	170	166	168.01	168.01	0.46		0.5	0.23	0.46	0.23	10	10	2.21	**0.5**
I-BO-05	168	164	182.58	168	40.1	6.52	0.5	20.05	47.08	23.54	10	11.56	2.06	**48.8**
I-BO-04	160	156	192.75	160	0.16		0.5	0.08	47.24	23.62	10	11.62	2.05	**48.8**
I-BO-03	157.1	151.1	154.32	153.61	3.66		0.5	1.83	50.9	25.45	10	11.67	2.05	**52.5**
J-BO-02	157	151	153.42	153.35	0		0	0	50.9	25.45	0	11.71	2.04	**52.4**
I-BO-01	156	150	153.13	152.36	0.38		0.5	0.19	51.28	25.64	10	11.78	2.04	**52.6**
O-BO	133.8	129.8	124.1	124.1	0		0	0	51.28	25.64	0	12.56	1.97	**51.0**
Alameda de las Pulgas (south)														
I-BP-01N	156.2	151.2	151.43	151.43	0.4		0.5	0.2	0.4	0.2	10	10	2.21	**0.5**
I-BP-03S	155	151	155	155	6.1		0.5	3.05	6.1	3.05	10	10	2.21	**6.8**
I-BP-02S	152	148	152.58	152	0.4		0.5	0.2	6.5	3.25	10	10.17	2.19	**7.2**
I-BP-01S	147	143	158.42	147	14.4	0.4	0.5	7.2	21.3	10.45	10	10.96	2.11	**22.2**
O-BP	146	142	143.8	143.8	0		0	0	21.3	10.65	0	10.98	2.11	**22.6**
Coronet Boulevard														
I-BQ-01-01	176	172	172.51	172.51	1.5		0.5	0.75	1.5	0.75	10	10	2.21	**1.7**
I-BQ-05	212.5	208.5	209.29	209.29	3.08		0.5	1.54	3.08	1.54	10	10	2.21	**3.4**
I-BQ-04	202	198	198.99	198.79	0		0	0	3.08	1.54	10	10.11	2.2	**3.4**
I-BQ-03	188.1	184.1	185.81	185.47	0.25		0.5	0.13	3.33	1.67	10	10.5	2.16	**3.6**
I-BQ-02	188	183.5	184.63	184.42	1.9		0.5	0.95	5.23	2.62	10	10.58	2.15	**5.7**
J-BQ-01	165	160	161.16	161.03	0	1.5	0	0	6.73	3.37	0	11.19	2.09	**7.1**
O-BQ	153	149	149.2	149.2	0		0	0	6.73	3.37	0	11.54	2.06	**7.0**

(1) Nodes are presented in Figure D-BN-BQ in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
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Table D-B6b

Existing Hydraulics, 10-Year Event, Systems BN, BO, BP & BQ

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Ralston Avenue nr Alameda de las Pulgas Branch																	
P-BN-03	I-BN-03	J-BN-02	11.2	12.7	15 inch	256	0.039	0.013	142.0	132.1	146.0	137.1	143.2	133.8	**2.8**	2.8	11.7
P-BN-02	J-BN-02	I-BN-01	11.0	9.5	24 inch	57	0.002	0.013	132.1	132.0	137.1	137.0	133.7	133.4	**3.4**	3.0	3.5
P-BN-01	I-BN-01	O-BN	14.7	22.6	24 inch	220	0.010	0.013	132.0	129.8	137.0	133.8	133.4	131.0	**3.6**	3.0	7.7
Alameda de las Pulgas (north)																	
P-BO-05-01	I-BO-05-01	I-BO-05	7.3	11.2	12 inch	51	0.098	0.013	169.0	164.0	173.0	168.0	170.1	168.0	**2.9**	3.0	9.2
P-BO-06	I-BO-06	I-BO-05	0.5	6.5	12 inch	61	0.033	0.013	166.0	164.0	170.0	168.0	168.0	168.0	**2.0**	3.0	0.7
P-BO-05	I-BO-05	I-BO-04	48.8	6.6	12 inch	234	0.034	0.013	164.0	156.0	168.0	160.0	598.4	160.0	**ABOVE RIM**	3.0	62.1
P-BO-04	I-BO-04	I-BO-03	48.8	5.9	12 inch	182	0.027	0.013	156.0	151.1	160.0	157.1	495.8	154.3	**ABOVE RIM**	3.0	62.1
P-BO-03	I-BO-03	J-BO-02	52.5	48.4	36 inch	19	0.005	0.013	151.1	151.0	157.1	157.0	153.6	153.4	**3.5**	3.0	7.4
P-BO-02	J-BO-02	I-BO-01	52.4	91.6	36 inch	53	0.019	0.013	151.0	150.0	157.0	156.0	153.4	153.1	**3.7**	3.0	13.4
P-BO-01	I-BO-01	O-BO	52.6	111.0	36 inch	729	0.028	0.013	150.0	129.8	156.0	133.8	152.4	131.3	**3.6**	3.0	15.5
Alameda de las Pulgas (south)																	
P-BP-01N	I-BP-01N	O-BP	0.5	44.2	24 inch	241	0.038	0.013	151.2	142.0	156.2	146.0	151.4	143.8	**4.8**	3.0	4.5
P-BP-03S	I-BP-03S	I-BP-02S	6.8	6.5	12 inch	89	0.034	0.013	151.0	148.0	155.0	152.0	155.2	152.0	**ABOVE RIM**	3.0	8.7
P-BP-02S	I-BP-02S	I-BP-01S	7.2	3.8	12 inch	432	0.012	0.013	148.0	143.0	152.0	147.0	164.5	147.0	**ABOVE RIM**	3.0	9.1
P-BP-01S	I-BP-01S	O-BP	22.2	5.7	12 inch	39	0.026	0.013	143.0	142.0	147.0	146.0	159.0	143.8	**ABOVE RIM**	3.0	28.3
Coronet Boulevard																	
P-BQ-01-01	I-BQ-01-01	J-BQ-01	1.7	10.6	15 inch	132	0.091	0.024	172.0	160.0	176.0	165.0	172.5	161.2	**3.5**	2.8	6.3
P-BQ-05	I-BQ-05	I-BQ-04	3.4	7.9	12 inch	62	0.169	0.024	208.5	198.0	212.5	202.0	209.3	199.0	**3.2**	3.0	9.7
P-BQ-04	I-BQ-04	I-BQ-03	3.4	5.5	12 inch	172	0.081	0.024	198.0	184.1	202.0	188.1	198.8	185.8	**3.2**	3.0	7.4
P-BQ-03	I-BQ-03	I-BQ-02	3.6	3.1	12 inch	24	0.025	0.024	184.1	183.5	188.1	188.0	185.5	184.6	**2.6**	3.0	4.6
P-BQ-02	I-BQ-02	J-BQ-01	5.7	15.9	18 inch	302	0.078	0.024	183.5	160.0	188.0	165.0	184.4	161.2	**3.6**	3.0	8.2
P-BQ-01	J-BQ-01	O-BQ	7.1	14.4	18 inch	171	0.064	0.024	160.0	149.0	165.0	153.0	161.0	149.7	**4.0**	3.5	8.1

(1) Pipes are presented in Figure 2 and Figure D-BN-BQ in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B6c

Proposed Hydrology, 25-Year Event, Systems BN, BO, BP & BQ

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
I-BN-03	146	142	143.4	143.4	10.04		0.55	5.52	10.04	5.52	10	10	2.64	**14.7**
J-BN-02	137.1	132.1	134.2	133.94	0		0	0	10.04	5.52	0	10.34	2.6	**14.5**
I-BN-01	137	132	133.66	133.58	3.57		0.55	1.96	13.61	7.49	10	10.54	2.57	**19.4**
O-BN	133.8	129.8	129.4	129.4	0		0	0	13.61	7.49	0	11	2.52	**19.0**
I-BO-05-01	173	169	181.54	173	6.52		0.55	3.59	6.52	10.19	10	10.94	2.53	**25.9**
I-BO-06	170	166	166.34	166.34	0.46		0.55	0.25	0.46	0.25	10	10	2.64	**0.7**
I-BO-05	168	164	165.93	165.8	40.1	6.52	0	0	47.08	10.44	10	10.96	2.52	**26.6**
I-BO-04	161	155	159.25	158.91	0.16		0.55	0.09	47.24	10.53	10	11.23	2.49	**26.5**
I-BO-03	157.1	151.1	156.42	154.66	3.66		0.55	2.01	50.9	12.54	10	11.59	2.45	**31.0**
J-BO-02	157	151	154.3	154.09	0		0	0	50.9	12.54	0	11.62	2.45	**31.0**
I-BO-01	156	150	153.1	151.88	0.38		0.55	0.21	51.28	12.75	10	11.71	2.44	**31.4**
O-BO	133.8	129.8	123.6	123.6	0		0	0	51.28	12.75	0	12.61	2.35	**30.2**
I-BP-01N	156.2	151.2	151.46	151.46	0.4		0.55	0.22	0.4	0.22	10	10	2.64	**0.6**
I-BP-03S	155	151	155	155	6.1		0.55	3.36	6.1	3.36	10	10	2.64	**8.9**
I-BP-02S	152	148	152.89	152	0.4		0	0	6.5	3.36	10	10.13	2.63	**8.9**
I-BP-01S	147	143	148.71	147	14.4	0.4	0	0	21.3	3.36	10	10.77	2.55	**8.6**
O-BP	146	142	148.5	148.5	0		0	0	21.3	3.58	0	10.83	2.54	**9.2**
I-BQ-01-01	176	172	172.59	172.59	1.5		0.55	0.83	1.5	0.83	10	10	2.64	**2.2**
I-BQ-05	212.5	208.5	209.39	209.39	3.08		0.55	1.69	3.08	1.69	10	10	2.64	**4.5**
I-BQ-04	202	198	199.19	198.89	0		0	0	3.08	1.69	10	10.1	2.63	**4.5**
I-BQ-03	188.1	184.1	186.28	185.72	0.25		0	0	3.33	1.69	10	10.47	2.58	**4.4**
I-BQ-02	188	183.5	184.46	184.3	1.9		0	0	5.23	1.69	10	10.54	2.57	**4.4**
J-BQ-01	165	160	161.08	160.97	0	1.5	0	0	6.73	2.52	0	11.19	2.5	**6.3**
O-BQ	153	149	151.7	151.7	0		0	0	6.73	2.52	0	11.55	2.46	**6.2**

(1) Nodes are presented in Figure D-BN-BQ in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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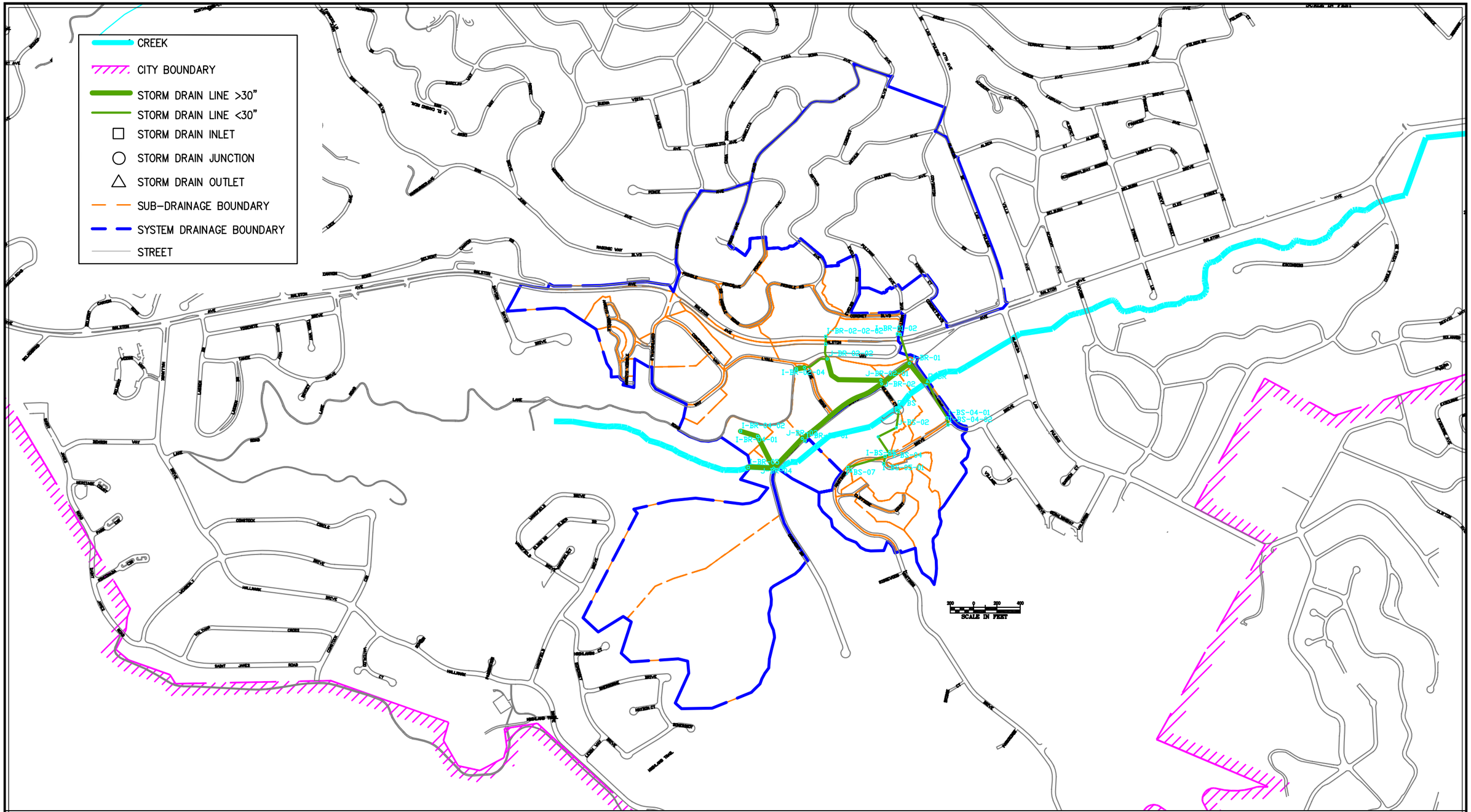
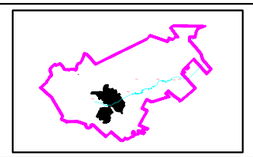
Table D-B6d

Proposed Hydraulics, 25-Year Event, Systems BN, BO, BP & BQ

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Ralston Avenue nr Alameda de las Pulgas Branch																		
P-BN-03	I-BN-03	J-BN-02	14.7	20.7	18 inch	256	0.039	0.013	142.0	132.1	146.0	137.1	143.4	134.2	**2.6**	2.5	12.7	upsized
P-BN-02	J-BN-02	I-BN-01	14.5	9.5	24 inch	57	0.002	0.013	132.1	132.0	137.1	137.0	133.9	133.7	**3.2**	3.0	4.6	no change
P-BN-01	I-BN-01	O-BN	19.4	22.6	24 inch	220	0.010	0.013	132.0	129.8	137.0	133.8	133.6	131.2	**3.4**	3.0	8.1	no change
Alameda de las Pulgas (north)																		
P-BO-05-01	I-BO-05-01	I-BO-05	25.9	11.2	12 inch	51	0.098	0.013	169.0	164.0	173.0	168.0	193.6	166.6	**ABOVE RIM**	3.0	33.0	no change
P-BO-06	I-BO-06	I-BO-05	0.7	6.5	12 inch	61	0.033	0.013	166.0	164.0	170.0	168.0	166.3	165.9	**3.7**	3.0	5.3	no change
P-BO-05	I-BO-05	I-BO-04	26.6	44.4	24 inch	234	0.038	0.013	164.0	155.0	168.0	161.0	165.8	159.3	**2.2**	2.0	14.8	upsized
P-BO-04	I-BO-04	I-BO-03	26.5	33.1	24 inch	182	0.021	0.013	155.0	151.1	161.0	157.1	158.9	156.4	**2.1**	4.0	8.4	upsized
P-BO-03	I-BO-03	J-BO-02	31.0	16.4	24 inch	19	0.005	0.013	151.1	151.0	157.1	157.0	154.7	154.3	**2.4**	4.0	9.9	upsized
P-BO-02	J-BO-02	I-BO-01	31.0	31.1	24 inch	53	0.019	0.013	151.0	150.0	157.0	156.0	154.1	153.1	**2.9**	4.0	9.9	upsized
P-BO-01	I-BO-01	O-BO	31.4	37.7	24 inch	729	0.028	0.013	150.0	129.8	156.0	133.8	151.9	131.2	**4.1**	4.0	13.4	upsized
Alameda de las Pulgas (south)																		
P-BP-01N	I-BP-01N	O-BP	0.6	44.2	24 inch	241	0.038	0.013	151.2	142.0	156.2	146.0	151.5	148.5	**4.7**	3.0	4.9	no change
P-BP-03S	I-BP-03S	I-BP-02S	8.9	6.5	12 inch	89	0.034	0.013	151.0	148.0	155.0	152.0	157.6	152.0	**ABOVE RIM**	3.0	11.4	no change
P-BP-02S	I-BP-02S	I-BP-01S	8.9	3.8	12 inch	432	0.012	0.013	148.0	143.0	152.0	147.0	173.8	147.0	**ABOVE RIM**	3.0	11.3	no change
P-BP-01S	I-BP-01S	O-BP	8.6	5.7	12 inch	39	0.026	0.013	143.0	142.0	147.0	146.0	150.8	148.5	**ABOVE RIM**	3.0	11.0	no change
Coronet Boulevard																		
P-BQ-01-01	I-BQ-01-01	J-BQ-01	2.2	10.6	15 inch	132	0.091	0.024	172.0	160.0	176.0	165.0	172.6	161.1	**3.4**	2.8	6.8	no change
P-BQ-05	I-BQ-05	I-BQ-04	4.5	7.9	12 inch	62	0.169	0.024	208.5	198.0	212.5	202.0	209.4	199.2	**3.1**	3.0	10.4	no change
P-BQ-04	I-BQ-04	I-BQ-03	4.5	5.5	12 inch	172	0.081	0.024	198.0	184.1	202.0	188.1	198.9	186.3	**3.1**	3.0	7.8	no change
P-BQ-03	I-BQ-03	I-BQ-02	4.4	3.1	12 inch	24	0.025	0.024	184.1	183.5	188.1	188.0	185.7	184.5	**2.4**	3.0	5.6	no change
P-BQ-02	I-BQ-02	J-BQ-01	4.4	15.9	18 inch	302	0.078	0.024	183.5	160.0	188.0	165.0	184.3	161.1	**3.7**	3.0	7.7	no change
P-BQ-01	J-BQ-01	O-BQ	6.3	14.4	18 inch	171	0.064	0.024	160.0	149.0	165.0	153.0	161.0	151.7	**4.0**	3.5	7.9	no change

(1) Pipes are presented in Figure 2 and Figure D-BN-BQ in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





NOTE :
INLETS I-BS-04-01 & I-BS-04-02 HAVE BEEN FIELD VERIFIED AS FLOWING TO O-BR
SEE FOLLOWING TABLES D-B7A TO D-B7D

FIGURE D-BR-BS
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B7a

Existing Hydrology, 10-Year Event, Systems BR & BS

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Carlmont Drive														
I-BR-04-02	240	233	233.42	233.42	1.92		0.5	0.96	1.92	0.96	10	10	2.21	**2.1**
I-BR-04-01	226	219	219.44	219.42	0		0	0	1.92	0.96	10	10.27	2.18	**2.1**
I-BR-03-01	202	198	202	202	12.93		0.5	6.47	12.93	6.47	10	10	2.21	**14.4**
I-BR-02-02-02	269.5	265.75	269.5	269.5	30.75		0.5	15.38	30.75	15.38	10	10	2.21	**34.2**
I-BR-02-02-01	269	264	314.14	269	5.21		0.5	2.61	35.96	17.98	10	10.02	2.21	**40.0**
I-BR-02-04	240	233	235.08	235.08	34.09		0.5	17.05	34.09	17.05	10	10	2.21	**38.0**
J-BR-02-03	230.2	227.2	229.37	229.14	0		0	0	34.09	17.05	0	10.06	2.2	**37.9**
J-BR-02-02	220	215	226.12	220	0	35.96	0	0	70.05	35.03	0	10.25	2.18	**77.0**
J-BR-02-01	181	176	194.68	181	0		0	0	70.05	35.03	0	10.65	2.14	**75.6**
I-BR-01-02	221	217.25	217.99	217.99	3.02		0.5	1.51	3.02	1.51	10	10	2.21	**3.4**
I-BR-01-01	218	212.25	213.24	213.05	0.48		0.5	0.24	3.5	1.75	10	10.03	2.21	**3.9**
I-BR-05	210	204	209.78	209.78	52.08		0.5	26.04	52.08	26.04	10	10	2.21	**178.0**
J-BR-04	212	204	208.02	207.76	0	1.92	0	0	54	27	0	10.94	2.11	**177.5**
J-BR-03	203	195	199.09	198.97	0	12.93	0	0	66.93	33.47	0	11.22	2.09	**190.4**
J-BR-02	180.5	174.5	181.03	180.5	0	70.05	0	0	136.98	68.49	0	11.85	2.03	**260.1**
J-BR-01	182.6	170.6	176.4	174.91	0	3.5	0	0	140.48	70.24	0	12.16	2	**261.9**
O-BR	162	151.8	155.2	155.2	0		0	0	140.48	74.19	0	12.26	2	**269.2**
Hastings Drive / Mullberry Court														
I-BS-05-01	276.4	273	274.45	274.45	7.48		0.5	3.74	7.48	3.74	10	10	2.21	**8.3**
I-BS-04-02	190	186	186.94	186.94	4.88		0.5	2.44	4.88	2.44	10	10	2.21	**5.4**
I-BS-04-01	188	184.9	186.22	186.04	3.01		0.5	1.5	7.89	3.94	10	10.13	2.19	**8.7**
I-BS-07	333	329	329.99	329.99	8.22		0.5	4.11	8.22	4.11	10	10	2.21	**9.2**
I-BS-06	332	318	319.86	319.17	0.3		0.5	0.15	8.52	4.26	10	10.02	2.21	**9.5**
I-BS-05	281	272	273.85	273.45	0	7.48	0	0	16	8	10	10.33	2.17	**17.5**
I-BS-04	264	259	266.73	261.14	10.12	7.89	0.5	5.06	34.01	13.06	10	10.37	2.17	**28.6**
J-BS-03	215	210	221.43	215	0		0	0	34.01	13.06	0	10.56	2.15	**28.3**
J-BS-02	200	195	205.44	200	0		0	0	34.01	13.06	0	10.74	2.13	**28.1**
J-BS-01	173	168.5	176.2	172.15	0		0	0	34.01	13.06	0	10.88	2.12	**27.9**
O-BS	173	168.4	165.5	165.5	0		0	0	34.01	13.06	0	10.92	2.11	**27.8**

(1) Nodes are presented in Figure D-BR-BS in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B7b

Existing Hydraulics, 10-Year Event, Systems BR & BS

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Carlmont Drive																	
P-BR-04-02	I-BR-04-02	I-BR-04-01	2.1	470.7	48 inch	153	0.092	0.012	233.00	219.00	240.00	226.00	233.42	219.44	**6.6**	3.0	9.5
P-BR-04-01	I-BR-04-01	J-BR-04	2.1	344.5	48 inch	306	0.049	0.012	219.00	204.00	226.00	212.00	219.42	208.02	**6.6**	3.0	7.6
P-BR-03-01	I-BR-03-01	J-BR-03	14.4	10.6	12 inch	34	0.088	0.013	198.00	195.00	202.00	203.00	204.65	199.09	**ABOVE RIM**	3.0	18.3
P-BR-02-02-02	I-BR-02-02-02	I-BR-02-02-01	34.2	1.9	10 inch	66	0.027	0.024	265.75	264.00	269.50	269.00	818.48	269.00	**ABOVE RIM**	2.9	62.8
P-BR-02-02-01	I-BR-02-02-01	J-BR-02-02	40.0	7.3	10 inch	131	0.374	0.024	264.00	215.00	269.00	220.00	1,708.90	220.00	**ABOVE RIM**	4.2	73.4
P-BR-02-04	I-BR-02-04	J-BR-02-03	38.0	117.2	30 inch	71	0.082	0.013	233.00	227.20	240.00	230.20	235.08	229.37	**4.9**	4.5	21.3
P-BR-02-03	J-BR-02-03	J-BR-02-02	37.9	53.5	24 inch	218	0.056	0.013	227.20	215.00	230.20	220.00	229.14	220.00	**1.1**	1.0	18.5
P-BR-02-02	J-BR-02-02	J-BR-02-01	77.0	58.7	24 inch	580	0.067	0.013	215.00	176.00	220.00	181.00	248.27	181.00	**ABOVE RIM**	3.0	24.5
P-BR-02-01	J-BR-02-01	J-BR-02	75.6	50.6	24 inch	30	0.050	0.013	176.00	174.50	181.00	180.50	183.85	180.50	**ABOVE RIM**	3.0	24.1
P-BR-01-02	I-BR-01-02	I-BR-01-01	3.4	29.5	15 inch	24	0.208	0.013	217.25	212.25	221.00	218.00	217.99	213.24	**3.0**	2.5	16.0
P-BR-01-01	I-BR-01-01	J-BR-01	3.9	14.0	15 inch	259	0.161	0.024	212.25	170.60	218.00	182.60	213.05	176.40	**4.9**	4.5	9.8
P-BR-05	I-BR-05	J-BR-04	178.0	0.0	72 inch	221	0.000	0.012	204.00	204.00	210.00	212.00	209.78	209.44	**0.2**	0.0	6.3
P-BR-04	J-BR-04	J-BR-03	177.5	248.5	48 inch	353	0.025	0.012	204.00	195.00	212.00	203.00	207.76	199.31	**4.2**	4.0	21.5
P-BR-03	J-BR-03	J-BR-02	190.4	334.4	54 inch	832	0.025	0.012	195.00	174.50	203.00	180.50	198.97	180.50	**4.0**	3.5	21.7
P-BR-02	J-BR-02	J-BR-01	260.1	244.9	54 inch	295	0.013	0.012	174.50	170.60	180.50	182.60	182.12	177.72	**ABOVE RIM**	1.5	16.4
P-BR-01	J-BR-01	O-BR	261.9	613.1	54 inch	227	0.083	0.012	170.60	151.80	182.60	162.00	174.91	154.07	**7.7**	7.5	37.0
Hastings Drive / Mullberry Court																	
P-BS-05-01	I-BS-05-01	I-BS-05	8.3	13.0	18 inch	65	0.015	0.013	273.00	272.00	276.40	281.00	274.45	274.05	**1.9**	1.9	7.8
P-BS-07	I-BS-07	I-BS-06	9.2	20.9	12 inch	32	0.344	0.013	329.00	318.00	333.00	332.00	329.99	319.86	**3.0**	3.0	25.7
P-BS-06	I-BS-06	I-BS-05	9.5	23.9	15 inch	336	0.137	0.013	318.00	272.00	332.00	281.00	319.17	273.85	**12.8**	12.8	18.4
P-BS-05	I-BS-05	I-BS-04	17.5	30.9	18 inch	44		0.024	272.00		281.00	264.00	273.45	264.00	**7.6**	7.5	18.1
P-BS-04	I-BS-04	J-BS-03	28.6	29.4	18 inch	183	0.268	0.024	259.00	210.00	264.00	215.00	261.14	215.00	**2.9**	3.5	16.2
P-BS-03	J-BS-03	J-BS-02	28.3	16.6	18 inch	176	0.085	0.024	210.00	195.00	215.00	200.00	243.59	200.00	**ABOVE RIM**	3.5	16.0
P-BS-02	J-BS-02	J-BS-01	28.1	24.9	18 inch	138	0.192	0.024	195.00	168.50	200.00	173.00	206.61	173.00	**ABOVE RIM**	3.5	15.9
P-BS-01	J-BS-01	O-BS	27.9	5.9	18 inch	32	0.003	0.013	168.50	168.40	173.00	173.00	172.15	169.89	**0.8**	3.0	15.8

(1) Pipes are presented in Figure 2 and Figure D-BR-BS in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B7c

Proposed Hydrology, 25-Year Event, Systems BR & BS

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
I-BR-04-02	240	233	233.48	233.48	1.92		0.55	1.06	1.92	1.06	10	10	2.64	**2.8**
I-BR-04-01	226	219	219.5	219.48	0		0	0	1.92	1.06	10	10.25	2.61	**2.8**
I-BR-03-01	202	198	199.46	199.46	12.93		0.55	7.11	12.93	7.11	10	10	2.64	**18.9**
I-BR-02-02-02	269.5	265.75	268.83	268.83	30.75		0.55	16.91	30.75	16.91	10	10	2.64	**45.0**
I-BR-02-02-01	269	264	266.6	265.98	5.21		0.55	2.87	35.96	19.78	10	10.08	2.63	**52.5**
I-BR-02-04	240	233	235.3	235.3	34.09		0.55	18.75	34.09	18.75	10	10	2.64	**49.9**
J-BR-02-03	230.2	227.2	230.65	230.14	0		0	0	34.09	18.75	0	10.05	2.64	**49.8**
J-BR-02-02	220	215	218.92	217.49	0	35.96	0	0	70.05	38.53	0	10.28	2.61	**101.2**
J-BR-02-01	181	176	182.68	179.86	0		0	0	70.05	38.53	0	10.67	2.56	**99.3**
I-BR-01-02	221	217.25	218.1	218.1	3.02		0.55	1.66	3.02	1.66	10	10	2.64	**4.4**
I-BR-01-01	218	212.25	213.43	213.17	0.48		0.55	0.26	3.5	1.93	10	10.02	2.64	**5.1**
I-BR-05	210	204.1	207.35	207.35	52.08		0.55	28.64	52.08	28.64	10	10	2.64	**76.3**
J-BR-04	212	204	206.71	206.63	0	1.92	0	0	54	29.7	0	10.96	2.52	**75.5**
J-BR-03	203	195	197.92	197.82	0	12.93	0	0	66.93	36.81	0	11.3	2.49	**92.2**
J-BR-02	180.5	174.5	178.65	178.41	0	70.05	0	0	136.98	75.34	0	12.08	2.4	**182.6**
J-BR-01	182.6	170.6	175.34	174.53	0	3.5	0	0	140.48	77.26	0	12.37	2.38	**185.0**
O-BR	162	151.8	157.7	157.7	0		0	0	140.48	81.6	0	12.48	2.37	**194.6**
I-BS-05-01	276	273	275.21	275.21	7.48		0.55	4.11	7.48	4.11	10	10	2.64	**11.0**
I-BS-04-02	190	186	187.12	187.12	4.88		0.55	2.68	4.88	2.68	10	10	2.64	**7.2**
I-BS-04-01	188	184.9	186.46	186.19	3.01		0.55	1.66	7.89	4.34	10	10.13	2.63	**11.5**
I-BS-07	333	329	330	330	8.22		0.55	4.52	8.22	4.52	10	10	2.64	**12.0**
I-BS-06	332	318	320.31	319.22	0.3		0	0	8.52	4.52	10	10.02	2.64	**12.0**
I-BS-05	281	272	274.16	273.48	0	7.48	0	0	16	8.64	10	10.31	2.6	**22.7**
I-BS-04	264	259	262.48	260.48	10.12	7.89	0	0	34.01	8.64	10	10.33	2.6	**22.6**
J-BS-03	215	210	212.38	211.69	0		0	0	34.01	8.64	0	10.43	2.59	**22.5**
J-BS-02	200	195	197.27	196.69	0		0	0	34.01	8.64	0	10.58	2.57	**22.4**
J-BS-01	173	168.5	170.95	170.51	0		0	0	34.01	8.64	0	10.67	2.56	**22.3**
O-BS	173	168.4	167.4	167.4	0		0	0	34.01	8.64	0	10.74	2.55	**22.2**

(1) Nodes are presented in Figure D-BR-BS in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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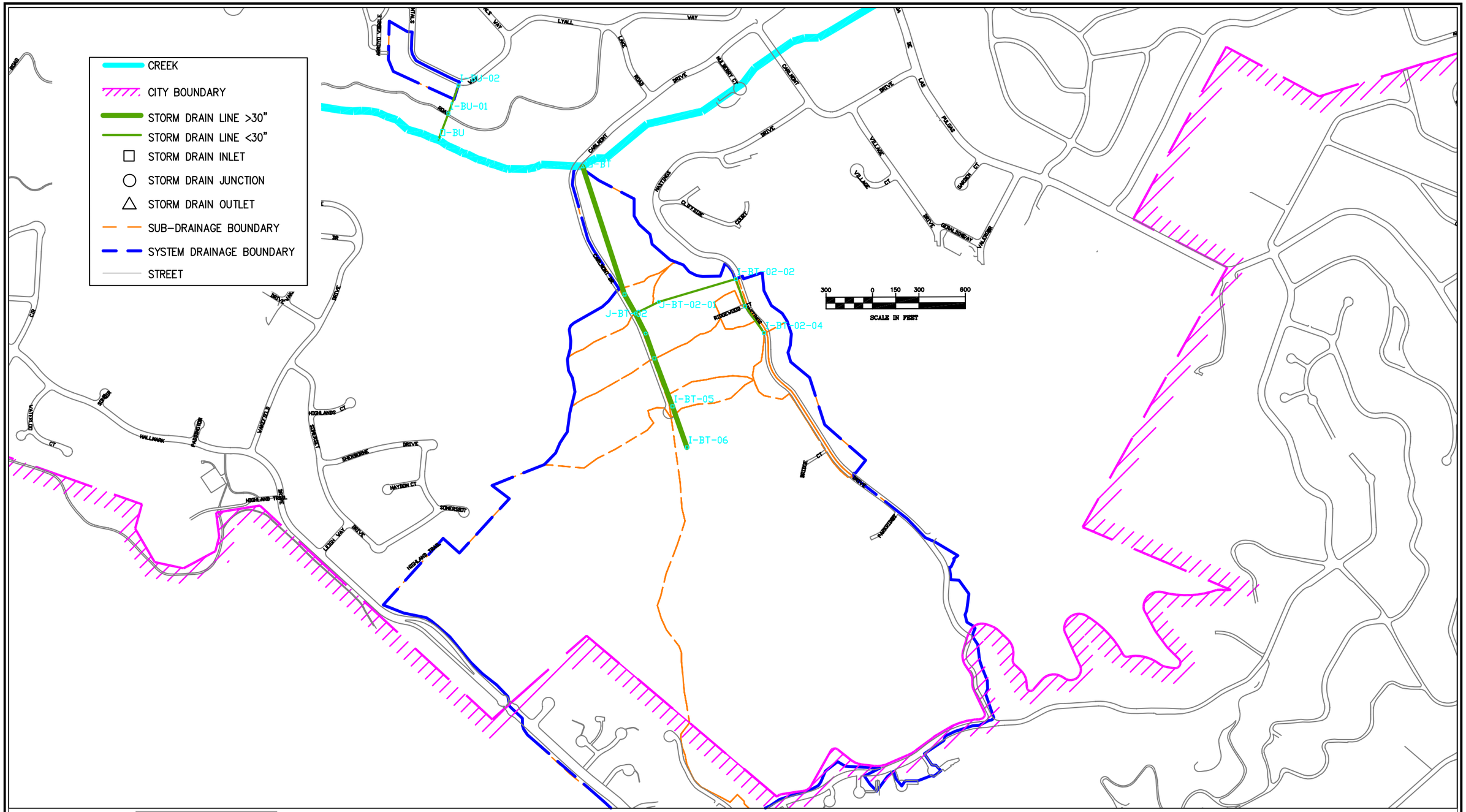
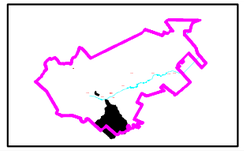
Table D-B7d

Proposed Hydraulics, 25-Year Event, Systems BR & BS

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Carlmont Drive																		
P-BR-04-02	I-BR-04-02	I-BR-04-01	2.8	470.7	48 inch	153	0.092	0.012	233.0	219.0	240.0	226.0	233.5	219.5	**6.5**	3.0	10.3	no change
P-BR-04-01	I-BR-04-01	J-BR-04	2.8	344.5	48 inch	306	0.049	0.012	219.0	204.0	226.0	212.0	219.5	206.7	**6.5**	3.0	8.3	no change
P-BR-03-01	I-BR-03-01	J-BR-03	18.9	31.2	18 inch	34	0.088	0.013	198.0	195.0	202.0	203.0	199.5	197.9	**2.5**	2.5	18.5	upsized
P-BR-02-02-02	I-BR-02-02-02	I-BR-02-02-01	45.0	39.9	24 inch	66	0.027	0.012	265.8	264.0	269.5	269.0	268.8	266.6	**0.7**	1.8	14.3	upsized
P-BR-02-02-01	I-BR-02-02-01	J-BR-02-02	52.5	149.9	24 inch	131	0.374	0.012	264.0	215.0	269.0	220.0	266.0	218.9	**3.0**	3.0	43.5	upsized
P-BR-02-04	I-BR-02-04	J-BR-02-03	49.9	117.2	30 inch	71	0.082	0.013	233.0	227.2	240.0	230.2	235.3	230.2	**4.7**	4.5	22.9	no change
P-BR-02-03	J-BR-02-03	J-BR-02-02	49.8	53.5	24 inch	218	0.056	0.013	227.2	215.0	230.2	220.0	230.1	219.6	**0.1**	1.0	15.9	no change
P-BR-02-02	J-BR-02-02	J-BR-02-01	101.2	106.4	30 inch	580	0.067	0.013	215.0	176.0	220.0	181.0	217.5	181.0	**2.5**	2.5	24.7	upsized
P-BR-02-01	J-BR-02-01	J-BR-02	99.3	149.1	36 inch	30	0.050	0.013	176.0	174.5	181.0	180.5	179.9	179.2	**1.1**	2.0	14.1	upsized
P-BR-01-02	I-BR-01-02	I-BR-01-01	4.4	29.5	15 inch	24	0.208	0.013	217.3	212.3	221.0	218.0	218.1	213.4	**2.9**	2.5	17.3	no change
P-BR-01-01	I-BR-01-01	J-BR-01	5.1	14.0	15 inch	259	0.161	0.024	212.3	170.6	218.0	182.6	213.2	175.3	**4.8**	4.5	10.5	no change
P-BR-05	I-BR-05	J-BR-04	76.3	97.6	72 inch	221	0.000	0.012	204.1	204.0	210.0	212.0	207.4	207.1	**2.7**	-0.1	3.8	no change
P-BR-04	J-BR-04	J-BR-03	75.5	248.5	48 inch	353	0.025	0.012	204.0	195.0	212.0	203.0	206.6	198.0	**5.4**	4.0	17.4	no change
P-BR-03	J-BR-03	J-BR-02	92.2	334.4	54 inch	832	0.025	0.012	195.0	174.5	203.0	180.5	197.8	178.7	**5.2**	3.5	18.0	no change
P-BR-02	J-BR-02	J-BR-01	182.6	244.9	54 inch	295	0.013	0.012	174.5	170.6	180.5	182.6	178.4	176.0	**2.1**	1.5	16.9	no change
P-BR-01	J-BR-01	O-BR	185.0	613.1	54 inch	227	0.083	0.012	170.6	151.8	182.6	162.0	174.5	157.7	**8.1**	7.5	33.8	no change
Hastings Drive / Mullberry Court																		
P-BS-05-01	I-BS-05-01	I-BS-05	11.0	13.0	18 inch	65	0.015	0.013	273.0	272.0	276.0	281.0	275.2	274.5	**0.8**	1.5	6.2	no change
P-BS-04-02	I-BS-04-02	I-BS-04-01	7.2	8.8	15 inch	60	0.018	0.013	186.0	184.9	190.0	188.0	187.1	186.5	**2.9**	2.8	8.0	no change
P-BS-04-01	I-BS-04-01	O-BR	11.5	32.1	18 inch	354	0.094	0.013	184.9	151.8	188.0	162.0	186.2	157.7	**1.8**	1.6	16.7	no change
P-BS-07	I-BS-07	I-BS-06	12.0	20.9	12 inch	32	0.344	0.013	329.0	318.0	333.0	332.0	330.0	320.3	**3.0**	3.0	27.5	no change
P-BS-06	I-BS-06	I-BS-05	12.0	23.9	15 inch	336	0.137	0.013	318.0	272.0	332.0	281.0	319.2	274.2	**12.8**	12.8	19.5	no change
P-BS-05	I-BS-05	I-BS-04	22.7	57.1	18 inch	44	0.295	0.013	272.0	259.0	281.0	264.0	273.5	262.5	**7.5**	7.5	30.4	no change
P-BS-04	I-BS-04	J-BS-03	22.6	54.4	18 inch	183	0.268	0.013	259.0	210.0	264.0	215.0	260.5	212.4	**3.5**	3.5	29.4	no change
P-BS-03	J-BS-03	J-BS-02	22.5	71.5	24 inch	176	0.085	0.012	210.0	195.0	215.0	200.0	211.7	197.3	**3.3**	3.0	20.2	upsized
P-BS-02	J-BS-02	J-BS-01	22.4	107.4	24 inch	138	0.192	0.012	195.0	168.5	200.0	173.0	196.7	171.0	**3.3**	3.0	27.0	upsized
P-BS-01	J-BS-01	O-BS	22.3	13.7	24 inch	32	0.003	0.012	168.5	168.4	173.0	173.0	170.5	170.1	**2.5**	2.5	7.1	upsized

(1) Pipes are presented in Figure 2 and Figure D-BR-BS in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B8A TO D-B8D

FIGURE D-BT-BU
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B8a

Existing Hydrology, 10-Year Event, Systems BT & BU

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
Carlmont Drive (south)														
I-BT-02-04	516.8	512.8	513.69	513.69	4.31		0.5	2.15	4.31	2.15	10	10	2.21	**4.8**
I-BT-02-03	482	478	479.12	478.97	0.94		0.5	0.47	5.25	2.63	10	10.21	2.19	**5.8**
I-BT-02-02	460	454	455.55	455.07	1.29		0.5	0.65	6.54	3.27	10	10.41	2.17	**7.1**
J-BT-02-01	308	304	305.12	305.02	0		0	0	6.54	3.27	0	10.8	2.13	**7.0**
I-BT-06	317	310	314.13	314.13	91.2		0.5	45.6	91.2	45.6	10	10	2.21	**101.6**
I-BT-05	317	309	312.95	312.76	72.9		0.5	36.45	164.1	82.05	10	10.58	2.15	**177.7**
I-BT-04	310	302	306.01	305.8	10.77		0.5	5.39	174.87	87.44	10	10.86	2.12	**186.9**
J-BT-03	300	293	297.26	296.8	0		0	0	174.87	87.44	0	10.96	2.11	**186.0**
J-BT-02	292	285	288.9	288.82	0	6.54	0	0	181.41	90.71	0	11.04	2.1	**192.3**
I-BT-01	282	275	279.57	279.1	17.29		0.5	8.65	198.7	99.35	0	11.11	2.1	**209.9**
O-BT	212	200.5	207.1	207.1	0		0	0	198.7	99.35	0	11.54	2.06	**206.0**
Continentals Way														
I-BU-02	375.3	371.3	371.95	371.95	1.91		0.5	0.96	1.91	0.96	10	10	2.21	**2.1**
I-BU-01	325	321	321.72	321.65	0		0.5	0	1.91	0.96	10	10.2	2.19	**2.1**
O-BU	260	205	244.6	244.6	0		0	0	1.91	0.96	0	10.34	2.17	**2.1**

(1) Nodes are presented in Figure D-BT-BU in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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STORM DRAIN MASTER PLAN

Table D-B8b

Existing Hydraulics, 10-Year Event, Systems BT & BU

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 24"																	
Carlmont Drive (south)																	
P-BT-02-04	I-BT-02-04	I-BT-02-03	4.8	26.3	15 inch	210	0.166	0.013	512.8	478.0	516.8	482.0	513.7	479.1	**3.1**	2.8	16.3
P-BT-02-03	I-BT-02-03	I-BT-02-02	5.8	23.1	15 inch	187	0.128	0.013	478.0	454.0	482.0	460.0	479.0	455.6	**3.0**	2.8	15.7
P-BT-02-02	I-BT-02-02	J-BT-02-01	7.1	34.8	15 inch	518	0.290	0.013	454.0	304.0	460.0	308.0	455.1	305.1	**4.9**	4.8	22.3
P-BT-02-01	J-BT-02-01	J-BT-02	7.0	35.2	18 inch	169	0.112	0.013	304.0	285.0	308.0	292.0	305.0	288.9	**3.0**	2.5	15.5
P-BT-06	I-BT-06	I-BT-05	101.6	92.8	48 inch	281	0.004	0.012	310.0	309.0	317.0	317.0	314.1	313.0	**2.9**	3.0	8.1
P-BT-05	I-BT-05	I-BT-04	177.7	226.3	48 inch	331	0.021	0.012	309.0	302.0	317.0	310.0	312.8	306.0	**4.2**	4.0	19.9
P-BT-04	I-BT-04	J-BT-03	186.9	357.0	48 inch	171	0.053	0.012	302.0	293.0	310.0	300.0	305.8	297.3	**4.2**	4.0	28.7
P-BT-03	J-BT-03	J-BT-02	186.0	365.5	48 inch	145	0.055	0.012	293.0	285.0	300.0	292.0	296.8	289.1	**3.2**	3.0	29.2
P-BT-02	J-BT-02	I-BT-01	192.3	412.9	48 inch	142	0.070	0.012	285.0	275.0	292.0	282.0	288.8	279.6	**3.2**	3.0	32.3
P-BT-01	I-BT-01	O-BT	209.9	612.6	54 inch	901	0.083	0.012	275.0	200.5	282.0	212.0	279.1	207.1	**2.9**	2.5	34.9
Continentals Way																	
P-BU-02	I-BU-02	I-BU-01	2.1	11.2	10 inch	192	0.262	0.013	371.3	321.0	375.3	325.0	372.0	321.7	**3.4**	3.2	15.8
P-BU-01	I-BU-01	O-BU	2.1	17.5	10 inch	182	0.637	0.013	321.0	205.0	325.0	260.0	321.7	244.6	**3.4**	3.2	21.6

(1) Pipes are presented in Figure 2 and Figure D-BT-BU in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B8c

Proposed Hydrology, 25-Year Event, Systems BT & BU

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 24"														
I-BT-02-04	516.8	512.8	513.81	513.81	4.31		0.55	2.37	4.31	2.37	10	10	2.64	**6.3**
I-BT-02-03	482	478	479.31	479.1	0.94		0.55	0.52	5.25	2.89	10	10.2	2.62	**7.6**
I-BT-02-02	460	454	455.93	455.17	1.29		0.55	0.71	6.54	3.6	10	10.38	2.59	**9.4**
J-BT-02-01	308	304	305.31	305.18	0		0	0	6.54	3.6	0	10.74	2.55	**9.2**
I-BT-06	317	310	316.3	316.3	91.2		0.55	50.16	91.2	50.16	10	10	2.64	**133.6**
I-BT-05	317	309	314.23	313.85	72.9		0.55	40.1	164.1	90.26	10	10.44	2.59	**235.3**
I-BT-04	310	302	306.28	305.93	10.77		0.55	5.92	174.87	96.18	10	10.74	2.55	**247.2**
J-BT-03	300	293	297.72	296.93	0		0	0	174.87	96.18	0	10.83	2.54	**246.2**
J-BT-02	292	285	289.07	288.94	0	6.54	0	0	181.41	99.78	0	10.91	2.53	**254.4**
I-BT-01	282	275	279.96	279.29	17.29		0	0	198.7	99.78	0	10.98	2.52	**253.6**
O-BT	212	200.5	207.7	207.7	0		0	0	198.7	99.78	0	11.39	2.48	**249.0**
I-BU-02	375.3	371.3	372.02	372.02	1.91		0.55	1.05	1.91	1.05	10	10	2.64	**2.8**
I-BU-01	325	321	321.77	321.71	0		0.55	0	1.91	1.05	10	10.19	2.62	**2.8**
O-BU	260	205	242.04	242.04	0		0	0	1.91	1.05	0	10.32	2.6	**2.8**

(1) Nodes are presented in Figure D-BT-BU in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

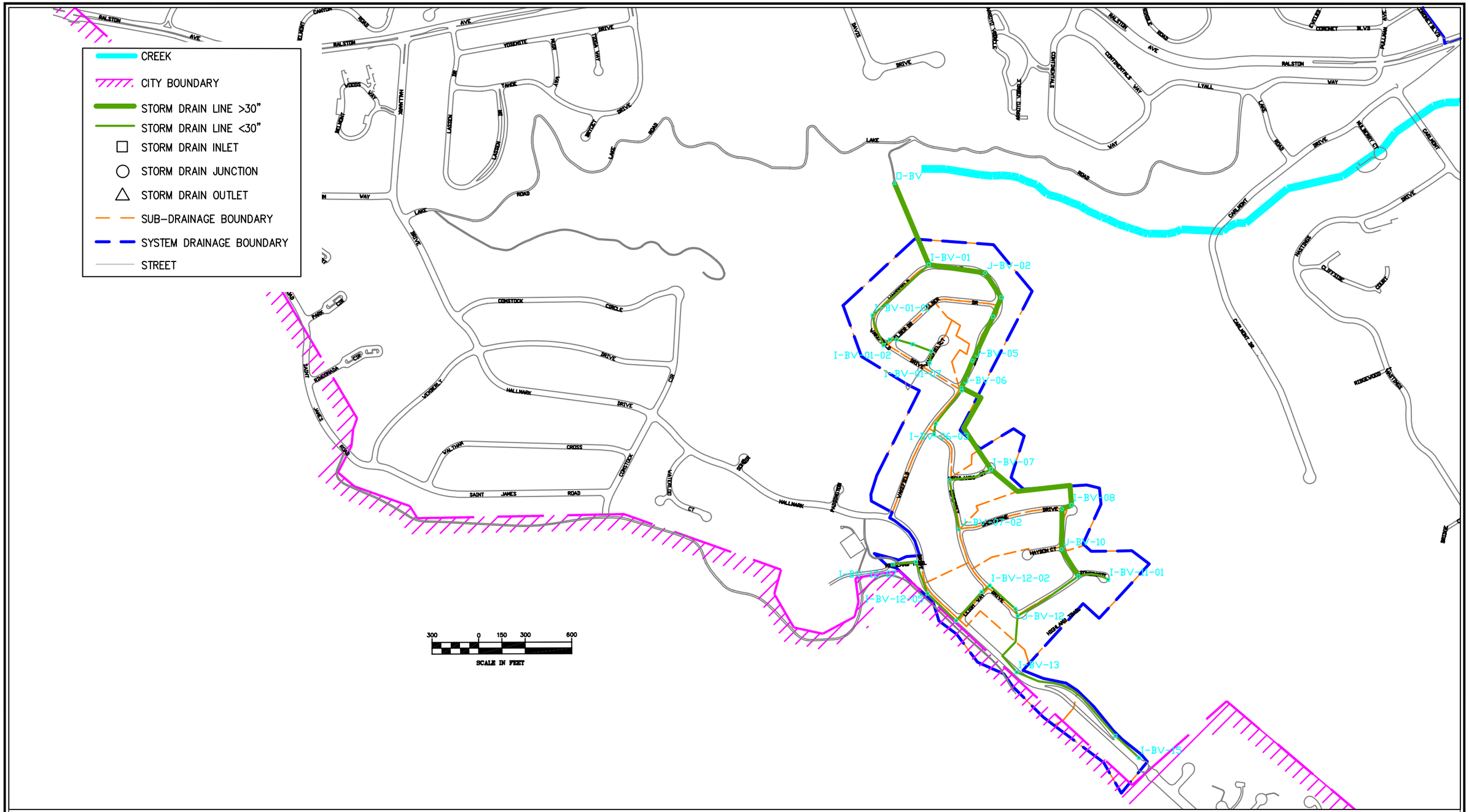
CITY OF BELMONT
STORM DRAIN MASTER PLAN

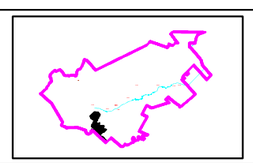
Table D-B8d

Proposed Hydraulics, 25-Year Event, Systems BT & BU

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Carlmont Drive (south)																		
P-BT-02-04	I-BT-02-04	I-BT-02-03	6.3	26.3	15 inch	210	0.166	0.013	512.8	478.0	516.8	482.0	513.8	479.3	**3.0**	2.8	17.6	no change
P-BT-02-03	I-BT-02-03	I-BT-02-02	7.6	23.1	15 inch	187	0.128	0.013	478.0	454.0	482.0	460.0	479.1	455.9	**2.9**	2.8	16.9	no change
P-BT-02-02	I-BT-02-02	J-BT-02-01	9.4	34.8	15 inch	518	0.290	0.013	454.0	304.0	460.0	308.0	455.2	305.3	**4.8**	4.8	24.1	no change
P-BT-02-01	J-BT-02-01	J-BT-02	9.2	35.2	18 inch	169	0.112	0.013	304.0	285.0	308.0	292.0	305.2	289.1	**2.8**	2.5	16.8	no change
P-BT-06	I-BT-06	I-BT-05	133.6	92.8	48 inch	281	0.004	0.012	310.0	309.0	317.0	317.0	316.3	314.2	**0.7**	3.0	10.6	no change
P-BT-05	I-BT-05	I-BT-04	235.3	226.3	48 inch	331	0.021	0.012	309.0	302.0	317.0	310.0	313.9	306.3	**3.1**	4.0	18.7	no change
P-BT-04	I-BT-04	J-BT-03	247.2	357.0	48 inch	171	0.053	0.012	302.0	293.0	310.0	300.0	305.9	297.7	**4.1**	4.0	30.7	no change
P-BT-03	J-BT-03	J-BT-02	246.2	365.5	48 inch	145	0.055	0.012	293.0	285.0	300.0	292.0	296.9	289.5	**3.1**	3.0	31.2	no change
P-BT-02	J-BT-02	I-BT-01	254.4	412.9	48 inch	142	0.070	0.012	285.0	275.0	292.0	282.0	288.9	280.0	**3.1**	3.0	34.6	no change
P-BT-01	I-BT-01	O-BT	253.6	612.6	54 inch	901	0.083	0.012	275.0	200.5	282.0	212.0	279.3	207.7	**2.7**	2.5	36.7	no change
Continentals Way																		
P-BU-02	I-BU-02	I-BU-01	2.8	18.2	12 inch	192	0.262	0.013	371.3	321.0	375.3	325.0	372.0	321.8	**3.3**	3.0	16.8	upsized
P-BU-01	I-BU-01	O-BU	2.8	28.4	12 inch	182	0.637	0.013	321.0	205.0	325.0	260.0	321.7	242.0	**3.3**	3.0	23.0	upsized

(1) Pipes are presented in Figure 2 and Figure D-BT-BU in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B9A TO D-B9D

FIGURE D-BV
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B9a

Existing Hydrology, 10-Year Event, Systems BV

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
Wakefield Drive														
Somerset Drive														
I-BV-12-07	735	731	731.57	731.57	1.79		0.5	0.9	1.79	0.9	10	10	2.29	**2.1**
I-BV-12-06	737.1	730	730.67	730.56	0		0	0	1.79	0.9	10	10.61	2.23	**2.0**
I-BV-12-05	730.8	726.8	727.42	727.36	0		0	0	1.79	0.9	10	11.29	2.16	**2.0**
I-BV-12-04	724.1	719.6	720.2	720.12	0		0	0	1.79	0.9	10	11.92	2.1	**1.9**
I-BV-12-03	722.9	718.4	718.93	718.91	0		0	0	1.79	0.9	10	13.1	2	**1.8**
I-BV-12-02	722	717.5	718.08	718	0		0	0	1.79	0.9	10	13.33	1.99	**1.8**
I-BV-12-01	708	703.5	704.05	704	0		0	0	1.79	0.9	10	13.78	1.96	**1.8**
I-BV-11-01	685.7	680.7	685.7	685.7	6.93		0.5	3.46	6.93	3.46	10	10	2.29	**8.0**
Highlands Court														
J-BV-07-02	716.5	712.5	712.5	712.5	0		0	0	0	0	0	0	0	**0.0**
J-BV-07-01	696	692	692	692	0		0	0	0	0	0	0	0	**0.0**
Wakefield Drive														
I-BV-06-03	680.9	676.9	679.73	679.73	6.25		0.5	3.13	6.25	3.13	10	10	2.29	**7.2**
I-BV-06-02	678	674	676.77	675.77	0		0	0	6.25	3.13	10	10.13	2.28	**7.2**
I-BV-06-01	664.8	660.8	683.53	664.8	15.21		0.5	7.61	21.46	10.73	10	10.62	2.23	**24.1**
Wakefield Court														
I-BV-01-07	646	642	642.5	642.5	1.21		0.5	0.61	1.21	0.61	10	10	2.29	**1.4**
I-BV-01-06	644	640	640.61	640.5	0		0	0	1.21	0.61	10	10.22	2.27	**1.4**
I-BV-01-05	639	635	635.52	635.49	0		0	0	1.21	0.61	10	10.52	2.24	**1.4**
I-BV-01-04	594	590	590.94	590.8	1.93		0.5	0.97	3.14	1.57	10	10.63	2.23	**3.5**
I-BV-01-03	590	586	587.03	586.8	0		0	0	3.14	1.57	10	10.7	2.22	**3.5**
I-BV-01-02	589	585	586.1	585.8	0		0	0	3.14	1.57	10	10.83	2.21	**3.5**
I-BV-01-01	560	556	557.07	556.79	0		0	0	3.14	1.57	10	11.07	2.18	**3.5**
Wakefield Drive														
I-BV-15	702.7	700.7	702.7	702.7	3.18		0.5	1.59	3.18	1.59	10	10	2.29	**3.7**
I-BV-14	703.1	700.5	702.04	702.03	0		0	0	3.18	1.59	10	10.74	2.21	**3.6**
I-BV-13	707	700	701.16	701.03	5.54		0.5	2.77	8.72	4.36	10	17.25	1.75	**7.7**
J-BV-12	706.7	695	696.17	696.11	0	1.79	0	0	10.51	5.26	0	18.3	1.7	**9.0**
I-BV-11	691.7	680	691.07	690.62	0	6.93	0	0	17.44	8.72	10	19.05	1.66	**14.6**
J-BV-10	695.2	679	688.88	688.35	0		0	0	17.44	8.72	0	19.61	1.64	**14.4**
J-BV-09	686.2	678	686.99	686.2	0		0	0	17.44	8.72	0	20.34	1.61	**14.2**
I-BV-08	686.2	677	688.38	686.2	11.41		0.5	5.71	28.85	14.43	10	20.52	1.6	**23.3**
I-BV-07	681.4	676	680.57	680.27	3.54	0	0.5	1.77	32.39	16.2	10	21.71	1.56	**25.4**
J-BV-06	664	659	662.55	660.74	0	21.46	0	0	53.85	26.93	0	22.79	1.52	**41.3**
J-BV-05	625	620	624.87	621.74	0		0	0	53.85	26.93	0	22.89	1.52	**41.2**
I-BV-04	596	591	593.98	592.74	2.1		0.5	1.05	55.95	27.98	10	23.13	1.51	**42.6**
I-BV-03	574	569	579.09	572.59	0		0	0	55.95	27.98	10	23.21	1.51	**42.5**
J-BV-02	559	554	564.1	559	0		0	0	55.95	27.98	0	23.38	1.5	**42.3**
I-BV-01	551.8	546.8	549.15	548.78	4.18	3.14	0.5	2.09	63.27	31.64	10	23.84	1.49	**47.4**
O-BV	356	352	352	352	0		0	0	63.27	31.64	0	24.08	1.48	**47.2**

(1) Nodes are presented in Figure D-BV in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B9b

Existing Hydraulics, 10-Year Event, Systems BV

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
Belmont Creek Drainage																	
Mean Annual Precipitation 26"																	
Wakefield Drive																	
P-BV-12-07	I-BV-12-07	I-BV-12-06	2.1	5.3	15 inch	149	0.007	0.013	731.0	730.0	735.0	737.1	731.6	730.7	**3.4**	2.8	4.1
P-BV-12-06	I-BV-12-06	I-BV-12-05	2.0	7.9	15 inch	216	0.015	0.013	730.0	726.8	737.1	730.8	730.6	727.4	**6.5**	5.9	5.4
P-BV-12-05	I-BV-12-05	I-BV-12-04	2.0	10.9	15 inch	255	0.028	0.013	726.8	719.6	730.8	724.1	727.4	720.2	**3.4**	2.8	6.7
P-BV-12-04	I-BV-12-04	I-BV-12-03	1.9	7.3	18 inch	247	0.005	0.013	719.6	718.4	724.1	722.9	720.1	718.9	**4.0**	3.0	3.5
P-BV-12-03	I-BV-12-03	I-BV-12-02	1.8	12.1	18 inch	68	0.013	0.013	718.4	717.5	722.9	722.0	718.9	718.1	**4.0**	3.0	4.9
P-BV-12-02	I-BV-12-02	I-BV-12-01	1.8	26.2	18 inch	225	0.062	0.013	717.5	703.5	722.0	708.0	718.0	704.1	**4.0**	3.0	8.5
P-BV-12-01	I-BV-12-01	J-BV-12	1.8	44.7	18 inch	47	0.181	0.013	703.5	695.0	708.0	706.7	704.0	696.2	**4.0**	3.0	12.3
Somerset Drive																	
P-BV-11-01	I-BV-11-01	I-BV-11	8.0	3.8	15 inch	201	0.003	0.013	680.7	680.0	685.7	691.7	694.6	691.5	**ABOVE RIM**	3.8	6.5
P-BV-07-02	J-BV-07-02	J-BV-07-01	0.0	8.9	12 inch	326	0.063	0.013	712.5	692.0	716.5	696.0	712.5	692.0	**4.0**	3.0	0.0
P-BV-07-01	J-BV-07-01	I-BV-07	0.0	8.5	12 inch	280	0.057	0.013	692.0	676.0	696.0	681.4	692.0	680.6	**4.0**	3.0	0.0
Highlands Court																	
P-BV-06-03	I-BV-06-03	I-BV-06-02	7.2	7.2	12 inch	72	0.040	0.013	676.9	674.0	680.9	678.0	679.7	676.8	**1.2**	3.0	9.2
P-BV-06-02	I-BV-06-02	I-BV-06-01	7.2	7.9	12 inch	270	0.049	0.013	674.0	660.8	678.0	664.8	675.8	664.8	**2.2**	3.0	9.1
P-BV-06-01	I-BV-06-01	J-BV-06	24.1	10.7	12 inch	20	0.090	0.013	660.8	659.0	664.8	664.0	671.9	662.8	**ABOVE RIM**	3.0	30.7
P-BV-01-07	I-BV-01-07	I-BV-01-06	1.4	5.7	12 inch	78	0.026	0.013	642.0	640.0	646.0	644.0	642.5	640.6	**3.5**	3.0	6.0
P-BV-01-06	I-BV-01-06	I-BV-01-05	1.4	7.0	12 inch	128	0.039	0.013	640.0	635.0	644.0	639.0	640.5	635.5	**3.5**	3.0	7.0
P-BV-01-05	I-BV-01-05	I-BV-01-04	1.4	23.1	12 inch	107	0.421	0.013	635.0	590.0	639.0	594.0	635.5	590.9	**3.5**	3.0	16.1
P-BV-01-04	I-BV-01-04	I-BV-01-03	3.5	10.6	12 inch	45	0.089	0.013	590.0	586.0	594.0	590.0	590.8	587.0	**3.2**	3.0	12.2
P-BV-01-03	I-BV-01-03	I-BV-01-02	3.5	4.9	12 inch	53	0.019	0.013	586.0	585.0	590.0	589.0	586.8	586.1	**3.2**	3.0	6.8
P-BV-01-02	I-BV-01-02	I-BV-01-01	3.5	13.4	12 inch	206	0.141	0.013	585.0	556.0	589.0	560.0	585.8	557.1	**3.2**	3.0	14.3
P-BV-01-01	I-BV-01-01	I-BV-01	3.5	4.9	12 inch	487	0.019	0.013	556.0	546.8	560.0	551.8	556.8	549.2	**3.2**	3.0	6.8
Wakefield Drive																	
P-BV-15	I-BV-15	I-BV-14	3.7	1.1	12 inch	208	0.001	0.013	700.7	700.5	702.7	703.1	704.3	702.0	**ABOVE RIM**	1.0	4.7
P-BV-14	I-BV-14	I-BV-13	3.6	2.7	18 inch	785	0.001	0.013	700.5	700.0	703.1	707.0	702.0	701.2	**1.1**	1.1	2.0
P-BV-13	I-BV-13	J-BV-12	7.7	17.0	21 inch	434	0.012	0.013	700.0	695.0	707.0	706.7	701.0	696.3	**6.0**	5.3	6.9
P-BV-12	J-BV-12	I-BV-11	9.0	28.3	21 inch	469	0.032	0.013	695.0	680.0	706.7	691.7	696.1	691.1	**10.6**	10.0	10.5
P-BV-11	I-BV-11	J-BV-10	14.6	11.1	21 inch	204	0.005	0.013	680.0	679.0	691.7	695.2	690.6	688.9	**1.1**	10.0	6.1
P-BV-10	J-BV-10	J-BV-09	14.4	9.8	21 inch	260	0.004	0.013	679.0	678.0	695.2	686.2	688.4	686.2	**6.9**	14.5	6.0
P-BV-09	J-BV-09	I-BV-08	14.2	19.5	21 inch	66	0.015	0.013	678.0	677.0	686.2	686.2	686.7	686.2	**ABOVE RIM**	6.5	5.9
P-BV-08	I-BV-08	I-BV-07	23.3	6.0	21 inch	689	0.001	0.013	677.0	676.0	686.2	681.4	696.3	681.4	**ABOVE RIM**	7.5	9.7
P-BV-07	I-BV-07	J-BV-06	25.4	24.9	21 inch	688	0.025	0.013	676.0	659.0	681.4	664.0	680.3	662.6	**1.1**	3.7	10.6
P-BV-06	J-BV-06	J-BV-05	41.3	72.2	21 inch	188	0.207	0.013	659.0	620.0	664.0	625.0	660.7	624.9	**3.3**	3.3	31.0
P-BV-05	J-BV-05	I-BV-04	41.2	48.2	21 inch	314	0.092	0.013	620.0	591.0	625.0	596.0	621.7	594.0	**3.3**	3.3	22.5
P-BV-04	I-BV-04	I-BV-03	42.6	64.0	21 inch	135	0.163	0.013	591.0	569.0	596.0	574.0	592.7	574.0	**3.3**	3.3	28.5
P-BV-03	I-BV-03	J-BV-02	42.5	44.6	21 inch	189	0.079	0.013	569.0	554.0	574.0	559.0	572.6	559.0	**1.4**	3.3	17.7
P-BV-02	J-BV-02	I-BV-01	42.3	31.7	24 inch	366	0.020	0.013	554.0	546.8	559.0	551.8	563.6	550.8	**ABOVE RIM**	3.0	13.5
P-BV-01	I-BV-01	O-BV	47.4	132.2	24 inch	570	0.342	0.013	546.8	352.0	551.8	356.0	548.8	352.8	**3.0**	3.0	38.6

(1) Pipes are presented in Figure 2 and Figure D-BV in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B9c

Proposed Hydrology, 25-Year Event, System BV

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage Mean Annual Precipitation 26"														
I-BV-12-07	735	731	731.66	731.66	1.79		0.55	0.98	1.79	0.98	10	10	2.74	**2.7**
I-BV-12-06	737.1	730	730.79	730.65	0		0	0	1.79	0.98	10	10.57	2.67	**2.7**
I-BV-12-05	730.8	726.8	727.52	727.44	0		0	0	1.79	0.98	10	11.19	2.59	**2.6**
I-BV-12-04	724.1	719.6	720.31	720.21	0		0	0	1.79	0.98	10	11.78	2.53	**2.5**
I-BV-12-03	722.9	718.4	719.02	718.99	0		0	0	1.79	0.98	10	12.88	2.42	**2.4**
I-BV-12-02	722	717.5	718.19	718.08	0		0	0	1.79	0.98	10	13.09	2.4	**2.4**
I-BV-12-01	708	703.5	704.14	704.08	0		0	0	1.79	0.98	10	13.5	2.36	**2.3**
I-BV-11-01	685.7	680.7	682.6	682.6	6.93		0.55	3.81	6.93	3.81	10	10	2.74	**10.5**
J-BV-07-02	716.5	712.5	712.5	712.5	0		0	0	0	0	0	0	0	**0.0**
J-BV-07-01	696	692	692	692	0		0	0	0	0	0	0	0	**0.0**
I-BV-06-03	680.9	676.9	680.9	680.9	6.25		0.55	3.44	6.25	3.44	10	10	2.74	**9.5**
I-BV-06-02	678	674	680.34	678	0		0	0	6.25	3.44	10	10.1	2.73	**9.5**
I-BV-06-01	664.8	660.8	663.84	662.69	15.21		0.55	8.37	21.46	11.8	10	10.47	2.68	**31.9**
I-BV-01-07	646	642	642.58	642.58	1.21		0.55	0.67	1.21	0.67	10	10	2.74	**1.8**
I-BV-01-06	644	640	640.72	640.57	0		0	0	1.21	0.67	10	10.2	2.72	**1.8**
I-BV-01-05	639	635	635.61	635.57	0		0	0	1.21	0.67	10	10.48	2.68	**1.8**
I-BV-01-04	594	590	591.11	590.9	1.93		0.55	1.06	3.14	1.73	10	10.59	2.67	**4.6**
I-BV-01-03	590	586	587.66	587.25	0		0	0	3.14	1.73	10	10.64	2.66	**4.6**
I-BV-01-02	589	585	586.36	585.89	0		0	0	3.14	1.73	10	10.79	2.64	**4.6**
I-BV-01-01	560	556	558.14	557.43	0		0	0	3.14	1.73	10	11.02	2.61	**4.6**
I-BV-15	705	702	703.88	703.88	3.18		0.55	1.75	3.18	1.75	10	10	2.74	**4.8**
I-BV-14	705	701	703.44	703.4	0		0	0	3.18	1.75	10	11.27	2.59	**4.6**
I-BV-13	707	700	701.92	701.24	5.54		0.55	3.05	8.72	4.8	10	16.34	2.15	**10.4**
J-BV-12	706.7	695	696.51	696.32	0	1.79	0	0	10.51	5.78	0	17.34	2.08	**12.1**
I-BV-11	691.7	680	682.18	682.01	0	6.93	0	0	17.44	9.59	10	18.03	2.04	**19.8**
J-BV-10	695.2	679	681.65	681.45	0		0	0	17.44	9.59	0	18.57	2.01	**19.5**
J-BV-09	686.2	678	680.87	680.58	0		0	0	17.44	9.59	0	19.33	1.97	**19.1**
I-BV-08	686.2	677.5	680.44	679.41	11.42		0.55	6.28	28.86	15.87	10	19.61	1.96	**31.4**
I-BV-07	681.4	672	674	673.98	3.54	0	0.55	1.95	32.4	17.82	10	20.98	1.89	**34.0**
J-BV-06	664	659	662.13	661.36	0	21.46	0	0	53.86	29.62	0	21.93	1.85	**55.3**
J-BV-05	625	620	622.57	622.36	0		0	0	53.86	29.62	0	22.03	1.85	**55.2**
I-BV-04	596	591	593.58	593.37	2.1		0.55	1.16	55.96	30.78	10	22.24	1.84	**57.1**
I-BV-03	574	569	572.74	571.37	0		0	0	55.96	30.78	10	22.31	1.84	**57.0**
J-BV-02	559	554	560.14	557.71	0		0	0	55.96	30.78	0	22.45	1.83	**56.8**
I-BV-01	551.8	546.8	549.48	549.21	4.18	3.14	0.55	2.3	63.28	34.8	10	22.97	1.81	**63.5**
O-BV	356	352	352	352	0	0	0	0	63.28	34.8	0	23.2	1.8	**63.2**

(1) Nodes are presented in Figure D-BV in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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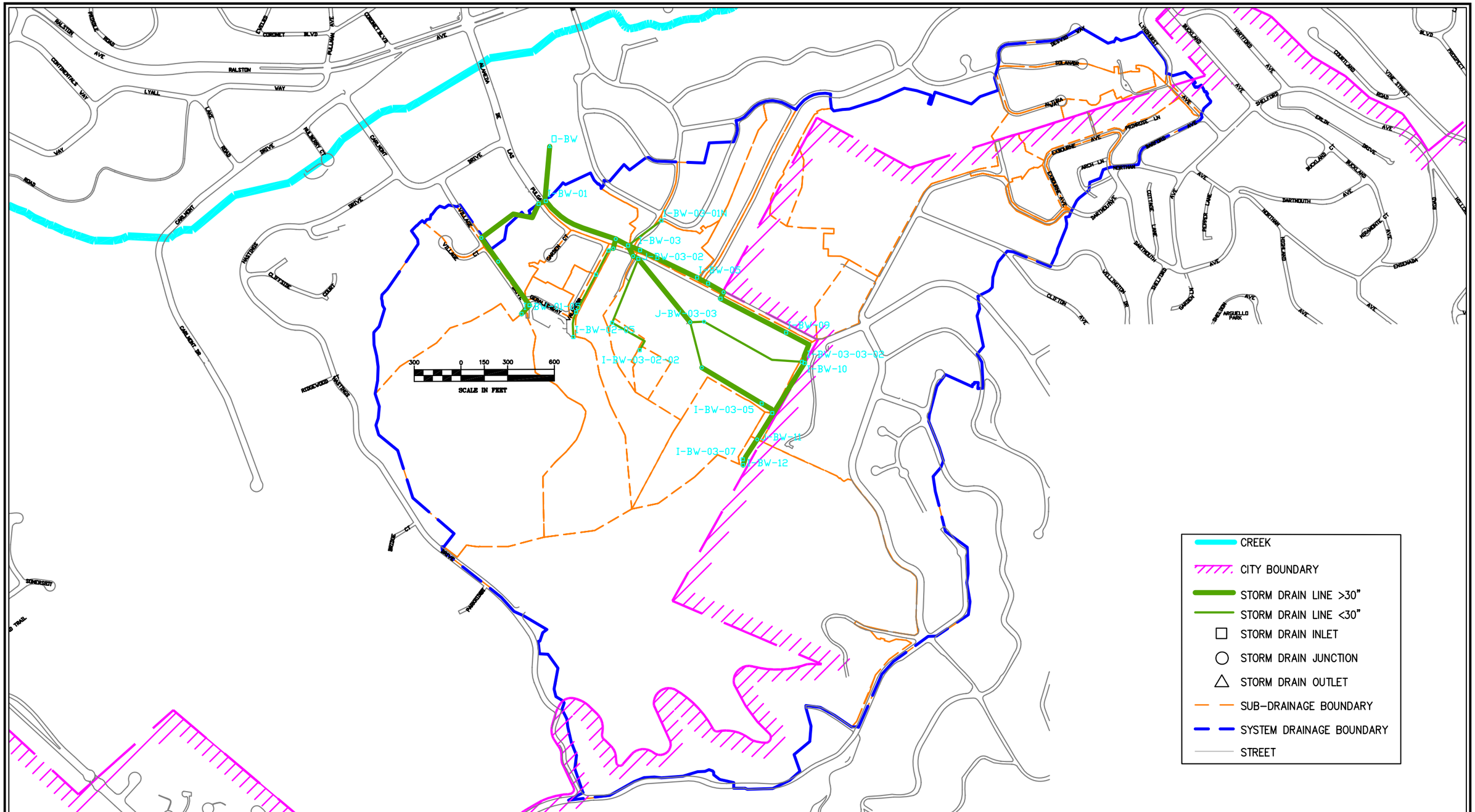
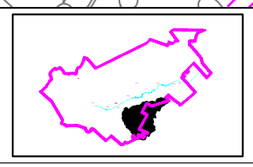
Table D-B9d

Proposed Hydraulics, 25-Year Event, System BV

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
Belmont Creek Drainage																		
Mean Annual Precipitation 26"																		
Wakefield Drive																		
P-BV-12-07	I-BV-12-07	I-BV-12-06	2.7	5.3	15 inch	149	0.007	0.013	731.0	730.0	735.0	737.1	731.7	730.8	**3.3**	2.8	4.3	no change
P-BV-12-06	I-BV-12-06	I-BV-12-05	2.7	7.9	15 inch	216	0.015	0.013	730.0	726.8	737.1	730.8	730.7	727.5	**6.5**	5.9	5.8	no change
P-BV-12-05	I-BV-12-05	I-BV-12-04	2.6	10.9	15 inch	255	0.028	0.013	726.8	719.6	730.8	724.1	727.4	720.3	**3.4**	2.8	7.2	no change
P-BV-12-04	I-BV-12-04	I-BV-12-03	2.5	7.3	18 inch	247	0.005	0.013	719.6	718.4	724.1	722.9	720.2	719.0	**3.9**	3.0	3.8	no change
P-BV-12-03	I-BV-12-03	I-BV-12-02	2.4	12.1	18 inch	68	0.013	0.013	718.4	717.5	722.9	722.0	719.0	718.2	**3.9**	3.0	5.3	no change
P-BV-12-02	I-BV-12-02	I-BV-12-01	2.4	26.2	18 inch	225	0.062	0.013	717.5	703.5	722.0	708.0	718.1	704.1	**3.9**	3.0	9.2	no change
P-BV-12-01	I-BV-12-01	J-BV-12	2.3	44.7	18 inch	47	0.181	0.013	703.5	695.0	708.0	706.7	704.1	696.5	**3.9**	3.0	13.4	no change
Somerset Drive																		
P-BV-11-01	I-BV-11-01	I-BV-11	10.5	13.4	24 inch	201	0.003	0.013	680.7	680.0	685.7	691.7	682.6	682.2	**3.1**	3.0	4.7	upsized
P-BV-07-02	J-BV-07-02	J-BV-07-01	0.0	8.9	12 inch	326	0.063	0.013	712.5	692.0	716.5	696.0	712.5	692.0	**4.0**	3.0	0.0	no change
P-BV-07-01	J-BV-07-01	I-BV-07	0.0	9.5	12 inch	280	0.071	0.013	692.0	672.0	696.0	681.4	692.0	674.0	**4.0**	3.0	0.0	no change
Highlands Court																		
P-BV-06-03	I-BV-06-03	I-BV-06-02	9.5	7.2	12 inch	72	0.040	0.013	676.9	674.0	680.9	678.0	683.1	678.0	**ABOVE RIM**	3.0	12.1	no change
P-BV-06-02	I-BV-06-02	I-BV-06-01	9.5	7.9	12 inch	270	0.049	0.013	674.0	660.8	678.0	664.8	682.9	663.8	**ABOVE RIM**	3.0	12.1	no change
P-BV-06-01	I-BV-06-01	J-BV-06	31.9	67.9	24 inch	20	0.090	0.013	660.8	659.0	664.8	664.0	662.7	662.2	**2.1**	2.0	21.3	upsized
P-BV-01-07	I-BV-01-07	I-BV-01-06	1.8	5.7	12 inch	78	0.026	0.013	642.0	640.0	646.0	644.0	642.6	640.7	**3.4**	3.0	6.5	no change
P-BV-01-06	I-BV-01-06	I-BV-01-05	1.8	7.0	12 inch	128	0.039	0.013	640.0	635.0	644.0	639.0	640.6	635.6	**3.4**	3.0	7.5	no change
P-BV-01-05	I-BV-01-05	I-BV-01-04	1.8	23.1	12 inch	107	0.421	0.013	635.0	590.0	639.0	594.0	635.6	591.1	**3.4**	3.0	17.5	no change
P-BV-01-04	I-BV-01-04	I-BV-01-03	4.6	10.6	12 inch	45	0.089	0.013	590.0	586.0	594.0	590.0	590.9	587.7	**3.1**	3.0	13.1	no change
P-BV-01-03	I-BV-01-03	I-BV-01-02	4.6	4.9	12 inch	53	0.019	0.013	586.0	585.0	590.0	589.0	587.3	586.4	**2.8**	3.0	5.9	no change
P-BV-01-02	I-BV-01-02	I-BV-01-01	4.6	13.4	12 inch	206	0.141	0.013	585.0	556.0	589.0	560.0	585.9	558.1	**3.1**	3.0	15.4	no change
P-BV-01-01	I-BV-01-01	I-BV-01	4.6	4.9	12 inch	487	0.019	0.013	556.0	546.8	560.0	551.8	557.4	549.5	**2.6**	3.0	5.8	no change
Wakefield Drive																		
P-BV-15	I-BV-15	I-BV-14	4.8	7.3	18 inch	208	0.005	0.013	702.0	701.0	705.0	705.0	703.9	703.4	**1.1**	1.5	2.7	upsized
P-BV-14	I-BV-14	I-BV-13	4.6	3.8	18 inch	785	0.001	0.013	701.0	700.0	705.0	707.0	703.4	701.9	**1.6**	2.5	2.6	no change
P-BV-13	I-BV-13	J-BV-12	10.4	11.3	18 inch	434	0.012	0.013	700.0	695.0	707.0	706.7	701.2	697.1	**5.8**	5.5	7.2	upsized
P-BV-12	J-BV-12	I-BV-11	12.1	18.8	18 inch	469	0.032	0.013	695.0	680.0	706.7	691.7	696.3	682.3	**10.4**	10.2	11.3	upsized
P-BV-11	I-BV-11	J-BV-10	19.8	28.7	30 inch	204	0.005	0.013	680.0	679.0	691.7	695.2	682.0	681.7	**9.7**	9.2	6.3	upsized
P-BV-10	J-BV-10	J-BV-09	19.5	25.4	30 inch	260	0.004	0.013	679.0	678.0	695.2	686.2	681.5	680.9	**13.8**	13.7	5.7	upsized
P-BV-09	J-BV-09	I-BV-08	19.1	35.7	30 inch	66	0.008	0.013	678.0	677.5	686.2	686.2	680.6	680.4	**5.6**	5.7	3.9	upsized
P-BV-08	I-BV-08	I-BV-07	31.4	36.6	30 inch	689	0.008	0.013	677.5	672.0	686.2	681.4	679.4	674.3	**6.8**	6.2	8.4	upsized
P-BV-07	I-BV-07	J-BV-06	34.0	56.4	30 inch	688	0.019	0.013	672.0	659.0	681.4	664.0	674.0	662.1	**7.4**	6.9	12.0	upsized
P-BV-06	J-BV-06	J-BV-05	55.3	186.8	30 inch	188	0.207	0.013	659.0	620.0	664.0	625.0	661.4	622.6	**2.6**	2.5	33.2	upsized
P-BV-05	J-BV-05	I-BV-04	55.2	124.7	30 inch	314	0.092	0.013	620.0	591.0	625.0	596.0	622.4	593.6	**2.6**	2.5	24.6	upsized
P-BV-04	I-BV-04	I-BV-03	57.1	165.6	30 inch	135	0.163	0.013	591.0	569.0	596.0	574.0	593.4	572.7	**2.6**	2.5	30.6	upsized
P-BV-03	I-BV-03	J-BV-02	57.0	115.6	30 inch	189	0.079	0.013	569.0	554.0	574.0	559.0	571.4	559.0	**2.6**	2.5	23.5	upsized
P-BV-02	J-BV-02	I-BV-01	56.8	57.5	30 inch	366	0.020	0.013	554.0	546.8	559.0	551.8	557.7	550.7	**1.3**	2.5	11.6	upsized
P-BV-01	I-BV-01	O-BV	63.5	239.8	30 inch	570	0.342	0.013	546.8	352.0	551.8	356.0	549.2	352.9	**2.6**	2.5	41.3	upsized

(1) Pipes are presented in Figure 2 and Figure D-BV in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-10A TO D-10D

FIGURE D-BW
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B10a

Existing Hydrology, 10-Year Event, Systems BW

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
to Alameda de las Pulgas Branch of Belmont Creek														
El Verano Way														
I-BW-03-03-02	206	201.5	201.5	201.5	0		0.5	0	0	0	10	10	0	**0.0**
J-BW-03-03-01	198	193	193	193	0		0	0	0	0	0	10	0	**0.0**
I-BW-03-02-02	208.4	204.4	204.89	204.89	1.16		0.5	0.58	1.16	0.58	10	10	2.29	**1.3**
I-BW-03-02-01	196	192	192.9	192.69	1.15		0.5	0.57	2.31	1.15	10	10.73	2.22	**2.6**
I-BW-03-01N	186	181	182	182	5.31		0.5	2.65	5.31	2.65	10	10	2.29	**6.1**
I-BW-03-07	225	220	220.95	220.95	6.65		0.5	3.33	6.65	3.33	10	10	2.29	**7.7**
I-BW-03-06	212	206	206.99	206.91	0.32		0	0	6.97	3.33	10	10.56	2.23	**7.5**
I-BW-03-05	206	200	200.89	200.88	0		0	0	6.97	3.33	10	10.69	2.22	**7.4**
J-BW-03-04	201	195	196.08	195.94	0		0	0	6.97	3.33	0	11.83	2.11	**7.1**
J-BW-03-03	194	187	187.92	187.87	0	0	0	0	6.97	3.33	0	12.39	2.06	**6.9**
I-BW-03-02	171	167	172.83	171	23.66	2.31	0.5	11.83	32.94	16.31	10	13.27	1.99	**32.8**
J-BW-03-01	170.7	166.7	203.19	170.7	0	5.31	0	0	38.25	16.31	0	13.28	1.99	**32.7**
Valerga Drive														
I-BW-02-05	230	226	227.23	227.23	12.51		0.5	6.26	12.51	6.26	10	10	2.29	**14.5**
I-BW-02-04	214	209.5	211.17	210.91	0.92		0.5	0.46	13.43	6.72	10	10.15	2.28	**15.4**
I-BW-02-03	178	173.5	175.09	174.92	0.61		0.5	0.31	14.04	7.02	10	10.37	2.25	**15.9**
I-BW-02-02	171	166.5	170.31	169.05	2.14		0.5	1.07	16.18	8.09	10	10.59	2.23	**18.2**
J-BW-02-01	169	162.5	168.06	168.02	0		0	0	16.18	8.09	0	10.65	2.22	**18.1**
Village Drive														
I-BW-01-05	240	235	240	240	41.58		0.5	20.79	41.58	20.79	10	10	2.29	**48.1**
I-BW-01-04	242	234	249.58	242	0		0	0	41.58	20.79	10	10.08	2.29	**47.9**
J-BW-01-03	213.2	208.2	210.53	210.18	0		0	0	41.58	20.79	0	10.29	2.26	**47.4**
J-BW-01-02	201	195	197.9	197.23	0		0	0	41.58	20.79	0	10.44	2.25	**47.1**
I-BW-01-01	161.9	155.9	161.81	161.14	5.22		0.5	2.61	46.8	23.4	10	10.8	2.21	**52.1**
Alameda de las Pulgas														
I-BW-12	228.8	222.8	226.15	226.15	93.2		0.5	46.6	93.2	46.6	10	10	2.29	**107.8**
J-BW-11	221	215	218.3	218.14	0		0	0	93.2	46.6	0	10.17	2.28	**106.9**
I-BW-10	206.7	200.7	209.57	206.7	47.9		0.5	23.95	141.1	70.55	10	10.72	2.22	**157.7**
I-BW-09	201	195	201.65	201	2.64		0.5	1.32	143.74	71.87	10	11.01	2.19	**158.4**
J-BW-07	185	179	199.08	185	0		0	0	143.74	71.87	0	11.39	2.15	**155.8**
I-BW-07	185	179	197.01	185	0		0	0	143.74	71.87	10	11.36	2.15	**156.0**
I-BW-06	182	176	184.22	182	61.28		0.5	30.64	205.02	102.51	10	11.48	2.14	**221.3**
I-BW-05	180	174	182.93	180	3.47		0.5	1.74	208.49	104.24	10	11.52	2.14	**224.6**
I-BW-04	170.7	164.7	174.14	170.7	2.74		0.5	1.37	211.23	105.61	10	11.74	2.12	**225.5**
I-BW-03	170	164	176.25	170	3.15	38.25	0.5	1.57	252.63	126.16	10	13.31	1.99	**253.0**
J-BW-02	168	161	168.74	168	0	16.18	0	0	268.81	134.25	0	13.35	1.99	**268.8**
I-BW-01	161.9	155.9	160.83	159.87	3.79	46.8	0.5	1.9	319.4	159.54	10	13.76	1.96	**314.6**
O-BW	140	135	142	142	0		0	0	319.4	159.54	0	13.93	1.94	**312.7**

(1) Nodes are presented in Figure D-BW in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B10b

Existing Hydraulics, 10-Year Event, Systems BW

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
Belmont Creek Drainage																	
Mean Annual Precipitation 26"																	
to Alameda de las Pulgas Branch of Belmont Creek																	
El Verano Way																	
P-BW-03-03-02	I-BW-03-03-02	J-BW-03-03-01	0.0	11.6	18 inch	693	0.012	0.013	201.5	193.0	206.0	198.0	201.5	193.0	**4.5**	3.0	0.0
P-BW-03-03-01	J-BW-03-03-01	J-BW-03-03	0.0	16.8	15 inch	89	0.067	0.013	193.0	187.0	198.0	194.0	193.0	187.9	**5.0**	3.8	0.0
P-BW-03-02-02	I-BW-03-02-02	I-BW-03-02-01	1.3	7.2	12 inch	306	0.041	0.013	204.4	192.0	208.4	196.0	204.9	192.9	**3.5**	3.0	7.0
P-BW-03-02-01	I-BW-03-02-01	I-BW-03-02	2.6	8.4	12 inch	445	0.056	0.013	192.0	167.0	196.0	171.0	192.7	171.0	**3.3**	3.0	9.4
P-BW-03-01N	I-BW-03-01N	I-BW-03	6.1	16.3	15 inch	267	0.064	0.013	181.0	164.0	186.0	170.0	182.0	170.0	**4.0**	3.8	12.4
P-BW-03-01	J-BW-03-01	I-BW-03	32.7	6.7	12 inch	76	0.036	0.013	166.7	164.0	170.7	170.0	234.2	170.0	**ABOVE RIM**	3.0	41.7
Valerga Drive																	
P-BW-03-07	I-BW-03-07	I-BW-03-06	7.7	61.7	27 inch	353	0.040	0.013	220.0	206.0	225.0	212.0	221.0	207.0	**4.1**	2.8	10.6
P-BW-03-06	I-BW-03-06	I-BW-03-05	7.5	101.5	30 inch	98	0.061	0.013	206.0	200.0	212.0	206.0	206.9	200.5	**5.1**	3.5	12.1
P-BW-03-05	I-BW-03-05	J-BW-03-04	7.4	55.9	33 inch	448	0.011	0.013	200.0	195.0	206.0	201.0	200.9	196.1	**5.1**	3.3	6.5
P-BW-03-04	J-BW-03-04	J-BW-03-03	7.1	36.9	24 inch	300	0.027	0.013	195.0	187.0	201.0	194.0	195.9	187.6	**5.1**	4.0	9.1
P-BW-03-03	J-BW-03-03	I-BW-03-02	6.9	79.9	30 inch	527	0.038	0.013	187.0	167.0	194.0	171.0	187.9	171.0	**6.1**	4.5	10.0
P-BW-03-02	I-BW-03-02	J-BW-03-01	32.8	3.3	12 inch	36	0.008	0.013	167.0	166.7	171.0	170.7	201.1	170.7	**ABOVE RIM**	3.0	41.7
P-BW-02-05	I-BW-02-05	I-BW-02-04	14.5	20.6	15 inch	163	0.101	0.013	226.0	209.5	230.0	214.0	227.2	211.2	**2.8**	2.8	18.1
P-BW-02-04	I-BW-02-04	I-BW-02-03	15.4	38.1	18 inch	274	0.131	0.013	209.5	173.5	214.0	178.0	210.9	175.1	**3.1**	3.0	20.4
P-BW-02-03	I-BW-02-03	I-BW-02-02	15.9	21.1	18 inch	174	0.040	0.013	173.5	166.5	178.0	171.0	174.9	170.3	**3.1**	3.0	13.1
P-BW-02-02	I-BW-02-02	J-BW-02-01	18.2	36.6	18 inch	33	0.121	0.013	166.5	162.5	171.0	169.0	169.1	168.1	**1.9**	3.0	10.3
P-BW-02-01	J-BW-02-01	J-BW-02	18.1	155.2	42 inch	63	0.024	0.013	162.5	161.0	169.0	168.0	168.0	168.0	**1.0**	3.0	1.9
Village Drive																	
P-BW-01-05	I-BW-01-05	I-BW-01-04	48.1	26.1	24 inch	75	0.013	0.013	235.0	234.0	240.0	242.0	245.4	242.0	**ABOVE RIM**	3.0	15.3
P-BW-01-04	I-BW-01-04	J-BW-01-03	47.9	28.7	18 inch	345	0.075	0.013	234.0	208.2	242.0	213.2	282.3	210.5	**ABOVE RIM**	6.5	27.1
P-BW-01-03	J-BW-01-03	J-BW-01-02	47.4	60.1	24 inch	187	0.071	0.013	208.2	195.0	213.2	201.0	210.2	197.9	**3.0**	3.0	21.2
P-BW-01-02	J-BW-01-02	I-BW-01-01	47.1	191.0	36 inch	477	0.082	0.013	195.0	155.9	201.0	161.9	197.2	161.8	**3.8**	3.0	22.4
P-BW-01-01	I-BW-01-01	I-BW-01	52.1	0.0	36 inch	50	0.000	0.013	155.9	155.9	161.9	161.9	161.1	160.8	**0.8**	3.0	7.4
Alameda de las Pulgas																	
P-BW-12	I-BW-12	J-BW-11	107.8	107.4	33 inch	189	0.041	0.013	222.8	215.0	228.8	221.0	226.2	218.3	**2.7**	3.3	18.2
P-BW-11	J-BW-11	I-BW-10	106.9	158.5	42 inch	576	0.025	0.013	215.0	200.7	221.0	206.7	218.1	206.7	**2.9**	2.5	17.7
P-BW-10	I-BW-10	I-BW-09	157.7	141.0	42 inch	290	0.020	0.013	200.7	195.0	206.7	201.0	208.1	201.0	**ABOVE RIM**	2.5	16.4
P-BW-09	I-BW-09	I-BW-07	158.4	122.5	36 inch	474	0.034	0.013	195.0	179.0	201.0	185.0	211.8	185.0	**ABOVE RIM**	3.0	22.4
P-BW-08	I-BW-07	J-BW-07	156.0	0.0	3 x 2 ft	46	0.000	0.013	179.0	179.0	185.0	185.0	189.7	185.0	**ABOVE RIM**	4.0	26.0
P-BW-07	J-BW-07	I-BW-06	155.8	108.2	36 inch	114	0.026	0.013	179.0	176.0	185.0	182.0	188.2	182.0	**ABOVE RIM**	3.0	22.0
P-BW-06	I-BW-06	I-BW-05	221.3	104.8	36 inch	81	0.025	0.013	176.0	174.0	182.0	180.0	188.9	180.0	**ABOVE RIM**	3.0	31.3
P-BW-05	I-BW-05	I-BW-04	224.6	100.9	36 inch	406	0.023	0.013	174.0	164.7	180.0	170.7	216.8	170.7	**ABOVE RIM**	3.0	31.8
P-BW-04	I-BW-04	I-BW-03	225.5	61.3	36 inch	83	0.008	0.013	164.7	164.0	170.7	170.0	179.5	170.0	**ABOVE RIM**	3.0	31.9
P-BW-03	I-BW-03	J-BW-02	253.0	122.5	36 inch	89	0.034	0.013	164.0	161.0	170.0	168.0	180.8	168.0	**ABOVE RIM**	3.0	35.8
P-BW-02	J-BW-02	I-BW-01	268.8	153.8	48 inch	522	0.010	0.012	161.0	155.9	168.0	161.9	177.5	161.9	**ABOVE RIM**	3.0	21.4
P-BW-01	I-BW-01	O-BW	314.6	379.2	48 inch	352	0.059	0.012	155.9	135.0	161.9	140.0	159.9	142.0	**2.0**	2.0	33.7

(1) Pipes are presented in Figure 2 and Figure D-BW in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B10c

Proposed Hydrology, 25-Year Event, System BW

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C [6]	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
I-BW-03-03-02	206	201.5	201.5	201.5	0		0.55	0	0	0	10	10	0	**0.0**
J-BW-03-03-01	198	193	193	193	0		0	0	0	0	0	10	0	**0.0**
I-BW-03-02-02	208.4	204.4	204.97	204.97	1.16		0.55	0.64	1.16	0.64	10	10	2.74	**1.8**
I-BW-03-02-01	196	192	193.09	192.79	1.15		0.55	0.63	2.31	1.27	10	10.67	2.66	**3.4**
I-BW-03-01N	186	181	182.12	182.12	5.31		0.55	2.92	5.31	2.92	10	10	2.74	**8.1**
I-BW-03-07	225	220	221.1	221.1	6.65		0.55	3.66	6.65	3.66	10	10	2.74	**10.1**
I-BW-03-06	212	206	207.15	207.05	0.32		0	0	6.97	3.66	10	10.51	2.68	**9.9**
I-BW-03-05	206	200	201.03	201.02	0		0	0	6.97	3.66	10	10.64	2.66	**9.8**
J-BW-03-04	201	195	196.27	196.09	0		0	0	6.97	3.66	0	11.69	2.54	**9.4**
J-BW-03-03	194	187	188.07	188.01	0	0	0	0	6.97	3.66	0	12.2	2.48	**9.2**
I-BW-03-02	171	167	170.39	170.32	23.66	2.31	0.55	13.01	32.94	17.94	10	13.01	2.41	**43.5**
J-BW-03-01	170.7	165.5	169.92	169.74	0	5.31	0	0	38.25	17.94	0	13.08	2.4	**43.4**
I-BW-02-05	230	226	227.24	227.24	12.51		0.55	6.88	12.51	6.88	10	10	2.74	**19.0**
I-BW-02-04	214	209.5	211.4	210.97	0.92		0.55	0.51	13.43	7.39	10	10.14	2.72	**20.3**
I-BW-02-03	178	173.5	178.53	177.95	0.61		0.55	0.34	14.04	7.72	10	10.35	2.7	**21.0**
I-BW-02-02	171	166.5	171.65	169.09	2.14		0.55	1.18	16.18	8.9	10	10.6	2.67	**23.9**
J-BW-02-01	169	162.5	167.38	167.31	0		0	0	16.18	8.9	0	10.64	2.66	**23.9**
I-BW-01-05	242	236	240.06	240.06	41.58		0.55	22.87	41.58	22.87	10	10	2.74	**63.3**
I-BW-01-04	242	234	238.27	236.41	0		0	0	41.58	22.87	10	10.1	2.73	**63.0**
J-BW-01-03	213.2	208.2	210.81	210.61	0		0	0	41.58	22.87	0	10.34	2.7	**62.2**
J-BW-01-02	201	195	198.51	197.53	0		0	0	41.58	22.87	0	10.48	2.68	**61.8**
I-BW-01-01	161.9	155.9	162.45	161.3	5.22		0.55	2.87	46.8	25.74	10	10.81	2.64	**68.5**
I-BW-12	228.8	222.8	228.8	228.8	93.2		0.55	51.26	93.2	51.26	10	10	2.74	**141.8**
J-BW-11	221	215	218.61	218.36	0		0	0	93.2	51.26	0	10.13	2.73	**140.9**
I-BW-10	206.7	200.7	208.27	206.41	47.9		0	0	141.1	51.26	10	10.65	2.66	**137.4**
I-BW-09	201	195	201.47	201	2.64		0	0	143.74	51.26	10	10.99	2.62	**135.3**
J-BW-07	185	179	183.86	182.44	0		0	0	143.74	51.26	0	11.49	2.56	**132.3**
I-BW-07	185	179.5	185.31	184.16	0		0	0	143.74	51.26	10	11.4	2.57	**132.8**
I-BW-06	182	176	180.31	179.97	61.28		0.55	33.7	205.02	84.96	10	11.58	2.55	**218.4**
I-BW-05	180	174	178.39	177.9	3.47		0.55	1.91	208.49	86.87	10	11.64	2.54	**222.7**
I-BW-04	170.7	164.7	169.2	168.99	2.74		0.55	1.51	211.23	88.38	10	11.96	2.51	**223.6**
I-BW-03	170	164	168.92	168.51	3.15	38.25	0.55	1.73	252.63	110.97	10	13.36	2.37	**265.6**
J-BW-02	168	161	167.27	167.09	0	16.18	0	0	268.81	119.87	0	13.42	2.37	**286.3**
I-BW-01	161.9	152.9	160.78	160.21	3.79	46.8	0.55	2.08	319.4	147.7	10	14.02	2.32	**345.1**
O-BW	159	154	142.5	142.5	0		0	0	319.4	147.7	0	14.08	2.31	**344.3**

(1) Nodes are presented in Figure D-BW in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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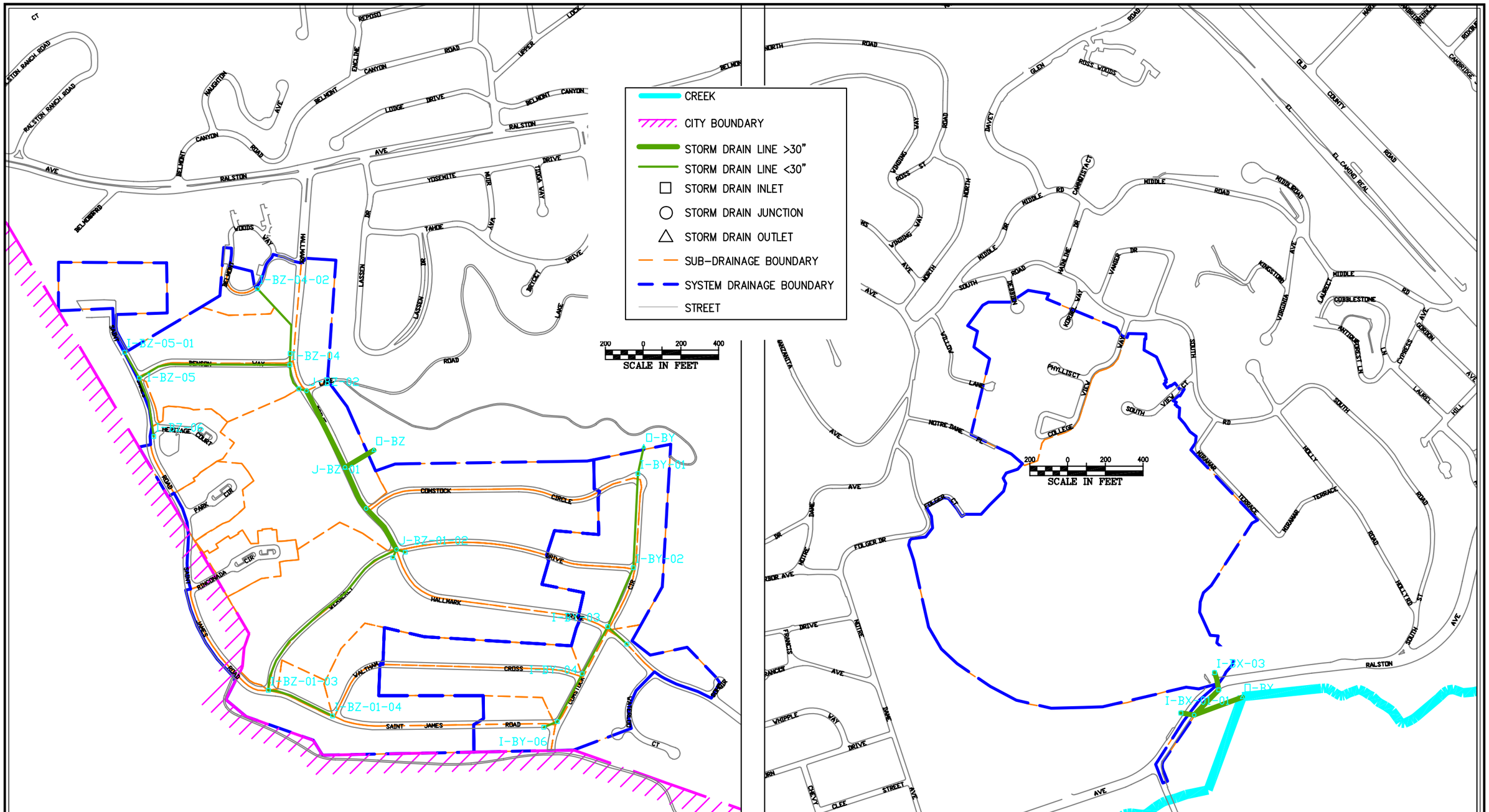
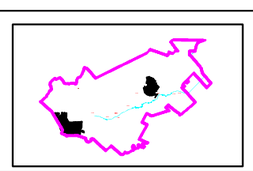
Table D-B10d

Proposed Hydraulics, 25-Year Event, System BW

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
Belmont Creek Drainage																		
Mean Annual Precipitation 26"																		
to Alameda de las Pulgas Branch of Belmont Creek																		
El Verano Way																		
P-BW-03-03-02	I-BW-03-03-02	J-BW-03-03-01	0.0	11.6	18 inch	693	0.0123	0.013	201.50	193.00	206.00	198.00	201.50	193.00	**4.5**	3.0	0.0	no change
P-BW-03-03-01	J-BW-03-03-01	J-BW-03-03	0.0	16.8	15 inch	89	0.067	0.013	193.0	187.0	198.0	194.0	193.0	188.1	**5.0**	3.8	0.0	no change
P-BW-03-02-02	I-BW-03-02-02	I-BW-03-02-01	1.8	7.2	12 inch	306	0.041	0.013	204.4	192.0	208.4	196.0	205.0	193.1	**3.4**	3.0	7.6	no change
P-BW-03-02-01	I-BW-03-02-01	I-BW-03-02	3.4	8.4	12 inch	445	0.056	0.013	192.0	167.0	196.0	171.0	192.8	170.4	**3.2**	3.0	10.2	no change
P-BW-03-01N	I-BW-03-01N	I-BW-03	8.1	16.3	15 inch	267	0.064	0.013	181.0	164.0	186.0	170.0	182.1	168.9	**3.9**	3.8	13.3	no change
Valerga Drive																		
P-BW-03-07	I-BW-03-07	I-BW-03-06	10.1	61.7	27 inch	353	0.040	0.013	220.0	206.0	225.0	212.0	221.1	207.2	**3.9**	2.8	11.5	no change
P-BW-03-06	I-BW-03-06	I-BW-03-05	9.9	101.5	30 inch	98	0.061	0.013	206.0	200.0	212.0	206.0	207.1	200.5	**4.9**	3.5	13.1	no change
P-BW-03-05	I-BW-03-05	J-BW-03-04	9.8	55.9	33 inch	448	0.011	0.013	200.0	195.0	206.0	201.0	201.0	196.3	**5.0**	3.3	7.1	no change
P-BW-03-04	J-BW-03-04	J-BW-03-03	9.4	36.9	24 inch	300	0.027	0.013	195.0	187.0	201.0	194.0	196.1	187.7	**4.9**	4.0	9.8	no change
P-BW-03-03	J-BW-03-03	I-BW-03-02	9.2	79.9	30 inch	527	0.038	0.013	187.0	167.0	194.0	171.0	188.0	171.0	**6.0**	4.5	10.8	no change
P-BW-03-02	I-BW-03-02	J-BW-03-01	43.5	83.7	30 inch	36	0.042	0.013	167.0	165.5	171.0	170.7	170.3	169.9	**0.7**	1.5	8.9	upsized
P-BW-03-01	J-BW-03-01	I-BW-03	43.4	141.3	42 inch	76	0.020	0.013	165.5	164.0	170.7	170.0	169.7	169.6	**1.0**	1.7	4.5	upsized
P-BW-02-05	I-BW-02-05	I-BW-02-04	19.0	20.6	15 inch	163	0.101	0.013	226.0	209.5	230.0	214.0	227.2	211.4	**2.8**	2.8	19.0	no change
P-BW-02-04	I-BW-02-04	I-BW-02-03	20.3	38.1	18 inch	274	0.131	0.013	209.5	173.5	214.0	178.0	211.0	178.0	**3.0**	3.0	21.9	no change
P-BW-02-03	I-BW-02-03	I-BW-02-02	21.0	21.1	18 inch	174	0.040	0.013	173.5	166.5	178.0	171.0	178.0	171.0	**0.1**	3.0	11.9	no change
P-BW-02-02	I-BW-02-02	J-BW-02-01	23.9	36.6	18 inch	33	0.121	0.013	166.5	162.5	171.0	169.0	169.1	167.4	**1.9**	3.0	13.5	no change
P-BW-02-01	J-BW-02-01	J-BW-02	23.9	155.2	42 inch	63	0.024	0.013	162.5	161.0	169.0	168.0	167.3	167.3	**1.7**	3.0	2.5	no change
Village Drive																		
P-BW-01-05	I-BW-01-05	I-BW-01-04	63.3	67.0	30 inch	75	0.027	0.013	236.0	234.0	242.0	242.0	240.1	238.3	**1.9**	3.5	12.9	upsized
P-BW-01-04	I-BW-01-04	J-BW-01-03	63.0	112.2	30 inch	345	0.075	0.013	234.0	208.2	242.0	213.2	236.4	210.8	**5.6**	5.5	23.5	upsized
P-BW-01-03	J-BW-01-03	J-BW-01-02	62.2	109.0	30 inch	187	0.071	0.013	208.2	195.0	213.2	201.0	210.6	198.5	**2.6**	2.5	22.9	upsized
P-BW-01-02	J-BW-01-02	I-BW-01-01	61.8	191.0	36 inch	477	0.082	0.013	195.0	155.9	201.0	161.9	197.5	161.9	**3.5**	3.0	24.1	no change
P-BW-01-01	I-BW-01-01	I-BW-01	68.5	163.4	36 inch	50	0.060	0.013	155.9	152.9	161.9	161.9	161.3	160.8	**0.6**	3.0	9.7	no change
Alameda de las Pulgas																		
P-BW-12	I-BW-12	J-BW-11	141.8	107.4	33 inch	189	0.041	0.013	222.8	215.0	228.8	221.0	232.2	218.6	**ABOVE RIM**	3.3	23.9	no change
P-BW-11	J-BW-11	I-BW-10	140.9	158.5	42 inch	576	0.025	0.013	215.0	200.7	221.0	206.7	218.4	206.7	**2.6**	2.5	18.6	no change
P-BW-10	I-BW-10	I-BW-09	137.4	141.0	42 inch	290	0.020	0.013	200.7	195.0	206.7	201.0	206.4	201.0	**0.3**	2.5	14.3	no change
P-BW-09	I-BW-09	I-BW-07	135.3	120.6	36 inch	474	0.033	0.013	195.0	179.5	201.0	185.0	204.5	185.0	**ABOVE RIM**	3.0	19.1	no change
P-BW-08	I-BW-07	J-BW-07	132.8	171.2	5 x 3 ft	46	0.011	0.013	179.5	179.0	185.0	185.0	184.2	183.9	**0.8**	2.5	8.9	upsized
P-BW-07	J-BW-07	I-BW-06	132.3	252.4	48 inch	114	0.026	0.012	179.0	176.0	185.0	182.0	182.4	180.3	**2.6**	2.0	20.3	upsized
P-BW-06	I-BW-06	I-BW-05	218.4	244.5	48 inch	81	0.025	0.012	176.0	174.0	182.0	180.0	180.0	178.4	**2.0**	2.0	22.0	upsized
P-BW-05	I-BW-05	I-BW-04	222.7	235.5	48 inch	406	0.023	0.012	174.0	164.7	180.0	170.7	177.9	169.2	**2.1**	2.0	21.3	upsized
P-BW-04	I-BW-04	I-BW-03	223.6	259.1	60 inch	83	0.008	0.012	164.7	164.0	170.7	170.0	169.0	168.9	**1.7**	1.0	14.9	upsized
P-BW-03	I-BW-03	J-BW-02	265.6	518.0	60 inch	89	0.034	0.012	164.0	161.0	170.0	168.0	168.5	167.8	**1.5**	1.0	26.6	upsized
P-BW-02	J-BW-02	I-BW-01	286.3	351.5	60 inch	522	0.016	0.012	161.0	152.9	168.0	161.9	167.1	161.7	**0.9**	2.0	14.6	upsized
P-BW-01	I-BW-01	O-BW	345.1	-319.7	60 inch	73	-0.015	0.013	152.9	154.0	161.9	159.0	160.2	158.8	**1.7**	4.0	17.6	upsized

(1) Pipes are presented in Figure 2 and Figure D-BW in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B11A TO D-B11D

