GUADALUPE DRAINAGE IMPROVEMENT PROJECT
10-YEAR DESIGN

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FINAL DRAINAGE REPORT

November, 2001

Prepared for
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Prepared by

SVERDRUP CIVIL, INC.
875 West Elliot Road
Suite 201
Tempe, Arizona 85284

Registered Professional Engineer (Civil)
CERTIFICATE NO. 26882
DANIEL E. STOUGH
Date Signed 11-05-01
ARIZONA U.S.A.

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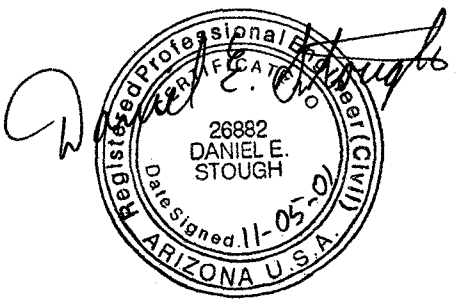

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1.0 INTRODUCTION

1.1 HISTORY, PURPOSE AND SCOPE OF WORK

1.1.1 History and Introduction

Incorporated in 1975, Guadalupe is a small "land-locked" community with a population of approximately 5,400 residing within a land area of 465 acres. The Town is located between the cities of Phoenix and Tempe. The land use within the town is mostly residential with some industrial and commercial/retail areas. The Town is located immediately east of Interstate 10 (I-10), south of Baseline Road, and west of the Highline Canal, and experiences severe flooding on a frequent basis. Runoff flows from I-10 to the east or north through the town and collects along the west side of the Highline Canal. The Town has only minimal drainage infrastructure to collect and contain the storm flows with streets being used as the main means to collect the runoff. However, most streets have no curb and gutter, thus limiting their hydraulic capacity. Further, several home sites have been constructed below the elevation of the adjacent street, which diverts runoff from the street and through the lot. The lack of drainage outfalls is also a problem. Runoff that ponds behind the Highline Canal builds up until it overtops the west canal bank/maintenance road and flows into the canal. Storm flows originating from the Town of Guadalupe have caused flooding of streets and private property in the City of Tempe.

In 1996, the Flood Control District of Maricopa County (the District, FCDMC) retained the consulting firm of Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) to prepare a drainage study for the Guadalupe area. The "Guadalupe Pre-Design Study Final Report" study identified the drainage problems of the area, developed hydrologic modeling, and developed alternatives to contain and identify discharge points. The recommendation from the report named three retention basin sites (north, central, and south basins) and identified the means to bleed off the retained flows utilizing an existing storm drain constructed for I-10 by the Arizona Department of Transportation (ADOT), and the Highline Canal, owned by Salt River Project (SRP).

In 1998, the District retained the consulting firm of Pentacore Arizona (Pentacore) to prepare an Alternative Analysis for Conveyance Facilities (FCD 98-45) that expanded upon the work done previously by PBS&J. Several conveyance channels/storm drain concepts were examined and a recommended system was brought forward for final design. Pentacore was responsible for aerial mapping along the Highline Canal and for fine-tuning the earlier hydrology model for use during the alternative analysis. The District approved the hydrology model for use in the future design. Also, the District prepared Intergovernmental Agreements with and between the Town of Guadalupe, SRP, and the City of Tempe.

In 1999, the District retained the consulting firm of Sverdrup Civil, Inc. (Sverdrup) to prepare final design plans for the Guadalupe Drainage Improvement Project (FCD 99-17). Sverdrup was to prepare final construction plans for retention basins and conveyance systems to handle and contain the 100-year design storm. In addition, the retention basins and conveyance systems were to be designed for multi-use purposes (i.e. flood control and recreational use). Sverdrup was provided

the Pentacore hydrology model as a basis for design of the project elements. Subsequently, 60% construction plans were developed and reviewed by several agencies and the Town. The Town and SRP were concerned about the significant impacts to the residents located along the Highline Canal, and impacts to the canal west bank that were affected by the 100-year project. Because of these various concerns the project design basis was revisited and a revised scope to downsize the project to a 10-year system was implemented. In 2000, the District issued a change order, approved by the Flood Control Board of Directors, reducing the design storm to a 10-year event and revised the drainage concept to include a storm drain system. Multi-use retention basins would be reduced in size and a storm drain system developed for areas east of Avenida del Yaqui that potentially could be expanded by the Town at a later date. The storm drain system and catch basins were designed to account for the planned curb and gutter improvements to be implemented by the Town under a contract with Pentacore. Until all planned curb and gutter improvements are implemented the storm drain system will not function to design levels. Both projects utilize the same vertical/horizontal control datum utilized by Pentacore for the project. Evaluations to modify the existing flood plain for the 100-year storm were deleted from the scope of work due to the downsizing of the project.

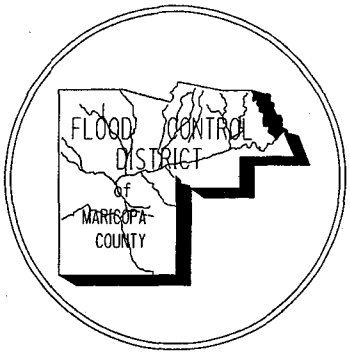
1.2 SCOPE OF WORK

The Guadalupe Drainage Improvement Project - Final Design is identified as Flood Control District of Maricopa County (FCDMC) contract number PCN Number 035-02-31. The project involves work within Maricopa County in Township 1 South, Range 4 East of the Gila and Salt River Base and Meridian in Sections 4, 5, 8, and 9 (see Figure 1). The FCDMC, the Town of Guadalupe, and the City of Tempe are part of an inter-government team formed to provide four retention basins and storm drain improvements within the Town of Guadalupe and the City of Tempe to reduce the flooding within the Town of Guadalupe and to a lesser extent, in the City of Tempe. The flood control facilities will be designed to contain the 10-year storm event.

1.3 EXISTING DRAINAGE CONDITIONS AND PROBLEMS

The existing surface runoff from the Town of Guadalupe drains eastward and northward and normally collects and ponds along the western bank of the Highline Canal North Branch. The total area that contributes runoff is 0.684 square miles. The resulting flooding affects numerous Town of Guadalupe residences along the canal. Intense runoff causes overflow of the Highline Canal into the City of Tempe and the adjacent residences. At public meetings, town residents had noted severe ponding of storm water near the intersection of Calle Vauo Nawi and Calle San Angelo, and at Calle Batoua and Calle Pitaya. Large street flows were reported on Calle Gloria, Avenida Del Yaqui, and Guadalupe Road.

Concentrated street runoff in Avenida Del Yaqui typically drains northward from Calle Pitaya to the intersection of Baseline Road and Priest Drive, causing severe street flooding. A 48-inch diameter storm drain was installed as part of an ADOT project to improve Avenida Del Yaqui (1996) in anticipation of this project. The existing storm drain has no outlet and the inlets have been temporarily blocked off.



MARICOPA COUNTY

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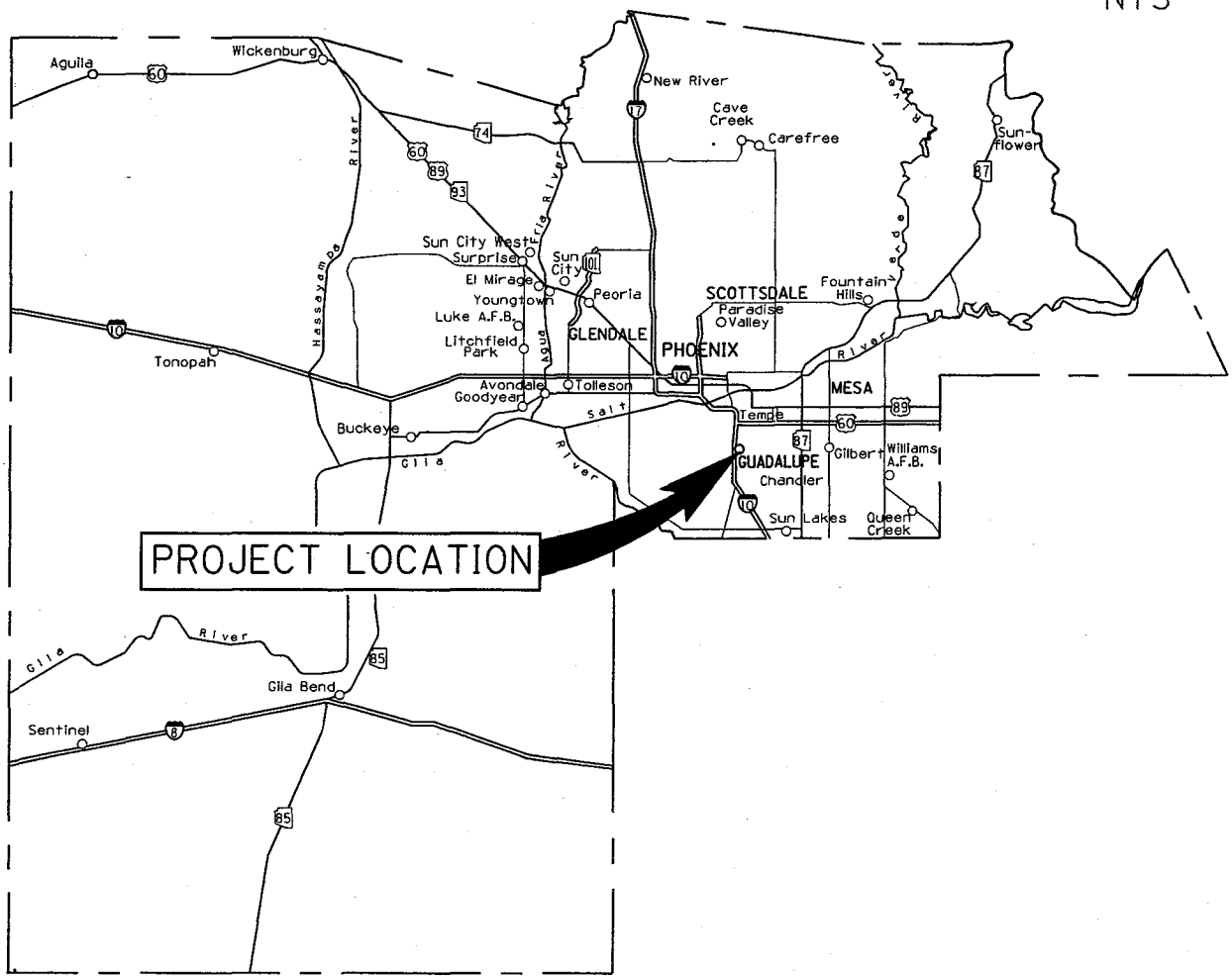


	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY ENGINEERING DIVISION
FIGURE 1 LOCATION MAP	GUADALUPE DRAINAGE IMPROVEMENT PROJECT - 10-YR DESIGN PCN NO. 035-02-31

Runoff from sub-basins south of Calle Sonora (near Frank School) flows from west to east. The intersections of Avenida Del Yaqui and Calle Magdalena, Calle San Angelo, Calle Iglesia, and Calle Mexico typically have a cross-slope from west to east to allow storm flows to continue in an easterly direction.

The concentrated runoff on Guadalupe Road drains eastward to the intersection of Hardy Drive and Guadalupe Road, causing street flooding. Small area inlets have been installed on both sides of Guadalupe Road, just west of the canal collect minor flows and discharge into either the canal or an existing 24-inch irrigation pipe. However, the catch basins and pipes are only able to intercept approximately 20 cfs, which is considerably less than the 10-year storm runoff.

When Guadalupe storm runoff flows into the Highline Canal, the canal provides approximately 2-acre feet of detention. The flows are conveyed northward to the crossing under Avenida Del Yaqui. Storm runoff in excess of the existing 66-inch diameter pipe capacity breaks out of the north bank of the canal at a location approximately 100 feet east of Avenida Del Yaqui. The breakout volume flows along the cinder-block wall adjacent the storage facility, then turns eastward at the end of the wall and discharges onto Beck Avenue.

A secondary canal breakout location is located approximately 400 feet south of Calle Pitaya. This lesser breakout volume flows along the SRP east right-of-way block wall, turns eastward at the north end of the wall, then flows along the alley to Beck Avenue.

When the canal is already full, additional runoff flows enter the canal at Calle Iglesia and Calle Mexico and then overtop the canal east bank. This overtopping volume then follows the aforementioned SRP east right-of-way wall northward to ultimately discharge onto Beck Avenue.

1.4 DESCRIPTION OF IMPROVEMENTS

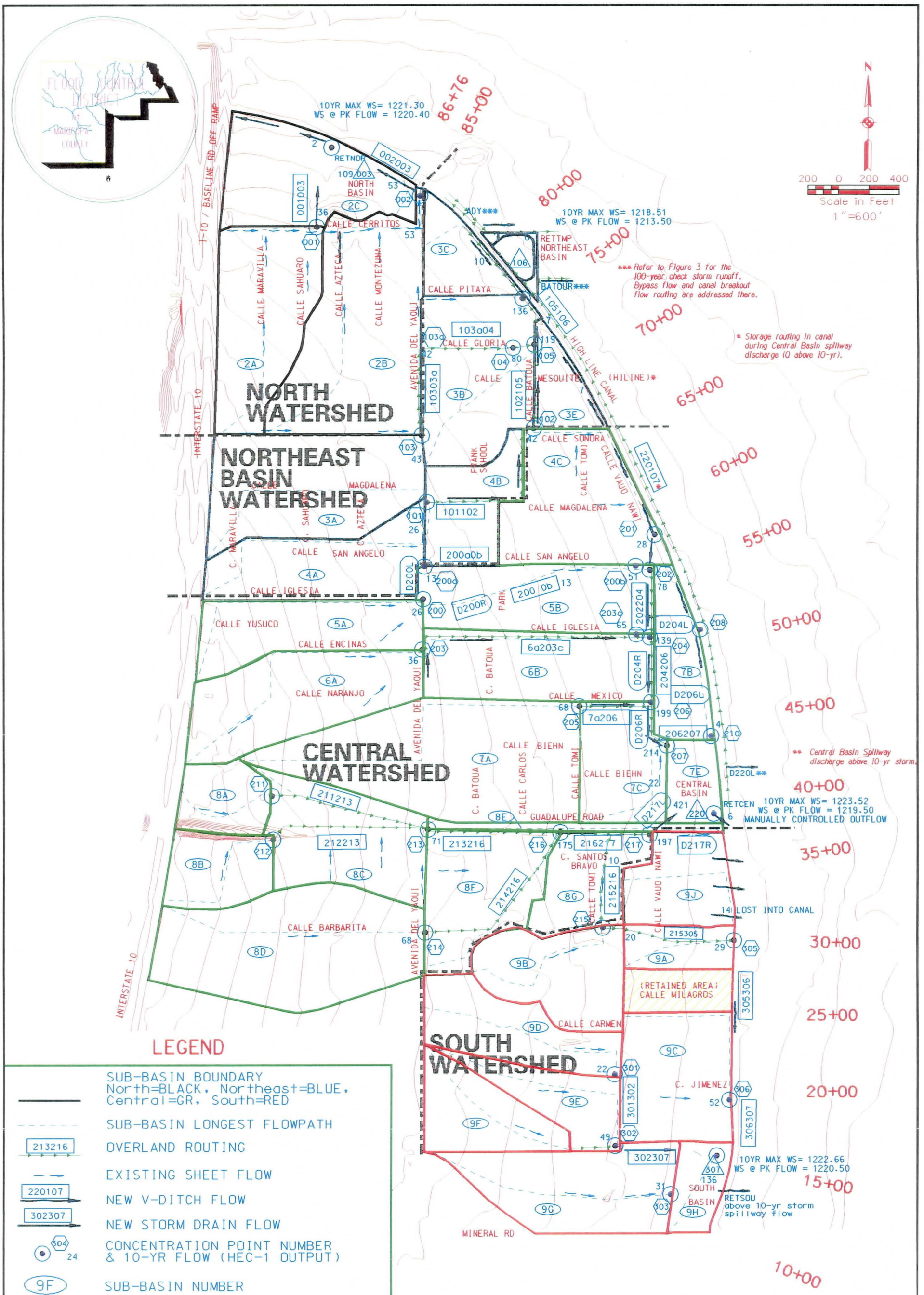
See the Vicinity Map (Figure 2) for the overall project area.

- Four new retention basins identified as the: North Basin, Northeast Basin, Central Basin, and South Basin will be constructed to capture and retain the 10-year runoff volume;

1.4.1 Storm Drains

Eight collector storm drains were designed for the following locations:

- STORM DRAIN 1 —Along Calle Magdalena and Calle Batoua, a system of storm drain pipes, laterals, and catch basins will be used to collect the surface runoff from the west, and convey the flows to the new Northeast Retention Basin;
- STORM DRAIN 2 — Along Calle Vauo Nawi, north of Guadalupe Road, a system of storm-drain pipes, laterals, and catch basins will be used to collect the surface runoff from the west, and convey the flows to the new Central Retention Basin;
- STORM DRAIN 3 — Along Guadalupe Road, a new storm drain will connect to the existing storm drains under the Avenida Del Yaqui intersection. The flows will be conveyed eastward to the new Central Retention Basin.



LEGEND

- SUB-BASIN BOUNDARY North=BLACK, Northeast=BLUE, Central=GR, South=RED
- SUB-BASIN LONGEST FLOWPATH
- 213216 — OVERLAND ROUTING
- EXISTING SHEET FLOW
- 220107 — NEW V-DITCH FLOW
- 302307 — NEW STORM DRAIN FLOW
- 304 / 24 — CONCENTRATION POINT NUMBER & 10-YR FLOW (HEC-1 OUTPUT)
- 9F — SUB-BASIN NUMBER
- 307 — RETENTION BASIN INFLOW CONCENTRATION POINT
- D103L — DIVERSION OR FLOW SPLIT

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

FIGURE 2 - VICINITY MAP & WATERSHED DELINEATION MAP 10-YEAR DESIGN STORM

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PCN NO. 035-02-31

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- STORM DRAIN 4 — Provisions were made for future development to the northwest of the South Retention Basin. The Town of Guadalupe requested a stub-out at the main SD4 inlet, to accommodate future storm drain infrastructure development. A new median catch basin serves as the interim primary inlet that collects flows from area, and discharges into Storm Drain 4 that runs west to east, into the South Basin.
- STORM DRAIN 5 — Located along the west side of the Highline Canal O&M road, starting to the north of Calle Milagros and discharging into the South Retention Basin.
- STORM DRAIN 6 — Located along the west side of the Highline Canal O&M road, starting just north of Calle Iglesia and discharging into the Central Retention Basin.
- STORM DRAIN 7 — Starting at Avenida Del Yaqui, at the north end of town, the existing storm drain network will be connected to the new North Retention Basin;
- STORM DRAIN 9 — A new V-ditch will be constructed from Calle Cerritos around La Lomita (Ceremonial Hill) to convey approximately half of the North watershed runoff directly into Storm Drain 9 located on the south side of the North Retention Basin, which discharges into the North Retention Basin.

Two bleedoff storm drains were also designed:

- STORM DRAIN 8 — The bleedoff pipe from the North Basin to the existing ADOT storm drain alongside the I-10 / Baseline Road off ramp.
- STORM DRAIN 10 — The bleedoff pipe from the Central Basin to the existing SRP irrigation lateral that ultimately discharges into the Western Canal.

1.4.2 V-Ditches

Along the Highline Canal, a system of V-ditches will act as collection sumps for the area catch basins of Storm Drains 1, 2, 5, 6, 7, and 9. A new short V-ditch Along Calle Pitaya conveys flow into the Highline ditch. A new V-ditch along the new O&M road that parallels the northern boundary of the South Basin and a new perimeter V-ditch along the South Basin west boundary intercept overland flow and discharge into the basin.

1.5 FINAL DESIGN ASSUMPTIONS & CRITERIA

The design for the this project was redefined in the year 2000, such that a storm drain collector system under local streets would collect the 10-year storm. The hydrology model in the Pentacore Report was reviewed by Sverdrup Civil and verified based on field observations during runoff events. The model was then used as the basis for the final HEC-1 model for this project, pending certain modifications. The HEC-1 model was modified to obtain the **10-year** design flows needed for this project and a second ratio was added to emulate the 100-year runoff.

Additional modifications to the original Pentacore HEC-1 include: addition of additional diversions to emulate actual drainage conditions, certain sub-basins were re-delineated, certain concentration points were relocated, routing steps for storm drains, channels, V-ditches, and retention basins. The modifications were reviewed and accepted by the Flood Control District of Maricopa County for use with the final design of the drainage improvements.

This Final Drainage Report and design concepts described herein, follow the guidelines stated in the Drainage Design Manuals for Maricopa County: Hydrology (Volume 1), Hydraulics (Volume 2), and Erosion Control (Volume 3). All size references, stations, distances, flow rates, and volumes are in Standard English units. The drainage design criteria is as follows:

- 10-year, 6-hour design storm for storm drain, V-ditch, and retention basin headwater.
- The 10-yr rainfall depth of 1.925 inches was used uniformly throughout the 4 watersheds.
- The retention basins were sized to provide a minimum 1-foot of freeboard from the 10-year high water surface to the spillway elevation.
- A table of rainfall depths was developed using the PREFRE program. The rainfall depths are summarized for a range of frequencies and durations in Appendix A. The ratio for the 100-year, 6-hour design storm was calculated to be 1.62 times the 10-year, 6-hour depth.
- The 100-year, 6-hour design storm was modeled in HEC-1 by applying a ratio of 1.62 to the 10-year rainfall in the HEC-1 runs. The 100-year runoff was checked only to determine the 100-year high water elevations of each retention basin, spillway flows, and overall flood routing for each watershed;
- The first hour of runoff of the 100-year storm will be captured in the North Retention Basin prior to the onset of the 2-cfs bleedoff flow into the ADOT Interstate-10 storm drain;
- Central Basin bleedoff flows will be allowed to drain via a manually controlled valve, into an existing SRP irrigation pipeline, at a rate not to exceed 6 cfs;
- The Northeast, Central and South basins were designed to hold the entire 10-year storm event and a significant portion of the 100-year volume, without the benefit of bleedoff outflow;
- The South and Northeast Basins will use drywells and soil infiltration to evacuate the retained storm water;
- Northeast Basin will have additional capacity to intercept the 100-year, 2-hour onsite runoff;
- Spillway overflows or basin bypass flows will continue along historic flow paths;
- Retention basins will be drained within 36 hours after cessation of the rainfall event;

The FCDMC guidelines for storm water management call for future development of private parcels to contain their own runoff by providing onsite storm water retention for the 100-year, 2-hour event. This final design hydrologic model (HEC-1) accounts for the existing retention in the new subdivision along Calle Milagros. To be conservative, all other future development areas in the South and Central watersheds were assumed NOT to have onsite retention.

1.6 TOPOGRAPHIC SURVEY DATA

Salt River Project (SRP) performed the original survey for the project in 1997. Pentacore of Arizona (Pentacore) expanded the SRP survey for this project (Survey Report dated July 7, 1999). The basis of survey was the brass caps in hand-holes at the intersections of Hardy Drive/Guadalupe Road and Kyrene Road/Guadalupe Road. The SRP vertical datum was based on the elevation of the brass cap in the hand hole located at Guadalupe Road and Avenida Del Yaqui.

Pentacore used the same SRP horizontal control and vertical datum to perform additional surveys for this Drainage Improvement Project in 1999 through 2000. Pentacore also provided the existing digital terrain model and associated topographic CADD files to Sverdrup.

For this project, all of the existing right of way and property lines were based upon the 1999 Pentacore horizontal control and section corner locations.

Pentacore provided additional topographic survey based on project needs in the areas around Avenida Del Yaqui, Calle Cerritos, Calle Gloria, Calle Magdalena, Calle San Angelo, Calle Iglesia, Calle Mexico, Calle Biehn, and Guadalupe Road. Project Engineering Consultants provided additional topographic survey.

Pentacore provided additional survey information taken from an ongoing street improvement project in the Town of Guadalupe. The additional topo data was provided to Sverdrup and added to the digital terrain model for the project. Existing and proposed curb and gutter improvements from the street improvement project were imported into the CADD file for this project.

1.7 GEOTECHNICAL SURVEY DATA

Speedie and Associates performed three geotechnical surveys (dated 1/2000, 3/2000, 4/2001). Forty-five borings were performed to determine the soil strata configuration at the retention basin sites along the western side of the Highline Canal and at strategic locations along the streets of the Town of Guadalupe.

Percolation tests were performed using ADEQ Engineering Bulletin No. 12 method. The rates determined by the tests were used to model the natural infiltration of retained runoff at the retention basins. Those rates were:

North Basin – 0.3 feet per hour (or Cubic Feet / Hr / Sq Ft of Basin)
Northeast Basin – 0.5 feet per hour
Central Basin – 0.5 feet per hour
South Basin – 0.5 feet per hour

1.7.1 Drywell Percolation Rates

Maxwell drywells was consulted regarding the percolation rate that could be used for the design of drywells in the basins. The working flow rate at the time of installation is typically 0.4 cfs. A clogging safety factor of 50% was used to reduce the effective rate to 0.2 cfs, which was used to determine the number of drywells needed. Additional measures were taken in the design to reduce the effects of siltation and are discussed in Chapter 3. Recommendations regarding drywell maintenance are set forth in Chapter 5.

2.0 HYDROLOGY

2.1 WATERSHED BOUNDARY AND ROUTING ALTERATIONS

The Corps of Engineers, HEC-1 computer model provided by Pentacore was the base hydrologic model for the existing condition. It was necessary to divide the single HEC-1 model into three separate hydrologic models to accommodate the new routing steps and to model diversions for the 10- and 100-year storm events (see Appendix B for NOR10_11.oh1, TMCE10_8.oh1, SOU10_6.oh1). The following modifications were made to the models to provide concentration points needed for the hydraulic design. See the Watershed Delineation Map (Figure 2). See Table 1 in this chapter for a summary of the 10- and 100-year runoff flows at the principal concentration points.

2.1.1 North Watershed

The North Watershed is bounded by: the Highline Canal on the north, ADY on the east, Calle Sonora on the south, and Interstate 10 on the west. The runoff from Sub-basins 2A-2C flows directly into the North Retention Basin. See the Appendix for HEC-1 output (NOR10_11.OH1). Sub-basins 3A through 3E were routed into the Northeast Watershed. Changes to the North Watershed include:

- Storm Drain 7, 8, and 9 were modeled in the NOR10_11 HEC-1 run. See Figure 3 that illustrates the storm drain alignments.
- The North Retention Basin was reduced in size due to the reduced volume of retention required for the 10-year design.

2.1.2 Northeast / Central Watershed

The Northeast Retention Basin was added eliminate the need for a major storm drain along the Highline Canal and a storm drain crossing of Avenida Del Yaqui. Sub-basins 3A-3E were redefined to be within the Northeast Watershed. The Highline Canal hydraulically connects the Northeast and Central watersheds during major storm events. Therefore, the two retention basins are modeled in the same HEC-1 hydrologic analysis to simulate the flood routing along the Highline Canal for the 100-year storm. See the Appendix for HEC-1 output (TMCE10_8.OH1).

The Northeast Watershed is bounded by: Avenida Del Yaqui and Interstate 10 on the west, the Highline Canal on the east and north, and a meandering southern boundary along Calle Iglesia, Calle San Angelo, Calle Batoua, and Calle Sonora. The runoff from Sub-basins 3A-3C, 3E and 4A-4B (formerly in the North watershed) were directed into the Northeast Retention Basin. Changes to the sub-basin boundaries include:

- The Sub-basins 3A-3C, 3E and 4A-4B were rerouted into the Northeast Retention Basin;
- Sub-basins 3C and 3D were combined into SUB3C;
- Sub-basins 4B and 4C were re-delineated to correspond to the new storm drain along Calle Batoua; and
- Storm Drains 1, 2, 3, and 5 are modeled in the TMCE10_8 HEC-1 run.

The Central Watershed is the largest watershed, bounded by: the Highline Canal on the east, the aforementioned meandering line (for Northeast Watershed) as the north boundary, Interstate 10 on the west, and a meandering line along Calle Carmen, Calle Carlos and Guadalupe Road. The runoff from Sub-basins 4C, 5A-5B, 6A-6B, 7A-7C, 7E, 8A-8G and half of 9B will be directed into the Central Retention Basin. Changes to the sub-basin boundaries include:

- Sub-basin 5B was re-delineated with boundaries corresponding to new storm drains along

Calle San Angelo and Calle Vauo Nawi;

- Sub-basin 6B was re-delineated with boundaries corresponding to new storm drains along Calle Iglesia, Calle Mexico, and Calle Vauo Nawi;
- Sub-basins 5C, 7B and 7D were combined into SUB7B;
- Sub-basin 8F was re-delineated to correspond to the new Guadalupe Town Hall development limits. A residential portion formerly in SUB8F was delineated and designated SUB8G;
- Sub-basins 8A-8G were rerouted into the Central Retention Basin, thus reducing the size requirements for the South Retention Basin.

2.1.3 South Watershed

The South Watershed is bounded by: the aforementioned meandering line (Carmen/Carlos/ Guadalupe) on the north, Highline Canal on the east, Mineral Road on the south, and ADY to the West. Runoff from Sub-basins 9A-9H and 9J will be directed into the South Retention Basin. See the Appendix for HEC-1 output (SOU10_6.OH1). Changes to the South Watershed include:

- Sub-basins to the south of Guadalupe Road (9A-9G) were re-delineated to correspond to the new Yaqui Channel, the new V-ditch and minor storm drain system along the canal, and the South Retention Basin;
- A portion of Sub-basin 9A was split out and renamed SUB9J. The runoff from SUB9J can not be intercepted by the South storm drain network without significant relocations of the property south of Guadalupe Road;
- The South Retention Basin was reduced in size and depth due to the reduced volume of retention required for the 10-year design;
- The area including the new subdivision along Calle Milagros was excluded because of onsite retention that will remain;
- The new Yaqui channel and Storm Drain 4 intercept runoff from SUB 9D, 9E, and 9F; and
- Storm Drain 6 along the canal is also modeled in the SOU10_6 HEC-1 run.

2.2 STORM DRAIN 10-YEAR FLOOD ROUTING AND DIVERSIONS

The HEC-1 routing for the storm drain reaches was developed from the final plans & profiles, diameters, inlets, and junction locations. The changes to the HEC-1 routing steps are discussed in this section, arranged by Storm Drain number. Some of the HEC-1 storm-drain routing reaches are composites of two or more shorter segments of pipe. As with the Pentacore model, the Muskingum-Cunge routing method was used. In such instances, the average pipe diameter and slope was used for the HEC-1 routing reach. See Appendix B for schematics of the HEC-1 routing steps.

The peak flow results of the HEC-1 model has been summarized in Table 1 for both the 10-yr, 6-hr and 100-yr, 6-hr rainfall events. See also Figure 3, which illustrates the storm drain alignments listed after Table 1.

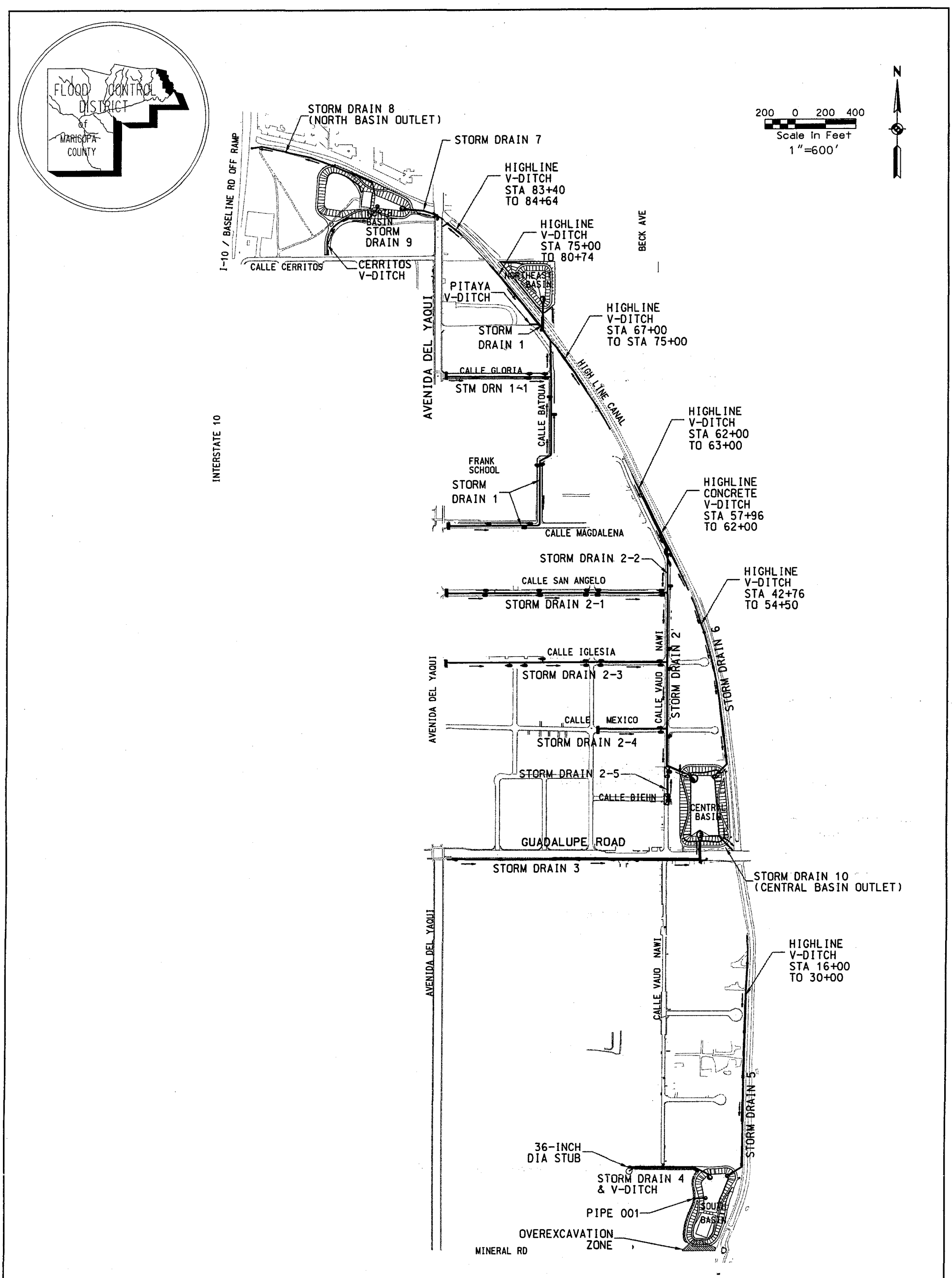
TABLE 1 - SUMMARY OF FLOWS

CONCENTRATION POINT (CP#)	INFLOW INTO CONVEYANCE	Q_{10} (cfs)	Q_{100} (cfs)
NOR10_11.OH1	Avenida Del Yaqui		
001	Calle Cerritos V-Ditch, Sta 10+00	36	66
002 (SUB 2B)	Storm Drain 7, Sta 17+74	53	98
TMCE10_8.OH1	Calle Batoua		
101 (SUB 4A)	Storm Drain 1, Sta 10+00	26	48
102	Storm Drain 1, Sta 20+11	42	76
103 (SUB 3A)	Storm Drain 1-1, C. Gloria Sta 10+54	43	80
104	Storm Drain 1-1, C. Gloria Sta 16+00	80	152
105	Storm Drain 1, Sta 26+40	119	226
106	Storm Drain 1, Sta 30+36;	136	256
TMCE10_8.OH1	Calle Vauo Nawi (north)		
200 (SUB 5A)	ADY, at channel / San Angelo split	26	48
200a (D200L)	Storm Drain 2-1, C. San Angelo Sta 10+00	13	24
200b	Storm Drain 2-1, C. San Angelo Sta 24+93	51	97
201 (SUB 4C)	Storm Drain 2-2, Sta 2+74	28	52
202	Storm Drain 2, Sta 23+01	78	149
203 (SUB 6A)	Storm Drain 2-3, C. Iglesia Sta 10+60	36	66
204	Total runoff at Storm Drain 2, Iglesia	139	263 *
D204L	Flow-by to East, Iglesia	0	123
D204R	Storm Drain 2 inflow	139	140
205 (SUB 7A)	Storm Drain 2-4, C. Mexico Sta 10+42	68	124
206	Total runoff at Storm Drain 2, Mexico	199	263 *
D206L	Flow-by to East, Mexico	1	63
D206R	Storm Drain 2 inflow	199	200
207	Storm Drain 2, Sta 11+36	214	240
	Highline Canal (north)		
210 (SUB7B)	Storm Drain 6 and V-ditch, Sta 43+60	4	7
	Guadalupe Road		
213	Storm Drain 3, Sta 10+72	71	130
216	Storm Drain 3, Sta 19+50	175	310
217	Storm Drain 3, Sta 24+76	197	355 **
D217R	Flow-by to East, Guadalupe Rd	0	150
SOU10_6.OH1	Calle Vauo Nawi (south)		
302	Storm Drain 4, Sta 15+21	49	92
SUB9G	Pipe 001, Sta 9+98	31	45
	Highline Canal (south)		
305	Storm Drain 5, Sta 29+60	29	51
306	Storm Drain 5, Sta 22+02	52	95

* Flow exceeding 10-year design flow drains to V-ditch along Highline canal.

** Exceeds capacity of storm drain, see flow-by D217R.

*** Runoff for Sub-basins 2C, 7E, and 9H are for the retention basin parcels and are not true "flows" (calculation of runoff volume only in HEC-1). The Northeast basin runoff volume was calculated separately in Appendix C.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

FIGURE 3
STORM DRAIN ALIGNMENTS
V-DITCHES AND CHANNELS

GUADALUPE DRAINAGE
IMPROVEMENT PROJECT
PCN NO. 035-02-31

2.2.1 Storm Drain 1

- Starting at CP101 (SUB4A), storm drain routing was added along Calle Magdalena (101102), turning north along Calle Batoua to CP102;
- A diversion could possibly occur at CP103 (SUB3A) with flow diverting along Avenida Del Yaqui to Calle Gloria or across the Frank School grounds. However, ALL of the CP 103 flow was used for the design of Storm Drain 1-1, which is conservative;
- CP104 was added just east of the northeast corner of the school, and is the total flow in Storm Drain 1-1 just upstream of the junction with Storm Drain 1 (CP105);
- Storm drain routing was added (102105) to model the storm drain between Calle Gloria and Calle Pitaya; and
- Overland, street flows, and any flow-by on Calle Gloria are intercepted at CP106.

2.2.2 Storm Drain 2

- Storm Drain 2 starts in the median area between Calle Vauo Nawi and the Highline Canal (CP201);
- No routing was used for short storm drain (SD 2-2) along Calle Vauo Nawi to the north of Calle San Angelo;
- A diversion was added at CP200 to split flow between Calle San Angelo (D200L) and the park channel (D200R). The D200L flow was routed along ADY directly to CP200a. In the final storm drain models the ENTIRE CP200 flow is assumed to reach the ADY / San Angelo intersection;
- The San Angelo flow is routed through the Storm Drain 2-1 routing step (200a_0b);
- CP200b is the total flow into Storm Drain 2 from Storm Drain 2-1;
- Collector storm drain (SD 2-3) routing was also added along Calle Iglesia (6a203c), and SD 2-4 routing was added for Calle Mexico (7a206);
- Collector storm drain inflows entered Storm Drain 2 at Calle San Angelo (CP202), Calle Iglesia (CP204), Calle Mexico (CP206);
- The diversion at CP 204 (Calle Iglesia) is based on the premise that Storm Drain 2 can only carry the 10-year flow. Therefore the diversion down SD-2 for the 100-year flow will be the same or only slightly larger than the 10-year flow. Likewise for CP 206 at Calle Mexico.
- Storm drain routing was added along Calle Vauo Nawi between each of the concentration points for the collectors (202204 and 204206); and
- After the 40-degree bend in the main drain, Storm Drain 2-5 flow from Calle Biehn was the final Storm Drain 2 flow, discharging into the Central basin (CP207).

2.2.3 Storm Drain 3

- Starting at ADY (CP213), storm drain routing was added along Guadalupe Road (213216);
- Concentrated flow entered at (CP216) (The existing detention basin to the west of Calle Tomi was not modeled), and the unabated storm drain flow was routed through Storm Drain 3 eastward (216217);
- Concentrated flow from four minor area inlets entered Storm Drain 3 at Calle Vauo Nawi (CP217);
- A diversion was added at CP217 to model 10-year flow that reached the Central Basin (D217L) and flow-by to the east along Guadalupe Road (D217R, for events exceeding the Q10); and
- Storm drain routing CP217 under Guadalupe Road, into the Central Basin was added.

2.2.4 Storm Drain 4

- Because the diverted flow from CP215 had to be simulated, the same SUB9B, D215L/D215R split was recreated in this model; the routed flow 215305 was considered the starting point for Storm Drain 4; An area catch basin serves as the main inlet into Storm Drain 4.;
- Storm Drain 4 routing was added (302307);

2.2.5 Storm Drain 5

- CP305 was renamed as the confluence of the overland runoff from SUB9A and the routed diversion flow from SUB9B (215305);
- Starting at CP305, Storm Drain 5 routing was used to CP307 (305306), the V-ditch was considered only a collection device. Therefore the ditch was not modeled in HEC-1;
- Additional flow entered at CP3306, with a routing step (306307) to CP307 where the total Storm Drain 5 flow enters the South Basin;
- The pipe flows were combined at CP307 as the total inflow into the South Basin.

2.2.6 Storm Drain 6

The runoff from SUB7E had an extremely flat slope and was modeled in HEC-1 without a routed reach.

2.2.7 Storm Drain 7

The concentrated flow in the storm drain along ADY (CP002) was considered to discharge directly into the North Basin (no reach routing).

2.2.8 Storm Drain 8

- The outlet pipe for the North Basin was modeled only as the North Basin routing step;
- A rating curve was developed after modeling the bleedoff structure with a crest elevation 2.5 feet above the lowest portion of the retention basin; The minor outflow through an 8-inch bleedoff orifice was included. The orifice was used to bleed off the last two feet of stored runoff from the east half of the basin; and
- The main bleedoff flow was considered to flow directly out of the system into the existing ADOT storm drain (next to I-10).

2.2.9 Storm Drain 9

The storm drain from the end of the V-ditch was modeled as the entire routing step from CP001 to the North Basin. Modeling constraints required that the entire V-ditch/Storm Drain routing reach be combined into just the storm drain reach (001003).

2.2.10 Storm Drain 10

- The Central Basin bleedoff outlet was not modeled (i.e. the manually controlled valve was considered to be closed for the HEC-1 hydrologic model).
- Only the spillway flow was modeled for the 100-year flow.

2.3 RETENTION BASINS

The retention basin footprints were reduced in size (from the original 100-year design) due to the reduced volume required by the 10-year design. See Chapter 4 for specifics on each retention basin design. The stage-storage relationships were calculated with the digital terrain model (DTM) for the new basins and incremental water surfaces (see Inroads – Triangle Volume reports in

Appendix B for the four retention basin design surfaces. The spillway stage discharge relationships were calculated internally in HEC-1 using the weir equation (see Appendix C). The bleedoff stage/discharge tables for the North and Central basins appear in Appendix A.

2.3.1 North Retention Basin

The North Retention Basin was reduced in size to hold the 10-year runoff volume for the Sub-basins 2A, 2B, and 2C.

2.3.2 Northeast Retention Basin

The Northeast Retention Basin was added to store the 10-year runoff volume for Sub-basins 3A, 3B, 3C, 3E, 4A, and 4B. The basin was oversized to contain not only the 100-year, 2-hour onsite runoff, but the majority of the 100-year 6-hour storm for the entire Northeastern Watershed, as required by the City of Tempe.

2.3.3 Central Retention Basin

The Central Retention Basin original layout was used to hold the 10-year runoff volume from sub-basins 4C, 5A-5B, 6A-6B, 7A-7C, and 7E. Sub-basins 8A-8G and part of 9B were added.

