CITY OF ESCALON

Storm Drain Master Plan

December 2007

Prepared for
City of Escalon

Prepared by
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Section 1

Project Background

1.1 INTRODUCTION

The City of Escalon (City), retained ECO:LOGIC Engineering in January 2006 to update the City's Storm Drain Master Plan (Master Plan). The need for the Master Plan update was precipitated by the City's adoption of their 2005 General Plan update, which provides the guidelines for community growth through the year 2035.

This report presents the methodology and the analyses conducted, the results of the analyses and the recommended improvements to the City's storm drain collection and discharge system to meet the needs of the City's future growth. Project cost information is included for use in the Public Facilities Implementation Plan and the proposed Capital Improvement Plan (CIP).

The City's storm drain systems rely on a long-standing relationship with the South San Joaquin Irrigation District (SSJID) and the use of SSJID's system of drains and laterals as a terminus or discharge point. The Master Plan was prepared in consultation with SSJID and is consistent with SSJID's system operating criteria. This Master Plan is predicated on the City's continued use of SSJID facilities for terminal drainage.

1.1.1. PLANNING APPROACH AND DESIGN CRITERIA

This Master Plan builds on the City's previous master planning efforts and updates. The objective of this Master Plan is to provide storm drainage facilities to collect and convey runoff from a 10-year rainfall event. All proposed facilities are to be designed to meet the design criteria and the standards of the City and SSJID.

1.2 DATA COLLECTION

This section summarizes the data and information sources that were referenced in formulating this Master Plan. The base mapping to be used in developing and presenting the master plan is also discussed.

1.2.1. PREVIOUS MASTER PLAN

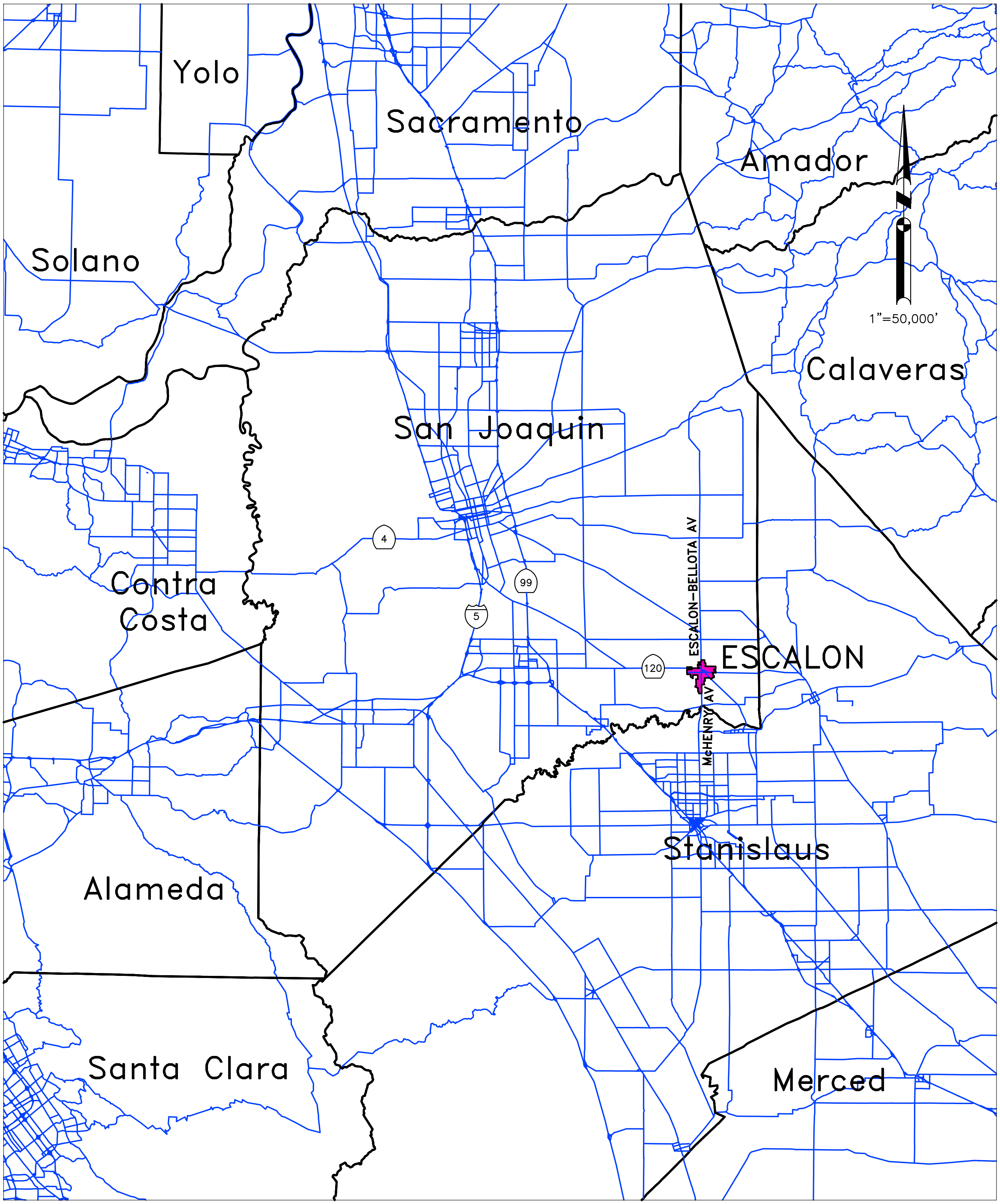
This Master Plan builds on the previous master planning efforts of 1978, which provided valuable information and analyses.

1.2.2. CITY OF ESCALON

GIS mapping, available through the City, was used to propose work maps, and was the starting point for preparation of base maps.

1.2.3. SOUTH SAN JOAQUIN IRRIGATION DISTRICT

SSJID owns the drains and laterals that convey the City's storm drainage to the local surface waterways. The Master Plan must meet SSJID requirements for limiting stormwater inflows to drains and laterals. The Master Plan must also maintain the integrity of SSJID facilities and include provisions to meet the National Pollutant Discharge Elimination System (NPDES) water quality restrictions.



CITY OF ESCALON
STORM DRAIN MASTER PLAN
VICINITY MAP

FIGURE 1-1

1.2.4. San Joaquin County

The San Joaquin County Hydrology Manual was used as a reference to update the City's precipitation data and rainfall intensity curves. Soils information and recent aerial photography were also obtained from the County.

1.2.5. Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) soils maps for San Joaquin County were used to identify hydrologic soil groups within the study area.

1.2.6. Survey/Topographic Data

Field surveys were conducted to verify elevation and horizontal location of existing drainage facilities. This information was used in the modeling of the existing storm drain systems.

1.2.7. City of Escalon General Plan Update 2005

Existing and proposed land uses specified in the City's 2005 General Plan update were used in modeling both the existing and proposed storm drain systems.

1.3 ORGANIZATION OF THE STORM DRAIN MASTER PLAN REPORT

1.3.1. Section Organization

Section 2 examines the City's existing storm drainage systems. Figure 2-1 shows the existing storm drain systems referred to throughout the Master Plan.

Section 3 summarizes design criteria. The design criteria will guide development of storm drain systems throughout the City.

Section 4 analyzes both existing and future storm drain systems, making improvement recommendations where appropriate. This section also evaluates SSJID requirements.

Section 5 is the Capital Improvement Program, providing a guide for implementation of the recommended improvements. The cost data and capital improvement data will be used in the preparation of an updated Public Facilities Implementation Plan.

Section 2

Existing Storm Drain System

The City of Escalon's storm drainage system depends on SSJID's existing system of irrigation laterals to transport storm drain runoff from the City. These laterals run south and west, to the Stanislaus River and the Lone Tree Creek respectively. The City is divided into ten drainage sheds, shown in Figure 2-1, each of which contains a storm drain system that collects runoff from within the drainage shed and transports the flows to a City maintained storm drain basin. There is an existing drainage shed within the City that utilizes interim retention basin Storm Drain System 11. The basins within the existing systems are designed to reduce the peak flow rates released to the SSJID laterals. Runoff is temporarily stored in the basins then is pumped into the SSJID laterals at the reduced flow rate.

Storm Drain System 4 is the only system that does not discharge to a SSJID lateral. Runoff collected by Storm Drain System 4 is pumped directly to the industrial ponds at the City's waste water treatment plant.

2.1 EXISTING STORM DRAINAGE FACILITIES

The City's existing drainage facilities, shown on Figure 2-2, consist of:

- Storm Drain Collection System
- Basins
- Pump Stations
- SSJID Laterals

2.1.1. STORM DRAIN COLLECTION SYSTEM

The storm drain collection system includes inlets, manholes and piping. The system collects storm drainage from the surrounding streets through inlets, and transports the drainage via a piping network to basins and/or pump stations.

2.1.2. BASINS

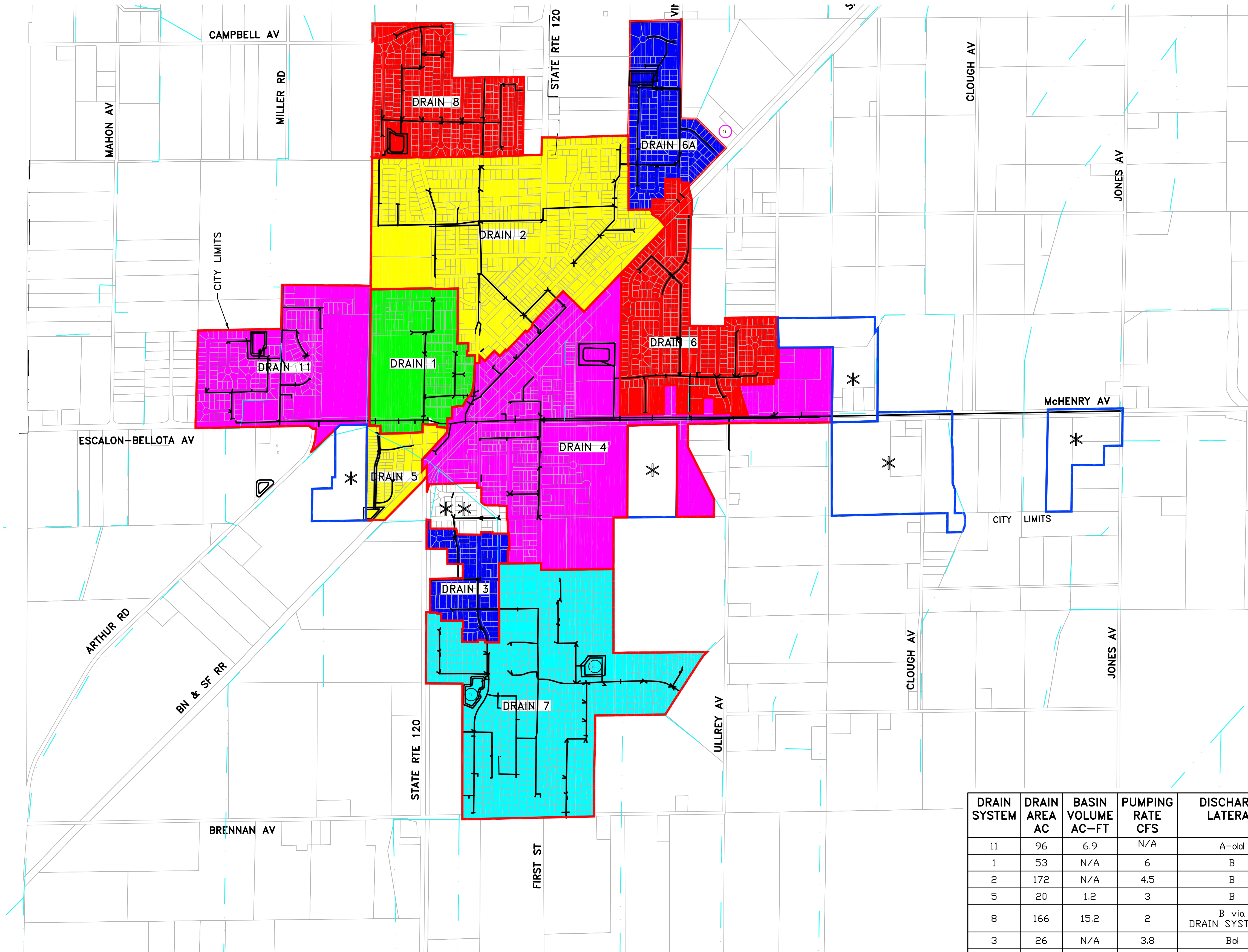
Detention basins are used to temporarily store runoff from the drainage sheds in order to reduce the flow rates that are pumped into the SSJID laterals. SSJID requires the flows entering the lateral be regulated to ensure that the capacities of the laterals are not exceeded. Basins allow the use of smaller pumps that reduce capital expense and energy costs. Detention basins are typically joint use facilities providing recreation and other uses when not occasionally being used for stormwater storage. There are currently ten existing basins within the City and thirteen new basins proposed in the Master Plan.

2.1.3. PUMP STATIONS

With the exception of runoff from Storm Drain System 4, storm drainage from the City is pumped into the SSJID laterals. Pumps are sized according to the City's design criteria, and their operation is controlled by water levels in the pump station sump and in the downstream SSJID laterals. There are ten existing drainage pump stations in the City with an additional thirteen pump stations planned for each of the thirteen future detention basins.

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING DRAIN SHEDS



DRAIN SYSTEM	DRAIN AREA AC	BASIN VOLUME AC-FT	PUMPING RATE CFS	DISCHARGE LATERAL	S.S.J.I.D. DISCHARGE DRAIN
11	96	6.9	N/A	A-dd	LONE TREE CREEK
1	53	N/A	6	B	LONE TREE CREEK
2	172	N/A	4.5	B	LONE TREE CREEK
5	20	1.2	3	B	LONE TREE CREEK
8	166	15.2	2	B via DRAIN SYSTEM 2	LONE TREE CREEK
3	26	N/A	3.8	Bd	D.R. 14
7	215	21	3.8	Bd	D.R. 14
6A	52	6.6	N/A	K	D.R. 13
4	196	13	7.5	INDUSTRIAL BASINS	N/A
6	126	4	4.5	INDUSTRIAL BASINS via DRAIN SYSTEM 4	N/A

* : DENOTES PRIVATE ON-SITE DRAIN SYSTEMS

** : DENOTES DRAIN SYSTEM THAT FLOWS DIRECTLY TO LATERAL

Date DECEMBER 2007

Project File No. 2021-0010

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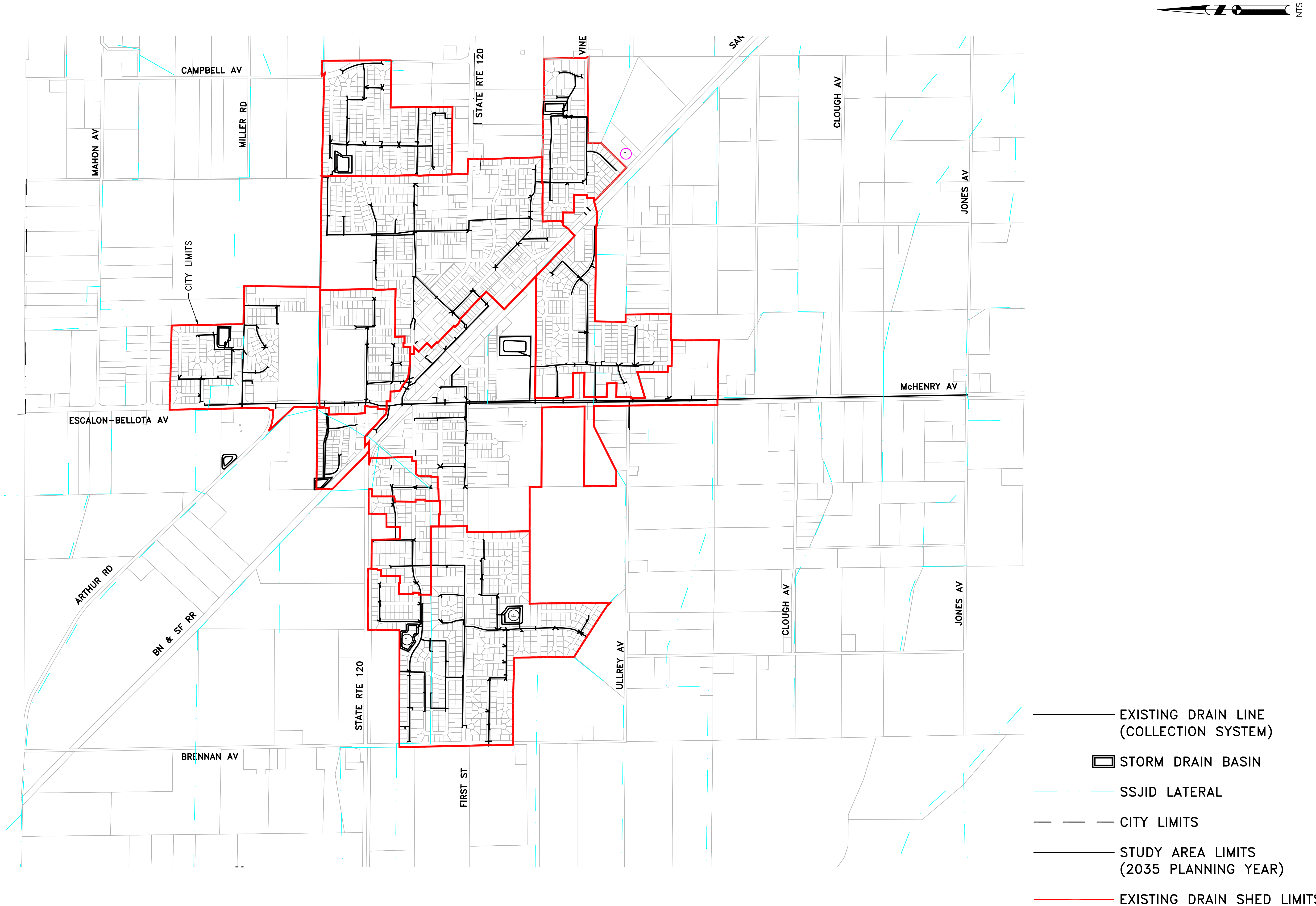
FIGURE 2-1



CITY OF ESCALON

STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS

Date DECEMBER 2007

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FIGURE 2-2

2.2 SOUTH SAN JOAQUIN IRRIGATION DISTRICT

The City currently discharges to three SSJID laterals. The SSJID laterals deliver irrigation water and are also used to convey drainage. SSJID requires the capacity of the laterals be maintained year-round for the delivery of irrigation water. For this reason, the flow of drainage into laterals must be monitored to insure adequate capacity is maintained. This Master Plan proposes to use four additional SSJID laterals, Laterals K, Ka, Bc and Bf. The SSJID laterals currently used to transport City storm drainage include:

- Lateral B - Lateral receives drainage from Drain Systems 1, 2, 5 and 11
- Lateral Bd (Bk)- Lateral receives drainage from Drain Systems 3 and 7
- Drain Systems 4 and 6 discharge to the industrial basins at the City of Escalon's wastewater treatment plant.

Section 3

Design Criteria

Design Criteria act as guidelines and minimum standards for the design of storm drainage systems, retention facilities and drainage pump stations within the City. Project specific engineering issues requiring unique solutions not specifically covered by these criteria are expected.

These design criteria will be used in conjunction with the City of Escalon Standard Plans and Specifications. This information is intended to be used as a design guideline, and the appropriate review of this information and its application to specific design is the sole responsibility of the design engineer.

3.1 GENERAL

3.1.1. MASTER PLAN

Storm drain design shall conform to the City's Storm Drain Master Plan, and the City's Improvement Standards.

3.1.2. DRAINAGE ANALYSIS

A drainage study that includes the entire tributary area of the subject area shall be submitted and approved by the Public Works Department prior to the approval/recording of a final subdivision or parcel map. The proposed drainage plan may be evaluated by the City using the Storm Drain Master Plan to assure that the proposed facilities conform to said plan. The project drainage study shall include the following:

1. A topographic map of the drainage shed and adjacent area showing existing and proposed ground elevations and sub-drainage shed areas.
2. 10-year and 100-year design flows at key locations.
3. Preliminary pipe sizes and typical drainage channel geometry with hydraulic grade lines, inverts, and proposed ground elevations.
4. A map showing analysis points, proposed street grades, and storm drain facilities.
5. Configuration and elevations of proposed retention basins, including a preliminary grading plan.
6. Information on proposed pumps, stage/storage, and discharge information, including the SSJID lateral discharged to if applicable, for retention basins.
7. A preliminary site plan for each basin and a site and equipment layout plan for each pump station.
8. Requirements for stormwater quality treatment BMPs.

3.1.3. GEOTECHNICAL AND GROUNDWATER INFORMATION

Geotechnical and groundwater information shall be included as part of the drainage study. At a minimum, the following information should be provided.

1. Preliminary geotechnical analysis
2. Groundwater information (depths)
3. Basin depth limitation

3.1.4. PROJECT PHASING

If project phasing is proposed, a drainage system phasing plan shall be submitted prior to approval of improvement plans or map recordation. Drainage facilities shall be designed to provide acceptable drainage protection for each phase. Triggering mechanisms must be clearly identified for constructing subsequent phases of drainage facilities.

3.2 DESIGN RUNOFF

Criteria for computing design runoff shall be consistent with established City design criteria and with the San Joaquin County Hydrology Manual. Rational Method-based solutions are accepted by the City. Other methods may be acceptable subject to prior approval by the City Public Works Department.

3.2.1. RATIONAL METHOD

The Rational Method was developed to estimate peak runoff from small urban and developed areas. The rational method formula relates rainfall intensity, a runoff coefficient, and drainage area to the peak runoff from the drainage area. This relationship is expressed by the equation:

$$Q = CIA$$

Where

Q = the runoff rate from a drainage area in cubic feet per second (cfs)
C = a runoff coefficient that represents the ratio of runoff to rainfall
I = the time averaged rainfall intensity corresponding to the time of concentration, expressed in inches per hour
A = tributary drainage area in acres

The values of the runoff coefficient and the rainfall intensity are determined using drainage area characteristics. The drainage area is determined by computing the area tributary to the point where flow is to be determined (point of concentration) based on a topographic map.

Runoff coefficient (C) - The runoff coefficient is the ratio of the rate of runoff to the rate of rainfall at an average rainfall intensity (I). The value of the runoff coefficient depends on rainfall intensity, drainage area slope, vegetative cover, infiltration and other factors. Runoff coefficients for the City of Escalon are shown in Table 3-1. The coefficients listed in the table are typical for the corresponding developments. When storm water qualities are utilized to reduce the runoff coefficient, the design engineer should adjust “C” values. A more vigorous method to compute coefficients is contained in the San Joaquin County Hydrology Manual. Runoff coefficients for typical surface types are shown in Table 3-2.

Table 3-1
Runoff Coefficients

Land Use	Runoff Coefficient, C	Minimum Overland Flow Time, minutes
Single Family Residential	0.35	25
Multi-Family Residential	0.50	20
Apartments	0.65	15
Commercial	0.90	10
Industrial	0.85	10
Parks	0.15	30
Schools	0.30	25

Table 3-2
Runoff Coefficients for Surface Types

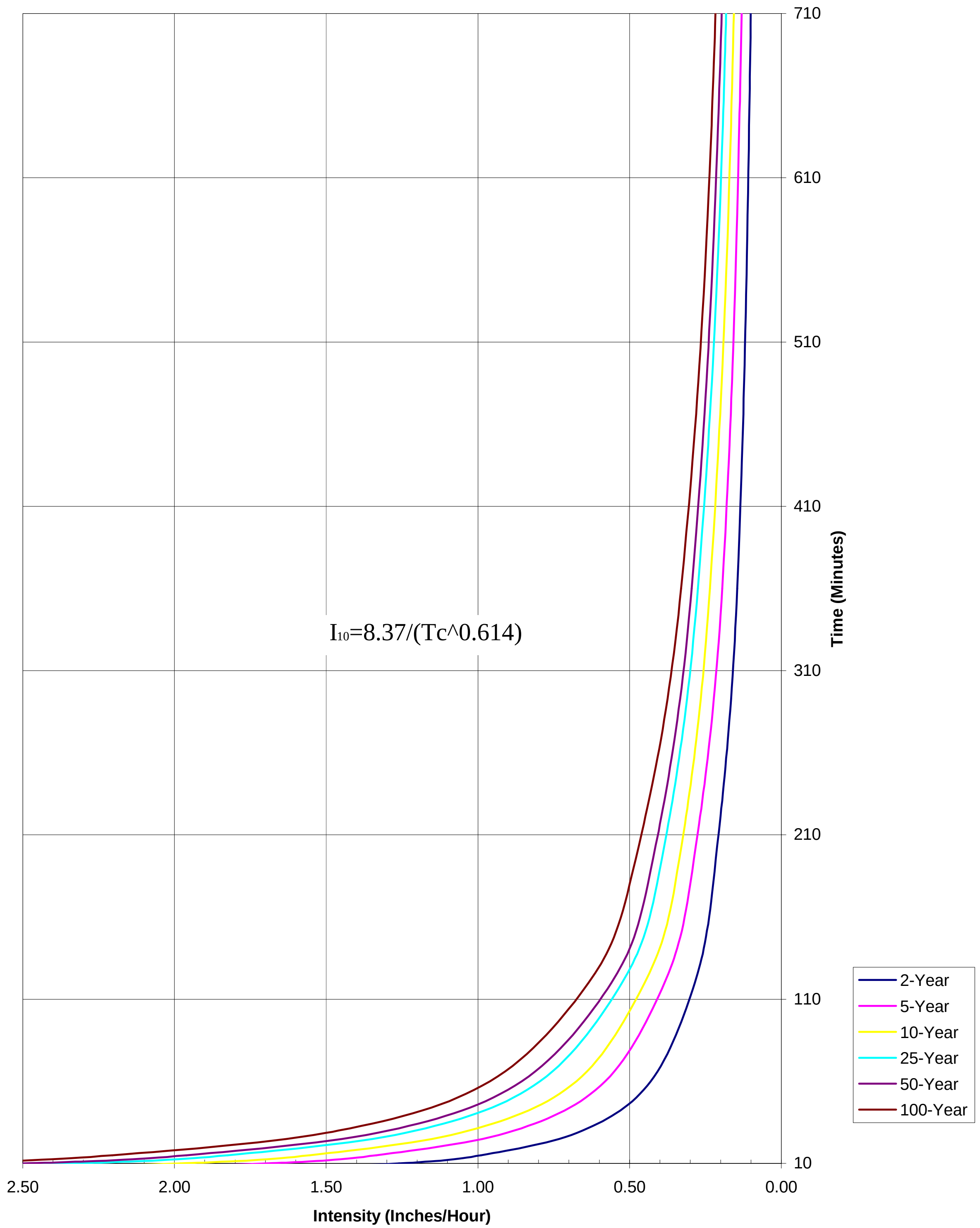
Surface	Runoff Coefficient
Pavement	0.95
Roof	0.80
Compacted Earth	0.75
Lawns and Open Area	0.15

Rainfall Intensity – Rainfall intensity is determined by using the intensity-duration-frequency curves in the City's Improvement Standards and derived from the San Joaquin County Hydrology Manual. The critical duration of the storm rainfall used to enter the intensity curves is based on the time of concentration of the drainage area under study. The time of concentration, Tc, is the time required for the flow at a given point to reach a peak from uniform rainfall intensity. The time of concentration is commonly defined as the time from the beginning of rainfall for runoff from the most remote part of the drainage area to reach the point where flow is to be determined or point of concentration. Figure 3-1 contains the intensity-duration curves for both the 10 and 100 year rainfall frequencies.

The time of concentration is computed as the initial overland flow time plus the travel time in conveyance facilities (gutter, channel and/or pipe). Minimum values for this initial time are shown in Table 3-1 (minimum overland flow time).

Tributary Drainage Area – The tributary drainage area of the drainage shed to the point of concentration is measured using the capability of CAD with the shed map. The drainage area is expressed in acres.

Figure 3-1
Intensity Duration Frequency Curves



3.3 DESIGN OF STORM DRAIN FACILITIES

Storm drain facilities shall be designed and constructed in accordance with the current City Improvement Standards. This section presents design criteria for the following storm drain facilities:

- Pipelines (gravity)
- Pump Stations
- Drainage Basins

3.3.1. STORM DRAIN PIPELINES

Design Capacity - Storm drain pipelines shall be typically designed with the hydraulic grade line (HGL) at or below the crown of the pipe. When necessary, storm drains may be designed with the HGL above the crown of the pipe, but shall not exceed an elevation six (6) inches below the lowest drain inlet.

The hydraulic grade line in storm drain pipelines upstream of the detention basin shall not be higher than six inches below any drain inlet in the drainage area. The starting elevation in the basin shall be the elevation of the basin design volume as described in Section 3.3.2 of this manual.

Flow Velocity - The minimum velocity at design flow in pipes shall be 2.5 feet per second (fps). The maximum design velocity shall be 10.0 fps.

Roughness Coefficient - Storm drain pipelines are primarily either reinforced concrete pipe (RCP) with rubber gaskets, Polyvinyl Chloride (PVC) plastic pipe or corrugated polyethylene (HDPE) pipe, smooth interior only. The following design values for the Manning's "n" coefficient shall be used:

Table 3-3
Roughness Coefficient (n)

Pipe Material	Roughness Coefficient (n)
Reinforced concrete pipe (RCP)	0.013
Polyvinyl Chloride (PVC)	0.011
Corrugated Polyethylene HDPE (smooth interior only)	0.011

Minimum Size and Slope - The minimum pipe diameter for both storm drain mains and laterals that connect catch basins to manholes shall be 12 inches. Allowable pipe slopes for the City of Escalon are as follows:

Table 3-4
Pipe Criteria

Pipe Diameter (inches)	Min. Slope ft/ft (n=0.013)	Min. Slope ft/ft (n=0.011)
12	0.0030	0.0022
15	0.0023	0.0016
18	0.0018	0.0013
24	0.0012	0.0009
30	0.0009	0.0006
36	0.0007	0.0005
42	0.0006	0.0004
48	0.0005	0.0003

3.3.2. DRAINAGE BASINS

Stormwater storage is required to reduce runoff to meet restrictions imposed by SSJID on the use of SSJID's Drains and Laterals. Storage can also provide treatment of stormwater runoff. Two primary types of drainage basins are used in the City:

- Detention Basins
- Retention Basins

A detention basin is designed to detain all or a portion of the volume of a storm, thereby reducing the peak outflow. After a period of time, the stored runoff is discharged to downstream drains.

A retention basin is designed to hold the entire volume of a storm with no provision for discharge. Retention basins are used only as an interim measure until capability to discharge to a drainage system is available and/or for a maximum of 10 years. The use of a retention basin requires the approval of the Public Works Department.

Basins are also used as a best management practice in the treatment of stormwater quality.

The design of stormwater storage basins shall include considerations for the following attributes:

- Sustainable dual and multi-uses including parks, ponds, open space, recreation and/or nature areas
- Water quality enhancement
- Low maintenance
- Accessibility

Capacity, - The sizing of a basin shall be based on the following:

Detention Basin

$$V = \frac{C\ A\ R}{12}$$

Retention Basin

$$V = \frac{2\ C\ A\ R}{12}$$

Where:

V = The basin volume in acre feet
C = Runoff coefficient for the basin tributary shed.
A = Tributary shed area in acres
R = Total rainfall in inches for a design storm *(2.38 inches for a 24-hour discharge period or 3.12 inches for a 48-hour discharge period)*

The volume for a detention basin shall be computed with no allowance for percolation or outlet facilities. The maximum water surface elevation in the basin shall be 12 inches below the lowest drain inlet elevation in the tributary drainage shed and 2 feet below the top (hinge point) of the basin.

Volume of a retention basin shall be based on storing runoff from two (2) consecutive 10-year, 48-hour storms. The ground surface of the basin, defined as the area within the boundaries of the maximum water surface, must be able to percolate the design volume within 72 hours.

Discharge - Detention basins shall discharge, either by gravity or by pumps, within a 24-hour period. Positive control by pumps or valves is required via telemetry. The discharge shall have positive shutoff controls as required by SSJID.

Basin Side Slopes - Detention basins shall have recommended side slopes of not steeper than 5 horizontal to 1 vertical.

Bottom Elevation - The bottom elevation of a basin shall be a minimum of four feet above the groundwater elevation. Any exception must be approved by Public Works Department.

Bottom Slopes - The bottom of the basin shall have minimum slopes of ½ percent or as approved by Public Works Department.

Maximum Depth - The maximum recommended depth of water in the basin shall be seven feet.

Hydraulic Grade Line - The hydraulic grade line in storm drains upstream of the detention basin shall be not more than six inches below any drain inlet in the upstream drainage system.

3.3.3. PUMP STATIONS

Pump station design shall be closely coordinated with Public Works Department.

Site Design - The pump station site shall provide adequate space to accommodate the pump structure, support structures, maintenance activities and parking. The finished pad area at the pump station site shall be at least two feet above the 100-year flood elevation.

Pump Discharge - Detention basin pump stations shall be designed to discharge the design volume from the basin during a period of not less than 24 hours. Pumps shall be alternated to balance operating hours.

Number of Pumps - Pump stations shall be designed with a minimum of two pumps with a total pumping capacity of 1.5 times the designed discharge rate.

Telemetry - Pumps shall be monitored and controlled by the City approved telemetry system.

Trash Racks - Pump stations shall be designed with trash racks.

Emergency energy source – Each pump station electrical controls shall include the capability of connecting a generator (receptacle) during time of power outage.

3.3.4. PUMP STATION DISCHARGE

Pipe Material - Discharge pipe shall be welded steel pipe or High Density Polyethylene Pipe (HDPE). Joints in the HDPE pipe shall be thermal butt fused joints. The minimum pipe wall thickness for steel pipe shall be 3/8-inch. Steel pipe shall conform to AWWA C-200. The pipe shall be epoxy coated and lined. HDPE pipe shall be DR 26, and shall comply with AWWA C906. Special inspection is required for installation and bedding.

Relief Valves - Adequate air and vacuum relief valves shall be provided. Air and vacuum relief valves shall be enclosed in an approved vault located outside any travel way.

Outfall - The discharge pipe to an open channel shall exit through a reinforced concrete outfall structure. Adequate rip-rap or concrete apron shall be provided as needed to protect ground slope from erosion.

Backwater - The discharge pipe shall be protected from backwater conditions by a device approved by the Public Works Department. The backwater protection device, such as a pinch valve, shall be mounted to the concrete outfall structure.

Gravity Discharge - Gravity discharge from basins shall be provided with a positive shut-off valve as required by SSJID.

Erosion Protection – Approved erosion protection such as rip-rap shall be placed on the adjacent and opposite canal bank. The erosion protection shall be extended at least ten feet upstream and downstream of the outfall structure.

Modified Design Criteria – To ensure the cumulative discharge in any SSJID Lateral complies with the current SSJID agreement, modified design criteria may be necessarily utilized. Any modified design criteria shall be approved by the City of Escalon Public Works Department prior to use in design.

SSJID Approval - Drawings of any proposed pipe passing under, pipe discharging to, or pipe crossing of SSJID Drains or Laterals must be submitted to and approved by SSJID prior to construction.

3.3.5. STORMWATER QUALITY

Stormwater source control and treatment control measures shall be designed consistent with principles set forth in the California Stormwater Quality Association Stormwater Best Management Practice Handbook (CASQA Handbook), January 2003 or later edition.

The Extended Detention Basin, (CASQA Handbook TC-22), or a variant thereof, is the BMP that has the most potential in the City of Escalon.

Basins used as a BMP in the treatment of stormwater quality shall be designed using the methodology and procedures of the CASQA Handbook. Volume-Based BMP design treats 85 percent of annual runoff as presented in the CASQA Handbook.

Functionally, basins will have a water quality function and a stormwater detention function to reduce peak flows. Basins will also function as parks with recreation and trails and will provide habitat, vegetation and open space. Each basin contains a low flow area that is frequently wet even during non-storm days, a broad turfed area with flatter side slopes that provides storage during large storm events, and recreation facilities including trails and pathways. Depending on the design, some of the lower areas of the basin may have to be fenced or protected from intrusion with a vegetation barrier.

There are other BMPs described in the CASQA Handbook that may provide treatment of stormwater runoff. These BMPs should be developed by the design engineer when appropriate in a close working relationship with City staff.

Section 4

Storm Drain System Analysis

The City's existing storm drain system was reviewed and analyzed with objectives to assess the systems' capability to collect and convey, to identify problem areas, and to recommend improvements to drainage facilities that will prevent potential flooding and meet the City's design standards. The review and analysis was carried out through:

- Discussions with City staff
- Review of previous studies and reports
- Review of plans and design drawings
- Model of the system based on the rational method
- Model analysis to identify potential problems

Drains are discussed with a description of each drain, identification of flood problems, results of the analysis, discussion of potential solutions, and recommendations for improvement projects. The Storm Drain Master Plan focuses primarily on SSJID requirements, the existing drainage basins, and the storm drain collection systems upstream of the basins.

A key part of the Master Plan analysis was the modeling of the existing systems and analysis of the 2035 planning area described in the City's 2005 General Plan Update. The Master Plan model also includes the operation plan for detention basins/pumps and facilities to serve new areas.

The Existing Conditions model was used to identify problems and evaluate solutions.

The analysis discussed in this chapter, including modeling, is based on assumptions that the recommended Master Plan improvements are completed and functional. The initial analysis studied operation of detention basins and pumps with the objective of defining operation criteria that would optimize the use of detention storage in the basins to minimize downstream flooding.

4.1 SOUTH SAN JOAQUIN IRRIGATION DISTRICT REQUIREMENTS

The agreement between the City and SSJID that governed the City's use of District facilities for urban drainage expired in 1997. SSJID has delayed entering into a new agreement until the City's Storm Drain Master Plan has been updated. Two major restrictions of the District impacting the update of the Storm Drain Master Plan are:

- The City will not pump drainage into a SSJID drain that will exceed the capacity of the SSJID facilities.

- Stormwater entering any SSJID facility must have been treated with best management practices (BMP) in accordance with requirements placed by SSJID. All discharges shall meet the requirements of the latest applicable discharge agreement with SSJID.

SSJID facilities not previously used by the City are a part of the Master Plan for use in the future. To meet SSJID limitations, control of pumping rates will be expanded and will be included with future pump installations.

4.2 DETENTION BASIN / PUMP OPERATION CRITERIA

The analysis showed a number of potential flooding areas within existing drainage areas. By adjusting detention basin and pump operating criteria, the potential flooding was alleviated and eliminated the violation of City standards. The Storm Drain Master Plan will be used to optimize the design and operating conditions of future development storm drain facilities to minimize possible violations of SSJID restrictions.

A general approach to improving basin and pump operation was adopted for Master Plan analyses. The approach was to postpone pumping from the basins, allowing a greater volume of runoff to be stored. In a design storm, the objective is to fill a large percentage of the storage volume and maximize the basin's impact on downstream flows. At least one foot of freeboard was maintained in basins. Pumps were programmed to turn on when the depth in a basin reached from two to four feet below the maximum water surface elevation. A storage safety factor was also included, necessary in case downstream monitoring and control shuts down basin pumps for a period of time.

4.3 EXISTING STORM DRAIN SYSTEMS

As described in Section 2 and shown in Figure 2-1, the City's drainage improvements consist of ten drain systems. The approximate size of each drain system, along with other system data is tabulated in Table 4-1.

Table 4-1
Existing Drain Area Data

Drain System	Drain Area (Ac)	Runoff Coefficient, C	Basin Volume Ac-ft	Pumping Rate (cfs)	Discharge Lateral
1	53	0.35	N/A	6	B
2	172	0.35	N/A	4.5	B
3	26	0.35	N/A	3.8	B
4	196	0.35	13	7.5	N/A (c)
5	20	0.35	1.2	3	B
6	126	0.33	4	4.5	N/A (a)
6A	52	0.33	6.6	N/A	N/A (b)
7	215	0.33	21	3.8	Bd
8	166	0.35	15.2	2	N/A (b)
11	96	0.33	6.9	N/A	N/A

(a): Discharges into Drain System 4
(b): Discharges into Drain System 2
(c): Discharges into Industrial Basins at City's Wastewater Treatment Plant

A drainage analysis, limited to pipe sizes 18-inch diameter and larger, was performed on each Drain System listed in Table 4-1. A copy of each analysis is presented in the appendix of this report. Following is a discussion of each drain system including a description, results of the analysis, identification of any potential drainage problems and recommended improvements to minimize and/or eliminate the problem.

4.3.1. DRAIN SYSTEM 1

Drain System 1 is located in mid-town north of the railroad and State Route 120 as shown on Figure 4-1. Drainage runoff is transported by a drainage collection system to the existing pump station located on the east side of Escalon-Bellota Avenue, just north of La Mesa Street and adjacent to the Escalon High School soccer field. The pump station discharges drainage into SSJID Lateral B. The collection system that transports runoff to the pump station consists of the piping network ranging in size from 36-inch down to 12-inch diameter pipe. A basin located at the west end of the Hogan Field sports complex, east of Arthur Road and west of Escalon-Bellota Avenue, is connected to the collection system by a 24-inch pipeline in Escalon-Bellota Avenue. The basin is a gravity inflow/outflow basin. The basin fills when the hydraulic grade in the collection system rises to an elevation above the basin inflow pipe, and discharges from the basin when the hydraulic grade recedes. The 24-inch pipeline in Escalon-Bellota Avenue also connects Drain System 11 to the existing pump station described above. Drain System 1 is also connected to Drain System 4, providing relief to the system if necessary.

The system analysis of Drain System 1 and 11 combined indicates that the collection system conforms to current City Standards, due to the system relief provided by the gravity-fed basin connected to the system.

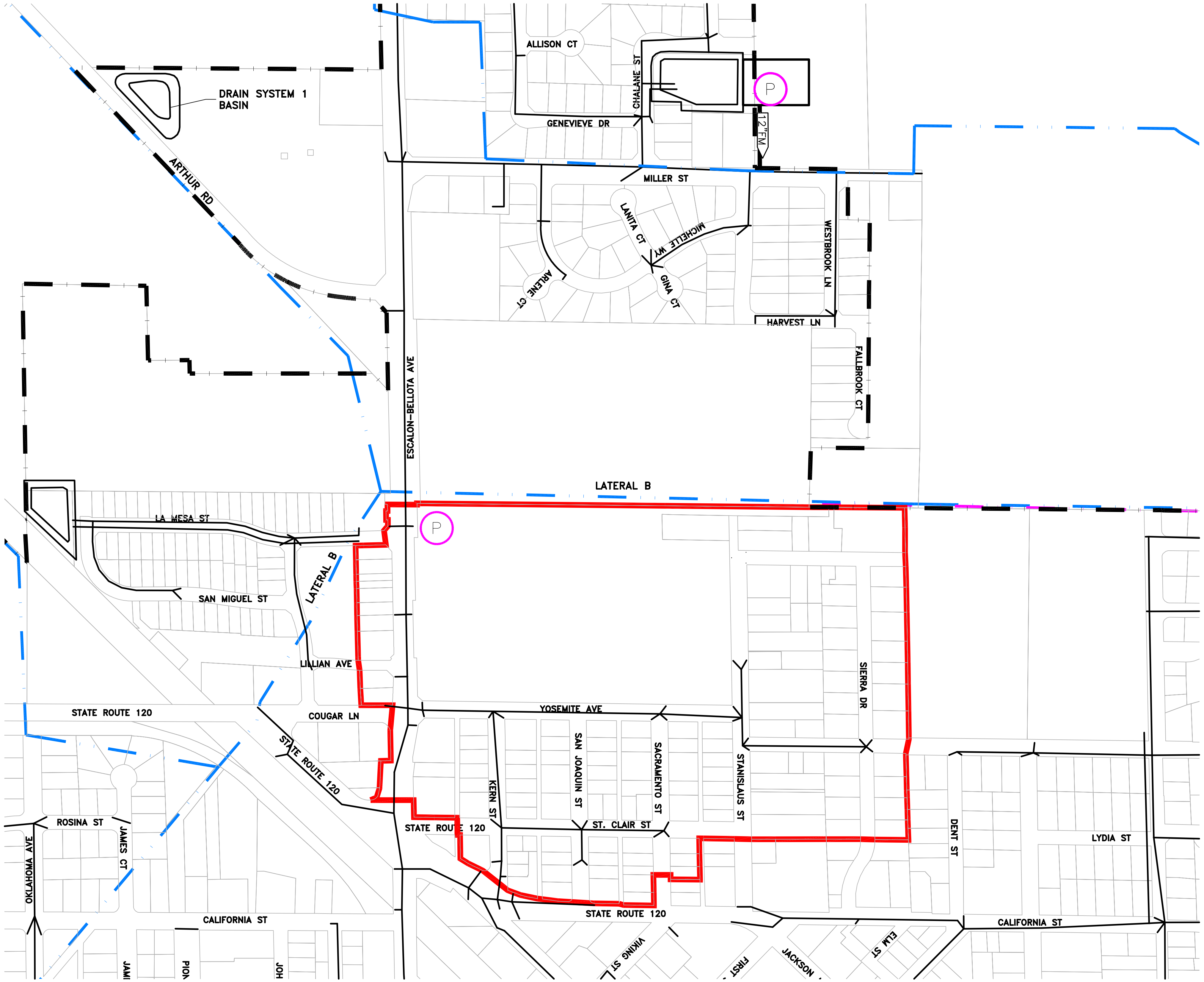
4.3.2. DRAIN SYSTEM 2

Drain System 2 is located north of the railroad and is adjacent to the east boundary of Drain System 1, as shown on Figure 4-2. This system does not utilize a detention basin. Drain System 2 includes a collection network ranging from 12-inch up to 30-inch diameter pipe that conveys drainage runoff to a pump station located at the north end of Mitchell Avenue (west side of Mitchell Ave. north of Mission St.). The pump station discharges drainage into SSJID Lateral B at an approximate rate of 4.5 cfs. The analysis of this system shows that the collection network is not adequately sized to transport drainage runoff to the pump station. Also a detention basin is needed to reduce the peak flow rate to the pump station. The excessive flow rates at the pump station are compounded by the drainage from both Drain System 6A and 8 basins discharging into Drain System 2 (see Drain System 6A and 8). Drain System 2 is interconnected to Drain System 4 at Main Street. This interconnect provides some relief to Drain System 2.

Table 4-2 describes the recommended improvements necessary to bring Drain System 2 collection system up to current City standards and to minimize potential flooding from Drain System 2 runoff. A detailed study is required to develop possible alternatives and/or evaluate the recommended improvements and/or possible alternatives.

Table 4-2
Recommended Improvements to
Drain System 2

Item	Description	Unit	Estimated Quantity
1	Replace 30-inch Storm Drain Pipe with 36-inch Storm Drain Pipe	FT	780
2	Replace 24-inch Storm Drain Pipe with 30-inch Storm Drain Pipe	FT	590
3	Replace 21-inch Storm Drain Pipe with 30-inch Storm Drain Pipe	FT	820
4	Construct Storm Drain Detention Basin (15 Ac-Ft)	Ac	3.15



STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

DRAIN SHED AREA: 53AC

BASIN VOLUME: N/A

BASIN SURFACE AREA: N/A

PUMP STA CAPACITY: 6CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 1

Date DECEMBER 2007

Project File No. 2021-0010

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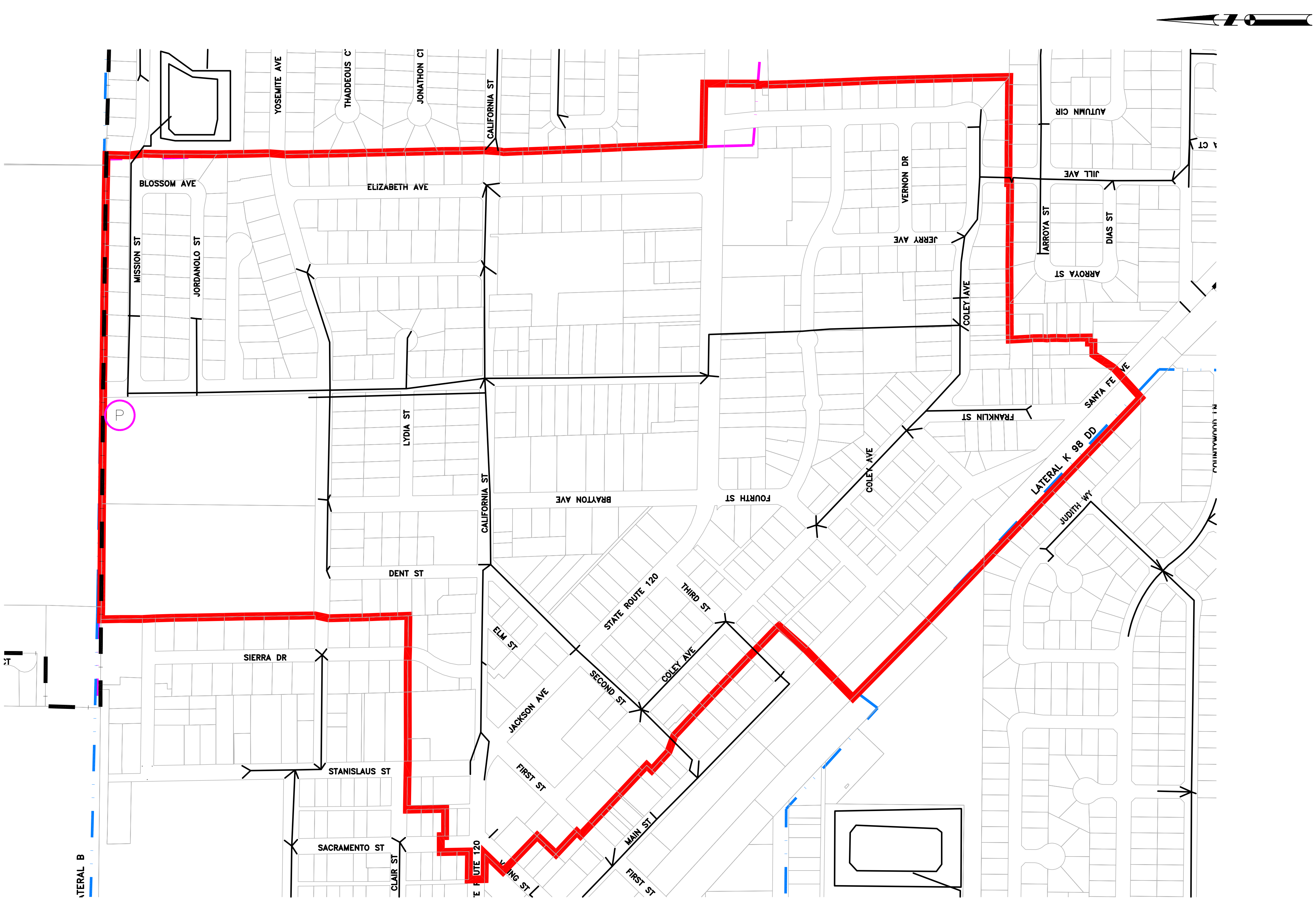
FIGURE 4-1



STORM DRAIN BASIN	SSJID LATERAL	DRAIN SHED AREA:	172AC
STORM DRAIN PUMP STATION	CITY LIMITS	BASIN VOLUME:	N/A
	DRAIN SHED LIMITS	BASIN SURFACE AREA:	N/A
		PUMP STA CAPACITY:	6CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 2

Date DECEMBER 2007
Project File No. 2021-0010

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FIGURE 4-2

4.3.3. DRAIN SYSTEM 3

Drain System 3 is located to the south of State Route 120/Yosemite Avenue, and is adjacent to the north boundary of Drain System 7, as shown in Figure 4-3. All drainage is routed through a drainage collection system to the pump station on Walnut Avenue, where it is discharged to Lateral B at an approximate rate of 3.8 cfs. The drainage collection system that transports the drainage runoff to the pump station consists of a pipe network ranging in size from 24 inch down to 12 inch diameter pipe. The drainage lines on Oklahoma Avenue are not included in Drain System 3, instead flowing by gravity directly into Lateral Bd.

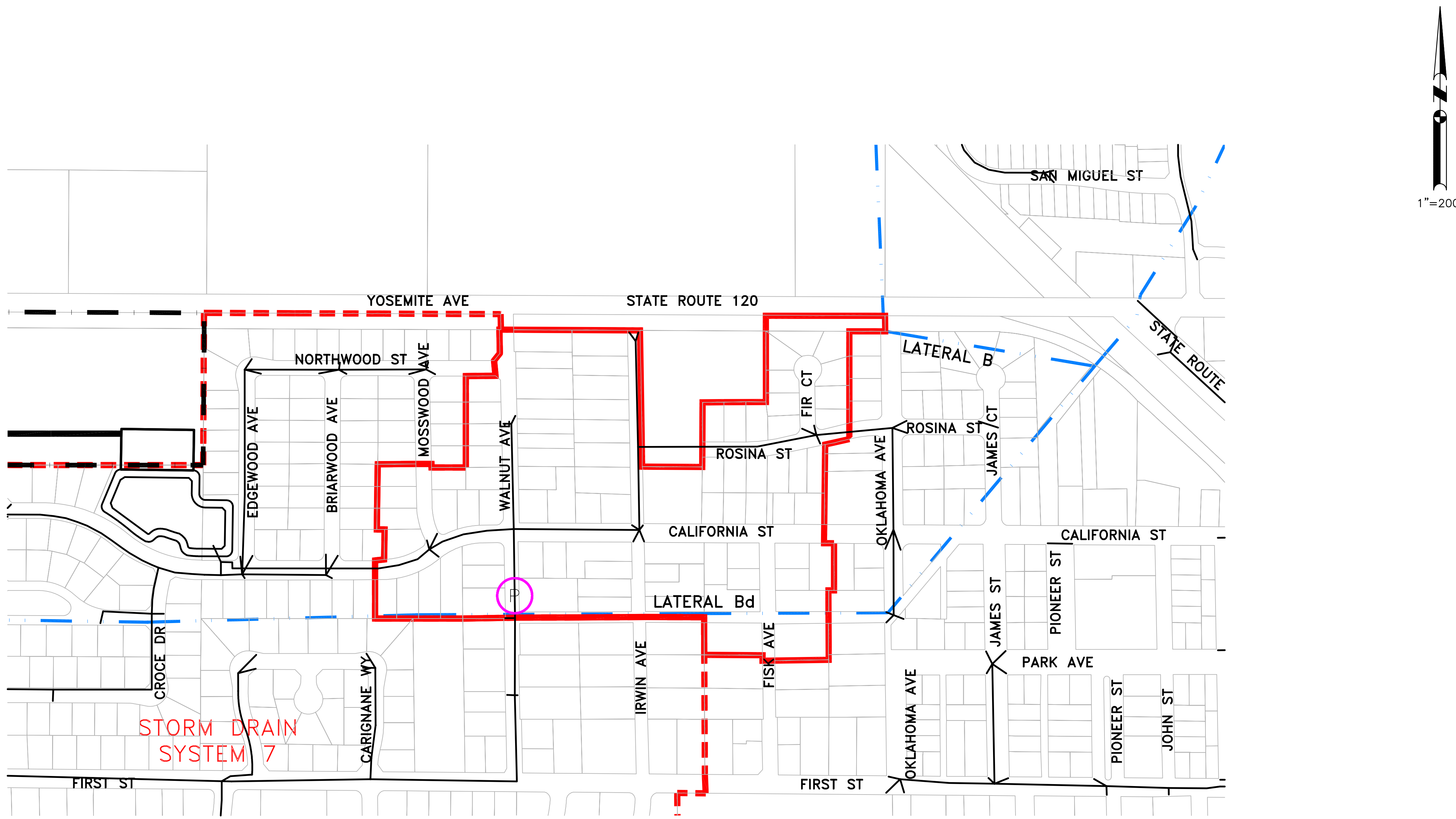
The system analysis shows that Drain System 3 conforms to current City Standards. Since Drain Systems 3 and 7 are both discharged through the pump at Walnut Avenue, the existing pump station should be upgraded to submersible pumps, and the pump station as a whole must conform to SSJID standards.

4.3.4. DRAIN SYSTEM 4

Drain System 4 is located south of Drain System 1 and the railroad as shown in Figure 4-4. Drainage runoff is transported by a drainage collection system to an existing pump station located on the west side of McHenry Avenue approximately 500 feet south of Catherine Way. The pump station discharges drainage through a force main into the industrial basins at the City's wastewater treatment plant. The drainage collection system that transports the drainage runoff to the pump station consists of a piping network ranging in size from 54-inch down to 12-inch diameter pipe. Included in the collection system is a basin located 650 feet east of McHenry Avenue and between Roosevelt Avenue and Countrywood Lane. The basin is a gravity inflow/outflow basin. The basin fills when the hydraulic grade in the collection system rises to an elevation above the basin inflow pipe and flow discharges from the basin when the hydraulic grade recedes. In addition to this drainage shed runoff, the collection system receives terminal drainage from Drain System 6. Drainage from Drain System 6 enters into Drain System 4 at the north end of Swanson Drive.

The drainage basin serving Drain System 4 was constructed based on recommendations within the McHenry Avenue/State Route 120 Hydrology/Hydraulics Report prepared by Korve Engineering in May 1998 (See Appendix 3). It was later expanded per the recommendations of the McHenry Avenue Storm Drain Basin calculations prepared by O'Dell Engineering, Inc. in February 2000 to its current interim volume of 36.8 acre-feet (See Appendix 4). Further development to Drain Systems 4 and 6 will require a final expansion of the basin, bringing the basin to its ultimate volume of 41.8 acre-feet, per the O'Dell Engineering, Inc. study.

The system analysis performed on Drain System 4 shows that the pipe sizing meets current design standard. The pump station flow rate is 7.5 cfs. The system detention basin is sufficient for the current development, including runoff from both Drain System 6 and Drain System 4, but will require further expansion prior to further development.



STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

FUTURE DRAIN LINES

DRAIN SHED AREA:	26AC
BASIN VOLUME:	N/A
BASIN SURFACE AREA:	N/A
PUMP STA CAPACITY:	3.8CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 3

Date DECEMBER 2007
Project File No. 2021-0010

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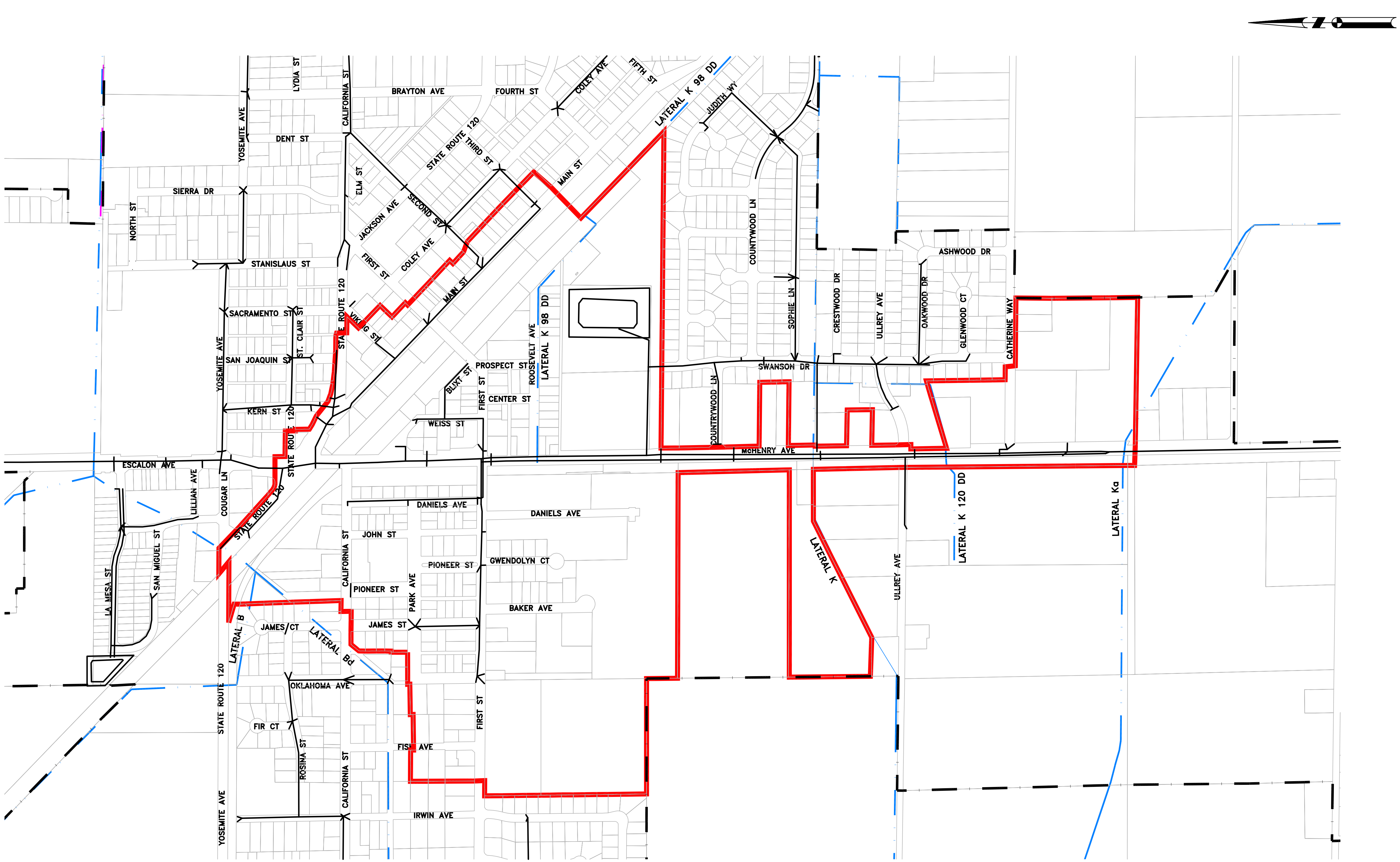
FIGURE 4-3



STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

DRAIN SHED AREA: 205AC

BASIN VOLUME: N/A

BASIN SURFACE AREA: N/A

PUMP STA CAPACITY: 7.5CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 4

Date DECEMBER 2007

Project File No. 2021-0010

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FIGURE 4-4

4.3.5. Drain System 5

Drain System 5 is located northwest of the intersection of Escalon-Bellota Avenue and Yosemite Avenue (see Figure 4-5). Drainage runoff is conveyed via a drainage collection system to a detention basin located on the west end of the drain system. An existing pump station at the east end of the basin evacuates runoff into SSJID Lateral B at an approximate rate of 3 cfs.

The system analysis shows that Drain System 5 conforms to current City Standards.

4.3.6. Drain System 6

Drain System 6 is generally bounded by McHenry Avenue, Countrywood Lane, the railroad, and Catherine Way, as shown on Figure 4-6. The drainage collection system that transports the drainage runoff consists of a piping network ranging in size from 36-inch down to 12-inch diameter pipe. The outfall of Drain System 6 feeds directly into Drain System 4 at the north end of Swanson Drive. There is a backup pump station at Swanson Drive that pumps directly into Lateral K that may be utilized if Drain Systems 4 and 6 require relief. See Section 4.4.1 for future expansion of Drain System 6.