FIGURE D-BX-BZ
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B11a

Existing Hydrology, 10-Year Event, Systems BX, BY & BZ

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
Ralston Avenue near Notre Dame														
I-BX-01-01	80	75	80	80	283.26		0.5	141.63	283.26	141.63	10	10	2.29	**327.6**
I-BX-03	90	85.5	90	90	60.16		0.5	30.08	60.16	30.08	10	10	2.29	**69.6**
I-BX-02	86.2	81.7	118.94	86.2	0.4		0.5	0.2	60.56	30.28	10	10.04	2.29	**69.9**
J-BX-01	80	72	90.16	80	0	283.26	0	0	343.82	171.91	0	10.12	2.28	**395.3**
O-BX	69.3	64.3	65	65	0		0	0	343.82	171.91	0	10.23	2.27	**393.2**
Comstock Circle														
I-BY-03-01	625.2	621	625.2	625.2	5.63		0.5	2.82	5.63	2.82	10	10	2.29	**6.5**
I-BY-06	663	659	659.63	659.63	1.39		0.5	0.7	1.39	0.7	10	10	2.29	**1.6**
I-BY-05	662.6	658.6	659.51	659.33	1.17		0.5	0.58	2.56	1.28	10	10.38	2.25	**2.9**
I-BY-04	640.9	636.4	637.81	637.61	7.46		0.5	3.73	10.02	5.01	10	10.81	2.21	**11.2**
I-BY-03	625.4	620.9	626.46	625.4	0.7	5.63	0.5	0.35	16.35	8.18	10	11.16	2.17	**17.9**
I-BY-02	613.3	608.8	611.63	610.27	2.26		0.5	1.13	18.61	9.31	10	11.55	2.14	**20.0**
I-BY-01	594	589.5	591.85	590.99	7.33		0.5	3.67	25.94	12.97	10	12.18	2.08	**27.2**
O-BY	580	575	575	575	0		0	0	25.94	12.97	0	12.29	2.07	**27.1**
Saint James Road														
I-BZ-05-01	644.6	640.1	640.92	640.92	3.51		0.5	1.75	3.51	1.75	10	10	2.29	**4.1**
Hallmark Drive														
I-BZ-04-02	638	634	634.55	634.55	1.43		0.5	0.72	1.43	0.72	10	10	2.29	**1.7**
I-BZ-04-01	570	565.5	566.74	566.63	6.01		0.5	3.01	7.44	3.72	10	10.56	2.23	**8.4**
Wemberly Way														
I-BZ-01-02-01W	562	558	562	562	16.09		0.5	8.05	16.09	8.05	10	10	2.29	**18.6**
I-BZ-01-02-01E	564	560	564	564	16.89		0.5	8.45	32.98	8.45	10	10	2.29	**19.5**
I-BZ-01-04	652.6	648.6	651.7	651.7	4.83		0.5	2.42	4.83	2.42	10	10	2.29	**5.6**
I-BZ-01-03	644.6	639.6	642.61	640.83	8.2		0.5	4.1	13.03	6.52	10	10.87	2.2	**14.5**
J-BZ-01-02	560.2	555.2	566.36	560.2	0	32.98	0	0	46.01	23.01	0	11.92	2.1	**48.8**
J-BZ-01-01	546.9	541.9	548.08	546.9	0		0	0	46.01	23.01	0	12.14	2.08	**48.3**
Hallmark Drive														
I-BZ-06	669	665	665.83	665.83	3.31		0.5	1.66	3.31	1.66	10	10	2.29	**3.8**
I-BZ-05	643.5	639	640.33	640.11	0.2	3.51	0.5	0.1	7.02	3.51	10	10.54	2.24	**7.9**
I-BZ-04	566.9	561.9	563.87	563.37	4.33	7.44	0.5	2.17	18.79	9.4	10	11.43	2.15	**20.3**
I-BZ-03	548	543	555.43	548	20.43		0.5	10.22	39.22	19.61	10	11.54	2.14	**42.2**
J-BZ-02	546.6	541.6	551.75	546.6	0		0	0	39.22	19.61	0	11.58	2.13	**42.2**
J-BZ-01	539.9	534.9	547.04	539.9	0	46.01	0	0	85.23	42.62	0	12.41	2.06	**88.5**
O-BZ	540	532	532	532	0		0	0	85.23	42.62	0	12.51	2.05	**88.1**

(1) Nodes are presented in Figure D-BX-BZ in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B11b

Existing Hydraulics, 10-Year Event, Systems BX, BY & BZ

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 26"																	
Ralston Avenue near Notre Dame																	
P-BX-01-01	I-BX-01-01	J-BX-01	327.6	337.6	5 x 3 ft	71	0.042	0.013	75.00	72.00	80.00	80.00	82.83	80.00	**ABOVE RIM**	2.0	21.8
P-BX-03	I-BX-03	I-BX-02	69.6	21.1	18 inch	94	0.0404	0.013	85.50	81.70	90.00	86.20	127.45	86.20	**ABOVE RIM**	3.0	39.4
P-BX-02	I-BX-02	J-BX-01	69.9	23.9	18 inch	187	0.0519	0.013	81.70	72.00	86.20	80.00	162.83	80.00	**ABOVE RIM**	3.0	39.6
P-BX-01	J-BX-01	O-BX	395.3	169.0	42 inch	273	0.028	0.013	72.00	64.30	80.00	69.30	109.95	67.80	**ABOVE RIM**	4.5	41.1
Comstock Circle																	
P-BY-03-01	I-BY-03-01	I-BY-03	6.5	2.8	18 inch	137	0.001	0.013	621.00	620.90	625.20	625.40	625.93	625.40	**ABOVE RIM**	2.7	3.7
P-BY-06	I-BY-06	I-BY-05	1.6	2.6	12 inch	78	0.005	0.013	659.00	658.60	663.00	662.60	659.63	659.51	**3.4**	3.0	3.4
P-BY-05	I-BY-05	I-BY-04	2.9	9.9	12 inch	285	0.078	0.013	658.60	636.40	662.60	640.90	659.33	637.81	**3.3**	3.0	11.0
P-BY-04	I-BY-04	I-BY-03	11.2	15.1	15 inch	284	0.055	0.013	636.40	620.90	640.90	625.40	637.61	625.40	**3.3**	3.3	13.5
P-BY-03	I-BY-03	I-BY-02	17.9	12.2	15 inch	341	0.035	0.013	620.90	608.80	625.40	613.30	637.81	611.63	**ABOVE RIM**	3.3	14.6
P-BY-02	I-BY-02	I-BY-01	20.0	20.6	18 inch	500	0.039	0.013	608.80	589.50	613.30	594.00	610.27	591.85	**3.0**	3.0	13.3
P-BY-01	I-BY-01	O-BY	27.2	33.1	18 inch	146	0.099	0.013	589.50	575.00	594.00	580.00	590.99	576.04	**3.0**	3.0	20.9
Saint James Road																	
P-BZ-05-01	I-BZ-05-01	I-BZ-05	4.1	5.4	15 inch	157	0.0070	0.013	640.10	639.00	644.60	643.50	640.92	640.34	**3.7**	3.3	4.8
P-BZ-04-02	I-BZ-04-02	I-BZ-04-01	1.7	14.5	12 inch	414	0.1655	0.013	634.00	565.50	638.00	570.00	634.55	566.74	**3.5**	3.0	12.3
P-BZ-04-01	I-BZ-04-01	I-BZ-04	8.4	16.0	15 inch	59	0.0610	0.013	565.50	561.90	570.00	566.90	566.63	563.97	**3.4**	3.3	13.2
Hallmark Drive																	
P-BZ-01-02-01W	I-BZ-01-02-01W	J-BZ-01-02	18.6	8.7	12 inch	47	0.0596	0.013	558.00	555.20	562.00	560.20	573.02	560.20	**ABOVE RIM**	3.0	23.7
P-BZ-01-02-01E	I-BZ-01-02-01E	J-BZ-01-02	19.5	11.2	12 inch	49	0.0980	0.013	560.00	555.20	564.00	560.20	574.93	560.20	**ABOVE RIM**	3.0	24.9
Wemberly Way																	
P-BZ-01-04	I-BZ-01-04	I-BZ-01-03	5.6	5.6	12 inch	370	0.0243	0.013	648.60	639.60	652.60	644.60	651.70	642.61	**0.9**	3.0	7.1
P-BZ-01-03	I-BZ-01-03	J-BZ-01-02	14.5	18.4	15 inch	1043	0.0809	0.013	639.60	555.20	644.60	560.20	640.83	560.20	**3.8**	3.8	16.6
P-BZ-01-02	J-BZ-01-02	J-BZ-01-01	48.8	35.0	21 inch	273	0.0487	0.013	555.20	541.90	560.20	546.90	572.75	546.90	**ABOVE RIM**	3.3	20.3
P-BZ-01-01	J-BZ-01-01	J-BZ-01	48.3	38.2	24 inch	246	0.0285	0.013	541.90	534.90	546.90	539.90	551.11	539.90	**ABOVE RIM**	3.0	15.4
Hallmark Drive																	
P-BZ-06	I-BZ-06	I-BZ-05	3.8	10.1	12 inch	321	0.0810	0.013	665.00	639.00	669.00	643.50	665.83	640.33	**3.2**	3.0	12.0
P-BZ-05	I-BZ-05	I-BZ-04	7.9	19.8	15 inch	817	0.0944	0.013	639.00	561.90	643.50	566.90	640.11	563.87	**3.4**	3.3	15.3
P-BZ-04	I-BZ-04	I-BZ-03	20.3	38.3	18 inch	142	0.1331	0.013	561.90	543.00	566.90	548.00	563.37	548.00	**3.5**	3.5	22.0
P-BZ-03	I-BZ-03	J-BZ-02	42.2	29.3	21 inch	41	0.0341	0.013	543.00	541.60	548.00	546.60	549.51	546.60	**ABOVE RIM**	3.3	17.6
P-BZ-02	J-BZ-02	J-BZ-01	42.2	27.5	24 inch	455	0.0147	0.013	541.60	534.90	546.60	539.90	555.70	539.90	**ABOVE RIM**	3.0	13.4
P-BZ-01	J-BZ-01	O-BZ	88.5	28.9	24 inch	178	0.0163	0.013	534.90	532.00	539.90	540.00	561.25	534.00	**ABOVE RIM**	3.0	28.2

(1) Pipes are presented in Figure 2 and Figure D-BX-BZ in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B11c

Proposed Hydrology, 25-Year Event, Systems BX, BY & BZ

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
I-BX-01-01	85.6	75	82.05	82.05	283.26		0.55	155.79	283.26	155.79	10	10	2.74	**431.0**
I-BX-03	90	85.5	88.36	88.36	60.16		0.55	33.09	60.16	33.09	10	10	2.74	**91.5**
I-BX-02	86.2	81.7	86.13	84.56	0.4		0.55	0.22	60.56	33.31	10	10.08	2.73	**91.8**
J-BX-01	80	72	79.91	77.38	0	283.26	0	0	343.82	189.1	0	10.22	2.72	**517.6**
O-BX	69.3	64.3	67.7	67.7	0		0	0	343.82	189.1	0	10.37	2.69	**513.6**
I-BY-03-01	625.2	621	623.78	623.78	5.63		0.55	3.1	5.63	3.1	10	10	2.74	**8.6**
I-BY-06	663	659	659.95	659.95	1.39		0.55	0.76	1.39	0.76	10	10	2.74	**2.1**
I-BY-05	662.6	658.6	659.69	659.43	1.17		0.55	0.64	2.56	1.41	10	10.36	2.7	**3.8**
I-BY-04	640.9	636.4	638.14	637.63	7.46		0.55	4.1	10.02	5.51	10	10.76	2.65	**14.7**
I-BY-03	625.4	620.9	622.83	622.62	0.7	5.63	0.55	0.39	16.35	8.99	10	11.1	2.61	**23.6**
I-BY-02	613.3	608.8	610.98	610.6	2.26		0.55	1.24	18.61	10.24	10	11.51	2.56	**26.4**
I-BY-01	594	589.5	591.84	591.43	7.33		0.55	4.03	25.94	14.27	10	12.07	2.5	**35.9**
O-BY	580	575	575	575	0		0	0	25.94	14.27	0	12.18	2.49	**35.8**
I-BZ-05-01	644.6	640.1	641.64	641.64	3.51		0.55	1.93	3.51	1.93	10	10	2.74	**5.3**
I-BZ-04-02	638	634	634.63	634.63	1.43		0.55	0.79	1.43	0.79	10	10	2.74	**2.2**
I-BZ-04-01	570	565.5	566.89	566.7	6.01		0.55	3.31	7.44	4.09	10	10.52	2.68	**11.0**
I-BZ-01-02-01W	562	558	561.12	561.12	16.09		0.55	8.85	16.09	8.85	10	10	2.74	**24.5**
I-BZ-01-02-01E	564	560	561.62	561.62	16.89		0.55	9.29	16.89	9.29	10	10	2.74	**25.7**
I-BZ-01-04	652.6	648.6	652.6	652.6	4.83		0.55	2.66	4.83	2.66	10	10	2.74	**7.4**
I-BZ-01-03	644.6	639.6	656.83	644.6	8.2		0.55	4.51	13.03	7.17	10	10.66	2.66	**19.2**
J-BZ-01-02	560.2	555.2	558.07	557.62	0	32.98	0	0	46.01	25.31	0	11.77	2.53	**64.5**
J-BZ-01-01	546.9	541.9	546.23	545.87	0		0	0	46.01	25.31	0	12	2.51	**63.9**
I-BZ-06	669	665	665.92	665.92	3.31		0.55	1.82	3.31	1.82	10	10	2.74	**5.0**
I-BZ-05	643.5	639	640.55	640.19	0.2	3.51	0.55	0.11	7.02	3.86	10	10.6	2.67	**10.4**
I-BZ-04	566.9	561.9	564.25	563.39	4.33	7.44	0.55	2.38	18.79	10.33	10	11.43	2.57	**26.7**
I-BZ-03	548	543	550.98	547.15	20.43		0.55	11.24	39.22	21.57	10	11.54	2.56	**55.6**
J-BZ-02	546.6	541.6	544.68	544.02	0		0	0	39.22	21.57	0	11.57	2.55	**55.5**
J-BZ-01	539.9	534.9	541.36	539.63	0	46.01	0	0	85.23	46.88	0	12.31	2.47	**116.9**
O-BZ	540	532	532	532	0		0	0	85.23	46.88	0	12.49	2.46	**116.0**

(1) Nodes are presented in Figure D-BX-BZ in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

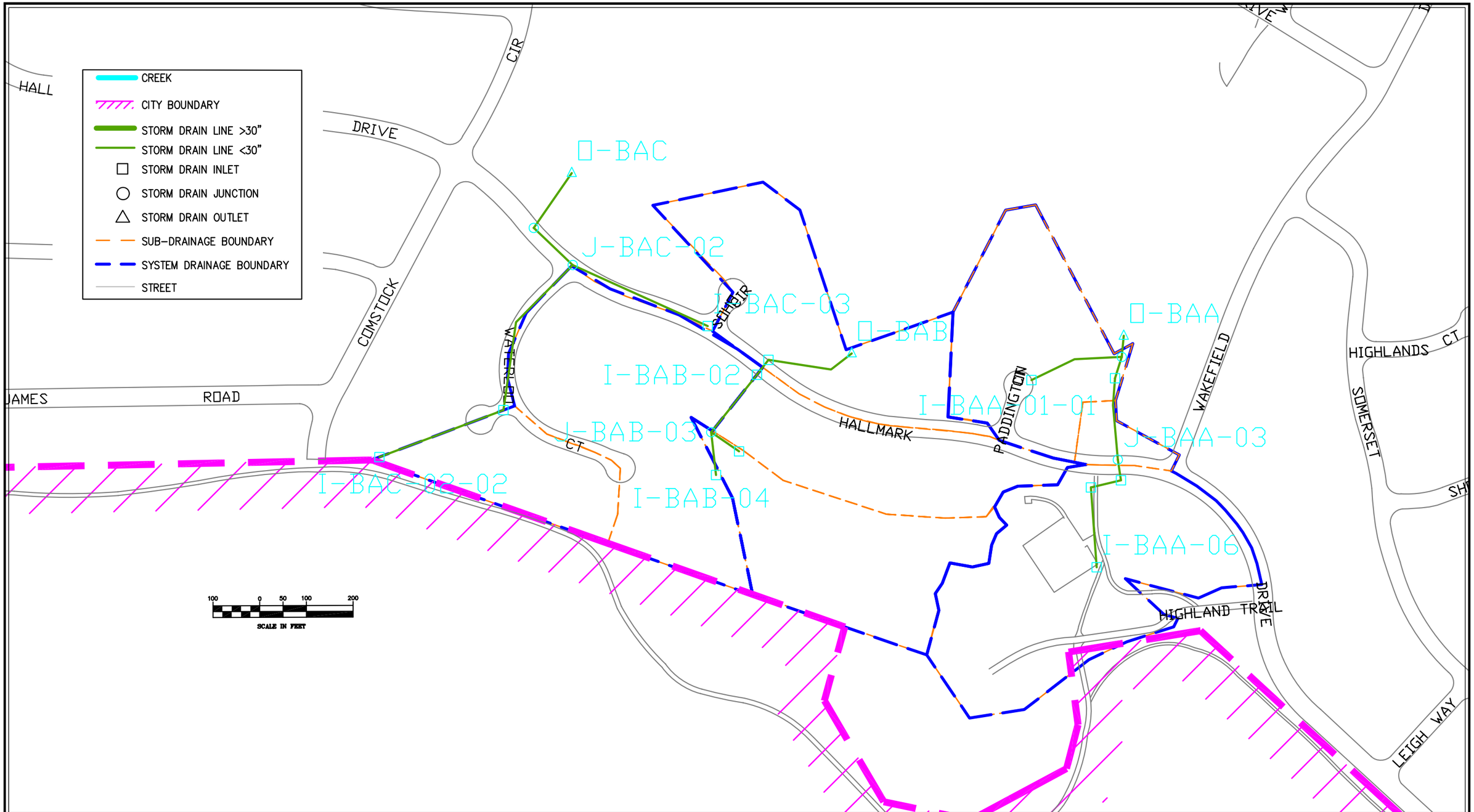
CITY OF BELMONT
STORM DRAIN MASTER PLAN

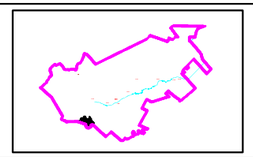
Table D-B11d

Proposed Hydraulics, 25-Year Event, Systems BX, BY & BZ

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
Belmont Creek Drainage																		
Mean Annual Precipitation 24"																		
Ralston Avenue near Notre Dame																		
P-BX-01-01	I-BX-01-01	J-BX-01	431.0	509.7	7 x 3 ft	71	0.042	0.013	75.00	72.00	85.60	80.00	82.05	79.91	**3.6**	7.6	20.5	upsized
P-BX-03	I-BX-03	I-BX-02	91.5	134.1	36 inch	94	0.040	0.013	85.5	81.7	90.0	86.2	88.4	86.1	**1.6**	1.5	20.4	upsized
P-BX-02	I-BX-02	J-BX-01	91.8	151.9	36 inch	187	0.052	0.013	81.7	72.0	86.2	80.0	84.6	79.9	**1.6**	1.5	22.5	upsized
P-BX-01	J-BX-01	O-BX	517.6	610.9	66 inch	273	0.028	0.012	72.0	64.3	80.0	69.3	77.4	68.5	**2.6**	2.5	28.9	upsized
Comstock Circle																		
P-BY-03-01	I-BY-03-01	I-BY-03	8.6	2.8	18 inch	137	0.001	0.013	621.0	620.9	625.2	625.4	623.8	622.9	**1.4**	2.7	4.9	no change
P-BY-06	I-BY-06	I-BY-05	2.1	2.6	12 inch	78	0.005	0.013	659.0	658.6	663.0	662.6	660.0	659.7	**3.0**	3.0	3.6	no change
P-BY-05	I-BY-05	I-BY-04	3.8	9.9	12 inch	285	0.078	0.013	658.6	636.4	662.6	640.9	659.4	638.1	**3.2**	3.0	11.8	no change
P-BY-04	I-BY-04	I-BY-03	14.7	15.1	15 inch	284	0.055	0.013	636.4	620.9	640.9	625.4	637.6	622.8	**3.3**	3.3	14.0	no change
P-BY-03	I-BY-03	I-BY-02	23.6	42.6	24 inch	341	0.035	0.013	620.9	608.8	625.4	613.3	622.6	611.0	**2.8**	2.5	13.9	upsized
P-BY-02	I-BY-02	I-BY-01	26.4	44.4	24 inch	500	0.039	0.013	608.8	589.5	613.3	594.0	610.6	591.8	**2.7**	2.5	14.8	upsized
P-BY-01	I-BY-01	O-BY	35.9	71.3	24 inch	146	0.099	0.013	589.5	575.0	594.0	580.0	591.4	576.0	**2.6**	2.5	22.7	upsized
Mean Annual Precipitation 26"																		
Saint James Road																		
P-BZ-05-01	I-BZ-05-01	I-BZ-05	5.3	5.4	15 inch	157	0.007	0.013	640.1	639.0	644.6	643.5	641.6	640.6	**3.0**	3.3	4.4	no change
P-BZ-04-02	I-BZ-04-02	I-BZ-04-01	2.2	14.5	12 inch	414	0.165	0.013	634.0	565.5	638.0	570.0	634.6	566.9	**3.4**	3.0	13.3	no change
P-BZ-04-01	I-BZ-04-01	I-BZ-04	11.0	16.0	15 inch	59	0.061	0.013	565.5	561.9	570.0	566.9	566.7	564.4	**3.3**	3.3	14.0	no change
Hallmark Drive																		
P-BZ-01-02-01W	I-BZ-01-02-01W	J-BZ-01-02	24.5	25.6	18 inch	47	0.060	0.013	558.0	555.2	562.0	560.2	561.1	558.6	**0.9**	2.5	13.9	upsized
P-BZ-01-02-01E	I-BZ-01-02-01E	J-BZ-01-02	25.7	32.9	18 inch	49	0.098	0.013	560.0	555.2	564.0	560.2	561.6	558.7	**2.4**	2.5	14.5	upsized
Wemberly Way																		
P-BZ-01-04	I-BZ-01-04	I-BZ-01-03	7.4	5.6	12 inch	370	0.024	0.013	648.6	639.6	652.6	644.6	660.3	644.6	**ABOVE RIM**	3.0	9.4	no change
P-BZ-01-03	I-BZ-01-03	J-BZ-01-02	19.2	18.4	15 inch	1043	0.081	0.013	639.6	555.2	644.6	560.2	650.2	558.1	**ABOVE RIM**	3.8	15.7	no change
P-BZ-01-02	J-BZ-01-02	J-BZ-01-01	64.5	90.5	30 inch	273	0.049	0.013	555.2	541.9	560.2	546.9	557.6	546.2	**2.6**	2.5	20.0	upsized
P-BZ-01-01	J-BZ-01-01	J-BZ-01	63.9	69.2	30 inch	246	0.028	0.013	541.9	534.9	546.9	539.9	545.9	539.9	**1.0**	2.5	13.0	upsized
Hallmark Drive																		
P-BZ-06	I-BZ-06	I-BZ-05	5.0	10.1	12 inch	321	0.081	0.013	665.0	639.0	669.0	643.5	665.9	640.6	**3.1**	3.0	12.9	no change
P-BZ-05	I-BZ-05	I-BZ-04	10.4	19.8	15 inch	817	0.094	0.013	639.0	561.9	643.5	566.9	640.2	564.3	**3.3**	3.3	16.4	no change
P-BZ-04	I-BZ-04	I-BZ-03	26.7	38.3	18 inch	142	0.133	0.013	561.9	543.0	566.9	548.0	563.4	548.0	**3.5**	3.5	23.5	no change
P-BZ-03	I-BZ-03	J-BZ-02	55.6	41.8	24 inch	41	0.034	0.013	543.0	541.6	548.0	546.6	547.2	544.7	**0.9**	3.0	17.7	upsized
P-BZ-02	J-BZ-02	J-BZ-01	55.5	80.9	36 inch	455	0.015	0.013	541.6	534.9	546.6	539.9	544.0	539.9	**2.6**	2.0	12.3	upsized
P-BZ-01	J-BZ-01	O-BZ	116.9	92.2	36 inch	178	0.016	0.012	534.9	532.0	539.9	540.0	539.6	534.9	**0.3**	2.0	16.5	upsized

(1) Pipes are presented in Figure 2 and Figure D-BX-BZ in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-B12A TO D-B12D

FIGURE D-BAA-BAC
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B12a

Existing Hydrology, 10-Year Event, Systems BAA, BAB & BAC

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
Hallmark Drive														
Paddington Court														
I-BAA-01-01	707.3	703.3	704.1	704.1	3.01		0.5	1.5	3.01	1.5	10	10	2.29	**3.5**
I-BAA-06	743	738	738.95	738.95	5.19		0.5	2.6	5.19	2.6	10	10	2.29	**6.0**
I-BAA-05	722	717	718.18	717.94	0		0	0	5.19	2.6	10	10.19	2.27	**6.0**
I-BAA-04	720	715	716.18	715.94	0		0	0	5.19	2.6	10	10.31	2.26	**5.9**
J-BAA-03	719.5	714.5	715.49	715.44	0		0	0	5.19	2.6	0	10.42	2.25	**5.9**
I-BAA-02	690	685	686.06	685.97	0.44		0.5	0.22	5.63	2.82	10	10.59	2.23	**6.3**
J-BAA-01	680	675	676.33	676.2	0	3.01	0	0	8.64	4.32	0	10.64	2.23	**9.7**
O-BAA	665	660	660	660	0		0	0	8.64	4.32	0	10.67	2.22	**9.7**
Soho Circle														
I-BAB-03-01	694.5	690.5	691.25	691.25	2.67		0.5	1.33	2.67	1.33	10	10	2.29	**3.1**
I-BAB-04	700	696	696.81	696.81	3.1		0.5	1.55	3.1	1.55	10	10	2.29	**3.6**
J-BAB-03	693	689	690.33	689.97	0	2.67	0	0	5.77	2.88	0	10.18	2.28	**6.6**
I-BAB-02	665.5	661.5	663	662.93	0		0	0	5.77	2.88	10	10.32	2.26	**6.6**
I-BAB-01	665.1	661.1	662.5	662.13	3.45		0	0	9.22	2.88	10	10.45	2.25	**6.5**
O-BAB	645	640	640	640	0		0	0	9.22	2.88	0	10.65	2.22	**6.5**
Waterloo Court														
I-BAC-02-02	672	668	670.84	670.84	1.75		0.8	1.4	1.75	1.4	10	10	2.29	**3.2**
I-BAC-02-01	674	667.5	668.49	668.25	0		0	0	1.75	1.4	10	11.15	2.17	**3.1**
I-BAC-03	659.3	655.3	659.3	659.3	4.7		0.8	3.76	4.7	3.76	10	10	2.29	**8.7**
J-BAC-02	645.3	641.3	642.73	642.5	0	1.75	0	0	6.45	5.16	0	11.71	2.12	**11.0**
J-BAC-01	632	628	629.61	629.24	0		0	0	6.45	5.16	0	11.81	2.11	**11.0**
O-BAC	585	580	580	580	0		0	0	6.45	5.16	0	11.91	2.1	**10.9**

(1) Nodes are presented in Figure D-BAA-BAC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-B12b

Existing Hydraulics, 10-Year Event, Systems BAA, BAB & BAC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 26"																	
Hallmark Drive																	
Paddington Court																	
P-BAA-01-01	I-BAA-01-01	J-BAA-01	3.5	13.3	12 inch	204	0.139	0.013	703.3	675.0	707.3	680.0	704.1	676.3	**3.2**	3.0	14.2
P-BAA-06	I-BAA-06	I-BAA-05	6.0	36.7	18 inch	172	0.122	0.013	738.0	717.0	743.0	722.0	739.0	718.2	**4.0**	3.5	15.3
P-BAA-05	I-BAA-05	I-BAA-04	6.0	18.3	18 inch	66	0.030	0.013	717.0	715.0	722.0	720.0	717.9	716.2	**4.1**	3.5	9.3
P-BAA-04	I-BAA-04	J-BAA-03	5.9	11.1	18 inch	45	0.011	0.013	715.0	714.5	720.0	719.5	715.9	715.5	**4.1**	3.5	6.4
P-BAA-03	J-BAA-03	I-BAA-02	5.9	43.1	18 inch	175	0.169	0.013	714.5	685.0	719.5	690.0	715.4	686.1	**4.1**	3.5	17.1
P-BAA-02	I-BAA-02	J-BAA-01	6.3	47.9	18 inch	48	0.208	0.013	685.0	675.0	690.0	680.0	686.0	676.4	**4.0**	3.5	18.8
P-BAA-01	J-BAA-01	O-BAA	9.7	60.0	18 inch	46	0.326	0.013	675.0	660.0	680.0	665.0	676.2	660.4	**3.8**	3.5	24.9
Soho Circle																	
P-BAB-03-01	I-BAB-03-01	J-BAB-03	3.1	5.1	12 inch	72	0.021	0.013	690.5	689.0	694.5	693.0	691.3	690.3	**3.3**	3.0	6.8
P-BAB-04	I-BAB-04	J-BAB-03	3.6	9.8	12 inch	92	0.076	0.013	696.0	689.0	700.0	693.0	696.8	690.5	**3.2**	3.0	11.5
P-BAB-03	J-BAB-03	I-BAB-02	6.6	14.9	12 inch	157	0.175	0.013	689.0	661.5	693.0	665.5	690.0	663.0	**3.0**	3.0	18.4
P-BAB-02	I-BAB-02	I-BAB-01	6.6	6.4	15 inch	41	0.010	0.013	661.5	661.1	665.5	665.1	662.9	662.5	**2.6**	2.8	5.4
P-BAB-01	I-BAB-01	O-BAB	6.5	21.5	15 inch	191	0.110	0.013	661.1	640.0	665.1	645.0	662.1	640.5	**3.0**	2.8	15.4
Waterloo Court																	
P-BAC-02-02	I-BAC-02-02	I-BAC-02-01	3.2	1.5	12 inch	284	0.002	0.013	668.0	667.5	672.0	674.0	670.8	668.5	**1.2**	3.0	4.1
P-BAC-02-01	I-BAC-02-01	J-BAC-02	3.1	9.6	12 inch	363	0.072	0.013	667.5	641.3	674.0	645.3	668.3	642.7	**5.8**	5.5	10.8
P-BAC-03	I-BAC-03	J-BAC-02	8.7	7.5	12 inch	317	0.044	0.013	655.3	641.3	659.3	645.3	661.9	643.1	**ABOVE RIM**	3.0	11.1
P-BAC-02	J-BAC-02	J-BAC-01	11.0	22.0	15 inch	115	0.116	0.013	641.3	628.0	645.3	632.0	642.5	629.6	**2.8**	2.8	17.9
P-BAC-01	J-BAC-01	O-BAC	11.0	91.8	21 inch	143	0.336	0.013	628.0	580.0	632.0	585.0	629.2	580.4	**2.8**	2.3	25.7

(1) Pipes are presented in Figure 2 and Figure D-BAA-BAC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-B12c

Proposed Hydrology, 25-Year Event, Systems BAA, BAB & BAC

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage Mean Annual Precipitation 26"														
I-BAA-01-01	707.3	703.3	704.19	704.19	3.01		0.55	1.66	3.01	1.66	10	10	2.74	**4.6**
I-BAA-06	743	738	739.09	739.09	5.19		0.55	2.85	5.19	2.85	10	10	2.74	**7.9**
I-BAA-05	722	717	718.42	718.08	0		0	0	5.19	2.85	10	10.17	2.72	**7.8**
I-BAA-04	720	715	716.42	716.08	0		0	0	5.19	2.85	10	10.28	2.71	**7.8**
J-BAA-03	719.5	714.5	715.65	715.58	0		0	0	5.19	2.85	0	10.39	2.69	**7.8**
I-BAA-02	690	685	686.25	686.12	0.44		0.55	0.24	5.63	3.1	10	10.55	2.67	**8.3**
J-BAA-01	680	675	676.54	676.34	0	3.01	0	0	8.64	4.75	0	10.59	2.67	**12.8**
O-BAA	665	660	660	660	0		0	0	8.64	4.75	0	10.62	2.66	**12.8**
I-BAB-03-01	694.5	690.5	691.54	691.54	2.67		0.55	1.47	2.67	1.47	10	10	2.74	**4.1**
I-BAB-04	700	696	696.9	696.9	3.1		0.55	1.71	3.1	1.71	10	10	2.74	**4.7**
J-BAB-03	693	689	690.6	689.99	0	2.67	0	0	5.77	3.17	0	10.23	2.71	**8.7**
I-BAB-02	665.5	661.5	663.72	663.55	0		0	0	5.77	3.17	10	10.36	2.7	**8.6**
I-BAB-01	665.1	661.1	662.82	662.24	3.45		0	0	9.22	3.17	10	10.46	2.68	**8.6**
O-BAB	645	640	640	640	0		0	0	9.22	3.17	0	10.65	2.66	**8.5**
I-BAC-02-02	672	668	669.14	669.14	1.75		0.88	1.54	1.75	1.54	10	10	2.74	**4.3**
I-BAC-02-01	674	667.5	668.41	668.26	0		0	0	1.75	1.54	10	11.67	2.54	**3.9**
I-BAC-03	659.3	655.3	659.3	659.3	4.7		0.88	4.14	4.7	4.14	10	10	2.74	**11.4**
J-BAC-02	645.3	641.3	642.87	642.69	0	1.75	0	0	6.45	5.68	0	12.2	2.48	**14.2**
J-BAC-01	632	628	629.92	629.4	0		0	0	6.45	5.68	0	12.3	2.47	**14.2**
O-BAC	585	580	580	580	0		0	0	6.45	5.68	0	12.38	2.47	**14.1**

(1) Nodes are presented in Figure D-BAA-BAC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

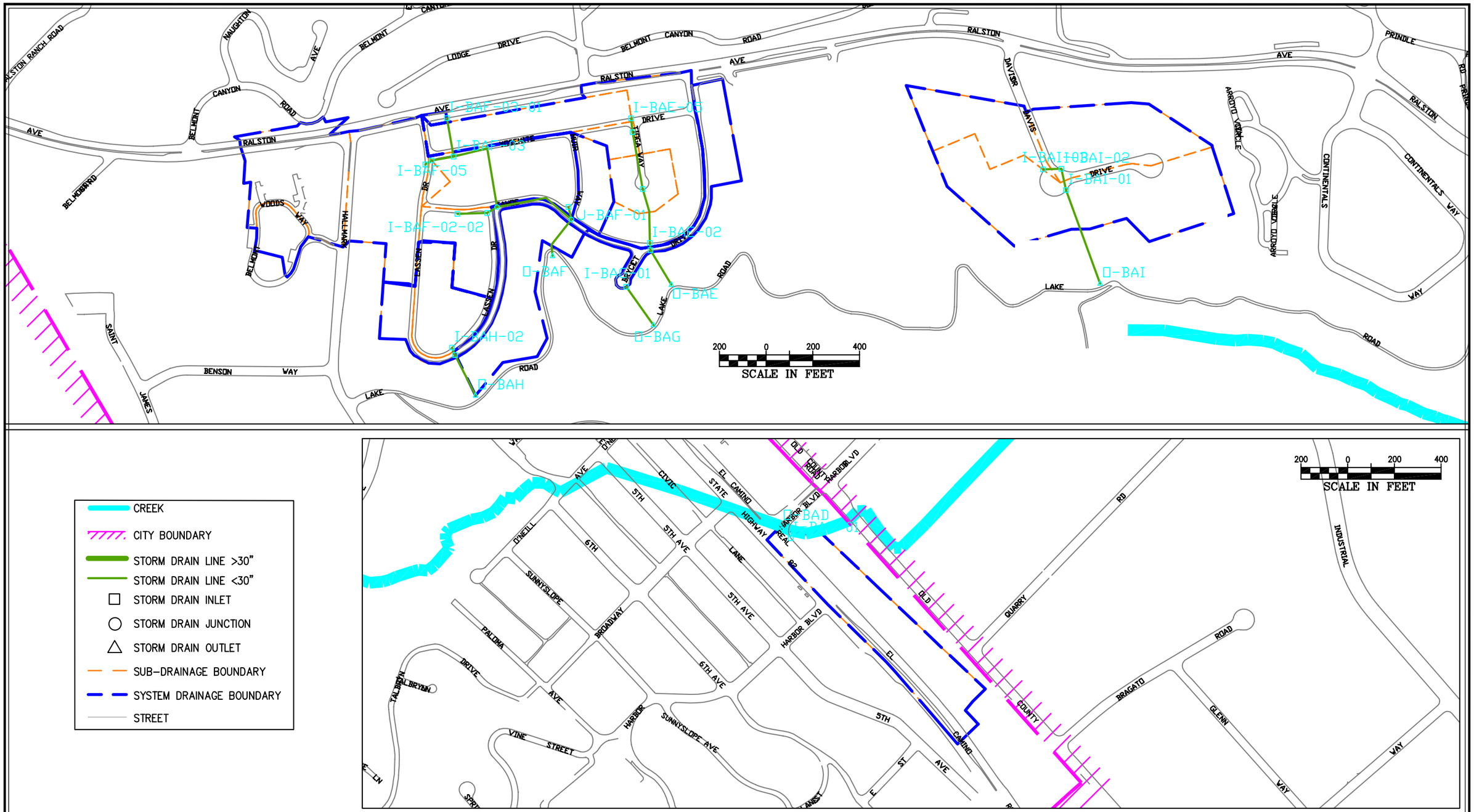
CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B12d

Proposed Hydraulics, 25-Year Event, Systems BAA, BAB & BAC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Mean Annual Precipitation 26"																		
Hallmark Drive																		
Paddington Court																		
P-BAA-01-01	I-BAA-01-01	J-BAA-01	4.6	13.3	12 inch	204	0.139	0.013	703.3	675.0	707.3	680.0	704.2	676.5	**3.1**	3.0	15.3	no change
P-BAA-06	I-BAA-06	I-BAA-05	7.9	36.7	18 inch	172	0.122	0.013	738.0	717.0	743.0	722.0	739.1	718.4	**3.9**	3.5	16.6	no change
P-BAA-05	I-BAA-05	I-BAA-04	7.8	18.3	18 inch	66	0.030	0.013	717.0	715.0	722.0	720.0	718.1	716.4	**3.9**	3.5	10.0	no change
P-BAA-04	I-BAA-04	J-BAA-03	7.8	11.1	18 inch	45	0.011	0.013	715.0	714.5	720.0	719.5	716.1	715.7	**3.9**	3.5	6.8	no change
P-BAA-03	J-BAA-03	I-BAA-02	7.8	43.1	18 inch	175	0.169	0.013	714.5	685.0	719.5	690.0	715.6	686.3	**3.9**	3.5	18.5	no change
P-BAA-02	I-BAA-02	J-BAA-01	8.3	47.9	18 inch	48	0.208	0.013	685.0	675.0	690.0	680.0	686.1	676.6	**3.9**	3.5	20.4	no change
P-BAA-01	J-BAA-01	O-BAA	12.8	60.0	18 inch	46	0.326	0.013	675.0	660.0	680.0	665.0	676.3	660.5	**3.7**	3.5	27.0	no change
Soho Circle																		
P-BAB-03-01	I-BAB-03-01	J-BAB-03	4.1	5.1	12 inch	72	0.021	0.013	690.5	689.0	694.5	693.0	691.5	690.6	**3.0**	3.0	5.2	no change
P-BAB-04	I-BAB-04	J-BAB-03	4.7	9.8	12 inch	92	0.076	0.013	696.0	689.0	700.0	693.0	696.9	691.0	**3.1**	3.0	12.4	no change
P-BAB-03	J-BAB-03	I-BAB-02	8.7	14.9	12 inch	157	0.175	0.013	689.0	661.5	693.0	665.5	690.0	663.7	**3.0**	3.0	19.7	no change
P-BAB-02	I-BAB-02	I-BAB-01	8.6	6.4	15 inch	41	0.010	0.013	661.5	661.1	665.5	665.1	663.6	662.8	**2.0**	2.8	7.0	no change
P-BAB-01	I-BAB-01	O-BAB	8.6	21.5	15 inch	191	0.110	0.013	661.1	640.0	665.1	645.0	662.2	640.6	**2.9**	2.8	16.5	no change
Waterloo Court																		
P-BAC-02-02	I-BAC-02-02	I-BAC-02-01	4.3	4.4	18 inch	284	0.002	0.013	668.0	667.5	672.0	674.0	669.1	668.4	**2.9**	2.5	2.8	upsized
P-BAC-02-01	I-BAC-02-01	J-BAC-02	3.9	28.2	18 inch	363	0.072	0.013	667.5	641.3	674.0	645.3	668.3	642.9	**5.7**	5.0	11.3	upsized
P-BAC-03	I-BAC-03	J-BAC-02	11.4	7.5	12 inch	317	0.044	0.013	655.3	641.3	659.3	645.3	675.8	643.1	**ABOVE RIM**	3.0	14.6	no change
P-BAC-02	J-BAC-02	J-BAC-01	14.2	38.7	18 inch	115	0.116	0.012	641.3	628.0	645.3	632.0	642.7	629.9	**2.6**	2.5	20.2	upsized
P-BAC-01	J-BAC-01	O-BAC	14.2	91.8	21 inch	143	0.336	0.013	628.0	580.0	632.0	585.0	629.4	580.5	**2.6**	2.3	27.7	no change

(1) Pipes are presented in Figure 2 and Figure D-BAA-BAC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.



- CREEK
- CITY BOUNDARY
- STORM DRAIN LINE >30"
- STORM DRAIN LINE <30"
- STORM DRAIN INLET
- STORM DRAIN JUNCTION
- STORM DRAIN OUTLET
- SUB-DRAINAGE BOUNDARY
- SYSTEM DRAINAGE BOUNDARY
- STREET

SEE FOLLOWING TABLES D-B13A TO D-B13D

FIGURE D-BAD-BAI
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B13a

Existing Hydrology, 10-Year Event, Systems BAD, BAE, BAF, BAG, BAH & BAI

Node [1] #	Ground Elevation (ft) [2]	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area [3] (acres)	Cumulative C*A (acres)	Inlet Tc [5] (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge [4] (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
Harbor Boulevard at El Camino Real														
I-BAD-01	31	28	31	31	5.34		0.5	2.67	5.34	2.67	10	10	2.29	**6.2**
O-BAD	31	27	30.46	30.46	0		0	0	5.34	2.67	0	10.14	2.28	**6.1**
Bryce Court														
I-BAE-05	562	558	559.44	559.44	2.72		0.5	1.36	2.72	1.36	10	10	2.29	**3.2**
I-BAE-04	561.5	557.5	558.97	558.87	0.58		0.5	0.29	3.3	1.65	10	10.25	2.27	**3.8**
I-BAE-03	559	555	556.1	555.93	1.43		0.5	0.72	4.73	2.37	10	11.11	2.18	**5.2**
I-BAE-02	532.9	528.6	529.99	529.88	5.56		0.5	2.78	10.29	5.14	10	11.38	2.15	**11.2**
I-BAE-01	532	528	529.58	529.28	0		0	0	10.29	5.14	10	11.43	2.15	**11.1**
O-BAE	469.5	465.5	465.5	465.5	0		0	0	10.29	5.14	0	11.54	2.14	**11.1**
Muir Way														
I-BAF-03-01	598	594	594.96	594.96	5.25		0.5	2.63	5.25	2.63	10	10	2.29	**6.1**
I-BAF-02-02	573.6	569.6	570.42	570.42	2.02		0.8	1.62	2.02	1.62	10	10	2.29	**3.7**
I-BAF-02-01	562.7	558.7	563.05	562.7	0		0	0	2.02	1.62	10	10.17	2.28	**3.7**
I-BAF-01-01	556	552.8	555.79	555.79	3.7		0.5	1.85	3.7	1.85	10	10	2.29	**4.3**
I-BAF-05	586.7	582.7	585.19	585.19	4.36		0.5	2.18	4.36	2.18	10	10	2.29	**5.0**
I-BAF-04	586.5	582.5	584.55	584.13	0.25		0.5	0.13	4.61	2.31	10	10.08	2.29	**5.3**
I-BAF-03	582	578	584.26	582	0	5.25	0	0	9.86	4.93	10	10.32	2.26	**11.2**
J-BAF-02	562.7	558.7	568.42	562.7	0	2.02	0	0	11.88	6.55	0	10.79	2.21	**14.6**
J-BAF-01	555	551	555.27	552	0	3.7	0	0	15.58	8.4	0	11.11	2.18	**18.4**
O-BAF	490	485	485	485	0		0	0	15.58	8.4	0	11.21	2.17	**18.3**
Bryce Court														
I-BAG-01	521	517.5	518.27	518.27	2.76		0.5	1.38	2.76	1.38	10	10	2.29	**3.2**
O-BAG	464	460	460	460	0		0	0	2.76	1.38	0	10.29	2.26	**3.2**
Lassen Drive														
I-BAH-02	591	587	587.73	587.73	2.51		0.5	1.25	2.51	1.25	10	10	2.29	**2.9**
I-BAH-01	590	586	586.95	586.84	0.9		0.5	0.45	3.41	1.7	10	10.07	2.29	**3.9**
O-BAH	536	530	530	530	0		0	0	3.41	1.7	0	10.24	2.27	**3.9**
Davis Drive														
I-BAI-03	502.9	498.9	500.31	500.31	2.7		0.5	1.35	2.7	1.35	10	10	2.29	**3.1**
I-BAI-02	502	498	499.7	499.23	3.92		0.8	3.14	6.62	4.49	10	10.33	2.26	**10.2**
I-BAI-01	501.5	496.5	498.19	498.07	7.8		0.5	3.9	14.42	8.39	10	10.52	2.24	**18.9**
O-BAI	405	400	400	400	0		0	0	14.42	8.39	0	10.95	2.19	**18.5**

(1) Nodes are presented in Figure D-BAD-BAI in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumulative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B13b

Existing Hydraulics, 10-Year Event, Systems BAD, BAE, BAF, BAG, BAH & BAI

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Belmont Creek Drainage																	
Mean Annual Precipitation 26"																	
Harbor Boulevard at El Camino Real																	
P-BAD-01	I-BAD-01	O-BAD	6.2	4.4	12 inch	67	0.0149	0.013	28.00	27.00	31.00	31.00	32.47	30.46	**ABOVE RIM**	2.0	7.9
Bryce Court																	
P-BAE-05	I-BAE-05	I-BAE-04	3.2	3.3	12 inch	60	0.008	0.013	558.00	557.50	562.00	561.50	559.44	558.97	**2.6**	3.0	4.0
P-BAE-04	I-BAE-04	I-BAE-03	3.8	3.6	12 inch	247	0.010	0.013	557.50	555.00	561.50	559.00	558.87	556.10	**2.6**	3.0	4.8
P-BAE-03	I-BAE-03	I-BAE-02	5.2	11.9	12 inch	236	0.112	0.013	555.00	528.60	559.00	532.90	555.93	529.99	**3.1**	3.0	14.7
P-BAE-02	I-BAE-02	I-BAE-01	11.2	14.9	18 inch	30	0.020	0.013	528.60	528.00	532.90	532.00	529.88	529.58	**3.0**	2.8	9.2
P-BAE-01	I-BAE-01	O-BAE	11.1	63.1	18 inch	173	0.361	0.013	528.00	465.50	532.00	469.50	529.28	465.93	**2.7**	2.5	26.9
Muir Way																	
P-BAF-03-01	I-BAF-03-01	I-BAF-03	6.1	11.0	12 inch	168	0.095	0.013	594.00	578.00	598.00	582.00	594.96	582.00	**3.0**	3.0	14.4
Bryce Court																	
P-BAF-02-02	I-BAF-02-02	I-BAF-02-01	3.7	10.4	12 inch	127	0.086	0.013	569.60	558.70	573.60	562.70	570.42	562.70	**3.2**	3.0	12.2
P-BAF-02-01	I-BAF-02-01	J-BAF-02	3.7	0.0	12 inch	49	0.000	0.013	558.70	558.70	562.70	562.70	563.23	562.70	**ABOVE RIM**	3.0	4.7
P-BAF-01-01	I-BAF-01-01	J-BAF-01	4.3	6.5	12 inch	55	0.0327	0.013	552.80	551.00	556.00	555.00	555.79	555.00	**0.2**	2.2	5.5
P-BAF-05	I-BAF-05	I-BAF-04	5.0	2.8	12 inch	32	0.006	0.013	582.70	582.50	586.70	586.50	585.19	584.55	**1.5**	3.0	6.4
P-BAF-04	I-BAF-04	I-BAF-03	5.3	7.7	12 inch	96	0.047	0.013	582.50	578.00	586.50	582.00	584.13	582.00	**2.4**	3.0	6.8
P-BAF-03	I-BAF-03	J-BAF-02	11.2	7.8	12 inch	403	0.048	0.013	578.00	558.70	582.00	562.70	602.72	562.70	**ABOVE RIM**	3.0	14.3
P-BAF-02	J-BAF-02	J-BAF-01	14.6	5.2	12 inch	356	0.022	0.013	558.70	551.00	562.70	555.00	614.65	555.00	**ABOVE RIM**	3.0	18.6
P-BAF-01	J-BAF-01	O-BAF	18.4	21.2	12 inch	186	0.355	0.013	551.00	485.00	555.00	490.00	552.00	485.72	**3.0**	3.0	30.4
P-BAF-05	I-BAF-05	I-BAF-04	5.0	2.8	12 inch	32	0.006	0.013	582.70	582.50	586.70	586.50	585.19	584.55	**1.5**	3.0	6.4
Lassen Drive																	
P-BAG-01	I-BAG-01	O-BAG	3.2	10.3	12 inch	202	0.285	0.024	517.50	460.00	521.00	464.00	518.27	460.38	**2.7**	2.5	11.6
P-BAH-02	I-BAH-02	I-BAH-01	2.9	6.1	12 inch	34	0.029	0.013	587.00	586.00	591.00	590.00	587.73	586.95	**3.3**	3.0	7.7
P-BAH-01	I-BAH-01	O-BAH	3.9	19.1	12 inch	195	0.287	0.013	586.00	530.00	590.00	536.00	586.84	530.31	**3.2**	3.0	19.1
Davis Drive																	
P-BAI-03	I-BAI-03	I-BAI-02	3.1	3.8	12 inch	79	0.011	0.013	498.90	498.00	502.90	502.00	500.31	499.70	**2.6**	3.0	4.0
P-BAI-02	I-BAI-02	I-BAI-01	10.2	13.3	18 inch	93	0.016	0.013	498.00	496.50	502.00	501.50	499.23	498.19	**2.8**	2.5	8.3
P-BAI-01	I-BAI-01	O-BAI	18.9	58.3	24 inch	426	0.227	0.024	496.50	400.00	501.50	405.00	498.07	400.78	**3.4**	3.0	16.6

(1) Pipes are presented in Figure 2 and Figure D-BAD-BAI in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-B13c

Proposed Hydrology, 25-Year Event, Systems BAD, BAE, BAF, BAG, BAH & BAI

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Belmont Creek Drainage														
Mean Annual Precipitation 26"														
I-BAD-01	31.2	28	31.13	31.13	5.34		0.55	2.94	5.34	2.94	10	10	2.74	**8.1**
O-BAD	31.2	27	31.06	31.06	0		0	0	5.34	2.94	0	10.43	2.69	**8.0**
I-BAE-05	562	558	562	562	2.72		0.55	1.5	2.72	1.5	10	10	2.74	**4.1**
I-BAE-04	561.5	557.5	561.37	561.09	0.58		0.55	0.32	3.3	1.82	10	10.19	2.72	**5.0**
I-BAE-03	559	555	556.28	555.97	1.43		0.55	0.79	4.73	2.6	10	10.84	2.64	**6.9**
I-BAE-02	532.9	528.6	530.69	530.49	5.56		0.55	3.06	10.29	5.66	10	11.09	2.61	**14.9**
I-BAE-01	532	528	529.88	529.4	0		0	0	10.29	5.66	10	11.15	2.6	**14.8**
O-BAE	469.5	465.5	465.5	465.5	0		0	0	10.29	5.66	0	11.25	2.59	**14.8**
I-BAF-03-01	598	594	594.99	594.99	6.55		0.55	3.6	6.55	3.6	10	10	2.74	**10.0**
I-BAF-02-02	573.6	569.6	570.51	570.51	2.02		0.88	1.78	2.02	1.78	10	10	2.74	**4.9**
I-BAF-02-01	562.7	558.7	560.7	560.69	0		0	0	2.02	1.78	10	10.16	2.72	**4.9**
I-BAF-01-01	556	552.8	554.52	554.52	3.7		0.55	2.04	3.7	2.04	10	10	2.74	**5.6**
I-BAF-05	586.7	582.7	585.05	585.05	4.36		0.55	2.4	4.36	2.4	10	10	2.74	**6.6**
I-BAF-04	586.5	582.5	583.94	583.47	0.25		0	0	4.61	2.4	10	10.06	2.74	**6.6**
I-BAF-03	582	578	579.8	579.43	0	6.55	0	0	11.16	6	10	10.21	2.72	**16.4**
J-BAF-02	562.7	558.7	560.67	560.34	0	2.02	0	0	13.18	7.78	0	10.69	2.65	**20.8**
J-BAF-01	555	551	553.14	552.78	0	3.7	0	0	16.88	9.81	0	11.22	2.59	**25.6**
O-BAF	490	485	485	485	0		0	0	16.88	9.81	0	11.31	2.58	**25.5**
I-BAG-01	521	517.5	518.36	518.36	2.76		0.55	1.52	2.76	1.52	10	10	2.74	**4.2**
O-BAG	464	460	460	460	0		0	0	2.76	1.52	0	10.27	2.71	**4.1**
I-BAH-02	591	587	587.83	587.83	2.51		0.55	1.38	2.51	1.38	10	10	2.74	**3.8**
I-BAH-01	590	586	587.09	586.93	0.9		0.55	0.5	3.41	1.88	10	10.07	2.73	**5.2**
O-BAH	536	530	530	530	0		0	0	3.41	1.88	0	10.23	2.71	**5.1**
I-BAI-03	502.9	498.9	501.9	501.9	2.7		0.55	1.49	2.7	1.49	10	10	2.74	**4.1**
I-BAI-02	502	498	500.85	499.99	3.92		0.88	3.45	6.62	4.93	10	10.25	2.71	**13.5**
I-BAI-01	501.5	496.5	498.45	498.26	7.8		0.55	4.29	14.42	9.22	10	10.45	2.68	**25.0**
O-BAI	405	400	400	400	0		0	0	14.42	9.22	0	10.85	2.63	**24.5**

(1) Nodes are presented in Figure D-BAD-BAI in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

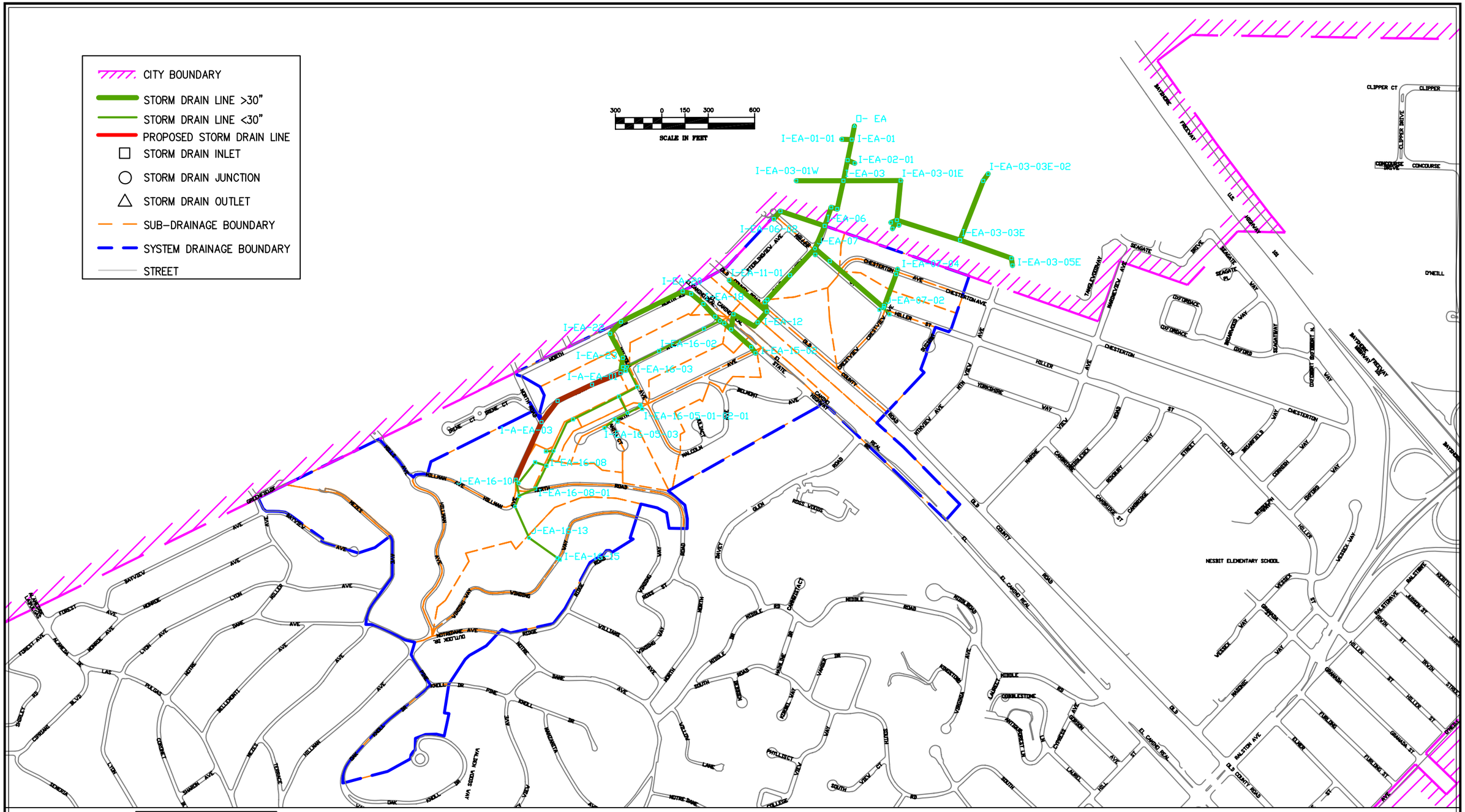
CITY OF BELMONT
STORM DRAIN MASTER PLAN

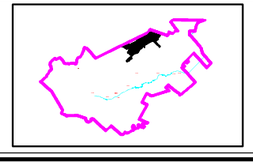
Table D-B13d

Proposed Hydraulics, 25-Year Event, Systems BAD, BAE, BAF, BAG, BAH & BAI

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Belmont Creek Drainage																		
Harbor Boulevard at El Camino Real																		
P-BAD-01	I-BAD-01	O-BAD	7.5	29.9	24 inch	67	0.015	0.012	28.0	27.0	31.2	31.2	31.1	31.1	**0.1**	1.2	2.4	upsized
Mean Annual Precipitation 26"																		
Bryce Court																		
P-BAE-05	I-BAE-05	I-BAE-04	4.1	3.3	12 inch	60	0.008	0.013	558.0	557.5	562.0	561.5	562.2	561.4	**ABOVE RIM**	3.0	5.3	no change
P-BAE-04	I-BAE-04	I-BAE-03	5.0	3.6	12 inch	247	0.010	0.013	557.5	555.0	561.5	559.0	561.1	556.3	**0.4**	3.0	6.3	no change
P-BAE-03	I-BAE-03	I-BAE-02	6.9	11.9	12 inch	236	0.112	0.013	555.0	528.6	559.0	532.9	556.0	530.7	**3.0**	3.0	15.7	no change
P-BAE-02	I-BAE-02	I-BAE-01	14.9	14.9	18 inch	30	0.020	0.013	528.6	528.0	532.9	532.0	530.5	529.9	**2.4**	2.8	8.4	no change
P-BAE-01	I-BAE-01	O-BAE	14.8	63.1	18 inch	173	0.361	0.013	528.0	465.5	532.0	469.5	529.4	466.0	**2.6**	2.5	29.2	no change
Muir Way																		
P-BAF-03-01	I-BAF-03-01	I-BAF-03	10.0	11.0	12 inch	168	0.095	0.013	594.0	578.0	598.0	582.0	595.0	580.0	**3.0**	3.0	15.9	no change
Bryce Court																		
P-BAF-02-02	I-BAF-02-02	I-BAF-02-01	4.9	10.4	12 inch	127	0.086	0.013	569.6	558.7	573.6	562.7	570.5	560.7	**3.1**	3.0	13.1	no change
P-BAF-02-01	I-BAF-02-01	J-BAF-02	4.9	0.0	24 inch	49	0.000	0.013	558.7	558.7	562.7	562.7	560.7	560.7	**2.0**	2.0	1.6	upsized
P-BAF-01-01	I-BAF-01-01	J-BAF-01	5.6	6.5	12 inch	55	0.033	0.013	552.8	551.0	556.0	555.0	554.5	553.1	**1.5**	2.2	7.2	no change
P-BAF-05	I-BAF-05	I-BAF-04	6.6	2.8	12 inch	32	0.006	0.013	582.7	582.5	586.7	586.5	585.1	583.9	**1.7**	3.0	8.5	no change
P-BAF-04	I-BAF-04	I-BAF-03	6.6	7.7	12 inch	96	0.047	0.013	582.5	578.0	586.5	582.0	583.5	579.8	**3.0**	3.0	11.0	no change
P-BAF-03	I-BAF-03	J-BAF-02	16.4	23.0	18 inch	403	0.048	0.013	578.0	558.7	582.0	562.7	579.4	560.8	**2.6**	2.5	14.1	upsized
P-BAF-02	J-BAF-02	J-BAF-01	20.8	33.3	24 inch	356	0.022	0.013	558.7	551.0	562.7	555.0	560.3	553.4	**2.4**	2.0	11.2	upsized
P-BAF-01	J-BAF-01	O-BAF	25.6	146.0	24 inch	186	0.355	0.012	551.0	485.0	555.0	490.0	552.8	485.6	**2.2**	2.0	35.0	upsized
Lassen Drive																		
P-BAG-01	I-BAG-01	O-BAG	4.2	10.3	12 inch	202	0.285	0.024	517.5	460.0	521.0	464.0	518.4	460.4	**2.6**	2.5	12.4	no change
P-BAH-02	I-BAH-02	I-BAH-01	3.8	6.1	12 inch	34	0.029	0.013	587.0	586.0	591.0	590.0	587.8	587.1	**3.2**	3.0	8.2	no change
P-BAH-01	I-BAH-01	O-BAH	5.2	19.1	12 inch	195	0.287	0.013	586.0	530.0	590.0	536.0	586.9	530.4	**3.1**	3.0	20.7	no change
Davis Drive																		
P-BAI-03	I-BAI-03	I-BAI-02	4.1	3.8	12 inch	79	0.011	0.013	498.9	498.0	502.9	502.0	501.9	500.9	**1.0**	3.0	5.2	no change
P-BAI-02	I-BAI-02	I-BAI-01	13.5	13.3	18 inch	93	0.016	0.013	498.0	496.5	502.0	501.5	500.0	498.5	**2.0**	2.5	7.6	no change
P-BAI-01	I-BAI-01	O-BAI	25.0	58.3	24 inch	426	0.227	0.024	496.5	400.0	501.5	405.0	498.3	400.9	**3.2**	3.0	17.8	no change

(1) Pipes are presented in Figure 2 and Figure D-BAD-BAI in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-E1A TO D-E1D

FIGURE D-EA
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E1a (page 1 of 2)

Existing Hydrology, 10-Year Event, System EA

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (cfs)**
Ruth Avenue, Backyard Easement												
I-EA-16-08-01	139.40	136.90	1.94		0.50	0.97	1.94	1.0	10.0	10.0	2.12	**2.1**
I-EA-16-07-01	104.04	100.20	0.78		0.50	0.39	0.78	0.4	10.0	10.0	2.12	**0.8**
I-EA-16-05-02-01	99.08	95.08	1.86		0.50	0.93	1.86	0.9	10.0	10.0	2.12	**2.0**
I-EA-16-05-01-02-01	94.00	89.00	0.70		0.50	0.35	0.70	0.9	10.0	10.3	2.09	**1.8**
I-EA-16-05-01-02	94.00	90.00	1.00	0.70	0.50	0.50	1.70	0.5	10.0	10.0	2.12	**1.1**
J-EA-16-05-01-01	94.00	88.00	0.00		0.00	0.00	1.70	0.9	0.0	10.4	2.08	**1.8**
I-EA-16-05-03	100.68	95.68	1.62		0.50	0.81	1.62	0.8	10.0	10.0	2.12	**1.7**
I-EA-16-05-02	98.68	93.38	0.00	1.86	0.00	0.00	3.48	1.7	10.0	10.2	2.10	**3.7**
J-EA-16-05-01	94.84	85.34	0.00	1.70	0.00	0.00	5.18	2.6	0.0	10.6	2.06	**5.4**
I-EA-16-03-02	52.51	48.51	1.79		0.50	0.90	1.79	0.9	10.0	10.0	2.12	**1.9**
I-EA-16-03-01	52.57	47.57	0.00		0.00	0.00	1.79	0.0	10.0	10.0	0.00	**0.0**
I-EA-16-15	273.70	270.70	7.62		0.50	3.81	7.62	3.8	10.0	10.0	2.12	**8.2**
I-EA-16-14	273.39	270.39	13.54		0.50	6.77	21.16	10.6	10.0	10.0	2.12	**22.6**
J-EA-16-13	199.05	196.05	0.00		0.00	0.00	21.16	10.6	0.0	10.2	2.11	**22.5**
J-EA-16-12	149.50	144.50	0.00		0.00	0.00	21.16	10.6	0.0	10.3	2.09	**22.3**
I-EA-16-11	142.70	139.70	9.17		0.50	4.59	30.33	15.2	10.0	10.3	2.09	**31.9**
J-EA-16-10	123.10	116.40	0.00		0.00	0.00	30.33	15.2	0.0	10.4	2.09	**31.9**
I-EA-16-09	114.80	109.80	0.00		0.00	0.00	30.33	15.2	10.0	10.5	2.07	**31.7**
I-EA-16-08	111.20	106.00	0.00	1.94	0.00	0.00	32.27	16.1	10.0	10.6	2.06	**33.6**
J-EA-16-07	103.01	100.01	0.00	0.78	0.00	0.00	33.05	16.5	0.0	11.2	2.00	**33.4**
I-EA-16-06	80.00	75.00	0.52		0.50	0.26	33.57	16.8	10.0	11.4	1.99	**33.7**
I-EA-16-05	67.91	60.90	1.46	5.18	0.50	0.73	40.21	20.1	10.0	11.8	1.96	**18.7**
I-EA-16-04	70.08	59.08	0.32		0.50	0.16	40.53	20.3	10.0	12.0	1.94	**18.6**
J-EA-16-03	52.44	44.44	0.00	1.79	0.00	0.00	42.32	21.2	0.0	12.1	1.93	**20.2**
I-EA-16-02	47.70	42.70	0.00		0.00	0.00	42.32	21.2	10.0	12.5	1.90	**19.6**
I-EA-16-01	25.66	20.66	2.20		0.50	1.10	44.52	22.3	10.0	12.8	1.88	**21.2**
El Camino Real												
I-EA-15-02	22.95	17.95	11.35		0.50	5.68	11.35	5.7	10.0	10.0	2.12	**12.2**
I-EA-15-01	21.49	15.99	2.09		0.50	1.04	13.44	6.7	10.0	10.1	2.12	**14.4**
Old County Road												
I-EA-11-01	21.50	19.00	0.27		0.50	0.14	0.27	0.1	10.0	10.0	2.12	**0.3**

(1) Nodes are presented in Figure D-EA in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
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Table D-E1a (page 2 of 2)

Existing Hydrology, 10-Year Event, System EA

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (cfs)**
Hiller Street												
I-EA-07-02-03	7.04	2.70	5.18		0.50	2.59	5.18	2.6	10.0	10.0	2.12	**5.6**
I-EA-07-02-02	7.03	2.39	2.93		0.50	1.47	8.11	1.5	10.0	10.0	2.12	**3.1**
I-EA-07-02-01	7.04	2.60	2.04		0.50	1.02	10.15	1.0	10.0	10.0	2.12	**2.2**
I-EA-07-04	7.92	3.00	2.60		0.50	1.30	2.60	1.3	10.0	10.0	2.12	**2.8**
I-EA-07-03	6.88	2.90	2.07		0.50	1.03	4.67	2.3	10.0	10.2	2.11	**5.0**
J-EA-07-02	7.08	2.03	0.00	10.15	0.00	0.00	14.82	7.4	0.0	10.8	2.05	**15.3**
I-EA-07-01	7.94	1.50	0.00		0.00	0.00	14.82	7.4	10.0	11.7	1.97	**14.7**
I-EA-07S	7.08	2.08	1.69		0.50	0.85	1.69	0.9	10.0	10.0	2.12	**1.8**
I-EA-06-08	54.00	48.00	7.66		0.50	3.83	7.66	3.8	10.0	10.0	2.12	**29.2**
I-EA-06-02	8.10	3.65	3.65		0.50	1.82	11.31	1.8	10.0	10.0	2.12	**3.9**
I-EA-06-01	8.10	3.64	0.79		0.50	0.40	12.10	2.2	10.0	10.2	2.10	**4.7**
Rosilie Street, San Mateo												
I-EA-03-03E-02	5.84	1.94	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-03E-01	5.84	1.75	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-02E-03	4.84	0.44	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-02E-02	5.34	0.74	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-02E-01	5.34	0.54	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-05E	5.64	2.14	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-04E	5.74	1.84	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-03E	5.44	1.34	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-02E	6.28	0.74	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-01W	5.04	1.04	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-03-01E	7.28	-0.36	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-02-01	7.28	5.64	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-EA-01-01	8.28	6.64	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
Ruth Avenue / Dale View Avenue												
I-EA-23	47.05	42.05	0.14		0.50	0.07	0.14	3.9	10.0	10.1	2.11	**29.3**
I-EA-22	40.80	36.80	2.17		0.50	1.08	2.31	5.0	10.0	10.3	2.09	**31.5**
I-EA-21	36.00	30.00	0.00		0.00	0.00	2.31	5.0	10.0	10.4	2.08	**31.5**
I-EA-20	20.47	17.47	0.00		0.00	0.00	2.31	5.0	10.0	11.0	2.03	**31.2**
I-EA-19	19.56	16.56	2.17		0.50	1.08	4.48	6.1	10.0	11.1	2.02	**33.4**
I-EA-18	20.01	14.70	0.29		0.50	0.15	4.77	6.2	10.0	11.2	2.00	**33.6**
I-EA-17	19.48	14.65	1.75		0.50	0.88	6.52	7.1	10.0	11.4	1.99	**35.2**
J-EA-16	20.04	14.54	0.00	44.52	0.00	0.00	51.04	29.4	0.0	12.9	1.87	**55.3**
I-EA-15	20.04	14.31	0.00	13.44	0.00	0.00	64.48	29.4	10.0	13.0	1.87	**55.2**
I-EA-14	19.58	13.08	16.57		0.50	8.29	81.05	44.4	10.0	13.0	1.86	**83.3**
I-EA-13	19.48	11.10	1.64		0.50	0.82	82.69	45.2	10.0	13.2	1.85	**84.1**
I-EA-12	21.49	7.62	71.11		0.50	35.56	153.80	80.7	10.0	13.7	1.81	**147.6**
I-EA-11	21.49	6.43	2.67	0.27	0.50	1.33	156.74	82.2	10.0	24.3	1.36	**112.9**
I-EA-10	21.49	6.10	2.61		0.50	1.30	159.35	83.5	10.0	24.3	1.36	**114.6**
I-EA-09	10.62	3.62	0.00		0.00	0.00	159.35	83.5	10.0	24.4	1.36	**114.6**
I-EA-08	8.60	1.60	0.00		0.00	0.00	159.35	83.5	10.0	24.5	1.36	**114.3**
J-EA-07	7.92	-0.08	0.00	16.51	0.00	0.00	175.86	91.8	0.0	24.6	1.36	**125.4**
I-EA-06	8.00	-0.15	0.74	12.10	0.50	0.37	188.70	94.4	10.0	24.6	1.35	**128.7**
I-EA-05	7.64	-0.26	0.00		0.00	0.00	188.70	94.4	10.0	24.7	1.35	**128.6**
I-EA-04	6.44	-0.36	0.00		0.00	0.00	188.70	94.4	10.0	24.7	1.35	**128.6**
I-EA-03	5.34	-0.56	0.00	0.00	0.00	0.00	188.70	94.4	10.0	24.8	1.35	**128.4**
I-EA-02	7.28	-1.06	0.00	0.00	0.00	0.00	188.70	94.4	10.0	24.8	1.35	**128.2**
I-EA-01	8.28	-2.66	0.00	0.00	0.00	0.00	188.70	94.4	10.0	24.9	1.35	**128.1**
O- EA	7.28	-3.96	0.00		0.00	0.00	188.70	94.4	0.0	24.9	1.35	**128.0**

(1) Nodes are presented in Figure D-EA in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
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Table D-E1b (page 1 of 2)

Existing Hydraulics, 10-Year Event, System EA

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Ruth Avenue, Backyard Easement																	
P-EA-16-08-01	I-EA-16-08-01	I-EA-16-08	2.1	15.4	12 inch	165	0.187	0.013	136.9	106.0	139.4	111.2	**137.5**	108.3	**1.9**	1.5	13.7
P-EA-16-07-01	I-EA-16-07-01	J-EA-16-07	0.8	4.0	15 inch	50	0.004	0.013	100.2	100.0	104.0	103.0	**102.2**	102.2	**1.8**	2.6	0.7
P-EA-16-05-02-01	I-EA-16-05-02-01	I-EA-16-05-02	2.0	9.5	12 inch	24	0.071	0.013	95.1	93.4	99.1	98.7	**95.7**	94.4	**3.4**	3.0	9.6
P-EA-16-05-01-02-01	I-EA-16-05-01-02-01	J-EA-16-05-01-01	1.8	6.7	12 inch	28	0.036	0.013	89.0	88.0	94.0	94.0	**89.6**	88.7	**4.4**	4.0	7.3
P-EA-16-05-01-02	I-EA-16-05-01-02	I-EA-16-05-01-02-01	1.1	3.9	12 inch	84	0.012	0.013	90.0	89.0	94.0	94.0	**90.4**	89.7	**3.6**	3.0	4.2
P-EA-16-05-01-01	J-EA-16-05-01-01	J-EA-16-05-01	1.8	5.9	12 inch	97	0.027	0.013	88.0	85.3	94.0	94.8	**88.6**	86.5	**5.4**	5.0	6.6
P-EA-16-05-03	I-EA-16-05-03	I-EA-16-05-02	1.7	5.8	12 inch	86	0.027	0.013	95.7	93.4	100.7	98.7	**96.2**	94.4	**4.4**	4.0	6.5
P-EA-16-05-02	I-EA-16-05-02	J-EA-16-05-01	3.7	10.5	12 inch	93	0.086	0.013	93.4	85.3	98.7	94.8	**94.2**	86.6	**4.5**	4.3	12.2
P-EA-16-05-01	J-EA-16-05-01	I-EA-16-05	5.4	16.1	12 inch	120	0.204	0.013	85.3	60.9	94.8	67.9	**86.3**	62.9	**8.6**	8.5	18.4
P-EA-16-03-02	I-EA-16-03-02	J-EA-16-03	1.9	14.1	12 inch	26	0.157	0.013	48.5	44.4	52.5	52.4	**52.5**	52.4	**ABOVE RIM**	3.0	2.4
P-EA-16-03-01	I-EA-16-03-01	J-EA-16-03	0.0	11.5	12 inch	30	0.104	0.013	47.6	44.4	52.6	52.4	**52.4**	52.4	**0.1**	4.0	0.0
P-EA-16-15	I-EA-16-15	I-EA-16-14	8.2	4.8	12 inch	17	0.018	0.013	270.7	270.4	273.7	273.4	**274.3**	273.4	**ABOVE RIM**	2.0	10.4
P-EA-16-14	I-EA-16-14	J-EA-16-13	22.6	20.4	12 inch	226	0.329	0.013	270.4	196.1	273.4	199.1	**290.2**	199.1	**ABOVE RIM**	2.0	28.8
P-EA-16-13	J-EA-16-13	J-EA-16-12	22.5	17.1	12 inch	223	0.231	0.013	196.1	144.5	199.1	149.5	**238.3**	149.5	**ABOVE RIM**	2.0	28.6
P-EA-16-12	J-EA-16-12	I-EA-16-11	22.3	9.1	12 inch	74	0.065	0.013	144.5	139.7	149.5	142.7	**171.8**	142.7	**ABOVE RIM**	4.0	28.4
P-EA-16-11	I-EA-16-11	J-EA-16-10	31.9	19.1	12 inch	81	0.288	0.013	139.7	116.4	142.7	123.1	**188.2**	123.1	**ABOVE RIM**	2.0	40.7
P-EA-16-10	J-EA-16-10	I-EA-16-09	31.9	20.5	18 inch	173	0.038	0.013	116.4	109.8	123.1	114.8	**130.8**	114.8	**ABOVE RIM**	5.2	18.1
P-EA-16-09	I-EA-16-09	I-EA-16-08	31.7	23.3	18 inch	77	0.049	0.013	109.8	106.0	114.8	111.2	**116.1**	109.1	**ABOVE RIM**	3.5	17.9
P-EA-16-08	I-EA-16-08	J-EA-16-07	33.6	53.8	24 inch	106	0.057	0.013	106.0	100.0	111.2	103.0	**107.9**	102.1	**3.3**	3.2	18.1
P-EA-16-07	J-EA-16-07	I-EA-16-06	33.4	72.0	24 inch	247	0.101	0.013	100.0	75.0	103.0	80.0	**101.9**	77.1	**1.1**	1.0	22.5
P-EA-16-06	I-EA-16-06	I-EA-16-05	33.7	46.6	24 inch	332	0.042	0.013	75.0	60.9	80.0	67.9	**76.9**	62.9	**3.1**	3.0	16.2
P-EA-16-05	I-EA-16-05	I-EA-16-04	18.7	26.5	24 inch	133	0.014	0.013	60.9	59.1	67.9	70.1	**62.8**	61.9	**5.1**	5.0	9.1
P-EA-16-04	I-EA-16-04	J-EA-16-03	18.6	33.3	18 inch	146	0.100	0.013	59.1	44.4	70.1	52.4	**60.5**	52.4	**9.5**	9.5	19.4
P-EA-16-03	J-EA-16-03	I-EA-16-02	20.2	9.1	18 inch	230	0.008	0.013	44.4	42.7	52.4	47.7	**52.9**	44.4	**ABOVE RIM**	6.5	11.4
P-EA-16-02	I-EA-16-02	I-EA-16-01	19.6	27.4	18 inch	324	0.068	0.013	42.7	20.7	47.7	25.7	**44.2**	25.3	**3.5**	3.5	16.9
P-EA-16-01	I-EA-16-01	J-EA-16	21.2	24.2	18 inch	115	0.053	0.013	20.7	14.5	25.7	20.0	**24.7**	20.0	**0.9**	3.5	12.0
El Camino Real																	
P-EA-15-02	I-EA-15-02	I-EA-15-01	12.2	7.2	12 inch	48	0.041	0.013	18.0	16.0	23.0	21.5	**26.0**	20.4	**ABOVE RIM**	4.0	15.5
P-EA-15-01	I-EA-15-01	I-EA-14	14.4	29.3	24 inch	173	0.017	0.013	16.0	13.1	21.5	19.6	**20.3**	19.6	**1.2**	3.5	4.6
Old County Road																	
P-EA-11-01	I-EA-11-01	I-EA-11	0.3	7.1	12 inch	316	0.040	0.013	19.0	6.4	21.5	21.5	**21.5**	21.5	**ABOVE RIM**	1.5	0.4

(1) Pipes are presented in Figure 2 and Figure D-EA in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-E1b (page 2 of 2)

Existing Hydraulics, 10-Year Event, System EA

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Hiller Street																	
P-EA-07-02-03	I-EA-07-02-03	J-EA-07-02	5.6	3.8	12 inch	58	0.012	0.013	2.7	2.0	7.0	7.1	**8.5**	7.1	**ABOVE RIM**	3.3	7.1
P-EA-07-02-02	I-EA-07-02-02	J-EA-07-02	3.1	3.9	12 inch	30	0.012	0.013	2.4	2.0	7.0	7.1	**7.3**	7.1	**ABOVE RIM**	3.6	4.0
P-EA-07-02-01	I-EA-07-02-01	J-EA-07-02	2.2	7.8	12 inch	12.00	0.048	0.013	2.6	2.0	7.0	7.1	**7.1**	7.1	**ABOVE RIM**	3.4	2.8
P-EA-07-04	I-EA-07-04	I-EA-07-03	2.8	2.0	12 inch	33	0.003	0.013	3.0	2.9	7.9	6.9	**7.1**	6.9	**0.8**	3.9	3.5
P-EA-07-03	I-EA-07-03	J-EA-07-02	5.0	2.2	12 inch	231	0.004	0.013	2.9	2.0	6.9	7.1	**11.6**	7.1	**ABOVE RIM**	3.0	6.3
P-EA-07-02	J-EA-07-02	I-EA-07-01	15.3	3.6	18 inch	460	0.001	0.013	2.0	1.5	7.1	7.9	**17.7**	7.9	**ABOVE RIM**	3.6	8.7
P-EA-07-01S	I-EA-07S	J-EA-07	1.8	8.3	12 inch	40	0.054	0.013	2.1	- .1	7.1	7.9	**8.0**	7.9	**ABOVE RIM**	4.0	2.3
P-EA-07-01	I-EA-07-01	J-EA-07	14.7	25.3	24 inch	126	0.013	0.013	1.5	- .1	7.9	7.9	**8.5**	7.9	**ABOVE RIM**	4.4	4.7
P-EA-06-02	I-EA-06-02	I-EA-06-01	3.9	0.4	12 inch	66	0.000	0.013	3.7	3.6	8.1	8.1	**8.9**	8.1	**ABOVE RIM**	3.5	5.0
P-EA-06-01	I-EA-06-01	I-EA-06	4.7	4.0	12 inch	301	0.013	0.013	3.6	- .2	8.1	8.0	**13.2**	8.0	**ABOVE RIM**	3.5	6.0
Rosilie Street, San Mateo																	
P-EA-03-03E-02	I-EA-03-03E-02	I-EA-03-03E-01	0.0	0.0	12 inch	56	0.000	0.013	**.0**	**.0**	5.8	5.8	**5.3**	5.3	**0.5**	4.8	0.0
P-EA-03-03E-01	I-EA-03-03E-01	I-EA-03-03E	0.0	0.0	12 inch	411	0.000	0.013	**.0**	**.0**	5.8	5.4	**5.3**	5.3	**0.5**	4.8	0.0
P-EA-03-02E-03	I-EA-03-02E-03	I-EA-03-02E	0.0	0.0	12 inch	42	0.000	0.013	**.0**	**.0**	4.8	6.3	**5.3**	5.3	**ABOVE RIM**	3.8	0.0
P-EA-03-02E-02	I-EA-03-02E-02	I-EA-03-02E	0.0	0.0	12 inch	63	0.000	0.013	**.0**	**.0**	5.3	6.3	**5.3**	5.3	**0.0**	4.3	0.0
P-EA-03-02E-01	I-EA-03-02E-01	I-EA-03-02E	0.0	0.0	12 inch	35	0.000	0.013	**.0**	**.0**	5.3	6.3	**5.3**	5.3	**0.0**	4.3	0.0
P-EA-03-05E	I-EA-03-05E	I-EA-03-04E	0.0	0.0	12 inch	47	0.000	0.013	**.0**	**.0**	5.6	5.7	**5.3**	5.3	**0.3**	4.6	0.0
P-EA-03-04E	I-EA-03-04E	I-EA-03-03E	0.0	0.0	12 inch	352	0.000	0.013	**.0**	**.0**	5.7	5.4	**5.3**	5.3	**0.4**	4.7	0.0
P-EA-03-03E	I-EA-03-03E	I-EA-03-02E	0.0	0.0	12 inch	428	0.000	0.013	**.0**	**.0**	5.4	6.3	**5.3**	5.3	**0.1**	4.4	0.0
P-EA-03-02E	I-EA-03-02E	I-EA-03-01E	0.0	0.0	12 inch	256	0.000	0.013	**.0**	**.0**	6.3	7.3	**5.3**	5.3	**0.9**	5.3	0.0
P-EA-03-01W	I-EA-03-01W	I-EA-03	0.0	0.0	12 inch	306	0.000	0.013	**.0**	**.0**	5.0	5.3	**5.3**	5.3	**ABOVE RIM**	4.0	0.0
P-EA-03-01E	I-EA-03-01E	I-EA-03	0.0	0.0	12 inch	370	0.000	0.013	**.0**	**.0**	7.3	5.3	**5.3**	5.3	**1.9**	6.3	0.0
P-EA-02-01	I-EA-02-01	I-EA-02	0.0	0.0	12 inch	50	0.000	0.013	**.0**	**.0**	7.3	7.3	**7.3**	7.3	**0.0**	6.3	0.0
P-EA-01-01	I-EA-01-01	I-EA-01	0.0	0.0	12 inch	65	0.000	0.013	**.0**	**.0**	8.3	8.3	**8.3**	8.3	**0.0**	7.3	0.0
Ruth Avenue / Dale View Avenue																	
P-EA-24	I-EA-06-08	I-EA-23	29.2	52.4	24 inch	111	0.054	0.013	48.0	42.1	54.0	47.1	**49.9**	44.2	**4.2**	4.0	17.1
P-EA-23	I-EA-23	I-EA-22	29.3	39.0	24 inch	177	0.030	0.013	42.1	36.8	47.1	40.8	**43.9**	39.8	**3.2**	3.0	13.6
P-EA-22	I-EA-22	I-EA-21	31.5	57.8	24 inch	104	0.065	0.013	36.8	30.0	40.8	36.0	**38.7**	32.4	**2.1**	2.0	18.8
P-EA-21	I-EA-21	I-EA-20	31.5	38.0	24 inch	445	0.028	0.013	30.0	17.5	36.0	20.5	**31.9**	20.5	**4.1**	4.0	13.5
P-EA-20	I-EA-20	I-EA-19	31.2	37.2	24 inch	57	0.016	0.010	17.5	16.6	20.5	19.6	**20.2**	19.6	**0.3**	1.0	9.9
P-EA-19	I-EA-19	I-EA-18	33.4	39.5	24 inch	103	0.018	0.010	16.6	14.7	19.6	20.0	**21.3**	20.0	**ABOVE RIM**	1.0	10.6
P-EA-18	I-EA-18	I-EA-17	33.6	6.2	24 inch	112	0.000	0.010	14.7	14.7	20.0	19.5	**20.9**	19.5	**ABOVE RIM**	3.3	10.7
P-EA-17	I-EA-17	J-EA-16	35.2	11.7	24 inch	41	0.003	0.013	14.7	14.5	19.5	20.0	**21.0**	20.0	**ABOVE RIM**	2.8	11.2
P-EA-16	J-EA-16	I-EA-15	55.3	11.4	18 inch	33	0.007	0.010	14.5	14.3	20.0	20.0	**25.4**	20.0	**ABOVE RIM**	4.0	31.3
P-EA-15	I-EA-15	I-EA-14	55.2	19.7	18 inch	59	0.021	0.010	14.3	13.1	20.0	19.6	**29.2**	19.6	**ABOVE RIM**	4.2	31.2
P-EA-14	I-EA-14	I-EA-13	83.3	203.1	48 inch	99	0.020	0.013	13.1	11.1	19.6	19.5	**19.8**	19.5	**ABOVE RIM**	2.5	6.6
P-EA-13	I-EA-13	I-EA-12	84.1	194.9	48 inch	189	0.018	0.013	11.1	7.6	19.5	21.5	**22.1**	21.5	**ABOVE RIM**	4.4	6.7
P-EA-12	I-EA-12	I-EA-11	147.6	25.7	24 inch	92	0.013	0.013	7.6	6.4	21.5	21.5	**60.7**	21.5	**ABOVE RIM**	11.9	47.0
P-EA-11	I-EA-11	I-EA-10	112.9	16.6	24 inch	61	0.005	0.013	6.4	6.1	21.5	21.5	**36.7**	21.5	**ABOVE RIM**	13.1	35.9
P-EA-10	I-EA-10	I-EA-09	114.6	74.3	24 inch	23	0.108	0.013	6.1	3.6	21.5	10.6	**16.5**	10.6	**5.0**	13.4	36.5
P-EA-09	I-EA-09	I-EA-08	114.6	21.9	24 inch	216	0.009	0.013	3.6	1.6	10.6	8.6	**64.0**	8.6	**ABOVE RIM**	5.0	36.5
P-EA-08	I-EA-08	J-EA-07	114.3	19.1	24 inch	236	0.007	0.013	1.6	- .1	8.6	7.9	**68.2**	7.9	**ABOVE RIM**	5.0	36.4
P-EA-07	J-EA-07	I-EA-06	125.4	4.8	24 inch	159	0.000	0.013	- .1	- .2	7.9	8.0	**56.8**	8.0	**ABOVE RIM**	6.0	39.9
P-EA-06	I-EA-06	I-EA-05	128.7	6.7	24 inch	127	0.001	0.013	- .2	- .3	8.0	7.6	**48.8**	7.6	**ABOVE RIM**	6.2	41.0
P-EA-05	I-EA-05	I-EA-04	128.6	11.2	24 inch	41	0.002	0.013	- .3	- .4	7.6	6.4	**19.7**	6.4	**ABOVE RIM**	5.9	40.9
P-EA-04	I-EA-04	I-EA-03	128.6	7.4	24 inch	187	0.001	0.013	- .4	- .6	6.4	5.3	**65.7**	5.3	**ABOVE RIM**	4.8	40.9
P-EA-03	I-EA-03	I-EA-02	128.4	13.7	24 inch	136	0.004	0.013	- .6	- 1.1	5.3	7.3	**51.1**	7.3	**ABOVE RIM**	3.9	40.9
P-EA-02	I-EA-02	I-EA-01	128.2	24.5	24 inch	136	0.012	0.013	- 1.1	- 2.7	7.3	8.3	**52.0**	8.3	**ABOVE RIM**	6.3	40.8
P-EA-01	I-EA-01	O- EA	128.1	27.2	24 inch	90	0.014	0.013	- 2.7	- 4.0	8.3	7.3	**29.0**	.2	**ABOVE RIM**	8.9	40.8

(1) Pipes are presented in Figure 2 and Figure D-EA in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-E1c (page 1 of 2)

Proposed Hydrology, 25-Year Event, System EA

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Ruth Avenue, Backyard Easement													
I-EA-16-08-01	139.40	134.40	1.94		0.55	1.07	1.94	1.1	10.0	10.0	2.54	0.00	**2.7**
I-EA-16-07-01	104.04	100.00	0.78		0.55	0.43	0.78	0.4	10.0	10.0	2.54	0.00	**1.1**
I-EA-16-05-02-01	99.08	95.00	1.86		0.55	1.02	1.86	1.0	10.0	10.0	2.54	0.00	**2.6**
I-EA-16-05-01-02-01	94.00	91.00	0.70		0.55	0.39	0.70	0.4	10.0	10.0	2.54	0.00	**1.0**
I-EA-16-05-01-02	94.00	90.00	1.00	0.70	0.55	0.55	1.70	0.6	10.0	10.0	2.54	0.00	**1.4**
J-EA-16-05-01-01	95.00	88.00	0.00		0.00	0.00	1.70	0.9	0.0	10.0	2.54	0.00	**2.4**
I-EA-16-05-03	100.68	95.68	1.62		0.55	0.89	1.62	0.9	10.0	10.0	2.54	0.00	**2.3**
I-EA-16-05-02	98.68	93.38	0.00	1.86	0.00	0.00	3.48	1.9	10.0	10.2	2.51	0.00	**4.9**
J-EA-16-05-01	94.84	85.34	0.00	1.70	0.00	0.00	5.18	2.9	0.0	10.3	2.50	0.00	**7.2**
I-EA-16-03-02	52.70	48.51	1.79		0.55	0.98	1.79	1.0	10.0	10.0	2.54	0.00	**2.5**
I-EA-16-03-01	52.57	47.57	0.00		0.00	0.00	1.79	0.0	10.0	10.0	0.00	0.00	**0.0**
Proposed Inlets													
I-A-EA-04	**134.60**	**129.60**	**0.00**		**0.00**	**0.00**	0.00	**16.7**	**0.0**	**10.4**	**2.49**	**0.00**	**41.9**
I-A-EA-03	**124.10**	**119.10**	**0.00**	**30.33**	**0.00**	**0.00**	30.33	**16.7**	**0.0**	**10.9**	**2.43**	**0.00**	**40.9**
I-A-EA-02	**88.90**	**83.90**	**0.00**		**0.00**	**0.00**	30.33	**16.7**	**0.0**	**11.0**	**2.42**	**0.00**	**40.7**
I-A-EA-01	**62.00**	**57.00**	**0.00**		**0.00**	**0.00**	30.33	**16.7**	**0.0**	**11.2**	**2.40**	**0.00**	**40.4**
I-EA-16-15	273.70	270.70	7.62		0.55	4.19	7.62	4.2	10.0	10.0	2.54	0.00	**10.7**
I-EA-16-14	273.39	270.39	13.54		0.55	7.45	21.16	11.6	10.0	10.1	2.53	0.00	**29.7**
J-EA-16-13	199.05	196.05	0.00		0.00	0.00	21.16	11.6	0.0	10.2	2.52	0.00	**29.6**
J-EA-16-12	149.50	144.50	0.00		0.00	0.00	21.16	11.6	0.0	10.3	2.51	0.00	**29.4**
I-EA-16-11	142.70	139.70	9.17		0.55	5.04	30.33	16.7	10.0	10.3	2.50	0.00	**42.0**
J-EA-16-10	123.10	116.40	0.00	30.33	0.00	0.00	30.33	0.0	0.0	0.0	0.00	0.00	**0.0**
I-EA-16-09	114.80	109.80	0.00		0.00	0.00	30.33	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-16-08	111.20	106.00	0.00	1.94	0.00	0.00	32.27	1.1	10.0	10.2	2.52	0.00	**2.7**
J-EA-16-07	103.01	99.00	0.00	0.78	0.00	0.00	33.05	1.5	0.0	10.4	2.49	0.00	**3.8**
I-EA-16-06	80.00	75.00	0.52		0.55	0.29	33.57	1.8	10.0	10.7	2.45	0.00	**4.4**
I-EA-16-05	67.91	64.41	1.46	5.18	0.55	0.80	40.21	5.2	10.0	11.4	2.38	0.00	**12.5**
I-EA-16-04	70.08	59.08	0.32		0.55	0.18	40.53	5.4	10.0	11.6	2.36	0.00	**12.9**
J-EA-16-03	52.44	44.44	0.00	1.79	0.00	0.00	42.32	6.4	0.0	11.7	2.35	0.00	**15.1**
I-EA-16-02	47.70	42.70	0.00		0.00	0.00	42.32	6.4	10.0	12.2	2.30	0.00	**14.8**
I-EA-16-01	25.66	20.66	2.20		0.55	1.21	44.52	7.6	10.0	12.5	2.27	0.00	**17.4**
El Camino Real													
I-EA-15-02	22.95	17.95	11.35		0.55	6.24	11.35	6.2	10.0	10.0	2.54	0.00	**16.0**
I-EA-15-01	21.49	15.99	2.09		0.55	1.15	13.44	7.4	10.0	10.1	2.53	0.00	**18.9**
Old County Road													
I-EA-11-01	21.50	19.00	0.27		0.55	0.15	0.27	0.2	10.0	10.0	2.54	0.00	**0.4**

San Mateo drainage areas are not included
(1) Nodes are presented in Figure D-EA in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.
(6) New inlets are in Bold.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E1c (Page 2 of 2)

Proposed Hydrology, 25-Year Event, System EA

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Hiller Street													
I-EA-07-02-03	7.04	2.70	5.18		0.55	2.85	5.18	2.9	10.0	10.0	2.54	0.00	**7.3**
I-EA-07-02-02	7.03	2.39	2.93		0.55	1.61	8.11	1.6	10.0	10.0	2.54	0.00	**4.1**
I-EA-07-02-01	7.04	2.60	2.04		0.55	1.12	10.15	1.1	10.0	10.0	2.54	0.00	**2.9**
I-EA-07-04	7.92	3.00	2.60		0.55	1.43	2.60	1.4	10.0	10.0	2.54	0.00	**3.7**
I-EA-07-03	6.88	2.90	2.07		0.55	1.14	4.67	2.6	10.0	10.1	2.53	0.00	**6.5**
J-EA-07-02	7.08	2.03	0.00	10.15	0.00	0.00	14.82	8.2	0.0	12.0	2.32	0.00	**19.1**
I-EA-07-01	7.94	1.50	0.00		0.00	0.00	14.82	8.2	10.0	14.8	2.09	0.00	**17.2**
I-EA-07S	7.08	2.08	1.69		0.55	0.93	1.69	0.9	10.0	10.0	2.54	0.00	**2.4**
I-EA-06-08	54.00	46.25	7.66		0.55	4.21	7.66	21.1	10.0	11.4	2.38	0.00	**50.7**
I-EA-06-02	8.10	3.65	3.65		0.55	2.01	11.31	2.0	10.0	10.0	2.54	0.00	**5.1**
I-EA-06-01	8.10	3.64	0.79		0.55	0.43	12.10	2.4	10.0	10.7	2.46	0.00	**6.1**
Rosilie Street, San Mateo													
I-EA-03-03E-02	5.84	1.94	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-03E-01	5.84	1.75	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-02E-03	4.84	0.84	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-02E-02	5.34	0.84	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-02E-01	5.34	0.84	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-05E	5.64	2.14	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-04E	5.74	1.84	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-03E	5.44	1.34	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-02E	6.28	0.74	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-01W	5.04	1.04	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-03-01E	7.28	-0.36	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-02-01	7.28	5.64	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-EA-01-01	8.28	6.64	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
Ruth Avenue / Dale View Avenue													
I-EA-23	47.05	42.05	0.14		0.55	0.08	0.14	21.2	10.0	11.5	2.37	0.00	**50.6**
I-EA-22	40.80	36.80	2.17		0.55	1.19	2.31	22.4	10.0	11.6	2.35	0.00	**53.1**
I-EA-21	36.00	30.00	0.00		0.00	0.00	2.31	22.4	10.0	11.7	2.35	0.00	**52.9**
I-EA-20	19.47	15.60	0.00		0.00	0.00	2.31	22.4	10.0	12.2	2.30	0.00	**52.0**
I-EA-19	20.00	15.00	2.17		0.55	1.19	4.48	23.6	10.0	12.2	2.30	0.00	**54.6**
I-EA-18	20.01	14.80	0.29		0.55	0.16	4.77	23.7	10.0	12.5	2.27	0.00	**54.3**
I-EA-17	19.68	14.65	1.75		0.55	0.96	6.52	24.7	10.0	12.9	2.24	0.00	**55.7**
J-EA-16	20.04	14.54	0.00	44.52	0.00	0.00	51.04	32.3	0.0	13.0	2.23	0.00	**72.6**
I-EA-15	20.04	14.31	0.00	13.44	0.00	0.00	64.48	32.3	10.0	13.0	2.22	0.00	**72.4**
I-EA-14	19.58	13.08	16.57		0.55	9.11	81.05	48.8	10.0	13.1	2.22	0.00	**109.1**
I-EA-13	19.48	11.10	1.64		0.55	0.90	82.69	49.7	10.0	13.2	2.21	0.00	**110.7**
I-EA-12	21.49	7.62	71.11		0.55	39.11	153.80	88.8	10.0	13.4	2.19	0.00	**196.4**
I-EA-11	21.49	6.43	2.67	0.27	0.55	1.47	156.74	90.4	10.0	13.5	2.19	0.00	**199.3**
I-EA-10	21.49	6.10	2.61		0.55	1.44	159.35	91.9	10.0	13.6	2.18	0.00	**201.9**
I-EA-09	10.62	3.62	0.00		0.00	0.00	159.35	91.9	10.0	13.6	2.18	0.00	**201.8**
I-EA-08	8.60	1.60	0.00		0.00	0.00	159.35	91.9	10.0	13.8	2.16	0.00	**200.1**
J-EA-07	7.92	-0.08	0.00	16.51	0.00	0.00	175.86	100.9	0.0	15.7	2.03	0.00	**206.4**
I-EA-06	9.00	-0.16	0.74	12.10	0.55	0.41	188.70	103.8	10.0	16.1	2.00	0.00	**209.4**
I-EA-05	8.50	-0.26	0.00		0.00	0.00	188.70	103.8	10.0	16.4	1.98	0.00	**207.3**
I-EA-04	8.50	-0.36	0.00		0.00	0.00	188.70	103.8	10.0	16.5	1.98	0.00	**206.8**
I-EA-03	7.50	-0.56	0.00	0.00	0.00	0.00	188.70	103.8	10.0	17.0	1.95	0.00	**203.9**
I-EA-02	7.28	-1.06	0.00	0.00	0.00	0.00	188.70	103.8	10.0	17.2	1.94	0.00	**202.7**
I-EA-01	8.28	-2.66	0.00	0.00	0.00	0.00	188.70	103.8	10.0	17.3	1.93	0.00	**201.9**
O- EA	7.28	-3.96	0.00		0.00	0.00	188.70	103.8	0.0	17.4	1.93	0.00	**201.4**

San Mateo drainage areas are not included
(1) Nodes are presented in Figure D-EA in Appendix D
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(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table E1d (page 1 of 2)

Proposed Hydraulics, 25-Year Event, System EA

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Ruth Avenue, Backyard Easement																		
P-EA-16-08-01	I-EA-16-08-01	I-EA-16-08	2.7	14.8	12 inch	165	0.172	0.013	134.4	106.0	139.4	111.2	135.1	106.3	**4.3**	4.0	14.4	no change
P-EA-16-07-01	I-EA-16-07-01	J-EA-16-07	1.1	9.1	15 inch	50	0.020	0.013	100.0	99.0	104.0	103.0	100.4	99.7	**3.6**	2.8	5.0	no change
P-EA-16-05-02-01	I-EA-16-05-02-01	I-EA-16-05-02	2.6	9.3	12 inch	24	0.068	0.013	95.0	93.4	99.1	98.7	95.7	94.6	**3.4**	3.1	10.1	no change
P-EA-16-05-01-02-01	I-EA-16-05-01-02-01	J-EA-16-05-01-01	1.0	20.6	12 inch	9	0.333	0.013	91.0	88.0	94.0	95.0	91.4	88.7	**2.6**	2.0	13.5	no change
P-EA-16-05-01-02	I-EA-16-05-01-02	J-EA-16-05-01-01	1.4	11.6	12 inch	19	0.105	0.013	90.0	88.0	94.0	95.0	90.5	88.8	**3.5**	3.0	10.0	no change
P-EA-16-05-01-01	J-EA-16-05-01-01	J-EA-16-05-01	2.4	5.9	12 inch	96	0.028	0.013	88.0	85.3	95.0	94.8	88.7	86.6	**6.3**	6.0	7.1	no change
P-EA-16-05-03	I-EA-16-05-03	I-EA-16-05-02	2.3	5.8	12 inch	86	0.027	0.013	95.7	93.4	100.7	98.7	96.3	94.6	**4.4**	4.0	7.0	no change
P-EA-16-05-02	I-EA-16-05-02	J-EA-16-05-01	4.9	10.5	12 inch	93	0.086	0.013	93.4	85.3	98.7	94.8	94.3	87.0	**4.4**	4.3	13.1	no change
P-EA-16-05-01	J-EA-16-05-01	I-EA-16-05	7.2	14.9	12 inch	120	0.174	0.013	85.3	64.4	94.8	67.9	86.3	65.8	**8.5**	8.5	18.8	no change
P-EA-16-03-02	I-EA-16-03-02	J-EA-16-03	2.5	14.1	12 inch	26	0.157	0.013	48.5	44.4	52.7	52.4	52.6	52.4	**0.1**	3.2	3.2	no change
P-EA-16-03-01	I-EA-16-03-01	J-EA-16-03	0.0	11.5	12 inch	30	0.104	0.013	47.6	44.4	52.6	52.4	51.7	51.7	**0.9**	4.0	0.0	no change
P-EA-16-15	I-EA-16-15	I-EA-16-14	10.7	15.4	18 inch	17	0.018	0.012	270.7	270.4	273.7	273.4	272.6	272.5	**1.1**	1.5	6.1	upsized
P-EA-16-14	I-EA-16-14	J-EA-16-13	29.7	65.3	18 inch	226	0.329	0.012	270.4	196.1	273.4	199.1	271.9	199.1	**1.5**	1.5	36.1	upsized
P-EA-16-13	J-EA-16-13	J-EA-16-12	29.6	54.7	18 inch	223	0.231	0.012	196.1	144.5	199.1	149.5	197.5	149.5	**1.5**	1.5	31.6	upsized
P-EA-16-12	J-EA-16-12	I-EA-16-11	29.4	29.0	18 inch	74	0.065	0.012	144.5	139.7	149.5	142.7	147.6	142.7	**1.9**	3.5	16.6	upsized
P-EA-16-11	I-EA-16-11	I-A-EA-04	42.0	75.7	24 inch	106	0.095	0.012	139.7	129.6	142.7	134.6	141.7	132.3	**1.0**	1.0	24.7	upsized
Proposed Pipes (5)																		
P-A-EA-04	**I-A-EA-04**	**I-A-EA-03**	**41.9**	**65.8**	**30 inch**	**408**	**0.026**	**0.013**	**129.6**	**119.1**	**134.6**	**124.1**	**131.8**	**121.5**	**2.8**	**2.5**	**14.2**	**new pipe**
P-A-EA-03	**I-A-EA-03**	**I-A-EA-02**	**40.9**	**185.5**	**30 inch**	**172**	**0.205**	**0.013**	**119.1**	**83.9**	**124.1**	**88.9**	**121.3**	**86.5**	**2.8**	**2.5**	**30.3**	**new pipe**
P-A-EA-02	**I-A-EA-02**	**I-A-EA-01**	**40.7**	**135.6**	**30 inch**	**246**	**0.109**	**0.013**	**83.9**	**57.0**	**88.9**	**62.0**	**86.0**	**59.3**	**2.9**	**2.5**	**24.2**	**new pipe**
P-A-EA-01	**I-A-EA-01**	**I-EA-06-08**	**40.4**	**95.6**	**30 inch**	**198**	**0.054**	**0.013**	**57.0**	**46.3**	**62.0**	**54.0**	**59.1**	**49.7**	**2.9**	**2.5**	**18.7**	**new pipe**
P-EA-16-10	J-EA-16-10	I-EA-16-09	0.0	20.5	18 inch	173	0.038	0.013	116.4	109.8	123.1	114.8	116.4	109.8	**6.7**	5.2	0.0	no change
P-EA-16-09	I-EA-16-09	I-EA-16-08	0.0	23.3	18 inch	77	0.049	0.013	109.8	106.0	114.8	111.2	109.8	106.6	**5.0**	3.5	0.0	no change
P-EA-16-08	I-EA-16-08	J-EA-16-07	2.7	58.1	24 inch	106	0.066	0.013	106.0	99.0	111.2	103.0	106.6	99.7	**4.6**	3.2	9.4	no change
P-EA-16-07	J-EA-16-07	I-EA-16-06	3.8	70.5	24 inch	247	0.097	0.013	99.0	75.0	103.0	80.0	99.7	75.8	**3.3**	2.0	11.9	no change
P-EA-16-06	I-EA-16-06	I-EA-16-05	4.4	40.4	24 inch	332	0.032	0.013	75.0	64.4	80.0	67.9	75.7	65.8	**4.3**	3.0	8.4	no change
P-EA-16-05	I-EA-16-05	I-EA-16-04	12.5	45.3	24 inch	133	0.040	0.013	64.4	59.1	67.9	70.1	65.7	61.1	**2.2**	1.5	12.3	no change
P-EA-16-04	I-EA-16-04	J-EA-16-03	12.9	33.3	18 inch	146	0.100	0.013	59.1	44.4	70.1	52.4	60.4	50.4	**9.7**	9.5	17.6	no change
P-EA-16-03	J-EA-16-03	I-EA-16-02	15.1	9.1	18 inch	230	0.008	0.013	44.4	42.7	52.4	47.7	49.0	44.2	**3.4**	6.5	8.6	no change
P-EA-16-02	I-EA-16-02	I-EA-16-01	14.8	27.4	18 inch	324	0.068	0.013	42.7	20.7	47.7	25.7	44.1	22.3	**3.6**	3.5	15.8	no change
P-EA-16-01	I-EA-16-01	J-EA-16	17.4	24.2	18 inch	115	0.053	0.013	20.7	14.5	25.7	20.0	22.1	17.4	**3.6**	3.5	14.9	no change
El Camino Real																		
P-EA-15-02	I-EA-15-02	I-EA-15-01	16.0	23.0	18 inch	48	0.041	0.012	18.0	16.0	23.0	21.5	19.4	17.8	**3.6**	3.5	14.1	upsized
P-EA-15-01	I-EA-15-01	I-EA-14	18.9	29.3	24 inch	173	0.017	0.013	16.0	13.1	21.5	19.6	17.6	16.6	**3.9**	3.5	9.9	no change
Old County Road																		
P-EA-11-01	I-EA-11-01	I-EA-11	0.4	7.1	12 inch	316	0.040	0.013	19.0	6.4	21.5	21.5	19.3	11.4	**2.3**	1.5	4.8	no change

(1) Pipes are presented in Figure 2 and Figure D-EA in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.