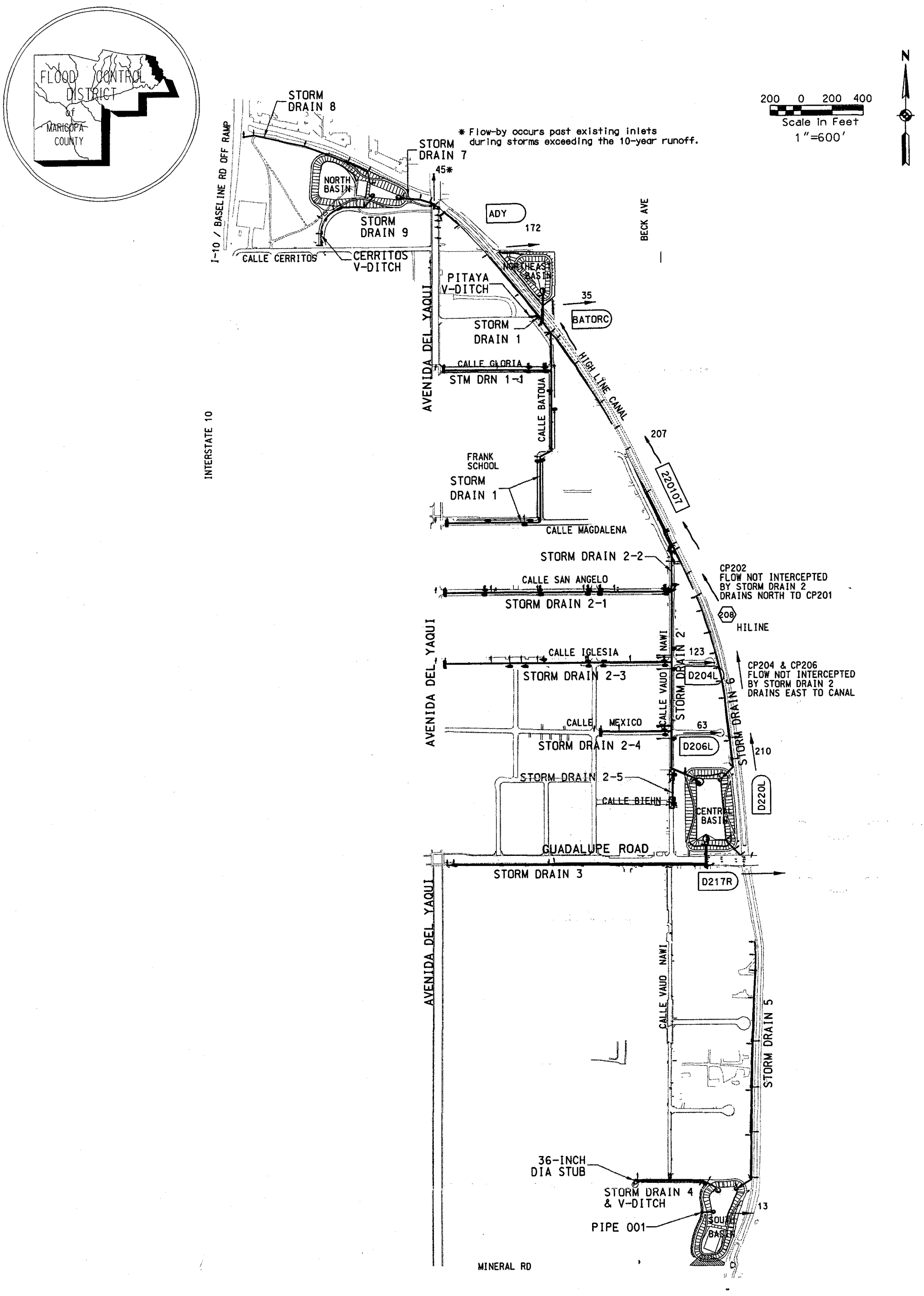
2.3.4 South Retention Basin

The South Retention Basin was reduced in size to hold the 10-year runoff volume for the Sub-basins 9A-9H.

2.4 100-YEAR FLOOD ROUTING AND DIVERSIONS

Because the storm drains were designed for the 10-year flow, a portion of the100-year flow would bypass the storm drain system. Therefore, additional routing steps were necessary in the Tempe / Central HEC-1 run to model the bypass flows into, along, and out of the Highline Canal into the City of Tempe (see also Figure 3).

- Diversions were added at CP 204 and CP 206 to determine the 100-year bypass flows to the east and directly into the Highline Canal;
- Diversion was added at the inlet at CP 217 to determine the 100-year bypass flows along Guadalupe Road to the east (leaving the system);
- A diversion was added at the Central basin spillway (D220L), and D220R was bleed-off pipe flow out of the system; and
- Additional channel routing along the Highline Canal and breakout simulations (diversions) were added between the Central Basin and the concentration point to the east of the Tempe Basin (BECKAV).



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

FIGURE 4
100 YEAR
FLOOD ROUTING

GUADALUPE DRAINAGE
IMPROVEMENT PROJECT
PCN NO. 035-02-31

3.0 HYDRAULIC DESIGN AND CALCULATIONS

3.1 RETENTION BASINS

3.1.1 General Design Features

- The North, Northeast, Central, and South retention basins were sized to contain the 10-year runoff within the boundaries of the parcels previously purchased by the FCDMC. The overall footprint of the North and South basins were reduced due to the reduced volume required for the 10-year design.
- The North, Central, and South basins were assumed to be handicap accessible and the ramps were designed to meet ADA requirements.
- The sideslopes of the North, Central, and South basins are 6:1 or flatter to provide easy escape during times of flooding.
- New chain link fencing (6-foot high) will be installed along the new west right-of-way (R/W) of the north basin, the west, north, and east R/W of the Central Basin, and the west, and east R/W of the South Basin. New 3-foot high chain link fencing will be installed along the northern edge of the North Basin.
- The 2:1 inner side slopes of the Northeast Basin require that the basin be enclosed with 6-foot high fence. Per the City of Tempe's request, wrought iron fence will be installed around the basin perimeter.
- The layouts of the multi-use areas and paths for the landscaping requirements were coordinated with the drainage requirements.
- The elevations of the various terraces in each basin were coordinated with the landscaping and long-range planning concepts for multi-use areas.
- The storm drain invert elevations and basin storage volume requirements dictated the basin bottom elevations (Table 2).
- The stage-storage curves and earthwork volumes were calculated using Inroads digital terrain modeling software (Appendix B).
- The outflow routing stage for the Central basin was simulated using a stage discharge curve for the spillway only. The valve controlling the low-flow pipe (Storm Drain 10) shall normally be closed until SRP grants permission to discharge into the 24-inch irrigation pipeline, so bleedoff was not considered in HEC-1.
- The bleedoff for the North Basin was modeled using Haestad FlowMaster software to develop the rating tables for the bleedoff low-flow orifice, the bleedoff weir structure, and the pressure pipe (SD 8). A spreadsheet was used to combine the bleedoff flows then compare with the pipe capacity to develop the stage/outflow table. At elevations above the spillway, the spillway flow was included in the same rating table (see Appendix A for spreadsheet). The resulting stage / storage table was used in HEC-1 to model the overall system. StormCad software was used to model the hydraulic grade line of Storm Drain 8 with the average anticipated bleedoff rate.
- The 4 retention basin peak water surface elevations (WSEL) and runoff flows for the 10-year were calculated using HEC-1 (Appendix A). From those elevations and the stage/storage relationships for each basin, the 10-year stored volumes were interpolated (Table 2).
- In the same HEC-1 runs, the 100-year water surface and flow values were calculated.

- The spillways were set above the respective 10-year high water elevations (Table 2). The North, Central, and South spillway elevations were set as close as possible to the elevation of the adjacent Highline Canal western O&M road. The Northeast Basin spillway was set as close as possible to the elevation of the Highline canal east O&M road.
- Infiltration tables were calculated using a spreadsheet for each basin to determine the total time to drain and the number of drywells needed.
- Drywell rim elevations were set approximately six-inches above the floor of the North, Central, and South retention basins. The Tempe Basin had drywell rims set 6- to 12- inches above the floor to accommodate additional sediment.

3.2 STORM DRAINS

See Appendix C for the storm drain summary tables created using the StormCAD computer software. See Appendix A for figure illustrating the storm drain alignments. The following station limits and layouts were dictated by FCDMC drafting standards:

Storm Drain 1 — Calle Magdalena / Batoua, Sta 10+73 to 32+13, which includes:
Storm Drain 1-1— Calle Gloria, Sta 10+54 to 17+50, increasing downstream; joins SD1

Storm Drain 2 — Calle Vauo Nawi, Sta 10+00 to 23+01, which includes Storm Drains:
Storm Drain 2-1 — Calle San Angelo, Sta 10+60 to 25+31, increasing downstream; joins SD2
Storm Drain 2-2— Calle Vauo Nawi North, Sta 0+00 to 2+70, joins Storm Drain 2-1
Storm Drain 2-3— Calle Iglesia, Sta 10+60 to 25+26, increasing downstream; joins SD2
Storm Drain 2-4— Calle Mexico, Sta 10+42 to 15+01, increasing downstream; joins SD2
Storm Drain 2-5— Calle Vauo Nawi South, Sta 10+00 to 12+18, joins SD2

Storm Drain 3 — Guadalupe Road, Sta 10+72 to 28+80, increasing downstream;
Storm Drain 4 —Sta 10+00 to 15+21, increasing upstream;
Storm Drain 5 — Highline Canal (south), Sta 15+00 to 29+60, increasing upstream;
Storm Drain 6 — Highline Canal (north), Sta 42+00 to 52+00, increasing upstream;

Storm Drain 7 — Avenida Del Yaqui, Sta 9+83 to 12+18, increasing upstream;
Storm Drain 8 — North Basin Outlet, Sta 10+00 to 19+24, increasing upstream;
Storm Drain 9 —From end of Cerritos Ditch to North RB, Sta 10+00 to 12+28, increasing downstream; and
Storm Drain 10 — Central Basin Outlet, Sta 0+14 to 1+50, increasing upstream.

3.2.1 Pipe Numbering

Since many of the trunk lines and Storm Drains on the east-west streets had similar starting and ending stations, and all of these pipes appeared in the same computer output, the following pipe naming convention was adopted for use exclusively in the storm drain models

P 2 01 = Main pipe, Storm Drain number 2, pipe 02
(Pipe P201 is the first or uppermost pipe in Storm Drain 2)
or
P 11 05 >> Pipe1105 is the 5th pipe of Storm Drain 1-1.

Laterals appear as:

L203L is the lateral pipe at the upper end of pipe 203, on the left side.
L2206R is the lateral pipe at the upper end of pipe 2206, on the right side.

The pipe numbers ALWAYS increase downhill. Lateral directions are located left or right relative to the downhill direction. Refer to the Combined Pipe/Node Report for the appropriate pipe or lateral.

3.2.2 General Storm Drain Parameters

- A two-foot minimum depth of cover and a trench depth of not more than 10 feet was desirable;
- High Density Polyethylene (HDPE) was modeled for storm drains 48-inches or less in diameter. Reinforced Concrete Pipe was assumed for 54-inch or larger pipe.
- The pipe flow velocity was kept between 3 and 11 feet per second for the design flows;
- Minor lateral junctions from opposite sides of the street were generally staggered 6-feet along the storm drain;
- Typically, 18-inch laterals were the outlets for the catch basins along the streets. Each lateral connected via a Tee section on the main storm drain;
- The junctions of larger diameter (> 18-inches) lateral pipes or larger were positioned downstream of trunk line expansions to reduce head losses;
- Lateral inverts were set at 0.50 feet to 1.5 feet above the main storm drain invert, in most cases;
- Diameter transitions for pipes 48-inches or less in diameter were typically made in 6-inch increments at standard manhole junctions (MAG 220 & MAG 522);
- Transitions for pipes larger than 48-inches were done with separate 2-foot long conical sections (6-inch or 12-inch diameter increments);
- In extremely flat reaches, the pipe inverts were matched to help maintain adequate cover over the pipe in the upper reaches; Roughness factor was n=0.013 for reinforced concrete pipe (RCP), or n=0.012 for HDPE pipe;
- Losses for each manhole, tee junction, bends, and expansions were modeled using the HEC-22, "Flat-Bench" option.
- Manholes were spaced according to the Drainage Design Manual, Volume 2 — Hydraulics.
- The manholes for 48-inch diameter (or smaller) pipes are shown on the plans and MAG Standard Detail 520 was used for hydraulic modeling parameters. However, if HDPE storm drain is used, the manholes can be 36-inch diameter HDPE risers that connect to the storm drain at a pre-manufactured Tee.
- On streets with slopes steeper than the critical slopes, attempts to design the pipe for sub-critical flow resulted in very deep trenches. Special "Drop Manholes" (see Detail D09) were designed for the storm drains on Calle Gloria, Calle Magdalena, Calle San Angelo, and Calle Iglesia. On Guadalupe Road, concrete vaults were used as drop manholes (see Detail D09).
- Some of the east-west storm drain pipes had to be set at the same grade as the existing pavement to avoid conflicts with numerous house sewer connections.
- Each storm-drain outlet will have a circular dumped-riprap erosion pad immediately downstream. The 2-foot deep riprap will cover geotextile fabric and be surrounded by a 4-foot deep concrete cutoff wall. The pad will be overlain with a layer of soil to promote grasses to

grow and reduce the visual impact of the pad. During extreme flow events, the soil overlay will be swept away, but the riprap plunge basin will remain (Detail D19).

3.2.3 Storm Drain Hydraulic Calculations

The retention basin water surface elevation at the time of the peak inflow showed to occur at time 4:04 hours. That elevation was read from the HEC-1 intermediate output and recorded on Table 2 along with other pertinent retention basin data. The retention basins were the outfalls for each of the following Storm Drains:

- North Basin — Storm Drains 7 and 9;
- Northeast Basin — Storm Drain 1;
- Central Basin — Storm Drains 2, 3, and 6;
- South Basin — Storm Drains 4 and 5, and Pipe 001.

The StormCad software calculates the intercepted 10-year inflow at each catch basin, total system flow, slope, losses at manholes, bends, junctions, and pipe expansions. The pipe roughness (n=0.012) pertains to HDPE pipe for diameters 48-inches or less. Otherwise, RCP roughness (n=0.013) was used.

The 10-year design storm hydraulic grade lines (HGL) for each storm drain were plotted on the 90-percent pipe profiles. The HGL is more than 0.5 feet below each of the manholes and grate elevations shown on the plans.

It was desirable for the storm drains to operate at full-pipe flow conditions or a slight surcharge for the 10-year flow condition. Any flow in excess of the 10-year runoff was expected to drain within the street section to inlets or V-ditches located along the Highline Canal.

3.3 CATCH BASINS AND STORM DRAIN INLETS

3.3.1 Cross-Street Catch Basins

Cross-street catch basins were used at the following Avenida Del Yaqui intersections: Calle Gloria, Calle Magdalena, Calle San Angelo, and Calle Iglesia (see Details D12 – D16). A fifth cross-street catch basin was designed at Calle Mexico just east of Calle Tomi. These cross-street catch basins are comprised of shallow rectangular trench drains that discharge into a sump located at the head of the respective storm drain. Vane-grates comply with MAG Standard Detail 534-5 and shall be oriented upslope, then tack welded into place.

The pavement for approximately six feet from the catch basin will be flared into the lip of the basin. The existing curb will be reconstructed for 5-6 feet up and down slope from the catch basin lip. The lip of the new cross-street catch basin will be a straight cross-slope from one curb to the other. This effectively eliminates the crown of the street at the inlet location, increases the street flow capacity, makes for a shallower flow depth, and increases the capacity of the catch basin. The pavement on both sides of the new catch basin will have to be transitioned to match the existing pavement. Existing Terrazo curb and sidewalk will be protected in place.

The "width" dimension of the cross-street catch basins is dictated by each respective street width. The "length" dimension required for total interception is the opening length of the grates measured longitudinally along the street. The length (L in feet) was calculated for each cross-street basin using the nomograph shown on Chart 7 (FHWA HEC-12, included in Appendix C). An on-slope clogging factor of 0.60 was applied to the initial grate length calculation (per Table 3.2, FCD DDM, Volume 2):

$L_r = C_f \times L$ Where: $C_f = 1.60$ (Clogging Factor)

Refer to the hand calculations for each cross-street basin in Appendix C. Complete interception was possible if the calculated (adjusted required) length was less than the standard grate length. The adjusted lengths in all five inlet locations was less than the actual inlet grate length of 3.08 feet. Therefore, all of the cross-street inlets will be sufficient for the theoretical 10-year design flows that could enter from Avenida Del Yaqui at the designated concentration points. The StormCad models show these cross-street inlets as "Generic Inlet —100-percent interception".

3.3.2 Curb Opening Catch Basins

The only curb opening inlets utilized in this project were the existing catch basins along Avenida Del Yaqui (Storm Drain 7). It was necessary to model these inlets to determine the need for additional inlets along Avenida Del Yaqui. The inlets have curb-opening wings on both sides of the inlet box and present a continuous opening along the curb face. The "Curb Opening Lengths" used in the Storm Drain 7 StormCad model are the adjusted lengths after the reduction factor of 0.80 was applied to the measured length. Those lengths are:

Station	Measured Length	Adjusted Length
12+60L	14.0 feet	7.8 feet
12+94R	38.0 feet	21.1 feet
13+37R	24.0 feet	13.3 feet
13+37L	24.0 feet	13.3 feet
14+00L	24.0 feet	13.3 feet

3.3.3 Grate Inlets and Slotted Drains

New roll-type curb and gutter (MAG Standard Detail 220, Type "C") is being installed "by others" in the Town of Guadalupe. The catch basins described herein, were designed for the roll-curb, vertical curb, and valley gutter cases. The typical inlet was a grate-opening catch basin with an 18-inch slotted drain on the upslope side. In most of the cases, the inlets were on a continuous slope, so bypass flow had to be modeled at each inlet.

The double Type "N" catch basins (City of Phoenix, standard detail P-1570) were used as the base inlets in the local streets with roll curb. The 30-degree vane-grates (MAG Standard Detail 534-5) are recommended for the increased capture efficiency and for bicycle/recreational safety concerns. The slotted drains will also have vane-grates. The vanes on the grate inlets and the slotted drain shall be installed facing UPSTREAM in the gutter to be effective. Refer to Detail D02 for the layout of the grate inlet / slotted drain combination. These basins will be referred to as COP P-1570 basins, heretofore.

Generally, a separate inlet was modeled for each catch basin location. However, due to the large network size of Storm Drain 2, and the limited number of nodes available in the StormCad software, certain inlet pairs were modeled as individual inlets and the slotted drain length was doubled. Therefore, in locations shown as 16+60RL indicates "right and left" inlets.

3.3.4 Slotted Drain Hydraulic Modeling

Slotted drain (18-inch, ADOT Standard Detail C-13.60, modified) was used at each curbside grate catch basin location to augment the capture efficiency at each inlet location. Vane grates are recommended for the slotted drains to increase the capture efficiency. The partial clogging of the slotted drains was modeled by making the assumption that the inflow contribution of each P-1570 grate inlet was assumed to be zero. Therefore, only the slotted drain is assumed to intercept flow along the gutter. The "Slotted Drain Length" shown on the storm drain calculations represents the full slotted drain length.

The longitudinal curb slope was taken from the Pentacore survey or from the Pentacore plan/profile sheets. The StormCad software modeled the intercepted flow, bypass flow, gutter depth, and gutter spread. An "Inlet Report" was generated for Storm Drains 1, 2, and 7, and the aforementioned parameters are included there.

The inlets for Calle Vauo Nawi near Calle Biehn (Storm Drain 2-5) were set in sag areas formed by reconstructing the asphalt pavement. Each of these double P-1570 inlets has two slotted drains, set in new vertical curb extending north and south. Near the ends of the pavement reconstruction, the curb transitions back to roll curb. In locations where the roll curb has not been built, the area adjacent the catch basin will be graded to divert minor roadside flows into the catch basin.

3.3.5 New Area Inlets

The "additional inflow" option was used to enter the anticipated flow at each inlet location. Such locations are indicated in the StormCad software with station and direction (13+00R or 16+00L).

New area inlets were modeled with a 50-percent clogging factor on all grates. The area inlets listed herein were used in the following instances:

- MAG Det 538, double Type-H — installed on top of the drain for flows up to 18 cfs;
- MAG Det 535, double Type-F —used at storm drain ends, or angle points for pipes 30-inches or less, or at points where truck wheel loads are possible, for flows up to 30 cfs ;
- ADOT C-15.90 median dike catch basins were used along Guadalupe Road, Cerritos V-ditch, and Calle Batoua where more than 30 cfs was anticipated. Some locations (SD-3 and SD-4) warranted double C-15.90 catch basins positioned side-by-side or placed on both sides of a concrete vault (SD-1).

All of the area inlets are assumed to operate in sag conditions and all flow is intercepted. The "Area Inlet Reports" generated for Storm Drains 3, 4, 5, 6, 9, and Pipe 001 show the depth above the grate (Ditch Depth).

3.3.6 Drop Inlet Headwall

A drop inlet headwall (MAG Standard Detail 501-5) was used at the inlet for Storm Drain 2-2. The headwall lip elevation is 0.5 feet above the sediment trap bottom to provide sediment-catching capability. The drop inlet will have an access barrier and is assumed to have an entrance loss of Ke=0.50.

For safety, all new inlet or outlet headwalls will have 42-inch high handrail to protect pedestrians.

3.4 BLEEDOFF PIPES, ORIFICES, AND MINOR PIPES

The bleedoff structures for the Central and North Basins were unique and were each modeled hydraulically, for use in the HEC-1 routing steps.

- The bleedoff orifice for the Central Basin was sized using a target flow of 6 cfs. The orifice was needed to reduce the flow into the SRP lateral, while still keeping the pipe itself large enough to maintain easily.
- No bleedoff orifice was necessary for the very long, flat 18-inch bleedoff pipe for the North Basin.

The final hydraulic grade line for Storm Drains 8 and 10 were calculated in StormCad using the flows calculated in the HEC-1 output.

3.5 V-DITCHES

The normal depth flow calculations appear in Appendix C. The depth of flow was calculated for each ditch given the design flow, ditch slope, and sideslope configuration. In some cases, the adjacent O&M road governs the available depth of flow, and is noted on the calculation sheet. However, most of the V-ditches served as collectors for storm drain inlets, a backwater condition over the area inlet would typically control the water surface for most of the V-ditches.

A concrete V-ditch was used for approximately 400 feet along the Highline Canal, between stations 58+20 and 62+00. The steeper sideslopes were necessary to reduce the total length of relocation of a 6-inch water line and prevent encroachment into the west SRP O&M road. Handrail (42-inches high, steel) was recommended along the SRP O&M road for this reach as well.

3.6 SPILLWAY AND WEIR CALCULATIONS

The broad-crested weir calculations for the four retention-basin spillways are included in the HEC-1 output for the 100-year storm event (Appendix B). In each case, the length and elevation of the concrete cutoff wall that defines the spillway was used as the weir length and height.

3.7 PERCOLATION CALCULATIONS

The spreadsheet output for the Percolation Calculations is arranged by basin with the HEC-1 support data (Appendix A). The spreadsheet shows the stored volume, wetted area, bleedoff rate, the number of drywells used, drywell inflow rate, and the base rate of infiltration for surface soil used in the calculation. An infiltration rate of 0.2 cfs was used for each of the drywells. This rate is half the typical infiltration rate possible with new drywells.

3.8 SEDIMENT SUPPLY CALCULATIONS

The calculations that estimate the sediment load into each retention basin are shown in Appendix C. The equation is taken from the "Stormwater Detention/Retention Manual" (Pima County Department of Transportation and Flood Control District / City of Tucson, Arizona). The equation estimates the sediment volume for a 10-year period. The annual sediment volumes that would have to be cleared out of sediment traps was estimated to be one-tenth of the 10-year volumes.

The sediment load in the Northeast and South retention basins is more critical due to the reliance on these basins to drain by drywell percolation and infiltration only. Design features that will reduce the impacts of this sediment load are discussed in Chapter Five. Several maintenance measures that will help keep the system operative are also listed.

4.0 RESULTS OF HYDRAULIC ANALYSIS

4.1 RETENTION BASINS

All four retention basins all have sump areas or "dead storage" zones, below which the stored runoff must be evacuated by infiltration and drywell percolation. The 10-year storage volume includes the dead storage volume. The emergency storage is the zone between the 10-year high water and the spillway (or perimeter road). Cutoff walls for the North, Northeast, and Central Basins were set as close as possible to the average SRP O&M road profile. Only the South basin has an actual emergency spillway, which is directed into the Highline Canal, away from the existing SRP well site. The North and Central basins have bleedoff pipes that drain the 10-year stored volume in less than 36 hours.

The summary Table 2 shows the following data for the retention basins:

- Physical Elevations: Basin Bottom, Dead Storage, Spillway
- High Water Elevations: 10-Year and 100-Year
- Water Surface Elevations at Time of Peak Flow: 10-Year and 100-Year
- Storage Volumes: Dead Storage, 10-Year/6-Hour Storm Volume (which includes the dead storage volume), Emergency Storage Volume
- Spillway Data: Peak Spillway flow and total duration of spillway flow above 1 cfs.
- Bleedoff Data: Number of Drywells, Pipe Bleedoff Rate, Time to Drain

4.2 STORM DRAINS

Figure 4 shows the storm drain alignments, V-ditches, and channels for the project. Chapter 5 lists the findings based on the StormCad models, and specifics of each drainage system. The Pipe/Node Reports in Appendix C show the following data for the storm drains:

- Storm Drain Pipe Number or Lateral Number
- Stations of nodes (pipe ends)
- Invert elevations, pipe length, constructed slope
- 10-year Design Flow (System Flow)
- Rim elevations and ground elevations
- Upstream and Downstream Hydraulic Grade Line
- Constructed slope, energy grade line slope, critical slope
- Pipe velocities and open-channel, full-flow capacity for the pipe

The Inlet Reports list the following additional information:

- Slotted drain design length
- Ground, grate, and sump elevations
- Additional carryover (new concentrated flow at that inlet)
- Total Inlet Additional Flow (the additional carryover and flow-by from upstream catch basins)
- Intercepted Additional Flow (for the full length slotted drain on a continuous grade)
- Bypass Additional Flow (which routes to the " Bypass Target" downstream)
- Gutter depth, and Gutter spread

The V-ditches serve as collection facilities for the storm drain catch basins. Therefore, the ditches will typically operate in a backwater condition at peak flow. Generally, a sump condition exists at

each of the area inlets, so 100-percent interception is implied. The "Area Inlet Reports" are provided in Appendix C that show the Ditch Depth, which is used to set inlet dike or bank heights.

TABLE 2 –RETENTION BASIN SUMMARY

DESCRIPTION	NORTH	NORTHEAST	CENTRAL	SOUTH
Basin Bottom Elevation	1216.0	1207.5	1214.0	1217.2
Dead Storage Elevation (Note 6)	1219.00	1223.00	1216.2 (note 4)	1225.00
Spillway Elevation	1224.00	1223.00	1224.50	1225.00
Spillway Length	696	526	403	97
Basin R/W Area (acres)	5.846	1.755	4.494	4.313
	w/ Lomita and Cerritos entry road	w/ S nonuse area		(w/ Drng esmt)
10-Year High Water	1221.52	1218.51	1223.33	1222.86
100-Year High Water	1223.18	1223.09	1224.80	1225.18
WSEL @ Q(10) max, time 04:06	1220.50	1213.50	1219.30	1220.40
Dead Storage Volume (ac ft, note 6)	0.73	6.72	4.04	7.07
10-yr Stored Volume (ac ft)	4.49	6.72 (see note 2)	20.43	7.07
Volume @ Spillway (ac ft)	11.42	11.08	24.39	11.73
Number of Drywells (note 1)	2	8	2	3
Total Drywell Outflow	0.4	1.6	0.4	0.6
Max Bleedoff Rate (cfs)	2.20 (note 3)	0	6.3 (note 3)	0
Time To Drain V10 (hours)	17.0	23.5	27.5	19.4
Time To Drain Vspillway (hours)	28.2	35.5	30.4	26.8

NOTES NUMBERS UPDATED 10-05-01 PER NOR10_13, TMCE10_8, AND SOU10_6

1) Bleedoff rate is exclusively drywell bleedoff rate, 0.2 cfs per drywell;
   assumes actual rate is 0.50% of original percolation rate of 0.4 cfs per well.
2) Includes 100-year, 6-hour offsite volume = 6.722 ac ft; and 100-year, 2-hr onsite runoff volume = 0.146 ac ft
3) Bleedoff rate through outlet pipe with headwater at spillway depth.
4) Elevation of existing SRP irrigation pipe invert.
5) Time to bleed off volume at **spillway depth**, per Percolation Calculations spreadsheet. (North, Northeast, Central, South)
6) Dead storage is retained volume below main outlet level, or the 10-year volume, whichever is less.
   North basin has bleedoff orifice at main outlet, Central basin has positive drainage to invert of SRP irrigation line.
   All basins use drywells and infiltration to remove dead storage.

5.0 DRAINAGE DESIGN FUNCTIONAL ANALYSIS

Refer to the summary Table 1 for a listing of runoff flows by concentration point and location. See Table 2 for the retention basin volumes, acreages, elevations, flows, and other hydraulic data. The schematics for each storm drain network are provided in Appendix C along with the 10-year Combined Pipe/Node Reports and Inlet Reports. The following analysis is necessary to explain the functionality of the individual components of each watershed system during normal routing conditions for the 10-year design storm and the flood routing conditions for the 100-year storm.

5.1 NORTH WATERSHED

5.1.1 Calle Cerritos V-ditch and Storm Drain 9

Runoff from the residential area SUB2A will be collected at the existing dip on the north side of Calle Cerritos, just east of Calle Sahuaro. A shallow concrete spillway is used to prevent damage or erosion over the 4.5-inch HP gas line (El Paso NG).

At station 7+25 a riprap lined V-ditch will convey the flow northward to an area catch basin (ADOT C-15.90) positioned along the south edge of the south perimeter road of the North Retention Basin. The catch basin will collect flows into a 30-inch storm drain that discharges into the lower level of the North Retention Basin. The lower pipe reach must be 30-inch DIP because of the shallow cover at the access ramp. The outlet headwall will have an access barrier and riprap erosion protection.

5.1.2 Storm Drain 7 — Avenida Del Yaqui

The existing runoff from the residential area (SUB2B) flows along Calle Cerritos starting at Calle Azteca. The SUB2B 10-year flow concentrates at the corner of Avenida Del Yaqui (ADY) and Calle Cerritos, then turns northward and spans the entire ADY street section. The existing ADY storm drain has 5 curb-opening inlets that can intercept all but 3cfs of the total 53 cfs (see the Storm Drain 7 — Inlet Report in the Appendix C. To make the inlets functional, all five must have asphalt blockages removed as part of this project.

The existing ADY 48-inch diameter storm drain will carry the entire 53 cfs without surcharge. A new 48-inch diameter pipe will connect the existing storm drain to the new North Retention Basin. The new pipe will pass through SRP right-of-way for 25 feet to avoid an SRP 12-kV power pole. The storm drain discharges through a new headwall located, at the east end of the North Retention Basin. The new headwall will have an access barrier and riprap erosion protection.

5.1.3 Highline V-ditch — Sta 83+40 to 84+64

Existing overland flow on the eastern side of the road and minor runoff along the south side of the Highline Canal and behind the Dry Cleaner's building will be collected in a shallow graded V-ditch between Station 83+40 and 84+64 to a new area catch basin (MAG Det 535, Type –F). A new 18-inch lateral will connect the new catch basin and the existing curb inlet on the east side of ADY at Station 12+60. The new pipe will be installed through a chiseled opening in the back of the inlet. Refer to Detail D05 of the plan set.

5.2 NORTH RETENTION BASIN

The North Retention Basin limits are: the Highline Canal on the north, Calle Cerritos on the South, ADY on the east. The west boundary was shifted further west to avoid the protected La Lomita hillside and to accommodate the access road / V-ditch from Calle Cerritos. A 12-foot wide perimeter road will be constructed with 4-inch thick aggregate base course around the retention basin. Ramps into the basin were 8-foot wide with 4-foot drainage swales.

Grading points in the Site Plan reflect the finished grade of the basin layout. The basin will contain the first hour of runoff for the North watershed for the 100-year storm before storm water enters the primary outlet pipe. The stage-storage relation was calculated with the digital terrain model (DTM) for the new basin and incremental water surfaces (see Inroads – Triangle Volume report for surface BASFGNO13).

The basin side slopes are 6:1 or flatter. The different "use" areas were set at different elevations to minimize the flooded period for the future baseball field. The future basketball court area was set on a terrace at the same level as the baseball field. This will allow both recreational areas to be useable immediately after most storms.

The basin will contain the 10-year, 6-hour, storm-runoff volume (4.5 acre-feet) per the HEC-1 model (NOR10_13.oh1). The perimeter road on the north side and east end is set at 1224.0, and a 696 foot long cutoff wall defines the edge of the road. The cutoff wall elevation sets the spillway height for the basin. The 1224 elevation was necessary to insure that outflow from the basin occurs as backflow through Storm Drain 7, before spillway flow commences.

The low-point along the SRP road is the historical flowpath for flows from the Cerritos/Sahuaro intersection. The spillway cutoff wall is approximately 1-foot above the SRP road at that point. The basin perimeter road will have a 3:1 graded slope between the cutoff wall and the SRP Right-of-Way line. The height of the perimeter road fill is approximately 0.5-foot at the locations for pedestrian access along the north boundary.

For the 100-year storm or greater, the water surface in the North Retention Basin will back into Storm Drain 7, which causes any additional street flows to bypass the system and continue northward on Avenida Del Yaqui (as with the existing case).

The bottom elevation of 1216.0 was established in the lower portion of the retention basin to maintain 2-foot pipe cover over Storm Drain 7 and to facilitate positive drainage from ADY to the North Basin. This low area of the North Basin will hold 0.7 acre-feet before bleedoff flow will commence out of Storm Drain 8. This delays the outflow for the first hour of the 100-yr, 6-hr design storm, per the ADOT requirement (per Section 1.2).

A bleedoff structure with an 8-inch orifice plate will serve as the primary drain for the North Basin. To insure that the orifice is kept clear, a catch basin with the grate set at 1219.00 will be the primary inlet to Storm Drain 8. The outflow pipe (Storm Drain 8) is an 18-inch pipe that leads to

an existing ADOT catch basin. The orifice plate will limit the flow to approximately 2 cfs (per ADOT request).

Two drywells are required to aid in the infiltration of the dead storage below the level of the bleedoff pipe invert and drain the 10-year volume in approximately 28 hours (see the Percolation Calculations for the North Retention Basin). A two-chamber drywell set at the east end of the basin will handle nuisance volumes (under elevation 1216.9). A second drywell (single-chamber) will be positioned at the downstream end of a swale on the northwest slope of the North Basin. Both drywells will have the rims set approximately 6-inches above the surrounding basin floor.

5.3 NORTHEAST WATERSHED

5.3.1 Storm Drain 1-1 — Calle Gloria

The runoff from SUB 3A concentrates at ADY, in front of the driveway entrance to Frank School. The flow splits and was modeled with D103L routing north along ADY to the intersection of Calle Gloria, and D103R routing across the school grounds to the east.

Storm Drain 1-1 is a collector that begins at a new cross-street catch basin located just east of the ADY / Calle Gloria intersection (Sta 10+54). As an added safety measure, the storm drain was designed to carry the entire 43 cfs from CP103, in the event of a change of split flow conditions.

Four grate catch basins with slotted drains will be installed at varying intervals along Calle Gloria. All of the grate/slotted drain inlets are placed downstream from the Frank School playground (at CP104). This will reduce the sediment inflow into the system.

The drop manholes along Storm Drain 1-1 are intended to dissipate energy of the flow in the drain. The diameter of the storm drain increases to slow the velocity prior to the junction with Storm Drain 1-1 at Calle Batoua. Any hydraulic jumps that occur are either within the pipe, or at the drop manholes, which are upstream of nearby catch basins. The hydraulic grade line at least 2-feet below the ground level for this storm drain.

5.3.2 Storm Drain Line 1 — C. Magdalena / C. Batoua

Storm Drain 1 is designed to carry the 10-year runoff along Calle Magdalena and Calle Batoua with minimal surcharge. The flows vary between 26 and 136 cubic feet per second. The storm drain varies in diameter from 30- to 60-inches.

The existing runoff from the residential area (SUB4A) concentrates at ADY and Calle Magdalena. Storm Drain 1 begins at Station 10+73 with a cross-street catch basin, located just east of the curb returns on Calle Magdalena. The storm drain intercepts inflows from additional combination curb catch basins at Calle Batoua, Calle Sonora (CP102), Calle Gloria (CP105), and increases in diameter from 30-inch to 48-inches.

A Detail D23 catch basin (Double ADOT Det C-15.90) is required at Calle Pitaya to intercept the runoff that collects alongside the canal. The bottom of each sloped grate will be set at 1220.5. The catch basin serves as a backup for the upstream catch basins, in the event of clogging. V-ditches from the Highline canal to the north and south, and the Pitaya V-ditch all discharge into this catch basin.

The decision was made to steepen the pipe entering the vault from the south to match the inverts, rather than create a drop manhole condition. The pipe inverts were matched in this catch basin to increase the flow efficiency during the design flow and especially for normal flows. Any hydraulic jumps that occur are either within the pipe (when the retention basin is nearly full), or within the catch basin (at the onset of a storm). The depth of the catch basin is 12-feet and the hydraulic grade line is at least 3-feet below the ground level at the end of the 10-year storm.

The final reach of Storm Drain 1 is a 60-inch diameter RCP that projects into the corner of the area catch basin. The pipe deflects approximately 35-degrees at this junction. This reach of storm drain will be installed within a steel sleeve under the canal lining using jack-and-bore construction. The clearance between the top of the storm drain and the bottom of the canal lining is greater than 3 feet. Storm Drain 1 will discharge into the south end of the new Northeast Retention Basin.

5.3.3 Storm Drain Operation (10-Year Flow)

Storm Drain 1 will intercept all of the 10-year runoff that reaches CP106 (see Table 1). The hydraulic grade elevation at the Sta 30+80 inlet (CP106) will be 1217.1 at the time of 10-year peak flow. The final 10-year water surface elevation in the basin will be 1218.5. As extreme event flows (greater than the 10-year) fill the Northeast Basin, the inlet at CP106 will function with reduced capacity and the ponded water over that inlet will provide additional sediment catching capability. This area near the inlet will be protected with shotcrete bank lining to protect from erosion near the inlet. However, this area will require regular sediment removal to reduce the amount of sediment that reaches the Northeast Basin.

5.3.4 Highline V-Ditch, Sta 67+00 to 80+74

An unlined V-ditch with 3:1 sideslopes will be constructed along the Highline Canal west O&M road. The SRP O&M road width shall be at least 12-feet wide (measured from the edge of the new V-ditch to the existing canal-side hinge point on the O&M road). The ditch limits in this segment are:

- V-ditch Station 67+00 to 75+00, draining northwest; discharging at CP106 and;
- V-ditch Station 75+00 to 80+74; draining southeast and discharging at CP106.

A 50-foot reach of unlined, 1-foot deep V-ditch will also be constructed along the north side of Calle Pitaya (near Calle Batoua) to convey local runoff southeastward into the Highline V-ditch.

5.4 NORTHEAST RETENTION BASIN

The new retention basin will be constructed on a triangular parcel across the Highline Canal from the intersection of Calle Batoua and Calle Pitaya. A 12-foot maintenance road will be constructed around the basin perimeter at elevation 1223.0, which is approximately level with the Highline Canal bank and the SRP O&M road. The elevation of the retention basin bank will be defined with a 3-foot deep concrete cutoff wall around the outside of the perimeter road.

Due to the limited right-of-way available and the requirement to store the 100-year 2-hour storm, the retention basin inner sideslopes will be 2:1 and the outer slopes will be 3:1.

The Northeast Basin will be sized to contain the 10-year runoff volume (6.72 acre-feet for the Northeast Watershed). The total stored volume is 6.86 acre-feet, which includes the local runoff

volume. The additional 0.14 acre-feet is the 100-year, 2-hour local runoff volume from the 1.3-acre basin site (see separate calculation in Appendix A).

During peak inflow, the water surface in the Northeast Basin is 1213.5, and the 10-year peak water surface elevation of 1218.5, which is 4.5 foot below the perimeter road. The 10-year stored volume will percolate within 23.9 hours, through 8 drywells and by infiltration through the basin sideslopes. The 100-year stored volume will require 35.5 hours for disposal.

The south corner will be kept clear to allow SRP access to the adjacent 230-kV tower. The southern area (0.24 acre) will drain into a 6170 cubic foot sump area formed by an excavated area and a low dike.

5.5 CENTRAL WATERSHED

5.5.1 Storm Drain Line 2 — Calle Vauo Nawi

Storm Drain 2 along Calle Vauo Nawi is designed to carry the 10-year runoff with surcharge. The flows vary between 28 and 214 cubic feet per second. The pipe varies in diameter from 36- to 66-inches. Five collector drains will intercept flows west of Avenida Del Yaqui and discharge into Storm Drain 2:

- Storm Drain 2-1 along Calle San Angelo
- Storm Drain 2-2 along Calle Vauo Nawi north of Calle San Angelo
- Storm Drain 2-3 along Calle Iglesia
- Storm Drain 2-4 along Calle Mexico
- Storm Drain 2-5 along Calle Vauo Nawi, from the Calle Biehn intersection

Construction of the curb and gutter for the Storm Drain 2 system is ongoing. In most locations the curb and gutter will be constructed prior to the installation of the catch basins for this Drainage Improvement Project. However, in the event of the catch basin construction preceding curb and gutter construction, the slotted drain will be constructed at the planned slope of the future curb and gutter (per the Pentacore plans). Then at a later date, the curb and gutter (installed by others) will be constructed to match the slotted drain and catch basin grades. The assumption made for hydraulic modeling of the storm drains was: ALL curb and gutter sections and catch basins were in place for in the final configuration.

5.5.2 Storm Drain 2-1 — Calle San Angelo

The runoff from SUB 5A concentrates at Avenida Del Yaqui (ADY), where an existing riprap lined channel begins. The flow splits (modeled with D200L in HEC-1) and routes northward along ADY to the intersection of Calle San Angelo, and D200R routes eastward down the channel and through the park to the east.

The uppermost reach of Storm Drain 2 is actually Storm Drain 2-1, which begins at a new cross-street catch basin located just east of the ADY / Calle San Angelo intersection (Sta 10+60). Five pairs of combination curb catch basins with slotted drains will be installed at approximately 300-foot intervals along Calle San Angelo. Two of the catch basins were placed at the east end of the park.

Storm Drain 2-1 varies in diameter from 30- to 54-inches. The surcharge condition in Storm Drain 2 influences the hydraulic grade line in Storm Drain 2-1. As a precaution, a pressure manhole lid is recommended at manhole (station 24+80) on Calle San Angelo. The pressure condition could only occur at this point for runoff exceeding the 10-year storm on San Angelo.

At Station 25+20, the pipe angles bends 45-degrees to the right, past a tee with Storm Drain 2-2, and then bends again at Station 25+31.35. Storm Drain 2-1 becomes Storm Drain 2 at that point (new stationing, 23+01.11), which drains southward.

5.5.3 Storm Drain 2 — Calle Vauo Nawi

Storm Drain 2 intercepts pipe flow from Storm Drains 2-1, 2-3, and 2-4 (CP202, CP204, and CP206 respectively). The diameter of the storm drain varies from 54- to 66-inches, which are too large for HDPE pipe. Therefore, either RCP or Cast-In-Place can be used for Storm Drain 2.

The storm drain follows Calle Vauo Nawi (CVN) to the south and increases in diameter from 54-inches to 60-inches, just north of Calle Iglesia. A similar diameter increase (60-inch to 66-inch) occurs just north of Calle Mexico. Due to the hydraulic grade line at the uppermost end of Calle Vauo Nawi, the Storm Drain 2 pipes were designed to be as deep and gently sloped as possible. This required that the inverts be matched at the pipe diameter expansions. Since SD-2 is in a pressure-flow condition for the entire length, there is no difference in the hydraulics (matched crowns versus matched inverts).

Local street runoff along Calle Vauo Nawi and flow-by from the east will be intercepted by curb catch basins on the east side of CVN. Two P-1570 catch basins with slotted drains will be located near the northeast and southeast curb returns at Calle Iglesia (2 catch basins), and one at the southeast curb return of Calle Mexico.

The main storm drain continues southward 230-feet from Calle Mexico to a 40-degree bend. A short length of V-ditch will be constructed along the west edge of the Central basin to direct local runoff into a new area catch basin that will discharge through a grate inlet (MAG Det 535, Type F) into a lateral that joins Storm Drain 2. The 66-inch diameter storm-drain discharges into the Central Basin through a new concrete headwall with an access barrier and riprap erosion protection.