The system analysis shows that Drain System 6 conforms to current City Standards.

4.3.7. Drain System 6A

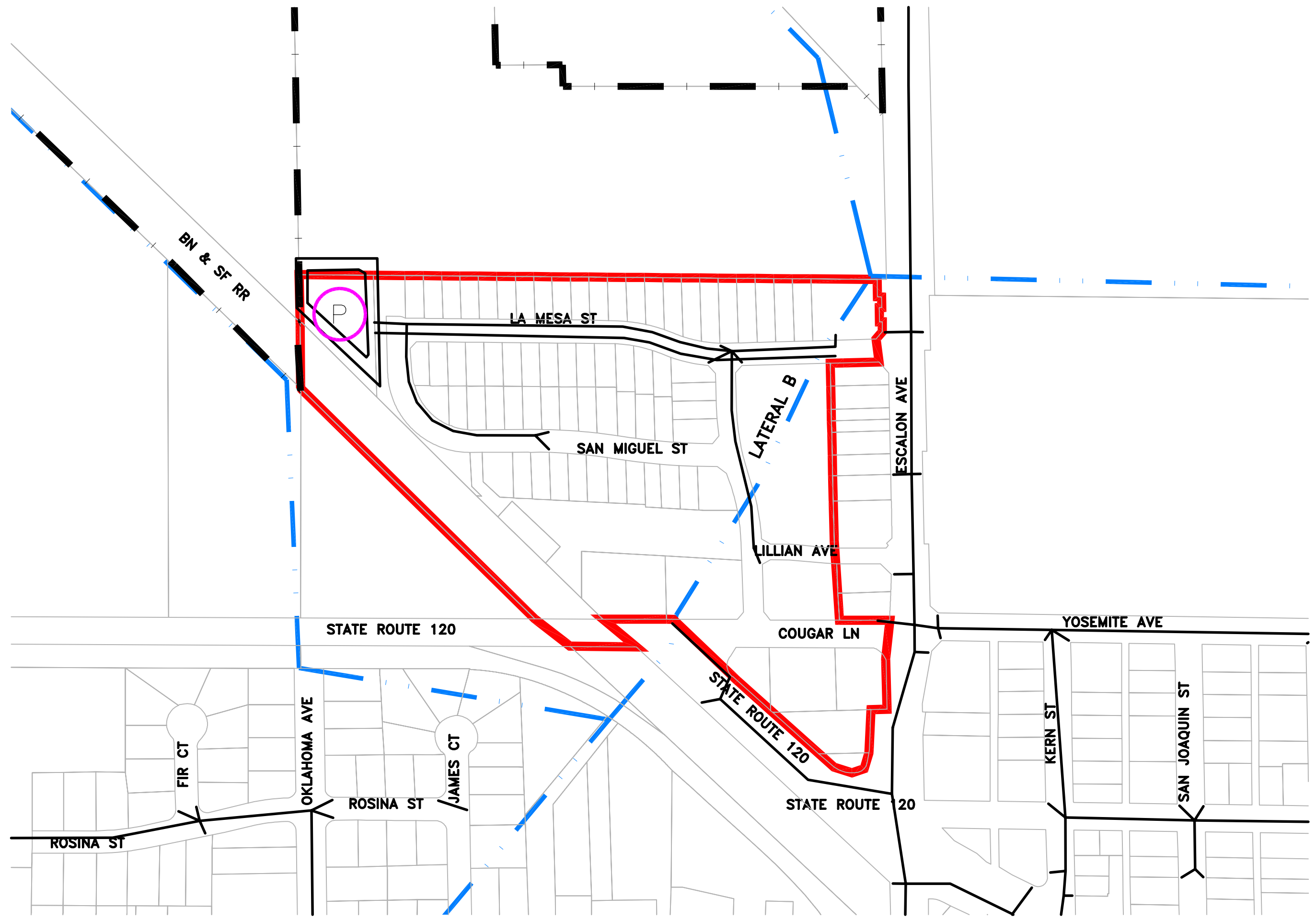
As shown in Figure 4-7, Drain System 6A straddles Vine Street east of the railroad. Drainage runoff is transported by a drainage collection system to a detention basin located on the east end of the drain system. A pump station pumps drainage water from the basin into Drain System 2 at an approximate rate of 6.6 cfs.

The system analysis shows that while Drain System 6A conforms to current City Standards, Drain System 2 does not have the capacity to accommodate the added flow from Drain System 6A. Drain System 6A discharge must be redirected, possibly to SSJID Lateral K. Discussion with SSJID regarding Lateral K is recommended prior to making any improvements.

4.3.8. Drain System 7

Drain System 7 is located on the west side of the City, as shown in Figure 4-8. A drainage collection system transports drainage runoff from the south portion of the drainage shed to a detention basin located on the south end of the drain system, where the runoff is detained in a basin then pumped to the pump station at Walnut Avenue. The drainage runoff from the north portion of the drainage shed is collected by a drainage collection system, and is transported to a detention basin north of the intersection of California Street and Croce Drive then pumped to the same pump station. The pump station at Walnut Avenue then pumps the runoff into SSJID Lateral Bd. The two sections of Drain System 7 are interconnected at Riesling Way.

Each section of Drain System 7 conforms to current City Standards. If either sections overflows into the other; the section receiving the additional runoff, however, does not have sufficient capacity. A detailed study of Drain System 7 is recommended to analyze the interaction, and the actions required to provide sufficient storage capacity. As noted in Section 4.3.3, Drain Systems 3 and 7 are both discharged through the pump at Walnut Avenue. The existing pump station should therefore be upgraded to submersible pumps, and the pump station as a whole must conform to SSJID standards. See Section 4.4.2 for future expansion of Drain System 7.



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STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

DRAIN SHED AREA:	20AC
BASIN VOLUME:	1.2AC–FT
BASIN SURFACE AREA:	0.4AC
PUMP STA CAPACITY:	3CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 5

Date DECEMBER 2007

Project File No. 2021–0010

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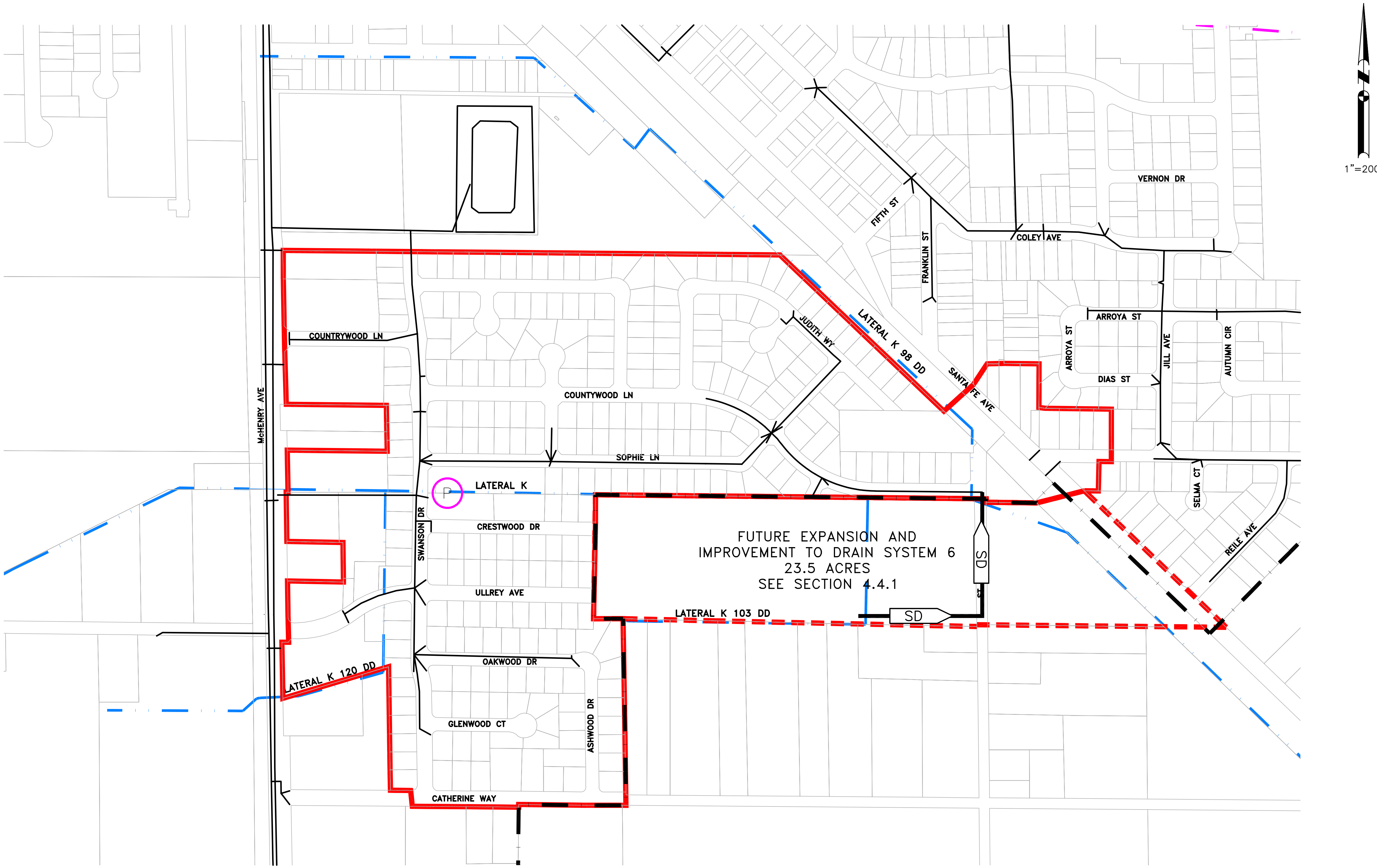
FIGURE 4–5



STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

SD FUTURE DRAIN LINES

DRAIN SHED AREA:	81AC
BASIN VOLUME:	32AC–FT
BASIN SURFACE AREA:	2.9AC
PUMP STA CAPACITY:	4.5CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 6

Date DECEMBER 2007

Project File No. 2021–0010

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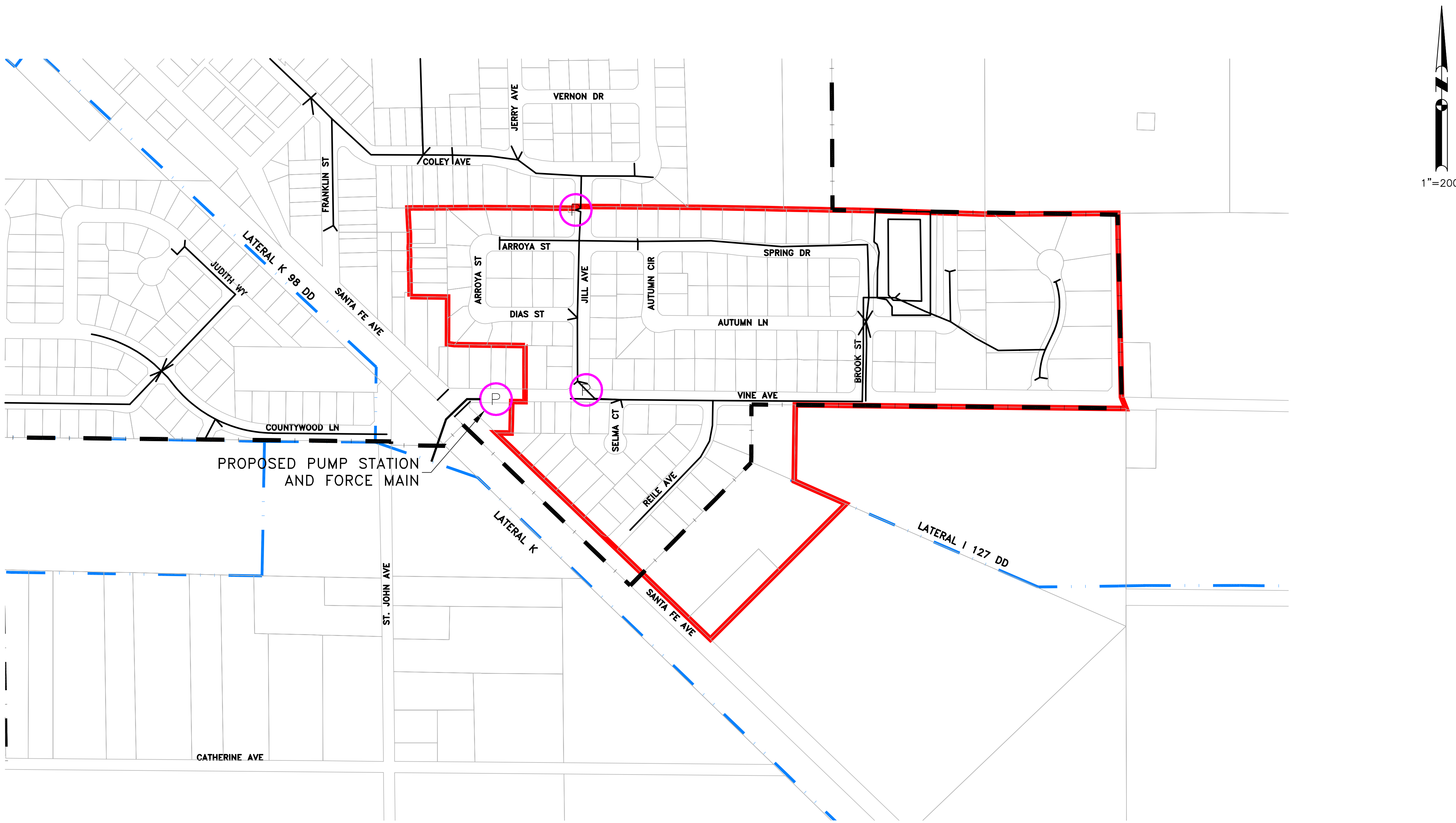
FIGURE 4–6



STORM DRAIN BASIN

STORM DRAIN PUMP STATION

SSJID LATERAL

CITY LIMITS

DRAIN SHED LIMITS

DRAIN SHED AREA:	51AC
BASIN VOLUME:	6.6AC-FT
BASIN SURFACE AREA:	1.1AC
PUMP STA CAPACITY:	N/A

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 6A

Date
DECEMBER 2007

Project File No.
2021-0010

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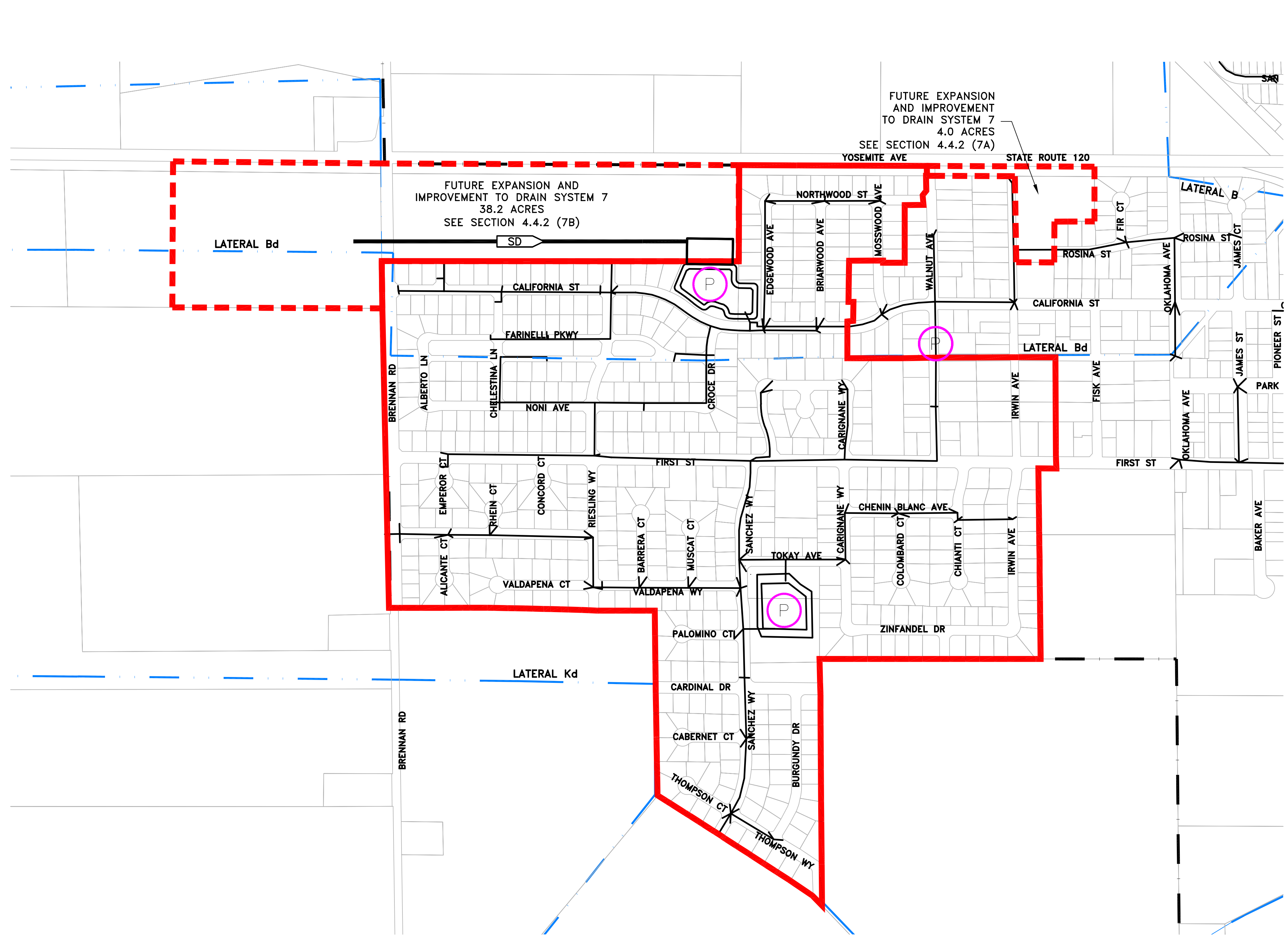
FIGURE 4-7



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STORM DRAIN BASIN	SSJID LATERAL	DRAIN SHED AREA:	163AC
STORM DRAIN PUMP STATION	CITY LIMITS	BASIN VOLUME:	21AC-FT TOTAL
	DRAIN SHED LIMITS	BASIN SURFACE AREA:	3.4AC
	FUTURE DRAIN LINES	PUMP STA CAPACITY:	3.8CFS

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 7

Date
DECEMBER 2007

Project File No.
2021-0010

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FIGURE 4-8

4.3.9. DRAIN SYSTEM 8

Drain System 8 is located in the northeastern quadrant of the City at the east end of Mission Street, as shown in Figure 4-9. The drainage collection system conveys drainage runoff to a detention basin located in the northwest corner of the drain system where the runoff is detained and then pumped into Drain System 2. The drainage is then pumped into SSJID Lateral B.

The system analysis shows that Drain System 8 conforms to current City Standards. The City's discharging into Drain System 2 is contributing to its drainage overload. Drain System 8 discharge should be rerouted to discharge directly into SSJID Lateral B or the Campbell Drain. See Section 4.4.3 for future expansion of Drain System 8. See Section 4.4.3 for future expansion of Drain System 8.

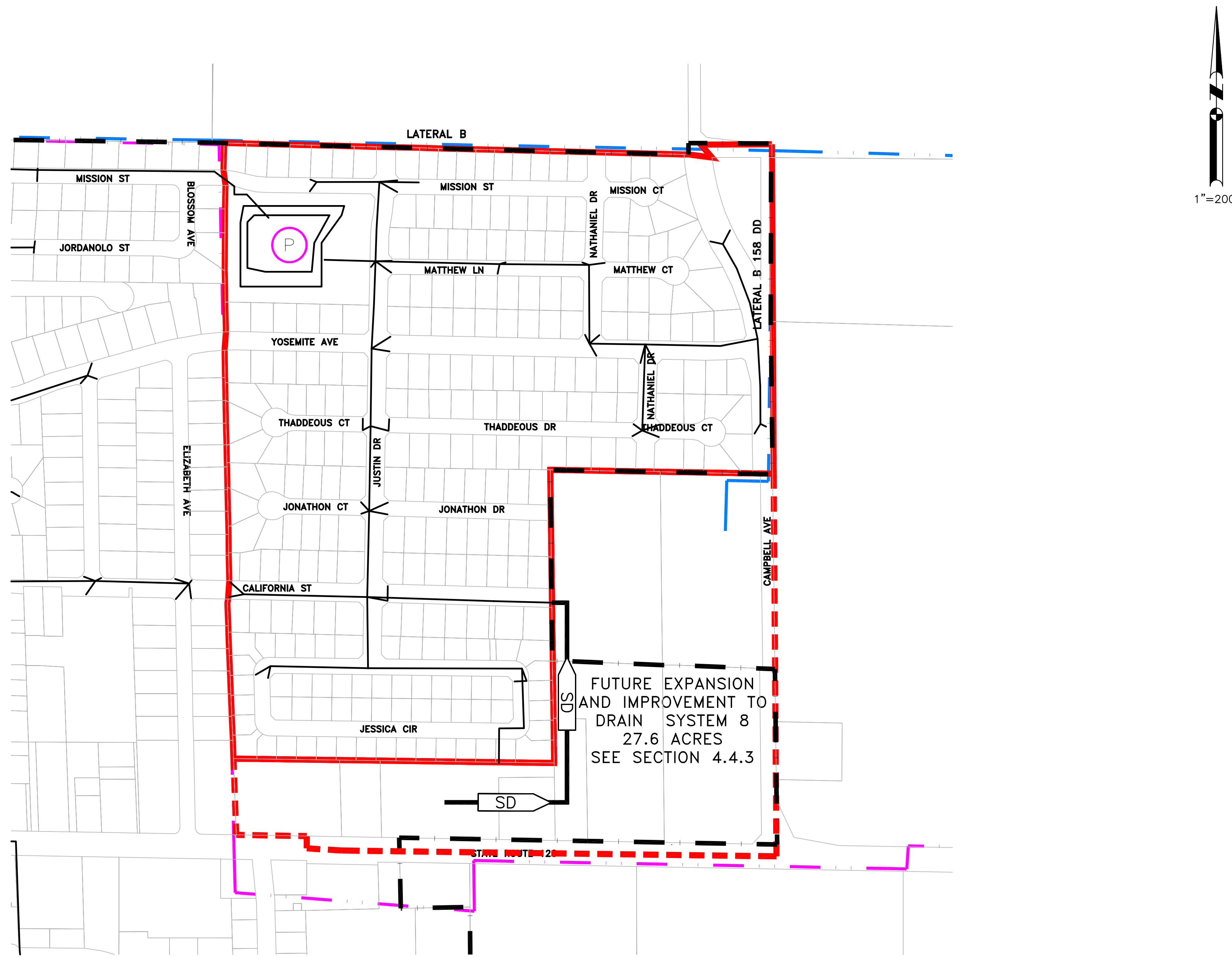
4.3.10. DRAIN SYSTEM 11

Drain System 11 is located on the north side of the City (see Figure 4-10). Through a drainage collection system the drainage runoff is directed to a detention basin located on the east side of the Drain System. Currently the system is interconnected to Drain System 1 and the basin is a gravity inflow/outflow basin.

The system analysis shows that Drain System 11 generally conforms to current City Standards. Prior to any further development to Drain System 11 the existing basin must be converted into a detention basin. See Section 4.4.4 for future expansion of Drain System 11.

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 8



Legend	
STORM DRAIN BASIN	SSJID LATERAL
P STORM DRAIN PUMP STATION	CITY LIMITS
	DRAIN SHED LIMITS
	SD FUTURE DRAIN LINES

DRAIN SHED AREA:	66AC
BASIN VOLUME:	15.2AC–FT
BASIN SURFACE AREA:	2.2AC
PUMP STA CAPACITY:	2CFS

Date DECEMBER 2007
Project File No. 2021-0010

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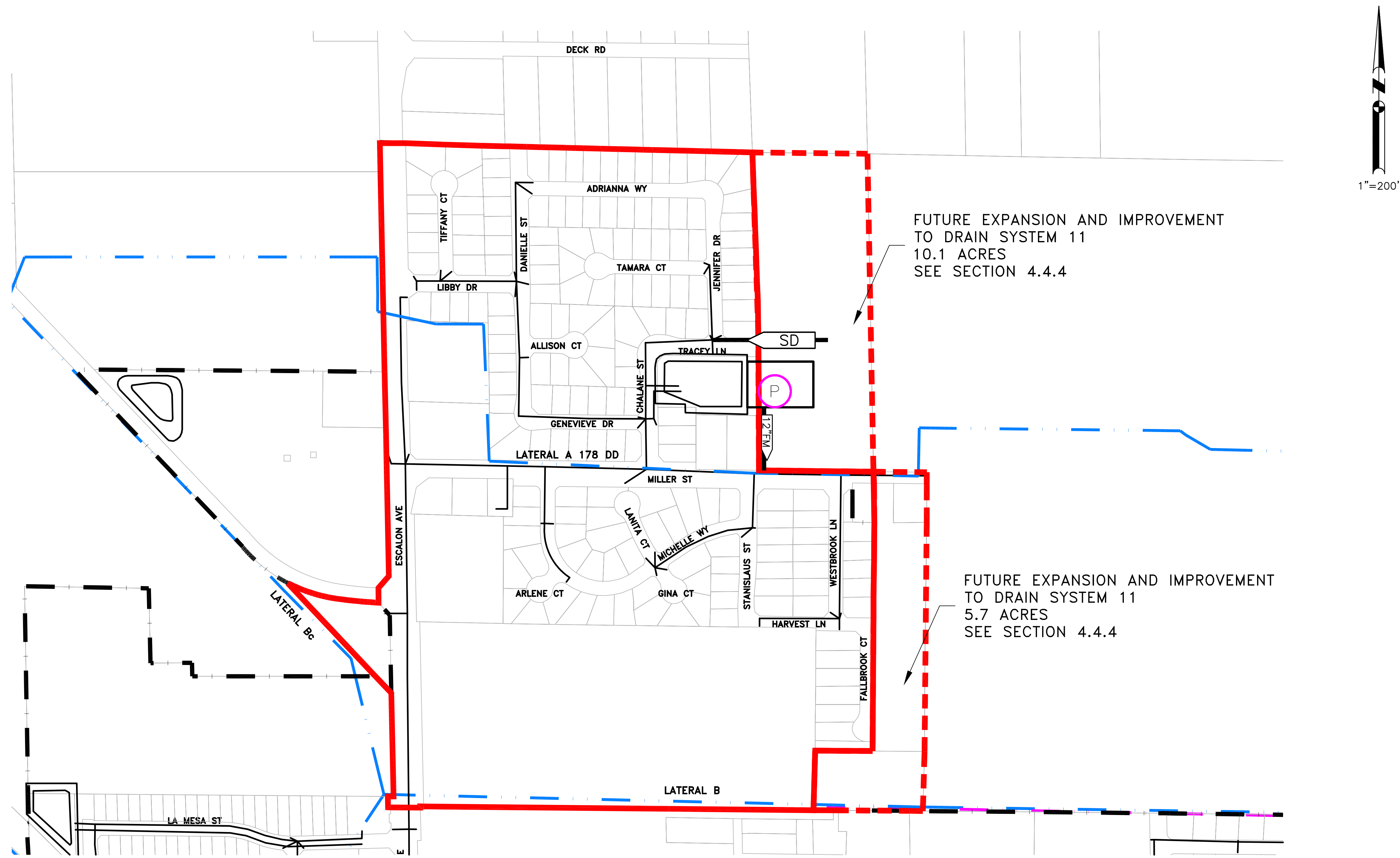
LAND of PEACHES & CREAM ESCALON

FIGURE 4–9



STORM DRAIN BASIN	SSJID LATERAL	DRAIN SHED AREA:	86AC
STORM DRAIN PUMP STATION	CITY LIMITS	BASIN VOLUME:	6.9AC-FT
	DRAIN SHED LIMITS	BASIN SURFACE AREA:	1.2AC
	FUTURE DRAIN LINES	PUMP STA CAPACITY:	N/A

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

EXISTING STORM DRAIN SYSTEMS
STORM DRAIN SYSTEM 11

Date
DECEMBER 2007

Project File No.
2021-0010

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FIGURE 4-10

4.4 FUTURE DEVELOPMENT

The City's 2005 General Plan Update establishes the 2035 planning area that encompasses thirteen future drainage sheds. Figure 4-11 shows the location of the future storm drainage sheds along with their designation. Table 4-3 lists the area, required basin volume, basin discharge rate and the discharge receiving SSJID lateral for each future storm drainage shed.

Table 4-3
Future Storm Drain Shed
Infrastructure Improvements

Drain System	Drain Area (Ac)	Runoff Coefficient, C **	Required Basin Volume (Ac-ft) **	Required Pumping Rate (cfs)	Discharge Lateral
A	261.2	0.73	37.73	19.02	Be
B	48.2	0.40	3.82	1.93	B via Drain System 5
C	70.1	0.35	N/A	N/A	A-dd
D	20.8	0.35	N/A	N/A	N/A
E	229.2	0.35	15.91	8.02	A-dd
F	11.6	0.90	2.07	1.04	B (Campbell Drain)
G	63.2	0.56	7.06	3.56	B (Campbell Drain)
H*	64.5	0.35	4.45	2.24	K
I*	171.2	0.35	11.74	5.92	K
I_1*	11.4	0.35	0.79	0.40	Exist. Basin (west)
J*	96.9	0.74	14.29	7.20	Ka
K*	128.8	0.85	21.71	10.94	Ka
L*	117.7	0.67	15.71	7.92	Ka
M*	219.3	0.35	15.01	7.57	K

* : For Modified Design Criteria; See Appendix 5
** : See Appendix 6 for Basin Volume Calculations

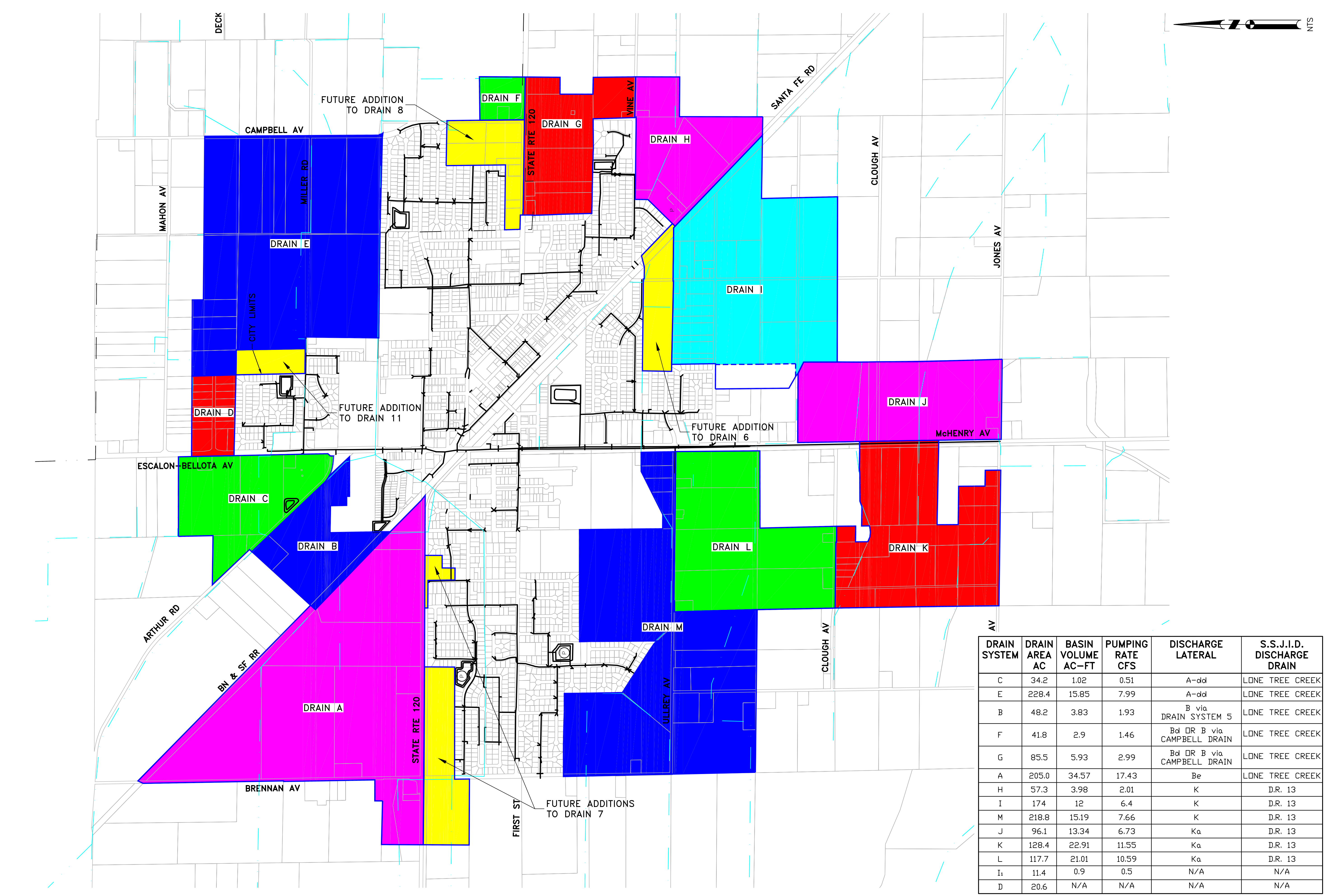
As described in Section 2 and shown in Figure 2-1, the City's drainage improvements consist of ten drain systems. The approximate size of each drain system, along with other system data is tabulated in Table 4-1.

4.4.1. FUTURE EXPANSION AND IMPROVEMENTS TO DRAINAGE SHED 6

Future development will expand Drain System 6. The eastern border of the future development will extend past Reile Avenue along Santa Fe Avenue, and the southern border will be parallel to the existing border, as shown on Figure 4-6. This expansion will add approximately 23.5 acres, for a total shed area of 104.9 acres. In order to transport the additional runoff, the future development south of Sophie Lane will require the pipeline additions and basin expansion shown in Table 4-4. Drain Systems 4 and 6 will continue to conform to City Standards after this expansion.

Table 4-4
Recommended Improvements to Drain System 6

Item	Description	Unit	Estimated Quantity
1	24" Storm Drain Pipe	FT	620
2	30" Storm Drain Pipe	FT	220
3	36" Storm Drain Pipe	FT	120
4	Expansion of Existing Storm Drain Basin (Volume Approximately 0.67 Additional Ac-Ft)	Ac	0.16



DRAIN SYSTEM	DRAIN AREA AC	BASIN VOLUME AC-FT	PUMPING RATE CFS	DISCHARGE LATERAL	S.S.J.I.D. DISCHARGE DRAIN
C	34.2	1.02	0.51	A-dd	LONE TREE CREEK
E	228.4	15.85	7.99	A-dd	LONE TREE CREEK
B	48.2	3.83	1.93	B via DRAIN SYSTEM 5	LONE TREE CREEK
F	41.8	2.9	1.46	Bd OR B via CAMPBELL DRAIN	LONE TREE CREEK
G	85.5	5.93	2.99	Bd OR B via CAMPBELL DRAIN	LONE TREE CREEK
A	205.0	34.57	17.43	Be	LONE TREE CREEK
H	57.3	3.98	2.01	K	D.R. 13
I	174	12	6.4	K	D.R. 13
M	218.8	15.19	7.66	K	D.R. 13
J	96.1	13.34	6.73	Ka	D.R. 13
K	128.4	22.91	11.55	Ka	D.R. 13
L	117.7	21.01	10.59	Ka	D.R. 13
I_1	11.4	0.9	0.5	N/A	N/A
D	20.6	N/A	N/A	N/A	N/A

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE DRAIN SHEDS

Date DECEMBER 2007

Project File No. 2021-0010

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FIGURE 4-11

4.4.2. FUTURE EXPANSION AND IMPROVEMENTS TO DRAINAGE SHED 7

Future development in Drain System 7 will incorporate area 7A, which refers to the undeveloped parcel at the intersection of State Route 120 and Irwin Avenue, as well as area 7B, referring to the parcels adjacent to the northwest of the existing system, bordered by State Route 120, and spanning Brennan Road, as shown on Figure 4-8. The additional areas of these undeveloped sections of Drain System 7 will add 4.0 acres and 38.2 acres (17.8 acres west of Brennan Road and 20.4 acres east on Brennan Road), respectively, for a total shed area of 205.5 acres. These new areas of development will require the pipeline additions, basin expansion, and pump station improvements shown in Tables 4-5 and 4-6. Drain System 7 will continue to conform to City Standards after completion of this expansion.

Table 4-5
Recommended Improvements to Drain System 7 (7A)

Item	Description	Unit	Estimated Quantity
1	24" Storm Drain Pipe	FT	100
2	30" Storm Drain Pipe	FT	40
3	36" Storm Drain Pipe	FT	20
4	Expansion of Existing Storm Drain Basin (Volume Serving Expansion 7A is Approximately 0.3 Additional Ac-Ft)	Ac	0.1
5	Pump Station Improvements at Storm Drain Basin	LS	1
6	Pump Station Improvements at Walnut Avenue	LS	1

Table 4-6
Recommended Improvements to Drain System 7 (7B)

Item	Description	Unit	Estimated Quantity
1	24" Storm Drain Pipe	FT	1000
2	30" Storm Drain Pipe	FT	350
3	36" Storm Drain Pipe	FT	195
4	Expansion of Existing Storm Drain Basin (Volume Serving Expansion 7B is Approximately 2 Additional Ac-Ft)	Ac	1
5	Pump Station Improvements at Storm Drain Basin	LS	1
6	Pump Station Improvements at Walnut Avenue	LS	1

4.4.3. FUTURE EXPANSION AND IMPROVEMENTS TO DRAINAGE SHED 8

Future development will expand Drain System 8, extending the drainage area to Campbell Avenue on the east and Jackson Avenue on the south, as shown on Figure 4-9. This expansion will add approximately 27.6 acres, for a total shed area of 93.6 acres, and will require improving the existing pump station. After this development is incorporated into Drain System 8, the system analysis shows that Drain System 8 will continue to conform to current City Standards.

Table 4-7
Recommended Improvements to Drain System 8

Item	Description	Unit	Estimated Quantity
1	24" Storm Drain Pipe	FT	745
2	30" Storm Drain Pipe	FT	250
3	36" Storm Drain Pipe	FT	140
4	Pump Station Improvements	LS	1

4.4.4. FUTURE EXPANSION AND IMPROVEMENTS TO DRAINAGE SHED 11

Future development will incorporate two previously undeveloped areas, one to the east of Jennifer Drive, and the other to the east of Fallbrook Court, as shown in Figure 4-10. The additional areas of these undeveloped sections of Drain System 11 will add 10.1 acres and 5.7 acres, respectively, for a total shed area of 95.5 acres. Prior to developing this parcel, the existing basin must be expanded and converted into a detention basin by constructing a pump station at the basin that discharges to SSJID Lateral A-dd. The improvements will also require the additional pipeline quantified in Table 4-8. The system will conform to City Standards with these improvements.

Table 4-8
Recommended Improvements to Drain System 11

Item	Description	Unit	Estimated Quantity
1	24" Storm Drain Pipe	FT	250
2	30" Storm Drain Pipe	FT	90
3	36" Storm Drain Pipe	FT	50
4	Expansion of Existing Storm Drain Basin (Volume Approximately 1.56 Additional Ac-Ft)	Ac	0.32
5	Storm Drain Pump Station	LS	1
6	Force Main	LF	220

4.4.5. FUTURE DRAINAGE SHED A

Future Drainage Shed A, also known as the Liberty Business Park, is bounded by the railroad on the northeast, Yosemite Avenue on the south and extends past Brennan Road on the west. The approximate location of the two future drainage shed detention basins is shown in Figure 4-12. One future pump station will discharge detained runoff into SSJID Lateral Be, and another will discharge detained runoff into SSJID Lateral B.

4.4.6. FUTURE DRAINAGE SHED B

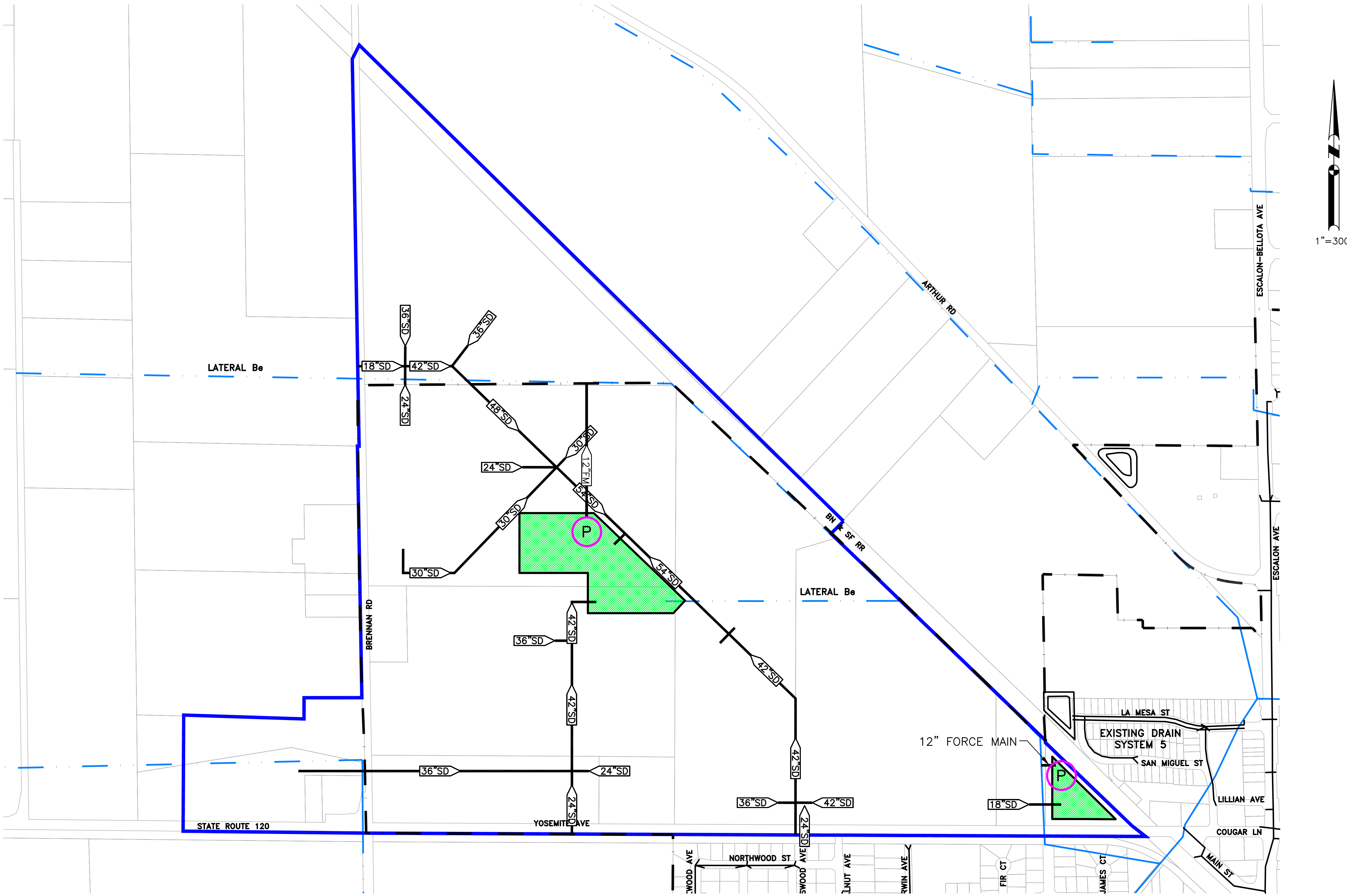
Future Drainage Shed B is located between Arthur Road and the railroad. Detention storage will be provided by the expansion of the Existing Drain System 5 basin and pump station as shown on Figure 4-13. The existing pump serving Drain System 5 should be upgraded to provide sufficient service to the expanded basin. This pump station will discharge the detained runoff from the basin into SSJID Lateral Be.

4.4.7. FUTURE DRAINAGE SHED C

Future Drainage Shed C is located north and west of Arthur Road and Escalon-Bellota Avenue respectively as illustrated on Figure 4-11. This area is designated as open space and will be developed with on-site drainage.

4.4.8. FUTURE DRAINAGE SHED D

As shown in Figure 4-14 Future Drainage Shed D straddles Deck Road. Because over 90% of this drainage shed is developed, each undeveloped parcel will have to contain all runoff on-site by utilizing site retention basins.



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON

STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED A

Date DECEMBER 2007

Project File No. 2021-0010

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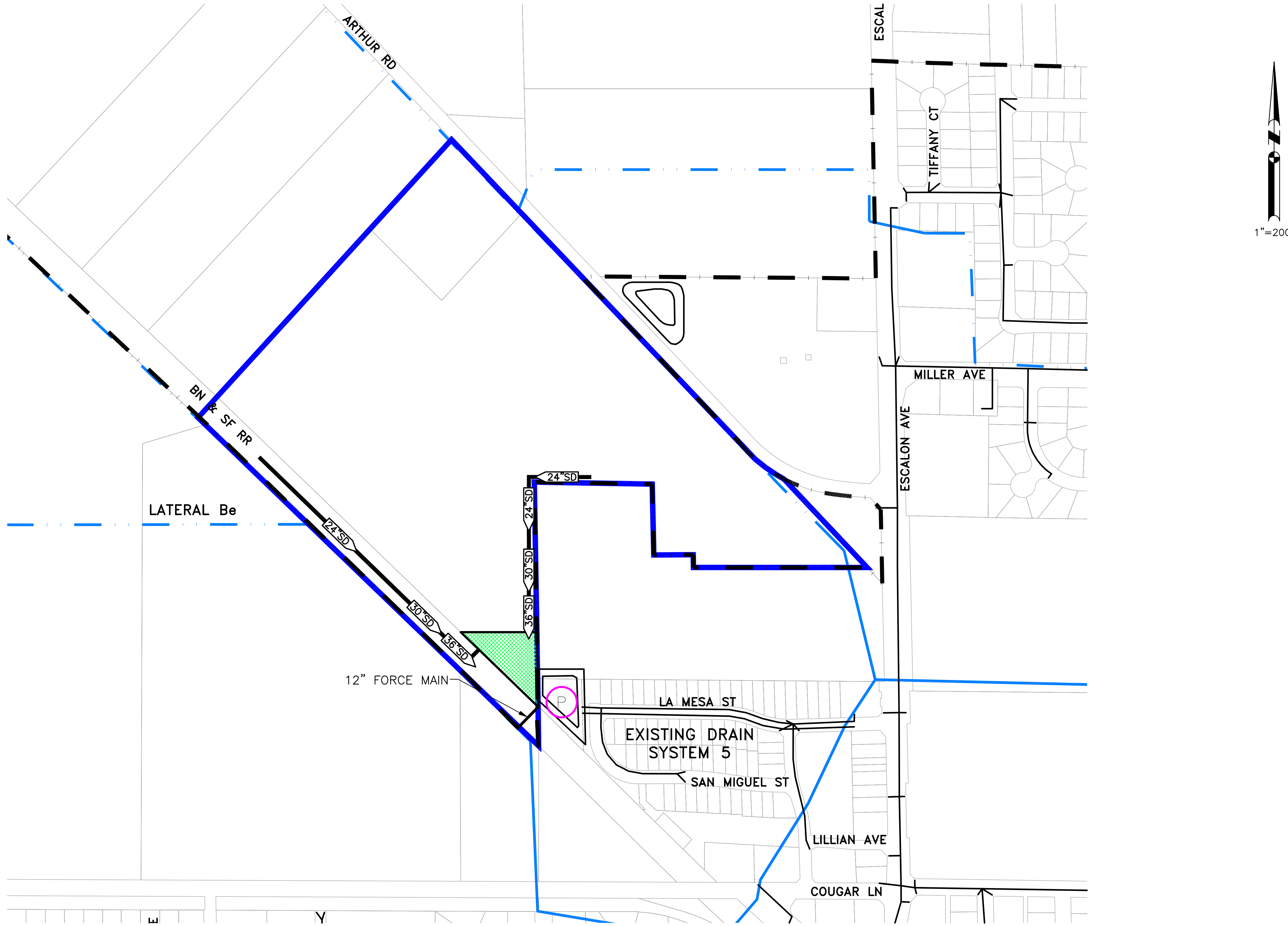
FIGURE 4-12



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED B

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FIGURE 4-13

STORM DRAIN BASIN

FUTURE DRAIN BASIN

P FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED D

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FIGURE 4-14

4.4.9. FUTURE DRAINAGE SHED E

Future Drainage Shed E is located between Mahon Road and Mission Street and is bounded on the east by Campbell Avenue. The future detention basin will be located near the west end of Miller Road as shown on Figure 4-15. A future pump station will discharge the detained runoff from the basin into SSJID Lateral A-dd

4.4.10. FUTURE DRAINAGE SHED F

As shown in Figure 4-16 Future Drainage Shed F is bordered on the south by Jackson Avenue. A future detention basin is to be located to the north of Jackson Avenue. A future pump station will pump the detained runoff to SSJID's Campbell Avenue Drain.

4.4.11. FUTURE DRAINAGE SHED G

As shown in Figure 4-17 Future Drainage Shed G is bordered on the north by Jackson Avenue. A future detention basin is to be located south of the intersection of Jackson and Campbell Avenues. A future pump station will pump the detained runoff to SSJID's Campbell Avenue Drain.

4.4.12. FUTURE DRAINAGE SHED H

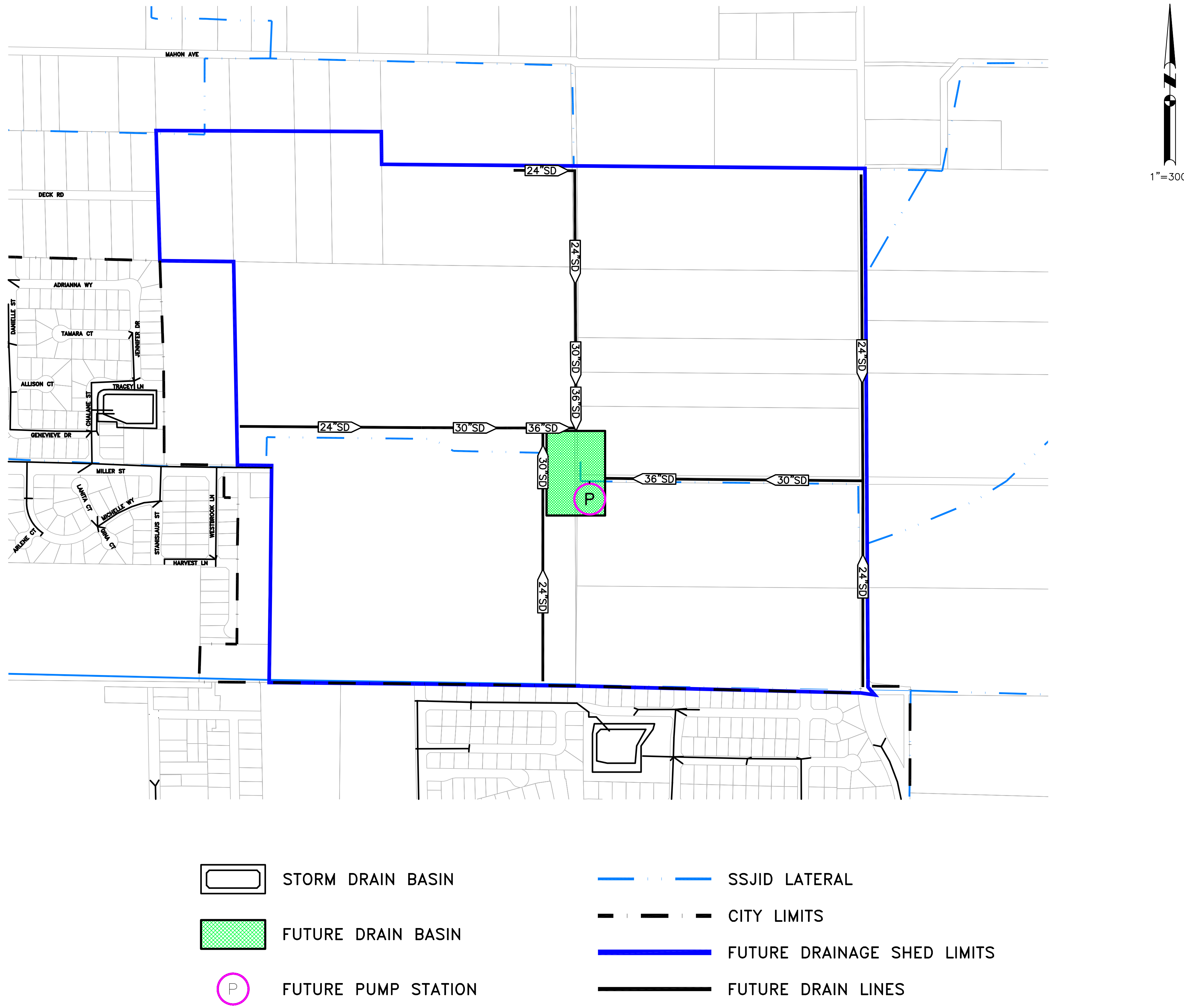
Future Drainage Shed H is located on the northeast side of Main Street/Santa Fe Avenue and extends north and east along the eastern boundary of the City beyond Vine Avenue as shown on Figure 4-18. A future detention basin is to be located northeast of Main Street and southeast of Reile Avenue in the location that is designated as open space in the General Plan update. A future pump station will pump the detained runoff from the basin into SSJID Lateral K.

4.4.13. FUTURE DRAINAGE SHED I

Future Drainage Shed I is located east of McHenry Avenue, north of Clough Avenue and on the southwest side of Main Street/Santa Fe Road as illustrated on Figure 4-19. A future detention basin shall be located east of St. John Road and north of Catherine Way within the location designated as open space in the General Plan update and will serve 171.2 acres of Drainage Shed I. A second basin will be constructed in the portion of Drainage Shed I designated as Drainage Shed I-1, as shown in Figure 4-19, which will detain the runoff from 11.5 acres of Drainage Shed I prior to pumping the runoff to the existing basin east of McHenry Avenue. Basin detained runoff will be discharged by a future pump station into SSJID Lateral K.

4.4.14. FUTURE DRAINAGE SHED I-1

Future Drainage Shed I-1 is located on the west side of Future Drainage Shed I as shown in Figure 4-19. A future detention basin shall be constructed north of Narcissus Road. A future pump station will discharge the basin detained runoff to an existing basin located to the west adjacent to McHenry Avenue.



CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED E

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FIGURE 4-15

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED F

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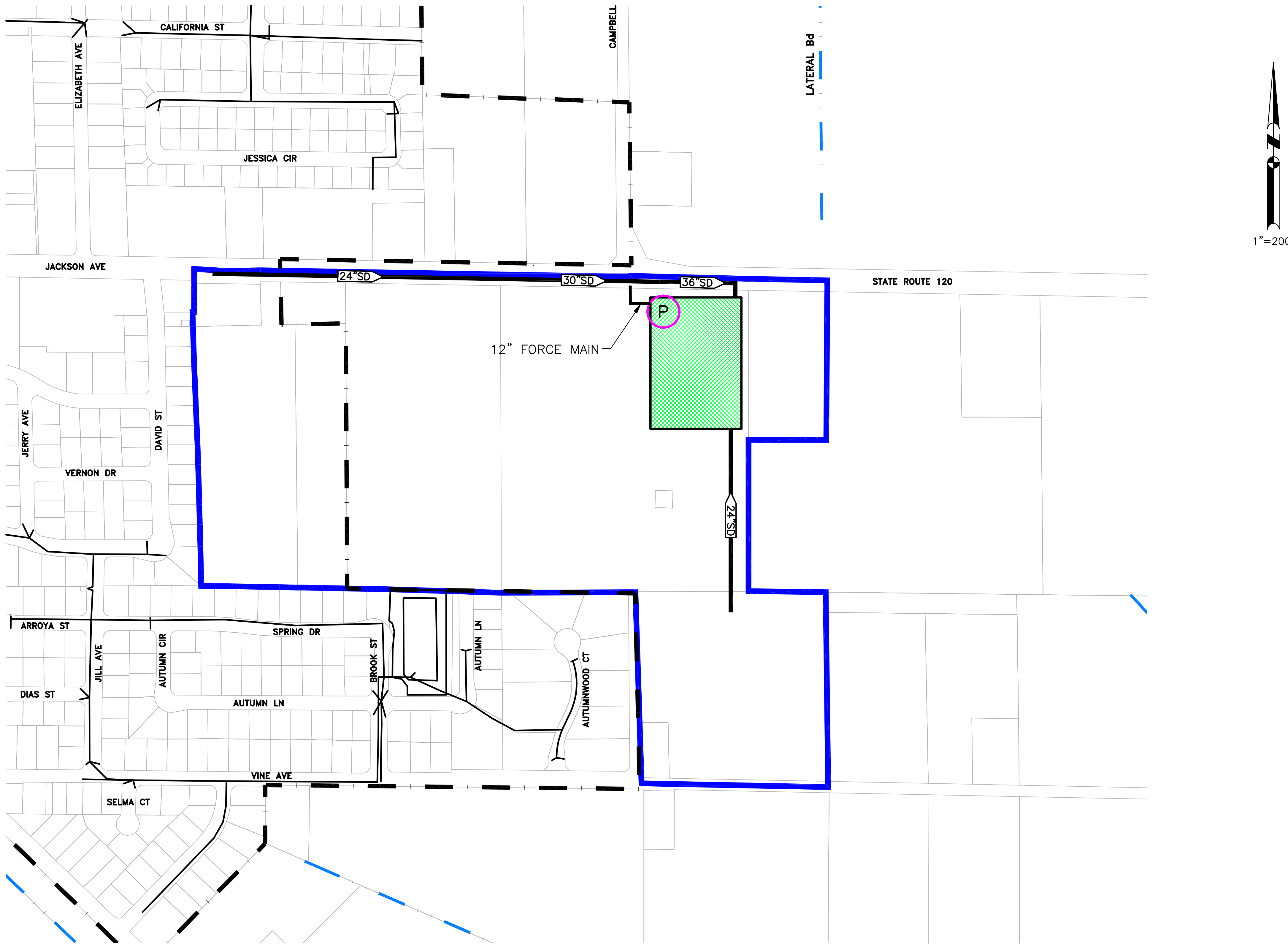
FIGURE 4-16



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED G

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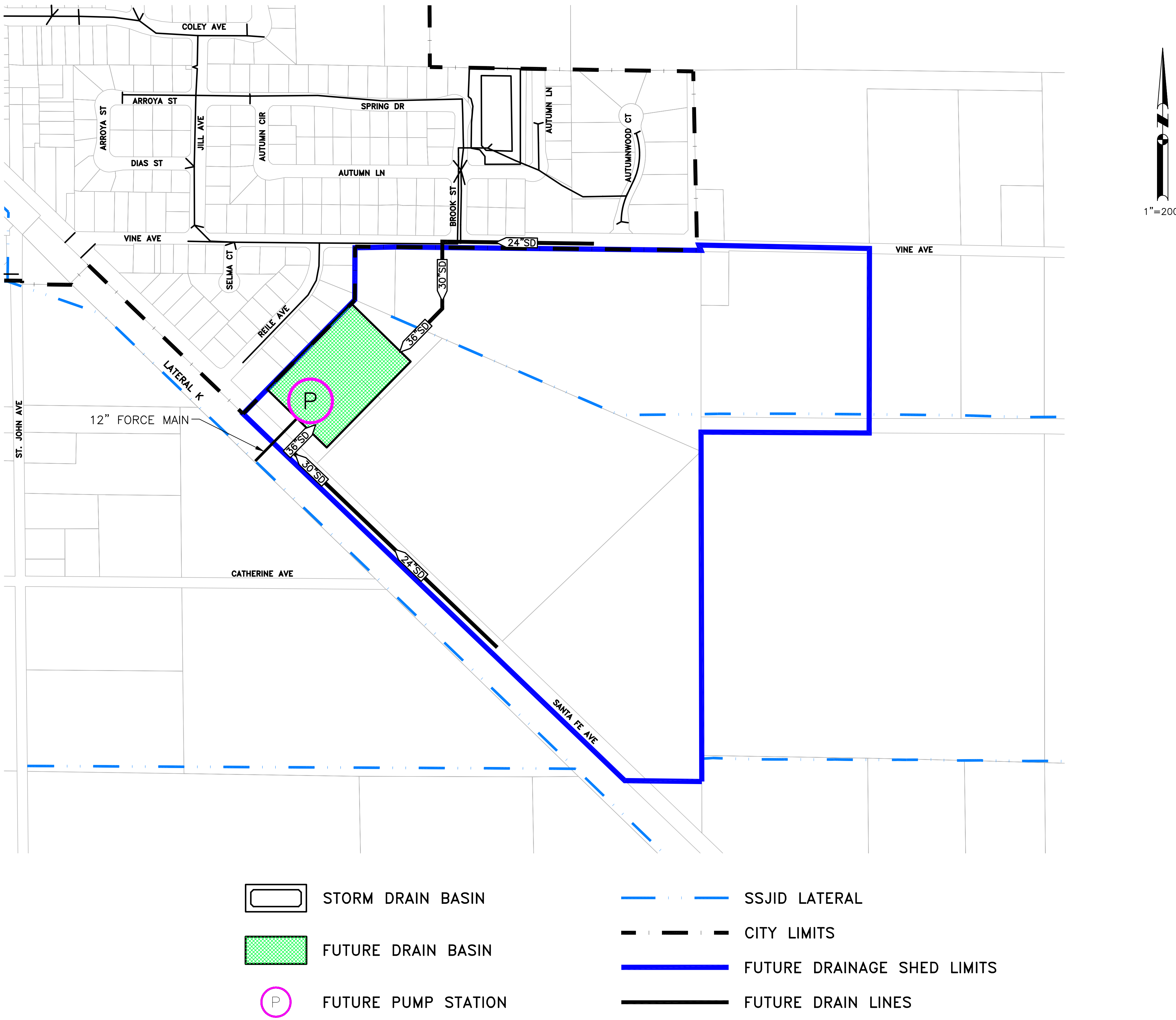
LAND of PEACHES & CREAM ESCALON

FIGURE 4-17



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STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED H

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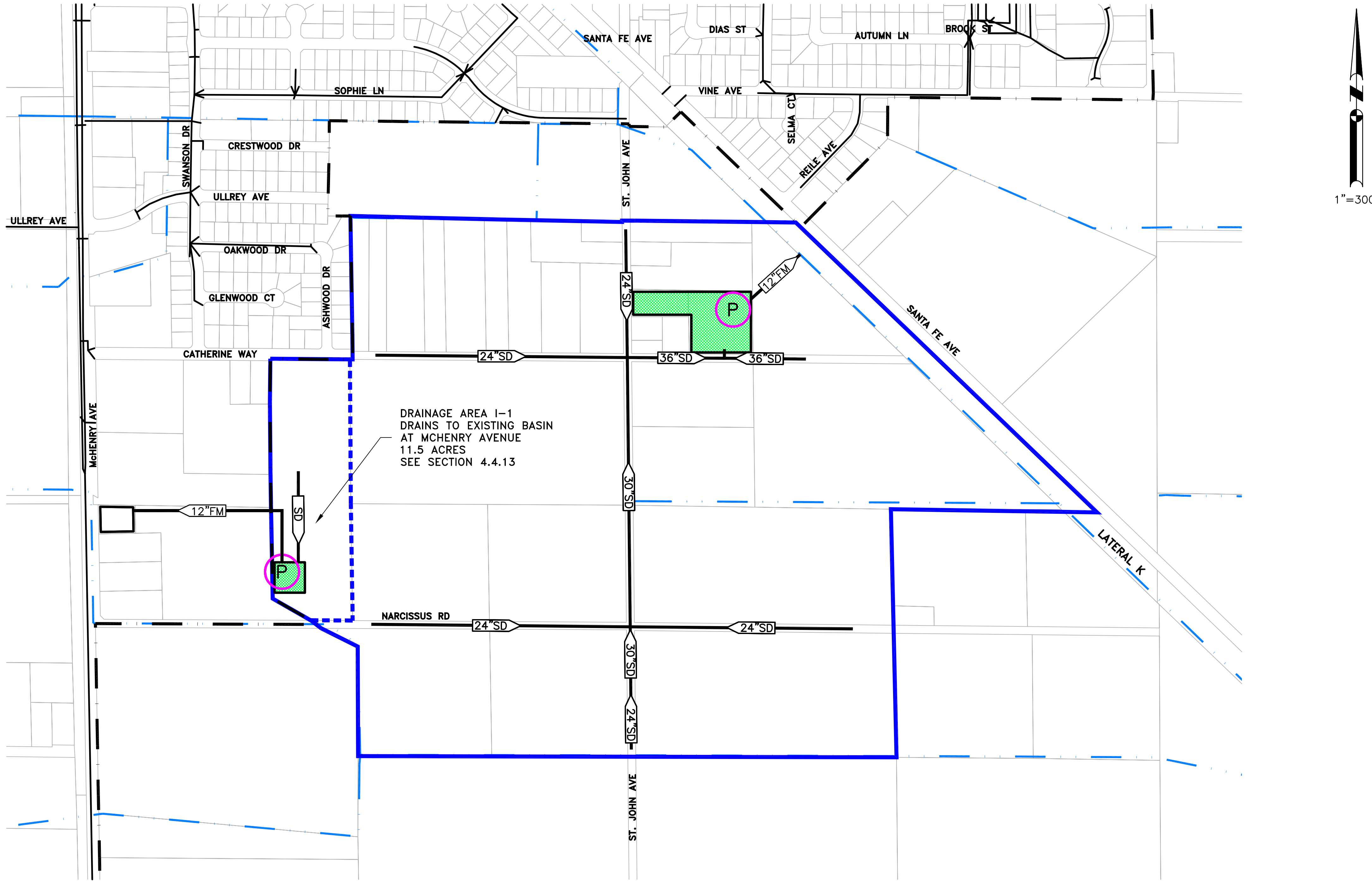
FIGURE 4-18

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED I



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

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FIGURE 4-19

4.4.15. Future Drainage Shed J

As shown in Figure 4-20 Future Drainage Shed J is located on the east side of McHenry Avenue between Catherine Way and Jones Avenue. The future drainage shed basin is proposed to be located along the east side the drainage shed between Narcissus Road and Clough Avenue. A future pump station will pump detained runoff into SSJID Lateral Ka.