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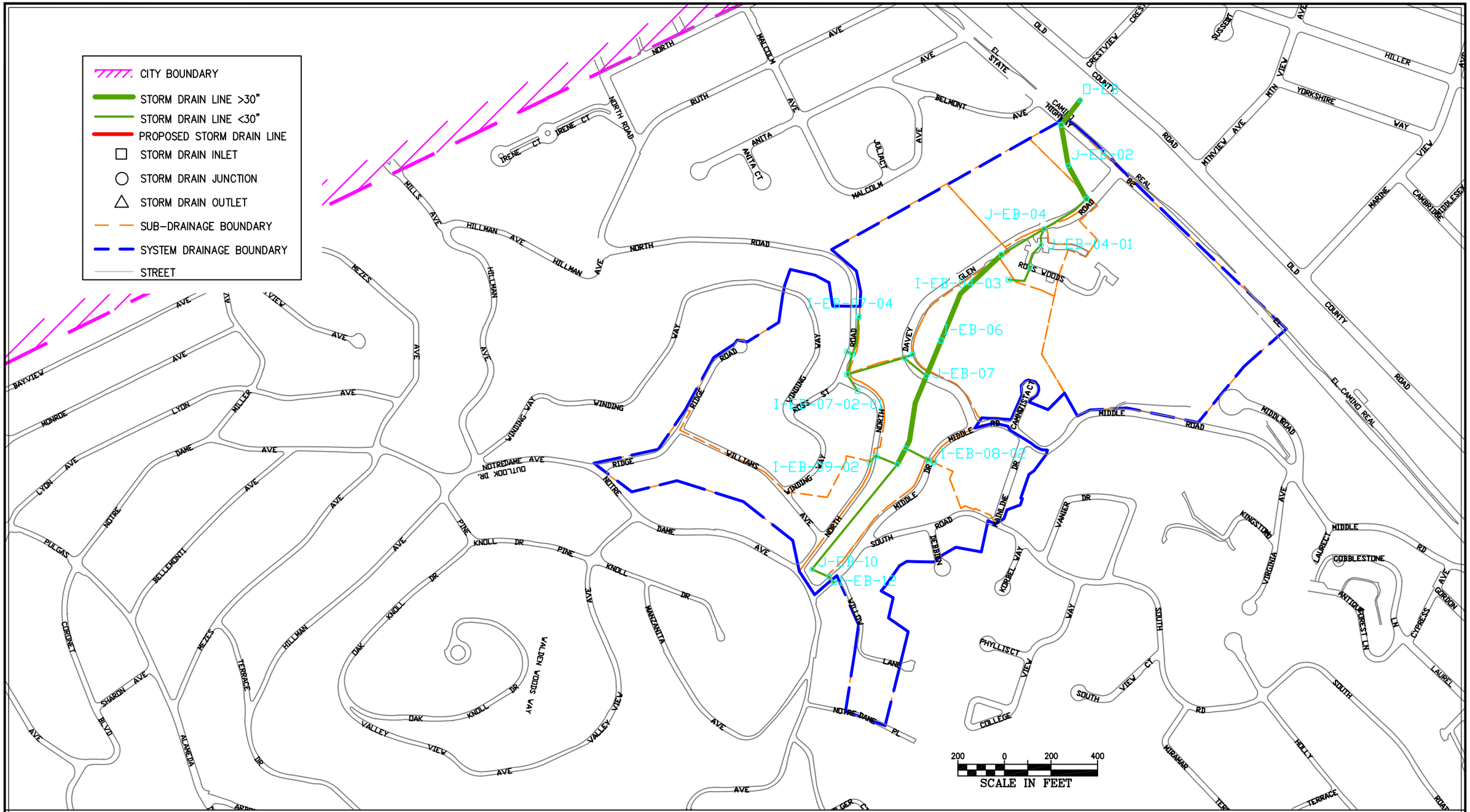
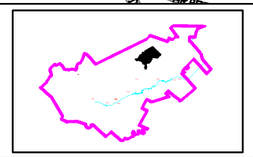
Table E1d (page 2 of 2)

Proposed Hydraulics, 25-Year Event, System EA

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
Hiller Street																		
P-EA-07-02-03	I-EA-07-02-03	J-EA-07-02	7.3	11.3	18 inch	58	0.012	0.013	2.7	2.0	7.0	7.1	6.6	6.3	**0.5**	2.8	4.1	upsized
P-EA-07-02-02	I-EA-07-02-02	J-EA-07-02	4.1	11.5	18 inch	30	0.012	0.013	2.4	2.0	7.0	7.1	6.4	6.3	**0.7**	3.1	2.3	upsized
P-EA-07-02-01	I-EA-07-02-01	J-EA-07-02	2.9	22.9	18 inch	12.00	0.048	0.013	2.6	2.0	7.0	7.1	6.3	6.3	**0.7**	2.9	1.6	upsized
P-EA-07-04	I-EA-07-04	I-EA-07-03	3.7	2.0	12 inch	33	0.003	0.013	3.0	2.9	7.9	6.9	6.9	6.5	**1.1**	3.9	4.7	upsized
P-EA-07-03	I-EA-07-03	J-EA-07-02	6.5	13.9	24 inch	231	0.004	0.013	2.9	2.0	6.9	7.1	6.5	6.3	**0.4**	2.0	2.1	upsized
P-EA-07-02	J-EA-07-02	I-EA-07-01	19.1	22.6	36 inch	460	0.001	0.013	2.0	1.5	7.1	7.9	6.3	5.9	**0.8**	2.1	2.7	upsized
P-EA-07-01S	I-EA-07S	J-EA-07	2.4	26.5	18 inch	40	0.054	0.012	2.1	- .1	7.1	7.9	6.0	6.0	**1.1**	3.5	1.4	upsized
P-EA-07-01	I-EA-07-01	J-EA-07	17.2	81.0	36 inch	126	0.013	0.012	1.5	- .1	7.9	7.9	5.9	5.8	**2.1**	3.4	2.4	upsized
P-EA-06-02	I-EA-06-02	I-EA-06-01	5.1	2.8	24 inch	66	0.000	0.013	3.7	3.6	8.1	8.1	5.8	5.8	**2.3**	2.5	1.6	upsized
P-EA-06-01	I-EA-06-01	I-EA-06	6.1	25.4	24 inch	301	0.013	0.013	3.6	- .2	8.1	9.0	5.7	5.5	**2.4**	2.5	1.9	upsized
Rosilie Street, San Mateo																		
P-EA-03-03E-02	I-EA-03-03E-02	I-EA-03-03E-01	0.0	0.0	12 inch	56	0.000	0.013	**.0**	**.0**	5.8	5.8	4.3	4.3	**1.5**	4.8	0.0	no change
P-EA-03-03E-01	I-EA-03-03E-01	I-EA-03-03E	0.0	0.0	12 inch	411	0.000	0.013	**.0**	**.0**	5.8	5.4	4.3	4.3	**1.5**	4.8	0.0	no change
P-EA-03-02E-03	I-EA-03-02E-03	I-EA-03-02E	0.0	1.7	12 inch	42	0.002	0.013	.8	.7	4.8	6.3	4.3	4.3	**0.5**	3.0	0.0	no change
P-EA-03-02E-02	I-EA-03-02E-02	I-EA-03-02E	0.0	1.4	12 inch	63	0.002	0.013	.8	.7	5.3	6.3	4.3	4.3	**1.0**	3.5	0.0	no change
P-EA-03-02E-01	I-EA-03-02E-01	I-EA-03-02E	0.0	1.9	12 inch	35	0.003	0.013	.8	.7	5.3	6.3	4.3	4.3	**1.0**	3.5	0.0	upsized
P-EA-03-05E	I-EA-03-05E	I-EA-03-04E	0.0	0.0	12 inch	47	0.000	0.013	**.0**	**.0**	5.6	5.7	4.3	4.3	**1.3**	4.6	0.0	upsized
P-EA-03-04E	I-EA-03-04E	I-EA-03-03E	0.0	0.0	12 inch	352	0.000	0.013	**.0**	**.0**	5.7	5.4	4.3	4.3	**1.4**	4.7	0.0	upsized
P-EA-03-03E	I-EA-03-03E	I-EA-03-02E	0.0	0.0	12 inch	428	0.000	0.013	**.0**	**.0**	5.4	6.3	4.3	4.3	**1.1**	4.4	0.0	no change
P-EA-03-02E	I-EA-03-02E	I-EA-03-01E	0.0	2.3	12 inch	256	0.004	0.013	.7	- .4	6.3	7.3	4.3	4.3	**2.0**	4.5	0.0	no change
P-EA-03-01W	I-EA-03-01W	I-EA-03	0.0	2.6	12 inch	306	0.005	0.013	1.0	- .6	5.0	7.5	3.9	3.9	**1.2**	3.0	0.0	upsized
P-EA-03-01E	I-EA-03-01E	I-EA-03	0.0	0.0	12 inch	370	0.000	0.013	**.0**	**.0**	7.3	7.5	4.3	4.3	**3.0**	6.3	0.0	upsized
P-EA-02-01	I-EA-02-01	I-EA-02	0.0	0.0	12 inch	50	0.000	0.013	**.0**	**.0**	7.3	7.3	4.3	4.3	**3.0**	6.3	0.0	no change
P-EA-01-01	I-EA-01-01	I-EA-01	0.0	0.0	12 inch	65	0.000	0.013	**.0**	**.0**	8.3	8.3	4.3	4.3	**4.0**	7.3	0.0	no change
Ruth Avenue / Dale View Avenue																		
P-EA-24	I-EA-06-08	I-EA-23	50.7	91.1	30 inch	100	0.042	0.012	46.3	42.1	54.0	47.1	48.6	45.2	**5.4**	5.3	19.0	upsized
P-EA-23	I-EA-23	I-EA-22	50.6	76.5	30 inch	177	0.030	0.012	42.1	36.8	47.1	40.8	44.4	40.4	**2.7**	2.5	16.7	upsized
P-EA-22	I-EA-22	I-EA-21	53.1	113.6	30 inch	104	0.065	0.012	36.8	30.0	40.8	36.0	39.1	32.9	**1.7**	1.5	22.8	upsized
P-EA-21	I-EA-21	I-EA-20	52.9	79.9	30 inch	445	0.032	0.012	30.0	15.6	36.0	19.5	32.3	19.5	**3.7**	3.5	17.4	upsized
P-EA-20	I-EA-20	I-EA-19	52.0	45.6	30 inch	57	0.011	0.012	15.6	15.0	19.5	20.0	18.8	18.0	**0.7**	1.4	10.6	upsized
P-EA-19	I-EA-19	I-EA-18	54.6	68.6	48 inch	103	0.002	0.012	15.0	14.8	20.0	20.0	17.9	17.7	**2.2**	1.0	6.1	upsized
P-EA-18	I-EA-18	I-EA-17	54.3	57.0	48 inch	112	0.001	0.012	14.8	14.7	20.0	19.7	17.7	17.4	**2.4**	1.2	5.2	upsized
P-EA-17	I-EA-17	J-EA-16	55.7	80.6	48 inch	41	0.003	0.012	14.7	14.5	19.7	20.0	17.4	17.3	**2.3**	1.0	6.9	upsized
P-EA-16	J-EA-16	I-EA-15	72.6	119.9	48 inch	33	0.007	0.013	14.5	14.3	20.0	20.0	17.1	17.0	**2.9**	1.5	10.0	upsized
P-EA-15	I-EA-15	I-EA-14	72.4	207.4	48 inch	59	0.021	0.013	14.3	13.1	20.0	19.6	16.9	16.8	**3.2**	1.7	15.0	upsized
P-EA-14	I-EA-14	I-EA-13	109.1	203.1	48 inch	99	0.020	0.013	13.1	11.1	19.6	19.5	16.2	15.3	**3.3**	2.5	16.5	upsized
P-EA-13	I-EA-13	I-EA-12	110.7	194.9	48 inch	189	0.018	0.013	11.1	7.6	19.5	21.5	14.3	11.7	**5.2**	4.4	16.0	upsized
P-EA-12	I-EA-12	I-EA-11	196.4	320.9	60 inch	92	0.013	0.012	7.6	6.4	21.5	21.5	11.6	11.7	**9.9**	8.9	17.2	upsized
P-EA-11	I-EA-11	I-EA-10	199.3	267.6	66 inch	61	0.005	0.012	6.4	6.1	21.5	21.5	11.0	11.0	**10.5**	9.6	12.3	upsized
P-EA-10	I-EA-10	I-EA-09	201.9	1194.5	66 inch	23	0.108	0.012	6.1	3.6	21.5	10.6	10.1	7.7	**11.4**	9.9	37.4	upsized
P-EA-09	I-EA-09	I-EA-08	201.8	351.8	66 inch	216	0.009	0.012	3.6	1.6	10.6	8.6	7.6	6.5	**3.0**	1.5	15.3	upsized
P-EA-08	I-EA-08	J-EA-07	200.1	307.2	66 inch	236	0.007	0.012	1.6	- .1	8.6	7.9	6.5	5.9	**2.2**	1.5	13.8	upsized
P-EA-07	J-EA-07	I-EA-06	206.4	125.0	78 inch	159	0.000	0.012	- .1	- .2	7.9	9.0	5.8	5.5	**2.2**	1.5	6.2	upsized
P-EA-06	I-EA-06	I-EA-05	209.4	159.4	78 inch	127	0.001	0.012	- .2	- .3	9.0	8.5	5.5	5.3	**3.5**	2.7	6.3	upsized
P-EA-05	I-EA-05	I-EA-04	207.3	280.5	78 inch	41	0.002	0.012	- .3	- .4	8.5	8.5	4.8	4.8	**3.7**	2.3	9.3	upsized
P-EA-04	I-EA-04	I-EA-03	206.8	226.3	84 inch	187	0.001	0.012	- .4	- .6	8.5	7.5	4.3	3.9	**4.2**	1.9	6.7	upsized
P-EA-03	I-EA-03	I-EA-02	203.9	419.6	84 inch	136	0.004	0.012	- .6	- 1.1	7.5	7.3	3.9	3.9	**3.6**	1.1	10.8	upsized
P-EA-02	I-EA-02	I-EA-01	202.7	750.6	84 inch	136	0.012	0.012	- 1.1	- 2.7	7.3	8.3	3.9	4.1	**3.4**	1.3	16.6	upsized
P-EA-01	I-EA-01	O- EA	201.9	831.7	84 inch	90	0.014	0.012	- 2.7	- 4.0	8.3	7.3	4.1	4.0	**4.2**	3.9	17.8	upsized

(1) Pipes are presented in Figure 2 and Figure D-EA in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-E2A TO D-E2D

FIGURE D-EB
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E2a

Existing Hydrology, 10-Year Event, System EB

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (cfs)**
I-EB-09-02	238.00	235.00	4.87		0.50	2.44	4.87	2.4	10.0	10.0	2.12	**5.2**
I-EB-09-01	235.00	230.00	0.00		0.00	0.00	4.87	2.4	10.0	10.1	2.12	**5.2**
I-EB-08-02	236.00	232.50	2.82		0.50	1.41	2.82	1.4	10.0	10.0	2.12	**3.0**
I-EB-08-01	235.50	232.00	0.00		0.00	0.00	2.82	1.4	10.0	10.1	2.12	**3.0**
I-EB-07-03-01	223.50	219.50	3.78		0.50	1.89	3.78	1.9	10.0	10.0	2.12	**4.1**
I-EB-07-02-01	223.00	220.50	3.78		0.50	1.89	3.78	1.9	10.0	10.0	2.12	**4.1**
I-EB-07-01-01	174.00	170.00	5.50		0.50	2.75	5.50	2.8	10.0	10.0	2.12	**5.9**
I-EB-07-04	223.60	219.60	3.78		0.50	1.89	3.78	1.9	10.0	10.0	2.12	**4.1**
I-EB-07-03	223.10	219.00	0.00	3.78	0.00	0.00	7.56	3.8	10.0	10.5	2.07	**7.9**
I-EB-07-02	224.80	218.00	0.00	3.78	0.50	0.00	11.34	5.7	10.0	10.7	2.05	**11.7**
I-EB-07-01	172.70	169.20	0.00	5.50	0.50	0.00	16.84	8.4	10.0	10.9	2.04	**17.3**
I-EB-04-03	100.00	97.50	7.55		0.50	3.78	7.55	3.8	10.0	10.0	2.12	**8.1**
J-EB-04-02	101.00	97.00	0.00		0.00	0.00	7.55	3.8	0.0	10.2	2.10	**8.0**
J-EB-04-01	90.00	85.00	0.00		0.00	0.00	7.55	3.8	0.0	10.3	2.09	**8.0**
I-EB-12	272.00	269.00	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.12	**1.1**
I-EB-11	272.00	269.00	5.50		0.50	2.75	6.50	3.3	10.0	10.6	2.07	**6.8**
J-EB-10	272.00	267.00	0.00		0.00	0.00	6.50	3.3	0.0	10.7	2.05	**6.7**
J-EB-09	200.00	194.00	0.00	4.87	0.00	0.00	11.37	5.7	0.0	11.3	2.00	**11.4**
J-EB-08	190.00	184.00	0.00	2.82	0.00	0.00	14.19	7.1	0.0	11.4	1.99	**14.2**
J-EB-07	186.00	161.00	0.00	16.84	0.00	0.00	31.03	15.5	0.0	12.0	1.94	**30.3**
I-EB-06	153.00	148.00	0.00		0.00	0.00	31.03	15.5	10.0	12.2	1.92	**30.1**
I-EB-05	110.00	104.50	6.70		0.50	3.35	37.73	18.9	10.0	12.8	1.88	**35.7**
J-EB-04	78.00	73.00	0.00	7.55	0.00	0.00	45.28	22.6	0.0	12.9	1.87	**42.6**
I-EB-03	52.00	46.00	4.02		0.50	2.01	49.30	24.7	10.0	13.1	1.86	**46.2**
J-EB-02	44.00	40.00	0.00		0.00	0.00	49.30	24.7	0.0	13.2	1.85	**45.9**
I-EB-01	39.00	35.00	16.67		0.50	8.34	65.97	33.0	10.0	13.4	1.83	**60.9**
O-EB	29.00	25.00	0.00		0.00	0.00	65.97	33.0	0.0	13.7	1.82	**60.4**

(1) Nodes are presented in Figure D-EB in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E2b

Existing Hydraulics, 10-Year Event, System EB

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Ruth Avenue, Backyard Easement																	
P-EB-09-02	I-EB-09-02	I-EB-09-01	5.2	12.7	15 inch	38	0.132	0.024	235.0	230.0	238.0	235.0	235.9	231.21	**2.1**	1.8	9.8
P-EB-09-01	I-EB-09-01	J-EB-09	5.2	21.1	15 inch	99	0.364	0.024	230.0	194.0	235.0	200.0	230.9	195.13	**4.1**	3.8	14.2
P-EB-08-02	I-EB-08-02	I-EB-08-01	3.0	9.0	15 inch	26	0.019	0.013	232.5	232.0	236.0	235.5	233.2	232.74	**2.8**	2.3	6.6
P-EB-08-01	I-EB-08-01	J-EB-08	3.0	23.2	15 inch	109	0.440	0.024	232.0	184.0	235.5	190.0	232.7	185.23	**2.8**	2.3	13.1
P-EB-07-03-01	I-EB-07-03-01	I-EB-07-03	4.1	5.1	12 inch	24	0.021	0.013	219.5	219.0	223.5	223.1	223.4	223.10	**0.1**	3.0	5.2
P-EB-07-02-01	I-EB-07-02-01	I-EB-07-02	4.1	6.2	12 inch	84	0.030	0.013	220.5	218.0	223.0	224.8	221.4	219.57	**1.7**	1.5	8.4
P-EB-07-01-01	I-EB-07-01-01	I-EB-07-01	5.9	5.0	12 inch	40	0.020	0.013	170.0	169.2	174.0	172.7	172.2	171.13	**1.8**	3.0	7.5
P-EB-07-04	I-EB-07-04	I-EB-07-03	4.1	2.1	12 inch	166	0.004	0.013	219.6	219.0	223.6	223.1	225.2	223.10	**ABOVE RIM**	3.0	5.2
P-EB-07-03	I-EB-07-03	I-EB-07-02	7.9	3.7	12 inch	91	0.011	0.013	219.0	218.0	223.1	224.8	224.4	219.92	**ABOVE RIM**	3.1	10.0
P-EB-07-02	I-EB-07-02	I-EB-07-01	11.7	28.3	15 inch	255	0.191	0.013	218.0	169.2	224.8	172.7	219.2	171.38	**5.6**	5.6	22.0
P-EB-07-01	I-EB-07-01	J-EB-07	17.3	27.0	18 inch	124	0.066	0.013	169.2	161.0	172.7	186.0	170.6	162.98	**2.1**	2.0	16.2
P-EB-04-03	I-EB-04-03	J-EB-04-02	8.1	2.2	12 inch	131	0.004	0.013	97.5	97.0	100.0	101.0	105.8	99.03	**ABOVE RIM**	1.5	10.3
P-EB-04-02	J-EB-04-02	J-EB-04-01	8.0	11.5	12 inch	116	0.103	0.013	97.0	85.0	101.0	90.0	98.0	86.36	**3.0**	3.0	15.8
P-EB-04-01	J-EB-04-01	J-EB-04	8.0	42.6	18 inch	73	0.164	0.013	85.0	73.0	90.0	78.0	86.1	75.88	**3.9**	3.5	18.5
P-EB-12	I-EB-12	I-EB-11	1.1	0.0	15 inch	30	0.000	0.013	269.0	269.0	272.0	272.0	270.3	270.27	**1.7**	1.8	0.9
P-EB-11	I-EB-11	J-EB-10	6.8	10.1	15 inch	82	0.024	0.013	269.0	267.0	272.0	272.0	270.1	268.47	**1.9**	1.8	8.8
P-EB-10	J-EB-10	J-EB-09	6.7	22.9	15 inch	580	0.126	0.013	267.0	194.0	272.0	200.0	268.0	195.13	**4.0**	3.8	16.2
P-EB-09	J-EB-09	J-EB-08	11.4	128.5	36 inch	79	0.127	0.024	194.0	184.0	200.0	190.0	195.1	185.23	**4.9**	3.0	11.2
P-EB-08	J-EB-08	J-EB-07	14.2	96.1	36 inch	325	0.071	0.024	184.0	161.0	190.0	186.0	185.2	162.85	**4.8**	3.0	9.7
P-EB-07	J-EB-07	I-EB-06	30.3	101.4	36 inch	165	0.079	0.024	161.0	148.0	186.0	153.0	162.8	149.81	**23.2**	22.0	12.5
P-EB-06	I-EB-06	I-EB-05	30.1	110.9	36 inch	462	0.094	0.024	148.0	104.5	153.0	110.0	149.8	106.82	**3.2**	2.0	13.3
P-EB-05	I-EB-05	J-EB-04	35.7	118.8	27 inch	214	0.147	0.013	104.5	73.0	110.0	78.0	106.5	75.33	**3.5**	3.3	26.1
P-EB-04	J-EB-04	I-EB-03	42.6	107.5	27 inch	224	0.121	0.013	73.0	46.0	78.0	52.0	75.1	49.30	**2.9**	2.8	25.5
P-EB-03	I-EB-03	J-EB-02	46.2	78.7	30 inch	163	0.037	0.013	46.0	40.0	52.0	44.0	48.2	42.66	**3.8**	3.5	16.7
P-EB-02	J-EB-02	I-EB-01	45.9	68.7	30 inch	178	0.028	0.013	40.0	35.0	44.0	39.0	42.2	37.90	**1.8**	1.5	15.0
P-EB-01	I-EB-01	O-EB	60.9	133.3	3 x 2 ft	134	0.075	0.013	35.0	25.0	39.0	29.0	37.0	28.00	**2.0**	2.0	10.2

(1) Pipes are presented in Figure 2 and Figure D-EB in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E2c

Proposed Hydrology, 25-Year Event, System EB

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
I-EB-09-02	238.00	233.00	4.87		0.55	2.68	4.87	2.7	10.0	10.0	2.44	0.00	**6.6**
I-EB-09-01	235.00	230.00	0.00		0.00	0.00	4.87	2.7	10.0	10.1	2.43	0.00	**6.6**
I-EB-08-02	236.00	232.50	2.82		0.55	1.55	2.82	1.6	10.0	10.0	2.44	0.00	**3.8**
I-EB-08-01	235.50	232.00	0.00		0.00	0.00	2.82	1.6	10.0	10.1	2.43	0.00	**3.8**
I-EB-07-03-01	223.50	219.50	3.78		0.55	2.08	3.78	2.1	10.0	10.0	2.44	0.00	**5.1**
I-EB-07-02-01	223.00	220.50	3.78		0.55	2.08	3.78	2.1	10.0	10.0	2.44	0.00	**5.1**
I-EB-07-01-01	174.00	170.00	5.50		0.55	3.03	5.50	3.0	10.0	10.0	2.44	0.00	**7.4**
I-EB-07-04	223.60	219.60	3.78		0.55	2.08	3.78	2.1	10.0	10.0	2.44	0.00	**5.1**
I-EB-07-03	223.10	219.00	0.00	3.78	0.00	0.00	7.56	4.2	10.0	10.7	2.36	0.00	**9.9**
I-EB-07-02	224.00	218.00	0.00	3.78	0.55	0.00	11.34	6.2	10.0	10.9	2.33	0.00	**14.7**
I-EB-07-01	172.70	169.20	0.00	5.50	0.00	0.00	16.84	9.3	10.0	11.1	2.31	0.00	**21.6**
I-EB-04-03	99.00	95.00	7.55		0.55	4.15	7.55	4.2	10.0	10.0	2.44	0.00	**10.2**
J-EB-04-02	101.00	90.00	0.00		0.00	0.00	7.55	4.2	0.0	10.2	2.42	0.00	**10.1**
J-EB-04-01	90.00	85.00	0.00		0.00	0.00	7.55	4.2	0.0	10.3	2.40	0.00	**10.0**
I-EB-12	272.00	269.00	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.44	0.00	**1.4**
I-EB-11	272.00	269.00	5.50		0.55	3.03	6.50	3.6	10.0	10.5	2.38	0.00	**8.6**
J-EB-10	272.00	267.00	0.00		0.00	0.00	6.50	3.6	0.0	10.6	2.37	0.00	**8.5**
J-EB-09	200.00	194.00	0.00	4.87	0.00	0.00	11.37	6.3	0.0	11.2	2.31	0.00	**14.6**
J-EB-08	190.00	184.00	0.00	2.82	0.00	0.00	14.19	7.8	0.0	11.3	2.30	0.00	**18.1**
J-EB-07	186.00	161.00	0.00	16.84	0.00	0.00	31.03	17.1	0.0	11.8	2.25	0.00	**38.6**
I-EB-06	153.00	148.00	0.00		0.00	0.00	31.03	17.1	10.0	12.0	2.23	0.00	**38.3**
I-EB-05	110.00	104.50	6.70		0.55	3.69	37.73	20.8	10.0	12.5	2.18	0.00	**45.5**
J-EB-04	78.00	73.00	0.00	7.55	0.00	0.00	45.28	24.9	0.0	12.7	2.17	0.00	**54.4**
I-EB-03	52.00	46.00	4.02		0.55	2.21	49.30	27.1	10.0	12.8	2.15	0.00	**58.9**
J-EB-02	44.00	39.00	0.00		0.00	0.00	49.30	27.1	0.0	13.0	2.14	0.00	**58.6**
I-EB-01	39.00	35.00	16.67		0.55	9.17	65.97	36.3	10.0	13.2	2.12	0.00	**77.6**
O-EB	29.00	25.00	0.00		0.00	0.00	65.97	36.3	0.0	13.4	2.11	0.00	**77.1**

(1) Nodes are presented in Figure D-EB in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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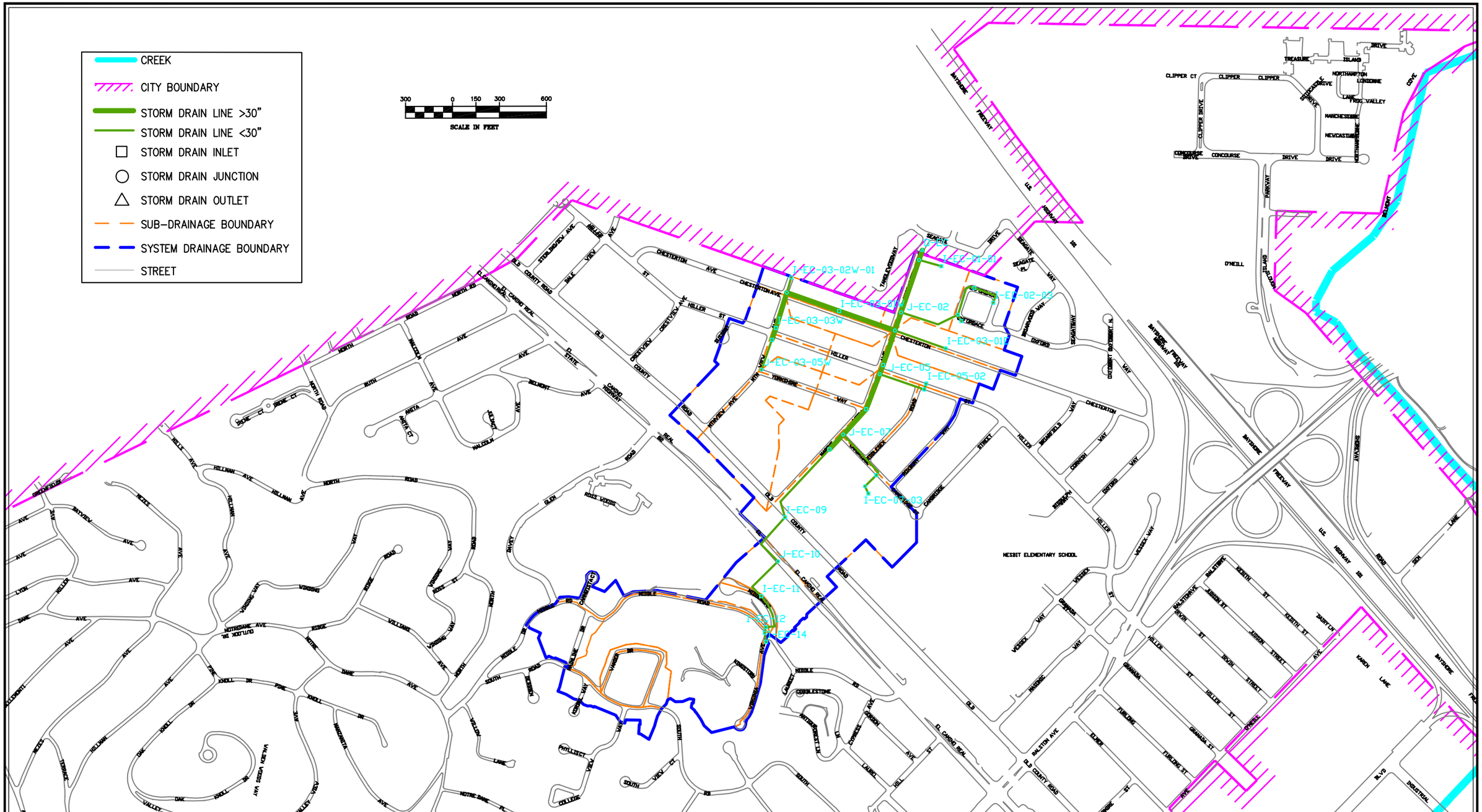
STORM DRAIN MASTER PLAN

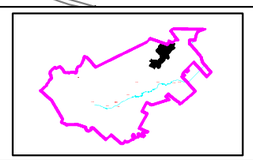
Table E2d

Proposed Hydraulics, 25-Year Event, System EB

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Ruth Avenue, Backyard Easement																		
P-EB-09-02	I-EB-09-02	I-EB-09-01	6.9	9.8	15 inch	38	0.079	0.024	233.0	230.0	238.0	235.0	234.1	231.5	**3.9**	3.8	8.7	no change
P-EB-09-01	I-EB-09-01	J-EB-09	6.8	21.1	15 inch	99	0.364	0.024	230.0	194.0	235.0	200.0	231.1	195.3	**3.9**	3.8	15.4	no change
P-EB-08-02	I-EB-08-02	I-EB-08-01	4.0	9.0	15 inch	26	0.019	0.013	232.5	232.0	236.0	235.5	233.3	232.9	**2.7**	2.3	7.1	no change
P-EB-08-01	I-EB-08-01	J-EB-08	4.0	23.2	15 inch	109	0.440	0.024	232.0	184.0	235.5	190.0	232.8	185.4	**2.7**	2.3	14.1	no change
P-EB-07-03-01	I-EB-07-03-01	I-EB-07-03	5.3	5.1	12 inch	24	0.021	0.013	219.5	219.0	223.5	223.1	221.4	220.9	**2.1**	3.0	6.8	no change
P-EB-07-02-01	I-EB-07-02-01	I-EB-07-02	5.3	6.2	12 inch	84	0.030	0.013	220.5	218.0	223.0	224.0	221.6	219.7	**1.4**	1.5	6.8	no change
P-EB-07-01-01	I-EB-07-01-01	I-EB-07-01	7.7	16.1	18 inch	40	0.020	0.012	170.0	169.2	174.0	172.7	171.3	171.2	**2.7**	2.5	9.0	upsized
P-EB-07-04	I-EB-07-04	I-EB-07-03	5.3	6.8	18 inch	166	0.004	0.012	219.6	219.0	223.6	223.1	221.3	220.9	**2.3**	2.5	3.0	upsized
P-EB-07-03	I-EB-07-03	I-EB-07-02	10.2	11.9	18 inch	91	0.011	0.012	219.0	218.0	223.1	224.0	220.7	220.0	**2.4**	2.6	5.8	upsized
P-EB-07-02	I-EB-07-02	I-EB-07-01	15.1	49.8	18 inch	255	0.191	0.012	218.0	169.2	224.0	172.7	219.4	171.3	**4.6**	4.5	24.7	upsized
P-EB-07-01	I-EB-07-01	J-EB-07	22.3	63.0	24 inch	124	0.066	0.012	169.2	161.0	172.7	186.0	170.9	163.3	**1.8**	1.5	18.3	upsized
P-EB-04-03	I-EB-04-03	J-EB-04-02	10.6	22.2	18 inch	131	0.038	0.012	95.0	90.0	99.0	101.0	96.3	91.6	**2.8**	2.5	12.4	upsized
P-EB-04-02	J-EB-04-02	J-EB-04-01	10.5	21.8	18 inch	116	0.043	0.013	90.0	85.0	101.0	90.0	91.3	86.6	**9.8**	9.5	12.2	upsized
P-EB-04-01	J-EB-04-01	J-EB-04	10.5	42.6	18 inch	73	0.164	0.013	85.0	73.0	90.0	78.0	86.2	76.5	**3.8**	3.5	19.9	no change
P-EB-12	I-EB-12	I-EB-11	1.4	0.0	15 inch	30	0.000	0.013	269.0	269.0	272.0	272.0	270.8	270.8	**1.2**	1.8	1.2	no change
P-EB-11	I-EB-11	J-EB-10	9.0	10.1	15 inch	82	0.024	0.013	269.0	267.0	272.0	272.0	270.4	268.8	**1.6**	1.8	7.3	no change
P-EB-10	J-EB-10	J-EB-09	8.9	22.9	15 inch	580	0.126	0.013	267.0	194.0	272.0	200.0	268.2	195.3	**3.9**	3.8	17.5	no change
P-EB-09	J-EB-09	J-EB-08	15.2	128.5	36 inch	79	0.127	0.024	194.0	184.0	200.0	190.0	195.2	185.4	**4.8**	3.0	12.2	no change
P-EB-08	J-EB-08	J-EB-07	18.8	96.1	36 inch	325	0.071	0.024	184.0	161.0	190.0	186.0	185.4	163.2	**4.6**	3.0	10.6	no change
P-EB-07	J-EB-07	I-EB-06	40.2	101.4	36 inch	165	0.079	0.024	161.0	148.0	186.0	153.0	163.1	150.1	**22.9**	22.0	13.5	no change
P-EB-06	I-EB-06	I-EB-05	39.9	110.9	36 inch	462	0.094	0.024	148.0	104.5	153.0	110.0	150.1	107.2	**2.9**	2.0	14.4	no change
P-EB-05	I-EB-05	J-EB-04	47.5	118.8	27 inch	214	0.147	0.013	104.5	73.0	110.0	78.0	106.7	75.6	**3.3**	3.3	28.2	no change
P-EB-04	J-EB-04	I-EB-03	56.7	107.5	27 inch	224	0.121	0.013	73.0	46.0	78.0	52.0	75.2	50.3	**2.8**	2.8	27.4	no change
P-EB-03	I-EB-03	J-EB-02	61.4	85.0	30 inch	163	0.043	0.013	46.0	39.0	52.0	44.0	48.4	43.6	**3.6**	3.5	18.9	no change
P-EB-02	J-EB-02	I-EB-01	61.0	61.5	30 inch	178	0.022	0.013	39.0	35.0	44.0	39.0	42.5	38.6	**1.5**	2.5	12.4	no change
P-EB-01	I-EB-01	O-EB	80.9	133.3	3 x 2 ft	134	0.075	0.013	35.0	25.0	39.0	29.0	37.0	28.0	**2.0**	2.0	13.5	no change

(1) Pipes are presented in Figure 2 and Figure D-EB in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-E3A TO D-E3D

FIGURE D-EC
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E3a

Existing Hydrology, 10-Year Event, System EC

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Cambridge Street													
I-EC-07-03	16.00	11.00	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
J-EC-07-02	14.50	9.50	0.00		0.00	0.00	0.00	0.0	0.0	10.0	0.00	0.00	**0.0**
I-EC-07-01	10.50	6.50	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
Hiller Avenue													
I-EC-05-02	7.60	4.00	2.02		0.50	1.01	2.02	1.0	10.0	10.0	2.04	0.00	**2.1**
I-EC-05-01	7.50	4.00	3.76		0.50	1.88	5.78	2.9	10.0	10.3	2.01	0.00	**5.9**
Chesterton Avenue													
I-EC-03-02W-01	7.90	3.90	0.70		0.50	0.35	0.70	0.4	10.0	10.0	2.04	0.00	**0.7**
J-EC-03-05W	7.60	3.60	0.00		0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00	**0.0**
I-EC-03-04W	7.20	3.20	14.60		0.50	7.30	14.60	7.3	10.0	10.0	2.04	0.00	**15.0**
I-EC-03-03W	7.20	3.10	1.26		0.50	0.63	15.86	7.9	10.0	10.1	2.03	0.00	**16.2**
J-EC-03-02W	7.80	1.80	0.00	0.70	0.00	0.00	16.56	8.3	0.0	11.9	1.87	0.00	**15.6**
I-EC-03-01W	7.60	1.70	4.00		0.50	2.00	20.56	10.3	10.0	12.5	1.82	0.00	**18.9**
I-EC-03-01E	7.60	3.90	4.37		0.50	2.19	24.93	2.2	10.0	10.0	2.04	0.00	**4.5**
Oxford Place													
I-EC-02-01-01	8.00	4.00	3.00		0.50	1.50	3.00	1.5	10.0	10.0	2.04	0.00	**3.1**
I-EC-02-03	8.00	4.00	0.19		0.50	0.10	0.19	0.1	10.0	10.0	2.04	0.00	**0.2**
I-EC-02-02	8.00	3.90	0.00		0.00	0.00	0.19	0.1	10.0	13.8	1.73	0.00	**0.2**
J-EC-02-01	8.00	3.80	0.00	3.00	0.00	0.00	3.19	1.6	0.0	19.3	1.47	0.00	**2.4**
I-EC-01-01	6.30	2.30	3.33		0.80	2.66	3.33	2.7	10.0	10.0	2.04	0.00	**5.5**
Marine View Avenue													
I-EC-14	128.00	123.00	0.32		0.50	0.16	0.32	0.2	10.0	10.0	2.04	0.00	**0.3**
I-EC-13	122.80	117.80	18.80		0.50	9.40	19.12	9.6	10.0	10.2	2.02	0.00	**19.5**
I-EC-12	124.00	114.00	1.66		0.50	0.83	20.78	10.4	10.0	10.2	2.02	0.00	**21.1**
I-EC-11	102.60	93.60	5.18		0.50	2.59	25.96	13.0	10.0	10.5	1.99	0.00	**26.1**
J-EC-10	60.00	54.50	0.00		0.00	0.00	25.96	13.0	0.0	10.7	1.97	0.00	**25.8**
I-EC-09	32.20	28.20	0.00		0.50	0.00	25.96	13.0	10.0	11.0	1.94	0.00	**25.4**
I-EC-08	10.00	5.00	13.30		0.80	10.64	39.26	23.6	10.0	11.6	1.89	0.00	**45.0**
J-EC-07	8.30	4.20	0.00	0.00	0.00	0.00	39.26	23.6	0.0	11.7	1.88	0.00	**44.9**
I-EC-06	7.30	4.10	8.78		0.50	4.39	48.04	28.0	10.0	12.0	1.86	0.00	**52.6**
J-EC-05	7.50	4.00	0.00	5.78	0.00	0.00	53.82	30.9	0.0	12.2	1.85	0.00	**57.5**
I-EC-04	7.40	3.90	2.00		0.50	1.00	55.82	31.9	10.0	12.3	1.84	0.00	**59.2**
J-EC-03	8.20	1.60	0.00	24.93	0.00	0.00	80.75	44.4	0.0	13.3	1.77	0.00	**79.0**
J-EC-02	6.90	0.90	0.00	3.19	0.00	0.00	83.94	46.0	0.0	20.9	1.41	0.00	**65.3**
J-EC-01	6.20	-0.30	0.00	3.33	0.00	0.00	87.27	48.6	0.0	21.8	1.38	0.00	**67.7**
O-EC	6.10	-0.50	0.00		0.00	0.00	87.27	48.6	0.0	21.9	1.38	0.00	**67.5**

(1) Nodes are presented in Figure D-EC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-E-3b

Existing Hydraulics, 10-Year Event, System EC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Cambridge Street																	
P-EC-07-03	I-EC-07-03	J-EC-07-02	0.0	6.1	12 inch	52	0.029	0.013	11.00	9.50	16.00	14.50	11.00	9.50	**5.0**	4.0	0.0
P-EC-07-02	J-EC-07-02	I-EC-07-01	0.0	11.1	15 inch	102	0.029	0.013	9.50	6.50	14.50	10.50	9.50	8.30	**5.0**	3.8	0.0
P-EC-07-01	I-EC-07-01	J-EC-07	0.0	18.3	24 inch	351	0.007	0.013	6.50	4.20	10.50	8.30	8.30	8.30	**2.2**	2.0	0.0
Hiller Avenue																	
P-EC-05-02	I-EC-05-02	I-EC-05-01	2.1	0.0	12 inch	40	0.000	0.013	4.00	4.00	7.60	7.50	7.64	7.50	**ABOVE RIM**	2.6	2.6
P-EC-05-01	I-EC-05-01	J-EC-05	5.9	0.0	12 inch	300	0.000	0.013	4.00	4.00	7.50	7.50	15.63	7.50	**ABOVE RIM**	2.5	7.5
Chesterton Avenue																	
P-EC-03-02W-01	I-EC-03-02W-01	J-EC-03-02W	0.7	6.7	12 inch	102	0.021	0.010	3.90	1.80	7.90	7.80	7.82	7.80	**0.1**	3.0	0.9
P-EC-03-05W	J-EC-03-05W	I-EC-03-04W	0.0	1.6	12 inch	202	0.002	0.013	3.60	3.20	7.60	7.20	7.20	7.20	**0.4**	3.0	0.0
P-EC-03-04W	I-EC-03-04W	I-EC-03-03W	15.0	2.3	15 inch	80	0.001	0.013	3.20	3.10	7.20	7.20	11.51	7.20	**ABOVE RIM**	2.8	12.2
P-EC-03-03W	I-EC-03-03W	J-EC-03-02W	16.2	7.8	18 inch	236	0.006	0.013	3.10	1.80	7.20	7.80	13.42	7.80	**ABOVE RIM**	2.6	9.2
P-EC-03-02W	J-EC-03-02W	I-EC-03-01W	15.6	1.8	18 inch	354	0.000	0.013	1.80	1.70	7.80	7.60	15.43	7.60	**ABOVE RIM**	4.5	8.8
P-EC-03-01W	I-EC-03-01W	J-EC-03	18.9	2.6	21 inch	377	0.000	0.013	1.70	1.60	7.60	8.20	13.55	8.20	**ABOVE RIM**	4.2	7.9
P-EC-03-01E	I-EC-03-01E	J-EC-03	4.5	2.9	12 inch	344	0.007	0.013	3.90	1.60	7.60	8.20	13.66	8.20	**ABOVE RIM**	2.7	5.7
Oxford Place																	
P-EC-02-01-01	I-EC-02-01-01	J-EC-02-01	3.1	2.4	12 inch	46	0.004	0.013	4.00	3.80	8.00	8.00	5.07	4.73	**2.9**	3.0	3.9
P-EC-02-03	I-EC-02-03	I-EC-02-02	0.2	0.8	12 inch	194	0.001	0.013	4.00	3.90	8.00	8.00	4.55	4.54	**3.5**	3.0	0.9
P-EC-02-02	I-EC-02-02	J-EC-02-01	0.2	0.7	12 inch	231	0.000	0.013	3.90	3.80	8.00	8.00	4.54	4.54	**3.5**	3.1	0.7
P-EC-02-01	J-EC-02-01	J-EC-02	2.4	3.1	12 inch	390	0.007	0.013	3.80	.90	8.00	6.90	4.34	3.01	**3.7**	3.2	4.0
P-EC-01-01	I-EC-01-01	J-EC-01	5.5	4.7	12 inch	148	0.018	0.013	2.30	- .30	6.30	6.20	5.43	1.93	**0.9**	3.0	7.0
Marine View Avenue																	
P-EC-14	I-EC-14	I-EC-13	0.3	19.2	15 inch	59	0.088	0.013	123.00	117.80	128.00	122.80	123.22	122.62	**4.8**	3.8	5.9
P-EC-13	I-EC-13	I-EC-12	19.5	21.0	15 inch	36	0.106	0.013	117.80	114.00	122.80	124.00	120.49	117.22	**2.3**	3.8	15.9
P-EC-12	I-EC-12	I-EC-11	21.1	28.6	18 inch	276	0.074	0.013	114.00	93.60	124.00	102.60	115.47	95.77	**8.5**	8.5	17.7
P-EC-11	I-EC-11	J-EC-10	26.1	37.0	18 inch	315	0.124	0.013	93.60	54.50	102.60	60.00	95.09	58.67	**7.5**	7.5	22.7
P-EC-10	J-EC-10	I-EC-09	25.8	35.6	18 inch	386	0.068	0.010	54.50	28.20	60.00	32.20	55.99	32.20	**4.0**	4.0	22.0
P-EC-09	I-EC-09	I-EC-08	25.4	21.3	18 inch	562	0.041	0.013	28.20	5.00	32.20	10.00	42.98	10.00	**ABOVE RIM**	2.5	14.4
P-EC-08	I-EC-08	J-EC-07	45.0	2.7	15 inch	130	0.006	0.024	5.00	4.20	10.00	8.30	223.22	8.30	**ABOVE RIM**	3.8	36.7
P-EC-07	J-EC-07	I-EC-06	44.9	4.8	24 inch	219	0.000	0.013	4.20	4.10	8.30	7.30	15.92	7.30	**ABOVE RIM**	2.1	14.3
P-EC-06	I-EC-06	J-EC-05	52.6	4.6	24 inch	240	0.000	0.013	4.10	4.00	7.30	7.50	20.50	7.50	**ABOVE RIM**	1.2	16.8
P-EC-05	J-EC-05	I-EC-04	57.5	16.3	30 inch	63	0.002	0.013	4.00	3.90	7.50	7.40	8.64	7.40	**ABOVE RIM**	1.0	11.7
P-EC-04	I-EC-04	J-EC-03	59.2	40.8	30 inch	233	0.010	0.013	3.90	1.60	7.40	8.20	13.05	8.20	**ABOVE RIM**	1.0	12.1
P-EC-03	J-EC-03	J-EC-02	79.0	31.1	30 inch	122	0.006	0.013	1.60	.90	8.20	6.90	7.91	3.36	**0.3**	4.1	16.1
P-EC-02	J-EC-02	J-EC-01	65.3	83.5	48 inch	355	0.003	0.013	.90	- .30	6.90	6.20	3.00	1.95	**3.9**	2.0	6.8
P-EC-01	J-EC-01	O-EC	67.7	79.1	48 inch	66	0.003	0.013	- .30	- .50	6.20	6.10	1.91	1.57	**4.3**	2.5	6.6

(1) Pipes are presented in Figure 2 and Figure D-EC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-E3c

Proposed Hydrology, 25-Year Event, System EC

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Cambridge Street													
I-EC-07-03	16.00	11.00	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
J-EC-07-02	14.50	9.50	0.00		0.00	0.00	0.00	0.0	0.0	10.0	0.00	0.00	**0.0**
I-EC-07-01	10.50	6.50	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
Hiller Avenue													
I-EC-05-02	7.60	4.00	2.02		0.55	1.11	2.02	1.1	10.0	10.0	2.44	0.00	**2.7**
I-EC-05-01	7.50	4.00	3.76		0.55	2.07	5.78	3.2	10.0	10.8	2.35	0.00	**7.5**
Chesterton Avenue													
I-EC-03-02W-01	7.90	3.90	0.70		0.55	0.39	0.70	0.4	10.0	10.0	2.44	0.00	**1.0**
J-EC-03-05W	7.60	3.60	0.00		0.00	0.00	0.00	0.0	0.0	0.0	0.00	0.00	**0.0**
I-EC-03-04W	7.20	3.20	14.60		0.55	8.03	14.60	8.0	10.0	10.0	2.44	0.00	**19.7**
I-EC-03-03W	7.20	3.10	1.26		0.55	0.69	15.86	8.7	10.0	10.4	2.40	0.00	**21.1**
J-EC-03-02W	7.80	1.80	0.00	0.70	0.00	0.00	16.56	9.1	0.0	11.4	2.28	0.00	**21.0**
I-EC-03-01W	7.60	1.70	4.00		0.55	2.20	20.56	11.3	10.0	15.0	1.99	0.00	**22.7**
I-EC-03-01E	7.60	3.90	4.37		0.55	2.40	24.93	2.4	10.0	10.0	2.44	0.00	**5.9**
Oxford Place													
I-EC-02-01-01	8.00	4.00	3.00		0.55	1.65	3.00	1.7	10.0	10.0	2.44	0.00	**4.1**
I-EC-02-03	8.00	4.00	0.19		0.55	0.10	0.19	0.1	10.0	10.0	2.44	0.00	**0.3**
I-EC-02-02	8.00	3.90	0.00		0.00	0.00	0.19	0.1	10.0	19.9	1.73	0.00	**0.2**
J-EC-02-01	8.00	3.80	0.00	3.00	0.00	0.00	3.19	1.8	0.0	36.5	1.28	0.00	**2.3**
I-EC-01-01	6.30	2.30	3.33		0.88	2.93	3.33	2.9	10.0	10.0	2.44	0.00	**7.2**
Marine View Avenue													
I-EC-14	128.00	123.00	0.32		0.55	0.18	0.32	0.2	10.0	10.0	2.44	0.00	**0.4**
I-EC-13	122.80	117.80	18.80		0.55	10.34	19.12	10.5	10.0	10.2	2.42	0.00	**25.7**
I-EC-12	124.00	115.00	1.66		0.55	0.91	20.78	11.4	10.0	10.2	2.42	0.00	**27.8**
I-EC-11	102.60	93.60	5.18		0.55	2.85	25.96	14.3	10.0	10.4	2.39	0.00	**34.4**
J-EC-10	60.00	54.00	0.00		0.00	0.00	25.96	14.3	0.0	10.7	2.36	0.00	**34.0**
I-EC-09	32.20	28.20	0.00		0.55	0.00	25.96	14.3	10.0	11.0	2.33	0.00	**33.5**
I-EC-08	10.00	5.00	13.30		0.88	11.70	39.26	26.0	10.0	11.5	2.27	0.00	**59.5**
J-EC-07	8.30	2.80	0.00	0.00	0.00	0.00	39.26	26.0	0.0	11.7	2.26	0.00	**59.1**
I-EC-06	7.50	2.00	8.78		0.55	4.83	48.04	30.8	10.0	12.2	2.21	0.00	**68.7**
J-EC-05	7.50	1.90	0.00	5.78	0.00	0.00	53.82	34.0	0.0	13.1	2.13	0.00	**73.1**
I-EC-04	7.40	1.75	2.00		0.55	1.10	55.82	35.1	10.0	13.2	2.12	0.00	**75.0**
J-EC-03	8.20	1.60	0.00	24.93	0.00	0.00	80.75	48.8	0.0	18.4	1.80	0.00	**88.4**
J-EC-02	6.90	0.90	0.00	3.19	0.00	0.00	83.94	50.6	0.0	38.8	1.24	0.00	**63.1**
J-EC-01	6.20	-0.30	0.00	3.33	0.00	0.00	87.27	53.5	0.0	40.3	1.22	0.00	**65.5**
O-EC	6.10	-0.35	0.00		0.00	0.00	87.27	53.5	0.0	40.5	1.21	0.00	**65.3**

(1) Nodes are presented in Figure D-EC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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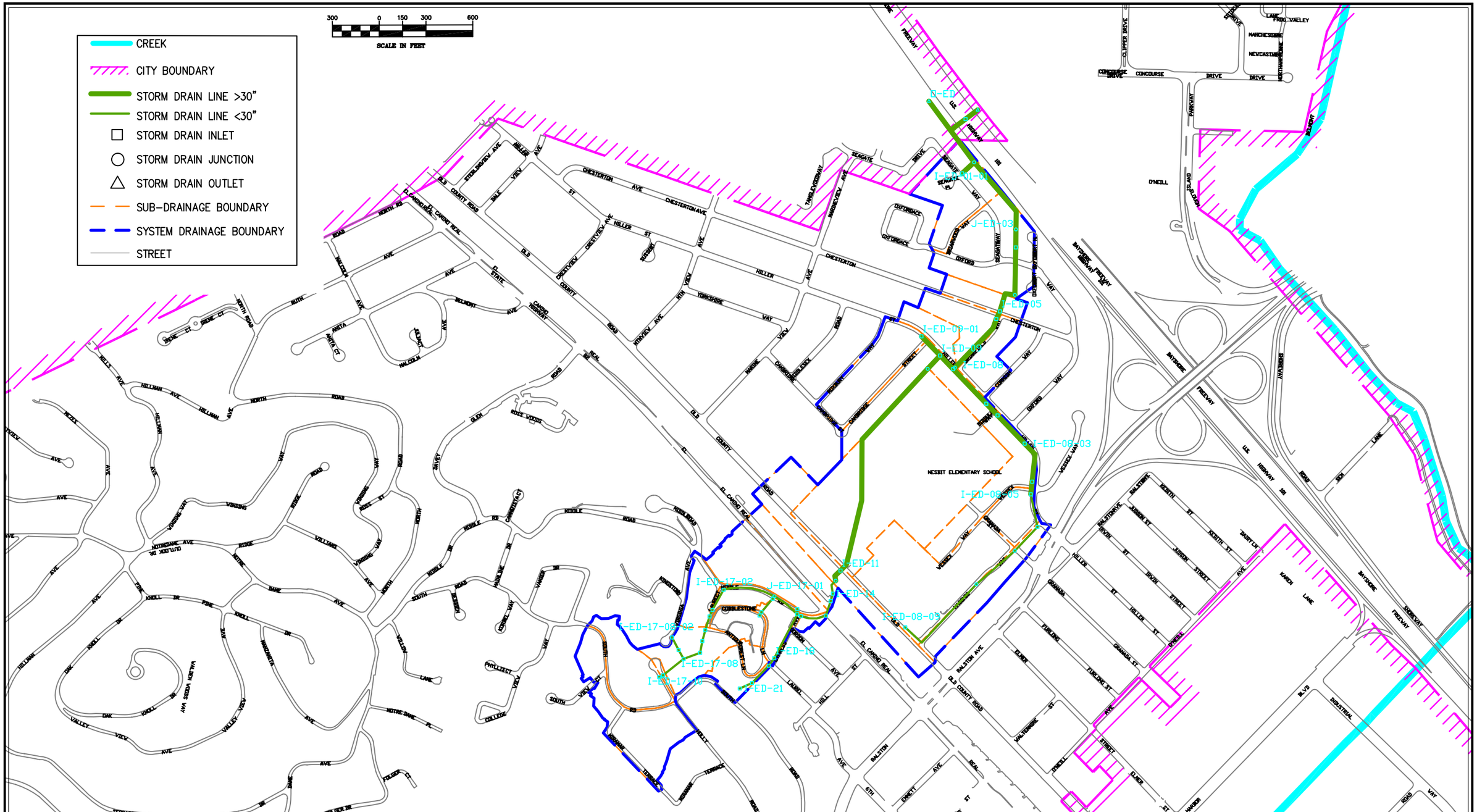
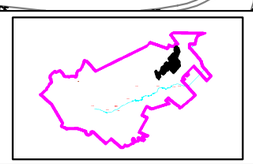
Table E3d

Proposed Hydraulics, 25-Year Event, System EC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Cambridge Street																		
P-EC-07-03	I-EC-07-03	J-EC-07-02	0.0	6.1	12 inch	52	0.029	0.013	11.0	9.5	16.0	14.5	11.0	9.5	**5.0**	4.0	0.0	no change
P-EC-07-02	J-EC-07-02	I-EC-07-01	0.0	11.1	15 inch	102	0.029	0.013	9.5	6.5	14.5	10.5	9.5	6.5	**5.0**	3.8	0.0	no change
P-EC-07-01	I-EC-07-01	J-EC-07	0.0	23.2	24 inch	351	0.011	0.013	6.5	2.8	10.5	8.3	6.5	6.5	**4.0**	2.0	0.0	no change
Hiller Avenue																		
P-EC-05-02	I-EC-05-02	I-EC-05-01	2.7	0.0	24 inch	40	0.000	0.013	4.0	4.0	7.6	7.5	6.5	6.5	**1.1**	1.6	0.9	upsized
P-EC-05-01	I-EC-05-01	J-EC-05	7.5	18.9	24 inch	300	0.007	0.013	4.0	1.9	7.5	7.5	6.4	6.1	**1.1**	1.5	2.4	upsized
Chesterton Avenue																		
P-EC-03-02W-01	I-EC-03-02W-01	J-EC-03-02W	1.0	6.7	12 inch	102	0.021	0.010	3.9	1.8	7.9	7.8	5.9	5.9	**2.0**	3.0	1.2	no change
P-EC-03-05W	J-EC-03-05W	I-EC-03-04W	0.0	1.6	12 inch	202	0.002	0.013	3.6	3.2	7.6	7.2	6.2	6.2	**1.4**	3.0	0.0	no change
P-EC-03-04W	I-EC-03-04W	I-EC-03-03W	19.7	23.6	36 inch	80	0.001	0.013	3.2	3.1	7.2	7.2	6.2	6.1	**1.0**	1.0	3.7	upsized
P-EC-03-03W	I-EC-03-03W	J-EC-03-02W	21.1	53.6	36 inch	236	0.006	0.012	3.1	1.8	7.2	7.8	6.1	5.9	**1.1**	1.1	7.1	upsized
P-EC-03-02W	J-EC-03-02W	I-EC-03-01W	21.0	26.2	48 inch	354	0.000	0.012	1.8	1.7	7.8	7.6	5.9	5.8	**1.9**	2.0	1.7	upsized
P-EC-03-01W	I-EC-03-01W	J-EC-03	22.7	25.3	48 inch	377	0.000	0.012	1.7	1.6	7.6	8.2	5.8	5.7	**1.8**	1.9	1.8	upsized
P-EC-03-01E	I-EC-03-01E	J-EC-03	5.9	8.6	18 inch	344	0.007	0.013	3.9	1.6	7.6	8.2	6.8	5.7	**0.9**	2.2	3.3	upsized
Oxford Place																		
P-EC-02-01-01	I-EC-02-01-01	J-EC-02-01	4.1	2.4	12 inch	46	0.004	0.013	4.0	3.8	8.0	8.0	7.9	7.3	**0.2**	3.0	5.2	no change
P-EC-02-03	I-EC-02-03	I-EC-02-02	0.3	0.8	12 inch	194	0.001	0.013	4.0	3.9	8.0	8.0	7.2	7.2	**0.8**	3.0	0.3	no change
P-EC-02-02	I-EC-02-02	J-EC-02-01	0.2	0.7	12 inch	231	0.000	0.013	3.9	3.8	8.0	8.0	7.2	7.2	**0.8**	3.1	0.2	no change
P-EC-02-01	J-EC-02-01	J-EC-02	2.3	3.1	12 inch	390	0.007	0.013	3.8	.9	8.0	6.9	7.1	5.5	**0.9**	3.2	2.9	no change
P-EC-01-01	I-EC-01-01	J-EC-01	7.2	4.7	12 inch	148	0.018	0.013	2.3	- .3	6.3	6.2	11.2	5.2	**ABOVE RIM**	3.0	9.2	no change
Marine View Avenue																		
P-EC-14	I-EC-14	I-EC-13	0.4	19.2	15 inch	59	0.088	0.013	123.0	117.8	128.0	122.8	123.3	122.8	**4.7**	3.8	6.4	no change
P-EC-13	I-EC-13	I-EC-12	25.7	18.0	15 inch	36	0.078	0.013	117.8	115.0	122.8	124.0	125.2	119.5	**ABOVE RIM**	3.8	20.9	no change
P-EC-12	I-EC-12	I-EC-11	27.8	29.3	18 inch	276	0.078	0.013	115.0	93.6	124.0	102.6	116.5	96.3	**7.5**	7.5	18.8	no change
P-EC-11	I-EC-11	J-EC-10	34.4	37.2	18 inch	315	0.126	0.013	93.6	54.0	102.6	60.0	95.1	60.0	**7.5**	7.5	23.9	no change
P-EC-10	J-EC-10	I-EC-09	34.0	27.2	18 inch	386	0.067	0.013	54.0	28.2	60.0	32.2	71.8	31.3	**ABOVE RIM**	4.5	19.2	no change
P-EC-09	I-EC-09	I-EC-08	33.5	49.8	24 inch	562	0.041	0.012	28.2	5.0	32.2	10.0	30.1	7.6	**2.1**	2.0	17.0	upsized
P-EC-08	I-EC-08	J-EC-07	59.5	94.0	36 inch	130	0.017	0.012	5.0	2.8	10.0	8.3	7.5	6.5	**2.5**	2.0	14.1	upsized
P-EC-07	J-EC-07	I-EC-06	59.1	128.8	54 inch	219	0.004	0.012	2.8	2.0	8.3	7.5	6.5	6.4	**1.8**	1.0	7.9	upsized
P-EC-06	I-EC-06	J-EC-05	68.7	43.5	54 inch	240	0.000	0.012	2.0	1.9	7.5	7.5	6.3	6.1	**1.2**	1.0	4.3	upsized
P-EC-05	J-EC-05	I-EC-04	73.1	104.0	54 inch	63	0.002	0.012	1.9	1.8	7.5	7.4	6.0	6.0	**1.5**	1.1	7.1	upsized
P-EC-04	I-EC-04	J-EC-03	75.0	54.1	54 inch	233	0.001	0.012	1.8	1.6	7.4	8.2	6.0	5.7	**1.5**	1.2	4.7	upsized
P-EC-03	J-EC-03	J-EC-02	88.4	161.4	54 inch	122	0.006	0.012	1.6	.9	8.2	6.9	5.6	5.5	**2.6**	2.1	10.4	upsized
P-EC-02	J-EC-02	J-EC-01	63.1	123.9	54 inch	355	0.003	0.012	.9	- .3	6.9	6.2	5.5	5.2	**1.4**	1.5	4.0	upsized
P-EC-01	J-EC-01	O-EC	65.5	58.6	54 inch	66	0.0	0.012	- .3	- .4	6.2	6.1	5.2	5.1	**1.0**	2.0	4.1	upsized

(1) Pipes are presented in Figure 2 and Figure D-EC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-E4A TO D-E4D

FIGURE D-ED
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E4a

Existing Hydrology, 10-Year Event, System ED

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Virginia Avenue													
I-ED-17-08-02	192.00	188.00	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-ED-17-08-01	180.00	178.00	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
Cobblestone Lane													
I-ED-17-01-03	104.50	100.50	1.41		0.80	1.13	1.41	1.1	10.0	10.0	2.12	0.00	**2.4**
I-ED-17-01-02	104.10	100.10	0.22		0.50	0.11	1.63	1.2	10.0	10.1	2.12	0.00	**2.6**
I-ED-17-01-01	74.50	71.50	0.88		0.50	0.44	2.51	1.7	10.0	10.2	2.10	0.00	**3.6**
I-ED-17-01N	61.50	57.50	4.34		0.50	2.17	6.85	2.2	10.0	10.0	2.12	0.00	**4.7**
Middle Road/Laurel Road													
I-ED-17-10	214.00	211.50	9.50		0.50	4.75	9.50	4.8	10.0	10.0	2.12	0.00	**10.2**
I-ED-17-09	214.00	208.50	0.20		0.50	0.10	9.70	4.9	10.0	10.0	2.12	0.00	**10.4**
I-ED-17-08	184.00	177.00	3.07	0.00	0.50	1.53	12.77	6.4	10.0	10.1	2.11	0.00	**13.6**
I-ED-17-07	180.00	176.00	0.00		0.00	0.00	12.77	6.4	10.0	10.3	2.10	0.00	**13.5**
I-ED-17-06	158.00	154.00	0.00		0.00	0.00	12.77	6.4	10.0	10.3	2.09	0.00	**13.5**
I-ED-17-05	142.00	138.00	0.00		0.50	0.00	12.77	6.4	10.0	10.4	2.09	0.00	**13.4**
I-ED-17-04	140.00	136.00	0.00		0.00	0.00	12.77	6.4	10.0	10.4	2.08	0.00	**13.4**
I-ED-17-03	118.90	114.90	0.00		0.00	0.00	12.77	6.4	10.0	10.5	2.08	0.00	**13.4**
I-ED-17-02	99.50	96.00	2.06		0.50	1.03	14.83	7.4	10.0	10.6	2.06	0.00	**15.4**
J-ED-17-01	75.00	71.00	0.00	6.85	0.00	0.00	21.68	9.1	0.0	11.0	2.03	0.00	**18.6**
Hiller Avenue													
I-ED-09-01	7.80	3.80	5.86		0.50	2.93	5.86	2.9	10.0	10.0	2.12	0.00	**6.3**
I-ED-08-09	31.60	26.60	12.26		0.80	9.81	12.26	9.8	10.0	10.0	2.12	0.00	**21.0**
J-ED-08-08	22.80	17.80	0.00		0.00	0.00	12.26	9.8	0.0	10.9	2.03	0.00	**20.1**
J-ED-08-07	16.50	11.50	0.00		0.00	0.00	12.26	9.8	0.0	11.4	1.99	0.00	**19.7**
I-ED-08-06	14.70	9.70	0.00		0.50	0.00	12.26	9.8	10.0	11.7	1.96	0.00	**19.4**
I-ED-08-05	11.50	6.50	1.90		0.50	0.95	14.16	10.8	10.0	12.0	1.94	0.00	**21.0**
I-ED-08-04	10.90	5.90	0.00		0.00	0.00	14.16	10.8	10.0	12.2	1.93	0.00	**20.9**
I-ED-08-03	10.40	4.80	4.04		0.50	2.02	18.20	12.8	10.0	12.5	1.90	0.00	**24.4**
I-ED-08-02	9.60	4.60	0.00		0.50	0.00	18.20	12.8	10.0	12.8	1.87	0.00	**24.1**
I-ED-08-01	9.50	4.50	0.00		0.00	0.00	18.20	12.8	10.0	13.0	1.87	0.00	**24.0**
Seagate Place													
I-ED-01-01	3.60	0.25	4.28		0.50	2.14	4.28	2.1	10.0	10.0	2.12	0.00	**4.6**
Cypruss Road													
I-ED-21	160.00	156.00	1.45		0.50	0.73	1.45	0.7	10.0	10.0	2.12	0.00	**1.6**
I-ED-20	136.00	132.00	0.00		0.00	0.00	1.45	0.7	10.0	10.1	2.11	0.00	**1.5**
I-ED-19	120.00	115.50	0.63		0.50	0.32	2.08	1.0	10.0	10.4	2.09	0.00	**2.2**
I-ED-18	110.00	105.00	1.33		0.50	0.67	3.41	1.7	10.0	10.4	2.08	0.00	**3.6**
I-ED-17	61.20	56.20	0.05	21.68	0.50	0.03	25.14	13.0	10.0	11.1	2.01	0.00	**26.4**
I-ED-16	60.00	55.00	0.33		0.50	0.17	25.47	13.2	10.0	11.2	2.01	0.00	**26.7**
I-ED-15	45.00	42.00	0.00		0.80	0.00	25.47	13.2	10.0	11.3	2.00	0.00	**26.5**
I-ED-14	42.00	32.00	2.49		0.50	1.25	27.96	14.4	10.0	11.4	1.99	0.00	**28.9**
I-ED-13	41.50	30.00	0.00		0.50	0.00	27.96	14.4	10.0	11.4	1.99	0.00	**28.8**
J-ED-12	33.00	28.00	0.00		0.00	0.00	27.96	14.4	0.0	11.6	1.97	0.00	**28.6**
I-ED-11	32.90	27.90	26.05		0.50	13.03	54.01	27.4	10.0	11.8	1.96	0.00	**54.2**
J-ED-10	10.80	4.80	0.00		0.00	0.00	54.01	27.4	0.0	14.0	1.80	0.00	**49.6**
I-ED-09	8.20	2.40	4.03	5.86	0.50	2.02	63.90	32.4	10.0	14.2	1.78	0.00	**58.1**
I-ED-08	8.30	2.30	4.61	18.20	0.50	2.31	86.71	47.5	10.0	14.4	1.77	0.00	**84.6**
Briarfield Way													
J-ED-07	8.30	2.30	0.00	86.71	0.00	0.00	86.71	47.5	0.0	14.5	1.77	0.00	**84.5**
I-ED-06	7.50	1.50	0.00		0.50	0.00	86.71	47.5	10.0	14.9	1.74	0.00	**83.1**
I-ED-05	7.70	1.50	8.01		0.50	4.00	94.72	51.5	10.0	15.0	1.73	0.00	**90.0**
J-ED-04	8.50	1.00	0.00		0.00	0.00	94.72	51.5	0.0	15.4	1.71	0.00	**88.7**
J-ED-03	8.00	0.50	0.00		0.50	0.00	94.72	51.5	10.0	16.2	1.67	0.00	**86.5**
J-ED-02	8.00	0.25	0.00		0.00	0.00	94.72	51.5	0.0	16.5	1.65	0.00	**85.8**
J-ED-01	8.00	0.00	0.00	4.28	0.00	0.00	99.00	53.6	0.0	18.5	1.56	0.00	**84.3**
O-ED	9.00	-0.25	0.00		0.00	0.00	99.00	53.6	0.0	20.4	1.49	0.00	**80.3**

(1) Nodes are presented in Figure D-ED in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

STORM DRAIN MASTER PLAN

Table D-E4b

Existing Hydraulics, 10-Year Event, System ED

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Virginia Avenue																	
P-ED-17-08-02	I-ED-17-08-02	I-ED-17-08-01	0.0	4.0	8 inch	90	0.111	0.013	188.00	178.00	192.00	180.00	188.00	180.00	**4.0**	3.3	0.0
P-ED-17-08-01	I-ED-17-08-01	I-ED-17-08	0.0	1.5	8 inch	65	0.015	0.013	178.00	177.00	180.00	184.00	184.00	184.00	**ABOVE RIM**	1.3	0.0
Cobblestone Lane																	
P-ED-17-01N	I-ED-17-01N	I-ED-17	4.7	7.1	12 inch	33	0.039	0.013	57.50	56.20	61.50	61.20	61.76	61.20	**ABOVE RIM**	3.0	5.9
P-ED-17-01-03	I-ED-17-01-03	I-ED-17-01-02	2.4	4.6	12 inch	24	0.017	0.013	100.50	100.10	104.50	104.10	101.17	100.87	**3.3**	3.0	5.9
P-ED-17-01-02	I-ED-17-01-02	I-ED-17-01-01	2.6	17.9	12 inch	113	0.253	0.013	100.10	71.50	104.10	74.50	100.80	72.94	**3.3**	3.0	16.3
P-ED-17-01-01	I-ED-17-01-01	J-ED-17-01	3.6	5.8	12 inch	19	0.026	0.013	71.50	71.00	74.50	75.00	72.85	72.66	**1.7**	2.0	4.5
Middle Road/Laurel Road																	
P-ED-17-10	I-ED-17-10	I-ED-17-09	10.2	11.9	12 inch	27	0.111	0.013	211.50	208.50	214.00	214.00	212.60	210.40	**1.4**	1.5	13.0
P-ED-17-09	I-ED-17-09	I-ED-17-08	10.4	20.0	12 inch	169	0.186	0.010	208.50	177.00	214.00	184.00	209.49	184.00	**4.5**	4.5	25.7
P-ED-17-08	I-ED-17-08	I-ED-17-07	13.6	4.4	12 inch	113	0.009	0.010	177.00	176.00	184.00	180.00	189.70	180.00	**ABOVE RIM**	6.0	17.3
P-ED-17-07	I-ED-17-07	I-ED-17-06	13.5	19.2	12 inch	76	0.289	0.013	176.00	154.00	180.00	158.00	177.00	156.11	**3.0**	3.0	26.4
P-ED-17-06	I-ED-17-06	I-ED-17-05	13.5	16.8	12 inch	72	0.222	0.013	154.00	138.00	158.00	142.00	155.00	142.00	**3.0**	3.0	23.8
P-ED-17-05	I-ED-17-05	I-ED-17-04	13.4	5.2	12 inch	93	0.022	0.013	138.00	136.00	142.00	140.00	151.51	138.28	**ABOVE RIM**	3.0	17.1
P-ED-17-04	I-ED-17-04	I-ED-17-03	13.4	24.1	12 inch	46	0.459	0.013	136.00	114.90	140.00	118.90	137.00	118.90	**3.0**	3.0	31.5
P-ED-17-03	I-ED-17-03	I-ED-17-02	13.4	12.8	12 inch	147	0.129	0.013	114.90	96.00	118.90	99.50	118.84	98.16	**0.1**	3.0	17.0
P-ED-17-02	I-ED-17-02	J-ED-17-01	15.4	28.6	18 inch	337	0.074	0.013	96.00	71.00	99.50	75.00	97.41	72.93	**2.1**	2.0	16.5
P-ED-17-01	J-ED-17-01	I-ED-17	18.6	29.6	18 inch	186	0.080	0.013	71.00	56.20	75.00	61.20	72.46	61.20	**2.5**	2.5	17.7
Hiller Avenue																	
P-ED-09-1	I-ED-09-01	I-ED-09	6.3	5.8	15 inch	172	0.008	0.013	3.80	2.40	7.80	8.20	9.82	8.20	**ABOVE RIM**	2.8	5.1
P-ED-08-09	I-ED-08-09	J-ED-08-08	21.0	12.2	18 inch	657	0.013	0.013	26.60	17.80	31.60	22.80	49.06	22.80	**ABOVE RIM**	3.5	11.9
P-ED-08-08	J-ED-08-08	J-ED-08-07	20.1	14.6	18 inch	327	0.019	0.013	17.80	11.50	22.80	16.50	28.47	16.50	**ABOVE RIM**	3.5	11.4
P-ED-08-07	J-ED-08-07	I-ED-08-06	19.7	9.7	18 inch	211	0.009	0.013	11.50	9.70	16.50	14.70	22.10	14.70	**ABOVE RIM**	3.5	11.1
P-ED-08-06	I-ED-08-06	I-ED-08-05	19.4	12.9	18 inch	213	0.015	0.013	9.70	6.50	14.70	11.50	18.77	11.50	**ABOVE RIM**	3.5	11.0
P-ED-08-05	I-ED-08-05	I-ED-08-04	21.0	9.0	18 inch	81	0.007	0.013	6.50	5.90	11.50	10.90	14.13	10.90	**ABOVE RIM**	3.5	11.9
P-ED-08-04	I-ED-08-04	I-ED-08-03	20.9	6.7	18 inch	272	0.004	0.013	5.90	4.80	10.90	10.40	21.16	10.40	**ABOVE RIM**	3.5	11.8
P-ED-08-03	I-ED-08-03	I-ED-08-02	24.4	3.0	18 inch	251	0.001	0.013	4.80	4.60	10.40	9.60	23.18	9.60	**ABOVE RIM**	4.1	13.8
P-ED-08-02	I-ED-08-02	I-ED-08-01	24.1	3.3	18 inch	104	0.001	0.013	4.60	4.50	9.60	9.50	14.99	9.50	**ABOVE RIM**	3.5	13.7
P-ED-08-01	I-ED-08-01	I-ED-08	24.0	8.9	18 inch	308	0.007	0.013	4.50	2.30	9.50	8.30	24.41	8.30	**ABOVE RIM**	3.5	13.6
Seagate Place																	
P-ED-01-01	I-ED-01-01	J-ED-01	4.6	5.2	18 inch	104	0.002	0.013	.25	**.00**	3.60	8.00	3.89	3.70	**ABOVE RIM**	1.9	2.6
Cypruss Road																	
P-ED-21	I-ED-21	I-ED-20	1.6	18.9	12 inch	85	0.282	0.013	156.00	132.00	160.00	136.00	156.53	132.59	**3.5**	3.0	14.5
P-ED-20	I-ED-20	I-ED-19	1.5	11.7	12 inch	154	0.107	0.013	132.00	115.50	136.00	120.00	132.53	116.08	**3.5**	3.0	10.3
P-ED-19	I-ED-19	I-ED-18	2.2	145.7	18 inch	60	1.925	0.013	115.50	**.00**	120.00	110.00	116.06	105.82	**3.9**	3.0	29.9
P-ED-18	I-ED-18	I-ED-17	3.6	25.3	15 inch	318	0.153	0.013	105.00	56.20	110.00	61.20	105.76	61.20	**4.2**	3.8	14.6
P-ED-17	I-ED-17	I-ED-16	26.4	13.4	15 inch	28	0.043	0.013	56.20	55.00	61.20	60.00	64.67	60.00	**ABOVE RIM**	3.8	21.5
P-ED-16	I-ED-16	I-ED-15	26.7	18.2	15 inch	164	0.079	0.013	55.00	42.00	60.00	45.00	72.98	45.00	**ABOVE RIM**	3.8	21.7
P-ED-15	I-ED-15	I-ED-14	26.5	33.2	18 inch	100	0.100	0.013	42.00	32.00	45.00	42.00	46.66	40.28	**ABOVE RIM**	1.5	15.0
P-ED-14	I-ED-14	I-ED-13	28.9	21.4	18 inch	48	0.042	0.013	32.00	30.00	42.00	41.50	39.00	35.36	**3.0**	8.5	16.4
P-ED-13	I-ED-13	J-ED-12	28.8	32.8	24 inch	95	0.021	0.013	30.00	28.00	41.50	33.00	34.54	33.00	**7.0**	9.5	9.2
P-ED-12	J-ED-12	I-ED-11	28.6	8.0	24 inch	80	0.001	0.013	28.00	27.90	33.00	32.90	34.18	32.90	**ABOVE RIM**	3.0	9.1
P-ED-11	I-ED-11	J-ED-10	54.2	51.2	30 inch	1,485	0.016	0.013	27.90	4.80	32.90	10.80	35.26	9.35	**ABOVE RIM**	2.5	11.0
P-ED-10	J-ED-10	I-ED-09	49.6	75.7	33 inch	117	0.021	0.013	4.80	2.40	10.80	8.20	9.23	8.20	**1.6**	3.3	8.4
P-ED-09	I-ED-09	I-ED-08	58.1	15.3	33 inch	119	0.001	0.013	2.40	2.30	8.20	8.30	9.74	8.30	**ABOVE RIM**	3.1	9.8
P-ED-08	I-ED-08	J-ED-07	84.6	0.0	33 inch	14	0.000	0.013	2.30	2.30	8.30	8.30	8.66	8.30	**ABOVE RIM**	3.3	14.2
Briarfield Way																	
P-ED-07	J-ED-07	I-ED-06	84.5	23.3	33 inch	414	0.002	0.013	2.30	1.50	8.30	7.50	18.08	7.50	**ABOVE RIM**	3.3	14.2
P-ED-06	I-ED-06	I-ED-05	83.1	0.0	33 inch	54	0.000	0.013	1.50	1.50	7.50	7.70	7.43	6.10	**0.1**	3.3	14.0
P-ED-05	I-ED-05	J-ED-04	90.0	81.8	48 inch	181	0.003	0.012	1.50	1.00	7.70	8.50	5.96	5.35	**1.7**	2.2	7.2
P-ED-04	J-ED-04	J-ED-03	88.7	86.4	54 inch	304	0.002	0.012	1.00	.50	8.50	8.00	4.93	4.46	**3.6**	3.0	6.2
P-ED-03	J-ED-03	J-ED-02	86.5	131.0	60 inch	116	0.002	0.012	.50	.25	8.00	8.00	4.44	4.36	**3.6**	2.5	7.1
P-ED-02	J-ED-02	J-ED-01	85.8	61.3	60 inch	530	0.000	0.012	.25	**.00**	8.00	8.00	4.34	3.72	**3.7**	2.8	4.4
P-ED-01	J-ED-01	O-ED	84.3	63.9	60 inch	487	0.001	0.012	**.00**	- .25	8.00	9.00	3.68	2.35	**4.3**	3.0	4.3

(1) Pipes are presented in Figure 2 and Figure D-ED in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-E4c

Proposed Hydrology, 25-Year Event, System ED

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Virginia Avenue													
I-ED-17-08-02	192.00	188.00	0.50		0.55	0.28	0.50	0.3	10.0	10.0	2.54	0.00	**0.7**
I-ED-17-08-01	180.00	178.00	0.00		0.00	0.00	0.50	0.3	10.0	10.2	2.52	0.00	**0.7**
Cobblestone Lane													
I-ED-17-01-03	104.50	100.50	1.41		0.88	1.24	1.41	1.2	10.0	10.0	2.54	0.00	**3.2**
I-ED-17-01-02	104.10	100.10	0.22		0.55	0.12	1.63	1.4	10.0	10.1	2.53	0.00	**3.5**
I-ED-17-01-01	74.50	71.50	0.88		0.55	0.48	2.51	1.9	10.0	10.2	2.52	0.00	**4.7**
I-ED-17-01N	61.50	57.50	4.34		0.55	2.39	6.85	2.4	10.0	10.0	2.54	0.00	**6.1**
Middle Road/Laurel Road													
I-ED-17-10	214.00	211.50	9.50		0.55	5.23	9.50	5.2	10.0	10.0	2.54	0.00	**13.4**
I-ED-17-09	214.00	208.50	0.20		0.55	0.11	9.70	5.3	10.0	10.0	2.54	0.00	**13.6**
I-ED-17-08	184.00	177.00	3.07	0.50	0.00	0.00	13.27	5.6	10.0	11.4	2.38	0.00	**13.5**
I-ED-17-07	180.00	176.00	0.00		0.00	0.00	13.27	5.6	10.0	11.6	2.35	0.00	**13.3**
I-ED-17-06	158.00	154.00	0.00		0.00	0.00	13.27	5.6	10.0	11.7	2.35	0.00	**13.3**
I-ED-17-05	142.00	138.00	0.00		0.55	0.00	13.27	5.6	10.0	11.7	2.34	0.00	**13.3**
I-ED-17-04	140.00	136.00	0.00		0.00	0.00	13.27	5.6	10.0	11.9	2.33	0.00	**13.2**
I-ED-17-03	118.90	114.90	0.00		0.00	0.00	13.27	5.6	10.0	11.9	2.33	0.00	**13.2**
I-ED-17-02	99.50	96.00	2.06		0.55	1.13	15.33	6.7	10.0	12.0	2.31	0.00	**15.7**
J-ED-17-01	75.00	71.00	0.00	6.85	0.00	0.00	22.18	8.6	0.0	12.4	2.28	0.00	**19.8**
Hiller Avenue													
I-ED-09-01	7.80	2.50	5.86		0.55	3.22	5.86	3.2	10.0	10.0	2.54	0.00	**8.3**
I-ED-08-09	31.60	26.60	12.26		0.88	10.79	12.26	10.8	10.0	10.0	2.54	0.00	**27.6**
J-ED-08-08	22.80	17.80	0.00		0.00	0.00	12.26	10.8	0.0	11.3	2.40	0.00	**26.1**
J-ED-08-07	16.50	11.50	0.00		0.00	0.00	12.26	10.8	0.0	11.9	2.33	0.00	**25.3**
I-ED-08-06	14.70	9.70	0.00		0.55	0.00	12.26	10.8	10.0	12.3	2.29	0.00	**24.9**
I-ED-08-05	11.50	6.50	1.90		0.55	1.04	14.16	11.8	10.0	12.7	2.25	0.00	**26.9**
I-ED-08-04	10.90	5.90	0.00		0.00	0.00	14.16	11.8	10.0	12.9	2.24	0.00	**26.7**
I-ED-08-03	10.40	4.80	4.04		0.00	0.00	18.20	11.8	10.0	13.7	2.17	0.00	**25.9**
I-ED-08-02	9.60	4.60	0.00		0.55	0.00	18.20	11.8	10.0	14.8	2.08	0.00	**24.9**
I-ED-08-01	9.50	4.50	0.00		0.00	0.00	18.20	11.8	10.0	15.3	2.05	0.00	**24.5**
Seagate Place													
I-ED-01-01	7.00	0.25	4.28		0.55	2.35	4.28	2.4	10.0	10.0	2.54	0.00	**6.0**
Cypruss Road													
I-ED-21	160.00	156.00	1.45		0.55	0.80	1.45	0.8	10.0	10.0	2.54	0.00	**2.0**
I-ED-20	136.00	132.00	0.00		0.00	0.00	1.45	0.8	10.0	10.1	2.53	0.00	**2.0**
I-ED-19	120.00	115.50	0.63		0.55	0.35	2.08	1.1	10.0	10.3	2.50	0.00	**2.9**
I-ED-18	110.00	105.00	1.33		0.00	0.00	3.41	1.1	10.0	10.4	2.49	0.00	**2.9**
I-ED-17	61.20	56.20	0.05	22.18	0.55	0.03	25.64	12.2	10.0	12.6	2.27	0.00	**27.8**
I-ED-16	60.00	55.00	0.33		0.55	0.18	25.97	12.3	10.0	12.6	2.26	0.00	**28.1**
I-ED-15	44.00	42.00	0.00		0.88	0.00	25.97	12.3	10.0	12.7	2.25	0.00	**28.0**
I-ED-14	42.00	32.00	2.49		0.00	0.00	28.46	12.3	10.0	12.8	2.25	0.00	**27.9**
I-ED-13	41.50	31.00	0.00		0.55	0.00	28.46	12.3	10.0	12.9	2.24	0.00	**27.8**
J-ED-12	33.00	28.00	0.00		0.00	0.00	28.46	12.3	0.0	13.0	2.23	0.00	**27.7**
I-ED-11	32.90	27.90	26.05		0.55	14.33	54.51	26.7	10.0	13.3	2.20	0.00	**59.2**
J-ED-10	10.80	4.80	0.00		0.00	0.00	54.51	26.7	0.0	15.1	2.07	0.00	**55.5**
I-ED-09	9.40	2.40	4.03	5.86	0.00	0.00	64.40	29.9	10.0	15.3	2.06	0.00	**61.9**
I-ED-08	9.30	2.30	4.61	18.20	0.55	2.54	87.21	44.3	10.0	16.0	2.01	0.00	**89.7**
Briarfield Way													
J-ED-07	9.30	2.30	0.00	87.21	0.00	0.00	87.21	44.3	0.0	16.0	2.01	0.00	**89.5**
I-ED-06	9.00	1.50	0.00		0.55	0.00	87.21	44.3	10.0	17.1	1.94	0.00	**86.7**
I-ED-05	9.00	1.50	8.01		0.00	0.00	95.22	44.3	10.0	17.4	1.93	0.00	**85.9**
J-ED-04	8.50	1.00	0.00		0.00	0.00	95.22	44.3	0.0	17.8	1.90	0.00	**84.9**
J-ED-03	9.00	0.50	6.39		0.55	3.51	101.61	47.8	10.0	18.6	1.86	0.00	**89.6**
J-ED-02	9.00	0.25	0.00		0.00	0.00	101.61	47.8	0.0	18.9	1.85	0.00	**88.9**
J-ED-01	10.00	0.00	0.00	4.28	0.00	0.00	105.89	50.1	0.0	21.1	1.75	0.00	**88.4**
O-ED	7.00	-0.25	0.00		0.00	0.00	105.89	50.1	0.0	23.0	1.67	0.00	**84.6**

(1) Nodes are presented in Figure D-ED in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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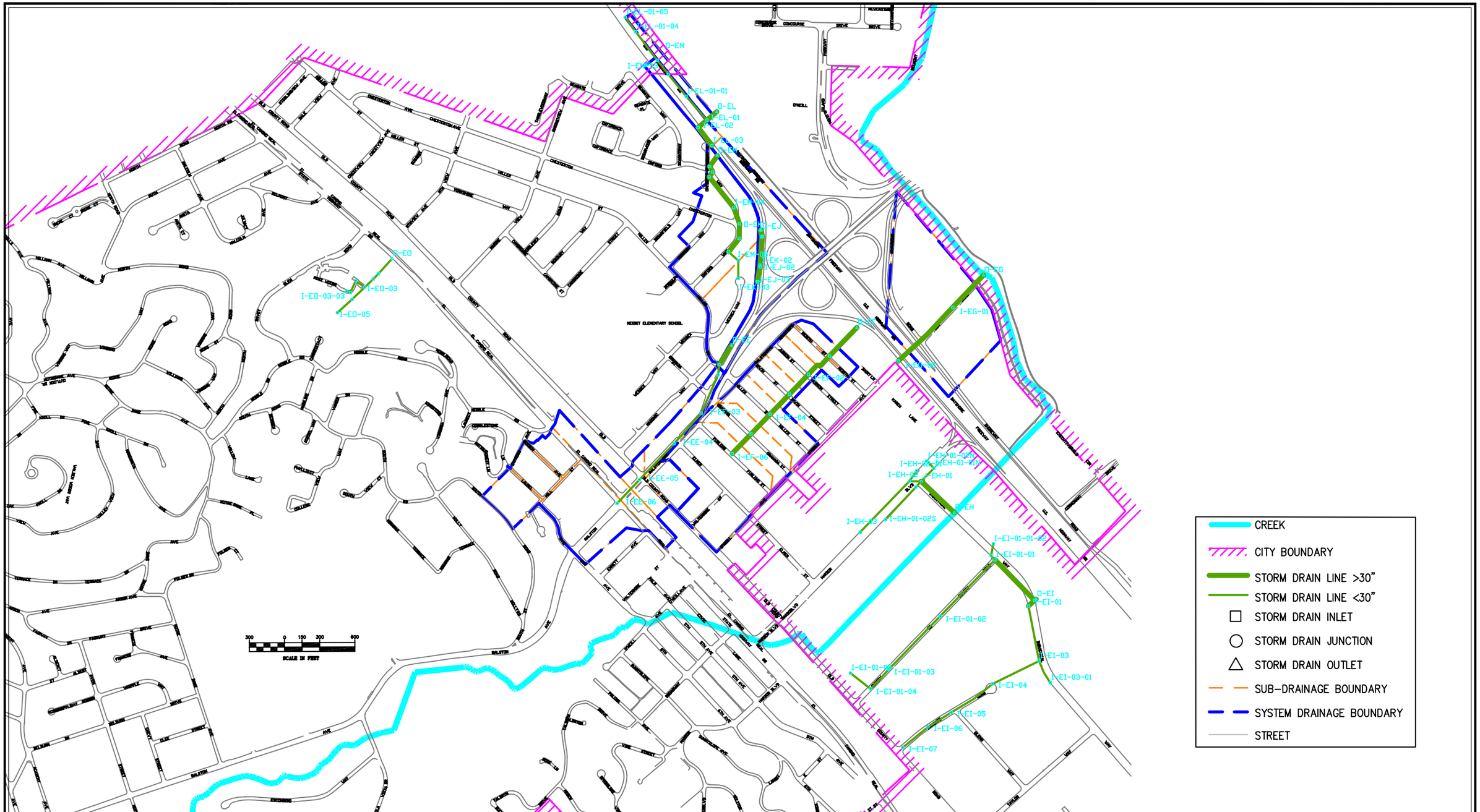
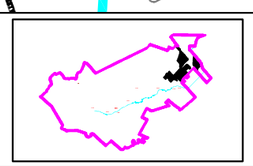
Table E4d

Proposed Hydraulics, 25-Year Event, System ED

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Virginia Avenue																		
P-ED-17-08-02	I-ED-17-08-02	I-ED-17-08-01	0.7	4.0	8 inch	90	0.111	0.013	188.0	178.0	192.0	180.0	188.4	179.7	**3.6**	3.3	8.7	no change
P-ED-17-08-01	I-ED-17-08-01	I-ED-17-08	0.7	4.4	12 inch	65	0.015	0.013	178.0	177.0	180.0	184.0	179.7	179.7	**0.3**	1.0	0.9	upsized
Cobblestone Lane																		
P-ED-17-01N	I-ED-17-01N	I-ED-17	6.1	7.1	12 inch	33	0.039	0.013	57.5	56.2	61.5	61.2	61.6	60.7	**ABOVE RIM**	3.0	7.8	no change
P-ED-17-01-03	I-ED-17-01-03	I-ED-17-01-02	3.2	4.6	12 inch	24	0.017	0.013	100.5	100.1	104.5	104.1	101.3	101.0	**3.2**	3.0	6.3	no change
P-ED-17-01-02	I-ED-17-01-02	I-ED-17-01-01	3.5	17.9	12 inch	113	0.253	0.013	100.1	71.5	104.1	74.5	100.9	73.2	**3.2**	3.0	17.7	no change
P-ED-17-01-01	I-ED-17-01-01	J-ED-17-01	4.7	5.8	12 inch	19	0.026	0.013	71.5	71.0	74.5	75.0	73.1	72.7	**1.4**	2.0	6.0	no change
Middle Road/Laurel Road																		
P-ED-17-10	I-ED-17-10	I-ED-17-09	13.4	11.9	12 inch	27	0.111	0.013	211.5	208.5	214.0	214.0	214.9	211.1	**ABOVE RIM**	1.5	17.0	no change
P-ED-17-09	I-ED-17-09	I-ED-17-08	13.6	20.0	12 inch	169	0.186	0.010	208.5	177.0	214.0	184.0	209.5	180.1	**4.5**	4.5	27.4	no change
P-ED-17-08	I-ED-17-08	I-ED-17-07	13.5	10.7	18 inch	113	0.009	0.012	177.0	176.0	184.0	180.0	179.6	178.0	**4.4**	5.5	7.6	upsized
P-ED-17-07	I-ED-17-07	I-ED-17-06	13.3	56.5	18 inch	76	0.289	0.013	176.0	154.0	180.0	158.0	177.4	155.5	**2.6**	2.5	26.2	upsized
P-ED-17-06	I-ED-17-06	I-ED-17-05	13.3	49.5	18 inch	72	0.222	0.013	154.0	138.0	158.0	142.0	155.4	139.5	**2.6**	2.5	23.8	upsized
P-ED-17-05	I-ED-17-05	I-ED-17-04	13.3	15.4	18 inch	93	0.022	0.013	138.0	136.0	142.0	140.0	139.4	137.6	**2.6**	2.5	9.8	upsized
P-ED-17-04	I-ED-17-04	I-ED-17-03	13.2	71.1	18 inch	46	0.459	0.013	136.0	114.9	140.0	118.9	137.4	116.4	**2.6**	2.5	30.8	upsized
P-ED-17-03	I-ED-17-03	I-ED-17-02	13.2	40.8	18 inch	147	0.129	0.012	114.9	96.0	118.9	99.5	116.3	98.2	**2.6**	2.5	20.6	upsized
P-ED-17-02	I-ED-17-02	J-ED-17-01	15.7	28.6	18 inch	337	0.074	0.013	96.0	71.0	99.5	75.0	97.4	73.0	**2.1**	2.0	16.6	no change
P-ED-17-01	J-ED-17-01	I-ED-17	19.8	29.6	18 inch	186	0.080	0.013	71.0	56.2	75.0	61.2	72.5	61.2	**2.5**	2.5	18.0	no change
Hiller Avenue																		
P-ED-09-01	I-ED-09-01	I-ED-09	8.3	24.3	42 inch	172	0.001	0.013	2.5	2.4	7.8	9.4	6.8	6.8	**1.0**	1.8	0.9	upsized
P-ED-08-09	I-ED-08-09	J-ED-08-08	27.6	26.2	24 inch	657	0.013	0.013	26.6	17.8	31.6	22.8	29.9	20.1	**1.7**	3.0	8.8	upsized
P-ED-08-08	J-ED-08-08	J-ED-08-07	26.1	31.4	24 inch	327	0.019	0.013	17.8	11.5	22.8	16.5	19.8	15.5	**3.0**	3.0	8.3	upsized
P-ED-08-07	J-ED-08-07	I-ED-08-06	25.3	20.9	24 inch	211	0.009	0.013	11.5	9.7	16.5	14.7	15.2	12.5	**1.3**	3.0	8.1	upsized
P-ED-08-06	I-ED-08-06	I-ED-08-05	24.9	27.7	24 inch	213	0.015	0.013	9.7	6.5	14.7	11.5	11.5	9.0	**3.2**	3.0	10.0	upsized
P-ED-08-05	I-ED-08-05	I-ED-08-04	26.9	35.3	30 inch	81	0.007	0.013	6.5	5.9	11.5	10.9	8.8	8.5	**2.7**	2.5	7.9	upsized
P-ED-08-04	I-ED-08-04	I-ED-08-03	26.7	28.3	30 inch	272	0.004	0.012	5.9	4.8	10.9	10.4	8.5	7.5	**2.5**	2.5	5.4	upsized
P-ED-08-03	I-ED-08-03	I-ED-08-02	25.9	20.4	36 inch	251	0.001	0.012	4.8	4.6	10.4	9.6	7.5	7.1	**3.0**	2.6	3.7	upsized
P-ED-08-02	I-ED-08-02	I-ED-08-01	24.9	22.4	36 inch	104	0.001	0.012	4.6	4.5	9.6	9.5	7.1	7.0	**2.5**	2.0	3.5	upsized
P-ED-08-01	I-ED-08-01	I-ED-08	24.5	61.1	36 inch	308	0.007	0.012	4.5	2.3	9.5	9.3	7.0	6.7	**2.5**	2.0	8.2	upsized
Seagate Place																		
P-ED-01-01	I-ED-01-01	J-ED-01	6.0	20.1	30 inch	104	0.002	0.013	.3	**.0**	7.0	10.0	6.1	6.1	**0.9**	4.3	1.2	upsized
Cypruss Road																		
P-ED-21	I-ED-21	I-ED-20	2.0	18.9	12 inch	85	0.282	0.013	156.0	132.0	160.0	136.0	156.6	132.7	**3.4**	3.0	15.8	no change
P-ED-20	I-ED-20	I-ED-19	2.0	11.7	12 inch	154	0.107	0.013	132.0	115.5	136.0	120.0	132.6	116.2	**3.4**	3.0	11.2	no change
P-ED-19	I-ED-19	I-ED-18	2.9	43.9	18 inch	60	0.175	0.013	115.5	105.0	120.0	110.0	116.1	105.7	**3.9**	3.0	14.1	no change
P-ED-18	I-ED-18	I-ED-17	2.9	41.2	18 inch	318	0.153	0.013	105.0	56.2	110.0	61.2	105.6	59.6	**4.4**	3.5	13.4	no change
P-ED-17	I-ED-17	I-ED-16	27.8	23.6	18 inch	28	0.043	0.012	56.2	55.0	61.2	60.0	59.2	57.5	**2.0**	3.5	15.7	no change
P-ED-16	I-ED-16	I-ED-15	28.1	32.0	18 inch	164	0.079	0.012	55.0	42.0	60.0	44.0	56.5	44.0	**3.5**	3.5	20.5	no change
P-ED-15	I-ED-15	I-ED-14	28.0	77.5	24 inch	100	0.100	0.012	42.0	32.0	44.0	42.0	43.8	34.2	**0.2**	0.0	22.7	upsized
P-ED-14	I-ED-14	I-ED-13	27.9	32.7	24 inch	48	0.021	0.013	32.0	31.0	42.0	41.5	34.0	33.3	**8.0**	8.0	8.9	upsized
P-ED-13	I-ED-13	J-ED-12	27.8	40.2	24 inch	95	0.032	0.013	31.0	28.0	41.5	33.0	32.8	30.4	**8.7**	8.5	13.8	no change
P-ED-12	J-ED-12	I-ED-11	27.7	55.0	48 inch	80	0.001	0.012	28.0	27.9	33.0	32.9	30.3	30.3	**2.7**	1.0	4.4	upsized
P-ED-11	I-ED-11	J-ED-10	59.2	194.1	48 inch	1,485	0.016	0.012	27.9	4.8	32.9	10.8	30.2	6.3	**2.7**	1.0	13.6	upsized
P-ED-10	J-ED-10	I-ED-09	55.5	222.9	48 inch	117	0.021	0.012	4.8	2.4	10.8	9.4	7.0	6.8	**3.8**	2.0	14.7	upsized
P-ED-08	I-ED-08	J-ED-07	89.7	0.0	72 inch	14	0.000	**0.013**	2.3	2.3	9.3	9.3	6.7	6.6	**2.7**	1.0	3.2	upsized
Briarfield Way																		
P-ED-07	J-ED-07	I-ED-06	89.5	186.2	72 inch	414	0.002	**0.013**	2.3	1.5	9.3	9.0	6.6	6.5	**2.7**	1.0	6.5	upsized
P-ED-06	I-ED-06	I-ED-05	86.7	0.0	72 inch	54	0.000	**0.013**	1.5	1.5	9.0	9.0	6.5	6.4	**2.6**	1.5	3.1	upsized
P-ED-05	I-ED-05	J-ED-04	85.9	222.6	72 inch	181	0.003	**0.013**	1.5	1.0	9.0	8.5	6.4	6.4	**2.6**	1.5	7.4	upsized
P-ED-04	J-ED-04	J-ED-03	84.9	171.8	72 inch	304	0.002	**0.013**	1.0	.5	8.5	9.0	6.3	6.2	**2.2**	1.5	6.1	upsized
P-ED-03	J-ED-03	J-ED-02	89.6	296.6	84 inch	116	0.002	**0.013**	.5	.3	9.0	9.0	6.2	6.2	**2.8**	1.5	6.8	upsized
P-ED-02	J-ED-02	J-ED-01	88.9	150.3	84 inch	530	0.000	0.012	.3	**.0**	9.0	10.0	6.2	6.1	**2.9**	1.8	4.1	upsized
P-ED-01	J-ED-01	O-ED	88.4	156.8	84 inch	487	0.001	0.012	**.0**	- .3	10.0	7.0	6.1	6.0	**3.9**	3.0	4.2	upsized

(1) Pipes are presented in Figure 2 and Figure D-ED in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE TABLE D-E5b

FIGURE D-EE-EO
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-E5a

Existing Hydrology, 10-Year Event, System EE, EF, EG, EJ, EK, EL, EM, EN & EO

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (cfs)**
Ralston Avenue												
I-EE-06	32.00	27.00	20.80		0.80	16.64	20.80	16.6	10.0	10.0	2.04	**34.2**
I-EE-05	30.00	25.00	4.29		0.50	2.15	25.09	18.8	10.0	10.2	2.01	**38.2**
I-EE-04	28.10	23.00	3.58		0.80	2.86	28.67	21.7	10.0	10.8	1.96	**42.8**
I-EE-03	22.00	17.00	0.00		0.00	0.00	28.67	21.7	10.0	11.3	1.92	**42.0**
I-EE-02	17.40	12.40	0.00		0.00	0.00	28.67	21.7	10.0	11.7	1.88	**41.1**
J-EE-01	16.10	11.10	0.00		0.00	0.00	28.67	21.7	0.0	11.8	1.88	**40.9**
O-EE	14.60	9.60	0.00		0.00	0.00	28.67	21.7	0.0	12.0	1.86	**40.7**
Furlong Street to Diary Lane												
I-EF-06	22.40	18.40	13.14		0.80	10.51	13.14	10.5	10.0	10.0	2.04	**21.6**
I-EF-05	19.60	15.60	4.68		0.50	2.34	17.82	12.9	10.0	10.1	2.02	**26.2**
I-EF-04	15.00	11.00	4.91		0.50	2.46	22.73	15.3	10.0	10.3	2.01	**31.1**
I-EF-03	12.90	8.90	2.41		0.80	1.93	25.14	17.2	10.0	10.4	2.00	**34.8**
I-EF-02	9.90	4.90	2.43		0.50	1.22	27.57	18.5	10.0	10.5	1.99	**37.1**
I-EF-01	7.80	2.80	3.43		0.50	1.72	31.00	20.2	10.0	10.9	1.95	**39.7**
O-EF	6.00	0.00	0.00		0.00	0.00	31.00	20.2	0.0	11.5	1.90	**38.7**
Sem Lane												
I-EG-02	6.00	-0.10	0.21		0.80	0.17	0.21	0.2	10.0	10.0	2.04	**0.4**
I-EG-01	6.70	-0.30	21.00		0.80	16.80	21.21	17.0	10.0	406.8	0.32	**5.5**
O-EG	7.00	-0.40	0.00		0.00	0.00	21.21	17.0	0.0	421.3	0.31	**5.4**
Ralston Exit, Highway 101												
I-EJ-03	9.50	4.50	7.12		0.80	5.70	7.12	5.7	10.0	10.0	2.04	**11.7**
I-EJ-02	9.00	4.00	0.00		0.00	0.00	7.12	5.7	0.0	10.3	2.01	**11.5**
I-EJ-01	8.90	3.90	0.00		0.00	0.00	7.12	5.7	0.0	11.0	1.94	**11.2**
O-EJ	9.00	3.70	0.00		0.00	0.00	7.12	5.7	0.0	11.1	1.93	**11.1**
Ralston Exit, Highway 101												
I-EK-03	9.50	4.50	7.13		0.80	5.70	7.13	5.7	10.0	10.0	2.04	**11.7**
I-EK-02	9.00	4.00	0.00		0.00	0.00	7.13	5.7	0.0	10.4	2.00	**11.5**
I-EK-01	8.90	3.90	0.00		0.00	0.00	7.13	5.7	0.0	11.0	1.95	**11.2**
O-EK	9.00	3.70	0.00		0.00	0.00	7.13	5.7	0.0	11.1	1.93	**11.1**
Highway 101												
I-EL-01-05	8.50	-2.25	1.63		0.80	1.30	1.63	1.3	10.0	10.0	2.04	**2.7**
I-EL-01-04	9.00	-2.50	0.00		0.00	0.00	1.63	1.3	0.0	11.7	1.89	**2.5**
I-EL-01-03	10.20	-2.75	0.00		0.00	0.00	1.63	1.3	0.0	15.3	1.65	**2.2**
I-EL-01-02	9.00	-3.00	0.00		0.00	0.00	1.63	1.3	0.0	17.4	1.55	**2.0**
I-EL-01-01	9.10	-3.25	0.00		0.00	0.00	1.63	1.3	0.0	20.9	1.41	**1.9**
I-EL-03	9.50	-3.02	40.00		0.80	32.00	40.00	32.0	10.0	10.0	2.04	**65.8**
I-EL-02	8.50	-3.25	0.60		0.80	0.48	40.60	32.5	10.0	10.2	2.02	**66.2**
I-EL-01	10.00	-3.50	0.00	1.63	0.00	0.00	42.23	33.8	0.0	25.2	1.29	**43.8**
O-EL	7.00	-3.75	0.00		0.00	0.00	42.23	33.8	0.0	25.7	1.27	**43.3**
Oxford Way												
I-EM-09	9.10	5.80	5.76		0.50	2.88	5.76	2.9	10.0	10.0	2.04	**5.9**
I-EM-08	10.20	5.00	0.00		0.00	0.00	5.76	2.9	0.0	10.3	2.01	**5.8**
I-EM-07	8.40	4.00	0.00		0.00	0.00	5.76	2.9	0.0	10.6	1.98	**5.8**
I-EM-06	7.90	3.90	0.00		0.00	0.00	5.76	2.9	0.0	10.9	1.95	**5.7**
I-EM-05	7.80	3.80	11.48		0.50	5.74	17.24	8.6	10.0	11.2	1.93	**16.7**
I-EM-04	8.50	3.70	0.00		0.00	0.00	17.24	8.6	0.0	11.3	1.92	**16.7**
I-EM-03	9.80	3.50	0.00		0.00	0.00	17.24	8.6	0.0	11.6	1.89	**16.5**
I-EM-02	9.70	3.00	0.00		0.00	0.00	17.24	8.6	0.0	11.7	1.89	**16.4**
I-EM-01	10.00	2.00	0.00		0.00	0.00	17.24	8.6	0.0	11.8	1.88	**16.3**
O-EM	9.80	-2.20	0.00		0.00	0.00	17.24	0.5	0.0	12.0	1.86	**16.2**
Highway 101												
I-EN-03	10.00	-2.25	1.80		0.80	1.44	1.80	1.4	10.0	10.0	2.04	**3.0**
I-EN-02	9.00	-2.50	0.00		0.00	0.00	1.80	1.4	0.0	10.6	1.98	**2.9**
I-EN-01	10.20	-2.75	0.00		0.00	0.00	1.80	1.4	0.0	12.6	1.81	**2.6**
O-EN	5.00	-3.00	0.00		0.00	0.00	1.80	1.4	0.0	15.6	1.63	**2.4**
Ross Woods												
I-EO-03-03	101.00	97.00	0.82		0.50	0.41	0.82	0.4	10.0	10.0	2.12	**0.9**
I-EO-03-02	100.00	96.00	0.00		0.00	0.00	0.82	0.4	0.0	10.1	2.11	**0.9**
I-EO-03-01	85.00	81.00	0.00		0.00	0.00	0.82	0.4	0.0	10.3	2.09	**0.9**
I-EO-05	140.00	136.00	7.00		0.50	3.50	7.00	3.5	10.0	10.0	2.12	**7.5**
I-EO-04	102.00	98.00	0.00		0.00	0.00	7.00	3.5	0.0	10.1	2.11	**7.4**
I-EO-03	80.00	76.00	0.00	0.82	0.00	0.00	7.82	3.9	0.0	10.5	2.07	**8.2**
I-EO-02	70.00	66.00	0.00		0.00	0.00	7.82	3.9	0.0	10.6	2.06	**8.1**
I-EO-01	55.00	51.00	0.00		0.00	0.00	7.82	3.9	0.0	10.7	2.05	**8.1**
O-EO	52.00	48.00	0.00		0.00	0.00	7.82	3.9	0.0	11.0	2.03	**8.0**

(1) Nodes are presented in Figure D-EE-EO in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-E5b