5.5.4 Storm Drain 2-2 — Calle Vauo Nawi (North Lateral)

The existing runoff from SUB4C collected by the aforementioned concrete V-ditch will discharge into a sediment trap immediately upstream of a new drop-inlet headwall with trash rack at Storm Drain 2-2, Station 2+70 (MAG Det 501-5). Existing runoff at Concentration Point 201 accumulates in this same area under current conditions. The water depth is dictated by the profile of the western SRP O&M road. Since the SRP road will not be modified for this project, the high water elevation in this area will not increase.

The drop inlet headwall will function normally until the Central Basin water surface reaches elevation 1221.0. After that, the water will enter the system more slowly and a backwater will form

in the V-ditch. This stilling effect will provide additional sediment removal for this area (see discussion on sediment trap in Chapter 3).

Storm Drain 2-2 begins at that point (CP201), draining southward along Calle Vauo Nawi to the Calle San Angelo intersection. The storm drain discharges into a Tee section near the end of Storm Drain 2-1, immediately upstream from the junction of Storm Drains 2-1 and 2.

5.5.5 Storm Drain 2-3 — Calle Iglesia

The runoff from SUB6A concentrates at ADY (CP203) and turns north for a short distance to Calle Iglesia where flow turns eastward. Storm Drain 2-3 begins at a new cross-street catch basin will be located just east of the ADY / Calle Iglesia intersection (Sta 10+60). Nine grate catch basins with slotted drains will be installed at varying intervals along Calle Iglesia. Storm Drain 2-3 varies in diameter from 30- to 42- inches.

5.5.6 Storm Drain 2-4 — Calle Mexico

The runoff from SUB7A concentrates at CP205. Storm Drain 2-4 begins at a new cross-street catch basin will be located just east of the Calle Tomi / Calle Mexico intersection (Sta 10+42). Two combination curb catch basins with slotted drains will be installed just west of Calle Vauo Nawi. Storm Drain 2-4 varies in diameter from 36- to 42- inches.

5.5.7 Storm Drain 2-5 — Calle Vauo Nawi (South Lateral)

Storm Drain 2-5 will be a 24-inch diameter storm drain constructed along CVN, starting at Calle Biehn and discharging into Storm Drain 2 just downstream of the bend. Two sections of Calle Vauo Nawi roadway must be regraded and resurfaced with a one-way crown to the east in order to form sumps that collect runoff. Roll curb and new pavement will be constructed around the two new double grate inlets and slotted drains (Sta 10+00 and 11+81). The two repaved areas are located using coordinates in the construction plans.

5.5.8 Storm Drain 3 — Guadalupe Road

The SUB8A, 8B, and 8C runoff concentrates at the intersection of ADY and Guadalupe Road. The existing storm drain network at that intersection will be utilized to intercept a portion of the concentrated street flows at CP213.

Storm Drain 3 will be installed on the south side of Guadalupe Road, along the existing shallow V-ditch. The storm drain varies in diameter from 24- to 54- inches. The existing headwall on the southeast corner of Avenida Del Yaqui will be removed and short section of 24-inch pipe will join the existing pipe with a concrete collar. The new, steeply sloped pipe discharges into the first area catch basin (MAG 535 – Type F). A 36-inch pipe exits the catch basin at Sta 11+15 and continues until Sta 14+26.

The sheet flow on Guadalupe Road drains laterally into the existing roadside shallow V-ditch, which will discharge into a new double-grate median catch basin at Station 14+30. Two similar inlets on short laterals will intercept additional flow at Station 19+50 and 21+80, which is just before Calle Tomi. Three additional area inlets with concrete aprons (MAG Det 535, Type F) will be installed at Stations 23+10, 24+76, and 27+55 to intercept nuisance flows along the south side

of Guadalupe Road. A Type-H inlet will be located over the western pipe of the (2) 42-inch storm drains, to intercept roadside flow on the north side of Guadalupe Road.

The existing minor headwalls, culverts, and driveways on the north side of Guadalupe Road will be removed and the existing V-ditch regraded to drain to the existing catch basin near Storm Drain 10. Two feet of the existing 18-inch pipe on the west face of the catch basin will be left intact and will project into the regraded V-ditch.

At station 27+55, a concrete vault will provide a junction for the double 42-inch storm drains that will cross Guadalupe Road, under the 30-inch water line (City of Tempe). The double 42-inch pipes will terminate in the Central Basin at a new concrete headwall with an access barrier and riprap erosion protection.

The recommended headwall will be an ADOT Standard Detail B-11.14 headwall for double 48-inch diameter pipes. The headwall can be used if the vertical distance between the top of headwall and the crown of 42-inch pipe are 2.00 feet instead of the normal 1.50 feet. Similarly, the distance between pipe centerlines is the same as for a pair of 48-inch pipes. A detail showing the modifications will be added to the plan set for the 90-percent submittal. *NOTE: The more standard MAG 501-2 double headwall was unsatisfactory for this location, and will not be used.*

During the 100-year storm, the high water elevation in the Central Basin will raise the Storm Drain 3 hydraulic grade line, which impedes the inflow of additional runoff into the system. The flow exceeding the 10-yr flow (D217L, 202 cfs) will bypass the Storm Drain 3 system and continue east into Tempe along Guadalupe Road (D217R, 157 cfs).

5.5.9 Storm Drain 6 — Highline (North)

The storm drain starts upstream at Sta 52+00 and ends at the Central basin at Sta 42+00. Storm Drain 6 will intercept minor 10-year flow-by from Calle Iglesia and Calle Mexico, as well as local flows along the Highline Canal. The 24-inch diameter storm drain will be positioned directly under the Highline V-ditch invert (Sta 42+76 to 54+50). The area catch basins (Type-F or Type-H, double) will be positioned at the locations of the V-ditch sag points.

During storms exceeding the 10-year intensity, flow-by will occur at the Calle Vauo Nawi intersections of Calle Iglesia and Calle Mexico. Since the V-ditch along the Highline Canal is only sized for the 10-year flow, the flow-by will discharge into the canal, as it does in the existing case.

5.5.10 Highline V-Ditch — Sta 42+76 to 54+50

The existing runoff from SUB7B accumulates along the west bank of the Highline Canal. To intercept this runoff, a V-ditch with 3:1 sideslopes will be constructed along the Highline Canal west O&M road. The minimum SRP O&M road width that will be maintained is 12-feet (measured from the edge of the V-ditch to the existing canal-side hinge point on the O&M road).

The ditch limits are from Station 42+76 to 54+50. Sag points in the V-ditch at stations 43+60, 45+00, 49+60, and 52+00 will collect the 10-year runoff into Storm Drain 6.

5.5.11 Highline V-Ditch — Sta 55+00 to 63+00

The V-ditches in this section discharges into Storm Drain 2-2. Between Station 55+00 and 57+94, North of Calle Sonora, the V-ditch drains northward into a sediment trap for Storm Drain 2-2. This sediment trap area will need sediment removal on a regular basis. A concrete ramp is provided on the south side of the trap for this purpose.

The concrete V-ditch will be installed northward from Station 58+20 to 62+00 to protect portions of the existing 6-inch water line (City of Tempe) that is not being relocated. The water line in the immediate vicinity of the sediment trap must be relocated.

The section between 62+00 and 63+00 will be a graded V-ditch that will match the existing low area beside Calle Vauo Nawi.

5.6 CENTRAL RETENTION BASIN

The Central Retention Basin is bounded by: Guadalupe Road on the South, Highline Canal on the East, and private property on the west and north. Basin side slopes will be approximately 6:1 throughout. A 12-foot wide perimeter road (4-inch thick ABC) will be built around the top edge of the retention basin.

The basin will contain the 10-year, 6-hour, storm-runoff volume (20.4 acre-feet), per the HEC-1 model (TMCE10_8.ih1, see also Table 2). The spillway elevation for the Central Basin is set at 1224.5, which is approximately at the elevation of the west SRP O&M road. The 10-year water surface is approximately 1.2-feet below the spillway. The stage-storage relation was calculated with the digital terrain model (DTM) for the new basin and incremental water surfaces (see Inroads – Triangle Volume report for surface BASFGCE1).

5.6.1 Storm Drain 10 — Central Basin Outlet

Storm Drain 10 is the primary outlet for the Central Basin, consisting of an 18-inch diameter bleedoff pipe that starts at small headwall located in the southeast corner of the basin. An 18-inch outlet pipe will be installed with an adverse grade from the headwall in the Central Basin, to the existing manhole at the head of the SRP 24-inch irrigation lateral beneath the north edge of Guadalupe Road. The existing irrigation line ultimately discharges into the Western Canal to the east.

Releases will be controlled with a manually operated gate valve set in a 4-foot x 4-foot concrete bleed-off structure located along the Central Basin perimeter road. A 10-inch orifice plate in front of the outlet pipe limits the bleed-off flow to approximately 6 cfs (depending on the water surface in the basin).

The existing area catch basin just north of the existing SRP manhole will be protected in place. A 2-foot section of driveway pipe that connects to the catch basin west wall will drain the regraded V-ditch on the north side of Guadalupe Road.

5.6.2 Central Basin Spillway

A concrete cutoff wall on the east side of the basin will be set at elevation 1224.50, and will define the spillway weir elevation. The spillway flow will discharge into the Highline Canal at the tail end of the 100-year storm. The canal lies in the historical flow path of runoff from the Central Watershed. The rest of the perimeter road will be elevation 1225 or above.

At least one drywell will be required to dispose of the stored runoff below the level of the bleedoff pipe inlet (elevation 1215.0). See the Percolation Calculations in Appendix B for the calculation of the time to drain the Central Basin (30.0 hours).

During the most extreme events (greater than the 10-year), runoff will fill the canal. The canal will in turn, eventually overtop the east bank and flow northward along the SRP east right-of-way block wall. The overflow turns eastward at the alley near the south edge of the Northeast Basin. All flow-by from the canal will accumulate along Beck Avenue, as it does for the existing case. The total 100-year flow reaching Beck Avenue will be approximately 190 cfs, which is a significant reduction in comparison to existing 100-year flows (660 cfs).

5.6.3 Access and Right-of-Way Fence

A 12-foot wide ABC covered O&M road at the northwest corner will serve as the primary O&M access. The ramps on the west and east sideslopes will be 8-foot wide, with a 4-feet wide drainage swale provide non-vehicular access into the basin from the Town property, the canal and Guadalupe Road. Additional five-foot wide meandering multi-use paths on the north and south sideslopes of the basin will connect with the 8-foot wide ramps.

The side slopes of the Central Retention basin are gentle enough (5:1 to 6:1) that fencing is not mandatory around the basin for safety reasons. However, the Town requested a six-foot high chain link fence to keep children in the park and to hinder their entry onto the SRP right-of-way. Six-foot high chain link fence will be installed along the western and northern right-of-way lines to adjacent the existing private properties.

A swing gate will be installed at the northwest corner of the basin. Pedestrian access will be at the same location, and two other locations near the southeast and northeast corners of the basin (gate in the fence). The pedestrian access points will be adjacent the eight-foot access ramps at the intersections with the perimeter road for the Central Basin.

5.7 SOUTH WATERSHED

5.7.1 Storm Drain 4 — Calle Vauo Nawi

Sub basins 9D, 9E, and 9F drain eastward across the Pascua Yaqui Tribal property located east of Avenida Del Yaqui. The runoff will be collected in a double median catch basin at Station15+32 (Detail D11), which discharges into Storm Drain 4.

Storm Drain 4 is a 36-inch diameter drain that begins at Station 15+21 and discharges through a concrete headwall (MAG Det 501-4) with trash rack, riprap outlet protection.. A capped 36-inch stub-out will be provided at the inlet catch basin. The stub-out will handle all of the 10-year flow at

that location. If runoff is increased by future development without onsite retention, the storm drain will operate in a surcharged condition.

An area inlet and apron will be used at the end of Calle Vauo Nawi at Station 13+08 (MAG Det 535, Type F) . The 10-year flow in the storm drain at this point is 49 cfs (CP302).

The runoff from the new South Basin access road will be intercepted by roadside V-ditch and an area catch basin (MAG Det 535, Type F, Double) at Station 10+66. This same catch basin will handle up to 11 cfs of the runoff from SUB 9G. A portion of the collector V-ditch along the west perimeter of the South Basin will drain toward the O&M road V-ditch.

5.7.2 Pipe 001

Runoff from SUB 9G (31 cfs) will be intercepted by V-ditch along the western perimeter of the South basin. The V-ditch discharges into an area catch basin (MAG Detail 535, Type F, Double) located at the sag point of the ditch. The catch basin can handle 23 cfs that will discharge into a 36-inch pipe with headwall, trash rack, and riprap outlet protection at the bottom of the South basin.

5.7.3 Highline V-Ditch — Sta 16+00 to 30+00

The existing runoff from SUB9A and split-flow from SUB9B accumulates along the west bank of the Highline Canal, just north of Calle Milagros (CP305). To intercept this runoff, a V-ditch with 3:1 sideslopes will be constructed along the Highline Canal west O&M road from Station 16+00 to 30+00 (Storm Drain 6 Stations). The V-ditch acts as a series of collector sumps for Storm Drain 5, and varies in depth from 0.5 to 2.0 feet. A minimum SRP O&M road width of 12-feet will be maintained (measured from the edge of the V-ditch to the existing canal-side hinge point on the O&M road).

5.7.4 Storm Drain 5 — Highline Storm Drain (South)

Five double-width area catch basins located at the V-ditch sag points will take the concentrated flow into Storm Drain 5. The storm drain ranges in flow from 29- to 52-cfs, and the diameter ranges from 30- to 42-inches.

The upstream end of Storm Drain 5 is at Station 29+60 (CP305) and is a 30-inch diameter to Station 27+80 (for pipe cover considerations). At that manhole, the pipe increases to 36-inch diameter. The storm drain picks up the V-ditch flow at Sta 25+00, 22+02, 19+12, and 16+15, then bends 60-degrees and discharges into the South Basin through a concrete headwall (MAG Det 501-4) with trash rack, and riprap outlet protection.

5.8 SOUTH RETENTION BASIN

The South Retention Basin is bounded by: the Highline Canal on the east, the City of Tempe corporate boundary on the south, and private property on the west and north.

Basin side slopes will range from 4:1 to 6:1. A 12-foot wide perimeter road (4-inch thick ABC) will be built around the top edge of the retention basin. The basin retains the entire South

watershed 10-year, 6-hour runoff volume (7.1 acre feet) with 2.3 feet of freeboard, and without the benefit of positive bleedoff.

Low-flow channels along the north, west, and east sideslopes will convey nuisance water to the drywells. Three drywells are required to facilitate infiltration of the stored volume. The lowest will be a two-chamber drywell located at the northeast corner near the Storm Drain 5 outlet. The other two will be single-chamber drywells. The drywells will be no closer than 420 feet from the existing SRP well at the southeast corner of the property.

The southern slope of the new South retention basin will be over-excavated to remove a lens of pesticide-contaminated soil. The soil conditions, and the approximate limits of the lens are identified in the 1999 Brown and Caldwell report.

5.8.1 South Basin Spillway

The elevation of the South-basin emergency spillway (1225.0) is set level with the Highline Canal bank, along the east side of the basin. A 138-foot long concrete cutoff wall, with 98-feet of the wall set at elevation 1225.00, defines the spillway weir elevation. The spillway overflow will discharge into the Highline Canal North Branch at historical flow path location. During such infrequent events, the runoff will either be conveyed northward along the canal or overtop the canal at the various locations between Mineral Avenue and Guadalupe Road. However, as a result of the South Retention Basin, the intensity and frequency of such flooding will be greatly reduced from the existing case.

5.8.2 Safety and Access Control

A 12-foot wide ABC covered ramp on the west side slope will serve as the primary O&M access. A similar ramp located on the eastern slope will also provide maintenance access out of the basin. A 12-foot wide perimeter road will surround the entire basin.

The side slopes of the South Retention basin are gentle enough that fencing is not mandatory around the basin for safety reasons. However, the Town requested a six-foot high chain link fence to keep children in the park and to hinder their entry onto the SRP right-of-way.

Six-foot high chain link fence will be installed along the western right-of-way line, also to prevent unauthorized vehicular access. The existing northern and southern six-foot chain link fences will be protected in place and will define the northern boundary of the FCDMC property.

The existing gate at the south end of Calle Vauo Nawi will be protected in place. Pedestrian access openings will be provided at the southeast and northeast corners of the basin. A new access gate and a third pedestrian access will be installed where the Storm Drain 4 O&M road crosses the new FCDMC western boundary (at the northeast corner of the basin).

5.9 100-YR SYSTEM RESPONSE

This section is a summary on how the drainage improvement project would function during storms greater than the 10-year storm event. The summary is divided up into the areas served by the retention basins.

5.9.1 North Retention Basin Area

The North Retention Basin itself has the volume capacity to contain the 100-year storm. The basin was increased beyond the 10-year capacity when additional basin area was added to include a little league baseball diamond. The storm drain inlets and pipes to the basin are sized for the 10-year system. Storm flows above the 10-year peak on Avenida del Yaqui (ADY) will continue to flow north on ADY into the City of Tempe as it has in the past. Flows in excess of the 10-year peak flow from Calle Cerritos will follow the Cerritos Ditch. Flows in excess of the storm drain inlet will flow out of the ditch and into the North Retention Basin with the possibility of some erosion along the basin access road located on the south side of the basin.

If the retention basin fills to capacity, the storm drain inlets along Avenida del Yaqui, which are only 0.3 to 1.0 feet higher than the spillway elevation of the basin, will have very limited capacity. Flows will essentially bypass the inlets and continue to flow north on ADY into the City of Tempe as it has in the past. Storm flows that continue to enter the basin from the Cerritos ditch will flow out of the basin over the spillway and follow the historic drainage pathway for the area.

5.9.2 Northeast Retention Basin Area

The Northeast Retention Basin (located inside the City of Tempe) has the volume capacity to contain the 100-year storm. The retention basin was increased beyond the 10-year capacity to meet retention requirements by the City of Tempe. The storm drain inlets and pipes to the basin are sized to function for the 10-year design storm. Because of the present topography of the area and the design capacity of the storm drain system, the storm drain system will not be able to deliver the 100-year peak storm flows to the basin. However, if the 100-year storm is a long duration type storm with lower peak flows the basin has the volume capacity to store it. Storm flows above the 10-year peak will follow historic drainage pathways for the area and will pond adjacent to the Highline Canal O&M Road and flow into the canal. A portion of the storm flow will be stored in the canal and carried off by the canal system or it will break out of the canal and continue north into the City of Tempe as it has in the past.

The spillway elevation of the retention basin is set at 1223.0. The elevation at which ponded water adjacent to the Highline Canal O&M Road flows into the canal is 1223.5. If the retention basin fills to capacity, the storm drain system will begin backing up. The storm drain system will continue to deliver storm water to the retention basin spilling over the emergency spillway. When the available head in the storm drain system is greater than the Highline O&M Road elevation, storm water will bubble out of the inlet located adjacent to the Highline Canal and combine with overland flows. The combined flows will discharge into the Highline Canal. The nearest roadway storm drain inlets along Calle Gloria are 1.5 feet higher than the spillway elevation of the retention basin. For storm flows to bubble out of the lowest inlets on Calle Gloria with the retention basin full will take a storm event greater than the 100-year storm.

5.9.3 Central Retention Basin Area

The Central Retention Basin itself has the volume capacity to contain slightly more than the 10-year storm. The storm drain inlets and pipes to the basin are sized for the 10-year system. During

an event greater than the 10-year storm, the retention basin would fill to its capacity and begin spilling into the Highline Canal. The storm drain line located in Calle Vauo Nawi would have limited hydraulic capacity because of a lack of hydraulic head to drive water into the retention basin. The storm drain line along the Highline Canal would essentially cease to function and storm flows would continue to flow in an easterly direction and discharge into the Highline Canal. A portion of the storm flow will be stored in the canal and carried off by the canal system or it will break out of the canal and continue north into the City of Tempe as it has in the past. The storm drain line on Guadalupe Road would function in much the same way as the line on Calle Vauo Nawi. The exception is that storm flows would continue to flow eastwardly along Guadalupe Road with a portion entering the Highline Canal and the remaining portion flowing into the City of Tempe as it has in the past. The emergency spillway elevation of the retention basin was set at 1224.5. This spillway elevation is based on the average elevation of the existing low flow crossings of the Highline Canal O&M Road along the west side of the canal north of Guadalupe Road in the vicinity of the basin.

5.9.4 South Retention Basin Area

The South Retention Basin itself has the volume capacity to contain slightly more than the 10-year storm. The storm drain inlets and pipes to the basin are sized for the 10-year system. During an event greater than the 10-year storm, the retention basin would fill to its capacity and begin spilling into the Highline Canal. There are two storm drain lines that convey water to the retention basin. The storm drain line located along the north side of the Flood Control District property will serve the Pascua Yaqui Tribe property. When the Pascua Yaqui Tribal property is developed, it is anticipated that flows in excess of the storm drain capacity will be stored in retention basins on the developed property. The second storm drain parallels the Highline Canal. This storm drain will serve the area between the Pascua Yaqui property and the Highline Canal. The emergency spillway elevation of the retention basin was set at 1225.0. This spillway elevation is based on the average elevation of the existing low flow crossings of the Highline Canal O&M Road along the west side of the canal south of Guadalupe Road in the vicinity of the basin. During storms greater than the 10-year storm, the storm drain system along the Highline Canal would essentially cease to function and storm flows would continue to flow in an easterly direction and discharge into the Highline Canal. A portion of the storm flow will be stored in the canal and carried off by the canal system or it will break out of the canal and continue to the east into the City of Tempe as it has in the past.

APPENDIX A

Clark Hydrograph Parameters for Resized Sub-basins

(The following is arranged by basin)
Percolation Calculations — North, Tempe, Central, and South Retention Basins

Stage-Storage Volumes and Earthwork Volumes for Retention Basins

Orifice Worksheet, Weir Worksheet, Pressure Pipe Worksheet (FlowMaster Output), and Spreadsheet Stage-discharge calculations for North Basins

Orifice Worksheets for Central Basin Outlet

Northeast Basin Local Runoff — 100-year, 2-hour volume

Registered Professional Engineer (Civil)
CERTIFICATE NO
26882
DANIEL E.
STOUGH
Date Signed 11-05-01
ARIZONA U.S.A.

TABLE A0.1

RAINFALL DEPTHS (inches)

Guadalupe Drainage Improvement Project

	FLOOD FREQUENCY (years)						
DURATION	2	5	10	25	50	100	500
5 min	0.28	0.40	0.48	**0.59**	**0.67**	**0.76**	0.95
10 min	0.42	0.61	0.73	**0.90**	**1.03**	**1.16**	1.46
15 min	0.52	0.76	0.93	**1.15**	**1.32**	**1.49**	1.89
30 min	0.68	1.02	1.25	**1.55**	**1.79**	**2.02**	2.56
1 hour	0.83	1.26	1.55	**1.94**	**2.23**	**2.53**	3.21
2 hour	0.92	1.39	1.70	**2.12**	**2.44**	**2.76**	3.50
3 hour	0.99	1.47	1.80	**2.24**	**2.57**	**2.91**	3.69
6 hour	1.10	1.63	1.98	**2.46**	**2.83**	**3.20**	4.05
12 hour	1.23	1.80	2.18	**2.70**	**3.10**	**3.50**	4.42
24 hour	1.35	1.97	2.38	**2.94**	**3.37**	**3.80**	4.79

TABLE A0.2

RAINFALL INTENSITIES (inches/hr)

Guadalupe Drainage Improvement Project

	FLOOD FREQUENCY (years)						
DURATION	2	5	10	25	50	100	500
5 min	3.40	4.82	5.77	**7.09**	**8.10**	**9.10**	11.43
10 min	2.55	3.66	4.40	**5.42**	**6.20**	**6.98**	8.78
15 min	2.07	3.05	3.70	**4.60**	**5.28**	**5.97**	7.54
30 min	1.37	2.05	2.49	**3.11**	**3.58**	**4.05**	5.13
1 hour	0.83	1.26	1.55	**1.94**	**2.23**	**2.53**	3.21
2 hour	0.46	0.69	0.85	**1.06**	**1.22**	**1.38**	1.75
3 hour	0.33	0.49	0.60	**0.75**	**0.86**	**0.97**	1.23
6 hour	0.18	0.27	0.33	**0.41**	**0.47**	**0.53**	0.67
12 hour	0.10	0.15	0.18	**0.23**	**0.26**	**0.29**	0.37
24 hour	0.06	0.08	0.10	**0.12**	**0.14**	**0.16**	0.20

TABLE A1.1

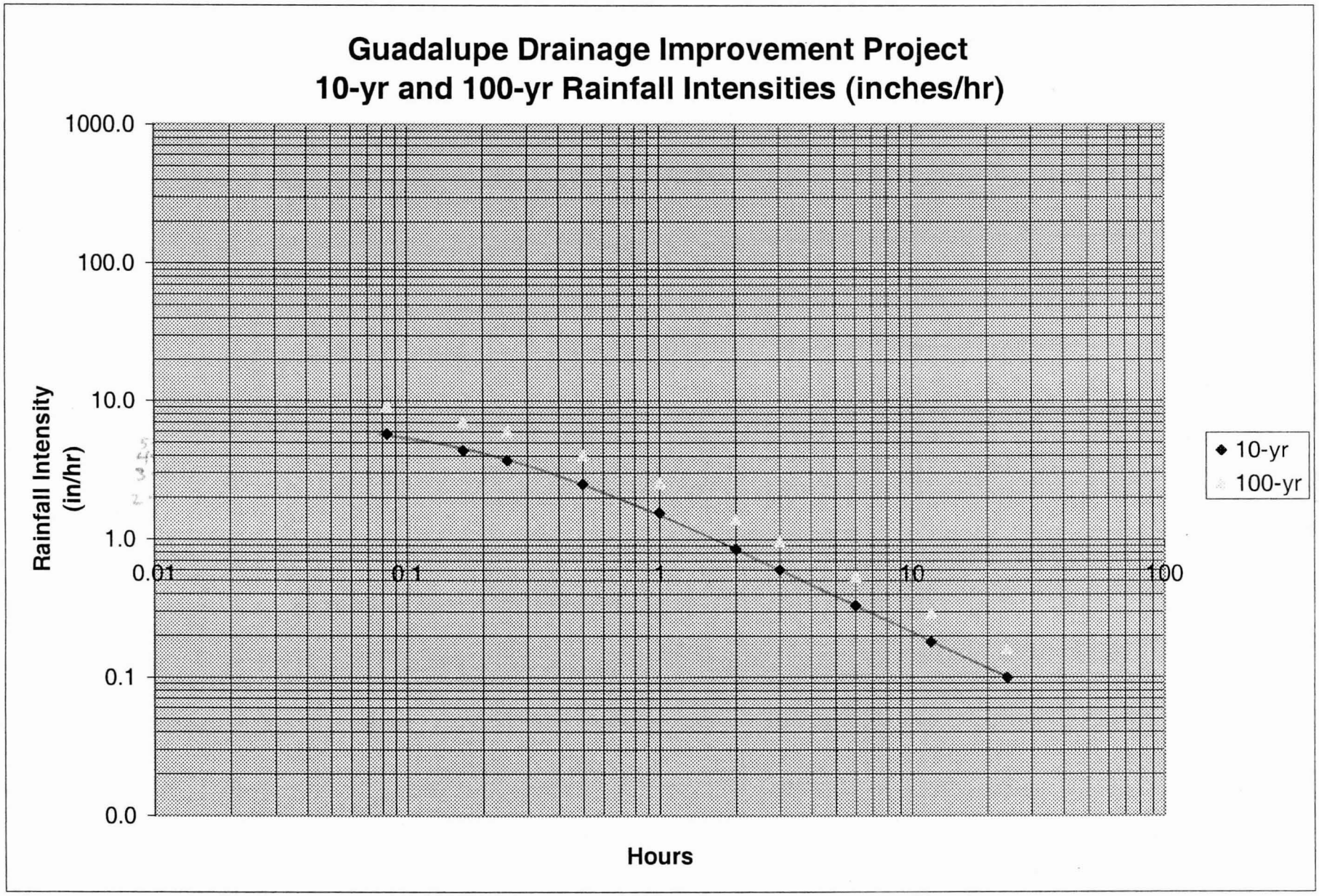
Supplemental Summary of Sub-basin Characteristics and HEC-1 Modeling Input Parameters
Sub-basins Modified for 10-Year Storm Drain Layout

PHYSICAL SUB-BASIN DATA																	
Sub-Basin	Area (Sq Ft)	Sub-Basin Area (Sq Mi)	Total Basin Area (Sq Mi)	Flowpath Length (Ft)	L (Mi)	Elev High (Ft)	Elev Low (Ft)	Average Basin Slope (mi/ft)	Weighted Veg Cover (%)	Kb	IA (Inches)	DTHETA	PSIF (Inches)	XKSAT (Inches/Hour)	RTIMP (%)	Tc (Hours)	R (Hours)
4B	396,400	0.014		1,490	0.28	1242	1229	46	14	0.034	0.13	0.25	3.95	0.42	43	0.213	0.273
4C	766,425	0.027		1,700	0.32	1232	1223	28	14	0.033	0.14	0.25	3.95	0.42	35	0.267	0.269
6B	693,240	0.025		1,860	0.35	1249	1227	62	14	0.033	0.14	0.25	3.95	0.42	34	0.213	0.234
7B	346,380	0.012		1,700	0.32	1226	1225	3	15	0.034	0.15	0.25	3.95	0.42	30	0.762	1.369
7C	441,800	0.016		980	0.19	1236	1227	48	15	0.034	0.15	0.25	3.95	0.42	30	0.175	0.149
8F	621,820	0.022		1,330	0.25	1248	1233	60	15	0.032	0.15	0.25	3.95	0.42	30	0.179	0.159
8G	391,850	0.014		1,340	0.25	1235	1230	20	15	0.032	0.15	0.25	3.95	0.42	30	0.258	0.310
9A	211,166	0.008		750	0.14	1228	1226	14	15	0.035	0.15	0.25	3.95	0.42	30	0.233	0.239
9B	549,850	0.020		1,140	0.22	1245	1230	69	15	0.033	0.15	0.25	3.95	0.44	25	0.175	0.148
9C	629,100	0.023		1,250	0.24	1230	1225	21	15	0.033	0.15	0.25	3.95	0.42	28	0.267	0.234
9D	505,768	0.018		1,480	0.28	1249	1232	61	13	0.032	0.20	0.25	3.95	0.41	39	0.196	0.216
9E	343,470	0.012		1,640	0.31	1248	1229	61	13	0.033	0.19	0.25	3.95	0.41	36	0.213	0.323
9F	415,990	0.015		1,220	0.23	1248	1237	48	10	0.033	0.22	0.25	3.95	0.40	48	0.192	0.200
9G	701,933	0.025		1,648	0.31	1243	1228	48	10	0.034	0.15	0.25	3.95	0.40	55	0.233	0.236
9H	191,935	0.007		610	0.12	1226	1217	78	10	0.034	0.45	0.25	3.95	0.40	5	0.142	0.131
9J	395,740	0.014		1,000	0.19	1228	1225	16	15	0.035	0.15	0.25	3.95	0.42	30	0.262	0.253
		0.142	<<<<<<<			SOUTH WATERSHED AREA (Square Miles)											

NOTES:

See Pentacore Final Drainage Design Report; Table A-1 and Loss Parameter worksheets for original values of Top and Bottom Elevations, Weighted Veg Cover, Kb, IA, Dtheta, PSIF, XKSAT, and RTIMP.
The parameters for SUB9B for the Pentacore model were used in the HEC-1 models for Northeast/Central and the South watersheds.
New values for A, L and Bottom elevations were adjusted as needed for the present design and inlet locations.
Tc and R were calculated using MCUHP1, the data shown above, and a 10-year, 6-hour rainfall depth of 1.62 inches.

By: DES
Ckd: NW


Guadalupe Drainage Improvement Project
10-yr and 100-yr Rainfall Intensities (inches/hr)
1000.0
100.0
10.0
1.0
0.1
0.0
Rainfall Intensity (in/hr)
0.01
0.1
1
10
100
Hours
10-yr
100-yr

By: DES
Ckd: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PERCOLATION CALCULATIONS
10-YEAR STORAGE VOLUME

NORTH RETENTION BASIN - FINAL

Bleedoff Pipe: None				# Drywells	2		Drywell Q	0.2	cfs			
			Pipe/Splwy	0.3	INFILTRATION							
WSEL	Stored Volume (cu ft)	Stored Volume (Ac Ft)	Bleedoff Rate (cfs)	Infiltration Unit Rate (Ft/Hr)	Available Area (Sq Ft)	Available Area (Acre)	Surface Infiltration (cfs)	Drywell Inflow (cfs)	TOTAL OUTFLOW (cfs)	AVERAGE TOTAL OUTFLOW (Ac-In/Hr)	Incremental Volume Change (Ac In)	Drain Time Incremental Volume (Hr)
1224	497474	11.420	2.20	0.15	140783	3.23	5.82	0.40	**8.42**			
										7.99	**36.58**	**4.58**
1223	364693	8.372	2.00	0.15	124880	2.87	5.16	0.40	**7.56**			
										7.19	**32.61**	**4.53**
1222	246305	5.654	1.80	0.15	111976	2.57	4.63	0.40	**6.83**			
										6.65	**13.97**	**2.10**
1221.52	195600	4.490	1.70	0.15	105960	2.43	4.38	0.40	**6.48**			
										6.29	**15.15**	**2.41**
1221	140612	3.228	1.60	0.15	99446	2.28	4.11	0.40	**6.11**			
										4.86	**22.54**	**4.64**
1220	58783	1.349	1.30	0.15	46224	1.06	1.91	0.40	**3.61**			
										2.89	**7.34**	**2.54**
1219	32150	0.738	1.00	0.15	18696	0.43	0.77	0.40	**2.17**			
										1.79	**4.67**	**2.60**
1218	15198	0.349	0.60	0.15	14864	0.34	0.61	0.20	**1.41**			
										1.04	**3.60**	**3.46**
1217	2119	0.049	0.00	0.15	11346	0.26	0.47	0.20	**0.67**			
										0.43	**0.58**	**1.34**
1216	0	0.000	0.00	0.15	10	0.00	0.00	0.20	**0.20**			
									TOTAL TIME IN HOURS TO EMPTY BASIN:			**28.20**

16.99

Volumes per BASFGNO12.dtm (revised 10-04-01)

Two Stage Bleedoff: 8-inch diameter orifice with trash screen on face of bleedoff structure;
Main outlet grate elevation set at 1223.50 (MAG 535 Type F catch basin).
Outlet pipe is 18-inch storm drain.
The Storm Drain 8 pipe operates in outlet control, which has a lower capacity and governs the flow out of the N Basin.

Available Area values were measured from area of each contour element in the CADD drawings for each respective basin.

Available Area value for maximum WSEL is extrapolated from lower values.

Percolation Rate (ft/hr) = Value recommended in Speedie & Assoc. report (dated 1-3-2000) x 0.5 reduction factor, to account for long term reduction in infiltration.

Surface Infiltration (ft/hr) = Percolation Rate (Ft/Hr) x Available Area (Ac) x 12 (In/Ft) x 1 (cfs/ ac-ft/hr)

Drywell Inflow data was determined using 0.20 cfs per drywell.

Total Outflow (cfs) = Bleedoff Rate + Soil Infiltration + Drywell Inflow

Average Total Outflow (ac-in/hr) = [Total Outflow $_i$ + Total Outflow $_{i+1}$] / 2 (Assumes 1 cfs ~ 1 ac-in/hr)

Incremental Volume (ac-in) = [Stored Volume $_i$ - Stored Volume $_{i-1}$ (ac-ft)] * 12 in/ft

Drain Time Incremental Volume (hr) = Incremental Volume (ac-in) / Average Outflow (ac-in/hr)

Triangle Volume

Triangle Volume Report

Original Surface: GUADEG90
Design Surface: BASFGNO12

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 571582.68 cu ft
Fill: 10241.85 cu ft
Net: 561340.83 cu ft

Cut: 21169.73 cu yd
Fill: 379.33 cu yd
Net: 20790.40 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1216

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 1033199.26 cu ft
Fill: 0.00 cu ft
Net: 1033199.26 cu ft

Cut: 38266.64 cu yd
Fill: 0.00 cu yd
Net: 38266.64 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1217

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 854519.37 cu ft
Fill: 2119.12 cu ft
Net: 852400.25 cu ft

Cut: 31648.87 cu yd
Fill: 78.49 cu yd
Net: 31570.38 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1218

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 686799.99 cu ft
Fill: 15198.75 cu ft
Net: 671601.24 cu ft

Cut: 25437.04 cu yd

BASFGNO12
NORTH
10-4-01

Fill: 562.92 cu yd
Net: 24874.12 cu yd

Triangle Volume

T ngle Volume Report

Original Surface: BASFGNO12
Design Surface: 1219

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 522952.29 cu ft
Fill: 32150.06 cu ft
Net: 490802.23 cu ft

Cut: 19368.60 cu yd
Fill: 1190.74 cu yd
Net: 18177.86 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1220

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 368786.24 cu ft
Fill: 58783.02 cu ft
Net: 310003.22 cu ft

Cut: 13658.75 cu yd
Fill: 2177.15 cu yd
Net: 11481.60 cu yd

riangle Volume

Triangle Volume Report

riginal Surface: BASFGNO12
Design Surface: 1221

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 269816.00 cu ft
Fill: 140611.78 cu ft
Net: 129204.21 cu ft

Cut: 9993.19 cu yd
Fill: 5207.84 cu yd
Net: 4785.34 cu yd

angle Volume

Triangle Volume Report

al Surface: BASFGNO12
D gn Surface: 1222

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 194710.25 cu ft
Fill: 246305.04 cu ft

Net: -51594.79 cu ft

Cut: 7211.49 cu yd
Fill: 9122.41 cu yd
Net: -1910.92 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1223

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 132299.29 cu ft
Fill: 364693.09 cu ft
Net: -232393.80 cu ft

Cut: 4899.97 cu yd
Fill: 13507.15 cu yd
Net: -8607.18 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1224

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 84281.91 cu ft
Fill: 497474.72 cu ft
Net: -413192.81 cu ft

Cut: 3121.55 cu yd
Fill: 18424.99 cu yd
Net: -15303.44 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGNO12
Design Surface: 1225

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 57701.69 cu ft
Fill: 651693.51 cu ft
Net: -593991.82 cu ft

Cut: 2137.10 cu yd
Fill: 24136.80 cu yd
Net: -21999.70 cu yd

BY: DES
CKD: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
NORTH BASIN OUTFLOW
RATING CURVE CALCULATION

SOURCES:

Bleedoff Structure Orifice Flow	SEE RATING TABLE
Pressure Pipe Flow	SEE RATING TABLE
Spillway Weir Flow	SEE RATING TABLE

Water Surface Elev (ft)	Orifice Capac (cfs)	Pressure Pipe Capac (cfs)	Governing Flow (cfs) (Note 2)	Spillway Weir Capac (cfs)	**TOTAL OUTFLOW CAPAC (cfs)**
1217.5	0.0	0.0	0.0	0.0	**0.0**
1218.0	0.6	2.9	0.6	0.0	**0.6**
1218.5	0.8	4.3	0.8	0.0	**0.8**
1219.0	1.0	5.3	1.0	0.0	**1.0**
1219.5	1.2	6.2	1.2	0.0	**1.2**
1220.0	1.3	7.0	1.3	0.0	**1.3**
1220.5	1.5	7.7	1.5	0.0	**1.5**
1221.0	1.6	8.4	1.6	0.0	**1.6**
1221.5	1.7	9.0	1.7	0.0	**1.7**
1222.0	1.8	9.6	1.8	0.0	**1.8**
1222.5	1.9	10.1	1.9	0.0	**1.9**
1223.0	2.0	10.7	2.0	0.0	**2.0**
1223.5	2.1	11.2	2.1	0.0	**2.1**
1224.0	2.2	11.7	2.2	0.0	**2.2**
1224.5	2.2	12.2	2.2	662.7	**664.9**
1225.0	2.3	12.6	2.3	1968.3	**1970.6**

NOTES:

1) The governing flow is the lesser of the orifice flow and pressure pipe flow.

2) Total outflow is the combined outflow from the North Basin.

NORTH BASIN BLEEDOFF STRUCTURE, WEIR FLOW
Worksheet for Generic Weir

Project Description	
Worksheet	N Basin Bleedoff Weir Structure
Type	Generic Weir
Solve For	Discharge

Input Data		
Headwater Elevation	1,224.00	ft
Crest Elevation	1,219.00	ft
Discharge Coefficient	2.80	US
Crest Length	4.80	ft

Results		
Discharge	150.26	cfs
Headwater Height Above Crest	5.00	ft
Flow Area	24.0	ft^2
Velocity	6.26	ft/s
Wetted Perimeter	14.80	ft
Top Width	4.80	ft

Notes: Design crest length is 50% of actual crest length which is the perimeter of the BLEEDOFF STRUCTURE.

The bleedoff structure is a catch basin w/ grate (MAG DET 537, Type G).

Orifice flow is considered in a separate calculation.

Flow is the maximum possible through bleedoff structure, when retention basin is filled to overflowing.

Actual outflow is outlet control conditions, governed by bleedoff pipe length, slope, roughness, losses, and tailwater conditions at the ADOT storm drain. See pressure pipe calcs.

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NORTH BASIN BLEEDOFF STRUCTURE, WEIR FLOW
Rating Table for Generic Weir

Project Description	
Worksheet	N Basin Bleedoff Weir Structure
Type	Generic Weir
Solve For	Discharge

Input Data		
Crest Elevation	1,219.00	ft
Discharge Coefficient	2.80	US
Crest Length	4.80	ft

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,219.00	1,224.00	0.50

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,219.00	N/A	N/A
1,219.50	4.75	1.98
1,220.00	13.44	2.80
1,220.50	24.69	3.43
1,221.00	38.01	3.96
1,221.50	53.13	4.43
1,222.00	69.84	4.85
1,222.50	88.00	5.24
1,223.00	107.52	5.60
1,223.50	128.30	5.94
1,224.00	150.26	6.26

N BASIN BLEEDOFF ORIFICE (SD 8)
Worksheet for Generic Orifice

Project Description	
Worksheet	N Basin Outlet Orifice (8" dia)
Type	Generic Orifice
Solve For	Discharge

Input Data		
Headwater Elevation	1,219.00	ft
Centroid Elevation	1,217.40	ft
Tailwater Elevation	1,217.50	ft
Discharge Coefficient	0.60	
Opening Area	0.3	ft^2

Results		
Discharge	2.06	cfs
Headwater Height Above Centroid	1.60	ft
Tailwater Height Above Centroid	0.10	ft
Velocity	5.89	ft/s

NORTH BASIN BLEEDOFF - ORIFICE FLOW
Rating Table for Generic Orifice

Project Description	
Worksheet	N Basin Outlet Orifice (8" dia)
Type	Generic Orifice
Solve For	Discharge

Input Data	
Centroid Elevation	1,217.40 ft
Tailwater Elevation	1,217.50 ft
Discharge Coefficient	0.60
Opening Area	0.3 ft²

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,217.50	1,224.00	0.50

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,217.50	N/A	N/A
1,218.00	1.19	3.40
1,218.50	1.68	4.81
1,219.00	2.06	5.89
1,219.50	2.38	6.81
1,220.00	2.66	7.61
1,220.50	2.92	8.34
1,221.00	3.15	9.00
1,221.50	3.37	9.63
1,222.00	3.57	10.21
1,222.50	3.77	10.76
1,223.00	3.95	11.29
1,223.50	4.13	11.79
1,224.00	4.29	12.27

STORM DRAIN 8 - MAXIMUM PRESSURE FLOW
Worksheet for Pressure Pipe

Project Description	
Worksheet	STM DRN 8 - PRESSURE FLOW - N BASIN BLEEDO
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data		
Pressure at 1	0.00	psi
Pressure at 2	0.00	psi
Elevation at 1	1,224.00	ft
Elevation at 2	1,217.50	ft
Length	922.00	ft
C Coefficient	135.0	
Diameter	18	in

Results		
Discharge	11.67	cfs
Headloss	6.50	ft
Energy Grade at 1	1,224.68	ft
Energy Grade at 2	1,218.18	ft
Hydraulic Grade at 1	1,224.00	ft
Hydraulic Grade at 2	1,217.50	ft
Flow Area	1.8	ft^2
Wetted Perimeter	4.71	ft
Velocity	6.61	ft/s
Velocity Head	0.68	ft
Friction Slope	0.007050	ft/ft

Notes: STORM DRAIN 8 - PRESSURE FLOW CONDITION
WATER SURFACE AT SPILLWAY ELEVATION = 1224.00
TAILWATER ELEVATION IS CROWN OF OUTLET PIPE
ELEV = 1217.50

STORM DRAIN 8 - PRESSURE FLOW
Rating Table for Pressure Pipe

Project Description	
Worksheet	STM DRN 8 - PRESSURE FLOW - N BASIN BLEEDO
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data		
Pressure at 1	0.00	psi
Pressure at 2	0.00	psi
Elevation at 2	1,217.50	ft
Length	922.00	ft
C Coefficient	135.0	
Diameter	18	in

Attribute	Minimum	Maximum	Increment
Elevation at 1 (ft)	1,217.50	1,225.00	0.50

Elevation at 1 (ft)	Discharge (cfs)
1,217.50	0.00
1,218.00	2.92
1,218.50	4.25
1,219.00	5.29
1,219.50	6.18
1,220.00	6.97
1,220.50	7.69
1,221.00	8.36
1,221.50	8.98
1,222.00	9.57
1,222.50	10.13
1,223.00	10.67
1,223.50	11.18
1,224.00	11.67
1,224.50	12.15
1,225.00	12.61

SPILLWAY - NORTH RETENTION BASIN - FULL 10-YEAR FLOW
Worksheet for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - N BASIN (PERIM ROAD)
Type	Broad Crested Weir
Solve For	Headwater Elevation

Input Data		
Discharge	109.00	cfs
Crest Elevation	1,224.00	ft
Tailwater Elevation	1,223.50	ft
Crest Surface Type	Gravel	
Crest Breadth	12.00	ft
Crest Length	696.00	ft

Results		
Headwater Elevation	1,224.15	ft
Headwater Height Above Crest	0.15	ft
Tailwater Height Above Crest	-0.50	ft
Discharge Coefficient	2.57	US
Submergence Factor	1.00	
Adjusted Discharge Coefficient	2.57	US
Flow Area	107.8	ft^2
Velocity	1.01	ft/s
Wetted Perimeter	696.31	ft
Top Width	696.00	ft

Notes: CREST LENGTH IS LENGTH OF CUTOFF WALL ALONG PERIMETER ROAD, ON NORTH SIDE OF BASIN.