4.4.16. Future Drainage Shed K

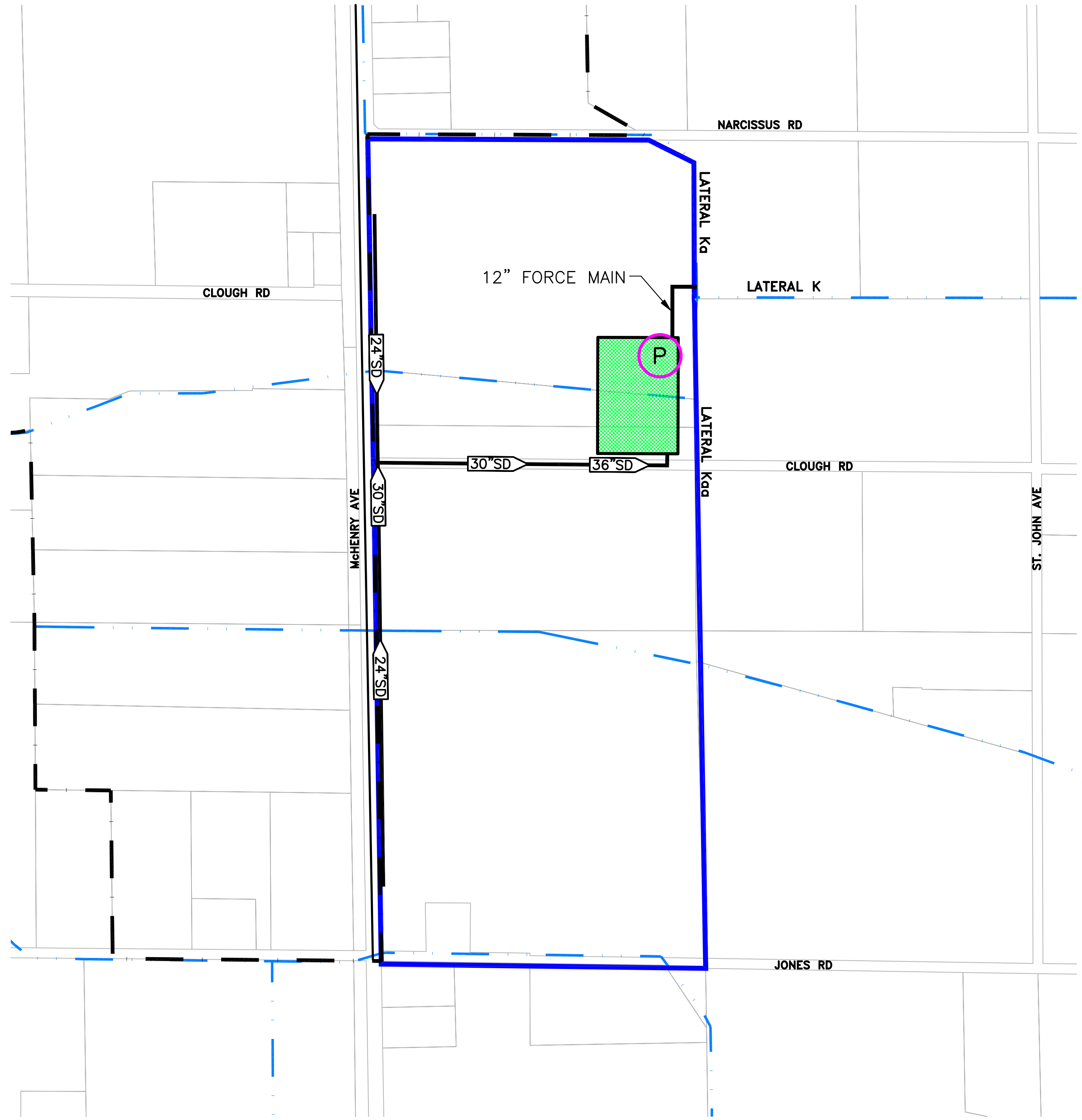
Future Drainage Shed K is roughly bounded by McHenry Avenue on the east, Jones Avenue on the south, Ellis Road on the west and Clough Avenue on the north as shown on Figure 4-21. The future detention basin is proposed to be centrally located within the drainage shed. Basin detained runoff will be discharged by a future pump station into SSJID Lateral Ka.

4.4.17. Future Drainage Shed L

Future Drainage Shed L is located on the west side of McHenry Avenue and between Clough and Ullrey Avenues. The future detention basin shall be located near McHenry Avenue as shown in Figure 4-22. A future pump station will pump detained runoff into SSJID Lateral Ka.

4.4.18. Future Drainage Shed M

As shown in Figure 4-23 Future Drainage Shed M is located on both the north and south sides of Ullrey Avenue and straddles Dahlin Road. The proposed future detention basin location is on the south side of Ullrey Avenue near the west side of the drainage shed. Detained runoff from the proposed basin will be pumped by a future pump station into SSJID Lateral K.



N

1"=300'

STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED J

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FIGURE 4-20

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED K

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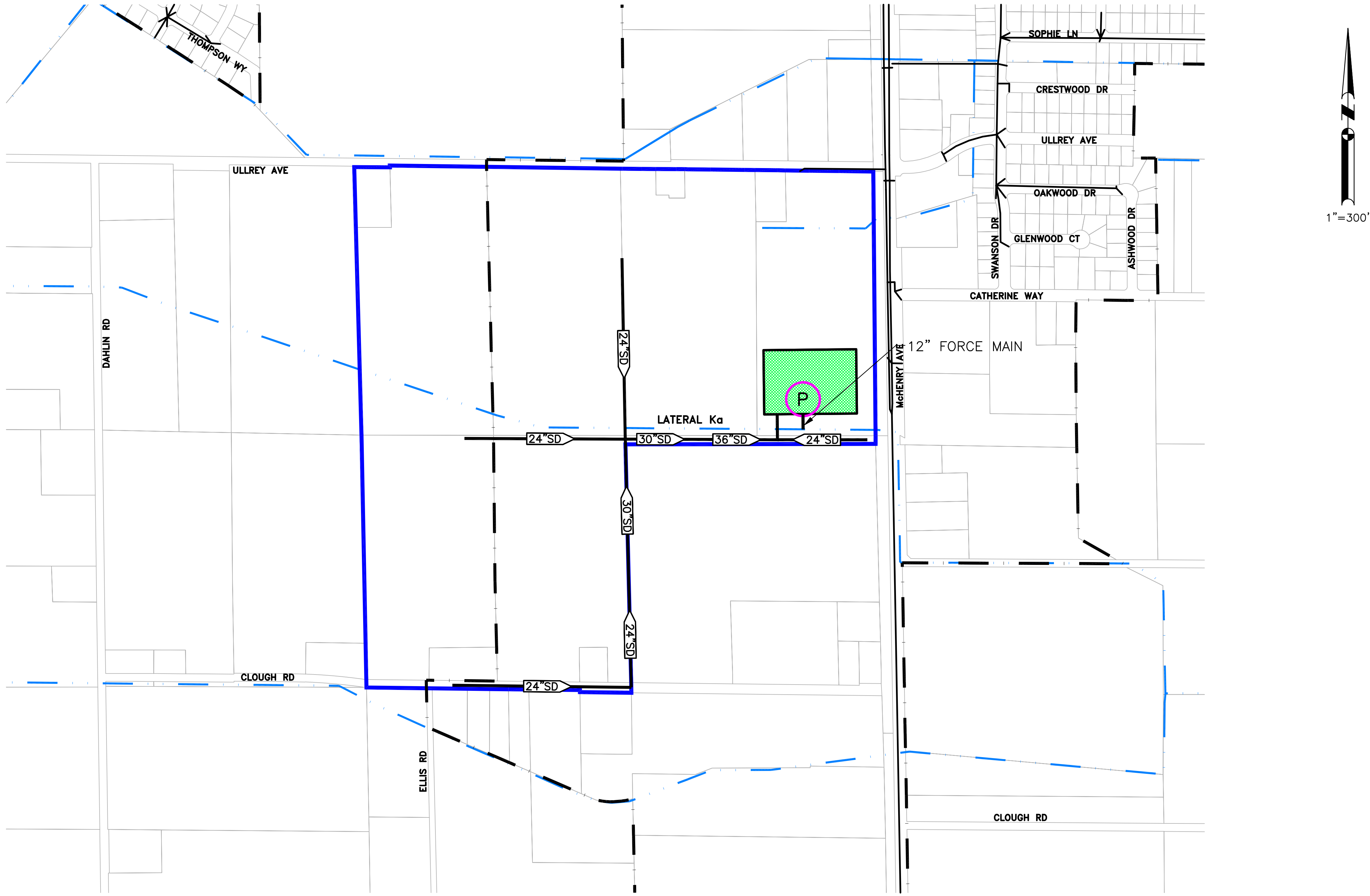
FIGURE 4-21



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED L

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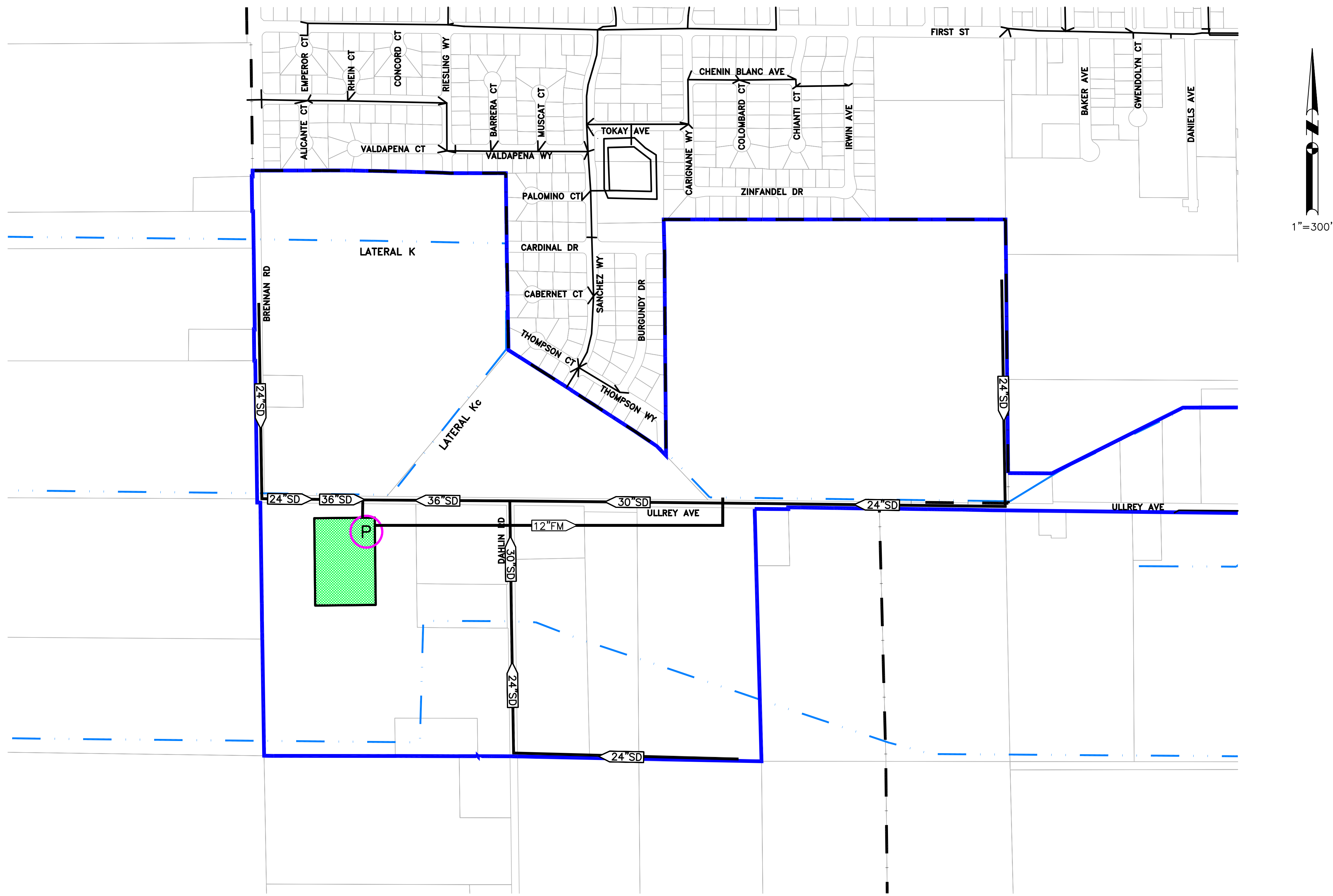
FIGURE 4-22



STORM DRAIN BASIN

FUTURE DRAIN BASIN

FUTURE PUMP STATION

SSJID LATERAL

CITY LIMITS

FUTURE DRAINAGE SHED LIMITS

FUTURE DRAIN LINES

CITY OF ESCALON
STORM DRAINAGE MASTER PLAN

FUTURE STORM DRAIN SYSTEMS
FUTURE DRAINAGE SHED M

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FIGURE 4-23

4.4.19. FUTURE IMPROVEMENTS

Utilizing the design criteria described in this Master Plan and the land use designation described in the City's 2005 General Plan Update, the proposed storm drain infrastructure requirements were developed for each future storm drain shed. The proposed storm drain infrastructure is itemized by future storm drain shed in Table 4-9.

Table 4-9
Future Storm Drain Shed
Infrastructure Improvements

Future Storm Drain Shed	Description	Unit	Estimated Quantity
A	24" & Smaller Storm Drain Pipe	FT	6800
A	30" Storm Drain Pipe	FT	2400
A	36" & Larger Storm Drain Pipe	FT	1300
A	Storm Drain Pump Station	LS	2
A	Force Main	LF	830
A	Storm Drain Basin Surface Area (Volume Approximately 38 Acre-Feet)	Ac	7.2
B	24" Storm Drain Pipe	FT	1250
B	30" Storm Drain Pipe	FT	440
B	36" Storm Drain Pipe	FT	240
B	Storm Drain Pump Station	LS	1
B	Force Main	LF	115
B	Storm Drain Basin Surface Area (Volume Approximately 4 Acre-Feet)	Ac	0.77
E	24" Storm Drain Pipe	FT	5960
E	30" Storm Drain Pipe	FT	2060
E	36" Storm Drain Pipe	FT	1150
E	Storm Drain Pump Station	LS	1
E	Force Main	LF	20
E	Storm Drain Basin Surface Area (Volume Approximately 16 Acre-Feet)	Ac	3.24
F	24" Storm Drain Pipe	FT	310
F	30" Storm Drain Pipe	FT	110
F	36" Storm Drain Pipe	FT	60
F	Storm Drain Pump Station	LS	1
F	Force Main	LF	450
F	Storm Drain Basin Surface Area (Volume Approximately 2 Acre-Feet)	Ac	0.40
G	24" Storm Drain Pipe	FT	1650
G	30" Storm Drain Pipe	FT	570
G	36" Storm Drain Pipe	FT	330
G	Storm Drain Pump Station	LS	1
G	Force Main	LF	170
G	Storm Drain Basin Surface Area (Volume Approximately 7 Acre-Feet)	Ac	1.37
H	24" Storm Drain Pipe	FT	1500
H	30" Storm Drain Pipe	FT	520
H	36" Storm Drain Pipe	FT	290
H	Storm Drain Pump Station	LS	1

Future Storm Drain Shed	Description	Unit	Estimated Quantity
H	Force Main	LF	230
H	Storm Drain Basin Surface Area (Volume Approximately 4 Acre-Feet)	Ac	0.80
I	24" Storm Drain Pipe	FT	4450
I	30" Storm Drain Pipe	FT	1540
I	36" Storm Drain Pipe	FT	860
I	Storm Drain Pump Station	LS	1
I	Force Main	LF	330
I	Storm Drain Basin Surface Area (Volume Approximately 12 Acre-Feet)	Ac	2.48
I-1	24" Storm Drain Pipe	FT	300
I-1	30" Storm Drain Pipe	FT	100
I-1	36" Storm Drain Pipe	FT	60
I-1	Storm Drain Pump Station	LS	1
I-1	Force Main	LF	740
I-1	Storm Drain Basin Surface Area (Volume Approximately 1Acre-Feet)	Ac	0.19
J	24" Storm Drain Pipe	FT	2520
J	30" Storm Drain Pipe	FT	870
J	36" Storm Drain Pipe	FT	490
J	Storm Drain Pump Station	LS	1
J	Force Main	LF	300
J	Storm Drain Basin Surface Area (Volume Approximately 14 Acre-Feet)	Ac	2.72
K	24" Storm Drain Pipe	FT	3350
K	30" Storm Drain Pipe	FT	1160
K	36" Storm Drain Pipe	FT	650
K	Storm Drain Pump Station	LS	1
K	Force Main	LF	2,670
K	Storm Drain Basin Surface Area (Volume Approximately 21 Acre-Feet)	Ac	4.10
L	24" Storm Drain Pipe	FT	3060
L	30" Storm Drain Pipe	FT	1060
L	36" Storm Drain Pipe	FT	590
L	Storm Drain Pump Station	LS	1
L	Force Main	LF	2,665
L	Storm Drain Basin Surface Area (Volume Approximately 16 Acre-Feet)	Ac	2.92
M	24" Storm Drain Pipe	FT	5700
M	30" Storm Drain Pipe	FT	1970
M	36" Storm Drain Pipe	FT	1100
M	Storm Drain Pump Station	LS	1
M	Force Main	LF	2,000
M	Storm Drain Basin Surface Area (Volume Approximately 15 Acre-Feet)	Ac	3.11

Section 5

Capital Improvement Program

The Master Plan developed procedures and the City-wide storm drain system analysis was used to evaluate drainage problems and solutions. The Master Plan identifies specific drainage improvements needed to address deficiencies in the existing storm drain systems and proposed future improvement needs within the General Plan planning area. The existing storm drain systems as well as the proposed future improvements were presented in Section 4. This Capital Improvement Program (CIP) estimates costs for the recommended improvement to the existing storm drain systems and presents approximate costs for the future storm drain capital improvements.

Phasing of improvements to the existing storm drain systems is based on available funding. Phasing of future improvements is development driven and will be adjusted as necessary to meet the needs of community development.

Construction of each pump station will require the purchase of a suitable site; site excavation and grading; construction of a pump station sump, structure, electrical service controls, telemetry and panel, and support structures; installation of fencing; purchase and installation of the pumps; and design costs. See Section 3.3.3 for pump station design requirements.

Construction of each detention basin will require the purchase of a suitable site; site excavation and grading; landscaping if required; fencing if required; connection with the new or existing storm drain collection system; connection to a pump station; installation of a force main; connection to an SSJID lateral; and design costs. The approximate basin volumes and surface areas provided in this report include the requirements of the basin only, measured at the hinge points of the side slopes. No dual or multi use facilities or water quality improvement measures beyond those required as Best Management Practices at the time this report was published are included in any basin calculations, including basin cost. See Section 3.3.2 for drainage basin design requirements.

Tables 5-1 through 5-6 list the estimated construction costs for the proposed improvements to the existing storm drain systems. Tables 5-7 through 5-18 list the estimated construction costs for the future improvements by drainage shed and an estimated per acre rate is calculated for each drainage shed. Storm drain basin cost includes land cost, excavating and grading. A twenty percent cost contingency factor has been included in the total cost, which accounts for variation in construction methods, quantities and costs.

At the time of development, the City may implement connection fees to offset the cost of storm drainage improvements. The fees are based on the per-acre cost of the future drainage shed improvements, weighted by the intended land use. See Appendix 7 for suggested costs per acre by land use within each future drainage shed.

Table 5-1
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 2

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	Replace 30-inch Storm Drain Pipe with 36-inch Storm Drain Pipe	FT	780	$250	$195,000
2	Replace 24-inch Storm Drain Pipe with 30-inch Storm Drain Pipe	FT	590	$200	$118,000
3	Replace 21-inch Storm Drain Pipe with 30-inch Storm Drain Pipe	FT	820	$200	$164,000
4	Construct Storm Drain Detention Basin (15 Ac-Ft)	Ac	3.15	$850,000	$2,677,500
	Subtotal				$3,154,500
	Contingency 20%				$630,900
	Total				$3,785,400

Table 5-2
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 6

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	620	$115	$71,300
2	30" Storm Drain Pipe	FT	220	$140	$30,800
3	36" Storm Drain Pipe	FT	120	$170	$20,400
4	Expansion of Existing Storm Drain Basin (Volume Approximately 0.67 Additional Ac-Ft)	Ac	0.16	$800,000	$127,360
	Subtotal				$249,860
	Contingency 20%				$49,965
	Total				$299,825
	Cost per Undeveloped Acre (23.5 Acres)				$12,758.51

Table 5-3
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 7 (7A)

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	100	$115	$11,500
2	30" Storm Drain Pipe	FT	40	$140	$5,600
3	36" Storm Drain Pipe	FT	20	$170	$3,400
4	Expansion of Existing Storm Drain Basin (Volume Serving Expansion 7A is Approximately 0.3 Additional Ac-Ft)	Ac	0.1	$800,000	$80,000
5	Pump Station Improvements at Storm Drain Basin	LS	1	$34,000	$34,000
6	Pump Station Improvements at Walnut Avenue	LS	1	$34,000	$34,000
	Subtotal				$168,500
	Contingency 20%				$33,724
	Total				$202,224
	Cost per Undeveloped Acre (4.0 Acres)				$50,556.00

Table 5-4
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 7 (7B)

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	1000	$115	$115,000
2	30" Storm Drain Pipe	FT	350	$140	$49,000
3	36" Storm Drain Pipe	FT	195	$170	$33,150
4	Expansion of Existing Storm Drain Basin (Volume Serving Expansion 7B is Approximately 2 Additional Ac-Ft)	Ac	1	$830,000	$830,000
5	Pump Station Improvements at Storm Drain Basin	LS	1	$250,000	$250,000
6	Pump Station Improvements at Walnut Avenue	LS	1	$300,000	$300,000
Subtotal					$1,577,150
Contingency 20%					$314,989
Total					$1,892,139
Cost per Undeveloped Acre (38.2 Acres)					$49,532.43

Table 5-5
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 8

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	745	$115	$85,675
2	30" Storm Drain Pipe	FT	250	$140	$35,000
3	36" Storm Drain Pipe	FT	140	$170	$23,800
Subtotal					$178,475
Contingency 20%					$35,750
Total					$214,225
Cost per Undeveloped Acre (27.6 Acres)					$7,761.78

Table 5-6
Preliminary Probable Construction Costs
Proposed Improvements to Existing Drain System 11

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	250	$115	$28,750
2	30" Storm Drain Pipe	FT	90	$140	$12,600
3	36" Storm Drain Pipe	FT	50	$170	$8,500
4	Expansion of Existing Storm Drain Basin (Volume Approximately 1.56 Additional Ac-Ft)	Ac	0.32	$800,000	$256,000
5	Storm Drain Pump Station	LS	1	$200,000	$200,000
6	Force Main	LF	220	$24	$5,280
Subtotal					$511,130
Contingency 20%					$102,120
Total					$613,250
Cost per Undeveloped Acre (15.8 Acres)					$38,813.29

Table 5-7
Preliminary Probable Construction Costs
Future Drainage Shed A

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" & Smaller Storm Drain Pipe	FT	6800	$115	$782,000
2	30" Storm Drain Pipe	FT	2400	$140	$336,000
3	36" & Larger Storm Drain Pipe	FT	1300	$170	$221,000
4	Storm Drain Pump Station	LS	2	$300,000	$600,000
5	Force Main	LF	830	$24	$19,920
6	Storm Drain Basin Surface Area (Volume Approximately 38 Acre-Feet)	Ac	7.2	$800,000	$5,732,480
Subtotal					$7,691,400
Contingency 20%					$1,538,238
Total					$9,229,638
Cost per Acre (261.2 Acres)					$35,331

Table 5-8
Preliminary Probable Construction Costs
Future Drainage Shed B

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	1250	$115	$143,750
2	30" Storm Drain Pipe	FT	440	$140	$61,600
3	36" Storm Drain Pipe	FT	240	$170	$40,800
4	Storm Drain Pump Station	LS	1	$150,000	$150,000
5	Force Main	LF	115	$24	$2,760
6	Storm Drain Basin Surface Area (Volume Approximately 4 Acre-Feet)	Ac	0.77	$800,000	$613,200
Subtotal					$1,012,110
Contingency 20%					$202,425
Total					$1,214,535
Cost per Acre (48.2 Acres)					$25,203

Table 5-9
Preliminary Probable Construction Costs
Future Drainage Shed E

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	5960	$115	$685,400
2	30" Storm Drain Pipe	FT	2060	$140	$288,400
3	36" Storm Drain Pipe	FT	1150	$170	$195,500
4	Storm Drain Pump Station	LS	1	$240,000	$240,000
5	Force Main	LF	20	$24	$480
6	Storm Drain Basin Surface Area (Volume Approximately 16 Acre-Feet)	Ac	3.24	$800,000	$2,593,600
Subtotal					$4,003,380
Contingency 20%					$800,708
Total					$4,804,088
Cost per Acre (229.2 Acres)					$20,964

Table 5-10
Preliminary Probable Construction Costs
Future Drainage Shed F

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	310	$115	$35,650
2	30" Storm Drain Pipe	FT	110	$140	$15,400
3	36" Storm Drain Pipe	FT	60	$170	$10,200
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	450	$24	$10,800
6	Storm Drain Basin Surface Area (Volume Approximately 2 Acre-Feet)	Ac	0.40	$800,000	$319,600
Subtotal					$641,650
Contingency 20%					$128,338
Total					$769,988
Cost per Acre (11.6 Acres)					$66,321

Table 5-11
Preliminary Probable Construction Costs
Future Drainage Shed G

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	1650	$115	$189,750
2	30" Storm Drain Pipe	FT	570	$140	$79,800
3	36" Storm Drain Pipe	FT	330	$170	$56,100
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	170	$24	$4,080
6	Storm Drain Basin Surface Area (Volume Approximately 7 Acre-Feet)	Ac	1.37	$800,000	$1,096,000
Subtotal					$1,675,730
Contingency 20%					$335,145
Total					$2,010,875
Cost per Acre (63.2 Acres)					$31,808

Table 5-12
Preliminary Probable Construction Costs
Future Drainage Shed H

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	1500	$115	$172,500
2	30" Storm Drain Pipe	FT	520	$140	$72,800
3	36" Storm Drain Pipe	FT	290	$170	$49,300
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	230	$24	$5,520
6	Storm Drain Basin Surface Area (Volume Approximately 4 Acre-Feet)	Ac	0.80	$800,000	$643,360
Subtotal					$1,193,480
Contingency 20%					$238,633
Total					$1,432,113
Cost per Acre (65.3 Acres)					$25,204

Table 5-13
Preliminary Probable Construction Costs
Future Drainage Shed I

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	4450	$115	$511,750
2	30" Storm Drain Pipe	FT	1540	$140	$215,600
3	36" Storm Drain Pipe	FT	860	$170	$146,200
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	330	$24	$7,920
6	Storm Drain Basin Surface Area (Volume Approximately 12 Acre-Feet)	Ac	2.48	$800,000	$1,983,040
Subtotal					$3,114,510
Contingency 20%					$622,878
Total					$3,737,388
Cost per Acre (171.2 Acres)					$21,825

Table 5-14
Preliminary Probable Construction Costs
Future Drainage Shed I-1

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	300	$115	$34,500
2	30" Storm Drain Pipe	FT	100	$140	$14,000
3	36" Storm Drain Pipe	FT	60	$170	$10,200
4	Storm Drain Pump Station	LS	1	$300,000	$300,000
5	Force Main	LF	740	$24	$17,760
6	Storm Drain Basin Surface Area (Volume Approximately 1Acre-Feet)	Ac	0.19	$800,000	$148,280
Subtotal					$524,740
Contingency 20%					$104,948
Total					$629,688
Cost per Acre (11.5 Acres)					$54,899

Table 5-15
Preliminary Probable Construction Costs
Future Drainage Shed J

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	2520	$115	$289,800
2	30" Storm Drain Pipe	FT	870	$140	$121,800
3	36" Storm Drain Pipe	FT	490	$170	$83,300
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	300	$24	$7,200
6	Storm Drain Basin Surface Area (Volume Approximately 14 Acre-Feet)	Ac	2.72	$800,000	$2,173,280
Subtotal					$2,925,380
Contingency 20%					$585,108
Total					$3,510,488
Cost per Acre (96.9 Acres)					$36,217

Table 5-16
Preliminary Probable Construction Costs
Future Drainage Shed K

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	3350	$115	$385,250
2	30" Storm Drain Pipe	FT	1160	$140	$162,400
3	36" Storm Drain Pipe	FT	650	$170	$110,500
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	2,670	$24	$64,080
6	Storm Drain Basin Surface Area (Volume Approximately 21 Acre-Feet)	Ac	4.10	$800,000	$3,278,240
Subtotal					$4,250,470
Contingency 20%					$850,080
Total					$5,100,550
Cost per Acre (128.8 Acres)					$39,616

Table 5-17
Preliminary Probable Construction Costs
Future Drainage Shed L

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	3060	$115	$351,900
2	30" Storm Drain Pipe	FT	1060	$140	$148,400
3	36" Storm Drain Pipe	FT	590	$170	$100,300
4	Storm Drain Pump Station	LS	1	$250,000	$250,000
5	Force Main	LF	2,665	$24	$63,960
6	Storm Drain Basin Surface Area (Volume Approximately 16 Acre-Feet)	Ac	2.92	$800,000	$2,333,200
	Subtotal				$3,247,760
	Contingency 20%				$649,578
	Total				$3,897,338
	Cost per Acre (117.7 Acres)				$33,110

Table 5-18
Preliminary Probable Construction Costs
Future Drainage Shed M

Item	Description	Unit	Estimated Quantity	Item Price	Total
1	24" Storm Drain Pipe	FT	5700	$115	$655,500
2	30" Storm Drain Pipe	FT	1970	$140	$275,800
3	36" Storm Drain Pipe	FT	1100	$170	$187,000
4	Storm Drain Pump Station	LS	1	$300,000	$300,000
5	Force Main	LF	2,000	$24	$48,000
6	Storm Drain Basin Surface Area (Volume Approximately 15 Acre-Feet)	Ac	3.11	$800,000	$2,489,152
	Subtotal				$3,955,452
	Contingency 20%				$791,123
	Total				$4,746,575
	Cost per Acre (219.2 Acres)				$21,649

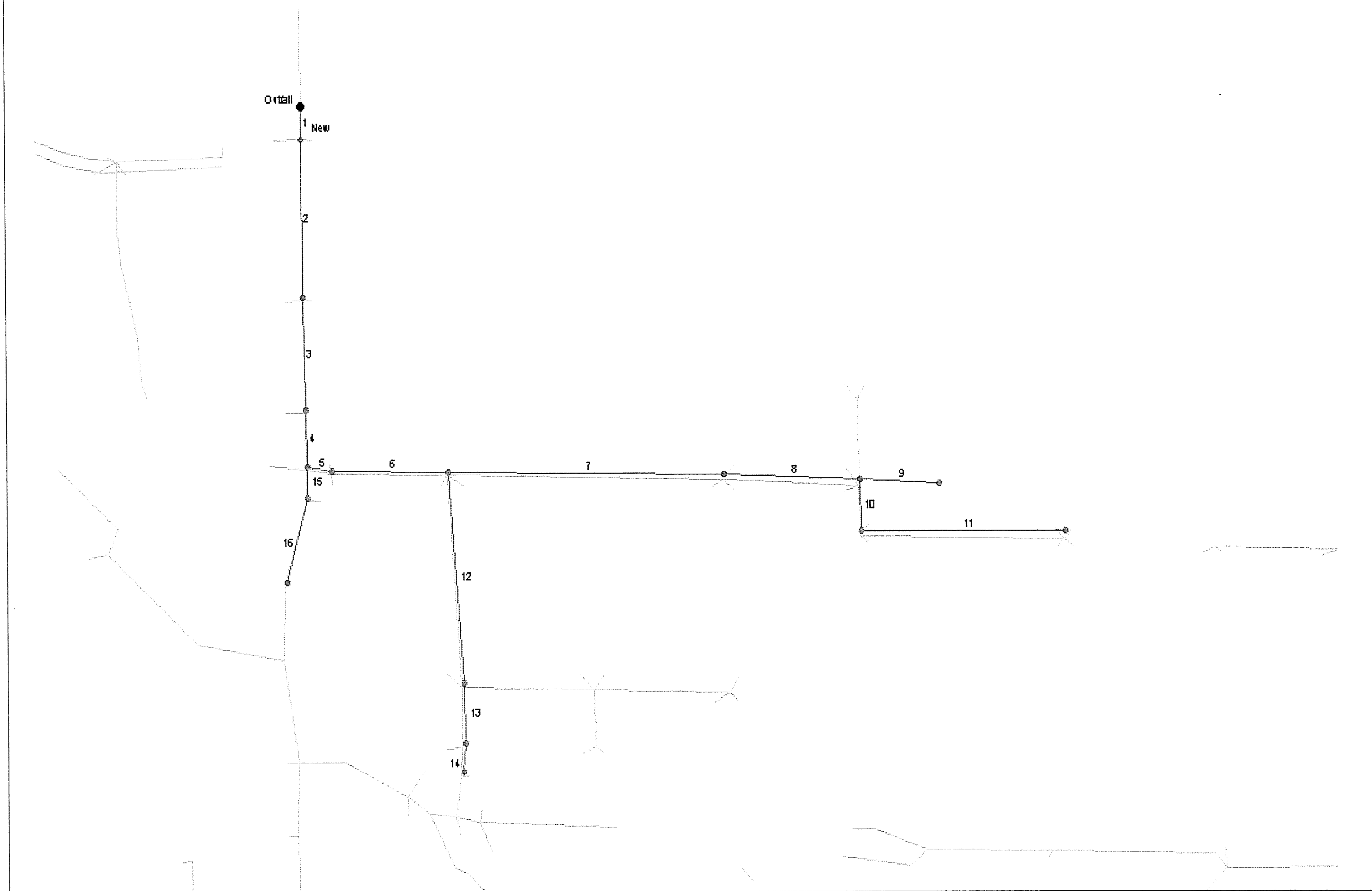
Section 6

Appendices

Appendix 1: Analysis of Existing Storm Drain System

Drain System 1

Hydraflow Plan View



Project File: 060915-Network_E01.stm	No. Lines: 16	03-27-2007

Hydraflow Storm Sewers 2005

COS

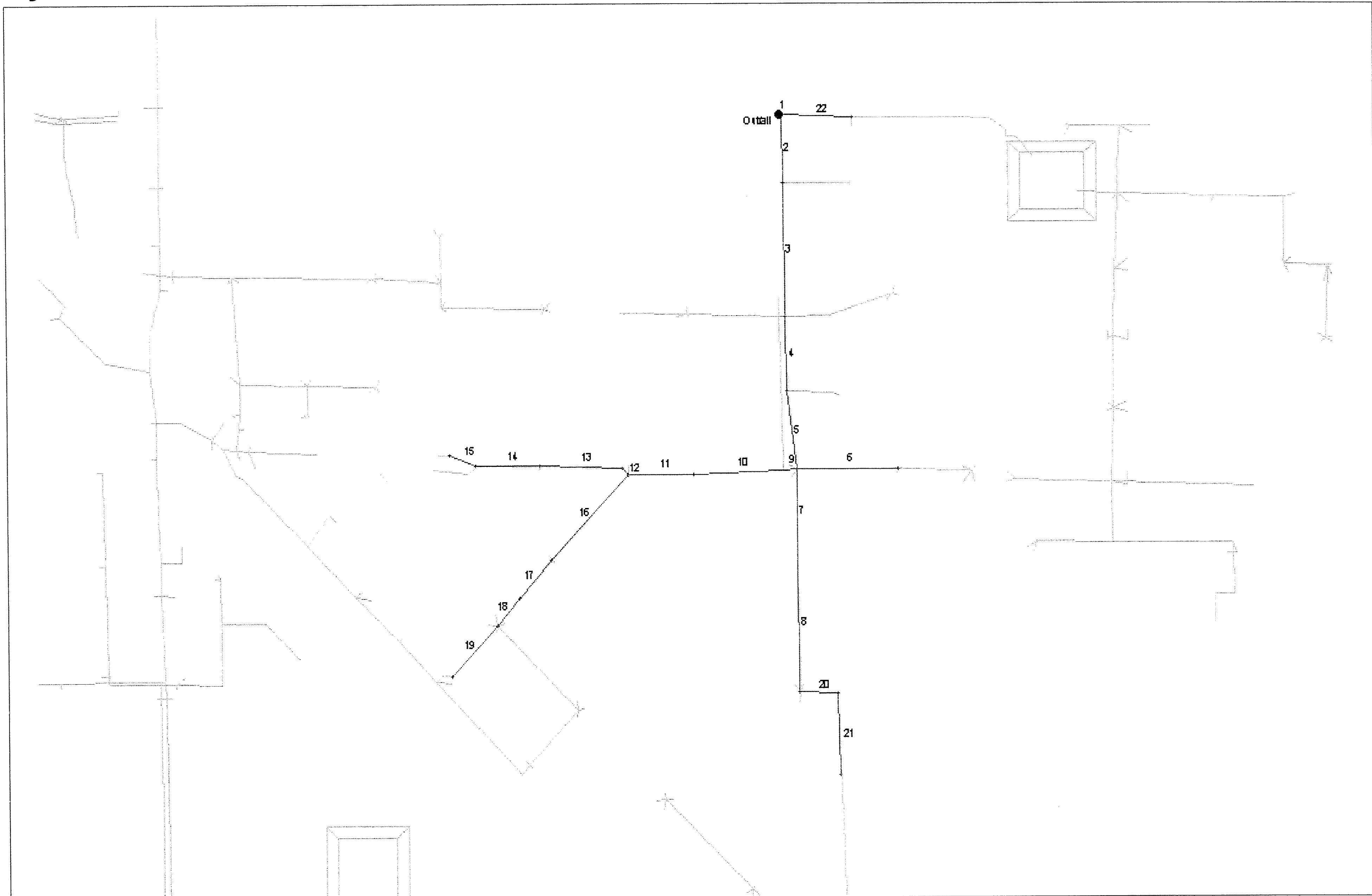
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	17.93	0.35	6.28	18.63	0.60	11.24	30	0.02	0.224	106.78	106.53	63.75	105.27	105.26	4.05	72.4	0.31	0.00	0.00
2	1	1.16	0.35	0.41	12.36	0.61	7.60	30	0.10	0.074	107.04	106.83	303.50	105.57	105.27	2.44	70.3	2.18	0.00	0.00
3	2	0.91	0.35	0.32	11.95	0.62	7.45	30	0.10	0.082	107.21	107.04	217.29	105.79	105.57	2.53	68.7	1.58	0.00	0.00
4	3	0.56	0.35	0.20	11.63	0.63	7.31	30	0.10	0.086	107.30	107.21	110.77	105.90	105.79	2.56	67.9	0.82	0.00	0.00
5	4	0.19	0.35	0.07	10.80	0.63	6.79	21	0.15	0.183	108.48	108.40	51.97	106.73	106.65	2.82	67.7	0.20	0.00	0.00
6	5	3.09	0.35	1.08	10.73	0.63	6.81	21	0.16	0.180	108.88	108.48	247.03	107.13	106.73	2.83	66.7	0.94	0.00	0.00
7	6	3.12	0.35	1.09	7.33	0.98	7.18	21	0.21	0.187	109.96	108.88	584.57	108.33	107.13	3.03	33.0	3.05	0.00	0.00
8	7	1.20	0.35	0.42	6.24	1.01	6.31	21	0.16	0.139	110.35	109.96	287.01	108.78	108.33	2.74	31.3	1.70	0.00	0.00
9	8	5.11	0.35	1.79	1.79	1.16	2.07	21	0.10	0.015	110.47	110.45	168.31	108.95	108.78	0.91	25.0	3.25	0.00	0.00
10	8	3.54	0.35	1.24	4.03	1.03	4.15	21	0.10	0.060	110.46	110.41	98.78	108.88	108.78	1.80	30.4	0.90	0.00	0.00
11	10	7.98	0.35	2.79	2.79	1.16	3.24	21	0.10	0.043	110.64	110.46	432.52	109.31	108.88	1.54	25.0	5.35	0.00	0.00
12	6	6.09	0.35	2.13	2.32	0.67	1.56	21	0.10	0.009	109.02	108.98	408.82	107.54	107.13	0.68	60.5	6.24	0.00	0.00
13	12	0.14	0.35	0.05	0.19	0.89	0.16	21	0.10	0.000	109.02	109.02	116.25	107.66	107.54	0.08	38.7	21.83	0.00	0.00
14	13	0.39	0.35	0.14	0.14	1.16	0.16	21	0.09	0.000	109.02	109.02	53.90	107.71	107.66	0.08	25.0	13.65	0.00	0.00
15	4	0.78	0.35	0.27	0.64	0.69	0.44	30	0.10	0.000	107.40	107.40	59.00	105.96	105.90	0.15	57.9	6.65	0.00	0.00
16	15	1.05	0.35	0.37	0.37	1.16	0.43	30	0.10	0.000	107.40	107.40	171.22	106.13	105.96	0.16	25.0	32.88	0.00	0.00

Project File: 060915-Network_E01.stm | Number of lines: 16 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 2

Hydraflow Plan View



Project File: 060915-Network_E02.stm	No. Lines: 22	03-27-2007

Hydraflow Storm Sewers 2005

COS

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	0.79	0.35	0.28	57.21	0.72	41.44	36	0.82	0.367	111.74	111.70	11.00	108.79	108.70	5.87	53.8	0.03	0.00	119.23
2	1	5.40	0.35	1.89	56.20	0.73	41.06	36	0.13	0.379	112.78	111.79	261.51	109.12	108.79	5.81	53.0	0.75	0.00	0.00
3	2	13.71	0.35	4.80	54.31	0.74	40.36	36	0.05	0.366	114.64	112.80	503.59	109.39	109.12	5.71	51.6	1.45	0.00	0.00
4	3	3.40	0.35	1.19	49.51	0.75	37.07	30	0.05	0.817	117.00	114.64	287.81	109.54	109.39	7.55	51.0	0.62	0.00	0.00
5	4	6.73	0.35	2.36	48.32	0.75	36.46	30	0.06	0.791	119.39	117.02	299.49	109.71	109.54	7.43	50.3	0.65	119.81	0.00
6	5	12.42	0.35	4.35	4.35	1.16	5.04	18	0.15	0.230	121.10	120.12	425.60	110.35	109.71	2.85	25.0	2.49	0.00	119.81
7	5	0.00	0.35	0.00	26.83	0.83	22.17	30	0.13	0.292	120.87	119.93	321.00	110.13	109.71	4.52	43.4	1.22	0.00	119.81
8	7	8.44	0.35	2.95	26.83	0.85	22.79	30	0.13	0.309	122.49	120.87	524.31	110.79	110.13	4.64	41.5	1.91	0.00	0.00
9	5	0.00	0.35	0.00	14.78	0.76	11.20	30	0.02	0.075	120.21	120.17	55.10	109.72	109.71	2.28	50.0	0.32	0.00	119.81
10	9	8.43	0.35	2.95	14.78	0.78	11.50	30	0.02	0.079	120.51	120.21	376.26	109.78	109.72	2.34	47.9	2.11	0.00	0.00
11	10	2.41	0.35	0.84	11.83	0.80	9.43	30	0.01	0.053	120.68	120.53	273.01	109.82	109.78	1.92	46.0	1.85	120.37	0.00
12	11	4.34	0.35	1.52	5.37	1.04	5.58	15	0.19	0.746	120.95	120.68	36.40	110.39	110.32	4.54	29.9	0.13	0.00	120.37
13	12	2.55	0.35	0.89	3.85	1.08	4.14	15	0.20	0.412	122.51	121.09	345.04	111.58	110.89	3.38	28.3	1.66	0.00	0.00
14	13	4.85	0.35	1.70	2.96	1.11	3.30	15	0.20	0.261	123.28	122.58	267.52	112.61	112.08	2.69	26.7	1.62	0.00	0.00
15	14	3.61	0.35	1.26	1.26	1.16	1.46	15	0.28	0.051	123.43	123.37	118.33	113.44	113.11	1.19	25.0	1.65	0.00	0.00
16	11	3.45	0.35	1.21	5.62	0.87	4.89	30	0.05	0.014	120.78	120.72	454.49	110.55	110.32	1.00	39.9	6.17	0.00	120.37
17	16	2.70	0.35	0.95	4.41	0.92	4.05	30	0.05	0.010	120.81	120.79	199.95	111.15	111.05	0.83	36.5	3.37	0.00	0.00
18	17	7.62	0.35	2.67	3.47	0.97	3.35	30	0.04	0.007	120.82	120.81	136.56	111.70	111.65	0.68	33.6	2.88	0.00	0.00
19	18	2.28	0.35	0.80	0.80	1.16	0.93	18	0.05	0.008	120.85	120.82	270.47	112.34	112.20	0.52	25.0	8.61	0.00	0.00
20	8	19.47	0.35	6.81	23.88	0.85	20.40	24	0.15	0.814	123.76	122.49	156.02	111.53	111.29	6.49	41.1	0.40	0.00	0.00
21	20	48.75	0.35	17.06	17.06	0.87	14.82	24	0.17	0.430	125.41	124.07	311.44	112.56	112.03	4.72	40.0	1.10	0.00	0.00

Project File: 060915-Network_E02.stm | Number of lines: 22 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

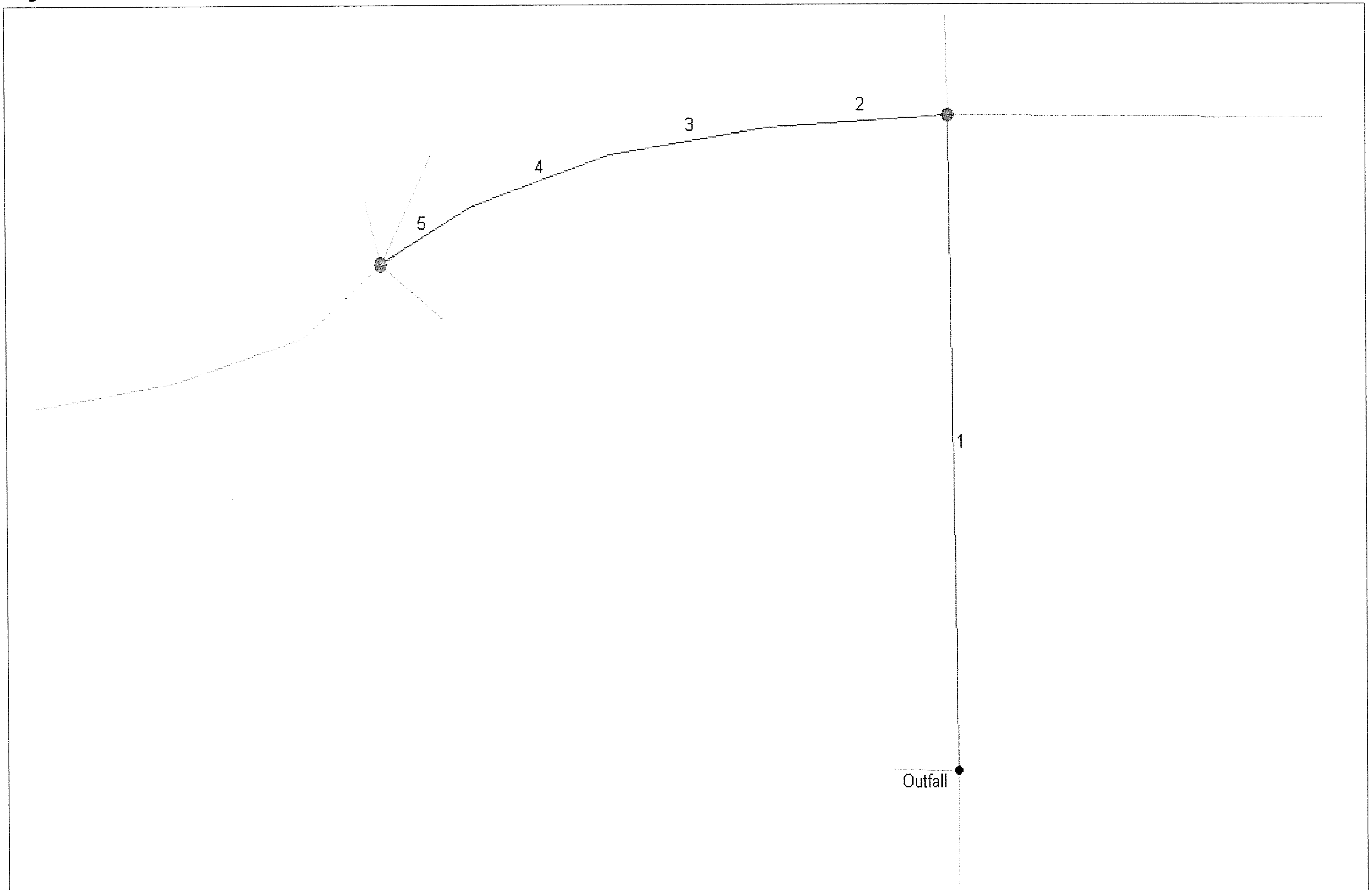
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	1	2.11	0.35	0.74	0.74	1.16	0.86	30	0.06	0.000	112.28	112.27	293.60	108.98	108.79	0.17	25.0	28.05	0.00	0.00

Project File: 060915-Network_E02.stm | Number of lines: 22 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 3

Hydraflow Plan View



Project File: 060915-Network_E03.stm	No. Lines: 5	03-27-2007

Hydraflow Storm Sewers 2005

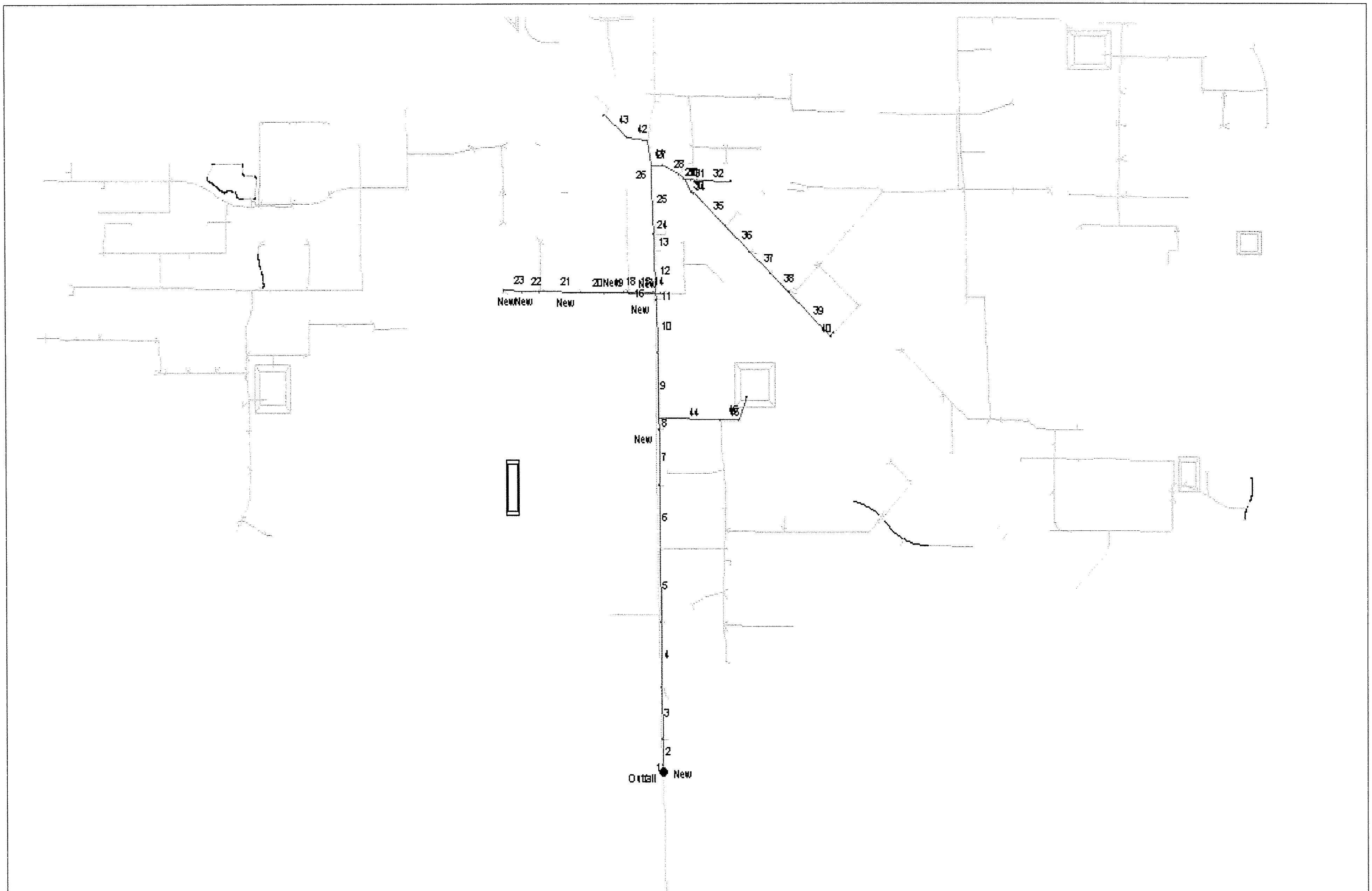
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	23.34	0.35	8.17	9.22	0.87	8.01	24	0.34	0.156	106.75	106.39	284.53	105.37	104.39	3.01	40.0	1.86	0.00	0.00
2	1	0.00	0.00	0.00	1.05	1.07	1.13	15	0.09	0.067	106.94	106.88	85.66	106.20	106.12	1.46	28.3	1.48	0.00	0.00
3	2	0.00	0.00	0.00	1.05	1.11	1.16	15	0.10	0.078	107.00	106.94	76.41	106.28	106.20	1.56	27.0	1.30	0.00	0.00
4	3	0.00	0.00	0.00	1.05	1.14	1.19	15	0.10	0.088	107.06	107.00	70.28	106.35	106.28	1.65	25.8	1.19	0.00	0.00
5	4	3.00	0.35	1.05	1.05	1.16	1.22	15	0.10	0.095	107.10	107.06	49.31	106.40	106.35	1.70	25.0	0.83	0.00	0.00

Project File: 060915-Network_E03.stm | Number of lines: 5 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 4

Hydraflow Plan View



Project File: 060915-Network_E04.stm	No. Lines: 46	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	14.22	0.90	12.80	123.36	0.53	65.36	42	0.09	0.422	103.54	103.30	56.81	99.85	99.80	6.79	89.5	0.11	26.31	0.00
2	1	6.27	0.90	5.64	110.57	0.53	58.75	42	0.09	0.341	104.46	103.79	196.52	100.03	99.85	6.11	89.1	0.43	114.80	26.31
3	2	10.25	0.90	9.22	104.92	0.53	56.10	42	0.10	0.311	105.84	104.59	402.07	100.42	100.03	5.83	88.2	0.90	0.00	114.80
4	3	5.50	0.90	4.95	95.70	0.54	51.61	42	0.11	0.263	107.33	106.01	505.26	100.98	100.42	5.36	87.0	1.21	0.00	0.00
5	4	2.46	0.90	2.21	90.75	0.54	49.41	42	0.09	0.241	108.79	107.44	560.51	101.50	100.98	5.14	85.6	1.37	0.00	0.00
6	5	15.31	0.90	13.78	88.53	0.55	48.94	54	0.10	0.062	109.44	109.12	516.01	101.00	100.50	3.08	83.5	2.06	0.00	0.00
7	6	0.98	0.90	0.88	74.76	0.56	41.93	54	0.06	0.045	109.69	109.50	433.25	101.27	101.00	2.64	81.6	1.99	0.00	0.00
8	7	13.82	0.90	12.44	73.87	0.56	41.56	54	0.30	0.045	109.75	109.71	85.90	101.53	101.27	2.61	81.2	0.40	0.00	0.00
9	8	2.75	0.90	2.48	54.83	0.58	31.59	54	0.13	0.026	109.94	109.81	511.53	102.20	101.53	1.99	78.1	3.06	0.00	0.00
10	9	1.66	0.90	1.49	52.36	0.59	30.78	54	0.06	0.024	110.06	109.96	414.84	102.44	102.20	1.94	75.6	2.52	92.93	0.00
11	10	0.13	0.90	0.12	50.87	0.59	29.99	54	0.10	0.023	110.13	110.12	58.51	102.50	102.44	1.89	75.2	0.36	114.80	92.93
12	11	2.40	0.90	2.16	12.10	0.61	7.35	36	0.10	0.012	110.27	110.23	324.74	104.33	104.01	1.04	71.6	3.66	0.00	114.80
13	12	1.01	0.90	0.91	9.94	0.62	6.13	36	0.09	0.008	110.28	110.27	127.01	104.45	104.33	0.87	69.8	1.73	0.00	0.00
14	11	10.91	0.90	9.82	38.65	0.85	32.98	16	5.19	18.495	113.86	110.19	19.83	107.04	106.01	23.62	41.2	0.01	0.00	114.80
15	14	0.24	0.65	0.16	28.83	0.86	24.77	24	0.02	1.200	132.84	130.24	216.50	105.05	105.01	7.89	40.7	0.46	103.65	0.00
16	15	3.10	0.65	2.02	9.11	1.11	10.13	24	0.08	0.201	133.81	133.79	11.85	105.06	105.05	3.22	26.8	0.06	51.79	103.65
17	16	10.91	0.65	7.09	7.09	1.16	8.22	24	0.00	0.132	134.26	133.89	275.50	105.07	105.06	2.62	25.0	1.75	0.00	51.79
18	15	5.26	0.65	3.42	19.57	0.86	16.85	24	1.89	0.555	133.71	133.51	37.00	106.12	105.42	5.36	40.6	0.12	0.00	103.65
19	18	2.98	0.30	0.89	16.15	0.87	14.03	24	0.38	0.385	134.54	133.91	163.56	106.74	106.12	4.47	40.0	0.61	0.00	0.00
20	19	16.32	0.30	4.90	15.26	1.07	16.32	24	0.27	0.520	135.63	134.59	199.58	107.27	106.74	5.19	28.5	0.64	0.00	0.00
21	20	9.11	0.30	2.73	10.36	1.11	11.48	24	0.15	0.258	137.18	136.26	356.60	107.27	106.74	3.66	26.9	1.62	0.00	0.00