Existing Hydraulics, 10-Year Event, System EE, EF, EG, EJ, EK, EL, EM, EN & EO

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
Ralston Avenue																	
P-EE-06	I-EE-06	I-EE-05	34.2	8.9	18 inch	278	0.007	0.013	27.00	25.00	32.00	30.00	59.46	30.00	**ABOVE RIM**	3.5	19.4
P-EE-05	I-EE-05	I-EE-04	38.2	15.5	24 inch	425	0.005	0.013	25.00	23.00	30.00	28.10	40.19	28.10	**ABOVE RIM**	3.0	12.1
P-EE-04	I-EE-04	I-EE-03	42.8	29.8	24 inch	347	0.017	0.013	23.00	17.00	28.10	22.00	34.40	22.00	**ABOVE RIM**	3.1	13.6
P-EE-03	I-EE-03	I-EE-02	42.0	25.6	24 inch	359	0.013	0.013	17.00	12.40	22.00	17.40	29.74	17.40	**ABOVE RIM**	3.0	13.4
P-EE-02	I-EE-02	J-EE-01	41.1	27.5	24 inch	88	0.015	0.013	12.40	11.10	17.40	16.10	19.01	16.10	**ABOVE RIM**	3.0	13.1
P-EE-01	J-EE-01	O-EE	40.9	9.2	18 inch	195	0.008	0.013	11.10	9.60	16.10	14.60	40.72	11.10	**ABOVE RIM**	3.5	23.2
Furlong Street to Diary Lane																	
P-EF-06	I-EF-06	I-EF-05	21.6	3.9	12 inch	233	0.012	0.013	18.40	15.60	22.40	19.60	105.25	19.60	**ABOVE RIM**	3.0	27.5
P-EF-05	I-EF-05	I-EF-04	26.2	5.0	12 inch	236	0.019	0.013	15.60	11.00	19.60	15.00	142.87	15.00	**ABOVE RIM**	3.0	33.4
P-EF-04	I-EF-04	I-EF-03	31.1	3.4	12 inch	236	0.009	0.013	11.00	8.90	15.00	12.90	192.21	12.90	**ABOVE RIM**	3.0	39.5
P-EF-03	I-EF-03	I-EF-02	34.8	4.7	12 inch	234	0.017	0.013	8.90	4.90	12.90	9.90	233.13	9.90	**ABOVE RIM**	3.0	44.3
P-EF-02	I-EF-02	I-EF-01	37.1	28.5	27 inch	248	0.008	0.013	4.90	2.80	9.90	7.80	11.36	7.80	**ABOVE RIM**	2.8	9.3
P-EF-01	I-EF-01	O-EF	39.7	28.2	27 inch	338	0.008	0.013	2.80	**.00**	7.80	6.00	10.56	5.00	**ABOVE RIM**	2.8	10.0
Sem Lane																	
P-EG-02	I-EG-02	I-EG-01	0.4	27.2	48 inch	654	0.000	0.012	- .10	- .30	6.00	6.70	6.70	6.70	**ABOVE RIM**	2.1	0.0
P-EG-01	I-EG-01	O-EG	5.5	25.2	48 inch	380	0.000	0.012	- .30	- .40	6.70	7.00	6.83	6.83	**ABOVE RIM**	3.0	0.4
Ralston Exit, Highway 101																	
P-EJ-03	I-EJ-03	I-EJ-02	11.7	6.6	18 inch	128	0.004	0.013	4.50	4.00	9.50	9.00	10.59	9.00	**ABOVE RIM**	3.5	6.6
P-EJ-02	I-EJ-02	I-EJ-01	11.5	2.1	18 inch	263	0.000	0.013	4.00	3.90	9.00	8.90	12.06	8.90	**ABOVE RIM**	3.5	6.5
P-EJ-01	I-EJ-01	O-EJ	11.2	6.4	18 inch	54	0.004	0.013	3.90	3.70	8.90	9.00	9.51	8.90	**ABOVE RIM**	3.5	6.3
Ralston Exit, Highway 101																	
P-EK-03	I-EK-03	I-EK-02	11.7	6.2	18 inch	145	0.003	0.013	4.50	4.00	9.50	9.00	10.81	9.00	**ABOVE RIM**	3.5	6.6
P-EK-02	I-EK-02	I-EK-01	11.5	2.1	18 inch	242	0.000	0.013	4.00	3.90	9.00	8.90	11.81	8.90	**ABOVE RIM**	3.5	6.5
P-EK-01	I-EK-01	O-EK	11.2	6.2	18 inch	58	0.003	0.013	3.90	3.70	8.90	9.00	9.56	8.90	**ABOVE RIM**	3.5	6.3
Highway 101																	
P-EL-01-05	I-EL-01-05	I-EL-01-04	2.7	4.3	18 inch	152	0.002	0.013	- 2.25	- 2.50	8.50	9.00	4.63	4.53	**3.9**	9.3	1.5
P-EL-01-04	I-EL-01-04	I-EL-01-03	2.5	3.0	18 inch	305	0.001	0.013	- 2.50	- 2.75	9.00	10.20	4.52	4.35	**4.5**	10.0	1.4
P-EL-01-03	I-EL-01-03	I-EL-01-02	2.2	4.3	18 inch	153	0.002	0.013	- 2.75	- 3.00	10.20	9.00	4.34	4.28	**5.9**	11.5	1.2
P-EL-01-02	I-EL-01-02	I-EL-01-01	2.0	3.4	18 inch	242	0.001	0.013	- 3.00	- 3.25	9.00	9.10	4.27	4.18	**4.7**	10.5	1.2
P-EL-01-01	I-EL-01-01	I-EL-01	1.9	3.2	18 inch	270	0.001	0.013	- 3.25	- 3.50	9.10	10.00	4.18	4.09	**4.9**	10.9	1.1
P-EL-03	I-EL-03	I-EL-02	65.8	7.8	24 inch	194	0.001	0.013	- 3.02	- 3.25	9.50	8.50	21.35	4.96	**ABOVE RIM**	10.5	20.9
P-EL-02	I-EL-02	I-EL-01	66.2	62.8	4 x 3 ft	97	0.003	0.013	- 3.25	- 3.50	8.50	10.00	4.38	4.10	**4.1**	8.8	5.5
P-EL-01	I-EL-01	O-EL	43.8	74.2	48 inch	110	0.002	0.012	- 3.50	- 3.75	10.00	7.00	4.09	4.00	**5.9**	9.5	3.5
Oxford Way																	
P-EM-09	I-EM-09	I-EM-08	5.9	2.6	12 inch	152	0.005	0.013	5.80	5.00	9.10	10.20	14.39	10.20	**ABOVE RIM**	2.3	7.5
P-EM-08	I-EM-08	I-EM-07	5.8	3.4	12 inch	111	0.009	0.013	5.00	4.00	10.20	8.40	11.36	8.40	**ABOVE RIM**	4.2	7.4
P-EM-07	I-EM-07	I-EM-06	5.8	0.9	12 inch	145	0.001	0.013	4.00	3.90	8.40	7.90	11.68	7.90	**ABOVE RIM**	3.4	7.3
P-EM-06	I-EM-06	I-EM-05	5.7	1.0	12 inch	125	0.001	0.013	3.90	3.80	7.90	7.80	10.96	7.80	**ABOVE RIM**	3.0	7.2
P-EM-05	I-EM-05	I-EM-04	16.7	0.9	12 inch	146	0.001	0.013	3.80	3.70	7.80	8.50	40.71	8.50	**ABOVE RIM**	3.0	21.3
P-EM-04	I-EM-04	I-EM-03	16.7	0.9	12 inch	336	0.001	0.013	3.70	3.50	8.50	9.80	83.18	9.80	**ABOVE RIM**	3.8	21.2
P-EM-03	I-EM-03	I-EM-02	16.5	6.3	15 inch	53	0.009	0.013	3.50	3.00	9.80	9.70	13.14	9.70	**ABOVE RIM**	5.1	13.4
P-EM-02	I-EM-02	I-EM-01	16.4	22.0	21 inch	52	0.019	0.013	3.00	2.00	9.70	10.00	10.56	10.00	**ABOVE RIM**	5.0	6.8
P-EM-01	I-EM-01	O-EM	16.3	20.1	18 inch	115	0.037	0.013	2.00	- 2.20	10.00	9.80	11.68	8.90	**ABOVE RIM**	6.5	9.2
Highway 101																	
P-EN-03	I-EN-03	I-EN-02	3.0	89.1	36 inch	14	0.018	0.013	- 2.25	- 2.50	10.00	9.00	4.02	4.01	**6.0**	9.3	0.4
P-EN-02	I-EN-02	I-EN-01	2.9	15.3	2 x 2 ft	89	0.003	0.013	- 2.50	- 2.75	9.00	10.20	4.01	4.00	**5.0**	9.5	0.7
P-EN-01	I-EN-01	O-EN	2.6	20.8	30 inch	97	0.003	0.013	- 2.75	- 3.00	10.20	5.00	4.00	4.00	**6.2**	10.5	0.5
Ross Woods																	
P-EO-03-03	I-EO-03-03	I-EO-03-02	0.9	6.0	12 inch	35	0.029	0.013	97.00	96.00	101.00	100.00	97.39	96.46	**3.6**	3.0	5.5
P-EO-03-02	I-EO-03-02	I-EO-03-01	0.9	13.1	12 inch	111	0.135	0.013	96.00	81.00	100.00	85.00	96.39	81.46	**3.6**	3.0	9.5
P-EO-03-01	I-EO-03-01	I-EO-03	0.9	8.2	12 inch	94	0.053	0.013	81.00	76.00	85.00	80.00	81.39	77.14	**3.6**	3.0	6.8
P-EO-05	I-EO-05	I-EO-04	7.5	16.8	12 inch	170	0.224	0.013	136.00	98.00	140.00	102.00	136.98	99.26	**3.0**	3.0	20.8
P-EO-04	I-EO-04	I-EO-03	7.4	13.6	12 inch	150	0.147	0.013	98.00	76.00	102.00	80.00	98.98	77.35	**3.0**	3.0	17.8
P-EO-03	I-EO-03	I-EO-02	8.2	11.3	12 inch	100	0.100	0.013	76.00	66.00	80.00	70.00	76.99	67.32	**3.0**	3.0	15.6
P-EO-02	I-EO-02	I-EO-01	8.1	17.5	12 inch	62	0.242	0.013	66.00	51.00	70.00	55.00	66.99	55.00	**3.0**	3.0	21.9
P-EO-01	I-EO-01	O-EO	8.1	4.7	12 inch	175	0.017	0.013	51.00	48.00	55.00	52.00	60.04	51.00	**ABOVE RIM**	3.0	10.3

(1) Pipes are presented in Figure 2 and Figure D-EE-EO in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-E5c

Proposed Hydrology, 25-Year Event, System EE, EF, EG, EJ, EK, EL, EM, EN & EO

Node # (2)	Ground Elevation (1) (ft)	Sump Elevation (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C	Inlet C*A (acres)	Cumulative Area (acres)	Cumulative C*A (acres)	Inlet Tc (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (cfs)**
Ralston Avenue													
I-EE-06	32.00	27.00	20.89		0.88	18.38	20.89	18.4	10.0	10.0	2.44	0.00	**45.2**
I-EE-05	30.00	25.00	4.29		0.55	2.36	25.18	20.7	10.0	10.2	2.42	0.00	**50.5**
I-EE-04	28.10	23.00	3.58		0.88	3.15	28.76	23.9	10.0	10.6	2.37	0.00	**57.0**
I-EE-03	22.00	17.00	0.00		0.00	0.00	28.76	23.9	10.0	10.9	2.33	0.00	**56.1**
I-EE-02	17.40	12.40	0.00		0.00	0.00	28.76	23.9	10.0	11.3	2.30	0.00	**55.3**
J-EE-01	16.10	11.10	0.00		0.00	0.00	28.76	23.9	0.0	11.4	2.29	0.00	**55.1**
O-EE	14.60	9.60	0.00		0.00	0.00	28.76	23.9	0.0	11.7	2.26	0.00	**54.4**
Furlong Street to Diary Lane													
I-EF-06	22.40	18.40	13.14		0.88	11.56	13.14	11.6	10.0	10.0	2.44	0.00	**28.4**
I-EF-05	19.60	15.60	4.68		0.55	2.57	17.82	14.1	10.0	10.4	2.39	0.00	**34.1**
I-EF-04	15.00	11.00	4.91		0.55	2.70	22.73	16.8	10.0	10.7	2.35	0.00	**40.0**
I-EF-03	12.90	8.90	2.41		0.88	2.12	25.14	19.0	10.0	11.1	2.31	0.00	**44.1**
I-EF-02	9.90	4.90	2.43		0.55	1.34	27.57	20.3	10.0	11.5	2.28	0.00	**46.6**
I-EF-01	7.80	2.80	3.43		0.55	1.89	31.00	22.2	10.0	12.1	2.22	0.00	**49.6**
O-EF	6.00	0.00	0.00		0.00	0.00	31.00	22.2	0.0	12.9	2.15	0.00	**48.0**
Sem Lane													
I-EG-02	7.00	-0.15	0.21		0.88	0.18	0.21	0.2	10.0	10.0	2.44	0.00	**0.5**
I-EG-01	6.70	-0.40	21.00		0.88	18.48	21.21	18.7	10.0	391.8	0.39	0.00	**7.3**
O-EG	7.00	-0.50	0.00		0.00	0.00	21.21	18.7	0.0	405.5	0.38	0.00	**7.2**
Ralston Exit, Highway 101													
I-EJ-03	9.50	4.50	7.12		0.88	6.27	7.12	6.3	10.0	10.0	2.44	0.00	**15.4**
I-EJ-02	9.00	4.00	0.00		0.00	0.00	7.12	6.3	0.0	10.4	2.39	0.00	**15.1**
I-EJ-01	8.80	3.80	0.00		0.00	0.00	7.12	6.3	0.0	11.8	2.24	0.00	**14.2**
O-EJ	8.70	3.70	0.00		0.00	0.00	7.12	6.3	0.0	12.0	2.22	0.00	**14.0**
Ralston Exit, Highway 101													
I-EK-03	9.50	4.50	7.13		0.88	6.27	7.13	6.3	10.0	10.0	2.44	0.00	**15.4**
I-EK-02	9.00	4.00	0.00		0.00	0.00	7.13	6.3	0.0	10.5	2.38	0.00	**15.1**
I-EK-01	8.80	3.80	0.00		0.00	0.00	7.13	6.3	0.0	11.8	2.25	0.00	**14.2**
O-EK	8.70	3.70	0.00		0.00	0.00	7.13	6.3	0.0	12.0	2.22	0.00	**14.1**
Highway 101													
I-EL-01-05	8.50	-2.25	1.63		0.88	1.43	1.63	1.4	10.0	10.0	2.44	0.00	**3.5**
I-EL-01-04	9.00	-2.50	0.00		0.00	0.00	1.63	1.4	0.0	11.3	2.30	0.00	**3.3**
I-EL-01-03	10.20	-2.75	0.00		0.00	0.00	1.63	1.4	0.0	14.0	2.06	0.00	**3.0**
I-EL-01-02	9.00	-3.00	0.00		0.00	0.00	1.63	1.4	0.0	15.5	1.96	0.00	**2.8**
I-EL-01-01	9.10	-3.25	0.00		0.00	0.00	1.63	1.4	0.0	18.0	1.82	0.00	**2.6**
I-EL-03	9.50	-3.02	40.00		0.88	35.20	40.00	35.2	10.0	10.0	2.44	0.00	**86.5**
I-EL-02	8.50	-3.25	0.00		0.00	0.00	40.00	35.2	0.0	10.9	2.34	0.00	**82.9**
I-EL-01	10.00	-3.50	0.00	1.63	0.00	0.00	41.63	36.6	0.0	21.0	1.68	0.00	**62.1**
O-EL	7.00	-3.75	0.00		0.00	0.00	41.63	36.6	0.0	22.5	1.62	0.00	**60.0**
Oxford Way													
I-EM-09	9.10	5.80	5.76		0.55	3.17	5.76	3.2	10.0	10.0	2.44	0.00	**7.8**
I-EM-08	10.20	5.00	0.00		0.00	0.00	5.76	3.2	0.0	10.6	2.37	0.00	**7.6**
I-EM-07	8.40	4.00	0.00		0.00	0.00	5.76	3.2	0.0	11.0	2.32	0.00	**7.4**
I-EM-06	7.90	3.90	0.00		0.00	0.00	5.76	3.2	0.0	12.0	2.23	0.00	**7.1**
I-EM-05	9.00	3.80	11.48		0.55	6.31	17.24	9.5	10.0	12.8	2.16	0.00	**20.6**
I-EM-04	9.00	3.75	0.00		0.00	0.00	17.24	9.5	0.0	13.6	2.09	0.00	**20.0**
I-EM-03	9.80	3.50	0.00		0.00	0.00	17.24	9.5	0.0	15.4	1.97	0.00	**18.8**
I-EM-02	9.70	3.25	0.00		0.00	0.00	17.24	9.5	0.0	15.5	1.96	0.00	**18.7**
I-EM-01	10.00	3.00	0.00		0.00	0.00	17.24	9.5	0.0	15.6	1.95	0.00	**18.6**
O-EM	9.80	2.80	0.00		0.00	0.00	17.24	9.5	0.0	16.1	1.92	0.00	**18.4**
Highway 101													
I-EN-03	10.00	-2.25	1.80		0.88	1.58	1.80	1.6	10.0	10.0	2.44	0.00	**3.9**
I-EN-02	9.00	-2.50	0.00		0.00	0.00	1.80	1.6	0.0	10.4	2.39	0.00	**3.8**
I-EN-01	10.20	-2.75	0.00		0.00	0.00	1.80	1.6	0.0	12.0	2.23	0.00	**3.6**
O-EN	7.00	-3.00	0.00		0.00	0.00	1.80	1.6	0.0	14.2	2.04	0.00	**3.3**
Ross Woods													
I-EO-03-03	101.00	97.00	0.82		0.55	0.45	0.82	0.5	10.0	10.0	2.54	0.00	**1.2**
I-EO-03-02	100.00	96.00	0.00		0.00	0.00	0.82	0.5	0.0	10.1	2.53	0.00	**1.2**
I-EO-03-01	85.00	81.00	0.00		0.00	0.00	0.82	0.5	0.0	10.3	2.51	0.00	**1.1**
I-EO-05	140.00	136.00	7.00		0.55	3.85	7.00	3.9	10.0	10.0	2.54	0.00	**9.9**
I-EO-04	102.00	98.00	0.00		0.00	0.00	7.00	3.9	0.0	10.1	2.52	0.00	**9.8**
I-EO-03	80.00	76.00	0.00	0.82	0.00	0.00	7.82	4.3	0.0	10.5	2.48	0.00	**10.8**
I-EO-02	70.00	66.00	0.00		0.00	0.00	7.82	4.3	0.0	10.6	2.47	0.00	**10.7**
I-EO-01	55.00	51.00	0.00		0.00	0.00	7.82	4.3	0.0	10.6	2.46	0.00	**10.7**
O-EO	52.00	48.00	0.00		0.00	0.00	7.82	4.3	0.0	11.1	2.41	0.00	**10.4**

(1) Nodes are presented in Figure D-EE-EO in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

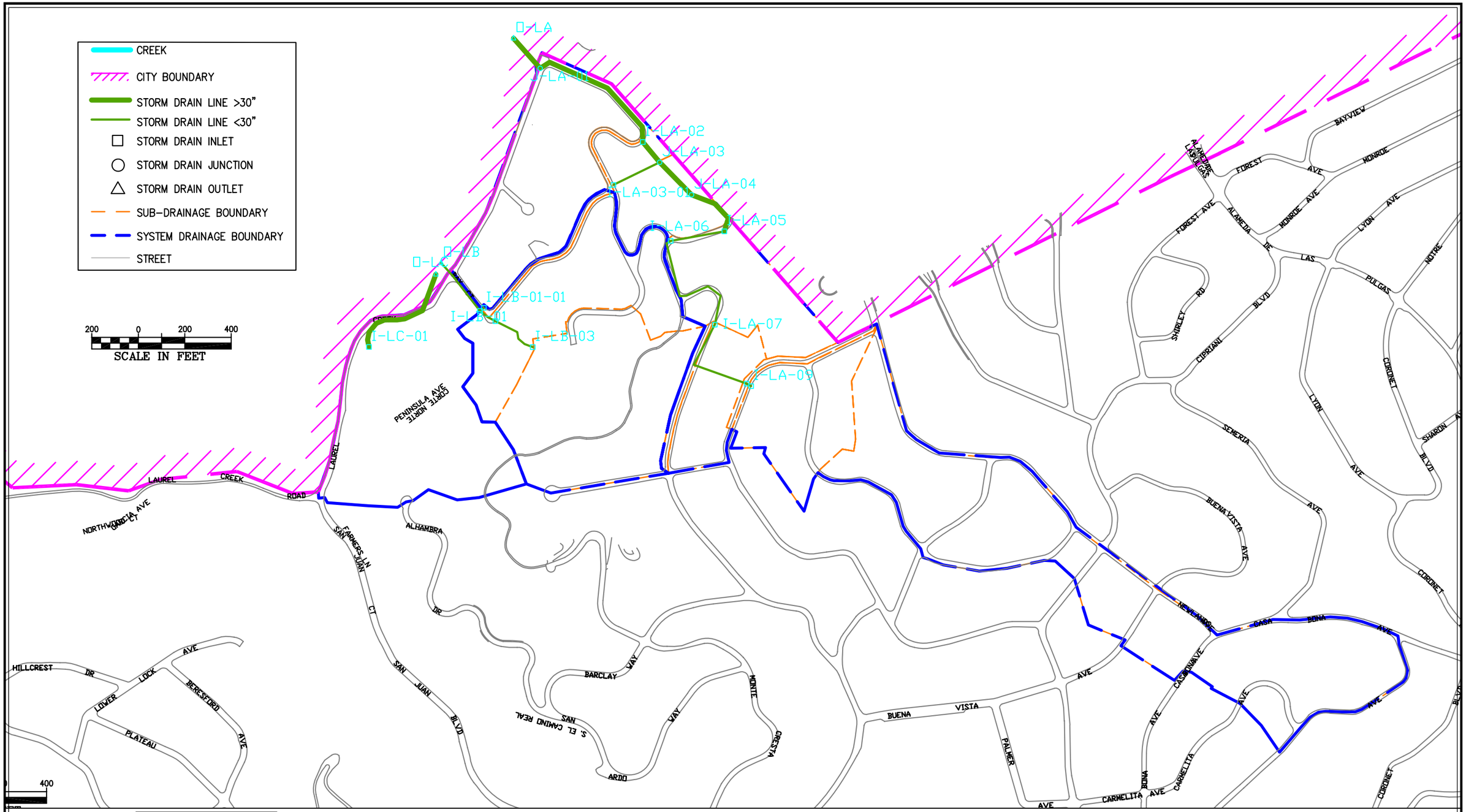
CITY OF BELMONT
STORM DRAIN MASTER PLAN

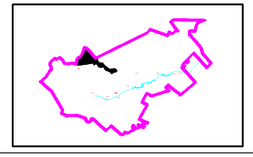
Table E5d

Proposed Hydraulics, 25-Year Event, Systems EE, EF, EG, EJ, EK, EL, EM, EN & EO

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/	Notes (6)
Ralston Avenue																		
P-EE-06	I-EE-06	I-EE-05	45.2	8.9	18 inch	278	0.007	0.013	27.0	25.0	32.0	30.0	81.4	30.0	**ABOVE RIM**	3.5	25.6	no change
P-EE-05	I-EE-05	I-EE-04	50.5	15.5	24 inch	425	0.005	0.013	25.0	23.0	30.0	28.1	49.3	28.1	**ABOVE RIM**	3.0	16.1	no change
P-EE-04	I-EE-04	I-EE-03	57.0	29.8	24 inch	347	0.017	0.013	23.0	17.0	28.1	22.0	44.0	22.0	**ABOVE RIM**	3.1	18.1	no change
P-EE-03	I-EE-03	I-EE-02	56.1	25.6	24 inch	359	0.013	0.013	17.0	12.4	22.0	17.4	39.5	17.4	**ABOVE RIM**	3.0	17.9	no change
P-EE-02	I-EE-02	J-EE-01	55.3	27.5	24 inch	88	0.015	0.013	12.4	11.1	17.4	16.1	21.4	16.1	**ABOVE RIM**	3.0	17.6	no change
P-EE-01	J-EE-01	O-EE	55.1	36.0	30 inch	195	0.008	0.013	11.1	9.6	16.1	14.6	15.6	12.0	**0.5**	2.5	11.2	upsized
Furlong Street to Diary Lane																		
P-EF-06	I-EF-06	I-EF-05	28.4	45.0	30 inch	233	0.012	0.013	18.4	15.6	22.4	19.6	20.2	17.7	**2.2**	1.5	9.7	upsized
P-EF-05	I-EF-05	I-EF-04	34.1	57.3	30 inch	236	0.019	0.013	15.6	11.0	19.6	15.0	17.6	13.1	**2.0**	1.5	12.2	upsized
P-EF-04	I-EF-04	I-EF-03	40.0	62.9	36 inch	236	0.009	0.013	11.0	8.9	15.0	12.9	13.1	11.1	**1.9**	1.0	9.4	upsized
P-EF-03	I-EF-03	I-EF-02	44.1	87.2	36 inch	234	0.017	0.013	8.9	4.9	12.9	9.9	11.1	8.2	**1.8**	1.0	12.4	upsized
P-EF-02	I-EF-02	I-EF-01	46.6	61.4	36 inch	248	0.008	0.013	4.9	2.8	9.9	7.8	8.2	7.0	**1.7**	2.0	6.6	upsized
P-EF-01	I-EF-01	O-EF	49.6	60.7	36 inch	338	0.008	0.013	2.8	**.0**	7.8	6.0	6.9	5.0	**0.9**	2.0	7.0	upsized
Sem Lane																		
P-EG-02	I-EG-02	I-EG-01	0.5	41.7	54 inch	654	0.000	0.012	- .2	- .4	7.0	6.7	6.7	6.7	**0.3**	2.7	0.0	upsized
P-EG-01	I-EG-01	O-EG	7.3	34.6	54 inch	380	0.000	0.012	- .4	- .5	6.7	7.0	7.6	7.6	**ABOVE RIM**	2.6	0.5	upsized
Ralston Exit, Highway 101																		
P-EJ-03	I-EJ-03	I-EJ-02	15.4	25.6	30 inch	128	0.004	0.013	4.5	4.0	9.5	9.0	6.1	6.0	**3.4**	2.5	5.5	upsized
P-EJ-02	I-EJ-02	I-EJ-01	15.1	11.3	30 inch	263	0.001	0.013	4.0	3.8	9.0	8.8	6.0	5.4	**3.0**	2.5	3.1	upsized
P-EJ-01	I-EJ-01	O-EJ	14.2	17.7	30 inch	54	0.002	0.013	3.8	3.7	8.8	8.7	5.3	5.0	**3.5**	2.5	4.0	upsized
Ralston Exit, Highway 101																		
P-EK-03	I-EK-03	I-EK-02	15.4	24.1	30 inch	145	0.003	0.013	4.5	4.0	9.5	9.0	6.2	6.0	**3.4**	2.5	5.2	upsized
P-EK-02	I-EK-02	I-EK-01	15.1	11.8	30 inch	242	0.001	0.013	4.0	3.8	9.0	8.8	6.0	5.4	**3.1**	2.5	3.1	upsized
P-EK-01	I-EK-01	O-EK	14.2	17.0	30 inch	58	0.002	0.013	3.8	3.7	8.8	8.7	5.3	5.0	**3.5**	2.5	3.9	upsized
Highway 101																		
P-EL-01-05	I-EL-01-05	I-EL-01-04	3.5	4.3	18 inch	152	0.002	0.013	- 2.3	- 2.5	8.5	9.0	5.0	4.9	**3.5**	9.3	2.0	no change
P-EL-01-04	I-EL-01-04	I-EL-01-03	3.3	3.0	18 inch	305	0.001	0.013	- 2.5	- 2.8	9.0	10.2	4.9	4.6	**4.2**	10.0	1.9	no change
P-EL-01-03	I-EL-01-03	I-EL-01-02	3.0	4.3	18 inch	153	0.002	0.013	- 2.8	- 3.0	10.2	9.0	4.5	4.4	**5.7**	11.5	1.7	no change
P-EL-01-02	I-EL-01-02	I-EL-01-01	2.8	3.4	18 inch	242	0.001	0.013	- 3.0	- 3.3	9.0	9.1	4.4	4.2	**4.6**	10.5	1.6	no change
P-EL-01-01	I-EL-01-01	I-EL-01	2.6	3.2	18 inch	270	0.001	0.013	- 3.3	- 3.5	9.1	10.0	4.2	4.1	**4.9**	10.9	1.5	no change
P-EL-03	I-EL-03	I-EL-02	86.5	125.3	66 inch	194	0.001	0.012	- 3.0	- 3.3	9.5	8.5	4.5	4.4	**5.0**	7.0	3.6	upsized
P-EL-02	I-EL-02	I-EL-01	82.9	125.7	4 x 3 ft	97	0.003	0.013	- 3.3	- 3.5	8.5	10.0	4.2	4.1	**4.3**	8.8	3.5	2 parallel
P-EL-01	I-EL-01	O-EL	62.1	148.4	48 inch	110	0.002	0.012	- 3.5	- 3.8	10.0	7.0	4.0	4.0	**6.0**	9.5	2.5	2 parallel
Oxford Way																		
P-EM-09	I-EM-09	I-EM-08	7.8	8.3	18 inch	152	0.005	0.012	5.8	5.0	9.1	10.2	7.7	6.9	**1.5**	1.8	4.4	upsized
P-EM-08	I-EM-08	I-EM-07	7.6	10.8	18 inch	111	0.009	0.012	5.0	4.0	10.2	8.4	6.7	6.2	**3.5**	3.7	4.3	upsized
P-EM-07	I-EM-07	I-EM-06	7.4	11.7	30 inch	145	0.001	0.012	4.0	3.9	8.4	7.9	6.2	6.2	**2.2**	1.9	2.5	upsized
P-EM-06	I-EM-06	I-EM-05	7.1	12.6	30 inch	125	0.001	0.012	3.9	3.8	7.9	9.0	6.2	6.1	**1.7**	1.5	2.6	upsized
P-EM-05	I-EM-05	I-EM-04	20.6	12.3	36 inch	146	0.000	0.013	3.8	3.8	9.0	9.0	6.1	5.9	**2.9**	2.2	2.9	upsized
P-EM-04	I-EM-04	I-EM-03	20.0	19.7	36 inch	336	0.001	0.012	3.8	3.5	9.0	9.8	5.8	5.2	**3.2**	2.3	3.2	upsized
P-EM-03	I-EM-03	I-EM-02	18.8	49.6	36 inch	53	0.005	0.012	3.5	3.3	9.8	9.7	4.9	5.0	**4.9**	3.3	6.5	upsized
P-EM-02	I-EM-02	I-EM-01	18.7	50.1	36 inch	52	0.005	0.012	3.3	3.0	9.7	10.0	4.8	4.9	**4.9**	3.5	6.6	upsized
P-EM-01	I-EM-01	O-EM	18.6	27.8	36 inch	115	0.002	0.013	3.0	2.8	10.0	9.8	4.7	4.2	**5.3**	4.0	4.2	upsized
Highway 101																		
P-EN-03	I-EN-03	I-EN-02	3.9	89.1	36 inch	14	0.018	0.013	- 2.3	- 2.5	10.0	9.0	4.0	4.0	**6.0**	9.3	0.6	no change
P-EN-02	I-EN-02	I-EN-01	3.8	15.3	2 x 2 ft	89	0.003	0.013	- 2.5	- 2.8	9.0	10.2	4.0	4.0	**5.0**	9.5	1.0	no change
P-EN-01	I-EN-01	O-EN	3.6	20.8	30 inch	97	0.003	0.013	- 2.8	- 3.0	10.2	7.0	4.0	4.0	**6.2**	10.5	0.7	no change
Ross Woods																		
P-EO-03-03	I-EO-03-03	I-EO-03-02	1.2	6.0	12 inch	35	0.029	0.013	97.0	96.0	101.0	100.0	97.5	96.5	**3.6**	3.0	5.9	no change
P-EO-03-02	I-EO-03-02	I-EO-03-01	1.2	13.1	12 inch	111	0.135	0.013	96.0	81.0	100.0	85.0	96.5	81.5	**3.6**	3.0	10.3	no change
P-EO-03-01	I-EO-03-01	I-EO-03	1.1	8.2	12 inch	94	0.053	0.013	81.0	76.0	85.0	80.0	81.5	77.3	**3.6**	3.0	7.4	no change
P-EO-05	I-EO-05	I-EO-04	9.9	16.8	12 inch	170	0.224	0.013	136.0	98.0	140.0	102.0	137.0	99.5	**3.0**	3.0	22.3	no change
P-EO-04	I-EO-04	I-EO-03	9.8	13.6	12 inch	150	0.147	0.013	98.0	76.0	102.0	80.0	99.0	77.7	**3.0**	3.0	18.9	no change
P-EO-03	I-EO-03	I-EO-02	10.8	11.3	12 inch	100	0.100	0.013	76.0	66.0	80.0	70.0	77.0	67.6	**3.0**	3.0	16.3	no change
P-EO-02	I-EO-02	I-EO-01	10.7	17.5	12 inch	62	0.242	0.013	66.0	51.0	70.0	55.0	67.0	52.9	**3.0**	3.0	23.4	no change
P-EO-01	I-EO-01	O-EO	10.7	13.8	18 inch	175	0.017	0.013	51.0	48.0	55.0	52.0	52.8	51.0	**2.2**	2.5	6.0	upsized

(1) Pipes are presented in Figure 2 and Figure D-EE-EO in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(5) New Pipes are in Bold
(6) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-L1A TO D-L1D

FIGURE D-LA-LC
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L1a

Existing Hydrology, 10-Year Event, Systems LA, LB & LC

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Laurel Creek Drainage														
Mean Annual Precipitation 24"														
Haskins Drive														
I-LA-03-01	300.00	296.50	297.43	297.43	5.26		0.50	2.63	5.26	2.6	10.0	10.0	2.21	**5.9**
I-LA-09	553.00	549.75	553.00	553.00	27.26		0.80	21.81	27.26	21.8	10.0	10.0	2.21	**48.6**
I-LA-08	553.00	549.00	588.54	553.00	0.49		0.80	0.39	27.75	22.2	10.0	10.0	2.21	**49.4**
I-LA-07	478.00	474.00	516.57	478.00	3.77		0.50	1.89	31.52	24.1	10.0	10.1	2.20	**53.3**
I-LA-06	384.60	380.60	406.45	384.60	0.00		0.00	0.00	31.52	24.1	10.0	10.3	2.17	**52.7**
I-LA-05	364.00	359.00	363.98	360.98	0.00		0.50	0.00	31.52	24.1	10.0	10.4	2.16	**52.5**
J-LA-04	333.00	329.00	332.61	330.98	0.00		0.00	0.00	31.52	24.1	0.0	10.6	2.15	**52.1**
J-LA-03	284.00	279.00	281.49	280.99	0.00	5.26	0.00	0.00	36.78	26.7	0.0	10.7	2.14	**57.6**
I-LA-02	253.20	247.20	251.65	249.66	12.97		0.80	10.38	49.75	37.1	10.0	10.7	2.13	**79.7**
J-LA-01	145.00	138.00	141.35	140.69	0.00		0.00	0.00	49.75	37.1	0.0	11.0	2.10	**78.7**
O-LA	144.00	137.00	137.00	137.00	0.00		0.00	0.00	49.75	37.1	0.0	11.3	2.08	**77.7**
Laurel Creek Road at Bay Court														
I-LB-01-01	202.00	197.50	198.85	198.85	0.36		0.50	0.18	0.36	0.2	10.0	10.0	2.21	**0.4**
I-LB-03	240.00	235.00	236.59	236.59	11.03		0.80	8.82	11.03	8.8	10.0	10.0	2.21	**19.7**
I-LB-02	209.40	204.40	206.36	206.24	8.02		0.50	4.01	19.05	12.8	10.0	10.2	2.19	**28.4**
I-LB-01	202.00	197.00	198.85	198.84	0.00	0.36	0.50	0.00	19.41	13.0	10.0	10.2	2.19	**0.4**
O-LB	150.00	145.00	164.40	164.40	0.00		0.00	0.00	19.41	13.0	0.0	10.4	2.17	**28.7**
Laurel Creek Road near Bay Court														
I-LC-01	163.00	152.00	163.00	163.00	225.49		0.50	112.75	225.49	112.8	10.0	10.0	2.21	**251.1**
O-LC	160.00	149.00	164.80	164.80	0.00		0.00	0.00	225.49	112.8	0.0	11.6	2.05	**232.8**

(1) Nodes are presented in Figure D-LA-LC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L1b

Existing Hydraulics, 10-Year Event, Systems LA, LB & LC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Laurel Creek Drainage																	
Mean Annual Precipitation 24"																	
Haskins Drive																	
P-LA-03-01	I-LA-03-01	J-LA-03	5.9	16.0	18 inch	222	0.079	0.024	296.5	279.0	300.0	284.0	297.4	281.5	**2.6**	2.0	8.3
P-LA-09	I-LA-09	I-LA-08	48.6	3.6	12 inch	22	0.034	0.024	549.8	549.0	553.0	553.0	692.4	553.0	**ABOVE RIM**	2.3	61.8
P-LA-08	I-LA-08	I-LA-07	49.4	8.0	12 inch	437	0.172	0.024	549.0	474.0	553.0	478.0	3,344.9	478.0	**ABOVE RIM**	3.0	62.9
P-LA-07	I-LA-07	I-LA-06	53.3	25.9	15 inch	581	0.161	0.013	474.0	380.6	478.0	384.6	780.4	384.6	**ABOVE RIM**	2.8	43.5
P-LA-06	I-LA-06	I-LA-05	52.7	19.6	15 inch	235	0.092	0.013	380.6	359.0	384.6	364.0	520.7	364.0	**ABOVE RIM**	2.8	43.0
P-LA-05	I-LA-05	J-LA-04	52.5	78.1	24 inch	252	0.119	0.013	359.0	329.0	364.0	333.0	361.0	332.6	**3.0**	3.0	26.7
P-LA-04	J-LA-04	J-LA-03	52.1	114.3	24 inch	196	0.255	0.013	329.0	279.0	333.0	284.0	331.0	281.9	**2.0**	2.0	35.5
P-LA-03	J-LA-03	I-LA-02	57.6	119.5	24 inch	114	0.279	0.013	279.0	247.2	284.0	253.2	281.0	251.7	**3.0**	3.0	37.7
P-LA-02	I-LA-02	J-LA-01	79.7	173.4	30 inch	611	0.179	0.013	247.2	138.0	253.2	145.0	249.7	141.4	**3.5**	3.5	34.6
P-LA-01	J-LA-01	O-LA	78.7	118.3	48 inch	173	0.006	0.012	138.0	137.0	145.0	144.0	140.7	139.4	**4.3**	3.0	10.1
Laurel Creek Road at Bay Court																	
P-LB-01-01	I-LB-01-01	I-LB-01	0.4	34.9	24 inch	21	0.024	0.013	197.5	197.0	202.0	202.0	198.9	198.9	**3.2**	2.5	3.7
P-LB-03	I-LB-03	I-LB-02	19.7	87.0	24 inch	207	0.148	0.013	235.0	204.4	240.0	209.4	236.6	206.4	**3.4**	3.0	22.4
P-LB-02	I-LB-02	I-LB-01	28.4	68.4	24 inch	81	0.091	0.013	204.4	197.0	209.4	202.0	206.2	199.2	**3.2**	3.0	20.8
P-LB-01	I-LB-01	O-LB	28.7	100.0	24 inch	266	0.195	0.013	197.0	145.0	202.0	150.0	198.8	164.4	**3.2**	3.0	27.5
Laurel Creek Road near Bay Court																	
P-LC-01	I-LC-01	O-LC	251.1	772.3	96 inch	491	0.006	0.012	152.0	149.0	163.0	160.0	165.1	164.8	**ABOVE RIM**	3.0	5.0

(1) Pipes are presented in Figure 2 and Figure D-LA-LC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L1c

Proposed Hydrology, 25-Year Event, Systems LA, LB & LC

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (4) (cfs)**
Laurel Creek Drainage															
Mean Annual Precipitation 24"															
Haskins Drive															
I-LA-03-01	300.00	296.50	297.58	297.58	5.26		0.55	2.89	5.26	2.9	10.0	10.0	2.64	0.00	**7.7**
I-LA-09	553.00	549.75	551.74	551.74	27.26		0.88	23.99	27.26	24.0	10.0	10.0	2.64	0.00	**63.9**
I-LA-08	553.00	540.00	543.31	541.99	0.49		0.88	0.43	27.75	24.4	10.0	10.0	2.64	0.00	**65.0**
I-LA-07	478.00	474.00	478.14	475.99	3.77		0.55	2.07	31.52	26.5	10.0	10.2	2.61	0.00	**69.8**
I-LA-06	384.60	360.00	385.04	380.19	0.00		0.00	0.00	31.52	26.5	10.0	10.5	2.58	0.00	**68.8**
I-LA-05	364.00	354.00	358.44	356.43	0.00		0.55	0.00	31.52	26.5	10.0	10.7	2.56	0.00	**68.2**
J-LA-04	333.00	329.00	332.50	331.43	0.00		0.00	0.00	31.52	26.5	0.0	10.8	2.54	0.00	**67.8**
J-LA-03	284.00	279.00	281.79	281.45	0.00	5.26	0.00	0.00	36.78	29.4	0.0	10.9	2.53	0.00	**74.9**
I-LA-02	253.20	247.20	253.06	249.69	12.97		0.88	11.41	49.75	40.8	10.0	11.0	2.52	0.00	**103.7**
J-LA-01	145.00	138.00	141.98	141.07	0.00		0.00	0.00	49.75	40.8	0.0	11.3	2.49	0.00	**102.5**
O-LA	144.00	137.00	138.40	138.40	0.00		0.00	0.00	49.75	40.8	0.0	11.5	2.46	0.00	**101.2**
Laurel Creek Road at Bay Court															
I-LB-01-01	202.00	197.50	198.96	198.96	0.36		0.55	0.20	0.36	0.2	10.0	10.0	2.64	0.00	**0.5**
I-LB-03	240.00	235.00	236.78	236.78	11.03		0.88	9.71	11.03	9.7	10.0	10.0	2.64	0.00	**25.9**
I-LB-02	209.40	204.40	206.54	206.34	8.02		0.55	4.41	19.05	14.1	10.0	10.1	2.62	0.00	**37.3**
I-LB-01	202.00	197.00	198.96	198.94	0.00	0.36	0.55	0.00	19.41	14.3	10.0	10.2	2.62	0.00	**0.5**
O-LB	150.00	145.00	166.10	166.10	0.00		0.00	0.00	19.41	14.3	0.0	10.4	2.60	0.00	**37.7**
Laurel Creek Road near Bay Court															
I-LC-01	163.00	152.00	163.00	163.00	225.49		0.55	124.02	225.49	124.0	10.0	10.0	2.64	0.00	**330.3**
O-LC	160.00	149.00	166.50	166.50	0.00		0.00	0.00	225.49	124.0	0.0	11.3	2.49	0.00	**311.5**

(1) Nodes are presented in Figure D-LA-LC in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

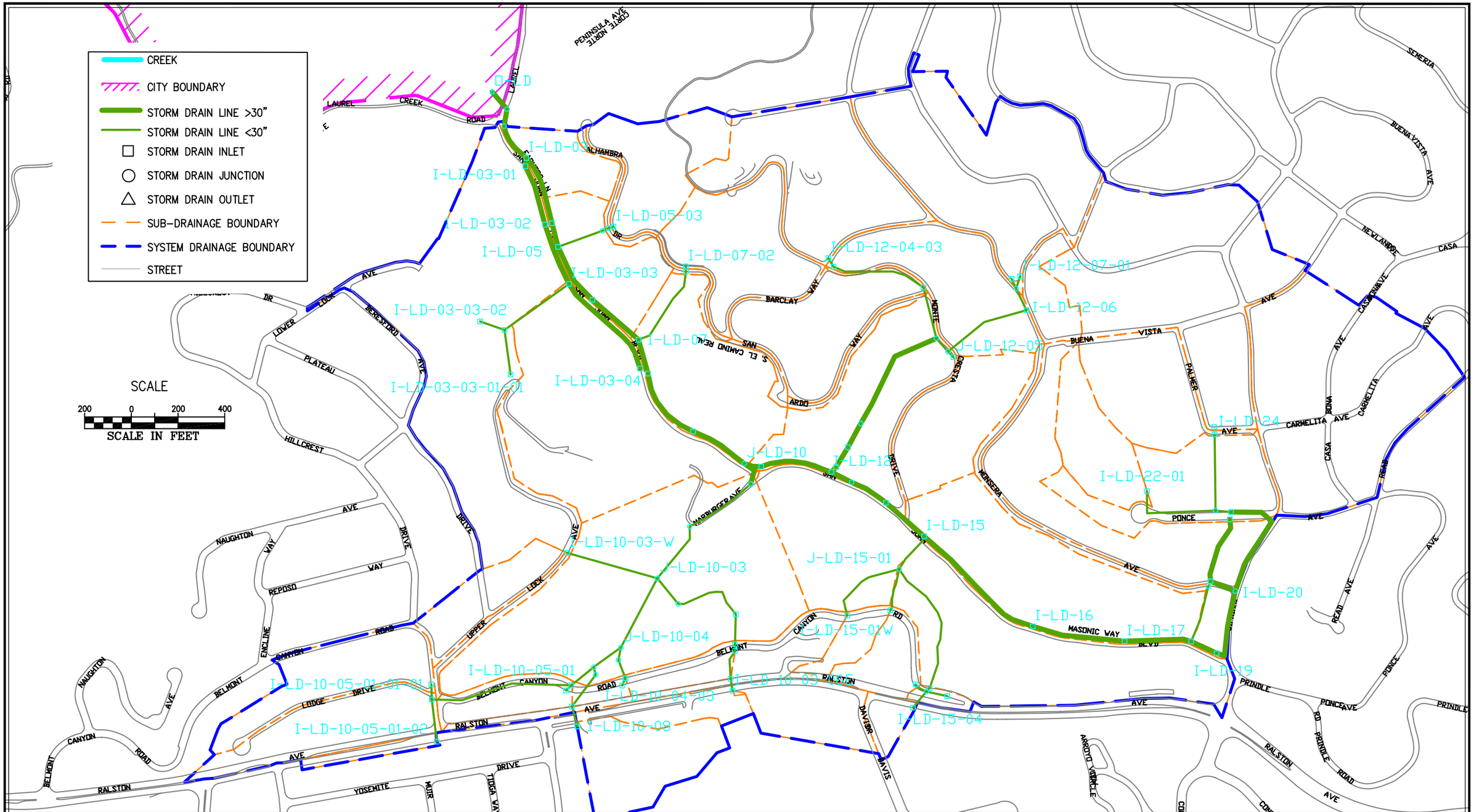
CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L1d

Proposed Hydraulics, 25-Year Event, Systems LA, LB & LC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Laurel Creek Drainage																		
Mean Annual Precipitation 24"																		
Haskins Drive																		
P-LA-03-01	I-LA-03-01	J-LA-03	7.7	16.0	18 inch	222	0.079	0.024	296.50	279.00	300.00	284.00	297.58	281.79	**2.4**	2.0	9.0	no change
P-LA-09	I-LA-09	I-LA-08	63.9	163.1	24 inch	22	0.443	0.012	549.75	540.00	553.00	553.00	551.74	543.31	**1.3**	1.3	48.8	upsized
P-LA-08	I-LA-08	I-LA-07	65.0	95.2	24 inch	437	0.151	0.012	540.00	474.00	553.00	478.00	541.99	478.00	**11.0**	11.0	32.6	upsized
P-LA-07	I-LA-07	I-LA-06	69.8	100.2	24 inch	581	0.196	0.013	474.00	360.00	478.00	384.60	475.99	384.60	**2.0**	2.0	34.5	upsized
P-LA-06	I-LA-06	I-LA-05	68.8	36.2	24 inch	235	0.026	0.013	360.00	354.00	384.60	364.00	380.19	358.44	**4.4**	22.6	21.9	upsized
P-LA-05	I-LA-05	J-LA-04	68.2	140.0	30 inch	252	0.099	0.012	354.00	329.00	364.00	333.00	356.43	332.50	**7.6**	7.5	28.3	upsized
P-LA-04	J-LA-04	J-LA-03	67.8	207.2	30 inch	196	0.255	0.013	329.00	279.00	333.00	284.00	331.43	282.02	**1.6**	1.5	37.8	upsized
P-LA-03	J-LA-03	I-LA-02	74.9	216.6	30 inch	114	0.279	0.013	279.00	247.20	284.00	253.20	281.45	253.06	**2.6**	2.5	40.1	upsized
P-LA-02	I-LA-02	J-LA-01	103.7	173.4	30 inch	611	0.179	0.013	247.20	138.00	253.20	145.00	249.69	141.98	**3.5**	3.5	36.9	no change
P-LA-01	J-LA-01	O-LA	102.5	118.3	48 inch	173	0.006	0.012	138.00	137.00	145.00	144.00	141.07	139.88	**3.9**	3.0	10.6	no change
Laurel Creek Road at Bay Court																		
P-LB-01-01	I-LB-01-01	I-LB-01	0.5	34.9	24 inch	21	0.024	0.013	197.50	197.00	202.00	202.00	198.96	198.96	**3.0**	2.5	4.0	no change
P-LB-03	I-LB-03	I-LB-02	25.9	87.0	24 inch	207	0.148	0.013	235.00	204.40	240.00	209.40	236.78	206.54	**3.2**	3.0	24.1	no change
P-LB-02	I-LB-02	I-LB-01	37.3	68.4	24 inch	81	0.091	0.013	204.40	197.00	209.40	202.00	206.34	199.50	**3.1**	3.0	22.2	no change
P-LB-01	I-LB-01	O-LB	37.7	100.0	24 inch	266	0.195	0.013	197.00	145.00	202.00	150.00	198.94	166.10	**3.1**	3.0	29.6	no change
Laurel Creek Road near Bay Court																		
P-LC-01	I-LC-01	O-LC	330.3	772.3	96 inch	491	0.006	0.012	152.00	149.00	163.00	160.00	167.05	166.50	**ABOVE RIM**	3.0	6.6	no change

(1) Pipes are presented in Figure 2 and Figure D-LA-LC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.



SEE FOLLOWING
TABLES D-L2A TO D-L2D

FIGURE D-LD
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L2a (page 1 of 2)

Existing Hydrology, 10-Year Event, System LD

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Laurel Creek Drainage														
Mean Annual Precipitation 24"														
San Juan Court at Laurel Creek Road														
Ponce Avenue														
I-LD-22-01	430.00	426.50	427.32	427.32	3.31		0.50	1.66	3.31	1.7	10.0	10.0	2.21	**3.7**
I-LD-20-02	400.00	394.00	395.51	395.51	19.80		0.50	9.90	19.80	9.9	10.0	10.0	2.21	**22.1**
I-LD-20-01	387.00	381.00	384.01	383.71	7.61		0.80	6.09	27.41	16.0	10.0	10.3	2.17	**35.0**
I-LD-18-01	386.90	381.90	382.33	382.33	1.20		0.50	0.60	1.20	0.6	10.0	10.0	2.21	**1.3**
I-LD-15-03W	469.00	465.00	465.77	465.77	2.06		0.80	1.65	2.06	1.7	10.0	10.0	2.21	**3.7**
I-LD-15-03E	462.00	459.50	460.22	460.22	0.43		0.50	0.22	0.43	0.2	10.0	10.0	2.21	**0.5**
I-LD-15-01W	495.10	492.10	492.69	492.69	1.98		0.50	0.99	1.98	1.0	10.0	10.0	2.21	**2.2**
I-LD-15-01S	486.10	482.85	483.41	483.41	1.12		0.80	0.90	1.12	0.9	10.0	10.0	2.21	**2.0**
I-LD-15-04	478.00	474.00	474.73	474.73	3.89		0.50	1.95	3.89	2.0	10.0	10.0	2.21	**4.3**
J-LD-15-03	464.00	459.00	460.20	460.10	0.00	2.49	0.00	0.00	6.38	3.8	0.0	10.9	2.11	**8.1**
I-LD-15-02	464.00	457.50	458.78	458.60	0.00		0.00	0.00	6.38	3.8	10.0	11.0	2.11	**8.1**
J-LD-15-01	385.00	380.00	381.80	381.21	0.00	3.10	0.00	0.00	9.48	5.7	0.0	11.9	2.03	**11.6**
I-LD-12-07-01	476.50	471.50	476.50	476.50	12.02		0.50	6.01	12.02	6.0	10.0	10.0	2.21	**13.4**
I-LD-12-05-01	359.00	355.50	357.83	357.83	6.03		0.80	4.82	6.03	4.8	10.0	10.0	2.21	**10.7**
I-LD-12-04-03	424.00	420.00	422.57	422.57	8.21		0.50	4.11	8.21	4.1	10.0	10.0	2.21	**9.1**
I-LD-12-04-02	422.00	418.00	419.63	419.16	0.00		0.00	0.00	8.21	4.1	10.0	10.1	2.20	**9.1**
I-LD-12-04-01	389.20	384.20	385.64	385.35	0.11		0.50	0.06	8.32	4.2	10.0	10.8	2.12	**8.9**
I-LD-12-08	476.00	471.50	475.00	475.00	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
J-LD-12-07	475.00	470.00	478.07	475.00	0.00	12.02	0.00	0.00	12.02	6.0	0.0	10.1	2.20	**13.3**
I-LD-12-06	469.80	462.50	465.20	463.73	1.70		0.00	0.00	13.72	6.0	10.0	10.2	2.19	**13.3**
J-LD-12-05	360.00	355.00	356.91	356.72	0.00	6.03	0.00	0.00	19.75	10.8	0.0	10.6	2.15	**23.5**
J-LD-12-04	370.00	350.00	352.07	351.92	0.00	8.32	0.00	0.00	28.07	15.0	0.0	11.0	2.10	**31.8**
J-LD-12-03	275.00	269.00	270.99	270.91	0.00		0.00	0.00	28.07	15.0	0.0	11.4	2.07	**31.3**
I-LD-12-02	266.00	259.00	260.99	260.90	0.00		0.00	0.00	28.07	15.0	10.0	11.5	2.06	**31.2**
I-LD-12-01	265.00	258.00	260.08	259.90	0.00		0.00	0.00	28.07	15.0	10.0	11.6	2.05	**31.0**
Marburger Avenue														
I-LD-10-05-01-01-01	563.00	559.00	559.24	559.24	0.00		0.80	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-10-05-01-02	576.00	572.00	572.32	572.32	0.68		0.50	0.34	0.68	0.3	10.0	10.0	2.21	**0.8**
I-LD-10-05-01-01	562.90	558.90	559.24	559.24	9.60	0.00	0.00	0.00	10.28	0.3	10.0	10.4	2.16	**0.7**
I-LD-10-05-02	540.00	536.00	536.00	536.00	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-10-05-01	530.00	524.50	525.17	525.13	2.00	10.28	0.50	1.00	12.28	1.3	10.0	12.0	2.02	**2.7**
I-LD-10-04-03	528.00	524.00	524.90	524.90	4.20		0.50	2.10	4.20	2.1	10.0	10.0	2.21	**4.7**
I-LD-10-04-02	522.00	519.00	520.27	519.90	0.00		0.00	0.00	4.20	2.1	10.0	10.0	2.21	**4.7**
J-LD-10-04-01	480.00	475.00	476.21	475.90	0.00		0.00	0.00	4.20	2.1	0.0	10.1	2.20	**4.7**
I-LD-10-03-06E	534.00	530.00	530.68	530.68	1.80		0.80	1.44	1.80	1.4	10.0	10.0	2.21	**3.2**
I-LD-10-03-05E	531.00	526.00	526.76	526.73	0.40		0.50	0.20	2.20	1.6	10.0	10.1	2.20	**3.6**
I-LD-10-03-04E	507.00	502.00	502.82	502.72	0.00		0.00	0.00	2.20	1.6	10.0	10.3	2.18	**3.6**
I-LD-10-03-03E	504.00	501.25	502.15	502.11	1.26		0.50	0.63	3.46	2.3	10.0	10.4	2.17	**5.0**
I-LD-10-03-02E	475.00	470.00	471.10	470.90	0.00		0.00	0.00	3.46	2.3	10.0	10.6	2.15	**4.9**
J-LD-10-03-01E	400.00	395.00	396.12	395.89	0.00		0.00	0.00	3.46	2.3	0.0	11.0	2.11	**4.8**
I-LD-10-03-W	502.60	498.60	499.34	499.34	2.70		0.50	1.35	2.70	1.4	10.0	10.0	2.21	**3.0**

(1) Nodes are presented in Figure D-LD in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L2a (page 2 of 2)

Existing Hydrology, 10-Year Event, System LD

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
I-LD-10-08	560.00	556.50	556.50	556.50	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-10-07	556.00	552.00	552.29	552.26	0.41		0.50	0.21	0.41	0.2	10.0	10.0	2.21	**0.5**
J-LD-10-06	500.00	495.00	495.27	495.25	0.00		0.00	0.00	0.41	0.2	0.0	10.3	2.18	**0.5**
J-LD-10-05	490.00	485.00	485.71	485.67	0.00	12.28	0.00	0.00	12.69	1.6	0.0	12.2	2.00	**3.1**
J-LD-10-04	460.00	455.00	456.20	456.04	0.00	4.20	0.00	0.00	16.89	3.7	0.0	12.4	1.98	**7.3**
J-LD-10-03	350.00	345.00	346.47	346.37	0.00	6.16	0.00	0.00	23.05	7.3	0.0	12.7	1.96	**14.4**
J-LD-10-02	300.00	295.00	296.60	296.31	0.00		0.00	0.00	23.05	7.3	0.0	12.9	1.95	**14.3**
J-LD-10-01	265.00	258.00	259.40	259.23	0.00		0.00	0.00	23.05	7.3	0.0	13.2	1.92	**14.1**
I-LD-07-02	327.50	323.50	323.50	323.50	0.00		0.50	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-07-01	327.00	323.00	323.23	323.23	0.31		0.50	0.16	0.31	0.2	10.0	10.0	2.21	**0.4**
I-LD-05-03	323.50	318.50	319.42	319.42	4.58		0.50	2.29	4.58	2.3	10.0	10.0	2.21	**5.1**
I-LD-05-02	323.00	317.75	318.80	318.71	0.48		0.50	0.24	5.06	2.5	10.0	10.0	2.21	**5.6**
J-LD-05-01	310.00	305.00	305.86	305.84	0.00		0.00	0.00	5.06	2.5	0.0	10.1	2.20	**5.6**
I-LD-03-03-01-01	408.00	403.00	403.00	403.00	0.00		0.80	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-03-03-02	400.00	395.00	395.00	395.00	0.00		0.80	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-03-03-01	395.00	390.00	390.00	390.00	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-03-04	232.50	225.50	225.50	225.50	0.00		0.00	0.00	0.00	0.0	10.0	10.0	0.00	**0.0**
I-LD-03-03	218.00	211.00	212.56	212.55	13.00	0.00	0.80	10.40	13.00	10.4	10.0	10.0	2.21	**23.2**
I-LD-03-02	212.40	205.40	206.98	206.93	0.00		0.00	0.00	13.00	10.4	10.0	10.4	2.17	**22.7**
I-LD-03-01	204.00	197.00	200.37	200.14	18.27		0.50	9.14	31.27	19.5	10.0	10.8	2.13	**42.0**
San Juan Boulevard														
I-LD-24	422.70	417.70	419.99	419.99	14.28		0.50	7.14	14.28	7.1	10.0	10.0	2.21	**15.9**
I-LD-23	421.00	416.00	419.28	418.62	4.82		0.80	3.86	19.10	11.0	10.0	10.1	2.20	**24.4**
J-LD-22	403.00	398.00	400.14	399.70	0.00	3.31	0.00	0.00	22.41	12.7	0.0	10.6	2.15	**27.4**
I-LD-21	400.80	384.80	386.55	386.49	0.00		0.00	0.00	22.41	12.7	10.0	10.6	2.15	**27.4**
J-LD-20	389.00	380.00	383.28	383.02	0.00	27.41	0.00	0.00	49.82	28.6	0.0	11.6	2.05	**59.2**
I-LD-19	384.00	378.00	380.65	380.48	0.91		0.50	0.46	50.73	29.1	10.0	12.3	2.00	**58.5**
I-LD-18	373.10	369.10	371.53	371.49	0.00	1.20	0.00	0.00	51.93	29.7	10.0	12.3	1.99	**59.5**
I-LD-17	355.40	349.40	352.13	351.88	0.00		0.00	0.00	51.93	29.7	10.0	12.6	1.97	**59.0**
I-LD-16	339.20	334.20	336.82	336.66	0.00		0.00	0.00	51.93	29.7	10.0	12.9	1.94	**58.2**
I-LD-15	306.00	300.00	303.15	302.71	32.15	9.48	0.50	16.07	93.56	51.5	10.0	13.4	1.91	**98.9**
I-LD-14	287.00	281.00	284.15	283.71	0.00		0.00	0.00	93.56	51.5	10.0	13.6	1.90	**98.5**
J-LD-13	267.30	261.30	264.51	264.19	0.00		0.00	0.00	93.56	51.5	0.0	13.7	1.89	**98.1**
I-LD-12	263.00	253.00	256.67	256.37	0.00	28.07	0.00	0.00	121.63	66.5	10.0	13.7	1.89	**126.4**
I-LD-11	254.90	247.90	252.41	251.60	26.30		0.80	21.04	147.93	87.5	10.0	14.0	1.87	**164.6**
J-LD-10	253.00	246.00	250.24	249.77	0.00	23.05	0.00	0.00	170.98	94.8	0.0	14.1	1.86	**177.9**
I-LD-09	244.00	237.00	241.16	240.80	6.10		0.80	4.88	177.08	99.6	10.0	14.3	1.85	**185.9**
I-LD-08	236.00	232.00	236.96	236.00	0.00		0.00	0.00	177.08	99.6	10.0	14.6	1.83	**183.9**
I-LD-07	236.00	230.00	237.60	236.00	6.81	0.31	0.80	5.45	184.20	105.3	10.0	14.7	1.82	**193.6**
I-LD-06	220.60	212.60	219.79	219.20	0.00		0.00	0.00	184.20	105.3	10.0	14.8	1.81	**192.5**
I-LD-05	215.00	206.50	216.35	215.00	0.00	5.06	0.00	0.00	189.26	107.8	10.0	15.1	1.80	**195.2**
I-LD-04	212.40	206.40	212.80	212.07	4.00		0.80	3.20	193.26	111.0	10.0	15.2	1.79	**200.4**
I-LD-03	200.00	192.00	200.80	199.23	2.22	31.27	0.50	1.11	226.75	131.6	10.0	15.5	1.78	**235.8**
J-LD-02	195.30	188.30	200.41	195.30	0.00		0.00	0.00	226.75	131.6	0.0	15.6	1.77	**234.7**
J-LD-01	194.00	186.00	193.79	192.38	0.00		0.00	0.00	226.75	131.6	0.0	15.6	1.77	**234.4**
O-LD	193.00	185.00	191.70	191.70	0.00		0.00	0.00	226.75	131.6	0.0	15.8	1.76	**233.4**

(1) Nodes are presented in Figure D-LD in Appendix D
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(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
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CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L2b (page 1 of 2)

Existing Hydraulics, 10-Year Event, Systems LD

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
Laurel Creek Drainage																	
Mean Annual Precipitation 24"																	
San Juan Court at Laurel Creek Road																	
Ponce Avenue																	
P-LD-22-01	I-LD-22-01	J-LD-22	3.7	9.6	12 inch	389	0.073	0.013	426.5	398.0	430.0	403.0	427.3	400.1	**2.7**	2.5	11.5
P-LD-20-02	I-LD-20-02	I-LD-20-01	22.1	142.0	36 inch	287	0.045	0.013	394.0	381.0	400.0	387.0	395.5	384.0	**4.5**	3.0	14.6
P-LD-20-01	I-LD-20-01	J-LD-20	35.0	62.5	36 inch	114	0.009	0.013	381.0	380.0	387.0	389.0	383.7	383.4	**3.3**	3.0	9.1
P-LD-18-01	I-LD-18-01	I-LD-18	1.3	12.9	18 inch	249	0.051	0.024	381.9	369.1	386.9	373.1	382.3	371.5	**4.6**	3.5	4.7
P-LD-15-04	I-LD-15-04	J-LD-15-03	4.3	50.0	24 inch	90	0.167	0.024	474.0	459.0	478.0	464.0	474.7	460.2	**3.3**	2.0	9.8
P-LD-15-03W	I-LD-15-03W	J-LD-15-03	3.7	27.2	15 inch	57	0.105	0.010	465.0	459.0	469.0	464.0	465.8	460.2	**3.2**	2.8	15.5
P-LD-15-03E	I-LD-15-03E	J-LD-15-03	0.5	2.6	15 inch	91	0.005	0.024	459.5	459.0	462.0	464.0	460.2	460.2	**1.8**	1.3	1.6
P-LD-15-03	J-LD-15-03	I-LD-15-02	8.1	15.2	18 inch	21	0.071	0.024	459.0	457.5	464.0	464.0	460.1	458.8	**3.9**	3.5	8.7
P-LD-15-02	I-LD-15-02	J-LD-15-01	8.1	20.7	18 inch	586	0.132	0.024	457.5	380.0	464.0	385.0	458.6	381.9	**5.4**	5.0	11.0
P-LD-15-01W	I-LD-15-01W	J-LD-15-01	2.2	19.8	15 inch	349	0.321	0.024	492.1	380.0	495.1	385.0	492.7	381.8	**2.4**	1.8	10.7
P-LD-15-01S	I-LD-15-01S	J-LD-15-01	2.0	26.4	15 inch	181	0.568	0.024	482.9	380.0	486.1	385.0	483.4	381.9	**2.7**	2.0	12.7
P-LD-15-01	J-LD-15-01	I-LD-15	11.6	23.4	15 inch	179	0.447	0.024	380.0	300.0	385.0	306.0	381.2	303.3	**3.8**	3.8	19.0
P-LD-12-07-01	I-LD-12-07-01	J-LD-12-07	13.4	5.7	15 inch	56	0.027	0.024	471.5	470.0	476.5	475.0	483.2	475.0	**ABOVE RIM**	3.8	10.9
P-LD-12-05-01	I-LD-12-05-01	J-LD-12-05	10.7	8.0	15 inch	33	0.015	0.013	355.5	355.0	359.0	360.0	357.8	356.9	**1.2**	2.3	8.8
P-LD-12-04-03	I-LD-12-04-03	I-LD-12-04-02	9.1	7.6	15 inch	43	0.047	0.024	420.0	418.0	424.0	422.0	422.6	419.6	**1.4**	2.8	7.5
P-LD-12-04-02	I-LD-12-04-02	I-LD-12-04-01	9.1	10.1	15 inch	408	0.083	0.024	418.0	384.2	422.0	389.2	419.2	385.6	**2.8**	2.8	9.3
P-LD-12-04-01	I-LD-12-04-01	J-LD-12-04	8.9	41.0	18 inch	225	0.152	0.013	384.2	350.0	389.2	370.0	385.4	352.1	**3.8**	3.5	18.5
P-LD-12-08	I-LD-12-08	J-LD-12-07	0.0	6.4	12 inch	46	0.033	0.013	471.5	470.0	476.0	475.0	475.0	475.0	**1.0**	3.5	0.0
P-LD-12-07	J-LD-12-07	I-LD-12-06	13.3	9.6	12 inch	103	0.073	0.013	470.0	462.5	475.0	469.8	479.6	465.2	**ABOVE RIM**	4.0	17.0
P-LD-12-06	I-LD-12-06	J-LD-12-05	13.3	18.4	15 inch	388	0.277	0.024	462.5	355.0	469.8	360.0	463.7	357.1	**6.1**	6.1	16.3
P-LD-12-05	J-LD-12-05	J-LD-12-04	23.5	58.4	24 inch	75	0.067	0.013	355.0	350.0	360.0	370.0	356.7	352.3	**3.3**	3.0	17.6
P-LD-12-04	J-LD-12-04	J-LD-12-03	31.8	162.4	30 inch	517	0.157	0.013	350.0	269.0	370.0	275.0	351.9	271.0	**18.1**	17.5	25.7
P-LD-12-03	J-LD-12-03	I-LD-12-02	31.3	120.4	30 inch	116	0.086	0.013	269.0	259.0	275.0	266.0	270.9	261.0	**4.1**	3.5	20.6
P-LD-12-02	I-LD-12-02	I-LD-12-01	31.2	41.4	30 inch	98	0.010	0.013	259.0	258.0	266.0	265.0	260.9	260.1	**5.1**	4.5	9.3
P-LD-12-01	I-LD-12-01	I-LD-12	31.0	167.4	30 inch	30	0.167	0.013	258.0	253.0	265.0	263.0	259.9	256.8	**5.1**	4.5	26.1
Marburger Avenue																	
P-LD-10-05-01-01-01	-LD-10-05-01-01-0	I-LD-10-05-01-01	0.0	1.4	12 inch	65	0.002	0.013	559.0	558.9	563.0	562.9	559.2	559.2	**3.8**	3.0	0.0
P-LD-10-05-01-02	I-LD-10-05-01-02	I-LD-10-05-01-01	0.8	28.2	18 inch	182	0.072	0.013	572.0	558.9	576.0	562.9	572.3	559.3	**3.7**	2.5	6.9
P-LD-10-05-01-01	I-LD-10-05-01-01	I-LD-10-05-01	0.7	15.4	15 inch	609	0.056	0.013	558.9	524.5	562.9	530.0	559.2	525.2	**3.7**	2.8	6.5
P-LD-10-05-02	I-LD-10-05-02	I-LD-10-05-01	0.0	21.4	12 inch	32	0.359	0.013	536.0	524.5	540.0	530.0	536.0	525.2	**4.0**	3.0	0.0
P-LD-10-05-01	I-LD-10-05-01	J-LD-10-05	2.7	32.1	18 inch	124	0.319	0.024	524.5	485.0	530.0	490.0	525.1	485.8	**4.9**	4.0	11.1
P-LD-10-04-03	I-LD-10-04-03	I-LD-10-04-02	4.7	13.5	12 inch	35	0.143	0.013	524.0	519.0	528.0	522.0	524.9	520.3	**3.1**	3.0	15.6
P-LD-10-04-02	I-LD-10-04-02	J-LD-10-04-01	4.7	14.0	12 inch	84	0.524	0.024	519.0	475.0	522.0	480.0	519.9	476.2	**2.1**	2.0	16.0
P-LD-10-04-01	J-LD-10-04-01	J-LD-10-04	4.7	11.6	12 inch	55	0.364	0.024	475.0	455.0	480.0	460.0	475.9	456.2	**4.1**	4.0	14.0
P-LD-10-03-W	I-LD-10-03-W	J-LD-10-03	3.0	22.1	12 inch	401	0.383	0.013	498.6	345.0	502.6	350.0	499.3	346.5	**3.3**	3.0	19.6
P-LD-10-03-06E	I-LD-10-03-06E	I-LD-10-03-05E	3.2	29.1	18 inch	52	0.077	0.013	530.0	526.0	534.0	531.0	530.7	526.8	**3.3**	2.5	10.8
P-LD-10-03-05E	I-LD-10-03-05E	I-LD-10-03-04E	3.6	24.6	18 inch	128	0.188	0.024	526.0	502.0	531.0	507.0	526.7	502.8	**4.3**	3.5	10.0
P-LD-10-03-04E	I-LD-10-03-04E	I-LD-10-03-03E	3.6	9.3	18 inch	28	0.027	0.024	502.0	501.3	507.0	504.0	502.7	502.2	**4.3**	3.5	4.9
P-LD-10-03-03E	I-LD-10-03-03E	I-LD-10-03-02E	5.0	27.9	18 inch	130	0.240	0.024	501.3	470.0	504.0	475.0	502.1	471.1	**1.9**	1.3	11.9
P-LD-10-03-02E	I-LD-10-03-02E	J-LD-10-03-01E	4.9	17.2	15 inch	312	0.240	0.024	470.0	395.0	475.0	400.0	470.9	396.1	**4.1**	3.8	12.1
P-LD-10-03-01E	J-LD-10-03-01E	J-LD-10-03	4.8	20.8	15 inch	141	0.355	0.024	395.0	345.0	400.0	350.0	395.9	346.5	**4.1**	3.8	13.8

(1) Pipes are presented in Figure 2 and Figure D-LA-LC in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-L2b (page 2 of 2)

Existing Hydraulics, 10-Year Event, Systems LD

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
P-LD-10-08	I-LD-10-08	I-LD-10-07	0.0	14.5	15 inch	89	0.051	0.013	556.5	552.0	560.0	556.0	556.5	552.3	**3.5**	2.3	0.0
P-LD-10-07	I-LD-10-07	J-LD-10-06	0.5	37.4	15 inch	170	0.335	0.013	552.0	495.0	556.0	500.0	552.3	495.3	**3.7**	2.8	10.4
P-LD-10-06	J-LD-10-06	J-LD-10-05	0.5	57.0	18 inch	34	0.294	0.013	495.0	485.0	500.0	490.0	495.3	485.7	**4.8**	3.5	9.6
P-LD-10-05	J-LD-10-05	J-LD-10-04	3.1	25.9	18 inch	145	0.207	0.024	485.0	455.0	490.0	460.0	485.7	456.2	**4.3**	3.5	9.9
P-LD-10-04	J-LD-10-04	J-LD-10-03	7.3	60.2	18 inch	335	0.328	0.013	455.0	345.0	460.0	350.0	456.0	346.5	**4.0**	3.5	23.0
P-LD-10-03	J-LD-10-03	J-LD-10-02	14.4	97.0	24 inch	272	0.184	0.013	345.0	295.0	350.0	300.0	346.4	296.6	**3.6**	3.0	22.1
P-LD-10-02	J-LD-10-02	J-LD-10-01	14.3	105.5	27 inch	319	0.116	0.013	295.0	258.0	300.0	265.0	296.3	259.4	**3.7**	2.8	18.5
P-LD-10-01	J-LD-10-01	J-LD-10	14.1	171.6	33 inch	114	0.105	0.013	258.0	246.0	265.0	253.0	259.2	250.2	**5.8**	4.3	17.4
P-LD-07-02	I-LD-07-02	I-LD-07-01	0.0	9.7	15 inch	22	0.023	0.013	323.5	323.0	327.5	327.0	323.5	323.2	**4.0**	2.8	0.0
P-LD-07-01	I-LD-07-01	I-LD-07	0.4	32.3	15 inch	372	0.250	0.013	323.0	230.0	327.0	236.0	323.2	236.0	**3.8**	2.8	8.6
P-LD-05-03	I-LD-05-03	I-LD-05-02	5.1	6.6	12 inch	22	0.034	0.013	318.5	317.8	323.5	323.0	319.4	318.8	**4.1**	4.0	9.3
P-LD-05-02	I-LD-05-02	J-LD-05-01	5.6	43.6	15 inch	28	0.455	0.013	317.8	305.0	323.0	310.0	318.7	305.3	**4.3**	4.0	24.5
P-LD-05-01	J-LD-05-01	I-LD-05	5.6	85.4	24 inch	203	0.485	0.024	305.0	206.5	310.0	215.0	305.8	215.0	**4.2**	3.0	15.4
P-LD-03-03-01-01	I-LD-03-03-01-01	I-LD-03-03-01	0.0	14.8	18 inch	193	0.067	0.024	403.0	390.0	408.0	395.0	403.0	390.0	**5.0**	3.5	0.0
P-LD-03-03-02	I-LD-03-03-02	I-LD-03-03-01	0.0	12.1	18 inch	111	0.045	0.024	395.0	390.0	400.0	395.0	395.0	390.0	**5.0**	3.5	0.0
P-LD-03-03-01	I-LD-03-03-01	I-LD-03-03	0.0	41.3	18 inch	339	0.528	0.024	390.0	211.0	395.0	218.0	390.0	212.6	**5.0**	3.5	0.0
P-LD-03-04	I-LD-03-04	I-LD-03-03	0.0	115.6	36 inch	483	0.030	0.013	225.5	211.0	232.5	218.0	225.5	212.7	**7.0**	4.0	0.0
P-LD-03-03	I-LD-03-03	I-LD-03-02	23.2	95.4	36 inch	274	0.020	0.013	211.0	205.4	218.0	212.4	212.6	207.0	**5.4**	4.0	11.1
P-LD-03-02	I-LD-03-02	I-LD-03-01	22.7	118.7	36 inch	265	0.032	0.013	205.4	197.0	212.4	204.0	206.9	200.4	**5.5**	4.0	13.0
P-LD-03-01	I-LD-03-01	I-LD-03	42.0	252.1	36 inch	35	0.143	0.013	197.0	192.0	204.0	200.0	200.1	200.0	**3.9**	4.0	5.9
San Juan Boulevard																	
P-LD-24	I-LD-24	I-LD-23	15.9	24.6	18 inch	31	0.055	0.013	417.7	416.0	422.7	421.0	420.0	419.3	**2.7**	3.5	9.0
P-LD-23	I-LD-23	J-LD-22	24.4	24.6	18 inch	327	0.055	0.013	416.0	398.0	421.0	403.0	418.6	401.0	**2.4**	3.5	13.8
P-LD-22	J-LD-22	I-LD-21	27.4	70.9	21 inch	66	0.200	0.013	398.0	384.8	403.0	400.8	399.7	386.6	**3.3**	3.3	27.6
P-LD-21	I-LD-21	J-LD-20	27.4	63.5	36 inch	529	0.009	0.013	384.8	380.0	400.8	389.0	386.5	383.3	**14.3**	13.0	8.7
P-LD-20	J-LD-20	I-LD-19	59.2	53.1	36 inch	316	0.006	0.013	380.0	378.0	389.0	384.0	383.0	380.7	**6.0**	6.0	8.4
P-LD-19	I-LD-19	I-LD-18	58.5	181.6	36 inch	120	0.074	0.013	378.0	369.1	384.0	373.1	380.5	371.9	**3.5**	3.0	22.9
P-LD-18	I-LD-18	I-LD-17	59.5	107.5	30 inch	287	0.069	0.013	369.1	349.4	373.1	355.4	371.5	352.1	**1.6**	1.5	22.5
P-LD-17	I-LD-17	I-LD-16	59.0	103.1	33 inch	400	0.038	0.013	349.4	334.2	355.4	339.2	351.9	336.8	**3.5**	3.3	17.9
P-LD-16	I-LD-16	I-LD-15	58.2	124.8	33 inch	614	0.056	0.013	334.2	300.0	339.2	306.0	336.7	303.2	**2.5**	2.3	20.6
P-LD-15	I-LD-15	I-LD-14	98.9	156.1	33 inch	218	0.087	0.013	300.0	281.0	306.0	287.0	302.7	284.2	**3.3**	3.3	27.8
P-LD-14	I-LD-14	J-LD-13	98.5	179.0	33 inch	172	0.115	0.013	281.0	261.3	287.0	267.3	283.7	264.5	**3.3**	3.3	30.9
P-LD-13	J-LD-13	I-LD-12	98.1	195.1	36 inch	97	0.086	0.013	261.3	253.0	267.3	263.0	264.2	256.7	**3.1**	3.0	27.6
P-LD-12	I-LD-12	I-LD-11	126.4	199.6	48 inch	310	0.016	0.012	253.0	247.9	263.0	254.9	256.4	252.4	**6.6**	6.0	16.8
P-LD-11	I-LD-11	J-LD-10	164.6	247.7	48 inch	75	0.025	0.012	247.9	246.0	254.9	253.0	251.6	250.6	**3.3**	3.0	21.1
P-LD-10	J-LD-10	I-LD-09	177.9	289.5	48 inch	260	0.035	0.012	246.0	237.0	253.0	244.0	249.8	241.2	**3.2**	3.0	24.2
P-LD-09	I-LD-09	I-LD-08	185.9	191.5	48 inch	330	0.015	0.012	237.0	232.0	244.0	236.0	240.8	236.0	**3.2**	3.0	17.4
P-LD-08	I-LD-08	I-LD-07	183.9	76.8	36 inch	151	0.013	0.013	232.0	230.0	236.0	236.0	247.5	236.0	**ABOVE RIM**	1.0	26.0
P-LD-07	I-LD-07	I-LD-06	193.6	172.2	36 inch	261	0.067	0.013	230.0	212.6	236.0	220.6	241.8	219.8	**ABOVE RIM**	3.0	27.4
P-LD-06	I-LD-06	I-LD-05	192.5	232.2	48 inch	274	0.022	0.012	212.6	206.5	220.6	215.0	219.2	215.0	**1.4**	4.0	15.3
P-LD-05	I-LD-05	I-LD-04	195.2	31.1	42 inch	105	0.001	0.013	206.5	206.4	215.0	212.4	216.4	212.4	**ABOVE RIM**	5.0	20.3
P-LD-04	I-LD-04	I-LD-03	200.4	219.0	42 inch	304	0.047	0.013	206.4	192.0	212.4	200.0	212.1	200.0	**0.3**	2.5	20.8
P-LD-03	I-LD-03	J-LD-02	235.8	228.9	48 inch	171	0.022	0.012	192.0	188.3	200.0	195.3	199.2	195.3	**0.8**	4.0	18.8
P-LD-02	J-LD-02	J-LD-01	234.7	118.4	36 inch	73	0.032	0.013	188.3	186.0	195.3	194.0	202.8	193.8	**ABOVE RIM**	4.0	33.2
P-LD-01	J-LD-01	O-LD	234.4	285.0	60 inch	98	0.010	0.012	186.0	185.0	194.0	193.0	192.4	191.7	**1.6**	3.0	11.9

(1) Pipes are presented in Figure 2 and Figure D-LD in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-L2c (page 1 of 2)

Proposed Hydrology, 25-Year Event, System LD

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flow (cfs)	**Discharge (4) (cfs)**
Laurel Creek Drainage															
Mean Annual Precipitation 24"															
San Juan Court at Laurel Creek Road															
Ponce Avenue															
I-LD-22-01	430.00	426.50	427.41	427.41	3.31		0.55	1.82	3.31	1.8	10.0	10.0	2.64	0.00	**4.9**
I-LD-20-02	400.00	394.00	395.74	395.74	19.80		0.55	10.89	19.80	10.9	10.0	10.0	2.64	0.00	**29.0**
I-LD-20-01	387.00	381.00	387.61	386.91	7.61		0.88	6.70	27.41	17.6	10.0	10.3	2.60	0.00	**46.1**
I-LD-18-01	386.90	381.90	382.40	382.40	1.20		0.55	0.66	1.20	0.7	10.0	10.0	2.64	0.00	**1.8**
I-LD-15-03W	469.00	463.00	463.89	463.89	2.06		0.88	1.81	2.06	1.8	10.0	10.0	2.64	0.00	**4.8**
I-LD-15-03E	462.00	459.50	460.43	460.43	0.43		0.55	0.24	0.43	0.2	10.0	10.0	2.64	0.00	**0.6**
I-LD-15-01W	495.10	492.10	492.78	492.78	1.98		0.55	1.09	1.98	1.1	10.0	10.0	2.64	0.00	**2.9**
I-LD-15-01S	486.10	482.85	483.50	483.50	1.12		0.88	0.99	1.12	1.0	10.0	10.0	2.64	0.00	**2.6**
I-LD-15-04	478.00	474.00	474.84	474.84	3.89		0.55	2.14	3.89	2.1	10.0	10.0	2.64	0.00	**5.7**
J-LD-15-03	464.00	459.00	460.40	460.26	0.00	2.49	0.00	0.00	6.38	4.2	0.0	10.9	2.53	0.00	**10.7**
I-LD-15-02	464.00	457.50	459.02	458.75	0.00		0.00	0.00	6.38	4.2	10.0	10.9	2.53	0.00	**10.7**
J-LD-15-01	385.00	380.00	382.26	381.24	0.00	3.10	0.00	0.00	9.48	6.3	0.0	11.7	2.44	0.00	**15.4**
I-LD-12-07-01	476.50	471.50	473.96	473.96	12.02		0.55	6.61	12.02	6.6	10.0	10.0	2.64	0.00	**17.6**
I-LD-12-05-01	359.00	355.50	358.77	358.77	6.03		0.88	5.31	6.03	5.3	10.0	10.0	2.64	0.00	**14.1**
I-LD-12-04-03	424.00	420.00	421.51	421.51	8.21		0.55	4.52	8.21	4.5	10.0	10.0	2.64	0.00	**12.0**
I-LD-12-04-02	422.00	418.00	420.02	419.22	0.00		0.00	0.00	8.21	4.5	10.0	10.1	2.63	0.00	**12.0**
I-LD-12-04-01	389.20	384.20	385.95	385.51	0.11		0.55	0.06	8.32	4.6	10.0	10.5	2.58	0.00	**11.9**
I-LD-12-08	476.00	471.50	471.88	471.88	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
J-LD-12-07	475.00	470.00	471.88	471.45	0.00	12.02	0.00	0.00	12.02	6.6	0.0	10.1	2.63	0.00	**17.5**
I-LD-12-06	469.80	462.50	465.14	463.95	1.70		0.00	0.00	13.72	6.6	10.0	10.2	2.62	0.00	**17.4**
J-LD-12-05	360.00	355.00	357.19	356.88	0.00	6.03	0.00	0.00	19.75	11.9	0.0	10.4	2.59	0.00	**31.1**
J-LD-12-04	370.00	350.00	352.40	352.18	0.00	8.32	0.00	0.00	28.07	16.5	0.0	10.7	2.56	0.00	**42.5**
J-LD-12-03	275.00	269.00	271.29	271.17	0.00		0.00	0.00	28.07	16.5	0.0	11.0	2.52	0.00	**41.9**
I-LD-12-02	266.00	259.00	261.67	261.52	0.00		0.00	0.00	28.07	16.5	10.0	11.1	2.51	0.00	**41.7**
I-LD-12-01	265.00	258.00	260.51	260.16	0.00		0.00	0.00	28.07	16.5	10.0	11.3	2.49	0.00	**41.4**
Marburger Avenue														0.00	
I-LD-10-05-01-01-01	563.00	559.00	559.50	559.50	0.60		0.88	0.53	0.60	0.5	10.0	10.0	2.64	0.00	**1.4**
I-LD-10-05-01-02	576.00	572.00	572.37	572.37	0.68		0.55	0.37	0.68	0.4	10.0	10.0	2.64	0.00	**1.0**
I-LD-10-05-01-01	562.90	552.00	552.61	552.58	9.00	0.60	0.00	0.00	10.28	0.9	10.0	10.5	2.57	0.00	**2.3**
I-LD-10-05-02	540.00	536.00	536.00	536.00	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-10-05-01	530.00	524.50	525.44	525.35	2.00	10.28	0.55	1.10	12.28	2.0	10.0	11.8	2.43	0.00	**4.9**
I-LD-10-04-03	528.00	524.00	524.96	524.96	4.20		0.55	2.31	4.20	2.3	10.0	10.0	2.64	0.00	**6.2**
I-LD-10-04-02	522.00	519.00	520.58	519.96	0.00		0.00	0.00	4.20	2.3	10.0	10.0	2.64	0.00	**6.1**
J-LD-10-04-01	480.00	475.00	476.48	475.96	0.00		0.00	0.00	4.20	2.3	0.0	10.1	2.63	0.00	**6.1**
I-LD-10-03-06E	534.00	530.00	530.79	530.79	1.80		0.88	1.58	1.80	1.6	10.0	10.0	2.64	0.00	**4.2**
I-LD-10-03-05E	531.00	526.00	526.89	526.84	0.40		0.55	0.22	2.20	1.8	10.0	10.1	2.63	0.00	**4.8**
I-LD-10-03-04E	507.00	502.00	502.96	502.84	0.00		0.00	0.00	2.20	1.8	10.0	10.3	2.61	0.00	**4.7**
I-LD-10-03-03E	504.00	501.20	502.24	502.19	1.26		0.55	0.69	3.46	2.5	10.0	10.4	2.60	0.00	**6.5**
I-LD-10-03-02E	475.00	470.00	471.32	471.03	0.00		0.00	0.00	3.46	2.5	10.0	10.5	2.58	0.00	**6.5**
J-LD-10-03-01E	400.00	395.00	396.35	396.02	0.00		0.00	0.00	3.46	2.5	0.0	10.9	2.53	0.00	**6.4**
I-LD-10-03-W	502.60	498.60	499.44	499.44	2.70		0.55	1.49	2.70	1.5	10.0	10.0	2.64	0.00	**4.0**

(1) Nodes are presented in Figure D-LD in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table D-L2c (page 2 of 2)

Proposed Hydrology, 25-Year Event, System LD

I-LD-10-08	560.00	556.50	556.50	556.50	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-10-07	556.00	552.00	552.33	552.30	0.41		0.55	0.23	0.41	0.2	10.0	10.0	2.64	0.00	**0.6**
J-LD-10-06	500.00	495.00	495.31	495.29	0.00		0.00	0.00	0.41	0.2	0.0	10.3	2.61	0.00	**0.6**
J-LD-10-05	490.00	485.00	485.97	485.90	0.00	12.28	0.00	0.00	12.69	2.2	0.0	11.9	2.42	0.00	**5.4**
J-LD-10-04	460.00	455.00	456.55	456.27	0.00	4.20	0.00	0.00	16.89	4.5	0.0	12.1	2.40	0.00	**11.0**
J-LD-10-03	350.00	345.00	346.78	346.62	0.00	6.16	0.00	0.00	23.05	8.5	0.0	12.3	2.38	0.00	**20.5**
J-LD-10-02	300.00	295.00	296.99	296.58	0.00		0.00	0.00	23.05	8.5	0.0	12.5	2.36	0.00	**20.3**
J-LD-10-01	265.00	258.00	259.72	259.48	0.00		0.00	0.00	23.05	8.5	0.0	12.8	2.34	0.00	**20.1**
I-LD-07-02	327.50	323.50	323.50	323.50	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-07-01	327.00	323.00	323.27	323.26	0.31		0.55	0.17	0.31	0.2	10.0	10.0	2.64	0.00	**0.5**
I-LD-05-03	323.50	318.50	319.74	319.74	4.58		0.55	2.52	4.58	2.5	10.0	10.0	2.64	0.00	**6.7**
I-LD-05-02	323.00	317.75	318.96	318.83	0.48		0.55	0.26	5.06	2.8	10.0	10.0	2.64	0.00	**7.4**
J-LD-05-01	310.00	305.00	306.00	305.97	0.00		0.00	0.00	5.06	2.8	0.0	10.1	2.63	0.00	**7.4**
I-LD-03-03-01-01	408.00	403.00	403.00	403.00	0.00		0.88	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-03-03-02	400.00	395.00	395.00	395.00	0.00		0.88	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-03-03-01	395.00	390.00	390.00	390.00	0.00	0.00	0.00	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-03-04	232.50	225.50	225.50	225.50	0.00		0.55	0.00	0.00	0.0	10.0	10.0	0.00	0.00	**0.0**
I-LD-03-03	218.00	211.00	211.97	211.97	3.98	0.00	0.88	3.50	3.98	3.5	10.0	10.0	2.64	0.00	**9.3**
I-LD-03-02	212.40	205.40	206.37	206.35	13.00		0.00	0.00	16.98	3.5	10.0	10.5	2.57	0.00	**9.1**
I-LD-03-01	204.00	197.00	199.22	198.91	18.27		0.55	10.05	35.25	13.6	10.0	11.0	2.52	0.00	**34.5**
San Juan Boulevard															
I-LD-24	422.70	417.70	419.32	419.32	14.28		0.55	7.85	14.28	7.9	10.0	10.0	2.64	0.00	**20.9**
I-LD-23	421.00	416.00	418.09	417.72	4.82		0.88	4.24	19.10	12.1	10.0	10.0	2.64	0.00	**32.1**
J-LD-22	403.00	398.00	400.49	399.73	0.00	3.31	0.00	0.00	22.41	13.9	0.0	10.5	2.58	0.00	**36.1**
I-LD-21	400.80	384.80	387.52	387.46	0.00		0.00	0.00	22.41	13.9	10.0	10.6	2.57	0.00	**36.1**
J-LD-20	389.00	380.00	385.98	385.37	0.00	27.41	0.00	0.00	49.82	31.5	0.0	11.5	2.46	0.00	**78.2**
I-LD-19	384.00	378.00	381.02	380.75	0.91		0.55	0.50	50.73	32.0	10.0	12.0	2.41	0.00	**77.8**
I-LD-18	373.10	369.10	371.63	371.56	0.00	1.20	0.00	0.00	51.93	32.7	10.0	12.1	2.40	0.00	**79.2**
I-LD-17	355.40	349.40	352.47	352.05	0.00		0.00	0.00	51.93	32.7	10.0	12.3	2.39	0.00	**78.5**
I-LD-16	339.20	334.20	337.10	336.84	0.00		0.00	0.00	51.93	32.7	10.0	12.6	2.35	0.00	**77.4**
I-LD-15	306.00	300.00	303.52	302.74	32.15	9.48	0.55	17.68	93.56	56.6	10.0	13.1	2.31	0.00	**131.8**
I-LD-14	287.00	281.00	284.52	283.74	0.00		0.00	0.00	93.56	56.6	10.0	13.2	2.30	0.00	**131.2**
J-LD-13	267.30	261.30	264.95	264.26	0.00		0.00	0.00	93.56	56.6	0.0	13.3	2.29	0.00	**130.8**
I-LD-12	263.00	253.00	258.84	258.21	0.00	28.07	0.00	0.00	121.63	73.1	10.0	13.4	2.29	0.00	**168.5**
I-LD-11	254.90	247.90	254.58	252.90	26.30		0.88	23.14	147.93	96.3	10.0	13.7	2.25	0.00	**218.7**
J-LD-10	253.00	246.00	250.75	249.92	0.00	23.05	0.00	0.00	170.98	104.8	0.0	13.8	2.25	0.00	**237.5**
I-LD-09	244.00	237.00	241.43	240.93	6.10		0.88	5.37	177.08	110.1	10.0	14.0	2.24	0.00	**248.1**
I-LD-08	234.80	220.00	224.62	224.40	0.00		0.00	0.00	177.08	110.1	10.0	14.2	2.22	0.00	**246.5**
I-LD-07	236.00	215.00	219.50	219.48	6.81	0.31	0.88	5.99	184.20	116.3	10.0	14.3	2.21	0.00	**259.5**
I-LD-06	220.60	212.60	217.33	217.07	0.00		0.00	0.00	184.20	116.3	10.0	14.5	2.19	0.00	**257.0**
I-LD-05	215.00	206.50	212.16	212.11	0.00	5.06	0.00	0.00	189.26	119.1	10.0	14.7	2.18	0.00	**261.3**
I-LD-04	212.40	206.40	211.04	210.93	4.00		0.88	3.52	193.26	122.6	10.0	14.9	2.17	0.00	**267.8**
I-LD-03	200.00	192.00	197.84	197.21	2.22	35.25	0.55	1.22	230.73	137.4	10.0	15.0	2.16	0.00	**298.4**
J-LD-02	195.30	188.30	196.16	194.81	0.00		0.00	0.00	230.73	137.4	0.0	15.2	2.14	0.00	**296.6**
J-LD-01	194.00	186.00	196.84	194.00	0.00		0.00	0.00	230.73	137.4	0.0	15.3	2.14	0.00	**295.8**
O-LD	193.00	185.00	194.30	194.30	0.00		0.00	0.00	230.73	137.4	0.0	15.4	2.13	0.00	**294.7**

(1) Nodes are presented in Figure D-LD in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L2d (page 1 of 2)

Proposed Hydraulics, 25-Year Event, System LD

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
Laurel Creek Drainage																		
Mean Annual Precipitation 24"																		
San Juan Court at Laurel Creek Road																		
Ponce Avenue																		
P-LD-22-01	I-LD-22-01	J-LD-22	4.9	9.6	12 inch	389	0.073	0.013	426.50	398.00	430.00	403.00	427.41	400.49	**2.6**	2.5	12.3	no change
P-LD-20-02	I-LD-20-02	I-LD-20-01	29.0	142.0	36 inch	287	0.045	0.013	394.00	381.00	400.00	387.00	395.74	387.00	**4.3**	3.0	15.8	no change
P-LD-20-01	I-LD-20-01	J-LD-20	46.1	62.5	36 inch	114	0.009	0.013	381.00	380.00	387.00	389.00	386.91	386.36	**0.1**	3.0	6.5	no change
P-LD-18-01	I-LD-18-01	I-LD-18	1.8	12.9	18 inch	249	0.051	0.024	381.90	369.10	386.90	373.10	382.40	371.63	**4.5**	3.5	5.1	no change
P-LD-15-04	I-LD-15-04	J-LD-15-03	5.7	50.0	24 inch	90	0.167	0.024	474.00	459.00	478.00	464.00	474.84	460.42	**3.2**	2.0	10.6	no change
P-LD-15-03W	I-LD-15-03W	J-LD-15-03	4.8	22.2	15 inch	57	0.070	0.010	463.00	459.00	469.00	464.00	463.89	460.46	**5.1**	4.8	14.5	no change
P-LD-15-03E	I-LD-15-03E	J-LD-15-03	0.6	2.6	15 inch	91	0.005	0.024	459.50	459.00	462.00	464.00	460.43	460.40	**1.6**	1.3	1.7	no change
P-LD-15-03	J-LD-15-03	I-LD-15-02	10.7	15.2	18 inch	21	0.071	0.024	459.00	457.50	464.00	464.00	460.26	459.02	**3.7**	3.5	9.3	no change
P-LD-15-02	I-LD-15-02	J-LD-15-01	10.7	20.7	18 inch	586	0.132	0.024	457.50	380.00	464.00	385.00	458.75	382.45	**5.3**	5.0	11.8	no change
P-LD-15-01W	I-LD-15-01W	J-LD-15-01	2.9	19.8	15 inch	349	0.321	0.024	492.10	380.00	495.10	385.00	492.78	382.26	**2.3**	1.8	11.5	no change
P-LD-15-01S	I-LD-15-01S	J-LD-15-01	2.6	26.4	15 inch	181	0.568	0.024	482.85	380.00	486.10	385.00	483.50	382.45	**2.6**	2.0	13.7	no change
P-LD-15-01	J-LD-15-01	I-LD-15	15.4	23.4	15 inch	179	0.447	0.024	380.00	300.00	385.00	306.00	381.24	303.75	**3.8**	3.8	20.4	no change
P-LD-12-07-01	I-LD-12-07-01	J-LD-12-07	17.6	17.2	18 inch	56	0.027	0.013	471.50	470.00	476.50	475.00	473.96	472.38	**2.5**	3.5	10.0	upsized
P-LD-12-05-01	I-LD-12-05-01	J-LD-12-05	14.1	8.0	15 inch	33	0.015	0.013	355.50	355.00	359.00	360.00	358.77	357.19	**0.2**	2.3	11.5	no change
P-LD-12-04-03	I-LD-12-04-03	I-LD-12-04-02	12.0	7.6	15 inch	43	0.047	0.024	420.00	418.00	424.00	422.00	427.08	422.00	**ABOVE RIM**	2.8	9.8	no change
P-LD-12-04-02	I-LD-12-04-02	I-LD-12-04-01	12.0	10.1	15 inch	408	0.083	0.024	418.00	384.20	422.00	389.20	433.78	385.93	**ABOVE RIM**	2.8	9.8	no change
P-LD-12-04-01	I-LD-12-04-01	J-LD-12-04	11.7	41.0	18 inch	225	0.152	0.013	384.20	350.00	389.20	370.00	385.50	352.39	**3.7**	3.5	20.0	no change
P-LD-12-08	I-LD-12-08	J-LD-12-07	0.0	6.4	12 inch	46	0.033	0.013	471.50	470.00	476.00	475.00	471.88	471.88	**4.1**	3.5	0.0	no change
P-LD-12-07	J-LD-12-07	I-LD-12-06	17.5	30.7	18 inch	103	0.073	0.012	470.00	462.50	475.00	469.80	471.45	465.14	**3.6**	3.5	18.0	upsized
P-LD-12-06	I-LD-12-06	J-LD-12-05	17.4	30.0	18 inch	388	0.277	0.024	462.50	355.00	469.80	360.00	463.95	357.42	**5.9**	5.8	17.6	upsized
P-LD-12-05	J-LD-12-05	J-LD-12-04	30.9	58.4	24 inch	75	0.067	0.013	355.00	350.00	360.00	370.00	356.88	352.75	**3.1**	3.0	18.9	no change
P-LD-12-04	J-LD-12-04	J-LD-12-03	42.0	162.4	30 inch	517	0.157	0.013	350.00	269.00	370.00	275.00	352.17	271.28	**17.8**	17.5	27.8	no change
P-LD-12-03	J-LD-12-03	I-LD-12-02	41.4	120.4	30 inch	116	0.086	0.013	269.00	259.00	275.00	266.00	271.16	261.43	**3.8**	3.5	22.3	no change
P-LD-12-02	I-LD-12-02	I-LD-12-01	41.2	41.4	30 inch	98	0.010	0.013	259.00	258.00	266.00	265.00	261.27	260.49	**4.7**	4.5	9.6	no change
P-LD-12-01	I-LD-12-01	I-LD-12	40.9	167.4	30 inch	30	0.167	0.013	258.00	253.00	265.00	263.00	260.15	259.02	**4.9**	4.5	28.2	no change
Marburger Avenue																		
P-LD-10-05-01-01-01	I-LD-10-05-01-01-01	I-LD-10-05-01-01	1.4	11.7	12 inch	65	0.108	0.013	559.00	552.00	563.00	562.90	559.50	552.63	**3.5**	3.0	10.0	no change
P-LD-10-05-01-02	I-LD-10-05-01-02	I-LD-10-05-01-01	1.0	18.9	18 inch	182	0.110	0.024	572.00	552.00	576.00	562.90	572.37	552.61	**3.6**	2.5	5.7	no change
P-LD-10-05-01-01	I-LD-10-05-01-01	I-LD-10-05-01	2.3	22.3	18 inch	609	0.045	0.013	552.00	524.50	562.90	530.00	552.58	525.47	**10.3**	9.4	8.2	upsized
P-LD-10-05-02	I-LD-10-05-02	I-LD-10-05-01	0.0	21.4	12 inch	32	0.359	0.013	536.00	524.50	540.00	530.00	536.00	525.44	**4.0**	3.0	0.0	no change
P-LD-10-05-01	I-LD-10-05-01	J-LD-10-05	4.9	64.2	18 inch	124	0.319	0.012	524.50	485.00	530.00	490.00	525.35	486.08	**4.6**	4.0	21.5	no change
P-LD-10-04-03	I-LD-10-04-03	I-LD-10-04-02	6.2	13.5	12 inch	35	0.143	0.013	524.00	519.00	528.00	522.00	524.96	520.29	**3.0**	3.0	16.8	no change
P-LD-10-04-02	I-LD-10-04-02	J-LD-10-04-01	6.1	25.3	15 inch	84	0.524	0.024	519.00	475.00	522.00	480.00	520.00	476.48	**2.0**	1.8	17.0	upsized
P-LD-10-04-01	J-LD-10-04-01	J-LD-10-04	6.1	11.6	12 inch	55	0.364	0.024	475.00	455.00	480.00	460.00	475.96	456.55	**4.0**	4.0	15.0	no change
P-LD-10-03-W	I-LD-10-03-W	J-LD-10-03	4.0	22.1	12 inch	401	0.383	0.013	498.60	345.00	502.60	350.00	499.44	346.78	**3.2**	3.0	21.3	no change
P-LD-10-03-06E	I-LD-10-03-06E	I-LD-10-03-05E	4.2	29.1	18 inch	52	0.077	0.013	530.00	526.00	534.00	531.00	530.79	526.89	**3.2**	2.5	11.7	no change
P-LD-10-03-05E	I-LD-10-03-05E	I-LD-10-03-04E	4.8	24.6	18 inch	128	0.188	0.024	526.00	502.00	531.00	507.00	526.84	502.96	**4.2**	3.5	10.8	no change
P-LD-10-03-04E	I-LD-10-03-04E	I-LD-10-03-03E	4.7	9.6	18 inch	28	0.029	0.024	502.00	501.20	507.00	504.00	502.84	502.24	**4.2**	3.5	5.4	no change
P-LD-10-03-03E	I-LD-10-03-03E	I-LD-10-03-02E	6.5	27.9	18 inch	130	0.240	0.024	501.20	470.00	504.00	475.00	502.19	471.32	**1.8**	1.3	12.9	no change
P-LD-10-03-02E	I-LD-10-03-02E	J-LD-10-03-01E	6.5	17.2	15 inch	312	0.240	0.024	470.00	395.00	475.00	400.00	471.03	396.35	**4.0**	3.8	13.0	no change
P-LD-10-03-01E	J-LD-10-03-01E	J-LD-10-03	6.4	20.8	15 inch	141	0.355	0.024	395.00	345.00	400.00	350.00	396.02	346.78	**4.0**	3.8	14.9	no change

(1) Pipes are presented in Figure 2 and Figure D-LD in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.