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SPILLWAY WEIR - NORTH BASIN
Rating Table for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - N BASIN (PERIM ROAD)
Type	Broad Crested Weir
Solve For	Discharge

Input Data	
Crest Elevation	1,224.00 ft
Tailwater Elevation	1,223.50 ft
Crest Surface Type	Gravel
Crest Breadth	12.00 ft
Crest Length	696.00 ft

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,224.00	1,225.00	0.10

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,224.00	N/A	N/A
1,224.10	56.02	0.80
1,224.20	160.98	1.16
1,224.30	300.11	1.44
1,224.40	468.33	1.68
1,224.50	662.71	1.90
1,224.60	881.20	2.11
1,224.70	1,122.23	2.30
1,224.80	1,384.48	2.49
1,224.90	1,666.84	2.66
1,225.00	1,968.28	2.83

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PERCOLATION CALCULATIONS
100-YEAR STORAGE VOLUME

NORTHEAST RETENTION BASIN - FINAL

Bleedoff Pipe: None				# Drywells	8		Drywell Q	0.2	cfs			
			Pipe/Splwy	0.50	INFILTRATION							
WSEL	Stored Volume (Cu Ft)	Stored Volume (Ac Ft)	Bleedoff Rate (cfs)	Infiltration Unit Rate (Ft/Hr)	Available Area (Sq Ft)	Available Area (Acre)	Surface Infiltration (cfs)	Drywell Inflow (cfs)	TOTAL OUTFLOW (cfs)	AVERAGE TOTAL OUTFLOW (Ac-In/Hr)	Incremental Volume Change (Ac In)	Drain Time Incremental Volume (Hr)
1223	482581	11.079	0.00	0.25	45200	1.04	3.11	1.60	4.71			
										4.60	13.47	2.93
1222	433680	9.956	0.00	0.25	41900	0.96	2.89	1.60	4.49			
										4.37	23.56	5.40
1220	348173	7.993	0.00	0.25	38400	0.88	2.64	1.60	4.24			
										4.16	15.25	3.67
1218.51	292809	6.722	0.00	0.25	35900	0.82	2.47	1.60	4.07			
										4.04	5.22	1.29
1218	273859	6.287	0.00	0.25	35000	0.80	2.41	1.60	4.01			
										3.90	13.71	3.52
1216	224105	5.145	0.00	0.25	31700	0.73	2.18	1.60	3.78			
										3.68	21.21	5.77
1214	147104	3.377	0.00	0.25	28600	0.66	1.97	1.60	3.57			
										3.46	14.86	4.29
1212	93152	2.138	0.00	0.25	25500	0.59	1.76	1.60	3.36			
										3.26	13.22	4.06
1210	45156	1.037	0.00	0.25	22600	0.52	1.56	1.60	3.16			
										3.06	12.44	4.07
1208	2875	0.066	0.00	0.25	19800	0.45	1.36	1.60	2.96			
										1.58	0.79	0.50
1207.5	0	0.000	0.00	0.25	10	0.00	0.00	0.20	0.20			
							TOTAL TIME IN HOURS TO EMPTY COMPLETELY FILLED BASIN:					35.49

23.50

Volumes from Inroads digital terrain model BASFGTM8.dtm (5-17-01).
Peak WSEL from TMCE10_8.OH1 HEC-1 output for Tempe Retention Basin (RETTMP).
Bleedoff Rate for outlet pipe and spillway per rating tables created in FlowMaster, for respective retention basins (South, Central, North).
Available Area values were measured from area of each contour element in the CADD drawings for each respective basin.
Available Area value for maximum WSEL is extrapolated from lower values.

Percolation Rate (ft/hr) =	Value recommended in Speedie & Assoc. report (dated 1-3-2000) x 0.5 reduction factor, to account for long term reduction in infiltration.
Surface Infiltration (ft/hr) =	Percolation Rate (Ft/Hr) x Available Area (Ac) x 12 (In/Ft) x 1 (cfs/ ac-ft/hr)
Drywell Inflow data was determined using 0.20 cfs per drywell.	
Total Outflow (cfs) =	Bleedoff Rate + Soil Infiltration + Drywell Inflow
Average Total Outflow (ac-in/hr) =	[Total Outflow $_i$ + Total Outflow $_{i+1}$] / 2 (Assumes 1 cfs ~ 1 ac-in/hr)
Incremental Volume (ac-in) =	[Stored Volume $_i$ - Stored Volume $_{i-1}$ (ac-ft)] * 12 in/ft
Drain Time Incremental Volume (hr) =	Incremental Volume (ac-in) / Average Outflow (ac-in/hr)

NORTHEAST RETENTION BASIN (TEMPE)
05/17/01
Triangle Volume

Triangle Volume Report

Original Surface: GUADEG10
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 356250.35 cu ft
Fill: 67379.25 cu ft
Net: 288871.10 cu ft

Cut: 13194.46 cu yd
Fill: 2495.53 cu yd
Net: 10698.93 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: 1208
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 2875.51 cu ft
Fill: 584957.81 cu ft
Net: -582082.30 cu ft

Cut: 106.50 cu yd
Fill: 21665.10 cu yd
Net: -21558.60 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: 1209
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00

NE BASIN
BASFGTM8

```
     Fill Factor: 1.00

             Cut: 23316.73 cu ft
            Fill: 534745.32 cu ft
             Net: -511428.58 cu ft

             Cut: 863.58 cu yd
            Fill: 19805.38 cu yd
             Net: -18941.80 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1210
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 45156.57 cu ft
            Fill: 485931.44 cu ft
             Net: -440774.86 cu ft

             Cut: 1672.47 cu yd
            Fill: 17997.46 cu yd
             Net: -16324.99 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1211
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 68425.14 cu ft
            Fill: 438546.29 cu ft
             Net: -370121.14 cu ft

             Cut: 2534.26 cu yd
            Fill: 16242.46 cu yd
             Net: -13708.19 cu yd
```

Triangle Volume

Triangle Volume Report

Original Surface: 1212
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 93152.56 cu ft
Fill: 392619.99 cu ft
Net: -299467.42 cu ft

Cut: 3450.09 cu yd
Fill: 14541.48 cu yd
Net: -11091.39 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: 1213
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 119368.95 cu ft
Fill: 348182.65 cu ft
Net: -228813.70 cu ft

Cut: 4421.07 cu yd
Fill: 12895.65 cu yd
Net: -8474.58 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: 1214
Design Surface: BASFGTM8

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

```
       Cut: 147104.41 cu ft
      Fill: 305264.40 cu ft
       Net: -158159.98 cu ft

       Cut: 5448.31 cu yd
      Fill: 11306.09 cu yd
       Net: -5857.78 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1215
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

       Cut: 176389.08 cu ft
      Fill: 263895.35 cu ft
       Net: -87506.26 cu ft

       Cut: 6532.93 cu yd
      Fill: 9773.90 cu yd
       Net: -3240.97 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1216
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

       Cut: 207253.06 cu ft
      Fill: 224105.61 cu ft
       Net: -16852.54 cu ft

       Cut: 7676.04 cu yd
      Fill: 8300.21 cu yd
       Net: -624.17 cu yd


Triangle Volume
```

```
  Triangle Volume Report

Original Surface: 1217
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 239726.49 cu ft
            Fill: 185925.32 cu ft
             Net: 53801.18 cu ft

             Cut: 8878.76 cu yd
            Fill: 6886.12 cu yd
             Net: 1992.64 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1218
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 273859.39 cu ft
            Fill: 149404.50 cu ft
             Net: 124454.90 cu ft

             Cut: 10142.94 cu yd
            Fill: 5533.50 cu yd
             Net: 4609.44 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1219
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 309852.84 cu ft
            Fill: 114744.23 cu ft
```

```
            Net: 195108.62 cu ft

            Cut: 11476.03 cu yd
           Fill: 4249.79 cu yd
            Net: 7226.25 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1220
  Design Surface: BASFGTM8

           Mode: Fence
     Cut Factor: 1.00
    Fill Factor: 1.00

            Cut: 348173.15 cu ft
           Fill: 82410.81 cu ft
            Net: 265762.34 cu ft

            Cut: 12895.30 cu yd
           Fill: 3052.25 cu yd
            Net: 9843.05 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1221
  Design Surface: BASFGTM8

           Mode: Fence
     Cut Factor: 1.00
    Fill Factor: 1.00

            Cut: 389248.69 cu ft
           Fill: 52832.63 cu ft
            Net: 336416.06 cu ft

            Cut: 14416.62 cu yd
           Fill: 1956.76 cu yd
            Net: 12459.85 cu yd


Triangle Volume

  Triangle Volume Report
```

```
Original Surface: 1222
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 433679.68 cu ft
            Fill: 26609.90 cu ft
             Net: 407069.78 cu ft

             Cut: 16062.21 cu yd
            Fill: 985.55 cu yd
             Net: 15076.66 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1223
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 482581.81 cu ft
            Fill: 4858.31 cu ft
             Net: 477723.50 cu ft

             Cut: 17873.40 cu yd
            Fill: 179.94 cu yd
             Net: 17693.46 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1224
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 548377.22 cu ft
            Fill: 0.00 cu ft
             Net: 548377.22 cu ft
```

12.589

```
       Cut: 20310.27 cu yd
      Fill: 0.00 cu yd
       Net: 20310.27 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: 1225
  Design Surface: BASFGTM8

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 619030.94 cu ft
            Fill: 0.00 cu ft
             Net: 619030.94 cu ft

             Cut: 22927.07 cu yd
            Fill: 0.00 cu yd
             Net: 22927.07 cu yd
```

SPILLWAY - NORTHEAST RETENTION BASIN - FULL 10-YEAR FLOW
Worksheet for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - NE BASIN (PERIM ROAD)
Type	Broad Crested Weir
Solve For	Headwater Elevation

Input Data		
Discharge	136.00	cfs
Crest Elevation	1,223.00	ft
Tailwater Elevation	1,219.00	ft
Crest Surface Type	Gravel	
Crest Breadth	12.00	ft
Crest Length	526.00	ft

Results		
Headwater Elevation	1,223.22	ft
Headwater Height Above Crest	0.22	ft
Tailwater Height Above Crest	-4.00	ft
Discharge Coefficient	2.59	US
Submergence Factor	1.00	
Adjusted Discharge Coefficient	2.59	US
Flow Area	113.1	ft^2
Velocity	1.20	ft/s
Wetted Perimeter	526.43	ft
Top Width	526.00	ft

Notes: CREST LENGTH IS LENGTH OF CUTOFF WALL ALONG PERIMETER ROAD, ON NORTH AND EAST SIDE OF BASIN.

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SPILLWAY WEIR - NORTHEAST BASIN
Rating Table for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - NE BASIN (PERIM ROAD)
Type	Broad Crested Weir
Solve For	Discharge

Input Data	
Crest Elevation	1,223.00 ft
Tailwater Elevation	1,219.00 ft
Crest Surface Type	Gravel
Crest Breadth	12.00 ft
Crest Length	526.00 ft

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,223.00	1,225.00	0.10

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,223.00	N/A	N/A
1,223.10	42.34	0.80
1,223.20	121.66	1.16
1,223.30	226.81	1.44
1,223.40	353.94	1.68
1,223.50	500.84	1.90
1,223.60	665.97	2.11
1,223.70	848.12	2.30
1,223.80	1,046.32	2.49
1,223.90	1,259.71	2.66
1,224.00	1,487.53	2.83
1,224.10	1,729.08	2.99
1,224.20	1,983.75	3.14
1,224.30	2,250.92	3.29
1,224.40	2,530.06	3.44
1,224.50	2,820.63	3.57
1,224.60	3,122.16	3.71
1,224.70	3,434.18	3.84
1,224.80	3,756.26	3.97
1,224.90	4,062.51	4.06
1,225.00	4,396.67	4.18

SVERDRUP

JOB GUADALUPE DR, IMP. 10-YR

COMPUTATIONS FOR NORTHEAST BASIN LOCAL RUNOFF

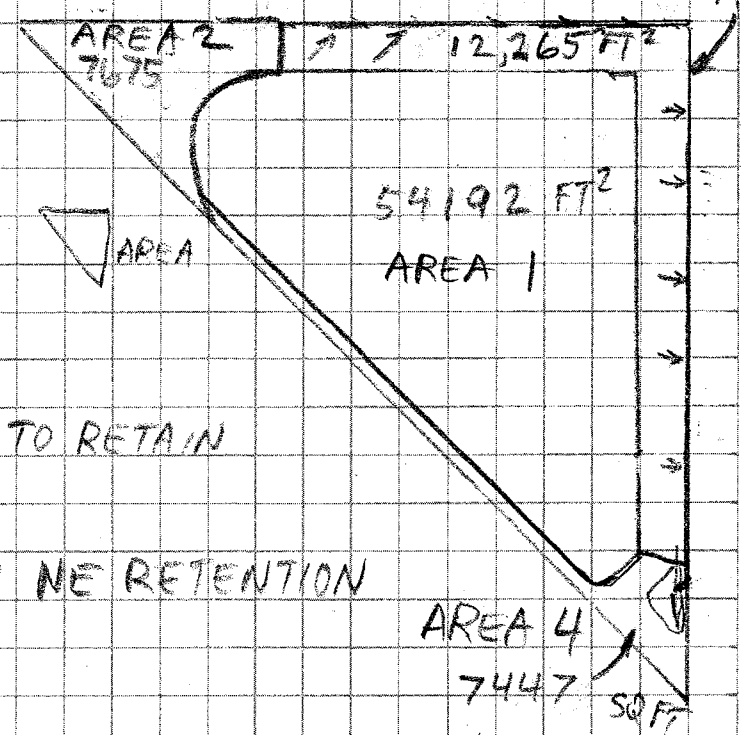
SHEET NO. 1 OF 3

DATE 3-13-2001

BY DES CHKD SDO

100-YEAR, 2-HOUR VOLUME

BASIN FOOTPRINT



TOTAL ENVELOPE

$A_{TOT.}$ = 81,579 SQ.FT.

LESS A_3 = 12,265 SQ FT.

69,314 SQ FT TO RETAIN

AREA 1 IS RETAINED IN NE RETENTION BASIN:

$A = 54,192\ ft^2$

$C = 0.50$ — 70% BARE GROUND (C=0.38), 30% GRAVEL ROAD (C=0.75) } C_{AVG} = 0.49, USE 0.50

$P_{100,2}$ = 2.68 INCHES — 100-YR, 2 HR DEPTH FIG. 3.3

$$V_1 = C\left(\frac{P}{12}\right)A = 0.50 \cdot \left(\frac{2.68}{12}\right) \cdot \frac{54,192}{43560} = 0.14 \text{ AC-FT}$$

RETENTION BASIN 10 YR DESIGN VOL = 6.72 AC FT @ WSEL 1218.51

TOTAL RETENTION REQ FOR BASIN = 6.86 AC FT

MAX RETENTION AVAILABLE 11.078 AC FT ✓ @ SPILLWAY ELEV 1223.00

SVERDRUP

JOB GUAD DR. IMP 10-YR

COMPUTATIONS FOR NORTHEAST BASIN LOCAL RUNOFF

SHEET NO. 2 OF 3

DATE 3-13-2001

BY DES CHKD BLD

AREA 3 WILL DRAIN ONTO THE ALLEY AS IT DOES IN THE EXISTING CASE (NO INCREASE IN RUNOFF)

$A_3 = 12{,}265$ SQ FT

$C = 0.38$ GRAVEL HILLSIDE OR BARE GROUND

$P_{100,2} = 2.68$ INCH

$V_3 = 0.38 * \left(\frac{2.68}{12}\right) * \frac{12265}{43560} = 0.024$ AC FT (1040 CU FT)

AREA A_4 WILL BE INTERCEPTED BY A SHALLOW V-DITCH ALONG THE WEST PROPERTY LINE & A SUMP AREA AT THE SOUTH CORNER.

$A_4 = 7447$ SQ FT

$C_4 = 0.38$ BARE GROUND

$P_{100,2} = 2.68''$

$V_4 = 0.38 * \left(\frac{2.68}{12}\right) \frac{7447}{43560} = 0.014$ AC-FT (630 CU FT)

SUMP CONTAINS 6170 CU FT (0.142 AC FT)
SEE VOLUME REPORT BASFGTM8-1.TXT
FOR ELEVATION 1221

SVERDRUP

JOB GUADALUPE DR. IMP. 10-YR

COMPUTATIONS FOR NORTHEAST BASIN LOCAL RUNOFF

SHEET NO. 3 OF 3

DATE 8-28-01

BY DFG CHKD SDO

AREA A2 WILL BE COLLECTED IN A DEPRESSION IN THE CENTER OF A2.

$A_2 = 7675$ SQ FT

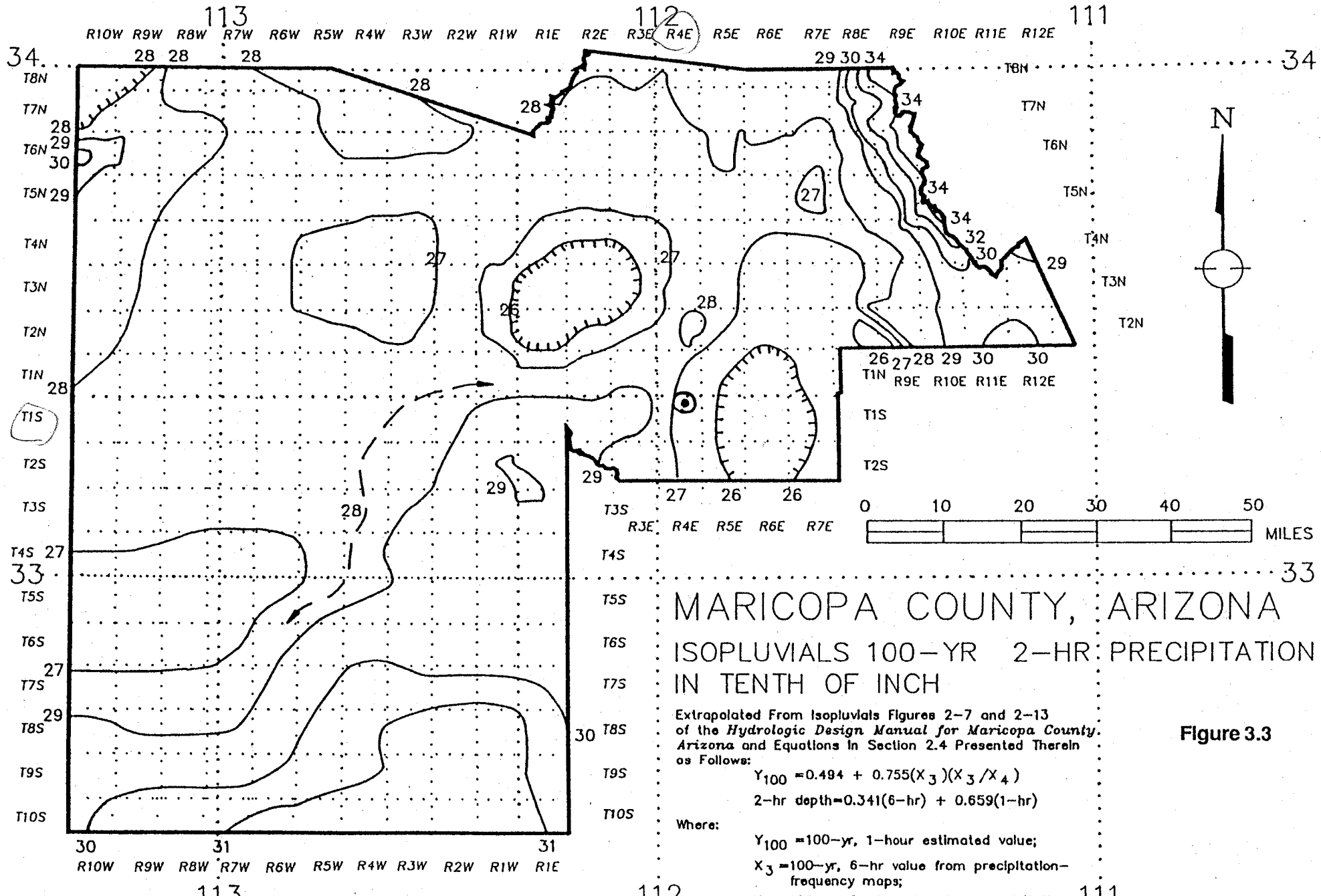
$C = 0.38$ BARE GROUND OR GRAVEL

$P_{100,2} = 2.68$ INCHES

$$V_1 = C\left(\frac{P}{12}\right)A = 0.38 * \left(\frac{2.68}{12}\right)\frac{7675}{43560}\ \text{ACFT/CUFT}$$

$$= 0.015 \text{ AC FT}$$
$$(650 \text{ CU FT})$$

THE CAPACITY OF THE DEPRESSION IS 2738 CUFT (SEE INROADS TRIANGLE VOLUME REPORT)



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 2-HR PRECIPITATION IN TENTH OF INCH

Extrapolated From Isopluvials Figures 2-7 and 2-13 of the *Hydrologic Design Manual for Maricopa County, Arizona* and Equations In Section 2.4 Presented Therein as Follows:

$$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$$

$$\text{2-hr depth} = 0.341(\text{6-hr}) + 0.659(\text{1-hr})$$

Where:

Y_{100} = 100-yr, 1-hour estimated value;

X_3 = 100-yr, 6-hr value from precipitation-frequency maps;

X_4 = 100-yr, 24-hr value from precipitation-frequency maps;

6-hr = Isopluvial values from figure 2.7;

1-hr = Y_{100} value as computed above.

Figure 3.3

$P_{100,2} = 2.68$ INCHES

TEMPE BASIN
LOCAL RUNOFF 100-YR

BIADAIIIPE DRAINAGE

Triangle Volume

Triangle Volume Report

DEPRESSION, N CORNER AREA A3

Original Surface: BASFGTM8
Design Surface: 1223

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 1429.05 cu ft
Fill: 2738.33 cu ft
Net: -1309.29 cu ft

Cut: 52.93 cu yd
Fill: 101.42 cu yd
Net: -48.49 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: GUADEG10 AREA A4
Design Surface: WEDGE_DIKE

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 4639.81 cu ft
Fill: 699.29 cu ft
Net: 3940.53 cu ft

Cut: 171.84 cu yd
Fill: 25.90 cu yd
Net: 145.95 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: WEDGE_DIKE
Design Surface: 1217

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 9850.37 cu ft
Fill: 0.00 cu ft
Net: 9850.37 cu ft

Cut: 364.83 cu yd
Fill: 0.00 cu yd
Net: 364.83 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: WEDGE_DIKE
Design Surface: 1218

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

```
            Cut: 6105.80 cu ft
           Fill: 251.41 cu ft
            Net: 5854.39 cu ft

            Cut: 226.14 cu yd
           Fill: 9.31 cu yd
            Net: 216.83 cu yd

Triangle Volume

  Triangle Volume Report

Original Surface: WEDGE_DIKE
  Design Surface: 1219

           Mode: Fence
     Cut Factor: 1.00
    Fill Factor: 1.00

            Cut: 2979.02 cu ft
           Fill: 1120.62 cu ft
            Net: 1858.40 cu ft

            Cut: 110.33 cu yd
           Fill: 41.50 cu yd
            Net: 68.83 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: WEDGE_DIKE
  Design Surface: 1220

           Mode: Fence
     Cut Factor: 1.00
    Fill Factor: 1.00

            Cut: 883.29 cu ft
           Fill: 3020.88 cu ft
            Net: -2137.59 cu ft

            Cut: 32.71 cu yd
           Fill: 111.88 cu yd
            Net: -79.17 cu yd


Triangle Volume
```

Triangle Volume Report

Original Surface: WEDGE_DIKE
Design Surface: 1221

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 38.19 cu ft
Fill: 6171.77 cu ft
Net: -6133.58 cu ft

Cut: 1.41 cu yd
Fill: 228.58 cu yd
Net: -227.17 cu yd

By: DES
Ckd: NW

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PERCOLATION CALCULATIONS
10-YEAR STORAGE VOLUME

CENTRAL BASIN - FINAL

Bleedoff Pipe: 10" Orifice				# Drywells	2		Drywell Q	0.2	cfs			
			Pipe/Splwy	0.5	INFILTRATION					AVERAGE	Incremental	Drain Time
WSEL	Stored Volume (Cu Ft)	Stored Volume (Ac Ft)	Bleedoff Rate (cfs)	Infiltration Unit Rate (Ft/Hr)	Available Area (Sq Ft)	Available Area (Acre)	Surface Infiltration (cfs)	Drywell Inflow (cfs)	TOTAL OUTFLOW (cfs)	TOTAL OUTFLOW (Ac-In/Hr)	Volume Change (Ac In)	Incremental Volume (Hr)
1224.5	1062382	24.389	6.28	0.25	153737	3.53	10.59	0.40	17.27			
										16.87	21.44	1.27
1224	984560	22.602	6.04	0.25	145524	3.34	10.02	0.40	16.46			
										16.08	26.03	1.62
1223.33	890070	20.433	5.70	0.25	139470	3.20	9.61	0.40	15.71			
										15.52	12.82	0.83
1223	843532	19.365	5.54	0.25	136490	3.13	9.40	0.40	15.34			
										14.76	36.38	2.46
1222	711475	16.333	4.99	0.25	127665	2.93	8.79	0.40	14.18			
										13.57	33.97	2.50
1221	588168	13.502	4.37	0.25	119008	2.73	8.20	0.40	12.97			
										12.30	31.46	2.56
1220	473960	10.881	3.65	0.25	110083	2.53	7.58	0.40	11.63			
										10.92	29.30	2.68
1219	367606	8.439	2.74	0.25	102680	2.36	7.07	0.40	10.21			
										9.26	27.30	2.95
1218	268496	6.164	1.32	0.25	95667	2.20	6.59	0.40	8.31			
										7.42	25.43	3.43
1217	176178	4.044	0.00	0.25	89007	2.04	6.13	0.40	6.53			
										6.30	23.61	3.75
1216	90473	2.077	0.00	0.25	82357	1.89	5.67	0.40	6.07			
										4.92	20.29	4.12
1215	16815	0.386	0.00	0.25	49042	1.13	3.38	0.40	3.78			
										2.09	4.63	2.21
1214	24	0.001	0.00	0.25	85	0.00	0.01	0.40	0.41			
							TOTAL TIME IN HOURS TO EMPTY COMPLETELY FILLED BASIN:					30.38

27.49

Volumes from Inroads digital terrain model BASFGCE3.dtm (10-04-01).
Peak WSEL from TMCE10_7.OH1 HEC-1 output for Central Retention Basin (RETCEN).
Bleedoff Rate for outlet pipe and spillway per rating tables created in FlowMaster, for respective retention basins (South, Central, North).
Available Area values were measured from area of each contour element in the CADD drawings for each respective basin.
Available Area value for maximum WSEL is extrapolated from lower values.

Percolation Rate (ft/hr) = Value recommended in Speedie & Assoc. report (dated 1-3-2000) x 0.5 reduction factor, to account for long term reduction in infiltration.
Surface Infiltration (ft/hr) = Percolation Rate (Ft/Hr) x Available Area (Ac) x 12 (In/Ft) x 1 (cfs/ ac-ft/hr)
Drywell Inflow data was determined using 0.20 cfs per drywell.
Total Outflow (cfs) = Bleedoff Rate + Soil Infiltration + Drywell Inflow
Average Total Outflow (ac-in/hr) = [Total Outflow $_i$ + Total Outflow $_{i+1}$] / 2 (Assumes 1 cfs ~ 1 ac-in/hr)
Incremental Volume (ac-in) = [Stored Volume $_i$ - Stored Volume $_{i-1}$ (ac-ft)] * 12 in/ft
Drain Time Incremental Volume (hr) = Incremental Volume (ac-in) / Average Outflow (ac-in/hr)

Triangle Volume

Triangle Volume Report

Original Surface: GUADEG90
Design Surface: BASFGCE3

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 946791.03 cu ft
Fill: 1963.54 cu ft
Net: 944827.49 cu ft

Cut: 35066.33 cu yd
Fill: 72.72 cu yd
Net: 34993.61 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGCE3
Design Surface: 1213

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 987708.25 cu ft
Fill: 0.00 cu ft
Net: 987708.25 cu ft

Cut: 36581.79 cu yd
Fill: 0.00 cu yd
Net: 36581.79 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: BASFGCE3
Design Surface: 1214

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

BASFGCE3
CENTRAL
10-4-01

```
      Cut: 811496.46 cu ft
     Fill: 23.57 cu ft
      Net: 811472.90 cu ft

      Cut: 30055.42 cu yd
     Fill: 0.87 cu yd
      Net: 30054.55 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1215

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

      Cut: 652052.63 cu ft
     Fill: 16815.09 cu ft
      Net: 635237.54 cu ft

      Cut: 24150.10 cu yd
     Fill: 622.78 cu yd
      Net: 23527.32 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1216

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

      Cut: 549475.28 cu ft
     Fill: 90473.09 cu ft
      Net: 459002.19 cu ft

      Cut: 20350.94 cu yd
     Fill: 3350.86 cu yd
      Net: 17000.08 cu yd


Triangle Volume
```

```
  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1217

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 458944.86 cu ft
            Fill: 176178.02 cu ft
             Net: 282766.83 cu ft

             Cut: 16997.96 cu yd
            Fill: 6525.11 cu yd
             Net: 10472.85 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1218

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 375027.29 cu ft
            Fill: 268495.81 cu ft
             Net: 106531.48 cu ft

             Cut: 13889.90 cu yd
            Fill: 9944.29 cu yd
             Net: 3945.61 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1219

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 297902.88 cu ft
```

```
Fill: 367606.76 cu ft
 Net: -69703.87 cu ft

 Cut: 11033.44 cu yd
Fill: 13615.07 cu yd
 Net: -2581.62 cu yd
```

Triangle Volume

```
  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1220

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 228020.76 cu ft
            Fill: 473959.99 cu ft
             Net: -245939.23 cu ft

             Cut: 8445.21 cu yd
            Fill: 17554.07 cu yd
             Net: -9108.86 cu yd
```

Triangle Volume

```
  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1221

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 165993.94 cu ft
            Fill: 588168.52 cu ft
             Net: -422174.58 cu ft

             Cut: 6147.92 cu yd
            Fill: 21784.02 cu yd
             Net: -15636.10 cu yd
```

Triangle Volume

```
  Triangle Volume Report
```

```
Original Surface: BASFGCE3
  Design Surface: 1222

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 113065.19 cu ft
            Fill: 711475.13 cu ft
             Net: -598409.94 cu ft

             Cut: 4187.60 cu yd
            Fill: 26350.93 cu yd
             Net: -22163.33 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1223

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 68887.45 cu ft
            Fill: 843532.74 cu ft
             Net: -774645.29 cu ft

             Cut: 2551.39 cu yd
            Fill: 31241.95 cu yd
             Net: -28690.57 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1224

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

             Cut: 33679.62 cu ft
            Fill: 984560.27 cu ft
             Net: -950880.65 cu ft
```

```
          Cut: 1247.39 cu yd
         Fill: 36465.20 cu yd
          Net: -35217.80 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1225

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

          Cut: 13089.90 cu ft
         Fill: 1140205.90 cu ft
          Net: -1127116.00 cu ft

          Cut: 484.81 cu yd
         Fill: 42229.85 cu yd
          Net: -41745.04 cu yd


Triangle Volume

  Triangle Volume Report

Original Surface: BASFGCE3
  Design Surface: 1226

            Mode: Fence
      Cut Factor: 1.00
     Fill Factor: 1.00

          Cut: 3352.34 cu ft
         Fill: 1306703.69 cu ft
          Net: -1303351.36 cu ft

          Cut: 124.16 cu yd
         Fill: 48396.43 cu yd
          Net: -48272.27 cu yd
```

26.18 AC FT

30.00 AC FT

Central Basin Bleedoff 10" Orifice Plate
Rating Table for Generic Orifice

Project Description	
Worksheet	C Basin Outlet Orifice (10" dia)
Type	Generic Orifice
Solve For	Discharge

Input Data	
Centroid Elevation	1,215.50 ft
Tailwater Elevation	1,217.70 ft
Discharge Coefficient	0.60
Opening Area	0.5 ft^2

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,215.00	1,226.00	0.50

Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,215.00	N/A	N/A
1,215.50	N/A	N/A
1,216.00	N/A	N/A
1,216.50	N/A	N/A
1,217.00	N/A	N/A
1,217.50	N/A	N/A
1,218.00	1.32	2.64
1,218.50	2.15	4.30
1,219.00	2.74	5.49
1,219.50	3.23	6.46
1,220.00	3.65	7.30
1,220.50	4.03	8.05
1,221.00	4.37	8.74
1,221.50	4.69	9.38
1,222.00	4.99	9.98
1,222.50	5.27	10.54
1,223.00	5.54	11.08
1,223.50	5.80	11.59
1,224.00	6.04	12.08
1,224.50	6.28	12.55
1,225.00	6.50	13.00
1,225.50	6.72	13.44
1,226.00	6.93	13.87

SRP 24" IRRIGATION PIPE (CENTRAL BASIN OUTFALL)
Worksheet for Circular Channel

Project Description	
Worksheet	24" GUAD IRRIGATION PIPE
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Slope	0.009340	ft/ft
Diameter	24	in
Discharge	6.00	cfs

Results		
Depth	0.72	ft
Flow Area	1.0	ft²
Wetted Perimeter	2.57	ft
Top Width	1.92	ft
Critical Depth	0.87	ft
Percent Full	35.8	%
Critical Slope	0.004645	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	1.26	ft
Froude Number	1.44	
Maximum Discharge	23.52	cfs
Discharge Full	21.86	cfs
Slope Full	0.000704	ft/ft
Flow Type	Supercritical	

Notes: SRP 24" RCP IRRIGATION PIPE.
INV = 1217.00 (PER AS-BUILT PLANS
A-95-166.1

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Central Basin Spillway - Full 10-year flow
Worksheet for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - Central Basin
Type	Broad Crested Weir
Solve For	Headwater Elevation

Input Data		
Discharge	423.00	cfs
Crest Elevation	1,224.50	ft
Tailwater Elevation	1,224.00	ft
Crest Surface Type	Gravel	
Crest Breadth	15.00	ft
Crest Length	403.00	ft

Results		
Headwater Elevation	1,225.03	ft
Headwater Height Above Crest	0.53	ft
Tailwater Height Above Crest	-0.50	ft
Discharge Coefficient	2.70	US
Submergence Factor	1.00	
Adjusted Discharge Coefficient	2.70	US
Flow Area	214.5	ft^2
Velocity	1.97	ft/s
Wetted Perimeter	404.06	ft
Top Width	403.00	ft

Notes: SPILLWAY DISCHARGES INTO HIGHLINE CANAL

CENTRAL BASIN SPILLWAY WEIR FLOW
Rating Table for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - Central Basin
Type	Broad Crested Weir
Solve For	Headwater Elevation

Input Data	
Crest Elevation	1,224.50 ft
Tailwater Elevation	1,224.00 ft
Crest Surface Type	Gravel
Crest Breadth	15.00 ft
Crest Length	403.00 ft

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	20.00	500.00	20.00

Discharge (cfs)	Headwater Elevation (ft)	Velocity (ft/s)
20.00	1,224.57	0.68
40.00	1,224.61	0.86
60.00	1,224.65	0.99
80.00	1,224.68	1.10
100.00	1,224.71	1.19
120.00	1,224.74	1.26
140.00	1,224.76	1.33
160.00	1,224.78	1.40
180.00	1,224.81	1.46
200.00	1,224.83	1.51
220.00	1,224.85	1.56
240.00	1,224.87	1.61
260.00	1,224.89	1.66
280.00	1,224.91	1.70
300.00	1,224.93	1.74
320.00	1,224.94	1.78
340.00	1,224.96	1.82
360.00	1,224.98	1.86
380.00	1,225.00	1.90
400.00	1,225.01	1.93
420.00	1,225.03	1.97
440.00	1,225.05	2.00
460.00	1,225.06	2.03
480.00	1,225.08	2.06
500.00	1,225.09	2.09

By: DES
Ckd: NW

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PERCOLATION CALCULATIONS
10-YEAR STORAGE VOLUME

SOUTH RETENTION BASIN - FINAL

Bleedoff Pipe: None				# Drywells	3		Drywell Q	0.2	cfs			
			Pipe/Splwy	0.5	INFILTRATION							
WSEL	Stored Volume (cu ft)	Stored Volume (Ac Ft)	Bleedoff Rate (cfs)	Infiltration Unit Rate (Ft/Hr)	Available Area (Sq Ft)	Available Area (Acre)	Surface Infiltration (cfs)	Drywell Inflow (cfs)	TOTAL OUTFLOW (cfs)	**AVERAGE TOTAL OUTFLOW (Ac-In/Hr)**	Incremental Volume Change (Ac In)	**Drain Time Incremental Volume (Hr)**
1225	510994	11.731	0.00	0.25	103612	2.38	7.14	0.60	**7.74**			
										7.46	**27.49**	**3.69**
1224	411189	9.440	0.00	0.25	95485	2.19	6.58	0.60	**7.18**			
										6.91	**25.22**	**3.65**
1223	319635	7.338	0.00	0.25	87705	2.01	6.04	0.60	**6.64**			
										6.60	**3.24**	**0.49**
1222.86	307875	7.068	0.00	0.25	86670	1.99	5.97	0.60	**6.57**			
										6.35	**19.90**	**3.13**
1222	235638	5.410	0.00	0.25	80342	1.84	5.53	0.60	**6.13**			
										5.76	**21.10**	**3.66**
1221	159041	3.651	0.00	0.25	69537	1.60	4.79	0.60	**5.39**			
										4.93	**17.29**	**3.51**
1220	96268	2.210	0.00	0.25	56065	1.29	3.86	0.60	**4.46**			
										3.90	**11.70**	**3.00**
1219	53815	1.235	0.00	0.25	39836	0.91	2.74	0.60	**3.34**			
										3.21	**10.44**	**3.25**
1218	15931	0.366	0.00	0.25	35976	0.83	2.48	0.60	**3.08**			
										1.84	**4.39**	**2.39**
1217	0	0.000	0.00	0.25	10	0.00	0.00	0.60	**0.60**			
									TOTAL TIME IN HOURS TO EMPTY BASIN:			**26.77**

19.43

Volumes from Inroads digital terrain model (BASFGSO6.dtm; 10-04-01).
Available Area values were measured from area of each contour element in the CADD drawings for each respective basin.
Available Area value for maximum WSEL is extrapolated from lower values.

Percolation Rate (ft/hr) = Value recommended in Speedie & Assoc. report (dated 1-3-2000) x 0.5 reduction factor, to account for long term reduction in infiltration.
Surface Infiltration (ft/hr) = Percolation Rate (Ft/Hr) x Available Area (Ac) x 12 (In/Ft) x 1 (cfs/ ac-ft/hr)
Drywell Inflow data was determined using 0.20 cfs per drywell. No bleedoff pipe for South Retention Basin.
Total Outflow (cfs) = Bleedoff Rate + Soil Infiltration + Drywell Inflow
Average Total Outflow (ac-in/hr) = [Total Outflow $_i$ + Total Outflow $_{i+1}$] / 2 (Assumes 1 cfs ~ 1 ac-in/hr)
Incremental Volume (ac-in) = [Stored Volume $_i$ - Stored Volume $_{i-1}$ (ac-ft)] * 12 in/ft
Drain Time Incremental Volume (hr) = Incremental Volume (ac-in) / Average Outflow (ac-in/hr)

Triangle Volume

Triangle Volume Report

Original Surface: GUADEG90
Design Surface: basfgso6

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 704469.81 cu ft
Fill: 3688.92 cu ft
Net: 700780.90 cu ft

Cut: 26091.47 cu yd
Fill: 136.63 cu yd
Net: 25954.85 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1217

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 799088.75 cu ft
Fill: 0.00 cu ft
Net: 799088.75 cu ft

Cut: 29595.88 cu yd
Fill: 0.00 cu yd
Net: 29595.88 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1218

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 663672.91 cu ft
Fill: 15931.48 cu ft
Net: 647741.43 cu ft

Cut: 24580.48 cu yd
Fill: 590.05 cu yd
Net: 23990.42 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1219

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 550209.23 cu ft
Fill: 53815.12 cu ft
Net: 496394.11 cu ft

Cut: 20378.12 cu yd

BASFGSO6
SOUTH

10-4-01

Fill: 1993.15 cu yd
Net: 18384.97 cu yd

Triangle Volume

T ngle Volume Report

Original Surface: basfgso6
Design Surface: 1220

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 441315.09 cu ft
Fill: 96268.30 cu ft
Net: 345046.79 cu ft

Cut: 16345.00 cu yd
Fill: 3565.49 cu yd
Net: 12779.51 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1221

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 352741.37 cu ft
Fill: 159041.90 cu ft
Net: 193699.47 cu ft

Cut: 13064.50 cu yd
Fill: 5890.44 cu yd
Net: 7174.05 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1222

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 277989.81 cu ft
Fill: 235637.66 cu ft
Net: 42352.15 cu ft

Cut: 10295.92 cu yd
Fill: 8727.32 cu yd
Net: 1568.60 cu yd

Triangle Volume

Triangle Volume Report

Ori al Surface: basfgso6
D gn Surface: 1223

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 210640.15 cu ft
Fill: 319635.33 cu ft

Net: -108995.17 cu ft

Cut: 7801.49 cu yd
Fill: 11838.35 cu yd
Net: -4036.86 cu yd

Tri gle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1224

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 150847.18 cu ft
Fill: 411189.67 cu ft
Net: -260342.49 cu ft

Cut: 5586.93 cu yd
Fill: 15229.25 cu yd
Net: -9642.31 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1225

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 99304.46 cu ft
Fill: 510994.28 cu ft
Net: -411689.82 cu ft

Cut: 3677.94 cu yd
Fill: 18925.71 cu yd
Net: -15247.77 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1226

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 60278.40 cu ft
Fill: 623315.54 cu ft
Net: -563037.14 cu ft

14,309 AC FT

Cut: 2232.53 cu yd
Fill: 23085.76 cu yd
Net: -20853.23 cu yd

Triangle Volume

Triangle Volume Report

Original Surface: basfgso6
Design Surface: 1227

Mode: Fence
Cut Factor: 1.00
Fill Factor: 1.00

Cut: 38688.08 cu ft
Fill: 753072.54 cu ft
Net: -714384.46 cu ft

Cut: 1432.89 cu yd
Fill: 27891.58 cu yd
Net: -26458.68 cu yd

SPILLWAY - South Basin - Full 10-Year Flow
Worksheet for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - South Basin
Type	Broad Crested Weir
Solve For	Discharge

Input Data		
Headwater Elevation	1,226.03	ft
Crest Elevation	1,225.00	ft
Tailwater Elevation	1,225.00	ft
Crest Surface Type	Gravel	
Crest Breadth	30.00	ft
Crest Length	100.00	ft

Results		
Discharge	298.56	cfs
Headwater Height Above Crest	1.03	ft
Tailwater Height Above Crest	0.00	ft
Discharge Coefficient	2.84	US
Submergence Factor	1.00	
Adjusted Discharge Coefficient	2.84	US
Flow Area	103.5	ft^2
Velocity	2.88	ft/s
Wetted Perimeter	102.07	ft
Top Width	100.00	ft

SOUTH BASIN SPILLWAY WEIR FLOW
Rating Table for Broad Crested Weir

Project Description	
Worksheet	SPILLWAY - South Basin
Type	Broad Crested Weir
Solve For	Discharge

Input Data	
Crest Elevation	1,225.00 ft
Tailwater Elevation	1,225.00 ft
Crest Surface Type	Gravel
Crest Breadth	30.00 ft
Crest Length	100.00 ft

Attribute	Minimum	Maximum	Increment
Headwater Elevation (ft)	1,225.00	1,227.00	0.20

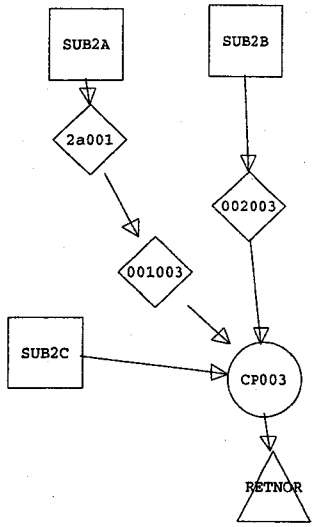
Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)
1,225.00	N/A	N/A
1,225.20	23.13	1.16
1,225.40	67.29	1.68
1,225.60	126.61	2.11
1,225.80	198.92	2.49
1,226.00	282.80	2.83
1,226.20	377.14	3.14
1,226.40	481.00	3.44
1,226.60	593.57	3.71
1,226.80	714.12	3.97
1,227.00	842.02	4.21

APPENDIX B

HEC-1 Routing Schematics for North, Northeast/Central, and South Watersheds

HEC-1 Computer Output —
(Input, Peak Flow & Stage Summary, and Muskingum-Cunge Routing Summary)
(10-year / 6-hour, 100-year / 6-hour) for North, Northeast/Central, and South Watersheds

Registered Professional Engineer (Civil)
CERTIFICATE NO.
26882
DANIEL E. STOUGH
Date Signed 11-05-01
ARIZONA U.S.A.