Project File: 060915-Network_E04.stm | Number of lines: 46 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	2.13	0.30	0.64	7.63	1.13	8.63	24	0.17	0.146	137.69	137.48	146.02	106.99	106.74	2.75	26.0	0.88	0.00	0.00
23	22	23.30	0.30	6.99	6.99	1.16	8.10	24	0.17	0.128	138.03	137.82	157.96	107.26	106.99	2.58	25.0	1.02	0.00	0.00
24	13	1.01	0.35	0.35	9.03	0.63	5.68	36	0.10	0.007	110.31	110.30	144.94	104.60	104.45	0.80	67.7	2.14	0.00	0.00
25	24	1.01	0.35	0.35	8.67	0.65	5.65	36	0.15	0.007	110.33	110.31	248.88	105.23	104.85	0.80	63.9	3.74	0.00	0.00
26	25	3.45	0.35	1.21	8.32	0.67	5.54	36	0.15	0.007	110.34	110.33	143.01	105.44	105.23	0.78	61.7	2.21	0.00	0.00
27	26	0.64	0.35	0.22	5.84	0.68	3.97	36	0.15	0.004	110.34	110.34	96.50	105.83	105.69	0.56	59.6	2.11	0.00	0.00
28	27	0.64	0.35	0.22	5.62	0.70	3.96	36	0.14	0.004	110.35	110.34	151.39	106.04	105.83	0.56	56.2	3.39	0.00	0.00
29	28	0.20	0.35	0.07	5.39	0.72	3.86	36	0.12	0.003	110.35	110.35	57.71	106.11	106.04	0.55	54.9	1.34	0.00	0.00
30	29	0.20	0.35	0.07	0.67	0.81	0.54	36	0.36	0.000	110.35	110.35	55.25	107.56	107.36	0.08	45.1	8.83	0.00	0.00
31	30	0.39	0.35	0.14	0.60	0.86	0.51	24	0.33	0.001	110.35	110.35	51.62	107.73	107.56	0.16	41.0	4.07	0.00	0.00
32	31	1.31	0.35	0.46	0.46	1.16	0.53	18	0.84	0.146	110.71	110.35	288.73	110.40	107.98	1.15	25.0	16.00	0.00	0.00
33	29	0.25	0.35	0.09	4.66	0.73	3.41	30	0.26	0.007	110.36	110.35	115.84	106.91	106.61	0.70	52.8	2.13	0.00	0.00
34	33	0.99	0.35	0.35	4.57	0.74	3.37	30	0.24	0.007	110.36	110.36	29.35	106.98	106.91	0.69	52.2	0.55	0.00	0.00
35	34	2.30	0.35	0.80	4.22	0.77	3.25	21	0.23	0.042	110.52	110.36	369.68	107.82	106.98	1.35	48.7	3.53	0.00	0.00
36	35	3.98	0.35	1.39	3.42	0.80	2.75	21	0.73	0.233	110.99 j	110.53	280.95	110.38	108.32	2.40	45.5	3.22	0.00	0.00
37	36	0.24	0.35	0.08	2.03	0.84	1.71	18	0.27	0.203	111.60	111.19	245.28	111.05	110.38	2.34	42.1	3.38	0.00	0.00
38	37	2.28	0.35	0.80	1.94	0.88	1.71	18	0.26	0.239	112.18	111.72	219.03	111.63	111.05	2.58	39.0	3.07	0.00	0.00
39	38	2.15	0.35	0.75	1.14	1.08	1.24	18	0.91	0.680	117.06	112.49	496.96	116.63	112.13	3.43	27.9	11.10	0.00	0.00
40	39	1.12	0.35	0.39	0.39	1.16	0.45	18	0.11	0.027	117.19	117.18	45.12	116.68	116.63	0.83	25.0	2.92	0.00	0.00
41	26	1.30	0.35	0.46	1.27	0.85	1.08	36	1.00	0.001	110.35	110.34	197.05	109.17	107.19	0.29	41.3	16.70	0.00	0.00
42	41	0.51	0.35	0.18	0.82	0.94	0.76	18	0.43	0.067	110.43	110.35	185.11	109.97	109.17	1.09	35.3	5.97	0.00	0.00

Project File: 060915-Network_E04.stm | Number of lines: 46 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

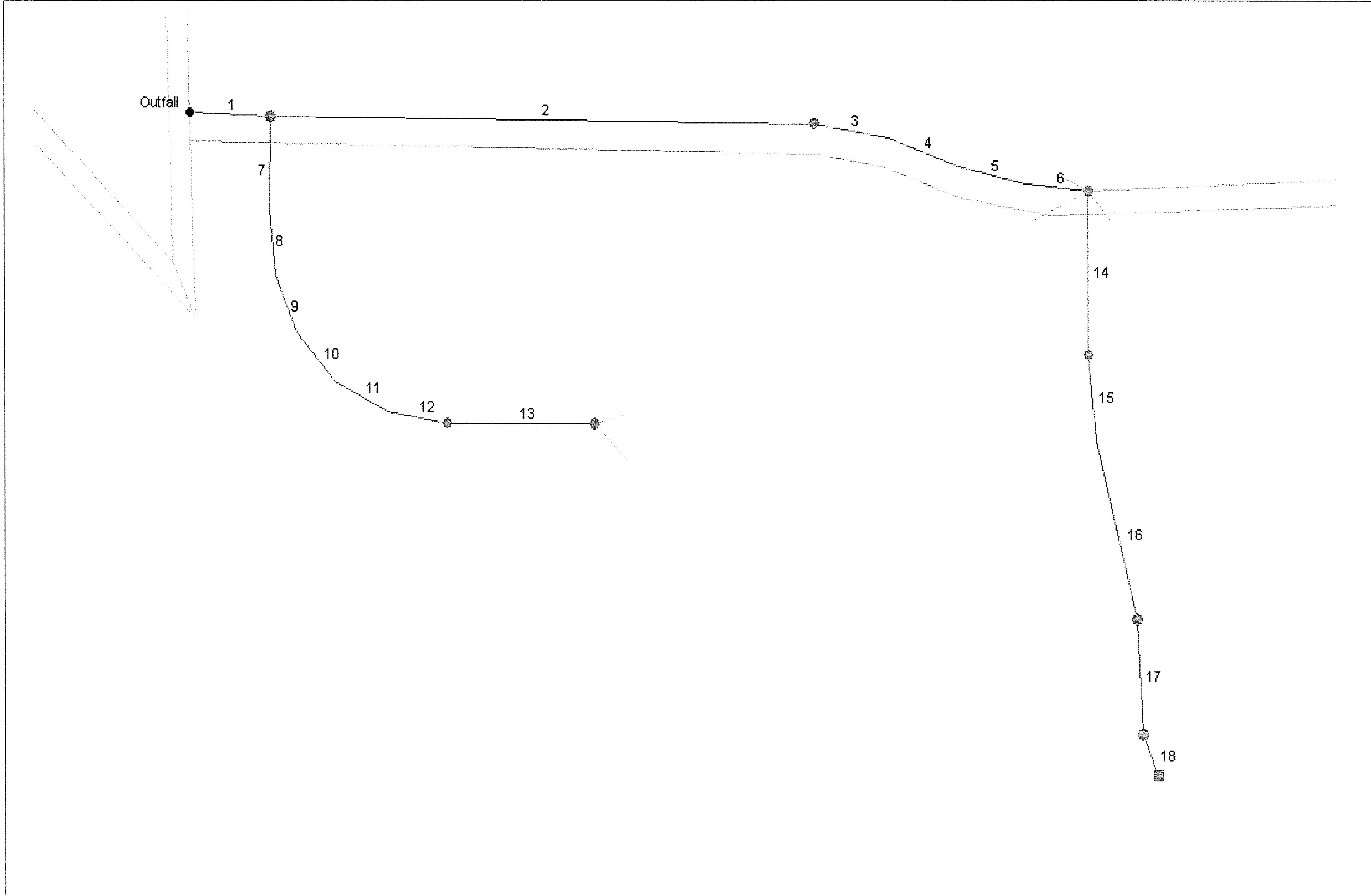
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
43	42	1.82	0.35	0.64	0.64	1.16	0.74	18	0.28	0.244	111.04	110.47	258.85	110.70	109.97	1.96	25.0	10.32	0.00	0.00
44	8	6.57	0.35	2.30	6.60	0.80	5.28	54	0.10	0.001	109.87	109.87	527.11	102.06	101.53	0.33	45.8	19.11	0.00	0.00
45	44	2.08	0.35	0.73	4.30	0.91	3.91	54	0.10	0.000	109.88	109.88	159.03	102.22	102.06	0.25	37.2	8.67	0.00	0.00
46	45	10.21	0.35	3.57	3.57	1.16	4.14	54	0.10	0.000	109.88	109.88	190.02	102.41	102.22	0.26	25.0	12.16	0.00	0.00

Project File: 060915-Network_E04.stm | Number of lines: 46 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 5

Hydraflow Plan View



Project File: 060915-Network_E05.stm	No. Lines: 18	03-27-2007

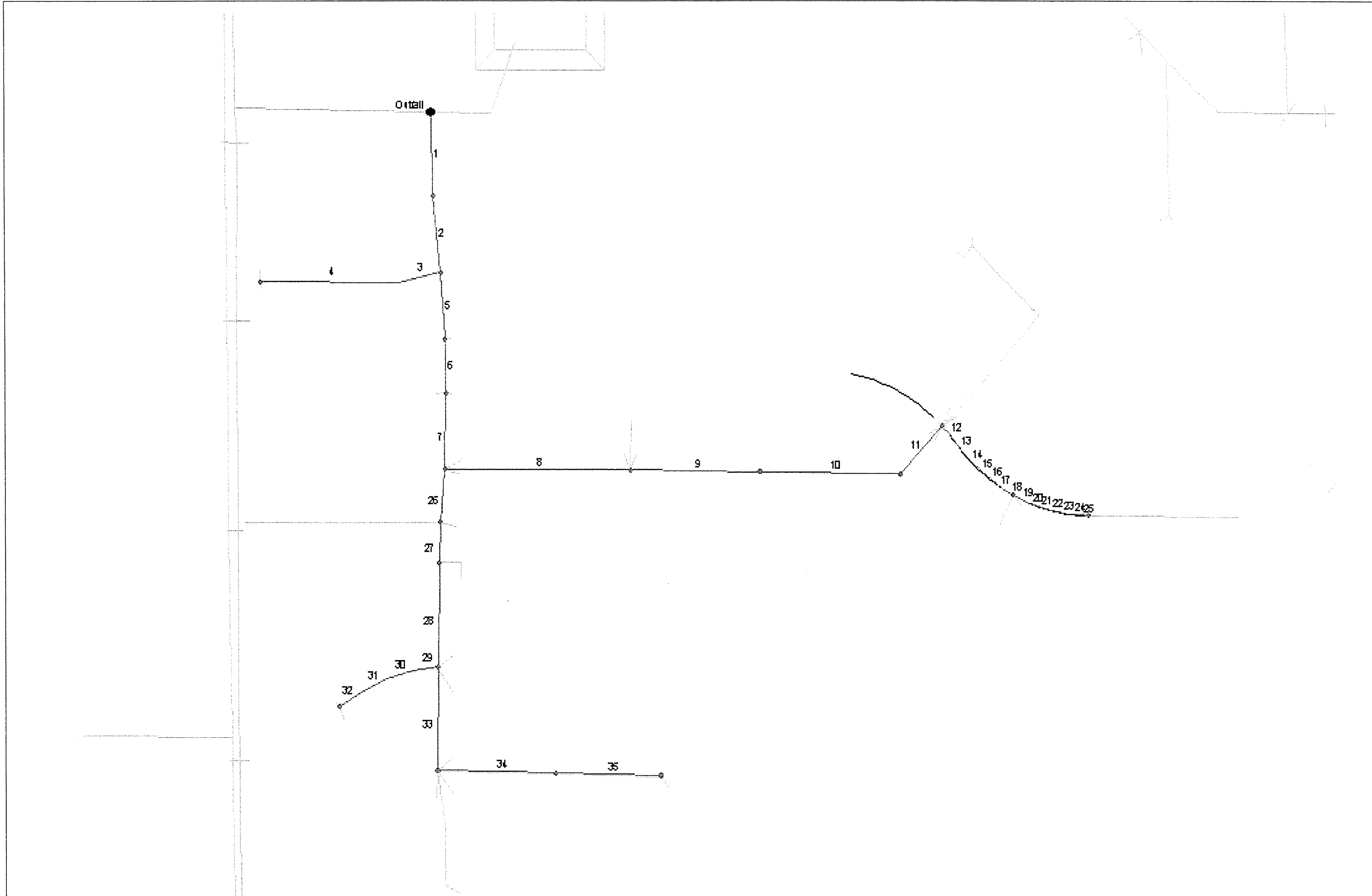
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	1.74	0.35	0.61	6.60	0.79	5.25	30	0.63	0.016	102.20	102.19	70.08	100.13	99.69	1.14	46.2	0.86	113.28	111.99
2	1	0.77	0.35	0.27	4.47	0.89	4.00	30	0.13	0.015	102.27	102.22	469.54	100.75	100.13	1.09	38.1	8.11	0.00	113.28
3	2	0.00	0.35	0.00	4.20	0.91	3.83	30	0.11	0.019	102.29	102.28	65.07	100.82	100.75	1.25	36.9	1.19	0.00	0.00
4	3	0.00	0.35	0.00	4.20	0.93	3.91	30	0.09	0.022	102.31	102.30	64.29	100.88	100.82	1.32	35.8	1.16	0.00	0.00
5	4	0.00	0.35	0.00	4.20	0.95	3.98	30	0.10	0.025	102.33	102.31	60.15	100.94	100.88	1.40	34.7	1.08	0.00	0.00
6	5	4.04	0.35	1.41	4.20	0.96	4.05	30	0.09	0.029	102.35	102.33	54.31	100.99	100.94	1.47	33.7	0.97	113.85	0.00
7	1	0.00	0.35	0.00	1.53	0.88	1.34	24	0.10	0.004	102.24	102.24	71.26	100.20	100.13	0.43	39.3	2.22	0.00	113.28
8	7	0.00	0.35	0.00	1.53	0.90	1.38	24	0.11	0.004	102.24	102.24	54.53	100.26	100.20	0.44	37.6	1.69	0.00	0.00
9	8	0.00	0.35	0.00	1.53	0.92	1.41	24	0.08	0.004	102.25	102.25	48.05	100.30	100.26	0.45	36.2	1.48	0.00	0.00
10	9	0.00	0.35	0.00	1.53	0.95	1.45	24	0.12	0.004	102.25	102.25	51.93	100.36	100.30	0.47	34.6	1.58	0.00	0.00
11	10	0.00	0.35	0.00	1.53	0.98	1.49	24	0.10	0.004	102.25	102.25	50.54	100.41	100.36	0.49	33.1	1.53	0.00	0.00
12	11	1.83	0.35	0.64	1.53	1.01	1.54	24	0.10	0.004	102.26	102.26	52.37	100.46	100.41	0.51	31.5	1.58	0.00	0.00
13	12	2.53	0.35	0.89	0.89	1.16	1.03	24	0.10	0.002	102.26	102.26	127.00	100.59	100.46	0.36	25.0	6.48	0.00	0.00
14	6	0.50	0.35	0.18	2.79	1.01	2.80	24	0.10	0.094	102.50	102.38	129.00	101.62	101.49	2.09	31.5	2.19	0.00	113.85
15	14	0.00	0.35	0.00	2.61	1.03	2.69	24	0.10	0.087	102.57	102.51	67.17	101.69	101.62	2.01	30.3	1.20	0.00	0.00
16	15	0.81	0.35	0.28	2.61	1.09	2.84	24	0.10	0.097	102.72	102.58	146.25	101.84	101.69	2.12	27.8	2.57	0.00	0.00
17	16	2.21	0.35	0.77	2.33	1.13	2.63	24	0.10	0.083	102.81	102.74	90.17	101.93	101.84	1.96	26.0	1.76	0.00	0.00
18	17	4.44	0.35	1.55	1.55	1.16	1.80	24	0.09	0.034	102.87	102.86	34.77	101.96	101.93	1.28	25.0	1.01	0.00	0.00

Project File: 060915-Network_E05.stm | Number of lines: 18 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 6

Hydraflow Plan View



Project File: 060915-Network_E06.stm	No. Lines: 35	03-27-2007

Hydraflow Storm Sewers 2005

COS

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	6.98	0.35	2.44	29.88	0.77	22.99	36	0.06	0.119	105.83	105.59	204.16	102.72	102.59	3.25	48.4	0.92	0.00	0.00
2	1	0.92	0.35	0.32	27.44	0.78	21.36	36	0.09	0.103	106.05	105.86	188.15	102.89	102.72	3.02	47.5	0.91	0.00	0.00
3	2	0.00	0.35	0.00	1.71	0.94	1.60	24	0.16	0.005	106.19	106.19	116.49	103.08	102.89	0.51	34.9	3.26	0.00	0.00
4	3	4.88	0.35	1.71	1.71	1.15	1.97	24	0.03	0.008	106.22	106.19	371.98	103.01	102.89	0.63	25.0	9.91	0.00	0.00
5	2	1.42	0.35	0.50	25.41	0.79	19.99	36	0.39	0.223	106.22	106.07	162.64	104.65	104.01	4.61	46.7	0.83	0.00	0.00
6	5	1.42	0.35	0.50	24.91	0.79	19.78	36	0.07	0.088	106.66	106.54	132.98	102.36	102.27	2.80	46.0	0.69	0.00	0.00
7	6	2.81	0.35	0.98	24.42	0.80	19.64	36	0.24	0.086	106.81	106.66	187.44	103.81	103.36	2.78	45.0	0.97	0.00	0.00
8	7	6.93	0.35	2.43	12.76	0.84	10.75	30	0.13	0.069	107.20	106.86	497.57	102.86	102.22	2.19	41.8	3.25	116.00	0.00
9	8	1.78	0.35	0.62	10.34	0.88	9.07	30	0.13	0.049	107.40	107.23	347.59	103.31	102.86	1.85	39.1	2.70	0.00	116.00
10	9	1.73	0.35	0.61	9.72	0.92	8.94	30	0.13	0.048	107.58	107.40	376.75	103.80	103.31	1.82	36.1	2.99	0.00	0.00
11	10	18.15	0.35	6.35	9.11	0.94	8.58	30	0.13	0.044	107.66	107.58	162.70	104.01	103.80	1.75	34.7	1.35	0.00	0.00
12	11	0.00	0.35	0.00	2.76	0.95	2.62	24	0.16	0.013	107.70	107.69	31.12	104.56	104.51	0.84	34.2	0.54	0.00	0.00
13	12	0.00	0.35	0.00	2.76	0.97	2.66	24	0.19	0.014	107.70	107.70	48.61	104.65	104.56	0.85	33.3	0.84	0.00	0.00
14	13	0.00	0.35	0.00	2.76	0.98	2.70	24	0.17	0.014	107.71	107.70	41.40	104.72	104.65	0.86	32.6	0.71	0.00	0.00
15	14	0.00	0.35	0.00	2.76	0.99	2.73	24	0.16	0.015	107.71	107.71	37.37	104.78	104.72	0.87	32.0	0.64	0.00	0.00
16	15	0.00	0.35	0.00	2.76	1.00	2.76	24	0.19	0.015	107.72	107.71	32.41	104.84	104.78	0.88	31.4	0.55	0.00	0.00
17	16	0.00	0.35	0.00	2.76	1.01	2.79	24	0.17	0.015	107.72	107.72	34.40	104.90	104.84	0.89	30.9	0.59	0.00	0.00
18	17	2.67	0.35	0.93	2.76	1.02	2.82	24	0.15	0.016	107.73	107.72	32.37	104.95	104.90	0.90	30.3	0.55	0.00	0.00
19	18	0.00	0.35	0.00	1.82	1.04	1.90	24	0.18	0.007	107.74	107.74	37.94	105.02	104.95	0.61	29.3	0.97	0.00	0.00
20	19	0.00	0.35	0.00	1.82	1.06	1.93	24	0.16	0.007	107.74	107.74	24.70	105.06	105.02	0.61	28.7	0.63	0.00	0.00
21	20	0.00	0.35	0.00	1.82	1.08	1.96	24	0.20	0.008	107.74	107.74	30.29	105.12	105.06	0.62	27.9	0.77	0.00	0.00

Project File: 060915-Network_E06.stm	Number of lines: 35	Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

COS

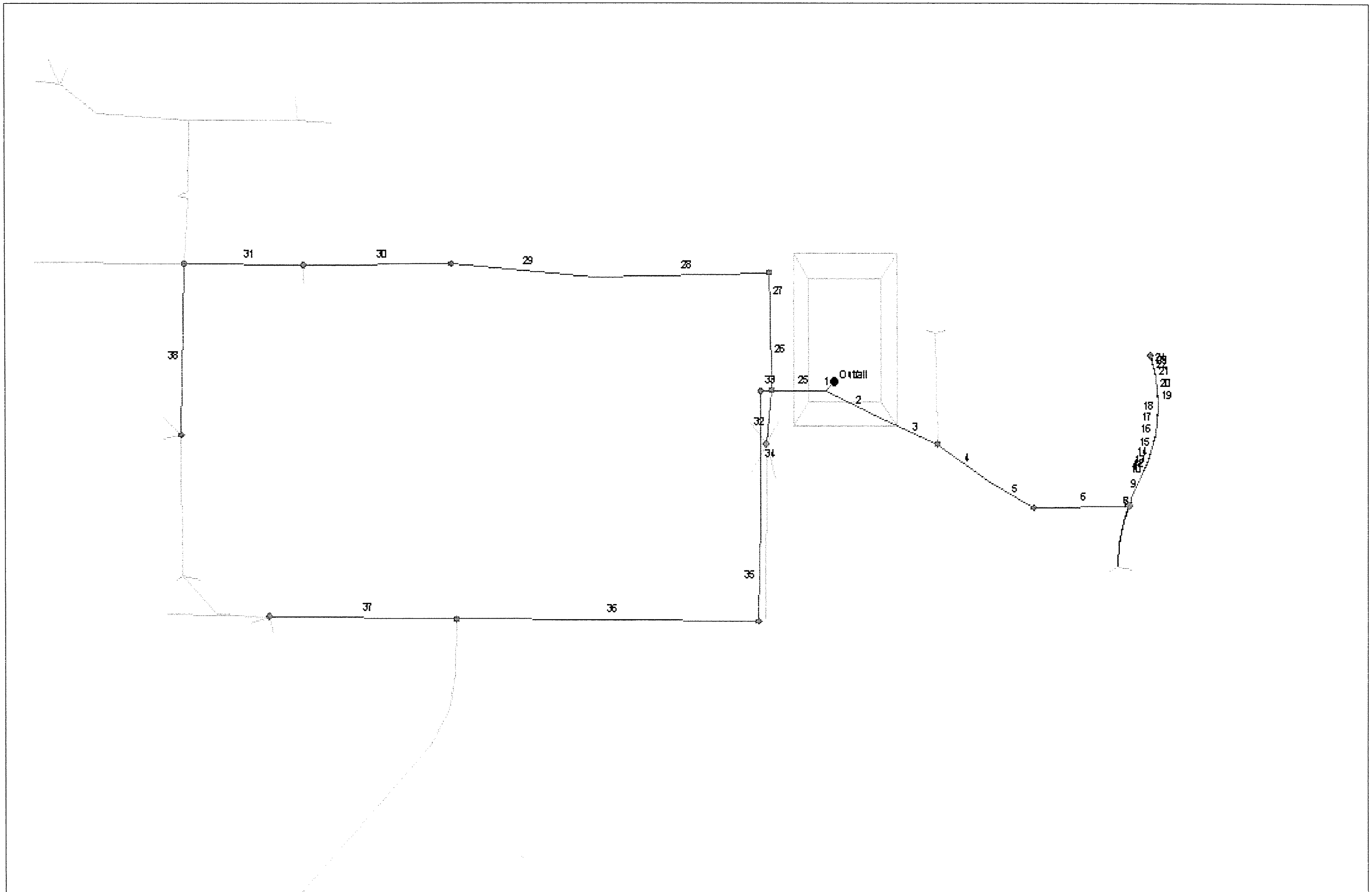
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	0.00	0.35	0.00	1.82	1.10	2.00	24	0.17	0.008	107.75	107.74	35.02	105.18	105.12	0.64	27.1	0.88	0.00	0.00
23	22	0.00	0.35	0.00	1.82	1.11	2.03	24	0.18	0.008	107.75	107.75	28.36	105.23	105.18	0.65	26.3	0.71	0.00	0.00
24	23	0.00	0.35	0.00	1.82	1.13	2.07	24	0.17	0.008	107.75	107.75	29.63	105.28	105.23	0.66	25.6	0.74	0.00	0.00
25	24	5.21	0.35	1.82	1.82	1.15	2.10	24	0.17	0.009	107.75	107.75	24.02	105.32	105.28	0.67	25.0	0.60	0.00	0.00
26	7	4.64	0.35	1.62	10.67	0.89	9.48	36	0.73	0.216	107.14 j	106.90	131.21	106.16	105.20	3.50	38.2	1.45	113.80	0.00
27	26	3.60	0.35	1.26	9.04	0.90	8.11	24	1.00	0.384	108.15 j	107.38	97.91	107.14	106.16	4.57	37.7	0.56	0.00	113.80
28	27	4.85	0.35	1.70	7.78	0.92	7.17	24	0.10	0.099	109.05	108.80	253.67	107.39	107.14	2.58	36.0	1.65	0.00	0.00
29	28	0.00	0.35	0.00	1.20	0.97	1.16	24	0.17	0.003	109.15	109.15	70.63	103.93	103.81	0.37	33.3	2.75	0.00	0.00
30	29	0.00	0.35	0.00	1.20	1.02	1.23	24	0.17	0.003	109.15	109.15	71.00	104.05	103.93	0.39	30.5	2.74	0.00	0.00
31	30	0.00	0.35	0.00	1.20	1.08	1.30	24	0.17	0.003	109.16	109.15	70.11	104.17	104.05	0.41	27.9	2.68	0.00	0.00
32	31	3.44	0.35	1.20	1.20	1.15	1.39	24	0.18	0.004	109.16	109.16	75.79	104.31	104.17	0.44	25.0	2.86	0.00	0.00
33	28	6.97	0.35	2.44	4.88	1.02	4.99	18	0.17	0.226	109.96	109.39	253.00	108.32	107.89	2.82	30.4	1.43	0.00	0.00
34	33	2.21	0.35	0.77	2.44	1.07	2.62	15	0.16	0.165	110.54	110.01	318.00	109.09	108.57	2.14	28.0	2.40	0.00	0.00
35	34	4.77	0.35	1.67	1.67	1.15	1.92	15	0.10	0.089	110.82	110.57	280.90	109.37	109.09	1.57	25.0	2.99	0.00	0.00

Project File: 060915-Network_E06.stm | Number of lines: 35 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 6A

Hydraflow Plan View



Project File: 060915-Network_E06A.stm	No. Lines: 38	03-27-2007

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
1	Outfall	0.00	0.35	0.00	16.22	0.42	6.78	42	0.10	0.004	109.85	109.85	21.04	106.37	106.35	0.70	131.8	0.22	0.00	110.25	
2	1	0.00	0.35	0.00	3.11	0.90	2.82	21	0.10	0.028	109.88	109.85	116.46	108.24	108.12	1.19	37.4	1.42	0.00	0.00	
3	2	1.87	0.30	0.56	3.11	0.92	2.87	21	0.09	0.029	109.91	109.88	97.21	108.33	108.24	1.24	36.3	1.17	0.00	0.00	
4	3	0.00	0.35	0.00	2.55	0.94	2.40	18	0.10	0.048	109.96	109.91	107.20	108.69	108.58	1.48	35.1	1.14	0.00	0.00	
5	4	2.42	0.30	0.73	2.55	0.96	2.44	18	0.10	0.053	110.00	109.96	90.38	108.78	108.69	1.56	34.2	0.95	0.00	0.00	
6	5	2.89	0.30	0.87	1.83	1.00	1.83	18	0.10	0.034	110.06	110.00	167.03	108.95	108.78	1.25	31.8	2.40	0.00	0.00	
7	6	0.00	0.35	0.00	0.96	1.00	0.96	18	0.14	0.010	110.07	110.07	7.16	108.96	108.95	0.68	31.6	0.20	0.00	0.00	
8	7	0.00	0.35	0.00	0.96	1.01	0.97	18	0.00	0.008	110.46	110.46	5.15	108.96	108.96	0.55	31.4	0.14	0.00	0.00	
9	8	0.00	0.35	0.00	0.96	1.03	0.99	18	0.10	0.008	110.46	110.46	49.87	109.01	108.96	0.56	30.1	1.35	0.00	0.00	
10	9	0.00	0.35	0.00	0.96	1.04	1.00	18	0.18	0.008	110.47	110.46	5.59	109.02	109.01	0.57	29.9	0.15	0.00	0.00	
11	10	0.00	0.35	0.00	0.96	1.04	1.00	18	0.00	0.009	110.52	110.52	6.27	109.02	109.02	0.57	29.8	0.17	0.00	0.00	
12	11	0.00	0.35	0.00	0.96	1.04	1.00	18	0.19	0.009	110.52	110.52	5.39	109.03	109.02	0.57	29.6	0.15	0.00	0.00	
13	12	0.00	0.35	0.00	0.96	1.05	1.01	18	0.15	0.009	110.52	110.52	6.73	109.04	109.03	0.57	29.4	0.18	0.00	0.00	
14	13	0.00	0.35	0.00	0.96	1.06	1.02	18	0.08	0.009	110.52	110.52	23.56	109.06	109.04	0.58	28.8	0.64	0.00	0.00	
15	14	0.00	0.35	0.00	0.96	1.07	1.03	18	0.07	0.008	110.52	110.52	13.34	109.07	109.06	0.59	28.4	0.36	0.00	0.00	
16	15	0.00	0.35	0.00	0.96	1.09	1.04	18	0.13	0.009	110.53	110.52	22.77	109.10	109.07	0.60	27.8	0.61	0.00	0.00	
17	16	0.00	0.35	0.00	0.96	1.09	1.05	18	0.07	0.009	110.53	110.53	13.54	109.11	109.10	0.61	27.5	0.36	0.00	0.00	
18	17	0.00	0.35	0.00	0.96	1.11	1.07	18	0.09	0.009	110.53	110.53	23.00	109.13	109.11	0.62	26.9	0.61	0.00	0.00	
19	18	0.00	0.35	0.00	0.96	1.12	1.07	18	0.08	0.009	110.53	110.53	12.29	109.14	109.13	0.63	26.5	0.33	0.00	0.00	
20	19	0.00	0.35	0.00	0.96	1.14	1.09	18	0.12	0.009	110.53	110.53	24.50	109.17	109.14	0.64	25.9	0.65	0.00	0.00	
21	20	0.00	0.35	0.00	0.96	1.15	1.10	18	0.06	0.010	110.53	110.53	16.38	109.18	109.17	0.65	25.4	0.43	0.00	0.00	

Project File: 060915-Network_E06A.stm | Number of lines: 38 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

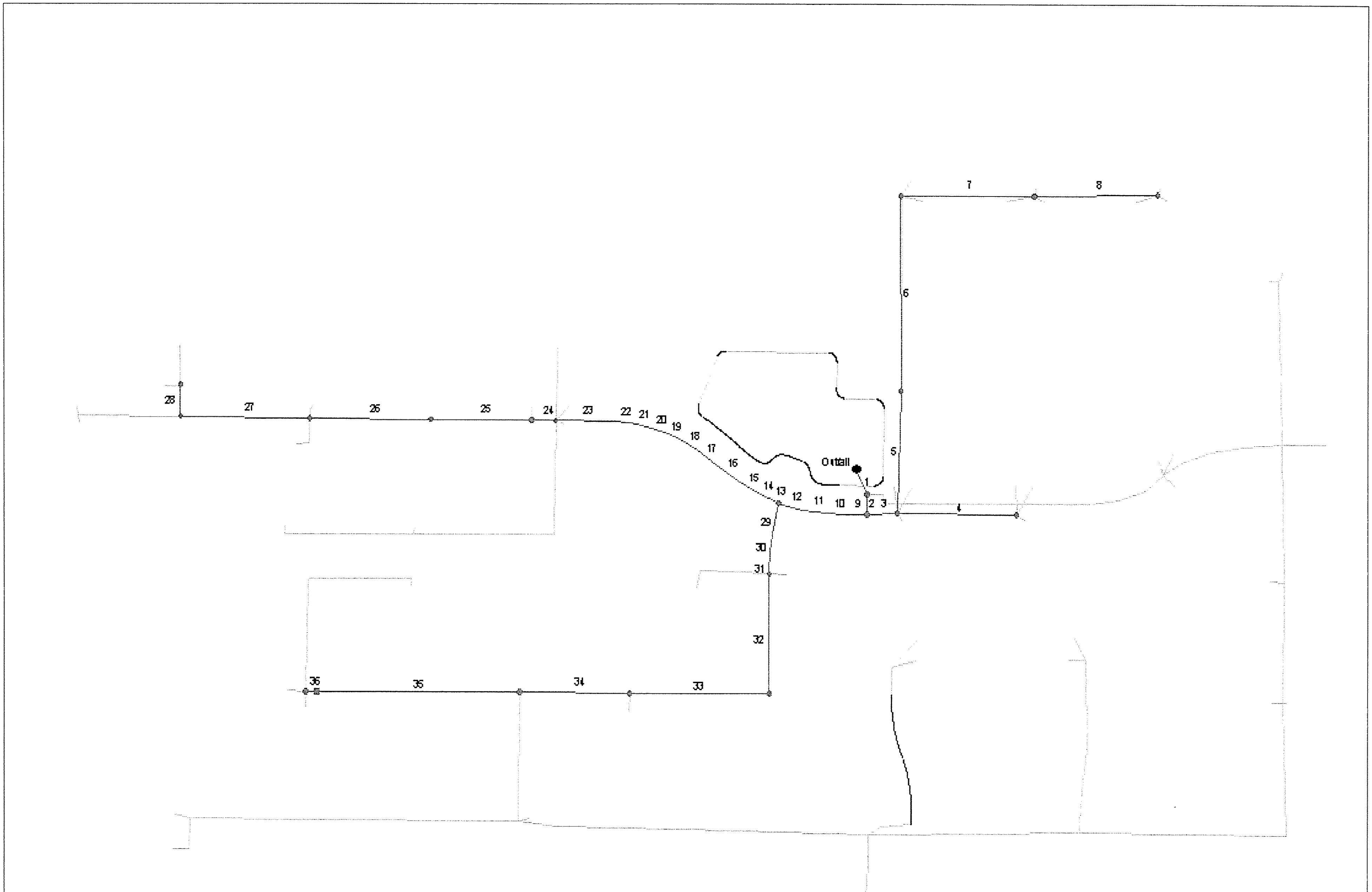
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	0.00	0.35	0.00	0.96	1.15	1.11	18	0.15	0.010	110.54	110.53	6.80	109.19	109.18	0.66	25.3	0.18	0.00	0.00
23	22	0.00	0.35	0.00	0.96	1.16	1.11	18	0.21	0.010	110.54	110.54	4.74	109.20	109.19	0.67	25.1	0.13	0.00	0.00
24	23	3.20	0.30	0.96	0.96	1.16	1.11	18	0.00	0.011	110.70	110.70	4.98	109.20	109.20	0.63	25.0	0.13	0.00	0.00
25	1	0.25	0.35	0.09	13.10	0.42	5.50	42	0.10	0.003	109.85	109.85	93.50	106.46	106.37	0.57	130.6	1.18	0.00	0.00
26	25	0.00	0.35	0.00	5.21	0.89	4.65	21	0.66	0.575	111.21	110.28	131.53	110.42	109.55	4.66	38.2	1.03	0.00	0.00
27	26	2.57	0.35	0.90	5.21	0.90	4.69	21	0.66	0.347	111.58 j	111.45	56.29	110.79	110.42	3.79	37.8	0.44	118.75	0.00
28	27	0.00	0.35	0.00	4.31	0.94	4.06	21	0.48	0.262	112.45 j	111.84	305.58	111.71	110.25	2.97	35.0	2.77	0.00	118.75
29	28	1.90	0.35	0.67	4.31	0.98	4.23	21	0.50	0.342	113.70	112.68	250.36	112.95	111.71	3.68	32.8	2.21	0.00	0.00
30	29	3.35	0.35	1.17	3.64	1.02	3.71	18	0.84	0.557	116.11	113.92	259.01	115.37	113.20	4.37	30.9	1.92	0.00	0.00
31	30	3.86	0.35	1.35	2.47	1.05	2.60	15	1.05	0.509	118.46 j	116.32	208.52	117.81	115.62	3.86	29.3	1.54	118.49	0.00
32	25	0.08	0.35	0.03	0.03	1.16	0.03	21	0.11	0.003	109.85	109.85	85.53	109.64	109.55	0.15	25.0	105.62	0.00	0.00
33	25	4.60	0.35	1.61	7.78	0.90	6.98	42	-0.21	0.005	113.05	113.05	19.50	109.51	109.55	0.73	38.0	0.40	118.60	0.00
34	33	0.00	0.35	0.00	6.17	0.91	5.59	15	-0.16	0.751	114.58	113.05	204.00	109.18	109.51	4.56	37.3	0.66	0.00	118.60
35	34	3.40	0.30	1.02	6.17	0.91	5.64	15	-0.20	0.764	115.84	114.58	164.55	108.85	109.18	4.60	36.8	0.52	119.50	0.00
36	35	10.06	0.30	3.02	5.15	1.00	5.14	24	-0.11	0.052	116.40	116.13	529.51	108.26	108.85	1.64	31.9	4.85	0.00	119.50
37	36	6.09	0.35	2.13	2.13	1.16	2.47	24	-0.11	0.012	116.47	116.43	327.02	107.90	108.26	0.79	25.0	6.93	119.04	0.00
38	31	3.20	0.35	1.12	1.12	1.16	1.30	15	0.23	0.040	118.81	118.69	274.19	112.28	111.64	1.06	25.0	4.32	0.00	118.49

Project File: 060915-Network_E06A.stm | Number of lines: 38 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 7

Hydraflow Plan View



Project File: 060915-Network_E07-North.stm	No. Lines: 36	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	1.33	0.35	0.47	15.74	0.69	10.82	30	2.22	0.253	98.38 j	98.51	57.27	97.28	96.01	3.71	58.5	0.31	0.00	96.01
2	1	0.24	0.35	0.08	15.27	0.69	10.53	30	0.19	0.165	98.79	98.73	41.75	97.36	97.28	3.59	58.3	0.23	0.00	0.00
3	2	0.74	0.35	0.26	5.17	0.85	4.41	21	3.61	0.276	100.59 j	98.94	68.06	99.82	97.36	3.13	41.3	0.53	109.92	0.00
4	3	3.33	0.35	1.17	1.17	1.16	1.35	30	0.10	0.015	100.89	100.86	268.51	100.09	99.82	0.85	25.0	16.26	0.00	109.92
5	3	1.11	0.35	0.39	3.75	0.95	3.56	18	0.10	0.113	101.57	101.32	253.64	100.07	99.82	2.01	34.6	1.94	0.00	109.92
6	5	2.96	0.35	1.04	3.36	1.01	3.39	18	0.10	0.100	101.97	101.57	400.25	100.47	100.07	1.92	31.4	3.26	0.00	0.00
7	6	3.12	0.35	1.09	2.32	1.06	2.46	15	0.10	0.145	102.41	101.97	301.50	101.03	100.72	2.01	29.0	2.37	0.00	0.00
8	7	3.52	0.35	1.23	1.23	1.16	1.43	15	0.10	0.048	102.55	102.45	278.50	101.30	101.03	1.16	25.0	3.99	0.00	0.00
9	2	0.00	0.35	0.00	10.01	0.69	6.94	30	0.17	0.062	98.93	98.90	52.51	97.45	97.36	2.24	57.9	0.45	0.00	0.00
10	9	0.00	0.35	0.00	10.01	0.70	6.96	30	0.18	0.070	98.95	98.93	39.10	97.52	97.45	2.35	57.5	0.33	0.00	0.00
11	10	0.00	0.30	0.00	10.01	0.70	6.99	30	0.18	0.081	98.99	98.95	55.68	97.62	97.52	2.48	57.1	0.47	0.00	0.00
12	11	0.82	0.30	0.25	10.01	0.70	7.03	30	0.18	0.095	99.03	98.99	54.74	97.72	97.62	2.64	56.6	0.46	109.52	0.00
13	12	0.00	0.30	0.00	4.47	0.70	3.15	24	0.77	0.037	99.09	99.09	23.31	97.90	97.72	1.49	56.3	0.28	0.00	109.52
14	13	0.00	0.30	0.00	4.47	0.71	3.16	24	0.77	0.075	99.08	99.09	33.56	98.16	97.90	1.94	55.9	0.40	0.00	0.00
15	14	0.00	0.30	0.00	4.47	0.71	3.18	24	0.77	0.248	99.16 j	99.14	46.82	98.52	98.16	2.89	55.4	0.56	0.00	0.00
16	15	0.00	0.30	0.00	4.47	0.72	3.21	24	0.79	0.288	99.69 j	99.35	68.67	99.06	98.52	3.17	54.6	0.81	0.00	0.00
17	16	0.00	0.30	0.00	4.47	0.72	3.23	24	0.76	0.288	100.02 j	99.90	41.88	99.38	99.06	3.17	54.1	0.49	0.00	0.00
18	17	0.00	0.30	0.00	4.47	0.73	3.25	24	0.80	0.288	100.43 j	100.22	51.44	99.79	99.38	3.18	53.5	0.60	0.00	0.00
19	18	0.00	0.30	0.00	4.47	0.73	3.27	24	0.80	0.288	100.69 j	100.63	32.69	100.05	99.79	3.18	53.1	0.38	0.00	0.00
20	19	0.00	0.30	0.00	4.47	0.73	3.28	24	0.79	0.289	101.00 j	100.89	39.05	100.36	100.05	3.19	52.6	0.45	0.00	0.00
21	20	0.00	0.30	0.00	4.47	0.74	3.30	24	0.79	0.289	101.31 j	101.21	39.04	100.67	100.36	3.20	52.2	0.45	0.00	0.00

Project File: 060915-Network_E07-North.stm | Number of lines: 36 | Date: 03-27-2007

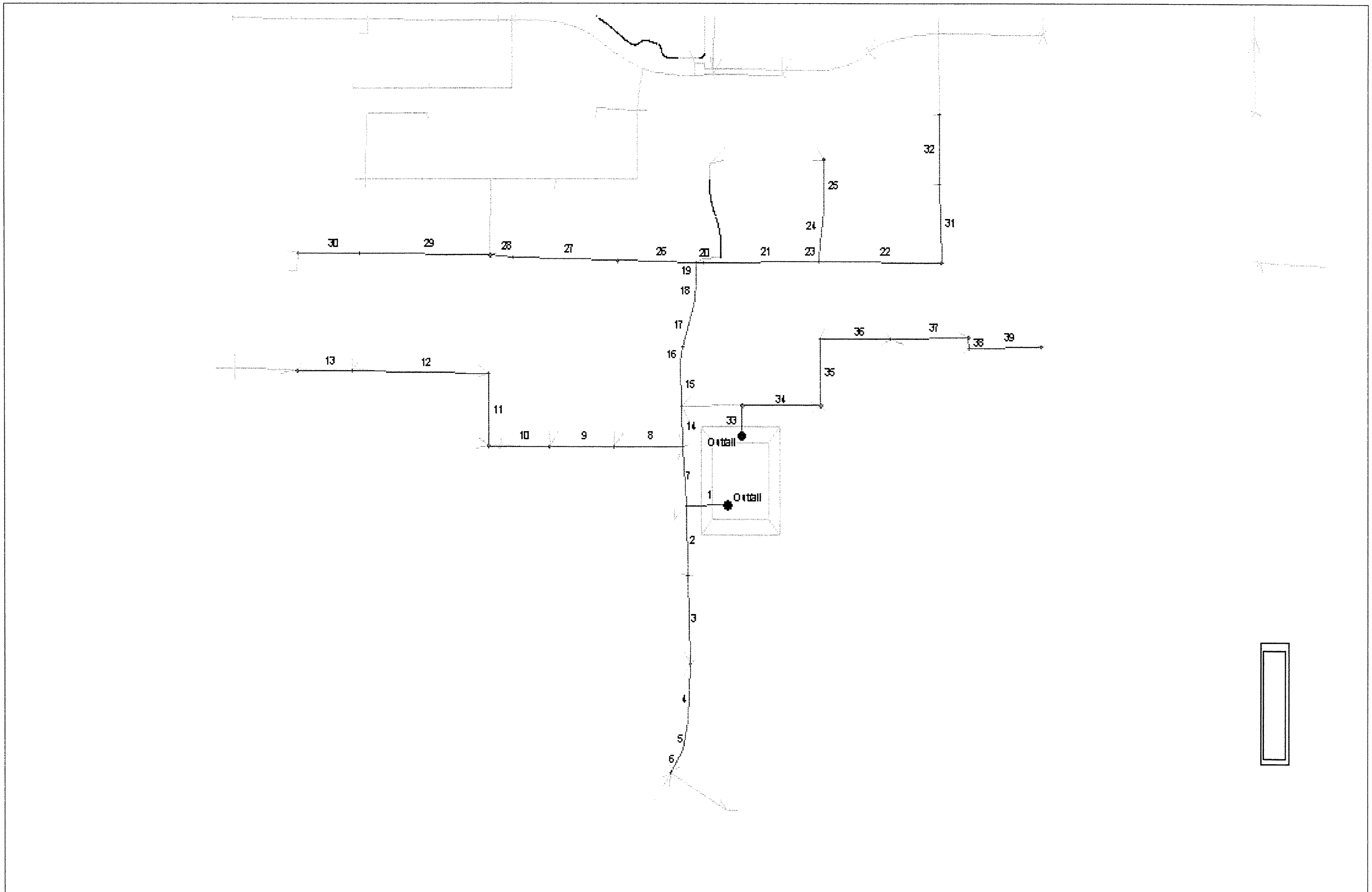
NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	0.00	0.30	0.00	4.47	0.74	3.32	24	0.81	0.289	101.68 j	101.52	44.26	101.03	100.67	3.20	51.7	0.51	0.00	0.00
23	22	6.98	0.30	2.09	4.47	0.75	3.38	24	3.77	2.089	106.85	101.91	124.00	106.20	101.53	6.03	50.3	1.40	108.21	0.00
24	23	1.35	0.30	0.41	2.38	0.76	1.81	18	0.78	0.030	107.08	107.06	55.00	99.34	98.91	1.02	49.6	0.65	0.00	108.21
25	24	0.68	0.30	0.20	1.97	0.79	1.56	18	0.76	0.022	107.13	107.08	227.01	101.06	99.34	0.89	46.5	3.17	0.00	0.00
26	25	2.58	0.30	0.77	1.77	0.84	1.48	18	0.68	0.020	107.19	107.13	273.00	102.93	101.06	0.84	42.4	4.11	0.00	0.00
27	26	2.76	0.30	0.83	1.00	0.95	0.94	18	0.67	0.008	107.22	107.19	291.02	104.88	102.93	0.53	34.9	7.49	108.53	0.00
28	27	0.56	0.30	0.17	0.17	1.16	0.19	18	0.55	0.000	107.22	107.22	65.25	100.64	100.28	0.11	25.0	9.87	0.00	108.53
29	12	0.00	0.30	0.00	5.30	0.84	4.42	30	0.10	0.037	99.10	99.09	68.17	97.79	97.72	1.65	42.6	1.07	0.00	109.52
30	29	0.00	0.30	0.00	5.30	0.84	4.46	30	0.08	0.041	99.12	99.10	36.59	97.82	97.79	1.72	42.1	0.57	0.00	0.00
31	30	4.26	0.30	1.28	5.30	0.85	4.51	30	0.11	0.044	99.14	99.12	44.28	97.87	97.82	1.78	41.4	0.69	0.00	0.00
32	31	1.48	0.30	0.44	4.02	0.89	3.59	24	0.10	0.099	99.61	99.38	242.75	98.61	98.37	2.27	38.3	3.10	0.00	0.00
33	32	2.15	0.30	0.65	3.57	0.96	3.44	24	0.10	0.084	99.93	99.68	315.00	98.93	98.61	2.10	33.9	4.37	0.00	0.00
34	33	1.23	0.30	0.37	2.93	1.04	3.05	24	0.10	0.081	100.12	99.93	248.51	99.18	98.93	2.02	29.8	4.08	109.31	0.00
35	34	1.01	0.30	0.30	2.56	1.15	2.95	18	0.10	0.095	100.58	100.15	456.50	99.47	99.01	2.08	25.3	4.55	0.00	109.31
36	35	7.52	0.30	2.26	2.26	1.16	2.62	18	0.08	0.076	100.60	100.58	25.50	99.49	99.47	1.86	25.0	0.29	0.00	0.00

Project File: 060915-Network_E07-North.stm	Number of lines: 36	Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Hydraflow Plan View



Project File: 060915-Network_E07-South.stm	No. Lines: 39	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
1	Outfall	3.60	0.35	1.26	28.97	0.70	20.37	48	-1.25	0.020	98.93	98.90	159.00	92.91	94.90	1.62	56.5	1.29	108.81	100.50	
2	1	2.52	0.35	0.88	6.28	1.07	6.72	24	0.81	0.088	99.15	98.93	246.00	95.41	93.41	2.14	28.5	1.93	0.00	108.81	
3	2	5.18	0.35	1.81	5.40	1.11	5.98	18	0.81	0.324	100.15	99.15	309.63	98.43	95.91	3.38	27.0	1.53	0.00	0.00	
4	3	0.00	0.35	0.00	3.59	1.13	4.06	15	0.81	0.532	101.37 j	100.16	200.25	100.56	98.93	4.09	26.0	1.01	0.00	0.00	
5	4	0.00	0.35	0.00	3.59	1.15	4.11	15	0.82	0.569	102.18 j	101.56	99.32	101.37	100.56	4.40	25.5	0.49	0.00	0.00	
6	5	10.25	0.35	3.59	3.59	1.16	4.16	15	0.82	0.574	102.95 j	102.37	93.10	102.13	101.37	4.42	25.0	0.46	107.43	0.00	
7	1	0.89	0.35	0.31	21.43	0.72	15.35	42	1.87	0.068	98.93	98.93	207.44	97.28	93.41	2.51	54.7	1.71	108.78	108.81	
8	7	3.25	0.35	1.14	7.49	0.86	6.42	24	0.64	0.310	100.38 j	99.05	264.50	99.48	97.78	3.87	40.9	1.90	0.00	108.78	
9	8	3.52	0.35	1.23	6.36	0.88	5.62	24	0.48	0.298	101.50 j	100.67	248.00	100.66	99.48	3.69	38.8	2.04	0.00	0.00	
10	9	4.32	0.35	1.51	5.12	0.92	4.71	24	0.33	0.253	102.22	101.78	232.51	101.42	100.66	3.32	36.5	2.31	106.77	0.00	
11	10	2.81	0.35	0.98	3.61	0.98	3.53	24	0.17	0.024	102.51	102.45	252.25	99.90	99.47	1.12	33.1	3.46	0.00	106.77	
12	11	2.15	0.35	0.75	2.63	1.08	2.85	18	0.46	0.220	103.51	102.51	522.63	102.81	100.40	2.56	27.9	5.20	0.00	0.00	
13	12	5.36	0.35	1.88	1.88	1.16	2.18	18	0.25	0.185	104.00	103.68	211.01	103.34	102.81	2.47	25.0	2.86	0.00	0.00	
14	7	0.89	0.35	0.31	13.62	0.72	9.83	24	-0.15	0.189	100.05	99.78	143.56	97.57	97.78	3.13	54.1	0.60	109.17	108.78	
15	14	0.00	0.35	0.00	13.31	0.73	9.76	36	-0.02	0.021	100.60	100.57	151.50	97.54	97.57	1.38	52.7	1.43	0.00	109.17	
16	15	2.50	0.35	0.88	13.31	0.74	9.82	36	-0.05	0.022	100.62	100.60	58.05	97.51	97.54	1.39	52.2	0.55	0.00	0.00	
17	16	0.00	0.35	0.00	12.44	0.75	9.36	36	-0.02	0.020	100.65	100.62	164.52	97.48	97.51	1.32	50.5	1.63	0.00	0.00	
18	17	0.00	0.35	0.00	12.44	0.76	9.44	36	-0.04	0.020	100.66	100.65	72.64	97.45	97.48	1.34	49.8	0.71	0.00	0.00	
19	18	4.10	0.35	1.44	12.44	0.76	9.51	36	-0.05	0.020	100.68	100.66	60.50	97.42	97.45	1.35	49.2	0.59	110.52	0.00	
20	19	2.30	0.35	0.80	6.52	0.77	5.00	24	0.48	0.049	100.69	100.68	31.50	98.07	97.92	1.59	49.0	0.26	0.00	110.52	
21	20	2.40	0.35	0.84	5.71	0.81	4.62	24	0.49	0.236	101.51 j	100.70	444.06	100.74	98.57	2.82	45.0	3.97	0.00	0.00	

Project File: 060915-Network_E07-South.stm	Number of lines: 39	Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

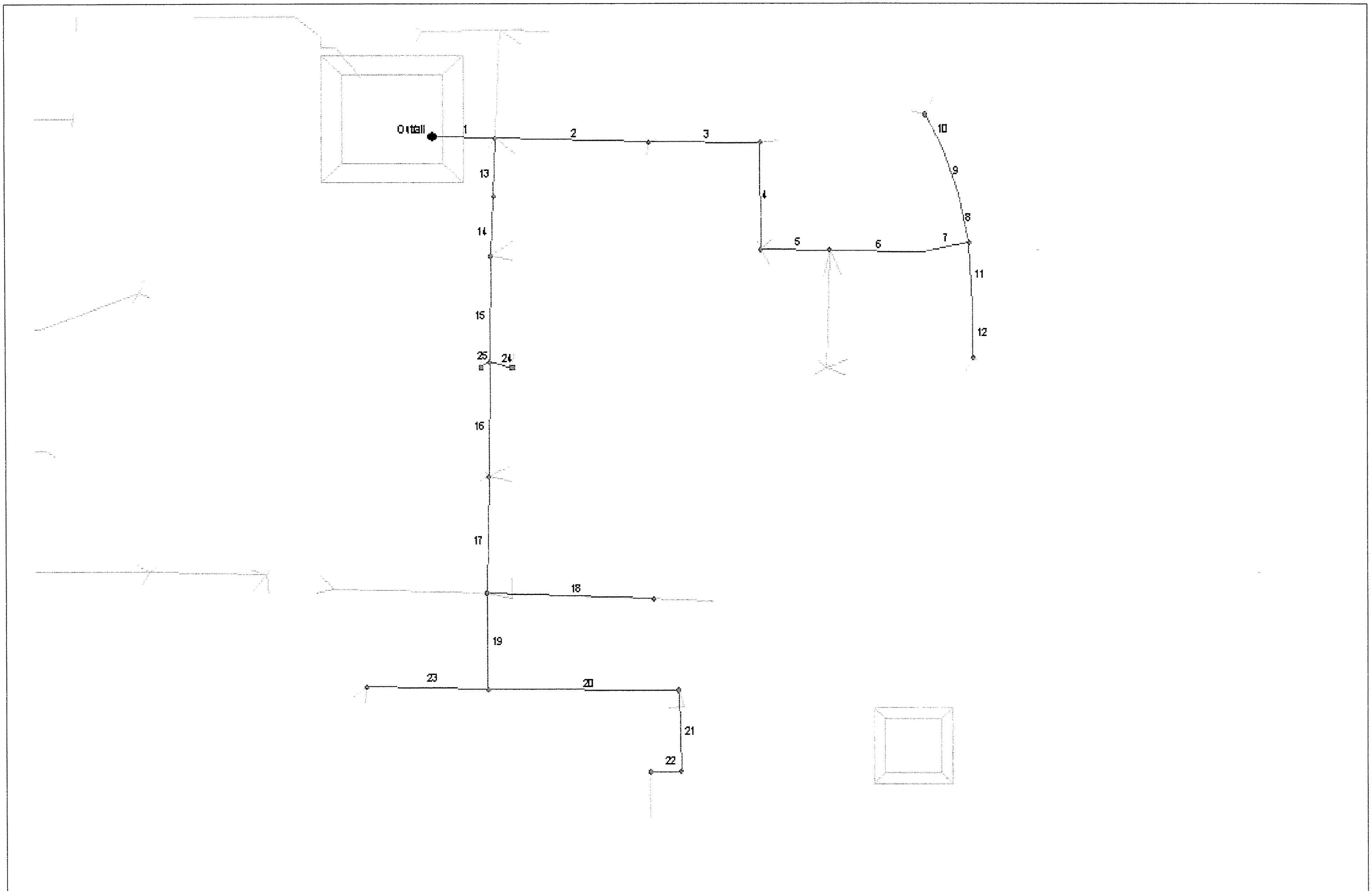
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	5.47	0.35	1.91	3.98	0.88	3.49	24	0.49	0.456	104.18	101.88	468.55	103.52	101.24	3.94	39.3	5.69	112.62	0.00
23	21	0.00	0.35	0.00	0.89	1.02	0.91	15	0.19	0.161	101.87	101.77	67.07	101.37	101.24	1.92	30.8	1.38	0.00	0.00
24	23	0.00	0.35	0.00	0.89	1.07	0.95	15	0.21	0.169	102.08	101.92	106.11	101.59	101.37	1.98	28.6	2.15	0.00	0.00
25	24	2.55	0.35	0.89	0.89	1.16	1.03	15	0.20	0.183	102.46	102.14	183.50	101.95	101.59	2.08	25.0	3.63	0.00	0.00
26	19	1.86	0.35	0.65	4.48	0.81	3.61	24	0.22	0.026	100.76	100.68	300.25	98.57	97.92	1.15	45.2	3.51	0.00	110.52
27	26	2.18	0.35	0.76	3.83	0.87	3.33	24	0.17	0.022	100.85	100.76	404.13	99.26	98.57	1.15	39.9	5.28	0.00	0.00
28	27	4.33	0.35	1.52	3.07	0.88	2.70	18	0.51	0.198	100.92	100.85	85.95	100.20	99.76	2.60	39.1	0.78	108.83	0.00
29	28	1.38	0.35	0.48	1.55	1.02	1.59	18	0.15	0.080	101.43	101.07	501.51	100.75	99.98	1.60	30.7	8.46	0.00	108.83
30	29	3.06	0.35	1.07	1.07	1.16	1.24	18	0.10	0.073	101.65	101.49	239.01	100.99	100.75	1.55	25.0	5.67	0.00	0.00
31	22	1.97	0.35	0.69	2.07	0.98	2.02	24	0.07	0.069	105.01	104.82	275.72	104.21	104.02	1.71	33.1	6.23	0.00	112.62
32	31	3.93	0.35	1.38	1.38	1.16	1.59	24	0.07	0.051	105.13	105.01	246.25	104.39	104.21	1.44	25.0	8.08	0.00	0.00
33	Outfall	1.35	0.35	0.47	9.14	1.00	9.12	24	0.10	0.163	103.60	103.43	107.25	101.54	101.43	2.90	31.9	0.63	109.99	0.00
34	33	6.16	0.35	2.16	8.67	1.03	8.96	24	0.10	0.157	104.52	104.04	302.50	102.34	102.04	2.85	30.1	1.81	0.00	109.99
35	34	1.60	0.35	0.56	6.51	1.06	6.88	18	0.15	0.429	105.53	104.52	235.53	103.20	102.84	3.89	29.1	1.03	0.00	0.00
36	35	3.91	0.35	1.37	5.95	1.09	6.46	18	0.15	0.379	106.58	105.55	270.51	104.10	103.70	3.66	27.8	1.25	0.00	0.00
37	36	0.86	0.35	0.30	4.59	1.11	5.11	15	0.20	0.627	108.46	106.58	299.52	105.20	104.60	4.17	26.6	1.20	0.00	0.00
38	37	2.86	0.35	1.00	4.28	1.12	4.79	15	0.19	0.551	108.69	108.49	36.53	105.77	105.70	3.91	26.5	0.16	0.00	0.00
39	38	9.38	0.35	3.28	3.28	1.16	3.81	15	0.20	0.348	109.74	108.78	277.53	106.83	106.27	3.10	25.0	1.49	0.00	0.00

Project File: 060915-Network_E07-South.stm	Number of lines: 39	Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 8

Hydraflow Plan View



Project File: 060915-Network_E08.stm	No. Lines: 25	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	4.69	0.35	1.64	21.62	0.50	10.87	36	0.25	0.025	111.83	111.79	166.57	109.20	108.79	1.60	97.1	1.00	121.20	113.64
2	1	2.58	0.35	0.90	7.15	0.51	3.67	24	0.31	0.051	112.05	111.89	404.61	110.95	109.70	1.62	94.0	3.05	0.00	121.20
3	2	7.01	0.35	2.45	6.24	0.52	3.25	24	0.24	0.134	112.41	112.11	292.01	111.65	110.95	2.34	91.6	2.44	123.04	0.00
4	3	2.50	0.35	0.88	3.79	0.53	2.02	24	0.10	0.084	112.89	112.68	256.75	112.15	111.89	1.84	88.1	3.44	0.00	123.04
5	4	5.13	0.35	1.80	2.92	0.54	1.57	18	0.25	0.253	113.67	113.21	181.52	113.11	112.65	2.61	86.4	1.74	0.00	0.00
6	5	0.00	0.35	0.00	1.12	0.56	0.63	18	0.10	0.051	113.84	113.73	245.55	113.36	113.11	1.11	80.5	5.95	0.00	0.00
7	6	0.71	0.35	0.25	1.12	0.58	0.65	18	0.10	0.071	113.95	113.87	123.17	113.48	113.36	1.28	77.5	2.94	0.00	0.00
8	7	0.00	0.35	0.00	0.74	0.98	0.72	18	0.10	0.077	114.09	114.01	119.05	113.60	113.48	1.36	32.5	4.26	0.00	0.00
9	8	0.00	0.35	0.00	0.74	1.07	0.79	18	0.10	0.086	114.23	114.13	120.03	113.72	113.60	1.46	28.2	4.23	0.00	0.00
10	9	2.10	0.35	0.74	0.74	1.15	0.85	18	0.10	0.097	114.33	114.24	92.50	113.81	113.72	1.55	25.0	3.22	0.00	0.00
11	7	0.00	0.35	0.00	0.14	0.77	0.11	18	0.10	0.004	114.00	114.00	153.76	113.63	113.48	0.25	48.2	29.31	0.00	0.00
12	11	0.39	0.35	0.14	0.14	1.15	0.16	18	0.11	0.028	114.03	114.00	123.75	113.76	113.63	0.59	25.0	23.21	0.00	0.00
13	1	0.96	0.35	0.34	12.83	0.60	7.72	36	0.14	0.020	111.89	111.87	141.09	109.90	109.70	1.48	72.5	1.40	0.00	121.20
14	13	5.00	0.35	1.75	12.50	0.61	7.61	36	0.14	0.024	111.92	111.90	143.72	110.10	109.90	1.61	71.0	1.45	0.00	0.00
15	14	0.36	0.35	0.13	10.75	0.62	6.71	36	0.10	0.026	111.99	111.93	253.02	110.36	110.10	1.60	68.2	2.89	0.00	0.00
16	15	6.77	0.35	2.37	8.10	0.65	5.25	36	0.10	0.023	112.08	112.03	276.53	110.64	110.36	1.43	64.1	4.07	0.00	0.00
17	16	3.53	0.35	1.24	5.73	0.69	3.93	36	0.10	0.022	112.14	112.09	281.08	110.92	110.64	1.31	58.4	5.68	120.50	0.00
18	17	3.05	0.35	1.07	1.07	1.15	1.23	30	0.10	0.082	112.55	112.21	438.22	112.04	111.60	1.53	25.0	29.19	0.00	120.50
19	17	2.02	0.35	0.71	3.43	0.71	2.44	24	0.11	0.108	112.64	112.39	231.76	111.85	111.60	2.12	55.0	3.39	0.00	120.50
20	19	1.56	0.35	0.55	1.68	0.85	1.43	24	0.10	0.050	113.00	112.77	502.50	112.36	111.85	1.32	40.9	14.14	0.00	0.00
21	20	1.91	0.35	0.67	1.13	0.97	1.10	24	0.10	0.052	113.14	113.05	194.00	112.55	112.36	1.29	33.0	7.89	0.00	0.00