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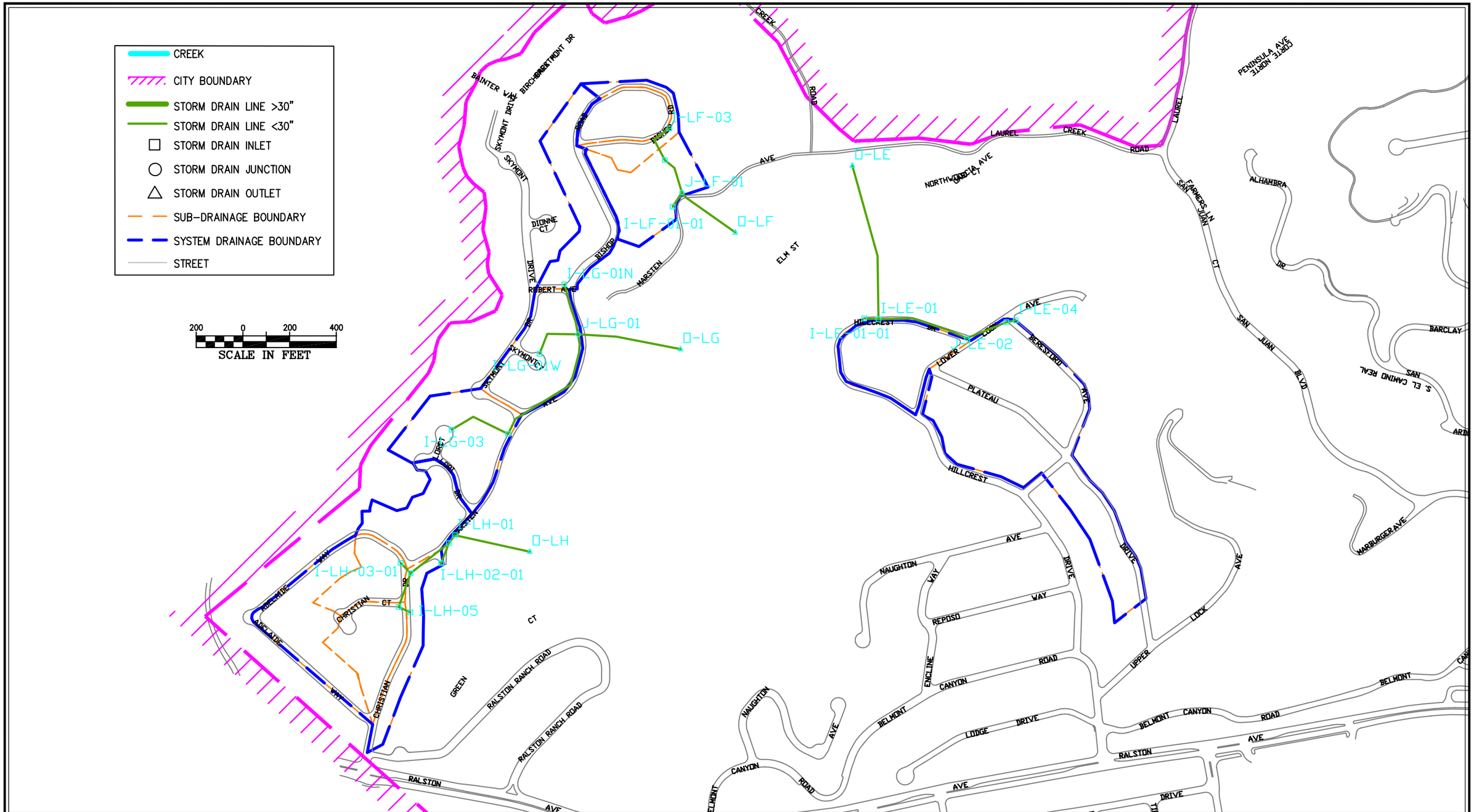
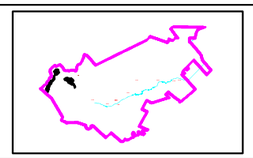
Table D-L2d (page 2 of 2)

Proposed Hydraulics, 25-Year Event, System LD

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
P-LD-10-08	I-LD-10-08	I-LD-10-07	0.0	7.9	15 inch	89	0.051	0.024	556.50	552.00	560.00	556.00	556.50	552.31	**3.5**	2.3	0.0	no change
P-LD-10-07	I-LD-10-07	J-LD-10-06	0.6	33.0	18 inch	170	0.335	0.024	552.00	495.00	556.00	500.00	552.29	495.31	**3.7**	2.5	7.2	upsized
P-LD-10-06	J-LD-10-06	J-LD-10-05	0.6	57.0	18 inch	34	0.294	0.013	495.00	485.00	500.00	490.00	495.28	485.97	**4.7**	3.5	10.5	no change
P-LD-10-05	J-LD-10-05	J-LD-10-04	5.4	25.9	18 inch	145	0.207	0.024	485.00	455.00	490.00	460.00	485.90	456.59	**4.1**	3.5	11.6	no change
P-LD-10-04	J-LD-10-04	J-LD-10-03	11.0	60.2	18 inch	335	0.328	0.013	455.00	345.00	460.00	350.00	456.27	346.87	**3.7**	3.5	25.9	no change
P-LD-10-03	J-LD-10-03	J-LD-10-02	20.5	97.0	24 inch	272	0.184	0.013	345.00	295.00	350.00	300.00	346.62	296.99	**3.4**	3.0	24.5	no change
P-LD-10-02	J-LD-10-02	J-LD-10-01	20.3	105.5	27 inch	319	0.116	0.013	295.00	258.00	300.00	265.00	296.58	259.72	**3.4**	2.8	20.5	no change
P-LD-10-01	J-LD-10-01	J-LD-10	20.1	171.6	33 inch	114	0.105	0.013	258.00	246.00	265.00	253.00	259.48	250.75	**5.5**	4.3	19.3	no change
P-LD-07-02	I-LD-07-02	I-LD-07-01	0.0	9.7	15 inch	22	0.023	0.013	323.50	323.00	327.50	327.00	323.50	323.27	**4.0**	2.8	0.0	no change
P-LD-07-01	I-LD-07-01	I-LD-07	0.5	34.8	15 inch	372	0.290	0.013	323.00	215.00	327.00	236.00	323.26	219.50	**3.7**	2.8	9.9	no change
P-LD-05-03	I-LD-05-03	I-LD-05-02	6.7	6.6	12 inch	22	0.034	0.013	318.50	317.75	323.50	323.00	319.74	318.96	**3.8**	4.0	8.5	no change
P-LD-05-02	I-LD-05-02	J-LD-05-01	7.4	43.6	15 inch	28	0.455	0.013	317.75	305.00	323.00	310.00	318.83	305.37	**4.2**	4.0	26.5	no change
P-LD-05-01	J-LD-05-01	I-LD-05	7.4	157.6	24 inch	203	0.485	0.013	305.00	206.50	310.00	215.00	305.97	212.16	**4.0**	3.0	25.7	no change
P-LD-03-03-01-01	I-LD-03-03-01-01	I-LD-03-03-01	0.0	14.8	18 inch	193	0.067	0.024	403.00	390.00	408.00	395.00	403.00	390.00	**5.0**	3.5	0.0	no change
P-LD-03-03-02	I-LD-03-03-02	I-LD-03-03-01	0.0	12.1	18 inch	111	0.045	0.024	395.00	390.00	400.00	395.00	395.00	390.00	**5.0**	3.5	0.0	no change
P-LD-03-03-01	I-LD-03-03-01	I-LD-03-03	0.0	41.3	18 inch	339	0.528	0.024	390.00	211.00	395.00	218.00	390.00	211.97	**5.0**	3.5	0.0	no change
P-LD-03-04	I-LD-03-04	I-LD-03-03	0.0	115.6	36 inch	483	0.030	0.013	225.50	211.00	232.50	218.00	225.50	212.01	**7.0**	4.0	0.0	no change
P-LD-03-03	I-LD-03-03	I-LD-03-02	9.3	95.4	36 inch	274	0.020	0.013	211.00	205.40	218.00	212.40	211.97	206.37	**6.0**	4.0	8.6	no change
P-LD-03-02	I-LD-03-02	I-LD-03-01	9.1	118.7	36 inch	265	0.032	0.013	205.40	197.00	212.40	204.00	206.35	199.22	**6.1**	4.0	9.9	no change
P-LD-03-01	I-LD-03-01	I-LD-03	34.5	252.1	36 inch	35	0.143	0.013	197.00	192.00	204.00	200.00	198.91	198.17	**5.1**	4.0	25.0	no change
San Juan Boulevard																		
P-LD-24	I-LD-24	I-LD-23	20.9	24.6	18 inch	31	0.055	0.013	417.70	416.00	422.70	421.00	419.32	418.09	**3.4**	3.5	11.8	no change
P-LD-23	I-LD-23	J-LD-22	32.1	40.3	21 inch	327	0.055	0.012	416.00	398.00	421.00	403.00	417.72	401.90	**3.3**	3.3	18.6	upsized
P-LD-22	J-LD-22	I-LD-21	36.1	70.9	21 inch	66	0.200	0.013	398.00	384.80	403.00	400.80	399.73	387.52	**3.3**	3.3	29.6	no change
P-LD-21	I-LD-21	J-LD-20	36.1	63.5	36 inch	529	0.009	0.013	384.80	380.00	400.80	389.00	387.46	385.98	**13.3**	13.0	9.3	no change
P-LD-20	J-LD-20	I-LD-19	78.2	53.1	36 inch	316	0.006	0.013	380.00	378.00	389.00	384.00	385.37	381.02	**3.6**	6.0	11.1	no change
P-LD-19	I-LD-19	I-LD-18	77.8	181.6	36 inch	120	0.074	0.013	378.00	369.10	384.00	373.10	380.75	372.23	**3.3**	3.0	24.7	no change
P-LD-18	I-LD-18	I-LD-17	79.2	107.5	30 inch	287	0.069	0.013	369.10	349.40	373.10	355.40	371.56	352.47	**1.5**	1.5	23.9	no change
P-LD-17	I-LD-17	I-LD-16	78.5	103.1	33 inch	400	0.038	0.013	349.40	334.20	355.40	339.20	352.05	337.10	**3.3**	3.3	19.1	no change
P-LD-16	I-LD-16	I-LD-15	77.4	124.8	33 inch	614	0.056	0.013	334.20	300.00	339.20	306.00	336.84	303.52	**2.4**	2.3	22.1	no change
P-LD-15	I-LD-15	I-LD-14	131.8	156.1	33 inch	218	0.087	0.013	300.00	281.00	306.00	287.00	302.74	284.52	**3.3**	3.3	29.5	no change
P-LD-14	I-LD-14	J-LD-13	131.2	179.0	33 inch	172	0.115	0.013	281.00	261.30	287.00	267.30	283.74	264.95	**3.3**	3.3	32.9	no change
P-LD-13	J-LD-13	I-LD-12	130.8	195.1	36 inch	97	0.086	0.013	261.30	253.00	267.30	263.00	264.26	258.84	**3.0**	3.0	29.6	no change
P-LD-12	I-LD-12	I-LD-11	168.5	199.6	48 inch	310	0.016	0.012	253.00	247.90	263.00	254.90	258.21	254.58	**4.8**	6.0	13.4	no change
P-LD-11	I-LD-11	J-LD-10	218.7	247.7	48 inch	75	0.025	0.012	247.90	246.00	254.90	253.00	252.90	251.42	**2.0**	3.0	17.4	no change
P-LD-10	J-LD-10	I-LD-09	237.5	289.5	48 inch	260	0.035	0.012	246.00	237.00	253.00	244.00	249.92	241.43	**3.1**	3.0	25.7	no change
P-LD-09	I-LD-09	I-LD-08	248.1	353.2	48 inch	330	0.052	0.012	237.00	220.00	244.00	234.80	240.93	224.62	**3.1**	3.0	30.4	no change
P-LD-08	I-LD-08	I-LD-07	246.5	513.4	60 inch	151	0.033	0.012	220.00	215.00	234.80	236.00	224.40	219.62	**10.4**	9.8	25.9	upsized
P-LD-07	I-LD-07	I-LD-06	259.5	270.5	60 inch	261	0.009	0.012	215.00	212.60	236.00	220.60	219.48	217.33	**16.5**	16.0	15.7	upsized
P-LD-06	I-LD-06	I-LD-05	257.0	421.0	60 inch	274	0.022	0.012	212.60	206.50	220.60	215.00	217.07	212.63	**3.5**	3.0	22.5	upsized
P-LD-05	I-LD-05	I-LD-04	261.3	87.1	60 inch	105	0.001	0.012	206.50	206.40	215.00	212.40	212.11	211.04	**2.9**	3.5	13.3	upsized
P-LD-04	I-LD-04	I-LD-03	267.8	614.0	60 inch	304	0.047	0.012	206.40	192.00	212.40	200.00	210.93	197.84	**1.5**	1.0	30.2	upsized
P-LD-03	I-LD-03	J-LD-02	298.4	415.0	60 inch	171	0.022	0.012	192.00	188.30	200.00	195.30	197.21	195.30	**2.8**	3.0	15.2	upsized
P-LD-02	J-LD-02	J-LD-01	296.6	500.8	60 inch	73	0.032	0.012	188.30	186.00	195.30	194.00	194.81	194.00	**0.5**	2.0	15.1	upsized
P-LD-01	J-LD-01	O-LD	295.8	285.0	60 inch	98	0.010	0.012	186.00	185.00	194.00	193.00	195.38	194.30	**ABOVE RIM**	3.0	15.1	no change

(1) Pipes are presented in Figure 2 and Figure D-LD in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-L3A TO D-L3D

FIGURE D-LE-LH
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L3a

Existing Hydrology, 10-Year Event, Systems LE, LF, LG & LH

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Laurel Creek Drainage														
Mean Annual Precipitation 26"														
Hillcrest Drive														
I-LE-01-01	456.00	452.00	452.76	452.76	3.06		0.50	1.53	3.06	1.5	10.0	10.0	2.29	**3.5**
I-LE-04	478.00	474.00	478.00	478.00	10.35		0.80	8.28	10.35	8.3	10.0	10.0	2.29	**19.2**
I-LE-03	477.60	473.60	483.17	477.60	0.00		0.00	0.00	10.35	8.3	10.0	10.0	2.29	**19.1**
J-LE-02	480.00	472.00	489.34	480.00	0.00		0.00	0.00	10.35	8.3	0.0	10.2	2.28	**19.0**
I-LE-01	454.00	450.00	451.75	451.49	2.22	3.06	0.50	1.11	15.63	10.9	10.0	10.6	2.23	**24.6**
O-LE	240.00	236.00	242.30	242.30	0.00		0.00	0.00	15.63	10.9	0.0	10.9	2.20	**24.2**
Bishop Road														
I-LF-01-01	315.50	311.50	312.28	312.28	2.85		0.50	1.43	2.85	1.4	10.0	10.0	2.29	**3.3**
I-LF-03	406.30	402.30	403.03	403.03	2.85		0.50	1.43	2.85	1.4	10.0	10.0	2.29	**3.3**
I-LF-02	390.00	386.00	386.82	386.73	0.00		0.00	0.00	2.85	1.4	10.0	10.3	2.27	**3.3**
J-LF-01	315.00	311.00	312.21	312.03	0.00	2.85	0.00	0.00	5.70	2.9	0.0	10.4	2.25	**6.5**
O-LF	252.00	248.00	255.70	255.70	0.00		0.00	0.00	5.70	2.9	0.0	10.6	2.23	**6.4**
Marsten Avenue														
I-LG-01W	427.30	423.30	424.07	424.07	3.14		0.50	1.57	3.14	1.6	10.0	10.0	2.29	**3.6**
I-LG-01N	397.10	393.10	394.08	394.08	3.19		0.80	2.55	3.19	2.6	10.0	10.0	2.29	**5.9**
I-LG-03	506.80	502.80	503.22	503.22	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.29	**1.2**
I-LG-02	454.00	450.00	451.05	450.82	2.59		0.50	1.29	3.59	1.8	10.0	10.4	2.25	**4.1**
J-LG-01	392.00	388.00	389.62	389.23	0.00	6.33	0.00	0.00	9.92	5.9	0.0	11.1	2.18	**13.0**
O-LG	284.00	280.00	287.70	287.70	0.00		0.00	0.00	9.92	5.9	0.0	11.4	2.15	**12.8**
Marsten Avenue near Lori Drive														
I-LH-03-01	514.50	510.50	511.10	511.10	1.70		0.50	0.85	1.70	0.9	10.0	10.0	2.29	**2.0**
I-LH-02-01	494.00	490.00	490.52	490.52	1.51		0.50	0.76	1.51	0.8	10.0	10.0	2.29	**1.8**
I-LH-05	526.00	522.00	522.45	522.45	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.29	**1.2**
I-LH-04	522.00	518.00	518.90	518.69	1.23		0.50	0.62	2.23	1.1	10.0	10.1	2.28	**2.6**
I-LH-03	514.00	510.00	510.95	510.86	0.00	1.70	0.00	0.00	3.93	2.0	10.0	10.4	2.25	**4.5**
I-LH-02	490.00	486.00	487.17	487.00	2.50	1.51	0.00	0.00	7.94	2.7	10.0	10.6	2.23	**6.1**
I-LH-01	488.00	479.50	480.85	480.50	0.00		0.00	0.00	7.94	2.7	10.0	10.7	2.22	**6.1**
O-LH	385.00	381.00	381.00	381.00	0.00		0.00	0.00	7.94	2.7	0.0	11.1	2.18	**6.0**

(1) Nodes are presented in Figure D-LE-LH in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L3b

Existing Hydraulics, 10-Year Event, Systems LE, LF, LG & LH

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Laurel Creek Drainage																	
Mean Annual Precipitation 26"																	
Hillcrest Drive																	
P-LE-01-01	I-LE-01-01	I-LE-01	3.5	11.7	15 inch	61	0.033	0.013	452.0	450.0	456.0	454.0	452.8	451.8	**3.2**	2.8	8.4
P-LE-04	I-LE-04	I-LE-03	19.2	3.5	12 inch	41	0.010	0.013	474.0	473.6	478.0	477.6	489.5	477.6	**ABOVE RIM**	3.0	24.4
P-LE-03	I-LE-03	J-LE-02	19.1	3.3	12 inch	183	0.009	0.013	473.6	472.0	477.6	480.0	532.8	480.0	**ABOVE RIM**	3.0	24.4
P-LE-02	J-LE-02	I-LE-01	19.0	15.3	15 inch	393	0.056	0.013	472.0	450.0	480.0	454.0	487.1	453.1	**ABOVE RIM**	6.8	15.5
P-LE-01	I-LE-01	O-LE	24.6	59.2	18 inch	673	0.318	0.013	450.0	236.0	454.0	240.0	451.5	242.3	**2.5**	2.5	32.0
Bishop Road																	
P-LF-01-01	I-LF-01-01	J-LF-01	3.3	5.4	15 inch	72	0.007	0.013	311.5	311.0	315.5	315.0	312.3	312.2	**3.2**	2.8	4.6
P-LF-03	I-LF-03	I-LF-02	3.3	19.4	15 inch	180	0.091	0.013	402.3	386.0	406.3	390.0	403.0	386.8	**3.3**	2.8	11.8
P-LF-02	I-LF-02	J-LF-01	3.3	43.7	15 inch	164	0.457	0.013	386.0	311.0	390.0	315.0	386.7	312.3	**3.3**	2.8	20.9
P-LF-01	J-LF-01	O-LF	6.5	30.3	15 inch	286	0.220	0.013	311.0	248.0	315.0	252.0	312.0	255.7	**3.0**	2.8	19.6
Marsten Avenue																	
P-LG-01W	I-LG-01W	J-LG-01	3.6	25.7	15 inch	223	0.158	0.013	423.3	388.0	427.3	392.0	424.1	389.8	**3.2**	2.8	14.8
P-LG-01N	I-LG-01N	J-LG-01	5.9	9.8	15 inch	222	0.023	0.013	393.1	388.0	397.1	392.0	394.1	389.8	**3.0**	2.8	8.4
P-LG-03	I-LG-03	I-LG-02	1.2	28.3	15 inch	275	0.192	0.013	502.8	450.0	506.8	454.0	503.2	451.1	**3.6**	2.8	11.3
P-LG-02	I-LG-02	J-LG-01	4.1	21.3	15 inch	571	0.109	0.013	450.0	388.0	454.0	392.0	450.8	389.6	**3.2**	2.8	13.4
P-LG-01	J-LG-01	O-LG	13.0	31.9	15 inch	444	0.243	0.013	388.0	280.0	392.0	284.0	389.2	287.7	**2.8**	2.8	24.6
Marsten Avenue near Lori Drive																	
P-LH-03-01	I-LH-03-01	I-LH-03	2.0	3.2	12 inch	62	0.008	0.013	510.5	510.0	514.5	514.0	511.1	511.0	**3.4**	3.0	4.3
P-LH-02-01	I-LH-02-01	I-LH-02	1.8	13.5	15 inch	91	0.044	0.013	490.0	486.0	494.0	490.0	490.5	487.2	**3.5**	2.8	7.6
P-LH-05	I-LH-05	I-LH-04	1.2	9.6	12 inch	55	0.073	0.013	522.0	518.0	526.0	522.0	522.5	518.9	**3.5**	3.0	8.3
P-LH-04	I-LH-04	I-LH-03	2.6	8.2	12 inch	153	0.052	0.013	518.0	510.0	522.0	514.0	518.7	511.0	**3.3**	3.0	9.2
P-LH-03	I-LH-03	I-LH-02	4.5	21.9	15 inch	208	0.115	0.013	510.0	486.0	514.0	490.0	510.9	487.2	**3.1**	2.8	14.0
P-LH-02	I-LH-02	I-LH-01	6.1	25.1	15 inch	43	0.151	0.013	486.0	479.5	490.0	488.0	487.0	480.9	**3.0**	2.8	16.9
P-LH-01	I-LH-01	O-LH	6.1	19.2	15 inch	328	0.300	0.024	479.5	381.0	488.0	385.0	480.5	381.5	**7.5**	7.3	13.9

(1) Pipes are presented in Figure 2 and Figure D-LE-LH in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L3c

Proposed Hydrology, 25-Year Event, Systems LE, LF, LG & LH

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (4) (cfs)**
Laurel Creek Drainage															
Mean Annual Precipitation 26"															
I-LE-01-01	456.00	452.00	452.87	452.87	3.06		0.55	1.68	3.06	1.7	10.0	10.0	2.74	0.00	**4.7**
I-LE-04	478.00	474.00	477.38	477.38	10.35		0.88	9.11	10.35	9.1	10.0	10.0	2.74	0.00	**25.2**
I-LE-03	477.60	473.60	476.87	476.60	0.00		0.00	0.00	10.35	9.1	10.0	10.1	2.73	0.00	**25.1**
J-LE-02	480.00	472.00	474.35	473.75	0.00		0.00	0.00	10.35	9.1	0.0	10.5	2.68	0.00	**24.6**
I-LE-01	454.00	450.00	452.03	451.89	2.22	3.06	0.55	1.22	15.63	12.0	10.0	10.9	2.63	0.00	**31.9**
O-LE	240.00	236.00	242.60	242.60	0.00		0.00	0.00	15.63	12.0	0.0	11.2	2.59	0.00	**31.4**
I-LF-01-01	315.50	311.50	312.74	312.74	2.85		0.55	1.57	2.85	1.6	10.0	10.0	2.74	0.00	**4.3**
I-LF-03	406.30	402.30	403.14	403.14	2.85		0.55	1.57	2.85	1.6	10.0	10.0	2.74	0.00	**4.3**
I-LF-02	390.00	386.00	386.96	386.84	0.00		0.00	0.00	2.85	1.6	10.0	10.2	2.71	0.00	**4.3**
J-LF-01	315.00	311.00	312.42	312.14	0.00	2.85	0.00	0.00	5.70	3.1	0.0	10.4	2.70	0.00	**8.5**
O-LF	252.00	248.00	256.30	256.30	0.00		0.00	0.00	5.70	3.1	0.0	10.6	2.67	0.00	**8.4**
I-LG-01W	427.30	423.30	424.19	424.19	3.14		0.55	1.73	3.14	1.7	10.0	10.0	2.74	0.00	**4.8**
I-LG-01N	397.10	393.10	394.20	394.20	3.19		0.88	2.81	3.19	2.8	10.0	10.0	2.74	0.00	**7.8**
I-LG-03	506.80	502.80	503.29	503.29	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LG-02	454.00	450.00	451.26	450.94	2.59		0.55	1.42	3.59	2.0	10.0	10.4	2.69	0.00	**5.4**
J-LG-01	392.00	388.00	389.93	389.24	0.00	6.33	0.00	0.00	9.92	6.5	0.0	11.0	2.61	0.00	**17.1**
O-LG	284.00	280.00	288.00	288.00	0.00		0.00	0.00	9.92	6.5	0.0	11.3	2.58	0.00	**16.9**
I-LH-03-01	514.50	510.50	511.41	511.41	1.70		0.55	0.94	1.70	0.9	10.0	10.0	2.74	0.00	**2.6**
I-LH-02-01	494.00	490.00	490.61	490.61	1.51		0.55	0.83	1.51	0.8	10.0	10.0	2.74	0.00	**2.3**
I-LH-05	526.00	522.00	522.52	522.52	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LH-04	522.00	518.00	519.08	518.79	1.23		0.55	0.68	2.23	1.2	10.0	10.1	2.73	0.00	**3.4**
I-LH-03	514.00	510.00	511.11	510.98	0.00	1.70	0.00	0.00	3.93	2.2	10.0	10.4	2.70	0.00	**5.9**
I-LH-02	490.00	486.00	487.39	487.12	2.50	1.51	0.00	0.00	7.94	3.0	10.0	10.6	2.67	0.00	**8.0**
I-LH-01	488.00	479.50	481.15	480.62	0.00		0.00	0.00	7.94	3.0	10.0	10.6	2.66	0.00	**8.0**
O-LH	385.00	381.00	381.00	381.00	0.00		0.00	0.00	7.94	3.0	0.0	11.0	2.62	0.00	**7.9**

(1) Nodes are presented in Figure D-LE-LH in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

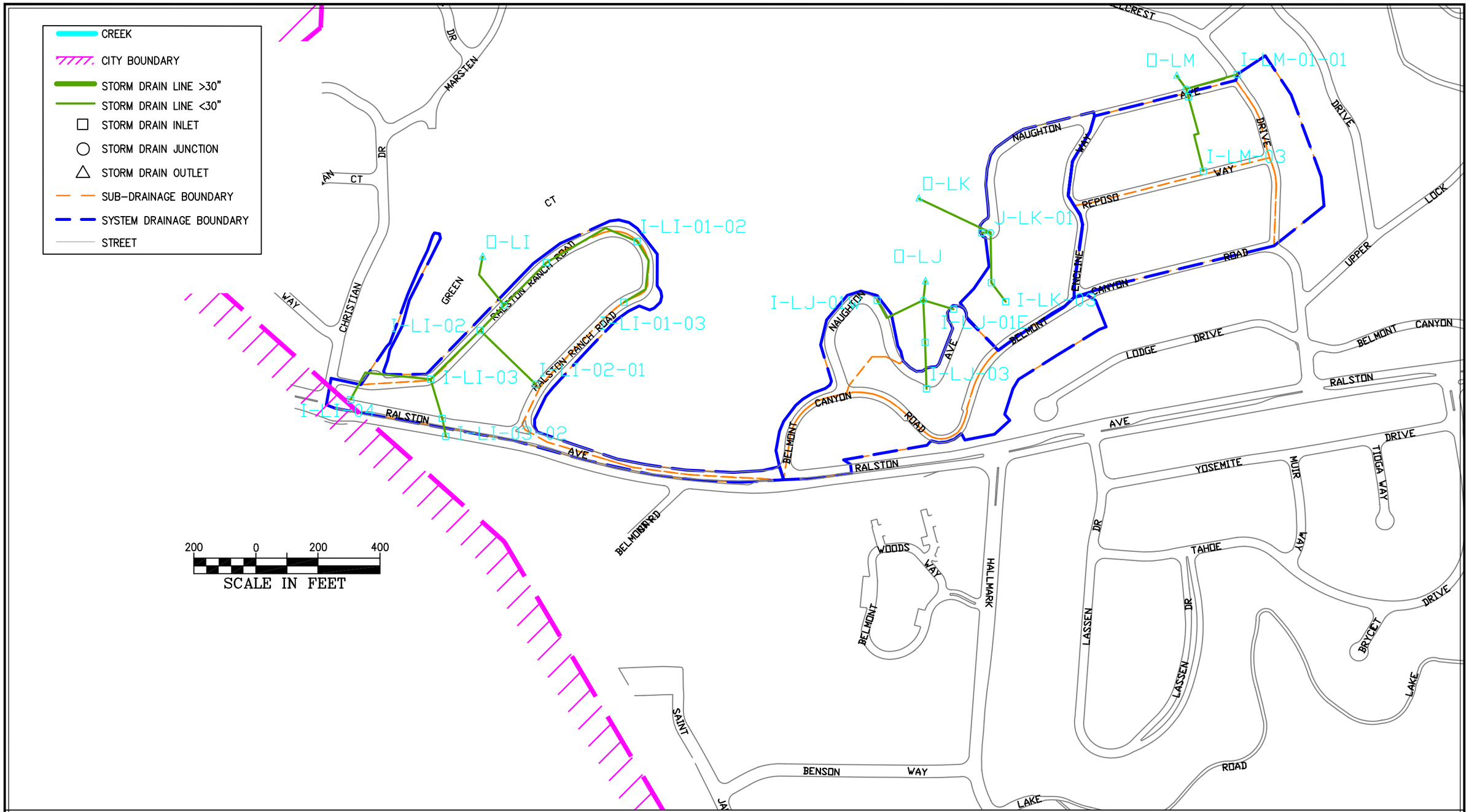
CITY OF BELMONT
STORM DRAIN MASTER PLAN

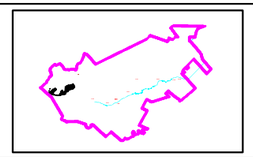
Table D-L3d

Proposed Hydraulics, 25-Year Event, Systems LE, LF, LG & LH

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Laurel Creek Drainage																		
Mean Annual Precipitation 26"																		
Hillcrest Drive																		
P-LE-01-01	I-LE-01-01	I-LE-01	4.7	11.7	15 inch	61	0.033	0.013	452.00	450.00	456.00	454.00	452.87	452.03	**3.1**	2.8	9.0	no change
P-LE-04	I-LE-04	I-LE-03	25.2	22.3	24 inch	41	0.010	0.013	474.00	473.60	478.00	477.60	477.38	476.87	**0.6**	2.0	8.0	upsized
P-LE-03	I-LE-03	J-LE-02	25.1	21.2	24 inch	183	0.009	0.013	473.60	472.00	477.60	480.00	476.60	474.35	**1.0**	2.0	8.0	upsized
P-LE-02	J-LE-02	I-LE-01	24.6	53.5	24 inch	393	0.056	0.013	472.00	450.00	480.00	454.00	473.75	452.71	**6.3**	6.0	16.7	upsized
P-LE-01	I-LE-01	O-LE	31.9	127.6	24 inch	673	0.318	0.013	450.00	236.00	454.00	240.00	451.89	242.60	**2.1**	2.0	33.8	upsized
Bishop Road																		
P-LF-01-01	I-LF-01-01	J-LF-01	4.3	5.4	15 inch	72	0.007	0.013	311.50	311.00	315.50	315.00	312.74	312.42	**2.8**	2.8	4.9	no change
P-LF-03	I-LF-03	I-LF-02	4.3	19.4	15 inch	180	0.091	0.013	402.30	386.00	406.30	390.00	403.14	386.96	**3.2**	2.8	12.8	no change
P-LF-02	I-LF-02	J-LF-01	4.3	43.7	15 inch	164	0.457	0.013	386.00	311.00	390.00	315.00	386.84	312.51	**3.2**	2.8	22.6	no change
P-LF-01	J-LF-01	O-LF	8.5	30.3	15 inch	286	0.220	0.013	311.00	248.00	315.00	252.00	312.14	256.30	**2.9**	2.8	21.2	no change
Marsten Avenue																		
P-LG-01W	I-LG-01W	J-LG-01	4.8	25.7	15 inch	223	0.158	0.013	423.30	388.00	427.30	392.00	424.19	390.24	**3.1**	2.8	16.0	no change
P-LG-01N	I-LG-01N	J-LG-01	7.8	9.8	15 inch	222	0.023	0.013	393.10	388.00	397.10	392.00	394.20	390.19	**2.9**	2.8	8.9	no change
P-LG-03	I-LG-03	I-LG-02	1.5	28.3	15 inch	275	0.192	0.013	502.80	450.00	506.80	454.00	503.29	451.26	**3.5**	2.8	12.3	no change
P-LG-02	I-LG-02	J-LG-01	5.4	21.3	15 inch	571	0.109	0.013	450.00	388.00	454.00	392.00	450.94	389.93	**3.1**	2.8	14.5	no change
P-LG-01	J-LG-01	O-LG	17.1	31.9	15 inch	444	0.243	0.013	388.00	280.00	392.00	284.00	389.24	288.00	**2.8**	2.8	26.4	no change
Marsten Avenue near Lori Drive																		
P-LH-03-01	I-LH-03-01	I-LH-03	2.6	3.2	12 inch	62	0.008	0.013	510.50	510.00	514.50	514.00	511.41	511.11	**3.1**	3.0	4.5	no change
P-LH-02-01	I-LH-02-01	I-LH-02	2.3	13.5	15 inch	91	0.044	0.013	490.00	486.00	494.00	490.00	490.61	487.44	**3.4**	2.8	8.2	no change
P-LH-05	I-LH-05	I-LH-04	1.5	9.6	12 inch	55	0.073	0.013	522.00	518.00	526.00	522.00	522.52	519.08	**3.5**	3.0	8.9	no change
P-LH-04	I-LH-04	I-LH-03	3.4	8.2	12 inch	153	0.052	0.013	518.00	510.00	522.00	514.00	518.79	511.19	**3.2**	3.0	9.9	no change
P-LH-03	I-LH-03	I-LH-02	5.9	21.9	15 inch	208	0.115	0.013	510.00	486.00	514.00	490.00	510.98	487.39	**3.0**	2.8	15.2	no change
P-LH-02	I-LH-02	I-LH-01	8.0	25.1	15 inch	43	0.151	0.013	486.00	479.50	490.00	488.00	487.12	481.15	**2.9**	2.8	18.2	no change
P-LH-01	I-LH-01	O-LH	8.0	19.2	15 inch	328	0.300	0.024	479.50	381.00	488.00	385.00	480.62	381.56	**7.4**	7.3	14.9	no change

(1) Pipes are presented in Figure 2 and Figure D-LE-LH in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-L4A TO D-L4D

FIGURE D-LI-LM
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L4a

Existing Hydrology, 10-Year Event, Systems LI, LJ, LK, LL & LM

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge (4) (cfs)**
Laurel Creek Drainage														
Mean Annual Precipitation 26"														
Ralston Ranch Road														
I-LI-03-02	579.50	575.50	575.98	575.98	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.29	**1.2**
I-LI-03-01	579.00	575.00	575.41	575.40	0.00		0.00	0.00	1.00	0.5	10.0	10.4	2.25	**1.1**
I-LI-02-01	560.00	556.00	556.46	556.46	1.01		0.50	0.51	1.01	0.5	10.0	10.0	2.29	**1.2**
I-LI-01-03	534.00	530.00	530.81	530.81	3.13		0.50	1.56	3.13	1.6	10.0	10.0	2.29	**3.6**
I-LI-01-02	510.00	506.00	507.08	506.87	0.00		0.00	0.00	3.13	1.6	10.0	10.3	2.26	**3.6**
I-LI-01-01	522.00	503.00	503.91	503.79	0.00		0.50	0.00	3.13	1.6	10.0	11.5	2.14	**3.4**
I-LI-04	569.00	565.00	565.45	565.45	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.29	**1.2**
I-LI-03	540.00	536.00	536.73	536.64	0.00	1.00	0.00	0.00	2.00	1.0	10.0	10.7	2.22	**2.2**
I-LI-02	528.00	524.00	525.03	524.93	1.82	1.01	0.50	0.91	4.83	2.4	10.0	11.1	2.18	**5.3**
J-LI-01	514.00	500.00	501.48	500.99	0.00	3.13	0.00	0.00	7.96	4.0	0.0	12.0	2.10	**8.4**
O-LI	480.00	476.00	476.00	476.00	0.00		0.00	0.00	7.96	4.0	0.0	12.2	2.08	**8.4**
Naughton Avenue														
I-LJ-01W	554.00	550.00	550.55	550.55	1.47		0.50	0.74	1.47	0.7	10.0	10.0	2.29	**1.7**
I-LJ-01E	552.00	548.00	548.81	548.81	1.95		0.80	1.56	1.95	1.6	10.0	10.0	2.29	**3.6**
I-LJ-03	559.00	555.00	555.78	555.78	3.62		0.50	1.81	3.62	1.8	10.0	10.0	2.29	**4.2**
I-LJ-02	540.00	536.00	536.81	536.78	0.00		0.00	0.00	3.62	1.8	10.0	10.3	2.26	**4.1**
J-LJ-01	505.00	501.00	502.31	502.18	0.00	3.42	0.00	0.00	7.04	4.1	0.0	10.5	2.24	**9.3**
O-LJ	490.00	486.00	486.00	486.00	0.00		0.00	0.00	7.04	4.1	0.0	10.5	2.23	**9.3**
Naughton Avenue														
I-LK-01-01	513.50	509.50	510.35	510.35	3.50		0.50	1.75	3.50	1.8	10.0	10.0	2.29	**4.1**
I-LK-03	560.00	556.00	556.45	556.45	1.00		0.50	0.50	1.00	0.5	10.0	10.0	2.29	**1.2**
I-LK-02	535.00	528.75	529.26	529.20	0.00		0.00	0.00	1.00	0.5	10.0	10.1	2.28	**1.2**
J-LK-01	513.00	503.00	503.94	503.87	0.00	3.50	0.00	0.00	4.50	2.3	0.0	10.3	2.26	**5.1**
O-LK	430.00	426.00	426.00	426.00	0.00		0.00	0.00	4.50	2.3	0.0	10.7	2.22	**5.0**
Naughton Avenue near Hillcrest Drive														
I-LM-01-01	537.50	533.50	534.26	534.26	1.71		0.80	1.37	1.71	1.4	10.0	10.0	2.29	**3.2**
I-LM-03	545.30	541.30	542.21	542.21	4.15		0.50	2.08	4.15	2.1	10.0	10.0	2.29	**4.8**
I-LM-02	523.20	519.20	523.96	523.20	3.66		0.50	1.83	7.81	3.9	10.0	10.3	2.26	**8.9**
J-LM-01	523.20	519.00	520.90	520.00	0.00	1.71	0.00	0.00	9.52	5.3	0.0	10.4	2.25	**12.0**
O-LM	515.00	511.00	511.00	511.00	0.00		0.00	0.00	9.52	5.3	0.0	10.4	2.25	**12.0**

(1) Nodes are presented in Figure D-LI-LM in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-L4b

Existing Hydraulics, 10-Year Event, Systems LI, LJ, LK. LL & LM

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Laurel Creek Drainage																	
Mean Annual Precipitation 26"																	
Ralston Ranch Road																	
P-LM-01-01	I-LM-01-01	J-LM-01	3.2	10.4	12 inch	171	0.085	0.013	533.5	519.0	537.5	523.2	534.3	520.9	**3.2**	3.0	11.6
P-LM-03	I-LM-03	I-LM-02	4.8	10.4	12 inch	260	0.085	0.013	541.3	519.2	545.3	523.2	542.2	523.2	**3.1**	3.0	13.0
P-LM-02	I-LM-02	J-LM-01	8.9	3.1	12 inch	26	0.008	0.013	519.2	519.0	523.2	523.2	523.4	521.8	**ABOVE RIM**	3.0	11.3
P-LM-01	J-LM-01	O-LM	12.0	14.0	12 inch	52	0.154	0.013	519.0	511.0	523.2	515.0	520.0	511.7	**3.2**	3.2	20.0
Naughton Avenue																	
P-LK-01-01	I-LK-01-01	J-LK-01	4.1	17.2	12 inch	28	0.232	0.013	509.5	503.0	513.5	513.0	510.4	504.0	**3.1**	3.0	17.9
P-LK-03	I-LK-03	I-LK-02	1.2	21.3	12 inch	76	0.359	0.013	556.0	528.8	560.0	535.0	556.5	529.3	**3.5**	3.0	14.5
P-LK-02	I-LK-02	J-LK-01	1.2	14.2	12 inch	162	0.159	0.013	528.8	503.0	535.0	513.0	529.2	503.9	**5.8**	5.3	10.9
P-LK-01	J-LK-01	O-LK	5.1	31.2	18 inch	256	0.301	0.024	503.0	426.0	513.0	430.0	503.9	426.4	**9.1**	8.5	13.0
Naughton Avenue																	
P-LJ-01-W	I-LJ-01W	J-LJ-01	1.7	9.7	12 inch	196	0.250	0.024	550.0	501.0	554.0	505.0	550.6	502.3	**3.5**	3.0	9.3
P-LJ-01-E	I-LJ-01E	J-LJ-01	3.6	13.1	12 inch	102	0.461	0.024	548.0	501.0	552.0	505.0	548.8	502.3	**3.2**	3.0	14.2
P-LJ-03	I-LJ-03	I-LJ-02	4.2	20.3	18 inch	149	0.128	0.024	555.0	536.0	559.0	540.0	555.8	536.8	**3.2**	2.5	9.1
P-LJ-02	I-LJ-02	J-LJ-01	4.1	28.8	18 inch	137	0.255	0.024	536.0	501.0	540.0	505.0	536.8	502.4	**3.2**	2.5	11.6
P-LJ-01	J-LJ-01	O-LJ	9.3	28.2	18 inch	61	0.246	0.024	501.0	486.0	505.0	490.0	502.2	486.6	**2.8**	2.5	14.3
Naughton Avenue near Hillcrest Drive																	
P-LI-03-02	I-LI-03-02	I-LI-03-01	1.2	5.2	18 inch	59	0.008	0.024	575.5	575.0	579.5	579.0	576.0	575.4	**3.5**	2.5	2.4
P-LI-03-01	I-LI-03-01	I-LI-03	1.1	30.9	18 inch	132	0.295	0.024	575.0	536.0	579.0	540.0	575.4	536.7	**3.6**	2.5	8.3
P-LI-02-01	I-LI-02-01	I-LI-02	1.2	12.8	12 inch	250	0.128	0.013	556.0	524.0	560.0	528.0	556.5	525.0	**3.5**	3.0	10.1
P-LI-01-03	I-LI-01-03	I-LI-01-02	3.6	11.1	12 inch	247	0.097	0.013	530.0	506.0	534.0	510.0	530.8	507.1	**3.2**	3.0	12.6
P-LI-01-02	I-LI-01-02	I-LI-01-01	3.6	3.4	12 inch	331	0.009	0.013	506.0	503.0	510.0	522.0	506.9	503.9	**3.1**	3.0	4.9
P-LI-01-01	I-LI-01-01	J-LI-01	3.4	4.4	12 inch	193	0.016	0.013	503.0	500.0	522.0	514.0	503.8	501.5	**18.2**	18.0	6.2
P-LI-04	I-LI-04	I-LI-03	1.2	10.9	12 inch	311	0.093	0.013	565.0	536.0	569.0	540.0	565.5	536.7	**3.5**	3.0	9.0
P-LI-03	I-LI-03	I-LI-02	2.2	8.2	12 inch	225	0.053	0.013	536.0	524.0	540.0	528.0	536.6	525.2	**3.4**	3.0	8.9
P-LI-02	I-LI-02	J-LI-01	5.3	16.5	12 inch	112	0.214	0.013	524.0	500.0	528.0	514.0	524.9	501.8	**3.1**	3.0	18.7
P-LI-01	J-LI-01	O-LI	8.4	12.8	12 inch	186	0.129	0.013	500.0	476.0	514.0	480.0	501.0	476.6	**13.0**	13.0	17.4

(1) Pipes are presented in Figure 2 and Figure D-LI-LM in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-L4c

Proposed Hydrology, 25-Year Event, Systems LI, LJ, LK, LL & LM

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (4) (cfs)**
Laurel Creek Drainage															
Mean Annual Precipitation 26"															
I-LI-03-02	579.50	575.50	576.05	576.05	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LI-03-01	579.00	575.00	575.47	575.46	0.00		0.00	0.00	1.00	0.6	10.0	10.4	2.69	0.00	**1.5**
I-LI-02-01	560.00	556.00	556.53	556.53	1.01		0.55	0.56	1.01	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LI-01-03	534.00	530.00	530.90	530.90	3.13		0.55	1.72	3.13	1.7	10.0	10.0	2.74	0.00	**4.8**
I-LI-01-02	510.00	506.00	510.64	510.00	0.00		0.00	0.00	3.13	1.7	10.0	10.3	2.70	0.00	**4.7**
I-LI-01-01	522.00	503.00	505.24	504.93	0.00		0.55	0.00	3.13	1.7	10.0	11.2	2.59	0.00	**4.5**
I-LI-04	569.00	565.00	565.52	565.52	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LI-03	540.00	536.00	536.86	536.74	0.00	1.00	0.00	0.00	2.00	1.1	10.0	10.6	2.66	0.00	**3.0**
I-LI-02	528.00	524.00	525.14	524.97	1.82	1.01	0.55	1.00	4.83	2.7	10.0	11.0	2.61	0.00	**7.0**
J-LI-01	514.00	500.00	501.85	501.00	0.00	3.13	0.00	0.00	7.96	4.4	0.0	11.8	2.53	0.00	**11.2**
O-LI	480.00	476.00	476.00	476.00	0.00		0.00	0.00	7.96	4.4	0.0	12.0	2.51	0.00	**11.1**
I-LJ-01W	554.00	550.00	550.64	550.64	1.47		0.55	0.81	1.47	0.8	10.0	10.0	2.74	0.00	**2.2**
I-LJ-01E	552.00	548.00	548.90	548.90	1.95		0.88	1.72	1.95	1.7	10.0	10.0	2.74	0.00	**4.8**
I-LJ-03	559.00	555.00	555.90	555.90	3.62		0.55	1.99	3.62	2.0	10.0	10.0	2.74	0.00	**5.5**
I-LJ-02	540.00	536.00	536.94	536.90	0.00		0.00	0.00	3.62	2.0	10.0	10.3	2.71	0.00	**5.4**
J-LJ-01	505.00	501.00	502.53	502.32	0.00	3.42	0.00	0.00	7.04	4.5	0.0	10.4	2.69	0.00	**12.2**
O-LJ	490.00	486.00	486.00	486.00	0.00		0.00	0.00	7.04	4.5	0.0	10.5	2.68	0.00	**12.2**
I-LK-01-01	513.50	509.50	510.43	510.43	3.50		0.55	1.93	3.50	1.9	10.0	10.0	2.74	0.00	**5.3**
I-LK-03	560.00	556.00	556.52	556.52	1.00		0.55	0.55	1.00	0.6	10.0	10.0	2.74	0.00	**1.5**
I-LK-02	535.00	528.75	529.35	529.27	0.00		0.00	0.00	1.00	0.6	10.0	10.1	2.73	0.00	**1.5**
J-LK-01	513.00	503.00	504.09	504.00	0.00	3.50	0.00	0.00	4.50	2.5	0.0	10.3	2.70	0.00	**6.7**
O-LK	430.00	426.00	426.00	426.00	0.00		0.00	0.00	4.50	2.5	0.0	10.6	2.66	0.00	**6.7**
I-LM-01-01	537.50	533.50	534.36	534.36	1.71		0.88	1.50	1.71	1.5	10.0	10.0	2.74	0.00	**4.2**
I-LM-03	545.30	541.30	542.26	542.26	4.15		0.55	2.28	4.15	2.3	10.0	10.0	2.74	0.00	**6.3**
I-LM-02	523.20	519.20	521.38	521.27	3.66		0.55	2.01	7.81	4.3	10.0	10.3	2.70	0.00	**11.7**
J-LM-01	523.20	519.00	520.71	520.42	0.00	1.71	0.00	0.00	9.52	5.8	0.0	10.4	2.69	0.00	**15.8**
O-LM	515.00	511.00	511.00	511.00	0.00		0.00	0.00	9.52	5.8	0.0	10.4	2.69	0.00	**15.7**

(1) Nodes are presented in Figure D-LI-LM in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

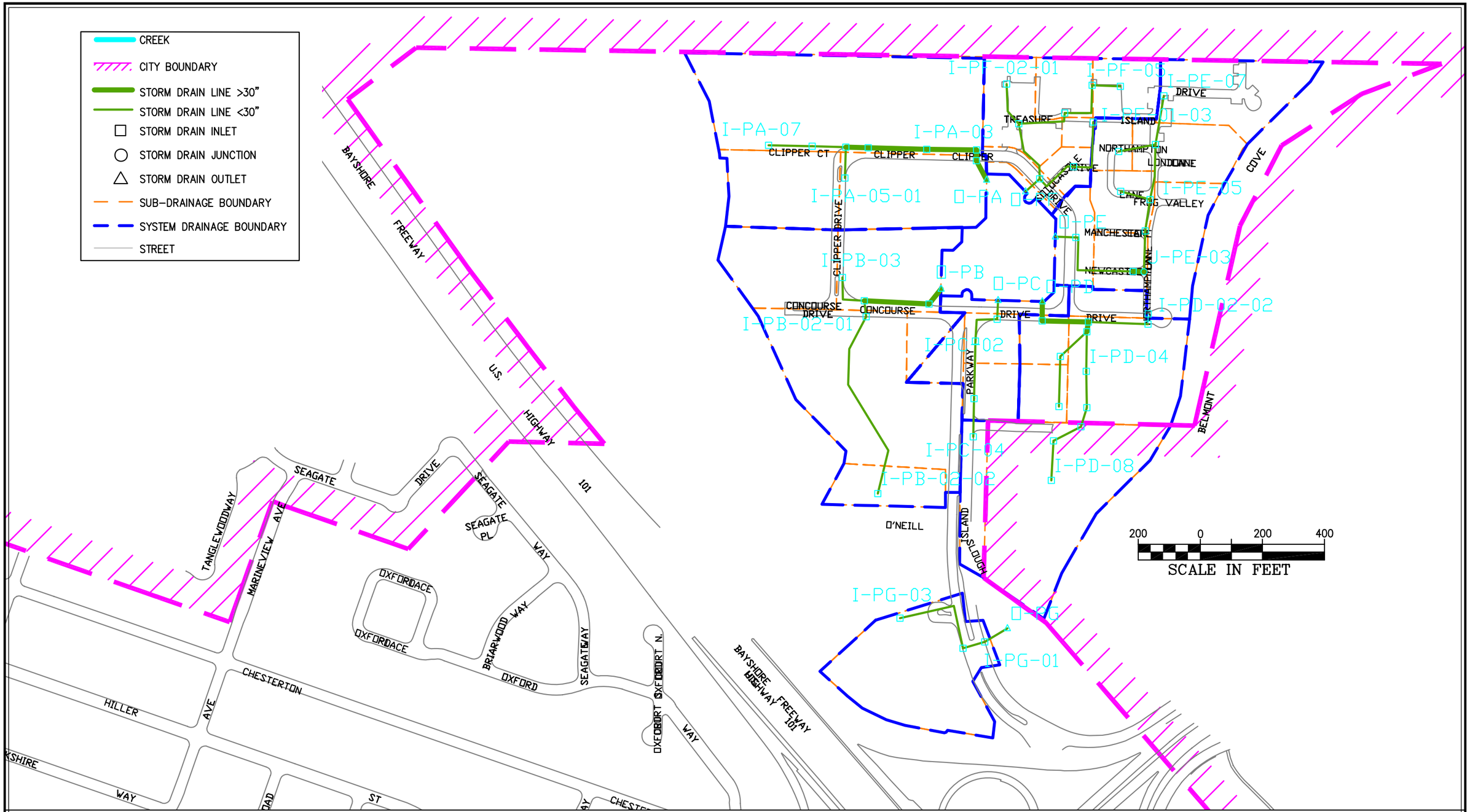
CITY OF BELMONT
STORM DRAIN MASTER PLAN

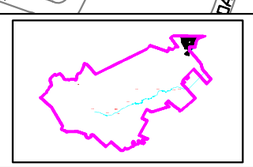
Table D-L4d

Proposed Hydraulics, 25-Year Event, Systems LI, LJ, LK, LL & LM

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Laurel Creek Drainage																		
Mean Annual Precipitation 26"																		
Ralston Ranch Road																		
P-LM-01-01	I-LM-01-01	J-LM-01	4.2	10.4	12 inch	171	0.085	0.013	533.50	519.00	537.50	523.20	534.36	520.71	**3.1**	3.0	12.5	no change
P-LM-03	I-LM-03	I-LM-02	6.3	10.4	12 inch	260	0.085	0.013	541.30	519.20	545.30	523.20	542.26	521.38	**3.0**	3.0	13.9	no change
P-LM-02	I-LM-02	J-LM-01	11.7	9.2	18 inch	26	0.008	0.013	519.20	519.00	523.20	523.20	521.27	520.95	**1.9**	2.5	6.6	upsized
P-LM-01	J-LM-01	O-LM	15.8	41.2	18 inch	52	0.154	0.013	519.00	511.00	523.20	515.00	520.42	511.69	**2.8**	2.7	21.8	upsized
Naughton Avenue																		
P-LK-01-01	I-LK-01-01	J-LK-01	5.3	17.2	12 inch	28	0.232	0.013	509.50	503.00	513.50	513.00	510.43	504.16	**3.1**	3.0	19.3	no change
P-LK-03	I-LK-03	I-LK-02	1.5	21.3	12 inch	76	0.359	0.013	556.00	528.75	560.00	535.00	556.52	529.35	**3.5**	3.0	15.7	no change
P-LK-02	I-LK-02	J-LK-01	1.5	14.2	12 inch	162	0.159	0.013	528.75	503.00	535.00	513.00	529.27	504.09	**5.7**	5.3	11.8	no change
P-LK-01	J-LK-01	O-LK	6.7	31.2	18 inch	256	0.301	0.024	503.00	426.00	513.00	430.00	504.00	426.47	**9.0**	8.5	14.1	no change
Naughton Avenue																		#REF!
P-LJ-01-W	I-LJ-01W	J-LJ-01	2.2	9.7	12 inch	196	0.250	0.024	550.00	501.00	554.00	505.00	550.64	502.55	**3.4**	3.0	10.0	no change
P-LJ-01-E	I-LJ-01E	J-LJ-01	4.8	13.1	12 inch	102	0.461	0.024	548.00	501.00	552.00	505.00	548.90	502.53	**3.1**	3.0	15.3	no change
P-LJ-03	I-LJ-03	I-LJ-02	5.5	20.3	18 inch	149	0.128	0.024	555.00	536.00	559.00	540.00	555.90	536.94	**3.1**	2.5	9.8	no change
P-LJ-02	I-LJ-02	J-LJ-01	5.4	28.8	18 inch	137	0.255	0.024	536.00	501.00	540.00	505.00	536.90	502.60	**3.1**	2.5	12.5	no change
P-LJ-01	J-LJ-01	O-LJ	12.2	28.2	18 inch	61	0.246	0.024	501.00	486.00	505.00	490.00	502.32	486.69	**2.7**	2.5	15.4	no change
Naughton Avenue near Hillcrest Drive																		#REF!
P-LI-03-02	I-LI-03-02	I-LI-03-01	1.5	5.2	18 inch	59	0.008	0.024	575.50	575.00	579.50	579.00	576.05	575.47	**3.5**	2.5	2.6	no change
P-LI-03-01	I-LI-03-01	I-LI-03	1.5	30.9	18 inch	132	0.295	0.024	575.00	536.00	579.00	540.00	575.46	536.86	**3.5**	2.5	9.0	no change
P-LI-02-01	I-LI-02-01	I-LI-02	1.5	12.8	12 inch	250	0.128	0.013	556.00	524.00	560.00	528.00	556.53	525.14	**3.5**	3.0	11.0	no change
P-LI-01-03	I-LI-01-03	I-LI-01-02	4.8	11.1	12 inch	247	0.097	0.013	530.00	506.00	534.00	510.00	530.90	510.00	**3.1**	3.0	13.6	no change
P-LI-01-02	I-LI-01-02	I-LI-01-01	4.7	3.4	12 inch	331	0.009	0.013	506.00	503.00	510.00	522.00	510.98	505.24	**ABOVE RIM**	3.0	6.0	no change
P-LI-01-01	I-LI-01-01	J-LI-01	4.5	4.4	12 inch	193	0.016	0.013	503.00	500.00	522.00	514.00	504.93	501.85	**17.1**	18.0	5.7	no change
P-LI-04	I-LI-04	I-LI-03	1.5	10.9	12 inch	311	0.093	0.013	565.00	536.00	569.00	540.00	565.52	536.88	**3.5**	3.0	9.8	no change
P-LI-03	I-LI-03	I-LI-02	3.0	8.2	12 inch	225	0.053	0.013	536.00	524.00	540.00	528.00	536.74	525.39	**3.3**	3.0	9.6	no change
P-LI-02	I-LI-02	J-LI-01	7.0	16.5	12 inch	112	0.214	0.013	524.00	500.00	528.00	514.00	524.97	502.37	**3.0**	3.0	20.1	no change
P-LI-01	J-LI-01	O-LI	11.2	12.8	12 inch	186	0.129	0.013	500.00	476.00	514.00	480.00	501.00	476.72	**13.0**	13.0	18.4	no change

(1) Pipes are presented in Figure 2 and Figure D-LI-LM in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.





SEE FOLLOWING
TABLES D-P1A TO D-P1D

FIGURE D-PA-PG
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

BKF

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table C-P1a

Existing Hydrology, 10-Year Event, Systems PA, PB, PC, PD, PE, PF and PG

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge(4) (cfs)**
Island Park														
Mean Annual Precipitation 20'														
Clipper Ct														
I-PA-05-01	6.25	1.25	6.25	6.25	2.08		0.80	1.66	2.08	1.7	10.0	10.0	2.04	**3.4**
I-PA-07	6.75	2.75	6.75	6.75	6.45		0.80	5.16	6.45	5.2	10.0	10.0	2.04	**10.6**
I-PA-06	6.50	1.50	6.64	6.50	0.00		0.00	0.00	6.45	5.2	10.0	10.4	2.00	**10.4**
I-PA-05	6.25	1.25	6.39	6.25	0.00	2.08	0.00	0.00	8.53	6.8	10.0	10.7	1.97	**13.6**
I-PA-04	6.00	1.00	5.80	5.71	0.00		0.00	0.00	8.53	6.8	10.0	10.9	1.95	**13.4**
I-PA-03	5.00	0.75	4.35	4.33	0.00		0.00	0.00	8.53	6.8	10.0	11.5	1.90	**13.1**
I-PA-02	5.50	0.50	4.04	3.89	0.00		0.00	0.00	8.53	6.8	10.0	12.3	1.84	**12.7**
I-PA-01	5.50	0.50	3.83	3.70	2.59		0.80	2.07	11.12	8.9	10.0	12.5	1.83	**16.4**
O-PA	5.00	0.00	3.50	3.50	0.00		0.00	0.00	11.12	8.9	0.0	12.8	1.81	**16.2**
Concourse Drive														
I-PB-02-02	16.50	12.50	13.06	13.06	1.07		0.80	0.86	1.07	0.9	10.0	10.0	2.04	**1.8**
I-PB-02-01	6.00	1.00	8.63	6.00	5.29		0.80	4.23	6.36	5.1	10.0	11.8	1.87	**9.6**
I-PB-03	8.50	4.50	8.50	8.50	4.20		0.80	3.36	4.20	3.4	10.0	10.0	2.04	**6.9**
I-PB-02	6.00	1.00	4.45	4.42	0.00	6.36	0.00	0.00	10.56	8.5	10.0	11.9	1.87	**15.9**
I-PB-01	5.25	0.25	3.87	3.67	0.49		0.80	0.39	11.05	8.8	10.0	12.8	1.80	**16.1**
O-PB	5.00	0.00	3.50	3.50	0.00		0.00	0.00	11.05	8.8	0.0	13.0	1.79	**15.9**
Island Parkway														
I-PC-04	14.00	10.00	10.48	10.48	0.77		0.80	0.62	0.77	0.6	10.0	10.0	2.04	**1.3**
I-PC-03	8.00	3.00	4.16	4.15	0.00		0.00	0.00	0.77	0.6	10.0	10.3	2.01	**1.3**
I-PC-02	7.00	2.00	3.92	3.90	1.14		0.80	0.91	1.91	1.5	10.0	12.2	1.84	**2.8**
I-PC-01	5.60	0.60	3.64	3.57	0.52		0.80	0.42	2.43	1.9	10.0	13.2	1.78	**3.5**
O-PC	5.00	0.00	3.50	3.50	0.00		0.00	0.00	2.43	1.9	0.0	13.7	1.74	**3.4**
Concourse Drive & Clipper Drive														
I-PD-03-02	7.40	3.40	6.52	6.52	0.66		0.80	0.53	0.66	0.5	10.0	10.0	2.04	**1.1**
I-PD-03-01	6.40	2.40	6.37	6.34	0.00		0.00	0.00	0.66	0.5	10.0	12.0	1.86	**1.0**
I-PD-02-02	6.75	2.75	5.40	5.40	0.53		0.80	0.42	0.53	0.4	10.0	10.0	2.04	**0.9**
I-PD-02-01	6.50	2.50	5.38	5.37	0.00		0.00	0.00	0.53	0.4	10.0	10.5	1.99	**0.9**
I-PD-08	8.00	4.00	8.00	8.00	5.98		0.80	4.78	5.98	4.8	10.0	10.0	2.04	**9.8**
I-PD-07	7.25	3.25	10.89	7.25	0.00		0.00	0.00	5.98	4.8	10.0	10.2	2.02	**9.8**
I-PD-06	7.00	3.00	13.91	7.00	2.92		0.80	2.34	8.90	7.1	10.0	10.3	2.01	**14.4**
I-PD-05	6.75	2.75	10.85	6.75	0.00		0.00	0.00	8.90	7.1	10.0	10.4	2.00	**14.4**
I-PD-04	6.50	2.50	8.62	6.50	0.00		0.00	0.00	8.90	7.1	10.0	10.5	1.99	**14.3**
I-PD-03	6.25	1.25	9.03	6.25	0.00	0.66	0.00	0.00	9.56	7.7	10.0	13.5	1.75	**13.5**
I-PD-02	6.00	1.00	5.33	5.13	0.00	0.53	0.00	0.00	10.09	8.1	10.0	15.1	1.66	**13.5**
I-PD-01	5.80	0.80	4.05	3.74	0.57		0.80	0.46	10.66	8.5	10.0	15.6	1.63	**14.1**
O-PD	5.00	0.00	3.50	3.50	0.00		0.00	0.00	10.66	8.5	0.0	15.8	1.62	**14.0**
Clipper Drive														
I-PE-06-01	9.00	5.00	8.81	8.81	0.49		0.80	0.39	0.49	0.4	10.0	10.0	2.04	**0.8**
I-PE-05-01	8.75	4.75	8.67	8.67	0.90		0.80	0.72	0.90	0.7	10.0	10.0	2.04	**1.5**
I-PE-07	9.00	5.00	9.00	9.00	2.20		0.80	1.76	2.20	1.8	10.0	10.0	2.04	**3.6**
I-PE-06	8.75	4.75	8.96	8.75	1.41	0.49	0.80	1.13	4.10	3.3	10.0	12.0	1.86	**6.2**
I-PE-05	8.50	4.50	8.99	8.50	1.71	0.90	0.80	1.37	6.71	5.4	10.0	12.4	1.83	**9.9**
I-PE-04	8.25	4.25	9.55	8.25	0.00		0.80	0.00	6.71	5.4	10.0	12.5	1.82	**9.9**
J-PE-03	8.00	4.00	11.54	7.37	0.00		0.00	0.00	6.71	5.4	0.0	12.7	1.81	**9.8**
I-PE-02	7.50	3.50	4.72	4.68	0.74		0.80	0.59	7.45	6.0	10.0	12.7	1.81	**10.9**
I-PE-01	6.00	1.00	3.71	3.68	0.86		0.80	0.69	8.31	6.7	10.0	13.4	1.76	**11.8**
O-PE	5.00	0.00	3.50	3.50	0.00		0.00	0.00	8.31	6.7	0.0	13.7	1.74	**11.7**
I-PF-02-01	6.25	2.25	6.25	6.25	1.40		0.80	1.12	1.40	1.1	10.0	10.0	2.04	**2.3**
I-PF-01-03	7.00	3.00	3.88	3.88	0.23		0.80	0.18	0.23	0.2	10.0	10.0	2.04	**0.4**
I-PF-01-02	6.00	2.00	3.86	3.85	0.42		0.80	0.34	0.65	0.5	10.0	11.5	1.90	**1.0**
I-PF-05	8.00	4.00	7.57	7.57	0.94		0.80	0.75	0.94	0.8	10.0	10.0	2.04	**1.6**
I-PF-04	7.50	3.50	7.40	7.31	0.00		0.00	0.00	0.94	0.8	10.0	10.8	1.96	**1.5**
I-PF-03	7.00	3.00	7.22	6.93	0.82		0.80	0.66	1.76	1.4	10.0	12.3	1.84	**2.6**
I-PF-02	6.00	2.00	6.41	6.00	0.00	1.40	0.00	0.00	3.16	2.5	10.0	13.2	1.77	**4.5**
I-PF-01	5.80	0.80	3.74	3.71	0.57	0.65	0.80	0.46	4.38	3.5	10.0	13.8	1.74	**6.1**
O-PF	5.00	0.00	3.50	3.50	0.00		0.00	0.00	4.38	3.5	0.0	14.1	1.72	**6.1**
I-PG-03	14.00	10.00	13.65	13.65	3.83		0.80	3.06	3.83	3.1	10.0	10.0	2.04	**6.3**
I-PG-02	13.50	9.50	10.52	10.37	0.00		0.00	0.00	3.83	3.1	10.0	11.0	1.94	**6.0**
I-PG-01	13.00	9.00	9.96	9.90	0.00		0.00	0.00	3.83	3.1	10.0	11.3	1.92	**5.9**
O-PG	12.00	8.00	4.00	4.00	0.00		0.00	0.00	3.83	3.1	0.0	11.5	1.90	**5.9**

(1) Nodes are presented in Figure D-PA-PG in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

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Table C-P1b

Existing Hydraulics, 10-Year Event, Systems PA, PB, PC, PD, PE, PF & PG

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
Island Park																	
Mean Annual Precipitation 20 inches																	
Clipper Ct																	
P-PA-05-01	I-PA-05-01	I-PA-05	3.4	0.0	12 inch	99	**0.000**	0.013	1.25	1.25	6.25	6.25	7.16	6.25	**ABOVE RIM**	4.0	4.4
P-PA-07	I-PA-07	I-PA-06	10.6	9.9	18 inch	141	0.009	0.013	2.75	1.50	6.75	6.50	7.94	6.50	**ABOVE RIM**	2.5	6.0
P-PA-06	I-PA-06	I-PA-05	10.4	5.0	18 inch	109	0.002	0.013	1.50	1.25	6.50	6.25	7.32	6.25	**ABOVE RIM**	3.5	5.9
P-PA-05	I-PA-05	I-PA-04	13.6	9.3	21 inch	72	0.003	0.013	1.25	1.00	6.25	6.00	6.33	5.80	**ABOVE RIM**	3.3	5.6
P-PA-04	I-PA-04	I-PA-03	13.4	5.8	21 inch	189	0.001	0.013	1.00	.75	6.00	5.00	5.71	4.35	**0.3**	3.3	5.6
P-PA-03	I-PA-03	I-PA-02	13.1	12.2	27 inch	160	0.002	0.013	.75	.50	5.00	5.50	4.33	4.04	**0.7**	2.0	3.3
P-PA-02	I-PA-02	I-PA-01	12.7	0.0	27 inch	35	0.000	0.013	.50	.50	5.50	5.50	3.89	3.83	**1.6**	2.8	3.2
P-PA-01	I-PA-01	O-PA	16.4	26.2	27 inch	70	0.007	0.013	.50	**.00**	5.50	5.00	3.70	3.50	**1.8**	2.8	4.1
Concourse Drive																	
P-PB-02-02	I-PB-02-02	I-PB-02-01	1.8	4.8	12 inch	624	0.018	0.013	12.50	1.00	16.50	6.00	13.06	6.00	**3.4**	3.0	5.7
P-PB-02-01	I-PB-02-01	I-PB-02	9.6	0.0	12 inch	52	**0.000**	0.013	**.00**	**.00**	6.00	6.00	8.46	4.67	**ABOVE RIM**	5.0	12.2
P-PB-03	I-PB-03	I-PB-02	6.9	5.6	12 inch	140	0.025	0.013	4.50	1.00	8.50	6.00	9.71	4.45	**ABOVE RIM**	3.0	8.8
P-PB-02	I-PB-02	I-PB-01	15.9	18.6	27 inch	209	0.004	0.013	1.00	.25	6.00	5.25	4.42	3.87	**1.6**	2.8	4.0
P-PB-01	I-PB-01	O-PB	16.1	19.7	27 inch	62	0.004	0.013	.25	**.00**	5.25	5.00	3.67	3.50	**1.6**	2.8	4.0
Island Parkway																	
P-PC-04	I-PC-04	I-PC-03	1.3	8.5	12 inch	123	0.057	0.013	10.00	3.00	14.00	8.00	10.48	4.16	**3.5**	3.0	7.8
P-PC-03	I-PC-03	I-PC-02	1.3	2.6	12 inch	186	0.005	0.013	3.00	2.00	8.00	7.00	4.15	3.92	**3.9**	4.0	1.6
P-PC-02	I-PC-02	I-PC-01	2.8	6.6	15 inch	134	0.010	0.013	2.00	.60	7.00	5.60	3.90	3.64	**3.1**	3.8	2.3
P-PC-01	I-PC-01	O-PC	3.5	10.4	18 inch	61	0.010	0.013	.60	**.00**	5.60	5.00	3.57	3.50	**2.0**	3.5	2.0
Concourse Drive & Clipper Drive																	
P-PD-03-02	I-PD-03-02	I-PD-03-01	1.1	2.8	12 inch	162	0.006	0.013	3.40	2.40	7.40	6.40	6.52	6.37	**0.9**	3.0	1.4
P-PD-03-01	I-PD-03-01	I-PD-03	1.0	3.5	12 inch	117	0.010	0.013	2.40	1.25	6.40	6.25	6.34	6.25	**0.1**	3.0	1.3
P-PD-02-02	I-PD-02-02	I-PD-02-01	0.9	3.1	12 inch	33	0.008	0.013	2.75	2.50	6.75	6.50	5.40	5.38	**1.4**	3.0	1.1
P-PD-02-01	I-PD-02-01	I-PD-02	0.9	5.7	15 inch	192	0.008	0.013	2.50	1.00	6.50	6.00	5.37	5.33	**1.1**	2.8	0.7
P-PD-08	I-PD-08	I-PD-07	9.8	2.7	12 inch	128	0.006	0.013	4.00	3.25	8.00	7.25	17.00	7.25	**ABOVE RIM**	3.0	12.5
P-PD-07	I-PD-07	I-PD-06	9.8	1.8	12 inch	99	0.003	0.013	3.25	3.00	7.25	7.00	14.41	7.00	**ABOVE RIM**	3.0	12.4
P-PD-06	I-PD-06	I-PD-05	14.4	2.2	12 inch	64	0.004	0.013	3.00	2.75	7.00	6.75	17.23	6.75	**ABOVE RIM**	3.0	18.4
P-PD-05	I-PD-05	I-PD-04	14.4	1.7	12 inch	117	0.002	0.013	2.75	2.50	6.75	6.50	25.54	6.50	**ABOVE RIM**	3.0	18.3
P-PD-04	I-PD-04	I-PD-03	14.3	3.5	12 inch	128	0.010	0.013	2.50	1.25	6.50	6.25	26.87	6.25	**ABOVE RIM**	3.0	18.2
P-PD-03	I-PD-03	I-PD-02	13.5	3.2	12 inch	32	0.008	0.013	1.25	1.00	6.25	6.00	10.38	5.77	**ABOVE RIM**	4.0	17.2
P-PD-02	I-PD-02	I-PD-01	13.5	5.8	21 inch	149	0.001	0.013	1.00	.80	6.00	5.80	5.13	4.05	**0.9**	3.3	5.6
P-PD-01	I-PD-01	O-PD	14.1	25.5	24 inch	63	0.013	0.013	.80	**.00**	5.80	5.00	3.74	3.50	**2.1**	3.0	4.5
Clipper Drive																	
P-PE-06-01	I-PE-06-01	I-PE-06	0.8	1.6	12 inch	121	0.002	0.013	5.00	4.75	9.00	8.75	8.81	8.75	**0.2**	3.0	1.0
P-PE-05-01	I-PE-05-01	I-PE-05	1.5	1.8	12 inch	98	0.003	0.013	4.75	4.50	8.75	8.50	8.67	8.50	**0.1**	3.0	1.9
P-PE-07	I-PE-07	I-PE-06	3.6	1.4	12 inch	159	0.002	0.013	5.00	4.75	9.00	8.75	10.39	8.75	**ABOVE RIM**	3.0	4.6
P-PE-06	I-PE-06	I-PE-05	6.2	1.3	12 inch	179	0.001	0.013	4.75	4.50	8.75	8.50	13.85	8.50	**ABOVE RIM**	3.0	7.8
P-PE-05	I-PE-05	I-PE-04	9.9	1.8	12 inch	102	0.002	0.013	4.50	4.25	8.50	8.25	16.17	8.25	**ABOVE RIM**	3.0	12.6
P-PE-04	I-PE-04	J-PE-03	9.9	1.6	12 inch	132	0.002	0.013	4.25	4.00	8.25	8.00	18.14	8.00	**ABOVE RIM**	3.0	12.6
P-PE-03	J-PE-03	I-PE-02	9.8	4.3	12 inch	35	0.014	0.013	4.00	3.50	8.00	7.50	7.37	4.72	**0.6**	3.0	12.5
P-PE-02	I-PE-02	I-PE-01	10.9	20.9	24 inch	292	0.009	0.013	3.50	1.00	7.50	6.00	4.68	3.71	**2.8**	2.0	6.7
P-PE-01	I-PE-01	O-PE	11.8	27.8	24 inch	66	0.015	0.013	1.00	**.00**	6.00	5.00	3.68	3.50	**2.3**	3.0	3.8
P-PF-02-01	I-PF-02-01	I-PF-02	2.3	1.5	12 inch	141	0.002	0.013	2.25	2.00	6.25	6.00	6.59	6.00	**ABOVE RIM**	3.0	2.9
P-PF-01-02	I-PF-01-03	I-PF-01-02	0.4	2.5	12 inch	206	0.005	0.013	3.00	2.00	7.00	6.00	3.88	3.86	**3.1**	3.0	2.3
P-PF-01-01	I-PF-01-02	I-PF-01	1.0	3.2	12 inch	146	0.008	0.013	2.00	.80	6.00	5.80	3.85	3.74	**2.2**	3.0	1.3
P-PF-05	I-PF-05	I-PF-04	1.6	2.6	12 inch	91	0.005	0.013	4.00	3.50	8.00	7.50	7.57	7.40	**0.4**	3.0	2.0
P-PF-04	I-PF-04	I-PF-03	1.5	1.9	12 inch	176	0.003	0.013	3.50	3.00	7.50	7.00	7.31	7.00	**0.2**	3.0	1.9
P-PF-03	I-PF-03	I-PF-02	2.6	2.7	12 inch	174	0.006	0.013	3.00	2.00	7.00	6.00	6.93	6.00	**0.1**	3.0	3.3
P-PF-02	I-PF-02	I-PF-01	4.5	2.8	12 inch	201	0.006	0.013	2.00	.80	6.00	5.80	7.10	3.86	**ABOVE RIM**	3.0	5.8
P-PF-01	I-PF-01	O-PF	6.1	11.9	18 inch	62	0.013	0.013	.80	**.00**	5.80	5.00	3.71	3.50	**2.1**	3.5	3.5
P-PG-03	I-PG-03	I-PG-02	6.3	2.6	15 inch	318	0.002	0.013	10.00	9.50	14.00	13.50	13.65	10.52	**0.4**	2.8	5.1
P-PG-02	I-PG-02	I-PG-01	6.0	18.7	24 inch	73	0.007	0.013	9.50	9.00	13.50	13.00	10.37	9.96	**3.1**	2.0	5.3
P-PG-01	I-PG-01	O-PG	5.9	17.2	21 inch	85	0.012	0.013	9.00	8.00	13.00	12.00	9.90	8.71	**3.1**	2.3	6.5

(1) Pipes are presented in Figure 2 and Figure D-PA-PG in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

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Table D-P1c

Proposed Hydrology, 25-Year Event, Systems PA, PB, PC, PD, PE, PF & PG

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (4) (cfs)**
Island Park															
Mean Annual Precipitation 20"															
I-PA-05-01	6.25	1.30	4.86	4.86	2.08		0.88	1.83	2.08	1.8	10.0	10.0	2.44	0.00	**4.5**
I-PA-07	6.75	2.75	5.64	5.64	6.45		0.88	5.68	6.45	5.7	10.0	10.0	2.44	0.00	**14.0**
I-PA-06	6.50	1.50	5.11	5.06	0.00		0.00	0.00	6.45	5.7	10.0	10.5	2.38	0.00	**13.6**
I-PA-05	6.25	1.25	4.67	4.65	0.00	2.08	0.00	0.00	8.53	7.5	10.0	11.0	2.33	0.00	**17.6**
I-PA-04	6.00	1.00	4.51	4.49	0.00		0.00	0.00	8.53	7.5	10.0	11.3	2.29	0.00	**17.4**
I-PA-03	5.00	0.75	4.16	4.14	0.00		0.00	0.00	8.53	7.5	10.0	12.2	2.21	0.00	**16.7**
I-PA-02	5.50	0.50	3.87	3.72	0.00		0.00	0.00	8.53	7.5	10.0	13.0	2.14	0.00	**16.2**
I-PA-01	5.50	0.50	3.67	3.59	2.59		0.00	0.00	11.12	7.5	10.0	13.1	2.13	0.00	**16.1**
O-PA	5.00	0.00	3.50	3.50	0.00		0.00	0.00	11.12	7.5	0.0	13.5	2.10	0.00	**15.9**
I-PB-02-02	16.50	12.50	13.15	13.15	1.07		0.88	0.94	1.07	0.9	10.0	10.0	2.44	0.00	**2.3**
I-PB-02-01	6.00	1.10	4.87	4.69	5.29		0.88	4.66	6.36	5.6	10.0	11.7	2.25	0.00	**12.7**
I-PB-03	8.50	4.50	5.67	5.67	4.20		0.88	3.70	4.20	3.7	10.0	10.0	2.44	0.00	**9.1**
I-PB-02	6.00	1.00	4.45	4.40	0.00	6.36	0.00	0.00	10.56	9.3	10.0	11.9	2.23	0.00	**20.9**
I-PB-01	5.25	0.25	3.86	3.64	0.49		0.88	0.43	11.05	9.7	10.0	12.8	2.16	0.00	**21.2**
O-PB	5.00	0.00	3.50	3.50	0.00		0.00	0.00	11.05	9.7	0.0	13.0	2.14	0.00	**21.0**
I-PC-04	14.00	10.00	10.55	10.55	0.77		0.88	0.68	0.77	0.7	10.0	10.0	2.44	0.00	**1.7**
I-PC-03	8.00	3.00	4.58	4.56	0.00		0.00	0.00	0.77	0.7	10.0	10.2	2.41	0.00	**1.7**
I-PC-02	7.00	2.00	4.16	4.13	1.14		0.88	1.00	1.91	1.7	10.0	11.7	2.25	0.00	**3.8**
I-PC-01	5.60	0.60	3.66	3.58	0.52		0.00	0.00	2.43	1.7	10.0	12.4	2.19	0.00	**3.7**
O-PC	5.00	0.00	3.50	3.50	0.00		0.00	0.00	2.43	1.7	0.0	12.9	2.14	0.00	**3.6**
I-PD-03-02	7.40	3.40	4.41	4.41	0.66		0.88	0.58	0.66	0.6	10.0	10.0	2.44	0.00	**1.4**
I-PD-03-01	6.40	2.40	4.15	4.11	0.00		0.00	0.00	0.66	0.6	10.0	11.5	2.27	0.00	**1.3**
I-PD-02-02	6.75	2.75	3.84	3.84	0.53		0.88	0.47	0.53	0.5	10.0	10.0	2.44	0.00	**1.2**
I-PD-02-01	6.50	2.50	3.80	3.79	0.00		0.00	0.00	0.53	0.5	10.0	10.4	2.39	0.00	**1.1**
I-PD-08	8.00	4.00	7.59	7.59	5.98		0.88	5.26	5.98	5.3	10.0	10.0	2.44	0.00	**12.9**
I-PD-07	7.25	3.25	7.17	6.91	0.00		0.00	0.00	5.98	5.3	10.0	10.5	2.38	0.00	**12.6**
I-PD-06	7.00	3.00	6.60	6.17	2.92		0.88	2.57	8.90	7.8	10.0	10.9	2.33	0.00	**18.4**
I-PD-05	6.75	2.75	5.74	5.53	0.00		0.00	0.00	8.90	7.8	10.0	11.1	2.31	0.00	**18.3**
I-PD-04	6.50	2.50	4.77	4.71	0.00		0.00	0.00	8.90	7.8	10.0	11.5	2.28	0.00	**18.0**
I-PD-03	6.25	1.25	3.90	3.86	0.00	0.66	0.00	0.00	9.56	8.4	10.0	12.6	2.17	0.00	**18.4**
I-PD-02	6.00	1.00	3.73	3.72	0.00	0.53	0.00	0.00	10.09	8.9	10.0	13.9	2.07	0.00	**18.5**
I-PD-01	5.80	0.80	3.63	3.54	0.57		0.88	0.50	10.66	9.4	10.0	14.5	2.02	0.00	**19.1**
O-PD	5.00	0.00	3.50	3.50	0.00		0.00	0.00	10.66	9.4	0.0	14.6	2.01	0.00	**19.1**
I-PE-06-01	9.00	5.00	7.55	7.55	0.49		0.88	0.43	0.49	0.4	10.0	10.0	2.44	0.00	**1.1**
I-PE-05-01	8.75	4.75	6.53	6.53	0.90		0.88	0.79	0.90	0.8	10.0	10.0	2.44	0.00	**2.0**
I-PE-07	9.00	4.75	7.89	7.89	2.20		0.88	1.94	2.20	1.9	10.0	10.0	2.44	0.00	**4.8**
I-PE-06	8.75	4.50	7.44	7.39	1.41	0.49	0.88	1.24	4.10	3.6	10.0	11.5	2.27	0.00	**8.3**
I-PE-05	8.50	4.25	6.23	6.16	1.71	0.90	0.00	0.00	6.71	4.4	10.0	12.1	2.21	0.00	**9.8**
I-PE-04	8.25	3.75	5.27	5.23	0.00		0.88	0.00	6.71	4.4	10.0	12.4	2.19	0.00	**9.7**
J-PE-03	8.00	3.50	4.85	4.60	0.00		0.00	0.00	6.71	4.4	0.0	13.1	2.13	0.00	**9.5**
I-PE-02	7.50	3.25	4.47	4.43	0.74		0.88	0.65	7.45	5.1	10.0	13.2	2.13	0.00	**10.8**
I-PE-01	6.00	1.00	3.72	3.69	0.86		0.88	0.76	8.31	5.8	10.0	13.9	2.07	0.00	**12.1**
O-PE	5.00	0.00	3.50	3.50	0.00		0.00	0.00	8.31	5.8	0.0	14.2	2.05	0.00	**12.0**
I-PF-02-01	6.25	2.25	4.95	4.95	1.40		0.88	1.23	1.40	1.2	10.0	10.0	2.44	0.00	**3.0**
I-PF-01-03	7.00	3.00	4.03	4.03	0.23		0.88	0.20	0.23	0.2	10.0	10.0	2.44	0.00	**0.5**
I-PF-01-02	6.00	2.00	3.99	3.98	0.42		0.88	0.37	0.65	0.6	10.0	15.4	1.96	0.00	**1.1**
I-PF-05	8.00	4.00	7.80	7.80	0.94		0.88	0.83	0.94	0.8	10.0	10.0	2.44	0.00	**2.0**
I-PF-04	7.50	3.50	7.67	7.50	0.00		0.00	0.00	0.94	0.8	10.0	10.6	2.37	0.00	**2.0**
I-PF-03	7.00	3.00	7.02	6.49	0.82		0.88	0.72	1.76	1.6	10.0	11.8	2.25	0.00	**3.5**
I-PF-02	6.00	2.00	4.80	4.69	0.00	1.40	0.00	0.00	3.16	2.8	10.0	12.4	2.19	0.00	**6.1**
I-PF-01	5.80	0.80	3.83	3.79	0.57	0.65	0.88	0.50	4.38	3.9	10.0	17.1	1.86	0.00	**7.2**
O-PF	5.00	0.00	3.50	3.50	0.00		0.00	0.00	4.38	3.9	0.0	17.4	1.85	0.00	**7.2**
I-PG-03	14.00	10.00	14.00	14.00	3.83		0.88	3.37	3.83	3.4	10.0	10.0	2.44	0.00	**8.3**
I-PG-02	13.50	9.50	10.71	10.51	0.00		0.00	0.00	3.83	3.4	10.0	10.8	2.35	0.00	**8.0**
I-PG-01	13.00	9.00	10.13	10.04	0.00		0.00	0.00	3.83	3.4	10.0	11.0	2.32	0.00	**7.9**
O-PG	12.00	8.00	3.50	3.50	0.00		0.00	0.00	3.83	3.4	0.0	11.2	2.30	0.00	**7.8**

(1) Nodes are presented in Figure D-PA-PG in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-P1d

Proposed Hydraulics, 25-Year Event, Systems PA, PB, PC, PD, PE, PF & PG

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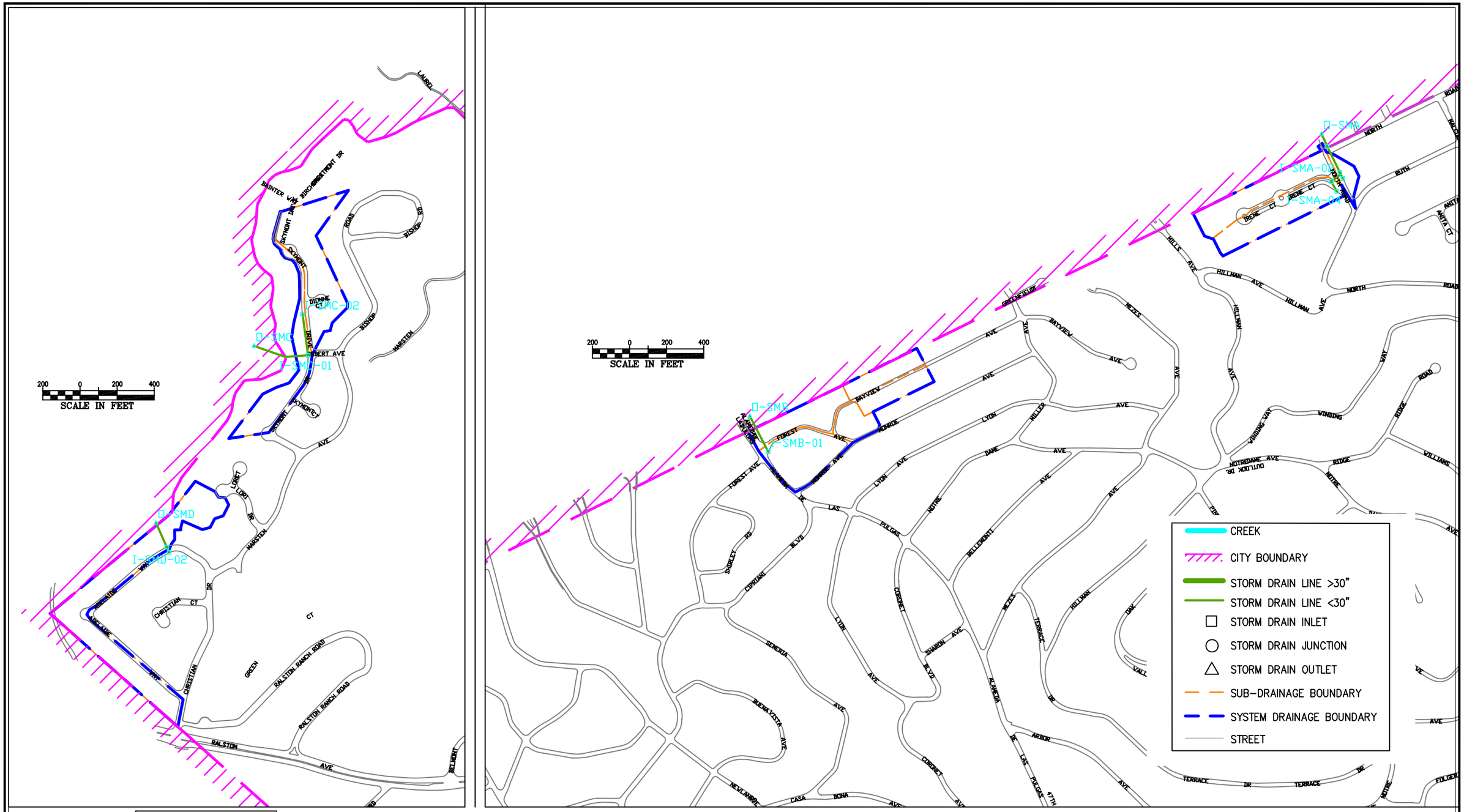
Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
Island Park																		
Mean Annual Precipitation 20 inches																		
P-PA-05-01	I-PA-05-01	I-PA-05	4.5	2.4	18 inch	99	0.001	0.013	1.3	1.3	6.3	6.3	4.9	4.7	**1.4**	3.5	2.6	upsized
P-PA-07	I-PA-07	I-PA-06	14.0	21.3	24 inch	141	0.009	0.013	2.8	1.5	6.8	6.5	5.6	5.1	**1.1**	2.0	4.4	upsized
P-PA-06	I-PA-06	I-PA-05	13.6	10.8	24 inch	109	0.002	0.013	1.5	1.3	6.5	6.3	5.1	4.7	1.4	3.0	4.3	upsized
P-PA-05	I-PA-05	I-PA-04	17.6	24.2	30 inch	72	0.003	0.013	1.3	1.0	6.3	6.0	4.7	4.5	**1.6**	2.5	3.6	upsized
P-PA-04	I-PA-04	I-PA-03	17.4	14.9	30 inch	189	0.001	0.013	1.0	.8	6.0	5.0	4.5	4.2	**1.5**	2.5	3.5	upsized
P-PA-03	I-PA-03	I-PA-02	16.7	16.2	30 inch	160	0.002	0.013	.8	.5	5.0	5.5	4.1	3.9	**0.9**	1.8	3.4	upsized
P-PA-02	I-PA-02	I-PA-01	16.2	0.0	30 inch	35	0.000	0.013	.5	.5	5.5	5.5	3.7	3.7	**1.8**	2.5	3.3	upsized
P-PA-01	I-PA-01	O-PA	16.1	37.6	30 inch	70	0.007	0.012	.5	**.0**	5.5	5.0	3.6	3.5	**1.9**	2.5	3.3	upsized
P-PB-02-02	I-PB-02-02	I-PB-02-01	2.3	4.8	12 inch	624	0.018	0.013	12.5	1.1	16.5	6.0	13.2	4.9	**3.4**	3.0	6.1	no change
P-PB-02-01	I-PB-02-01	I-PB-02	12.7	9.9	24 inch	52	0.002	0.013	1.1	1.0	6.0	6.0	4.7	4.5	**1.3**	2.9	4.0	upsized
P-PB-03	I-PB-03	I-PB-02	9.1	16.6	18 inch	140	0.025	0.013	4.5	1.0	8.5	6.0	5.7	4.5	**2.8**	2.5	9.6	upsized
P-PB-02	I-PB-02	I-PB-01	20.9	24.6	30 inch	209	0.004	0.013	1.0	.3	6.0	5.3	4.4	3.9	**1.6**	2.5	4.3	upsized
P-PB-01	I-PB-01	O-PB	21.2	28.2	30 inch	62	0.004	0.012	.3	**.0**	5.3	5.0	3.6	3.5	**1.6**	2.5	4.3	upsized
P-PC-04	I-PC-04	I-PC-03	1.7	8.5	12 inch	123	0.057	0.013	10.0	3.0	14.0	8.0	10.6	4.6	**3.5**	3.0	8.4	no change
P-PC-03	I-PC-03	I-PC-02	1.7	2.6	12 inch	186	0.005	0.013	3.0	2.0	8.0	7.0	4.6	4.2	**3.4**	4.0	2.1	no change
P-PC-02	I-PC-02	I-PC-01	3.8	6.6	15 inch	134	0.010	0.013	2.0	.6	7.0	5.6	4.1	3.7	**2.9**	3.8	3.1	no change
P-PC-01	I-PC-01	O-PC	3.7	10.4	18 inch	61	0.010	0.013	.6	**.0**	5.6	5.0	3.6	3.5	**2.0**	3.5	2.1	no change
P-PD-03-02	I-PD-03-02	I-PD-03-01	1.4	2.8	12 inch	162	0.006	0.013	3.4	2.4	7.4	6.4	4.4	4.2	**3.0**	3.0	1.8	no change
P-PD-03-01	I-PD-03-01	I-PD-03	1.3	3.5	12 inch	117	0.010	0.013	2.4	1.3	6.4	6.3	4.1	3.9	**2.3**	3.0	1.7	no change
P-PD-02-02	I-PD-02-02	I-PD-02-01	1.2	3.1	12 inch	33	0.008	0.013	2.8	2.5	6.8	6.5	3.8	3.8	**2.9**	3.0	1.5	no change
P-PD-02-01	I-PD-02-01	I-PD-02	1.1	5.7	15 inch	192	0.008	0.013	2.5	1.0	6.5	6.0	3.8	3.7	**2.7**	2.8	0.9	no change
P-PD-08	I-PD-08	I-PD-07	12.9	17.3	24 inch	128	0.006	0.013	4.0	3.3	8.0	7.3	7.6	7.2	**0.4**	2.0	4.1	upsized
P-PD-07	I-PD-07	I-PD-06	12.6	11.4	24 inch	99	0.003	0.013	3.3	3.0	7.3	7.0	6.9	6.6	**0.3**	2.0	4.0	upsized
P-PD-06	I-PD-06	I-PD-05	18.4	14.1	24 inch	64	0.004	0.013	3.0	2.8	7.0	6.8	6.2	5.7	**0.8**	2.0	5.9	upsized
P-PD-05	I-PD-05	I-PD-04	18.3	10.5	24 inch	117	0.002	0.013	2.8	2.5	6.8	6.5	5.5	4.8	**1.2**	2.0	5.8	upsized
P-PD-04	I-PD-04	I-PD-03	18.0	22.4	24 inch	128	0.010	0.013	2.5	1.3	6.5	6.3	4.7	3.9	**1.8**	2.0	5.7	upsized
P-PD-03	I-PD-03	I-PD-02	18.4	36.3	30 inch	32	0.008	0.013	1.3	1.0	6.3	6.0	3.9	3.8	**2.4**	2.5	3.8	upsized
P-PD-02	I-PD-02	I-PD-01	18.5	24.4	36 inch	149	0.001	0.013	1.0	.8	6.0	5.8	3.7	3.6	**2.3**	2.0	3.8	upsized
P-PD-01	I-PD-01	O-PD	19.1	75.2	36 inch	63	0.013	0.013	.8	**.0**	5.8	5.0	3.5	3.5	**2.3**	2.0	8.9	upsized
P-PE-06-01	I-PE-06-01	I-PE-06	1.1	2.3	12 inch	121	0.004	0.013	5.0	4.5	9.0	8.8	7.6	7.4	**1.5**	3.0	1.4	no change
P-PE-05-01	I-PE-05-01	I-PE-05	2.0	2.5	12 inch	98	0.005	0.013	4.8	4.3	8.8	8.5	6.5	6.2	**2.2**	3.0	2.5	no change
P-PE-07	I-PE-07	I-PE-06	4.8	4.2	18 inch	159	0.002	0.013	4.8	4.5	9.0	8.8	7.9	7.6	**1.1**	2.8	2.7	upsized
P-PE-06	I-PE-06	I-PE-05	8.3	3.9	18 inch	179	0.001	0.013	4.5	4.3	8.8	8.5	7.4	6.3	**1.4**	2.8	4.7	upsized
P-PE-05	I-PE-05	I-PE-04	9.8	7.4	18 inch	102	0.005	0.013	4.3	3.8	8.5	8.3	6.2	5.3	**2.3**	2.8	5.6	upsized
P-PE-04	I-PE-04	J-PE-03	9.7	9.8	24 inch	132	0.002	0.013	3.8	3.5	8.3	8.0	5.2	4.9	**3.0**	2.5	3.6	upsized
P-PE-03	J-PE-03	I-PE-02	9.5	19.1	24 inch	35	0.007	0.013	3.5	3.3	8.0	7.5	4.6	4.5	**3.4**	2.5	6.1	upsized
P-PE-02	I-PE-02	I-PE-01	10.8	19.9	24 inch	292	0.008	0.013	3.3	1.0	7.5	6.0	4.4	3.7	**3.1**	2.3	6.5	no change
P-PE-01	I-PE-01	O-PE	12.1	27.8	24 inch	66	0.015	0.013	1.0	**.0**	6.0	5.0	3.7	3.5	**2.3**	3.0	3.9	no change
P-PF-02-01	I-PF-02-01	I-PF-02	3.0	4.4	18 inch	141	0.002	0.013	2.3	2.0	6.3	6.0	5.0	4.8	**1.3**	2.5	1.7	upsized
P-PF-01-02	I-PF-01-03	I-PF-01-02	0.5	2.5	12 inch	206	0.005	0.013	3.0	2.0	7.0	6.0	4.0	4.0	**3.0**	3.0	0.6	no change
P-PF-01-01	I-PF-01-02	I-PF-01	1.1	3.2	12 inch	146	0.008	0.013	2.0	.8	6.0	5.8	4.0	3.8	**2.0**	3.0	1.4	no change
P-PF-05	I-PF-05	I-PF-04	2.0	2.6	12 inch	91	0.005	0.013	4.0	3.5	8.0	7.5	7.8	7.5	**0.2**	3.0	2.6	no change
P-PF-04	I-PF-04	I-PF-03	2.0	1.9	12 inch	176	0.003	0.013	3.5	3.0	7.5	7.0	7.5	7.0	**ABOVE RIM**	3.0	2.5	no change
P-PF-03	I-PF-03	I-PF-02	3.5	2.7	12 inch	174	0.006	0.013	3.0	2.0	7.0	6.0	6.5	4.8	**0.5**	3.0	4.5	no change
P-PF-02	I-PF-02	I-PF-01	6.1	8.1	18 inch	201	0.006	0.013	2.0	.8	6.0	5.8	4.7	4.0	**1.3**	2.5	3.5	upsized
P-PF-01	I-PF-01	O-PF	7.2	11.9	18 inch	62	0.013	0.013	.8	**.0**	5.8	5.0	3.8	3.5	**2.0**	3.5	4.1	no change
P-PG-03	I-PG-03	I-PG-02	8.3	2.6	15 inch	318	0.002	0.013	10.0	9.5	14.0	13.5	16.0	10.7	**ABOVE RIM**	2.8	6.8	no change
P-PG-02	I-PG-02	I-PG-01	8.0	18.7	24 inch	73	0.007	0.013	9.5	9.0	13.5	13.0	10.5	10.1	**3.0**	2.0	5.7	no change
P-PG-01	I-PG-01	O-PG	7.9	17.2	21 inch	85	0.012	0.013	9.0	8.0	13.0	12.0	10.0	8.8	**3.0**	2.3	7.0	no change

(1) Pipes are presented in Figure 2 and Figure D-PA-PG in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.



SEE FOLLOWING
TABLES D-SM1A TO D-SM1D

FIGURE D-SMA-SMD
BELMONT STORM DRAIN MASTER PLAN
EXISITING AND PROPSED STORM DRAIN SYSTEMS

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CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-SM1a

Existing Hydrology, 10-Year Event, Systems SMA, SMB, SMC & SMD

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	**Discharge(4) (cfs)**
to San Mateo Storm Drain System														
Mean Annual Precipitation = 24"														
North Road														
I-SMA-02-01	90.0	86.5	400.1	399.70	0.50		0.50	0.25	0.50	0.3	10.0	10.0	2.21	**0.6**
I-SMA-04	96.0	92.0	312.2	312.01	2.43		0.80	1.94	2.43	1.9	10.0	10.0	2.21	**4.3**
I-SMA-03	94.0	92.0	488.7	480.00	0.00		0.00	0.00	2.43	1.9	10.0	10.2	2.19	**4.3**
I-SMA-02	88.5	86.5	383.3	383.02	0.00	0.50	0.00	0.00	2.93	2.2	10.0	10.9	2.12	**4.7**
I-SMA-01	80.0	75.0	460.2	460.10	2.44		0.50	1.22	5.37	3.4	10.0	11.0	2.10	**7.2**
O-SMA	79.0	74.0	78.0	78.00	0.00		0.00	0.00	5.37	3.4	0.0	11.6	2.06	**7.1**
Alameda de las Pulgas														
I-SMB-01	384.0	380.0	389.6	389.22	6.70		0.50	3.35	6.70	3.4	10.0	10.0	2.21	**7.5**
O-SMB	383.0	379.0	382.0	382.00	0.00		0.00	0.00	6.70	3.4	0.0	10.4	2.17	**7.3**
Mean Annual Precipitation = 26"														
Robert Avenue/Skymont Drive														
I-SMC-02	401.4	397.4	502.3	502.18	3.43		0.50	1.72	3.43	1.7	10.0	10.0	2.29	**4.0**
I-SMC-01	408.1	395.0	501.5	500.99	2.16		0.50	1.08	5.59	2.8	10.0	10.7	2.21	**6.2**
O-SMC	340.0	336.0	336.0	336.00	0.00		0.00	0.00	5.59	2.8	0.0	11.0	2.19	**6.2**
Adelaide Way														
I-SMD-02	521.5	517.5	520.9	520.00	3.30		0.50	1.65	3.30	1.7	10.0	10.0	2.29	**3.8**
I-SMD-01	521.0	517.0	503.9	503.87	5.60		0.50	2.80	8.90	4.5	10.0	10.1	2.28	**10.2**
O-SMD	506.0	502.0	502.0	502.00	0.00		0.00	0.00	8.90	4.5	0.0	10.3	2.27	**10.2**

(1) Nodes are presented in Figure D-SMA-SMD in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-SM1b

Existing Hydraulics, 10-Year Event, Systems SMA, SMB, SMC, SMD & SME

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (4) (cfs) (2)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)
to San Mateo Storm Drain System																	
Mean Annual Precipitation = 24"																	
North Road																	
P-SMA-02-01	I-SMA-02-01	I-SMA-02	0.6	0.0	12 inch	36	0.000	0.010	86.50	86.50	90.00	88.50	87.62	87.62	**2.4**	2.5	0.7
P-SMA-04	I-SMA-04	I-SMA-03	4.3	0.0	12 inch	61	0.000	0.013	92.00	92.00	96.00	94.00	94.19	93.29	**1.8**	3.0	5.5
P-SMA-03	I-SMA-03	I-SMA-02	4.3	12.9	12 inch	71	0.077	0.010	92.00	86.50	94.00	88.50	92.87	87.72	**1.1**	1.0	14.8
P-SMA-02	I-SMA-02	I-SMA-01	4.7	12.5	12 inch	157	0.073	0.010	86.50	75.00	88.50	80.00	87.40	78.09	**1.1**	1.0	14.8
P-SMA-01	I-SMA-01	O-SMA	7.2	26.5	24 inch	73	0.014	0.013	75.00	74.00	80.00	79.00	78.07	78.00	**1.9**	3.0	2.3
Alameda de las Pulgas																	
P-SMB-01	I-SMB-01	O-SMB	7.5	2.4	12 inch	216	0.005	0.013	380.00	379.00	384.00	383.00	391.47	382.00	**ABOVE RIM**	3.0	9.5
Mean Annual Precipitation = 26"																	
Robert Avenue/Skymont Drive																	
P-SMC-02	I-SMC-02	I-SMC-01	4.0	3.7	12 inch	223	0.011	0.013	397.40	395.00	401.40	408.10	399.17	396.40	**2.2**	3.0	5.1
P-SMC-01	I-SMC-01	O-SMC	6.2	28.6	15 inch	301.00	0.196	0.013	395.00	336.00	408.10	340.00	396.01	336.40	**12.1**	11.9	18.7
Adelaide Way																	
P-SMD-02	I-SMD-02	I-SMD-01	3.8	4.5	12 inch	31	0.016	0.013	517.50	517.00	521.50	521.00	518.72	518.36	**2.8**	3.0	4.9
P-SMD-01	I-SMD-01	O-SMD	10.2	20.9	15 inch	143	0.105	0.013	517.00	502.00	521.00	506.00	518.19	502.62	**2.8**	2.8	17.0

(1) Pipes are presented in Figure 2 and Figure D-SMA-SMD in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-SM1c

Proposed Hydrology, 25-Year Event, Systems SMA, SMB, SMC & SMD

Node (1) #	Ground Elevation (ft) (2)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Inlet Area (acres)	Lateral Area (acres)	Inlet C (6)	Inlet C*A (acres)	Cumulative Area (3) (acres)	Cumulative C*A (acres)	Inlet Tc (5) (minutes)	System Tc (minutes)	Intensity (in/hr)	Additional Flows	**Discharge (4) (cfs)**
to San Mateo Storm Drain System															
Mean Annual Precipitation = 24"															
I-SMA-02-01	90.00	86.00	400.49	399.73	0.50		0.55	0.28	0.50	0.3	10.0	10.0	2.64	0.00	**0.7**
I-SMA-04	96.00	92.00	312.39	312.12	2.43		0.88	2.14	2.43	2.1	10.0	10.0	2.64	0.00	**5.7**
I-SMA-03	94.00	92.00	474.29	473.73	0.00		0.00	0.00	2.43	2.1	10.0	10.1	2.62	0.00	**5.7**
I-SMA-02	88.00	84.00	385.98	385.37	0.00	0.50	0.00	0.00	2.93	2.4	10.0	10.2	2.62	0.00	**6.4**
I-SMA-01	80.00	75.00	460.40	460.26	2.44		0.55	1.34	5.37	3.8	10.0	10.4	2.59	0.00	**9.8**
O-SMA	79.00	74.00	78.00	78.00	0.00		0.00	0.00	5.37	3.8	0.0	10.8	2.55	0.00	**9.6**
I-SMB-01	384.00	380.00	389.88	389.24	6.70		0.55	3.69	6.70	3.7	10.0	10.0	2.64	0.00	**9.8**
O-SMB	383.00	379.00	382.00	382.00	0.00		0.00	0.00	6.70	3.7	0.0	11.2	2.50	0.00	**9.3**
Mean Annual Precipitation = 26"															
I-SMC-02	401.40	397.40	502.53	502.32	3.43		0.55	1.89	3.43	1.9	10.0	10.0	2.74	0.00	**5.2**
I-SMC-01	408.10	395.00	501.85	501.00	2.16		0.55	1.19	5.59	3.1	10.0	10.6	2.67	0.00	**8.3**
O-SMC	340.00	336.00	336.00	336.00	0.00		0.00	0.00	5.59	3.1	0.0	10.8	2.64	0.00	**8.2**
I-SMD-02	521.50	517.50	520.71	520.42	3.30		0.55	1.81	3.30	1.8	10.0	10.0	2.74	0.00	**5.0**
I-SMD-01	521.00	517.00	504.09	504.00	5.60		0.55	3.08	8.90	4.9	10.0	10.1	2.73	0.00	**13.5**
O-SMD	506.00	502.00	502.00	502.00	0.00		0.00	0.00	8.90	4.9	0.0	10.2	2.72	0.00	**13.4**

(1) Nodes are presented in Figure D-SMA-SMD in Appendix D
(2) ft = feet, in/hr = inches/hour rainfall, cfs = cubic feet per second
(3) Cumlative Area = Inlet CA + Lateral Inlet CA
(4) Discharge is from the Rational Method, Q = CIA
(5) Tc = Time of Concentration is assumed to be 10-minutes roof to inlet, unless greater using the Kirpich Method.

CITY OF BELMONT
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Table D-SM1d

Proposed Hydraulics, 25-Year Event, Systems SMA, SMB, SMC & SMD

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) (2) (4)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (3) (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes (5)
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
to San Mateo Storm Drain System																		
Mean Annual Precipitation = 24"																		
P-SMA-02-01	I-SMA-02-01	I-SMA-02	0.7	10.9	12 inch	36	0.056	0.010	86.00	84.00	90.00	88.00	86.36	85.34	**3.6**	3.0	7.9	no change
P-SMA-04	I-SMA-04	I-SMA-03	5.7	0.0	12 inch	61	0.000	0.013	92.00	92.00	96.00	94.00	95.19	93.63	**0.8**	3.0	7.3	no change
P-SMA-03	I-SMA-03	I-SMA-02	5.7	15.6	12 inch	71	0.113	0.010	92.00	84.00	94.00	88.00	92.94	85.52	**1.1**	1.0	18.2	no change
P-SMA-02	I-SMA-02	I-SMA-01	6.4	11.1	12 inch	157	0.057	0.010	84.00	75.00	88.00	80.00	84.96	78.16	**3.0**	3.0	14.6	no change
P-SMA-01	I-SMA-01	O-SMA	9.8	26.5	24 inch	73	0.014	0.013	75.00	74.00	80.00	79.00	78.14	78.00	**1.9**	3.0	3.1	no change
P-SMB-01	I-SMB-01	O-SMB	9.8	15.4	24 inch	216	0.005	0.013	380.00	379.00	384.00	383.00	382.41	382.00	**1.6**	2.0	3.1	upsized
Mean Annual Precipitation = 26"																		
P-SMC-02	I-SMC-02	I-SMC-01	5.2	3.7	12 inch	223	0.011	0.013	397.40	395.00	401.40	408.10	401.52	396.74	**ABOVE RIM**	3.0	6.6	no change
P-SMC-01	I-SMC-01	O-SMC	8.3	28.6	15 inch	301.00	0.196	0.013	395.00	336.00	408.10	340.00	396.13	336.46	**12.0**	11.9	20.2	no change
P-SMD-02	I-SMD-02	I-SMD-01	5.0	4.5	12 inch	31	0.016	0.013	517.50	517.00	521.50	521.00	519.14	518.52	**2.4**	3.0	6.4	no change
P-SMD-01	I-SMD-01	O-SMD	13.5	20.9	15 inch	143	0.105	0.013	517.00	502.00	521.00	506.00	518.23	502.73	**2.8**	2.8	18.1	no change

(1) Pipes are presented in Figure 2 and Figure D-SMA-SMD in Appendix D
(2) ft = feet, cfs = cubic feet per second, ft/s = feet per second
(3) Freeboard is HGL (Hydraulic Grade Line) below Rim of Inlet
(4) Discharge is from the Rational Method, Q = CIA
(5) Upsized pipes are proposed size reported, no change are same existing pipes in the 25-year event.