NORTH
WATERSHED
GUADALUPE D.I.P.

HEC1 S/N: 1343001909 HMVersion: 6.33

Data File: GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PCN NO. 035-02-31
FINAL DRAINAGE REPORT
SVERDRUP CIVIL INC.
Data File: NOR10_13.OH1
NORTH WATERSHED, PROPOSED IMPROVEMENTS
LIMITED BLEEDOFF THROUGH ORIFICE TO ADOT STORM DRAIN
10-YR & 100-YR RUNOFF
10/22/01

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*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  10/24/2001  TIME  10:52:23 *
*                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                 by                 :::
:::        Haestad Methods, Inc.       :::
:::                                    :::
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37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

NORTH BASIN
w/ 8" ORIFICE PLATE
GUADALUPE D.I.P.

10-22-01

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

  1           ID
  2           IT       2                    1600
  3           IO
  4           JR    PREC       1    1.62
  5           IN      15

  6           KK  SUB2A
  7           KM  STORM DRAIN INTO N. RET BASIN, CP 001
  8           KO                                      22
  9           BA    .027
 10           PB   1.925
 11           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 12           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 13           PC    .962    .972    .983    .991   1.000
 14           LG    .150    .250   3.950    .420  30.000
 15           UC    .162    .167

 16           KK  2a001
 17           KM  Channel Routing to SD9
 18           KO                                      22
 19           RD     275     .02     .04            TRAP     .01       3

 20           KK  001003
 21           KM  STORM DRAIN INTO NORTH RETENTION BASIN
 22           KO                                      22
 23           RD     228  0.0043    .013            CIRC     2.5       0

 24           KK  SUB2B
 25           KM  L =  .45  Kb = .031  Adj. Slope =   56.0
 26           KO                                      22
 27           BA    .041
 28           PB   1.925
 29           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 30           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 31           PC    .962    .972    .983    .991   1.000
 32           LG    .140    .250   3.950    .420  40.000
 33           UC    .188    .188

 34           KK  002003
 35           KM  SD 7 - ADY TO N BASIN
 36           KO                                      22
 37           RD     235 0.00229    .013            CIRC     4.0       0

 38           KK  SUB2C
 39           KM     L =  .25  Kb = .032  Adj. Slope =   12.0
 40           KO                                      22
 41           BA    .025
 42           PB   1.925
 43           LG    .190    .250   3.950    .570  10.000
 44           UC    .237    .203

 45           KK  CP003
 46           KM  STORAGE ROUTE INFLOW HYDROGRAPH FOR NORTH BASIN
 47           KO                                      22
 48           HC       3

 49           KK  RETNOR
 50           KM  NORTH RETENTION BASIN, CP 003, per BASFGN12
 51           KO                                      22
 52           RS       1    STOR       0
 53           SV       0    .049    .349    .738   1.349   3.228   5.654   8.372   11.42   14.96
 54           SE    1216    1217    1218    1219    1220    1221    1222    1223    1224    1225
 55           SQ       0       0     0.6     1.0     1.3     1.6     1.8    2.00     2.2  1970.6
 56           SE    1216    1217    1218    1219    1220    1221    1222    1223    1224    1225
 57           ZZ
S/N: 1343001909        HMVersion: 6.33    Data File: C:\TEMP\~vbh056B.TMP
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PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

TION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00	RATIO 2 1.62
GRAPH AT	SUB2A	0.03	1	FLOW	36.	66.
				TIME	4.07	4.07
TED TO	2a001	0.03	1	FLOW	35.	66.
				TIME	4.07	4.07
D TO	001003	0.03	1	FLOW	35.	66.
				TIME	4.07	4.07
GRAPH AT	SUB2B	0.04	1	FLOW	53.	98.
				TIME	4.07	4.07
TED TO	002003	0.04	1	FLOW	53.	97.
				TIME	4.07	4.07
ROGRAPH AT	SUB2C	0.03	1	FLOW	23.	48.
				TIME	4.10	4.10
MBINED AT	CP003	0.09	1	FLOW	110.	210.
				TIME	4.10	4.07
D TO	RETNOR	0.09	1	FLOW	2.	2.
				TIME	5.03	5.57

** PEAK STAGES IN FEET **

1	STAGE	1221.52	1223.18
	TIME	5.20	5.73

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR PLAN = 1 RATIO= 0.00									
2a001	MANE	0.92	35.42	243.72	1.01	2.00	35.41	244.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1459E+01 EXCESS=0.0000E+00 OUTFLOW=0.1459E+01 BASIN STORAGE=0.1183E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
2a001	MANE	0.79	66.23	244.00	1.96	2.00	66.23	244.00	1.96

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2828E+01 EXCESS=0.0000E+00 OUTFLOW=0.2828E+01 BASIN STORAGE=0.1132E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
001003	MANE	0.49	35.17	244.55	1.01	2.00	35.09	244.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1459E+01 EXCESS=0.0000E+00 OUTFLOW=0.1458E+01 BASIN STORAGE=0.3914E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
001003	MANE	0.44	65.86	244.10	1.96	2.00	65.80	244.00	1.96

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2828E+01 EXCESS=0.0000E+00 OUTFLOW=0.2827E+01 BASIN STORAGE=0.3810E-04 PERCENT ERROR= 0.0

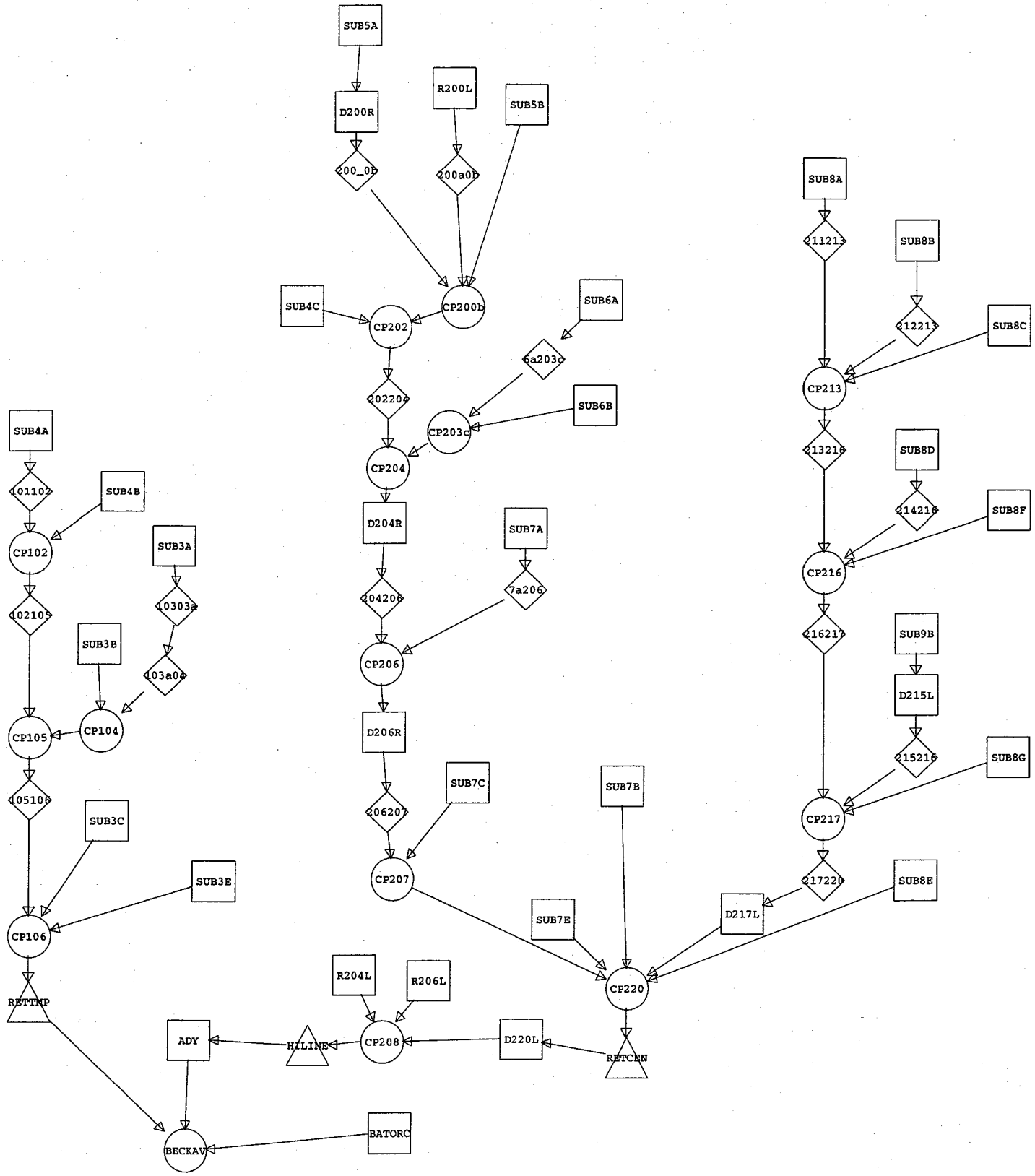
FOR PLAN = 1 RATIO= 0.00									
002003	MANE	0.57	52.92	244.83	1.14	2.00	52.74	244.00	1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2500E+01 EXCESS=0.0000E+00 OUTFLOW=0.2498E+01 BASIN STORAGE=0.4807E-04 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.00									
002003	MANE	0.50	96.97	244.06	2.13	2.00	96.88	244.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4652E+01 EXCESS=0.0000E+00 OUTFLOW=0.4648E+01 BASIN STORAGE=0.4994E-04 PERCENT ERROR= 0.1

*** NORMAL END OF HEC-1 ***



NORTHEAST & CENTRAL
WATERSHEDS
GUADALUPE D.I.P.

:1 S/N: 1343001909 HMVersion: 6.33 Data File: GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PCN NO. 035-02-31
FINAL DRAINAGE REPORT
SVERDRUP CIVIL INC.
Data File: TMCE10_8.OH1
NORTHEAST & CENTRAL WATERSHEDS,
PROPOSED IMPROVEMENTS
10-YR & 100-YR RUNOFF
11/04/01

```
************************************
*                                  *
LOOD HYDROGRAPH PACKAGE  (HEC-1)   *
        MAY  1991                  *
      VERSION 4.0.1E               *
                                   *
N DATE  11/05/2001  TIME  09:31:03 *
                                   *
************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

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

```
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                by                  :::
:::        Haestad Methods, Inc.       :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

NORTHEAST &
CENTRAL BASINS
GUADALUPE D.I.P.

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

  1           ID
  2           IT       2                    1600
  3           IO       0       0
  4           JR    PREC    1.00    1.62
  5           IN      15

  6           KK  SUB4A
  7           KM  L =  .40  Kb = .033  Adj. Slope =   65.0, conc at CP 101
  8           KO                                      22
  9           BA    .022
 10           PB   1.925
 11           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 12           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 13           PC    .962    .972    .983    .991   1.000
 14           LG    .140    .250   3.950    .420  37.000
 15           UC    .175    .226

 16           KK  101102
 17           KM  STORM DRAIN 1 ALONG MAGDALENA/BATOUA TO SONORA
 18           KO                                      22
 19           RD     519   0.006    .013            CIRC     2.5       0

 20           KK  SUB4B
 21           KM  L =  .28  Kb = .034  Adj. Slope =   46.0
 22           KO                                      22
 23           BA    .014
 24           PB   1.925
 25           LG   0.130    .250   3.950    .420  43.000
 26           UC   0.213   0.273

 27           KK  CP102
 28           KM  INFLOW INTO COMBINATION CURB INLETS ALONG CALLE BATOUA
 29           KO                                      22
 30           HC       2

 31           KK  102105
 32           KM  STORM DRAIN 1 ALONG BATOUA, MAGDALENA TO GLORIA
 33           KO                                      22
 34           RD     518   0.004    .013            CIRC     3.5       0

 35           KK  SUB3A
 36           KM  L =  .40  Kb = .032  Adj. Slope =   70.0
 37           KO                                      22
 38           BA    .033
 39           PB   1.925
 40           LG    .150    .250   3.950   0.420  33.000
 41           UC    .171    .175

 42           KK  10303a
 43           KM  Street flow along ADY to C. Gloria
 44           KO                                      22
 45           RD
 46           RC    .025    .015    .025     600    .003
 47           RX       0      20      25    25.1    55.1    74.9    75.0      90
 48           RY       2       1       1     0.5     1.0     0.5       1       2

 49           KK  103a04
 50           KM  SD 1_1 ALONG C. GLORIA, ADY TO BATOUA
 51           KO                                      22
 52           RD     697   0.006    .013            CIRC     2.5       0

 53           KK  SUB3B
 54           KM     L =  .26  Kb = .032  Adj. Slope =   65.0
 55           KO                                      22
 56           BA    .029
 57           PB   1.925
 58           LG    .140    .250   3.950    .540  35.000
 59           UC    .142    .108

 60           KK  CP104
 61           KM  C. Gloria next to school playground, just upstream of CP 105
 62           KO                                      22
 63           HC       2

 64           KK  CP105
 65           KM  TOTAL FLOW IN STORM DRAIN AT C. GLORIA AND BATOUA INTERSECTION
 66           KO                                      22
 67           HC       2

 68           KK  105106
 69           KM  STORM DRAIN 1 ALONG BATOUA, GLORIA TO CANAL X-ING
 70           KO                                      22
 71           RD     503  0.0141    .013            CIRC     4.0       0

 72           KK  SUB3E
 73           KM  L =  .21  Kb = .036  Adj. Slope =   29.0
 74           KO                                      22
 75           BA    .007
 76           PB   1.925
 77           LG    .140    .250   3.950    .420  26.000
 78           UC    .171    .253

 79           KK  SUB3C
 80           KM  L=0.28, Kb=0.036, adj slope = 17.6
 81           KO                                      22
 82           BA   0.009
 83           PB   1.925
 84           LG   0.100   0.250   3.950   0.400      69
 85           UC   0.218   0.361
```

```
KK  CP106
KM  TOTAL FLOW IN STORM DRAIN AT C. PITAYA, SHORT PIPE TO BASIN
KO                                        22
HC       3

KK  RETTMP
KM  NE RET BASIN, CP 107, 100YR+ CAP, BASFGTM8
KO                                        22
RS       1    STOR       0
SV   0.001   0.066   1.037   2.138   3.377   5.145   6.287   7.993   9.956  11.079
SV  12.589
SE  1207.5    1208    1210    1212    1214    1216    1218    1220    1222    1223
SE    1224
SL
SS  1223.0     526    2.80     1.5

KK  SUB5A
KM     L =  .36  Kb = .033  Adj. Slope =   75.0
KO                                        22
BA    .020
PB   1.925
LG    .140    .250   3.950    .420  40.000
UC    .158    .196

KK  D200R
KM  Flow split at ADY: D200R chl flow east, D200L flow to San Angelo SD
KO                                        22
DT  D200L
DI      .1       1      10      50     100
DQ     .05      .5       5      25      50

KK  200_0b
KM  Channel routing across park/San Angleo Street to CVN
KO                                        22
RD    1460   0.018   0.025            TRAP      10       3

KK  R200L
KM  Retrieve diverted flow D200L, inflow to San Angelo SD
KO                                        22
DR  D200L

KK  200a0b
KM  LATERAL 2_1 ALONG SAN ANGELO, ADY TO CVN
KO                                        22
RD    1471  0.0126    .013            CIRC     2.5       0

KK  SUB5B
KM  L =  .34  Kb = .032  Adj. Slope =   61.0
KO                                        22
BA    .025
PB   1.925
LG    .160    .250   3.950    .540  25.000
UC    .213    .229


KK  CP200b
KM  TOTAL FLOW IN LATERAL 2_1
KO                                        22
HC       3

KK  SUB4C
KM  STORM DRAIN INFLOW, C. VAUO NAWI & CANAL, CP 201
KO                                        22
BA    .027
PB   1.925
PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
PC    .962    .972    .983    .991   1.000
LG    .140    .250   3.950    .420  35.000
UC   0.267    .269

KK  CP202
KM  Junction of San Angelo lateral w/ main drain
KO                                        22
HC       2

KK  202204
KM  STORM DRAIN 2, SAN ANGELO TO IGLESIA
KO                                        22
RD     452  0.0015    .013            CIRC     4.5       0

KK  SUB6A
KM     L =  .42  Kb = .032  Adj. Slope =   74.0
KO                                        22
BA    .028
PB   1.925
LG    .150    .250   3.950    .410  42.000
UC    .171    .200

KK  6a203c
KM  SD 2-3 - IGLESIA, ADY TO CVN
KO                                        22
RD    1468  0.0155   0.013            CIRC     3.0       0

KK  SUB6B
KM  L =  .35  Kb = .033  Adj. Slope =   62.0
KO                                        22
BA    .025
PB   1.925
LG    .140    .250   3.950    .420  34.000
UC    .213    .234

KK  CP203c
```

```
KM  TOTAL FLOW IN LATERAL 2_2
KO                                      22
HC       2

KK  CP204
KM  TOTAL FLOW IN STORM DRAIN
KO                                      22
HC       2

KK  D204R
KM  D204R flow to storm drain, D204L is bypass flow east
KO                                      22
DT  D204L
DI     0.1     140     300
DQ     0.1     0.1     160

KK  204206
KM  SD 2, CVN - IGLESIA TO MEXICO
KO                                      22
RD     466  0.0015    .013            CIRC     5.0       0

KK  SUB7A
KM     L =  .45  Kb = .031  Adj. Slope =   82.0
KO                                      22
BA    .048
PB   1.925
LG    .140    .250   3.950    .420  38.000
UC    .167    .151

KK  7a206
KM  SD 2_4 ALONG C. MEXICO, TOMI TO CVN
KO                                      22
RD     460    .005   0.012            CIRC     3.0       0

KK  CP206
KM   TOTAL FLOW IN STORM DRAIN
KO                                      22
HC       2

KK  D206R
KM  D206R into storm drain, D206L is bypass to east
KO                                      22
DT  D206L
DI     0.1     200     400
DQ     0.1     0.1     200

KK  206207
KM  STORM DRAIN, C. MEXICO TO CENTRAL BASIN
KO                                      22
RD     402 0.00141    .013            CIRC     5.5       0

KK  SUB7C
KM  L =  .19  Kb = .034  Adj. Slope =   48.0
KO                                      22
BA    .016
PB   1.925
LG    .150    .250   3.950    .420  30.000
UC   0.175   0.149

KK  CP207
KM   TOTAL STORM DRAIN DISCHARGE AT NORTHWEST CORNER OF CENTRAL RETENTION BASIN
KO                                      22
HC       2

KK  SUB8A
KM  L =  .12  Kb = .035  Adj. Slope =  117.0, CP 211
KO                                      22
BA    .009
PB   1.925
PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
PC    .962    .972    .983    .991   1.000
LG    .150    .250   3.950    .410  47.000
UC    .083    .063

KK  211213
KM  ROUTE ALONG C. GUADALUPE FROM CP211 TO CP213
KO                                      22
RD    1100   .0163    .022            TRAP       5       4

KK  SUB8B
KM  L =  .20  Kb = .034  Adj. Slope =   60.0, CP 212, MINOR RETENTION NOT INCLUDED
KO                                      22
BA    .012
PB   1.925
LG    .150    .250   3.950    .420  30.000
UC    .129    .131

KK  212213
KM  ROUTE HYDROGRAPH FROM CP212 TO CP213
KO                                      22
RD    1000   .0163    .022            TRAP       5       4

KK  SUB8C
KM     L =  .26  Kb = .033  Adj. Slope =   92.0
KO                                      22
BA    .024
PB   1.925
LG    .140    .250   3.950    .420  36.000
UC    .129    .109

KK  CP213
KM  TOTAL FLOW AT STORM DRAIN INLET
```

```
KO                                        22
HC       3

KK  213216
KM  SD 3 ALONG GUADALUPE, ADY TO TOMI
KO                                        22
RD     878  0.0187   0.013            CIRC     3.5       0

KK  SUB8D
KM  L =  .34  Kb = .031  Adj. Slope =   91.0, CP 214
KO                                        22
BA    .042
PB   1.925
LG    .140    .250   3.950    .420  42.000
UC    .142    .109

KK  214216
KM  OVERLAND FLOW TO CP 216
KO                                        22
RD    1160   .0103    .022            TRAP       5       4

KK  SUB8F
KM  L =  .25  Kb = .032  Adj. Slope =   59.0, NO ONSITE RETENTION
KO                                        22
BA   0.022
PB   1.925
LG    .120    .250   3.950    .430    80.0
UC   0.179   0.159

KK  CP216
KM
KO                                        22
HC       3

KK  216217
KM  SD 3 ALONG GUADALUPE, TOMI TO CVN
KO                                        22
RD     805  0.0064   0.013            CIRC     4.5       0

KK  SUB9B
KM  L =  .20  Kb = .033  Adj. Slope =   55.0
KO                                        22
BA    .020
PB   1.925
LG    .150    .250   3.950    .440  25.000
UC    .133    .101

KK  D215L
KM   REMAINDER FLOWS IN STREET TO NORTH (D215L)
KO                                        22
DT  D215R
DI      .1       4      18      34      57      81     107     134     164     196
DI     230     259     286
DQ       0       3      12      23      35      47      60      73      87     101
DQ     116     125     131

KK  215216
KM  STREET FLOW  D215L ALONG C. TOMI FROM CP215 TO CP216
KO                                        22
RD    1000    .002    .015            TRAP      35       4

KK  SUB8G
KM  L =  .25  Kb = .032  Adj. Slope =   20.0, NO ONSITE RETENTION
KO                                        22
BA   0.014
PB   1.925
LG    .120    .250   3.950    .430    80.0
UC   0.258   0.310

KK  CP217
KM  TOTAL INFLOW INTO INLET FOR GUADALUPE RD. STORM DRAIN
KO                                        22
HC       3

KK  217220
KM  SB 3 - DUAL 42" RCP & RET BASIN FLOOR TO OUTLET
KO                                        22
RD     240 0.00207   0.013            DEEP    5.00       0

KK  D217L
KM  D217L pipe into basin, flow-by D217R flows east along Guad Rd
KO                                        22
DT  D217R
DI     0.1     202    1000
DQ     0.1     0.1     798

KK  SUB7B
KM  L =  .32  Kb = .034  Adj. Slope =   3.0
KO                                        22
BA    .012
PB   1.925
LG    .150    .250   3.950    .420  30.000
UC   0.762   1.369

KK  SUB7E
KM     L =  .12  Kb = .036  Adj. Slope =   17.0
KO                                        22
BA    .007
PB   1.925
LG    .190    .250   3.950    .550    .000
UC    .158    .148

KK  SUB8E
```

```
347          KM  L =  .37  Kb = .037  Adj. Slope =   62.0, INFLOW TO SEPARATE STORM DRAIN
348          KO                                      22
349          BA    .004
350          PB   1.925
351          LG    .160     .250   3.950     .520  23.000
352          UC    .183     .591

353          KK  CP220
354          KM  TOTAL FLOW INTO CROSSING UNDER GUADALUPE RD, W. OF HIGHLINE CANAL
355          KO                                      22
356          HC       5

357          KK  RETCEN
358          KM  CENTRAL RETENTION BASIN, 10-yr Cap, BASFGCE3
359          KO                                      22
360          RS       1    STOR       0
361          SV   0.001   0.386   2.077   4.044   6.164   8.439  10.881  13.502  16.333  19.365
362          SV  22.602   26.18   30.00
363          SE    1214    1215    1216    1217    1218    1219    1220    1221    1222    1223
364          SE    1224    1225    1226
365          SL
366          SS  1224.5     403     2.8     1.5

367          KK  D220L
368          KM  D220L is spillway flow, D220R is outlet pipe flow
369          KO                                      22
370          DT  D220R
371          DI     0.1       6    1000
372          DQ     0.1       6       7

373          KK  R204L
374          KM  Retrieve bypass flow D204L
375          KO                                      22
376          DR  D204L

377          KK  R206L
378          KM  Retrieve diverted flow D206L
379          KO                                      22
380          DR  D206L

381          KK  CP208
382          KM  HIGHLINE CANAL FLOOD INFLOW
383          KO                                      22
384          HC       3

385          KK  HILINE
386          KM  Storage within canal banks
387          KO                                      22
388          RS       1    STOR
389          SA    0.56    0.90    1.24    1.58    1.92
390          SE    1220    1221    1222    1223    1224
391          SQ     0.0     1.0    13.6    46.0   102.9   189.3   319.9   492.9   711.3   986.1
392          SE  1222.6  1222.7  1222.8  1222.9  1223.0  1223.1  1223.2  1223.3  1223.4  1223.5

393          KK  ADY
394          KM  ADY is canal bank breakout, BATOUA is breakout S of basin
395          KO                                      22
396          DT  BATOUA
397          DI     0.1    13.6    46.0   102.9   189.3   319.9   492.9   711.3   986.1
398          DQ     0.1     0.1     1.9    11.0    30.3    64.0   117.6   195.5     309

399          KK  BATORC
400          KM  Retrieve canal breakout near Batoua
401          KO                                      22
402          DR  BATOUA

403          KK  BECKAV
404          KM  Total flow reaching Beck Ave
405          KO                                      22
406          HC       3
407          ZZ
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					1.00	1.62
ROGRAPH AT	SUB4A	0.02	1	FLOW	26.	49.
				TIME	4.07	4.07
D TO	101102	0.02	1	FLOW	26.	48.
				TIME	4.10	4.10
GRAPH AT	SUB4B	0.01	1	FLOW	16.	28.
				TIME	4.10	4.10
COMBINED AT	CP102	0.04	1	FLOW	42.	76.
				TIME	4.10	4.10
TED TO	102105	0.04	1	FLOW	41.	76.
				TIME	4.10	4.10
GRAPH AT	SUB3A	0.03	1	FLOW	43.	80.
				TIME	4.07	4.07
D TO	10303a	0.03	1	FLOW	43.	80.
				TIME	4.10	4.10
TED TO	103a04	0.03	1	FLOW	42.	79.
				TIME	4.13	4.10
ROGRAPH AT	SUB3B	0.03	1	FLOW	43.	81.
				TIME	4.03	4.03
MBINED AT	CP104	0.06	1	FLOW	80.	152.
				TIME	4.07	4.07
NED AT	CP105	0.10	1	FLOW	119.	226.
				TIME	4.07	4.07
TED TO	105106	0.10	1	FLOW	119.	225.
				TIME	4.10	4.07
ROGRAPH AT	SUB3E	0.01	1	FLOW	7.	14.
				TIME	4.07	4.07
GRAPH AT	SUB3C	0.01	1	FLOW	10.	17.
				TIME	4.10	4.10
COMBINED AT	CP106	0.11	1	FLOW	136.	256.
				TIME	4.10	4.07
TED TO	RETTMP	0.11	1	FLOW	0.	38.
				TIME	0.03	4.63
			** PEAK STAGES IN FEET **			
			1	STAGE	1218.51	1223.09
				TIME	7.57	4.63
GRAPH AT	SUB5A	0.02	1	FLOW	26.	48.
				TIME	4.07	4.07
ERSION TO	D200L	0.02	1	FLOW	13.	24.
				TIME	4.07	4.07
DROGRAPH AT	D200R	0.02	1	FLOW	13.	24.
				TIME	4.07	4.07
TO	200_0b	0.02	1	FLOW	13.	24.
				TIME	4.13	4.13
OGRAPH AT	R200L	0.00	1	FLOW	13.	24.
				TIME	4.07	4.07
UTED TO	200a0b	0.00	1	FLOW	13.	24.
				TIME	4.10	4.10
DROGRAPH AT						

	SUB5B	0.03	1	FLOW	25.	50.
				TIME	4.10	4.10
MBINED AT						
	CP200b	0.05	1	FLOW	51.	97.
				TIME	4.10	4.10
APH AT						
	SUB4C	0.03	1	FLOW	28.	52.
				TIME	4.13	4.13
COMBINED AT						
	CP202	0.07	1	FLOW	78.	149.
				TIME	4.10	4.10
TED TO						
	202204	0.07	1	FLOW	77.	144.
				TIME	4.13	4.13
GRAPH AT						
	SUB6A	0.03	1	FLOW	36.	66.
				TIME	4.07	4.07
D TO						
	6a203c	0.03	1	FLOW	36.	66.
				TIME	4.10	4.10
ROGRAPH AT						
	SUB6B	0.03	1	FLOW	28.	53.
				TIME	4.10	4.10
OMBINED AT						
	CP203c	0.05	1	FLOW	65.	119.
				TIME	4.10	4.10
MBINED AT						
	CP204	0.13	1	FLOW	140.	263.
				TIME	4.10	4.10
RSION TO						
	D204L	0.13	1	FLOW	0.	123.
				TIME	0.13	4.10
ROGRAPH AT						
	D204R	0.13	1	FLOW	140.	140.
				TIME	4.10	4.10
D TO						
	204206	0.13	1	FLOW	136.	140.
				TIME	4.13	4.20
APH AT						
	SUB7A	0.05	1	FLOW	68.	124.
				TIME	4.07	4.07
TED TO						
	7a206	0.05	1	FLOW	68.	124.
				TIME	4.07	4.07
COMBINED AT						
	CP206	0.17	1	FLOW	200.	263.
				TIME	4.10	4.07
RSION TO						
	D206L	0.17	1	FLOW	0.	63.
				TIME	0.13	4.07
GRAPH AT						
	D206R	0.17	1	FLOW	200.	200.
				TIME	4.10	4.07
TED TO						
	206207	0.17	1	FLOW	194.	200.
				TIME	4.10	4.20
ROGRAPH AT						
	SUB7C	0.02	1	FLOW	22.	41.
				TIME	4.07	4.07
OMBINED AT						
	CP207	0.19	1	FLOW	215.	240.
				TIME	4.10	4.07
GRAPH AT						
	SUB8A	0.01	1	FLOW	17.	30.
				TIME	4.00	4.00
TED TO						
	211213	0.01	1	FLOW	17.	29.
				TIME	4.03	4.03
PH AT						
	SUB8B	0.01	1	FLOW	18.	33.
				TIME	4.03	4.03
D TO						
	212213	0.01	1	FLOW	17.	33.
				TIME	4.07	4.07
GRAPH AT						
	SUB8C	0.02	1	FLOW	38.	69.
				TIME	4.03	4.03

COMBINED AT	CP213	0.04	1	FLOW	71.	130.
				TIME	4.03	4.03
TED TO	213216	0.04	1	FLOW	71.	128.
				TIME	4.07	4.03
PH AT	SUB8D	0.04	1	FLOW	68.	122.
				TIME	4.03	4.03
D TO	214216	0.04	1	FLOW	68.	122.
				TIME	4.07	4.07
ROGRAPH AT	SUB8F	0.02	1	FLOW	36.	61.
				TIME	4.07	4.07
COMBINED AT	CP216	0.11	1	FLOW	175.	310.
				TIME	4.07	4.07
D TO	216217	0.11	1	FLOW	173.	308.
				TIME	4.07	4.07
GRAPH AT	SUB9B	0.02	1	FLOW	31.	57.
				TIME	4.03	4.03
ERSION TO	D215R	0.02	1	FLOW	21.	35.
				TIME	4.03	4.03
OGRAPH AT	D215L	0.02	1	FLOW	10.	22.
				TIME	4.03	4.03
D TO	215216	0.02	1	FLOW	10.	21.
				TIME	4.13	4.10
ROGRAPH AT	SUB8G	0.01	1	FLOW	17.	29.
				TIME	4.13	4.13
COMBINED AT	CP217	0.14	1	FLOW	197.	355.
				TIME	4.07	4.07
D TO	217220	0.14	1	FLOW	196.	352.
				TIME	4.10	4.07
RSION TO	D217R	0.14	1	FLOW	0.	150.
				TIME	0.13	4.07
ROGRAPH AT	D217L	0.14	1	FLOW	196.	202.
				TIME	4.10	4.07
ROGRAPH AT	SUB7B	0.01	1	FLOW	4.	7.
				TIME	4.60	4.60
OGRAPH AT	SUB7E	0.01	1	FLOW	7.	16.
				TIME	4.07	4.03
OGRAPH AT	SUB8E	0.00	1	FLOW	2.	5.
				TIME	4.13	4.10
COMBINED AT	CP220	0.36	1	FLOW	421.	465.
				TIME	4.10	4.07
UTED TO	RETCEN	0.36	1	FLOW	0.	184.
				TIME	0.03	4.50
			** PEAK STAGES IN FEET **			
			1	STAGE	1223.33	1224.80
				TIME	11.57	4.50
RSION TO	D220R	0.36	1	FLOW	0.	6.
				TIME	0.03	4.50
DR PH AT	D220L	0.36	1	FLOW	0.	177.
				TIME	0.03	4.50
ROGRAPH AT	R204L	0.00	1	FLOW	0.	123.
				TIME	0.13	4.10
OGRAPH AT	R206L	0.00	1	FLOW	0.	63.
				TIME	0.13	4.07

```
MBINED AT
          CP208      0.36    1   FLOW          0.     181.
                                 TIME         0.13     4.10

TED TO
          HILINE     0.36    1   FLOW          0.     172.
                                 TIME         0.03     4.53

                             ** PEAK STAGES IN FEET **
                             1   STAGE     1220.16  1223.08
                                 TIME         7.23     4.53

SION TO
          BATOUA     0.36    1   FLOW          0.      26.
                                 TIME         0.03     4.53

OGRAPH AT
          ADY        0.36    1   FLOW          0.     145.
                                 TIME         0.03     4.53

ROGRAPH AT
          BATORC     0.00    1   FLOW          0.      26.
                                 TIME         0.03     4.53

MBINED AT
          BECKAV     0.47    1   FLOW          0.     179.
                                 TIME         0.03     4.60
```

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR PLAN = 1 RATIO= 0.00									
101102	MANE	1.04	26.16	245.46	1.10	2.00	26.05	246.00	1.10

INUITY SUMMARY (AC-FT) - INFLOW=0.1296E+01 EXCESS=0.0000E+00 OUTFLOW=0.1296E+01 BASIN STORAGE=0.7848E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
101102	MANE	0.92	48.42	244.69	2.08	2.00	48.09	246.00	2.08

TINUITY SUMMARY (AC-FT) - INFLOW=0.2439E+01 EXCESS=0.0000E+00 OUTFLOW=0.2439E+01 BASIN STORAGE=0.7603E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
102105	MANE	1.07	41.29	247.12	1.13	2.00	41.22	246.00	1.13

TINUITY SUMMARY (AC-FT) - INFLOW=0.2179E+01 EXCESS=0.0000E+00 OUTFLOW=0.2178E+01 BASIN STORAGE=0.8593E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
102105	MANE	0.95	76.11	246.22	2.12	2.00	76.03	246.00	2.12

INUITY SUMMARY (AC-FT) - INFLOW=0.4065E+01 EXCESS=0.0000E+00 OUTFLOW=0.4063E+01 BASIN STORAGE=0.8936E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
10303a	MANE	2.00	42.72	246.00	1.05	2.00	42.72	246.00	1.05

INUITY SUMMARY (AC-FT) - INFLOW=0.1851E+01 EXCESS=0.0000E+00 OUTFLOW=0.1852E+01 BASIN STORAGE=0.2480E-03 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.00									
10303a	MANE	2.00	79.78	246.00	2.01	2.00	79.78	246.00	2.01

TINUITY SUMMARY (AC-FT) - INFLOW=0.3541E+01 EXCESS=0.0000E+00 OUTFLOW=0.3542E+01 BASIN STORAGE=0.2503E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
103a04	MANE	1.27	42.43	248.27	1.05	2.00	42.40	248.00	1.05

INUITY SUMMARY (AC-FT) - INFLOW=0.1852E+01 EXCESS=0.0000E+00 OUTFLOW=0.1851E+01 BASIN STORAGE=0.1203E-03 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.00									
103a04	MANE	1.12	79.12	247.20	2.01	2.00	78.72	246.00	2.01

INUITY SUMMARY (AC-FT) - INFLOW=0.3542E+01 EXCESS=0.0000E+00 OUTFLOW=0.3540E+01 BASIN STORAGE=0.1118E-03 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.00									
105106	MANE	0.50	119.32	245.15	1.08	2.00	119.04	246.00	1.08

TINUITY SUMMARY (AC-FT) - INFLOW=0.5629E+01 EXCESS=0.0000E+00 OUTFLOW=0.5629E+01 BASIN STORAGE=0.4982E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
105106	MANE	0.44	225.75	244.66	2.03	2.00	224.75	244.00	2.03

TINUITY SUMMARY (AC-FT) - INFLOW=0.1062E+02 EXCESS=0.0000E+00 OUTFLOW=0.1062E+02 BASIN STORAGE=0.5083E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
200_0b	MANE	2.00	13.03	248.00	0.57	2.00	13.03	248.00	0.57

INUITY SUMMARY (AC-FT) - INFLOW=0.6092E+00 EXCESS=0.0000E+00 OUTFLOW=0.6093E+00 BASIN STORAGE=0.1040E-02 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 0.00									
200_0b	MANE	2.00	23.80	248.00	1.06	2.00	23.80	248.00	1.06

TINUITY SUMMARY (AC-FT) - INFLOW=0.1134E+01 EXCESS=0.0000E+00 OUTFLOW=0.1134E+01 BASIN STORAGE=0.9322E-03 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.00									
200a0b	MANE	2.00	13.05	246.00	-1.00	2.00	13.05	246.00	-1.00