Project File: 060915-Network_E08.stm | Number of lines: 25 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

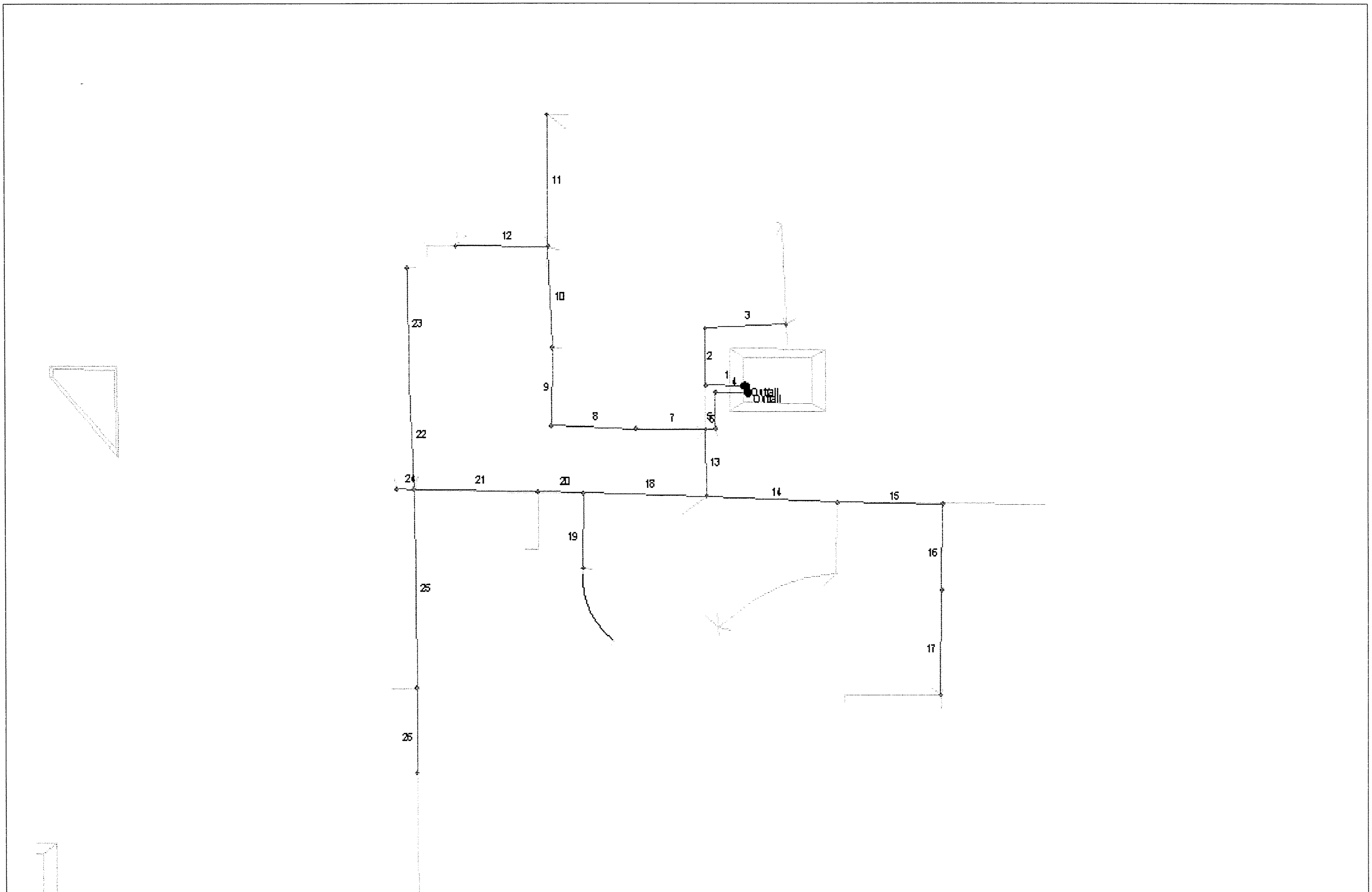
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
22	21	1.32	0.35	0.46	0.46	1.15	0.53	24	0.10	0.015	113.19	113.19	81.00	112.63	112.55	0.67	25.0	7.98	0.00	0.00	
23	19	2.98	0.35	1.04	1.04	1.15	1.20	15	0.20	0.205	113.81	113.16	318.57	113.25	112.60	2.26	25.0	5.43	0.00	0.00	
24	15	4.43	0.35	1.55	1.55	1.15	1.78	15	0.46	0.458	112.95	112.67	61.00	112.39	112.11	3.38	25.0	0.70	0.00	0.00	
25	15	2.77	0.35	0.97	0.97	1.15	1.12	15	0.18	0.176	112.72	112.67	28.29	112.16	112.11	2.10	25.0	0.52	0.00	0.00	

Project File: 060915-Network_E08.stm	Number of lines: 25	Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 11

Hydraflow Plan View



Project File: 060915-Network_E11.stm	No. Lines: 26	03-27-2007

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	0.39	0.35	0.14	2.63	1.05	2.77	18	0.10	0.066	106.60	106.53	114.01	105.14	105.03	1.57	29.2	1.16	0.00	108.43
2	1	0.57	0.35	0.20	2.49	1.09	2.72	18	0.10	0.059	106.69	106.60	149.25	105.29	105.14	1.57	27.6	1.57	115.86	0.00
3	2	6.55	0.35	2.29	2.29	1.16	2.66	18	0.25	0.253	107.40	106.81	233.21	106.65	106.06	2.99	25.0	2.58	115.35	115.86
4	Outfall	0.27	0.35	0.09	19.39	0.58	11.30	24	0.17	0.250	105.43	105.20	93.51	103.36	103.20	3.60	76.6	0.27	0.00	0.00
5	4	0.70	0.35	0.25	19.29	0.58	11.27	24	0.17	0.248	105.67	105.43	96.00	103.52	103.36	3.59	76.4	0.28	0.00	0.00
6	5	0.88	0.35	0.31	19.05	0.58	11.13	24	0.18	0.242	105.75	105.68	28.50	103.57	103.52	3.54	76.3	0.08	115.49	0.00
7	6	1.16	0.35	0.41	5.89	0.91	5.36	24	0.10	0.100	107.18	106.98	200.00	105.89	105.69	2.50	37.2	1.74	0.00	115.49
8	7	1.21	0.35	0.42	5.49	0.94	5.18	24	0.10	0.095	107.41	107.18	243.65	106.13	105.89	2.43	35.0	2.22	0.00	0.00
9	8	2.68	0.35	0.94	5.06	0.98	4.95	24	0.10	0.091	107.59	107.41	204.27	106.34	106.13	2.37	33.0	1.97	0.00	0.00
10	9	1.99	0.35	0.70	4.13	1.04	4.28	24	0.10	0.077	107.78	107.59	266.69	106.60	106.34	2.14	29.9	3.05	115.03	0.00
11	10	5.08	0.35	1.78	1.78	1.16	2.06	18	0.10	0.101	108.30	107.95	345.51	107.45	107.10	1.99	25.0	4.94	0.00	115.03
12	10	4.72	0.35	1.65	1.65	1.16	1.92	18	0.10	0.101	108.11	107.84	266.50	107.30	107.03	1.96	25.0	4.10	0.00	115.03
13	6	1.05	0.35	0.37	12.85	0.59	7.53	18	0.06	0.515	108.10	107.19	176.02	105.79	105.69	4.26	75.9	0.42	117.64	115.49
14	13	8.22	0.35	2.88	6.78	1.03	6.99	18	0.46	0.443	109.81	108.14	376.82	107.52	105.79	3.96	30.2	1.56	0.00	117.64
15	14	2.29	0.35	0.80	3.90	1.08	4.21	18	0.28	0.160	110.45	109.96	303.00	108.38	107.52	2.38	28.1	2.11	119.69	0.00
16	15	1.04	0.35	0.36	3.10	1.11	3.44	15	0.31	0.284	111.09	110.45	225.51	109.50	108.79	2.81	26.8	1.33	0.00	119.69
17	16	9.11	0.30	2.73	2.73	1.16	3.17	15	0.18	0.241	111.77	111.11	276.02	110.01	109.50	2.58	25.0	1.78	0.00	0.00
18	13	0.53	0.35	0.19	5.70	0.60	3.40	18	0.21	0.105	108.69	108.32	354.11	106.53	105.79	1.92	74.0	1.83	0.00	117.64
19	18	3.38	0.35	1.18	1.18	1.16	1.37	15	0.10	0.045	108.82	108.73	198.01	106.98	106.78	1.12	25.0	2.95	0.00	0.00
20	18	3.60	0.35	1.26	4.34	0.60	2.60	18	0.17	0.061	108.80	108.72	131.52	106.76	106.53	1.47	73.1	0.88	0.00	0.00
21	20	0.00	0.35	0.00	3.08	0.62	1.90	18	0.17	0.033	108.93	108.81	356.57	107.36	106.76	1.07	69.9	3.24	115.80	0.00

Project File: 060915-Network_E11.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	4.60	0.35	1.61	1.75	1.01	1.77	6	0.10	9.958	137.31	108.93	285.07	104.59	104.30	9.01	31.1	0.48	0.00	115.80
23	22	0.39	0.35	0.14	0.14	1.16	0.16	6	0.10	0.080	138.80	138.57	297.28	104.88	104.59	0.81	25.0	6.15	0.00	0.00
24	21	0.88	0.35	0.31	0.31	1.16	0.36	18	0.10	0.001	108.95	108.95	49.02	104.35	104.30	0.20	25.0	4.04	0.00	115.80
25	21	1.57	0.35	0.55	1.02	0.80	0.81	24	-0.12	0.001	108.95	108.95	521.80	103.66	104.30	0.26	46.1	23.78	116.96	115.80
26	25	1.57	0.30	0.47	0.47	1.16	0.55	24	0.19	0.001	108.95	108.95	220.37	104.07	103.66	0.17	25.0	21.13	0.00	116.96

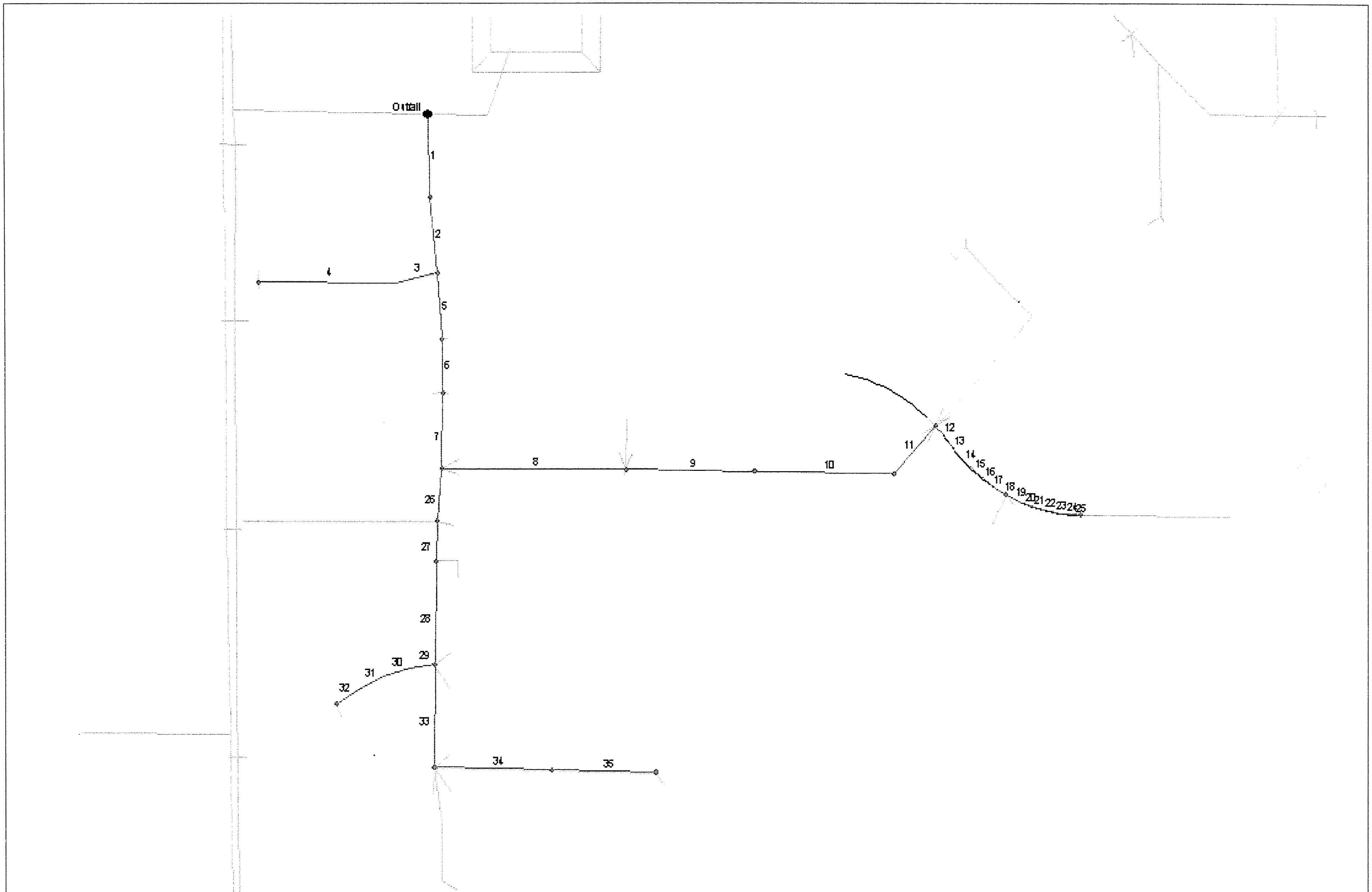
Project File: 060915-Network_E11.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Appendix 2: Analysis of Existing Storm Drain Systems, Including Future Development

Drain System 6, Including Future Development

Hydraflow Plan View



Project File: 060915-Network_E06_Future.stm	No. Lines: 35	03-27-2007

Hydraflow Storm Sewers 2005

COS

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	6.98	0.35	2.44	38.11	0.84	31.86	36	0.06	0.228	106.06	105.59	204.16	102.72	102.59	4.51	42.3	0.72	0.00	0.00
2	1	0.92	0.35	0.32	35.67	0.84	30.13	36	0.09	0.204	106.47	106.09	188.15	102.89	102.72	4.26	41.6	0.70	0.00	0.00
3	2	0.00	0.35	0.00	1.71	0.94	1.60	24	0.16	0.005	106.76	106.75	116.49	103.08	102.89	0.51	34.9	3.26	0.00	0.00
4	3	4.88	0.35	1.71	1.71	1.15	1.97	24	0.03	0.008	106.79	106.76	371.98	103.01	102.89	0.63	25.0	9.91	0.00	0.00
5	2	1.42	0.35	0.50	33.64	0.85	28.68	36	0.39	0.227	106.73	106.50	162.64	104.65	104.01	5.03	40.9	0.63	0.00	0.00
6	5	1.42	0.35	0.50	33.14	0.86	28.47	36	0.07	0.182	107.19	106.94	132.98	102.36	102.27	4.03	40.4	0.52	0.00	0.00
7	6	2.81	0.35	0.98	32.64	0.87	28.36	36	0.24	0.181	107.53	107.19	187.44	103.81	103.36	4.01	39.7	0.72	0.00	0.00
8	7	6.93	0.35	2.43	20.99	0.93	19.60	30	0.13	0.229	108.67	107.53	497.57	102.86	102.22	3.99	35.2	1.98	116.00	0.00
9	8	1.78	0.35	0.62	18.57	0.96	17.81	30	0.13	0.189	109.40	108.75	347.59	103.31	102.86	3.63	33.7	1.50	0.00	116.00
10	9	1.73	0.35	0.61	17.94	0.99	17.73	30	0.13	0.187	110.11	109.40	376.75	103.80	103.31	3.61	32.1	1.62	0.00	0.00
11	10	18.15	0.35	6.35	17.34	1.00	17.37	30	0.13	0.179	110.41	110.12	162.70	104.01	103.80	3.54	31.4	0.71	0.00	0.00
12	11	0.00	0.35	0.00	10.99	1.00	11.03	24	0.16	0.238	110.48	110.41	31.12	104.56	104.51	3.51	31.3	0.14	0.00	0.00
13	12	0.00	0.35	0.00	10.99	1.01	11.08	24	0.19	0.240	110.60	110.48	48.61	104.65	104.56	3.53	31.1	0.21	0.00	0.00
14	13	0.00	0.35	0.00	10.99	1.01	11.12	24	0.17	0.242	110.70	110.60	41.40	104.72	104.65	3.54	30.9	0.18	0.00	0.00
15	14	0.00	0.35	0.00	10.99	1.02	11.15	24	0.16	0.243	110.79	110.70	37.37	104.78	104.72	3.55	30.7	0.16	0.00	0.00
16	15	0.00	0.35	0.00	10.99	1.02	11.18	24	0.19	0.245	110.87	110.79	32.41	104.84	104.78	3.56	30.6	0.14	0.00	0.00
17	16	0.00	0.35	0.00	10.99	1.02	11.22	24	0.17	0.246	110.96	110.87	34.40	104.90	104.84	3.57	30.4	0.15	0.00	0.00
18	17	26.18	0.35	9.16	10.99	1.02	11.25	24	0.15	0.247	111.04	110.96	32.37	104.95	104.90	3.58	30.3	0.14	0.00	0.00
19	18	0.00	0.35	0.00	1.82	1.04	1.90	24	0.18	0.007	111.23	111.23	37.94	105.02	104.95	0.61	29.3	0.97	0.00	0.00
20	19	0.00	0.35	0.00	1.82	1.06	1.93	24	0.16	0.007	111.23	111.23	24.70	105.06	105.02	0.61	28.7	0.63	0.00	0.00
21	20	0.00	0.35	0.00	1.82	1.08	1.96	24	0.20	0.008	111.24	111.23	30.29	105.12	105.06	0.62	27.9	0.77	0.00	0.00

Project File: 060915-Network_E06_Future.stm	Number of lines: 35	Date: 03-27-2007
NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth		

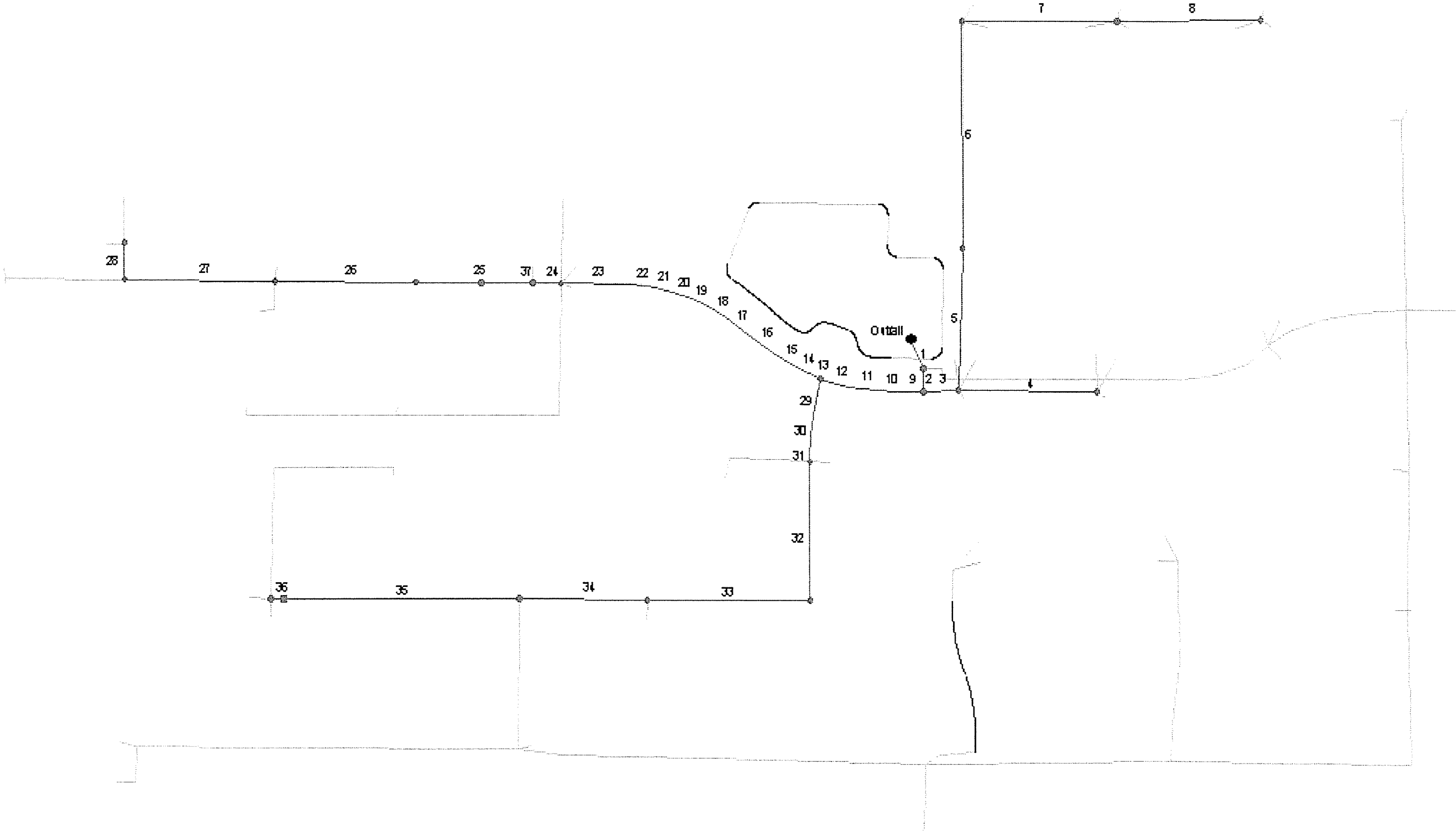
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	0.00	0.35	0.00	1.82	1.10	2.00	24	0.17	0.008	111.24	111.24	35.02	105.18	105.12	0.64	27.1	0.88	0.00	0.00
23	22	0.00	0.35	0.00	1.82	1.11	2.03	24	0.18	0.008	111.24	111.24	28.36	105.23	105.18	0.65	26.3	0.71	0.00	0.00
24	23	0.00	0.35	0.00	1.82	1.13	2.07	24	0.17	0.008	111.24	111.24	29.63	105.28	105.23	0.66	25.6	0.74	0.00	0.00
25	24	5.21	0.35	1.82	1.82	1.15	2.10	24	0.17	0.009	111.25	111.24	24.02	105.32	105.28	0.67	25.0	0.60	0.00	0.00
26	7	4.64	0.35	1.62	10.67	0.89	9.48	36	0.73	0.052	107.65	107.66	131.21	106.16	105.20	2.12	38.2	1.45	113.80	0.00
27	26	3.60	0.35	1.26	9.04	0.90	8.11	24	1.00	0.327	108.15 j	107.66	97.91	107.14	106.16	4.16	37.7	0.56	0.00	113.80
28	27	4.85	0.35	1.70	7.78	0.92	7.17	24	0.10	0.099	109.05	108.80	253.67	107.39	107.14	2.58	36.0	1.65	0.00	0.00
29	28	0.00	0.35	0.00	1.20	0.97	1.16	24	0.17	0.003	109.15	109.15	70.63	103.93	103.81	0.37	33.3	2.75	0.00	0.00
30	29	0.00	0.35	0.00	1.20	1.02	1.23	24	0.17	0.003	109.15	109.15	71.00	104.05	103.93	0.39	30.5	2.74	0.00	0.00
31	30	0.00	0.35	0.00	1.20	1.08	1.30	24	0.17	0.003	109.16	109.15	70.11	104.17	104.05	0.41	27.9	2.68	0.00	0.00
32	31	3.44	0.35	1.20	1.20	1.15	1.39	24	0.18	0.004	109.16	109.16	75.79	104.31	104.17	0.44	25.0	2.86	0.00	0.00
33	28	6.97	0.35	2.44	4.88	1.02	4.99	18	0.17	0.226	109.96	109.39	253.00	108.32	107.89	2.82	30.4	1.43	0.00	0.00
34	33	2.21	0.35	0.77	2.44	1.07	2.62	15	0.16	0.165	110.54	110.01	318.00	109.09	108.57	2.14	28.0	2.40	0.00	0.00
35	34	4.77	0.35	1.67	1.67	1.15	1.92	15	0.10	0.089	110.82	110.57	280.90	109.37	109.09	1.57	25.0	2.99	0.00	0.00

Project File: 060915-Network_E06_Future.stm | Number of lines: 35 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 7, Including Future Development

Hydraflow Plan View



Project File: 060915-Network_E07-North_Future.stm	No. Lines: 37	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
1	Outfall	1.33	0.35	0.47	31.36	0.81	25.50	30	2.22	0.497	98.97 j	98.51	57.27	97.28	96.01	6.21	44.5	0.16	0.00	96.01	
2	1	0.24	0.35	0.08	30.89	0.81	25.16	30	0.19	0.377	99.94	99.78	41.75	97.36	97.28	5.13	44.4	0.12	0.00	0.00	
3	2	0.74	0.35	0.26	6.57	0.85	5.60	21	3.61	0.320	100.69 j	100.26	68.06	99.82	97.36	3.52	41.3	0.42	109.92	0.00	
4	3	3.33	0.35	1.17	1.17	1.16	1.35	30	0.10	0.009	101.03	101.01	268.51	100.09	99.82	0.69	25.0	16.26	0.00	109.92	
5	3	1.11	0.35	0.39	5.15	1.02	5.26	18	0.10	0.251	101.96	101.32	253.64	100.07	99.82	2.98	30.7	1.41	0.00	109.92	
6	5	2.96	0.35	1.04	4.76	1.07	5.10	18	0.10	0.236	102.91	101.97	400.25	100.47	100.07	2.89	28.4	2.30	0.00	0.00	
7	6	3.12	0.35	1.09	3.72	1.11	4.13	15	0.10	0.409	104.14	102.91	301.50	101.03	100.72	3.36	26.9	1.48	0.00	0.00	
8	7	7.51	0.35	2.63	2.63	1.16	3.05	15	0.10	0.223	104.84	104.22	278.50	101.30	101.03	2.48	25.0	1.87	0.00	0.00	
9	2	0.00	0.35	0.00	24.24	0.82	19.80	30	0.17	0.233	100.22	100.09	52.51	97.45	97.36	4.03	44.2	0.18	0.00	0.00	
10	9	0.00	0.35	0.00	24.24	0.82	19.83	30	0.18	0.234	100.31	100.22	39.10	97.52	97.45	4.04	44.1	0.14	0.00	0.00	
11	10	0.00	0.30	0.00	24.24	0.82	19.89	30	0.18	0.235	100.44	100.31	55.68	97.62	97.52	4.05	43.9	0.19	0.00	0.00	
12	11	0.82	0.30	0.25	24.24	0.82	19.94	30	0.18	0.236	100.57	100.44	54.74	97.72	97.62	4.06	43.7	0.19	109.52	0.00	
13	12	0.00	0.30	0.00	18.70	0.89	16.61	24	0.77	0.539	100.69	100.57	23.31	97.90	97.72	5.29	38.6	0.07	0.00	109.52	
14	13	0.00	0.30	0.00	18.70	0.89	16.63	24	0.77	0.541	100.88	100.69	33.56	98.16	97.90	5.29	38.5	0.10	0.00	0.00	
15	14	0.00	0.30	0.00	18.70	0.89	16.67	24	0.77	0.543	101.13	100.88	46.82	98.52	98.16	5.31	38.4	0.13	0.00	0.00	
16	15	0.00	0.30	0.00	18.70	0.89	16.72	24	0.79	0.546	101.51	101.13	68.67	99.06	98.52	5.32	38.2	0.19	0.00	0.00	
17	16	0.00	0.30	0.00	18.70	0.90	16.75	24	0.76	0.549	101.73	101.51	41.88	99.38	99.06	5.33	38.0	0.12	0.00	0.00	
18	17	0.00	0.30	0.00	18.70	0.90	16.79	24	0.80	0.551	102.02	101.73	51.44	99.79	99.38	5.34	37.9	0.14	0.00	0.00	
19	18	0.00	0.30	0.00	18.70	0.90	16.81	24	0.80	0.553	102.20	102.02	32.69	100.05	99.79	5.35	37.8	0.09	0.00	0.00	
20	19	0.00	0.30	0.00	18.70	0.90	16.84	24	0.79	0.555	102.42	102.20	39.05	100.36	100.05	5.36	37.7	0.11	0.00	0.00	
21	20	0.00	0.30	0.00	18.70	0.90	16.87	24	0.79	0.524	102.61	102.42	39.04	100.67	100.36	5.39	37.6	0.11	0.00	0.00	

Project File: 060915-Network_E07-North_Future.stm | Number of lines: 37 | Date: 03-27-2007

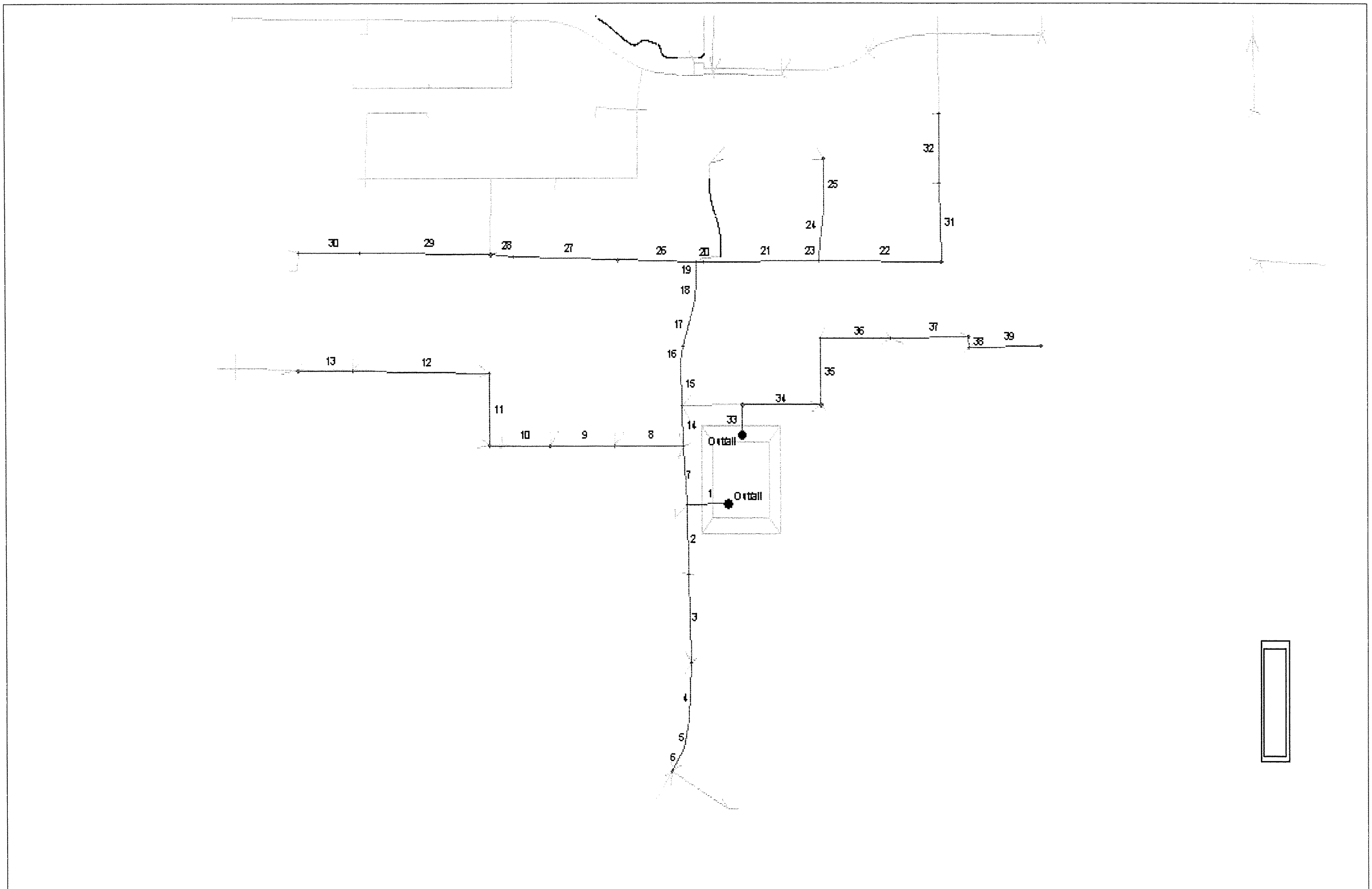
NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
22	21	0.00	0.30	0.00	18.70	0.90	16.91	24	0.81	0.502	102.77	102.62	44.26	101.03	100.67	5.62	37.5	0.12	0.00	0.00	
23	22	6.98	0.30	2.09	18.70	0.91	17.00	24	3.77	0.842	107.66	102.84	124.00	106.20	101.53	7.35	37.1	0.34	108.21	0.00	
24	23	1.35	0.30	0.41	10.70	0.91	9.75	18	0.78	0.862	108.41	107.93	55.00	99.34	98.91	5.52	37.0	0.15	0.00	108.21	
25	24	0.68	0.30	0.20	10.29	0.92	9.47	18	0.76	0.814	110.28	108.43	227.01	101.06	99.34	5.36	36.4	0.61	0.00	0.00	
26	25	2.58	0.30	0.77	10.09	0.93	9.40	18	0.68	0.802	112.48	110.29	273.00	102.93	101.06	5.32	35.7	0.72	0.00	0.00	
27	26	30.48	0.30	9.14	9.31	0.95	8.80	18	0.67	0.703	114.57	112.53	291.02	104.88	102.93	4.98	34.9	0.80	108.53	0.00	
28	27	0.56	0.30	0.17	0.17	1.16	0.19	18	0.55	0.000	114.96	114.96	65.25	100.64	100.28	0.11	25.0	9.87	0.00	108.53	
29	12	0.00	0.30	0.00	5.30	0.84	4.42	30	0.10	0.012	100.82	100.81	68.17	97.79	97.72	0.90	42.6	1.07	0.00	109.52	
30	29	0.00	0.30	0.00	5.30	0.84	4.46	30	0.08	0.012	100.82	100.82	36.59	97.82	97.79	0.91	42.1	0.57	0.00	0.00	
31	30	4.26	0.30	1.28	5.30	0.85	4.51	30	0.11	0.012	100.83	100.82	44.28	97.87	97.82	0.92	41.4	0.69	0.00	0.00	
32	31	1.48	0.30	0.44	4.02	0.89	3.59	24	0.10	0.025	100.89	100.83	242.75	98.61	98.37	1.14	38.3	3.10	0.00	0.00	
33	32	2.15	0.30	0.65	3.57	0.96	3.44	24	0.10	0.023	100.93	100.89	315.00	98.93	98.61	1.09	33.9	4.37	0.00	0.00	
34	33	1.23	0.30	0.37	2.93	1.04	3.05	24	0.10	0.017	100.97	100.93	248.51	99.18	98.93	1.00	29.8	4.08	109.31	0.00	
35	34	1.01	0.30	0.30	2.56	1.15	2.95	18	0.10	0.079	101.33	100.97	456.50	99.47	99.01	1.67	25.3	4.55	0.00	109.31	
36	35	7.52	0.30	2.26	2.26	1.16	2.62	18	0.08	0.062	101.36	101.34	25.50	99.49	99.47	1.48	25.0	0.29	0.00	0.00	
37	23	19.69	0.30	5.91	5.91	1.16	6.85	18	2.46	0.538	111.48 j	108.17	153.52	110.48	106.70	4.69	25.0	0.66	0.00	108.21	

Project File: 060915-Network_E07-North_Future.stm | Number of lines: 37 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Hydraflow Plan View



Project File: 060915-Network_E07-South.stm	No. Lines: 39	03-27-2007

Hydraflow Storm Sewers 2005

COS

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	3.60	0.35	1.26	28.97	0.70	20.37	48	-1.25	0.020	98.93	98.90	159.00	92.91	94.90	1.62	56.5	1.29	108.81	100.50
2	1	2.52	0.35	0.88	6.28	1.07	6.72	24	0.81	0.088	99.15	98.93	246.00	95.41	93.41	2.14	28.5	1.93	0.00	108.81
3	2	5.18	0.35	1.81	5.40	1.11	5.98	18	0.81	0.324	100.15	99.15	309.63	98.43	95.91	3.38	27.0	1.53	0.00	0.00
4	3	0.00	0.35	0.00	3.59	1.13	4.06	15	0.81	0.532	101.37 j	100.16	200.25	100.56	98.93	4.09	26.0	1.01	0.00	0.00
5	4	0.00	0.35	0.00	3.59	1.15	4.11	15	0.82	0.569	102.18 j	101.56	99.32	101.37	100.56	4.40	25.5	0.49	0.00	0.00
6	5	10.25	0.35	3.59	3.59	1.16	4.16	15	0.82	0.574	102.95 j	102.37	93.10	102.13	101.37	4.42	25.0	0.46	107.43	0.00
7	1	0.89	0.35	0.31	21.43	0.72	15.35	42	1.87	0.068	98.93	98.93	207.44	97.28	93.41	2.51	54.7	1.71	108.78	108.81
8	7	3.25	0.35	1.14	7.49	0.86	6.42	24	0.64	0.310	100.38 j	99.05	264.50	99.48	97.78	3.87	40.9	1.90	0.00	108.78
9	8	3.52	0.35	1.23	6.36	0.88	5.62	24	0.48	0.298	101.50 j	100.67	248.00	100.66	99.48	3.69	38.8	2.04	0.00	0.00
10	9	4.32	0.35	1.51	5.12	0.92	4.71	24	0.33	0.253	102.22	101.78	232.51	101.42	100.66	3.32	36.5	2.31	106.77	0.00
11	10	2.81	0.35	0.98	3.61	0.98	3.53	24	0.17	0.024	102.51	102.45	252.25	99.90	99.47	1.12	33.1	3.46	0.00	106.77
12	11	2.15	0.35	0.75	2.63	1.08	2.85	18	0.46	0.220	103.51	102.51	522.63	102.81	100.40	2.56	27.9	5.20	0.00	0.00
13	12	5.36	0.35	1.88	1.88	1.16	2.18	18	0.25	0.185	104.00	103.68	211.01	103.34	102.81	2.47	25.0	2.86	0.00	0.00
14	7	0.89	0.35	0.31	13.62	0.72	9.83	24	-0.15	0.189	100.05	99.78	143.56	97.57	97.78	3.13	54.1	0.60	109.17	108.78
15	14	0.00	0.35	0.00	13.31	0.73	9.76	36	-0.02	0.021	100.60	100.57	151.50	97.54	97.57	1.38	52.7	1.43	0.00	109.17
16	15	2.50	0.35	0.88	13.31	0.74	9.82	36	-0.05	0.022	100.62	100.60	58.05	97.51	97.54	1.39	52.2	0.55	0.00	0.00
17	16	0.00	0.35	0.00	12.44	0.75	9.36	36	-0.02	0.020	100.65	100.62	164.52	97.48	97.51	1.32	50.5	1.63	0.00	0.00
18	17	0.00	0.35	0.00	12.44	0.76	9.44	36	-0.04	0.020	100.66	100.65	72.64	97.45	97.48	1.34	49.8	0.71	0.00	0.00
19	18	4.10	0.35	1.44	12.44	0.76	9.51	36	-0.05	0.020	100.68	100.66	60.50	97.42	97.45	1.35	49.2	0.59	110.52	0.00
20	19	2.30	0.35	0.80	6.52	0.77	5.00	24	0.48	0.049	100.69	100.68	31.50	98.07	97.92	1.59	49.0	0.26	0.00	110.52
21	20	2.40	0.35	0.84	5.71	0.81	4.62	24	0.49	0.236	101.51 j	100.70	444.06	100.74	98.57	2.82	45.0	3.97	0.00	0.00

Project File: 060915-Network_E07-South.stm | Number of lines: 39 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

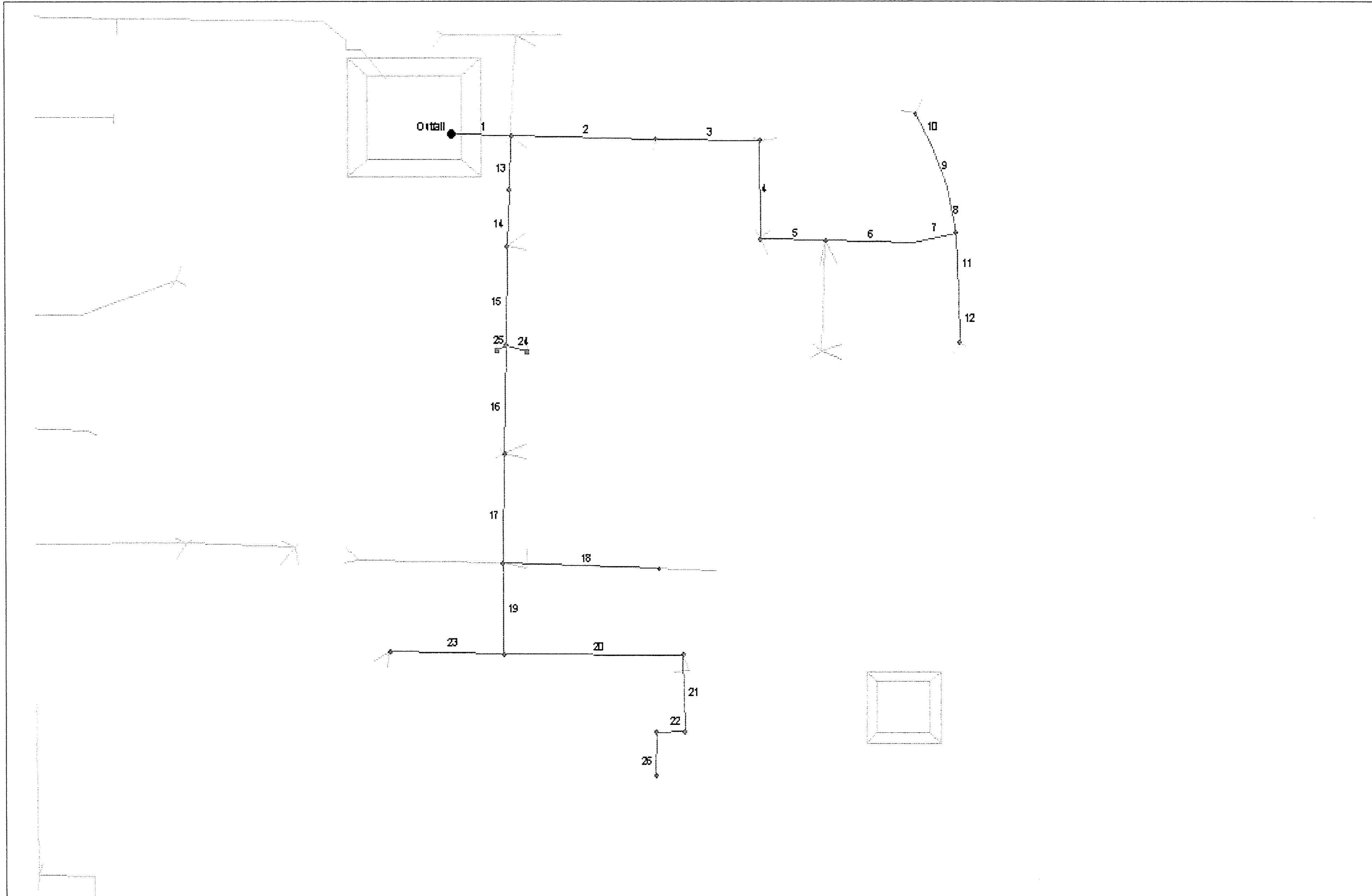
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	5.47	0.35	1.91	3.98	0.88	3.49	24	0.49	0.456	104.18	101.88	468.55	103.52	101.24	3.94	39.3	5.69	112.62	0.00
23	21	0.00	0.35	0.00	0.89	1.02	0.91	15	0.19	0.161	101.87	101.77	67.07	101.37	101.24	1.92	30.8	1.38	0.00	0.00
24	23	0.00	0.35	0.00	0.89	1.07	0.95	15	0.21	0.169	102.08	101.92	106.11	101.59	101.37	1.98	28.6	2.15	0.00	0.00
25	24	2.55	0.35	0.89	0.89	1.16	1.03	15	0.20	0.183	102.46	102.14	183.50	101.95	101.59	2.08	25.0	3.63	0.00	0.00
26	19	1.86	0.35	0.65	4.48	0.81	3.61	24	0.22	0.026	100.76	100.68	300.25	98.57	97.92	1.15	45.2	3.51	0.00	110.52
27	26	2.18	0.35	0.76	3.83	0.87	3.33	24	0.17	0.022	100.85	100.76	404.13	99.26	98.57	1.15	39.9	5.28	0.00	0.00
28	27	4.33	0.35	1.52	3.07	0.88	2.70	18	0.51	0.198	100.92	100.85	85.95	100.20	99.76	2.60	39.1	0.78	108.83	0.00
29	28	1.38	0.35	0.48	1.55	1.02	1.59	18	0.15	0.080	101.43	101.07	501.51	100.75	99.98	1.60	30.7	8.46	0.00	108.83
30	29	3.06	0.35	1.07	1.07	1.16	1.24	18	0.10	0.073	101.65	101.49	239.01	100.99	100.75	1.55	25.0	5.67	0.00	0.00
31	22	1.97	0.35	0.69	2.07	0.98	2.02	24	0.07	0.069	105.01	104.82	275.72	104.21	104.02	1.71	33.1	6.23	0.00	112.62
32	31	3.93	0.35	1.38	1.38	1.16	1.59	24	0.07	0.051	105.13	105.01	246.25	104.39	104.21	1.44	25.0	8.08	0.00	0.00
33	Outfall	1.35	0.35	0.47	9.14	1.00	9.12	24	0.10	0.163	103.60	103.43	107.25	101.54	101.43	2.90	31.9	0.63	109.99	0.00
34	33	6.16	0.35	2.16	8.67	1.03	8.96	24	0.10	0.157	104.52	104.04	302.50	102.34	102.04	2.85	30.1	1.81	0.00	109.99
35	34	1.60	0.35	0.56	6.51	1.06	6.88	18	0.15	0.429	105.53	104.52	235.53	103.20	102.84	3.89	29.1	1.03	0.00	0.00
36	35	3.91	0.35	1.37	5.95	1.09	6.46	18	0.15	0.379	106.58	105.55	270.51	104.10	103.70	3.66	27.8	1.25	0.00	0.00
37	36	0.86	0.35	0.30	4.59	1.11	5.11	15	0.20	0.627	108.46	106.58	299.52	105.20	104.60	4.17	26.6	1.20	0.00	0.00
38	37	2.86	0.35	1.00	4.28	1.12	4.79	15	0.19	0.551	108.69	108.49	36.53	105.77	105.70	3.91	26.5	0.16	0.00	0.00
39	38	9.38	0.35	3.28	3.28	1.16	3.81	15	0.20	0.348	109.74	108.78	277.53	106.83	106.27	3.10	25.0	1.49	0.00	0.00

Project File: 060915-Network_E07-South.stm | Number of lines: 39 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 8, Including Future Development

Hydraflow Plan View



Project File: 060915-Network_E08_Future.stm	No. Lines: 26	03-27-2007

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	4.69	0.35	1.64	31.26	0.50	15.72	36	0.25	0.053	111.87	111.79	166.57	109.20	108.79	2.30	97.1	0.70	121.20	113.64
2	1	2.58	0.35	0.90	7.15	0.51	3.67	24	0.31	0.042	112.16	112.02	404.61	110.95	109.70	1.51	94.0	3.05	0.00	121.20
3	2	7.01	0.35	2.45	6.24	0.52	3.25	24	0.24	0.113	112.45	112.20	292.01	111.65	110.95	2.18	91.6	2.44	123.04	0.00
4	3	2.50	0.35	0.88	3.79	0.53	2.02	24	0.10	0.084	112.89	112.68	256.75	112.15	111.89	1.83	88.1	3.44	0.00	123.04
5	4	5.13	0.35	1.80	2.92	0.54	1.57	18	0.25	0.253	113.67	113.21	181.52	113.11	112.65	2.61	86.4	1.74	0.00	0.00
6	5	0.00	0.35	0.00	1.12	0.56	0.63	18	0.10	0.051	113.84	113.73	245.55	113.36	113.11	1.11	80.5	5.95	0.00	0.00
7	6	0.71	0.35	0.25	1.12	0.58	0.65	18	0.10	0.071	113.95	113.87	123.17	113.48	113.36	1.28	77.5	2.94	0.00	0.00
8	7	0.00	0.35	0.00	0.74	0.98	0.72	18	0.10	0.077	114.09	114.01	119.05	113.60	113.48	1.36	32.5	4.26	0.00	0.00
9	8	0.00	0.35	0.00	0.74	1.07	0.79	18	0.10	0.086	114.23	114.13	120.03	113.72	113.60	1.46	28.2	4.23	0.00	0.00
10	9	2.10	0.35	0.74	0.74	1.15	0.85	18	0.10	0.097	114.33	114.24	92.50	113.81	113.72	1.55	25.0	3.22	0.00	0.00
11	7	0.00	0.35	0.00	0.14	0.77	0.11	18	0.10	0.004	114.00	114.00	153.76	113.63	113.48	0.25	48.2	29.31	0.00	0.00
12	11	0.39	0.35	0.14	0.14	1.15	0.16	18	0.11	0.028	114.03	114.00	123.75	113.76	113.63	0.59	25.0	23.21	0.00	0.00
13	1	0.96	0.35	0.34	22.47	0.81	18.29	36	0.14	0.094	112.08	111.95	141.09	109.90	109.70	3.27	44.1	0.81	0.00	121.20
14	13	5.00	0.35	1.75	22.13	0.82	18.23	36	0.14	0.098	112.24	112.10	143.72	110.10	109.90	3.33	43.3	0.83	0.00	0.00
15	14	0.36	0.35	0.13	20.38	0.84	17.16	36	0.10	0.090	112.49	112.26	253.02	110.36	110.10	3.18	41.8	1.54	0.00	0.00
16	15	6.77	0.35	2.37	17.73	0.87	15.36	36	0.10	0.065	112.82	112.65	276.53	110.64	110.36	2.73	39.9	1.88	0.00	0.00
17	16	3.53	0.35	1.24	15.37	0.90	13.76	36	0.10	0.059	112.99	112.83	281.08	110.92	110.64	2.57	37.7	2.14	120.50	0.00
18	17	22.76	0.35	7.97	7.97	1.15	9.17	30	0.10	0.100	113.59	113.15	438.22	112.04	111.60	2.87	25.0	3.91	0.00	120.50
19	17	2.02	0.35	0.71	6.16	0.92	5.70	24	0.11	0.082	113.28	113.10	231.76	111.85	111.60	2.32	35.8	1.91	0.00	120.50
20	19	1.56	0.35	0.55	4.41	1.02	4.51	24	0.10	0.060	113.64	113.36	502.50	112.36	111.85	1.95	30.4	5.45	0.00	0.00
21	20	1.91	0.35	0.67	3.87	1.07	4.15	24	0.10	0.058	113.81	113.71	194.00	112.55	112.36	1.91	28.0	2.34	0.00	0.00

Project File: 060915-Network_E08_Future.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

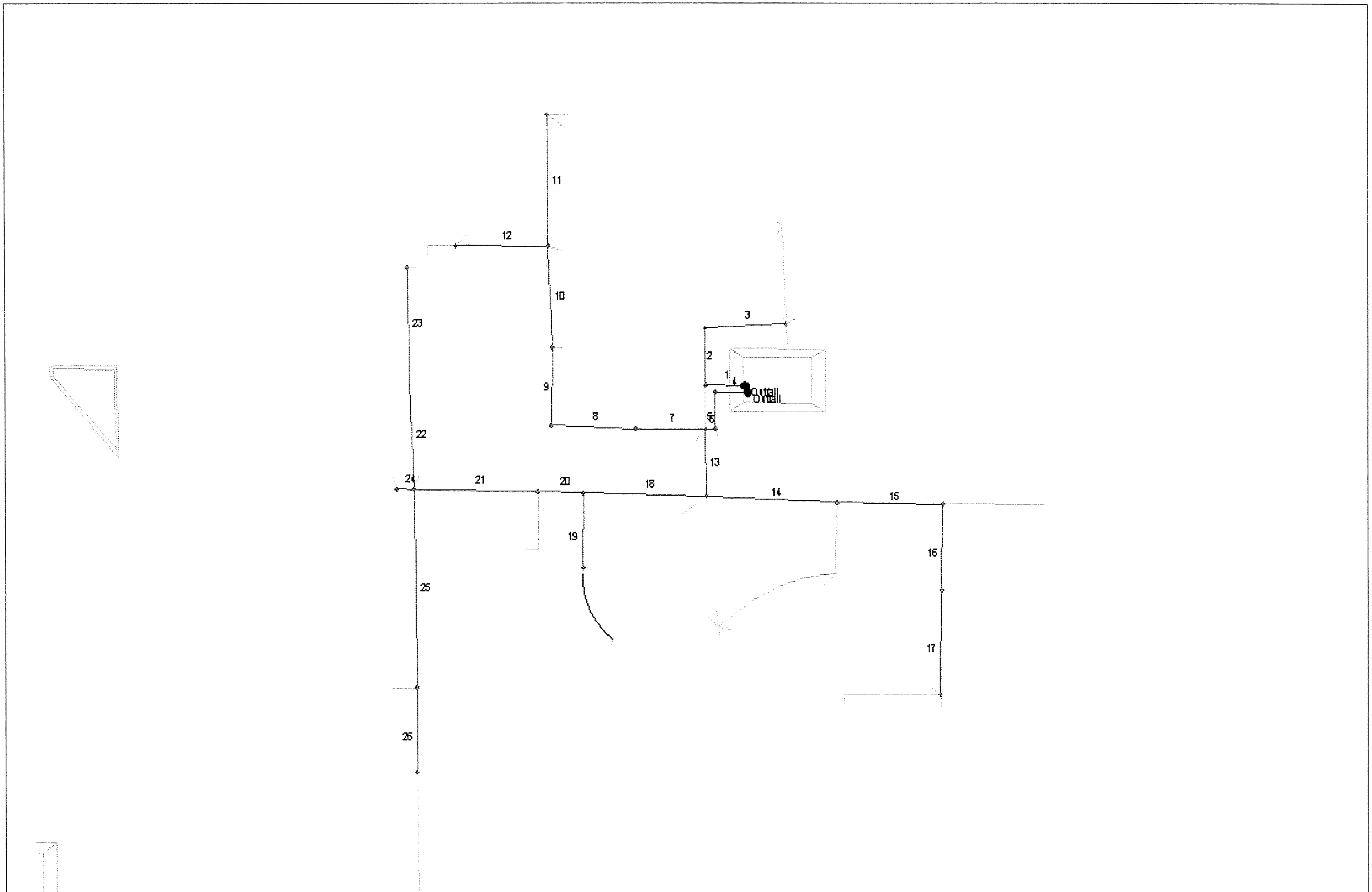
Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
22	21	1.32	0.35	0.46	3.20	1.10	3.52	24	0.10	0.042	113.91	113.89	81.00	112.63	112.55	1.62	26.9	1.17	0.00	0.00
23	19	2.98	0.35	1.04	1.04	1.15	1.20	15	0.20	0.133	113.80	113.44	318.57	113.25	112.60	1.83	25.0	5.43	0.00	0.00
24	15	4.43	0.35	1.55	1.55	1.15	1.78	15	0.46	0.386	112.93	112.77	61.00	112.39	112.11	3.13	25.0	0.70	0.00	0.00
25	15	2.77	0.35	0.97	0.97	1.15	1.12	15	0.18	0.131	112.76	112.73	28.29	112.16	112.11	1.88	25.0	0.52	0.00	0.00
26	22	7.82	0.35	2.74	2.74	1.15	3.15	24	0.10	0.035	113.99	113.96	112.47	112.74	112.63	1.47	25.0	1.87	0.00	0.00

Project File: 060915-Network_E08_Future.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.30) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Drain System 11, Including Future Development

Hydraflow Plan View



Project File: 060915-Network_E11_Future.stm	No. Lines: 26	03-27-2007

Hydraflow Storm Sewers 2005

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	Outfall	0.39	0.35	0.14	6.16	1.11	6.87	18	0.10	0.428	107.02	106.53	114.01	105.14	105.03	3.89	26.7	0.49	0.00	108.43
2	1	0.57	0.35	0.20	6.03	1.13	6.82	18	0.10	0.422	107.65	107.02	149.25	105.29	105.14	3.86	26.0	0.65	115.86	0.00
3	2	16.65	0.35	5.83	5.83	1.16	6.76	18	0.25	0.414	108.62	107.65	233.21	106.65	106.06	3.82	25.0	1.02	115.35	115.86
4	Outfall	0.27	0.35	0.09	25.44	0.88	22.33	24	0.17	0.975	106.11	105.20	93.51	103.36	103.20	7.11	39.3	0.21	0.00	0.00
5	4	0.70	0.35	0.25	25.34	0.88	22.32	24	0.17	0.974	107.05	106.11	96.00	103.52	103.36	7.11	39.1	0.21	0.00	0.00
6	5	0.88	0.35	0.31	25.10	0.88	22.13	24	0.18	0.958	107.33	107.06	28.50	103.57	103.52	7.04	39.0	0.06	115.49	0.00
7	6	1.16	0.35	0.41	5.89	0.91	5.36	24	0.10	0.056	108.17	108.06	200.00	105.89	105.69	1.70	37.2	1.74	0.00	115.49
8	7	1.21	0.35	0.42	5.49	0.94	5.18	24	0.10	0.052	108.30	108.18	243.65	106.13	105.89	1.65	35.0	2.22	0.00	0.00
9	8	2.68	0.35	0.94	5.06	0.98	4.95	24	0.10	0.048	108.41	108.31	204.27	106.34	106.13	1.58	33.0	1.97	0.00	0.00
10	9	1.99	0.35	0.70	4.13	1.04	4.28	24	0.10	0.033	108.50	108.42	266.69	106.60	106.34	1.38	29.9	3.05	115.03	0.00
11	10	5.08	0.35	1.78	1.78	1.16	2.06	18	0.10	0.038	108.63	108.50	345.51	107.45	107.10	1.29	25.0	4.94	0.00	115.03
12	10	4.72	0.35	1.65	1.65	1.16	1.92	18	0.10	0.031	108.58	108.50	266.50	107.30	107.03	1.14	25.0	4.10	0.00	115.03
13	6	1.05	0.35	0.37	18.90	0.89	16.74	18	0.06	2.541	111.81	107.33	176.02	105.79	105.69	9.47	38.8	0.28	117.64	115.49
14	13	8.22	0.35	2.88	10.30	1.09	11.26	18	0.46	1.150	116.91	112.57	376.82	107.52	105.79	6.37	27.5	1.03	0.00	117.64
15	14	2.29	0.35	0.80	7.42	1.12	8.32	18	0.28	0.628	119.10	117.19	303.00	108.38	107.52	4.71	26.4	1.11	119.69	0.00
16	15	1.04	0.35	0.36	6.62	1.14	7.53	15	0.31	1.362	122.17	119.10	225.51	109.50	108.79	6.14	25.8	0.62	0.00	119.69
17	16	20.86	0.30	6.26	6.26	1.16	7.26	15	0.18	1.263	125.70	122.21	276.02	110.01	109.50	5.91	25.0	0.78	0.00	0.00
18	13	0.53	0.35	0.19	8.23	0.90	7.44	18	0.21	0.502	114.70	112.93	354.11	106.53	105.79	4.21	37.5	1.27	0.00	117.64
19	18	3.38	0.35	1.18	1.18	1.16	1.37	15	0.10	0.045	115.05	114.96	198.01	106.98	106.78	1.12	25.0	2.95	0.00	0.00
20	18	3.60	0.35	1.26	6.86	0.91	6.26	18	0.17	0.355	115.25	114.78	131.52	106.76	106.53	3.54	36.9	0.56	0.00	0.00
21	20	0.00	0.35	0.00	5.60	0.94	5.27	18	0.17	0.252	116.21	115.31	356.57	107.36	106.76	2.98	35.2	1.78	115.80	0.00

Project File: 060915-Network_E11_Future.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Line No.	DnStm Ln No	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Total CxA	i Sys (in/hr)	Flow Rate (cfs)	Line Size (in)	Line Slope (%)	Sf Ave (%)	HGL Up (ft)	HGL Dn (ft)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Vel Ave (ft/s)	Tc (min)	Pipe Travel (min)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	
22	21	4.60	0.35	1.61	1.75	1.01	1.77	6	0.10	9.958	144.59	116.21	285.07	104.59	104.30	9.01	31.1	0.48	0.00	115.80	
23	22	0.39	0.35	0.14	0.14	1.16	0.16	6	0.10	0.080	146.08	145.85	297.28	104.88	104.59	0.81	25.0	6.15	0.00	0.00	
24	21	0.88	0.35	0.31	0.31	1.16	0.36	18	0.10	0.001	116.34	116.34	49.02	104.35	104.30	0.20	25.0	4.04	0.00	115.80	
25	21	1.57	0.35	0.55	3.55	1.07	3.81	24	-0.12	0.028	116.47	116.32	521.80	103.66	104.30	1.21	28.3	6.84	116.96	115.80	
26	25	9.99	0.30	3.00	3.00	1.16	3.47	24	0.19	0.024	116.53	116.47	220.37	104.07	103.66	1.11	25.0	3.32	0.00	116.96	

Project File: 060915-Network_E11_Future.stm | Number of lines: 26 | Date: 03-27-2007

NOTES: Intensity = 8.37 / (Inlet time + 0.00) ^ 0.61 -- Return period = 10 Yrs. ; ** Critical depth

Appendix 3: May 1998 Hydrology/Hydraulic Report for McHenry Avenue/SR 120 Improvement Project, Korve Engineering

HYDROLOGY / HYDRAULIC REPORT

FOR

McHenry Avenue /SR 120 Improvement Project

In the City of Escalon

May, 1998

PREPARED FOR:

The City of Escalon
1854 Main Street
Escalon, CA 95320-0248

PREPARED BY:

Korve Engineering

155 Grand Avenue, Suite 400
Oakland, CA 94612
(510) 763-2929

J.N. 195068X1
Prepared under the supervision of:

REGISTERED PROFESSIONAL ENGINEER
DANIEL J. O'ROURKE
No. 47677
Exp. 12 - 31 - 99
CIVIL
STATE OF CALIFORNIA

Signature	RCE #	Exp. Date
[signature]	47677	12-31-99

GENERAL

Korve Engineering, Inc. (KORVE) has been retained by the City of Escalon to provide a Hydrology/Hydraulics report to accompany the roadway and storm drain plans for the McHenry Avenue / SR120 Improvement Project. The approximate limits of the McHenry Avenue improvements are from Catherine Road on the south to Deck Road to the north. State Route 120 is to be realigned and improved from west of the BNSFRR tracks to just east of Sacramento Street. The realigned SR120 forms an intersection with McHenry Avenue south of the present four way intersection, between Yosemite Avenue and the BNSFRR tracks.