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-R1

Proposed Hydraulics: Regional Facility, 25-Year Event, Regional Line

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs)	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s)	Notes
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream				
Regional Facility																		
P-R07-04	I-ED-08-03	I-R07-03	30.9	20.0	36 inch	130	0.001	0.012	4.80	4.70	10.40	10.00	**7.25**	6.88	**3.2**	2.6	4.4	
P-R07-03	I-R07-03	I-R07-02	30.4	36.9	36 inch	461	0.003	0.012	4.70	3.50	10.00	8.40	**6.88**	6.14	**3.1**	2.3	5.8	
P-R07-02	I-R07-02	I-R07-01	35.6	42.4	36 inch	145	0.003	0.012	3.50	3.00	8.40	7.90	**6.02**	5.77	**2.4**	1.9	6.7	
P-R07-01	I-R07-01	I-R07	35.2	143.1	36 inch	125	0.039	0.012	3.00	- 1.90	7.90	9.00	**5.40**	5.24	**2.5**	1.9	16.7	
P-R17	J-R17	I-R16	19.1	56.7	48 inch	660	0.002	0.013	- .42	- 1.45	7.08	7.20	**6.53**	6.41	**0.6**	3.5	1.5	
P-R16	I-R16	I-R15	30.1	21.6	60 inch	725	0.000	0.013	- 1.45	- 1.50	7.20	7.40	**6.41**	6.31	**0.8**	3.7	1.5	
P-R15	I-R15	I-R14	75.0	54.2	72 inch	305	0.000	0.013	- 1.50	- 1.55	7.40	7.50	**6.28**	6.18	**1.1**	2.9	2.7	
P-R14	I-R14	I-R13	77.2	42.4	72 inch	499	0.000	0.013	- 1.55	- 1.60	7.50	7.80	**6.16**	6.00	**1.3**	3.1	2.7	
P-R13	I-R13	I-R12	78.1	72.2	72 inch	172	0.000	0.013	- 1.60	- 1.65	7.80	9.40	**5.95**	5.89	**1.9**	3.4	2.8	
P-R12	I-R12	I-R11	112.5	86.8	72 inch	119	0.000	0.013	- 1.65	- 1.70	9.40	9.30	**5.87**	5.79	**3.5**	5.1	4.0	
P-R10	J-R-10	I-R09	119.5	70.2	84 inch	414	0.000	0.013	- 1.75	- 1.80	9.30	9.10	**5.53**	5.38	**3.8**	4.1	3.1	
P-R09	I-R09	I-R08	119.1	194.4	84 inch	54	0.001	0.013	- 1.80	- 1.85	9.10	9.00	**5.37**	5.35	**3.7**	3.9	3.1	
P-R08	I-R08	I-R07	66.8	62.0	84 inch	531	0.000	0.013	- 1.85	- 1.90	9.00	9.00	**5.31**	5.25	**3.7**	3.9	1.7	
P-R07	I-R07	I-R-06	88.8	118.2	84 inch	146	0.000	0.013	- 1.90	- 1.95	9.00	9.00	**5.21**	5.18	**3.8**	3.9	2.3	
P-R06	I-R-06	I-R05	87.0	77.9	84 inch	336	0.000	0.013	- 1.95	- 2.00	9.00	9.80	**5.16**	5.09	**3.8**	4.0	2.3	
P-R05	I-R05	I-R04	83.1	196.2	84 inch	53	0.001	0.013	- 2.00	- 2.05	9.80	9.70	**5.03**	5.02	**4.8**	4.8	2.2	
P-R04	I-R04	I-R03	82.5	396.2	84 inch	52	0.004	0.013	- 2.05	- 2.25	9.70	10.00	**4.97**	4.96	**4.7**	4.8	2.1	
P-R03	I-R03	I-R02	81.9	184.4	84 inch	180	0.001	0.013	- 2.25	- 2.40	10.00	9.50	**4.92**	4.89	**5.1**	5.3	2.1	
P-R02	I-R02	I-R01	118.2	437.8	84 inch	181	0.005	0.013	- 2.40	- 3.25	9.50	8.50	**4.80**	4.74	**4.7**	4.9	3.1	
P-R01	I-R01	O-R	118.6	141.9	48 inch	205	0.002	0.013	- 3.25	- 3.75	8.50	7.00	**4.35**	4.00	**4.2**	7.8	4.7	2 Parallel Pipes

(1) Pipes are shown on Figure 6, Regional Solution Alternative
(2) Existing easements are used where possible.
(3) cfs = cubic feet per second, ft = feet, ft/s = feet per second

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-R2

Proposed Hydraulics: Regional Facility, 25-Year Event, System EA

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Hiller Street																	
P-EA-07-04	I-EA-07-04	I-EA-07-03	3.7	2.0	12 inch	33	0.003	0.013	3.00	2.90	7.92	6.88	**7.10**	6.75	**0.8**	3.9	4.7
P-EA-07-03	I-EA-07-03	J-R17	6.5	27.1	24 inch	231	0.014	0.013	2.90	- .42	6.88	7.08	**6.73**	6.54	**0.1**	2.0	2.1
P-EA-07-02-03	I-EA-07-02-03	J-R17	7.3	24.4	18 inch	58	0.054	0.013	2.70	- .42	7.04	7.08	**6.83**	6.55	**0.2**	2.8	4.1
P-EA-07-02-02	I-EA-07-02-02	J-R17	4.1	32.2	18 inch	30	0.094	0.013	2.39	- .42	7.03	7.08	**6.59**	6.55	**0.4**	3.1	2.3
P-EA-07-02-01	I-EA-07-02-01	J-R17	2.9	52.7	18 inch	12	0.252	0.013	2.60	- .42	7.04	7.08	**6.54**	6.53	**0.5**	2.9	1.6

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Table D-R3

Proposed Hydraulics: Regional Facility, 25-Year Event, System EC

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
Cambridge Street																	
P-EC-07-03	I-EC-07-03	J-EC-07-02	0.0	6.1	12 inch	52	0.029	0.013	11.00	9.50	16.00	14.50	**11.00**	9.50	**5.0**	4.0	0.0
P-EC-07-02	J-EC-07-02	I-EC-07-01	0.0	11.1	15 inch	102	0.029	0.013	9.50	6.50	14.50	10.50	**9.50**	7.11	**5.0**	3.8	0.0
P-EC-07-01	I-EC-07-01	J-EC-07	0.0	23.2	24 inch	351	0.011	0.013	6.50	2.80	10.50	8.30	**7.11**	7.11	**3.4**	2.0	0.0
Hiller Avenue																	
P-EC-05-02	I-EC-05-02	I-R14	2.7	39.1	18 inch	40	0.139	0.013	4.00	- 1.55	7.60	7.50	**5.91**	5.88	**1.7**	2.1	1.5
Chesterton Avenue																	
P-EC-03-02W-01	I-EC-03-02W-01	J-EC-03-02W	1.0	6.7	12 inch	102	0.021	0.010	3.90	1.80	7.90	7.80	**5.29**	5.24	**2.6**	3.0	1.2
P-EC-03-05W	J-EC-03-05W	I-EC-03-04W	0.0	1.6	12 inch	202	0.002	0.013	3.60	3.20	7.60	7.40	**6.31**	6.31	**1.3**	3.0	0.0
P-EC-03-04W	I-EC-03-04W	I-R16	10.6	54.5	24 inch	80	0.058	0.013	3.20	- 1.45	7.40	7.20	**6.28**	6.10	**1.1**	2.2	3.4
P-EC-03-02W	J-EC-03-02W	I-EC-03-01W	0.9	4.1	24 inch	354	0.000	0.012	1.80	1.70	7.80	7.60	**5.24**	5.24	**2.6**	4.0	0.3
P-EC-03-01W	I-EC-03-01W	J-EC-03	3.5	4.0	24 inch	377	0.000	0.012	1.70	1.60	7.60	8.20	**5.23**	5.16	**2.4**	3.9	1.1
P-EC-03-01E	I-EC-03-01E	J-EC-03	5.9	8.6	18 inch	344	0.007	0.013	3.90	1.60	7.60	8.20	**6.24**	5.16	**1.4**	2.2	3.3
Oxford Place																	
P-EC-02-01-01	I-EC-02-01-01	J-EC-02-01	4.1	2.4	12 inch	46	0.004	0.013	4.00	3.80	8.00	8.00	**5.92**	5.32	**2.1**	3.0	5.2
P-EC-02-03	I-EC-02-03	I-EC-02-02	0.3	0.8	12 inch	194	0.001	0.013	4.00	3.90	8.00	8.00	**5.32**	5.31	**2.7**	3.0	0.3
P-EC-02-02	I-EC-02-02	J-EC-02-01	0.2	0.7	12 inch	231	0.000	0.013	3.90	3.80	8.00	8.00	**5.31**	5.31	**2.7**	3.1	0.2
P-EC-02-01	J-EC-02-01	J-EC-02	2.3	9.1	18 inch	390	0.007	0.013	3.80	.90	8.00	6.90	**5.30**	5.12	**2.7**	2.7	4.3
P-EC-01-01	I-EC-01-01	J-EC-01	7.2	30.0	24 inch	148	0.018	0.013	2.30	- .30	6.30	6.20	**5.26**	5.11	**1.0**	2.0	2.3
Marine View Avenue																	
P-EC-14	I-EC-14	I-EC-13	0.4	19.2	15 inch	59	0.088	0.013	123.00	117.80	128.00	122.80	**123.26**	122.80	**4.7**	3.8	6.4
P-EC-13	I-EC-13	I-EC-12	25.7	18.0	15 inch	36	0.078	0.013	117.80	115.00	122.80	124.00	**125.19**	119.52	**ABOVE RIM**	3.8	20.9
P-EC-12	I-EC-12	I-EC-11	27.8	29.3	18 inch	276	0.078	0.013	115.00	93.60	124.00	102.60	**116.49**	96.30	**7.5**	7.5	18.8
P-EC-11	I-EC-11	J-EC-10	34.4	37.2	18 inch	315	0.126	0.013	93.60	54.00	102.60	60.00	**95.10**	60.00	**7.5**	7.5	23.9
P-EC-10	J-EC-10	I-EC-09	34.0	27.2	18 inch	386	0.067	0.013	54.00	28.20	60.00	32.20	**71.75**	31.29	**ABOVE RIM**	4.5	19.2
P-EC-09	I-EC-09	I-EC-08	33.5	49.8	24 inch	562	0.041	0.012	28.20	5.00	32.20	10.00	**30.11**	8.09	**2.1**	2.0	17.0
P-EC-08	I-EC-08	J-EC-07	59.5	94.0	36 inch	130	0.017	0.012	5.00	2.80	10.00	8.30	**8.01**	7.13	**2.0**	2.0	8.4
P-EC-07	J-EC-07	I-EC-06	58.8	119.9	48 inch	219	0.006	0.012	2.80	1.50	8.30	7.80	**7.10**	6.79	**1.2**	1.5	4.7
P-EC-06	I-EC-06	J-EC-05	67.5	71.0	48 inch	240	0.002	0.012	1.50	1.00	7.80	7.50	**6.62**	6.17	**1.2**	2.3	5.4
P-EC-05	J-EC-05	I-R15	65.6	310.0	48 inch	63	0.040	0.012	1.00	- 1.50	7.50	7.40	**6.14**	6.03	**1.4**	2.5	5.2
P-EC-03	J-EC-03	J-EC-02	6.3	31.1	30 inch	122	0.006	0.013	1.60	.90	8.20	6.90	**5.15**	5.12	**3.1**	4.1	1.3
P-EC-02	J-EC-02	J-EC-01	8.3	83.5	48 inch	355	0.003	0.013	.90	- .30	6.90	6.20	**5.12**	5.10	**1.8**	2.0	0.7
P-EC-01	J-EC-01	O-EC	10.8	39.5	48 inch	66	0.001	0.013	- .30	- .35	6.20	6.10	**5.10**	5.10	**1.1**	2.5	0.9

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Table D-R4

Proposed Hydraulics: Regional Facility, 25-Year Event, System ED

Pipe #	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation Upstream	Invert Elevation Downstream	Ground/Rim Elevation Upstream	Ground/Rim Elevation Downstream	HGL Elevation Upstream	HGL Elevation Downstream	**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
Virginia Avenue																	
P-ED-17-08-02	I-ED-17-08-02	I-ED-17-08-01	0.7	4.2	8 inch	90	0.122	0.013	188.00	177.00	192.00	180.50	**188.40**	180.50	**3.6**	3.3	9.0
P-ED-17-08-01	I-ED-17-08-01	I-ED-17-08	0.7	1.5	8 inch	65	0.015	0.013	177.00	176.00	180.50	184.00	**184.22**	184.00	**ABOVE RIM**	2.8	2.0
Cobblestone Lane																	
P-ED-17-01N	I-ED-17-01N	I-ED-17	5.6	7.1	12 inch	33	0.039	0.013	57.50	56.20	61.50	61.20	**59.01**	58.21	**2.5**	3.0	7.1
P-ED-17-01-03	I-ED-17-01-03	I-ED-17-01-02	3.2	4.6	12 inch	24	0.017	0.013	100.50	100.10	104.50	104.10	**101.26**	101.00	**3.2**	3.0	6.3
P-ED-17-01-02	I-ED-17-01-02	I-ED-17-01-01	3.5	17.9	12 inch	113	0.253	0.013	100.10	71.50	104.10	74.50	**100.90**	73.19	**3.2**	3.0	17.7
P-ED-17-01-01	I-ED-17-01-01	J-ED-17-01	4.7	5.8	12 inch	19	0.026	0.013	71.50	71.00	74.50	75.00	**73.03**	72.70	**1.5**	2.0	6.0
Middle Road/Laurel Road																	
P-ED-17-10	I-ED-17-10	I-ED-17-09	13.4	11.9	12 inch	27	0.111	0.013	211.50	208.50	214.00	214.00	**214.88**	211.08	**ABOVE RIM**	1.5	17.0
P-ED-17-09	I-ED-17-09	I-ED-17-08	13.6	20.3	12 inch	169	0.192	0.010	208.50	176.00	214.00	184.00	**209.50**	184.00	**4.5**	4.5	27.7
P-ED-17-08	I-ED-17-08	I-ED-17-07	13.9	0.0	12 inch	113	0.000	0.013	176.00	176.00	184.00	180.00	**197.15**	180.00	**ABOVE RIM**	7.0	17.7
P-ED-17-07	I-ED-17-07	I-ED-17-06	13.8	19.2	12 inch	76	0.289	0.013	176.00	154.00	180.00	158.00	**177.00**	156.17	**3.0**	3.0	26.6
P-ED-17-06	I-ED-17-06	I-ED-17-05	13.8	16.8	12 inch	72	0.222	0.013	154.00	138.00	158.00	142.00	**155.00**	142.00	**3.0**	3.0	23.9
P-ED-17-05	I-ED-17-05	I-ED-17-04	13.8	5.2	12 inch	93	0.022	0.013	138.00	136.00	142.00	140.00	**152.19**	138.34	**ABOVE RIM**	3.0	17.5
P-ED-17-04	I-ED-17-04	I-ED-17-03	13.7	24.1	12 inch	46	0.459	0.013	136.00	114.90	140.00	118.90	**137.00**	118.90	**3.0**	3.0	31.7
P-ED-17-03	I-ED-17-03	I-ED-17-02	13.7	12.8	12 inch	147	0.129	0.013	114.90	96.00	118.90	99.50	**119.64**	97.97	**ABOVE RIM**	3.0	17.4
P-ED-17-02	I-ED-17-02	J-ED-17-01	13.6	28.6	18 inch	337	0.074	0.013	96.00	71.00	99.50	75.00	**97.37**	72.90	**2.1**	2.0	16.0
P-ED-17-01	J-ED-17-01	I-ED-17	17.8	29.6	18 inch	186	0.080	0.013	71.00	56.20	75.00	61.20	**72.45**	58.35	**2.6**	2.5	17.5
Hiller Avenue																	
P-ED-08-09	I-ED-08-09	J-ED-08-08	27.6	26.2	24 inch	657	0.013	0.013	26.60	17.80	31.60	22.80	**30.08**	20.28	**1.5**	3.0	8.8
P-ED-08-08	J-ED-08-08	J-ED-08-07	26.1	31.4	24 inch	327	0.019	0.013	17.80	11.50	22.80	16.50	**20.02**	15.69	**2.8**	3.0	8.3
P-ED-08-07	J-ED-08-07	I-ED-08-06	25.3	20.9	24 inch	211	0.009	0.013	11.50	9.70	16.50	14.70	**15.36**	12.71	**1.1**	3.0	8.1
P-ED-08-06	I-ED-08-06	I-ED-08-05	24.9	27.7	24 inch	213	0.015	0.013	9.70	6.50	14.70	11.50	**11.46**	8.61	**3.2**	3.0	10.0
P-ED-08-05	I-ED-08-05	I-ED-08-04	26.9	35.3	30 inch	81	0.007	0.013	6.50	5.90	11.50	10.90	**8.27**	8.24	**3.2**	2.5	7.9
P-ED-08-04	I-ED-08-04	I-ED-08-03	26.7	28.3	30 inch	272	0.004	0.012	5.90	4.80	10.90	10.40	**8.18**	7.32	**2.7**	2.5	6.6
P-ED-08-02	I-ED-08-02	I-ED-08-01	0.0	3.5	18 inch	104	0.001	0.012	4.60	4.50	9.60	9.50	**5.56**	5.56	**4.0**	3.5	0.0
P-ED-08-01	I-ED-08-01	I-R11	0.0	24.4	21 inch	308	0.020	0.012	4.50	- 1.70	9.50	9.30	**5.56**	5.56	**3.9**	3.3	0.0
Seagate Place																	
P-ED-01-01	I-ED-01-01	J-ED-01	6.0	5.2	18 inch	104	0.002	0.013	.25	**.00**	7.00	10.00	**6.35**	6.00	**0.7**	5.3	3.4
Cypruss Road																	
P-ED-21	I-ED-21	I-ED-20	2.0	18.9	12 inch	85	0.282	0.013	156.00	132.00	160.00	136.00	**156.61**	132.69	**3.4**	3.0	15.8
P-ED-20	I-ED-20	I-ED-19	2.0	11.7	12 inch	154	0.107	0.013	132.00	115.50	136.00	120.00	**132.61**	116.18	**3.4**	3.0	11.2
P-ED-19	I-ED-19	I-ED-18	2.9	43.9	18 inch	60	0.175	0.013	115.50	105.00	120.00	110.00	**116.14**	105.73	**3.9**	3.0	14.1
P-ED-18	I-ED-18	I-ED-17	2.9	25.3	15 inch	318	0.153	0.013	105.00	56.20	110.00	61.20	**105.68**	58.04	**4.3**	3.8	13.7
P-ED-17	I-ED-17	I-ED-16	25.6	50.7	24 inch	28	0.043	0.012	56.20	55.00	61.20	60.00	**57.98**	57.03	**3.2**	3.0	16.2
P-ED-16	I-ED-16	I-ED-15	26.0	76.5	24 inch	164	0.098	0.012	55.00	39.00	60.00	44.00	**56.79**	41.50	**3.2**	3.0	22.0
P-ED-15	I-ED-15	I-ED-14	25.8	64.8	24 inch	100	0.070	0.012	39.00	32.00	44.00	42.00	**40.78**	35.57	**3.2**	3.0	19.5
P-ED-14	I-ED-14	I-ED-13	25.7	32.7	24 inch	48	0.021	0.013	32.00	31.00	42.00	41.50	**35.38**	34.75	**6.6**	8.0	8.2
P-ED-13	I-ED-13	J-ED-12	25.6	40.2	24 inch	95	0.032	0.013	31.00	28.00	41.50	33.00	**34.22**	33.00	**7.3**	8.5	8.2
P-ED-12	J-ED-12	I-ED-11	25.4	47.5	24 inch	80	0.038	0.012	28.00	25.00	33.00	32.90	**33.76**	32.90	**ABOVE RIM**	3.0	8.1
P-ED-11	I-ED-11	J-ED-10	58.2	47.8	30 inch	1485	0.014	0.013	25.00	4.80	32.90	10.80	**38.17**	8.26	**ABOVE RIM**	5.4	11.9
P-ED-10	J-ED-10	I-R12	53.9	96.3	30 inch	117	0.055	0.013	4.80	- 1.65	10.80	9.40	**7.94**	5.93	**2.9**	3.5	11.0
Briarfield Way																	
P-ED-04	J-ED-04	J-ED-03	53.0	79.8	54 inch	304	0.002	0.013	1.00	.50	8.50	9.00	**4.78**	4.61	**3.7**	3.0	5.4
P-ED-03	J-ED-03	I-R-EL-03	62.0	93.0	60 inch	196	0.001	0.013	.50	.25	9.00	9.00	**4.60**	4.50	**4.4**	3.5	5.1
P-ED-02	J-ED-02	J-ED-01	0.0	69.4	60 inch	413	0.001	0.012	.25	**.00**	9.00	10.00	**6.00**	6.00	**3.0**	3.8	0.0
P-ED-01	J-ED-01	O-ED	5.9	63.9	60 inch	487	0.001	0.012	**.00**	- .25	10.00	7.00	**6.00**	6.00	**4.0**	5.0	0.3

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Table D-R5

Proposed Hydraulics: 10-Year Event with Free Outfall

Pipe # (1)	Upstream Node	Downstream Node	Total Discharge (cfs) 1/	Capacity @ Constructed Slope (cfs)	Pipe Size (inches)	Length (feet)	Constructed Slope (ft/ft)	Pipe Roughness (Mannings n)	Invert Elevation		Ground/Rim Elevation		HGL Elevation		**Freeboard (feet)**	Upstream Cover (feet)	Velocity (ft/s) 1/
									Upstream	Downstream	Upstream	Downstream	Upstream	Downstream			
Highway 101																	
P-EL-01-05	I-EL-01-05	I-EL-01-04	3.5	4.3	18 inch	152	0.002	0.013	- 2.25	- 2.50	8.50	9.00	**5.15**	4.98	**3.4**	9.3	2.0
P-EL-01-04	I-EL-01-04	I-EL-01-03	3.3	3.0	18 inch	305	0.001	0.013	- 2.50	- 2.75	9.00	10.20	**4.97**	4.66	**4.0**	10.0	1.9
P-EL-01-03	I-EL-01-03	I-EL-01-02	3.0	4.3	18 inch	153	0.002	0.013	- 2.75	- 3.00	10.20	9.00	**4.65**	4.53	**5.6**	11.5	1.7
P-EL-01-02	I-EL-01-02	I-EL-01-01	2.8	3.4	18 inch	242	0.001	0.013	- 3.00	- 3.25	9.00	9.10	**4.52**	4.34	**4.5**	10.5	1.6
P-EL-01-01	I-EL-01-01	I-EL-01	2.6	3.2	18 inch	270	0.001	0.013	- 3.25	- 3.50	9.10	10.00	**4.33**	4.16	**4.8**	10.9	1.5
P-EL-02	I-EL-02	I-EL-01	55.0	62.8	4 x 3 ft	97	0.003	0.013	- 3.25	- 3.50	8.50	10.00	**4.37**	4.18	**4.1**	8.8	4.6
P-EL-01	I-EL-01	O-EL	57.4	74.2	48 inch	110	0.002	0.012	- 3.50	- 3.75	10.00	7.00	**4.15**	4.00	**5.9**	9.5	4.6

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STORM DRAIN MASTER PLAN

Table D-OUTFALL
Summary of Drainage Characteristics to Each Outfall

Node #	Belmont Creek Subarea	Ground Elevation (ft)	Sump Elevation (ft)	Hydraulic Grade Line Out (ft)	Cumulative Area (acres)	Cumulative C*A (acres)	System Tc (minutes)	Intensity (in/hr)	**10-Year Discharge (cfs)**
O-BA	6	33.00	27.00	31.10	22.2	12.8	15	1.75	22.6
O-BB	7	33.00	29.00	31.10	76.6	43.2	15	1.73	75.1
O-BC	6	40.00	28.00	38.97	6.9	4.7	13	1.89	8.9
O-BD	6	40.00	28.00	38.97	4.9	2.4	12	1.90	4.7
O-BE	7	40.00	30.00	39.00	3.6	1.8	11	2.05	3.7
O-BF	6	50.00	40.00	48.80	28.9	18.3	12	1.91	35.3
O-BG	5	82.00	78.00	80.00	7.8	3.6	18	1.63	6.0
O-BH	4	106.50	100.00	101.80	268.4	137.2	14	1.84	255.1
O-BI	7	86.30	80.00	74.00	39.4	19.7	11	2.12	42.1
O-BJ	7	89.00	84.00	83.49	6.3	3.2	10	2.18	7.0
O-BK	4	105.00	101.00	102.00	3.4	1.7	11	2.13	3.6
O-BL	4	118.00	111.00	112.00	4.0	2.0	10	2.18	4.3
O-BM	4	125.00	115.00	125.69	16.8	8.4	14	1.84	15.5
O-BN	3	133.80	129.80	124.10	13.6	6.8	11	2.10	14.4
O-BO	3	133.80	129.80	124.10	51.3	25.6	13	1.97	51.0
O-BP	3	146.00	142.00	143.80	21.3	10.7	11	2.11	22.6
O-BQ	3	153.00	149.00	149.20	6.7	3.4	12	2.06	7.0
O-BR	3	162.00	151.80	155.20	140.5	74.2	12	2.00	269.2
O-BS	3	173.00	168.40	165.50	34.0	13.1	11	2.11	27.8
O-BT	2	212.00	200.50	207.10	198.7	99.4	12	2.06	206.0
O-BU	3	260.00	205.00	244.60	1.9	1.0	10	2.17	2.1
O-BV	1	356.00	352.00	352.00	63.3	31.6	24	1.48	47.2
O-BW	3	140.00	135.00	142.00	319.4	159.5	14	1.94	312.7
O-BX	5	69.30	64.30	65.00	343.8	171.9	10	2.27	393.2
O-BY	1	580.00	575.00	575.00	25.9	13.0	12	2.07	27.1
O-BZ	1	540.00	532.00	532.00	85.2	42.6	13	2.05	88.1
O-BAA	1	665.00	660.00	660.00	8.6	4.3	11	2.22	9.7
O-BAB	1	645.00	640.00	640.00	9.2	2.9	11	2.22	6.5
O-BAC	1	585.00	580.00	580.00	6.5	5.2	12	2.10	10.9
O-BAD	7	31.00	27.00	30.46	5.3	2.7	10	2.28	6.1
O-BAE	1	469.50	465.50	465.50	10.3	5.1	12	2.14	11.1
O-BAF	1	490.00	485.00	485.00	15.6	8.4	11	2.17	18.3
O-BAG	1	464.00	460.00	460.00	2.8	1.4	10	2.26	3.2
O-BAH	1	536.00	530.00	530.00	3.4	1.7	10	2.27	3.9
O-BAI	3	405.00	400.00	400.00	14.4	8.4	11	2.19	18.5
O-EG	9	555.00	551.00	552.00	15.6	8.4	11	2.18	18.4
Total					**1886.5**	**960.1**			**2058.7**

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-Belmont Creek-1 (page 1 of 4)
Analysis of Existing Creek, 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lateral														
Street Route	19067	155	204	211.1	212.6	0.0521	9.7	16	0	0.6	214	2.7		
Street Route	19000	Culvert		211.1	212.6		12.3				214	2.7	67	48
Street Route	18684	155	192	199.3	200.8	0.0521	9.7	16	0	0.6	203	3.4	316	
Street Route	18680	155	192	199.1	200.6	0.0521	9.7	16	0	0.6	203	3.6	4	
Street Route	18500	Culvert		199.1	200.6		12.3				203	3.6	180	48
Street Route	18346	155	182	188.1	189.6	0.0521	9.7	16	0	0.7	192	4.0	154	
Street Route	18342	155	182	187.9	189.4	0.0521	9.7	16	0	0.7	192	4.3	4	
Street Route	18300	Culvert		187.9	189.4		12.3				192	4.3	42	48
Street Route	17848	155	171	178.2	179.7	0.0521	9.7	16	0	0.6	181	2.3	452	
Street Route	17844	155	171	178.0	179.5	0.0521	9.7	16	0	0.6	181	2.5	4	
Street Route	17800	Culvert		178.0	179.5		12.3				181	2.5	44	48
Street Route	17552	155	159	166.4	167.8	0.0521	9.7	16	0	0.6	184	17.2	248	
Street Route	17548	155	159	166.2	167.6	0.0521	9.7	16	0	0.6	184	17.4	4	
Street Route	17540	Culvert		166.2	167.6		12.3				184	17.4	8	48
Street Route	17516	155	151	158.8	160.2	0.0521	9.7	16	0	0.6	162	3.3	24	
Lateral														
Carlmont Trib	17242	410	148	158.5	158.6	0.0003	2.3	179	27	0.2	160	1.5		
Carlmont Trib	17214	410	148	158.5	158.6	0.0003	2.1	197	26	0.1	156	-2.5	28	
Carlmont Trib	17178	410	148	158.5	158.6	0.0002	2.0	227	58	0.1	155	-3.5	36	
Carlmont Trib	17158	410	147	157.7	158.5	0.0088	7.0	64	36	0.4	156	-1.7	20	
Carlmont Trib	17000	Culvert		157.7	158.5		16.4				158	-0.2	158	60
Carlmont Trib	16887	410	139	142.8	143.6	0.0106	7.2	57	25	0.9	148	5.2	113	
Carlmont Trib	16581	410	135	138.7	139.8	0.0149	8.6	48	21	1.0	140	1.3	306	
Carlmont Trib	16419	410	131	134.3	135.4	0.0150	8.4	49	22	1.0	138	3.7	162	
Carlmont Trib	16261	410	127	131.3	131.9	0.0054	6.0	69	24	0.6	136	4.7	158	
Carlmont Trib	16187	410	122	131.6	131.7	0.0002	1.7	243	43	0.1	131	-0.6	74	
Carlmont Trib	16001	410	118	131.6	131.6	0.0012	1.9	242	195	0.1	132	0.4	186	
Lateral														
Notre Dame	14041	370	99	103.3	104.0	0.0067	6.7	55	17	0.7	109	5.4		
Notre Dame	13737	370	95	100.7	101.6	0.0090	7.9	49	15	0.7	102	1.2	304	
Notre Dame	13255	370	90	94.5	95.9	0.0165	9.3	40	15	1.0	96	1.9	482	
Notre Dame	12806	370	82	87.1	88.0	0.0095	8.1	53	35	0.8	92	4.8	449	
Notre Dame	12478	370	74	87.2	87.2	0.0000	0.9	634	157	0.1	88	0.8	328	
Notre Dame	12474	370	75	85.7	86.9	0.0361	14.6	28	0	0.8	86	0.6	4	
Notre Dame	12400	Culvert		85.7	86.9		2.3				86	-0.1	74	5'x3'
Notre Dame	12395	370	70	86.7	86.8	0.0058	3.7	153	200	0.1	86	-0.4	5	
Notre Dame	12390	370	70	86.5	86.8	0.0153	5.3	111	192	0.1	86	-0.2	5	
Notre Dame	12300	Culvert		86.5	86.5		24.0				86	-0.8	90	42
Notre Dame	12117	370	58	67.3	72.1	0.1435	17.5	21	0	1.0	86	18.7	183	
Trunk														
Upper Belmont	21059	330	296	299.7	300.5	0.0167	6.9	48	32	1.0	320	20.3		
Upper Belmont	20839	330	274	276.5	277.6	0.0164	8.3	40	19	1.0	310	33.5	220	
Upper Belmont	20491	330	258	262.8	263.5	0.0193	6.6	50	38	1.0	290	27.2	348	
Upper Belmont	19924	330	239	243.1	244.6	0.0199	10.0	33	11	1.0	270	26.9	567	
Upper Belmont	19780	330	229	233.2	233.8	0.0090	6.3	52	25	0.8	270	36.8	144	
Upper Belmont	19364	330	226	228.2	229.0	0.0156	7.0	48	34	1.0	229	0.8	416	
Upper Belmont	19354	330	222	224.7	225.6	0.0146	7.4	46	29	1.0	225	0.3	10	
Upper Belmont	19344	330	214	219.0	220.1	0.0163	8.6	38	17	1.0	225	5.5	10	
Upper Belmont	19314	330	209	216.4	216.5	0.0010	3.2	104	23	0.3	222	5.6	30	
Upper Belmont	19295	330	208	215.0	216.4	0.0119	9.4	35	0	0.6	222	7.0	19	
Upper Belmont	19294	Culvert		215.0	216.4		11.7				218	3.0	1	72
Upper Belmont	19072	330	204	212.9	214.2	0.0263	9.1	36	0	0.5	214	0.9	222	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

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STORM DRAIN MASTER PLAN

Table D-Belmont Creek-1 (page 2 of 4)
Analysis of Existing Creek, 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Apt Route	19067	175	204	213.1	214.0	0.0231	7.3	24	0	0.4	214	0.7		
Apt Route	19020	Culvert		213.1	214.0		11.0				214	0.7	47	54
Apt Route	19012	175	203	212.6	213.1	0.0125	5.8	30	0	0.3	213	0.5	8	
Apt Route	19007	175	203	212.2	213.0	0.0202	7.0	25	0	0.4	213	0.9	5	
Apt Route	19000	Culvert		212.2	213.0		13.9				213	0.9	7	48
Apt Route	18139	175	172	177.9	178.7	0.0202	7.0	25	0	0.5	180	2.1	861	
Apt Route	18135	175	172	176.6	178.4	0.0664	10.9	16	0	0.9	180	3.4	4	
Apt Route	18130	Culvert		176.6	178.4		13.9				180	3.4	5	48
Apt Route	17862	175	162	171.5	173.3	0.0664	10.9	16	0	0.6	172	0.1	268	
Apt Route	17857	175	162	171.1	173.0	0.0664	10.9	16	0	0.6	172	0.4	5	
Apt Route	17850	Culvert		171.1	173.0		12.5				172	0.4	7	48
Apt Route	17843	175	162	170.2	172.1	0.0664	10.9	16	0	0.7	172	1.3	7	
Apt Route	17838	175	162	169.9	171.8	0.0664	10.9	16	0	0.7	172	1.7	5	
Apt Route	17800	Culvert		169.9	171.8		13.9				172	1.7	38	48
Apt Route	17516	175	151	158.5	160.3	0.0664	10.9	16	0	0.7	162	3.2	284	
Trunk														
Up-Mid Belmont	17510	470	151	158.6	160.1	0.0242	9.6	49	0	0.6	162	3.4		
Up-Mid Belmont	17500	Culvert		158.6	160.1		12.2				162	3.4	10	84
Up-Mid Belmont	17317	470	148	156.9	158.3	0.0242	9.6	49	0	0.6	158	1.2	183	
Up-Mid Belmont	17312	470	148	156.8	158.2	0.0242	9.6	49	0	0.6	158	1.3	5	
Up-Mid Belmont	17300	Culvert		156.8	158.2		12.2				158	1.3	12	84
Up-Mid Belmont	17139	470	145	153.9	155.3	0.0242	9.6	49	0	0.6	155	1.2	161	
Up-Mid Belmont	17135	470	145	153.8	155.2	0.0242	9.6	49	0	0.6	155	1.3	4	
Up-Mid Belmont	17000	Culvert		153.8	155.2		12.2				155	1.3	135	84
Up-Mid Belmont	16983	470	141	148.9	149.1	0.0011	3.6	130	23	0.3	149	0.0	17	
Up-Mid Belmont	16701	860	137	148.8	148.9	0.0005	3.1	374	127	0.2	148	-1.3	282	
Up-Mid Belmont	16678	860	138	148.3	148.8	0.0182	7.1	158	127	0.3	148	-0.8	23	
Up-Mid Belmont	16600	Culvert		148.3	148.4		14.5				147	-1.0	78	84
Up-Mid Belmont	16152	860	120	137.2	137.8	0.0155	7.7	149	93	0.2	137	-0.4	448	
Up-Mid Belmont	16136	860	119	131.5	131.7	0.0010	3.9	219	36	0.3	136	4.5	16	
Up-Mid Belmont	16096	860	119	131.6	131.7	0.0002	1.9	448	56	0.1	130	-1.6	40	
Trunk														
Mid Belmont	16001	860	118	131.2	131.6	0.0077	4.7	190	127	0.2	132	0.8		
Mid Belmont	15997	860	118	131.4	131.5	0.0002	2.0	532	217	0.1	132	0.6	4	
Mid Belmont	15975	Culvert		131.4	131.5		15.6				130	-1.2	22	72
Mid Belmont	15946	860	114	120.8	122.8	0.0157	11.4	75	19	1.0	132	11.2	29	
Mid Belmont	15940	860	113	120.1	122.2	0.0176	11.8	73	17	1.0	132	11.9	6	
Mid Belmont	15630	860	110	114.4	116.1	0.0139	10.4	83	25	1.0	127	12.1	310	
Mid Belmont	15266	860	97	106.0	107.4	0.0099	9.5	91	18	0.7	122	16.0	364	
Mid Belmont	14669	860	90	97.6	99.7	0.0170	11.7	73	17	1.0	114	16.4	597	
Mid Belmont	14576	860	88	94.2	96.6	0.0198	12.4	69	15	1.0	110	15.8	93	
Mid Belmont	14260	860	85	92.6	93.1	0.0030	5.9	146	31	0.5	108	15.4	316	
Mid Belmont	14182	860	85	90.8	92.6	0.0162	10.6	81	23	1.0	104	13.2	78	
Mid Belmont	13718	860	80	87.9	88.4	0.0027	5.7	150	31	0.5	97	9.1	464	
Mid Belmont	13679	860	80	85.9	88.0	0.0176	11.7	73	17	1.0	100	14.1	39	
Mid Belmont	13296	860	75	84.2	84.7	0.0025	5.6	155	28	0.4	92	7.8	383	
Mid Belmont	13210	860	76	83.4	84.3	0.0061	7.5	115	30	0.7	92	8.6	86	
Mid Belmont	12899	860	72	81.4	82.3	0.0068	7.5	115	25	0.6	88	6.6	311	
Mid Belmont	12894	860	71	80.7	82.2	0.0101	9.9	87	0	0.6	88	7.3	5	
Mid Belmont	12850	Culvert		80.7	82.2		9.6				87	5.8	44	90
Mid Belmont	12846	860	71	79.7	81.7	0.0121	11.3	76	0	0.7	85	5.3	4	
Mid Belmont	12842	860	71	81.0	81.2	0.0007	3.1	278	53	0.2	85	4.0	4	
Mid Belmont	12690	860	69	80.8	81.0	0.0008	3.8	227	24	0.2	70	-10.8	152	
Mid Belmont	12680	860	69	79.8	80.9	0.0122	8.6	100	0	0.5	70	-9.8	10	
Mid Belmont	12675	860	68	77.9	80.7	0.0271	13.4	64	0	0.8	82	4.2	5	
Mid Belmont	12644	Culvert		77.9	80.7		18.0				79	1.0	31	96
Mid Belmont	12611	860	68	77.3	80.1	0.0398	13.4	64	0	0.8	79	1.6	33	
Mid Belmont	12554	Culvert		77.3	80.1		18.0				79	1.6	57	96
Mid Belmont	12497	860	65	74.5	77.3	0.0398	13.4	64	0	0.8	81	6.6	57	
Mid Belmont	12429	Culvert		74.5	77.3		18.0				81	6.6	68	96
Mid Belmont	12360	860	64	73.0	75.8	0.0398	13.4	64	0	0.8	81	8.1	69	
Mid Belmont	12331	Culvert		73.0	75.8		18.0				81	8.1	29	96
Mid Belmont	12303	860	62	72.5	74.7	0.0291	11.9	72	0	0.7	76	3.3	28	
Mid Belmont	12209	Culvert		72.5	74.7		18.0				76	3.3	94	96
Mid Belmont	12115	860	58	69.8	71.6	0.0212	10.6	81	0	0.6	73	2.8	94	

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Table D-Belmont Creek-1 (page 3 of 4)
Analysis of Existing Creek, 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Lower Belmont	12115	1100	58	67.8	71.4	0.0476	15.3	72	0	0.9	73	4.8		
Lower Belmont	12050	Culvert		67.8	71.4		18.4				73	4.8	65	108
Lower Belmont	11985	1100	56	63.7	67.5	0.0343	15.8	70	9	1.0	76	12.1	65	
Lower Belmont	11980	1100	56	63.9	65.5	0.0104	10.3	107	14	0.6	76	11.9	5	
Lower Belmont	11890	Culvert		63.9	65.5		14.4				76	11.9	90	7'x7',5'x7'
Lower Belmont	11815	1100	53	58.9	61.9	0.0229	13.8	80	14	1.0	71	12.1	75	
Lower Belmont	11649	1100	47	56.3	56.6	0.0009	3.9	279	44	0.3	80	24.0	166	
Lower Belmont	11565	1100	46	54.2	56.2	0.0152	11.4	96	24	1.0	60	5.8	84	
Lower Belmont	11209	1100	44	53.2	53.2	0.0002	2.0	545	86	0.1	72	18.7	356	
Lower Belmont	11055	1100	43	51.9	53.0	0.0076	8.4	132	33	0.7	60	8.1	154	
Lower Belmont	10811	1100	42	52.1	52.4	0.0007	3.7	297	45	0.3	66	13.9	244	
Lower Belmont	10696	1100	41	49.7	51.9	0.0157	12.1	91	20	1.0	58	8.3	115	
Lower Belmont	10456	1100	38	46.0	46.4	0.0021	5.5	201	38	0.4	49	2.7	240	
Lower Belmont	10356	1100	37	45.9	46.2	0.0016	4.9	223	40	0.4	48	2.1	100	
Lower Belmont	10256	1100	37	45.8	46.1	0.0012	4.5	246	42	0.3	47	1.6	100	
Lower Belmont	10198	1100	36	45.7	46.0	0.0011	4.3	254	42	0.3	50	4.3	58	
Lower Belmont	10156	1100	34	45.7	45.8	0.0004	2.8	491	409	0.2	45	-1.1	42	
Lower Belmont	9821	1100	31	45.7	45.8	0.0002	2.4	459	75	0.1	46	0.3	335	
Lower Belmont	9799	1200	31	45.2	45.7	0.0033	5.8	212	96	0.5	45	-0.1	22	
Lower Belmont	9798	Culvert		45.2	45.7		8.5				42	-3.2	1	10'x7'
Lower Belmont	9775	1200	31	42.0	45.5	0.0430	15.0	80	0	0.8	45	2.8	23	
Lower Belmont	9600	Culvert		45.2	45.7		8.5				45	-0.3	175	10'x7'
Lower Belmont	9554	1200	27	43.2	43.7	0.0100	6.9	215	95	0.2	42	-1.7	46	
Lower Belmont	9550	1200	27	42.9	43.7	0.0164	8.1	185	98	0.3	42	-1.4	4	
Lower Belmont	9400	Culvert		42.9	42.9		15.5				42	-1.2	150	72",72"
Lower Belmont	9231	1200	26	38.2	38.9	0.0275	7.7	174	100	0.4	37	-1.2	169	
Lower Belmont	9224	1200	26	34.4	36.8	0.0270	12.5	96	0	0.8	38	3.1	7	
Lower Belmont	9000	Culvert		34.4	36.8		12.5				38	3.1	224	12'x8'
Lower Belmont	8988	1200	25	33.1	35.5	0.0270	12.5	96	0	0.8	34	1.3	12	
Lower Belmont	8982	1200	25	32.9	35.4	0.0306	12.5	96	0	0.8	34	1.5	6	
Lower Belmont	8800	Culvert		32.9	35.4		12.4				34	1.5	182	6'x6',9'x6'
Lower Belmont	8715	1200	24	32.1	33.0	0.0078	7.9	180	73	0.6	32	-0.6	85	
Lower Belmont	8711	1200	24	32.4	32.9	0.0019	5.6	275	95	0.4	31	-1.4	4	
Lower Belmont	8636	1200	23	32.1	32.7	0.0030	6.5	232	107	0.4	31	-0.9	75	
Lower Belmont	8632	1200	23	30.9	32.5	0.0218	10.1	119	0	1.4	32	0.6	4	
Lower Belmont	8600	Culvert		30.9	32.5		11.7				31	0.1	32	9'x6'
Lower Belmont	8550	1200	23	31.3	31.4	0.0021	3.5	374	156	0.4	31	-0.3	50	
Lower Belmont	8545	1200	23	31.3	31.4	0.0012	2.6	459	170	0.3	25	-6.3	5	
Lower Belmont	8482	1200	22	31.0	31.3	0.0013	4.9	323	85	0.3	28	-3.0	63	
Lower Belmont	8480	1200	22	30.8	31.3	0.0034	6.2	231	66	0.5	28	-2.8	2	
Lower Belmont	8478	Culvert		30.8	31.3		8.6				29	-2.0	2	13'x5.8'
Lower Belmont	8405	1200	22	30.0	30.9	0.0076	8.0	179	62	0.6	28	-1.8	73	
Lower Belmont	8403	1200	22	30.2	30.8	0.0030	6.4	230	64	0.4	28	-1.8	2	
Lower Belmont	7955	1200	21	27.7	28.6	0.0084	8.6	172	62	0.8	25	-2.3	448	
Lower Belmont	7875	1200	20	26.9	28.0	0.0062	9.5	171	73	0.7	25	-1.5	80	
Lower Belmont	7785	1200	18	26.1	26.5	0.0015	4.6	284	71	0.4	22	-4.2	90	
Lower Belmont	7705	1200	17	25.2	26.2	0.0042	8.3	157	34	0.6	27	1.7	80	
Lower Belmont	7595	1200	17	23.3	25.4	0.0104	12.2	110	27	0.9	26	2.4	110	
Lower Belmont	7505	1200	13	21.0	23.3	0.0126	12.3	104	25	0.9	22	0.7	90	
Lower Belmont	7435	1200	13	21.0	22.4	0.0073	9.2	131	29	0.7	21	0.2	70	
Lower Belmont	7315	1200	11	18.8	21.1	0.0146	12.0	100	23	1.0	21	2.3	120	
Lower Belmont	7165	1200	9	16.6	18.0	0.0070	9.5	127	24	0.7	16	-0.5	150	
Lower Belmont	7045	1200	7	14.3	16.7	0.0150	12.4	98	22	1.0	14	-0.7	120	
Lower Belmont	6945	1200	5	14.5	15.2	0.0030	6.8	177	28	0.5	13	-1.2	100	

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Table D-Belmont Creek-1 (page 4 of 4)
Analysis of Existing Creek, 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lower Belmont	6845	1200	5	13.1	14.6	0.0099	10.0	121	28	0.8	14	0.4	100	
Lower Belmont	6735	1200	5	13.0	13.8	0.0035	6.8	180	43	0.5	12	-1.0	110	
Lower Belmont	6635	1200	5	12.8	13.4	0.0026	6.2	193	32	0.4	11	-2.1	100	
Lower Belmont	6615	1200	5	12.8	13.4	0.0025	5.8	209	39	0.4	11	-1.7	20	
Lower Belmont	6545	1200	4	13.0	13.2	0.0005	3.4	383	105	0.2	10	-2.8	70	
Lower Belmont	6503	Culvert		13.0	13.2		9.1				13	-0.1	43	2@10'x4',10'x5'
Lower Belmont	6460	1200	4	12.1	12.2	0.0005	3.4	370	57	0.2	9	-2.8	43	
Lower Belmont	6450	1200	4	12.0	12.2	0.0008	3.9	308	45	0.3	9	-2.7	10	
Lower Belmont	6360	1200	4	11.6	12.1	0.0023	5.5	219	37	0.4	9	-2.2	90	
Lower Belmont	6260	1200	3	11.4	11.9	0.0022	5.6	216	37	0.4	9	-2.4	100	
Lower Belmont	6060	1400	3	10.8	11.4	0.0027	6.1	230	44	0.5	9	-2.0	200	
Lower Belmont	5995	1400	2	10.6	11.2	0.0026	5.9	239	48	0.5	8	-2.2	65	
Lower Belmont	5965	1400	1	11.0	11.0	0.0002	2.1	739	105	0.1	7	-3.8	30	
Lower Belmont	5860	Culvert		11.0	11.0		8.0				13	2.1	105	3@10'x6'
Lower Belmont	5750	1400	1	10.0	10.1	0.0005	3.2	500	106	0.2	8	-1.8	110	
Lower Belmont	5745	1400	1	10.0	10.1	0.0005	3.2	500	106	0.2	8	-1.8	5	
Lower Belmont	5659	1400	1	10.0	10.1	0.0005	2.5	903	429	0.2	8	-1.9	86	
Lower Belmont	5612	1400	1	9.8	10.0	0.0015	3.7	519	338	0.3	10	0.2	47	
Lower Belmont	5559	1400	1	9.8	9.9	0.0010	3.0	642	348	0.3	8	-1.4	53	
Lower Belmont	5525	1400	1	9.8	9.9	0.0004	2.0	919	361	0.2	9	-1.1	34	
Lower Belmont	5495	1400	1	9.8	9.9	0.0006	2.5	769	356	0.2	9	-0.9	30	
Lower Belmont	5469	1400	1	9.8	9.9	0.0006	2.4	829	383	0.2	9	-1.0	26	
Lower Belmont	5420	1400	2	9.8	9.8	0.0003	1.8	1130	551	0.2	9	-1.2	49	
Lower Belmont	5373	1400	2	9.8	9.8	0.0005	1.9	968	490	0.2	8	-2.0	47	
Lower Belmont	5325	1400	1	9.6	9.8	0.0010	3.4	457	154	0.3	6	-3.5	48	
Lower Belmont	5245	1400	2	9.5	9.7	0.0008	3.3	448	119	0.3	9	-1.0	80	
Lower Belmont	4415	1400	-1	9.1	9.2	0.0004	3.0	587	154	0.2	8	-1.1	830	
Lower Belmont	3710	1400	1	8.0	8.6	0.0032	5.9	239	64	0.5	8	0.2	705	
Lower Belmont	3075	1400	-1	7.4	7.6	0.0007	3.3	441	128	0.3	6	-1.0	635	
Lower Belmont	3035	1400	-3	7.4	7.6	0.0006	3.8	383	76	0.2	7	-0.9	40	
Lower Belmont	2920	Culvert		7.4	7.6		5.1				8	0.3	115	3@10'x9'
Lower Belmont	2805	1400	-4	7.1	7.2	0.0002	2.3	621	81	0.1	7	0.2	115	
Lower Belmont	2795	1400	-4	7.0	7.2	0.0008	3.4	409	77	0.3	7	0.3	10	

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Table D-Belmont Creek-2 (page 1 of 4)
Analysis of Existing Creek, 25-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lateral														
Street Route	19067	110	204	208.9	209.6	0.0262	6.9	16	0	0.6	214	5.0		
Street Route	19000	Culvert		208.9	209.6		10.3				214	5.0	67	48
Street Route	18684	110	192	196.9	197.7	0.0262	6.9	16	0	0.5	203	5.8	316	
Street Route	18680	110	192	196.8	197.6	0.0262	6.9	16	0	0.6	203	5.9	4	
Street Route	18500	Culvert		196.8	197.6		10.3				203	5.9	180	48
Street Route	18346	110	182	187.4	188.2	0.0262	6.9	16	0	0.5	192	4.8	154	
Street Route	18342	110	182	187.3	188.0	0.0262	6.9	16	0	0.5	192	4.8	4	
Street Route	18300	Culvert		187.3	188.0		10.3				192	4.8	42	48
Street Route	17848	110	171	175.8	176.6	0.0262	6.9	16	0	0.5	181	4.7	452	
Street Route	17844	110	171	175.7	176.5	0.0262	6.9	16	0	0.6	181	4.8	4	
Street Route	17800	Culvert		175.7	176.5		10.3				181	4.8	44	48
Street Route	17552	110	159	164.0	164.7	0.0262	6.9	16	0	0.5	184	19.6	248	
Street Route	17548	110	159	163.9	164.6	0.0262	6.9	16	0	0.6	184	19.7	4	
Street Route	17540	Culvert		163.9	164.6		10.3				184	19.7	8	48
Street Route	17516	110	151	157.8	158.6	0.0262	6.9	16	0	0.5	162	4.2	24	
Lateral														
Carlmont Trib	17242	330	148	157.9	158.0	0.0003	2.0	163	26	0.1	160	2.1		
Carlmont Trib	17214	330	148	157.9	157.9	0.0002	1.8	181	26	0.1	156	-1.9	28	
Carlmont Trib	17178	330	148	157.9	157.9	0.0002	1.8	193	54	0.1	158	-0.4	36	
Carlmont Trib	17158	330	147	157.1	157.9	0.0019	6.8	48	6	0.4	158	0.4	20	
Carlmont Trib	17000	Culvert		157.1	157.9		15.8				158	0.4	158	60
Carlmont Trib	16887	330	139	142.5	143.2	0.0106	6.7	49	24	0.8	148	5.5	113	
Carlmont Trib	16581	330	135	138.3	139.3	0.0153	8.2	40	20	1.0	140	1.7	306	
Carlmont Trib	16419	330	131	133.9	134.9	0.0156	8.0	41	21	1.0	138	4.1	162	
Carlmont Trib	16261	330	127	130.9	131.4	0.0054	5.6	59	23	0.6	136	5.1	158	
Carlmont Trib	16187	330	122	131.2	131.2	0.0001	1.5	223	42	0.1	131	-0.2	74	
Carlmont Trib	16001	330	118	131.1	131.1	0.0014	1.9	174	81	0.1	132	0.9	186	
Lateral														
Notre Dame	14041	276	99	102.6	103.2	0.0073	6.4	43	16	0.7	108	5.6		
Notre Dame	13737	276	95	100.0	100.8	0.0085	7.1	40	13	0.7	101	0.6	304	
Notre Dame	13255	276	90	94.0	95.1	0.0169	8.7	32	14	1.0	96	1.9	482	
Notre Dame	12806	276	82	86.1	87.4	0.0170	8.9	31	14	1.0	86	0.3	449	
Notre Dame	12478	276	74	86.9	86.9	0.0000	0.7	590	151	0.0	82	-5.3	328	
Notre Dame	12474	276	75	84.9	86.7	0.0201	10.9	28	0	0.6	83	-1.9	4	
Notre Dame	12400	Culvert		84.9	86.7		1.8				86	0.7	74	5'x3'
Notre Dame	12395	276	70	86.6	86.7	0.0051	3.4	130	198	0.1	86	-0.9	5	
Notre Dame	12390	276	70	86.4	86.6	0.0131	4.8	94	182	0.1	86	-0.7	5	
Notre Dame	12300	Culvert		86.4	86.2		24.8				86	-0.7	90	42
Notre Dame	12117	276	58	66.3	69.0	0.0799	13.0	21	0	0.8	69	2.9	183	
Trunk														
Upper Belmont	21059	240	296	299.4	300.0	0.0175	6.5	37	28	1.0	320	20.6		
Upper Belmont	20839	240	274	276.1	277.0	0.0171	7.6	32	18	1.0	287	10.9	220	
Upper Belmont	20491	240	258	261.8	263.0	0.0190	9.0	27	11	1.0	262	0.2	348	
Upper Belmont	19924	240	239	242.4	243.7	0.0201	9.2	26	10	1.0	250	7.6	567	
Upper Belmont	19780	240	229	232.8	233.3	0.0082	5.6	43	23	0.7	240	7.2	144	
Upper Belmont	19364	240	226	227.9	228.5	0.0168	6.3	38	32	1.0	227	-0.9	416	
Upper Belmont	19354	240	222	224.4	225.1	0.0163	6.8	35	26	1.0	224	-0.3	10	
Upper Belmont	19344	240	214	218.4	219.5	0.0174	8.1	30	15	1.0	222	3.6	10	
Upper Belmont	19314	240	209	214.6	214.8	0.0016	3.5	68	19	0.3	220	5.4	30	
Upper Belmont	19295	240	208	214.0	214.7	0.0025	6.8	35	18	0.5	220	6.0	19	
Upper Belmont	19294	Culvert		214.0	214.7		11.2				218	4.0	1	72
Upper Belmont	19072	240	204	208.7	209.8	0.0171	8.3	29	6	0.7	213	4.3	222	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for B-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

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Table D-Belmont Creek-2 (page 2 of 4)
Analysis of Existing Creek, 25-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Apt Route	19067	130	204	209.1	209.5	0.0128	5.4	24	0	0.4	213	3.9		
Apt Route	19020	Culvert		209.1	209.5		10.2				214	4.8	47	54
Apt Route	19012	130	203	208.2	208.5	0.0069	4.3	30	0	0.3	213	4.8	8	
Apt Route	19007	130	203	208.1	208.5	0.0111	5.2	25	0	0.4	213	4.9	5	
Apt Route	19000	Culvert		208.1	208.5		10.4				213	5.0	7	48
Apt Route	18139	130	172	178.7	179.1	0.0111	5.2	25	0	0.4	180	1.3	861	
Apt Route	18135	130	172	177.9	179.0	0.0366	8.1	16	0	0.6	180	2.1	4	
Apt Route	18130	Culvert		177.9	179.0		10.4				180	2.1	5	48
Apt Route	17862	130	162	168.4	169.4	0.0366	8.1	16	0	0.6	171	2.6	268	
Apt Route	17857	130	162	168.2	169.2	0.0366	8.1	16	0	0.6	171	2.8	5	
Apt Route	17850	Culvert		168.2	169.2		10.4				172	3.3	7	48
Apt Route	17843	130	162	167.5	168.6	0.0366	8.1	16	0	0.6	171	3.5	7	
Apt Route	17838	130	162	167.4	168.4	0.0366	8.1	16	0	0.6	171	3.7	5	
Apt Route	17800	Culvert		167.4	168.4		10.4				172	4.2	38	48
Apt Route	17516	130	151	157.6	158.6	0.0366	8.1	16	0	0.6	162	4.0	284	
Trunk														
Up-Mid Belmont	17510	340	151	157.7	158.5	0.0127	6.9	49	0	0.5	162	4.3		
Up-Mid Belmont	17500	Culvert		157.7	158.5		11.9				162	4.3	10	84
Up-Mid Belmont	17317	340	148	154.7	155.5	0.0127	6.9	49	0	0.5	158	3.4	183	
Up-Mid Belmont	17312	340	148	154.7	155.4	0.0127	6.9	49	0	0.5	158	3.4	5	
Up-Mid Belmont	17300	Culvert		154.7	155.4		11.9				158	3.4	12	84
Up-Mid Belmont	17139	340	145	151.7	152.5	0.0127	6.9	49	0	0.5	155	3.4	161	
Up-Mid Belmont	17135	340	145	151.7	152.4	0.0086	6.9	49	7	0.5	155	3.4	4	
Up-Mid Belmont	17000	Culvert		151.7	152.4		11.9				155	3.4	135	84
Up-Mid Belmont	16983	340	141	148.6	148.7	0.0007	2.8	123	23	0.2	149	0.3	17	
Up-Mid Belmont	16701	630	137	148.5	148.6	0.0003	2.4	342	127	0.2	147	-1.3	282	
Up-Mid Belmont	16678	630	138	148.1	148.5	0.0154	6.4	135	127	0.3	147	-0.9	23	
Up-Mid Belmont	16600	Culvert		148.1	147.9		14.8				147	-0.9	78	84
Up-Mid Belmont	16152	630	120	129.4	132.0	0.0435	12.9	49	0	0.7	137	7.4	448	
Up-Mid Belmont	16136	630	119	131.1	131.2	0.0007	3.1	204	34	0.2	136	4.6	16	
Up-Mid Belmont	16096	630	119	131.1	131.2	0.0001	1.5	422	56	0.1	130	-1.1	40	
Trunk														
Mid Belmont	16001	630	118	130.9	131.1	0.0042	3.9	164	26	0.2	130	-1.0		
Mid Belmont	15997	630	118	131.0	131.1	0.0001	1.6	452	172	0.1	130	-1.2	4	
Mid Belmont	15975	Culvert		131.0	131.1		15.3				130	-0.8	22	72
Mid Belmont	15946	630	114	119.8	121.6	0.0165	10.8	58	16	1.0	130	10.2	29	
Mid Belmont	15940	630	113	119.0	121.0	0.0185	11.2	56	15	1.0	130	11.0	6	
Mid Belmont	15630	630	110	113.7	115.2	0.0144	9.7	65	22	1.0	126	12.3	310	
Mid Belmont	15266	630	97	104.8	106.0	0.0093	8.8	71	14	0.7	121	16.3	364	
Mid Belmont	14669	630	90	96.6	98.5	0.0177	11.0	57	15	1.0	112	15.4	597	
Mid Belmont	14576	630	88	93.2	95.2	0.0197	11.4	55	14	1.0	101	8.1	93	
Mid Belmont	14260	630	85	91.7	92.1	0.0028	5.3	118	29	0.5	101	8.9	316	
Mid Belmont	14182	630	85	90.1	91.6	0.0167	9.8	65	22	1.0	97	6.9	78	
Mid Belmont	13718	630	80	86.7	87.1	0.0029	5.5	115	27	0.5	94	6.8	464	
Mid Belmont	13679	630	80	84.7	86.8	0.0184	11.4	55	14	1.0	85	0.2	39	
Mid Belmont	13296	630	75	83.2	83.6	0.0021	4.9	130	25	0.4	85	1.5	383	
Mid Belmont	13210	630	76	82.5	83.3	0.0066	7.2	88	26	0.7	88	5.5	86	
Mid Belmont	12899	630	72	77.6	79.8	0.0204	11.9	53	12	1.0	79	1.4	311	
Mid Belmont	12894	630	71	78.4	79.2	0.0054	7.2	87	0	0.5	80	1.6	5	
Mid Belmont	12850	Culvert		78.4	79.2		7.0				87	8.1	44	90
Mid Belmont	12846	630	71	77.5	78.9	0.0040	9.4	67	37	0.6	79	1.2	4	
Mid Belmont	12842	630	71	78.3	78.5	0.0015	4.1	156	36	0.3	78	-0.4	4	
Mid Belmont	12690	630	69	78.1	78.3	0.0011	3.9	162	24	0.3	70	-8.1	152	
Mid Belmont	12680	630	69	77.6	78.3	0.0065	6.3	100	0	0.4	70	-7.6	10	
Mid Belmont	12675	630	68	76.6	78.1	0.0145	9.8	64	0	0.6	82	5.4	5	
Mid Belmont	12644	Culvert		76.6	78.1		14.7				79	2.2	31	96
Mid Belmont	12611	630	68	76.0	77.5	0.0213	9.8	64	0	0.6	79	2.8	33	
Mid Belmont	12554	Culvert		76.0	77.5		14.7				79	2.8	57	96
Mid Belmont	12497	630	65	73.2	74.7	0.0213	9.8	64	0	0.6	81	7.8	57	
Mid Belmont	12429	Culvert		73.2	74.7		14.7				81	7.8	68	96
Mid Belmont	12360	630	64	71.7	73.2	0.0213	9.8	64	0	0.6	81	9.3	69	
Mid Belmont	12331	Culvert		71.7	73.2		14.7				81	9.3	29	96
Mid Belmont	12303	630	62	70.8	72.2	0.0132	9.5	67	8	0.6	76	5.0	28	
Mid Belmont	12209	Culvert		70.8	72.2		14.7				76	5.0	94	96
Mid Belmont	12115	630	58	67.7	68.7	0.0114	7.8	81	0	0.4	73	4.9	94	

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Table D-Belmont Creek-2 (page 3 of 4)
Analysis of Existing Creek, 25-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Lower Belmont	12115	790	58	66.7	68.6	0.0246	11.0	72	0	0.7	73	5.9		
Lower Belmont	12050	Culvert		66.7	68.6		15.0				73	5.9	65	108
Lower Belmont	11985	790	56	62.1	65.2	0.0308	14.1	56	9	1.0	76	13.7	65	
Lower Belmont	11980	790	56	62.3	63.6	0.0096	9.2	86	14	0.6	73	10.3	5	
Lower Belmont	11890	Culvert		62.3	63.6		12.9				76	13.5	90	7'x7',5'x7'
Lower Belmont	11815	790	53	57.7	60.1	0.0216	12.3	64	14	1.0	71	13.3	75	
Lower Belmont	11649	790	47	55.1	55.3	0.0008	3.5	227	40	0.3	58	3.0	166	
Lower Belmont	11565	790	46	53.2	55.0	0.0159	10.7	74	21	1.0	60	6.8	84	
Lower Belmont	11209	790	44	51.8	51.9	0.0002	1.8	435	79	0.1	57	5.1	356	
Lower Belmont	11055	790	43	50.4	51.7	0.0099	9.0	88	24	0.8	50	-0.3	154	
Lower Belmont	10811	790	42	50.8	50.9	0.0007	3.3	238	41	0.2	60	9.3	244	
Lower Belmont	10696	790	41	48.5	50.5	0.0165	11.3	70	18	1.0	50	1.5	115	
Lower Belmont	10456	790	38	43.5	44.2	0.0048	6.8	117	30	0.6	50	6.0	240	
Lower Belmont	10356	790	37	43.2	43.8	0.0038	6.2	127	31	0.6	49	5.6	100	
Lower Belmont	10256	790	37	42.9	43.4	0.0029	5.7	140	33	0.5	48	5.3	100	
Lower Belmont	10198	790	36	42.8	43.2	0.0025	5.4	146	32	0.4	50	7.2	58	
Lower Belmont	10156	790	34	42.7	42.9	0.0007	3.4	235	41	0.3	45	2.7	42	
Lower Belmont	9821	790	31	42.7	42.8	0.0003	2.5	314	43	0.2	46	3.3	335	
Lower Belmont	9799	860	31	41.6	42.7	0.0017	8.4	103	33	0.5	45	3.4	22	
Lower Belmont	9798	Culvert		41.6	42.7		12.3				42	0.4	1	10'x7'
Lower Belmont	9775	860	31	39.0	40.8	0.0143	10.7	80	10	0.7	45	5.7	23	
Lower Belmont	9600	Culvert		41.6	42.7		12.3				45	3.3	175	10'x7'
Lower Belmont	9554	860	27	37.7	39.5	0.0221	10.8	80	0	0.6	42	3.8	46	
Lower Belmont	9550	860	27	37.2	39.4	0.0308	11.9	73	0	0.6	42	4.5	4	
Lower Belmont	9400	Culvert		37.2	39.4		15.7				42	4.5	150	72",72"
Lower Belmont	9231	860	26	32.8	35.0	0.0467	11.8	73	0	0.8	37	4.2	169	
Lower Belmont	9224	860	26	33.1	34.7	0.0118	10.1	85	12	0.7	37	3.9	7	
Lower Belmont	9000	Culvert		33.1	34.7		13.2				38	4.4	224	12'x8'
Lower Belmont	8988	860	25	32.1	33.7	0.0119	10.1	85	12	0.7	34	2.3	12	
Lower Belmont	8982	860	25	32.2	33.5	0.0157	9.0	96	0	0.6	35	2.3	6	
Lower Belmont	8800	Culvert		32.2	33.5		10.8				34	2.2	182	6'x6',9'x6'
Lower Belmont	8715	860	24	30.8	31.7	0.0058	7.8	111	16	0.5	32	1.3	85	
Lower Belmont	8711	860	24	31.1	31.6	0.0027	5.9	149	61	0.5	32	0.9	4	
Lower Belmont	8636	860	23	30.8	31.4	0.0032	6.2	139	23	0.4	32	0.9	75	
Lower Belmont	8632	860	23	30.5	31.3	0.0110	7.3	119	0	1.1	31	0.4	4	
Lower Belmont	8600	Culvert		30.5	31.3		9.9				31	0.5	32	9'x6'
Lower Belmont	8550	860	23	30.3	30.6	0.0022	4.2	243	110	0.4	30	-0.4	50	
Lower Belmont	8545	860	23	30.4	30.5	0.0014	3.0	320	121	0.3	30	-0.4	5	
Lower Belmont	8482	860	22	30.1	30.4	0.0013	4.5	248	85	0.3	28	-2.1	63	
Lower Belmont	8480	860	22	29.9	30.4	0.0038	6.0	173	66	0.5	29	-1.2	2	
Lower Belmont	8478	Culvert		29.9	30.4		8.5				29	-1.1	2	13'x5.8'
Lower Belmont	8405	860	22	28.8	30.0	0.0114	8.8	106	61	0.7	30	1.5	73	
Lower Belmont	8403	860	22	29.3	29.8	0.0029	5.9	172	62	0.4	30	1.0	2	
Lower Belmont	7955	860	21	27.5	28.1	0.0055	6.8	157	62	0.6	30	2.2	448	
Lower Belmont	7875	860	20	25.3	27.3	0.0133	11.4	77	22	1.0	27	2.1	80	
Lower Belmont	7785	860	18	24.9	25.2	0.0020	4.6	199	62	0.4	26	0.8	90	
Lower Belmont	7705	860	17	24.1	24.9	0.0044	7.5	122	31	0.6	23	-1.3	80	
Lower Belmont	7595	860	17	22.3	24.1	0.0109	11.0	86	25	0.9	26	3.3	110	
Lower Belmont	7505	860	13	20.1	21.9	0.0130	11.0	81	22	0.9	22	1.6	90	
Lower Belmont	7435	860	13	19.9	21.0	0.0076	8.5	101	24	0.7	21	0.6	70	
Lower Belmont	7315	860	11	17.7	19.7	0.0151	11.2	77	20	1.0	21	3.4	120	
Lower Belmont	7165	860	9	15.4	16.6	0.0071	8.6	101	22	0.7	19	3.1	150	
Lower Belmont	7045	860	7	13.3	15.3	0.0159	11.2	77	20	1.0	15	1.7	120	
Lower Belmont	6945	860	5	13.2	13.8	0.0028	6.0	143	27	0.5	15	1.7	100	

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Table D-Belmont Creek-2 (page 4 of 4)
Analysis of Existing Creek, 25-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lower Belmont	6845	860	5	11.8	13.2	0.0115	9.6	89	22	0.8	14	2.5	100	
Lower Belmont	6735	860	5	11.4	12.2	0.0052	7.0	122	31	0.6	13	1.3	110	
Lower Belmont	6635	860	5	11.1	11.7	0.0035	6.2	139	32	0.5	13	1.9	100	
Lower Belmont	6615	860	5	11.1	11.6	0.0037	6.1	142	34	0.5	13	1.9	20	
Lower Belmont	6545	860	4	11.3	11.4	0.0005	3.1	290	54	0.2	13	1.7	70	
Lower Belmont	6503	Culvert		11.3	11.4		6.5				13	1.6	43	2@10'x4',10'x5'
Lower Belmont	6460	860	4	10.8	11.0	0.0005	3.0	299	57	0.2	13	2.2	43	
Lower Belmont	6450	860	4	10.8	11.0	0.0007	3.4	254	45	0.3	13	2.2	10	
Lower Belmont	6360	860	4	10.5	10.8	0.0021	4.9	175	37	0.4	11	0.6	90	
Lower Belmont	6260	860	3	10.2	10.6	0.0021	5.0	174	37	0.4	11	0.5	100	
Lower Belmont	6060	1010	3	9.7	10.1	0.0026	5.5	184	40	0.5	11	1.2	200	
Lower Belmont	5995	1010	2	9.5	10.0	0.0029	5.5	185	47	0.5	13	3.5	65	
Lower Belmont	5965	1010	1	9.8	9.8	0.0001	1.8	616	105	0.1	8	-1.8	30	
Lower Belmont	5860	Culvert		9.8	9.8		5.8				13	3.2	105	3@10'x6'
Lower Belmont	5750	1010	1	9.3	9.4	0.0004	2.6	424	106	0.2	8	-0.9	110	
Lower Belmont	5745	1010	1	9.3	9.4	0.0004	2.6	423	106	0.2	8	-0.9	5	
Lower Belmont	5659	1010	1	9.2	9.3	0.0007	2.8	574	415	0.2	9	-0.5	86	
Lower Belmont	5612	1010	1	9.0	9.2	0.0025	4.2	291	220	0.4	10	0.6	47	
Lower Belmont	5559	1010	1	8.9	9.1	0.0018	3.8	353	309	0.4	10	0.8	53	
Lower Belmont	5525	1010	1	9.0	9.0	0.0006	2.2	634	320	0.2	9	0.4	34	
Lower Belmont	5495	1010	1	8.9	9.0	0.0013	3.1	462	325	0.3	9	0.5	30	
Lower Belmont	5469	1010	1	8.9	9.0	0.0011	3.0	491	339	0.3	9	0.5	26	
Lower Belmont	5420	1010	2	8.8	8.9	0.0008	2.4	644	472	0.2	9	0.3	49	
Lower Belmont	5373	1010	2	8.8	8.9	0.0017	2.8	505	439	0.4	9	-0.2	47	
Lower Belmont	5325	1010	1	8.6	8.8	0.0012	3.3	320	121	0.3	9	0.0	48	
Lower Belmont	5245	1010	2	8.5	8.7	0.0009	3.1	335	105	0.3	7	-1.5	80	
Lower Belmont	4415	1010	-1	8.1	8.2	0.0004	2.6	461	104	0.2	9	1.1	830	
Lower Belmont	3710	1010	1	7.3	7.7	0.0024	5.1	200	44	0.4	8	1.0	705	
Lower Belmont	3075	1010	-1	6.8	6.9	0.0006	2.7	372	97	0.2	8	1.0	635	
Lower Belmont	3035	1010	-3	6.8	6.9	0.0004	2.9	349	48	0.2	8	0.8	40	
Lower Belmont	2920	Culvert		6.8	6.9		3.6				8	0.9	115	3@10'x9'
Lower Belmont	2805	1010	-4	6.7	6.7	0.0001	1.7	587	76	0.1	8	1.0	115	
Lower Belmont	2795	1010	-4	6.6	6.7	0.0005	2.7	378	76	0.2	8	1.1	10	

CITY OF BELMONT
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Table D-Belmont Creek-3 (page 1 of 4)
Analysis of Existing Creek, 10-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lateral														
Street Route	19067	79	204	207.8	208.2	0.0102	5.2	15	4	0.5	214	6.1		
Street Route	19000	Culvert		207.8	208.2		8.8				214	6.1	67	48
Street Route	18684	79	192	195.8	196.2	0.0099	5.1	16	4	0.5	203	6.9	316	
Street Route	18680	79	192	195.7	196.2	0.0102	5.2	15	4	0.5	203	7.0	4	
Street Route	18500	Culvert		195.7	196.2		8.8				203	7.0	180	48
Street Route	18346	79	182	186.2	186.7	0.0107	5.2	15	4	0.5	192	5.9	154	
Street Route	18342	79	182	186.2	186.6	0.0102	5.2	15	4	0.5	192	6.0	4	
Street Route	18300	Culvert		186.2	186.6		8.8				192	6.0	42	48
Street Route	17848	79	171	174.7	175.1	0.0099	5.1	16	4	0.5	181	5.8	452	
Street Route	17844	79	171	174.6	175.1	0.0102	5.2	15	4	0.5	181	5.9	4	
Street Route	17800	Culvert		174.6	175.1		8.8				181	5.9	44	48
Street Route	17552	79	159	162.9	163.3	0.0099	5.1	16	4	0.5	184	20.7	248	
Street Route	17548	79	159	162.8	163.3	0.0102	5.2	15	4	0.5	184	20.8	4	
Street Route	17540	Culvert		162.8	163.3		8.8				184	20.8	8	48
Street Route	17516	79	151	155.3	155.7	0.0135	4.9	16	0	0.4	162	6.7	24	
Lateral														
Carlmont Trib	17242	210	148	154.0	154.1	0.0009	2.8	76	18	0.2	160	6.1		
Carlmont Trib	17214	210	148	153.9	154.0	0.0007	2.5	83	21	0.2	156	2.1	28	
Carlmont Trib	17178	210	148	153.9	154.0	0.0006	2.4	88	21	0.2	158	3.6	36	
Carlmont Trib	17158	210	147	153.0	153.9	0.0048	7.5	28	6	0.6	158	4.5	20	
Carlmont Trib	17000	Culvert		153.0	153.9		12.1				158	4.5	158	60
Carlmont Trib	16887	210	139	142.0	142.5	0.0105	5.8	36	23	0.8	148	6.0	113	
Carlmont Trib	16581	210	135	137.6	138.5	0.0166	7.4	28	17	1.0	140	2.4	306	
Carlmont Trib	16419	210	131	133.3	134.1	0.0167	7.2	29	19	1.0	138	4.7	162	
Carlmont Trib	16261	210	127	130.2	130.6	0.0049	4.8	44	20	0.6	136	5.8	158	
Carlmont Trib	16187	210	122	130.4	130.4	0.0001	1.1	192	39	0.1	131	0.6	74	
Carlmont Trib	16001	210	118	130.4	130.4	0.0003	1.3	162	0	0.1	132	1.6	186	
Lateral														
Notre Dame	14041	190	99	101.8	102.3	0.0083	6.1	31	14	0.7	108	6.4		
Notre Dame	13737	190	95	99.2	99.8	0.0082	6.3	30	10	0.6	101	1.5	304	
Notre Dame	13255	190	90	93.4	94.3	0.0166	7.9	24	12	1.0	96	2.5	482	
Notre Dame	12806	190	82	85.5	86.5	0.0181	8.2	23	11	1.0	86	0.9	449	
Notre Dame	12478	190	74	82.6	82.7	0.0002	1.6	138	58	0.1	82	-1.0	328	
Notre Dame	12474	190	75	81.7	82.6	0.0095	7.5	28	0	0.5	83	1.3	4	
Notre Dame	12400	Culvert		81.7	82.6		12.7				86	3.9	74	5'x3'
Notre Dame	12395	190	70	76.6	77.4	0.0195	7.1	27	0	0.5	86	9.1	5	
Notre Dame	12390	190	70	75.7	77.2	0.0494	9.9	19	0	0.7	86	10.0	5	
Notre Dame	12300	Culvert		75.7	77.2		19.8				86	10.0	90	42
Notre Dame	12117	190	58	65.0	66.3	0.0378	9.0	21	0	0.6	69	4.2	183	
Trunk														
Upper Belmont	21059	170	296	299.0	299.6	0.0190	6.2	28	24	1.0	320	21.0		
Upper Belmont	20839	170	274	275.7	276.5	0.0179	6.8	25	18	1.0	287	11.3	220	
Upper Belmont	20491	170	258	261.2	262.2	0.0195	8.3	21	10	1.0	262	0.8	348	
Upper Belmont	19924	170	239	241.8	242.9	0.0203	8.4	20	10	1.0	250	8.2	567	
Upper Belmont	19780	170	229	232.4	232.8	0.0075	4.9	34	21	0.7	240	7.6	144	
Upper Belmont	19364	170	226	227.6	228.1	0.0182	5.8	29	29	1.0	227	-0.6	416	
Upper Belmont	19354	170	222	224.0	224.6	0.0177	6.2	28	24	1.0	224	0.0	10	
Upper Belmont	19344	170	214	217.9	218.8	0.0178	7.5	23	13	1.0	222	4.1	10	
Upper Belmont	19314	170	209	213.2	213.4	0.0027	3.9	43	15	0.4	220	6.8	30	
Upper Belmont	19295	170	208	212.8	213.4	0.0028	6.1	28	16	0.5	220	7.2	19	
Upper Belmont	19294	Culvert		212.8	213.4		9.8				218	5.2	1	72
Upper Belmont	19072	170	204	207.5	208.5	0.0184	8.0	21	6	0.7	213	5.5	222	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for B-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-Belmont Creek-3 (page 2 of 4)
Analysis of Existing Creek, 10-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Apt Route	19067	91	204	208.0	208.2	0.0063	3.8	24	0	0.3	213	5.0		
Apt Route	19020	Culvert		208.0	208.2		8.8				214	5.9	47	54
Apt Route	19012	91	203	207.2	207.4	0.0028	3.3	27	6	0.3	213	5.8	8	
Apt Route	19007	91	203	207.1	207.3	0.0050	4.1	22	5	0.3	213	5.9	5	
Apt Route	19000	Culvert		207.1	207.3		9.4				213	6.0	7	48
Apt Route	18139	91	172	176.6	176.9	0.0048	4.0	23	5	0.3	180	3.4	861	
Apt Route	18135	91	172	176.3	176.8	0.0179	5.7	16	0	0.5	180	3.7	4	
Apt Route	18130	Culvert		176.3	176.8		9.4				180	3.7	5	48
Apt Route	17862	91	162	166.2	166.7	0.0179	5.7	16	0	0.5	171	4.8	268	
Apt Route	17857	91	162	166.1	166.6	0.0179	5.7	16	0	0.5	171	4.9	5	
Apt Route	17850	Culvert		166.1	166.6		7.2				172	5.4	7	48
Apt Route	17843	91	162	165.8	166.3	0.0179	5.7	16	0	0.5	171	5.2	7	
Apt Route	17838	91	162	165.7	166.2	0.0179	5.7	16	0	0.5	171	5.3	5	
Apt Route	17800	Culvert		165.7	166.2		9.4				172	5.8	38	48
Apt Route	17516	91	151	155.2	155.8	0.0144	6.1	15	4	0.6	162	6.5	284	
Trunk														
Up-Mid Belmont	17510	170	151	155.2	155.7	0.0065	5.4	32	7	0.5	162	6.8		
Up-Mid Belmont	17500	Culvert		155.2	155.7		9.2				162	6.8	10	84
Up-Mid Belmont	17317	170	148	152.2	152.7	0.0063	5.3	32	7	0.4	158	5.9	183	
Up-Mid Belmont	17312	170	148	152.2	152.6	0.0065	5.4	32	7	0.5	158	5.9	5	
Up-Mid Belmont	17300	Culvert		152.2	152.6		9.2				158	5.9	12	84
Up-Mid Belmont	17139	170	145	149.2	149.7	0.0063	5.3	32	7	0.4	155	5.9	161	
Up-Mid Belmont	17135	170	145	149.2	149.6	0.0065	5.4	32	7	0.5	155	5.9	4	
Up-Mid Belmont	17000	Culvert		149.2	149.6		9.2				155	5.9	135	84
Up-Mid Belmont	16983	170	141	143.7	144.5	0.0172	7.1	24	16	1.0	149	5.2	17	
Up-Mid Belmont	16701	240	137	143.8	143.9	0.0005	2.3	105	22	0.2	147	3.4	282	
Up-Mid Belmont	16678	240	138	142.6	143.7	0.0150	8.4	29	7	0.7	147	4.6	23	
Up-Mid Belmont	16600	Culvert		142.6	143.7		10.4				147	4.6	78	84
Up-Mid Belmont	16152	240	120	130.2	130.5	0.0063	4.9	49	0	0.3	137	6.7	448	
Up-Mid Belmont	16136	240	119	130.4	130.4	0.0001	1.3	182	32	0.1	136	5.3	16	
Up-Mid Belmont	16096	240	119	130.4	130.4	0.0000	0.6	381	56	0.0	130	-0.4	40	
Trunk														
Mid Belmont	16001	420	118	130.3	130.4	0.0013	2.6	162	0	0.1	130	-0.4		
Mid Belmont	15997	420	118	130.3	130.4	0.0001	1.2	359	99	0.1	130	-0.5	4	
Mid Belmont	15975	Culvert		130.3	130.4		14.7				130	-0.1	22	72
Mid Belmont	15946	420	114	118.8	120.3	0.0171	9.9	42	14	1.0	130	11.2	29	
Mid Belmont	15940	420	113	117.9	119.5	0.0188	10.2	41	13	1.0	130	12.1	6	
Mid Belmont	15630	420	110	112.9	114.1	0.0151	8.8	48	20	1.0	126	13.1	310	
Mid Belmont	15266	420	97	103.5	104.4	0.0086	7.8	54	13	0.7	121	17.6	364	
Mid Belmont	14669	420	90	95.5	97.1	0.0188	10.2	41	13	1.0	112	16.6	597	
Mid Belmont	14576	420	88	92.1	93.7	0.0201	10.3	41	13	1.0	101	9.2	93	
Mid Belmont	14260	420	85	90.7	91.0	0.0026	4.6	91	26	0.4	101	9.9	316	
Mid Belmont	14182	420	85	89.3	90.5	0.0181	8.8	48	20	1.0	97	7.7	78	
Mid Belmont	13718	420	80	85.2	85.7	0.0036	5.3	79	23	0.5	94	8.3	464	
Mid Belmont	13679	420	80	83.7	85.3	0.0185	10.2	41	13	1.0	85	1.2	39	
Mid Belmont	13296	420	75	82.1	82.4	0.0017	4.1	104	22	0.3	85	2.6	383	
Mid Belmont	13210	420	76	81.3	82.0	0.0080	7.0	60	21	0.7	88	6.7	86	
Mid Belmont	12899	420	72	76.4	78.2	0.0204	10.7	39	11	1.0	79	2.6	311	
Mid Belmont	12894	420	71	76.2	76.9	0.0033	6.9	61	25	0.5	80	3.8	5	
Mid Belmont	12850	Culvert		76.2	76.9		6.7				87	10.3	44	90
Mid Belmont	12846	420	71	75.4	76.7	0.0062	9.2	46	31	0.8	79	3.3	4	
Mid Belmont	12842	420	71	76.0	76.4	0.0032	4.9	87	26	0.5	78	1.9	4	
Mid Belmont	12690	420	69	75.8	76.0	0.0016	3.9	107	22	0.3	70	-5.8	152	
Mid Belmont	12680	420	69	75.6	76.0	0.0030	5.2	81	13	0.4	70	-5.6	10	
Mid Belmont	12675	420	68	74.9	75.9	0.0067	8.1	52	12	0.6	82	7.1	5	
Mid Belmont	12644	Culvert		74.9	75.9		12.1				79	3.9	31	96
Mid Belmont	12611	420	68	74.3	75.3	0.0110	8.1	52	8	0.6	79	4.5	33	
Mid Belmont	12554	Culvert		74.3	75.3		12.1				79	4.5	57	96
Mid Belmont	12497	420	65	71.5	72.5	0.0110	8.1	52	8	0.6	81	9.5	57	
Mid Belmont	12429	Culvert		71.5	72.5		12.1				81	9.5	68	96
Mid Belmont	12360	420	64	70.0	71.0	0.0110	8.1	52	8	0.6	81	11.0	69	
Mid Belmont	12331	Culvert		70.0	71.0		12.1				81	11.0	29	96
Mid Belmont	12303	420	62	68.9	69.9	0.0110	8.1	52	8	0.6	76	6.9	28	
Mid Belmont	12209	Culvert		68.9	69.9		12.1				76	6.9	94	96
Mid Belmont	12115	420	58	65.6	66.2	0.0055	6.3	67	9	0.4	73	7.0	94	

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Table D-Belmont Creek-3 (page 3 of 4)
Analysis of Existing Creek, 10-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Trunk														
Lower Belmont	12115	520	58	65.1	66.2	0.0100	8.3	63	9	0.6	73	7.5		
Lower Belmont	12050	Culvert		65.1	66.2		12.4				73	7.5	65	108
Lower Belmont	11985	520	56	60.6	63.0	0.0277	12.3	42	9	1.0	76	15.2	65	
Lower Belmont	11980	520	56	60.7	61.7	0.0089	8.0	65	14	0.6	73	11.9	5	
Lower Belmont	11890	Culvert		60.7	61.7		11.2				76	15.1	90	7'x7',5'x7'
Lower Belmont	11815	520	53	56.6	58.4	0.0206	10.8	48	14	1.0	71	14.4	75	
Lower Belmont	11649	520	47	53.8	53.9	0.0007	3.0	176	36	0.2	58	4.4	166	
Lower Belmont	11565	520	46	52.1	53.6	0.0168	9.9	52	17	1.0	60	7.9	84	
Lower Belmont	11209	520	44	50.4	50.4	0.0002	1.6	324	71	0.1	57	6.6	356	
Lower Belmont	11055	520	43	48.8	50.2	0.0139	9.4	55	18	0.9	50	1.3	154	
Lower Belmont	10811	520	42	49.2	49.4	0.0006	2.9	180	36	0.2	60	10.8	244	
Lower Belmont	10696	520	41	47.3	49.0	0.0176	10.5	50	15	1.0	50	2.7	115	
Lower Belmont	10456	520	38	42.1	42.8	0.0067	6.8	76	26	0.7	50	7.4	240	
Lower Belmont	10356	520	37	41.4	42.1	0.0067	6.8	76	26	0.7	49	7.4	100	
Lower Belmont	10256	520	37	40.3	41.3	0.0100	7.9	66	24	0.8	48	7.9	100	
Lower Belmont	10198	520	36	39.5	40.6	0.0117	8.7	60	21	0.9	50	10.6	58	
Lower Belmont	10156	520	34	39.0	39.4	0.0028	5.0	105	29	0.5	45	6.4	42	
Lower Belmont	9821	520	31	39.0	39.1	0.0006	3.0	175	32	0.2	46	7.0	335	
Lower Belmont	9799	570	31	37.7	39.0	0.0037	8.9	64	26	0.6	45	7.3	22	
Lower Belmont	9798	Culvert		37.7	39.0		11.9				42	4.3	1	10'x7'
Lower Belmont	9775	570	31	37.1	38.5	0.0127	9.4	61	10	0.7	45	7.6	23	
Lower Belmont	9600	Culvert		37.7	39.0		11.9				45	7.2	175	10'x7'
Lower Belmont	9554	570	27	33.6	34.6	0.0093	8.3	69	10	0.6	42	7.9	46	
Lower Belmont	9550	570	27	33.6	34.6	0.0135	7.9	73	0	0.5	42	8.1	4	
Lower Belmont	9400	Culvert		33.6	34.6		10.4				42	8.1	150	72",72"
Lower Belmont	9231	570	26	31.5	32.7	0.0131	8.5	67	12	0.6	37	5.5	169	
Lower Belmont	9224	570	26	31.4	32.6	0.0109	8.9	64	12	0.7	37	5.6	7	
Lower Belmont	9000	Culvert		31.4	32.6		11.3				38	6.1	224	12'x8'
Lower Belmont	8988	570	25	30.8	31.8	0.0089	8.2	69	12	0.6	34	3.6	12	
Lower Belmont	8982	570	25	31.1	31.6	0.0069	5.9	96	0	0.4	35	3.4	6	
Lower Belmont	8800	Culvert		31.1	31.6		10.7				34	3.3	182	6'x6',9'x6'
Lower Belmont	8715	570	24	29.6	30.2	0.0043	6.3	91	16	0.5	32	2.5	85	
Lower Belmont	8711	570	24	29.7	30.1	0.0025	5.1	111	25	0.4	32	2.3	4	
Lower Belmont	8636	570	23	29.5	29.9	0.0027	5.2	110	22	0.4	32	2.2	75	
Lower Belmont	8632	570	23	29.5	29.9	0.0046	4.8	119	0	1.6	31	1.4	4	
Lower Belmont	8600	Culvert		29.5	29.9		6.6				31	1.5	32	9'x6'
Lower Belmont	8550	570	23	29.3	29.6	0.0015	4.1	149	89	0.3	30	0.7	50	
Lower Belmont	8545	570	23	29.4	29.5	0.0009	3.3	222	89	0.3	30	0.6	5	
Lower Belmont	8482	570	22	29.2	29.4	0.0013	4.1	167	85	0.3	28	-1.2	63	
Lower Belmont	8480	570	22	28.9	29.4	0.0052	6.0	104	66	0.6	29	-0.2	2	
Lower Belmont	8478	Culvert		28.9	29.4		8.2				29	-0.1	2	13'x5.8'
Lower Belmont	8405	570	22	28.4	29.0	0.0058	6.6	87	23	0.5	30	1.9	73	
Lower Belmont	8403	570	22	28.6	28.9	0.0021	4.8	127	61	0.4	30	1.7	2	
Lower Belmont	7955	570	21	26.5	27.2	0.0082	7.7	94	58	0.7	30	3.3	448	
Lower Belmont	7875	570	20	24.1	25.8	0.0156	10.3	55	17	1.0	27	3.3	80	
Lower Belmont	7785	570	18	23.6	23.9	0.0028	4.4	129	49	0.5	26	2.1	90	
Lower Belmont	7705	570	17	23.0	23.6	0.0043	6.4	91	28	0.6	23	-0.2	80	
Lower Belmont	7595	570	17	21.4	22.8	0.0119	9.8	62	24	0.9	26	4.2	110	
Lower Belmont	7505	570	13	19.0	20.5	0.0143	9.7	60	19	0.9	22	2.7	90	
Lower Belmont	7435	570	13	18.7	19.6	0.0081	7.8	73	21	0.7	21	1.9	70	
Lower Belmont	7315	570	11	16.5	18.2	0.0160	10.5	54	16	1.0	21	4.6	120	
Lower Belmont	7165	570	9	14.3	15.2	0.0069	7.5	76	20	0.7	19	4.2	150	
Lower Belmont	7045	570	7	12.4	13.9	0.0164	9.9	58	19	1.0	15	2.7	120	
Lower Belmont	6945	570	5	11.9	12.3	0.0025	5.2	109	24	0.4	15	3.0	100	

CITY OF BELMONT
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Table D-Belmont Creek-3 (page 4 of 4)
Analysis of Existing Creek, 10-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
Lower Belmont	6845	570	5	10.7	11.8	0.0108	8.4	68	19	0.8	14	3.6	100	
Lower Belmont	6735	570	5	10.1	10.8	0.0061	6.7	85	26	0.7	13	2.6	110	
Lower Belmont	6635	570	5	9.7	10.3	0.0043	5.9	97	29	0.6	13	3.3	100	
Lower Belmont	6615	570	5	9.6	10.2	0.0042	5.9	97	28	0.6	13	3.4	20	
Lower Belmont	6545	570	4	9.9	10.0	0.0006	2.7	214	46	0.2	13	3.1	70	
Lower Belmont	6503	Culvert		9.9	10.0		4.3				13	3.0	43	2@10'x4',10'x5'
Lower Belmont	6460	570	4	9.7	9.8	0.0005	2.5	233	57	0.2	13	3.3	43	
Lower Belmont	6450	570	4	9.6	9.8	0.0006	2.8	204	45	0.2	13	3.4	10	
Lower Belmont	6360	570	4	9.4	9.7	0.0020	4.2	136	37	0.4	11	1.6	90	
Lower Belmont	6260	570	3	9.2	9.5	0.0019	4.2	135	36	0.4	11	1.6	100	
Lower Belmont	6060	660	3	8.7	9.0	0.0023	4.5	146	39	0.4	11	2.2	200	
Lower Belmont	5995	660	2	8.5	8.9	0.0025	4.6	142	41	0.4	13	4.5	65	
Lower Belmont	5965	660	1	8.7	8.8	0.0001	1.4	508	105	0.1	8	-0.7	30	
Lower Belmont	5860	Culvert		8.7	8.8		3.8				13	4.3	105	3@10'x6'
Lower Belmont	5750	660	1	8.5	8.6	0.0002	2.0	346	106	0.1	8	-0.2	110	
Lower Belmont	5745	660	1	8.5	8.6	0.0002	2.0	346	106	0.1	8	-0.2	5	
Lower Belmont	5659	660	1	8.4	8.5	0.0010	3.2	240	244	0.3	9	0.4	86	
Lower Belmont	5612	660	1	8.3	8.5	0.0015	3.7	177	47	0.3	10	1.4	47	
Lower Belmont	5559	660	1	8.2	8.4	0.0011	3.4	200	88	0.3	10	1.5	53	
Lower Belmont	5525	660	1	8.3	8.3	0.0004	2.1	435	215	0.2	9	1.1	34	
Lower Belmont	5495	660	1	8.2	8.3	0.0011	3.2	251	189	0.3	9	1.3	30	
Lower Belmont	5469	660	1	8.1	8.3	0.0011	3.2	265	277	0.3	9	1.3	26	
Lower Belmont	5420	660	2	8.1	8.2	0.0011	3.0	326	373	0.3	9	1.1	49	
Lower Belmont	5373	660	2	7.3	8.0	0.0085	6.9	96	39	0.8	9	1.3	47	
Lower Belmont	5325	660	1	7.6	7.7	0.0011	3.0	227	76	0.3	9	1.0	48	
Lower Belmont	5245	660	2	7.5	7.7	0.0009	2.7	243	77	0.3	7	-0.5	80	
Lower Belmont	4415	660	-1	7.2	7.2	0.0003	2.1	370	94	0.2	9	2.0	830	
Lower Belmont	3710	660	1	6.6	6.9	0.0013	3.8	175	36	0.3	8	1.7	705	
Lower Belmont	3075	660	-1	6.4	6.5	0.0003	2.0	335	76	0.2	8	1.4	635	
Lower Belmont	3035	660	-3	6.4	6.4	0.0002	2.0	332	39	0.1	8	1.2	40	
Lower Belmont	2920	Culvert		6.4	6.4		2.4				8	1.3	115	3@10'x9'
Lower Belmont	2805	660	-4	6.3	6.4	0.0001	1.2	562	74	0.1	8	1.4	115	
Lower Belmont	2795	660	-4	6.3	6.4	0.0003	1.9	356	74	0.2	8	1.4	10	

CITY OF BELMONT
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Table D-Belmont Creek-4 (page 1 of 4)
Analysis of Existing Creek with Proposed Improvements, FEMA 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Lateral															
Street Route	19067	220	204	212.9	215.8	0.1049	13.8	16	0	0.8	214	1.0			
Street Route	19000	Culvert		212.9	215.8		15.3				214	1.0	67	48	
Street Route	18684	220	192	201.9	204.8	0.1049	13.8	16	0	0.8	203	0.8	316		
Street Route	18680	220	192	201.4	204.4	0.1049	13.8	16	0	0.8	203	1.3	4		
Street Route	18500	Culvert		201.4	204.4		15.7				203	1.3	180	48	
Street Route	18346	220	182	190.4	193.3	0.1049	13.8	16	0	0.9	192	1.8	154		
Street Route	18342	220	182	189.9	192.9	0.1049	13.8	16	0	0.9	192	2.2	4		
Street Route	18300	Culvert		189.9	192.9		17.0				192	2.2	42	48	
Street Route	17848	220	171	179.1	182.1	0.1049	13.8	16	0	0.8	181	1.4	452		
Street Route	17844	220	171	178.7	181.6	0.1049	13.8	16	0	0.9	181	1.8	4		
Street Route	17800	Culvert		178.7	181.6		17.5				181	1.8	44	48	
Street Route	17552	220	159	171.3	174.2	0.1049	13.8	16	0	0.7	184	12.4	248		
Street Route	17548	220	159	170.8	173.8	0.1049	13.8	16	0	0.7	184	12.8	4		
Street Route	17540	Culvert		170.8	173.8		17.5				184	12.8	8	48	
Street Route	17516	220	151	158.3	161.2	0.1049	13.8	16	0	0.9	162	3.8	24		
Lateral															
Carlmont Trib	17242	347	148	154.7	154.9	0.0016	3.9	89	20	0.3	160	5.3			
Carlmont Trib	17214	347	148	154.6	154.8	0.0013	3.5	99	23	0.3	156	1.4	28		
Carlmont Trib	17178	347	148	154.6	154.8	0.0011	3.4	103	23	0.3	155	0.4	36		
Carlmont Trib	17158	347	147	153.5	154.6	0.0132	8.6	40	7	0.6	156	2.5	20		
Carlmont Trib	17000	Culvert		153.5	154.6		12.0				158	4.0	158	**84**	
Carlmont Trib	16887	347	139	142.6	143.3	0.0106	6.8	51	25	0.8	148	5.4	113		
Carlmont Trib	16581	347	135	138.4	139.4	0.0152	8.3	42	20	1.0	140	1.6	306		
Carlmont Trib	16419	347	131	134.0	135.0	0.0156	8.1	43	22	1.0	138	4.0	162		
Carlmont Trib	16261	347	127	131.0	131.5	0.0053	5.6	62	23	0.6	136	5.0	158		
Carlmont Trib	16187	347	122	131.3	131.3	0.0002	1.5	228	42	0.1	131	-0.3	74		
Carlmont Trib	16001	347	118	131.2	131.3	0.0013	1.9	187	119	0.1	132	0.8	186		
Lateral															
Notre Dame	14041	518	99	104.3	105.1	0.0060	7.0	74	19	0.6	109	4.4			
Notre Dame	13737	518	95	101.2	102.6	0.0115	9.7	58	19	0.8	102	0.7	304		
Notre Dame	13255	518	90	95.4	96.8	0.0125	9.4	59	27	0.9	96	1.0	482		
Notre Dame	12806	518	82	87.7	88.7	0.0083	8.5	77	40	0.8	92	4.2	449		
Notre Dame	12478	518	74	87.4	87.4	0.0001	1.2	667	161	0.1	88	0.6	328		
Notre Dame	12474	518	75	83.5	87.0	0.0786	15.2	34	0	0.9	86	2.8	4		
Notre Dame	12400	Culvert		83.5	87.0		2.7				86	2.1	74	**7'x3'**	
Notre Dame	12395	518	70	86.8	87.0	0.0060	4.1	188	200	0.1	86	-0.5	5		
Notre Dame	12390	518	70	86.7	86.9	0.0134	5.7	144	200	0.2	86	-0.4	5		
Notre Dame	12300	Culvert		86.7	80.1		14.9				86	-1.0	90	**84**	
Notre Dame	12117	518	58	68.4	72.9	0.1064	17.1	30	0	0.9	86	17.6	183		
Lateral															
PR Leg	9821	585	31	38.3	39.4	0.0148	8.4	70	0	0.5	42	3.7	0		
PR Leg	9500	Culvert		38.3	39.4		12.4				42	3.7	321	**10'x6'**	
PR Leg	8988	585	26	34.3	35.3	0.0184	8.1	73	10	0.5	34	-0.3	512		
Trunk															
Upper Belmont	21059	440	296	300.1	300.9	0.0159	7.4	60	35	1.0	320	19.9			
Upper Belmont	20839	440	274	277.0	278.3	0.0158	9.0	49	20	1.0	310	33.0	220		
Upper Belmont	20491	440	258	263.1	263.9	0.0180	7.2	61	39	1.0	290	26.9	348		
Upper Belmont	19924	440	239	243.8	245.6	0.0196	10.7	41	12	1.0	270	26.2	567		

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet
(5) Base home elevations to be determined in final design, minor overtoping of lower is acceptable.

CITY OF BELMONT
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Table D-Belmont Creek-4 (page 2 of 4)
Analysis of Existing Creek with Proposed Improvements, FEMA 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Upper Belmont	19780	440	229	233.6	234.3	0.0100	7.1	62	27	0.8	270	36.5	144		
Upper Belmont	19364	440	226	228.5	229.4	0.0142	7.6	60	36	1.0	229	0.5	416		
Upper Belmont	19354	440	222	225.1	226.1	0.0137	7.9	57	31	1.0	225	-0.1	10		
Upper Belmont	19344	440	214	219.5	220.8	0.0158	9.1	48	19	1.0	225	5.0	10		
Upper Belmont	19314	440	209	218.2	218.3	0.0007	3.0	149	27	0.2	222	3.8	30		
Upper Belmont	19295	440	208	215.6	218.1	0.0211	12.5	35	0	0.8	222	6.4	19		
Upper Belmont	19294	Culvert		215.6	218.1		11.9				218	2.4	1	72	
Upper Belmont	19072	440	204	214.2	216.2	0.0526	11.5	38	6	0.6	214	-0.3	222		
Trunk															
Apt Route	19067	220	204	212.9	215.8	0.1049	13.8	16	0	0.8	214	1.0			
Apt Route	19020	Culvert		212.9	215.8		15.2				214	1.0	47	54	
Apt Route	19012	220	203	209.4	211.3	0.0583	11.0	20	0	0.7	213	3.7	8		
Apt Route	19007	220	203	209.7	210.9	0.0319	8.8	25	0	0.6	213	3.4	5		
Apt Route	19000	Culvert		209.7	210.9		11.2				213	3.4	7	48	
Apt Route	18139	220	172	179.2	180.5	0.0319	8.8	25	0	0.6	180	0.8	861		
Apt Route	18135	220	172	179.0	180.3	0.0366	9.2	24	0	0.6	180	1.0	4		
Apt Route	18130	Culvert		179.0	180.3		13.7				180	1.0	5	**54**	
Apt Route	17862	220	162	172.5	173.3	0.0256	7.4	30	6	0.4	172	-0.9	268		
Apt Route	17857	220	162	172.3	173.2	0.0301	7.8	28	6	0.4	172	-0.7	5		
Apt Route	17850	Culvert		172.3	173.2		11.8				172	-0.7	7	**54**	
Apt Route	17843	220	162	171.1	172.4	0.0366	9.2	24	0	0.5	172	0.5	7		
Apt Route	17838	220	162	169.0	171.9	0.1049	13.8	16	0	0.9	172	2.6	5		
Apt Route	17800	Culvert		169.0	171.9		13.7				172	2.6	38	**54**	
Apt Route	17516	220	151	161.9	164.2	0.0958	12.1	18	4	0.7	162	-0.3	284		
Trunk															
Up-Mid Belmont	17510	440	151	159.3	160.5	0.0212	9.0	49	0	0.5	162	2.7			
Up-Mid Belmont	17500	Culvert		159.3	160.5		13.5				162	2.7	10	84	
Up-Mid Belmont	17317	440	148	156.3	157.6	0.0212	9.0	49	0	0.5	158	1.8	183		
Up-Mid Belmont	17312	440	148	156.2	157.5	0.0212	9.0	49	0	0.5	158	1.9	5		
Up-Mid Belmont	17300	Culvert		156.2	157.5		13.5				158	1.9	12	84	
Up-Mid Belmont	17139	440	145	153.3	154.6	0.0212	9.0	49	0	0.5	155	1.8	161		
Up-Mid Belmont	17135	440	145	153.2	154.5	0.0212	9.0	49	0	0.5	155	1.9	4		
Up-Mid Belmont	17000	Culvert		153.2	154.5		13.5				155	1.9	135	84	
Up-Mid Belmont	16983	440	141	148.8	149.0	0.0010	3.4	128	23	0.3	149	0.1	17		
Up-Mid Belmont	16701	802	137	148.7	148.8	0.0004	2.9	366	127	0.2	148	-1.2	282		
Up-Mid Belmont	16678	802	138	148.3	148.7	0.0176	6.9	153	127	0.3	148	-0.8	23		
Up-Mid Belmont	16600	Culvert		148.3	148.3		14.4				147	-1.0	78	84	
Up-Mid Belmont	16152	802	120	137.2	137.8	0.0147	7.5	144	93	0.2	137	-0.4	448		
Up-Mid Belmont	16136	802	119	131.1	131.4	0.0010	3.9	207	35	0.3	136	4.9	16		
Up-Mid Belmont	16096	802	119	131.3	131.3	0.0002	1.9	429	56	0.1	130	-1.3	40		
Trunk															
Mid Belmont	16001	802	118	130.9	131.2	0.0061	4.9	163	17	0.3	132	1.1			
Mid Belmont	15997	802	118	131.1	131.1	0.0002	2.0	461	178	0.1	132	0.9	4		
Mid Belmont	15975	Culvert		131.1	131.1		14.8				130	-0.9	22	**84**	
Mid Belmont	15946	802	114	120.6	122.5	0.0158	11.3	71	18	1.0	132	11.4	29		
Mid Belmont	15940	802	113	119.8	121.9	0.0178	11.6	69	16	1.0	132	12.2	6		
Mid Belmont	15630	802	110	114.3	115.9	0.0140	10.3	78	24	1.0	127	12.2	310		
Mid Belmont	15266	802	97	105.7	107.1	0.0098	9.3	86	17	0.7	122	16.3	364		
Mid Belmont	14669	802	90	97.4	99.4	0.0171	11.6	69	17	1.0	114	16.6	597		
Mid Belmont	14576	802	88	93.9	96.2	0.0197	12.2	66	14	1.0	110	16.1	93		
Mid Belmont	14260	802	85	92.4	92.9	0.0029	5.8	139	31	0.5	108	15.6	316		
Mid Belmont	14182	802	85	90.6	92.3	0.0164	10.5	77	23	1.0	104	13.4	78		

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Table D-Belmont Creek-4 (page 3 of 4)
Analysis of Existing Creek with Proposed Improvements, FEMA 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Mid Belmont	13718	802	80	87.6	88.1	0.0027	5.7	142	30	0.5	97	9.4	464		
Mid Belmont	13679	802	80	85.6	87.7	0.0178	11.7	69	16	1.0	100	14.4	39		
Mid Belmont	13296	802	75	83.9	84.4	0.0024	5.5	147	27	0.4	92	8.1	383		
Mid Belmont	13210	802	76	83.0	84.0	0.0069	7.8	103	28	0.7	92	9.0	86		
Mid Belmont	12899	802	72	80.1	81.4	0.0098	9.2	87	17	0.7	88	7.9	311		
Mid Belmont	12894	802	71	80.0	81.4	0.0088	9.2	87	0	0.5	88	8.0	5		
Mid Belmont	12850	Culvert		80.0	81.4		8.9				87	6.5	44	90	
Mid Belmont	12846	802	71	79.2	80.9	0.0106	10.6	76	0	0.6	85	5.8	4		
Mid Belmont	12842	802	71	80.3	80.5	0.0009	3.3	241	49	0.3	85	4.7	4		
Mid Belmont	12690	802	69	80.1	80.3	0.0009	3.8	211	24	0.2	70	-10.1	152		
Mid Belmont	12680	802	69	79.2	80.2	0.0106	8.0	100	0	0.5	70	-9.2	10		
Mid Belmont	12675	802	68	77.6	80.0	0.0236	12.5	64	0	0.7	82	4.5	5		
Mid Belmont	12644	Culvert		77.6	80.0		17.1				79	1.3	31	96	
Mid Belmont	12611	802	68	77.0	79.4	0.0346	12.5	64	0	0.7	79	1.8	33		
Mid Belmont	12554	Culvert		77.0	79.4		17.1				79	1.8	57	96	
Mid Belmont	12497	802	65	74.2	76.6	0.0346	12.5	64	0	0.7	81	6.8	57		
Mid Belmont	12429	Culvert		74.2	76.6		17.1				81	6.8	68	96	
Mid Belmont	12360	802	64	72.7	75.1	0.0346	12.5	64	0	0.7	81	8.3	69		
Mid Belmont	12331	Culvert		72.7	75.1		17.1				81	8.3	29	96	
Mid Belmont	12303	802	62	72.0	73.9	0.0253	11.1	72	0	0.6	76	3.8	28		
Mid Belmont	12209	Culvert		72.0	73.9		16.0				76	3.8	94	96	
Mid Belmont	12115	802	58	71.2	72.7	0.0184	9.9	81	0	0.5	73	1.4	94		
Trunk															
Lower Belmont	12115	1214	58	68.1	72.5	0.0580	16.9	72	0	0.9	73	4.5			
Lower Belmont	12050	Culvert		68.1	72.5		19.9				73	4.5	65	108	
Lower Belmont	11985	1214	56	63.9	68.3	0.0384	16.8	72	9	1.1	76	11.9	65		
Lower Belmont	11980	1214	56	62.2	65.4	0.0233	14.3	85	14	1.0	76	13.6	5		
Lower Belmont	11890	Culvert		62.2	65.2		15.9				76	13.6	90	7'x7',5'x7'	
Lower Belmont	11815	1214	53	59.3	62.5	0.0234	14.3	85	14	1.0	71	11.7	75		
Lower Belmont	11649	1214	47	56.7	57.0	0.0009	4.1	297	45	0.3	80	23.6	166		
Lower Belmont	11565	1214	46	54.5	56.6	0.0151	11.7	104	25	1.0	60	5.5	84		
Lower Belmont	11209	1214	44	53.6	53.7	0.0002	2.1	583	89	0.1	72	18.3	356		
Lower Belmont	11055	1214	43	52.4	53.5	0.0068	8.2	149	37	0.7	60	7.6	154		
Lower Belmont	10811	1214	42	52.6	52.8	0.0007	3.8	318	46	0.3	66	13.4	244		
Lower Belmont	10696	1214	41	50.0	52.4	0.0158	12.4	98	21	1.0	58	8.0	115		
Lower Belmont	10456	1214	38	44.3	45.4	0.0067	8.6	141	33	0.7	49	4.4	240		
Lower Belmont	10356	1214	37	43.6	44.8	0.0069	8.7	140	33	0.7	48	4.4	100		
Lower Belmont	10256	1214	37	42.8	44.0	0.0073	8.9	137	32	0.8	47	4.6	100		
Lower Belmont	10198	1214	36	41.8	43.5	0.0109	10.4	116	28	0.9	50	8.2	58		
Lower Belmont	10156	1214	34	39.2	41.1	0.0132	11.0	110	30	1.0	45	5.4	42		
Lower Belmont	9821	1214	31	38.6	39.5	0.0041	7.4	164	31	0.6	46	7.4	335		
Trunk															
O'Neill culvert	9799	619	31	38.1	39.4	0.0036	9.1	68	26	0.6	45	7.0	22		
O'Neill culvert	9798	Culvert		38.1	39.4		11.8				42	3.9	1	10'x7'	
O'Neill culvert	9775	619	31	37.4	38.9	0.0130	9.6	64	10	0.7	45	7.3	23		
O'Neill culvert	9600	Culvert		38.1	39.4		11.8				45	6.8	175	10'x7'	
O'Neill culvert	9554	619	27	36.9	37.9	0.0115	7.7	80	0	0.4	42	4.6	46		
O'Neill culvert	9550	619	27	36.7	37.8	0.0159	8.5	73	0	0.5	42	4.8	4		
O'Neill culvert	9400	Culvert		36.7	37.8		11.0				42	5.0	150	72",72"	
O'Neill culvert	9231	619	26	34.8	35.9	0.0266	8.5	73	0	0.5	37	2.3	169		
O'Neill culvert	9224	619	26	35.0	35.7	0.0072	6.5	96	0	0.4	38	2.5	7		
O'Neill culvert	9000	Culvert		35.0	35.7		6.5				38	2.5	224	12'x8'	
O'Neill culvert	8988	619	25	35.0	35.3	0.0058	5.0	143	57	0.2	34	-0.6	12		

CITY OF BELMONT
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Table D-Belmont Creek-4 (page 4 of 4)
Analysis of Existing Creek with Proposed Improvements, FEMA 100-year Event

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Trunk															
Lowest Belmont	8982	1294	25	32.1	35.0	0.0356	13.5	96	0	0.9	34	2.3	6		
Lowest Belmont	8800	Culvert		32.1	35.0		12.5				34	2.3	182	6'x6',9'x6'	
Lowest Belmont	8715	1294	23	31.4	32.8	0.0075	9.4	149	59	0.6	32	0.1	85		
Lowest Belmont	8711	1294	23	32.0	32.5	0.0023	6.1	255	95	0.4	31	-1.0	4		
Lowest Belmont	8636	1294	23	31.6	32.3	0.0030	6.8	217	88	0.4	31	-0.4	75		
Lowest Belmont	8632	1294	23	30.9	32.2	0.0153	9.3	140	0	1.2	32	0.6	4		
Lowest Belmont	8600	Culvert		30.9	32.2		10.8				31	0.1	32	9'x6'	
Lowest Belmont	8550	1294	23	31.1	31.3	0.0013	4.3	410	155	0.3	31	-0.1	50		No
Lowest Belmont	8545	1294	22	31.2	31.3	0.0008	2.5	534	170	0.3	25	-6.2	5		No
Lowest Belmont	8482	1294	21	30.9	31.2	0.0015	5.2	324	85	0.3	28	-2.9	63		No
Lowest Belmont	8480	1294	21	30.6	31.2	0.0038	6.6	233	66	0.5	28	-2.6	2		No
Lowest Belmont	8478	Culvert		30.6	31.2		9.0				29	-1.8	2	13'x5.8' Arch	No
Lowest Belmont	8405	1294	21	29.7	30.8	0.0092	8.9	171	62	0.7	28	-1.5	73		No
Lowest Belmont	8403	1294	21	30.0	30.6	0.0031	6.6	236	64	0.4	28	-1.6	2		No
Lowest Belmont	7955	1294	21	27.5	28.7	0.0059	9.3	167	51	0.7	25	-2.1	448		No
Lowest Belmont	7875	1294	20	27.0	28.2	0.0063	9.8	182	73	0.7	25	-1.6	80		No
Lowest Belmont	7785	1294	18	26.4	26.8	0.0015	5.1	304	72	0.4	22	-4.5	90		No
Lowest Belmont	7705	1294	17	25.5	26.5	0.0042	8.5	167	35	0.6	27	1.5	80		No
Lowest Belmont	7595	1294	17	23.5	25.7	0.0104	12.5	116	27	0.9	26	2.2	110		No
Lowest Belmont	7505	1294	13	21.3	23.7	0.0122	12.5	111	26	0.9	22	0.4	90		No
Lowest Belmont	7435	1294	13	21.3	22.7	0.0072	9.4	139	33	0.7	21	-0.1	70		No
Lowest Belmont	7315	1294	11	19.1	21.4	0.0144	12.1	107	23	1.0	21	2.0	120		No
Lowest Belmont	7165	1294	9	16.9	18.3	0.0069	9.8	133	24	0.7	16	-0.8	150		No
Lowest Belmont	7045	1294	7	14.6	17.1	0.0148	12.6	104	22	1.0	14	-1.0	120		No
Lowest Belmont	6945	1294	5	14.8	15.6	0.0031	6.9	186	29	0.5	13	-1.5	100		No
Lowest Belmont	6845	1294	5	13.6	15.0	0.0087	9.7	136	35	0.8	14	-0.1	100		No
Lowest Belmont	6735	1294	5	13.6	14.3	0.0029	6.6	207	57	0.5	12	-1.6	110		No
Lowest Belmont	6635	1294	5	13.4	14.0	0.0024	6.1	214	40	0.4	11	-2.7	100		No
Lowest Belmont	6615	1294	5	13.4	13.9	0.0021	5.6	235	49	0.4	11	-2.3	20		No
Lowest Belmont	6545	1294	4	13.6	13.7	0.0004	3.3	442	105	0.2	10	-3.4	70		No
Lowest Belmont	6503	Culvert		13.6	13.7		9.8				13	-0.7	43	2@10'x4',10'x5'	No
Lowest Belmont	6460	1294	4	12.4	12.6	0.0005	3.5	391	57	0.2	9	-3.1	43		No
Lowest Belmont	6450	1294	4	12.4	12.6	0.0008	4.0	325	45	0.3	9	-3.1	10		No
Lowest Belmont	6360	1294	4	12.0	12.5	0.0022	5.6	233	37	0.4	9	-2.6	90		No
Lowest Belmont	6260	1294	3	11.8	12.3	0.0021	5.6	231	37	0.4	9	-2.8	100		No
Lowest Belmont	6060	1534	3	11.2	11.8	0.0026	6.2	248	45	0.5	9	-2.4	200		No
Lowest Belmont	5995	1534	2	11.1	11.6	0.0024	5.9	259	48	0.5	8	-2.7	65		
Lowest Belmont	5965	1534	1	11.4	11.4	0.0002	2.2	783	105	0.1	7	-4.2	30		
Lowest Belmont	5860	Culvert		11.4	11.4		8.8				13	1.6	105	3@10'x6'	
Lowest Belmont	5750	1534	1	10.2	10.4	0.0005	3.4	524	106	0.2	8	-2.0	110		
Lowest Belmont	5745	1534	1	10.2	10.4	0.0005	3.4	524	106	0.2	8	-2.0	5		
Lowest Belmont	5659	1534	1	10.2	10.3	0.0004	2.4	1007	429	0.2	8	-2.1	86		
Lowest Belmont	5612	1534	1	10.1	10.3	0.0012	3.5	618	387	0.3	10	-0.1	47		
Lowest Belmont	5559	1534	1	10.1	10.2	0.0008	2.8	743	391	0.3	8	-1.6	53		
Lowest Belmont	5525	1534	1	10.1	10.1	0.0003	2.0	1019	390	0.2	9	-1.4	34		
Lowest Belmont	5495	1534	1	10.1	10.1	0.0005	2.4	871	391	0.2	9	-1.2	30		
Lowest Belmont	5469	1534	1	10.1	10.1	0.0005	2.3	934	388	0.2	9	-1.3	26		
Lowest Belmont	5420	1534	2	10.1	10.1	0.0003	1.7	1281	555	0.2	9	-1.5	49		
Lowest Belmont	5373	1534	2	10.0	10.1	0.0004	1.8	1105	494	0.2	8	-2.3	47		
Lowest Belmont	5325	1534	1	9.9	10.0	0.0009	3.4	500	154	0.3	6	-3.8	48		
Lowest Belmont	5245	1534	2	9.8	10.0	0.0008	3.4	481	119	0.3	9	-1.3	80		No
Lowest Belmont	4415	1534	-1	9.3	9.5	0.0005	3.4	624	171	0.2	8	-1.3	830		No
Lowest Belmont	3710	1534	1	8.1	8.7	0.0038	6.4	240	65	0.5	8	0.1	705		No
Lowest Belmont	3075	1534	-1	7.2	7.5	0.0010	3.8	416	118	0.3	6	-0.8	635		No
Lowest Belmont	3035	1534	-3	7.1	7.4	0.0008	4.2	368	63	0.3	7	-0.6	40		No
Lowest Belmont	2920	Culvert		7.1	7.4		5.7				8	0.6	115	3@10'x9'	No
Lowest Belmont	2805	1534	-4	6.9	7.0	0.0003	2.6	602	77	0.2	7	0.4	115		No
Lowest Belmont	2795	1534	-4	6.7	7.0	0.0011	4.0	386	76	0.3	7	0.6	10		No

CITY OF BELMONT
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Table D-Belmont Creek-5 (page 1 of 4)
Analysis of Proposed Improvements on Belmont Creek, 100-year Event, HEC-1 Output

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Lateral															
Street Route	19067	165	204	211.8	213.4	0.0590	10.3	16	0	0.7	214	2.1			
Street Route	19000	Culvert		211.8	213.4		13.1				214	2.1	67	48	
Street Route	18684	165	192	200.0	201.6	0.0590	10.3	16	0	0.6	203	2.7	316		
Street Route	18680	165	192	199.7	201.4	0.0590	10.3	16	0	0.7	203	3.0	4		
Street Route	18500	Culvert		199.7	201.4		13.1				203	3.0	180	48	
Street Route	18346	165	182	188.4	190.0	0.0590	10.3	16	0	0.8	192	3.8	154		
Street Route	18342	165	182	188.1	189.8	0.0590	10.3	16	0	0.8	192	4.0	4		
Street Route	18300	Culvert		188.1	189.8		13.1				192	4.0	42	48	
Street Route	17848	165	171	178.9	180.5	0.0590	10.3	16	0	0.6	181	1.7	452		
Street Route	17844	165	171	178.6	180.3	0.0590	10.3	16	0	0.7	181	1.9	4		
Street Route	17800	Culvert		178.6	180.3		13.1				181	1.9	44	48	
Street Route	17552	165	159	167.0	168.7	0.0590	10.3	16	0	0.6	184	16.6	248		
Street Route	17548	165	159	166.8	168.4	0.0590	10.3	16	0	0.7	184	16.8	4		
Street Route	17540	Culvert		166.8	168.4		13.1				184	16.8	8	48	
Street Route	17516	165	151	158.6	160.3	0.0590	10.3	16	0	0.7	162	3.4	24		
Lateral															
Carlmont Trib	17242	410	148	155.5	155.7	0.0014	3.9	105	21	0.3	160	4.5			
Carlmont Trib	17214	410	148	155.5	155.6	0.0011	3.5	118	25	0.3	156	0.6	28		
Carlmont Trib	17178	410	148	155.4	155.6	0.0010	3.3	123	24	0.3	155	-0.4	36		
Carlmont Trib	17158	410	147	154.2	155.4	0.0141	9.1	45	7	0.6	156	1.8	20		
Carlmont Trib	17000	Culvert		154.2	155.5		13.0				158	3.3	158	**84**	
Carlmont Trib	16887	410	139	142.8	143.6	0.0106	7.2	57	25	0.9	148	5.2	113		
Carlmont Trib	16581	410	135	138.7	139.8	0.0149	8.6	48	21	1.0	140	1.3	306		
Carlmont Trib	16419	410	131	134.3	135.4	0.0150	8.4	49	22	1.0	138	3.7	162		
Carlmont Trib	16261	410	127	131.0	131.7	0.0073	6.7	62	23	0.7	136	5.0	158		
Carlmont Trib	16187	410	122	131.4	131.5	0.0002	1.8	233	43	0.1	131	-0.4	74		
Carlmont Trib	16001	410	118	131.3	131.4	0.0016	2.2	199	146	0.1	132	0.7	186		
Lateral															
Notre Dame	14041	370	99	103.3	104.0	0.0067	6.7	55	17	0.7	109	5.4			
Notre Dame	13737	370	95	100.7	101.6	0.0090	7.9	49	15	0.7	102	1.2	304		
Notre Dame	13255	370	90	94.5	95.9	0.0165	9.3	40	15	1.0	96	1.9	482		
Notre Dame	12806	370	82	87.1	88.0	0.0095	8.1	53	35	0.8	92	4.8	449		
Notre Dame	12478	370	74	87.0	87.0	0.0000	0.9	609	154	0.1	88	1.0	328		
Notre Dame	12474	370	75	85.0	86.8	0.0401	10.8	34	0	0.6	86	1.3	4		
Notre Dame	12400	Culvert		85.0	86.8		2.1				86	0.6	74	**7'x3'**	
Notre Dame	12395	370	70	86.7	86.8	0.0050	3.6	158	200	0.1	86	-0.4	5		
Notre Dame	12390	370	70	86.5	86.8	0.0116	5.2	117	190	0.1	86	-0.2	5		
Notre Dame	12300	Culvert		86.5	77.9		12.4				86	-0.8	90	**84**	
Notre Dame	12117	370	58	69.5	71.8	0.0543	12.2	30	0	0.6	86	16.5	183		
Lateral															
PR Leg	9821	584	31	38.3	39.4	0.0147	8.3	70	0	0.5	42	3.7	0		
PR Leg	9500	Culvert		38.3	39.4		12.3				42	3.7	321	**10x6'**	
PR Leg	8988	584	26	33.7	34.8	0.0147	8.3	70	0	0.5	34	0.3	512		
Trunk															
Upper Belmont	21059	330	296	299.7	300.5	0.0167	6.9	48	32	1.0	320	20.3			
Upper Belmont	20839	330	274	276.5	277.6	0.0164	8.3	40	19	1.0	310	33.5	220		
Upper Belmont	20491	330	258	262.8	263.5	0.0193	6.6	50	38	1.0	290	27.2	348		
Upper Belmont	19924	330	239	243.1	244.6	0.0199	10.0	33	11	1.0	270	26.9	567		

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet
(5) Base home elevations to be determined in final design, minor overtoping of lower is acceptable.