FOR PLAN = 1 RATIO= 0.00									
200a0b	MANE	2.00	23.81	246.00	-1.00	2.00	23.81	246.00	-1.00

```
FOR PLAN = 1  RATIO= 0.00
  202204  MANE        1.18     76.57    247.33      1.03      2.00     76.57    248.00        1.03

TINUITY SUMMARY (AC-FT) - INFLOW=0.3965E+01 EXCESS=0.0000E+00 OUTFLOW=0.3954E+01 BASIN STORAGE=0.1096E-03 PERCENT ERROR=   0.3

FOR PLAN = 1  RATIO= 0.00
  202204  MANE        1.04    145.07    247.49      1.96      2.00    144.43    248.00        1.96

TINUITY SUMMARY (AC-FT) - INFLOW=0.7567E+01 EXCESS=0.0000E+00 OUTFLOW=0.7541E+01 BASIN STORAGE=0.1151E-03 PERCENT ERROR=   0.3

FOR PLAN = 1  RATIO= 0.00
  6a203c  MANE        1.85     36.41    245.77      1.17      2.00     36.28    246.00        1.17

NUITY SUMMARY (AC-FT) - INFLOW=0.1751E+01 EXCESS=0.0000E+00 OUTFLOW=0.1751E+01 BASIN STORAGE=0.1504E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  6a203c  MANE        1.64     65.93    245.91      2.17      2.00     65.83    246.00        2.17

NUITY SUMMARY (AC-FT) - INFLOW=0.3235E+01 EXCESS=0.0000E+00 OUTFLOW=0.3235E+01 BASIN STORAGE=0.1510E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  204206  MANE        1.07    136.42    247.33      1.06      2.00    136.29    248.00        1.06

TINUITY SUMMARY (AC-FT) - INFLOW=0.7071E+01 EXCESS=0.0000E+00 OUTFLOW=0.7048E+01 BASIN STORAGE=0.1628E-03 PERCENT ERROR=   0.3

FOR PLAN = 1  RATIO= 0.00
  204206  MANE        1.07    139.93    252.57      1.64      2.00    139.93    254.00        1.64

NUITY SUMMARY (AC-FT) - INFLOW=0.1097E+02 EXCESS=0.0000E+00 OUTFLOW=0.1095E+02 BASIN STORAGE=0.1176E-03 PERCENT ERROR=   0.2

FOR PLAN = 1  RATIO= 0.00
  7a206   MANE        0.75     67.70    244.26      1.12      2.00     67.67    244.00        1.12

NUITY SUMMARY (AC-FT) - INFLOW=0.2862E+01 EXCESS=0.0000E+00 OUTFLOW=0.2860E+01 BASIN STORAGE=0.7121E-04 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  7a206   MANE        0.67    123.62    244.08      2.09      2.00    123.61    244.00        2.10

TTINUITY SUMMARY (AC-FT) - INFLOW=0.5365E+01 EXCESS=0.0000E+00 OUTFLOW=0.5362E+01 BASIN STORAGE=0.6740E-04 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  206207  MANE        0.87    194.68    246.12      1.06      2.00    194.28    246.00        1.06

TINUITY SUMMARY (AC-FT) - INFLOW=0.9854E+01 EXCESS=0.0000E+00 OUTFLOW=0.9821E+01 BASIN STORAGE=0.1245E-03 PERCENT ERROR=   0.3

FOR PLAN = 1  RATIO= 0.00
  206207  MANE        0.87    199.88    253.87      1.64      2.00    199.86    252.00        1.64

NUITY SUMMARY (AC-FT) - INFLOW=0.1519E+02 EXCESS=0.0000E+00 OUTFLOW=0.1516E+02 BASIN STORAGE=0.1169E-03 PERCENT ERROR=   0.2

FOR PLAN = 1  RATIO= 0.00
  211213  MANE        2.00     16.67    242.00      1.24      2.00     16.67    242.00        1.24

NUITY SUMMARY (AC-FT) - INFLOW=0.5940E+00 EXCESS=0.0000E+00 OUTFLOW=0.5941E+00 BASIN STORAGE=0.4099E-03 PERCENT ERROR=  -0.1

FOR PLAN = 1  RATIO= 0.00
  211213  MANE        2.00     29.33    242.00      2.25      2.00     29.33    242.00        2.25

NTINUITY SUMMARY (AC-FT) - INFLOW=0.1080E+01 EXCESS=0.0000E+00 OUTFLOW=0.1080E+01 BASIN STORAGE=0.5696E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  212213  MANE        2.00     17.46    244.00      1.01      2.00     17.46    244.00        1.01

NUITY SUMMARY (AC-FT) - INFLOW=0.6482E+00 EXCESS=0.0000E+00 OUTFLOW=0.6482E+00 BASIN STORAGE=0.4009E-03 PERCENT ERROR=  -0.1

FOR PLAN = 1  RATIO= 0.00
  212213  MANE        2.00     32.50    244.00      1.96      2.00     32.50    244.00        1.96

NUITY SUMMARY (AC-FT) - INFLOW=0.1256E+01 EXCESS=0.0000E+00 OUTFLOW=0.1256E+01 BASIN STORAGE=0.3764E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  213216  MANE        0.88     71.16    243.24      1.10      2.00     70.62    244.00        1.10

NTINUITY SUMMARY (AC-FT) - INFLOW=0.2641E+01 EXCESS=0.0000E+00 OUTFLOW=0.2641E+01 BASIN STORAGE=0.8654E-04 PERCENT ERROR=   0.0
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FOR PLAN = 1  RATIO= 0.00
  213216  MANE        0.78    129.34    243.04      2.07      2.00    128.42    242.00        2.07

TINUITY SUMMARY (AC-FT) - INFLOW=0.4978E+01 EXCESS=0.0000E+00 OUTFLOW=0.4978E+01 BASIN STORAGE=0.8456E-04 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  214216  MANE        2.00     67.58    244.00      1.17      2.00     67.58    244.00        1.17

INUITY SUMMARY (AC-FT) - INFLOW=0.2620E+01 EXCESS=0.0000E+00 OUTFLOW=0.2620E+01 BASIN STORAGE=0.6197E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  214216  MANE        2.00    121.60    244.00      2.16      2.00    121.60    244.00        2.16

TINUITY SUMMARY (AC-FT) - INFLOW=0.4841E+01 EXCESS=0.0000E+00 OUTFLOW=0.4841E+01 BASIN STORAGE=0.6193E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  216217  MANE        1.00    173.23    244.96      1.24      2.00    172.85    244.00        1.24

TINUITY SUMMARY (AC-FT) - INFLOW=0.7207E+01 EXCESS=0.0000E+00 OUTFLOW=0.7203E+01 BASIN STORAGE=0.1079E-03 PERCENT ERROR=   0.0

FOR PLAN = 1  RATIO= 0.00
  216217  MANE        0.89    308.28    244.23      2.25      2.00    307.96    244.00        2.25

INUITY SUMMARY (AC-FT) - INFLOW=0.1308E+02 EXCESS=0.0000E+00 OUTFLOW=0.1307E+02 BASIN STORAGE=0.1064E-03 PERCENT ERROR=   0.1

FOR PLAN = 1  RATIO= 0.00
  215216  MANE        2.00      9.59    248.00      0.32      2.00      9.59    248.00        0.32

INUITY SUMMARY (AC-FT) - INFLOW=0.3379E+00 EXCESS=0.0000E+00 OUTFLOW=0.3369E+00 BASIN STORAGE=0.1741E-02 PERCENT ERROR=  -0.2

FOR PLAN = 1  RATIO= 0.00
  215216  MANE        2.00     21.22    246.00      0.66      2.00     21.22    246.00        0.66

NTINUITY SUMMARY (AC-FT) - INFLOW=0.7012E+00 EXCESS=0.0000E+00 OUTFLOW=0.6989E+00 BASIN STORAGE=0.1766E-02 PERCENT ERROR=   0.1

FOR PLAN = 1  RATIO= 0.00
  217220  MANE        0.48    195.67    245.56      1.15      2.00    195.63    246.00        1.15

INUITY SUMMARY (AC-FT) - INFLOW=0.8776E+01 EXCESS=0.0000E+00 OUTFLOW=0.8765E+01 BASIN STORAGE=0.8842E-04 PERCENT ERROR=   0.1

FOR PLAN = 1  RATIO= 0.00
  217220  MANE        0.41    351.66    244.02      2.08      2.00    351.50    244.00        2.08

INUITY SUMMARY (AC-FT) - INFLOW=0.1585E+02 EXCESS=0.0000E+00 OUTFLOW=0.1583E+02 BASIN STORAGE=0.8897E-04 PERCENT ERROR=   0.1


NORMAL END OF HEC-1 ***
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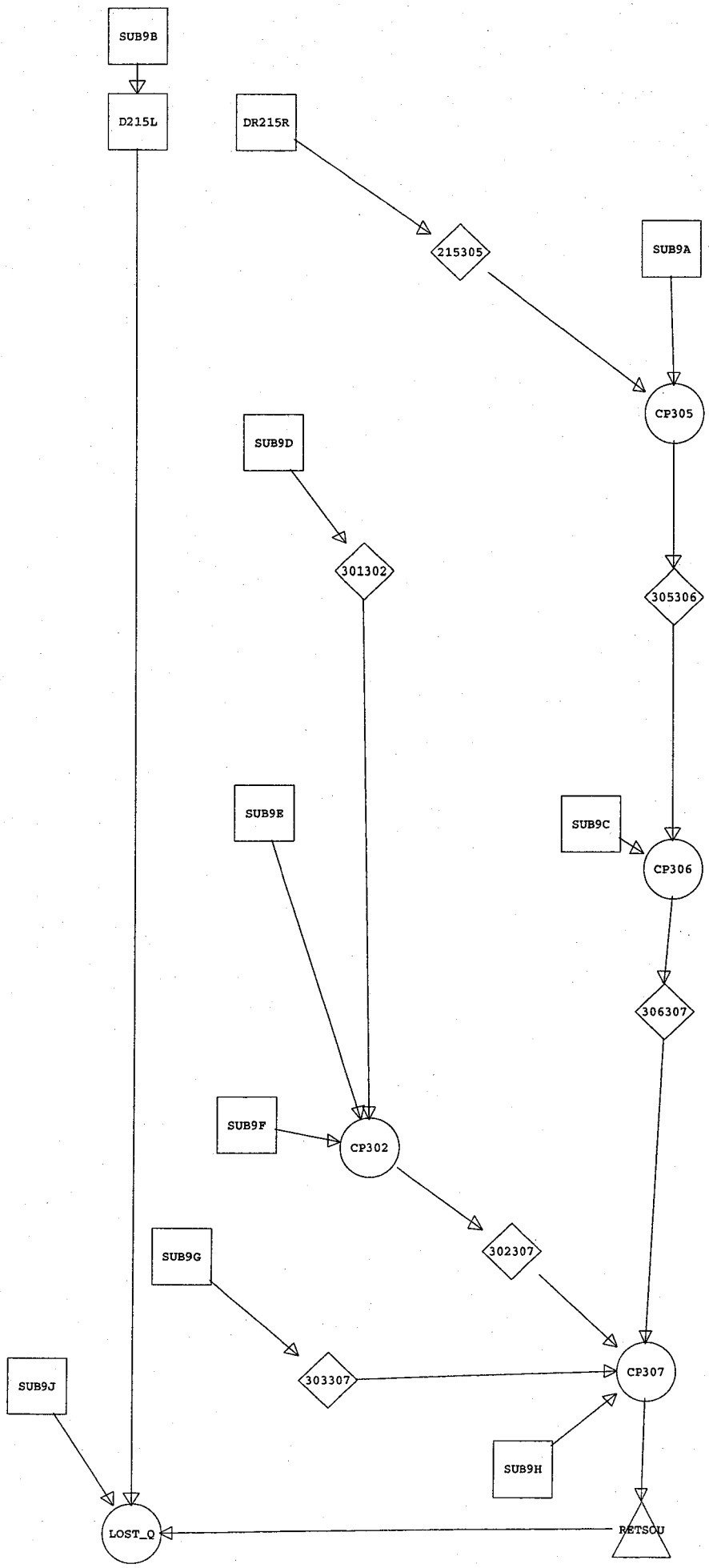

SOUTH WATERSHED
GUADALUPE D.I.P.

GUADALUPE DRAINAGE IMPROVEMENT PROJECT
PCN NO. 035-02-31
FINAL DRAINAGE REPORT
SVERDRUP CIVIL INC.
Data File: SOU10_6.OH1
SOUTH WATERSHED, PROPOSED IMPROVEMENTS
10-YR & 100-YR RUNOFF
10/05/01

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************************************
*                                  *
*LOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          MAY   1991              *
*        VERSION 4.0.1E            *
*                                  *
*RUN DATE  10/05/2001  TIME  13:09:21 *
*                                  *
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                by                  :::
:::       Haestad Methods, Inc.        :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

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

SOUTH
WATERSHED
GUADALUPE D.I.P.
10-05-01

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

  1           ID
  2           IT       2                    1600
  3           IO       0       0
  4           JR    PREC    1.00    1.62
  5           PG       1       0

  6           KK  SUB9B
  7           KM  L = .20  Kb = .033  Adj. Slope =   55.0
  8           KO                                     22
  9           BA    .020
 10           PB   1.925
 11           IN      15
 12           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 13           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 14           PC    .962    .972    .983    .991   1.000
 15           LG    .150    .250   3.950    .440  25.000
 16           UC    .133    .101

 17           KK  D215L
 18           KM  REMAINDER FLOWS IN STREET TO NORTH (D215L)
 19           KO                                     22
 20           DT  D215R
 21           DI      .1       4      18      34      57      81     107     134     164     196
 22           DI     230     259     286
 23           DQ       0       3      12      23      35      47      60      73      87     101
 24           DQ     116     125     131

 25           KK  DR215R
 26           KM  RETRIEVE DIVERTED FLOW CP215R from SUB9B runoff
 27           KO                                     22
 28           DR  D215R

 29           KK  215305
 30           KM  OVERLAND ROUTING
 31           KO                                     22
 32           RD     870   .0075    .022            TRAP       5       4

 33           KK  SUB9A
 34           KM  L =  .14  Kb = .035  Adj. Slope =   14
 35           KO                                     22
 36           BA   0.008
 37           PB   1.925
 38           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 39           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 40           PC    .962    .972    .983    .991   1.000
 41           LG    .150    .250   3.950    .420  30.000
 42           UC   0.233   0.239

 43           KK  CP305
 44           KM  INFLOW AT STA 29+60, STM DRN 6
 45           KO                                     22
 46           HC       2
```

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

 47           KK  305306
 48           KM  STORM DRAIN 5 (STA 29+60 TO 19+12)
 49           KO                                          22
 50           RD    1048    .0020     .013              CIRC       3        0

 51           KK  SUB9C
 52           KM  L =  .24  Kb = .033  Adj. Slope =    21
 53           KO                                        22
 54           BA   0.023
 55           PB   1.925
 56           LG    0.15     .250   3.950     0.42      28
 57           UC   0.267   0.234

 58           KK  CP306
 59           KM  INFLOW AT STA 22+02, STM DRN 6
 60           KO                                        22
 61           HC       2

 62           KK  306307
 63           KM  STA 19+12 TO 15+00, STM DRN 5
 64           KO                                        22
 65           RD     412    .0020     .013              CIRC     3.5        0

 66           KK  SUB9D
 67           KM  L =  .28  Kb = .032  Adj. Slope =    61.0
 68           KO                                        22
 69           BA   0.018
 70           PB   1.925
 71           LG    .200     .250   3.950     .410  39.000
 72           UC   0.196   0.216

 73           KK  301302
 74           KM  OVERLAND FLOW (STA 20+00 TO 15+35)
 75           KO                                        22
 76           RD     465  0.0020    0.050             TRAP      20       10

 77           KK  SUB9E
 78           KM  L =  .31  Kb = .033  Adj. Slope =    61
 79           KO                                        22
 80           BA    .012
 81           PB   1.925
 82           LG    .190     .250   3.950     .410  36.000
 83           UC   0.213   0.323

 84           KK  SUB9F
 85           KM  L =  .230  Kb = .033  Adj. Slope =    48
 86           KO                                        22
 87           BA   0.015
 88           PB   1.925
 89           LG    .220     .250   3.950     .400      48
 90           UC   0.192   0.200
```

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

 91           KK  CP302
 92           KM  TOTAL INFLOW INTO STM DRN 4
 93           KO                                      22
 94           HC       3

 95           KK  302307
 96           KM  STORM DRAIN 4 (STA 15+21 TO 10+00)
 97           KO                                      22
 98           RD     521     .006     .012            CIRC       3       0

 99           KK  SUB9G
100           KM  L =  .31  Kb = .034  Adj. Slope =   48.0
101           KO                                      22
102           BA   0.025
103           PB   1.925
104           LG    .150     .250   3.950    .400  55.000
105           UC   0.233    0.236

106           KK  303307
107           KM  OVERLAND ROUTING, INFLOW TO PIPE 001
108           KO                                      22
109           RD     500    0.008    0.022           TRAP       6       4

110           KK  SUB9H
111           KM  L =  0.12 Kb = .034  Adj. Slope =   78
112           KO                                      22
113           BA   0.007
114           PB   1.925
115           LG    0.45     .250   3.950    0.40       5
116           UC   0.142    0.070

117           KK  CP307
118           KM  TOTAL INFLOW INTO SOUTH RETENTION BASIN
119           KO                                      22
120           HC       4

121           KK  RETSOU
122           KM  SOUTH RETENTION BASIN, BASFGSO6.dtm
123           KO                                      22
124           RS       1    STOR       0
125           SV       0     .366   1.235   2.210   3.651    5.41   7.338   9.440  11.731  14.309
126           SE  1217.0  1218.0  1219.0  1220.0  1221.0  1222.0  1223.0  1224.0  1225.0  1226.0
127           SL
128           SS  1225.0      97    2.80     1.5

129           KK  SUB9J
130           KM  L =  .19  Kb = .035  Adj. Slope =   14, (INTO HILINE)
131           KO                                      22
132           BA   0.014
133           PB   1.925
134           LG    0.15     .250   3.950   0.420      30
135           UC   0.262    0.253
```

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

 136          KK  LOST_Q
 137          KM  LOST FROM SYSTEM
 138          KO                                      22
 139          HC       3
 140          ZZ
. 1343001909     HMVersion: 6.33    Data File: C:\TEMP\~vbh204B.TMP
```