PURPOSE / DESCRIPTION OF WATERSHED

The purpose of this report is to analyze the 10 year surface hydrology and determine design flows at key points of concentration. An underground storm drain system is proposed to convey the flows to facilities that will pump the storm flows into existing San Joaquin Irrigation District (SSJID) irrigation laterals.

- The proposed storm system north of the SR120/McHenry intersection (crossroads), is designed as being tributary to the existing Escalon/Bellota Pump Station located north of Yosemite Avenue, adjacent to the high school football field. Improvements and upgrades are proposed for the existing pump station but are not discussed in this report. The pump station pumps the storm flows into the existing SSJID Lateral "B", and relies on a proposed detention basin off Arthur Road to provide additional storage volume. The proposed basin is Basin 5 per the Master Storm Drainage Plan of Escalon, dated May 23, 1977, revised July, 1978, (Master Plan). The tributary area north of the crossroads includes a portion of the existing "downtown" system south of the high school, but does not include the existing Main Street system. These two systems are collectively referred to herein as the "Downtown System".

- KORVE was also retained to analyze the existing Downtown System and make recommendations with regard to the upsizing of pipes or the addition of storm inlets to properly convey runoff and reduce the potential of flooding from the 10 year storm event. The Downtown System connects to the proposed McHenry Avenue system at the intersection of Yosemite Avenue and is therefore an integral part of the analysis of the ultimate system. This analysis is in a separate memorandum dated January, 1997.

- The proposed storm system(s) south of the crossroads is primarily designed as being tributary to the south pump station, located on the west side of McHenry Avenue south of Catherine Street. The area bordered by California Street and the BNSFRR tracks to the north and east, Roosevelt Avenue to the south, and midway between Fisk Avenue and Irwin Avenue to the west, herein referred to as the "southern subdivision," was analyzed for inclusion into the proposed system. This area has been subject to flooding in the past, and currently drains into a 30" pipe west of McHenry Avenue that connects to the south pump station. A map of this area is in Appendix A.

METHODOLOGY

General Formula	Rational Method per City Imp. Std. D1
Return Frequency	10 Year
Intensity/Duration Curve	City of Escalon Imp.. Std. D2, 10 Year
Runoff Coefficients	City of Escalon Imp.. Std. D1
Minimum Inlet Time	10 Minutes
Land Use	City General Plan, Land Use Diagram by Lew-Garcia-Davis
Hydraulics	Open Channel Flow, Manning's Equation, with n=0.013
Minimum Velocity	2 Feet per Second

PROPOSED SYSTEM.

Attached is a Hydrology Map that defines the hydrological subareas, and depicts the proposed pipe layout. Hydrological and hydraulic calculations are included in Appendix A and the City criteria is included in Appendix D. Pipe systems are lettered so they may easily be cross referenced between the calculation sheets and the Hydrology Map.

The downtown system routing was revised so that lines C,D,E,F, and H flow to the south pond, rather than to the pump station north of Yosemite Street. Routing these areas in this manner reduced the size of the north detention basin, and reduced the need to upsize more pipes in the downtown area.

Both the north and south systems were analyzed using the Los Angeles County Flood Control District Water Surface Pressure Gradient (WSPG) hydraulic analysis program. The results are shown in Appendix B. With both pumps keeping up with the design flows, the underground system remains self-contained. If the pumps are overloaded, storage is provided by the north and south detention basins, with an interconnect between the two systems, as described below.

Spread calculations were done on McHenry Avenue, State Route 120, and Escalon-Bellota Road. Per the calculations in Appendix B, the spread during the 10-year storm on State Route 120 does not go beyond the outer lane half-width. On McHenry Avenue and Escalon-Bellota Road, the design flow spreads to allow one travel lane in each direction.

Detention Basin Sizing

The required detention basin capacity was determined by using the City of Escalon Standard D3. The calculations are in Appendix C. The areas included in the calculation were the entire area of the hydrology map, and the southern subdivision. The project area requires 15.6 Ac-Ft of capacity, and the southern subdivision requires 11.4 Ac-Ft for a total required capacity of 27.0 Ac-Ft.

The plans divide the capacity geographically: the north pond serves lines A,B,J,N, and P (required capacity=6.2 Ac-Ft), and the south pond serves lines C,D,E,F,G,H (required capacity=9.4 Ac-Ft), and, potentially, the southern subdivision (required capacity=11.4 Ac-Ft). The proposed north pond, with 3:1 side slopes and 10'-wide perimeter road, has a design capacity of 5.9 Ac-Ft, and the south pond has a design capacity of 21.3 Ac-Ft if 3:1 side slopes and a 12'-wide perimeter road are used. **Since the north and south pond are connected by the proposed pipe crest in McHenry Avenue near the intersection of McHenry Avenue and SR120, the excess capacity of the south pond will store the excess volume from the north.** The total design capacity, 27.2 Ac-Ft, exceeds the required capacity, but will require design exceptions from the city, since the proposed pond designs vary from the city standard.

Southern Subdivision Interconnection

At the direction of the City, KORVE investigated the interconnection of the southern subdivision to the proposed system. The analysis of the southern subdivision runoff indicates that the existing pipes underneath First Street are inadequate to convey the 10-year flows at their current size and slope.

After reaching these conclusions, Korve Engineering, Inc. was directed by the City to design an additional 24" pipe parallel to the existing 15" pipe under the railroad tracks between Daniels Street and McHenry Avenue, and an interconnection between the existing 30" McHenry Avenue storm drain, and the proposed 42" McHenry Avenue storm drain. **These improvements will not bring relief to the storm drain system that is upstream from the First Street/McHenry Avenue intersection due to inadequate pipe sizes and slopes upstream from the intersection.**

North -South Overflow Connection

If the south pump station were to fail, the runoff will back up into the south pond. The maximum water surface elevation for the south pond is 33.809m based an a high point pipe connection to the north, approximately 50m north of the McHenry Avenue/SR120 intersection. Once the water surface reaches this elevation, it will spill over into the north pipe system. This limiting elevation is below the lowest grate elevation in the system.

Similarly, the maximum water surface for the north pond is 33.809m. Should the north pump station fail, water will back up into the north pond until it reaches this elevation, where it will spill to the high point pipe connection to the south. Should both pumps fail, the entire system (ponds and pipes) has enough capacity to retain the design storm based on the city basin sizing standards. In the event of a larger storm, the ponded water will overflow the north pond banks (el.=34.460m).

The existing Sunrise Terrace Basin and storm drain system at the north end of the project was designed with a slide gate at the Miller Ave/Escalon-Bellota Road intersection. The slide gate must be closed for the basin to reach its design water surface elevation of 34.746m (114.0'). With the slide gate open, the Sunrise Terrace Basin would empty through its outlet structure at an elevation of 32.917m (108.0'), and would enter the storm drain system proposed as part of this project. The storage volume of the Sunrise Terrace Basin (4.25 Ac-Ft) cannot be contained in either the proposed north or south pond, and the additional flows would spill over the banks of the north pond (berm elev=34.460m). For this reason, we recommend that the slide gate remain closed. If, in the event of a major storm, the City Engineer determines that the water surface in the Sunrise Terrace Basin may threaten the adjacent homes, he could then decide that it is more desirable to overflow the proposed north pond banks, and open the slide gate to provide the necessary relief.

APPENDIX A

Hydrology / Hydraulic Report
For
McHenry Avenue /SR 120 Improvement Project

May, 1998

STORM DESIGN SHEET

Exist. from "A1" to Yosmite/Escalon-Bellota Rd, & Drainage System #2 to North Pump Station

Beginning Design Data: Assumed Time to Inlet: 23

Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (i)	Q cfs (CiA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
A1	10.67	0.42	4.48	4.48	1.41	6.32	21	0.0027	443	1.14	3.82	1.9	24.9	
A2	1.11	0.48	0.53	5.01	1.34	6.71	21	0.0025	108	1.23	3.73	0.5	25.4	
												Tmin=	23.2	
B1	3.43	0.42	1.44	1.44	1.4	2.02	15	0.0025	236	0.71	2.8	1.4	24.6	
													25.4	
A3 (confluence of A & B)				6.45	1.33	8.58	24	0.0025	285	1.3	3.97	1.2	26.6	Used next higher-sized pipe instead of existing
A4	3.69	0.55	2.03	8.48	1.29	10.94	21	0.0077	561	1.16	6.5	1.4	28	
A5	3.61	0.52	1.88	10.36	1.25	12.95	21	0.0076	264	1.33	6.6	0.7	28.7	
A6	1.68	0.47	0.79	11.15	1.23	13.71	21	0.0076	42	1.42	6.57	0.1	28.8	
												Tmin=	10	
J1	0.57	0.86	0.49	1.22	2.13	2.6	30	0.01	46	0.43	4.7	0.2	10.2	
													28.8	
A7 (confluence of A & J)				12.37	1.23	15.22	30	0.0025	129	1.6	4.59	0.5	29.3	
A8	0.96	0.86	0.82	13.19	1.22	16.09	30	0.0025	212	1.65	4.68	0.8	30.1	
A9	5.85	0.59	3.45	16.64	1.2	19.97	30	0.0124	330	1.15	9.06	0.6	30.7	
A10 (confl.of A and N)	0.70	0.9	0.63	22.88	1.18	27	36	0.0025	-------->> To North Pump Station					

STORM DESIGN SHEET

Drainage System #3, #8

Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (i)	Q cfs (CiA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
								Beginning Design Data: Assumed Time to Inlet:					10	
N1	0.92	0.9	0.83	0.83	2.13	1.77	12	0.0025	64	0.81	2.6	0.4	10.4	
N2	1.63	0.9	1.47	2.3	2.1	4.83	18	0.0025	577	1.13	3.4	2.8	13.2	
N3	2.27	0.67	1.52	3.82	1.89	7.22	24	0.0025	73	1.16	3.82	0.3	13.5	
N4	1.98	0.7	1.38	5.2	1.87	9.72	24	0.0025	422	1.42	4.07	1.7	15.2	
N5	0.45	0.9	0.41	5.61	1.76	9.87	24	------>>To	North Pump Station					
												Tmin=	10	
P1	0.83	0.9	0.75	0.85	2.13	1.81	12	0.02	10	0.41	5.97	0	------>>To	North Pond

Korve Engineering

SUBJECT: FIRST ST./McHENRY AVE. — EXIST. CONDITION | JOB NUMBER: 195068x1
SHEET NUMBER ____ OF ____
MADE BY: MG | DATE ____ | CHECKED BY ____ | DATE ____

"SOUTHERN SUBDIVISION" CALCULATIONS

PER STORM DESIGN SHEET, THIS AREA PRODUCES A COMBINED DISCHARGE Q = 54.63 CFS (10-yr STORM)

EXIST. 30" LINE, INV. @ PUMP STATION = 29.43 m = **96.56'**

PER CITY DWG #388 (SU-11), FRENCH CAMP RD/FARMINGTON RD. INTERSECTION, MANHOLE "A" INV. = **107.15**

APPROX. PIPE LENGTH = 4710.019 - 3579.45 = **1130.57 m**
= **3709.4'**

$$\text{PIPE SLOPE} = \frac{107.15 - 96.56}{3709.4'} = \underline{.0028}$$

PER MANNINGS EQUATION, MAX. DISCHARGE FOR 30" PIPE @ S = 0.0028 = **23.35 CFS**

TO CONVEY 54.63 CFS @ S = 0.0028 REQUIRES 42" PIPE.

OVERFLOW IS ∴ 54.63 - 23.35 = **31.28 CFS**

IF THIS OVERFLOW WERE ADDED TO PROPOSED DRAINAGE SYSTEM ⟨1⟩ AT NODE E9, TOTAL Q AT THAT POINT WOULD BE 34.68 + 31.28 = **65.96 CFS**

AND WOULD REQUIRE 48" PIPE FROM THAT POINT SOUTH.

STORM DESIGN SHEET

Drainage Systems 1,4,5,6

Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (i)	Q cfs (CiA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
								Beginning Design Data: Assumed Time to Inlet:					18.3	
C1	2.43	0.57	1.39	1.39	1.6	2.22	12	0.0036	285	0.85	3.12	1.5	19.8	
												Tmin=	18.3	
D1	1.74	0.57	0.99	0.99	1.6	1.58	12	0.0025	121	0.73	2.57	0.8	19.1	
													19.8	
C2 (Confl. of C & D)	3.87	0.57	2.21	4.59	1.53	7.02	18	0.0073	279	0.99	5.67	0.8	20.6	
C3	0.84	0.54	0.45	5.04	1.5	7.56	21	0.0056	262	1.02	5.23	0.8	21.4	
												Tmin=	10	
H1	0.31	0.9	0.28	0.28	2.13	0.6	18	0.01	313	0.24	3.29	1.6	11.6	
													21.4	
H2 (Confl. of C and H)	3.10	0.9	2.79	8.11	1.47	11.92	24	0.0025	127	1.74	4.11	0.5	21.9	
												Tmin=	18.6	
E1	6.33	0.59	3.73	3.73	1.59	5.93	21	0.0025	463	1.12	3.65	2.1	20.7	
E2	3.41	0.9	3.07	6.8	1.5	10.2	24	0.0025	292	1.48	4.09	1.2	21.9	
												Tmin=	10	
F1	1.95	0.9	1.76	1.76	2.13	3.75	12	0.0277	166	0.57	8.11	0.3	10.3	
												Tmin=	21.9	
E3 (Confl. of E & F)	0.52	0.9	0.47	9.03	1.45	13.09	27	0.0025	351	1.58	4.4	1.3	23.2	
E4	3.48	0.9	3.13	12.16	1.4	17.02	30	0.0025	190	1.73	4.71	0.7	23.9	
E5 (Confl. of E & H)	1.18	0.9	1.06	20.72	1.38	28.59	36	0.0025	294	2.13	5.33	0.9	24.8	
												Tmin=	10	
G1	0.43	0.9	0.39	0.39	2.13	0.83	18	0.0065	137	0.32	3.08	0.7	10.7	
G2	0.92	0.9	0.83	1.22	2.07	2.53	18	0.0085	72	0.51	4.77	0.3	11	
G3	1.70	0.9	1.53	2.75	2.05	5.64	18	0.0046	460	1.01	4.48	1.7	12.7	
												Tmin=	24.8	
E6 (Confl. of E & G)	0.18	0.9	0.16	23.63	1.35	31.9	36	0.002	217	2.73	4.72	0.8	25.6	
E7	0.22	0.9	0.19	23.82	1.32	31.44	36	0.002	373	2.61	4.82	1.3	26.9	
E8	0.59	0.9	0.53	24.35	1.28	31.17	36	0.002	481	2.58	4.82	1.7	28.6	
E9	2.39	0.9	2.15	26.5	1.24	32.86	36	0.0025	368	2.4	5.42	1.1	29.7	
E10	1.30	0.9	1.17	27.67	1.21	33.48	36	0.0025	964	2.46	5.4	3	32.7	
E11	3.16	0.9	2.85	30.52	1.14	34.79	42	0.0015	502	2.56	4.62	1.8	34.5	
E12	1.13	0.9	1.01	31.53	1.1	34.68	42	0.0015	514	2.56	4.61	1.9	36.4	
E13	2.68	0.9	2.41	32.93	1.1	36.22	42	0.0012	417	3.01	4.11	1.7	38.1	
E14	0.16	0.9	0.14	33.07	1.03	34.06	42	0.0012	122	2.77	4.18	0.5	38.6	
E15	1.56	0.9	1.4	34.47	1.02	35.16	42	0.0012	912	2.87	4.16	3.7	42.3	
E16	1.69	0.9	1.52	35.99	0.96	34.55	42	0.0012	9	2.84	--->>TO SOUTH PUMP STA			

STORM DESIGN SHEET

Area at First St/McHenry Intersection. To find added capacity for south pond

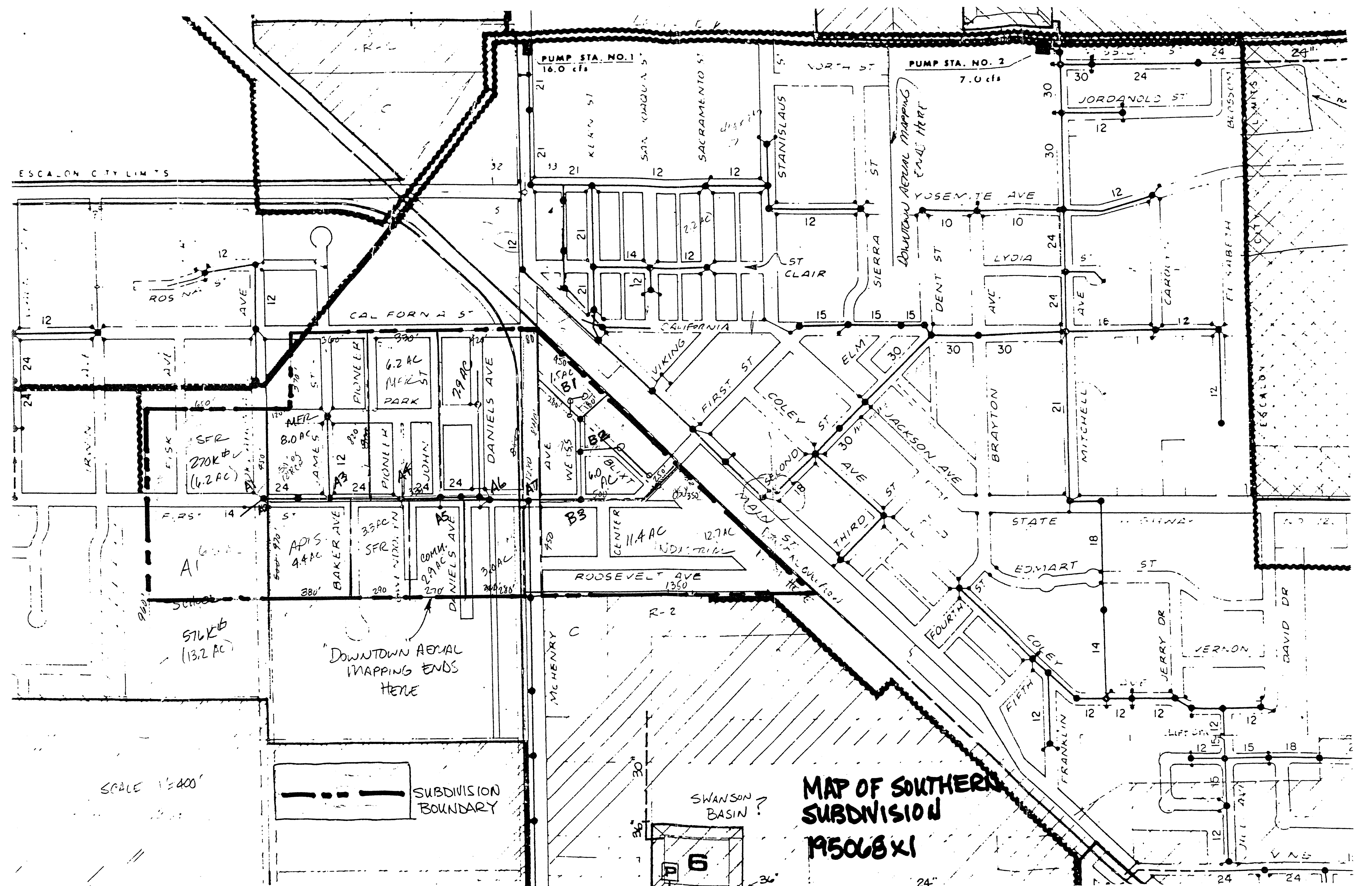
Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (I)	Q cfs (CIA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
								Beginning Design Data: Assumed Time to Inlet:					25	
A1 (SFR)	6.20	0.35	2.17	2.17	1.34	2.91	12	0.01	50	0.68	5.12	0.2	25.2	
A2 (School & Apts)	11.00	0.5	5.5	7.67	1.34	10.28	24	0.005	300	1.16	5.44	0.9	26.1	Slope is greater than exist
A3 (MFR)	8.00	0.5	4	11.67	1.31	15.29	24	0.01	350	1.2	7.77	0.8	26.9	Slope is greater than exist
A4 (MFR & SFR)	9.50	0.45	4.28	15.95	1.28	20.42	24	0.01	180	1.48	8.19	0.4	27.3	Slope is greater than exist
A5 (Commercial)	2.90	0.9	2.61	18.56	1.27	23.57	24	0.0125	250	1.52	9.2	0.5	27.8	Slope is greater than exist
A6 (MFR & Industrial)	10.9	0.6	6.54	25.1	1.26	31.63	24	0.0225	182	1.52	12.35	0.2	28	Slope is greater than exist
A7 (street)	2.40	0.9	2.16	27.26										
												Tmin=	10	
B1(Commercial)	1.5	0.9	1.35	1.35	2.13	2.88	15	0.005	270	0.71	3.99	1.1	11.1	
B2 (Commercial)	6	0.9	5.4	6.75	2.04	13.77	24	0.005	240	1.42	5.77	0.7	11.8	
B3 (Industrial)	11.4	0.85	9.69	16.44	1.99	32.72	24	0.005	250	2	10.42	0.4	12.2	
													28	
Confluence of A & B				43.7	1.25	54.63	30	0.0175	250	2.05	12.68	0.3	28.3	
									---------->>	To South Pump Station				

STORM DESIGN SHEET

Drainage Systems 1,4,5,6 and First St/McHenry Subdivision

Beginning Design Data: Assumed Time to Inlet: 18.3

Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (i)	Q cfs (CiA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
C1	2.43	0.57	1.39	1.39	1.6	2.22	12	0.0036	285	0.85	3.12	1.5	19.8	
												Tmin=	18.3	
D1	1.74	0.57	0.99	0.99	1.6	1.58	12	0.0025	121	0.73	2.57	0.8	19.1	
													19.8	
C2 (Confl. of C & D)	3.87	0.57	2.21	4.59	1.53	7.02	18	0.0073	279	0.99	5.67	0.8	20.6	
C3	0.84	0.54	0.45	5.04	1.5	7.56	21	0.0056	262	1.02	5.23	0.8	21.4	
												Tmin=	10	
H1	0.31	0.9	0.28	0.28	2.13	0.6	18	0.01	313	0.24	3.29	1.6	11.6	
													21.4	
H2 (Confl. of C and H)	3.10	0.9	2.79	8.11	1.47	11.92	24	0.0025	127	1.74	4.11	0.5	21.9	
												Tmin=	18.6	
E1	6.33	0.59	3.73	3.73	1.59	5.93	21	0.0025	463	1.12	3.65	2.1	20.7	
E2	3.41	0.9	3.07	6.8	1.5	10.2	24	0.0025	292	1.48	4.09	1.2	21.9	
												Tmin=	10	
F1	1.95	0.9	1.76	1.76	2.13	3.75	12	0.0277	166	0.57	8.11	0.3	10.3	
												Tmin=	21.9	
E3 (Confl. of E & F)	0.52	0.9	0.47	9.03	1.45	13.09	27	0.0025	351	1.58	4.4	1.3	23.2	
E4	3.48	0.9	3.13	12.16	1.4	17.02	30	0.0025	190	1.73	4.71	0.7	23.9	
E5 (Confl. of E & H)	1.18	0.9	1.06	20.72	1.38	28.59	36	0.0025	294	2.13	5.33	0.9	24.8	
												Tmin=	10	
G1	0.43	0.9	0.39	0.39	2.13	0.83	18	0.0065	137	0.32	3.08	0.7	10.7	
G2	0.92	0.9	0.83	1.22	2.07	2.53	18	0.0085	72	0.51	4.77	0.3	11	
G3	1.70	0.9	1.53	2.75	2.05	5.64	18	0.0046	460	1.01	4.48	1.7	12.7	
												Tmin=	24.8	
E6 (Confl. of E & G)	0.18	0.9	0.16	23.63	1.35	31.9	36	0.0025	214	2.34	5.39	0.7	25.5	
E7	0.22	0.9	0.19	23.82	1.33	31.68	36	0.0025	386	2.31	5.42	1.2	26.7	
E8	2.98	0.9	2.69	26.51	1.29	34.2	36	0.0025	481	2.52	5.4	1.5	28.2	
E9	1.36	0.9	1.23	52.77	1.25	65.96	48	0.0025	1188	3.00	6.52	3.00	31.2	Added in First St./McHenry Subdivision
E10	3.99	0.9	3.59	56.36	1.17	65.94	48	0.0025	930	3.00	6.52	2.4	33.6	
E11	3.00	0.9	2.7	59.06	1.12	66.15	48	0.0025	366	3.00	6.54	0.9	34.5	
E12	0.80	0.9	0.72	59.78	1.1	65.76	48	0.0025	627	3.00	6.5	1.6	36.1	
E13	2.10	0.9	1.89	60.95	1.1	67.05	48	0.0025	---------->> To South Pump Station					


MAP OF SOUTHERN SUBDIVISION
195068X1
SUBDIVISION BOUNDARY
SCALE 1"=400'
"DOWNTOWN AERIAL MAPPING ENDS HERE"
DOWNTOWN AERIAL MAPPING ENDS HERE
PUMP STA. NO. 1
16.0 cfs
PUMP STA. NO. 2
7.0 cfs
ESCALON CITY LIMITS
YOSEMITE AVE
CALIFORNIA ST
CALIFORNIA
FIRST ST
MAIN ST
ROOSEVELT AVE
STATE HIGHWAY
DANIELS AVE
PIONEER
BAKER AVE
MCHENRY
STANISLAUS
SIERRA
SACRAMENTO ST
ST CLAIR
VIKING
COLEY ST
ELM
JACKSON AVE
THIRD
FOURTH ST
FIFTH
BRAYTON
MITCHELL
LYDIA
JORDANOLD ST
EDMART ST
JERRY DR
DAVID DR
VERNON
FRANKLIN
CENTER
SWANSON BASIN?
SFR 270K
(6.2 AC)
APTS 4.4 AC
MFR 8.0 AC
6.2 AC MFR PARK
COMM. 2.9 AC
11.4 AC
12.7 AC INDUSTRIAL
6.0 AC
SCHOOL
516K
(13.2 AC)
A1
A3
A4
A5
A6
A7
B1
B2
B3
R-2
C
P
6

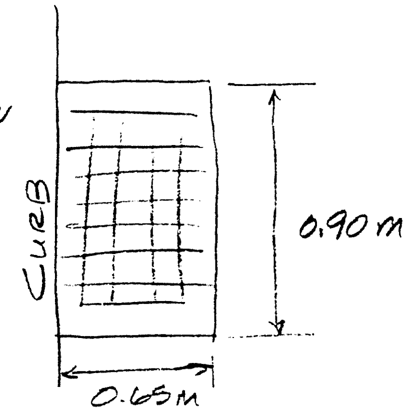
APPENDIX B

Hydrology / Hydraulic Report
For
McHenry Avenue /SR 120 Improvement Project

May, 1998

Korve Engineering

SUBJECT INLET CAPACITY CALCULATIONS JOB NUMBER 195068X0
TYPE GO INLET W/GUTTER DEP. SHEET NUMBER 1 OF 2
MADE BY MG DATE 8/19/97 CHECKED BY ______ DATE ______



CHECK IF INLET IS UNDER WEIR FLOW OR ORIFICE FLOW.

INLET: CALTRANS TYPE GO

① WEIR EQ. $Q = 1.66 P d^{3/2}$

② ORIFICE EQ. $Q = CA\sqrt{2gh}$

"d" and "h" are ponded water surface heights.

DESIGN Q: WORST CASE PER DESIGN STORM: E4-1 WITH 2.25"/HR. RAINFALL.

$$Q = CIA = (0.9)(2.25)(3.48) = 7.05 \text{ CFS} = 0.200 \frac{m^3}{s}$$

EQ. ① $Q = 1.66 P d^{3/2}$ $\qquad P = 0.65 + 0.65 + 0.90 = 2.2\ m$

$$d = \left(\frac{Q}{1.66 P}\right)^{2/3} = \left(\frac{0.200}{(1.66)(2.2)}\right)^{2/3} = \underline{0.144\ m}$$

EQ. ② $Q = CA\sqrt{2gh}$ $\qquad C = 0.67 \qquad A = \frac{1}{2}(0.9 \times 0.65) = 0.29\ m^2$

(ASSUME GRATE TAKES UP HALF)

$$h = \left(\frac{Q}{CA}\right)^2 \times \frac{1}{19.6} = \left[\frac{0.20}{(.67)(.29)}\right]^2 \times \frac{1}{19.6} = 0.054\ m$$

∴ ACTS AS WEIR PONDED HEIGHT IS BELOW TC (TC = FE + .150 m).

PER REPORT HEC No. 12 FHWA-TS-84-202 from FHA (3/84) COMB. INLETS IN SAGS ACTING AS WEIR HAVE INTERCEPTION CAPACITY EQUAL TO GRATE INLET ALONE. PER EQ. 1.

ASSUMING COMPLETE CLOGGING OF THE GRATE, INLET WILL BEHAVE AS A CURB OPENING INLET.

$$Q = 1.25(L + 1.8W)d^{3/2}$$

L = LENGTH OF CURB OPENING = 0.9 m

W = WIDTH OF GUTTER DEPRESSION = 1.2 m

$Q = 0.200 \frac{m^3}{s}$

$$\therefore 0.200 = 1.25(0.9 + (1.8 \times 1.2))d^{3/2}$$

$$\left(\frac{0.200}{3.825}\right)^{2/3} = d = 0.140 \text{ m}$$, still below curb.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
HEC No. 12 FHWA-TS-84-202		

4. Title and Subtitle	5. Report Date
Drainage of Highway Pavements	March 1984
	6. Performing Organization Code
	8. Performing Organization Report No.

7. Author(s)
Frank L. Johnson and Fred F.M. Chang

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Dye Engineering, Inc Centreville, Virginia 22020	11. Contract or Grant No.
	13. Type of Report and Period Covered

12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code
Federal Highway Administration Office of Implementation Engineering & Highway Operations McLean, Virginia 22101	

15. Supplementary Notes

COTR: John M. Kurdziel
Technical Assistance: Stanley Davis, Daniel O'Connor, and Robert Baumgardner (HNG-31)

16. Abstract

This edition of Hydraulic Engineering Circular No. 12 incorporates new design charts and procedures developed from laboratory tests of interception capacities and efficiencies of highway pavement drainage inlets. A chart for the solution of the kinematic wave equation for overland flow and a new chart for the solution of Manning's equation for triangular channels are provided. Charts and procedures for using the charts are provided for 7 grate types, slotted drain inlets, curb-opening inlets, and combination inlets on grade and in sump locations. Charts, tables, and example problem solutions are included in the text where introduced and discussed.

The text includes discussion of the effects of roadway geometry on pavement drainage; the philosophy of design frequency and design spread selection; storm runoff estimating methods; flow in gutters; pavement drainage inlets, factors affecting capacity and efficiency, and comparisons of interception capacity; median inlets; embankment inlets; and bridge deck inlets. Five appendixes are included with discussion of the development of rainfall intensity-duration-frequency curves and equations, mean velocity in a reach of triangular channel with unsteady flow, the development of gutter capacity curves for compound and parabolic roadway sections, and the development of design charts for grates of specific size and bar configuration.

17. Key Words	18. Distribution Statement
Pavement drainage inlets, inlet interception capacity, inlet efficiency, runoff, gutter flow spread, frontal flow, side flow bypass	This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	151	

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8.0 INTERCEPTION CAPACITY OF INLETS IN SAG LOCATIONS

Inlets in sag locations operate as weirs under low head conditions and as orifices at greater depths. Orifice flow begins at depths dependent on the grate size, the curb opening height, or the slot width of the inlet, as the case may be. At depths between those at which weir flow definitely prevails and those at which orifice flow prevails, flow is in a transition stage. At these depths, control is ill-defined and flow may fluctuate between weir and orifice control. Design procedures adopted for this Circular are based on a conservative approach to estimating the capacity of inlets in sump locations.

The efficiency of inlets in passing debris is critical in sag locations because all runoff which enters the sag must be passed through the inlet. Total or partial clogging of inlets in these locations can result in hazardous ponded conditions. Grate inlets alone are not recommended for use in sag locations because of the tendencies of grates to become clogged. Combination inlets or curb-opening inlets are recommended for use in these locations.

8.1 Grate Inlets

A grate inlet in a sag location operates as a weir to depths dependent on the bar configuration and size of the grate and as an orifice at greater depths. Grates of larger dimension and grates with more open area, i.e., with less space occupied by lateral and longitudinal bars, will operate as weirs to greater depths than smaller grates or grates with less open area.

The capacity of grate inlets operating as weirs is:

$$Q_i = C_w P d^{1.5} \qquad (17)$$

where: P = perimeter of the grate in ft (m) disregarding bars and the side against the curb
C_w = 3.0 (1.66 for SI)

The capacity of a grate inlet operating as an orifice is:

$$Q_i = C_o A (2gd)^{0.5} \qquad (18)$$

where: C_o = orifice coefficient = 0.67
A = clear opening area of the grate, ft^2 (m^2)
g = 32.16 ft/s^2 (9.80 m/s^2)

Conclusion:

A double 2 x 3-ft grate 50 percent clogged is adequate to intercept the design flow at a spread which does not exceed design spread and spread on the approaches to the low point will not exceed design spread. However, the tendency of grate inlets to clog completely warrants consideration of a combination inlet or curb-opening inlet in a sag where ponding can occur and flanking inlets on the low gradient approaches.

8.2 Curb-Opening Inlets

The capacity of a curb-opening inlet in a sag depends on water depth at the curb, the curb opening length, and the height of the curb opening. The inlet operates as a weir to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage.

Spread on the pavement is the usual criterion for judging the adequacy of pavement drainage inlet design. It is also convenient and practical in the laboratory to measure depth at the curb upstream of the inlet at the point of maximum spread on the pavement. Therefore, depth at the curb measurements from experiments coincide with the depth at curb of interest to designers. The weir coefficient for a curb-opening inlet is less than the usual weir coefficient for several reasons, the most obvious of which is that depth measurements from experimental tests were not taken at the weir, and drawdown occurs between the point where measurements were made and the weir.

The weir location for a depressed curb-opening inlet is at the edge of the gutter, and the effective weir length is dependent on the width of the depressed gutter and the length of the curb opening. The weir location for a curb-opening inlet that is not depressed is at the lip of the curb opening, and its length is equal to that of the inlet. Limited experiments and extrapolation of the results of tests on depressed inlets indicate that the weir coefficient for curb-opening inlets without depression is approximately equal to that for a depressed curb-opening inlet.

The equation for the interception capacity of a depressed curb-opening inlet operating as a weir is:

$$Q_i = C_w(L + 1.8W)d^{1.5} \quad (19)$$

where: C_w = 2.3 (1.25 for SI)
L = length of curb opening, ft (m)
W = lateral width of depression, ft (m)
d = depth at curb measured from the normal cross slope, ft (m), i.e., $d = TS_x$

The weir equation is applicable to depths at the curb approximately equal to the height of the opening plus the depth of the depression. Thus, the limitation on the use of equation (19) for a depressed curb-opening inlet is:

$$d \leq h + a/12 \quad (d \leq h + a \text{ , SI})$$

where: h = height of curb-opening inlet, ft (m)
a = depth of depression, in (m)

Experiments have not been conducted for curb-opening inlets with a continuously depressed gutter, but it is reasonable to expect that the effective weir length would be as great as that for an inlet in a local depression. Use of equation (19) will yield conservative estimates of the interception capacity.

The weir equation for curb-opening inlets without depression ($W = 0$) becomes:

$$Q_i = C_w L d^{1.5} \qquad (20)$$

The depth limitation for operation as a weir becomes: $d \leq h$

Curb-opening inlets operate as orifices at depths greater than approximately 1.4h. The interception capacity can be computed by equation (21):

$$Q_i = C_o h L (2 g d_o)^{0.5} = C_o A [2g(d_i - \frac{h}{2})]^{0.5} \qquad (21)$$

where: C_o = orifice coefficient
= 0.67
h = height of curb-opening inlet, ft (m)
d_o = effective head on the center of the orifice throat, ft (m)
A = clear area of opening, ft^2 (m^2)
d_i = depth at lip of curb opening, ft (m)
h = height of curb-opening orifice, ft (m)
= $TS_x + a/12$

Equation (21) is applicable to depressed and undepressed curb-opening inlets and the depth at the inlet includes any gutter depression.

8.4 Combination Inlets

Combination inlets consisting of a grate and a curb opening are considered advisable for use in sags where hazardous ponding can occur. The interception capacity of the combination inlet is essentially equal to that of a grate alone in weir flow unless the grate opening becomes clogged. In orifice flow, the capacity is equal to the capacity of the grate plus the capacity of the curb opening.

Equation (17) and Chart 11 can be used for weir flow in combination inlets in sag locations. Assuming complete clogging of the grate, equations (19), (20), and (21) and Charts 12, 13, and 14 for curb-opening inlets are applicable.

Where depth at the curb is such that orifice flow occurs, the interception capacity of the inlet is computed by adding equations (18) and (22):

$$Q_i = 0.67A_g(2gd)^{0.5} + 0.67hL(2gd_o)^{0.5} \qquad (25)$$

where: A_g = clear area of the grate, ft^2 (m^2)
g = 32.16 ft/s/s (9.08 m/s/s)
d = depth at the curb, ft
h = height of curb opening orifice, ft (m)
L = length of curb opening, ft (m)
d_o = effective depth at the center of the curb opening orifice, ft (m)

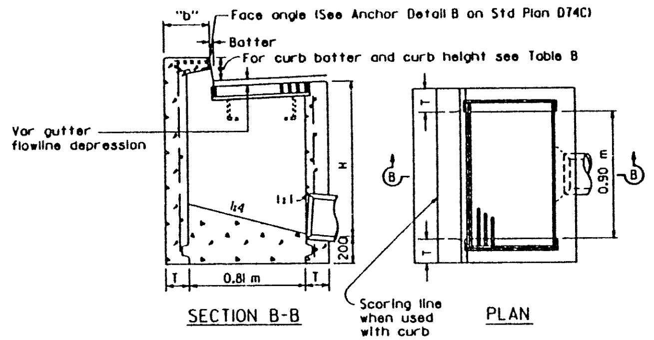
Trial and error solutions are necessary for depth at the curb for a given flow rate using Charts 11, 12 and 13 for orifice flow. Different assumptions for clogging of the grate can also be examined using these charts as illustrated by the following example.

Example 17:

Given: A combination inlet in a sag location.
Grate: P - 1-7/8, 2 x 4 ft
Curb opening: L = 4 ft, h = 4 in
S_x = 0.03

$Q = 5\ ft^3/s$

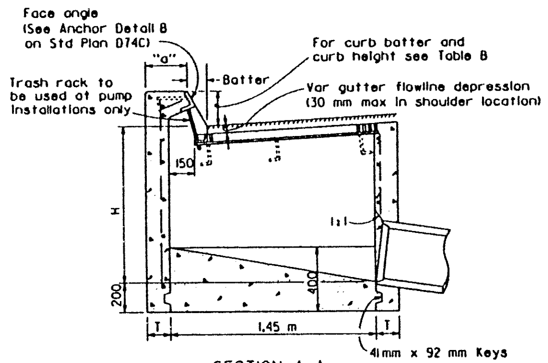
Find: Depth at curb and spread for:
(1) Grate clear of clogging
(2) Grate 100 percent clogged



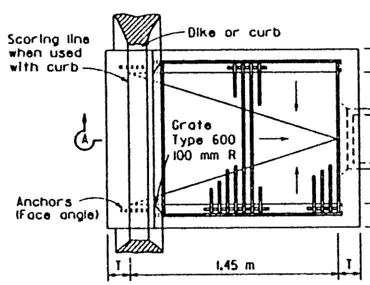
SECTION B-B

PLAN

TYPE GO

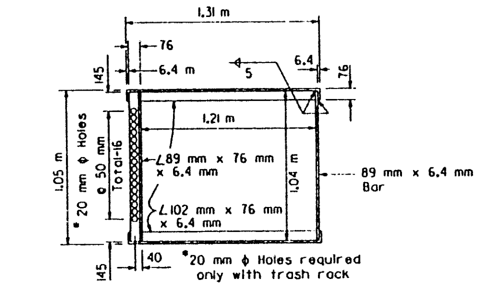


SECTION A-A

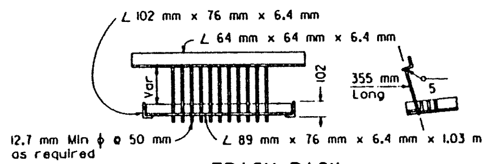


PLAN

TYPE GDO



GRATE FRAME FOR TYPE GDO INLET



TRASH RACK

(For use with pump installation)

TABLE B

CURB TYPE	NORMAL CURB HEIGHT	CURB BATTER	"a" DIMENSION	"b" DIMENSION
A-150	150	40	T+190	T+160
A-200	200	50	T+180	T+150
B	150	100	T+130	T+100
Dike	150	75	T+155	T+125

TABLE A

CONCRETE QUANTITIES

TYPE	H:0.90 m TO 2.50 m (T:150 mm)		H:2.5 m TO 6.00 m (T:200 mm)	
	H=0.90 m (m^3)	ADDITIONAL PCC PER METER (m^3)	H=2.51 m (m^3)	ADDITIONAL PCC PER METER (m^3)
GO	0.91	0.61	2.57	0.86
GDO	1.21	0.80	3.33	1.11

Table based on 200 mm floor slab, no deduction for pipe openings, and curb type giving highest quantity of concrete. No deductions or adjustments are to be made to these quantities because of pipe openings, different floor alternatives or different curb type.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

July 3, 1995
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER G. DeCou No. 14547 Exp. 9-30-95 CIVIL STATE OF CALIFORNIA

NOTES

1. "H" is the difference in elevation between the outlet pipe flow line and the normal gutter grade line undepressed.
2. For "T" wall thickness, see Table A below.
3. Wall reinforcing not required when "H" is 2.5 m or less and the unsupported width or length is 2.1 m or less. Walls exceeding these limits shall be reinforced with #10 bars @ 300 mm± centers placed 40 mm clear to inside of box unless otherwise shown.
4. Inlet bottom reinforcing not required. See Standard Plan D74C for alternative reinforced bottom.
5. Steps - None required where "H" is less than 0.75 m. Where "H" is 0.75 m or more, install steps with lowest rung 300 mm above the floor and highest rung not more than 150 mm below top of inlet. The distance between steps shall not exceed 300 mm and shall be uniform throughout the length of the wall. Place steps in the wall without an opening. Step inserts may be substituted for the bar steps. Step inserts shall comply with State Industrial Safety requirements. See Standard Plan D74C for step details.
6. When shown on the project plans, place a #20 protection bar horizontally across the length of the opening and bend back 100 mm into the inlet wall on each side.
7. Pipe(s) can be placed in any wall.
8. Curb section shall match adjacent curb.
9. Basin floors shall have wood trowel finish and shall slope toward the outlet pipe as shown.
10. Galvanizing - See Standard Specifications or Special Provisions.
11. W = 0.89 m for one grate. Add 1.05 m for additional grates in tandem.
12. See Standard Plan D77A and D77B for grate and frame details and masses of miscellaneous iron and steel.
13. See Standard Plan D78 for gutter depression details.
14. Full penetration butt welds may be substituted for the fillet welds on all anchors.
15. Standard square, hexagon, round or equivalent headed anchors may be substituted for the right angle hooks on the anchors shown on this plan.
16. Cast-in-place or precast alternative is optional with contractor. See Standard Specifications.

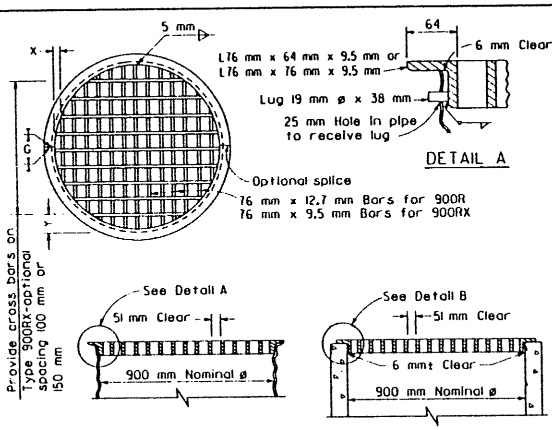
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DRAINAGE INLETS

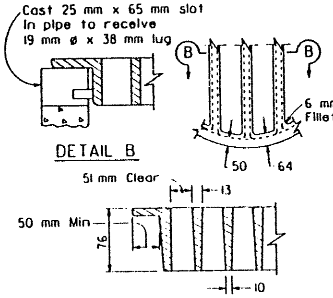
NO SCALE

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

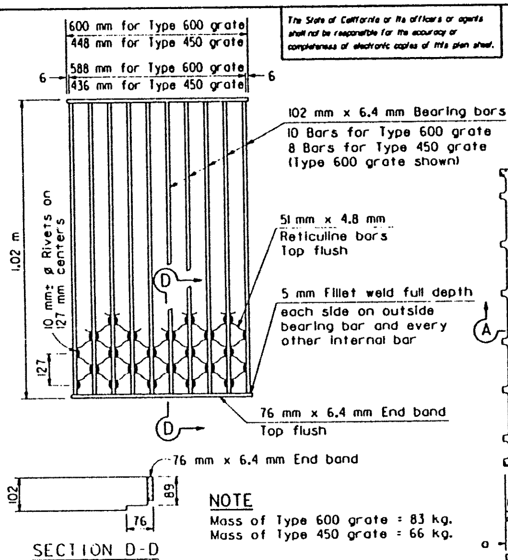
D74B



TYPE 900R & 900RX GRATE DETAILS



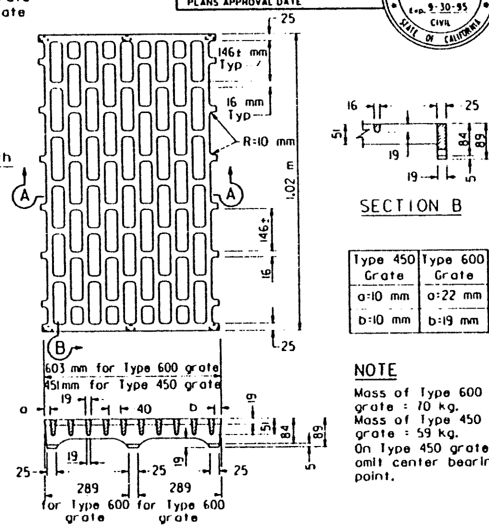
ALTERNATIVE CAST NODULAR IRON GRATE OR CAST STEEL GRATE TYPE 900R & 900RX



NOTE

Mass of Type 600 grate = 83 kg.
Mass of Type 450 grate = 66 kg.

TYPE 450-8S & 600-10S GRATE
(WELDED STEEL)
RETICULINE TYPE

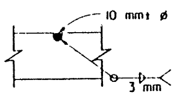


Type 450 Grate	Type 600 Grate
a:10 mm	a:22 mm
b:10 mm	b:19 mm

NOTE

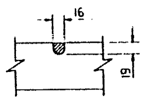
Mass of Type 600 grate = 70 kg.
Mass of Type 450 grate = 59 kg.
On Type 450 grate omit center bearing point.

TYPE 450-8C & 600-10C GRATE
(CAST NODULAR IRON)

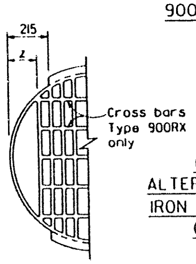


10 mm± ø Cross bars may be fillet welded, resistance welded or electroforged to bearing bars.

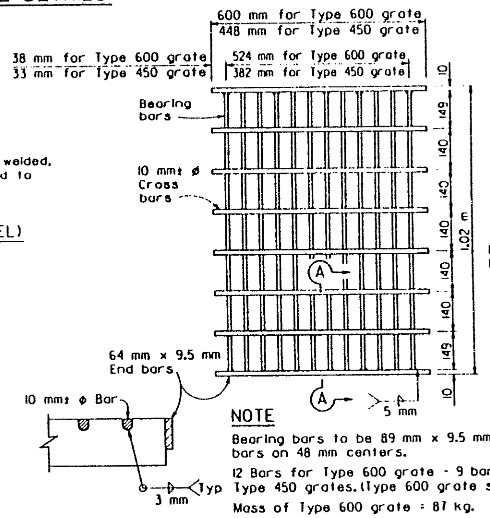
CROSS BAR DETAIL TYPE 900RX GRATE (WELDED STEEL)



CROSS BAR DETAIL ALTERNATIVE CAST NODULAR IRON GRATE OR CAST STEEL GRATE TYPE 900RX



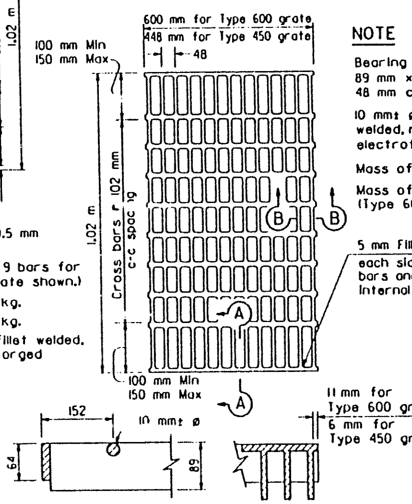
MODIFIED TYPE 900R & 900RX GRATE FOR ODI INLET



NOTE

Bearing bars to be 89 mm x 9.5 mm bars on 48 mm centers.
12 Bars for Type 600 grate - 9 bars for Type 450 grates. (Type 600 grate shown.)
Mass of Type 600 grate = 87 kg.
Mass of Type 450 grate = 66 kg.
10 mm± ø Cross bars may be fillet welded, resistance welded or electroforged to bearing bars.

TYPE 450-9X & 600-12X GRATE
(WELDED STEEL)



NOTE

Bearing bars to be 89 mm x 6.4 mm bars on 48 mm centers.
10 mm± ø Cross bars may be fillet welded, resistance welded or electroforged to bearing bars.
Mass of Type 600 grate = 64 kg.
Mass of Type 450 grate = 49 kg.
(Type 600 grate shown)

5 mm Fillet weld full depth each side on outside bearing bars and on every third internal bearing bar.

TYPE 450-10 & 600-13 GRATE
(WELDED STEEL)

GRATE BAR SPACING TABLE

TYPE	NO. OF BARS	CLEAR BAR SPACING	X (mm)	Y (mm) 100 mm SPACING	Y (mm) 150 mm SPACING	Z (mm)
900R	13	51 mm	54	-	-	-
900RX (Steel)	15	51 mm	14	95	146	-
900RX (Cast)	13	51 mm	54	95	146	-
900R Mod	12	51 mm	54	-	-	127
900RX Mod (Steel)	13	51 mm	14	95	146	144
900RX Mod (Cast)	12	51 mm	54	95	146	127

INLET TYPE	GRATE TYPE	NO. OF GRATES	MASS (kg)
ODI	900RX (Mod)	1	89
GMP, GCP, GCPI	900RX	1	98
ODI	900R (Mod)	1	100
GMP, GCP, GCPI	900R	1	107

BASIS FOR MISC IRON & STEEL FINAL PAY MASSES FOR DRAINAGE INLETS

INLET TYPE	GRATE TYPE	NO. GRATES	MASS (kg)
GDO	600-10C	2	177
	600-10S	2	202
	600-13	2	165
GO,GOL,GI,G2, G3,G4 (TYPE 600)	600-10C	1	92
	600-10S	1	104
	600-12X	1	108
	600-13	1	85
G4 (TYPE 450) G5,G6	450-8S	1	85
	450-9X	1	85
	450-10	1	68
GT-1,GT-2	450-8S	2	170
	450-9X	2	170
	450-10	2	135
GT-3,GT-4	600-10C	2	183
	600-10S	2	208
	600-12X	2	217
	600-13	2	171

NOTES

1. When alternative grates are allowed - Final pay based on alternative with the lesser mass.
2. Seal welding at all surfaces not required when grates are galvanized.
3. Use frame shown on Standard Plan D77A.
4. Either welded steel grate Types 450-10 and 600-13 or Types 450-9X and 600-12X may be used as alternative grates at the Contractor's option.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER

July 3, 1995
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. DeCou No. 14547 Exp. 9-30-95 CIVIL STATE OF CALIFORNIA

Caltrans Metric

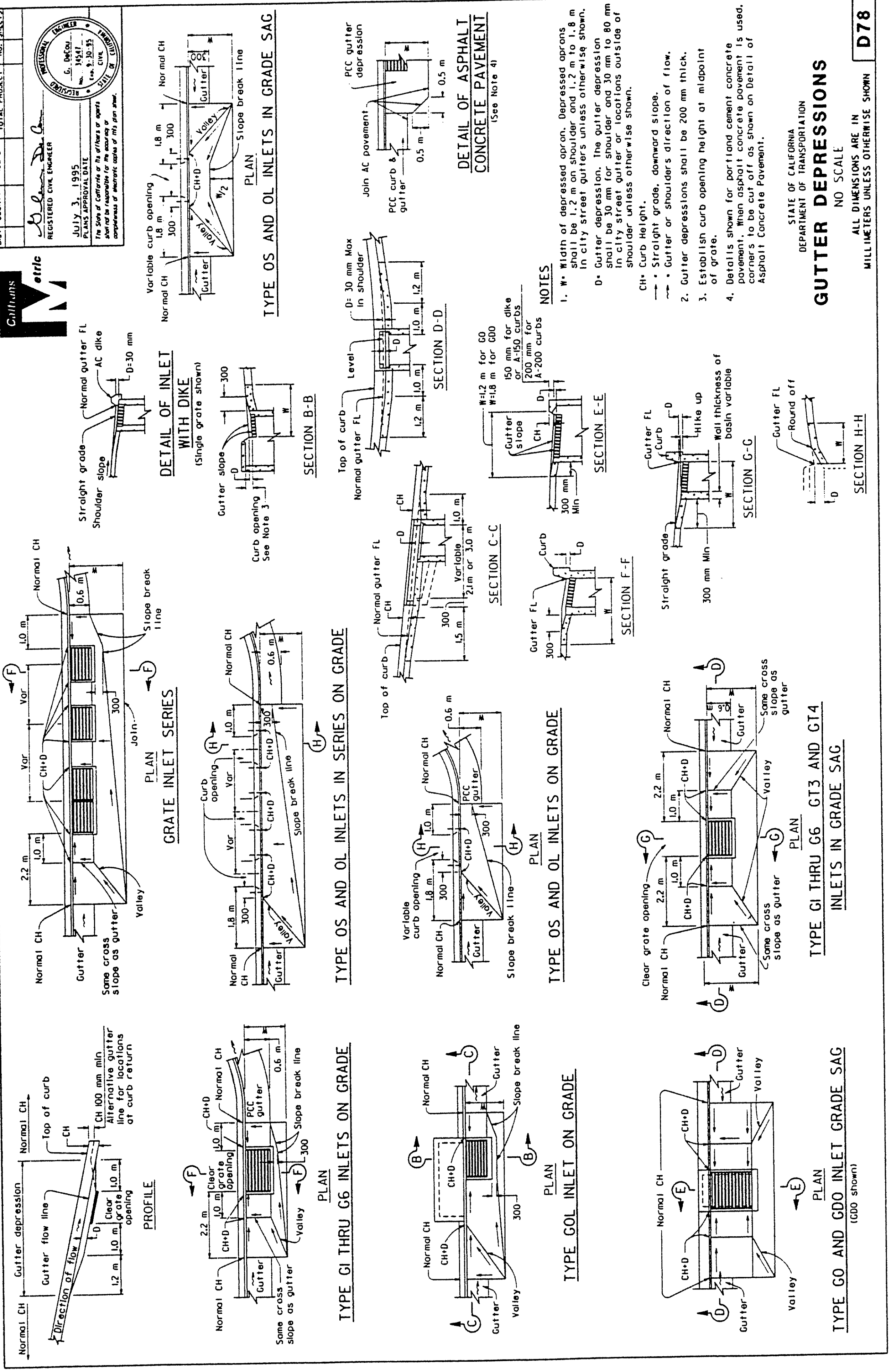
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BICYCLE PROOF GRATE DETAILS

NO SCALE

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

D77B



TYPE GO AND GDO INLET GRADE SAG
(GDO shown)
TYPE GOL INLET ON GRADE
TYPE GI THRU G6 INLETS ON GRADE
PROFILE
TYPE GI THRU G6, GT3 AND GT4 INLETS IN GRADE SAG
TYPE OS AND OL INLETS ON GRADE
TYPE OS AND OL INLETS IN SERIES ON GRADE
GRATE INLET SERIES
TYPE OS AND OL INLETS IN GRADE SAG
DETAIL OF INLET WITH DIKE
(Single grate shown)
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
DETAIL OF ASPHALT CONCRETE PAVEMENT
(See Note 4)
NOTES
1. W= Width of depressed apron. Depressed aprons shall be 1.2 m on shoulder and 1.2 m to 1.8 m in city street gutters unless otherwise shown.
D= Gutter depression. The gutter depression shall be 30 mm for shoulder and 30 mm to 80 mm in city street gutter or locations outside of shoulder unless otherwise shown.
CH= Curb Height.
→ = Straight grade, downward slope.
⇀ = Gutter or shoulders direction of flow.
2. Gutter depressions shall be 200 mm thick.
3. Establish curb opening height at midpoint of grate.
4. Details shown for portland cement concrete pavement. When asphalt concrete pavement is used, corners to be cut off as shown on Detail of Asphalt Concrete Pavement.
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
GUTTER DEPRESSIONS
NO SCALE
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN
D78
REGISTERED CIVIL ENGINEER
July 3, 1995
PLANS APPROVAL DATE

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project 195068x1
T3 Drainage System 1 under normal conditions
SO        .00  90.19  1                                 92.19
R      510.00  91.47  1        .013                                            .00    .00 0
JX     514.00  91.54  1  2   2.015      1.0      1.0 108.36 107.14 90.00 90.00
R     1141.00  93.05  1        .013                                            .00    .00 0
JX    1145.00  93.11  1  2   2.015       .4       .4 108.04 106.91 90.00 90.00
R     1511.00  94.10  1        .013                                            .00    .00 0
JX    1515.00  94.16  1  2   2.015      1.4      1.4 107.37 107.13 90.00 90.00
R     2443.00  96.56  1        .013                                            .00    .00 1
JX    2447.00  97.12  3  2   2.015      1.9      1.9 107.67 107.44 90.00 90.00
R     3635.00 100.24  3        .013                                            .00    .00 2
JX    3639.00 100.31  3  2   2.015       .7       .7 109.21 107.49 90.00 90.00
R     4120.00 101.58  3        .013                                            .00    .00 0
JX    4124.00 101.64  3  2   2.015      1.4      1.4 106.55 104.84 90.00 90.00
R     4510.00 102.68  3        .013                                            .00  10.00 1
JX    4514.00 102.74  3  2    .015       .2          112.33        40.00
R     4728.00 103.29  3        .013                                            .00  10.00 0
WE    4728.00 103.29  4        .500
SH    4728.00 103.29  4                                 105.29
CD    1  4   0     .00   3.50     .00  .00  .00  .00
CD    2  4   0     .00   1.00     .00  .00  .00  .00
CD    3  4   0     .00   3.00     .00  .00  .00  .00
CD    4  3   0     .00  16.12    4.00  .00  .00  .00
Q              24.7   .0
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F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 1 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
.00	90.19	2.000	92.190	38.5	6.78	.713	92.903	.00	1.928		3.50	.00	.00	0	.0
14.80	.00251					.003558	.05			2.290			.00		
14.80	90.23	2.080	92.307	38.5	6.46	.648	92.955	.00	1.928		3.50	.00	.00	0	.0
41.07	.00251					.003148	.13			2.290			.00		
55.87	90.33	2.165	92.496	38.5	6.16	.589	93.085	.00	1.928		3.50	.00	.00	0	.0
131.87	.00251					.002789	.37			2.290			.00		
187.74	90.66	2.256	92.917	38.5	5.87	.536	93.453	.00	1.928		3.50	.00	.00	0	.0
309.28	.00251					.002562	.79			2.290			.00		
497.03	91.44	2.290	93.728	38.5	5.77	.517	94.245	.00	1.928		3.50	.00	.00	0	.0
12.97	.00251					.002501	.03			2.290			.00		
510.00	91.47	2.290	93.760	38.5	5.77	.517	94.277	.00	1.928		3.50	.00	.00	0	.0
JUNCT STR	.01750					.003039	.01						.00		
514.00	91.54	2.369	93.909	36.5	5.27	.431	94.340	.00	1.875		3.50	.00	.00	0	.0
241.05	.00241					.002182	.53			2.240			.00		
755.05	92.12	2.272	94.392	36.5	5.52	.474	94.866	.00	1.875		3.50	.00	.00	0	.0
288.90	.00241					.002353	.68			2.240			.00		
1043.95	92.82	2.240	95.056	36.5	5.61	.489	95.545	.00	1.875		3.50	.00	.00	0	.0
97.05	.00241					.002395	.23			2.240			.00		
1141.00	93.05	2.240	95.290	36.5	5.61	.489	95.779	.00	1.875		3.50	.00	.00	0	.0
JUNCT STR	.01500					.003152	.01						.00		
1145.00	93.11	2.230	95.340	35.7	5.52	.473	95.813	.00	1.854		3.50	.00	.00	0	.0
184.29	.00271					.002479	.46			2.121			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 1 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
1329.29	93.61	2.142	95.750	35.7	5.79	.520	96.270	.00	1.854		3.50	.00	.00	0	.0
181.71	.00271					.002663	.48			2.121			.00		
1511.00	94.10	2.123	96.223	35.7	5.85	.531	96.754	.00	1.854		3.50	.00	.00	0	.0
JUNCT STR	.01500					.002993	.01						.00		
1515.00	94.16	2.306	96.466	32.9	4.89	.372	96.838	.00	1.776		3.50	.00	.00	0	.0
83.58	.00259					.001912	.16			2.041			.00		
1598.58	94.38	2.213	96.589	32.9	5.13	.409	96.998	.00	1.776		3.50	.00	.00	0	.0
108.95	.00259					.002155	.23			2.041			.00		
1707.53	94.66	2.125	96.783	32.9	5.38	.450	97.233	.00	1.776		3.50	.00	.00	0	.0
249.30	.00259					.002434	.61			2.041			.00		
1956.82	95.30	2.042	97.345	32.9	5.65	.495	97.839	.00	1.776		3.50	.00	.00	0	.0
59.01	.00259					.002579	.15			2.041			.00		
2015.83	95.46	2.041	97.496	32.9	5.65	.495	97.992	.00	1.776		3.50	.00	.00	0	.0
392.76	.00259					.002582	1.01			2.041			.00		
2408.58	96.47	2.041	98.512	32.9	5.65	.495	99.007	.00	1.776		3.50	.00	.00	0	.0
HYDRAULIC JUMP													.00		
2408.58	96.47	1.524	97.995	32.9	8.18	1.039	99.034	.00	1.776		3.50	.00	.00	0	.0
2.54	.00259					.006927	.02			2.041			.00		
2411.13	96.48	1.524	98.002	32.9	8.18	1.039	99.041	.00	1.776		3.50	.00	.00	0	.0
10.35	.00259					.007407	.08			2.041			.00		
2421.48	96.50	1.470	97.974	32.9	8.58	1.143	99.117	.00	1.776		3.50	.00	.00	0	.0
10.69	.00259					.008434	.09			2.041			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 1 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
2432.17	96.53	1.418	97.950	32.9	9.00	1.257	99.207	.00	1.776		3.50	.00	.00	0	.0
10.83	.00259					.009608	.10			2.041			.00		
2443.00	96.56	1.369	97.929	32.9	9.44	1.383	99.312	.00	1.776		3.50	.00	.00	0	.0
JUNCT STR	.14000					.009892	.04						.00		
2447.00	97.12	1.747	98.867	29.1	6.81	.721	99.588	.00	1.747		3.00	.00	.00	0	.0
3.00	.00263					.004359	.01			2.126			.00		
2450.00	97.13	1.818	98.946	29.1	6.49	.655	99.601	.00	1.747		3.00	.00	.00	0	.0
12.61	.00263					.003860	.05			2.126			.00		
2462.61	97.16	1.893	99.054	29.1	6.19	.595	99.649	.00	1.747		3.00	.00	.00	0	.0
32.20	.00263					.003423	.11			2.126			.00		
2494.81	97.25	1.973	99.218	29.1	5.90	.541	99.760	.00	1.747		3.00	.00	.00	0	.0
86.98	.00263					.003042	.26			2.126			.00		
2581.80	97.47	2.058	99.532	29.1	5.63	.492	100.024	.00	1.747		3.00	.00	.00	0	.0
297.16	.00263					.002741	.81			2.126			.00		
2878.96	98.25	2.126	100.380	29.1	5.43	.458	100.839	.00	1.747		3.00	.00	.00	0	.0
756.04	.00263					.002618	1.98			2.126			.00		
3635.00	100.24	2.126	102.366	29.1	5.43	.458	102.824	.00	1.747		3.00	.00	.00	0	.0
JUNCT STR	.01750					.003252	.01						.00		
3639.00	100.31	2.173	102.483	27.7	5.05	.396	102.879	.00	1.702		3.00	.00	.00	0	.0
216.22	.00264					.002390	.52			2.044			.00		
3855.22	100.88	2.079	102.960	27.7	5.30	.436	103.396	.00	1.702		3.00	.00	.00	0	.0
264.78	.00264					.002577	.68			2.044			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 1 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
4120.00	101.58	2.048	103.628	27.7	5.39	.451	104.079	.00	1.702		3.00	.00	.00	0	.0
JUNCT STR	.01500					.002897	.01						.00		
4124.00	101.64	2.224	103.864	24.9	4.43	.305	104.169	.00	1.610		3.00	.00	.00	0	.0
77.22	.00269					.001823	.14			1.882			.00		
4201.22	101.85	2.127	103.975	24.9	4.65	.335	104.310	.00	1.610		3.00	.00	.00	0	.0
86.67	.00269					.002041	.18			1.882			.00		
4287.89	102.08	2.036	104.118	24.9	4.87	.369	104.487	.00	1.610		3.00	.00	.00	0	.0
117.39	.00269					.002293	.27			1.882			.00		
4405.29	102.40	1.952	104.350	24.9	5.11	.406	104.756	.00	1.610		3.00	.00	.00	0	.0
104.71	.00269					.002501	.26			1.882			.00		
4510.00	102.68	1.913	104.593	24.9	5.23	.425	105.018	.00	1.610		3.00	.00	.00	0	.0
JUNCT STR	.01500					.003596	.01						.00		
4514.00	102.74	1.843	104.583	24.7	5.42	.457	105.040	.00	1.603		3.00	.00	.00	0	.0
210.58	.00257					.002695	.57			1.902			.00		
4724.58	103.28	1.902	105.183	24.7	5.23	.424	105.607	.00	1.603		3.00	.00	.00	0	.0
3.42	.00257					.002563	.01			1.902			.00		
4728.00	103.29	1.902	105.192	24.7	5.23	.424	105.616	.00	1.603		3.00	.00	.00	0	.0
WALL ENTRANCE													.00		
4728.00	103.29	2.413	105.703	24.7	2.56	.102	105.805	.00	1.058		16.12	4.00	.00	0	.0