CITY OF BELMONT
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Table D-Belmont Creek-5 (page 2 of 4)
Analysis of Proposed Improvements on Belmont Creek, 100-year Event, HEC-1 Output

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Upper Belmont	19780	330	229	233.2	233.8	0.0090	6.3	52	25	0.8	270	36.8	144		
Upper Belmont	19364	330	226	228.2	229.0	0.0156	7.0	48	34	1.0	229	0.8	416		
Upper Belmont	19354	330	222	224.7	225.6	0.0146	7.4	46	29	1.0	225	0.3	10		
Upper Belmont	19344	330	214	219.0	220.1	0.0163	8.6	38	17	1.0	225	5.5	10		
Upper Belmont	19314	330	209	216.4	216.5	0.0010	3.2	104	23	0.3	222	5.6	30		
Upper Belmont	19295	330	208	215.0	216.4	0.0119	9.4	35	0	0.6	222	7.0	19		
Upper Belmont	19294	Culvert		215.0	216.4		11.7				218	3.0	1	72	
Upper Belmont	19072	330	204	212.4	213.6	0.0263	9.1	36	0	0.6	214	1.5	222		
Trunk															
Apt Route	19067	165	204	211.8	213.4	0.0590	10.3	16	0	0.7	214	2.1			
Apt Route	19020	Culvert		211.8	213.4		13.1				214	2.1	47	54	
Apt Route	19012	165	203	207.9	208.9	0.0328	8.3	20	0	0.6	213	5.2	8		
Apt Route	19007	165	203	208.0	208.7	0.0179	6.6	25	0	0.5	213	5.1	5		
Apt Route	19000	Culvert		208.0	208.7		10.6				213	5.1	7	48	
Apt Route	18139	165	172	178.0	178.7	0.0179	6.6	25	0	0.5	180	2.0	861		
Apt Route	18135	165	172	177.9	178.6	0.0206	6.9	24	0	0.5	180	2.2	4		
Apt Route	18130	Culvert		177.9	178.6		10.4				180	2.2	5	**54**	
Apt Route	17862	165	162	169.0	169.8	0.0206	6.9	24	0	0.5	173	4.0	268		
Apt Route	17857	165	162	168.9	169.7	0.0206	6.9	24	0	0.5	173	4.1	5		
Apt Route	17850	Culvert		168.9	169.7		10.4				172	2.6	7	**54**	
Apt Route	17843	165	162	168.3	169.0	0.0206	6.9	24	0	0.5	172	3.3	7		
Apt Route	17838	165	162	167.1	168.7	0.0590	10.3	16	0	0.8	172	4.5	5		
Apt Route	17800	Culvert		167.1	168.7		10.4				172	4.5	38	**54**	
Apt Route	17516	165	151	158.6	160.3	0.0590	10.3	16	0	0.7	162	3.0	284		
Trunk															
Up-Mid Belmont	17510	470	151	158.6	160.1	0.0242	9.6	49	0	0.6	162	3.4			
Up-Mid Belmont	17500	Culvert		158.6	160.1		12.2				162	3.4	10	84	
Up-Mid Belmont	17317	470	148	156.9	158.3	0.0242	9.6	49	0	0.6	158	1.2	183		
Up-Mid Belmont	17312	470	148	156.8	158.2	0.0242	9.6	49	0	0.6	158	1.3	5		
Up-Mid Belmont	17300	Culvert		156.8	158.2		12.2				158	1.3	12	84	
Up-Mid Belmont	17139	470	145	153.9	155.3	0.0242	9.6	49	0	0.6	155	1.2	161		
Up-Mid Belmont	17135	470	145	153.8	155.2	0.0242	9.6	49	0	0.6	155	1.3	4		
Up-Mid Belmont	17000	Culvert		153.8	155.2		12.2				155	1.3	135	84	
Up-Mid Belmont	16983	470	141	148.9	149.1	0.0011	3.6	130	23	0.3	149	0.0	17		
Up-Mid Belmont	16701	860	137	148.8	148.9	0.0005	3.1	374	127	0.2	150	1.2	282		
Up-Mid Belmont	16678	860	138	148.3	148.8	0.0182	7.1	158	127	0.3	150	1.7	23		
Up-Mid Belmont	16600	Culvert		148.3	148.4		14.5				147	-1.0	78	84	
Up-Mid Belmont	16152	860	120	137.2	137.8	0.0155	7.7	149	93	0.2	137	-0.4	448		
Up-Mid Belmont	16136	860	119	131.2	131.5	0.0012	4.1	210	35	0.3	136	4.8	16		
Up-Mid Belmont	16096	860	119	131.4	131.4	0.0002	2.0	435	56	0.1	132	0.6	40		
Trunk															
Mid Belmont	16001	860	118	130.9	131.3	0.0086	5.2	164	33	0.3	132	1.1			
Mid Belmont	15997	860	118	131.2	131.2	0.0002	2.1	477	188	0.1	132	0.8	4		
Mid Belmont	15975	Culvert		131.2	131.2		14.9				130	-1.0	22	**84**	
Mid Belmont	15946	860	114	120.8	122.8	0.0157	11.4	75	19	1.0	132	11.2	29		
Mid Belmont	15940	860	113	120.1	122.2	0.0176	11.8	73	17	1.0	132	11.9	6		
Mid Belmont	15630	860	110	114.4	116.1	0.0139	10.4	83	25	1.0	127	12.1	310		
Mid Belmont	15266	860	97	106.0	107.4	0.0099	9.5	91	18	0.7	122	16.0	364		
Mid Belmont	14669	860	90	97.6	99.7	0.0170	11.7	73	17	1.0	114	16.4	597		
Mid Belmont	14576	860	88	94.2	96.6	0.0198	12.4	69	15	1.0	110	15.8	93		
Mid Belmont	14260	860	85	92.6	93.1	0.0030	5.9	146	31	0.5	108	15.4	316		
Mid Belmont	14182	860	85	90.8	92.6	0.0162	10.6	81	23	1.0	104	13.2	78		

CITY OF BELMONT
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Table D-Belmont Creek-5 (page 3 of 4)
Analysis of Proposed Improvements on Belmont Creek, 100-year Event, HEC-1 Output

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Mid Belmont	13718	860	80	87.9	88.4	0.0027	5.7	150	31	0.5	97	9.1	464		
Mid Belmont	13679	860	80	85.9	88.0	0.0176	11.7	73	17	1.0	100	14.1	39		
Mid Belmont	13296	860	75	84.2	84.7	0.0025	5.6	155	28	0.4	92	7.8	383		
Mid Belmont	13210	860	76	83.4	84.3	0.0061	7.5	115	30	0.7	92	8.6	86		
Mid Belmont	12899	860	72	81.4	82.3	0.0068	7.5	115	25	0.6	88	6.6	311		
Mid Belmont	12894	860	71	80.7	82.2	0.0101	9.9	87	0	0.6	88	7.3	5		
Mid Belmont	12850	Culvert		80.7	82.2		9.6				87	5.8	44	90	
Mid Belmont	12846	860	71	79.7	81.7	0.0121	11.3	76	0	0.7	85	5.3	4		
Mid Belmont	12842	860	71	81.0	81.2	0.0007	3.1	278	53	0.2	85	4.0	4		
Mid Belmont	12690	860	69	80.8	81.0	0.0008	3.8	228	24	0.2	77	-4.1	152		
Mid Belmont	12680	860	69	79.8	80.9	0.0122	8.6	100	0	0.5	77	-3.1	10		
Mid Belmont	12675	860	68	77.9	80.7	0.0271	13.4	64	0	0.8	82	4.2	5		
Mid Belmont	12644	Culvert		77.9	80.7		18.0				79	1.0	31	96	
Mid Belmont	12611	860	68	77.3	80.1	0.0398	13.4	64	0	0.8	79	1.6	33		
Mid Belmont	12554	Culvert		77.3	80.1		18.0				79	1.6	57	96	
Mid Belmont	12497	860	65	74.5	77.3	0.0398	13.4	64	0	0.8	81	6.6	57		
Mid Belmont	12429	Culvert		74.5	77.3		18.0				81	6.6	68	96	
Mid Belmont	12360	860	64	73.0	75.8	0.0398	13.4	64	0	0.8	81	8.1	69		
Mid Belmont	12331	Culvert		73.0	75.8		18.0				81	8.1	29	96	
Mid Belmont	12303	860	62	72.5	74.7	0.0291	11.9	72	0	0.7	76	3.3	28		
Mid Belmont	12209	Culvert		72.5	74.7		18.0				76	3.3	94	96	
Mid Belmont	12115	860	58	69.8	71.6	0.0212	10.6	81	0	0.6	73	2.8	94		
Trunk															
Lower Belmont	12115	1100	58	67.8	71.4	0.0476	15.3	72	0	0.9	73	4.8			
Lower Belmont	12050	Culvert		67.8	71.4		18.4				73	4.8	65	108	
Lower Belmont	11985	1100	56	63.7	67.5	0.0343	15.8	70	9	1.0	76	12.1	65		
Lower Belmont	11980	1100	56	63.9	65.5	0.0104	10.3	107	14	0.6	76	11.9	5		
Lower Belmont	11890	Culvert		63.9	65.5		14.4				76	11.9	90	7'x7',5'x7'	
Lower Belmont	11815	1100	53	58.9	61.9	0.0229	13.8	80	14	1.0	71	12.1	75		
Lower Belmont	11649	1100	47	56.3	56.6	0.0009	3.9	279	44	0.3	80	24.0	166		
Lower Belmont	11565	1100	46	54.2	56.2	0.0152	11.4	96	24	1.0	60	5.8	84		
Lower Belmont	11209	1100	44	53.2	53.2	0.0002	2.0	545	86	0.1	72	18.7	356		
Lower Belmont	11055	1100	43	52.0	53.0	0.0076	8.3	132	33	0.7	60	8.1	154		
Lower Belmont	10811	1100	42	52.1	52.4	0.0007	3.7	297	45	0.3	66	13.9	244		
Lower Belmont	10696	1100	41	49.6	51.9	0.0159	12.1	91	20	1.0	58	8.4	115		
Lower Belmont	10456	1100	38	44.0	45.1	0.0067	8.4	131	32	0.7	49	4.7	240		
Lower Belmont	10356	1100	37	43.3	44.4	0.0069	8.4	130	32	0.7	48	4.7	100		
Lower Belmont	10256	1100	37	42.5	43.7	0.0074	8.7	127	31	0.8	47	4.9	100		
Lower Belmont	10198	1100	36	41.4	43.1	0.0116	10.5	105	27	0.9	50	8.6	58		
Lower Belmont	10156	1100	34	39.1	40.7	0.0119	10.3	107	29	1.0	45	5.5	42		
Lower Belmont	9821	1100	31	38.8	39.5	0.0030	6.5	171	32	0.5	46	7.2	335		
Trunk															
O'Neill culvert	9799	616	31	38.1	39.4	0.0036	9.1	68	26	0.6	45	7.0	22		
O'Neill culvert	9798	Culvert		38.1	39.4		11.8				42	3.9	1	10'x7'	
O'Neill culvert	9775	616	31	37.4	38.8	0.0129	9.6	64	10	0.7	45	7.3	23		
O'Neill culvert	9600	Culvert		38.1	39.4		11.8				45	6.8	175	10'x7'	
O'Neill culvert	9554	616	27	36.4	37.3	0.0113	7.7	80	0	0.4	42	5.1	46		
O'Neill culvert	9550	616	27	36.1	37.3	0.0158	8.5	73	0	0.5	42	5.4	4		
O'Neill culvert	9400	Culvert		36.1	37.3		10.9				42	5.6	150	72",72"	
O'Neill culvert	9231	616	26	34.3	35.4	0.0257	8.5	73	0	0.5	37	2.8	169		
O'Neill culvert	9224	616	26	34.5	35.2	0.0071	6.4	96	0	0.4	38	3.0	7		
O'Neill culvert	9000	Culvert		34.5	35.2		6.4				38	3.0	224	12'x8'	
O'Neill culvert	8988	616	25	34.2	34.8	0.0070	6.4	102	43	0.4	34	0.2	12		

CITY OF BELMONT
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Table D-Belmont Creek-5 (page 4 of 4)
Analysis of Proposed Improvements on Belmont Creek, 100-year Event, HEC-1 Output

River Reach (1)	River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)	In City
Trunk															
Lowest Belmont	8982	1200	25	32.1	34.5	0.0306	12.5	96	0	0.8	34	2.3	6		
Lowest Belmont	8800	Culvert		32.1	34.5		12.3				34	2.3	182	6'x6',9'x6'	
Lowest Belmont	8715	1200	23	31.1	32.5	0.0073	9.2	132	45	0.6	32	0.4	85		
Lowest Belmont	8711	1200	23	31.6	32.2	0.0025	6.2	223	93	0.4	31	-0.6	4		
Lowest Belmont	8636	1200	23	31.3	32.0	0.0030	6.7	190	86	0.4	31	-0.1	75		
Lowest Belmont	8632	1200	23	30.8	31.9	0.0131	8.6	140	0	1.1	32	0.7	4		
Lowest Belmont	8600	Culvert		30.8	31.9		10.4				31	0.2	32	9'x6'	
Lowest Belmont	8550	1200	23	30.9	31.1	0.0013	4.4	374	150	0.3	31	0.1	50		No
Lowest Belmont	8545	1200	22	31.0	31.1	0.0009	2.5	495	168	0.3	31	0.0	5		No
Lowest Belmont	8482	1200	21	30.6	31.0	0.0015	5.2	304	85	0.3	28	-2.6	63		No
Lowest Belmont	8480	1200	21	30.4	30.9	0.0039	6.6	218	66	0.5	28	-2.4	2		No
Lowest Belmont	8478	Culvert		30.4	30.9		8.9				29	-1.6	2	13'x5.8' Arch	No
Lowest Belmont	8405	1200	21	29.3	30.6	0.0110	9.5	146	62	0.7	28	-1.1	73		No
Lowest Belmont	8403	1200	21	29.8	30.4	0.0031	6.6	218	63	0.4	28	-1.4	2		No
Lowest Belmont	7955	1200	21	27.4	28.5	0.0054	8.8	163	51	0.7	25	-2.0	448		No
Lowest Belmont	7875	1200	20	26.9	28.0	0.0062	9.5	171	73	0.7	25	-1.5	80		No
Lowest Belmont	7785	1200	18	26.1	26.5	0.0015	5.1	281	71	0.4	22	-4.2	90		No
Lowest Belmont	7705	1200	17	25.2	26.2	0.0042	8.3	157	34	0.6	27	1.7	80		No
Lowest Belmont	7595	1200	17	23.3	25.4	0.0104	12.2	110	27	0.9	26	2.4	110		No
Lowest Belmont	7505	1200	13	21.0	23.3	0.0126	12.3	104	25	0.9	22	0.7	90		No
Lowest Belmont	7435	1200	13	21.0	22.4	0.0073	9.2	131	29	0.7	21	0.2	70		No
Lowest Belmont	7315	1200	11	18.8	21.1	0.0146	12.0	100	23	1.0	21	2.3	120		No
Lowest Belmont	7165	1200	9	16.6	18.0	0.0070	9.5	127	24	0.7	16	-0.5	150		No
Lowest Belmont	7045	1200	7	14.3	16.7	0.0150	12.4	98	22	1.0	14	-0.7	120		No
Lowest Belmont	6945	1200	5	14.5	15.2	0.0030	6.8	177	28	0.5	13	-1.2	100		No
Lowest Belmont	6845	1200	5	13.1	14.6	0.0099	10.0	121	28	0.8	14	0.4	100		No
Lowest Belmont	6735	1200	5	13.0	13.8	0.0035	6.8	179	43	0.5	12	-1.0	110		No
Lowest Belmont	6635	1200	5	12.8	13.4	0.0026	6.2	193	32	0.4	11	-2.1	100		No
Lowest Belmont	6615	1200	5	12.8	13.4	0.0025	5.8	208	39	0.4	11	-1.7	20		No
Lowest Belmont	6545	1200	4	13.0	13.2	0.0005	3.4	382	105	0.2	10	-2.8	70		No
Lowest Belmont	6503	Culvert		13.0	13.2		9.1				13	-0.1	43	2@10'x4',10'x5'	No
Lowest Belmont	6460	1200	4	12.0	12.2	0.0005	3.5	369	57	0.2	9	-2.7	43		No
Lowest Belmont	6450	1200	4	12.0	12.2	0.0009	3.9	308	45	0.3	9	-2.7	10		No
Lowest Belmont	6360	1200	4	11.6	12.1	0.0023	5.5	219	37	0.4	9	-2.2	90		No
Lowest Belmont	6260	1200	3	11.4	11.8	0.0022	5.6	215	37	0.4	9	-2.4	100		No
Lowest Belmont	6060	1400	3	10.7	11.3	0.0028	6.1	229	44	0.5	9	-1.9	200		No
Lowest Belmont	5995	1400	2	10.6	11.1	0.0027	5.9	238	48	0.5	8	-2.2	65		No
Lowest Belmont	5965	1400	1	10.9	11.0	0.0002	2.1	736	105	0.1	7	-3.7	30		
Lowest Belmont	5860	Culvert		10.9	11.0		8.0				13	2.1	105	3@10'x6'	
Lowest Belmont	5750	1400	1	9.9	10.1	0.0005	3.2	496	106	0.2	8	-1.7	110		
Lowest Belmont	5745	1400	1	9.9	10.1	0.0005	3.2	496	106	0.2	8	-1.7	5		
Lowest Belmont	5659	1400	1	10.0	10.0	0.0005	2.5	888	429	0.2	8	-1.9	86		
Lowest Belmont	5612	1400	1	9.8	10.0	0.0016	3.8	504	326	0.4	10	0.2	47		
Lowest Belmont	5559	1400	1	9.8	9.9	0.0010	3.1	626	338	0.3	8	-1.3	53		
Lowest Belmont	5525	1400	1	9.8	9.8	0.0004	2.0	903	354	0.2	9	-1.1	34		
Lowest Belmont	5495	1400	1	9.8	9.8	0.0007	2.5	753	348	0.2	9	-0.9	30		
Lowest Belmont	5469	1400	1	9.7	9.8	0.0006	2.4	811	382	0.2	9	-1.0	26		
Lowest Belmont	5420	1400	2	9.7	9.8	0.0004	1.9	1104	550	0.2	9	-1.2	49		
Lowest Belmont	5373	1400	2	9.7	9.8	0.0006	2.0	944	490	0.2	8	-2.0	47		
Lowest Belmont	5325	1400	1	9.5	9.7	0.0010	3.5	449	154	0.3	6	-3.5	48		
Lowest Belmont	5245	1400	2	9.5	9.6	0.0009	3.4	441	119	0.3	9	-1.0	80		No
Lowest Belmont	4415	1400	-1	9.0	9.1	0.0004	3.1	576	150	0.2	8	-1.0	830		No
Lowest Belmont	3710	1400	1	7.9	8.5	0.0036	6.1	230	54	0.5	8	0.3	705		No
Lowest Belmont	3075	1400	-1	7.1	7.3	0.0009	3.5	405	113	0.3	6	-0.7	635		No
Lowest Belmont	3035	1400	-3	7.1	7.3	0.0007	3.9	364	59	0.2	7	-0.6	40		No
Lowest Belmont	2920	Culvert		7.1	7.3		5.1				8	0.6	115	3@10'x9'	No
Lowest Belmont	2805	1400	-4	6.8	6.9	0.0002	2.3	599	77	0.2	7	0.5	115		No
Lowest Belmont	2795	1400	-4	6.7	6.9	0.0009	3.6	386	76	0.3	7	0.6	10		No

CITY OF BELMONT
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Table D-East Branch of Laurel Creek-1
Analysis of Existing Creek, 100-year Event

River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
6449	76	490	494.8	494.8	0.1	1.1	73	30	0.1	520	25.2		
6194	99	430	432.0	432.5	5.6	5.8	17	17	1.0	450	17.5	255	
5812	155	330	331.8	331.9	0.1	1.2	132	80	0.2	410	78.1	382	
4832	207	284	288.6	288.6	0.0	0.8	248	83	0.1	290	1.4	980	
4282	227	252	257.1	257.2	0.2	1.9	120	47	0.2	260	2.8	550	
3697	292	238	243.2	243.2	0.0	0.6	516	158	0.1	250	6.8	585	
2743	360	198	204.9	205.1	0.6	3.8	95	31	0.4	205	-0.1	954	
2274	891	176	196.1	196.1	0.0	1.0	958	127	0.1	192	-4.1	469	
1960	891	172	189.5	189.6	0.1	1.4	627	149	0.1	189	-0.6	314	
1928	Culvert		189.5	189.6		1.6				185	-4.6	32	72
1895	896	170	189.5	189.5	0.0	1.4	640	122	0.1	190	0.5	33	
1645	898	163	176.7	176.8	0.1	2.2	409	53	0.1	182	5.3	250	
1394	Culvert		176.7	176.8		14.1				189	12.3	251	96
1142	898	148	169.5	169.5	0.0	0.7	1230	115	0.0	170	0.5	252	
1102	918	148	169.2	169.2	0.0	1.4	666	62	0.1	170	0.8	40	
560	918	136	156.0	156.1	0.0	1.5	616	82	0.1	160	3.9	542	
472	933	138	151.3	151.4	0.1	2.1	443	103	0.2	152	0.6	88	
373	Culvert		151.4	151.4		13.2				150	-1.4	99	72
273	933	130	143.1	143.2	0.0	1.0	989	172	0.1	144	0.8	100	
262	936	132	142.9	143.0	0.0	1.2	775	128	0.1	142	-0.9	11	
100	938	124	140.7	140.7	0.0	1.0	1002	122	0.1	143	2.3	162	
												5889	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 100-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-East Branch of Laurel Creek-2
Analysis of Existing Creek, 25-year Event

River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
6449	56	490	493.9	494.0	0.1	1.2	49	25	0.1	520	26.1		
6194	72	430	432.5	432.6	0.9	2.6	27	22	0.4	450	17.4	255	
5812	112	330	331.4	331.4	0.2	1.2	97	76	0.2	410	78.6	382	
4832	149	284	288.0	288.0	0.0	0.7	203	76	0.1	290	2.0	980	
4282	164	252	256.3	256.4	0.2	1.9	85	39	0.2	260	3.6	550	
3697	208	238	242.6	242.6	0.0	0.5	423	151	0.1	250	7.4	585	
2743	255	198	203.3	203.6	1.4	4.9	53	22	0.6	205	1.4	954	
2274	593	176	194.3	194.4	0.0	0.8	746	121	0.1	192	-2.3	469	
1960	593	172	188.4	188.4	0.0	1.2	477	117	0.1	189	0.6	314	
1928	Culvert		188.4	188.4		1.3				185	-3.4	32	72
1895	597	170	188.4	188.4	0.0	1.2	510	109	0.1	190	1.6	33	
1645	598	163	172.6	172.7	0.1	2.7	221	39	0.2	182	9.3	250	
1394	Culvert		172.6	172.7		13.2				189	16.3	251	96
1142	598	148	166.5	166.5	0.0	0.7	894	105	0.0	170	3.5	252	
1102	613	148	166.1	166.1	0.0	1.3	488	54	0.1	170	3.9	40	
560	613	136	154.2	154.2	0.0	1.3	483	64	0.1	160	5.8	542	
472	625	138	150.5	150.5	0.1	1.8	357	98	0.2	152	1.5	88	
373	Culvert		150.5	150.5		13.9				150	-0.5	99	72
273	625	130	141.3	141.3	0.0	0.9	681	161	0.1	144	2.7	100	
262	627	132	141.0	141.0	0.0	1.2	530	121	0.1	142	1.0	11	
100	629	124	138.4	138.4	0.0	0.9	742	105	0.1	143	4.6	162	
												5889	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 25-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

CITY OF BELMONT
STORM DRAIN MASTER PLAN

Table D-East Branch of Laurel Creek-3
Analysis of Existing Creek, 10-year Event

River Station (1) (ft)	Total Flow (2) (cfs)	Minimum Channel Elevation (ft)	Water Surface Elevation (ft)	Energy Grade Elevation (ft)	Energy Grade Slope (ft/ft)	Channel Velocity (ft/s)	Flow Area (sqft)	Top Width (ft)	Froude Number Channel	Channel Bank Elevation (ft)	Minimum Freeboard (3) (ft)	Section Length (ft)	Culvert Diameter (inches)
6449	45	490	493.2	493.3	0.2	1.4	33	20	0.2	520	26.8		
6194	58	430	432.8	432.9	0.3	1.7	34	24	0.3	450	17.1	255	
5812	89	330	331.1	331.1	0.2	1.2	73	73	0.2	410	78.9	382	
4832	119	284	287.7	287.7	0.0	0.7	179	72	0.1	290	2.3	980	
4282	130	252	255.7	255.7	0.3	2.1	62	34	0.3	260	4.3	550	
3697	166	238	242.3	242.3	0.0	0.4	374	147	0.1	250	7.7	585	
2743	203	198	201.5	202.6	5.3	8.4	24	11	1.0	205	2.4	954	
2274	454	176	191.7	191.7	0.0	0.8	544	52	0.0	192	0.3	469	
1960	454	172	187.7	187.7	0.0	1.2	396	101	0.1	189	1.3	314	
1928	Culvert		187.7	187.7		1.3				185	-2.7	32	72
1895	457	170	187.6	187.6	0.0	1.1	431	102	0.1	190	2.4	33	
1645	458	163	171.0	171.1	0.2	2.8	164	34	0.2	182	10.9	250	
1394	Culvert		171.0	171.1		11.9				189	17.9	251	96
1142	458	148	164.8	164.8	0.0	0.6	720	100	0.0	170	5.2	252	
1102	471	148	164.4	164.4	0.0	1.2	399	49	0.1	170	5.6	40	
560	471	136	152.3	152.4	0.0	1.2	379	49	0.1	160	7.6	542	
472	481	138	148.4	148.5	0.1	2.1	226	49	0.2	152	3.5	88	
373	Culvert		148.4	148.5		12.5				150	1.5	99	72
273	481	130	140.2	140.3	0.0	0.9	525	131	0.1	144	3.8	100	
262	483	132	139.9	139.9	0.0	1.2	400	113	0.1	142	2.1	11	
100	484	124	137.0	137.0	0.0	0.9	602	93	0.1	143	6.0	162	
												5889	

(1) Station 100 is the border of City of Belmont
(2) Flow is overland unserved areas and Storm CAD output for L-systems in Appendix D for the 25-year storm event
(3) Minimum freeboard is the lowest bank elevation - energy grade elevation at the station.
(4) ft = feet, cfs = cubic feet per second, sqft = sqare feet

City of Belmont Storm Drain Master Plan

Table D-Erosion
Sediment Loads, Annual Volumes, From Scour Areas Shown on Figure 8

Locations	Length of Slope (feet)	Upstream Elevation (feet)	Downstream Elevation (feet)	Change in Elevation	Slope Gradient (feet/feet)	Area (square feet)	LS Topographic Factor Factor	Universal Soil Loss Equation A = R x K x LS x C x P (tons/acre year)[1,2]	Area (acres)	Weight Per Year (tons/year)	Volume Per Year (cubic yards/ year)
1	700	560	230	330	0.47	1,746,005	0.3	**1.89**	40	76	50
2	333	500	360	140	0.42	159,621	0.2	**1.26**	4	5	3
3	500	580	450	130	0.26	241,693	0.2	**1.40**	6	8	5
4	850	480	270	210	0.25	230,198	0.3	**1.81**	5	10	6
5	880	440	250	190	0.22	781,953	0.3	**1.81**	18	32	22
6	1400	570	260	310	0.22	445,637	0.3	**2.29**	10	23	16
7	660	700	550	150	0.23	148,014	0.2	**1.58**	3	5	4
8	1250	460	340	120	0.10	321,865	0.3	**1.99**	7	15	10
9	410	280	180	100	0.24	264,851	0.2	**1.26**	6	8	5
Total Volume										**181**	**121**

(1) $LS = ((65.41 \times s^2 / s^2 + 10{,}000) + (4.56 \times s / ((s^2 + 10{,}000))^{.5}) + .065) * (L / 72.5)^m$
(2) 1.5 ton = 1 cubic yard of soil

Locations from Figure 8.

1 sugarloaf hill
2 above alhambra
3 below comstock
4 above village drive
5 above carlmont HS
6 above carlmont HS
7 below buttercup
8 below parkridge
9 notre dame de namur

```
1****************************************                                                  ****************************************
 *                                      *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                                  *          609 SECOND STREET           *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   14SEP06  TIME  10:03:25  *                                                  *           (916) 756-1104             *
 *                                      *                                                  *                                      *
 ****************************************                                                  ****************************************


                                                X     X  XXXXXXX   XXXXX           X
                                                X     X  X        X     X         XX
                                                X     X  X        X                X
                                                XXXXXXX  XXXX     X        XXXXX   X
                                                X     X  X        X                X
                                                X     X  X        X     X          X
                                                X     X  XXXXXXX   XXXXX          XXX


          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                                  HEC-1 INPUT                                                  PAGE  1

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1          ID        Belmont Creek
            2          ID        6-Hour, 100-Year Event                   BKF by Ed Boscacci 8/2006
            3          ID        With Water Dog Lake Detention Basin      BKF No 20050132
            4          ID           Average Railfall Used
            5          IT      10       0       0     144
            6          IN       5       0       0
            7          IO       5
            8          JR    PREC   3.120   4.650

            9          KK      A1
           10          KM        Subareas BAF,BAG,BAE,BAH,BZ,BY,BAC,BAB,BAA,BV   339 acres
                       *       MAP 26
           11          PB    1.18
           12          PI  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482
           13          PI  0.1482  0.1482  0.1358  0.1358  0.1358  0.1358  0.1358  0.1358  0.1358  0.1358
           14          PI  0.1358  0.1358  0.1358  0.1358  0.3223  0.3223  0.3223  0.3223  0.3223  0.3223
```

```
 15          PI  0.3223  0.3223  0.3223  0.3223  0.3223  0.3223  0.5930  0.5930  0.5930  0.5930
 16          PI  0.5930  0.5930  0.5930  0.5930  0.5930  0.5930  0.5930  0.5930  0.5285  0.5285
 17          PI  0.5285  0.5285  0.5285  0.5285  0.5285  0.5285  0.5285  0.5285  0.5285  0.5285
 18          PI  0.5266  0.5266  0.5266  0.5266  0.5266  0.5266  0.5266  0.5266  0.5266  0.5266
 19          PI  0.5266  0.5266  4.0600  4.0600  1.2750  1.2750  1.2750  1.2750  1.0169  1.0169
 20          PI  1.0169  1.0169  1.0169  1.0169  0.5229  0.5229  0.5229  0.5229  0.5229  0.5229
 21          PI  0.5229  0.5229  0.5229  0.5229  0.5229  0.5229  0.2860  0.2860  0.2860  0.2860
 22          PI  0.2860  0.2860  0.2860  0.2860  0.2860  0.2860  0.2860  0.2860  0.2384  0.2384
 23          PI  0.2384  0.2384  0.2384  0.2384  0.2384  0.2384  0.2384  0.2384  0.2384  0.2384
 24          PI  0.3337  0.3337  0.3337  0.3337  0.3337  0.3337  0.3337  0.3337  0.3337  0.3337
 25          PI  0.3337  0.3337  0.3933  0.3933  0.3933  0.3933  0.3933  0.3933  0.3933  0.3933
 26          PI  0.3933  0.3933  0.3933  0.3933  0.2979  0.2979  0.2979  0.2979  0.2979  0.2979
 27          PI  0.2979  0.2979  0.2979  0.2979  0.2979  0.2979  0.3099  0.3099  0.3099  0.3099
 28          PI  0.3099  0.3099  0.3099  0.3099  0.3099  0.3099  0.3099  0.3099  0.2223  0.2223
 29          PI  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223
 30          PI  0.2470  0.2470  0.2470  0.2470  0.2470  0.2470  0.2470  0.2470  0.2470  0.2470
 31          PI  0.2470  0.2470  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223  0.2223
 32          PI  0.2223  0.2223  0.2223  0.2223  0.1235  0.1235  0.1235  0.1235  0.1235  0.1235
 33          PI  0.1235  0.1235  0.1235  0.1235  0.1235  0.1235  0.1605  0.1605  0.1605  0.1605
 34          PI  0.1605  0.1605  0.1605  0.1605  0.1605  0.1605  0.1605  0.1605  0.1729  0.1729
 35          PI  0.1729  0.1729  0.1729  0.1729  0.1729  0.1729  0.1729  0.1729  0.1729  0.1729
 36          PI  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482
 37          PI  0.1482  0.1482  0.3581  0.3581  0.3581  0.3581  0.3581  0.3581  0.3581  0.3581
 38          PI  0.3581  0.3581  0.3581  0.3581  0.2840  0.2840  0.2840  0.2840  0.2840  0.2840
 39          PI  0.2840  0.2840  0.2840  0.2840  0.2840  0.2840  0.1482  0.1482  0.1482  0.1482
 40          PI  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482  0.1482
 41          BA    0.53
             *       0.7 initial abstration 81 AMC II 1/2  34 percent impervious
             *       LAG TIME IS .24 HOURS
 42          LS     0.7      81      34
 43          UD     .24
             *

 44          KK     DB1
 45          KM           WATER DOG LAKE      Spillway 358'                 5 ACRES
 46          KM        All flow through 15" outlet at base, all other inlets closed.
 47          KO       1
 48          RS       1    ELEV     340
 49          SA     1.0     1.8     3.2     4.5     4.8     5.1     5.4     5.6     5.9     6.2
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 50          SE     340     344     350     358     360     362     364     366     368     370
 51          SQ       0      15      26     108     415     851    1386    2003    2693    3449
             *

 52          KK     A2N
 53          KM        SUBAREAS BAI, BU, BR                    122 ACRES
 54          BA    0.19
 55          KO       3
 56          LS     0.7      81      41
 57          UD     .12
```

```
  58          KK  2N-A1C
  59          KM                Combine A2N with A1
  60          HC       2

  61          KK     A2S
  62          KM        SUBAREAS BT, BS                305 ACRES
              *       MAP 24
  63          PB    1.13
  64          BA    0.48
  65          LS     0.7      81      13
  66          UD     .12
              *

  67          KK  2S-2NC
  68          KM                Combine A2S with A2N
  69          HC       2
              *

  70          KK     A3N
  71          KM        SUBAREAS BQ,BO,BN                     96 ACRES
  72          BA    0.15
  73          LU     0.7      81      44
  74          UD     .13
              *

  75          KK  3N-2SC
  76          KM                Combine A3N with A2S
  77          HC       2
              *

  78          KK     A3S
  79          KM        SUBAREAS BW, BP                       347 ACRES
  80          BA    0.54
  81          LS     0.7      81      26
  82          UD     .14
              *

  83          KK   3S-3N
  84          KM                Combine A3S with A3N
  85          HC       2
              *
1                                          HEC-1 INPUT                                          PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  86          KK     A4N
  87          KM        SUBAREAS BH,BG,BX, BK                 378 ACRES
  88          BA    0.59
  89          LS     0.7      81      43
  90          UD     .18
              *

  91          KK   4N-3S
```

```
     92          KM                Combine A4N with A3S
     93          HC       2
                 *

     94          KK     A4S
     95          KM        SUBAREAS BM, BL, BJ, BI        81 ACRES
     96          BA    0.13
     97          LS     0.7      81      35
     98          UD     .14
                 *

     99          KK   4S-4N
    100          KM                Combine A4S with A4N
    101          HC       2

    102          KK      A5
    103          KM        Subarea BC,BF,BD,BE            91 ACRES
                 *       MAP 22
    104          PB    1.09
    105          BA    0.14
    106          LS     0.7      81      32
    107          UD     .16
                 *

    108          KK   5-4SC
    109          KM                Combine A5 with A4S
    110          HC       2
                 *

    111          KK      A6
    112          KM        Subarea BA,BB,                   99   acres
    113          BA    0.15
    114          LS     0.7      81      46
    115          UD     .15
                 *

    116          KK     6-5
    117          KM                Combine A6 with A5
    118          HC       2
                 *
1                                          HEC-1 INPUT                                          PAGE  4

   LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


    119          KK      A7
    120          KM        Subarea EF,EH, BAD                    138 ACRES
    121          BA    0.22
    122          LS     0.7      81      50
    123          UD     .12
                 *

    124          KK     7-6
    125          KM                Combine A7 with A6
```

```
          126          HC       2
                       *

          127          KK      A8
          128          KM        Subarea         NIKON                          15 ACRES
                       *       MAP 20
          129          PB    1.04
          130          BA    0.02
          131          LS     0.7      81      50
          132          UD    0.00
                       *

          133          KK     8-7
          134          KM                Combine A8 with A7
          135          HC       2
                       *

          136          KK      A9
          137          KM        Subarea EG                          35 ACRES
          138          BA    0.06
          139          LS     0.7      81      50
          140          UD    4.21
                       *

          141          KK    9-8C
          142          KM                Combine A9 with A8
          143          HC       2
                       *
                       *       MAP = 26"
                       *       10-yr  100-yr
                       *       2.880   4.290
                       *       1PALO ALTO
                       *     MAP = 26"
                       *       10-yr  100-yr
                       *       3.360   5.010
          144          *       2SAN FRANSCISCO
                       *       3average is 3.12 and 4.65
          145          ZZ
1*****************************************                                                  ****************************************
 *                                       *                                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                  *          609 SECOND STREET           *
 *                                       *                                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   14SEP06  TIME  10:03:25   *                                                  *           (916) 756-1104             *
 *                                       *                                                  *                                      *
 *****************************************                                                  ****************************************
```

Belmont Creek
6-Hour, 100-Year Event BKF by Ed Boscacci 8/2006

```
                              With Water Dog Lake Detention Basin      BKF No 20050132
                             Average Railfall Used

  7 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          10  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         144  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2350  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .17 HOURS
                       TOTAL TIME BASE   23.83 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT

    JP          MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                  3.12      4.65


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
 44 KK     *       DB1  *
           *            *
           **************

 47 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           1  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

             HYDROGRAPH ROUTING DATA
```

```
 48 RS          STORAGE ROUTING
                     NSTPS           1  NUMBER OF SUBREACHES
                      ITYP        ELEV  TYPE OF INITIAL CONDITION
                    RSVRIC      340.00  INITIAL CONDITION
                         X         .00 WORKING R AND D COEFFICIENT

 49 SA              AREA         1.0       1.8       3.2       4.5       4.8       5.1       5.4       5.6       5.9       6.2

 50 SE          ELEVATION      340.00    344.00    350.00    358.00    360.00    362.00    364.00    366.00    368.00    370.00

 51 SQ          DISCHARGE          0.       15.       26.      108.      415.      851.     1386.     2003.     2693.     3449.

                                                          ***

                                                COMPUTED STORAGE-ELEVATION DATA

          STORAGE        .00      5.52     20.32     50.97     60.27     70.17     80.67     91.67    103.17    115.27
        ELEVATION     340.00    344.00    350.00    358.00    360.00    362.00    364.00    366.00    368.00    370.00

*****************************************************************************************************************************

                                                HYDROGRAPH AT STATION      DB1
                                                   PLAN 1,   RATIO =  3.12

*****************************************************************************************************************************
```

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	340.0	1		0800	49	25.	18.6	349.3	1		1600	97	32.	22.6	350.6
1		0010	2	0.	.0	340.0	1		0810	50	25.	19.0	349.5	1		1610	98	32.	22.6	350.6
1		0020	3	0.	.0	340.0	1		0820	51	25.	19.3	349.6	1		1620	99	32.	22.6	350.6
1		0030	4	0.	.1	340.1	1		0830	52	25.	19.5	349.7	1		1630	100	32.	22.5	350.6
1		0040	5	1.	.2	340.1	1		0840	53	25.	19.6	349.7	1		1640	101	32.	22.5	350.6
1		0050	6	1.	.3	340.2	1		0850	54	26.	19.7	349.8	1		1650	102	32.	22.4	350.6
1		0100	7	1.	.4	340.3	1		0900	55	26.	19.8	349.8	1		1700	103	32.	22.4	350.5
1		0110	8	1.	.5	340.3	1		0910	56	26.	19.9	349.8	1		1710	104	31.	22.3	350.5
1		0120	9	2.	.6	340.4	1		0920	57	26.	19.9	349.8	1		1720	105	31.	22.2	350.5
1		0130	10	2.	.6	340.5	1		0930	58	26.	20.0	349.9	1		1730	106	31.	22.1	350.5
1		0140	11	2.	.7	340.5	1		0940	59	26.	20.0	349.9	1		1740	107	30.	21.9	350.4
1		0150	12	2.	.8	340.6	1		0950	60	26.	20.0	349.9	1		1750	108	30.	21.7	350.4
1		0200	13	2.	.8	340.6	1		1000	61	26.	20.0	349.9	1		1800	109	29.	21.5	350.3
1		0210	14	2.	.9	340.7	1		1010	62	26.	20.1	349.9	1		1810	110	29.	21.3	350.3
1		0220	15	3.	1.0	340.7	1		1020	63	26.	20.1	349.9	1		1820	111	28.	21.2	350.2
1		0230	16	3.	1.2	340.9	1		1030	64	26.	20.3	350.0	1		1830	112	28.	21.1	350.2
1		0240	17	4.	1.3	341.0	1		1040	65	26.	20.4	350.0	1		1840	113	28.	20.9	350.2
1		0250	18	4.	1.5	341.1	1		1050	66	27.	20.6	350.1	1		1850	114	27.	20.8	350.1
1		0300	19	5.	1.7	341.2	1		1100	67	27.	20.7	350.1	1		1900	115	27.	20.8	350.1
1		0310	20	5.	1.9	341.3	1		1110	68	28.	20.9	350.1	1		1910	116	27.	20.7	350.1
1		0320	21	6.	2.1	341.5	1		1120	69	28.	21.1	350.2	1		1920	117	27.	20.6	350.1
1		0330	22	6.	2.4	341.7	1		1130	70	29.	21.3	350.3	1		1930	118	27.	20.5	350.1

1	0340	23	7.	2.7	341.9	*	1	1140	71	29.	21.5	350.3	*	1	1940	119	26.	20.5	350.0
1	0350	24	8.	3.0	342.2	*	1	1150	72	30.	21.7	350.4	*	1	1950	120	26.	20.4	350.0
1	0400	25	9.	3.3	342.4	*	1	1200	73	30.	22.0	350.4	*	1	2000	121	26.	20.3	350.0
1	0410	26	10.	3.6	342.6	*	1	1210	74	31.	22.2	350.5	*	1	2010	122	26.	20.3	350.0
1	0420	27	10.	3.8	342.8	*	1	1220	75	31.	22.3	350.5	*	1	2020	123	26.	20.2	350.0
1	0430	28	11.	4.1	342.9	*	1	1230	76	32.	22.4	350.6	*	1	2030	124	26.	20.1	349.9
1	0440	29	12.	4.3	343.1	*	1	1240	77	32.	22.5	350.6	*	1	2040	125	26.	20.1	349.9
1	0450	30	12.	4.5	343.3	*	1	1250	78	32.	22.6	350.6	*	1	2050	126	26.	20.0	349.9
1	0500	31	13.	4.7	343.4	*	1	1300	79	32.	22.6	350.6	*	1	2100	127	26.	19.9	349.8
1	0510	32	13.	4.9	343.6	*	1	1310	80	32.	22.7	350.6	*	1	2110	128	26.	19.8	349.8
1	0520	33	14.	5.1	343.7	*	1	1320	81	32.	22.7	350.6	*	1	2120	129	26.	19.9	349.8
1	0530	34	15.	5.4	343.9	*	1	1330	82	33.	22.8	350.6	*	1	2130	130	26.	20.1	349.9
1	0540	35	15.	5.6	344.0	*	1	1340	83	33.	22.9	350.7	*	1	2140	131	26.	20.3	350.0
1	0550	36	15.	5.9	344.1	*	1	1350	84	33.	22.9	350.7	*	1	2150	132	27.	20.5	350.1
1	0600	37	15.	6.1	344.2	*	1	1400	85	33.	23.0	350.7	*	1	2200	133	27.	20.8	350.1
1	0610	38	16.	6.8	344.5	*	1	1410	86	33.	23.1	350.7	*	1	2210	134	28.	21.1	350.2
1	0620	39	17.	8.4	345.1	*	1	1420	87	33.	23.1	350.7	*	1	2220	135	29.	21.3	350.2
1	0630	40	19.	10.3	345.9	*	1	1430	88	33.	23.0	350.7	*	1	2230	136	29.	21.4	350.3
1	0640	41	20.	12.0	346.6	*	1	1440	89	33.	23.0	350.7	*	1	2240	137	29.	21.5	350.3
1	0650	42	21.	13.4	347.2	*	1	1450	90	33.	22.9	350.7	*	1	2250	138	30.	21.7	350.3
1	0700	43	22.	14.6	347.7	*	1	1500	91	33.	22.8	350.7	*	1	2300	139	30.	21.8	350.4
1	0710	44	23.	15.7	348.1	*	1	1510	92	33.	22.8	350.6	*	1	2310	140	30.	21.8	350.4
1	0720	45	23.	16.5	348.5	*	1	1520	93	32.	22.7	350.6	*	1	2320	141	30.	21.9	350.4
1	0730	46	24.	17.2	348.7	*	1	1530	94	32.	22.7	350.6	*	1	2330	142	30.	21.8	350.4
1	0740	47	24.	17.7	348.9	*	1	1540	95	32.	22.7	350.6	*	1	2340	143	30.	21.7	350.4
1	0750	48	24.	18.2	349.1	*	1	1550	96	32.	22.6	350.6	*	1	2350	144	29.	21.5	350.3
						*							*						

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	23.83-HR
+ (CFS)	(HR)					
		(CFS)				
+ 33.	14.33		32.	23.	23.	23.
		(INCHES)	.562	1.571	1.571	1.571
		(AC-FT)	16.	44.	44.	44.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	23.83-HR
+ (AC-FT)	(HR)				
23.	14.33	23.	16.	16.	16.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	23.83-HR
+ (FEET)	(HR)				
350.72	14.33	350.59	347.84	347.84	347.84

CUMULATIVE AREA = .53 SQ MI

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HYDROGRAPH AT STATION DB1
PLAN 1, RATIO = 4.65

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	340.0	1		0800	49	62.	33.7	353.5	1		1600	97	58.	32.2	353.1
1		0010	2	0.	.0	340.0	1		0810	50	63.	34.1	353.6	1		1610	98	57.	32.1	353.1
1		0020	3	0.	.1	340.1	1		0820	51	63.	34.3	353.7	1		1620	99	57.	32.0	353.0
1		0030	4	0.	.2	340.1	1		0830	52	64.	34.4	353.7	1		1630	100	57.	31.8	353.0
1		0040	5	1.	.3	340.2	1		0840	53	63.	34.3	353.6	1		1640	101	56.	31.7	353.0
1		0050	6	1.	.4	340.3	1		0850	54	63.	34.2	353.6	1		1650	102	56.	31.5	352.9
1		0100	7	2.	.6	340.4	1		0900	55	63.	34.1	353.6	1		1700	103	56.	31.4	352.9
1		0110	8	2.	.7	340.5	1		0910	56	62.	34.0	353.6	1		1710	104	55.	31.2	352.8
1		0120	9	2.	.8	340.6	1		0920	57	62.	33.8	353.5	1		1720	105	55.	31.0	352.8
1		0130	10	3.	.9	340.7	1		0930	58	62.	33.6	353.5	1		1730	106	54.	30.7	352.7
1		0140	11	3.	1.1	340.8	1		0940	59	61.	33.4	353.4	1		1740	107	53.	30.3	352.6
1		0150	12	3.	1.2	340.8	1		0950	60	60.	33.2	353.4	1		1750	108	52.	30.0	352.5
1		0200	13	3.	1.3	340.9	1		1000	61	60.	33.0	353.3	1		1800	109	51.	29.6	352.4
1		0210	14	4.	1.4	341.0	1		1010	62	59.	32.8	353.3	1		1810	110	50.	29.3	352.3
1		0220	15	4.	1.5	341.1	1		1020	63	59.	32.7	353.2	1		1820	111	49.	29.0	352.3
1		0230	16	5.	1.8	341.3	1		1030	64	59.	32.7	353.2	1		1830	112	49.	28.7	352.2
1		0240	17	5.	2.0	341.4	1		1040	65	59.	32.8	353.2	1		1840	113	48.	28.5	352.1
1		0250	18	6.	2.3	341.6	1		1050	66	59.	32.8	353.3	1		1850	114	47.	28.3	352.1
1		0300	19	7.	2.5	341.8	1		1100	67	60.	32.9	353.3	1		1900	115	47.	28.1	352.0
1		0310	20	8.	2.8	342.0	1		1110	68	60.	33.0	353.3	1		1910	116	46.	27.9	352.0
1		0320	21	8.	3.1	342.3	1		1120	69	60.	33.1	353.3	1		1920	117	46.	27.8	351.9
1		0330	22	10.	3.5	342.6	1		1130	70	61.	33.3	353.4	1		1930	118	46.	27.6	351.9
1		0340	23	11.	4.0	342.9	1		1140	71	61.	33.5	353.4	1		1940	119	45.	27.5	351.9
1		0350	24	12.	4.4	343.2	1		1150	72	62.	33.7	353.5	1		1950	120	45.	27.3	351.8
1		0400	25	13.	4.9	343.5	1		1200	73	62.	33.9	353.5	1		2000	121	44.	27.2	351.8
1		0410	26	15.	5.3	343.9	1		1210	74	63.	34.1	353.6	1		2010	122	44.	27.1	351.8
1		0420	27	15.	5.8	344.1	1		1220	75	63.	34.2	353.6	1		2020	123	44.	27.0	351.7
1		0430	28	16.	6.3	344.3	1		1230	76	63.	34.2	353.6	1		2030	124	43.	26.8	351.7
1		0440	29	16.	6.8	344.5	1		1240	77	63.	34.1	353.6	1		2040	125	43.	26.6	351.6
1		0450	30	16.	7.3	344.7	1		1250	78	63.	34.1	353.6	1		2050	126	42.	26.5	351.6
1		0500	31	17.	7.9	344.9	1		1300	79	63.	34.1	353.6	1		2100	127	42.	26.3	351.6
1		0510	32	17.	8.4	345.2	1		1310	80	63.	34.0	353.6	1		2110	128	42.	26.2	351.5
1		0520	33	18.	9.1	345.4	1		1320	81	63.	34.0	353.6	1		2120	129	42.	26.3	351.6
1		0530	34	18.	9.7	345.7	1		1330	82	63.	34.0	353.6	1		2130	130	43.	26.6	351.6
1		0540	35	19.	10.4	346.0	1		1340	83	62.	34.0	353.6	1		2140	131	44.	26.9	351.7
1		0550	36	19.	11.0	346.2	1		1350	84	62.	34.0	353.6	1		2150	132	45.	27.3	351.8
1		0600	37	20.	11.8	346.5	1		1400	85	62.	33.9	353.6	1		2200	133	46.	27.7	351.9
1		0610	38	21.	13.2	347.1	1		1410	86	62.	33.9	353.5	1		2210	134	47.	28.1	352.0
1		0620	39	23.	16.3	348.4	1		1420	87	62.	33.8	353.5	1		2220	135	47.	28.3	352.1
1		0630	40	26.	20.1	349.9	1		1430	88	62.	33.7	353.5	1		2230	136	48.	28.6	352.2
1		0640	41	34.	23.2	350.8	1		1440	89	61.	33.5	353.4	1		2240	137	49.	28.7	352.2
1		0650	42	41.	25.8	351.4	1		1450	90	61.	33.3	353.4	1		2250	138	49.	28.9	352.2
1		0700	43	46.	27.9	352.0	1		1500	91	60.	33.0	353.3	1		2300	139	49.	29.0	352.3
1		0710	44	51.	29.7	352.4	1		1510	92	60.	32.9	353.3	1		2310	140	50.	29.1	352.3
1		0720	45	55.	31.0	352.8	1		1520	93	59.	32.7	353.2	1		2320	141	50.	29.1	352.3
1		0730	46	57.	31.9	353.0	1		1530	94	59.	32.5	353.2	1		2330	142	49.	29.0	352.3
1		0740	47	59.	32.6	353.2	1		1540	95	58.	32.4	353.2	1		2340	143	49.	28.8	352.2
1		0750	48	60.	33.2	353.3	1		1550	96	58.	32.3	353.1	1		2350	144	48.	28.6	352.2

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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     23.83-HR
+   (CFS)       (HR)
                          (CFS)
+      64.      8.50                   62.         42.         42.          42.
                        (INCHES)     1.082       2.944       2.944        2.944
                         (AC-FT)       31.         83.         83.          83.

 PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR     23.83-HR
+  (AC-FT)      (HR)
       34.      8.50                   34.         24.         24.          24.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR     23.83-HR
+   (FEET)      (HR)
    353.66      8.50                 353.48      350.08      350.08       350.08

                         CUMULATIVE AREA =     .53 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


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            *            *
   52 KK    *       A2N  *
            *            *
            **************

   55 KO          OUTPUT CONTROL VARIABLES
                        IPRNT           3  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

                SUBBASIN RUNOFF DATA

   54 BA          SUBBASIN CHARACTERISTICS
                        TAREA         .19  SUBBASIN AREA

                  PRECIPITATION DATA

   11 PB                STORM        1.18  BASIN TOTAL PRECIPITATION

   12 PI            INCREMENTAL PRECIPITATION PATTERN
                        .30       .30       .30       .30       .30       .30       .27       .27       .27       .27
                        .27       .27       .64       .64       .64       .64       .64       .64      1.19      1.19
                       1.19      1.19      1.19      1.19      1.06      1.06      1.06      1.06      1.06      1.06
                       1.05      1.05      1.05      1.05      1.05      1.05      8.12      2.55      2.55      2.03
                       2.03      2.03      1.05      1.05      1.05      1.05      1.05      1.05       .57       .57
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                    .57       .57       .57       .57       .48       .48       .48       .48       .48       .48
                    .67       .67       .67       .67       .67       .67       .79       .79       .79       .79
                    .79       .79       .60       .60       .60       .60       .60       .60       .62       .62
                    .62       .62       .62       .62       .44       .44       .44       .44       .44       .44
                    .49       .49       .49       .49       .49       .49       .44       .44       .44       .44
                    .44       .44       .25       .25       .25       .25       .25       .25       .32       .32
                    .32       .32       .32       .32       .35       .35       .35       .35       .35       .35
                    .30       .30       .30       .30       .30       .30       .72       .72       .72       .72
                    .72       .72       .57       .57       .57       .57       .57       .57       .30       .30
                    .30       .30       .30

  56 LS          SCS LOSS RATE
                      STRTL         .70  INITIAL ABSTRACTION
                     CRVNBR       81.00  CURVE NUMBER
                      RTIMP       41.00  PERCENT IMPERVIOUS AREA

  57 UD          SCS DIMENSIONLESS UNITGRAPH
                       TLAG         .12  LAG

                                                                  ***

                                                          UNIT HYDROGRAPH
                                                       6 END-OF-PERIOD ORDINATES
               421.      233.       61.       16.        4.        0.

    TOTAL RAINFALL =    1.18, TOTAL LOSS =     .65, TOTAL EXCESS =     .53

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.83-HR
+   (CFS)       (HR)
                          (CFS)
+      18.      6.17                   5.          3.          3.           3.
                       (INCHES)      .238        .530        .530         .530
                        (AC-FT)        2.          5.          5.           5.

                        CUMULATIVE AREA =     .19 SQ MI


      ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION      A2N
                           FOR PLAN 1, RATIO = 3.12

    TOTAL RAINFALL =    3.68, TOTAL LOSS =    1.19, TOTAL EXCESS =    2.49

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.83-HR
+   (CFS)       (HR)
                          (CFS)
+      80.      6.17                  21.         13.         13.          13.
                       (INCHES)     1.052       2.484       2.484        2.484
                        (AC-FT)       11.         25.         25.          25.

                        CUMULATIVE AREA =     .19 SQ MI
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                         HYDROGRAPH AT STATION      A2N
                           FOR PLAN 1, RATIO = 4.65

     TOTAL RAINFALL =    5.49, TOTAL LOSS =    1.34, TOTAL EXCESS =    4.15

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR     23.83-HR
+   (CFS)       (HR)
                          (CFS)
+     146.      6.17                  37.         21.         21.          21.
                       (INCHES)     1.806       4.129       4.129        4.129
                        (AC-FT)       18.         42.         42.          42.

                        CUMULATIVE AREA =     .19 SQ MI


 *** HEC-1 ERROR 1 *** INVALID CARD IDENTIFICATION CODE OR CARD OUT OF SEQUENCE
      CARD NO.  144     *         2SAN FRANSCISCO
1

                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                  FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                 TIME TO PEAK IN HOURS


                                                          RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                       3.12     4.65

 HYDROGRAPH AT
+                    A1       .53     1   FLOW         165.     312.
                                          TIME         6.33     6.33

 ROUTED TO
+                   DB1       .53     1   FLOW          33.      64.
                                          TIME        14.33     8.50

                                      ** PEAK STAGES IN FEET **
                                      1   STAGE      350.72   353.66
                                          TIME        14.33     8.50

 HYDROGRAPH AT
+                   A2N       .19     1   FLOW          80.     146.
                                          TIME         6.17     6.17

  2 COMBINED AT
+                2N-A1C       .72     1   FLOW          96.     167.
                                          TIME         6.17     6.17

 HYDROGRAPH AT
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+                    A2S       .48     1   FLOW         119.     274.
                                             TIME         6.17     6.17

  2 COMBINED AT
+                 2S-2NC      1.20     1   FLOW         215.     440.
                                             TIME         6.17     6.17

 HYDROGRAPH AT
+                    A3N       .15     1   FLOW          43.      64.
                                             TIME         6.17     6.17

  2 COMBINED AT
+                 3N-2SC      1.35     1   FLOW         258.     504.
                                             TIME         6.17     6.17

 HYDROGRAPH AT
+                    A3S       .54     1   FLOW         155.     309.
                                             TIME         6.33     6.33

  2 COMBINED AT
+                  3S-3N      1.89     1   FLOW         405.     802.
                                             TIME         6.17     6.17

 HYDROGRAPH AT
+                    A4N       .59     1   FLOW         215.     388.
                                             TIME         6.33     6.33

  2 COMBINED AT
+                  4N-3S      2.48     1   FLOW         600.    1134.
                                             TIME         6.33     6.33

 HYDROGRAPH AT
+                    A4S       .13     1   FLOW          42.      80.
                                             TIME         6.33     6.33

  2 COMBINED AT
+                  4S-4N      2.61     1   FLOW         642.    1214.
                                             TIME         6.33     6.33

 HYDROGRAPH AT
+                     A5       .14     1   FLOW          42.      81.
                                             TIME         6.33     6.33

  2 COMBINED AT
+                  5-4SC      2.75     1   FLOW         684.    1294.
                                             TIME         6.33     6.33

 HYDROGRAPH AT
+                     A6       .15     1   FLOW          54.      96.
                                             TIME         6.33     6.33

  2 COMBINED AT
+                    6-5      2.90     1   FLOW         737.    1390.
                                             TIME         6.33     6.33
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 HYDROGRAPH AT
+                    A7       .22     1   FLOW          92.     161.
                                          TIME        6.17     6.17

  2 COMBINED AT
+                   7-6      3.12     1   FLOW         814.    1524.
                                          TIME        6.33     6.33

 HYDROGRAPH AT
+                    A8       .02     1   FLOW          10.      17.
                                          TIME        6.17     6.17

  2 COMBINED AT
+                   8-7      3.14     1   FLOW         820.    1534.
                                          TIME        6.33     6.33

 HYDROGRAPH AT
+                    A9       .06     1   FLOW           6.      10.
                                          TIME       10.83    10.83

  2 COMBINED AT
+                  9-8C      3.20     1   FLOW         822.    1537.
                                          TIME        6.33     6.33


 ***    1 ERROR(S) DETECTED BY HEC-1 ***
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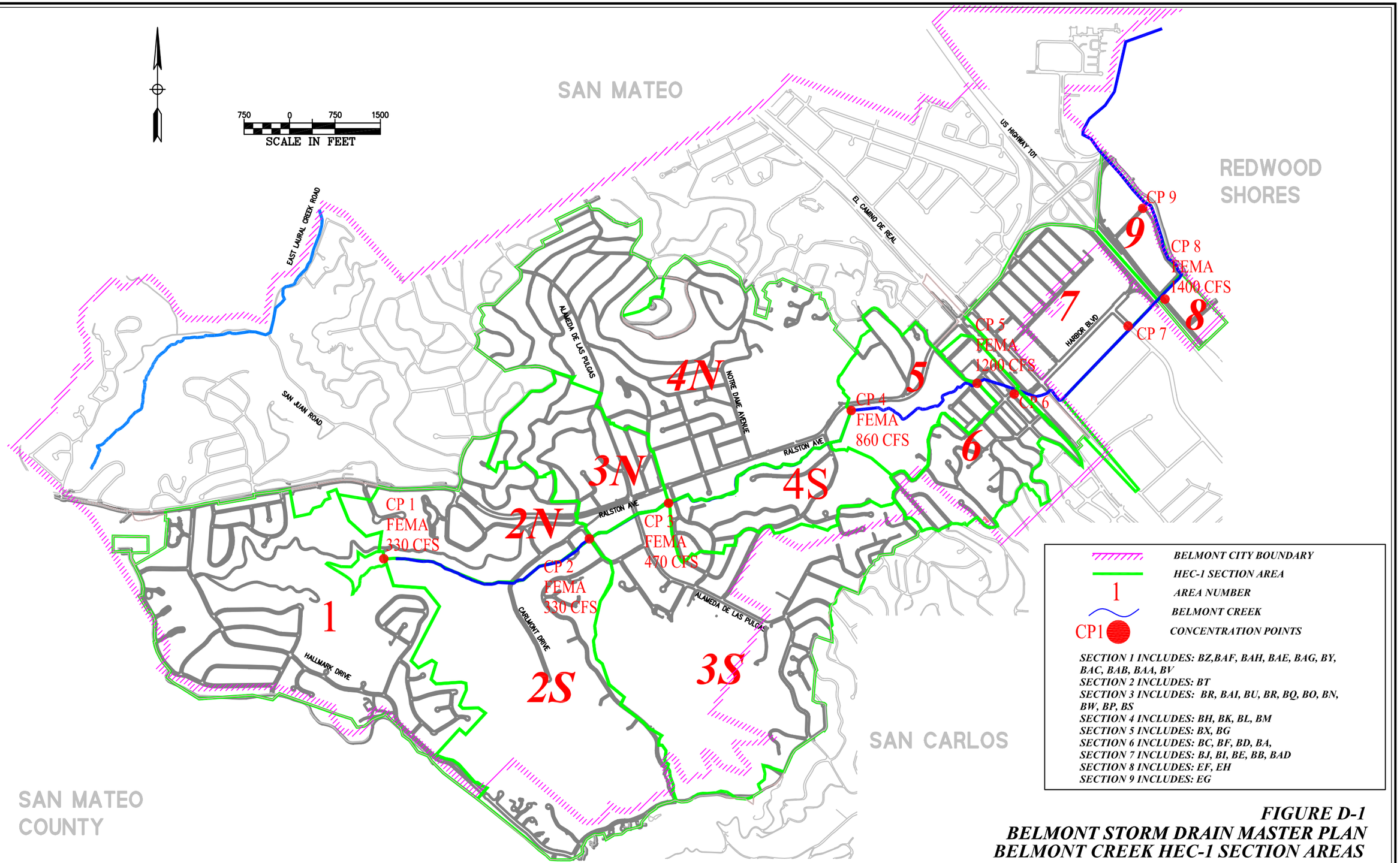

FIGURE D-1
BELMONT STORM DRAIN MASTER PLAN
BELMONT CREEK HEC-1 SECTION AREAS

BKF

APPENDIX E

Basis of Calculations

This Appendix includes the following for the Methodology and Design Criteria used in this report:

- Storm Drain Design Standards

Part 1 – General

- **1.01 Work Included**
- **1.02 Applicable Publications**
- **1.03 Quality Assurance**
- **1.04 Job Conditions**

Part 2 – Products

- **2.01 Reinforced Concrete Pipeline**
- **2.02 High Density Poly Ethylene Pipe**
- **2.03 Poly Vinyl Chloride Pipe**
- **2.04 PVC Underdrains**
- **2.05 Storm Drain Manholes**
- **2.06 Concrete Curb Inlets**
- **2.07 Cast-In-Place Drainage Structures**
- **2.08 Pipe Bedding and Cover Material**

Part 3 – Execution

- **3.01 Trenching, Backfilling and Shoring**
- **3.02 Pipe Installation**
- **3.03 Connections**
- **3.04 Structures**
- **3.05 Storm Drain Plugs and Cleaning**
- **3.06 Underdrains**

- Storm Drain Design Standards

A. Plans Required

B. Hydrologic Criteria

C. Size Criteria

D. Alignment

E. Materials

F. Storm Drain Design Serving Private Streets and Developments

G. On-Site Detention of Storm Water Runoff

H. NPDES Permit Requirements

- Master Plan Design Standards

A. Model Inputs

1. Existing Systems Level of Protection

2. Proposed Systems Level of Protection

3. Drainage Areas

4. Junction Losses

B. Design References

In addition it also contains:

1. Precipitation Intensity Duration Frequency Equation

   Tables E1A, E1B, E2 presents data used for the intensity-duration-frequency equation. Table E1a is the precipitation values for the San Francisco Bay Area modified for the City of Belmont, 10-year event, with a Mean Annual Precipitation (MAP) of 18 inches. Table E1b is the precipitation values for the San Francisco Bay Area modified for the City of Belmont, 25-year event, with a MAP of 18 inches. Table E2 is the adjustment in intensity with respect to different MAPs.

2. Flow in Street

   The flow capacity in the street is approximated using the analyses presented in Table E3. Analyses are based on Manning's Equation for the range of slope of the street. Calculations are presented for a depth at the gutter flow line of 6 inches and for a gutter spread width of 12 feet. Calculations are based on a 50-foot wide

street with a 2 percent crown. Calculations are used to assess the priority of improvements and should not be used for design purposes.

3. Runoff Coefficients

Figure E1 below presents the City Land Zoning used to calculate runoff coefficients used in the analyses. Runoff Coefficients for the City of Belmont are presented below under Storm Drain Standards, Section B - Hydrologic Criteria, sub- section 4. Runoff Coefficients are for build out conditions for each zone.

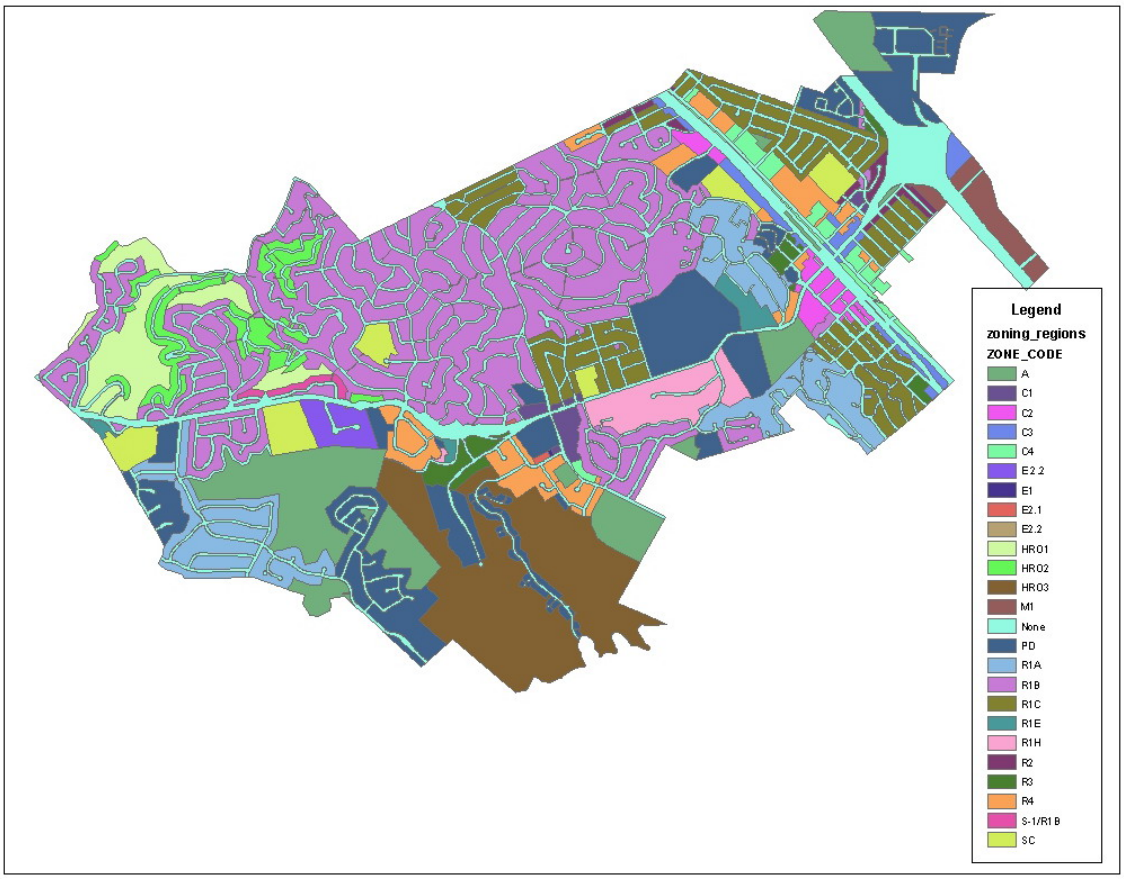

Figure E1

STANDARD SPECIFICATIONS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Trenching and other excavation.
B. Ground water control.
C. Pipe bedding.
D. Installation of storm drains and appurtenances.
E. Installation of under-drains and appurtenances.
F. Backfill and compaction of backfill.
G. Dust alleviation and control.
H. Cleanup and restoration of surface in improved areas.
I. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.02 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text only by the general designation.

B. American Society for Testing and Materials (ASTM) Publications:

A – 34	Structural Steel.
A – 48	Gray Iron Castings.
A – 123	Zinc Coatings, Rolled, Pressed Forged Mat.
A – 38 6	Zinc Coating (Hot-Dip) on Assembled Steel Products.
C – 76	Reinforced Concrete Culvert.
C – 443	Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
C – 478	Precast Reinforced Concrete Manhole Sections.
C – 497	Method of Testing Concrete Pipe, Sections, or Tile.
D – 1784	Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride Compounds
D – 1785	Pipe, Poly Vinyl Chloride (PVC) Schedules 40, 80 and 120.
D – 2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
D – 3034	PVC Sewer Pipe and Fittings
F – 477	Elastomeric Seals (Gaskets) for joining Plastic Pipe.
F – 679	Standard Specifications for Poly Vinyl Chloride large Diameter Plastic gravity sewer pipe and fittings

1.03 QUALITY ASSURANCE

A. Submit manufacturer's data on pipe, drainage structure and castings to be used.

B. The Engineer may require manufacturer's or supplier's certificates showing conformance with this specification to be delivered with each shipment of material delivered to the job site.

C. D-Load or class of pipe requirements shown or called for on the plans shall be the minimum acceptable.

D. All pipes shall bear the manufacturer's label for the type, specification, and classification of the pipe.

E. All storm drains shall be subject to passing a ball test.

1.04 JOB CONDITIONS

A. Note and conform to conditions and requirements indicated and specified under Section 02202 of the Specifications.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipe shall be bell and spigot-type pipe, conforming to the requirements of ASTM Designation C76 except that all pipe shall have been manufactured using Portland Cement Concrete conforming to the requirements of Section 02550 of these Specifications.

B. Pipe strength requirements shall be designated in terms of D-load as shown or called for on the plans. D-load as used herein is defined as the maximum load the pipe will sustain per foot of length per foot of internal diameter under the standard three-edge bearing test without the appearance of any crack one one hundredth (0.01) inch in width exceeding twelve (12) inches in length when tested in accordance with the procedure set forth in ASTM Designation C497.

C. Pipe wall thickness and bell and spigot mating surfaces shall be the same for each size and class or D-load of pipe delivered to the job site. The concrete cover over any reinforcement shall not be less than 1” for 12” RCP and 1-1/2” for 18” RCP.

D. Pipe shall be cured by water curing, steam curing, or a combination of both as required to produce the D-load strengths shown, noted or called for on the plans.

E. All reinforced concrete pipe shall have rubber gasket joints that are self-centering and so designed that after the joint is made up, the rubber gasket shall not be required to support the weight of the pipe. Spigot grooves shall be provided in all joints, and the joint and gasket shall conform to the requirements of ASTM Designation C443. All joints shall be watertight.

F. Pipe lengths shall not exceed twelve (12) feet for all pipe except that short lengths of pipe (two (2) feet nominal) shall be furnished and installed at all connections to structures and appurtenances.

G. Each section of pipe shall be clearly and legibly marked with waterproof paint to show the date of manufacture, the D-load classification of the pipe, and the type of cement used in the manufacture of the pipe.

2.02 HIGH DENSITY POLY ETHYLENE PIPE

A. This work shall consist of furnishing and installing corrugated or ribbed plastic pipe for culverts, drains and conduits, with all necessary fittings and coupling systems, as shown on the plans or as directed by the Engineer and as specified in these specifications and the special provisions. Plastic pipe shall be either Type C, Type D or Type S corrugated polyethylene pipe, ribbed profile wall polyethylene pipe, or ribbed polyvinyl chloride drain pipe. Where designated on the plans as corrugated interior wall type, plastic pipe shall be Type C corrugated polyethylene pipe. Where designated on the plans as smooth interior wall type, plastic pipe shall be, at the option of the Contractor, either Type D or Type S corrugated polyethylene pipe, ribbed profile wall polyethylene pipe or ribbed polyvinyl chloride drain pipe. Where the type of plastic pipe is not designated on the plans, plastic pipe shall be smooth interior wall.

B. Type C, Type D and Type S corrugated polyethylene pipe shall conform to the requirements in AASHTO Designation: M 294, except as otherwise specified. Corrugated polyethylene pipe shall be manufactured from high density polyethylene (HDPE) virgin compounds.

Ribbed profile wall polyethylene pipe shall be manufactured from high density polyethylene (HDPE) virgin compounds and shall conform to the requirements in ASTM Designation: F 894, except as otherwise specified in these specifications. Ribbed polyvinyl chloride drain pipe shall be manufactured from polyvinyl chloride (PVC) virgin compounds and shall conform to the requirements in AASHTO Designation: M 304, except as otherwise specified in these specifications.

PVC compounds used in the manufacture of plastic pipe culverts shall conform to the following Cell Classifications specified in ASTM Designation: D 1784:

Property	Cell Classification
Base resin	1
Impact strength (Izod)	2 through 6
Tensile strength	3 or 4
Modulus of elasticity	5 or 6
Deflection temperature	4 or 5
Chemical resistance	A, B or C

HDPE compounds used in the manufacture of plastic pipe culverts shall conform to the following Cell Classifications specified in ASTM Designation: D 3350:

Property	Cell Classification
Density	3
Melt index	2[a], 3 or 4
Flexural modulus	4, 5 or 6
Tensile strength	4, 5 or 6
Environmental stress crack resistance	1, 2 or 3
Hydrostatic design basis	0, 1, 2, 3 or 4
Ultraviolet stabilizer	C[b]

a The Melt Index for Cell Classification 2 material used to manufacture pipe shall not be greater than 0.6. Rotationally molded couplings and end fittings may be produced from material compounds having a Melt Index Cell classification of 1.

b HDPE resin shall contain not less than 2 ±0.5 percent carbon black ultraviolet stabilizer.

The residue from ignition of the HDPE and PVC compounds shall not exceed 30 percent as determined by ASTM Designation: D 2584, except that the muffle furnace temperature shall be

450 ±25°C. A Certificate of Compliance shall be furnished to the Engineer for each type of plastic pipe furnished. The certificate shall also certify that the plastic pipe complies with the requirements of the specifications, and shall include the resin material Cell Classification, unit mass of pipe, average pipe stiffness and date of manufacture.

C. Wall thickness of Type C corrugated polyethylene pipe shall be measured at the inside valley of the corrugation. Wall thickness of Type D corrugated polyethylene pipe shall be measured as the thickness of the inner liner. Wall thickness of Type S corrugated polyethylene pipe shall be the thickness of the inner liner measured between corrugation valleys. Wall thickness of ribbed profile wall polyethylene pipe shall be measured in the gap between ribs. The wall thickness of the various types of polyethylene pipe, measured as specified above, shall equal or exceed the minimum wall thickness values in Table 1. The wall thickness of ribbed profile wall PVC pipe measured in the gap between ribs shall equal or exceed the minimum wall thickness values in Table 3. The pipe stiffness shall be determined in conformance with the requirements in ASTM Designation: D 2412 at 5 percent deflection. Average pipe stiffness shall be determined for each manufactured run from 3 test specimens. The length of each test specimen shall equal the nominal pipe diameter, except that the specimen length shall not exceed 36 inches for pipe larger than 36 inches in nominal diameter. The average pipe stiffness shall equal or exceed the minimum pipe stiffness value for each individual kind and size of plastic pipe listed in Tables 1 and 3. The pipe unit weight shall be computed as the average weight per foot of length determined from 3 test specimens, taken from each manufactured run. Each test specimen for pipes 24 inches in diameter and less shall be a minimum length of 2 diameters. The length of each test specimen for pipes larger than 24 inches in diameter shall be one diameter or a maximum of 36 inches, whichever is less. The weight of pipe specimens shall be determined with any suitable weighing device accurate to 0.1 pounds. The pipe unit weight for each individual kind and size of plastic pipe shall equal or exceed the minimum unit weight value for each individual kind and size of plastic pipe listed in Tables 2 and 3.

TABLE 1
HDPE Pipe

Nominal Diameter (inches)	Minimum Wall Thickness (inches)	Minimum Pipe Stiffness (psi)
12	0.035	50
15	0.040	42
18	0.051	40
21	0.059	38
24	0.059	34
27	0.059	31
30	0.059	28
33	0.059	25
36	0.067	22
42	0.071	20
48	0.071	18

TABLE 2
HDPE Pipe

Nominal Diameter (inches)	Minimum Unit Weight			
	Type C Corrugated (pounds per foot)	Type D Corrugated (pounds per foot)	Type S Corrugated (pounds per foot)	Ribbed (pounds per foot)
12	2.8	na	2.7	na
15	4.0	na	4.0	na
18	5.8	na	6.0	9.6
21	Na	na	na	13.1
24	9.6	na	10.2	17.6
27	na	na	na	na
30	na	na	15.0	na
33	na	na	na	na
36	na	na	18.0	na
42	na	22.1	22.1	na
48	na	31.9	26.9	na

Note: "na" in the above table indicates that the pipe size of that type of pipe either is not available from manufacturers or has not been approved for use.

TABLE 3
Ribbed PVC Pipe

Nominal Diameter (inches)	Minimum Wall Thickness (inches)	Minimum Pipe Stiffness (psi)	Minimum Pipe Unit Weight (pounds per foot)
18	0.094	32	8.0
21	0.105	28	11.0
24	0.115	24	12.9
27	0.125	22	17.0
30	0.135	19	20.0
36	0.155	16	27.0
42	0.170	13.8	38.0
48	0.190	11.6	51.9

Plastic pipe culvert joints shall conform to either standard or positive joint provisions in Section 61-1.02, "Performance Requirements for Culvert and Drainage Pipe Joints," of the Caltrans Specifications except that where sleeve joint connections are utilized, the sleeve minimum width shall be 7.6 inches, and at least 2 corrugations from each pipe to be joined are engaged by the sleeve.

Where watertight joints are not specified, Type S corrugated polyethylene pipe shall incorporate, on each side of the joint, a closed-cell expanded rubber gasket conforming to the requirements in ASTM Designation: D 1056, Grade 2A2. Type D corrugated polyethylene pipe shall incorporate a rubber gasket in a groove on the spigot end of the pipe. The gasket for Type D polyethylene pipe shall conform to the requirements in ASTM Designation: F 477 or D 1056, Grade 2A2. The gaskets described in this paragraph shall be installed by the pipe manufacturer. Pipe shall be stored in a manner that protects the gaskets from weather. Cracks or splits occurring on gaskets will be cause for rejection.

Corrugated polyethylene pipe joints manufactured to conform to the integral joint provisions in Section 61-1.02, "Performance Requirements for Culvert and Drainage Pipe Joints," of the Caltrans Specifications shall be laid to line and grade with the sections jointed closely. Corrugated polyethylene pipe to be joined by sleeve joints shall be laid to line and grade with the

separate sections not more than 1.5 inches apart and then joined together firmly with at least 2 corrugations from each pipe section engaged in the coupler.

Joints for pipe designated on the plans as watertight, shall be watertight under pressure and all conditions of expansion, contraction and settlement, and shall conform to the provisions for watertightness in Section 61-1.02, "Performance Requirements for Culvert and Drainage Pipe Joints," of the Caltrans Specifications.

2.03 POLY VINYL CHLORIDE PIPE

A. PVC pipe shall conform to the requirements of ASTM 3034 or ASTM F-679 and shall have a DR rating of 26. All pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 13364-B as defined in ASTM D-1784. Pipe barrel shall have the words "STORM DRAIN" marked along the longitudinal axis of the outside in 1-5/8" high block letters with permanent ink. The words shall be repeated at 2-foot spacing along the pipe length.

B. The Contractor may substitute pressure-sensitive tape in lieu of stenciling. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.

C. Couplings and fittings for use with PVC non-pressure pipe shall be of the same materials and in compliance with the requirements specified for the pipe. Couplings and fittings shall be equipped with rubber rings which fit into individual grooves formed in the inner wall to the requirement of ASTM Designation F-477.

2.04 PVC UNDERDRAINS

A. PVC underdrains shall consist of four (4) inch Schedule 40 perforated Poly Vinyl chloride (PVC) pipe conforming to the requirements of ASTM Designation D1785. B. Joints and fittings for PVC underdrains shall conform to the requirements of ASTM Designation D1785.

B. Solvent cement for joining PVC underdrain pipe, couplings and fittings shall conform to the requirements of ASTM Designation D2564.

C. Permeable material bedding and cover for subsurface drains shall be as specified in Section 02202 of these Specifications.

D. Filter Fabric for underdrains shall conform to Section 88 of the Standard Specifications.

2.05 STORM DRAIN MANHOLES

A. Barrel and cone sections for storm drain manholes shall be precast reinforced concrete of the form and dimensions shown and detailed on the plans and shall conform to the requirements of

ASTM Designation C478. Concrete used for manhole barrel and cone sections shall conform to the requirements of Section 02550 of these Specifications.

B. Frames and covers for manholes shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. Each cover shall have cast into it the raised letters "STORM DRAIN". All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.

C. No steps shall be provided at manholes.

D. Concrete for manhole bases shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.

E. Reinforcement for manhole bases shall be deformed steel bars conforming to Section 02550 of these Specifications. Size and shape of reinforcement shall conform to the details shown on the plans.

F. Mortar for precast manhole section joints shall consist of one (1) part Portland Cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve.

G. Concrete for manhole frame anchor slabs shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.

2.06 CONCRETE CURB INLETS

A. Concrete curb inlets for storm drains shall be cast in place, reinforced concrete of the form and dimensions shown and detailed on the plans.

B. Insert form for the curb inlet and other parts shall be as manufactured by Central Products, or approved equal. Concrete used in the construction of concrete curb inlets shall conform to the requirements for Class "A" concrete set forth in Section 02550 of these Specifications. Forming, placing and finishing shall conform to Section 02550 of these Specifications.

C. Reinforcement used in the construction of precast curb inlets shall be deformed steel bars conforming to Section 02550 of these Specifications.

D. Miscellaneous steel shapes used in construction of concrete curb inlets shall be structural quality carbon steel conforming to the requirements of ASTM.

E. Designation A36 and shall be hot-dip galvanized after fabrication in conformance with the requirements of ASTM Designation A123.

F. Steps for curb inlets, where required, shall be polypropylene to the form and dimensions shown and detailed on the plans.

2.07 CAST-IN-PLACE DRAINAGE STRUCTURES

A. All concrete structures are to be cast in place except where specifically noted on the plans and specifications.

B. Concrete for cast-in-place drainage structures shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.

C. Forming, placing and finishing concrete, and reinforcement for cast-in-place drainage structures shall conform to Section 02550.

D. Steel for frames and grates or covers for cast-in-place drainage structures shall be structural steel conforming to the requirements of ASTM Designation A36. Frames and grates or covers shall be fabricated to the form and dimensions shown and detailed on the plans and shall be hot-dip galvanized after complete fabrication in conformance with the requirements of ASTM Designation A386. Frames and grates or covers shall be match marked in sets which have been so constructed as to provide a firm and continuous seat.

E. Welding for frames and grates shall conform to the requirements of the American Welding Society for Arc and Gas Welding in Building Construction.

2.08 PIPE BEDDING AND COVER MATERIAL

A. Shall be as specified in Section 02202 of these Specifications.

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILLING AND SHORING

A. Shall conform to Section 02202 of these Specifications.

3.02 PIPE INSTALLATION

A. Installation: Storm drain pipe, underdrains and appurtenances shall be installed in accordance with the best practice, and in conformance with the plans and these Specifications.

B. Handling: Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting and placing; no chains or hooks will be permitted. Broken or damaged pipe including chipped bells of spigots, will be rejected, and shall be removed from the work site.

C. Alignment: All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the Engineer. Each length shall be joined to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.

D. Pipe Deflections: The laying of pipe on curved alignment will be permitted only when necessary to conform with the alignment shown or called for on the plans. Joint deflections called for on the plans shall be permitted up to one half of the deflection recommended by the pipe manufacturer.

E. Cleaning**:** Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be closed with plugs in a satisfactory manner to the Engineer.

F. Bearing**:** Pipe in the trench shall have continuous uniform bearing along its bottom, except all bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.

G. Positioning: After the final positioning, pipe shall be held in place in the trench with cover materials placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. Position plastic pipe with "STORM DRAIN" markings facing up. After joints are completed, the cover material shall be redistributed and compacted as herein required.

H. Closure: At the end of each day and when work is not in progress, the open ends of pipe installed in the line shall be closed with plugs and openings for appurtenances shall be suitably covered.

3.03 CONNECTIONS

A. Unless separately listed on the bid schedule, make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.

B. All connections to manholes shall be constructed with concrete channels directed toward outlet pipe as shown and detailed on the plans.

C. Break-out holes in manholes for connecting new pipe shall be grouted all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole. Use PVC manhole adapters in break-out holes in manholes for connecting new PVC pipe and grout all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole.

D. A 2-foot nominal length of pipe shall be used when entering and leaving all manholes and structures.

3.04 STRUCTURES

A. Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings.

B. Structures shall be constructed and/or installed in conformance with the applicable requirements of Section 51 of the State Standard Specifications. Unless otherwise noted on the plans or detail drawings, all exposed surfaces of poured in place structures and appurtenances shall have a Class 1 surface finish.

C. Frames for manholes and tops of catch basins, inlets and other structures in paved areas shall be accurately placed flush with and in the plane of the finish pavement. All manhole frames in paved area shall be secured by means of concrete anchor slabs as shown and detailed on the plans and detail drawings.

D. All joints and pipe openings on manhole sections, risers, and grade adjustment rings shall be grouted smooth and flush with the interior of the structure in a workmanlike manner.

3.05 STORM DRAIN PLUGS & CLEANING

A. Where called for on the plans or directed, plugs shall be placed in open ends of storm drains. Plugs shall consist of a brick and mortar wall not less than eight (8) inches in thickness constructed in such a manner as to ensure a watertight seal.
Mortar for plugs shall conform to the requirements of paragraph 2.04F hereof.

B. Storm drain pipe and structures shall be cleaned of all dirt, debris, and form work.

C. Pipes shall be balled with an approved rubber ball to insure cleanliness prior to acceptance.

3.06 UNDERDRAINS

A. Trenches for underdrains shall be excavated in the location shown.

B. Place filter fabric in the trench to protect the permeable material and pipe prior to backfilling.

C. The pipe installed and the trench backfilled with permeable material according to the dimensions and details shown on the plans.

D. Perforated pipe, fabric, and permeable material shall be installed in accordance with Section 68-1.03 of the Standard Specifications.

STORM DRAIN DESIGN STANDARDS

1. A Drainage Area Master Plan, Storm Water Management Plan and Storm Water Pollution Prevention Plan are to be submitted with all subdivision improvement plans, permit improvement plans for storm drains, street improvements and with all grading plans.

2. Drainage Area Master Plans shall include the following information:

   a. For the on-site drainage, a scaled Engineering topographic map shall be used. A second map of appropriate scale, preferably 1"= 100' scale, used to show large offsite drainage basins.

   b. Delineated and labeled project site plan showing all existing drainage basins, both before and after development.

   c. The area in acres and the flow (Q) in cubic feet per second (CFS) of all drainage entering and leaving the site prior to development, as well as after development for the design storm event with associated calculations.

   d. Drainage area and peak rate flows for all the drainage facilities for the design storm and 100-year storm. Hydrologic computations shall be provided that document flow rates.

   e. Hydraulic computations for channel, structure and pipe sizing shall be provided. Hydraulic gradients (for proposed structures or systems) shall be shown on a set of drainage plans.

   f. A soils report or additional soils information may be required at the discretion of the Director of Public Works.

3. Storm Water Management Plans shall include the following information:

   a. A project description including graphics from the Drainage Area Master Plan.

   b. The hydrologic setting of the site including flows from the Drainage Area Master Plan.

   c. A listing of stormwater quality opportunities and constraints.

   d. Best Management Practices for Source Control that would be implemented as a part of the project. A checklist shall be provided showing City mandated source control measures. A description of supplemental source control measures shall be provided.

   e. Best Management Practices for Treatment of site runoff that would be implemented as a part of the project. Calculations shall be included that document compliance with Regional Water Quality Control Board C.3 Permit with San Mateo County.

f. A Monitoring and Maintenance Program shall be provided that includes an agreement stating that the property owner will maintain the Source Control and Treatment measures.

g. Hydromodification Management Measures for detention of site runoff that would be implemented as a part of the project (where required). Calculations shall be included that document compliance with Regional Water Quality Control Board C.3 Permit with San Mateo County.

4. Storm Water Pollution Prevention Plans shall be provided prior to start of construction that includes the following information:

   a. A project description including graphics from the Drainage Area Master Plan.

   b. The hydrologic setting of the site including flows from the Drainage Area Master Plan.

   c. A listing of pollutants at the site during construction.

   d. Best Management Practices for Source Control that would be implemented during construction.

   e. Best Management Practices for Treatment of site runoff that would be implemented as a part of the project. Calculations shall be included that document compliance with Regional Water Quality Control Board C.3 Permit with San Mateo County.

   f. A schedule stating dates or actions that trigger the need for source control and treatment measures.

   g. A Monitoring and Maintenance Program shall be provided that includes an agreement stating that the property owner will maintain the Source Control and Treatment measures.

   h. The Notice of Intent and WDID Number for the project.

B. HYDROLOGIC CRITIERIA

1. All drainage improvements discharging to City systems shall be designed to convey the peak design flows for the following storm return periods for the total tributary basin area with full build-out based on general plan land use.

a.) Drainage Systems	25-year event with at least 0.75 feet freeboard at lip of inlets.
b.) Bridge Structures	100-year event or largest flood of record, whichever is greater with of 1 foot freeboard to highest elevation on bottom of structure.
c.) Creeks and Channels Needing FEMA Flood	100-year event with two feet freeboard to lowest adjacent grade and minimum

Insurance Maps finished floor elevations.

In addition, every development or project shall provide at least 1 foot freeboard to the lowest grade adjacent to the structure and the minimum finished floor of each building during a 100-year flood based on a combination of overland flow and flow through the storm drain system. The Director of Public Works may allow the minimum finished floor elevation to be lower provided flood proofing is included that accommodates water levels up to one foot above the 100-year water level.

The level of protection may be required to be greater than the minimum cited above if, in the opinion of the Director of Public Works, project failure would cause potentia1 loss of life and/or unreasonable economic loss.

2 Maintain existing predevelopment run-off rates. This will minimize the impact to downstream drainage systems, eliminating scour and erosion. Stormwater detention may be used to achieve pre-development levels.

3. Hydraulic calculations shall accompany the plans as follows:

a. The project shall make provisions for storage and release of stormwater at a rate which will not exceed previously existing conditions release for the design storm event, in a publicly maintained street or storm drain.

b. The amount of post development storage can be determined using the Synthetic Unit Hydrograph or other means satisfactory to the City Engineer. (Use of the Redwood City Attachment "O" is acceptable).

c. Use of the Rational Method may be satisfactory for small drainage areas (< 200 acres); larger areas shall use the hydrologic model developed for this Master Plan. See section 8 below.

4. For areas less than 200 acres, to determine peak-flow, use rational formula Q=CIA. The rainfall intensity shall be calculated using the following equations:

$$I_{10\text{-year}} = 6.18 * K_2 / \text{Time of Concentration}^{0.50}$$

$$I_{25\text{-year}} = 7.39 * K_2 / \text{Time of Concentration}^{0.50}$$

$$I_{100\text{-year}} = 9.61 * K_2 / \text{Time of Concentration}^{0.51}$$

Where K_2 is the correction factor for City of Belmont, which varies with Mean Annual Precipitation (MAP). K_2, percent increase is presented in Table E2.

Runoff coefficients shall be as follows:

"C" Factor (10-Year Event)	Description
0.30	Parks and Open Areas
0.50	Residential (R-1) Areas
0.70	Multiple Dwelling and Single-Family Attached Areas

0.80	Industrial
0.90	Paved Areas
0.95	Roof Area

The 10-year Runoff Coefficients shall be multiplied by 1.1 for the 25-year event and by 1.25 for the 100-year event. The maximum runoff coefficient is 1.0.

(For combined paved and unpaved areas, a "weighted" C-factor shall be used, with a maximum C-coefficient of 1.0 used in the weighting equation.)

5. An initial time of concentration at the first catch point or concentration point of 5 minutes shall be used for steep (greater than 4:1 slope) and/or small (less than 100 feet to inlet) drainage areas and 10 minutes otherwise. The time of concentration shall be increased using the calculated flow time in pipe or drainage swale. For large drainage areas, the initial time of concentration is estimated from the equation below:

$$T_c = 10 + 0.0078 \left(\frac{L^{3/2}}{H^{1/2}} \right)^{0.77}$$

where: L = the maximum length of travel, in feet.
H = the difference in elevation along the effective slope line, in feet.
Tc = the time of concentration, in minutes.

6. The effect of debris, erosion, and channel bedload during flood flows shall be considered in the design of culverts and bridge structures.

7. Starting Water Level – Downstream Conditions
   a. Discharge to a Creek – Where practical, the systems are analyzed using the peak 25-year water levels for Belmont Creek and Laurel Creek. In some areas, the 25-year water level in the Creek is above top of bank or adjacent ground levels. In these areas, a water level at the top of the channel bank is used. The overland release from a project site shall be evaluated for the 100-year event water level in the Creek.

   b. Discharge to a Storm Drainage System – The drainage system shall be evaluated using the lower of the 25-year water level in the downstream system or 1 foot below the rim elevation at the connection point. The overland release from a project site shall be evaluated for the 100-year event

water level based on the expected water level in the street. Downstream system is either San Francisco Bay, or a city storm drain system not served by the City of Belmont.

c. The starting water level for the Island Park Lagoon is elevation 103.5. During normal dry weather conditions, the peak Lagoon water level is elevation 102.8. For a 400-year event (high tide and 100-year event), the water level is 104.5.

8. The Hydrograph Method

The hydrograph method is generally used when analyzing larger watersheds where the Rational Method should not be applied. The hydrograph method allows the user to account for hydrologic losses, including evaporation, transpiration, infiltration, surface routing, storage within the watershed, and varying antecedent moisture conditions. In addition, the hydrograph method allows for the analysis of complex drainage facilities, including diversions and detention ponds. In practice, this method allows for the development of a flood hydrograph using a design storm, an appropriate infiltration or loss rate technique, and a synthetic unit hydrograph. The basic process of the hydrograph method includes:

- Simulating rainfall from a specified storm event
- Simulating rainfall losses due to interception and infiltration
- Simulating the overland flow into creeks, channels, or pipes to provide a runoff hydrograph at concentrated points
- Routing the hydrograph through creeks, channels, or pipes
- Routing the hydrograph through detention basins or reservoirs

Detailed explanation of the hydrograph method can be found in the *Handbook of Applied Hydrology* by V. T. Chow,[1] *Hydrology for Engineers* by Linsley, Kohler, and Paulhus,[2] the ASCE Manual and Report on Engineering Practice No. 28, *Hydrology Handbook*,[3] and other appropriate references.

In San Mateo County, a hydrograph analysis is required for drainage areas greater than 200 acres, or if the drainage system includes a detention basin or storage reservoir. For areas less than 200 acres that do not require a detention basin or storage reservoir, the hydrograph method may be applied but should be compared to the results obtained by application of the Rational Method described above, which will be used by the Office of Development Services to check results.

8.1 Computer Programs

HEC-1 and HEC-HMS are hydrologic modeling computer programs developed by the Hydrologic Engineering Center (HEC) of the U. S. Army Corps of Engineers. Both programs are designed to compute rainfall-runoff hydrographs and route the hydrographs through channels, pipes, detention basins, and reservoirs. HEC-1 is a DOS-based program that receives its input data via a text file. It was originally released in 1968; the current version (Version 4.0) was released in 1990. HEC-HMS, originally released in 1998, is a Windows-based program that provides a Graphical User Interface (GUI) intended to simplify data input. HEC-HMS has many of the same capabilities as HEC-1. This manual is not intended to be a user's guide for either HEC-1 or HEC-HMS. It is assumed that the reader is familiar with one or both of these programs. However, if you are unfamiliar with either program, user's manuals for both can be downloaded from HEC's homepage, http://www.hec.usace.army.mil.

HEC-1 and HEC-HMS follow the same basic procedure for hydrologic modeling described in this section. It is important to recognize that these computer programs are intended only to simulate naturally-occurring events. In many instances, the simulated processes or results can vary significantly from those that occur naturally. Whenever possible, the simulated results should be calibrated with verified results, or at a minimum, analyzed to determine whether the results are reasonable for the given meteorological, topographic, and land use conditions. Other hydrologic modeling software packages are available, which include, but are not limited to the following:

- TR-20 and TR-55 developed by the Natural Resources Conservation Service (NRCS)
- Storm Water Management Model (SWMM) developed by the U. S. Environmental Protection Agency (EPA)
- Hydrological Simulation Program-Fortran (HSPF), originally developed as the Stanford Watershed Model
- HYDRO from the Federal Highway Administration (FHWA)
- MIKE SHE, available from the Danish Hydraulics Institute (DHI)
- Any hydrology method, including those listed above, may be used, provided the chosen method provides results consistent with those obtained using the County's hydrology procedures.

8.2 Rainfall Simulation (Design Storm)

"Design storm" is a term used to describe the total rainfall depth, which is determined from the combination of the return period and storm duration. Design Storm – The design storm is defined as the temporal (time variant) distribution of a specified design rainfall depth (inches) that is a function of the storm duration (hours) and frequency (years). Table D-1 and Figure D-1 attached provide tabular and graphical representations of the 24-hour incremental distribution (i.e. rainfall pattern) typically used for San Mateo County. This pattern is based on the three-day December 1955 rainfall event, still considered to be the storm of record for Northern California. In San Mateo County, rainfall is the only type of precipitation considered to cause runoff; significant snowfall is rare, and snowmelt does not contribute to runoff during flood events.

For most analyses and designs in the City, rainfall events of interest are those with 2-, 10-, and 100-year return periods. The standard storm duration for rainfall simulation is 24-hours.

The rainfall pattern (hyetograph) can be obtained for any watershed by multiplying the incremental rainfall distribution percentages by the 24-hour rainfall depth.

8.4 Synthetic Unit Hydrographs

A unit hydrograph is a numerical representation of the time response of catchment runoff caused by one inch of excess rainfall applied uniformly over a unit of time. Several different techniques are available to estimate unit hydrographs for rainfall-runoff calculations. The Soil Conservation Service (SCS, now the Natural Resources Conservation Service) synthetic unit hydrograph is used in this manual. This methodology requires only an estimate of basin lag, which is the time from the beginning of excess rainfall (i.e., direct runoff) to the point in time when fifty percent of the runoff has passed the catch point.

8.5 Watershed Parameters

The following watershed parameters are used in the unit hydrograph method, and are generally required input into the computer models listed in Section 8.2.

8.5.1 Basin Area (A)

The basin area is defined as the area enclosed by the watershed draining to the basin outlet point where the discharge is to be determined. Area should be expressed in the units required for analysis. For HEC-1, the basin area is in square miles.

8.5.2 Precipitation (P)

Precipitation is the total depth of rainfall over the basin before any losses due to interception, infiltration, and surface storage. A value for 24-hour precipitation depth shall be obtained at each basin centroid following the rational method procedures above. For HEC-1, basin precipitation is input as inches.

8.5.3 Initial Abstraction (Ia)

The initial abstraction represents rainfall that is absorbed by tree cover, depressions, and soil at the beginning of a storm. No runoff is calculated until the initial abstraction has been satisfied. The initial abstraction for pervious areas is set equal to 0.2S, where S = (1000/CN) - 10. For impervious or rural areas the initial abstraction is set equal to 0.05 inches.

8.5.4 SCS Curve Number (CN)

Direct runoff is estimated by subtracting soil infiltration and other losses from the rate of rainfall. The Curve Number (CN) method is an empirical methodology derived by the Soil Conservation Service (SCS). The Curve Number reflects the potential loss for a given soil and cover complex. After satisfying the initial abstraction defined above, the

soil becomes saturated at a certain rate so that a higher percentage of the accumulated rainfall becomes converted into runoff.

Estimates of the CN are made based on the soil types and cover within a drainage basin. The number varies from 0 to 100, and represents the relative runoff potential for a given soil-cover complex for given antecedent moisture conditions (that is, how wet it is prior to any precipitation event).

Curve numbers for Hydrologic Soil Group A, which is rarely found in the County outside of river beds, is not included in the table. Soil cover and land use maybe obtained from aerial photographs, USGS quadrangle maps, general plans, geographic information systems, and field reconnaissance surveys.

Antecedent moisture conditions (AMCs) represent prior soil saturation, depression storage conditions, and other hydrologic precursors prior to the initiation of design rainfall. The different categories of AMCs are characterized by the SCS as follows:

AMC I dry soils
AMC II average conditions
AMC III heavy rainfall, light rainfall with low temperatures, or saturated soil

Antecedent moisture conditions have been established for various return periods for use with the specific rainfall distribution pattern given on Figure D-1. Flood frequency analyses have been made following procedures outlined in USGS Bulletin #17B.6 . Table 8-1 provides AMC values to be used for various return periods of interest. Engineers may modify the AMC as long as sufficient justification is provided.

Design Return Period	AMC
2-year (50 percent)	II¼
10-year (10 percent)	II½
100-year (1 percent)	II½

Table 8-1. ***Antecedent Moisture Conditions for Simulation***

Antecedent moisture conditions given in Table 8-1 are calibrated **specifically** for the rainfall distribution in attached Figure D-1. AMC values must be recalibrated to use any other storm distribution.

Table E-1 attached shows the Curve Numbers for different land use and soil types for AMC II. Using Table E-2 attached, these Curve Number values can be translated to the appropriate AMC, using linear interpolation as necessary.

8.5.5 Percent Imperviousness

This is the percentage of watershed covered by an impermeable surface such as roofs, roads, sidewalks, driveways, and other hardscape. It is input into the hydrologic model as a percentage. In the absence of sufficient information to directly calculate the percentage of impervious area, ranges of typical percent imperviousness for various land use categories are provided in Table E-1.

8.5.6 Basin Lag (Tlag)

Use the SCS method of Basin Lag Time with the lag time equal 0.6 times the longest system time of concentration from the StormCAD model.

If possible, the unit hydrograph duration, D, should be selected to lie between one-fifth and one-third of the smallest basin's lag time. Or use D equal 10-minutes if values for D are less than 10 minutes.

8.6 Watershed Analysis

Watersheds with relatively uniform ground cover, soil type, and degree of urbanization maybe analyzed as a single basin with weighted values for Curve Number and percent impervious. Watersheds with significant variations in these parameters should be broken into smaller basins based on the geographic variation in parameters, if possible, to produce separate hydrographs, which can then be arithmetically combined to produce a design hydrograph at the concentration point.

Basin separation particularly applies when there is a significant portion of soil from either Hydrologic Soil Groups A or B, and soil from either Groups C or D. Non-linearities in the SCS Curve Number methodology can introduce errors when the Curve Number estimate is weighted by area when significant variance in soil type is present. Even if other hydrologic parameters are homogeneous throughout the watershed, the catchment should be split into at least two basins (A/B soils and C/D soils) and recombined for the final design hydrograph. If the soil types are widely dispersed within the watershed, the basin may be split into areas corresponding to the percentages of each soil type, but all with the same precipitation, basin lag, and percent imperviousness.

8.7 Base Flow

Base flow from groundwater infiltration and other sources is generally not considered to significantly impact estimates of peak flow, particularly for smaller watersheds. A base flow component was not used to calibrate antecedent moisture conditions. However, if experience or data show that a considerable base flow exists due to high water table, reservoir releases, or other circumstances, it shall be considered as an addition to the design flood hydrograph. Base flow is to be used when sizing and designing stormwater detention or retention facilities.

8.8 Channel Routing

Once design hydrographs at concentration points are calculated using the unit hydrograph method, those hydrographs are routed to simulate the movement of a flood wave through natural or man-made channel reaches of varying shapes, sizes, and materials. Routing techniques and parameters shall be determined by the engineer, and justification of each technique shall be provided to the County for review. Common routing techniques and their typical uses are:

8.8.1 Muskingum Routing

This method is commonly used in practice to route flood hydrographs through reaches where a channel and its adjoining overbank areas provide the conveyance and storage of flood waters. Routing parameters include a storage constant (K) and a parameter, "x,"

which represents the relative effects of wedge and prism storage in the reach. An "x" value of zero represents a true reservoir, and could be used if there is a significant amount of spill out of a low flow channel with substantial valley storage. Most channels have "x" values between 0.0 and 0.2, the latter representing cases where the flood wave is expected to remain in the channel with no overbanking and valley storage to attenuate the hydrograph. The storage constant, K, is approximately equal to the travel time through the reach and may be determined from average flow velocity.

To ensure the numerical stability of Muskingum Routing, each routing reach is broken into multiple routing segments so that the following relationship between K and x is maintained:

$$\frac{1}{2(1-x)} \leq \frac{K}{\Delta t} \leq \frac{1}{2x} \qquad (8\text{-}2)$$

8.8.2 Modified Puls Routing

While the Modified Puls procedure is commonly used for reservoir routing, it may also be used in channel routing. This routing method requires the input of physically meaningful and verifiable data to perform the hydrograph transformation by establishing storage-discharge relationships. These relationships may be established using normal depth methods or detailed backwater computations. Variables include channel geometry and roughness. If possible, routing lengths should be established so that the time of travel through a reach is more than four or five time steps on the inflow hydrograph.

8.8.3 Kinematic Wave Routing

This routing method is used almost exclusively for urban prismatic channels, and computer programs employing this method generally limit its application to predetermined channel shapes. Hydrographs routed by the kinematic wave procedure are translated downstream, but there is no attenuation.

8.8.4 Muskingum-Cunge Routing

The Muskingum-Cunge routing method is a non-linear routing technique that accounts for diffusion in the equations of motion and uses the Muskingum X-value to assess the effects of storage in the reach. The procedure estimates the X-value based on physical, rather than empirical, characteristics of the channel cross section, namely the reach length, slope, kinematic wave celerity, and the characteristic unit discharge at each time and stage increment. In practice it is believed to be a better routing technique than the kinematic wave procedure as it accounts for storage and not only translates the hydrograph but attenuates the hydrograph depending upon the computed X-values as a function of time. The major disadvantage of the Muskingum-Cunge method is that it assumes normal depth in the channel cross sections and won't account for backwater effects that produce M-1 or S-1curves

Each of these flood routing methods is described in the HEC-1 User's Manual. In general, these methods are based on the continuity equation and some relationship between flow and storage or stage. In all of the methods, routing proceeds on an independent-reach

basis from upstream to downstream without the consideration of backwater effects or discontinuities in the water surfaces. The Kinematic Wave method results primarily in the translation of the runoff hydrograph, with little to no attenuation, therefore it is only appropriate for short reaches of prismatic, concrete-lined channels.

8.9 Storage Routing

Storage routing is used to simulate the movement of a flood wave through a storage reservoir. By providing HEC-1 or HEC-HMS with information about storage (either by specifying volumes or an elevation-surface area relationship) and outflow, it models the inflow, storage, and outflow in the storage reservoir. In HEC-1, outflow information can be supplied in two ways, either by specifying actual discharges or by giving orifice and weir dimensions. In HEC-HMS, outflow information can be supplied only by the former method.

End Notes

[1]Chow, Ven Te. 1964. *Handbook of Applied Hydrology: A Compendium of Water Resources Technology.* New York: McGraw-Hill.

[2]Linsley, Ray K., Max Adam Kohler, and Joseph L. H. Paulhus. 1982. *Hydrology for Engineers.* New York: McGraw-Hill.

[3]American Society of Civil Engineers. Task Committee on Hydrology Handbook of Management Group D. 1996. *Hydrology Handbook*. New York.

[6]U. S. Geological Survey. Interagency Committee on Water Data. 1982. *Bulletin #17B of the Hydrology Subcommittee: Guidelines for Determining Flood Flow Frequency*.

9. Hydraulic Analysis and Design

Storm drainage and flood protection systems must be sized so that design flows calculated using one of the methodologies outlined can be collected, conveyed, and safely discharged to receiving waters while meeting general drainage requirements. This section presents methodologies for analyzing hydraulic gradients to determine whether a particular system can meet its design requirements. Both closed conduit and open channel systems are discussed.

9.1 Closed Conduits

Conveyance systems that carry storm runoff such as pipes and culverts, regardless of shape, are closed conduit systems. These systems may carry storm water under pressure (surcharged), or with a free water surface profile exposed to the atmosphere. With a free water surface, the flow is considered to be "open channel," but the methods for calculating hydraulic gradients are described in this section.

9.1.1 Flow Regimes

Flows can be carried within closed conduits and channels either as "subcritical" flow or "supercritical" flow, often referred to as "tranquil" and "rapid" flow, respectively. It is not the velocity of flow, however, that distinguishes the flow regime; rather, the flow regime is defined by how fast the water is moving relative to the velocity of the wave that results from a small disturbance in the water surface. Disturbances in subcritical flow move upstream; disturbances in supercritical flow cannot move upstream because such waves must be swept downstream. The Froude number (Fr), which is analogous to the Mach number for gas flow, is defined as the ratio of conduit or channel velocity to wave velocity:

$$F_r = \frac{v}{\sqrt{gy}} \qquad (9\text{-}1)$$

Where:
- v = average flow velocity (feet per second)
- g = gravitational acceleration (feet per second per second)
- y = flow depth (feet)

A Froude number greater than unity signifies supercritical flow (flow velocity greater than wave velocity), while a Froude number less than one indicates subcritical flow. When the Froude number is between 0.8 and 1.2, however, the flow can be unstable, characterized by standing waves and other disturbances that may tend to propagate upstream or downstream depending upon the state of flow.

Since Froude numbers depend on conduit and channel roughness, and "n" values are expected to vary within any given reach, hydraulic gradients should be analyzed for a range of "n" as described in this chapter to protect against unexpected changes in the flow regime which could compromise the design. The high end of the "n" value range should be used to establish required freeboard, and the lower end of conduit and channel roughness are used to examine erosion potential and hydraulic stability with possibly mixed or supercritical flow conditions.