```
**********************************
                                 *
FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
        MAY   1991               *
      VERSION 4.0.1E             *
                                 *
ATE  10/05/2001  TIME  13:09:21  *
                                 *
**********************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

```
IO        OUTPUT CONTROL VARIABLES
              IPRNT          0  PRINT CONTROL
              IPLOT          0  PLOT CONTROL
              QSCAL         0.  HYDROGRAPH PLOT SCALE

IT        HYDROGRAPH TIME DATA
               NMIN          2  MINUTES IN COMPUTATION INTERVAL
              IDATE      1   0  STARTING DATE
              ITIME       0000  STARTING TIME
                 NQ       1600  NUMBER OF HYDROGRAPH ORDINATES
             NDDATE      3   0  ENDING DATE
             NDTIME       0518  ENDING TIME
              ICENT         19  CENTURY MARK

          COMPUTATION INTERVAL    0.03 HOURS
               TOTAL TIME BASE   53.30 HOURS

    ENGLISH UNITS
         DRAINAGE AREA          SQUARE MILES
         PRECIPITATION DEPTH    INCHES
         LENGTH, ELEVATION      FEET
         FLOW                   CUBIC FEET PER SECOND
         STORAGE VOLUME         ACRE-FEET
         SURFACE AREA           ACRES
         TEMPERATURE            DEGREES FAHRENHEIT

JP        MULTI-PLAN OPTION
              NPLAN          1  NUMBER OF PLANS

JR        MULTI-RATIO OPTION
             RATIOS OF PRECIPITATION
           1.00      1.62
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION	
					RATIO 1	RATIO 2
ATION	STATION	AREA	PLAN		1.00	1.62
ROGRAPH AT	SUB9B	0.02	1	FLOW	31.	57.
				TIME	4.03	4.03
ERSION TO	D215R	0.02	1	FLOW	21.	35.
				TIME	4.03	4.03
OGRAPH AT	D215L	0.02	1	FLOW	10.	22.
				TIME	4.03	4.03
OGRAPH AT	DR215R	0.00	1	FLOW	21.	35.
				TIME	4.03	4.03
UTED TO	215305	0.00	1	FLOW	20.	35.
				TIME	4.07	4.07
ROGRAPH AT	SUB9A	0.01	1	FLOW	9.	16.
				TIME	4.10	4.10
COMBINED AT	CP305	0.01	1	FLOW	29.	51.
				TIME	4.07	4.07
UTED TO	305306	0.01	1	FLOW	28.	49.
				TIME	4.13	4.10
YDROGRAPH AT	SUB9C	0.02	1	FLOW	24.	46.
				TIME	4.13	4.13
COMBINED AT	CP306	0.03	1	FLOW	52.	95.
				TIME	4.13	4.10
U O	306307	0.03	1	FLOW	51.	94.
				TIME	4.13	4.13
HYDROGRAPH AT	SUB9D	0.02	1	FLOW	22.	40.
				TIME	4.07	4.07
ROUTED TO	301302	0.02	1	FLOW	20.	37.
				TIME	4.20	4.17
YDROGRAPH AT	SUB9E	0.01	1	FLOW	12.	22.
				TIME	4.10	4.10
YDROGRAPH AT	SUB9F	0.01	1	FLOW	20.	36.
				TIME	4.07	4.07
3 COMBINED AT	CP302	0.04	1	FLOW	49.	92.
				TIME	4.13	4.10
ROUTED TO	302307	0.04	1	FLOW	49.	91.
				TIME	4.13	4.13
YDROGRAPH AT	SUB9G	0.03	1	FLOW	31.	55.
				TIME	4.10	4.10
ROUTED TO	303307	0.03	1	FLOW	31.	55.
				TIME	4.13	4.13
HYDROGRAPH AT	SUB9H	0.01	1	FLOW	10.	20.
				TIME	4.03	4.03
4 COMBINED AT	CP307	0.11	1	FLOW	136.	252.
				TIME	4.13	4.10
ROUTED TO	RETSOU	0.11	1	FLOW	0.	22.
				TIME	0.03	4.87
			** PEAK STAGES IN FEET **			
			1	STAGE	1222.86	1225.18
				TIME	7.20	4.87
HYDROGRAPH AT						

	SUB9J	0.01	1	FLOW	14.	27.
				TIME	4.13	4.13
MBINED AT						
	LOST_Q	0.14	1	FLOW	23.	47.
				TIME	4.07	4.07

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR PLAN = 1 RATIO= 0.00									
215305	MANE	2.00	20.40	244.00	-1.00	2.00	20.40	244.00	-1.00
FOR PLAN = 1 RATIO= 0.00									
215305	MANE	2.00	34.82	244.00	-1.00	2.00	34.82	244.00	-1.00
FOR PLAN = 1 RATIO= 0.00									
305306	MANE	2.00	27.80	248.00	2.55	2.00	27.80	248.00	2.55

INUITY SUMMARY (AC-FT) - INFLOW=0.1096E+01 EXCESS=0.0000E+00 OUTFLOW=0.1088E+01 BASIN STORAGE=0.2549E-03 PERCENT ERROR= 0.8

FOR PLAN = 1 RATIO= 0.00									
305306	MANE	2.00	49.00	246.00	4.94	2.00	49.00	246.00	4.94

INUITY SUMMARY (AC-FT) - INFLOW=0.2123E+01 EXCESS=0.0000E+00 OUTFLOW=0.2109E+01 BASIN STORAGE=0.2543E-03 PERCENT ERROR= 0.7

FOR PLAN = 1 RATIO= 0.00									
306307	MANE	1.07	51.25	247.95	1.39	2.00	51.25	248.00	1.39

TINUITY SUMMARY (AC-FT) - INFLOW=0.2299E+01 EXCESS=0.0000E+00 OUTFLOW=0.2293E+01 BASIN STORAGE=0.9115E-04 PERCENT ERROR= 0.2

FOR PLAN = 1 RATIO= 0.00									
306307	MANE	0.95	93.74	247.37	2.70	2.00	93.65	248.00	2.70

TINUITY SUMMARY (AC-FT) - INFLOW=0.4476E+01 EXCESS=0.0000E+00 OUTFLOW=0.4465E+01 BASIN STORAGE=0.9236E-04 PERCENT ERROR= 0.2

FOR PLAN = 1 RATIO= 0.00									
301302	MANE	2.00	19.70	252.00	1.12	2.00	19.70	252.00	1.12

TY SUMMARY (AC-FT) - INFLOW=0.1080E+01 EXCESS=0.0000E+00 OUTFLOW=0.1072E+01 BASIN STORAGE=0.9856E-03 PERCENT ERROR= 0.7

FOR PLAN = 1 RATIO= 0.00									
301302	MANE	2.00	37.05	250.00	2.09	2.00	37.05	250.00	2.09

INUITY SUMMARY (AC-FT) - INFLOW=0.2022E+01 EXCESS=0.0000E+00 OUTFLOW=0.2009E+01 BASIN STORAGE=0.1037E-02 PERCENT ERROR= 0.6

FOR PLAN = 1 RATIO= 0.00									
302307	MANE	0.85	48.55	247.77	1.15	2.00	48.55	248.00	1.15

TINUITY SUMMARY (AC-FT) - INFLOW=0.2762E+01 EXCESS=0.0000E+00 OUTFLOW=0.2761E+01 BASIN STORAGE=0.7087E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
302307	MANE	0.75	91.38	247.55	2.14	2.00	91.21	248.00	2.14

INUITY SUMMARY (AC-FT) - INFLOW=0.5131E+01 EXCESS=0.0000E+00 OUTFLOW=0.5130E+01 BASIN STORAGE=0.7240E-04 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
303307	MANE	1.77	31.09	248.26	1.34	2.00	31.06	248.00	1.34

INUITY SUMMARY (AC-FT) - INFLOW=0.1789E+01 EXCESS=0.0000E+00 OUTFLOW=0.1789E+01 BASIN STORAGE=0.2617E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.00									
303307	MANE	1.52	55.27	247.55	2.38	2.00	55.02	248.00	2.38

TINUITY SUMMARY (AC-FT) - INFLOW=0.3177E+01 EXCESS=0.0000E+00 OUTFLOW=0.3177E+01 BASIN STORAGE=0.2716E-03 PERCENT ERROR= 0.0

AL END OF HEC-1 ***

APPENDIX C

Storm Drain Hydraulic Calculations (StormCad Output)
(Storm Drain Schematic, Combined Pipe/Node Reports, Inlet Reports)
For Storm Drains 1 through 10

V-Ditch Worksheets (FlowMaster Output)

Cross-Street Inlet Calculations (Grate Capacity Calculation, and Trench Drain Worksheets)

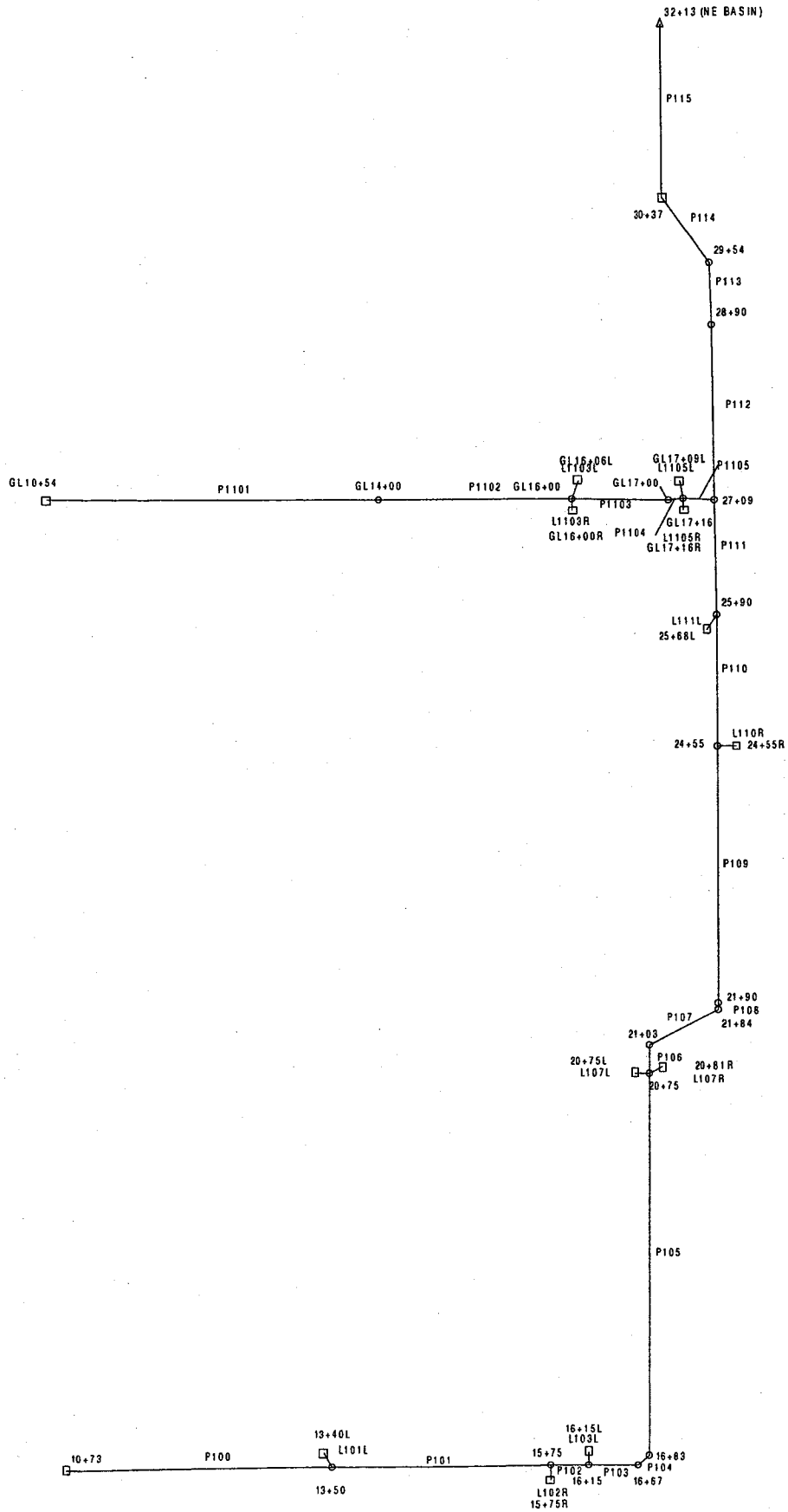
Grate Inlet Catch Basin Worksheets – (COP P-1570, MAG DET 538, MAG DET 535)

Sediment Supply Calculations

Sediment Trap Volume Calculations

Registered Professional Engineer (Civil)
CERTIFICATE NO
26882
DANIEL E.
STOUGH
Date Signed 11-05-01
ARIZONA U.S.A.

Scenario: STORM DRAIN 1, MAGDALENA/BATOUA: 10-yr



Title: STM DRN 1
p:\...\600disc\610drain\610estmdr\sd01_batoua.stm
09/12/01 05:24:34 PM

© Haestad Methods, Inc.

Sverdrup Civil, Inc
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Dan Stough
StormCAD v3.0 [319]

Inlet Report

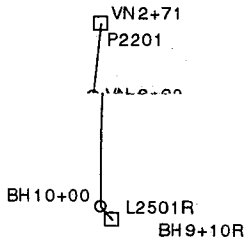
INLET	Inlet	Slotted Drain Length (ft)	Ground Elev (ft)	Grate Elev (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Bypass Target	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)	Gutter Long Slope (ft/ft)
10+73	Generic Default 100%		1,239.98	1,239.98	1,233.35	26.00	100.0		26.00	26.00	0.00		0.00	0.00	
13+40L	Slot ADOT C-13.60	20.00	1,235.90	1,235.90	1,231.90	3.00	91.8		3.00	2.75	0.25	16+15L	0.24	8.79	0.020000
15+75R	Slot ADOT C-13.60	10.00	1,233.16	1,233.16	1,229.16	2.00	71.0		2.00	1.42	0.58	16+15L	0.22	7.86	0.015000
16+15L	Slot ADOT C-13.60	20.00	1,232.25	1,232.25	1,228.25	3.00	100.0		3.83	3.83	0.00		0.18	5.98	
20+75L	Slot ADOT C-13.60	20.00	1,229.04	1,229.04	1,225.04	4.00	96.6		4.00	3.86	0.14	25+68L	0.31	12.27	0.007000
20+81R	Slot ADOT C-13.60	20.00	1,228.90	1,228.90	1,224.90	4.00	93.1		4.00	3.72	0.28	24+55R	0.29	11.42	0.010000
24+55R	Slot ADOT C-13.60	20.00	1,225.57	1,225.57	1,221.57	4.00	88.5		4.28	3.78	0.49	30+37	0.28	11.13	0.013000
25+68L	Slot ADOT C-13.60	20.00	1,224.54	1,224.54	1,220.54	4.00	94.7		4.14	3.92	0.22	30+37	0.30	12.11	0.008000
30+37	Ditch ADOT C-15.90 DBL WIDE		1,223.50	1,220.50	1,210.00	10.00	100.0	50.0	11.61	11.61	0.00		0.36	8.15	
GL10+54	Generic Default 100%		1,231.34	1,231.34	1,224.57	43.00	100.0		43.00	43.00	0.00		0.00	0.00	
GL16+00R	Slot ADOT C-13.60	20.00	1,225.32	1,225.32	1,221.32	4.00	90.1		4.00	3.60	0.40	GL17+16R	0.28	10.83	0.013000
GL16+06L	Slot ADOT C-13.60	20.00	1,225.11	1,225.11	1,221.11	4.00	88.3		4.00	3.53	0.47	GL17+09L	0.27	10.52	0.015000
GL17+09L	Slot ADOT C-13.60	20.00	1,223.83	1,223.83	1,219.83	4.00	91.8		4.47	4.10	0.36	30+37	0.30	12.19	0.009000
GL17+16R	Slot ADOT C-13.60	20.00	1,223.84	1,223.84	1,219.84	4.00	87.8		4.40	3.86	0.54	30+37	0.29	11.25	0.013000

Scenario: STORM DRAIN 1 MAGDALENA/BATOUA: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L101L	13+40L	13+50	2.75	17.50	18 inch	HDPE SMOOTH	1,231.90	1,231.90	1,231.50	0.022857	0.011819	0.004326	6.30	1,235.90	1,232.53	1,231.94	17.20
L102R	15+75R	15+75	1.42	15.00	18 inch	HDPE SMOOTH	1,229.16	1,229.16	1,227.00	0.144000	0.009883	0.004179	0.80	1,233.16	1,229.61	1,229.61	43.18
L103L	16+15L	16+15	3.83	14.70	18 inch	HDPE SMOOTH	1,228.25	1,228.25	1,227.10	0.078231	0.001155	0.004566	2.17	1,232.25	1,229.26	1,229.31	31.83
L107L	20+75L	20+75	3.86	15.70	18 inch	HDPE SMOOTH	1,225.04	1,225.04	1,221.80	0.206369	0.159543	0.004576	2.19	1,229.04	1,225.79	1,223.51	51.69
L107R	20+81R	20+75	3.72	14.60	18 inch	HDPE SMOOTH	1,224.90	1,224.66	1,221.80	0.195890	0.147322	0.004543	2.11	1,228.90	1,225.40	1,223.47	50.36
L110R	24+55R	24+55	3.78	19.40	18 inch	HDPE SMOOTH	1,221.57	1,221.57	1,218.50	0.158247	0.126297	0.004558	2.14	1,225.57	1,222.31	1,220.08	45.27
L111L	25+68L	25+90	3.92	18.40	18 inch	HDPE SMOOTH	1,220.54	1,220.54	1,218.00	0.138043	0.131169	0.004590	2.99	1,224.54	1,221.30	1,219.04	42.28
L1103L	GL16+06L	GL16+00	3.53	20.80	18 inch	HDPE SMOOTH	1,221.11	1,221.11	1,219.08	0.097596	0.012319	0.004491	2.00	1,225.11	1,221.83	1,221.79	35.55
L1103R	GL16+00R	GL16+00	3.60	11.40	18 inch	HDPE SMOOTH	1,221.32	1,221.32	1,219.08	0.196491	0.051358	0.004508	2.04	1,225.32	1,222.04	1,221.68	50.44
L1105L	GL17+09L	GL17+16	4.10	20.40	18 inch	HDPE SMOOTH	1,219.83	1,219.83	1,216.50	0.163235	0.052756	0.004641	2.32	1,223.83	1,220.61	1,219.75	45.97
L1105R	GL17+16R	GL17+16	3.86	11.50	18 inch	HDPE SMOOTH	1,219.84	1,219.84	1,217.00	0.246957	0.087903	0.004574	2.18	1,223.84	1,220.59	1,219.80	56.55
P100	10+73	13+50	26.00	276.70	30 inch	HDPE SMOOTH	1,233.35	1,233.35	1,230.70	0.009577	0.008879	0.004972	9.25	1,239.98	1,235.09	1,232.09	43.48
P101	13+50	15+75	28.75	225.00	30 inch	HDPE SMOOTH	1,227.68	1,227.68	1,226.34	0.005956	0.004155	0.005346	5.86	1,236.48	1,230.12	1,229.19	34.29
P102	15+75	16+15	30.17	74.00	30 inch	HDPE SMOOTH	1,226.34	1,226.34	1,226.10	0.003243	0.004611	0.005561	6.15	1,233.12	1,229.14	1,228.80	25.30
P103	16+15	16+67	34.00	122.60	30 inch	HDPE SMOOTH	1,226.10	1,226.10	1,225.79	0.002529	0.005495	0.006235	8.14	1,232.55	1,228.73	1,227.77	22.34
P104	16+67	16+83	34.00	16.10	36 inch	HDPE SMOOTH	1,223.28	1,223.28	1,223.19	0.005590	0.004626	0.004210	6.70	1,232.00	1,225.17	1,225.21	54.02
P105	16+83	20+75	34.00	392.50	36 inch	HDPE SMOOTH	1,223.19	1,223.19	1,220.84	0.005987	0.005845	0.004210	6.26	1,231.90	1,225.08	1,222.99	55.91
P106	20+75	21+03	41.59	25.90	36 inch	HDPE SMOOTH	1,220.84	1,220.84	1,220.67	0.006564	0.005158	0.004723	7.11	1,228.66	1,222.94	1,222.98	58.54
P107	21+03	21+84	41.59	71.80	36 inch	HDPE SMOOTH	1,220.67	1,220.67	1,219.25	0.019777	0.019270	0.004723	7.11	1,229.00	1,222.77	1,221.56	101.61
P108	21+84	21+90	41.59	6.20	36 inch	HDPE SMOOTH	1,219.25	1,219.25	1,219.16	0.014516	0.005764	0.004723	8.92	1,228.00	1,221.35	1,221.04	87.05
P109	21+90	24+55	41.59	261.40	36 inch	HDPE SMOOTH	1,218.15	1,218.15	1,217.09	0.004055	0.003669	0.004723	6.60	1,228.00	1,220.39	1,219.59	46.01
P110	24+55	25+90	45.37	138.70	36 inch	HDPE SMOOTH	1,217.09	1,217.09	1,216.55	0.003893	0.004031	0.005032	7.50	1,226.20	1,219.54	1,218.95	45.08
P111	25+90	27+09	49.29	118.30	48 inch	HDPE SMOOTH	1,215.55	1,215.55	1,215.08	0.003973	0.000904	0.003376	4.00	1,224.77	1,218.93	1,218.87	98.08
P112	27+09	28+90	107.39	181.90	48 inch	HDPE SMOOTH	1,215.08	1,215.08	1,214.35	0.004013	0.004165	0.005194	9.00	1,224.00	1,218.74	1,217.96	98.58
P113	28+90	29+54	107.39	63.50	48 inch	HDPE SMOOTH	1,214.35	1,214.35	1,214.10	0.003937	0.004290	0.005194	9.23	1,223.07	1,217.89	1,217.59	97.64
P114	29+54	30+37	107.39	82.30	48 inch	HDPE SMOOTH	1,214.10	1,214.10	1,210.00	0.049818	0.048369	0.005194	9.03	1,221.40	1,217.24	1,213.59	347.31
P115	30+37	32+13 (NE BA	119.00	176.90	60 inch	Concrete	1,210.00	1,210.00	1,208.00	0.011306	0.002118	0.003511	6.06	1,223.50	1,213.12	1,213.50	299.99
P1101	GL10+54	GL14+00	43.00	346.00	30 inch	HDPE SMOOTH	1,224.57	1,224.57	1,222.49	0.006012	0.009224	0.008472	9.43	1,231.34	1,228.06	1,224.68	34.45
P1102	GL14+00	GL16+00	43.00	200.20	30 inch	HDPE SMOOTH	1,219.78	1,219.78	1,218.58	0.005994	0.009365	0.008472	8.76	1,227.83	1,223.85	1,221.97	34.40
P1103	GL16+00	GL17+00	50.14	100.00	30 inch	HDPE SMOOTH	1,218.58	1,218.58	1,217.99	0.005900	0.012580	0.011049	10.61	1,225.26	1,221.68	1,220.29	34.13
P1104	GL17+00	GL17+16	50.14	15.80	36 inch	HDPE SMOOTH	1,215.45	1,215.45	1,215.42	0.001899	0.004815	0.005485	7.09	1,224.32	1,219.16	1,219.08	31.48
P1105	GL17+16	27+09	58.10	33.60	36 inch	HDPE SMOOTH	1,215.42	1,215.42	1,215.35	0.002083	0.006466	0.006427	8.22	1,224.27	1,218.96	1,218.74	32.98

Scenario: STORM DRAIN 2, Vauo Nawi: 10-yr



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Scenario: STORM DR 2, Vauo Nawi: 10-yr

Inlet Report

INLET	Inlet	Slotted Drain Length (ft)	Ground Elev (ft)	Grate Elev (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Bypass Target	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)	Gutter Long Slope (ft/ft)
10+62R	Ditch MAG 535 - TYPE F		1,228.80	1,226.30	1,222.30	2.00	100.0	50.0	2.00	2.00	0.00		0.17	4.03	
13+55R	Slot ADOT C-13.60	10.00	1,227.67	1,227.67	1,223.67	2.00	92.1		2.42	2.22	0.19	18+07R	0.32	12.88	0.00200
18+07R	Slot ADOT C-13.60	10.00	1,226.38	1,226.38	1,222.38	2.00	94.1		2.19	2.06	0.13	19+40R	0.31	12.39	0.00200
19+40R	Slot ADOT C-13.60	10.00	1,226.05	1,226.05	1,222.05	2.00	89.0		2.76	2.46	0.30	VN0+50R	0.33	13.58	0.00200
BH9+10R	Slot ADOT C-13.60	20.00	1,227.66	1,227.66	1,223.66	10.00	100.0		10.00	10.00	0.00		0.34	14.03	
BH11+81R	Slot ADOT C-13.60	20.00	1,227.50	1,227.50	1,223.50	8.00	100.0		8.00	8.00	0.00		0.29	11.67	
IG10+60	Generic Default 100%		1,245.08	1,245.08	1,240.00	36.00	100.0		36.00	36.00	0.00		0.00	0.00	
IG14+80R	Slot ADOT C-13.60	20.00	1,238.94	1,238.94	1,234.94	4.00	88.2		4.00	3.53	0.47	IG15+80R	0.27	10.50	0.01510
IG15+80R	Slot ADOT C-13.60	20.00	1,237.73	1,237.73	1,233.73	4.00	95.6		4.47	4.27	0.20	IG19+90RL	0.32	13.10	0.00630
IG17+00L	Slot ADOT C-13.60	20.00	1,235.59	1,235.59	1,230.19	4.00	92.4		4.00	3.70	0.30	IG19+90RL	0.29	11.29	0.01060
IG19+90RL	Slot ADOT C-13.60	20.00	1,232.26	1,232.26	1,228.26	4.00	83.7		4.50	3.76	0.73	IG20+85RL	0.27	10.74	0.01710
IG20+85RL	Slot ADOT C-13.60	20.00	1,230.69	1,230.69	1,226.69	4.00	82.7		4.73	3.92	0.82	IG24+78RL	0.28	11.04	0.01660
IG24+78RL	Slot ADOT C-13.60	20.00	1,227.20	1,227.20	1,223.20	4.00	86.9		4.82	4.18	0.63	19+40R	0.30	11.92	0.01170
MX10+42	Generic Default 100%		1,233.08	1,233.08	1,226.89	60.00	100.0		60.00	60.00	0.00		0.00	0.00	
MX14+60RL	Slot ADOT C-13.60	20.00	1,228.16	1,228.16	1,224.16	4.00	89.6		4.00	3.58	0.42	13+55R	0.27	10.75	0.01350
SA10+60	Generic Default 100%		1,242.56	1,242.56	1,237.77	13.00	100.0		13.00	13.00	0.00		0.00	0.00	
SA13+14RL	Slot ADOT C-13.60	20.00	1,238.30	1,238.30	1,234.30	4.00	83.6		4.00	3.34	0.66	SA16+74R	0.26	9.75	0.02170
SA16+74RL	Slot ADOT C-13.60	20.00	1,233.19	1,233.19	1,229.19	4.00	89.3		4.66	4.16	0.50	SA19+85R	0.30	12.07	0.01030
SA19+85RL	Slot ADOT C-13.60	20.00	1,229.73	1,229.73	1,225.73	5.00	86.1		5.50	4.73	0.76	SA20+69R	0.32	13.08	0.00960
SA20+69RL	Slot ADOT C-13.60	20.00	1,228.77	1,228.77	1,224.77	6.00	78.4		6.76	5.30	1.46	SA24+93R	0.33	13.70	0.01150
SA24+93RL	Slot ADOT C-13.60	40.00	1,225.96	1,225.96	1,220.96	16.00	95.9		17.46	16.74	0.72	VN0+50R	0.50	21.90	0.00680
VN0+50R	Slot ADOT C-13.60	20.00	1,225.50	1,225.50	1,221.50	2.00	100.0		3.03	3.03	0.00		0.15	4.68	
VN2+71	Generic MAG 501-5 DROP 36		1,224.60	1,221.50	1,218.84	26.00	100.0		26.00	26.00	0.00		0.00	0.00	

Scenario: STORM DRN 2, Vauo Nawi: 10-yr

Combined Pipe/Node Report

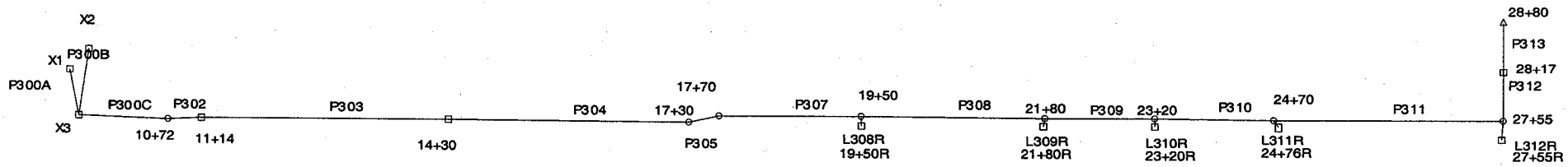
Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L203R	19+40R	19+06	2.46	39.00	18 inch	HDPE SMOOTH	1,222.05	1,222.05	1,219.00	0.07821	0.00047	0.00427	1.39	1,226.05	1,224.21	1,224.19	31.82
L204R	18+07R	18+07	2.06	15.90	18 inch	HDPE SMOOTH	1,222.38	1,222.38	1,220.00	0.14969	0.00033	0.00422	1.17	1,226.38	1,224.53	1,224.52	44.02
L207R	13+55R	13+55	2.22	15.40	18 inch	HDPE SMOOTH	1,223.67	1,223.67	1,220.00	0.23831	0.06740	0.00424	1.26	1,227.67	1,224.23	1,223.38	55.55
L210R	10+62R	10+62	2.00	12.80	18 inch	HDPE SMOOTH	1,222.30	1,222.30	1,218.50	0.29687	0.09136	0.00421	1.13	1,228.80	1,222.83	1,221.84	62.00
L2101L	SA13+14RL	SA13+60	3.34	49.00	18 inch	HDPE SMOOTH	1,234.30	1,234.30	1,233.00	0.02653	0.01807	0.00445	7.79	1,238.30	1,235.00	1,233.44	18.53
L2103R	SA16+74RL	SA16+60	4.16	24.10	18 inch	HDPE SMOOTH	1,229.19	1,229.19	1,228.60	0.02448	0.01067	0.00466	2.51	1,233.19	1,229.97	1,229.93	17.80
L2104L	SA19+85RL	SA19+60	4.73	30.10	18 inch	HDPE SMOOTH	1,225.73	1,225.73	1,224.00	0.05748	0.00231	0.00483	2.68	1,229.73	1,226.57	1,226.72	27.28
L2105R	SA20+69RL	SA20+69	5.30	19.20	18 inch	HDPE SMOOTH	1,224.77	1,224.77	1,223.50	0.06615	0.00215	0.00503	3.00	1,228.77	1,226.15	1,226.12	29.27
L2203R	VN0+50R	VN0+50	3.03	16.40	18 inch	HDPE SMOOTH	1,221.50	1,221.50	1,219.00	0.15244	0.00071	0.00437	1.71	1,225.50	1,224.87	1,224.85	44.43
L2303R	IG14+80R	IG14+80	3.53	20.10	18 inch	HDPE SMOOTH	1,234.94	1,234.94	1,232.00	0.14627	0.04668	0.00449	2.00	1,238.94	1,235.66	1,234.94	43.52
L2304R	IG15+80R	IG15+55	4.27	33.00	18 inch	HDPE SMOOTH	1,233.73	1,233.73	1,231.50	0.06758	0.02155	0.00469	2.42	1,237.73	1,234.52	1,234.04	29.58
L2305L	IG17+00L	IG16+60	3.70	47.10	18 inch	HDPE SMOOTH	1,230.19	1,230.19	1,229.00	0.02527	0.01365	0.00453	2.09	1,235.59	1,230.92	1,230.50	18.09
L2306R	IG19+90RL	IG19+75	3.76	24.50	18 inch	HDPE SMOOTH	1,228.26	1,228.26	1,225.20	0.12490	0.10585	0.00455	2.17	1,232.26	1,229.00	1,226.63	40.21
L2307R	IG20+85RL	IG20+85	3.92	20.40	18 inch	HDPE SMOOTH	1,226.69	1,226.69	1,224.50	0.10735	0.08340	0.00459	2.23	1,230.69	1,227.45	1,225.97	37.28
L2309L	IG24+78RL	IG24+78	4.18	9.80	18 inch	HDPE SMOOTH	1,223.20	1,223.20	1,220.00	0.32653	0.00135	0.00466	2.37	1,227.20	1,225.41	1,225.39	65.02
L2403R	MX14+60RL	MX14+40	3.58	31.70	18 inch	HDPE SMOOTH	1,224.16	1,224.16	1,220.50	0.11546	0.02909	0.00450	2.03	1,228.16	1,224.88	1,224.18	38.67
L2501R	BH9+10R	BH10+00	10.00	14.60	24 inch	HDPE SMOOTH	1,223.66	1,223.66	1,221.40	0.15479	0.14458	0.00443	3.96	1,227.66	1,224.79	1,222.90	96.42
L2502R	BH11+81R	BH11+81	8.00	8.50	18 inch	HDPE SMOOTH	1,223.50	1,223.50	1,223.00	0.05882	0.01376	0.00633	8.94	1,227.50	1,224.60	1,223.76	27.60
P-2107L	SA24+93RL	SA24+80	16.74	16.80	24 inch	HDPE SMOOTH	1,220.96	1,220.96	1,220.00	0.05714	0.00466	0.00584	5.33	1,225.96	1,225.24	1,225.16	58.58
P201	23+01(SD2)	19+06	76.30	395.50	54 inch	Concrete	1,217.90	1,217.94	1,217.31	0.00159	0.00151	0.00397	4.80	1,225.98	1,224.71	1,224.12	78.48
P202	19+06	18+49	78.76	55.50	60 inch	Concrete	1,217.31	1,217.31	1,217.23	0.00144	0.00091	0.00360	4.01	1,226.78	1,224.10	1,224.05	98.88
P203	18+49	18+07	138.13	31.90	60 inch	Concrete	1,217.23	1,217.23	1,217.17	0.00188	0.00281	0.00445	7.03	1,226.52	1,224.01	1,223.92	112.95
P204	18+07	14+46	140.19	362.30	60 inch	Concrete	1,217.17	1,217.17	1,216.63	0.00149	0.00290	0.00449	7.14	1,226.73	1,223.88	1,222.83	100.54
P205	14+46	14+02	140.19	42.00	66 inch	Concrete	1,216.63	1,216.63	1,216.57	0.00143	0.00174	0.00387	5.90	1,227.84	1,222.81	1,222.74	126.92
P206	14+02	13+55	203.78	24.20	66 inch	Concrete	1,216.57	1,216.57	1,216.51	0.00248	0.00368	0.00478	8.58	1,228.00	1,222.69	1,222.60	167.20
P207	13+55	11+59	206.00	201.10	66 inch	Concrete	1,216.51	1,216.51	1,216.22	0.00144	0.00376	0.00482	8.67	1,228.00	1,222.55	1,221.80	127.52
P208	11+59	11+36	206.00	22.20	66 inch	Concrete	1,216.22	1,216.22	1,216.18	0.00180	0.00327	0.00482	8.82	1,228.14	1,221.51	1,221.43	142.54
P209	11+36	10+62	224.00	69.70	66 inch	Concrete	1,216.18	1,216.18	1,216.07	0.00158	0.00388	0.00517	10.01	1,228.40	1,221.36	1,220.98	133.40
P210	10+62	10+00	226.00	58.30	66 inch	Concrete	1,216.07	1,216.07	1,215.98	0.00154	0.00439	0.00521	11.59	1,227.50	1,220.91	1,220.19	131.93
P2101	SA10+60	SA13+60	13.00	299.70	30 inch	HDPE SMOOTH	1,237.77	1,237.27	1,232.05	0.01742	0.01727	0.00381	4.61	1,242.56	1,238.48	1,233.45	58.64
P2102	SA13+60	SA16+60	16.34	299.80	30 inch	HDPE SMOOTH	1,232.05	1,232.05	1,228.27	0.01261	0.01238	0.00403	4.87	1,237.48	1,233.42	1,229.89	49.89
P2103	SA16+60	SA19+60	20.50	300.00	30 inch	HDPE SMOOTH	1,228.27	1,228.27	1,224.51	0.01253	0.01183	0.00437	4.76	1,233.59	1,229.81	1,226.56	49.74
P2104	SA19+60	SA20+69	25.24	109.70	30 inch	HDPE SMOOTH	1,223.46	1,223.46	1,223.24	0.00201	0.00323	0.00488	5.14	1,230.36	1,226.52	1,226.17	19.90
P2105	SA20+69	SA21+60	30.54	90.30	30 inch	HDPE SMOOTH	1,223.40	1,223.40	1,223.06	0.00377	0.00472	0.00562	6.22	1,228.91	1,226.06	1,225.64	27.26
P2106	SA21+60	SA24+80	30.54	320.70	36 inch	HDPE SMOOTH	1,222.55	1,222.55	1,220.37	0.00680	0.00179	0.00402	4.32	1,228.54	1,225.62	1,225.04	59.57

Scenario: STORM DRAIN 2, Vauo Nawi: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P2107	SA24+80	SA25+23	47.28	33.10	54 inch	HDPE SMOOTH	1,218.12	1,218.12	1,217.93	0.00574	0.00049	0.00304	2.97	1,226.19	1,225.04	1,225.02	161.40
P2108	SA25+23	23+01(SD2)	47.28	15.80	54 inch	HDPE SMOOTH	1,217.93	1,217.93	1,217.90	0.00190	0.00049	0.00304	2.97	1,226.02	1,224.92	1,224.91	92.82
P2201	VN2+71	VN 2+00	26.00	88.60	36 inch	HDPE SMOOTH	1,218.84	1,218.84	1,218.74	0.00113	0.00129	0.00380	3.68	1,224.60	1,225.27	1,225.16	24.27
P2202	VN 2+00	VN0+50	26.00	150.00	36 inch	HDPE SMOOTH	1,218.74	1,218.74	1,218.51	0.00153	0.00129	0.00380	3.68	1,225.48	1,225.11	1,224.92	28.29
P2203	VN0+50	VN0+08	29.03	42.00	36 inch	HDPE SMOOTH	1,218.51	1,218.51	1,218.45	0.00143	0.00161	0.00394	4.11	1,225.90	1,224.85	1,224.79	27.31
P2204	VN0+08	23+01(SD2)	29.03	12.40	36 inch	HDPE SMOOTH	1,218.45	1,218.45	1,218.44	0.00081	0.00161	0.00394	4.11	1,226.20	1,224.76	1,224.74	20.52
P2301	IG10+60	IG13+60	36.00	300.80	30 inch	HDPE SMOOTH	1,240.00	1,240.00	1,235.50	0.01496	0.01320	0.00665	11.84	1,245.08	1,242.04	1,236.99	54.35
P2302	IG13+60	IG14+80	36.00	119.80	30 inch	HDPE SMOOTH	1,231.79	1,231.79	1,231.08	0.00593	0.00656	0.00665	7.33	1,240.93	1,234.97	1,234.18	34.21
P2303	IG14+80	IG15+55	39.53	75.10	30 inch	HDPE SMOOTH	1,231.08	1,231.08	1,230.63	0.00599	0.00791	0.00749	8.05	1,239.11	1,234.09	1,233.49	34.39
P2304	IG15+55	IG16+60	43.80	105.30	30 inch	HDPE SMOOTH	1,230.63	1,230.63	1,230.01	0.00589	0.00934	0.00873	9.56	1,237.80	1,233.38	1,232.21	34.09
P2305	IG16+60	IG19+75	47.50	314.50	36 inch	HDPE SMOOTH	1,227.88	1,227.88	1,226.01	0.00595	0.00590	0.00523	8.85	1,236.34	1,230.12	1,228.14	55.71
P2306	IG19+75	IG20+85	51.27	112.60	36 inch	HDPE SMOOTH	1,223.70	1,223.70	1,223.05	0.00577	0.00573	0.00560	8.46	1,232.50	1,226.03	1,225.45	54.90
P2307	IG20+85	IG22+60	55.18	172.50	42 inch	HDPE SMOOTH	1,223.05	1,223.05	1,222.01	0.00603	0.00260	0.00421	5.76	1,231.04	1,225.40	1,225.44	84.63
P2308	IG22+60	IG24+78	55.18	218.50	42 inch	HDPE SMOOTH	1,219.26	1,219.26	1,218.39	0.00398	0.00256	0.00421	5.74	1,229.48	1,225.40	1,224.84	68.77
P2309	IG24+78	18+49	59.37	49.90	42 inch	HDPE SMOOTH	1,218.39	1,218.39	1,218.20	0.00381	0.00297	0.00440	6.17	1,227.37	1,224.79	1,224.64	67.25
P2401	MX10+42	MX11+60	60.00	119.20	36 inch	HDPE SMOOTH	1,226.89	1,226.89	1,226.19	0.00587	0.00620	0.00669	9.53	1,233.08	1,229.61	1,228.69	55.37
P2402	MX11+60	MX14+40	60.00	279.10	36 inch	HDPE SMOOTH	1,223.67	1,223.67	1,222.01	0.00595	0.00612	0.00669	9.53	1,231.77	1,226.41	1,224.51	55.72
P2403	MX14+40	14+02	63.58	61.30	42 inch	HDPE SMOOTH	1,218.84	1,218.84	1,218.48	0.00587	0.00340	0.00461	6.61	1,228.60	1,223.71	1,223.50	83.52
P2501	BH10+00	BH11+81	10.00	181.60	24 inch	HDPE SMOOTH	1,221.40	1,221.40	1,220.67	0.00402	0.00175	0.00443	3.22	1,228.00	1,222.78	1,222.59	15.54
P2502	BH11+81	11+36	18.00	36.90	24 inch	HDPE SMOOTH	1,220.67	1,220.67	1,218.27	0.06504	0.00535	0.00622	5.73	1,227.62	1,222.38	1,222.29	62.50

Scenario: STORM DRAIN 3, Guadalupe: 10-Yr



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Project Engineer: Dan Stough
StormCAD v3.0 [319]
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Scenario: STORM DRAIN 3, Guadalupe: 10-Yr

Area Inlet Report

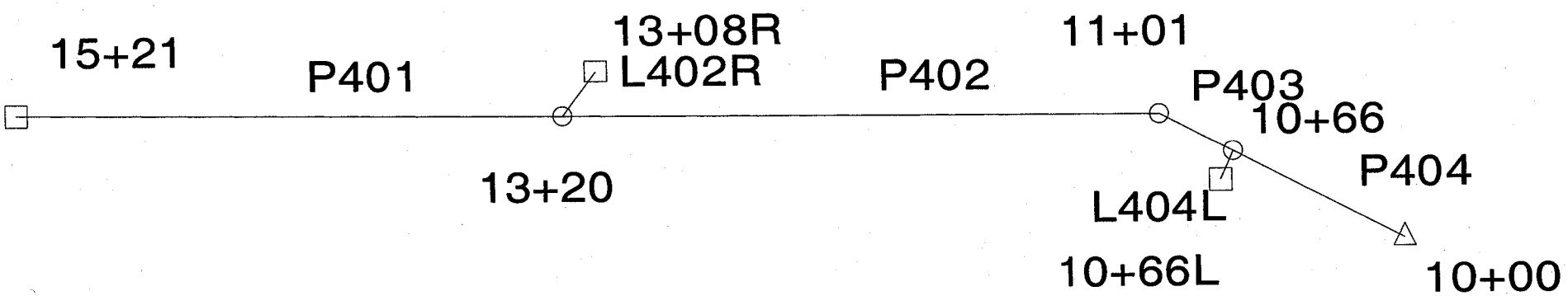
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
11+14	Ditch MAG 535 - TYPE F	1,247.25	1,246.20	1,243.94	1,243.76	1,238.50	8.00	100.0	50.0	32.45	32.45	0.00	0.82	8.94
14+30	Ditch ADOT C-15.90 DBL WIDE	1,243.20	1,242.15	1,240.22	1,239.91	1,234.00	40.00	100.0	50.0	40.00	40.00	0.00	0.82	10.91
19+50R	Ditch ADOT C-15.90 DBL WIDE	1,236.00	1,236.00	1,233.63	1,233.63	1,231.00	68.00	100.0	50.0	68.00	68.00	0.00	1.17	13.00
21+80R	Ditch ADOT C-15.90	1,233.00	1,233.00	1,231.74	1,231.74	1,227.00	20.00	100.0	50.0	20.00	20.00	0.00	1.13	10.77
23+20R	Ditch ADOT C-15.80	1,231.60	1,230.50	1,230.18	1,230.18	1,225.00	6.00	100.0	50.0	6.00	6.00	0.00	0.40	6.38
24+76R	Ditch ADOT C-15.80	1,229.60	1,228.50	1,228.00	1,228.00	1,224.50	2.00	100.0	50.0	2.00	2.00	0.00	0.13	4.79
27+55R	Ditch MAG 535 - TYPE F	1,227.00	1,226.50	1,221.53	1,221.53	1,221.00	2.00	100.0	50.0	2.00	2.00	0.00	0.18	5.10
28+17	Ditch MAG 538 - TYPE H	1,226.50	1,225.00	1,220.28	1,220.19	1,214.83	2.00	100.0	50.0	2.00	2.00	0.00	0.20	3.73
X1	Curb MAG 532 - TYPE C - 20	1,250.02	1,250.02	1,250.02	1,250.02	1,246.70	30.00	59.2		30.00	17.75	12.25	0.56	25.01
X2	Curb MAG 532 - TYPE C - 8.0'	1,249.50	1,249.50	1,249.50	1,249.50	1,246.70	3.00	72.9		3.00	2.19	0.81	0.25	9.26
X3	Curb MAG 532 - TYPE C - 20	1,249.91	1,249.91	1,249.91	1,249.91	1,246.50	30.00	62.0		30.00	18.61	11.39	0.58	26.21

Scenario: STORM DRAIN 3, Guadalupe: 10-Yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L308R	19+50R	19+50	68.00	12.10	36 inch	Concrete	1,231.00	1,231.00	1,228.00	0.247934	0.045797	0.009394	9.62	1,236.00	1,233.63	1,233.30	332.09
L309R	21+80R	21+80	20.00	9.40	36 inch	Concrete	1,227.00	1,227.00	1,223.00	0.425532	0.000899	0.004184	2.83	1,233.00	1,231.64	1,231.63	435.07
L310R	23+20R	23+20	6.00	9.20	24 inch	Concrete	1,225.00	1,225.00	1,223.00	0.217391	0.000704	0.004648	1.91	1,231.60	1,230.08	1,230.07	105.47
L311R	24+76R	24+70	2.00	11.60	18 inch	Concrete	1,224.50	1,224.50	1,222.00	0.215517	0.000363	0.004944	1.13	1,229.60	1,227.90	1,227.90	48.76
L312R	27+55R	27+55	2.00	23.40	18 inch	Concrete	1,221.00	1,221.00	1,219.45	0.066239	0.029868	0.004944	1.13	1,227.00	1,221.53	1,221.01	27.03
P300A	X1	X3	17.75	59.00	24 inch	Concrete	1,246.70	1,246.70	1,246.50	0.003390	0.006158	0.007203	5.65	1,250.02	1,250.27	1,249.91	13.17
P300B	X2	X3	2.19	85.50	18 inch	Concrete	1,246.70	1,246.70	1,246.50	0.002339	0.000434	0.004970	1.24	1,249.50	1,249.95	1,249.91	5.08
P300C	X3	10+72	38.55	111.80	24 inch	Concrete	1,246.50	1,246.50	1,246.12	0.003399	0.029037	0.025645	12.27	1,249.91	1,251.66	1,248.41	13.19
P302	10+72	11+14	38.55	42.20	24 inch	Concrete	1,246.12	1,246.12	1,239.50	0.156872	0.098701	0.025645	12.27	1,249.50	1,248.06	1,243.94	89.60
P303	11+14	14+30	71.00	312.80	36 inch	Concrete	1,238.50	1,238.50	1,236.63	0.005978	0.011333	0.010073	10.04	1,247.25	1,243.76	1,240.22	51.57
P304	14+30	17+30	111.00	301.90	42 inch	Concrete	1,234.00	1,234.00	1,230.67	0.011030	0.012173	0.010644	11.54	1,243.20	1,239.91	1,236.23	105.66
P305	17+30	17+70	111.00	40.00	42 inch	Concrete	1,230.67	1,230.67	1,230.46	0.005250	0.012173	0.010644	11.54	1,239.00	1,235.87	1,235.38	72.89
P307	17+70	19+50	111.00	180.10	42 inch	Concrete	1,230.46	1,230.46	1,229.50	0.005330	0.012037	0.010644	12.09	1,238.30	1,235.05	1,232.68	73.45
P308	19+50	21+80	179.00	230.20	54 inch	Concrete	1,223.65	1,223.65	1,221.86	0.007776	0.008286	0.007655	11.25	1,236.39	1,231.42	1,229.52	173.40
P309	21+80	23+20	199.00	139.90	54 inch	Concrete	1,221.86	1,221.86	1,220.77	0.007791	0.010242	0.009055	12.51	1,233.20	1,229.36	1,227.92	173.57
P310	23+20	24+70	205.00	150.10	54 inch	Concrete	1,220.77	1,220.77	1,219.60	0.007795	0.010869	0.009534	12.89	1,231.60	1,227.76	1,226.13	173.61
P311	24+70	27+55	207.00	285.00	54 inch	Concrete	1,219.60	1,219.60	1,218.50	0.003860	0.010988	0.009700	13.53	1,229.60	1,225.98	1,222.64	122.16
P312	27+55	28+17	209.00	62.20	42 inch	Concrete	1,214.95	1,214.95	1,214.83	0.001929	0.010789	0.009587	10.86	1,226.87	1,220.75	1,220.08	88.38
P313	28+17	28+80	211.00	63.10	42 inch	Concrete	1,214.83	1,214.83	1,214.70	0.002060	0.010997	0.009741	10.97	1,226.50	1,219.99	1,219.30	91.33

Scenario: Storm Drain 4: 10-yr



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Project Engineer: Dan Stough
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Scenario: Storm Drain 4: 10-yr

Area Inlet Report

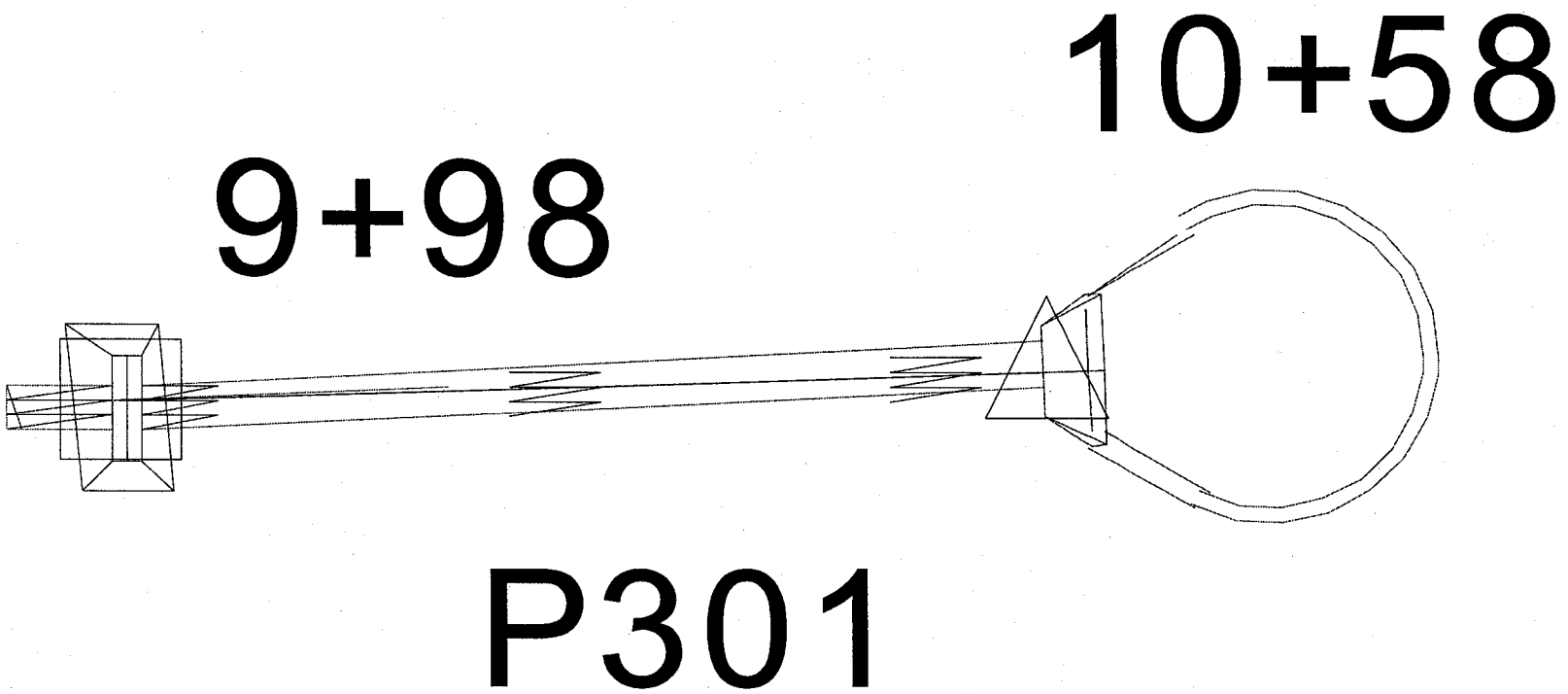
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
13+08R	Ditch MAG 535 - TYPE F	1,230.00	1,229.75	1,227.10	1,227.10	1,225.75	4.00	100.0	50.0	4.00	4.00	0.00	0.27	5.64
15+21	Ditch ADOT C-15.90	1,232.00	1,230.00	1,226.98	1,226.98	1,224.66	51.00	100.0	50.0	51.00	51.00	0.00	1.03	9.19
10+66L	Ditch MAG 535 - TYPE F DOUBL	1,228.00	1,226.50	1,223.91	1,223.91	1,222.50	15.00	100.0	50.0	15.00	15.00	0.00	0.92	8.53

Scenario: Storm Drain 4: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L402R	13+08R	13+20	14.00	20.50	24 inch	HDPE SMOOTH	1,225.75	1,225.75	1,220.85	0.239024	0.090702	0.005158	4.46	1,230.00	1,227.10	1,225.53	119.81
P401	15+21	13+20	51.00	200.80	36 inch	HDPE SMOOTH	1,224.66	1,224.66	1,223.46	0.005976	0.005952	0.005575	8.96	1,232.00	1,226.98	1,225.71	55.86
P402	13+20	11+01	65.00	219.30	36 inch	HDPE SMOOTH	1,219.95	1,219.95	1,218.64	0.005974	0.008093	0.007474	9.20	1,230.20	1,224.51	1,222.73	55.84
L404L	10+66L	10+66	15.00	11.60	18 inch	HDPE SMOOTH	1,222.50	1,222.50	1,220.00	0.215517	0.052505	0.015017	8.49	1,228.00	1,223.91	1,223.36	52.83
P403	11+01	10+66	65.00	30.50	36 inch	HDPE SMOOTH	1,218.64	1,218.64	1,218.44	0.006557	0.008093	0.007474	9.20	1,228.00	1,222.20	1,221.95	58.51
P404	10+66	10+00	80.00	70.20	36 inch	HDPE SMOOTH	1,218.44	1,218.44	1,218.04	0.005698	0.012013	0.010626	11.73	1,227.70	1,221.80	1,220.81	54.54

Scenario: PIPE001 -- 10-Yr (S. BASIN SW)



Scenario: PIPE001 -- 10-Yr (S. BASIN SW)

Area Inlet Report

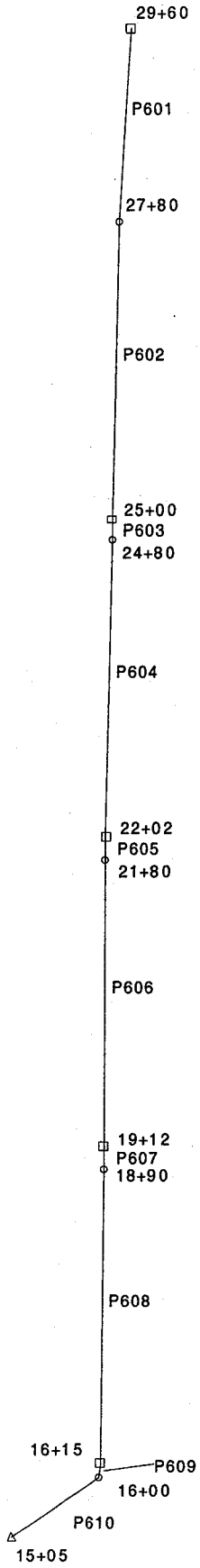
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
9+98	Ditch MAG 535 - TYPE F DOUBL	1,225.20	1,224.13	1,221.37	1,221.37	1,220.13	15.00	100.0	50.0	15.00	15.00	0.00	1.20	10.19

Scenario: PIPE001 -- 10-Yr (S. BASIN SW)

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P301	9+98	10+58	15.00	60.70	36 inch	HDPE SMOOTH	1,220.13	1,220.13	1,218.11	0.033278	0.020324	0.003418	2.48	1,225.20	1,221.37	1,220.50	131.81

Scenario: STORM DRAIN 5, Highline South: 10-yr



Scenario: STORM DRAIN 5, Highline South: 10-yr

Area Inlet Report