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1

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project 195068x1
T3 Drainage System 2 under normal conditions
SO         .00 101.22  1                          101.22
JX        2.00 101.38  1  2   .015       .7       107.10        90.00
R       332.00 105.48  1      .013                                .00    .00 0
JX      336.00 105.58  1  2  2.015      2.1    2.1 107.97 108.01 90.00 90.00
R       548.00 106.11  1      .013                                .00    .00 0
JX      552.00 106.21  1  2   .015      1.0       111.20        90.00
R       681.00 106.53  1      .013                                .00    .00 0
JX      685.00 106.63  1  3   .015     13.1       107.31        90.00
R       731.00 107.09  1      .013                                .00    .00 0
WE      731.00 107.09  4      .500
SH      731.00 107.09  4                          110.07
CD   1  4    0     .00   2.50      .00  .00  .00  .00
CD   2  4    0     .00   1.00      .00  .00  .00  .00
CD   3  4    0     .00   1.75      .00  .00  .00  .00
CD   4  3    0     .00  10.10     4.00  .00  .00  .00
Q                2.6   .0
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F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 2 under normal conditions

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
.00	101.22	1.210	102.430	21.6	9.18	1.308	103.738	.00	1.580		2.50	.00	.00	0	.0
JUNCT STR	.08000					.016566	.03						.00		
2.00	101.38	1.185	102.565	20.9	9.12	1.291	103.856	.00	1.553		2.50	.00	.00	0	.0
137.10	.01242					.012475	1.71			1.185			.00		
139.10	103.08	1.185	104.268	20.9	9.12	1.291	105.560	.00	1.553		2.50	.00	.00	0	.0
34.12	.01242					.012462	.43			1.185			.00		
173.23	103.51	1.186	104.693	20.9	9.11	1.289	105.982	.00	1.553		2.50	.00	.00	0	.0
100.35	.01242					.011702	1.17			1.185			.00		
273.57	104.75	1.231	105.985	20.9	8.69	1.172	107.157	.00	1.553		2.50	.00	.00	0	.0
28.11	.01242					.010302	.29			1.185			.00		
301.69	105.10	1.277	106.381	20.9	8.28	1.065	107.446	.00	1.553		2.50	.00	.00	0	.0
14.21	.01242					.009077	.13			1.185			.00		
315.90	105.28	1.327	106.607	20.9	7.90	.969	107.575	.00	1.553		2.50	.00	.00	0	.0
8.18	.01242					.008004	.07			1.185			.00		
324.08	105.38	1.379	106.760	20.9	7.53	.881	107.641	.00	1.553		2.50	.00	.00	0	.0
4.75	.01242					.007065	.03			1.185			.00		
328.83	105.44	1.433	106.874	20.9	7.18	.800	107.674	.00	1.553		2.50	.00	.00	0	.0
2.44	.01242					.006244	.02			1.185			.00		
331.27	105.47	1.491	106.962	20.9	6.85	.728	107.690	.00	1.553		2.50	.00	.00	0	.0
.73	.01242					.005520	.00			1.185			.00		
332.00	105.48	1.553	107.033	20.9	6.52	.661	107.694	.00	1.553		2.50	.00	.00	0	.0
JUNCT STR	.02500					.004537	.02						.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 2 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
336.00	105.58	2.064	107.644	16.7	3.85	.230	107.875	.00	1.382		2.50	.00	.00	0	.0
101.19	.00250					.001720	.17			1.712			.00		
437.19	105.83	1.962	107.795	16.7	4.04	.254	108.049	.00	1.382		2.50	.00	.00	0	.0
110.01	.00250					.001903	.21			1.712			.00		
547.19	106.11	1.871	107.979	16.7	4.24	.279	108.258	.00	1.382		2.50	.00	.00	0	.0
.81	.00250					.002004	.00			1.712			.00		
548.00	106.11	1.871	107.981	16.7	4.24	.279	108.260	.00	1.382		2.50	.00	.00	0	.0
JUNCT STR	.02500					.002566	.01						.00		
552.00	106.21	1.837	108.047	15.7	4.06	.256	108.303	.00	1.338		2.50	.00	.00	0	.0
104.57	.00248					.001960	.20			1.642			.00		
656.57	106.47	1.757	108.226	15.7	4.26	.282	108.508	.00	1.338		2.50	.00	.00	0	.0
24.43	.00248					.002092	.05			1.642			.00		
681.00	106.53	1.742	108.272	15.7	4.30	.287	108.559	.00	1.338		2.50	.00	.00	0	.0
JUNCT STR	.02500					.001433	.01						.00		
685.00	106.63	2.151	108.781	2.6	.58	.005	108.786	.00	.527		2.50	.00	.00	0	.0
11.35	.01000					.000039	.00			.430			.00		
696.35	106.74	2.037	108.781	2.6	.61	.006	108.787	.00	.527		2.50	.00	.00	0	.0
9.87	.01000					.000043	.00			.430			.00		
706.22	106.84	1.939	108.781	2.6	.64	.006	108.787	.00	.527		2.50	.00	.00	0	.0
8.85	.01000					.000047	.00			.430			.00		
715.07	106.93	1.850	108.781	2.6	.67	.007	108.787	.00	.527		2.50	.00	.00	0	.0
8.08	.01000					.000053	.00			.430			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 2 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
723.16	107.01	1.769	108.780	2.6	.70	.008	108.788	.00	.527		2.50	.00	.00	0	.0
7.46	.01000					.000059	.00			.430			.00		
730.61	107.09	1.694	108.780	2.6	.73	.008	108.788	.00	.527		2.50	.00	.00	0	.0
.39	.01000					.000063	.00			.430			.00		
731.00	107.09	1.690	108.780	2.6	.74	.008	108.788	.00	.527		2.50	.00	.00	0	.0
WALL ENTRANCE													.00		
731.00	107.09	1.703	108.793	2.6	.38	.002	108.795	.00	.236		10.10	4.00	.00	0	.0

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project #195068x1
T3 Drainage System 3 under normal conditions
SO       .00 101.22  1                               101.82
R     706.00 102.99  1       .013                                         .00    .00 0
JX    710.00 103.09  1  2  2.015       .3       .4 111.83 109.14 90.00 90.00
R    1132.00 104.15  1       .013                                         .00    .00 0
JX   1136.00 104.25  1  2   .015      2.5          108.83        90.00
R    1209.00 104.43  1       .013
JX   1213.00 104.93  3  2   .015      2.8          105.63        10.00
R    1790.00 106.48  3       .013                                         .00    .00 1
JX   1794.00 106.58  2  2   .015      2.7          110.00        90.00
R    1858.00 106.74  2       .013                                         .00 70.00 0
WE   1858.00 106.74  4       .500
SH   1858.00 106.74  4                             106.74
CD   1  4   0    .00   2.00     .00  .00  .00  .00
CD   2  4   0    .00   1.00     .00  .00  .00  .00
CD   3  4   0    .00   1.50     .00  .00  .00  .00
CD   4  3   0    .00   6.16    1.50  .00  .00  .00
Q               1.5   .0
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F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project #195068x1
Drainage System 3 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
.00	101.22	1.143	102.363	10.2	5.50	.469	102.832	.00	1.143		2.00	.00	.00	0	.0
1.34	.00251					.004937	.01			1.481			.00		
1.34	101.22	1.189	102.412	10.2	5.24	.426	102.839	.00	1.143		2.00	.00	.00	0	.0
5.28	.00251					.004368	.02			1.481			.00		
6.63	101.24	1.238	102.474	10.2	5.00	.388	102.862	.00	1.143		2.00	.00	.00	0	.0
12.07	.00251					.003871	.05			1.481			.00		
18.69	101.27	1.289	102.556	10.2	4.76	.352	102.909	.00	1.143		2.00	.00	.00	0	.0
24.80	.00251					.003437	.09			1.481			.00		
43.50	101.33	1.344	102.673	10.2	4.54	.320	102.994	.00	1.143		2.00	.00	.00	0	.0
54.22	.00251					.003058	.17			1.481			.00		
97.71	101.46	1.403	102.868	10.2	4.33	.291	103.160	.00	1.143		2.00	.00	.00	0	.0
168.54	.00251					.002729	.46			1.481			.00		
266.26	101.89	1.467	103.355	10.2	4.13	.265	103.620	.00	1.143		2.00	.00	.00	0	.0
274.35	.00251					.002539	.70			1.481			.00		
540.61	102.58	1.481	104.056	10.2	4.09	.260	104.316	.00	1.143		2.00	.00	.00	0	.0
165.39	.00251					.002501	.41			1.481			.00		
706.00	102.99	1.481	104.471	10.2	4.09	.260	104.731	.00	1.143		2.00	.00	.00	0	.0
JUNCT STR	.02500					.003198	.01						.00		
710.00	103.09	1.454	104.544	9.5	3.88	.234	104.778	.00	1.102		2.00	.00	.00	0	.0

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project #195068x1
Drainage System 3 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
282.64	.00251					.002391	.68			1.400			.00		
992.64	103.80	1.400	105.200	9.5	4.04	.254	105.454	.00	1.102		2.00	.00	.00	0	.0
139.36	.00251					.002497	.35			1.400			.00		
1132.00	104.15	1.400	105.550	9.5	4.04	.254	105.804	.00	1.102		2.00	.00	.00	0	.0
JUNCT STR	.02500					.002381	.01						.00		
1136.00	104.25	1.556	105.806	7.0	2.67	.111	105.917	.00	.939		2.00	.00	.00	0	.0
44.96	.00247					.001120	.05			1.141			.00		
1180.96	104.36	1.485	105.845	7.0	2.80	.122	105.967	.00	.939		2.00	.00	.00	0	.0
28.04	.00247					.001223	.03			1.141			.00		
1209.00	104.43	1.442	105.872	7.0	2.89	.129	106.002	.00	.939		2.00	.00	.00	0	.0
JUNCT STR	.12500												.00		
1213.00	104.93	.785	105.715	4.2	4.49	.313	106.028	.00	.785		1.50	.00	.00	0	.0
.84	.00269					.005162	.00			.990			.00		
1213.84	104.93	.816	105.748	4.2	4.28	.284	106.032	.00	.785		1.50	.00	.00	0	.0
3.35	.00269					.004555	.02			.990			.00		
1217.20	104.94	.848	105.789	4.2	4.08	.258	106.047	.00	.785		1.50	.00	.00	0	.0
7.79	.00269					.004023	.03			.990			.00		
1224.98	104.96	.882	105.844	4.2	3.89	.235	106.079	.00	.785		1.50	.00	.00	0	.0
16.68	.00269					.003558	.06			.990			.00		

WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project #195068x1
Drainage System 3 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
1241.67	105.01	.917	105.924	4.2	3.71	.214	106.138	.00	.785		1.50	.00	.00	0	.0
39.94	.00269					.003151	.13			.990			.00		
1281.61	105.11	.955	106.070	4.2	3.54	.194	106.264	.00	.785		1.50	.00	.00	0	.0
162.20	.00269					.002806	.46			.990			.00		
1443.81	105.55	.990	106.540	4.2	3.39	.179	106.719	.00	.785		1.50	.00	.00	0	.0
346.19	.00269					.002649	.92			.990			.00		
1790.00	106.48	.990	107.470	4.2	3.39	.179	107.649	.00	.785		1.50	.00	.00	0	.0
JUNCT STR	.02500					.002961	.01						.00		
1794.00	106.58	1.252	107.832	1.5	1.91	.057	107.888	.00	.519		1.00	.00	.00	0	.0
64.00	.00250					.001773	.11			.700			.00		
1858.00	106.74	1.218	107.958	1.5	1.91	.057	108.015	.00	.519		1.00	.00	.00	0	.0
WALL ENTRANCE													.00		
1858.00	106.74	1.314	108.054	1.5	.76	.009	108.063	.00	.314		6.16	1.50	.00	0	.0

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project 195068x1
T3 Drainage System 4 under normal conditions
SO        .00 106.63  1                                 106.63
R      456.00 108.75  1       .013                                        .00    .00 1
JX     460.00 108.85  1  1    .015     3.1              108.85         20.00
R      517.50 109.34  1       .013                                        .00 90.00 0
JX     520.50 109.43  1       .015
R      658.00 110.33  1       .013                                        .00 90.00 0
WE     658.00 110.33  2       .500
SH     658.00 110.33  2                                 110.33
CD   1  4   0     .00   1.50     .00  .00  .00  .00
CD   2  3   0     .00   5.81    2.13  .00  .00  .00
Q               2.5   .0
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F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 4 under normal conditions

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
.00	106.63	.913	107.543	5.6	4.97	.384	107.927	.00	.913		1.50	.00	.00	0	.0
2.71	.00465					.005685	.02			1.000			.00		
2.71	106.64	.951	107.593	5.6	4.74	.349	107.942	.00	.913		1.50	.00	.00	0	.0
21.51	.00465					.005043	.11			1.000			.00		
24.22	106.74	.991	107.734	5.6	4.52	.317	108.051	.00	.913		1.50	.00	.00	0	.0
211.79	.00465					.004662	.99			1.000			.00		
236.01	107.73	1.000	108.727	5.6	4.47	.311	109.038	.00	.913		1.50	.00	.00	0	.0
219.99	.00465					.004580	1.01			1.000			.00		
456.00	108.75	1.000	109.750	5.6	4.47	.311	110.061	.00	.913		1.50	.00	.00	0	.0
JUNCT STR	.02500					.003455	.01						.00		
460.00	108.85	1.231	110.081	2.5	1.61	.040	110.121	.00	.599		1.50	.00	.00	0	.0
7.10	.00852					.000595	.00			.520			.00		
467.10	108.91	1.170	110.081	2.5	1.69	.044	110.125	.00	.599		1.50	.00	.00	0	.0
6.29	.00852					.000659	.00			.520			.00		
473.39	108.96	1.116	110.080	2.5	1.77	.049	110.129	.00	.599		1.50	.00	.00	0	.0
5.69	.00852					.000734	.00			.520			.00		
479.08	109.01	1.067	110.080	2.5	1.86	.054	110.133	.00	.599		1.50	.00	.00	0	.0
5.20	.00852					.000822	.00			.520			.00		
484.28	109.06	1.022	110.079	2.5	1.95	.059	110.138	.00	.599		1.50	.00	.00	0	.0
4.78	.00852					.000923	.00			.520			.00		
489.05	109.10	.980	110.077	2.5	2.04	.065	110.142	.00	.599		1.50	.00	.00	0	.0
4.41	.00852					.001039	.00			.520			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 4 under normal conditions

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
493.46	109.14	.940	110.075	2.5	2.14	.071	110.147	.00	.599		1.50	.00	.00	0	.0
4.09	.00852					.001171	.00			.520			.00		
497.55	109.17	.903	110.073	2.5	2.25	.079	110.152	.00	.599		1.50	.00	.00	0	.0
3.77	.00852					.001323	.00			.520			.00		
501.32	109.20	.868	110.070	2.5	2.36	.086	110.157	.00	.599		1.50	.00	.00	0	.0
3.50	.00852					.001497	.01			.520			.00		
504.82	109.23	.835	110.067	2.5	2.47	.095	110.162	.00	.599		1.50	.00	.00	0	.0
3.22	.00852					.001696	.01			.520			.00		
508.04	109.26	.803	110.063	2.5	2.60	.105	110.167	.00	.599		1.50	.00	.00	0	.0
2.95	.00852					.001922	.01			.520			.00		
510.99	109.28	.773	110.058	2.5	2.72	.115	110.173	.00	.599		1.50	.00	.00	0	.0
2.68	.00852					.002182	.01			.520			.00		
513.67	109.31	.745	110.052	2.5	2.85	.127	110.179	.00	.599		1.50	.00	.00	0	.0
1.48	.00852					.002478	.00			.520			.00		
515.15	109.32	.718	110.038	2.5	2.99	.139	110.177	.00	.599		1.50	.00	.00	0	.0
HYDRAULIC JUMP													.00		
515.15	109.32	.483	109.803	2.5	5.09	.402	110.205	.00	.599		1.50	.00	.00	0	.0
2.35	.00852					.011261	.03			.520			.00		
517.50	109.34	.483	109.823	2.5	5.09	.402	110.225	.00	.599		1.50	.00	.00	0	.0
JUNCT STR	.03000					.011779	.04						.00		
520.50	109.43	.560	109.990	2.5	4.16	.268	110.258	.00	.599		1.50	.00	.00	0	.0
127.72	.00654					.006434	.82			.560			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 4 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
648.22	110.27	.560	110.826	2.5	4.16	.268	111.094	.00	.599		1.50	.00	.00	0	.0
8.39	.00654					.006094	.05			.560			.00		
656.61	110.32	.577	110.898	2.5	3.99	.247	111.145	.00	.599		1.50	.00	.00	0	.0
1.39	.00654					.005386	.01			.560			.00		
658.00	110.33	.599	110.929	2.5	3.80	.224	111.153	.00	.599		1.50	.00	.00	0	.0
WALL ENTRANCE													.00		
658.00	110.33	.872	111.202	2.5	1.35	.028	111.230	.00	.350		5.81	2.13	.00	0	.0

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project 195068x1
T3 Drainage System 5 under normal conditions
SO        .00 103.02  1                                105.29
R      294.00 103.75  1      .013                                            .00   .00 0
JX     298.00 103.85  1  2  3.015      1.5     17.0 103.85 103.85 80.00 30.00
R      425.00 104.17  1      .013                                            .00   .00 0
JX     429.00 108.37  2  2  2.015      5.2      5.2 110.57 110.57 40.00 35.00
R      742.00 111.50  2      .013                                            .00 20.00 0
WE     742.00 111.50  3      .500
SH     742.00 111.50  3                                111.50
CD   1  4   0    .00   3.00     .00  .00  .00  .00
CD   2  4   0    .00   1.50     .00  .00  .00  .00
CD   3  3   0    .00   4.92    2.13  .00  .00  .00
Q               .6   .0
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F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 5 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
.00	103.02	2.270	105.290	29.5	5.14	.410	105.700	.00	1.759		3.00	.00	.00	0	.0
294.00	.00248					.002371	.70			2.200			.00		
294.00	103.75	2.217	105.967	29.5	5.27	.431	106.398	.00	1.759		3.00	.00	.00	0	.0
JUNCT STR	.02500					.001791	.01						.00		
298.00	103.85	2.569	106.419	11.0	1.71	.045	106.464	.00	1.051		3.00	.00	.00	0	.0
57.63	.00252					.000265	.02			1.182			.00		
355.63	104.00	2.434	106.429	11.0	1.79	.050	106.479	.00	1.051		3.00	.00	.00	0	.0
50.45	.00252					.000292	.01			1.182			.00		
406.09	104.12	2.317	106.439	11.0	1.88	.055	106.494	.00	1.051		3.00	.00	.00	0	.0
18.91	.00252					.000313	.01			1.182			.00		
425.00	104.17	2.273	106.443	11.0	1.91	.057	106.500	.00	1.051		3.00	.00	.00	0	.0
JUNCT STR	1.05000												.00		
429.00	108.37	.240	108.610	.6	3.29	.168	108.778	.00	.287		1.50	.00	.00	0	.0
287.71	.01000					.010583	3.04			.240			.00		
716.71	111.25	.240	111.487	.6	3.29	.168	111.655	.00	.287		1.50	.00	.00	0	.0
6.58	.01000					.010370	.07			.240			.00		
723.29	111.31	.242	111.555	.6	3.24	.163	111.718	.00	.287		1.50	.00	.00	0	.0
13.65	.01000					.009515	.13			.240			.00		
736.95	111.45	.251	111.700	.6	3.09	.148	111.848	.00	.287		1.50	.00	.00	0	.0
3.01	.01000					.008310	.02			.240			.00		
739.95	111.48	.259	111.738	.6	2.95	.135	111.873	.00	.287		1.50	.00	.00	0	.0
1.30	.01000					.007258	.01			.240			.00		

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 5 under normal conditions

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
741.25	111.49	.268	111.760	.6	2.81	.123	111.883	.00	.287		1.50	.00	.00	0	.0
.58	.01000					.006340	.00			.240			.00		
741.83	111.50	.277	111.775	.6	2.68	.111	111.886	.00	.287		1.50	.00	.00	0	.0
.17	.01000					.005502	.00			.240			.00		
742.00	111.50	.287	111.787	.6	2.54	.100	111.887	.00	.287		1.50	.00	.00	0	.0
WALL ENTRANCE													.00		
742.00	111.50	.419	111.919	.6	.67	.007	111.926	.00	.135		4.92	2.13	.00	0	.0