9.1.2 Hydraulic Grade Line

In non-surcharged pipe flow, the hydraulic grade line (HGL) represents the water surface profile. For surcharged pressure flow, the HGL represents a profile of the piezometric water surface; that is, the level to which water would rise along a conduit if it were allowed to do so. For subcritical flow conditions described above, the HGL is calculated as a backwater profile beginning at the most downstream point of the storm drain or outfall. For supercritical flow conditions, the HGL is calculated as a forewater profile beginning at the most upstream point of the storm drain system or inlet.

The water surface elevation at the storm drain outfall (subcritical flow) or inlet to the storm drain system (supercritical flow) must be known or calculated prior to an analysis of the conduit system since it acts as the starting elevation of the HGL. The HGL at the first junction in the pipe system can then be calculated by:

9.1.2.1 Subcritical Flow Where:

$$HGL_{J1} = WSEL_{outfall} + H_f + H_L \qquad (9\text{-}2)$$

Where:	HGLJ1	= hydraulic grade line at Junction 1
	WSELoutfall	= water surface elevation at system outfall
	HGLJ1	= WSELoutfall + Hf + HL (5-2) J1
	Hf	= friction loss in pipe from outfall to Junction 1
	HL	= minor losses in pipeline from outfall to Junction 1

9.1.2.2 Supercritical Flow

$$HGL_{J1} = WSEL_{inlet} - H_f - H_L \qquad (9\text{-}3)$$

Where:	WSELinlet	= water surface elevation at inlet
	Hf	= friction loss in pipe from inlet to Junction 1
	HL	= minor losses in pipeline from inlet to Junction 1

The hydraulic analysis is continued in the upstream direction for subcritical flow and the downstream direction for supercritical flow until the HGL at each junction (manhole or catch basin) is calculated. Based on the general drainage requirements, if the 10-year HGL is contained in existing pipe with adequate freeboard and the 100-year HGL is at or below the top of curb elevation, the design is generally acceptable to the City. If either or both of these conditions are not met, the most common ways to lower the HGL are to lower the pipe inverts or to increase the pipe size or slope for one or more runs of the storm drain system. Pipes may carry flow in a non-surcharged condition at less than full depth.

9.1.3 Conduit Losses

As shown in Equations 9-2 and 9-3, estimating energy losses due to conduit friction and transitions is a key element of hydraulic grade line computation.

9.1.3.1 Friction Losses

Head loss due to friction is a result of the kinetic energy lost as the flow travels through the conduit. The rougher the pipe is, the greater the head loss is going to be. Head loss due to friction can be calculated using Manning's Equation:

Where:

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} \qquad Q = \frac{1.49}{n} A R^{2/3} S_f^{1/2} \qquad (9\text{-}4)$$

Where:	V	= mean velocity (feet per second)
	Q	= flow rate (cubic feet per second)
	A	= cross sectional area (square feet)
	Sf	= friction slope (feet per foot)
	n	= coefficient of friction (dimensionless, Table F-1)
	R	= hydraulic radius (feet) = A/P
	P	= wetted perimeter (feet)

The wetted perimeter, P, represents the perimeter of the conduit (or channel) where a fixed boundary is in contact with the flow. Thus a free water surface is not included in the wetted perimeter.

Manning's Equation is an open channel flow equation used to find either the depth of flow or the velocity in an open channel or closed conduit flowing partially full where the channel roughness, slope, depth, and shape remain constant (steady, uniform flow). The depth of flow using Manning's Equation is referred to as the "normal depth" and the velocity is referred to as the "normal velocity." Table F-2 attached can be used to estimate cross-sectional area (A) and wetted perimeter (P) for a variety of channel shapes.

9.1.3.2 Minor Losses

In addition to friction losses along a channel or conduit, there are also local losses associated with sudden changes due to transitions, entrances, manholes, junctions, and bends. Minor losses are expressed as a loss coefficient, K, times either the velocity head or the difference in velocity head, depending on the type of loss. Minor losses are generally expressed by the following equation:

$$H_L = \frac{KV^2}{2g} \qquad (9\text{-}5)$$

Where:	HL	= minor head loss
	K	= dimensionless loss coefficient
	V	= average flow velocity
	g	= gravitational acceleration

In long reaches, where the length-to-diameter ratio is much greater than 1,000, minor losses are usually very small compared to friction losses and can be neglected. However,

if the reach is very short and there are several minor losses, the sum of these losses can easily exceed the losses due to friction. The following are typical minor losses than can occur in a pipe system and methods to determine their associated head losses.

Transition Losses
Transition losses occur where the conduit or channel changes size and/or shape. The corresponding change in cross-sectional area results in a change in velocity and a loss of energy, or "head". For open channel flow conditions, including non-pressure flow pipes, the energy losses due to contraction and expansion are given by the following equations:

Contractions:

$$H_c = K_c\left(\frac{V_2^2}{2g} - \frac{V_1^2}{2g}\right) \text{ for } V_2 > V_1 \qquad (9\text{-}6)$$

Expansions:

$$H_e = K_e\left(\frac{V_1^2}{2g} - \frac{V_2^2}{2g}\right) \text{ for } V_1 > V_2 \qquad (9\text{-}7)$$

Where:	Hc	= head loss due to contraction
	He	= head loss due to expansion
	Kc	= contraction loss coefficient
	Ke	= expansion loss coefficient
	V1	= velocity upstream of the transition
	V2	= velocity downstream of the transition

Typical values for Kc and Ke are given in Tables F-3 through F-6 attached.

Entrance Losses
Energy losses will occur at the entrance to box culverts and pipes. These entrance losses can be estimated using Equation 9-5 and the entrance loss coefficients given in Table F-7 attached.

Manhole Losses
In a straight-through manhole where there is no change in pipe size, the minor loss can be estimated by:

$$H_m = 0.05\left(\frac{V^2}{2g}\right) \qquad (9\text{-}8)$$

Simple transitions in pipe size in a straight-through manhole maybe analyzed by treating

Junction Losses

Junction losses are due to either changes in the direction of flow or multiple flows entering a manhole or catch basin. When flow changes direction inside a junction, as shown on Figure 9-1, there is an associated head loss. The amount of head loss that occurs is dependent on how great the angle of deflection is. As the deflection angle between the inflow and outflow pipes is increased, the amount of head loss increases, therefore, junctions should be designed to allow the flow to come together smoothly to minimize head losses. Recommended design considerations include minimizing the deflection angle (<60°), minimizing the vertical difference between the two inverts (< 6 inches), and providing a semicircular channel or bench in the junction manhole.

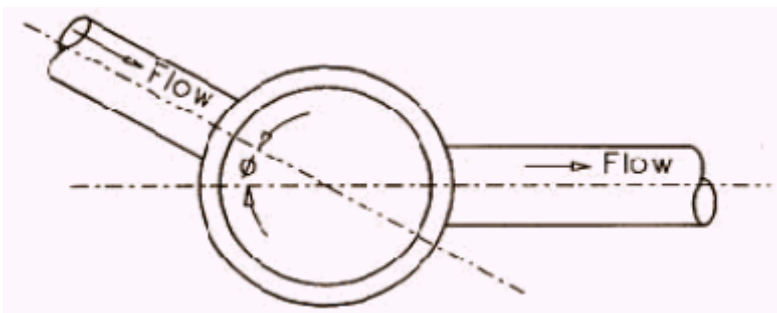

Figure 9-1.*Changes in Direction of Flow at a Junction*

Head losses due to changes in direction of flow can be calculated using Equation 9-5 and the loss coefficients, Kb, shown in Table 9-1.

Flow Change in Degrees	K_b
0	0.00
15	0.19
30	0.35
45	0.47
60	0.56
75	0.64
90 and greater	0.70

Table 9-1. *Loss coefficients for change in flow direction*

Head losses also occur when flow enters a junction from more than one pipe as shown on Figure 9-2. The head losses are dependent on the flow in each pipe and the direction that each pipe enters the junction and can be estimated with the following equation:

$$H_{mf} = \left(\frac{Q_2 V_2^2 - Q_3 V_3^2 - Q_1 V_1^2 + K_b Q_3 V_3^2}{2 g Q_2} \right) \qquad (9\text{-}9)$$

Where: Hmf = head loss from multiple flows
Kb = head loss coefficient for change in direction (Table 9-1)

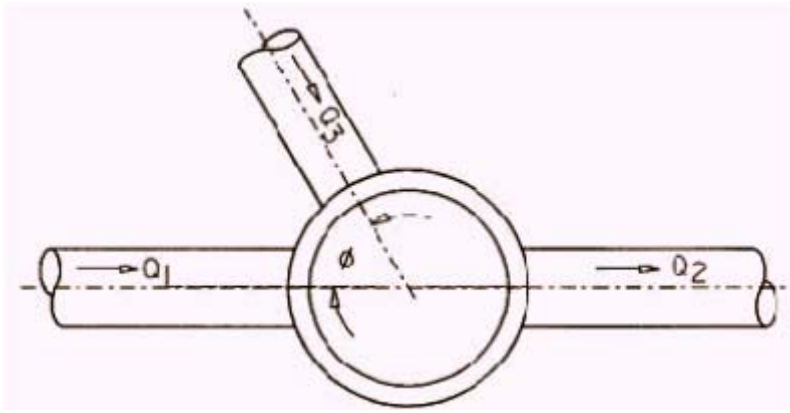

Figure 9-2.*Multiple Flows Entering a Junction*

Bend Losses

Bend losses in open channels are a function of the ratio of the radius of the bend, r, to the width of the channel, b. Bend losses in open channels can be estimated using Equation 9-5 and the bend loss coefficients given in Table9-2.If r/b is equal to or greater than 3.0, the bend loss is negligible.

r/b	K_b
2.5	0.02
2.0	0.07
1.5	0.12
1.0	0.25

Table 9-2.Bend loss coefficients in open channels

Bend losses in closed conduits are a function of the deflection angle between the upstream and downstream pipes. For curved segments where the angle is less than 40° the bend loss coefficient may be estimated as:

$$K_b = 0.25\left(\frac{\Delta}{90}\right)^{0.5} \qquad (9\text{-}10)$$

Where: Kb = bend loss coefficient (dimensionless)
Δ = deflection angle (degrees)

For greater angles of deflection and bends in manholes the bend loss can be estimated by using Equation 9-5 and the bend loss coefficients shown on Figure F-8 attached.

9.1.4 Pipe Standards

Storm drain systems built under City of Belmont jurisdiction shall adhere to the following standards.

9.1.4.1 Acceptable Pipe Sizes

Pipe sizes shall be limited to the following standard pipe diameters for all storm drainage systems:

- 8-inch (privately maintained systems or special cases as approved by the City)
- 12-inch
- 15-inch
- 18-inch
- 24-inch
- 30-inch
- A multiple of 6 inches (for pipes larger than 30 inches in diameter)

9.1.4.2 Allowable Pipe Materials

An engineer's evaluation and selection of materials for storm drain pipelines shall consider the following: intended use, scour or abrasion conditions, installation requirements, corrosion conditions, flow requirements, product characteristics, cost effectiveness, physical properties, and handling requirements. Given these considerations, the following pipe materials are allowed for all storm drainage systems to be maintained by City of Belmont:

1.Plain concrete pipe (12-inch diameter driveway culvert only)
2. Reinforced concrete pipe
3. Corrugated aluminum pipe
4. Aluminum spiral rib
5. Aluminized Type 2 corrugated steel (AASHTO M274 and M56)
6. Galvanized[1] corrugated iron or steel pipe, Treatments 1 through 6
7. Galvanized[1] steel spiral rib pipe, Treatments 1 through 6
8. Ductile iron (water supply, Class 50 or 52)
9. Lined corrugated polyethylene pipe (LCPE)[2]
10. Corrugated polyethylene pipe (CPE)[3]
11. Polyvinyl chloride (PVC)[4] sewer pipe
12. Solid wall polyethylene pipe (SWPE; also known as HDPE or HDPP)[5]

9.1.4.3 Allowable Pipe Joints

The use of reliable, tight pipe joints shall be used in the design of all drainage systems. The joints must be watertight, flexible, and durable. Given these considerations, the following criteria shall be met for all storm drainage systems to be maintained by City of Belmont:

1. Concrete pipe shall be rubber-gasketed.

2. CMP shall be rubber-gasketed and securely banded.

3. Spiral rib pipe shall be "hat-banded" with neoprene gaskets.

4. Ductile pipe joints shall be flanged, bell and spigot, or restrained mechanical joints.

5. LCPE pipe shall be joined by split corrugated couplings, with gaskets, which are at least 4 corrugations wide and exceed the soil tightness requirements of the AASHTO Standard Specifications for Highway Bridges, Section 23 (2.23.3).

6. CPE single wall, fully corrugated pipe shall be joined by split or snap-on couplings for 3- through 10-inch diameter pipe, and by split corrugated couplings with gasket for 12- through 24-inch diameter pipe. Couplings for 12- through 24-inch diameter pipe shall be

at least 7 corrugations wide and shall exceed the soil tightness requirements of the AASHTO Standard Specifications for Highway Bridges, Section23 (2.23.3).

7. PVC pipe shall be installed following the procedures outlined in ASTM D2321;joints shall conform to ASTM D3212, and gaskets shall conform to ASTM F477.

8. SWPE pipe shall be jointed by butt fusion methods or flanged.

9.1.4.4 Pipe Alignment

The following pipe alignment criteria shall be met for all storm drainage systems to be maintained.

1. Pipes shall be laid true to line and grade with no curves, bends, or deflections in any direction. An exception shall be allowed for vertical deflection in SWPE and ductile iron pipe with flanged restrained mechanical joint bends (< 30º) on steep slopes, provided the pipe drains.
2. A break in grade or alignment, or changes in pipe material shall only occur at catch basins or manholes.

9.1.4.5 Changes in Pipe Size

The following criteria shall be followed when changing pipe sizes for all storm drainage systems to be maintained:
1. Increases or decreases in pipe sizes shall be allowed only at junctions and structures. Pipe size shall not decrease in area or diameter in the downstream direction.
2. When connecting pipes at structures, the following shall be matched in descending order of preference: crowns, 80% diameters6, or pipe inverts. Lateral pipes 12inches in diameter and smaller are exempt from this requirement.
3. Downsizing of pipes larger than 12 inches in diameter may be allowed, provided pipe capacity is adequate for the design flows.

9.1.4.6 Permissible Pipe Slopes and Velocities

The following minimum and maximum pipe slopes and velocities shall be met for all storm drainage systems to be maintained:

1. A minimum velocity of 2.6 feet per second for the two-year return period shall be maintained as a self-cleaning velocity. Slopes required to maintain velocities of 2and 3 feet per second for full and half-full flow conditions are given in Table F-9 attached. If site constraints result in velocities less than 2.6 feet per second, sedimentation impacts shall be addressed by the following: increased pipe sizes, closer spacing of structures, or sediment/debris basins. City of Belmont may consider other sedimentation prevention measures when minimum storm drain velocities cannot be met.

2. Maximum velocities of 30 feet per second shall be allowed for CMP, Spiral Rib, PVC, and CPE7 pipe at a maximum slope of 30 percent. Pipe anchors shall be required at slopes greater than 20 percent and shall be spaced at 1 anchor per 100 LF of pipe. Maximum velocities of 30 feet per second shall be allowed for Concrete or LCPE7 pipe at a maximum slope of 20 percent. Pipe anchors shall be required at slopes greater than 10 percent and shall be spaced at least one anchor per 50 lineal feet of pipe. No maximum

velocities or slopes shall be set for ductile iron or SWPE pipe; however, butt-fused or flanged joints are required and above-ground installation is recommended on slopes greater than 40 percent. Pipe anchors shall be required for ductile iron pipe at slopes greater than 20 percent with at least one anchor for every pipe section. Pipe anchors shall be required for SWPE pipe at slopes greater than 20 percent with at least one anchor for every 100 lineal feet of pipe on cross-slope installations only.

9.1.4.7 Pipe Cover

Pipe cover, measured from the street sub-grade elevation to the top of the outside surface of the pipe, shall be 2.5 feet minimum. Under drainage easements, driveways, parking stalls, or other areas subject to light vehicular loading, pipe cover may be reduced with City approval provided the design considers the expected vehicular loading and is consistent with the pipe manufacturer's recommendations. Pipe cover in areas not subject to vehicular load may be reduced with City approval. The maximum pipe cover shall be based on the manufacturer's recommendations but shall never exceed 30 feet as measured from pipe invert to street sub-grade elevation.

9.1.4.8 Pipe Clearance

A minimum of one foot vertical and five feet horizontal clearance (outside surfaces) shall be provided between storm drain lines and other utility pipes and conduits. The minimum criteria for pipe clearance shall take into consideration the criteria of other local agencies and/or public utilities responsible for the utility pipes and conduits being crossed.

9.1.4.9 Pipe Anchors

All City-maintained CMP, Spiral Rib, PVC, and CPE storm drainage systems placed at slopes greater than twenty (20) percent shall be anchored as shown on Figures G-1 and G-2 attached. The minimum anchor spacing shall be one anchor per 100 lineal feet of pipe, or as required through a detailed load analysis. For concrete or LCPE pipe, anchors shall be required for slopes greater than ten (10) percent and shall be installed at least once for every 50 lineal feet. For anchoring specifications please also refer to Section 9.1.4.6, Criterion #2.

9.1.5 Culverts

A culvert is defined as any conduit designed to convey water through a roadway, railroad, canal, or other embankment without overtopping. Culverts are relatively short in length and may be circular, elliptical, square, rectangular, or arched in cross section. They are usually mounted in a headwall that provides an improved entrance and may contain multiple barrels.

The hydraulic design of culverts is primarily influenced by available headwater depth. If the headwater depth is not adequate to pass the flow through the culvert, the embankment may overtop or the flow may back up and cause upstream flooding. Other factors that influence discharge through a culvert are pipe size, pipe length, pipe roughness, pipe slope, inlet geometry, and tailwater conditions.

9.1.5.1 Hydraulic Control

Culvert flows are classified as either under inlet control or outlet control. Under inlet control conditions, the culvert inlet size, shape, and condition restricts the amount of water passing into the culvert. Major factors influencing the discharge of a culvert flowing under inlet control are: cross sectional area of the culvert barrel, inlet geometry, and headwater depth. A modified form of the orifice equation gives culvert capacity for a culvert governed by inlet control.

Under outlet control conditions, the culvert capacity is determined by a combination of tailwater depth, barrel conditions (pipe length, slope, and roughness), and inlet geometry. The energy equation and Manning's equation are used to calculate the capacity of a culvert flowing under outlet control.

Inlet Control

Nomographs developed by the Bureau of Roads, now the Federal Highway Administration, can be used to determine the inlet control headwater depth at design flow for various types of culverts and inlet configurations. Inlet control nomographs for concrete pipe, corrugated metal pipe, and box culverts are shown on Figures H-1 through H-3 in Appendix H. Additional nomographs can be found in the FHWA publication Hydraulic Design of Highway Culverts, HDS No. 5 (Report No. FHWA-IP-85-15), September 1985.

Outlet Control

Nomographs have also been developed for determining outlet control headwater depths. Outlet control nomographs for concrete pipe, corrugated metal pipe, and box culverts are shown on Figures H-4through H-6 in Appendix H. Additional nomographs can be found in FHWA, Hydraulic Design of Highway Culverts, previously referenced. Outlet control headwater depths for pipe systems can also be determined using a simple backwater analysis given by the following equation:

$$HW = H + TW - LS \qquad (9\text{-}11)$$

Where:

HW	= headwater depth, ft	
H	= Hf + He + Hex	
Hf	= friction loss, ft = $(V^2n^2L)/(2.22R^{1.33})$	
	Note[8]: If (Hf + TW - LS) < D, adjust Hf such that (Hf + TW-LS) = D	
He	= entrance head loss, ft = Ke (V2/2g)	
Hex	= exit head loss, ft = V2/2g	
TW	= tailwater depth above invert of culvert outlet, ft	
	Note[8]: If TW < (D+dc)/2, set TW = (D+dc)/2	
L	= culvert length, ft	
S	= culvert slope, ft/ft	
D	= culvert barrel diameter, ft	
V	= velocity, ft/s	
N	= Manning's coefficient, dimensionless	
R	= hydraulic radius, ft	
Ke	= entrance loss coefficient, dimensionless (Table F-7)	
g	= acceleration due to gravity, 32.2 ft/s2	

dc = critical depth, ft (see Figures H-7 and H-8 in Appendix H)

9.1.5.2 Minimum Design Criteria for Culverts

Culverts shall be sized to pass the 25-year design flow under free outfall conditions, without an inlet head in excess of the top of culvert (that is, with H/D no greater than unity). After the culvert is sized according to this criterion, culvert sizing shall be checked under all inlet and outlet control conditions to safely pass the 100-year design flow and meet the general drainage requirements.

9.1.6 Appurtenant Structures

The design of appurtenant structures for closed conduit drainage systems shall adhere to the following requirements.

9.1.6.1 Inlets

Storm drain inlets shall adhere to the current version of the Caltrans "Standard Plans Manual." The applicable Standard Details may include, but not be limited to D72, D73, D74A-C, D75A-C, and D78A-C.

9.1.6.2 Manholes

Storm drain manholes shall adhere to the current version of the Caltrans "Standard Plans Manual." The applicable Standard Details may include, but not be limited to, B7-11 Utility Details and Section 70-1.02H for precast structures.

9.1.6.3 Outfalls

Storm drain outfalls to natural channels, concrete channels, concrete box culverts, and other storm water conveyance pipes shall adhere to the current Caltrans "Standard Plans Manual"

9.1.6.4 Headwalls

The headwalls for storm drainage passage underneath roadways shall adhere to the current version of Caltrans' Standard Plans. The applicable Standard Details may include, but not be limited to, D86B, D86C, D89, and D90.

9.2 Open Channels

The detailed design of major open channel flood protection facilities is beyond the scope of this drainage manual, but drainage features such as open ditches and swales, and small channels shall be designed according to this section.

9.2.1 Flow Regimes

Flood flows can be carried within channels either as "subcritical" flow or "supercritical" flow, as defined in Section 9.1.1 for closed conduits. In subcritical flow, a disturbance caused by a channel feature can influence flow further upstream, even to the point of

making previously supercritical flow subcritical. Conversely, supercritical flow cannot be influenced by downstream channel features.

Whether flow is subcritical or supercritical depends on several factors including channel shape, channel slope, channel roughness, and discharge. As illustrated on Figure 9-3, a channel features such as downstream backwater or a bridge can act as a channel control, and change the flow regime upstream of that feature.

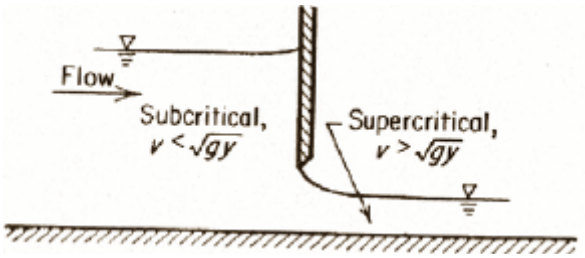

Figure 9-3.*Bridges as a Generator of Subcritical Flow* (Henderson, 1966)

9.2.2 Analytical Methods

Open channel analyses and designs shall be based upon commonly recognized analytical methods chosen by the engineer of record, and submitted with justification to the County for review and approval.

Depending upon project conditions, steady-state (constant flow) or unsteady (discharge varies with time) methodologies may need to be employed. Section 9.4 provides a variety of computer simulation programs for analyzing open channel flow.

Simple steady-state problems with uniform flow may be analyzed using Manning's formula (Equation 9-4) for normal depth and average velocity. Where tailwater conditions or system design are such that there are significant backwater effects, water surface profiles shall be computed using a one-dimensional open channel flow program. Two or three dimensional analytical techniques are beyond the scope of the Drainage Manual.

9.2.3 Channel Roughness

In one-dimensional open channel flow analysis as performed using HEC-2, HEC-RAS, and other commonly available software platforms, a single parameter known as "Manning's n" is used to represent the retarding forces to flow imposed by the channel. Values for "n" are published in the literature, and in the absence of high water marks with which to calibrate stream reaches with known discharge, are often relied upon for channel design. When selecting roughness values for design, it is important to remember that in one-dimensional flow, Manning's "n" accounts for the flow resistance due to a host of hydraulic phenomena beyond boundary shear. Other factors may include the effects of eddies, cross-waves, super-elevation, bed forms, sediment and debris.

Table F-1 attached summarizes design channel roughness values of various channel elements proposed for use in hydraulic analysis.

Given the uncertainty in "n" value selection, a range of "n" values is used to examine channel performance. Lower values tend to increase channel velocity, which may be important in terms of scour or wave formation. Higher values tend to maximize water depth and will generally set freeboard requirements. For vegetal channel linings, typical "n" values for temporary erosion control materials will be used to evaluate high flow velocities. Manning's "n" values are contingent upon maintenance conditions within natural and artificial channels. Analyses and designs presented to the Office of Development Services for approval shall clearly indicate proposed project maintenance and the basis for selecting long-term design roughness coefficients.

9.2.4 Bridge Hydraulics

In addition to the energy required to overcome channel resistance, structures such as bridges and culverts also cause energy losses, which can result in a raised water surface profile. Methods provided by HEC-RAS for analyzing bridges and culverts under low flow and pressurized conditions should be employed in backwater computations.

Several methods are available through HEC-RAS to compute energy losses through a bridge. The "energy only" or standard step method handles a bridge section without piers in the same manner as a natural river section, except that the area between the low chord of the bridge (soffit) and the top of road is subtracted from the total cross-sectional area, and the wetted perimeter is increased where water is in contact with the bridge. Increased frictional resistance due to the added wetted perimeter is included in the energy loss through the structure.

When bridge piers are present, either conservation of momentum may be applied by using a coefficient of drag, or Yarnell's method maybe used for subcritical "Class A" low flow through the bridge. Table 9-3 provides proposed drag coefficients for the momentum method and pier shape coefficients for Yarnell's low flow bridge loss calculations, respectively.

Pier Shape	Drag Coefficient	Pier Coefficient
Semicircular Nose and Tail	1.33	0.90
Multiple Cylinders	1.33	1.00
Triangular Nose and Tail	2.00	1.05
Square Nose and Tail	2.00	1.25

Table 9.3: ***Drag and Pier Coefficients***

When the computed water surface elevation is above the bridge soffit, a "pressure/weir" feature can compute losses through the structure for pressure (orifice) flow, weir flow over the top, or a combination of both. Changes to the water surface profile resulting from the bridge are calculated based on hydraulic formulae that estimate the change in energy and water surface elevation through the bridge. Other hydraulic routines are also available to perform the same function for standard culvert shapes.

Coefficients of discharge for orifice flow during bridge pressurization are evaluated on a case-by-case basis using the guidelines outlined in Table 9-4.When an orifice is located close to the bottom or bank of the channel, the approaching flow is guided so that the

orifice contraction is suppressed on those sides of the orifice close to such guides. Clear span bridges across trapezoidal or U-frame (rectangular) channels are examples of orifices contracted on three sides.

Condition	Orifice Coefficient
Orifice in Thick Wall (typical bridge)	0.80
Submerged, square-edged	0.80
Submerged, well-rounded	0.90
Increase in C per number of contracted sides	0.04

Table 9-4.*Orifice Coefficients*

9.2.5 Transition Losses

An energy loss also takes place just upstream and downstream from each structure as flow contracts and expands into and out of the bridge or culvert. The following contraction and expansion coefficients for channel transitions are used in the hydraulic models (Table 9-5). Wherever turbulent conditions create the potential for energy loss, contraction and expansion coefficients are increased. Other transitions include channel bends, resting pools, and maintenance access ramps.

Transition Type	Contraction	Expansion	Source
Gradual	0.1	0.3	HEC
Warped	0.1	0.2	Chow
Wedge	0.3	0.5	Chow
Square End	0.3	0.75	Chow
Abrupt	0.6	0.80	HEC

Table 9-5.*Expansion and Contraction Coefficients*

9.2.6 Channel Freeboard

As described above, the use of design "freeboard" provides a measure of safety that compensates for the many unknown and difficult-to-quantify parameters that affect the calculation of flood elevations. These factors include uncertainty in rainfall data, soil loss parameters, watershed urbanization, wave action, debris at bridge openings, and general uncertainties in hydrologic and hydraulic procedures. Freeboard is usually expressed in terms of feet above the design base flood elevation. To meet FEMA standards, freeboard is necessary whenever a levee system, including structural floodwalls, is used to provide flood protection.

When mapping flood-prone areas, FEMA only recognizes those levee systems meeting their criteria, which includes a minimum three feet of freeboard whenever the design one-percent water surface elevation is carried above the natural ground elevation. An additional six inches of freeboard (3.5 feet above the water surface) is required at the upstream end of the levee/floodwall system, tapering to the minimum freeboard of 3.0 feet at the downstream end of the levee.

FEMA does not impose a freeboard requirement when the base flood can be carried without the use of a levee system. Table 9-6 provides the respective criteria, where "D" refers to the estimated depth of flow in feet, and "V" is flow velocity in feet per second.

Situation	FEMA (Feet)	City (Feet
Water Surface Above Natural Bank Elevation	3.0	3.5
Water Surface Below Natural Bank Elevation	N/A	$0.2(D+V^2/2g)$
Minimum Freeboard	N/A	1.0

Table 9-6. ***Channel Freeboard Requirements***

City criteria for water surfaces below natural bank elevation are based on NRCS guidelines. Recently the NRCS has approved the use of a slightly different formula for its freeboard criterion within incised channels; that is, where the design water surface is carried below the natural bank. The velocity head term has been omitted, leaving the required freeboard within an incised channel as the minimum of one foot or 0.2D, where D is flow depth.

9.2.7 Hydraulic Jumps

Hydraulic jumps occur when the depth of flow changes rapidly from a low stage to a high stage as the flow regime changes from supercritical upstream to subcritical downstream. Where hydraulic sumps are likely to occur, their location and energy losses shall be determined and considered in the design.

9.2.8 Channel Curvature

The centrifugal force caused by flow around a curve raises the water surface on the outside wall of the curve, and depresses the water surface along the inside wall. This phenomenon is referred to as superelevation. In addition, curved channels tend to create secondary helicoidal flows that may persist downstream of the curve. Superelevation is checked with high and low Manning's "n" values to determine the most critical case for wall freeboard. The maximum amount of superelevation above the level water surface predicted by HEC-RAS is given by the following equation (ASCE, 1995):

$$\Delta y = C\frac{V^2 W}{gr} \qquad (9\text{-}12)$$

Where: Δy = the rise in water surface (feet)
C = a dimensionless coefficient (0.5 for subcritical flow in a simple circular curve in a rectangular channel; 1.0 for supercritical flow in the same type of curve)
V = mean channel velocity(feet per second)
W = channel width (feet)
G = gravitational acceleration (feet per second squared)
R = the radius of channel centerline curvature (feet)

9.2.9 Air Entrainment

At flow velocities in excess of 14 feet per second, air may be entrained, increasing the depth of flow. The increase in depth is related directly to the increase in the volume of water caused by entrainment:

$$\Delta y = C\frac{V^2 W}{gr} \qquad (9\text{-}13)$$

Where:	Ao	= increase in flow area attributable to air entrainment (percent)
	V	= mean channel velocity(feet per second)
	R	= hydraulic radius without air entrainment (feet)
	G	= gravitational acceleration (feet per second squared)

9.2.10 Channel Maintenance

Regular channel maintenance is important to upholding the integrity of channel design. During preliminary and final design phases, proposed maintenance protocols shall be iteratively evaluated for their impact on design channel roughness. For instance, natural elements with woody vegetation such as brush, willows, and even trees would be assumed to have higher roughness values in the 0.10 to 0.15 range. Justification regarding maintenance assumptions shall be provided to the County for review.

9.3 Coincident Analyses

Storm sewers most typically discharge into a receiving body of water. Often that body of water will not be studied or designed during the course of project work.

When discharging to another storm drain system, its design 10-year water surface elevation in the creek shall be used as the starting water surface elevation for calculating the HGL in the storm drain system. The design 100-year elevation in a receiving channel shall be used to evaluate storm drain performance and overland release in conformance with general drainage requirements. When discharging directly to San Francisco Bay, the 100-year tidal elevation starting water surface elevation for calculating the 10-yearHGL in the storm drain system and for discharging 100-year design flows with appropriate freeboard. Two-year return period analyses shall assume discharge to Mean Higher High Water (MHHW) tidal elevations at the nearest reporting station listed in Table I-1 and shown on Figure I-1 attached. Adopted 100-year tidal elevations shown on Figure I-2 are for South San Francisco Bay based on the U.S. Army Corps of Engineers. Engineers must be aware of datum differences and use these data accordingly. Location and datum conversion factors are shown in Table I-2.

9.4 Computer Programs

Several normal depth calculation computer programs exist for the design and analysis of pipes, ditches, open channels, weirs, orifices and inlets, including Flowmaster and StormCad by Haestad Methods. Most of these programs are capable of solving for or establishing rating relationships for any unknown variable using the Manning's, Hazen-Williams', Kutter's, Darcy-Weisbach, and Colebrook-White Formulas. Any of these computer programs shall be acceptable to the County provided that they are found to produce results consistent with the results obtained performing manual calculations using the equations provided in Chapter 5 of this manual.

The U.S. Army Corps of Engineers' HEC-2 and HEC-RAS are standard-step backwater program that are capable of computing water surface profiles for one-dimensional steady, gradually varied flow in rivers of any cross section. Flow may be subcritical or supercritical. Various routines are available for modifying input cross-section data, locating encroachments or inserting a trapezoidal excavation on cross sections. The water surface profile through structures such as bridges, culverts and weirs can be computed. Variable channel roughness and variable reach length between adjacent cross sections can be accommodated. HEC-RAS also has the capability of modeling mixed flow regimes and unsteady flow conditions.

Other hydraulic models are available, including WSPRO from the Federal Highway Administration (FHWA), MOUSE and MIKE-11, available from the Danish Hydraulics Institute (DHI). Any of these hydraulic models shall be acceptable to the County provided they are found to produce results consistent with those obtained performing backwater and/or forewater calculations using methodologies described in the Drainage Manual.

C. SIZE CRITERIA

1. Closed conduits should be designed for the full flow condition. They may be allowed to operate under pressure, provided the hydraulic gradient is 0.75 feet below the intake lip of any inlet, which may be affected after allowance for settlement. In no event shall the hydraulic gradient line rise above the lip of the intake.

2. Use the Manning Formula for determining the flow in pipes with the minimum "n" value of 0.013 for smooth-walled pipe 42-inch diameter and smaller; “n” = 0.012 for smooth-walled pipe 48-inch diameter and larger and box culverts; "n" = 0.024 for CMP, and other values as recommended by King's "Handbook" for miscellaneous conduit shapes.

3. Match the pipe soffit unless pipes are submerged during a 2-year event, whereby it is allowed to match inverts.

4. Where the design flow is greater than 0.5 cfs, the minimum design velocity shall be 2.0 fps at the design flow. Where the design flow is less than 0.5 cfs, a minimum slope of 0.5 percent shall be provided.

5. For losses in bends and structures, use the following formula:

   $H = K V^2/2g$
   where:
   K = 1.25 for 90° bends
   K = 0.75 for bends between 45° and 90°, and
   K = 0.50 for structures and bends 0° - 45°.

As an alternative, the HEC-22 Energy Method may be used.

6. Minimum pipe size within City rights-of-way, easements, and offers of dedication is 18 inches between catch basins and main lines.

7. Gutter flow shall not exceed five inches in depth for 10-year design storms.

8. Concrete valley gutters and bubble-up facilities will not be permitted across City streets.

D. ALIGNMENT

1. Where practical, conduits should be laid on straight alignment and uniform grade between consecutive manholes.

2. Horizontal curves are allowed on curving streets. A design report or letter report will be required from the design engineer to document the justifications for utilizing a curved alignment.

3. Radii of curvature must be of sufficient length to limit deflections to 1/2 the manufacturer's recommended allowable deflection. Complete and accurate details shall be furnished, including: the exact location of such curved sewers, length of curve, radius of curvature, and stationing of curve points.

4. Where curved alignments are utilized, the City may require the following:

   a. Slope greater than minimum slope for the size of pipe.

   b. Manhole spacing of less than 300 feet.

   c. Provide a licensed professional land surveyor or engineer to continuously monitor installation of the curved pipe during construction.

   d. Video inspection of curved pipes prior to final acceptance.

5. The following are common locations required for manholes/drainage structures:

   a. Where two or more conduits join,

   b. At intermediate points on long pipe runs, maximum spacing of 300 feet,

   c. Where the conduit changes in size,

   d. At sharp curves or angle points in excess of 10 degrees, and

   e. Points where an abrupt change of the grade occurs.

6. Minimum horizontal clearance to other utilities shall be five feet. Where this is not practical, pressure utilities shall be placed in a carrier pipe.

7. Minimum vertical clearance from other utilities shall be one foot. Where this cannot be met, a foam cushion shall be provided between utilities. A design report or letter report will be required from the design engineer to document the justifications for less than one foot vertical clearance.

8. Minimum cover from top of pipe to surface shall be three feet. Where this is not feasible, a 6-inch minimum thickness concrete cap shall be placed over the pipe. The concrete cap shall not infringe on the pavement structural section. Box culvert may be placed at the ground surface.

9. The maximum angle from in-going pipe to outgoing pipe shall be 90 degrees.

10. Minimum horizontal clearance from any structure shall be based on the criteria of keeping the bottom of the trench clear of the "1 to 1" plane from the bottom of the structural footing.

11. The minimum width of right-of-way or easement to be dedicated for watercourses shall be:
    a. Ten feet for conduits up to 48" in diameter,
    b. The outside diameter plus six feet for conduits over 48" in diameter.
    c. The top width plus 14 feet for earth channels.
    d. The top width plus 12 feet for lined channels.

E. MATERIALS

1. Materials shall be Reinforced Concrete pipe or High Density Poly Ethylene Pipe for pipes 12-inch in diameter and larger, and PVC for pipes less than 12" conforming to the requirements of the City's Standard Technical Specifications. Minimum "D" Load values for RCP and HDPE shall be 1350.

2. Trench load calculations shall be provided where depth of cover is less than three feet and greater than 20 feet.

3. For plastic pipe the maximum allowable deflection shall be 3%.

F. STORM DRAIN DESIGN SERVING PRIVATE STREETS AND DEVELOPMENTS

1. All concentrated run-off shall be carried in to an on-site stormwater treatment facility.

2. The minimum pipe diameter is twelve inches under streets. There is no minimum pipe size through landscaped areas. Pipe size shall not be less than the largest upstream pipe diameter.

3. Where the design flow is greater than 0.5 cfs, the minimum design velocity shall be 2.0 fps at the design flow. Where the design flow is less than 0.5 cfs, a minimum slope of 0.5 percent shall be provided.

4. All downspouts from buildings shall be shown with their relationship to the storm drain system. In no case shall the downspouts be permitted to discharge over walkway or a sidewalk or porch, or patio.

5. Parking bays should drain to a grass/vegetated swale, then into the concrete gutter of the private street.

6. Surface runoff shall be intercepted by an appropriately sized stormwater treatment facility and piped to the nearest storm drain in the street.

7. Gutter flow shall not exceed five inches in depth for 10-year design storms.

8. Inlets shall be sized such that the minimum inside width of the structure is at least 1 foot larger than the inside diameter of the out-going pipe.

9. Inlets over 4 feet deep shall have a minimum opening of 24" x 30", No steps are allowed within inlet or junction structures.

10. Concrete valley gutters and bubble-up facilities will not be permitted across Private streets.

11. Culverts may be designed using available head at the inlet. Adequate slope protection shall be placed to prevent scour at the inlet and outlet. Appropriate entrance slope protection shall be provided to prevent scour when utilizing available head.

12. Headwalls, downdrains, riprap and/or other adequate channel slope and bottom protection measures shall be required at Creek outlets. Erosion protection facilities shall be designed for the 100-year storm flow conditions where reasonably possible.

G. On-Site Detention of Storm Water Runoff

The criteria for providing on-site detention are that the maximum runoff rate leaving the development site during the 10, 25 and 100-year design storm shall not exceed the runoff rate from the undeveloped site. Detention of these events is for flood control purposes. The Hydrologic Management Practices (HMPs) from the Regional Water Quality Control Board (RWQCB) may differ based on erosion control measures. Higher levels of protection may be required by the Director of Public Works if a severe flooding hazard exists downstream.

1. Storage areas should be completely drained by properly sized out1ets which regulate outflows to pre-development rates. Outlets shall be designed to minimize clogging and future maintenance. The use of pumps as the primary low flow bypass is not permitted. However, pumps may be used to drain storage areas or facilities if there is no adverse impact on the total system bypass flow rate.

2. Ground percolation as a means of disposal shall be substantiated with adequate soils data and will normally be approved only as an incidental feature of storage plans or as an interim measure if soils conditions are not particularly we11 suited to percolation.

3. When on-site detention is required, such provisions shall be made in the preliminary planning of the site development and 1andscaping plans.

4. Stormwater detention storage facilities shall not produce hazardous conditions. Potential future legal liability shall be carefully considered by both the designer and reviewing agency.

5. Drainage easements shall be provided if required to insure perpetuity of storage areas when constructed as permanent drainage facilities. Parking lot detention can be considered only if the applicant and the Director of Public Works consent. Detention volume determination must include consideration of all proposed impervious areas, both on and off -site, to be constructed as part of the development. At the discretion of the

Director of Public Works, the requirement for detention may be waived.

H. NPDES Permit Requirements

1. Every project must have a completed 'NPDES Permit Compliance Checklist" (Attachment "R").

2. The checklist shows the requirements needed in order to prevent stormwater pollution as part of the County-wide Stormwater Pollution Prevention Program (STOPPP).

3. In addition to erosion control plans, the applicant will have to provide for permanent source control measures selected from the City's "Model List of Source Control Measures".

4. Projects over 10,000 square feet of impervious surface will need to obtain a Notice of Intent (NOI) with the State Water Resources Control Board, and must prepare a Stormwater Pollution Prevention Plan (SWPPP) and Stormwater Management Plan.

5. Developers are required to sign an Operations and Maintenance Agreement for any new permanent control measures. The Operations and Maintenance Agreement shall be based on the City's model Operations and Maintenance agreement.

6. Plans shall be approved by the San Mateo County Mosquito Abatement District. See the County's Vector Control Plan for guidance on how to address potential mosquito breeding habitat.

7. All drainage facilities, including treatment devices, shall dewater within 96 hours of the end of a rainfall event.

MASTER PLAN DESIGN STANDARDS

The drainage system flow capacity is evaluated using the StormCAD computer program by Haestad Methods version 5.6. The program uses the Rational Method (Q = CIA), using the Hydrologic Criteria above. Input is consistent with Section B-4, B-5, B-7, and C-2 of the **Storm Drain Design Standards**. The following describes the model input:

Existing Systems Level of Protection - Existing storm drain systems are evaluated for a 10-year storm event. Systems are considered adequate if the 10-year storm event is contained below the rim elevation of the inlet. Because many storm drain systems do not currently provide this level of protection, there is potential that street flows will overtop the curb.

Proposed Systems Level of Protection - Improvements are sized for a 25-year storm event with the water level at least one foot below the gutter flow line elevation, using a starting water level one foot below the gutter flow line elevation at the downstream connection point. During the design phase, the City may want to investigate the option of sizing improvements for a 100-year storm event for facilities that service areas greater than 100 acres.

Providing higher levels of service could increase flows to Belmont Creek, Laurel Creek, and/or the City Storm Drainage System.

Drainage Areas – The City drainage areas are shown on Figure 2, with detailed drainage maps presented in Appendix D. Drainage areas are based on a review of, (1) existing storm drain lines, (2) contours shown on the Belmont City Base map drawings, and (3) the list of known bubble ups from the City.

Junction Losses – Bend losses are computed using the Federal Highway Administration, Hydraulic Engineering Circular 22 (HEC-22) junction loss method. For this analysis, all manholes are considered having a flat bottom. Manholes where the bottom is rounded at the bottom will have a lower junction loss.

SECTION B -Design References

1. The design of storm drainage facilities shall conform to standard accepted engineering practices. Common reference texts are:

"Handbook of Hydraulics," King & Brater

"Street and Highway Drainage," The Institute of Transportation, University of California

"Highway Design Manual," CalTrans

"Practices in Detention of Urban Stormwater Runoff, Special Report No. 43," American Public Works Association '

Suggested Criteri a for Hydro1ogic Design of Storm Drainage Facilities in the San Francisco Bay Region, California, '"United States Department of the Interior, Geological Survey

ASCE Manual of Engineering Practice No. 37

"Open-Channel Hydraulics," V.T. Chow

"HEC-1 Flood Hydrograph Package," U.S. Army Corps of Engineers

"HEC-2 Water Surface Profile Users Manual" U.S. Army Corps Engineers

"A Guide to Hydrologic Analysis Using SCS Methods," McCuen

Attachments From Santa Clara County Drainage Manuel, Draft version March 2006

Figures B1 – B6	IDF Curves for various MAPs
Tables B1 – B2	Parameters A_{TD} and B_{TD} for TDS Equation
Table D-1	Fractions of Total Rainfall for 24-hour, 5-minute Pattern
Figure D-1	Normalized Rainfall Pattern
Table E-1	Curve Numbers for AMC II
Table E-2	Conversion of AMC II Curve Numbers to Other AMC Values
Table F-2	Geometric Elements of Channel Sections
Table F-3	Storm Sewer Energy Loss Coefficients
Tables F-4 – F-6	Values of K for Determining Loss of Head for Various Conditions
Table F-7	Entrance Head Loss Coefficients
Figure F-8	Bend Head Loss Coefficients
Table F-9	Slopes Required to Maintain Minimum Velocities for Full and Half Full Flow
Figures G-1 – G-2	Pipe Anchor Details 1 and 2
Figure I-1	NOAA Tidal Bench Marks in Santa Clara County
Figure I-2	Tidal Summary, Adopted 100-year Tidal Elevation
Table I-1	Mean High, High Water and Adopted 100-year Tide Data

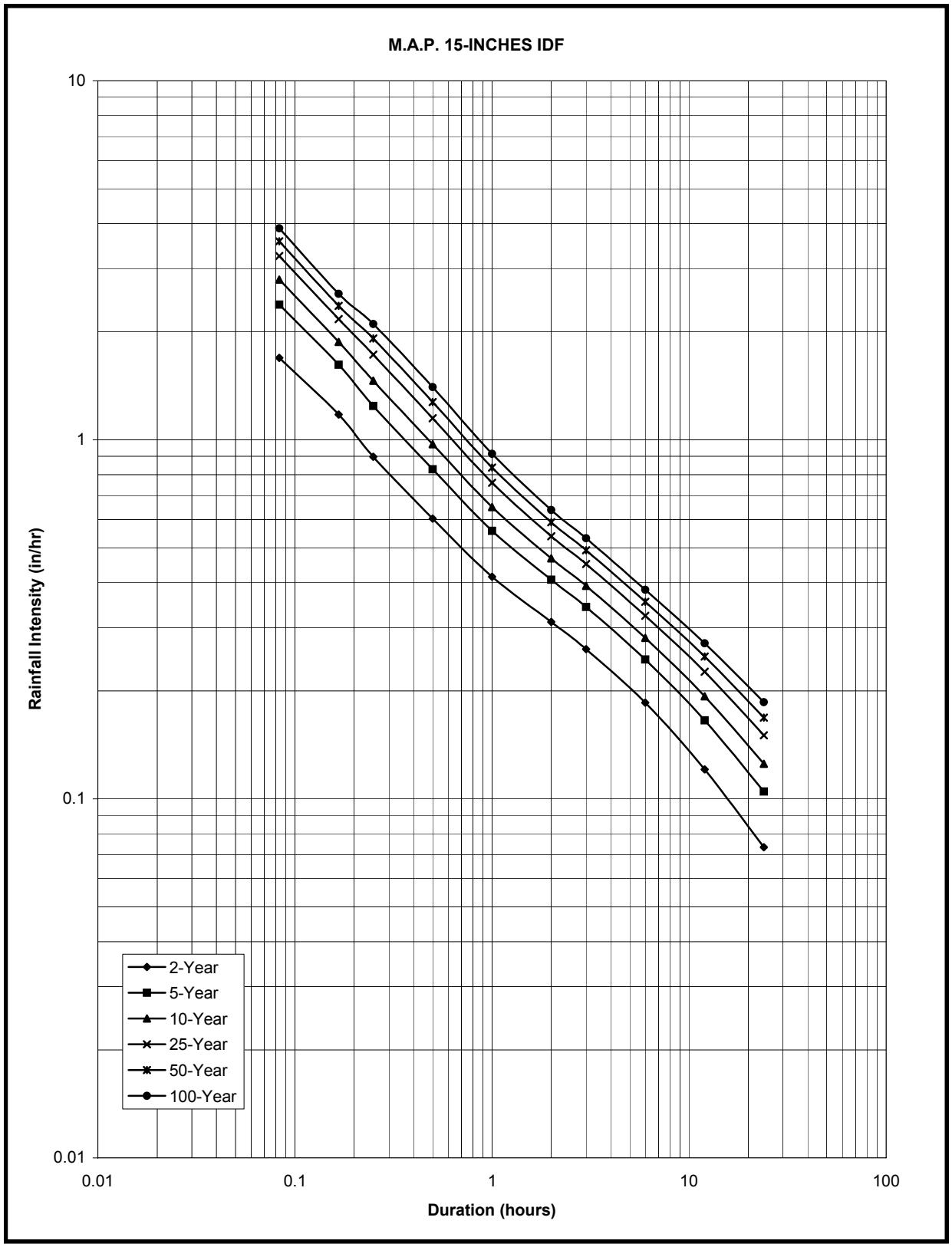

Figure B-1
IDF Curve, M.A.P. = 15 inches

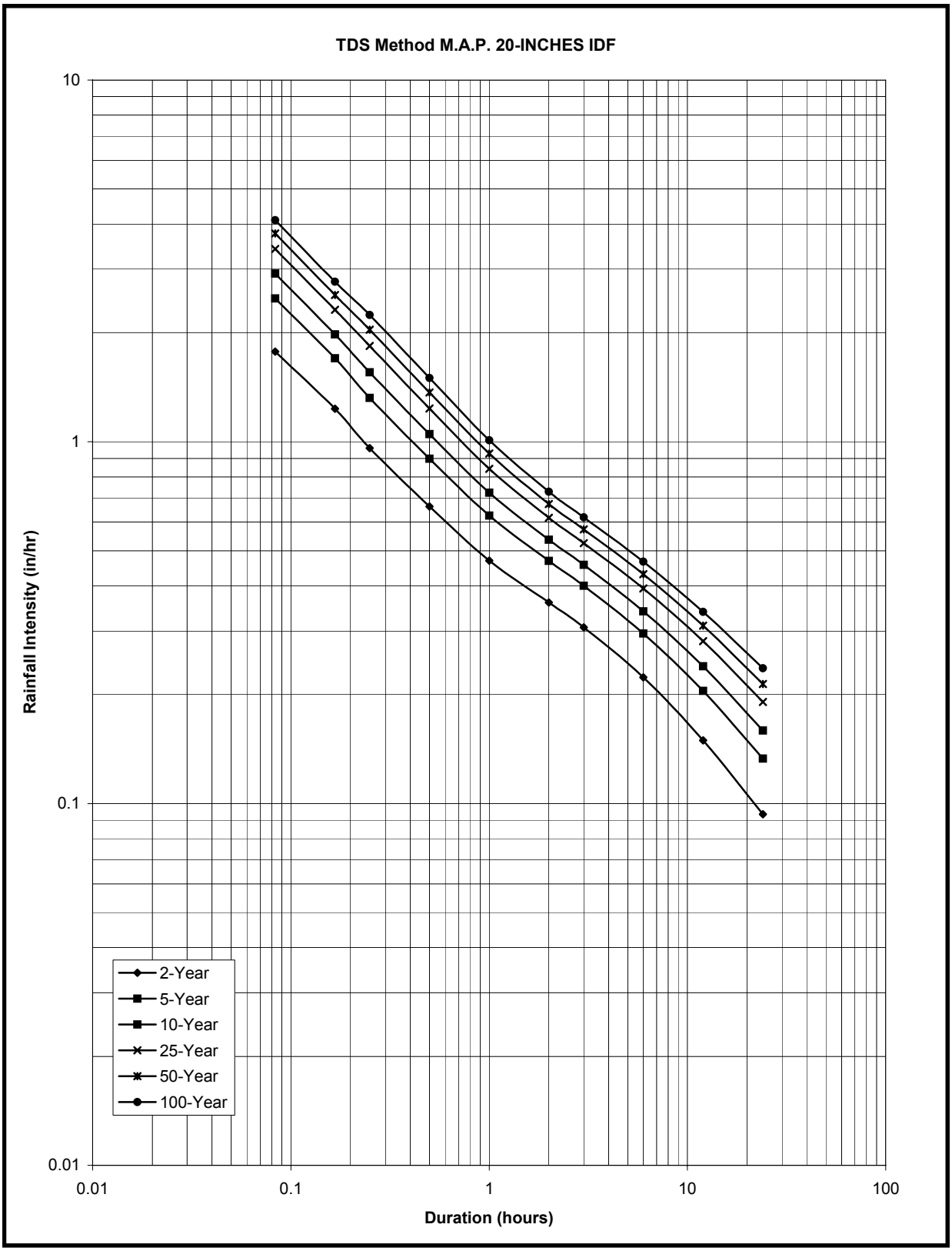

Figure B-2
IDF Curve, M.A.P. = 20 inches

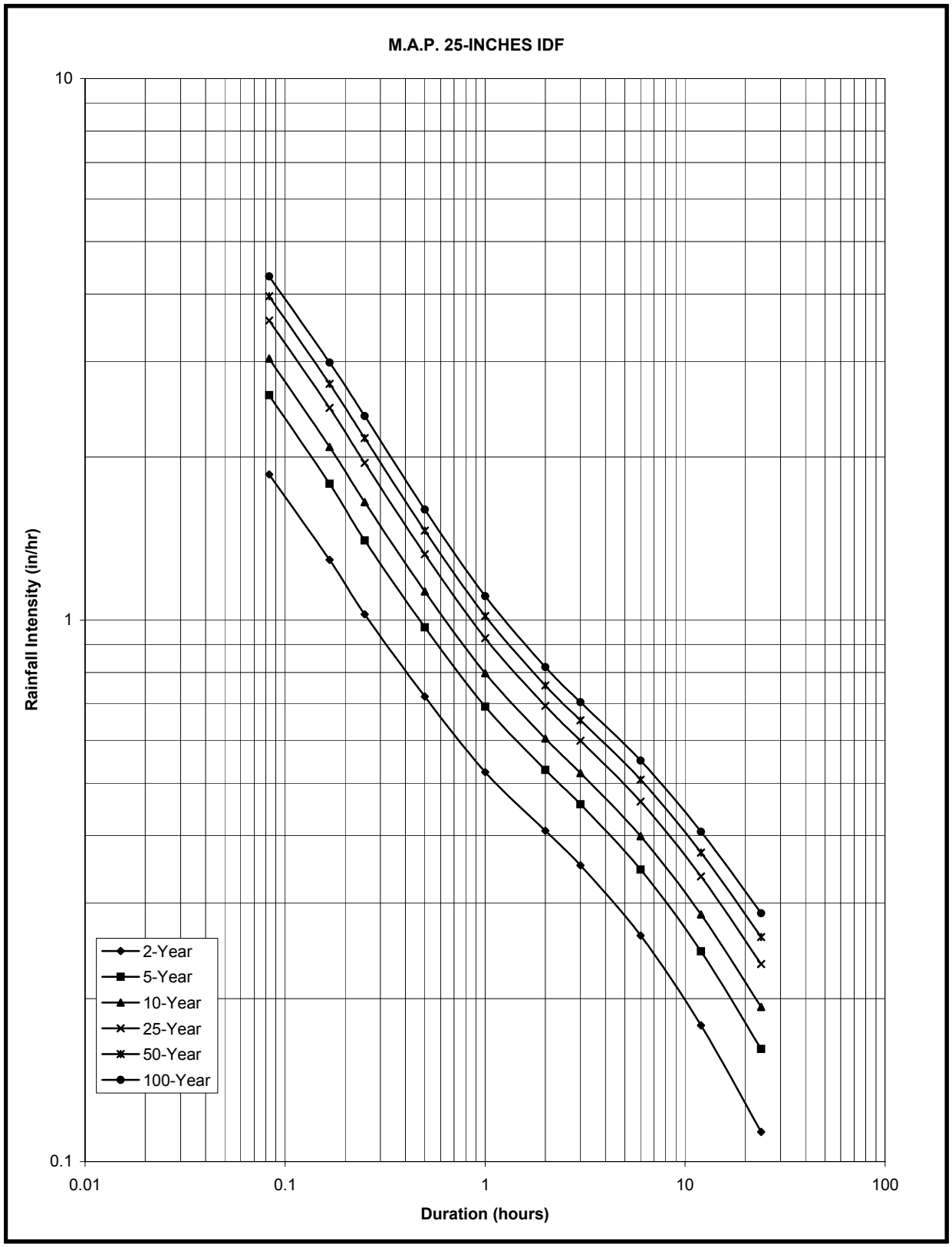

Figure B-3
IDF Curve, M.A.P. = 25 inches

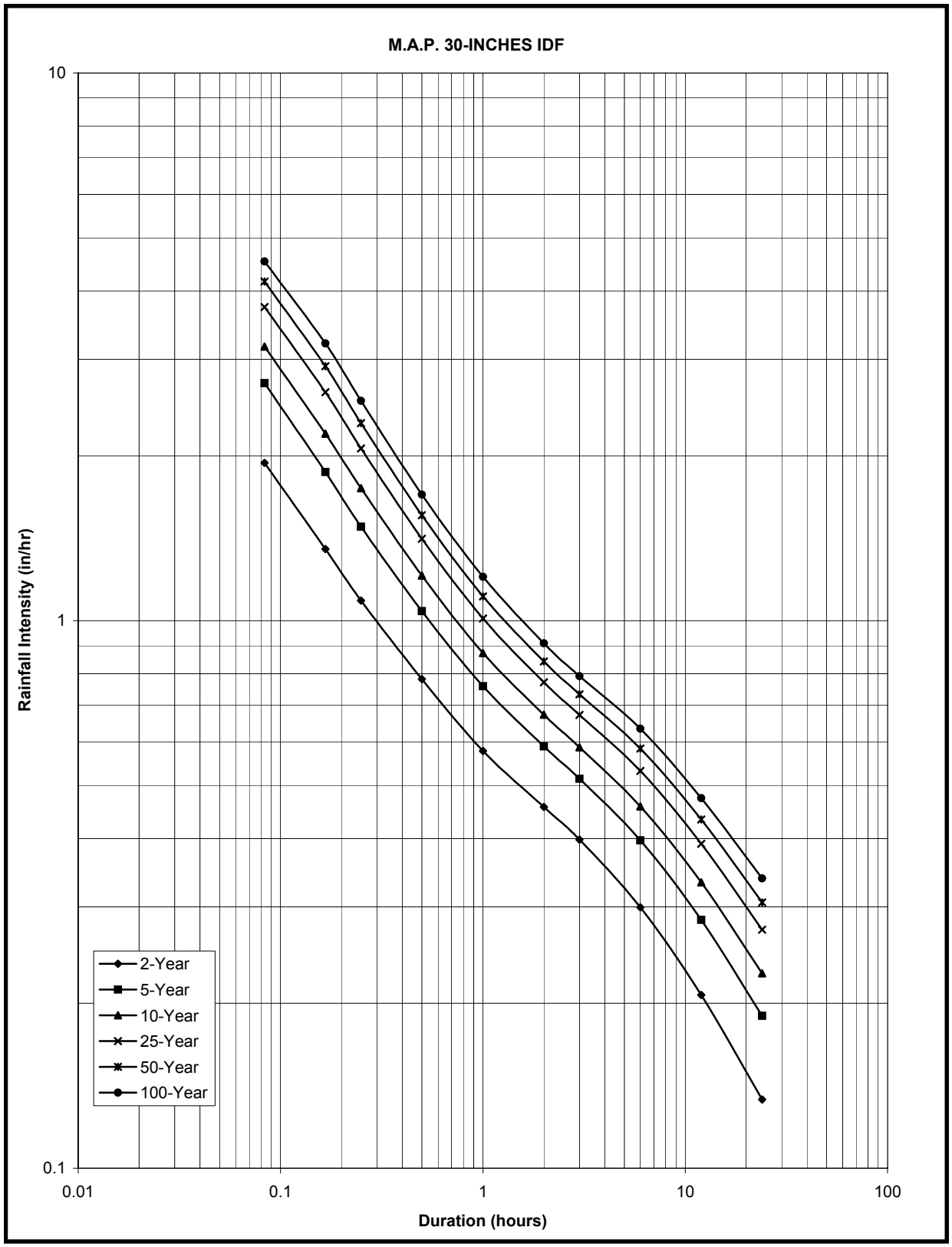

Figure B-4
IDF Curve, M.A.P. = 30 inches

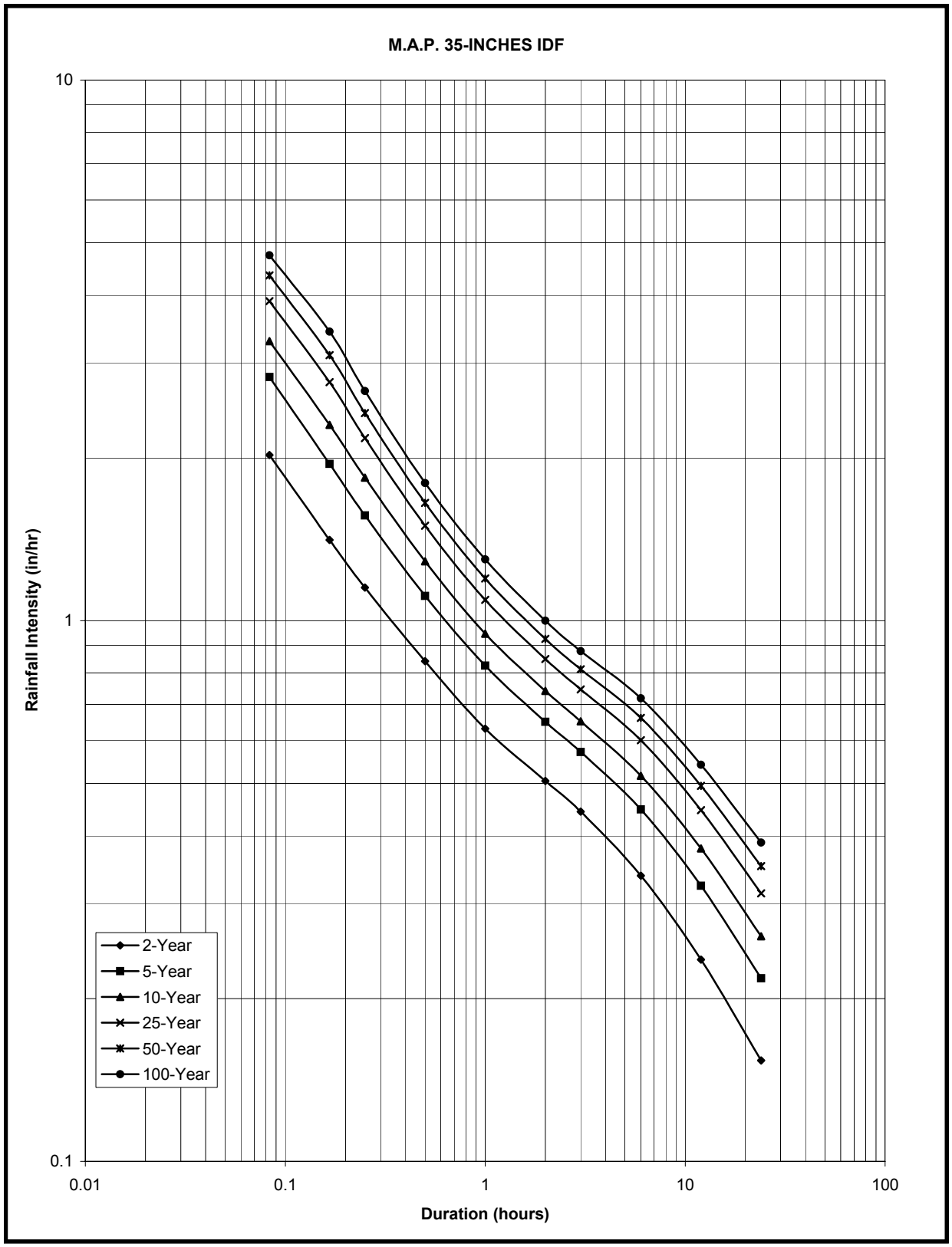

Figure B-5
IDF Curve, M.A.P. = 35 inches

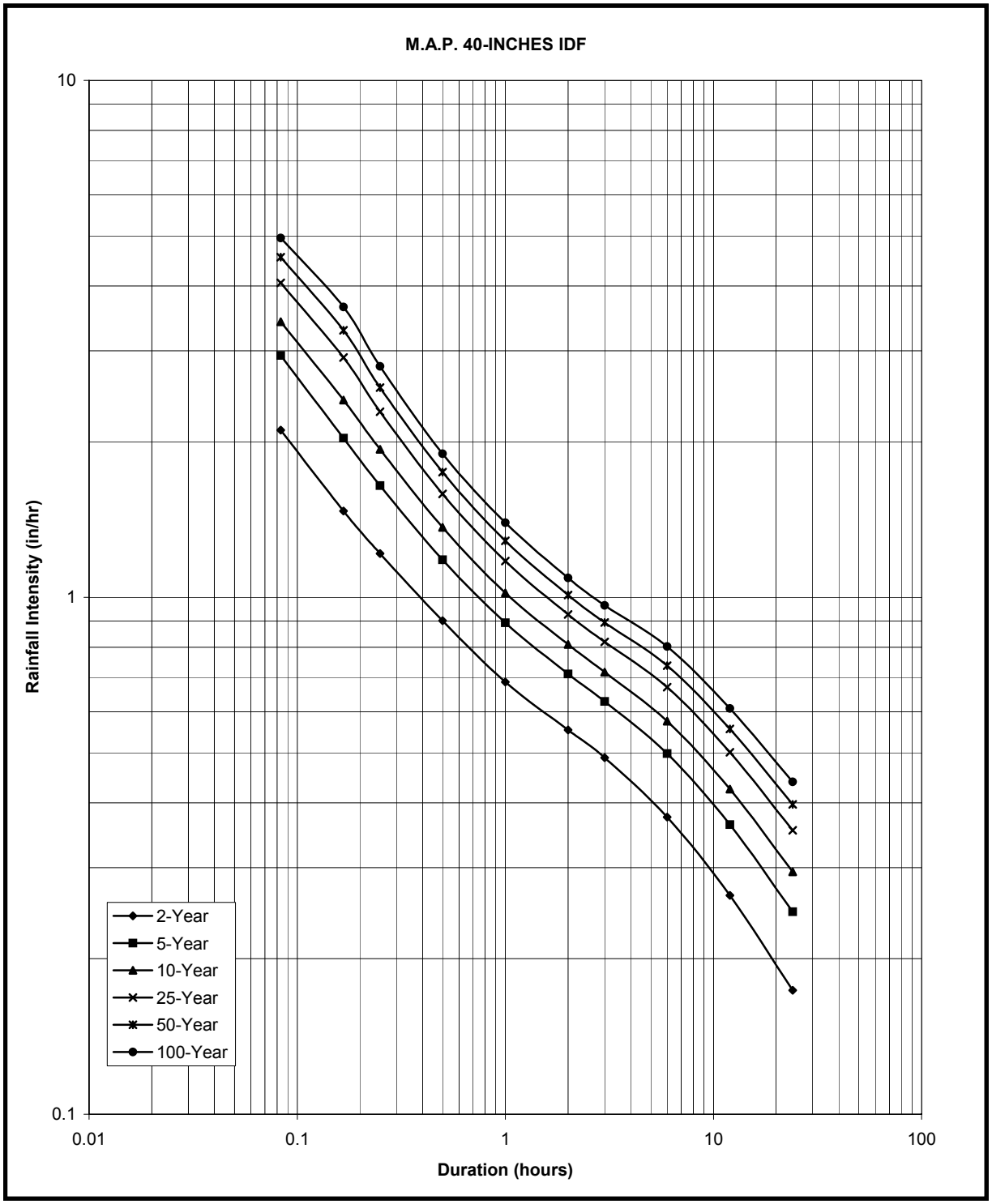

Figure B-6
IDF Curve, M.A.P. = 40 inches

Return Period/Duration	$A_{T,D}$	$B_{T,D}$
2-YR RETURN PERIOD		
5-min	0.120194	0.001385
10-min	0.166507	0.001956
15-min	0.176618	0.003181
30-min	0.212497	0.005950
1-hr	0.253885	0.010792
2-hr	0.330848	0.019418
3-hr	0.374053	0.027327
6-hr	0.425178	0.045735
12-hr	0.409397	0.069267
24-hr	0.314185	0.096343
48-hr	0.444080	0.134537
72-hr	0.447104	0.159461
5-YR RETURN PERIOD		
5-min	0.170347	0.001857
10-min	0.228482	0.002758
15-min	0.250029	0.004036
30-min	0.307588	0.007082
1-hr	0.357109	0.013400
2-hr	0.451840	0.024242
3-hr	0.512583	0.034359
6-hr	0.554937	0.060859
12-hr	0.562227	0.094871
24-hr	0.474528	0.136056
48-hr	0.692427	0.187173
72-hr	0.673277	0.224003
10-YR RETURN PERIOD		
5-min	0.201876	0.002063
10-min	0.258682	0.003569
15-min	0.294808	0.004710
30-min	0.367861	0.007879
1-hr	0.427723	0.014802
2-hr	0.522608	0.027457
3-hr	0.591660	0.038944
6-hr	0.625054	0.070715
12-hr	0.641638	0.111660
24-hr	0.567017	0.162550
48-hr	0.832445	0.221820
72-hr	0.810509	0.265469

Table B-1
Parameters $A_{T,D}$ and $B_{T,D}$ for TDS Equation

Return Period/Duration	$A_{T,D}$	$B_{T,D}$
25-YR RETURN PERIOD		
5-min	0.230641	0.002691
10-min	0.287566	0.004930
15-min	0.348021	0.005594
30-min	0.443761	0.008719
1-hr	0.508791	0.016680
2-hr	0.612629	0.031025
3-hr	0.689252	0.044264
6-hr	0.693566	0.083195
12-hr	0.725892	0.132326
24-hr	0.675008	0.195496
48-hr	0.989588	0.264703
72-hr	0.967854	0.316424
50-YR RETURN PERIOD		
5-min	0.249324	0.003241
10-min	0.300971	0.006161
15-min	0.384016	0.006315
30-min	0.496301	0.009417
1-hr	0.568345	0.017953
2-hr	0.672662	0.033694
3-hr	0.754661	0.048157
6-hr	0.740666	0.092105
12-hr	0.779967	0.147303
24-hr	0.747121	0.219673
48-hr	1.108358	0.295510
72-hr	1.075643	0.353143
100-YR RETURN PERIOD		
5-min	0.269993	0.003580
10-min	0.315263	0.007312
15-min	0.421360	0.006957
30-min	0.553934	0.009857
1-hr	0.626608	0.019201
2-hr	0.732944	0.036193
3-hr	0.816471	0.051981
6-hr	0.776677	0.101053
12-hr	0.821859	0.162184
24-hr	0.814046	0.243391
48-hr	1.210895	0.325943
72-hr	1.175000	0.389038

Table B-2
Parameters $A_{T,D}$ and $B_{T,D}$ for TDS Equation

Figure D-1. Normalized Rainfall Pattern

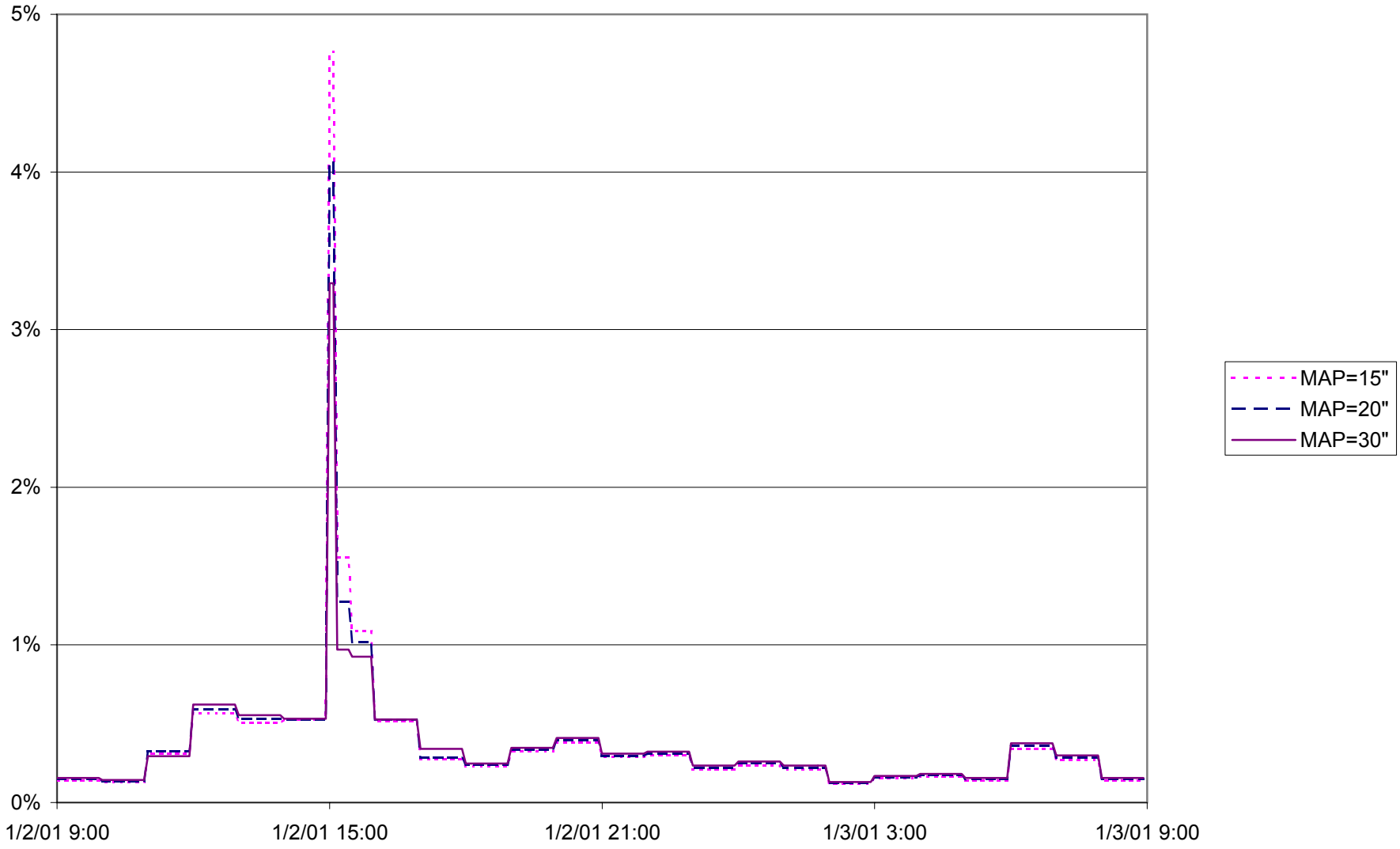

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Table D-1. Fractions of Total Rainfall for 24-Hour, 5-Minute Pattern

Time Starting	Time Ending	Fraction of Total Rainfall (%) For Each 5-Minute Increment of Time Period		
		MAP=15”	*MAP=20”*	*MAP=30”*
0:00	1:00	0.1412	0.1482	0.1558
1:00	2:00	0.1294	0.1358	0.1429
2:00	3:00	0.3080	0.3223	0.2945
3:00	4:00	0.5667	0.5930	0.6214
4:00	5:00	0.5051	0.5285	0.5538
5:00	6:00	0.5272	0.5266	0.5324
6:00	**6:05**	**4.7600**	**4.0600**	**3.2950**
6:05	**6:10**	**4.7600**	**4.0600**	**3.2950**
6:10	**6:15**	**1.5540**	**1.2750**	**0.9700**
6:15	**6:30**	**1.5540**	**1.2750**	**0.9700**
6:30	**6:45**	**1.0850**	**1.0169**	**0.9253**
6:45	**7:00**	**1.0850**	**1.0169**	**0.9253**
7:00	8:00	0.5177	0.5229	0.5263
8:00	9:00	0.2763	0.2860	0.3410
9:00	10:00	0.2302	0.2384	0.2478
10:00	11:00	0.3223	0.3337	0.3469
11:00	12:00	0.3799	0.3933	0.4089
12:00	13:00	0.2878	0.2979	0.3098
13:00	14:00	0.2993	0.3099	0.3222
14:00	15:00	0.2118	0.2223	0.2338
15:00	16:00	0.2353	0.2470	0.2597
16:00	17:00	0.2118	0.2223	0.2338
17:00	18:00	0.1177	0.1235	0.1299
18:00	19:00	0.1530	0.1605	0.1688
19:00	20:00	0.1647	0.1729	0.1818
20:00	21:00	0.1412	0.1482	0.1558
21:00	22:00	0.3142	0.3581	0.3766
22:00	23:00	0.2706	0.2840	0.2987
23:00	0:00	0.2824	0.1482	0.1558

Peak Hour

Table B-2 Curve Numbers for AMC II

DRAFT 5/01/2006

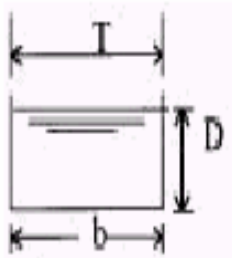
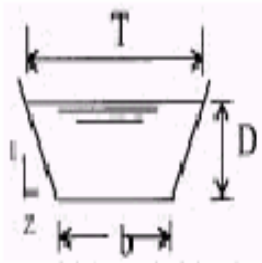
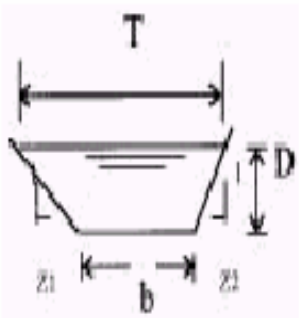
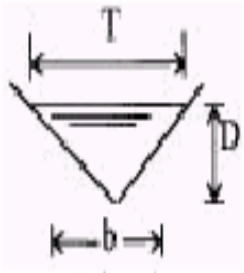
Land Use Type	Hydrologic Condition	Hydrologic Soil Group A	B	C	D
Open Water (100% Impervious)	good				
	fair				
	poor				
Low Density Residential (25% Impervious)	good	35	48	66	70
	fair	44	58	71	74
	poor	64	68	78	79
High Density Residential (50% Impervious)	good	35	48	65	70
	fair	44	58	71	74
	poor	64	68	78	79
Commercial/Industrial (80% Impervious)	good	35	48	65	70
	fair	44	58	71	74
	poor	64	68	78	79
Bare Rock/Sand/Clay (Imperviousness Varies)					
Quarries/Gravel Pits (0 % Impervious)	good	0	0	0	0
	fair	0	0	0	0
	poor	0	0	0	0
Deciduous Forest (0% Impervious)	good	27	30	41	48
	fair	35	48	57	63
	poor	48	66	74	79
Evergreen Forest (0% Impervious)	good	37	43	62	70
	fair	45	57	69	80
	poor	58	71	85	90
Mixed Forest	good	32	36	51	59
	fair	40	52	63	72
	poor	53	68	80	85
Shrub Land (0% Impervious)	good	27	43	60	68
	fair	35	51	65	72
	poor	48	62	72	78
Orchards (1% Impervious)	good	39	52	66	71
	fair	43	65	76	82
	poor	57	73	82	86
Vineyards (1% Impervious)	good	64	70	77	80
	fair	67	75	82	85
	poor	71	80	87	90
Grassland (0% Impervious)	good	38	50	69	76
	fair	48	60	74	80
	poor	58	70	80	84
Pasture/Hay (0% Impervious)	good	34	50	69	76
	fair	44	60	74	80
	poor	64	70	80	84
Row Crops (1% Impervious)	good	64	70	77	80
	fair	67	75	82	85
	poor	71	80	87	90
Small Grains (0% Impervious)	good	48	58	70	74
	fair	49	59	71	75
	poor	50	60	71	75
Fallow (1% Impervious)	good	64	68	78	79
	fair	70	77	84	86
	poor	77	86	91	94
Urban Recreational (10% Impervious)	good	34	48	66	70
	fair	44	58	71	74
	poor	64	64	78	79

Table E-2. Conversion of AMC II Curve Numbers to other AMC Values

DRAFT 3/01/2006

AMC II	AMC I	AMC III	AMC II-1/4	AMC II-1/2
100	100	100	100	100
99	97	100	99.5	100
98	94	99	98.5	99
97	91	99	97.5	98
96	89	99	97	98
95	87	98	96	97
94	85	98	95	96
93	83	98	94.5	96
92	81	97	93.5	95
91	80	97	92.5	94
90	78	96	91.5	93
89	76	96	91	93
88	75	95	90	92
87	73	95	89	91
86	72	94	88	90
85	70	94	87.5	90
84	68	93	86.5	89
83	67	93	85.5	88
82	66	92	84.5	87
81	64	92	84	87
80	63	91	83	86
79	62	91	82	85
78	60	90	81	84
77	59	89	80	83
76	58	89	79.5	83
75	57	88	78.5	82
74	55	88	77.5	81
73	54	87	76.5	80
72	53	86	75.5	79
71	52	86	75	79
70	51	85	74	78
69	50	84	73	77
68	48	84	72	76
67	47	83	71	75
66	46	82	70	74
65	45	82	69.5	74
64	44	81	68.5	73
63	43	80	67.5	72
62	42	79	66.5	71

AMC II	AMC I	AMC III	AMC II-1/4	AMC II-1/2
61	41	78	65.5	70
60	40	78	64.5	69
59	39	77	63.5	68
58	38	76	62.5	67
57	37	75	61.5	66
56	36	75	61	66
55	35	74	60	65
54	34	73	59	64
53	33	72	58	63
52	32	71	57	62
51	31	70	56	61
50	31	70	55	60
49	30	69	54	59
48	29	68	53	58
47	28	67	52	57
46	27	66	51	56
45	26	65	50	55
44	25	64	49	54
43	25	63	48	53
42	24	62	47	52
41	23	61	46	51
40	22	60	45	50
39	21	59	44	49
38	21	58	43	48
37	20	57	42	47
36	19	56	41	46
35	18	55	40	45
34	18	54	39	44
33	17	53	38	43
32	16	52	37	42
31	16	51	36	41
30	15	50	35	40
25	12	43	29.5	34
20	9	37	24.5	29
15	6	30	19	23
10	4	22	13	16
5	2	13	7	9
0	0	0	0	0

Cross Section	Area, A	Wetted Perimeter, WP
 Rectangle	bD	$b + 2D$
 Trapezoid (equal side slopes)	$(b + ZD)D$	$b + 2D\sqrt{1 + Z^2}$
 Trapezoid (unequal side slopes)	$\frac{D^2}{2}(Z_1 + Z_2) + Db$	$b + D(\sqrt{1 + Z_1^2} + \sqrt{1 + Z_2^2})$
 Triangle	ZD^2	$2D\sqrt{1 + Z^2}$

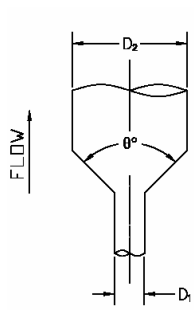
Reference: VT Chow "Open Channel Hydraulics" for a more complete table of geometric elements.

Table F-2
Geometric Elements of Channel Sections

(a) Expansion (K_c)

Θ*	$D_2/D_1 = 3$	$D_2/D_1 = 1.5$
10	0.17	0.17
20	0.40	0.40
45	0.86	1.06
60	1.02	1.21
90	1.06	1.14
120	1.04	1.07
180	1.00	1.00

* The angle is the angle in degrees between the sides of the tapering section

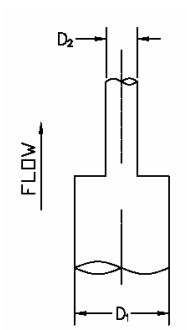


(b) Pipe Entrance from Reservoir

Bell Mouth	$H_L = 0.04 V^2/2g$
Square-Edge	$H_L = 0.04 V^2/2g$
Groove End U/S For Concrete Pipe	$H_L = 0.2 V^2/2g$

(c) Contractions (K_c)

D_2/D_1	K_c
0	0.5
0.4	0.4
0.6	0.3
0.8	0.1
1.0	0



Source:

Table F-3
Storm Sewer Energy Loss Coefficients

d_2/d_1 = ratio of larger pipe to smaller pipe													V_1 = velocity in smaller pipe
$\frac{d_2}{d_1}$	Velocity, V_1, in feet per second												
	2	3	4	5	6	7	8	10	12	15	20	30	40
1.2	.11	.10	.10	.10	.10	.10	.10	.09	.09	.09	.09	.09	.08
1.4	.26	.26	.25	.24	.24	.24	.24	.23	.23	.22	.22	.21	.20
1.6	.40	.39	.38	.37	.37	.36	.36	.35	.35	.34	.33	.32	.32
1.8	.51	.49	.48	.47	.47	.46	.46	.45	.44	.43	.42	.41	.40
2.0	.60	.58	.56	.55	.55	.54	.53	.52	.52	.51	.50	.48	.47
2.5	.74	.72	.70	.69	.68	.67	.66	.65	.64	.63	.62	.60	.58
3.0	.83	.80	.78	.77	.76	.75	.74	.73	.72	.70	.69	.67	.65
4.0	.92	.89	.87	.85	.84	.83	.82	.80	.79	.78	.76	.74	.72
5.0	.96	.93	.91	.89	.88	.87	.86	.84	.83	.82	.80	.77	.75
10.0	1.00	.99	.96	.95	.93	.92	.91	.89	.88	.86	.84	.82	.80
∞	1.00	1.00	.98	.96	.95	.94	.93	.91	.90	.88	.86	.83	.81

Table F-4
Values of K_e for Determining Loss of Head Due to Sudden Enlargement in Pipes, from the Equation:
$H_2 = K_2(V_1^2/2g)$

d_2/d_1 = ratio of diameter of larger pipe to diameter of smaller pipe. Angle of cone is twice the angle between the axis of the cone and its side.														
$\frac{d_2}{d_1}$	Angle of cone													
	2°	4°	6°	8°	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°
1.1	.01	.01	.01	.02	.03	.05	.10	.13	.16	.18	.19	.20	.21	.23
1.2	.02	.02	.02	.03	.04	.09	.16	.21	.25	.29	.31	.33	.35	.37
1.4	.02	.03	.03	.04	.06	.12	.23	.30	.36	.41	.44	.47	.50	.53
1.6	.03	.03	.04	.05	.07	.14	.26	.35	.42	.47	.51	.54	.57	.61
1.8	.03	.04	.04	.05	.07	.15	.28	.37	.44	.50	.54	.58	.61	.65
2.0	.03	.04	.04	.05	.07	.16	.29	.38	.46	.52	.56	.60	.63	.68
2.5	.03	.04	.04	.05	.08	.16	.30	.39	.48	.54	.58	.62	.65	.70
3.0	.03	.04	.04	.05	.08	.16	.31	.40	.48	.55	.59	.63	.66	.71
∞	.03	.04	.05	.06	.08	.16	.31	.40	.49	.56	.60	.64	.67	.72

Table F-5
Values of K_2 for Determining Loss of Head Due to Gradual Enlargement in Pipes, from the Equation:
$H_2 = K_2(V_1^2/2g)$

d_2/d_1 = ratio of larger to smaller diameter													V_2 = velocity in smaller pipe
$\frac{d_2}{d_1}$	Velocity, V_2, in feet per second												
	2	3	4	5	6	7	8	10	12	15	20	30	40
1.1	.03	.04	.04	.04	.04	.04	.04	.04	.04	.04	.05	.05	.06
1.2	.07	.07	.07	.07	.07	.07	.07	.08	.08	.08	.09	.10	.11
1.4	.17	.17	.17	.17	.17	.17	.17	.18	.18	.18	.18	.19	.20
1.6	.26	.26	.26	.26	.26	.26	.26	.26	.26	.25	.25	.25	.24
1.8	.34	.34	.34	.34	.34	.34	.33	.33	.32	.32	.31	.29	.27
2.0	.38	.38	.37	.37	.37	.37	.36	.36	.35	.34	.33	.31	.29
2.2	.40	.40	.40	.39	.39	.39	.39	.38	.37	.37	.35	.33	.30
2.5	.42	.42	.42	.41	.41	.41	.40	.40	.39	.38	.37	.34	.31
3.0	.44	.44	.44	.43	.43	.43	.42	.42	.41	.40	.39	.36	.33
4.0	.47	.46	.46	.46	.45	.45	.45	.44	.43	.42	.41	.37	.34
5.0	.48	.48	.47	.47	.47	.46	.46	.45	.45	.44	.42	.38	.35
10.0	.49	.48	.48	.48	.48	.47	.47	.46	.46	.45	.43	.40	.36
∞	.49	.49	.48	.48	.48	.47	.47	.47	.46	.45	.44	.41	.38

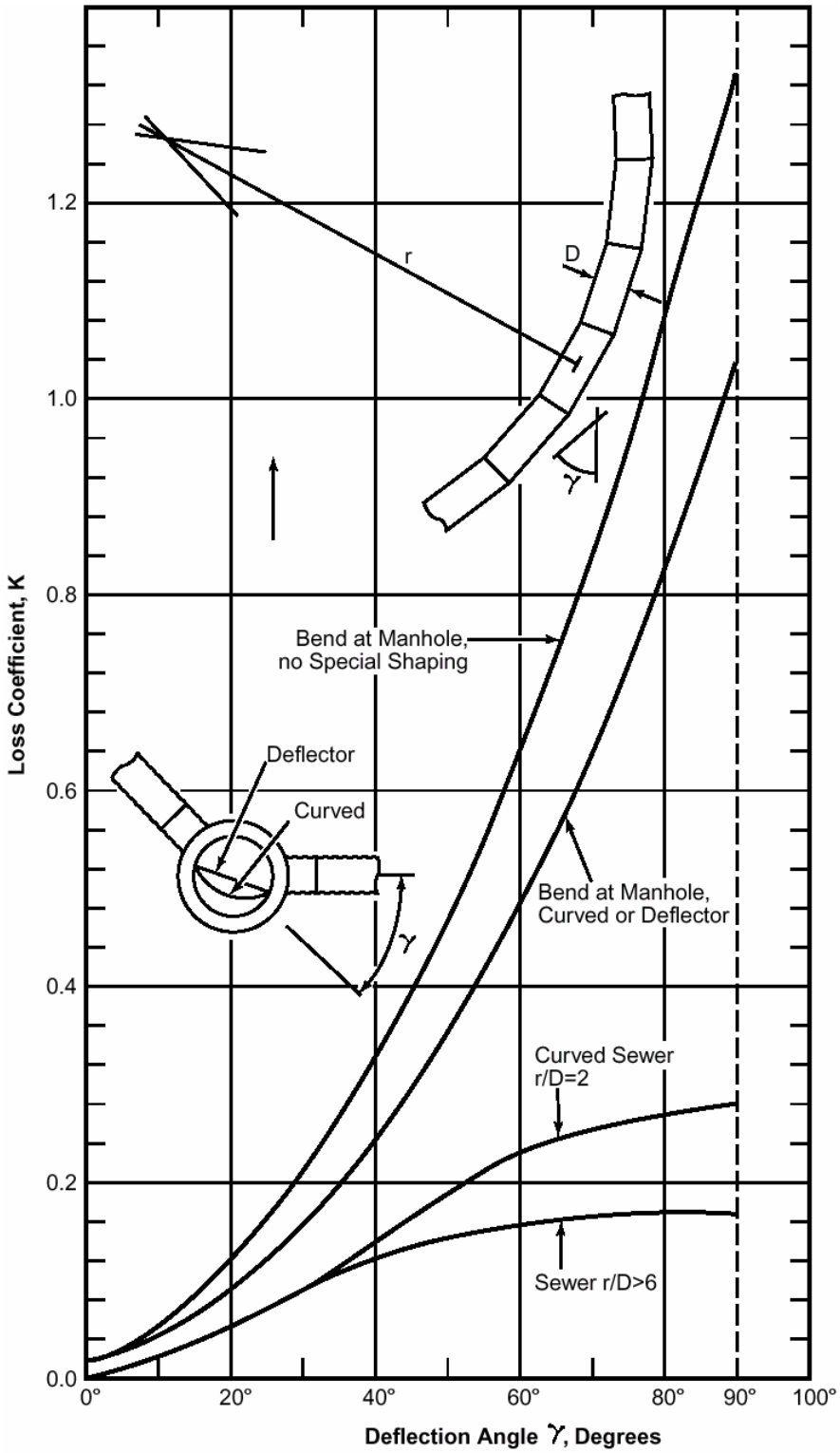
Table F-6
Values of K_3 for Determining Loss of Head Due to Sudden Contraction from the Equation:
$H_3 = K_3(V_2^2/2g)$

Type of Structure and Design of Entrance	Coefficient K_e
• Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = D/12)	0.2
Mitered to conform to fill slope	0.7
* End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
• Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
* End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels	0.2
Side- or slope-tapered inlet	0.2
• Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of D/12 or B/12 or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of D/12 or beveled top edge	0.2
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2

*Note: "End Sections conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.

Source:

Table F-7
Entrance Head Loss Coefficients

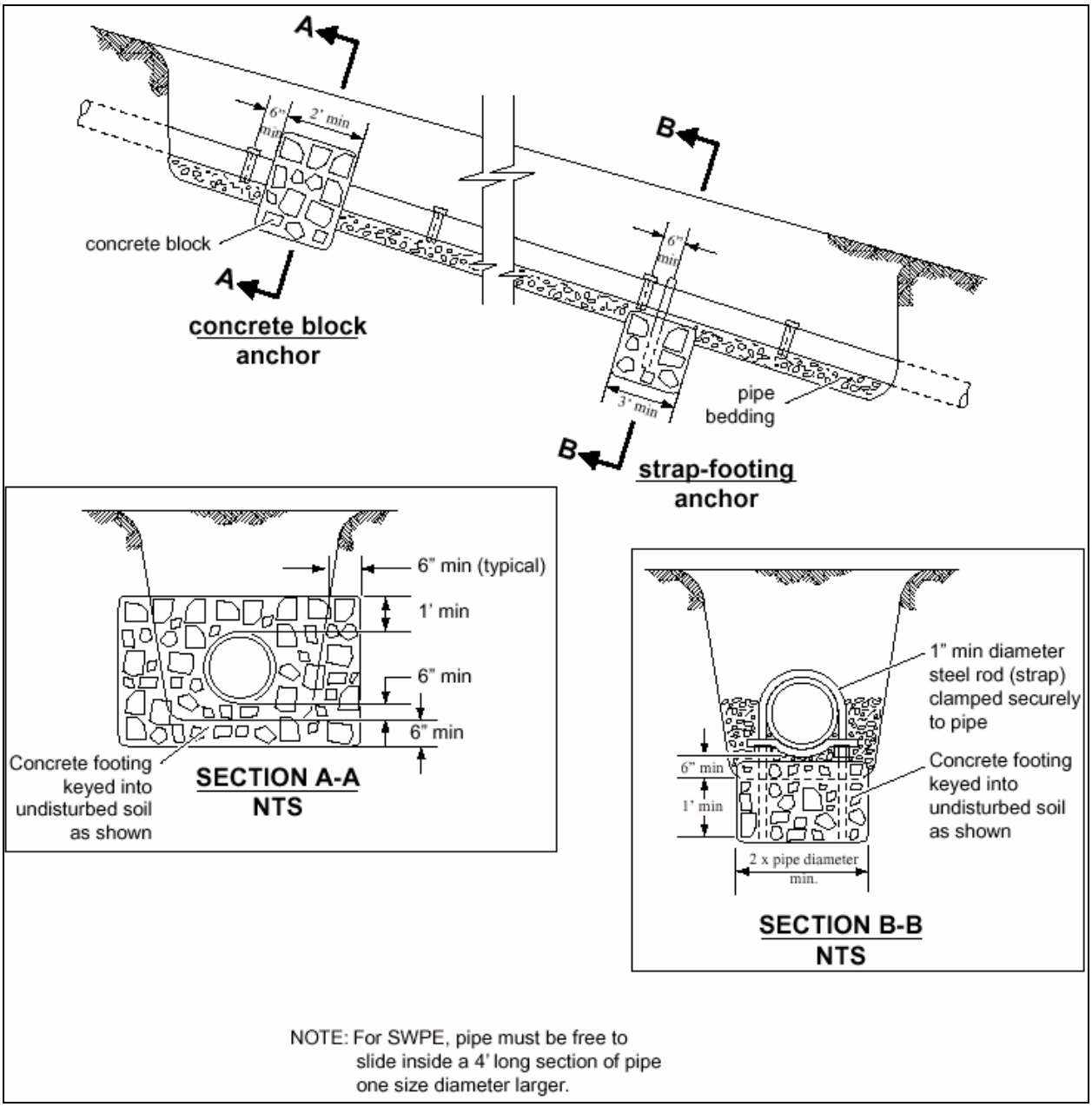


Source:

Figure F-8
Bend Head Loss Coefficients

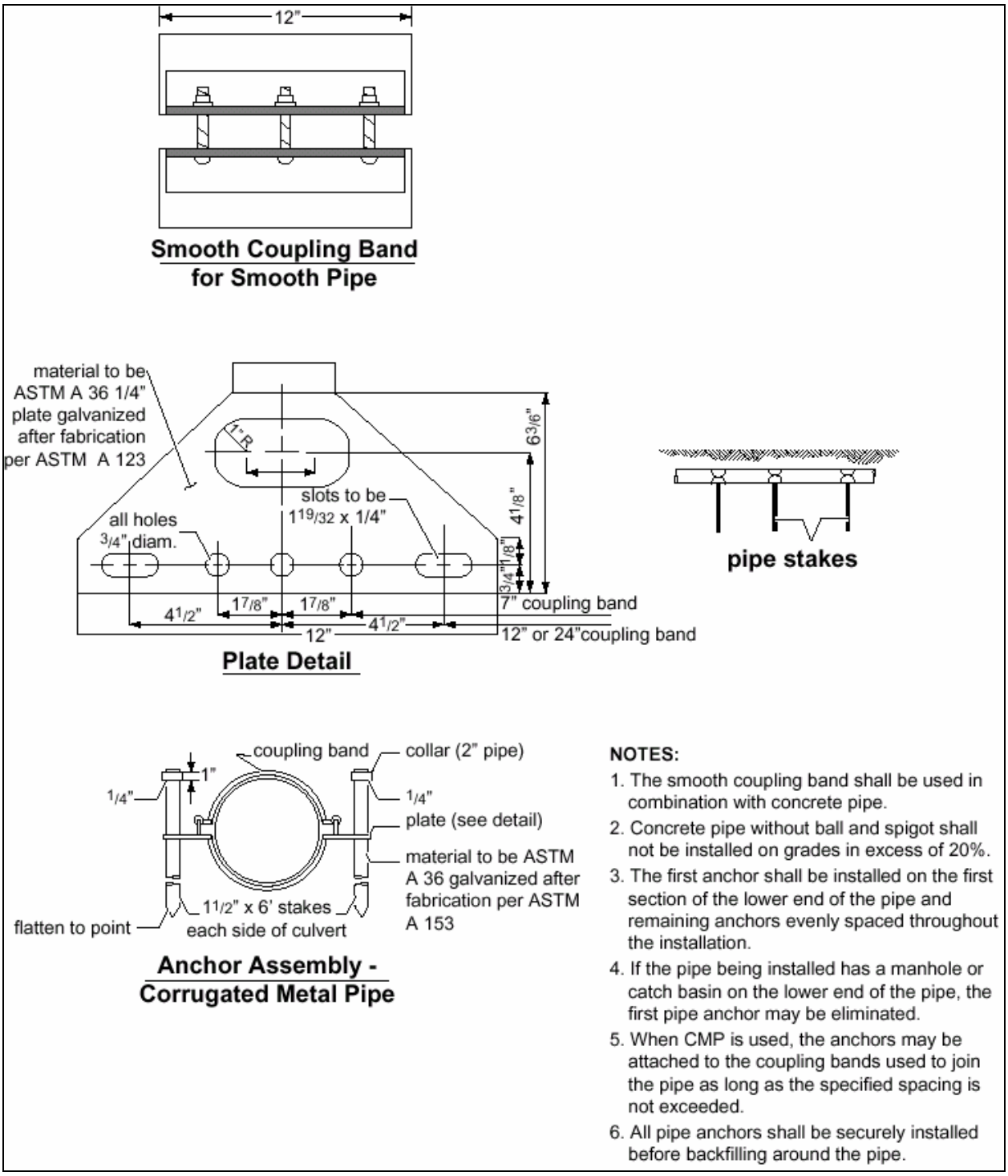
Pipe Diameter, Inches	V = 2 fps Slope, Percent				V = 3 fps Slope, Percent			
	n=0.010	n=0.011	n=0.012	n=0.013	n=0.010	n=0.011	n=0.012	n=0.013
8	0.197	0.238	0.284	0.332	0.443	0.536	0.638	0.749
10	0.147	0.178	0.213	0.248	0.329	0.399	0.474	0.557
12	0.115	0.139	0.166	0.194	0.259	0.313	0.372	0.437
15	0.086	0.104	0.123	0.145	0.192	0.232	0.277	0.325
18	0.067	0.081	0.097	0.114	0.151	0.182	0.217	0.255
21	0.055	0.066	0.079	0.092	0.123	0.149	0.177	0.208
24	0.046	0.055	0.066	0.077	0.103	0.124	0.148	0.174
27	0.039	0.047	0.056	0.065	0.088	0.106	0.127	0.149
30	0.034	0.041	0.049	0.057	0.076	0.092	0.110	0.129
33	0.030	0.036	0.043	0.051	0.067	0.081	0.097	0.114
36	0.027	0.032	0.038	0.045	0.060	0.073	0.086	0.101
42	0.022	0.026	0.031	0.036	0.049	0.059	0.070	0.083
48	0.018	0.022	0.026	0.31	0.041	0.049	0.059	0.069
54	0.015	0.019	0.022	0.027	0.035	0.042	0.050	0.059
60	0.013	0.016	0.019	0.023	0.030	0.037	0.044	0.051
66	0.012	0.014	0.017	0.020	0.027	0.032	0.039	0.045
72	0.011	0.013	0.015	0.018	0.024	0.029	0.034	0.040
78	0.010	0.011	0.014	0.016	0.021	0.026	0.031	0.036
84	0.009	0.010	0.012	0.015	0.019	0.024	0.028	0.033
90	0.008	0.010	0.011	0.013	0.018	0.021	0.026	0.030
96	0.007	0.009	0.010	0.012	0.016	0.020	0.023	0.027
102	0.007	0.008	0.010	0.011	0.015	0.018	0.022	0.025
108	0.006	0.007	0.009	0.010	0.014	0.017	0.020	0.024
114	0.006	0.007	0.008	0.010	0.013	0.016	0.019	0.022
120	0.005	0.006	0.008	0.009	0.012	0.015	0.017	0.020
126	0.005	0.006	0.007	0.008	0.011	0.014	0.016	0.019
132	0.004	0.006	0.007	0.008	0.011	0.013	0.015	0.018
138	0.004	0.005	0.006	0.007	0.010	0.012	0.014	0.017
144	0.004	0.005	0.006	0.007	0.009	0.011	0.014	0.016

Table F-9
Slopes Required to Maintain Minimum Velocities for Full and Half Full Flow



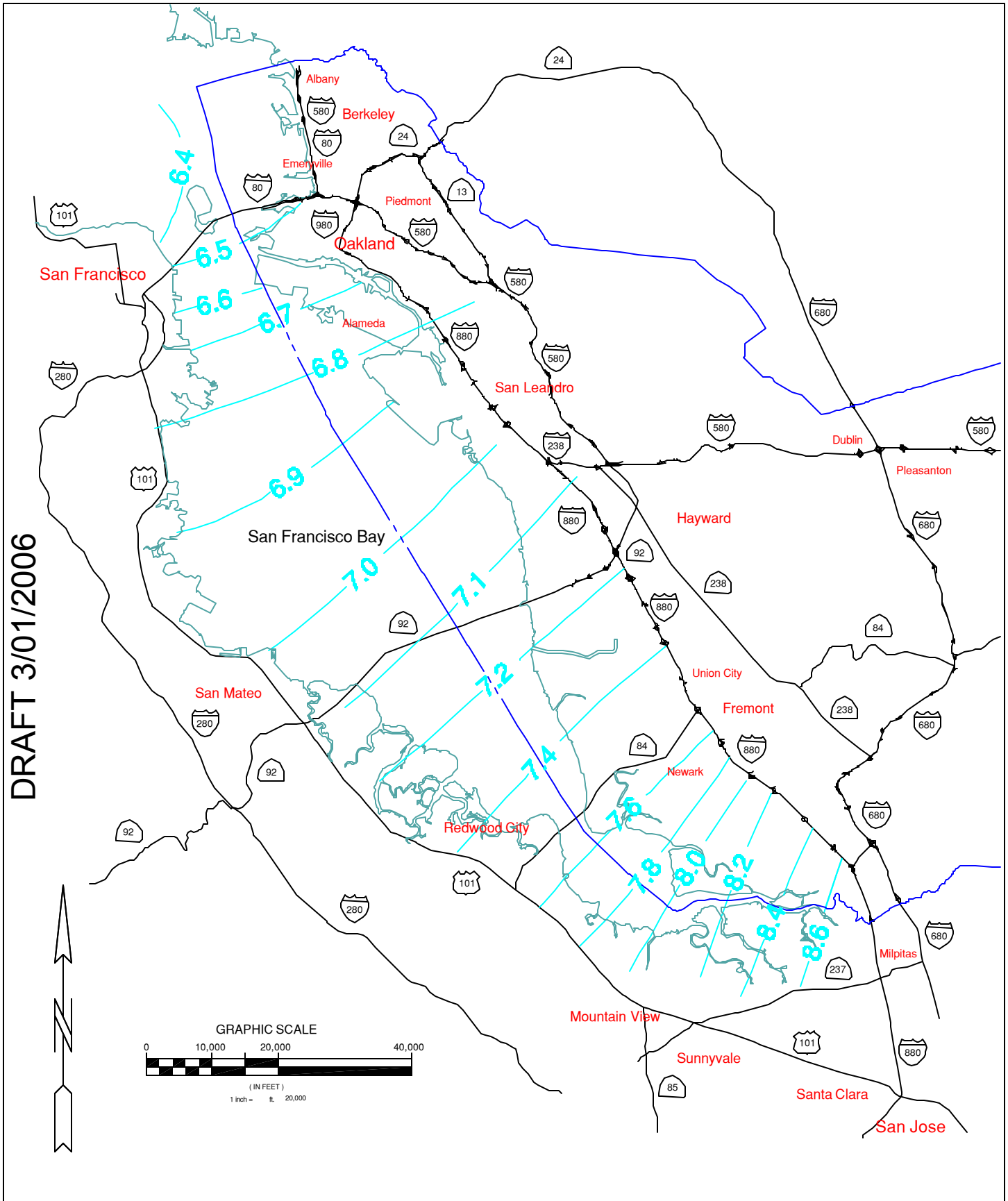
Source:

Figure G-1
Pipe Anchor Detail 1



Source:

Figure G-2
Pipe Anchor Detail 2



Source: Alameda County Flood Control and Water Conservation District

SANTA CLARA COUNTY OFFICE OF DEVELOPMENT SERVICES	**TIDAL SUMMARY- Adopted 100-yr Tidal Elevation(NGVD)**	DATE: APRIL 2003
		Figure I-2

DRAFT 3/01/2006

Table I-1. MHHW and Adopted 100-Year Tide Data
U. S. Army Corps of Engineers, San Francisco District
San Francisco Bay Tidal Study, June 1984
All elevations in feet.

		MHHW		***Adopted 100-Year Tide Elevation***
ID	*Bench Mark*	MLLW Datum	NGVD	NGVD
9414290	***San Francisco (Reference Station)***	*5.7*	*2.9*	*6.0*
9414525	***Palo Alto Yacht Harbor***	*8.3*	*4.3*	*7.8*
9414549	***Upper Guadalupe Slough***	*9.2*	*4.7*	*8.5*
9414551	***Gold Street Bridge, Alviso Slough***	*9.2*	*4.9*	*8.6*
9414561	***Coyote Creek, Tributary #1***	*8.4*	*4.0*	*8.6*
9414575	***Coyote Creek, Alviso Slough***	*8.9*	*4.6*	*8.2*

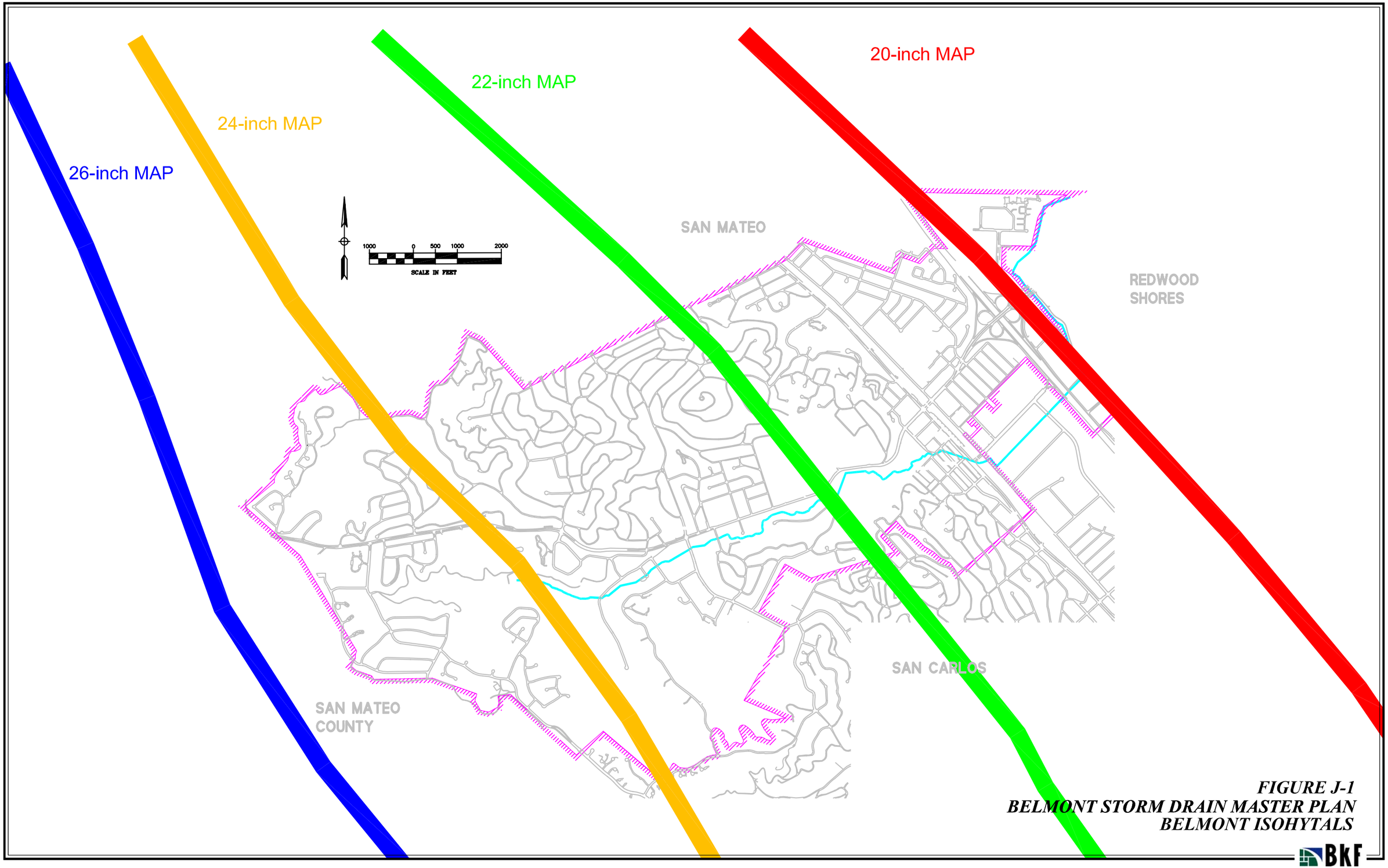


FIGURE J-1
BELMONT STORM DRAIN MASTER PLAN
BELMONT ISOHYTALS

BKF