1
1

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T1 City of Escalon - McHenry Avenue/SR120 Improvements
T2 Project 195068x1
T3 Drainage System 6 under normal conditions
SO       .00 107.21  1                            108.00
R     262.00 108.66  1      .013                                           .00    .00 0
WE    262.00 108.66  2      .500
SH    262.00 108.66  2                            108.66
CD   1  4   0    .00   1.75     .00  .00  .00  .00
CD   2  3   0    .00   8.74    4.00  .00  .00  .00
Q              7.6   .0
```

F0515P CD Vers 4.0
WATER SURFACE PROFILE LISTING
For: Korve Engineering, San Bernardino, California - S/N 631
City of Escalon - McHenry Avenue/SR120 Improvements
Project 195068x1
Drainage System 6 under normal conditions

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
.00	107.21	1.022	108.232	7.6	5.21	.422	108.654	.00	1.022		1.75	.00	.00	0	.0
2.66	.00553					.005533	.01			1.020			.00		
2.66	107.22	1.020	108.245	7.6	5.22	.424	108.668	.00	1.022		1.75	.00	.00	0	.0
259.34	.00553					.005526	1.43			1.020			.00		
262.00	108.66	1.020	109.680	7.6	5.22	.424	110.103	.00	1.022		1.75	.00	.00	0	.0
262.00	108.66	1.022	109.682	7.6	5.21	.422	110.104	.00	1.022		1.75	.00	.00	0	.0
WALL ENTRANCE													.00		
262.00	108.66	1.610	110.270	7.6	1.18	.022	110.292	.00	.482		8.74	4.00	.00	0	.0

1
1

Korve Engineering

SUBJECT: SPREAD CALCS SR 120 JOB NUMBER: 195068X1
SHEET NUMBER ____ OF ____
MADE BY ____ DATE ____ CHECKED BY ____ DATE ____

WORST CASE - AREA H2-2 7926 m^2 = 1.96 AC

$Q = CIA = (0.9)(2.25)(1.96) = 4$ CFS

ASSUME 1/2 OF FLOW ON MAIN ST., 1/2 ON SR 120.

INLET IS @ 16+90.970, ∴ BEGINNING OF GTR. DEPRESSION

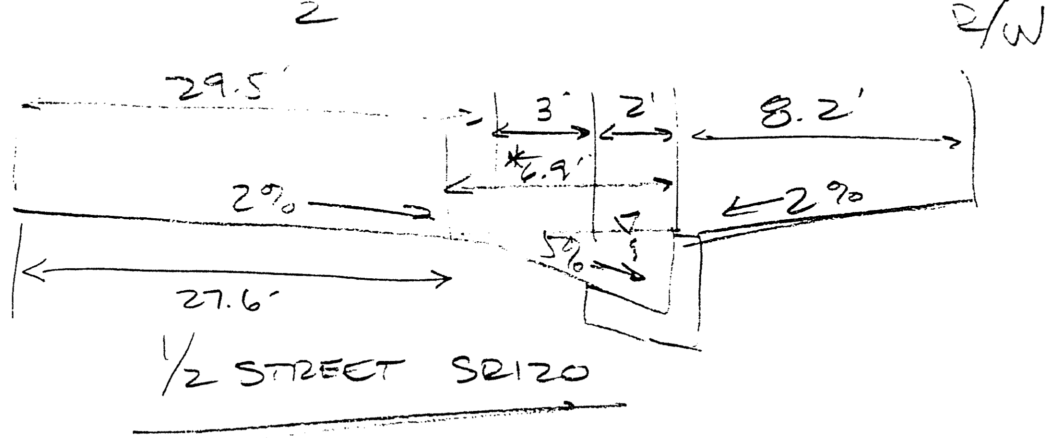
IS @ 16+90.970 + 2.65 = 1693.620

EL = 35.222m = 115.56'

10' upstream of GTR. Depress.; STA 16+96.62

EL = 35.242 = 115.63'

DESIGN $Q = \frac{4 \text{ CFS}}{2} = 2.0$ CFS



* PER CAPACITY CALCS ON FOLLOWING PAGE

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1992 Version 2.5

Street Flow Capacity at 16+90.970 SR120 - Subarea H2-2
City of Escalon - Project 195068x1
8/19/97 by MJG

Korve Engineering, San Bernardino, California - S/N 631

*** Street Flow Analysis ***

Upstream (headworks) Elevation = 115.630(Ft.)
Downstream (outlet) Elevation = 115.560(Ft.)
Runoff/Flow Distance = 10.000(Ft.)
Maximum flow rate in channel(s) = 2.000(CFS)

Top of street segment elevation = 115.630(Ft.)
End of street segment elevation = 115.560(Ft.)
Length of street segment = 10.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 34.500(Ft.)
Distance from crown to crossfall grade break = 29.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.050
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line = 8.200(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0130
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Half street cross section data points:

X-coordinate (Ft.)	Y-coordinate (Ft.)
0.0000	0.6640 right of way
8.2000	0.5000 top of curb
8.2000	0.0000 flow line
10.2000	0.1667 gutter end
13.2000	0.3167 grade break
42.7000	0.9067 crown

Depth of flow = 0.355(Ft.)
Average velocity = 2.177(Ft/s)
Total flow rate = 2.000(CFS)
Streetflow hydraulics:
Halfstreet flow width (curb to crown) = 6.908(Ft.)
Average flow velocity = 2.18(Ft/s)

Channel including Gutter and area towards property line:
Flow Width = 2.000(Ft.) Flow Area = 0.543(Sq.Ft)
Velocity = 2.731(Ft/s) Flow Rate = 1.483(CFS)
Froude No. = 0.9238

Channel from outside edge of gutter towards grade break:
Flow Width = 3.000(Ft.) Flow Area = 0.339(Sq.Ft)
Velocity = 1.474(Ft/s) Flow Rate = 0.501(CFS)
Froude No. = 0.7724

Channel from grade break to crown:
Flow Width = 1.908(Ft.) Flow Area = 0.036(Sq.Ft)
Velocity = 0.450(Ft/s) Flow Rate = 0.016(CFS)
Froude No. = 0.5745

Total flow rate in street = 2.000(CFS)

WORST CASE: AREA A9-1, 17155 m^2 = 4.24 AC

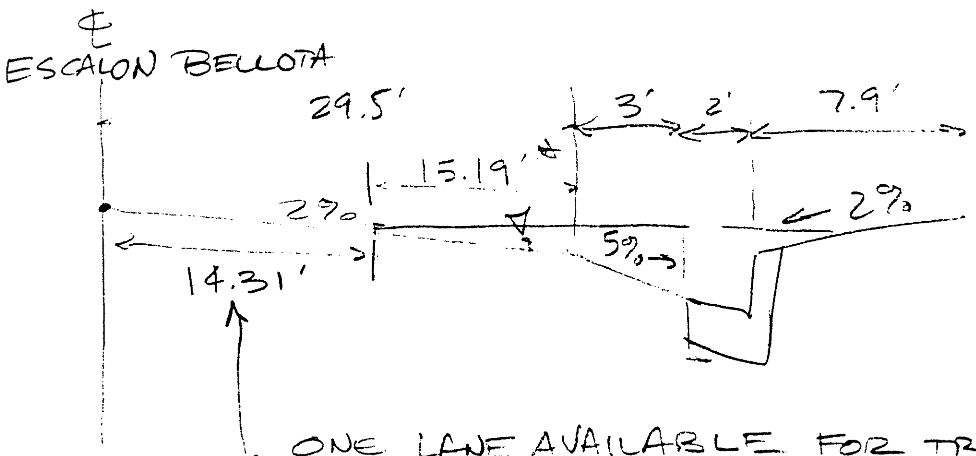
DIVIDE RUNOFF BASED ON AREA TRIBUTARY TO EACH SIDE OF INLET

SOUTH OF INLET, A = 8650 m^2 (50%) 2.81 CFS
NORTH OF INLET, A = 8505 m^2 (50%)

$Q_{2.25}$ = 4.24 x .59 x 2.25 = 5.62 CFS

EVALUATE SPREAD @ BEGINNING OF GUTTER DEPRESSION
INLET STATION = 52+92.099

∴ GUTTER DEPRESSION STARTS @ 5292.099 - 2.65 = 52+89.449
STREET ℄ ELEVATION @ 52+89.449 = 35.235 m
= 115.606'
10' UPSTREAM (STA 52+86.449) = 35.236 m
= 115.609'



ONE LANE AVAILABLE FOR TRAVEL ON NORTHBOUND SIDE OF ESCALON BELLOTA.

* PER CAPACITY CALCS ON FOLLOWING PAGE

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1992 Version 2.5

Street Flow Capacity at 52+92.099 Escalon-Bellota Rd. - Subarea A9-1
City of Escalon - Project 195068x1
8/19/97 by MJG

Korve Engineering, San Bernardino, California - S/N 631

*** Street Flow Analysis ***

Upstream (headworks) Elevation = 115.609(Ft.)
Downstream (outlet) Elevation = 115.606(Ft.)
Runoff/Flow Distance = 10.000(Ft.)
Maximum flow rate in channel(s) = 2.810(CFS)

Top of street segment elevation = 115.609(Ft.)
End of street segment elevation = 115.606(Ft.)
Length of street segment = 10.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 34.500(Ft.)
Distance from crown to crossfall grade break = 29.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.050
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line = 7.900(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0130
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Half street cross section data points:

X-coordinate (Ft.)	Y-coordinate (Ft.)
0.0000	0.6580 right of way
7.9000	0.5000 top of curb
7.9000	0.0000 flow line
9.9000	0.1667 gutter end
12.9000	0.3167 grade break
42.4000	0.9067 crown

Depth of flow = 0.620(Ft.)
Average velocity = 0.576(Ft/s)
Total flow rate = 2.810(CFS)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property = 6.02(Ft.)
Streetflow hydraulics:
Halfstreet flow width (curb to crown) = 20.191(Ft.)
Average flow velocity = 0.58(Ft/s)

Channel including Gutter and area towards property line:
Flow Width = 8.025(Ft.) Flow Area = 1.437(Sq.Ft)
Velocity = 0.563(Ft/s) Flow Rate = 0.809(CFS)
Froude No. = 0.2343

Channel from outside edge of gutter towards grade break:
Flow Width = 3.000(Ft.) Flow Area = 1.136(Sq.Ft)
Velocity = 0.837(Ft/s) Flow Rate = 0.951(CFS)
Froude No. = 0.2395

Channel from grade break to crown:
Flow Width = 15.191(Ft.) Flow Area = 2.308(Sq.Ft)
Velocity = 0.455(Ft/s) Flow Rate = 1.050(CFS)
Froude No. = 0.2058

Total flow rate in street = 2.810(CFS)

Korve Engineering

SUBJECT SPREAD CALCS - McHENRY AVE. JOB NUMBER ____
SHEET NUMBER ____ OF ____
MADE BY ____ DATE ____ CHECKED BY ____ DATE ____

WORST CASE SUBAREA E10-1 = 8885 m^2 = 2.20 AC
BASE ON MAX RAINFALL INTENSITY OF 2.25"/HR.

Q = CIA = 0.9 x 2.25 x 2.20 = 4.46 CFS

INLET IS @ 43+28.049

HI POINTS ARE @ 41+87.911 and 45+95.554

BASE Q COMING INTO EACH SIDE OF INLET ON THE LENGTH OF REACH:

4328.049 - 4187.911 = 140.138 m (35%) ∴ Q = 1.56 cfs
4595.554 - 4328.049 = 267.505 m (65%) ∴ Q = 2.90 cfs
407.643

MAX. SPREAD WILL BE AT BEGINNING OF GUTTER DEPRESSION, STA. 43+28.049 + 2.65 = 4330.699

STREET ℄ ELEVATION @ 43+30.699 = 34.588 m = 113.48'

OTHER SIDE OF McHENRY, AREA E10-2 = 8055 m^2 = 1.99 AC
MAX. RAINFALL = 2.25"/HR ∴ Q = CIA = .9 x 2.25 x 1.99 = 4.03 CFS

∴ Q FROM NORTH SIDE = .65 x 4.03 = 2.62 CFS
℄ ELEVATION AND GTR. DEPRESSION LOCATION SAME AS E10-1

ULTIMATE CONFIGURATION TRAVELLED WAY IS 18 m WIDE PER ATTACHED, TOTAL AREA IN TRAVELLED WAY INUNDATED IS 15.47' + 14.66' = 30.13' = 9.184 m

9.184 m allows for 1 lane each direction with a 2 m median or separation.

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1992 Version 2.5

Street Flow Capacity at 43+28.049 McHenry Avenue - SUBAREA E10-1
City of Escalon - Project 195068x1
8/19/97 by MJG

Korve Engineering, San Bernardino, California - S/N 631

*** Street Flow Analysis ***

Upstream (headworks) Elevation = 113.486(Ft.)
Downstream (outlet) Elevation = 113.483(Ft.)
Runoff/Flow Distance = 10.000(Ft.)
Maximum flow rate in channel(s) = 2.900(CFS)

Top of street segment elevation = 113.486(Ft.)
End of street segment elevation = 113.483(Ft.)
Length of street segment = 10.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 34.450(Ft.)
Distance from crown to crossfall grade break = 29.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.050
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line = 5.900(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0130
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Half street cross section data points:

X-coordinate (Ft.)	Y-coordinate (Ft.)
0.0000	0.6180 right of way
5.9000	0.5000 top of curb
5.9000	0.0000 flow line
7.9000	0.1667 gutter end
10.8500	0.3142 grade break
40.3500	0.9042 crown

Depth of flow = 0.624(Ft.)
Average velocity = 0.582(Ft/s)
Total flow rate = 2.900(CFS)
!!Warning: Water is above left or right bank elevations
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property = 6.18(Ft.)
Streetflow hydraulics:
Halfstreet flow width (curb to crown) = 20.420(Ft.)
Average flow velocity = 0.58(Ft/s)

Channel including Gutter and area towards property line:
Flow Width = 7.900(Ft.) Flow Area = 1.461(Sq.Ft)
Velocity = 0.576(Ft/s) Flow Rate = 0.841(CFS)
Froude No. = 0.2359

Channel from outside edge of gutter towards grade break:
Flow Width = 2.950(Ft.) Flow Area = 1.130(Sq.Ft)
Velocity = 0.844(Ft/s) Flow Rate = 0.954(CFS)
Froude No. = 0.2404

Channel from grade break to crown:
Flow Width = 15.470(Ft.) Flow Area = 2.393(Sq.Ft)
Velocity = 0.462(Ft/s) Flow Rate = 1.105(CFS)
Froude No. = 0.2068

Total flow rate in street = 2.900(CFS)

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Street Flow Capacity at 43+28.049 McHenry Ave - Subarea E10-2
City of Escalon - Project 195068x1
8/19/97 by MJG

Korve Engineering, San Bernardino, California - S/N 631

*** Street Flow Analysis ***

Upstream (headworks) Elevation = 113.486(Ft.)
Downstream (outlet) Elevation = 113.483(Ft.)
Runoff/Flow Distance = 10.000(Ft.)
Maximum flow rate in channel(s) = 2.620(CFS)

Top of street segment elevation = 113.486(Ft.)
End of street segment elevation = 113.483(Ft.)
Length of street segment = 10.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 34.500(Ft.)
Distance from crown to crossfall grade break = 29.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.050
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line = 5.900(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0130
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Half street cross section data points:

X-coordinate (Ft.)	Y-coordinate (Ft.)
0.0000	0.6180 right of way
5.9000	0.5000 top of curb
5.9000	0.0000 flow line
7.9000	0.1667 gutter end
10.9000	0.3167 grade break
40.4000	0.9067 crown

Depth of flow = 0.610(Ft.)
Average velocity = 0.569(Ft/s)
Total flow rate = 2.620(CFS)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property = 5.49(Ft.)
Streetflow hydraulics:
Halfstreet flow width (curb to crown) = 19.659(Ft.)
Average flow velocity = 0.57(Ft/s)

Channel including Gutter and area towards property line:
Flow Width = 7.492(Ft.) Flow Area = 1.355(Sq.Ft)
Velocity = 0.563(Ft/s) Flow Rate = 0.763(CFS)
Froude No. = 0.2335

Channel from outside edge of gutter towards grade break:
Flow Width = 3.000(Ft.) Flow Area = 1.105(Sq.Ft)
Velocity = 0.819(Ft/s) Flow Rate = 0.904(CFS)
Froude No. = 0.2378

Channel from grade break to crown:
Flow Width = 14.659(Ft.) Flow Area = 2.149(Sq.Ft)
Velocity = 0.443(Ft/s) Flow Rate = 0.953(CFS)
Froude No. = 0.2041

Total flow rate in street = 2.620(CFS)

Korve Engineering

SUBJECT SPREAD CALCS - MAIN ST JOB NUMBER 19068K1

SHEET NUMBER ____ OF ____

MADE BY ________ DATE ________ CHECKED BY ________ DATE ________

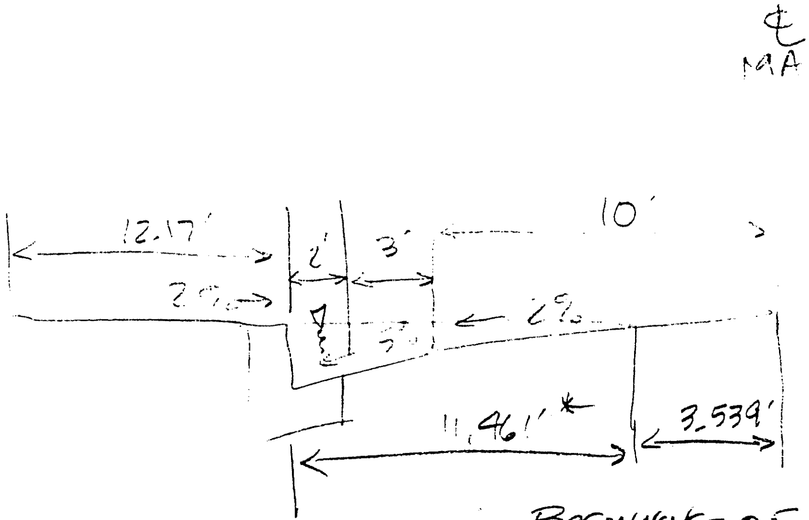
SUBAREA E4-1 14070 m^2 = 3.48 Ac

$Q = CIA = 0.9 \times 2.25 \times 3.48 = 7.04$ CFS

ASSUME ½ ARRIVES FROM EAST, ½ FROM WEST

ANALYZE WEST SIDE, DESIGN $Q = \frac{7.04}{2} = 3.52$ CFS

PER SURVEY, STREET SLOPE $= \frac{.034\ m}{6.71\ m} = .005$



BEGINNING OF GTR. DEPRESSION,

EL = 35.475 = 116.39'

10' upstream = 116.44'

* PER ATTACHED CAPACITY CALCS.

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1992 Version 2.5

Street Flow Capacity on Main Street - Subarea E4-1
City of Escalon - Project 195068x1
8/19/97 by MJG

Korve Engineering, San Bernardino, California - S/N 631

*** Street Flow Analysis ***

Upstream (headworks) Elevation = 116.440(Ft.)
Downstream (outlet) Elevation = 116.390(Ft.)
Runoff/Flow Distance = 10.000(Ft.)
Maximum flow rate in channel(s) = 3.520(CFS)

Top of street segment elevation = 116.440(Ft.)
End of street segment elevation = 116.390(Ft.)
Length of street segment = 10.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 10.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.050
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line = 12.170(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0130
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Half street cross section data points:

X-coordinate (Ft.)	Y-coordinate (Ft.)
0.0000	0.7434 right of way
12.1700	0.5000 top of curb
12.1700	0.0000 flow line
14.1700	0.1667 gutter end
17.1700	0.3167 grade break
27.1700	0.5167 crown

Depth of flow = 0.446(Ft.)
Average velocity = 2.006(Ft/s)
Total flow rate = 3.520(CFS)
Streetflow hydraulics:
Halfstreet flow width (curb to crown) = 11.461(Ft.)
Average flow velocity = 2.01(Ft/s)

Channel including Gutter and area towards property line:
Flow Width = 2.000(Ft.) Flow Area = 0.725(Sq.Ft)
Velocity = 2.770(Ft/s) Flow Rate = 2.008(CFS)
Froude No. = 0.8106

Channel from outside edge of gutter towards grade break:
Flow Width = 3.000(Ft.) Flow Area = 0.613(Sq.Ft)
Velocity = 1.874(Ft/s) Flow Rate = 1.148(CFS)
Froude No. = 0.7309

Channel from grade break to crown:
Flow Width = 6.461(Ft.) Flow Area = 0.417(Sq.Ft)
Velocity = 0.871(Ft/s) Flow Rate = 0.363(CFS)
Froude No. = 0.6037

Total flow rate in street = 3.520(CFS)

APPENDIX C

Hydrology / Hydraulic Report
For
McHenry Avenue /SR 120 Improvement Project

May, 1998

Korve Engineering

SUBJECT: ESCALON SR120 — DETENTION BASIN CAPACITY CALCS
JOB NUMBER: 195068x1
SHEET NUMBER 1 OF 5
MADE BY: MG DATE ____ CHECKED BY ____ DATE ____

NORTH DETENTION BASIN:

LINES A, B, V, N : $\Sigma CA = 22.84$

LINE P : $\Sigma CA = 0.85$

TOTAL = 23.69

$$V = \frac{CAR}{12} = \frac{(23.69)(3.12)}{12} = 6.2 \text{ Ac-Ft}$$

SOUTH DETENTION BASIN

LINES C, D, E, F, G, H : $\Sigma CA = 35.92$

$$V = \frac{CAR}{12} = \frac{(35.92)(3.12)}{12} = 9.4 \text{ Ac-Ft}$$

ADDED CAPACITY FOR McHenry / First St.

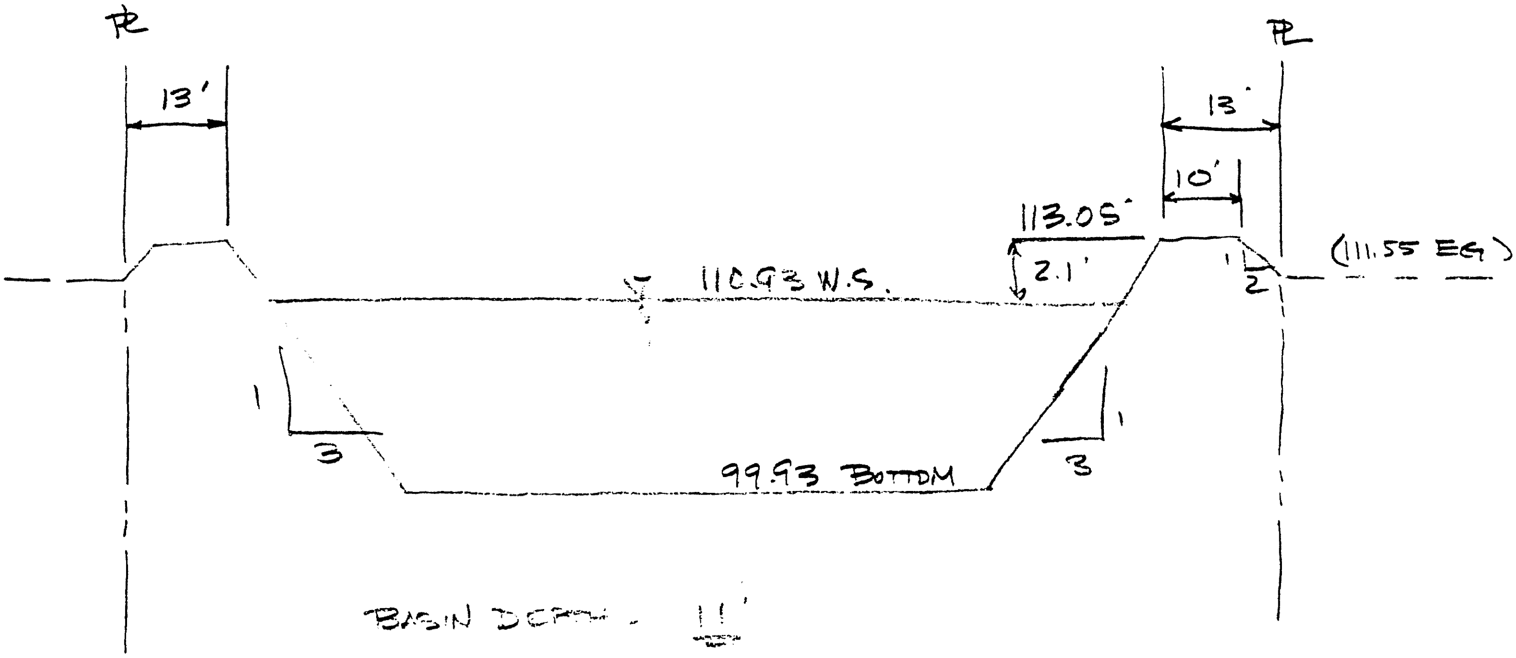
$\Sigma CA = 43.7$

$$V = \frac{CAR}{12} = \frac{(43.7)(3.12)}{12} = 11.4 \text{ Ac-Ft}$$

TOTAL = 20.8 Ac-FT

Korve Engineering

SUBJECT NORTH POND DETENTION BASIN DESIGN CAPACITY JOB NUMBER 195068X1
SHEET NUMBER 2 OF 5
MADE BY [initials] DATE 8/97 CHECKED BY ____ DATE ____



BASIN DEPTH = 11'

BOTTOM AREA = 1147.449 m² = 12,352 ft²
W.S. AREA = 3171.651 m² = 34,143 ft²

$$V = \left(\frac{34143 + 12352}{2}\right) \times 11' = 255{,}723 \text{ cf}$$

$$V = \frac{255{,}723 \text{ cf}}{43{,}560} = \boxed{5.87 \text{ Ac-Ft}}$$

REQUIRED CAPACITY = 6.2 Ac-Ft

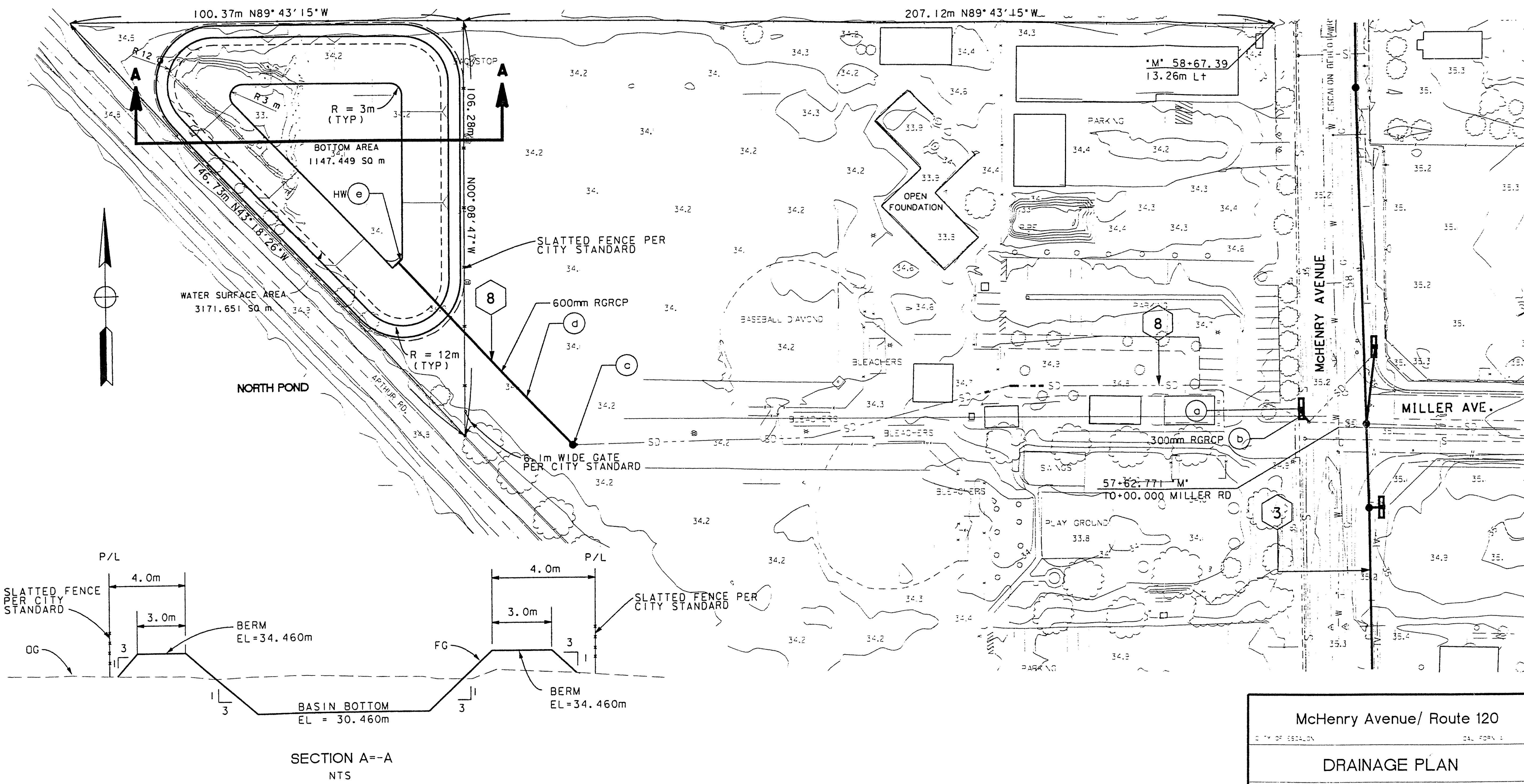
∴ (6.2 - 5.87 = 0.33 Ac-Ft TO BE DETAINED IN SOUTH POND

NOTE: ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

Caltrans Metric

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

KP 26.63/27.89



THIS PLAN ACCURATE FOR DRAINAGE ONLY

McHenry Avenue/ Route 120

DRAINAGE PLAN

D-13

Contract No. 10-455904

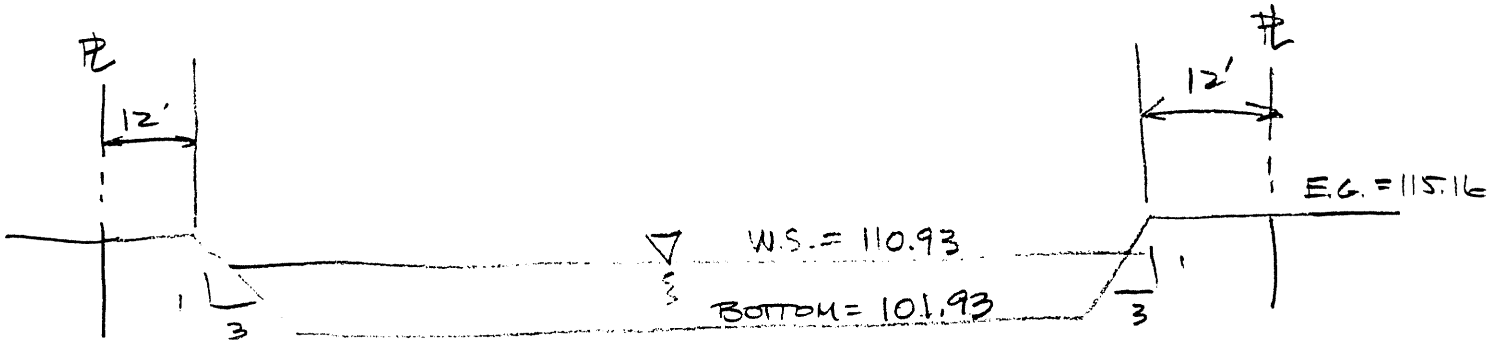
FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS

CU 10238 EA 455901

Korve Engineering

SUBJECT: SOUTH POND DETENTION BASIN DESIGN CAPACITY — JOB NUMBER: 195068x1 — SHEET NUMBER: 4 OF 5

MADE BY: MG — DATE: 5-1-98 — CHECKED BY: — DATE:



"SECTION"

BASIN DEPTH = 110.93 − 101.93 = 9.00' (AVG. DEPTH)

BOTTOM AREA = 8111.02 m^2 = 87274.58 sf

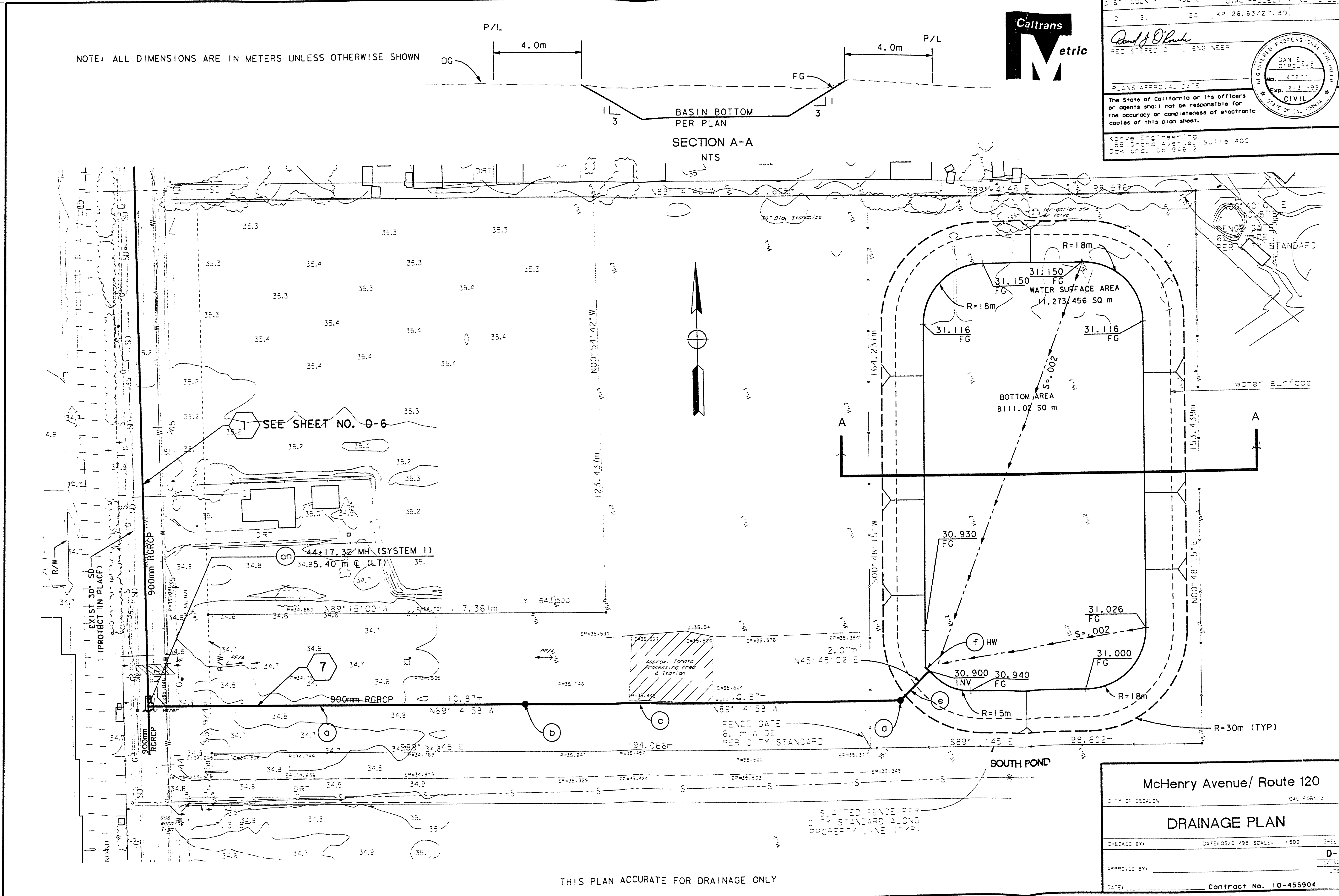
W.S. AREA = 11,273.46 m^2 = 121302.39 sf

$$V = \left(\frac{121302.39\,ft^2 + 87274.58\,ft^2}{2}\right) \times 9.00' = 938596.38\,ft^3$$

$$V = \frac{938596\,ft^3}{43560} = \underline{21.54\ Ac\text{-}Ft}$$

REQUIRED CAPACITY = 20.8 + 0.33 = 21.13 Ac-Ft

∴ DESIGN CAPACITY > REQUIRED CAPACITY



The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

KP 26.63/27.89

McHenry Avenue/ Route 120

DRAINAGE PLAN

D-12

Contract No. 10-455904

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS

CU 10238

EA 455901

APPENDIX D

Hydrology / Hydraulic Report
For
McHenry Avenue /SR 120 Improvement Project

May, 1998

Korve Engineering

SUBJECT SOUTH DETENTION BASIN STATIC ANALYSIS JOB NUMBER 195068x1

SHEET NUMBER 1 OF 1

MADE BY MG DATE 8/20/97 CHECKED BY ______ DATE ______

- IF THE SOUTH PUMP STATION FAILS, AND WATER IS STORED WITHIN THE PIPE SYSTEM AND POND SYSTEM THE ENTIRE NETWORK CAN BE CONSIDERED A LARGE RESERVOIR, AND THE WATER WILL SEEK ITS OWN LEVEL OVER TIME.
- AS THE WATER BACKS UP INTO THE SOUTH POND, THE ELEV. IN THE SOUTH POND = ELEVATION OF WATER IN THE PIPE SYSTEM.
- TO DETERMINE THE TOTAL CAPACITY OF THE STORM DRAIN NETWORK, THE CAPACITY OF THE PIPES AND MANHOLES SHOULD BE SUMMED AND ADDED TO THE CAPACITY OF THE PONDS.

OVERFLOW ELEVATION (CONNECTION BETWEEN SYSTEM (1) AND (2)) IS 33.809 m (110.93'). THIS IS THE MAX. WATER SURFACE ELEVATION IN THE POND, AND IS BELOW THE TG ELEVATIONS THROUGHOUT THE SYSTEM. THEREFORE, BACKFLOW INTO THE STREET IS NOT OF CONCERN.

Korve Engineering

SUBJECT: POSSIBLE CONNECTION OF SUNRISE TERRACE BASIN — JOB NUMBER: 195068 X 1

SHEET NUMBER: 1 OF: 1

MADE BY: MG — DATE: 8/20/97 — CHECKED BY: — DATE:

SUNRISE TERRACE BASIN - EXISTING CAPACITY = 4.25 Ac-Ft

IF CONNECTED TO PROPOSED SYSTEM, THEN TOP W.S. = 110.93' (WAS 114.0

NEW POND CAPACITY = 84687 FT^3 = 1.94 Ac-FT.

PROPOSED SYSTEM WOULD HAVE TO CONTAIN AN ADDITONAL 4.25 - 1.94 Ac-Ft = 2.31 Ac-Ft.

POND CAPACITIES ARE AT A MAXIMUM, SO AN ADDITONAL 2.31 Ac-Ft OF CAPACITY IS NOT POSSIBLE.

∴ SUNRISE TERRACE BASIN SHOULD NOT BE CONNECTED TO PROPOSED SYSTEM.

POND CALCS

$V = \frac{CAR}{12}$

R = 3.12 IN (10 yr)

C = .35 Res, .90 Comm.

$A_{UNIT\,1}$ = 14.5 Acres (WITH Heritage Homes.

A unit 2 = 10.5 Acres (1.8 Acres commercial)

A unit 3 = 7.75 Acres

A unit 4 = 6.90 Acres

A unit 5 = 4.20 Acres

TOTAL AREA = 43.85 Acres
42.05 Res & 1.8 Comm

$V = \frac{[(.35 \times 42.05) + (.90)(1.8)]}{12}(3.12) = 4.25\ Ac\text{-}FT$

4.25 Ac-FT = 185,050 FT^3

POND VOLUME

ELEV	AREA	AVERAGE AREA	HEIGHT	VOLUME
108 (BOTTOM)	22500 FT^2	24,435	1 FT	24435 FT^3
109	26370 FT^2	26,307	2 FT	52614 FT^3
110	30114 FT^2	28229	3 FT	84687 FT^3
111	33957 FT^2	30361	4 FT	121444 FT^3
112	32222 FT^2	32454	5 FT	162270 FT^3
113	42408 FT^2	33613	5.5 FT	184872 FT^3
113.5	44726 FT^2	34772	6.0 FT	208632 FT^3
114	47,043 FT^2			

NEED LOW T.C. @ 114.0 OR ABOVE --

BY R BARDINI
DATE
SHT. OF

THOMPSON-HYSELL ENGINEERS
1016 12TH ST. - MODESTO, CA 95354
(209) 521-8986

APPENDIX D

Hydrology / Hydraulic Report
For
McHenry Avenue /SR 120 Improvement Project

August, 1997

STORM DRAIN DESIGN CRITERIA

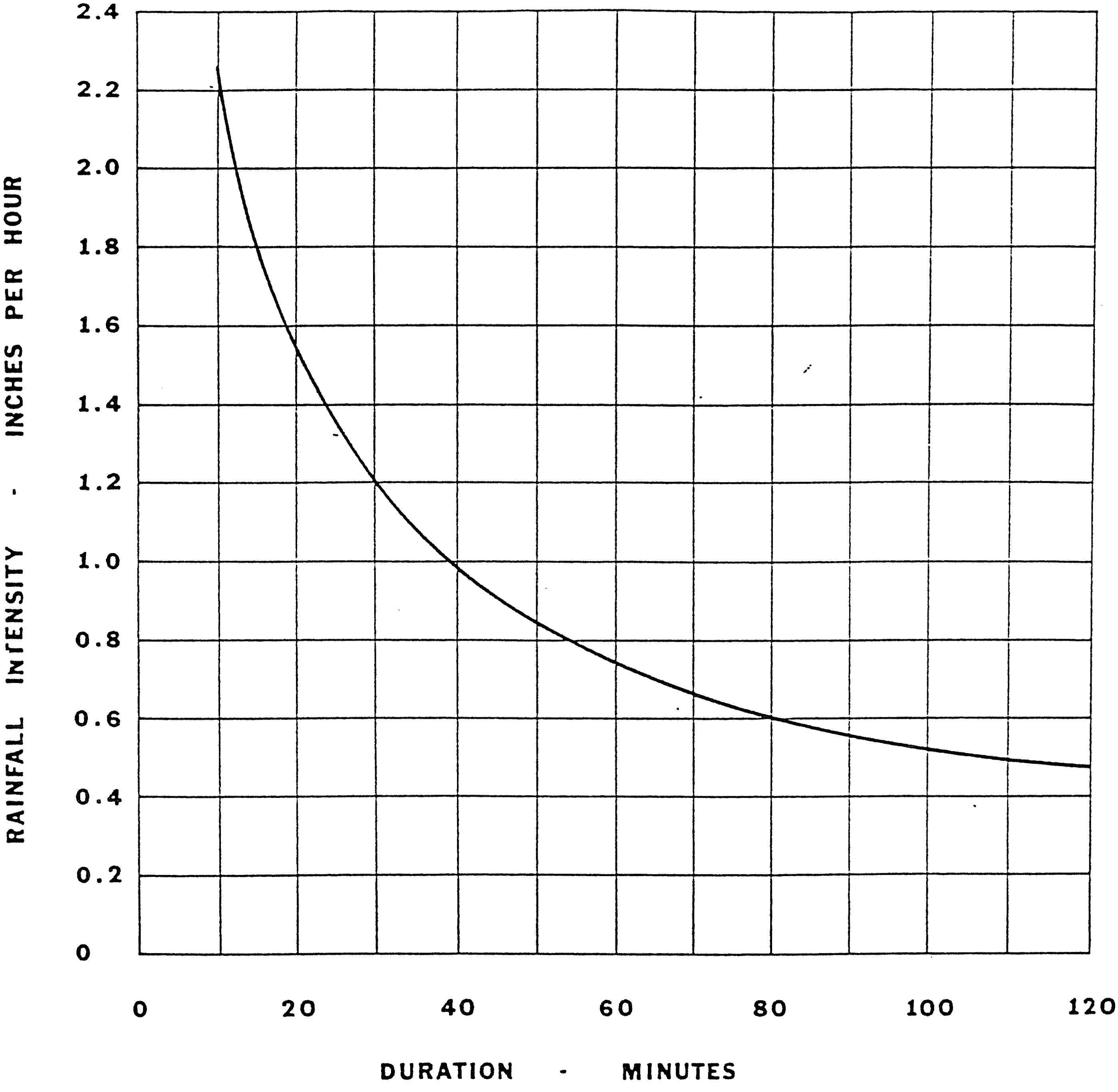
1. Minimum gutter slope shall be 0.0035 and a maximum of 0.3 feet fall around curb radius.
2. Maximum gutter length per catch basin shall be 900 feet.
3. The rational method used in determining the peak runoff shall be expressed by the equation Q=CIA, where:

   Q=Runoff in cubic feet per second.
   C=Runoff coefficient (See Item 4).
   I=Average rainfall intensity in inches per hour for a duration equal to the time of concentration.
   A=Tributary drainage area in acres.
4. Runoff coefficients for the City of Escalon:

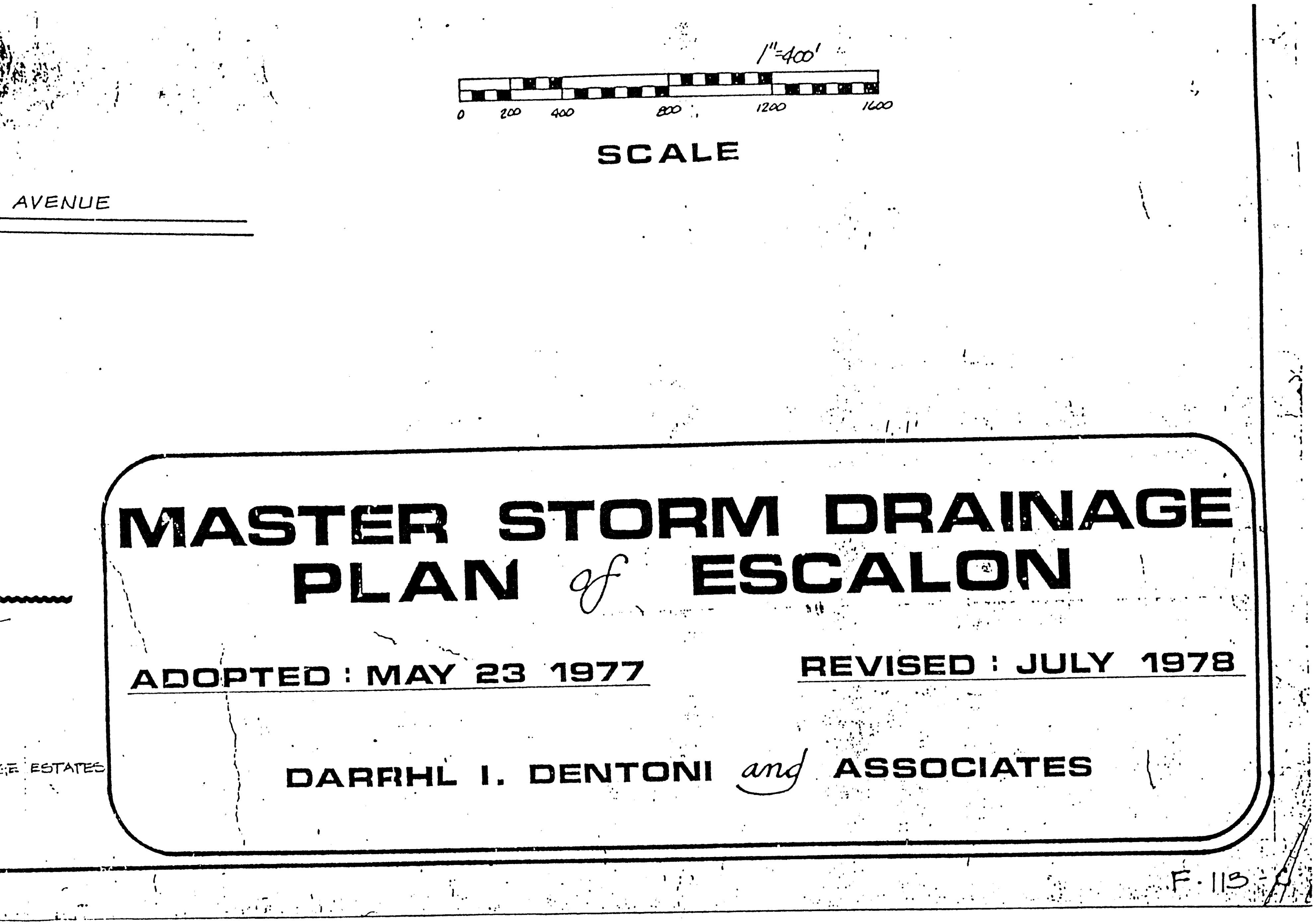
	C	Minimum Inlet Time (Minutes)
Single Family Residential	0.35	25
Multi Family Residential	0.50	20
Apartments	0.65	15
Commercial	0.90	10
Industrial	0.85	10
Parks	0.25	28
Schools	0.40	24

5. Rainfall intensity shall be determined using the 10 year rainfall intensity curve.
6. Minimum size for laterals from catchbasin to manhole shall be 10" diameter.
7. Minimum size for main storm trunk lines shall be 12" diameter.
8. The minimum value of Mannings "n" used in flow calculations shall be 0.013.
9. Main storm trunk lines shall be designed for a minimum velocity of 2.5 feet per second, flowing full.
10. Manholes shall be provided at all junctions, changes of alignment, grade or pipe size.
11. Laterals from catchbasins shall be connected to main storm trunk line at manholes only.
12. Access to main storm trunk line shall be provided by manholes at maximum intervals of 400 feet on lines 21 inches in diameter or smaller and at intervals of 700 feet on lines greater than 21 inches in diameter.
13. Storm drain pipe may be either Reinforced Concrete Pipe ASTM Designation C-76 with rubber gasket joint or Asbestos Cement Pipe ASTM Designation C-663 with flexible plastic coupling. In major streets standard "O" ring coupling shall be used on ACP installations.

REVISION	DATE	CITY OF ESCALON	APPROVED BY: Kenneth R. Gilldren CITY ENGINEER
DATE: 3/79		STORM DRAIN DESIGN CRITERIA	
DRAWN BY:			IMPROVEMENT STANDARD NO. D1
CHECKED BY:			



REVISION	DATE	CITY OF ESCALON	APPROVED BY:
			CITY ENGINEER
DATE: 3/79		INTENSITY - DURATION CURVE 10 - YEAR RAINFALL	IMPROVEMENT STANDARD NO. D2
DRAWN BY:			
CHECKED BY:			

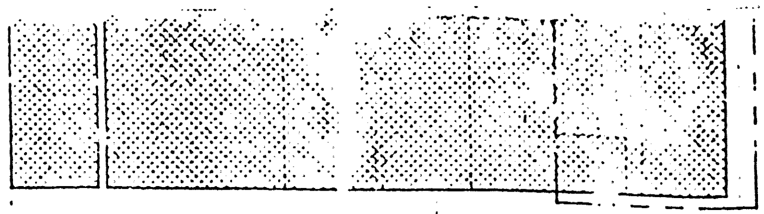


MASTER STORM DRAINAGE PLAN *of* ESCALON

ADOPTED : MAY 23 1977

REVISED : JULY 1978

DARRHL I. DENTONI *and* ASSOCIATES



GENERAL PLAN LAND USE DIAGRAM

LEW-GARCIA-DAVIS
ENGINEERS
SURVEYORS
CERES
(209)538-3360

DESIGN CRITERIA FOR STORM DRAINAGE BASINS AND PUMP STATION

THE DESIGN OF STORM DRAINAGE FACILITIES SHALL CONFORM TO CITY STANDARDS, THE STORM DRAINAGE MASTER PLAN, AND ANY CONDITIONS OR RESTRICTIONS CONTAINED THEREIN.

STORM DRAINAGE RETENTION POND

1. REQUIRED BASIN SIZING: $V = 2CAR / 12$

WHERE: C = Coefficient of runoff, from Detail SD1.
A = Area served by basin, in Acres.
R = 3.12", total rainfall for storm.
AND: V = Basin volume in Acre Feet.
FREEBOARD: 2 feet minimum

STORM DRAINAGE DETENTION BASIN

1. REQUIRED BASIN SIZING: $V = CAR / 12$

WHERE: C = Coefficient of runoff, from Detail SD1.
A = Area served by basin, in Acres.
R = 3.12", total rainfall for storm.
AND: V = Basin volume in Acre Feet.
FREEBOARD: 2 feet minimum

2. ALL DETENTION BASINS SHALL HAVE OUTLET FACILITIES PROVIDING TERMINAL DRAINAGE CAPABLE OF EMPTYING A FULL BASIN WITHIN 24 HOURS.

REVISION	DATE	CITY OF ESCALON	APPROVED BY:
DATE: 10/94		DRAINAGE BASIN & PUMP STATION CRITERIA	CITY ENGINEER
DRAWN BY: LT			IMPROVEMENT STANDARD NO. D3
CHECKED BY: LT			

CITY OF ESCALON

ENGINEERING/PUBLIC WORKS

1854 Main Street / P. O. Box 248 • Escalon, California 95320 • Office 209-838-4115

Fax 209-838-~~4027~~ 8045

FACSIMILE TRANSMITTAL SHEET

TO: Pete Davos / Bruce Cole
Desilva Gates

FAX NUMBER: 925-803-4281 or 4263

DATE TRANSMITTED: 4/25/01

TRANSMITTED BY: Doug Stidham

NUMBER OF PAGES (Including Cover Sheet): 15

NAME OF DOCUMENT: Master Storm Drainage Plan info
Revised KORVE Calc Sheet.

SPECIAL INSTRUCTIONS: For your reference

CITY OF ESCALON

April 25, 2001

DeSilva Gates Construction
Attn: Pete Davos
P.O. Box 2909
Dublin, CA 94568

Re: Highway 120 Project/ Storm Drain Master Plan

Dear Pete:

There is no text information to go with the master plan other than the design criteria that was included with KORVE's hydrology report and some cost information for each of the district (enclosed). As you can see, the plans I sent you are dated 1978. The Storm Drain Master Plan has not been updated since that date. The master plan does not indicate any of the new drainage facilities required for the new highway project. A copy of the revised calculations is also attached.

Very truly yours,

Doug Stidham
City Engineer

cc: Alfred Blum, CalTrans
Linda Beck

1854 Main Street / P.O. Box 248 • Escalon, California 95320-0248

Building Department (209) 838-4109 • City Clerk's Office (209) 838-4105 • City Manager's Office (209) 838-4101
Engineering Services (209) 838-4115 • Finance Department (209) 838-4107 • Planning Department (209) 838-4110
Public Works Department (209) 838-4139 • Fax (209) 838-8045

Post-it® Fax Note 7671	Date 4/24/01 pages 1
To Doug Smitham	From Jim Fea
Co./Dept.	Co.
Phone #	Phone #
Fax # 209 838 9113	Fax # 8095

195068x1
04/24/2001
1 of 1

STORM DESIGN SHEET

Drainage Systems 1,4,5,6 and First St/McHenry Subdivision

Beginning Design Data: Assumed Time to Inlet: 18.3

Point of Concentration	Contrib. Ac (A)	Runoff Coef. (C)	CA	Sum of CA	Intensity (i)	Q cfs (CiA)	Pipe Diameter	Slope Ft/Ft	Length (Ft)	Depth	Velocity (fps)	T, Min. in Pipe	T, Min. Total	Comments
C1	2.43	0.57	1.39	1.39	1.6	2.22	12	0.0036	285	0.85	3.12	1.5	19.8	
												Tmin=	18.3	
D1	1.74	0.57	0.99	0.99	1.6	1.58	12	0.0025	121	0.73	2.57	0.8	19.1	
													19.8	
C2 (Confl. of C & D)	3.87	0.57	2.21	4.59	1.53	7.02	18	0.0073	279	0.99	5.67	0.8	20.6	
C3	0.84	0.54	0.45	5.04	1.5	7.56	21	0.0056	262	1.02	5.23	0.8	21.4	
												Tmin=	10	
H1	0.31	0.9	0.28	0.28	2.13	0.6	18	0.01	313	0.24	3.29	1.6	11.6	
													21.4	
H2 (Confl. of C and H)	3.10	0.9	2.79	8.11	1.47	11.92	24	0.0025	127	1.74	4.11	0.5	21.9	
												Tmin=	18.6	
E1	6.33	0.59	3.73	3.73	1.59	5.93	21	0.0025	463	1.12	3.65	2.1	20.7	
E2	3.41	0.9	3.07	6.8	1.5	10.2	24	0.0025	292	1.48	4.09	1.2	21.9	
												Tmin=	10	
F1	1.95	0.9	1.76	1.76	2.13	3.75	12	0.0277	166	0.57	8.11	0.3	10.3	
												Tmin=	21.9	
E3 (Confl. of E & F)	0.52	0.9	0.47	9.03	1.45	13.09	27	0.0025	351	1.58	4.4	1.3	23.2	
E4	3.48	0.9	3.13	12.16	1.4	17.02	30	0.0025	190	1.73	4.71	0.7	23.9	
E5 (Confl. of E & H)	1.18	0.9	1.06	20.72	1.38	28.59	36	0.0025	294	2.13	5.33	0.9	24.8	
												Tmin=	10	
G1	0.43	0.9	0.39	0.39	2.13	0.83	18	0.0065	137	0.32	3.08	0.7	10.7	
G2	0.92	0.9	0.83	1.22	2.07	2.53	18	0.0085	72	0.51	4.77	0.3	11	
G3	1.70	0.9	1.53	2.75	2.05	5.64	18	0.0046	460	1.01	4.48	1.7	12.7	
												Tmin=	24.8	
E6 (Confl. of E & G)	0.18	0.9	0.16	23.63	1.35	31.9	36	0.0025	214	2.34	5.39	0.7	25.5	
E7	0.22	0.9	0.19	23.82	1.33	31.68	36	0.0025	386	2.31	5.42	1.2	26.7	
E8	2.98	0.9	2.69	26.51	1.29	34.2	36	0.0025	481	2.52	5.4	1.5	28.2	
E9	1.36	0.9	1.23	52.77	1.25	65.96	54	0.0025	1188	2.66	6.76	2.90	31.1	Added in First St./McHenry Subdivision
E10	3.99	0.9	3.59	56.36	1.17	65.94	54	0.0025	930	2.66	6.75	2.3	33.4	
E11	3.00	0.9	2.7	59.06	1.12	66.15	54	0.0025	366	2.70	6.64	0.9	34.3	
E12	0.80	0.9	0.72	59.78	1.1	65.76	42	0.0025	627	3.50	6.83	1.5	35.8	
E13	2.10	0.9	1.89	60.95	1.1	67.05	42	0.0025	------->> To South Pump Station					

Escstrm.xls

Korve Engineering, Inc.

STORM DRAINAGE DESIGN
CITY OF ESCALON
HYDROLOGIC CRITERIA

Design Storm

Storm drainage facilities shall be sized to accommodate the peak flow rate from a storm having a return frequency of once in 10 years. The 10 year rainfall intensity-duration curve for the Escalon area is attached. (Figure 1)

Peak Flow Rate

The Rational Formula shall be used to determine the peak flow rate. This formula is:

$$Q = C\ I\ A$$

where Q = peak rate of flow in cubic feet per second

C = coefficient of runoff having a value between 0.0 and 1.0 depending on surface characteristics.

I = the average intensity of rainfall in inches per hour for a duration equal to the critical time, usually the time of concentration.

A = the tributary area in acres corresponding to the critical time above.

The procedures for determining the values of C, A and I are given in the following sections.

Runoff Coefficient, "C"

The runoff coefficient will vary from 0.10 for lawns to 0.95 for paved areas. (Table 1) Where a tributary area contains more than one type of surface the value of C is the weighted average of the respective "C" values based on the percentage of each surface area to the total area.

Table 2 shows the values of C that are used in the Rational Formula for certain composite areas.

Tributary Area, "A"

The tributary area for each point of computation is based on actual field reconnaissance or use of appropriately scaled maps that clearly depict the drainage boundaries.

All of the area that will contribute runoff to the drainage system is considered, regardless of the limits of the particular development under consideration.

Critical Flow Time

The critical flow time is that time which results in the maximum flow rate for a given point in a drainage system. Maximum flow occurs when the product of the intensity and the contributing area corresponding to the flow time is a maximum.

The time required for water to flow from the most hydraulically remote point in the watershed to the point in question is called the time of concentration. Using the intensity corresponding to this time and the entire drainage area in the Rational Formula usually results in the maximum flow rate for the point.

When any part of the storm waters are conveyed to the point in question by pipes or open channels, the flow time in these conveyances shall be added to the inlet time to compute the total flow time. In complex drainage situations more than one computation may be required in order to determine the combination of contributing area and flow time which results in the maximum flow rate.

Rainfall Intensity, "I"

After determining the critical flow time, the Intensity-Duration curve on Figure 1 shall be used to determine the rainfall intensity for that time.

Retention Basins

Retention basins are considered in areas where terminal drainage is restricted and a large runoff must be disposed of over an extended period of time.

The volume of storage shall be computed from the following basic formula:

$$V = \frac{CAR}{12}$$

where V = the volume in acre feet

C = the runoff coefficient

A = the contributing area in acres

R = the total rainfall in inches for the storm period

In urbanized areas R shall be 3.12 inches. (Equivalent to a 10 year, 48 hour storm)

All retention basins shall have outlet facilities providing terminal drainage capable of emptying a full basin within 48 hours.

TABLE I

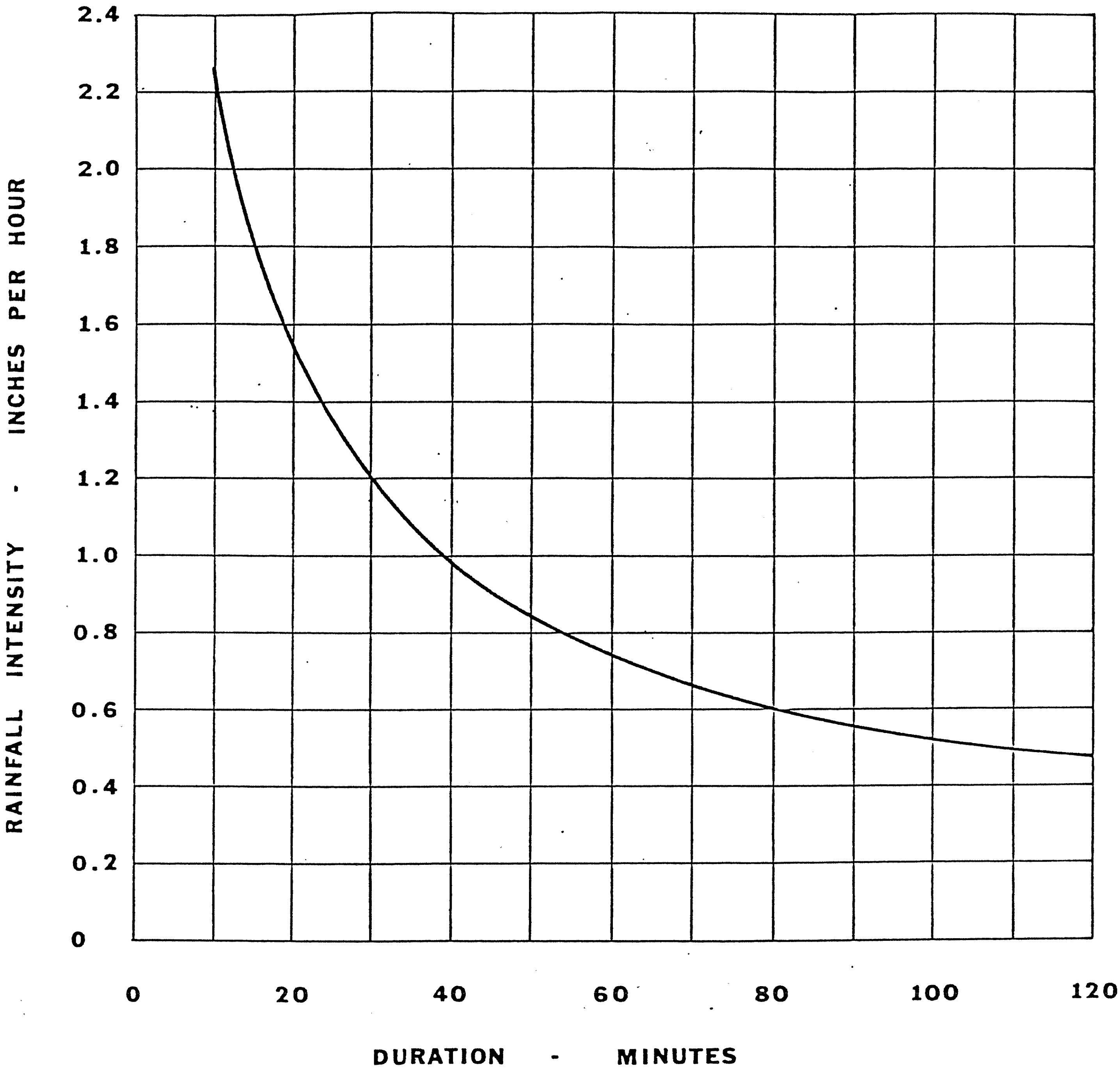
BASIC RUNOFF COEFFICIENTS

SURFACE	COEFFICIENTS
Pavement	0.95
Roofs	0.80
Compacted earth without paving	0.75
Lawns & Open Lands	0.15

TABLE 2

COMPOSITE RUNOFF COEFFICIENTS & MINIMUM INLET TIMES FOR VARIOUS LAND USES

LAND USE	RUNOFF COEFFICIENT	MINIMUM INLET TIME
Parks	.25	28 minutes
Schools	.40	24 minutes
Residential		
Low density (single family)	.35	25 minutes
Medium density (multi-family)	.50	20 minutes
High density (apartments)	.65	15 minutes
Light Industrial	.70	13 minutes
Business and Commercial	.90	10 minutes

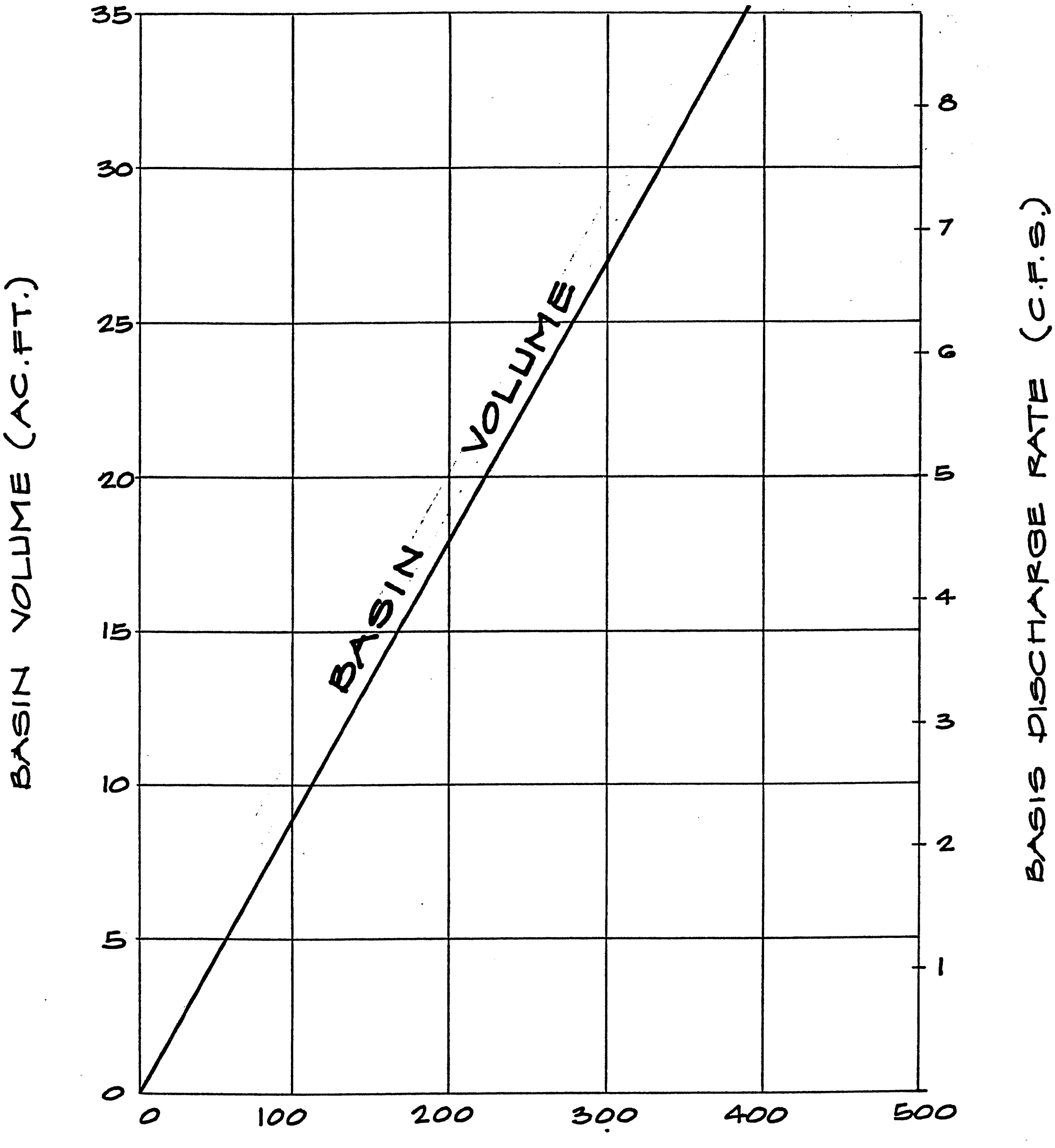


CITY OF ESCALON

INTENSITY - DURATION CURVE

10 - YEAR RAINFALL

FIGURE 1



C = .35 R = 3.12 in.

RETENTION BASIN DESIGN
CITY OF ESCALON

ESCALON STORM REVISION
COST ESTIMATE
REVISED AUGUST 31, 1978

BASIN COST ESTIMATES

ZONE	MULTIPLICATION FACTOR FOR R1 EQUIVALENT
R1 - Single Family Residential	1
R2 - Multi-Family Residential	1.43
I - Industrial	2
C - Commerical	2.57

BASIN #5 - NORTHWEST AREA

R1 -	104 Acres	(1)	=	104
R2 -	5 Acres	(1.43)	=	7
C -	7 Acres	(2.57)	=	18
				129 Acres

Actual Acreage = 116 Acres
Basin Volume = 11.7 Acre-Feet
Pump Out Rate = 2.9 CFS. (New Pumps)
Basin Area = 4.5 Acres

Cost Estimate:	11.7 Acre-Feet Basin @ $83,000 =	$ 83,000
	100 L.F. 12" Force Main @ $20/L.F. =	2,000
	100 L.F. 40" Pipe @ $64/L.F. =	6,400
	600 L.F. 36" Pipe @ $46.25/L.F. =	27,750
	1750 L.F. 30" Pipe @ $37.25/L.F. =	65,200
	600 L.F. 18" Pipe @ $21.25/L.F. =	12,750
	Subtotal	$197,100
	Contingencies & Engineering (25%)	49,275
	Subtotal	$246,375
	Land 4.5 Acres @ $15,000	67,500
	Total	$313,875

$\frac{\$313,875}{129}$ = $2433 per acre

BASIN #6 - SOUTH CENTRAL AREA

R1 - 92 Acres	(1)	=	92
R2 - 14 Acres	(1.43)	=	20
C - 17 Acres	(2.57)	=	44
			156 Acres

Actual Acreage = 123 Acres
Basin Volume = 14.0 Acre-Feet
Pump Out Rate = 4.5
Basin Area = 4.4 Acres

Cost Estimate:

14.0 Acre Feet Basin	=	$ 88,000
200 L.F. 36" Pipe @ $46.25/L.F.	=	9,250
550 L.F. 30" Pipe @ $37.25/L.F.	=	20,500
2300 L.F. 24" Pipe @ $29.25/L.F.	=	67,275
Subtotal		$185,025
Contingencies & Engineering (25%)		46,250
Subtotal		$231,275
Land 4.4 Acres @ $15,000		66,000
Total		$297,275

BASIN #6A - SOUTH EAST AREA

R1 - 91 Acres	(1)	=	91
R2 - 1 Acre	(1.43)	=	1
			92 Acres

Actual Acreage = 92 Acres
Basin Volume = 8.4 Acre-Feet
Pump Out Rate = 2.0 CFS
Basin Area = 3.8 Acres

Cost Estimate:

8.4 Acre-Feet Basin $79,000	=	$ 79,000
1600 L.F. 12" Force Main @ $20/L.F.	=	32,000
300 L.F. 42" Pipe @ $56.00/L.F.	=	16,800
300 L.F. 30" Pipe @ $37.25/L.F.	=	11,175
1250 L.F. 24" Pipe @ $29.25/L.F.	=	36,560
Subtotal		$175,535
Contingencies & Engineering (25%)		43,880
Subtotal		$219,415
Land 3.8 Acres @ $15,000		57,000
Total		$276,415

$$\frac{297,275 + 276,415}{(156 + 92)} = \$2,313$$

ESCALON STORM REVISION
COST ESTIMATE
REVISED AUGUST 31, 1978
PAGE THREE

BASIN #7 - WEST AREA

R1 - 173 Acres (1) = 173 Acres

Actual Acreage = 173 Acres
Basin Volume = 15.7 Acre-Feet
Basin Area = 4.5 Acres
Pump Out Rate = 3.8 CFS

Cost Estimate:

15.7 Acre-Feet Basin	=	$ 91,000
100 L.F. 48" Pipe @ $64/L.F.	=	6,400
300 L.F. 36" Pipe @ $46.25/L.F.	=	13,875
750 L.F. 30" Pipe @ $37.25/L.F.	=	27,935
1100 L.F. 24" Pipe @ $37.25/L.F.	=	40,975
450 L.F. 18" Pipe @ $21.25/L.F.	=	9,560
500 L.F. 12" Forcemain @ $20/L.F.	=	10,000
Subtotal		$199,745
Contingencies & Engineering (25%)		49,940
Subtotal		$249,685
Land 4.5 Acres @ $15,000		67,500
Total		$314,185

$\frac{\$314,185}{173}$ = $1816 per acre

BASIN #8 - EAST AREA

R1 - 85 Acres (1) = 85
C - 2 Acres (2.57) = 5
90 Acres

Actual Acreage = 87 Acres
Basin Volume = 8.2 Acre-Feet
Pump Out Rate = 2.0 CFS
Basin Area = 3.8 Acres

Cost Estimate:

8.2 Acre-Feet Basin	=	$ 79,000
100 L.F. 42" Pipe @ $56/L.F.	=	5,600
800 L.F. 30" Pipe @ $37.25/L.F.	=	29,800
900 L.F. 24" Pipe @ $29.25/L.F.	=	26,325
700 L.F. 18" Pipe @ $21.25/L.F.	=	14,875
Subtotal		$155,600
Contingencies & Engineering (25%)		38,900
Subtotal		$194,500
Land 3.8 Acres @ $15,000		57,000
Total		$251,500

$\frac{\$251,500}{90}$ = $2794 per acre

BASIN #9 - NORTHEAST AREA
R1 - 123 Acres (1) = 123 Acres

Actual Acreage = 123 Acres
Basin Volume = 11.2 Acre-Feet New Area
.6 Acre-Feet Old Area 17.2 Acre-Feet
Pump Out Rate = 4.3 CFS
Basin Area = 6.0 Acres (2 acres existing Mitchell Ave. drainage area

Cost Estimate:

			CITY SHARE
11.2 Acre-Feet Basin (Basin Only)	=	$ 50,000	(6) $30,000
950 L.F. 36" Pipe @ $46.25/L.F.	=	43,940	
800 L.F. 42" Pipe @ $56/L.F.	=	44,800	
100 L.F. 48" Pipe @ $64/L.F.	=	6,400	
Subtotal		$145,140	
Contingencies & Engineering (25%)		36,285	7,500
Subtotal		$181,425	
Land 4.0 Acres @ $15,000		60,000	(2) 30,000
Total		$241,425	$67,500

$\frac{\$241,425}{123}$ = $1963 per acre

BASIN #10 - SOUTH AREA
I - 101 Acres (2.00) = 202 Acres

Actual Acreage = 101 Acres
Basin Volume = 18 Acre-Feet
Basin Area = 6.0 Acres
Pump Out Rate = 4.5 CFS

Cost Estimate:

18 Acre-Feet Basin	=	$ 95,000
2500 L.F. 24" Forcemain @ $71/L.F.	=	177,500
650 L.F. 30" Pipe @ $37.25/L.F.		24,215
650 L.F. 42" Pipe @ $56/L.F.	=	36,400
850 L.F. 48" Pipe @ $64/L.F.	=	54,400
100 L.F. 60" Pipe @ $84/L.F.	=	8,400
Subtotal		$395,915
Contingencies & Engineering (25%)		98,980
Subtotal		$494,895
Land 6 Acres @ $15,000		90,000
Total		$584,895

ESCALON STORM REVISION
COST ESTIMATE
REVISED AUGUST 31, 1978
PAGE FIVE

BASIN #10A - SOUTH AREA

R1 -	121 Acres	(1)	=	121
R2 -	5 Acres	(1.43)	=	7
I -	86 Acres	(2.00)	=	172
C -	39 Acres	(2.57)	=	100
				400 Acres

Actual Acreage	=	251 Acres
Basin Volume	=	36 Acre-Feet
Basin Area	=	10 Acres
Pump Rate	=	9 CFS

Cost Estimate:

36 Acre-Feet Basin	=	$140,000
3000 L.F. 30" Pipe @ $37.25/L.F.	=	111,750
1600 L.F. 36" Pipe @ $46.25/L.F.	=	74,000
750 L.F. 42" Pipe @ $56.00/L.F.	=	42,000
600 L.F. 48" Pipe @ $64.00/L.F.	=	38,400
100 L.F. 54" Pipe @ $71.00/L.F.	=	7,100
700 L.F. 60" Pipe @ $84.00/L.F.	=	58,800
Subtotal		$472,050
Contingencies & Engineering (25%)		118,015
Subtotal		$590,065
Land 10 Acres @ $15,000		150,000
Total		$740,065

$$\frac{\$584,895 + \$740,065}{202 + 400} = \$2,200$$

STORM DRAINAGE DATA EXHIBIT B

		Zone	5	6	6A	7	8	9	10	10A
BASIN CRITERIA	Single Family Residence	R-1	104 = 104	92 = 92	91	173	85 = 85	123	0 = 0	121 = 121
	Multiple Family Residence	R-2	5 = 7	14 = 20	1	0	0 = 0	0	0 = 0	5 = 7
	Commercial	C	7 = 18	17 = 44	0	0	2 = 5	0	0 = 0	39 = 100
	Industrial	I	0 = 0	0 = 0	0	0	0 = 0	0	101 = 202	86 = 172
	Equivalent Residential Acres		129	156	92	173	90	123	202	400
	Basin Volume (acre-feet)		11.7	14.0	8.4	15.7	8.2	17.2 *	18.0	36
	Pump Out Rate (CFS)		2.9	4.5	2.0	3.8	2.0	4.3	4.5	9.0
	Basin Area (Acres)		4.5	4.4	3.8	4.5	3.8	6.0 **	6.0	10.0
COSTS	Improvements		$ 246,375	$ 450,690		$ 249,685	$ 194,500	$ 181,425	$ 1,084,960	
	Land		67,500	123,000		67,500	57,000	60,000 (New Area Only)	240,000	
	Total		$ 313,875	$ 573,690		$ 314,185	$ 251,500	$ 241,425	$ 1,324,960	
FEES	Single Family Residence	R-1	$ 2,433	$ 2,313		$ 1,816	$ 2,794	$ 1,963	$ 2,200	
	Multiple Family Residence	R-2	3,479	3,308		3,632	3,995	2,807	3,146	
	Commercial	C	6,253	5,620		4,413	6,789	4,770	5,654	
	Industrial	I	4,866	4,626		3,632	5,588	3,926	4,400	

*Includes 6 acre-feet for existing Mitchell Avenue drainage area.
**Includes 2 acres for existing Mitchell Avenue drainage area.

July, 1978

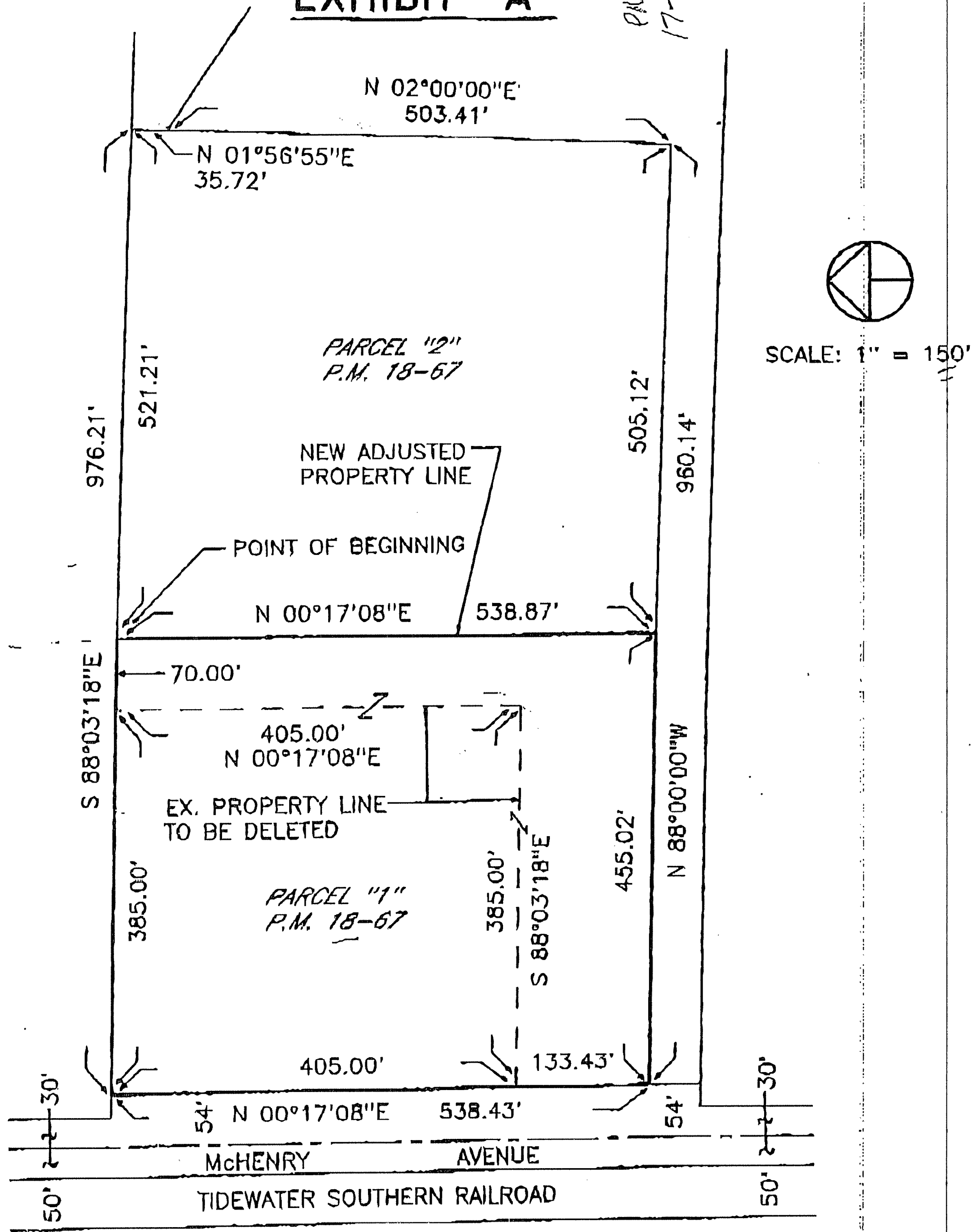
EXHIBIT B

Korve Engineering
155 GRAND AVENUE, SUITE 400
OAKLAND, CA 94612

HYDROLOGY MAP
MAY, 1998
SCALE: 1:2000

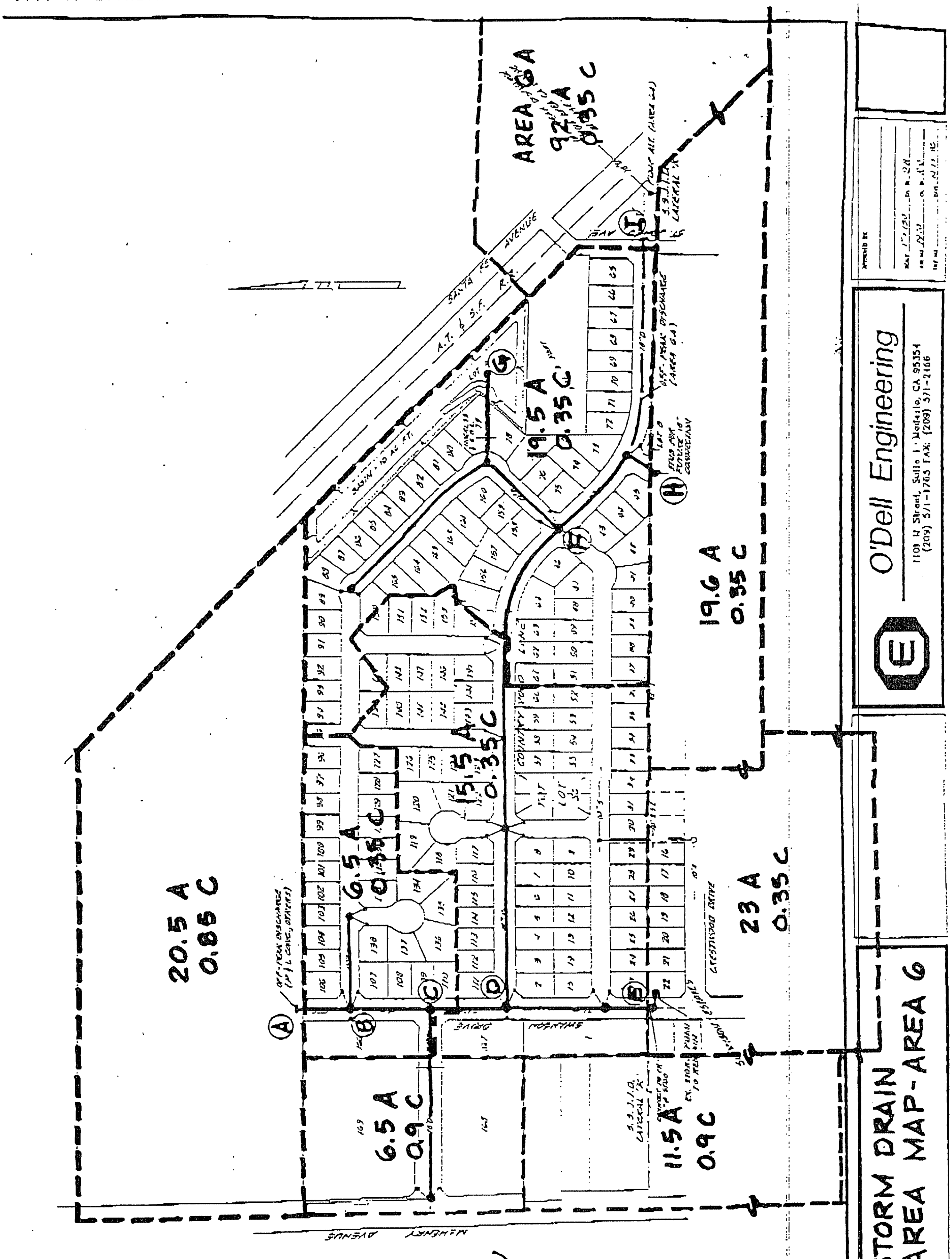
Appendix 4: February 2000 Westwood Estates: McHenry Avenue Storm Drain Basin Calculations, O'Dell Engineering, Inc.

EXHIBIT "A"



QUARTAROLI & ASSOCIATES
LAND SURVEYING LAND PLANNING
ENGINEERING
(209) 239-4908
310 SUN WEST PLACE, SUITE A
MANTECA, CA 95337

Westcrest Country
2 of 3
9/19/97



(USED TO DELINEATE AREA)

EXH. A

Westwood Estates
Job No. 1970

2/23/2000

McHenry Avenue Storm Drain Basin
Utimate Volume

AREA	"C"	Acres	"CA"
McHenry Frontage			
Street	0.95	3.57	3.39
Commercial	0.90	11.76	10.58
Future Area [1]			
Residential	0.35	19.60	6.86
Swanson Estates			
Residential	0.35	21.78	7.62
Park	0.25	1.02	0.26
Westwood Estates			
Residential	0.35	38.20	13.37
Commercial	0.90	1.04	0.94
Park	0.25	5.23	1.31
Totals		102.20	44.33

Addition Volume Required:

V = C*A*R / 12 = 11.53 ac - ft

where :
CA = 44.327
R= 3.12

[1] Area east of Swanson Estates bounded by Westwood Country to the North,extension of Ullrey Avenue to the south, and ~~Union Pacific~~ R.R. to the east.
BNSF

Westwood Estates
Job No. 1970

2/23/2000

McHenry Avenue Storm Drain Basin
Interim Volume
(Swanson Estates & Westwood Country)

AREA	"C"	Acres	"CA"
McHenry Frontage			
Street	0.95	3.57	3.39
Commercial	0.90	11.76	10.58
Swanson Estates			
Residential	0.35	21.78	7.62
Park	0.25	1.02	0.26
Westwood Estates			
Residential	0.35	38.20	13.37
Commercial	0.90	1.04	0.94
Park	0.25	5.23	1.31
Totals		82.60	37.47

Additoinal Volume Required;

V = C*A*R / 12 = 9.74 ac - ft

where :
CA = 37.467
R= 3.12

Westwood Estates
Job No. 1970

2/23/2000

Volume Calculations - Existing Basin

Elevation (ft)	Area (sf)	Ave. Area (sf)	depth (ft)	Volume (ft^3)	Cumm. Vol (ft^3)	Cumm. Vol (ac-ft)
115.5	140,042					
113.5	131,773				1,153,457	26.5
		129,716	1.0	129,716		
112.5	127,658				1,023,741	23.5
		69,997	1.0	69,997		
111.5	12,336				953,744	21.9
		66,002	1.0	66,002		
110.5	119,667				887,743	20.4
		117,709	1.0	117,709		
109.5	115,750				770,034	17.7
		113,818	1.0	113,818		
108.5	111,886				656,216	15.1
		109,981	1.0	109,981		
107.5	108,075				546,236	12.5
		106,196	1.0	106,196		
106.5	104,317				440,040	10.1
		102,464	1.0	102,464		
105.5	100,610				337,576	7.7
		98,168	1.0	98,168		
104.5	95,725				239,409	5.5
		94,540	1.0	94,540		
103.5	93,355				144,869	3.3
		91,581	1.0	91,581		
102.5	89,806				53,288	1.2
		88,814	0.6	53,288		
101.9	87,822				-	-

Westwood Estates
Job No. 1970

2/23/2000

Volume Calculations - Ultimate Basin

Elevation (ft)	Area (sf)	Ave. Area (sf)	depth (ft)	Volume (ft^3)	Cumm. Vol (ft^3)	Cumm. Vol (ac-ft)
115.5	193,421					
113.5	183,674				1,821,253	41.8
		181,280	1.0	181,280		
112.5	178,885				1,639,973	37.6
		176,519	1.0	176,519		
111.5	174,152				1,463,455	33.6
		171,814	1.0	171,814		
110.5	169,475				1,291,641	29.7
		167,180	1.0	167,180		
109.5	164,885				1,124,461	25.8
		162,588	1.0	162,588		
108.5	160,291				961,873	22.1
		158,037	1.0	158,037		
107.5	155,783				803,836	18.5
		153,557	1.0	153,557		
106.5	151,330				650,279	14.9
		149,132	1.0	149,132		
105.5	146,934				501,147	11.5
		144,764	1.0	144,764		
104.5	142,594				356,383	8.2
		140,452	1.0	140,452		
103.5	138,309				215,932	5.0
		136,195	1.0	136,195		
102.5	134,081				79,737	1.8
		132,895	0.6	79,737		
101.9	131,709				-	-

Westwood Estates
Job No. 1970

2/23/2000

Volume Calculations - Interim Basin

Elevation (ft)	Area (sf)	Ave. Area (sf)	depth (ft)	Volume (ft^3)	Cumm. Vol (ft^3)	Cumm. Vol (ac-ft)
115.5						
113.5	163,565				1,604,765	36.8
		161,293	1.0	161,293		
112.5	159,021				1,443,472	33.1
		156,778	1.0	156,778		
111.5	154,534				1,286,695	29.5
		152,319	1.0	152,319		
110.5	150,103				1,134,376	26.0
		147,916	1.0	147,916		
109.5	145,729				986,460	22.6
		143,571	1.0	143,571		
108.5	141,412				842,890	19.4
		139,281	1.0	139,281		
107.5	137,150				703,609	16.2
		135,048	1.0	135,048		
106.5	132,946				568,561	13.1
		130,872	1.0	130,872		
105.5	128,798				437,689	10.0
		126,753	1.0	126,753		
104.5	124,707				310,936	7.1
		122,690	1.0	122,690		
103.5	120,672				188,247	4.3
		118,818	1.0	118,818		
102.5	116,964				69,429	1.6
		115,715	0.6	69,429		
101.9	114,465				-	-

Appendix 5: Infrastructure Improvements Using Modified Design Criteria

Appendix 5 – Infrastructure Improvements using Modified Design Criteria

These proposed design alternatives are provided as an initial recommendation, and should be evaluated with the same care as any other alternatives considered by the design engineer.

Alternately Proposed Pumping Rates and Inlet Laterals

<table>
<tr><th>Drainage System</th><th>Pumping Rate (cfs)</th><th>SSJID Lateral Inlet</th><th>Total Pumping Rate to SSJID Lateral (cfs)</th><th>Downstream Lateral</th><th>Total Pumping Rate to Downstream Lateral (cfs)</th><th>SSJID Drain</th><th>Total Pumping Rate to SSJID Drain (cfs)</th></tr>
<tr><td>6A</td><td>-</td><td rowspan="4">K</td><td rowspan="4">8.88</td><td rowspan="7">Ka</td><td rowspan="7">24.89</td><td rowspan="7">13</td><td rowspan="7">24.89</td></tr>
<tr><td>H</td><td>1.10</td></tr>
<tr><td>I</td><td>3.54</td></tr>
<tr><td>M</td><td>4.24</td></tr>
<tr><td>J</td><td>3.75</td><td rowspan="3">Ka</td><td rowspan="3">16.02</td></tr>
<tr><td>K</td><td>6.41</td></tr>
<tr><td>L</td><td>5.86</td></tr>
<tr><td>3</td><td>3.8</td><td rowspan="2">Bd</td><td rowspan="2">7.60</td><td rowspan="2">Bk</td><td rowspan="2">7.60</td><td rowspan="2">14</td><td rowspan="2">7.60</td></tr>
<tr><td>7</td><td>3.8</td></tr>
<tr><td>11</td><td>-</td><td rowspan="3">A-dd</td><td rowspan="3">8.50</td><td rowspan="3">Bc</td><td rowspan="3">8.50</td><td rowspan="9">Lone Tree Creek</td><td rowspan="9">43.88</td></tr>
<tr><td>C</td><td>0.51</td></tr>
<tr><td>E</td><td>7.99</td></tr>
<tr><td>1</td><td>6</td><td rowspan="5">B</td><td rowspan="5">17.95</td><td rowspan="2">B</td><td rowspan="2"></td></tr>
<tr><td>2</td><td>4.5</td></tr>
<tr><td>5</td><td>3</td><td rowspan="2">Bc</td><td rowspan="2"></td></tr>
<tr><td>F
(Campbell Drain)</td><td>1.46</td></tr>
<tr><td>G
(Campbell Drain)</td><td>2.99</td><td>Bd</td><td></td></tr>
<tr><td>A</td><td>17.43</td><td>Be</td><td>17.43</td><td>Bf</td><td>17.43</td></tr>
</table>

Alternately Proposed Basin Sizes

Use: $C_{(Runoff\_Coefficient,\_inches/hour)} = \frac{8.37}{T_C^{0.614}} * T = \frac{8.37}{(60\sec)^{0.614}} * 60hr = 3.29\_inches$

Drainage System	Total Required Volume, 60 Hour Storm (Acre Feet)	Pump Rate (cfs), Basin Empty in 60 hours	Required Surface Area (Acres) for 60 Hour Storm, Assume 6.25' Depth	Surface Area (Acres), Currently Incorporated into SDMP	Increase in Required Surface Area (Acres)	Potentially Available Surface Area (Acres), from GIS parcels
H	5.45	1.10	0.87	3.38	-	4.80
I	16.43	3.54	2.63	2.77	-	3.15
I-1	1.10		0.18	0.52	-	2.36
J	18.60	3.75	2.98	3.38	-	4.40
K	31.77	6.41	5.08	3.38	1.70	5.29
L	29.04	5.86	4.65	3.38	1.26	6.40
M	21.04	4.24	3.37	3.38	-	6.58

Appendix 6: Proposed Storm Drain Basin Volume Calculations

Appendix 6 - Proposed Storm Drain Basin Volume Calculations

Equation-Based Calculations (Minimum Necessary Basin Volume)

Drainage Area	Total Volume (Acre-Feet)	Surface Area (Acres), Assuming 6.25' Depth (Avg. of Existing Basins)	C (Runoff Coefficient)	A (Tributary Shed Area, in Acres)	Area Residential C=0.35	Area Commercial C=0.90	Area Industrial C=0.85	Area Open Space C=0.15	Area Agriculture C=0.15	R (Total Design Storm Rainfall, in inches)
A	37.73	6.04	0.73	261.23		68.51	142.40		50.32	2.38
B	3.82	0.61	0.35 Use C=0.40 to account for higher density residential areas	48.19	48.19					2.38
E	15.91	2.55	0.35	229.16	229.16					2.38
F	2.07	0.33	0.90	11.61		11.61				2.38
G	7.06	1.13	0.56	63.22	38.70	24.52				2.38
H	3.94	0.63	0.35	56.82	52.88			3.94		2.38
I	11.89	1.90	0.35	171.24	167.52			3.72		2.38
I-1	0.80	0.13	0.35	11.47	11.47					2.38
J	14.29	2.29	0.74	96.93	21.44	7.20	68.29			2.38
K	21.71	3.47	0.85	128.75			128.75			2.38
L	15.71	2.51	0.67	117.71	37.10		77.36	3.26		2.38
M	15.22	2.44	0.35	219.25	175.24		11.05	32.96		2.38

Appendix 7: Future Storm Drain Connection Fees per Gross Acre

Appendix 7 - Storm Drainage Connection Fees per Gross Acre

Drainage Area	Total Improvement Cost	Area, Existing (Tributary Shed Area, in Acres)	Area, Future Addition (Ac)	Area (Ac), Single Family Residential	Cost per Acre, Single Family Residential	Area (Ac), Multi Family Residential	Cost per Acre, Multi Family Residential	Area (Ac), Commercial	Cost per Acre, Commercial	Area (Ac), Industrial	Cost per Acre, Industrial
1		53.1		47.52				5.56			
2		172.0		107.02		2.1		47.3			
3		26.3		26.34							
4		190.8		83.69		16.9		55.6		27.2	
5		19.5		8.13	$6,830.93	10.7	$9,764.34		$17,455.80		$13,657.76
6		81.4		64.48	$6,492.46	3.5	$9,285.35	11.7	$15,777.81		$13,126.47
6-Future	$299,825		23.5	23.51	$12,760.00		N/A		N/A		N/A
6A		45.2		43.16						2.1	
7		163.2		156.01	$5,096.53		$10,194.09		$12,386.96		$10,194.09
7A-Future	$202,224		4.0		N/A	4.0	$50,720.00		N/A		N/A
7B-Future	$1,892,139		38.2	21.60	$29,420.00		N/A	16.6	$75,660.00		N/A
8		66.0		62.03	$7,841.21		$11,219.76		$19,056.87		$15,699.86
8-Future	$214,225		27.6	10.56	$3,940.00		N/A	17.0	$10,140.00		N/A
11		85.6		77.17		2.6		4.2			
11-Future	$613,250		15.8	5.70	$25,080.00	10.1	$46,570.00		N/A		N/A
A	$9,229,638		261.2		N/A		N/A	68.5	$45,470.00	142.4	$42,950.00
B	$1,214,535		48.2	34.25	$22,430.00	13.9	$32,040.00		N/A		N/A
E	$4,804,088		229.2	229.16	$20,970.00		N/A		N/A		N/A
F	$769,988		11.6		N/A		N/A	11.6	$66,330.00		N/A
G	$2,010,875		63.2	38.7	$19,770.00		N/A	24.5	$50,820.00		N/A
H	$1,432,113		56.8	52.88	$27,090.00		N/A		N/A		N/A
I	$3,737,388		171.2	163.11	$21,820.00	4.4	$40,520.00		N/A		N/A
I-1	$629,688		11.5	11.47	$54,900.00		N/A		N/A		N/A
J	$3,510,488		96.9	21.44	$17,060.00		N/A	7.2	$43,870.00	68.3	$41,430.00
K	$5,100,550		128.8		N/A		N/A		N/A	128.8	$39,620.00
L	$3,897,338		117.7	27.86	$16,740.00	9.2	$31,090.00		N/A	77.4	$40,650.00
M	$4,746,575		219.3	175.24	$23,490.00		N/A		N/A	11.0	$57,050.00

Notes:
- Costs per acre are rounded up to the nearest $10
- Original Drainage Area 9 has been incorporated into new Drainage Area E
- Original Drainage Area 10 has been incorporated into new Drainage Areas K, L and M
- Connection fees for Drainage Areas 1, 2, 3, 4, 6A, and 11 will be determined on case-by-case basis
- Connection fees for land uses not shown above will be determined on a case-by-case basis
- ENR Construction Cost Index for January 2008: 8090.06