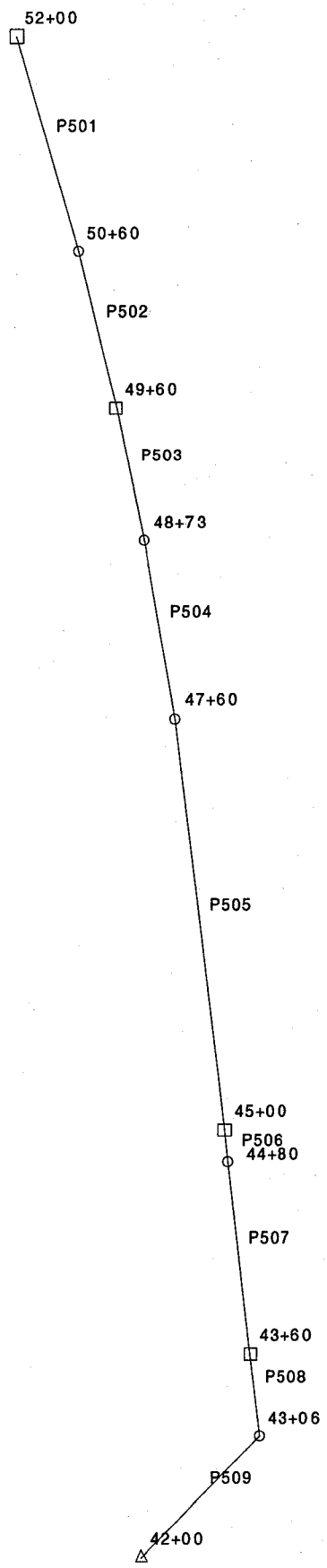
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
16+15	Ditch MAG 538 - TYPE H DBL	1,225.30	1,223.27	1,221.18	1,221.16	1,218.15	10.00	100.0	50.0	10.00	10.00	0.00	0.52	6.09
19+12	Ditch MAG 538 - TYPE H DBL	1,225.00	1,222.92	1,221.63	1,221.60	1,218.74	10.00	100.0	50.0	10.00	10.00	0.00	0.52	6.09
22+02	Ditch MAG 538 - TYPE H DBL	1,225.00	1,223.50	1,222.12	1,222.10	1,219.32	3.00	100.0	50.0	3.00	3.00	0.00	0.23	4.39
25+00	Ditch MAG 538 - TYPE H DBL	1,225.60	1,224.00	1,222.52	1,222.51	1,219.92	14.00	100.0	50.0	14.00	14.00	0.00	0.65	6.87
29+60	Ditch MAG 535 - TYPE F DOUBL	1,225.00	1,224.00	1,222.76	1,222.76	1,220.83	14.00	100.0	50.0	14.00	14.00	0.00	0.80	8.82

Scenario: STORM DRAIN 5, Highline South: 10-yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P601	29+60	27+80	14.00	179.50	30 inch	HDPE SMOOTH	1,220.83	1,220.83	1,220.47	0.002006	0.001011	0.003868	3.12	1,225.00	1,222.76	1,222.61	19.90
P602	27+80	25+00	14.00	280.00	36 inch	HDPE SMOOTH	1,220.47	1,220.47	1,219.92	0.001964	0.000415	0.003394	2.15	1,225.05	1,222.61	1,222.52	32.02
P603	25+00	24+80	28.00	20.10	36 inch	HDPE SMOOTH	1,219.92	1,219.92	1,219.88	0.001990	0.001378	0.003893	4.30	1,225.60	1,222.51	1,222.48	32.23
P604	24+80	22+02	28.00	278.60	36 inch	HDPE SMOOTH	1,219.88	1,219.88	1,219.32	0.002010	0.001335	0.003893	4.07	1,225.00	1,222.46	1,222.12	32.39
P605	22+02	21+80	31.00	21.40	36 inch	HDPE SMOOTH	1,219.32	1,219.32	1,219.27	0.002336	0.001584	0.004042	4.51	1,225.00	1,222.10	1,222.07	34.92
P606	21+80	19+12	31.00	268.30	36 inch	HDPE SMOOTH	1,219.27	1,219.27	1,218.74	0.001975	0.001600	0.004042	4.44	1,225.00	1,222.05	1,221.63	32.11
P607	19+12	18+90	41.00	21.80	36 inch	HDPE SMOOTH	1,218.74	1,218.74	1,218.69	0.002294	0.002791	0.004678	5.91	1,225.00	1,221.60	1,221.54	34.60
P608	18+90	16+15	41.00	275.80	42 inch	HDPE SMOOTH	1,218.69	1,218.69	1,218.15	0.001958	0.001373	0.003690	4.63	1,224.50	1,221.52	1,221.18	48.23
P609	16+15	16+00	51.00	12.80	42 inch	HDPE SMOOTH	1,218.15	1,218.15	1,218.12	0.002344	0.002018	0.004039	5.79	1,225.30	1,221.16	1,221.13	52.76
P610	16+00	15+05	51.00	95.10	42 inch	HDPE SMOOTH	1,218.12	1,218.12	1,217.92	0.002103	0.002614	0.004039	6.71	1,225.50	1,220.80	1,220.50	49.98

Scenario: STORM DRAIN 6 - C. BASIN 1-FOOT DEEP



Scenario: STORM DRAIN 6, Highline, Central: 10-yr

Area Inlet Report

INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
43+60	Ditch MAG 538 - TYPE H DBL	1,224.40	1,223.34	1,219.55	1,219.55	1,217.35	1.00	100.0	50.0	1.00	1.00	0.00	0.13	3.77
45+00	Ditch MAG 535 - TYPE F DOUBL	1,224.80	1,223.55	1,219.57	1,219.56	1,218.12	1.00	100.0	50.0	1.00	1.00	0.00	0.10	3.57
49+60	Ditch MAG 535 - TYPE F DOUBL	1,224.00	1,223.22	1,219.69	1,219.69	1,219.03	1.00	100.0	50.0	1.00	1.00	0.00	0.08	3.45
52+00	Ditch MAG 535 - TYPE F	1,224.00	1,223.23	1,219.92	1,219.92	1,219.51	1.00	100.0	50.0	1.00	1.00	0.00	0.11	3.66

Scenario: STORM DRAIN 6, Highline, Central: 10-yr

Combined Pipe/Node Report

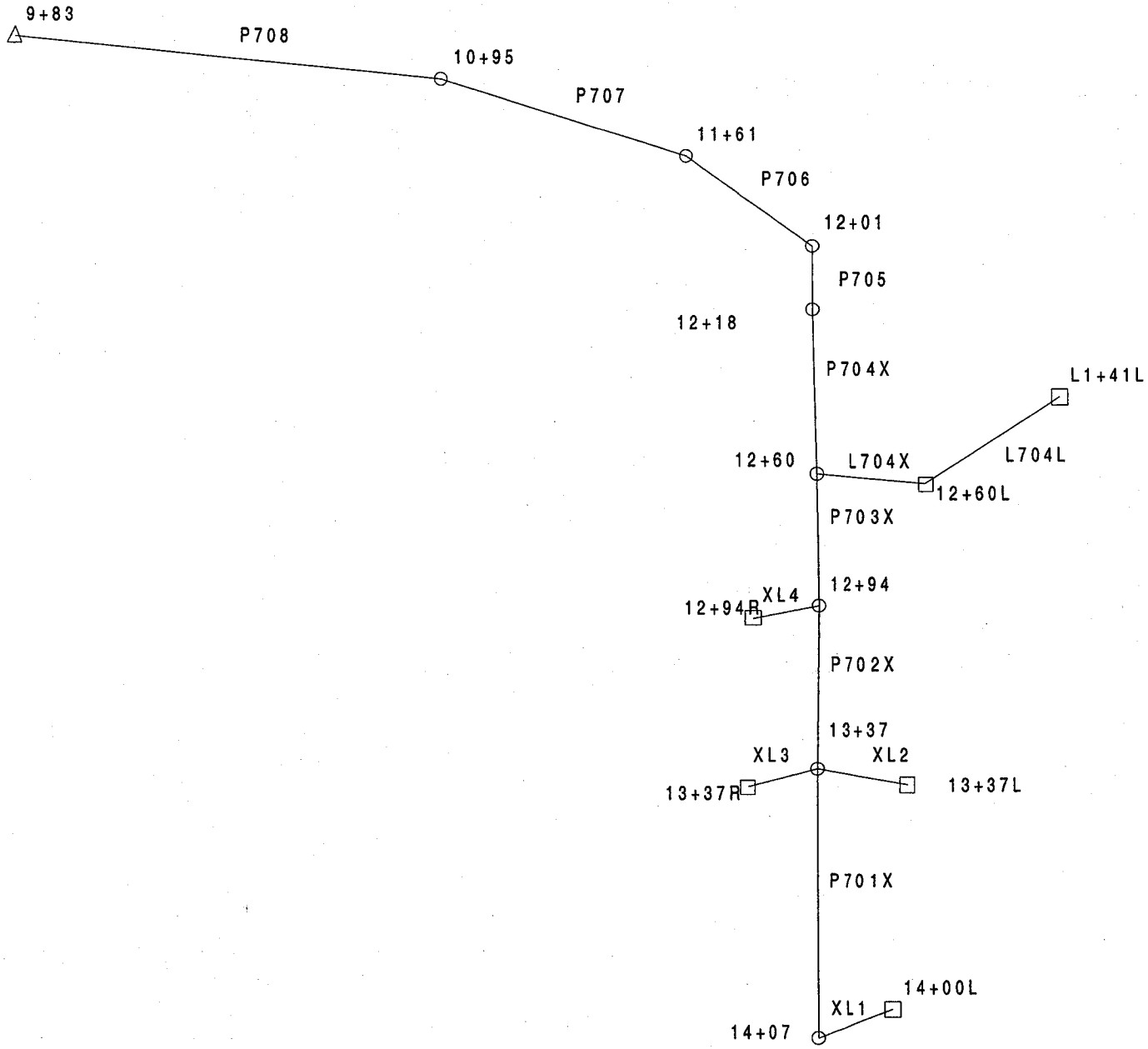
Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P501	52+00	50+60	1.00	139.90	24 inch	HDPE SMOOTH	1,219.51	1,219.51	1,219.24	0.001930	0.001785	0.003986	1.91	1,224.00	1,219.92	1,219.69	10.77
P502	50+60	49+60	1.00	100.00	24 inch	HDPE SMOOTH	1,219.24	1,219.24	1,219.03	0.002100	0.000849	0.003986	1.25	1,224.00	1,219.68	1,219.63	11.23
P503	49+60	48+73	2.00	86.40	24 inch	HDPE SMOOTH	1,219.03	1,219.03	1,218.87	0.001852	0.001661	0.003826	2.38	1,224.00	1,219.63	1,219.50	10.55
P504	48+73	47+60	2.00	113.50	24 inch	HDPE SMOOTH	1,218.87	1,218.87	1,218.64	0.002026	0.001051	0.003826	1.78	1,224.00	1,219.49	1,219.41	11.03
P505	47+60	45+00	2.00	259.90	24 inch	HDPE SMOOTH	1,218.64	1,218.64	1,218.12	0.002001	0.000318	0.003826	0.98	1,223.98	1,219.41	1,219.36	10.96
P506	45+00	44+80	3.00	20.20	24 inch	HDPE SMOOTH	1,218.12	1,218.12	1,218.08	0.001980	0.000281	0.003797	1.42	1,224.80	1,219.36	1,219.36	10.91
P507	44+80	43+60	3.00	121.40	24 inch	HDPE SMOOTH	1,218.08	1,218.08	1,217.35	0.006013	0.000174	0.003797	0.95	1,224.38	1,219.35	1,219.35	19.00
P508	43+60	43+06	4.00	52.30	24 inch	HDPE SMOOTH	1,217.35	1,217.35	1,217.03	0.006119	0.000266	0.003823	1.27	1,224.40	1,219.35	1,219.33	19.17
P509	43+06	42+00	4.00	106.30	24 inch	HDPE SMOOTH	1,217.03	1,217.03	1,215.50	0.014393	0.000266	0.003823	1.27	1,223.90	1,219.33	1,219.30	29.40

Scenario: STORM DRAIN 6 - C. BASIN 1-FOOT DEEP

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P501	52+00	50+60	1.00	139.90	24 inch	HDPE SMOOTH	1,219.51	1,219.51	1,219.24	0.001930	0.001803	0.003986	1.93	1,224.00	1,219.92	1,219.68	10.77
P502	50+60	49+60	1.00	100.00	24 inch	HDPE SMOOTH	1,219.24	1,219.24	1,219.03	0.002100	0.000886	0.003986	1.28	1,224.00	1,219.68	1,219.63	11.23
P503	49+60	48+73	2.00	86.40	24 inch	HDPE SMOOTH	1,219.03	1,219.03	1,218.87	0.001852	0.001910	0.003826	2.65	1,224.00	1,219.62	1,219.45	10.55
P504	48+73	47+60	2.00	113.50	24 inch	HDPE SMOOTH	1,218.87	1,218.87	1,218.64	0.002026	0.001989	0.003826	2.61	1,224.00	1,219.45	1,219.23	11.03
P505	47+60	45+00	2.00	259.90	24 inch	HDPE SMOOTH	1,218.64	1,218.64	1,218.12	0.002001	0.001735	0.003826	2.08	1,223.98	1,219.22	1,218.81	10.96
P506	45+00	44+80	3.00	20.20	24 inch	HDPE SMOOTH	1,218.12	1,218.12	1,218.08	0.001980	0.002729	0.003797	3.65	1,224.80	1,218.80	1,218.70	10.91
P507	44+80	43+60	3.00	121.40	24 inch	HDPE SMOOTH	1,218.08	1,218.08	1,217.35	0.006013	0.005775	0.003797	2.99	1,224.38	1,218.68	1,218.06	19.00
P508	43+60	43+06	4.00	52.30	24 inch	HDPE SMOOTH	1,217.35	1,217.35	1,217.03	0.006119	0.005970	0.003823	3.66	1,224.40	1,218.05	1,217.79	19.17
P509	43+06	42+00	4.00	106.30	24 inch	HDPE SMOOTH	1,217.03	1,217.03	1,215.50	0.014393	0.013059	0.003823	2.55	1,223.90	1,217.73	1,216.50	29.40

Scenario: STORM DRAIN 7, ADY: 10-YR



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Scenario: STORM DRAIN 7, ADY: 10-YR

Inlet Report

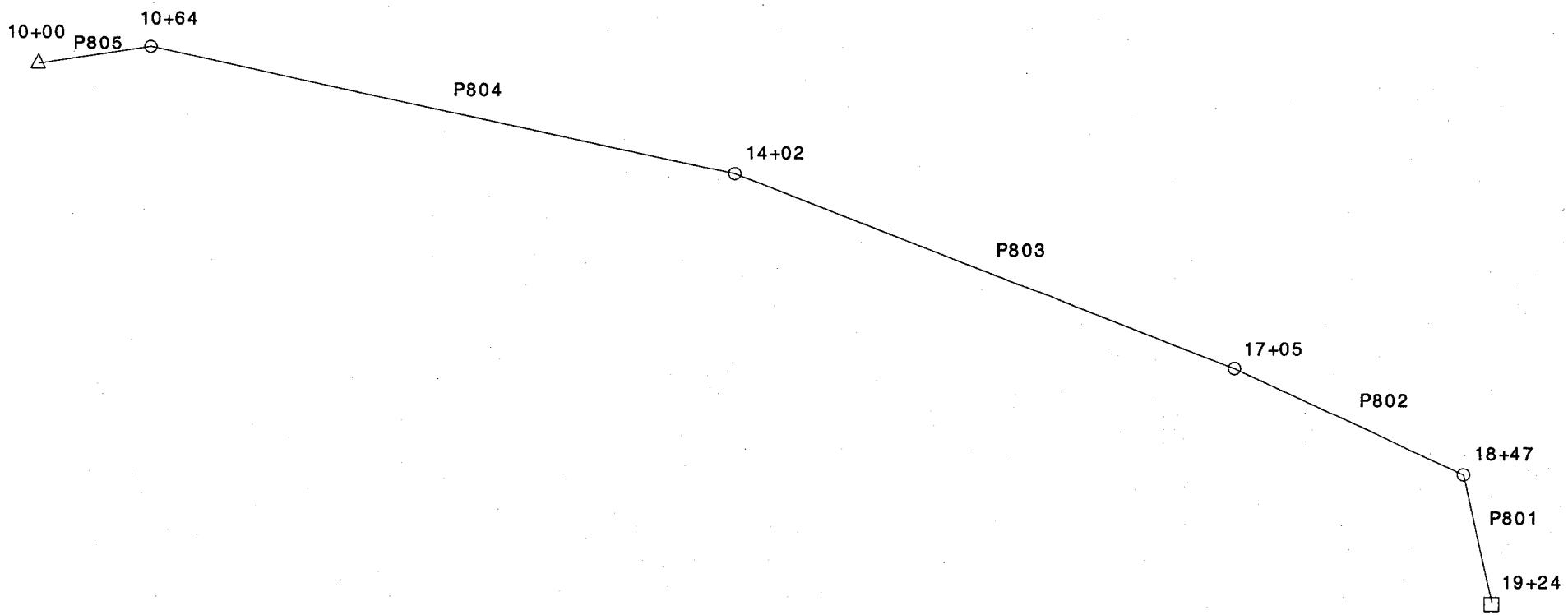
INLET	Inlet	Slotted Drain Length (ft)	Ground Elev (ft)	Grate Elev (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Bypass Target	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)	Gutter Long Slope (ft/ft)
12+60L	Curb MAG 532 - TYPE C - 13		1,224.30	1,224.30	1,219.00	1.00	70.3		5.95	4.18	1.77	<Automatic	0.40	16.83	0.003100
12+94R	Curb MAG 532 - TYPE C - 38		1,224.40	1,224.40	1,219.00	13.00	92.6		16.18	14.98	1.20	<Automatic	0.55	24.71	0.003100
13+37L	Curb MAG 532 - TYPE C - 24		1,224.50	1,224.50	1,219.00	13.00	69.4		16.18	11.23	4.95	12+60L	0.55	24.71	0.003100
13+37R	Curb MAG 532 - TYPE C - 24		1,224.50	1,224.50	1,219.00	13.00	75.6		13.00	9.82	3.18	12+94R	0.51	22.73	0.003100
14+00L	Curb MAG 532 - TYPE C - 24		1,224.60	1,224.60	1,219.00	13.00	75.6		13.00	9.82	3.18	13+37L	0.51	22.73	0.003100
L1+41L	Ditch MAG 535 - TYPE F		1,224.50	1,223.31	1,220.07	2.00	100.0	50.0	2.00	2.00	0.00		0.20	5.22	

Scenario: STORM DRAIN 7, ADY: 10-YR

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
L704L	L1+41L	12+60L	2.00	41.00	18 inch	Concrete	1,220.07	1,220.07	1,219.97	0.002439	0.000431	0.004944	1.35	1,224.50	1,221.16	1,221.15	5.19
L704X	12+60L	12+60	6.18	29.00	24 inch	Concrete	1,219.00	1,219.00	1,218.10	0.031034	0.000747	0.004668	1.97	1,224.30	1,221.11	1,221.09	39.85
P701X	14+07	13+37	9.82	70.00	48 inch	Concrete	1,218.21	1,218.21	1,217.96	0.003571	0.000059	0.003585	0.95	1,225.00	1,221.04	1,221.04	85.84
P702X	13+37	12+94	30.87	43.00	48 inch	Concrete	1,217.96	1,217.96	1,217.66	0.006977	0.000480	0.003645	2.73	1,224.50	1,221.03	1,221.03	119.97
P703X	12+94	12+60	45.86	129.00	48 inch	Concrete	1,217.66	1,217.66	1,217.48	0.001395	0.000965	0.003892	4.01	1,224.00	1,221.02	1,220.90	53.65
P704X	12+60	12+18	52.04	9.00	48 inch	Concrete	1,217.48	1,217.48	1,217.23	0.027778	0.001176	0.004023	4.30	1,224.50	1,220.89	1,220.91	239.39
P705	12+18	12+01	52.04	1.00	48 inch	Concrete	1,217.23	1,217.23	1,217.20	0.030000	0.001138	0.004023	4.29	1,224.30	1,220.89	1,220.89	248.78
P706	12+01	11+61	52.04	40.00	48 inch	Concrete	1,217.20	1,217.20	1,217.10	0.002500	0.001142	0.004023	4.29	1,224.25	1,220.84	1,220.80	71.82
P707	11+61	10+95	52.04	66.00	48 inch	Concrete	1,217.10	1,217.10	1,216.95	0.002273	0.001144	0.004023	4.28	1,223.80	1,220.73	1,220.66	68.48
P708	10+95	9+83	52.04	111.00	48 inch	Concrete	1,216.95	1,216.95	1,216.69	0.002342	0.001138	0.004023	4.21	1,223.50	1,220.61	1,220.50	69.52
XL1	14+00L	14+07	9.82	21.00	24 inch	Concrete	1,219.00	1,219.00	1,218.80	0.009524	0.001886	0.005172	3.13	1,224.60	1,221.09	1,221.05	22.08
XL2	13+37L	13+37	11.23	24.00	24 inch	Concrete	1,219.00	1,219.00	1,218.75	0.010417	0.002463	0.005430	3.57	1,224.50	1,221.17	1,221.11	23.09
XL3	13+37R	13+37	9.82	19.00	24 inch	Concrete	1,219.00	1,219.00	1,218.75	0.013158	0.001886	0.005172	3.13	1,224.50	1,221.15	1,221.11	25.95
XL4	12+94R	12+94	14.98	17.00	24 inch	Concrete	1,219.00	1,219.00	1,218.50	0.029412	0.004386	0.006313	4.77	1,224.40	1,221.25	1,221.18	38.79

Scenario: STORM DRAIN 8, N BASIN OUT: 10-Yr



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Scenario: STORM DRAIN 8, N BASIN OUT: 10-Yr

Area Inlet Report

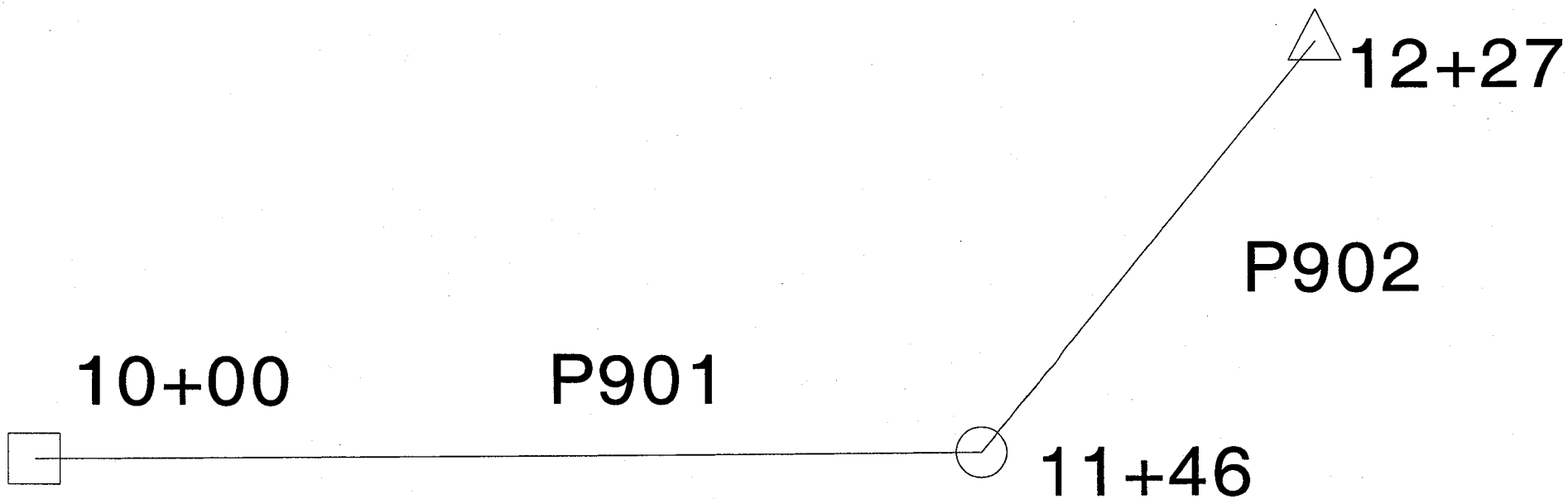
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
19+24	Ditch MAG 537 - TYPE G	1,223.50	1,219.00	1,217.88	1,217.88	1,216.83	0.00	100.0	50.0	0.00	0.00	0.00	0.00	0.00

Scenario: STORM DRAIN 8, N BASIN OUT: 10-Yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P801	19+24	18+47	2.20	75.10	18 inch	HDPE SMOOTH	1,216.83	1,216.83	1,216.76	0.000932	0.000506	0.004236	1.60	1,223.50	1,217.88	1,217.85	3.47
P802	18+47	17+05	2.20	142.00	18 inch	HDPE SMOOTH	1,216.76	1,216.76	1,216.64	0.000845	0.000482	0.004236	1.55	1,223.40	1,217.83	1,217.76	3.31
P803	17+05	14+02	2.20	303.10	18 inch	HDPE SMOOTH	1,216.64	1,216.64	1,216.36	0.000924	0.000397	0.004236	1.36	1,223.50	1,217.76	1,217.65	3.46
P804	14+02	10+64	2.20	337.60	18 inch	HDPE SMOOTH	1,216.36	1,216.36	1,216.06	0.000889	0.000334	0.004236	1.25	1,224.18	1,217.64	1,217.53	3.39
P805	10+64	10+00	2.20	64.50	18 inch	HDPE SMOOTH	1,216.06	1,216.06	1,216.00	0.000930	0.000348	0.004236	1.24	1,223.33	1,217.52	1,217.50	3.47

Scenario: STORM DRAIN 9, Cerritos: 10-Yr



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Scenario: STORM DRAIN 9, Cerritos: 10-Yr

Area Inlet Report

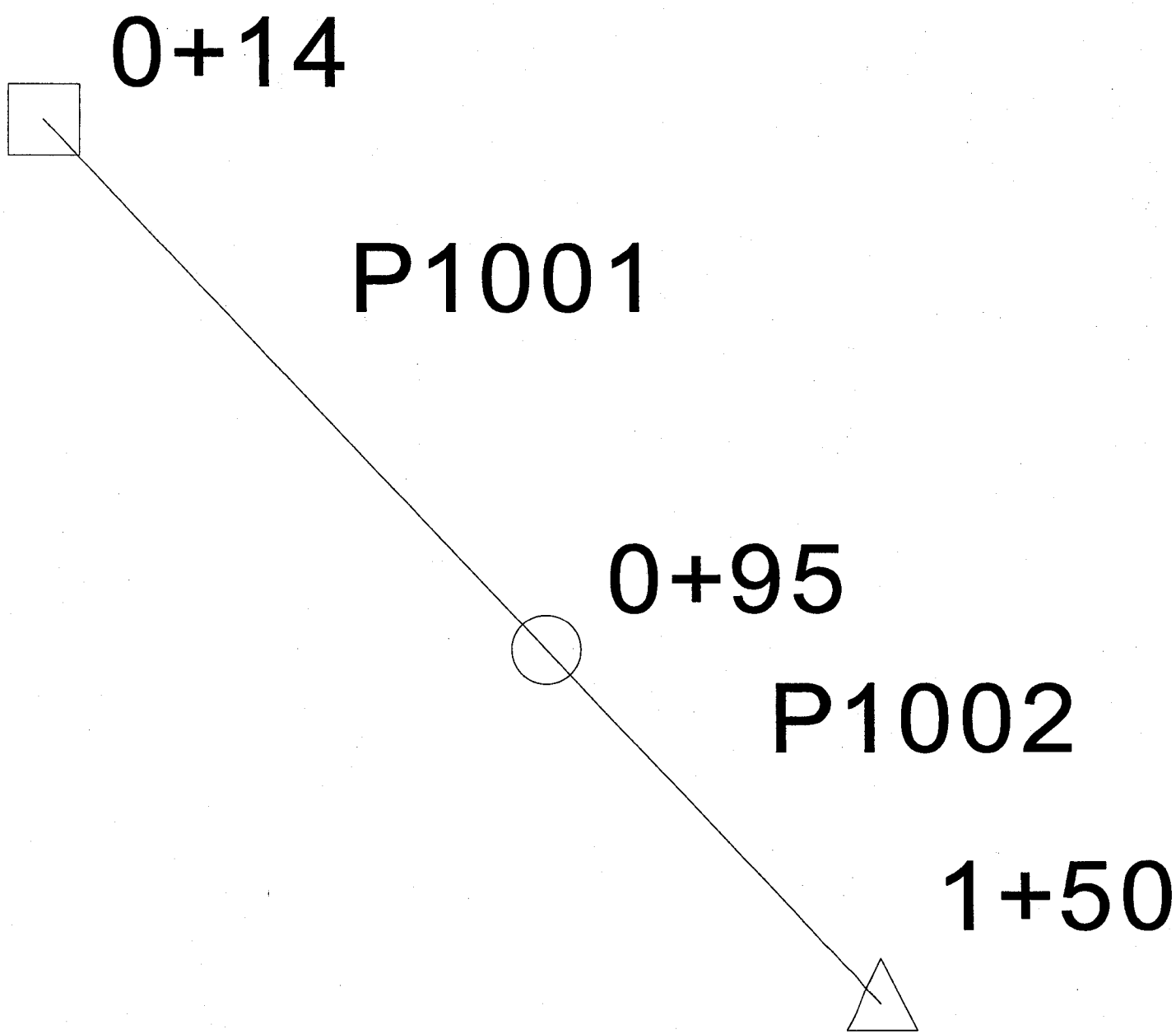
INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
10+00	Ditch ADOT C-15.90	1,226.00	1,225.32	1,222.91	1,222.91	1,220.37	36.00	100.0	50.0	36.00	36.00	0.00	0.91	8.48

Scenario: STORM DRAIN 9, Cerritos: 10-Yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P901	10+00	11+46	36.00	145.50	30 inch	HDPE SMOOTH	1,220.37	1,220.37	1,219.74	0.004330	0.005998	0.006646	8.34	1,226.00	1,222.91	1,221.80	29.24
P902	11+46	12+27	36.00	82.00	30 inch	Steel	1,217.13	1,217.13	1,216.78	0.004268	0.007704	0.007800	7.33	1,224.63	1,221.13	1,220.50	26.80

Scenario: STORM DRAIN 10, C BASIN OUT: 10-Yr



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Scenario: STORM DRAIN 10, C BASIN OUT: 10-Yr

Area Inlet Report

INLET	Inlet	Ground Elev (ft)	Grate Elev (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)	Sump Elev (ft)	Addtnl Carryover (cfs)	Capture Effic (%)	Clog (%)	Total Inlet Addtnl Flow (cfs)	Intercept Addtnl Flow (cfs)	Bypass Addtnl Flow (cfs)	Gutter or Ditch Depth (ft)	Gutter or Ditch Spread (ft)
0+14	Generic MAG 501-5 DROP 18	1,225.50	1,218.20	1,218.10	1,218.10	1,214.00	6.00	100.0		6.00	6.00	0.00	0.00	0.00

Scenario: STORM DRAIN 10, C BASIN OUT: 10-Yr

Combined Pipe/Node Report

Pipe	Up. Node	Dn. Node	System Q (cfs)	Length (ft)	Size	Material	Up Sump (ft)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Energy Slope (ft/ft)	Critical Slope (ft/ft)	Velocity Out (ft/s)	Up Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Cap (cfs)
P1001	0+14	0+95	6.00	79.00	18 inch	HDPE SMOOTH	1,214.00	1,214.50	1,215.54	-0.013165	0.002780	0.005304	3.40	1,225.50	1,218.10	1,217.88	-13.06
P1002	0+95	1+50	6.00	53.00	18 inch	HDPE SMOOTH	1,215.54	1,215.54	1,216.24	-0.013208	0.002770	0.005304	3.42	1,226.00	1,217.85	1,217.70	-13.08

Ditch, SD4 Sta 15+00 to 10+66
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch, SD4 Sta 15+00 to 10+66
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.010000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	22.00	cfs

Results		
Depth	1.32	ft
Flow Area	7.0	ft^2
Wetted Perimeter	10.89	ft
Top Width	10.56	ft
Critical Depth	1.13	ft
Critical Slope	0.022452	ft/ft
Velocity	3.15	ft/s
Velocity Head	0.15	ft
Specific Energy	1.48	ft
Froude Number	0.68	
Flow Type	Subcritical	

SD 4 O&M

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Ditch Sta 16+00 to 18+90
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 18+90 to 16+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.004320	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.54	ft
Flow Area	0.9	ft^2
Wetted Perimeter	3.44	ft
Top Width	3.26	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	1.13	ft/s
Velocity Head	0.02	ft
Specific Energy	0.56	ft
Froude Number	0.38	
Flow Type	Subcritical	

SD 5

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Ditch Sta 21+55 to 19+12
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 21+55 to 19+12
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.004440	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	11.00	cfs

Results		
Depth	1.33	ft
Flow Area	5.3	ft^2
Wetted Perimeter	8.40	ft
Top Width	7.97	ft
Critical Depth	0.96	ft
Critical Slope	0.024417	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	1.40	ft
Froude Number	0.45	
Flow Type	Subcritical	

SD5

Ditch Sta 24+80 to 22+02
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 24+80 to 22+02
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005400	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	11.00	cfs

Results		
Depth	1.28	ft
Flow Area	4.9	ft²
Wetted Perimeter	8.10	ft
Top Width	7.68	ft
Critical Depth	0.96	ft
Critical Slope	0.024417	ft/ft
Velocity	2.24	ft/s
Velocity Head	0.08	ft
Specific Energy	1.36	ft
Froude Number	0.49	
Flow Type	Subcritical	

5D5

Ditch Sta 27+80 to 25+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 27+80 to 25+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.003800	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	11.00	cfs

Results		
Depth	1.37	ft
Flow Area	5.6	ft^2
Wetted Perimeter	8.65	ft
Top Width	8.20	ft
Critical Depth	0.96	ft
Critical Slope	0.024417	ft/ft
Velocity	1.96	ft/s
Velocity Head	0.06	ft
Specific Energy	1.43	ft
Froude Number	0.42	
Flow Type	Subcritical	

SD 5

Ditch Sta 27+80 to 29+60
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 27+80 to 29+60
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005860	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	6.00	cfs

Results		
Depth	1.00	ft
Flow Area	3.0	ft^2
Wetted Perimeter	6.35	ft
Top Width	6.03	ft
Critical Depth	0.76	ft
Critical Slope	0.026472	ft/ft
Velocity	1.98	ft/s
Velocity Head	0.06	ft
Specific Energy	1.07	ft
Froude Number	0.49	
Flow Type	Subcritical	

SD 5

Ditch Sta 42+76 to 43+60
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 42+76 to 43+60
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.010190	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	5.00	cfs

Results		
Depth	0.85	ft
Flow Area	2.1	ft^2
Wetted Perimeter	5.35	ft
Top Width	5.07	ft
Critical Depth	0.70	ft
Critical Slope	0.027124	ft/ft
Velocity	2.33	ft/s
Velocity Head	0.08	ft
Specific Energy	0.93	ft
Froude Number	0.63	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD 6

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Ditch Sta 44+80 to 43+60
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 44+80 to 43+60
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.008680	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.48	ft
Flow Area	0.7	ft²
Wetted Perimeter	3.01	ft
Top Width	2.86	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	1.47	ft/s
Velocity Head	0.03	ft
Specific Energy	0.51	ft
Froude Number	0.53	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD6

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Ditch Sta 47+60 to 45+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 47+60 to 45+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.001670	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.65	ft
Flow Area	1.3	ft^2
Wetted Perimeter	4.11	ft
Top Width	3.89	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	0.79	ft/s
Velocity Head	0.01	ft
Specific Energy	0.66	ft
Froude Number	0.24	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD6

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Ditch Sta 47+60 to 49+60
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 47+60 to 49+60
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.002980	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.58	ft
Flow Area	1.0	ft²
Wetted Perimeter	3.68	ft
Top Width	3.49	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	0.98	ft/s
Velocity Head	0.02	ft
Specific Energy	0.60	ft
Froude Number	0.32	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD 6

Ditch Sta 50+60 to 49+60
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 50+60 to 49+60
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.007800	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.49	ft
Flow Area	0.7	ft^2
Wetted Perimeter	3.08	ft
Top Width	2.92	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	1.41	ft/s
Velocity Head	0.03	ft
Specific Energy	0.52	ft
Froude Number	0.50	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD 6

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Ditch Sta 50+60 to 52+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 50+60 to 52+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005530	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.52	ft
Flow Area	0.8	ft^2
Wetted Perimeter	3.28	ft
Top Width	3.11	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	1.24	ft/s
Velocity Head	0.02	ft
Specific Energy	0.54	ft
Froude Number	0.43	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD 6

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Ditch Sta 54+40 to 52+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 54+40 to 52+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.004610	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.54	ft
Flow Area	0.9	ft^2
Wetted Perimeter	3.39	ft
Top Width	3.22	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	1.16	ft/s
Velocity Head	0.02	ft
Specific Energy	0.56	ft
Froude Number	0.39	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD 6

Ditch Sta 55+10 to 57+67
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 55+10 to 57+67
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.002340	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	cfs

Results		
Depth	0.61	ft
Flow Area	1.1	ft²
Wetted Perimeter	3.85	ft
Top Width	3.66	ft
Critical Depth	0.37	ft
Critical Slope	0.033616	ft/ft
Velocity	0.90	ft/s
Velocity Head	0.01	ft
Specific Energy	0.62	ft
Froude Number	0.29	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD2-2

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Ditch Sta 62+00 to 58+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 62+00 to 58+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.020	
Slope	0.002000	ft/ft
Depth	3.00	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V

Results		
Discharge	113.50	cfs
Flow Area	27.0	ft^2
Wetted Perimeter	18.97	ft
Top Width	18.00	ft
Critical Depth	2.45	ft
Critical Slope	0.005841	ft/ft
Velocity	4.20	ft/s
Velocity Head	0.27	ft
Specific Energy	3.27	ft
Froude Number	0.61	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1225.0

SD2-2

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HIGHLINE CONCRETE V-DITCH - STA 63+60 TO 58+20
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 63+60 TO 58+20 CONC
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.020	
Slope	0.002000	ft/ft
Left Side Slope	1.50	H : V
Right Side Slope	2.00	H : V
Discharge	28.00	cfs

Results		
Depth	2.22	ft
Flow Area	8.6	ft²
Wetted Perimeter	8.98	ft
Top Width	7.78	ft
Critical Depth	1.74	ft
Critical Slope	0.007391	ft/ft
Velocity	3.24	ft/s
Velocity Head	0.16	ft
Specific Energy	2.39	ft
Froude Number	0.54	
Flow Type	Subcritical	

Notes: UPPER PORTION IS UNLINED FROM STA 63+60 TO 62+00.
CONC LINED DITCH FROM STA 62+00 TO 58+20.

SD 2-2

Ditch Sta 67+00 to 72+00
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 67+00 to 72+00
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.002400	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	5.00	cfs

Results		
Depth	1.11	ft
Flow Area	3.7	ft^2
Wetted Perimeter	7.01	ft
Top Width	6.65	ft
Critical Depth	0.70	ft
Critical Slope	0.027124	ft/ft
Velocity	1.36	ft/s
Velocity Head	0.03	ft
Specific Energy	1.14	ft
Froude Number	0.32	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD2-2

Ditch Sta 72+00 to 74+18
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 72+00 to 74+18
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.003350	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	7.00	cfs

Results		
Depth	1.18	ft
Flow Area	4.2	ft²
Wetted Perimeter	7.47	ft
Top Width	7.09	ft
Critical Depth	0.81	ft
Critical Slope	0.025934	ft/ft
Velocity	1.67	ft/s
Velocity Head	0.04	ft
Specific Energy	1.23	ft
Froude Number	0.38	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD 1

Ditch Sta 74+16 to 74+88
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 74+16 to 74+88
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.009380	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	12.00	cfs

Results		
Depth	1.19	ft
Flow Area	4.3	ft²
Wetted Perimeter	7.54	ft
Top Width	7.16	ft
Critical Depth	1.00	ft
Critical Slope	0.024135	ft/ft
Velocity	2.81	ft/s
Velocity Head	0.12	ft
Specific Energy	1.32	ft
Froude Number	0.64	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD 1

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Ditch Sta 75+13 TO 75+82
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 75+13 TO 75+82
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.014460	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	10.00	cfs

Results		
Depth	1.03	ft
Flow Area	3.2	ft²
Wetted Perimeter	6.50	ft
Top Width	6.16	ft
Critical Depth	0.93	ft
Critical Slope	0.024729	ft/ft
Velocity	3.16	ft/s
Velocity Head	0.16	ft
Specific Energy	1.18	ft
Froude Number	0.78	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD1

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Ditch Sta 80+70 to 75+82
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 80+70 to 75+82
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.002000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	10.00	cfs

Results		
Depth	1.49	ft
Flow Area	6.6	ft²
Wetted Perimeter	9.41	ft
Top Width	8.93	ft
Critical Depth	0.93	ft
Critical Slope	0.024729	ft/ft
Velocity	1.51	ft/s
Velocity Head	0.04	ft
Specific Energy	1.52	ft
Froude Number	0.31	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD1

Ditch Sta 83+40 to 84+63
Worksheet for Triangular Channel

Project Description	
Worksheet	Ditch Sta 83+40 to 84+63
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.003880	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	2.00	cfs

Results		
Depth	0.72	ft
Flow Area	1.5	ft^2
Wetted Perimeter	4.55	ft
Top Width	4.31	ft
Critical Depth	0.49	ft
Critical Slope	0.030648	ft/ft
Velocity	1.29	ft/s
Velocity Head	0.03	ft
Specific Energy	0.74	ft
Froude Number	0.38	
Flow Type	Subcritical	

Notes: O&M Road elevation is 1223.5

SD 7-1

DITCH - CERRITOS - 10-YR
Worksheet for Triangular Channel

Project Description	
Worksheet	DITCH CERRITOS
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Slope	0.020000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	36.00	cfs

Results		
Depth	1.64	ft
Flow Area	8.1	ft²
Wetted Perimeter	10.39	ft
Top Width	9.85	ft
Critical Depth	1.55	ft
Critical Slope	0.027228	ft/ft
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	1.95	ft
Froude Number	0.87	
Flow Type	Subcritical	

Notes: 10-YR FLOW - 36 CFS

SD9

TYPICAL DOUBLE GRATE INLET (P-1570)
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	GRATE ON GRADE (DOUBL
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.00	cfs
Slope	0.005000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.020000	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.015	
Grate Width	2.00	ft
Grate Length	6.50	ft
Grate Type	30 Deg Tilt Bar	
Clogging	50.0	%

Options	
Grate Flow Option	Exclude None

Results		
Efficiency	0.76	
Intercepted Flow	0.76	cfs
Bypass Flow	0.24	cfs
Spread	8.01	ft
Depth	0.16	ft
Flow Area	0.6	ft^2
Gutter Depression	0.0	in
Total Depression	0.0	in
Velocity	1.56	ft/s
Splash Over Velocity	6.47	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.47	
Grate Flow Ratio	0.54	
Active Grate Length	3.25	ft

P-1570 GRATE INLET-DOUBLE
Rating Table for Grate Inlet On Grade

Project Description	
Worksheet	GRATE ON GRADE (DOUBL
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Gutter Width	2.00	ft
Gutter Cross Slope	0.020000	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.015	
Grate Width	2.00	ft
Grate Length	6.50	ft
Grate Type	30 Deg Tilt Bar	
Clogging	50.0	%

Options	
Grate Flow Option	Exclude None

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	2.00	10.00	2.00
Slope (ft/ft)	0.003000	0.012000	0.003000

Discharge (cfs)	Slope (ft/ft)	Efficiency	Intercepted Flow (cfs)
2.00	0.003000	0.69	1.38
4.00	0.003000	0.60	2.39
6.00	0.003000	0.54	3.25
8.00	0.003000	0.50	4.02
10.00	0.003000	0.47	4.74
2.00	0.006000	0.65	1.30
4.00	0.006000	0.55	2.21
6.00	0.006000	0.49	2.97
8.00	0.006000	0.46	3.65
10.00	0.006000	0.43	4.27
2.00	0.009000	0.64	1.27
4.00	0.009000	0.53	2.14
6.00	0.009000	0.48	2.87
8.00	0.009000	0.44	3.52
10.00	0.009000	0.41	4.11
2.00	0.012000	0.63	1.26
4.00	0.012000	0.53	2.11
6.00	0.012000	0.47	2.82
8.00	0.012000	0.43	3.46
10.00	0.012000	0.40	4.04

Notes: FUNCTIONALLY, THE GRATE CATCH BASIN WILL INTERCEPT FLOW-BY PAST THE SLOTTED DRAIN, IN THE AMOUNT SHOWN ON THE RATING TABLE.

HOWEVER FOR DESIGN PURPOSES:
THIS GRATE CAPACITY IS NOT CONSIDERED IN STORM DRAIN HYDRAULIC MODELS.

RATHER, THE SLOTTED DRAIN IS ASSUMED TO BE THE SOLE INFLOW INTO ONE OF THESE CATCH BASINS.

SPILLWAY FOR CERRITOS CHANNEL
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	INLET APRON FOR CERRITOS CI
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Slope	0.002000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	6.00	ft
Discharge	36.00	cfs

Results		
Depth	0.94	ft
Flow Area	9.2	ft^2
Wetted Perimeter	13.77	ft
Top Width	13.54	ft
Critical Depth	0.85	ft
Critical Slope	0.002942	ft/ft
Velocity	3.91	ft/s
Velocity Head	0.24	ft
Specific Energy	1.18	ft
Froude Number	0.84	
Flow Type	Subcritical	

SPILLWAY FOR CERRITOS V-DITCH
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	DITCH - CERRITOS - INLET APRON
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Slope	0.006600	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	4.00	ft
Discharge	36.00	cfs

Results		
Depth	0.86	ft
Flow Area	6.4	ft^2
Wetted Perimeter	11.12	ft
Top Width	10.91	ft
Critical Depth	0.99	ft
Critical Slope	0.003872	ft/ft
Velocity	5.59	ft/s
Velocity Head	0.49	ft
Specific Energy	1.35	ft
Froude Number	1.28	
Flow Type	Supercritical	

SVERDRUP

JOB GUADALUPE 10-YR

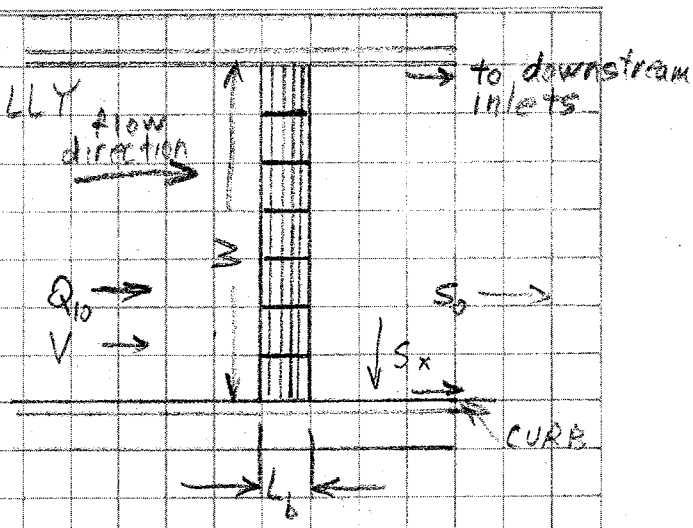
COMPUTATIONS FOR CROSS-STREET DRAINS

SHEET NO. 1 OF

DATE 11-04-2001

BY DES CHKD BDO

THE LENGTH OF GRATE TO IDEALLY INTERCEPT 100% OF FLOW IS:



Determined from Chart 7 (FHWA HEC-12)

L = Length of Grate Required to intercept 100% of flow

V = mean approach velocity

d = depth of flow at curb (ft)

GRATE USED

MAG DET 534-5, VANED GRATE (See Attached Figures)

C_f = clogging factor 0.60 → 1.60 applied to raw length for on-slope grate inlets

CALLE GLORIA

The velocity determined using FlowMaster software (SEE ATTACHED) and a Q = 43 cfs, S_o = 0.0177 ft/ft, W = 31.5', NORMAL CROWN

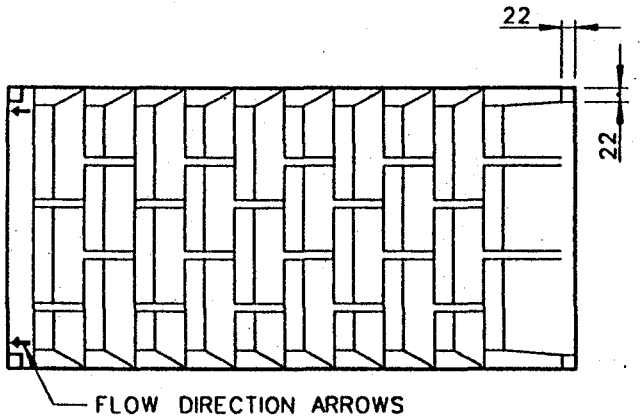
V = 5.26 ft/sec and d = 0.26'

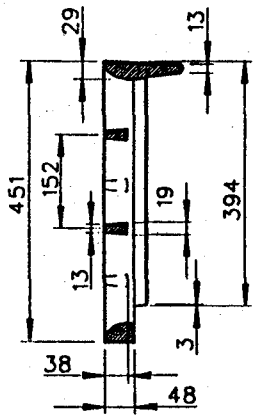
L = 1.6 feet (from figure) → L_T = 1.6' * 1.60 = 2.56' < 3.08' (ACTUAL LENGTH)

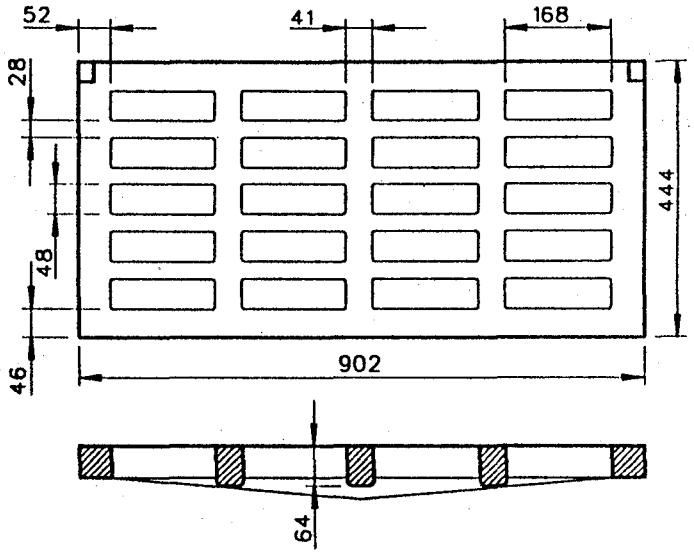
(THEREFORE GRATE WILL INTERCEPT 100% OF FLOW)

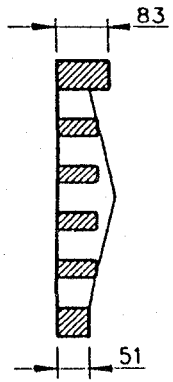
SIMILARLY FOR THE FOLLOWING STREETS

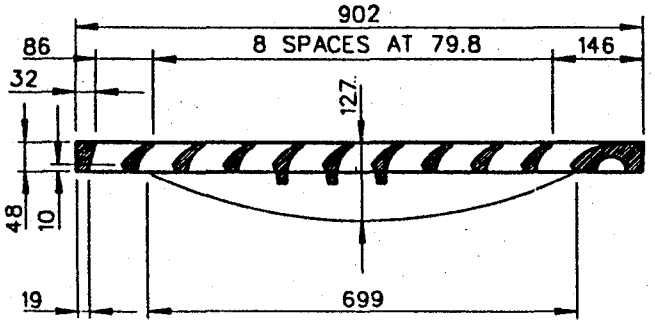
STREET	Q (cfs)	Slope (ft/ft)	W (ft)	V (ft/s)	d (ft)	L (ft)	L_b (ft)	OK?
C. MAGDALENA	26	0.033	30.0	5.34	0.16'	1.65'	2.64'	< 3.08' ✓
C. SAN ANGELO	26	0.0429	34.5	5.50	0.14'	1.70'	2.72'	< 3.08' ✓
C. IGLESIA	36	0.0200	31.5	5.09	0.22'	1.50'	2.40'	< 3.08' ✓
C. MEXICO	68	0.0080	31.5	5.00	0.44'	1.45'	2.32'	< 3.08' ✓

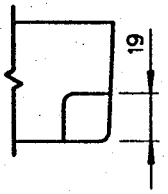




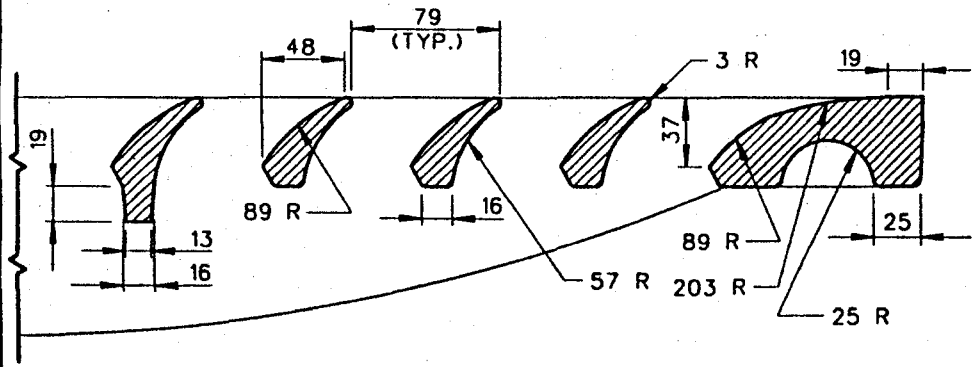




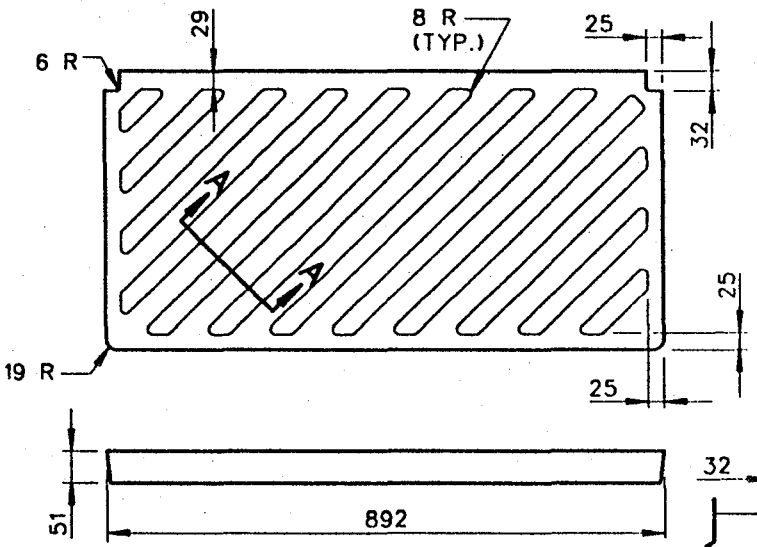


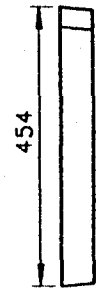


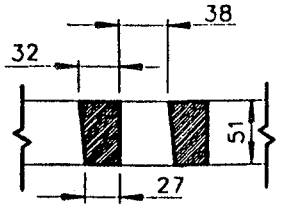
NOTCH DETAIL



VANE DETAIL







SECTION A-A

DETAIL NO.				DETAIL NO.
534–5	MARICOPA ASSOCIATION of GOVERNMENTS	STANDARD DETAIL METRIC	**ALTERNATE GRATE STYLES SUMP LOCATION**	534–5

CALLE GLORIA w/ X-STEET DRAIN
Worksheet for Irregular Channel

Project Description	
Worksheet	CALLE GLORIA - STREET SECTIOI
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.017700	ft/ft
Discharge	43.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.26	ft
Elevation Range	0.00 to 0.50	
Flow Area	8.2	ft^2
Wetted Perimeter	32.44	ft
Top Width	32.27	ft
Actual Depth	0.26	ft
Critical Elevation	0.38	ft
Critical Slope	0.004582	ft/ft
Velocity	5.26	ft/s
Velocity Head	0.43	ft
Specific Energy	0.69	ft
Froude Number	1.84	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+33	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.00
0+16	0.00
0+32	0.00
0+33	0.50

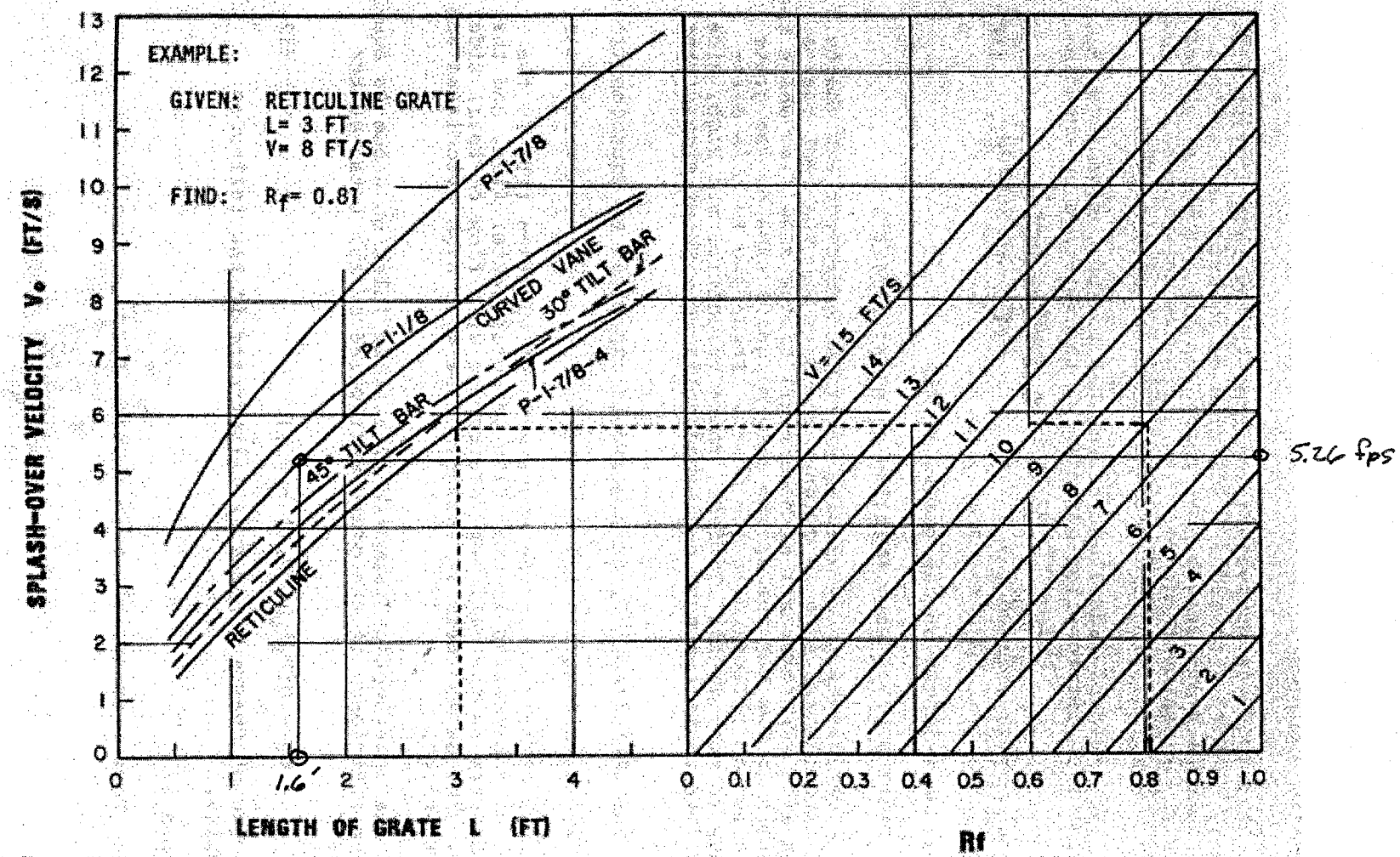


Chart 7. Grate inlet frontal flow interception efficiency.

This ratio is equivalent to frontal flow interception efficiency. Chart 7 provides a solution of Equation (9) which takes into account grate length, bar configuration and gutter velocity at which splash-over occurs. The gutter velocity needed to use Chart 7 is total gutter flow divided by the area of flow.

Calle Gloria for V= 5.26 fps need L= 1.6 feet of grate

CALLE MAGDALENA w/ X-STREET INLET
Worksheet for Irregular Channel

Project Description	
Worksheet	CALLE MAGDALENA - STREET SECTI
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.033000	ft/ft
Discharge	26.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.16	ft
Elevation Range	0.00 to 0.50	
Flow Area	4.9	ft²
Wetted Perimeter	30.10	ft
Top Width	29.99	ft
Actual Depth	0.16	ft
Critical Elevation	0.29	ft
Critical Slope	0.005032	ft/ft
Velocity	5.34	ft/s
Velocity Head	0.44	ft
Specific Energy	0.61	ft
Froude Number	2.34	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+31	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.00
0+15	0.00
0+30	0.00
0+31	0.50

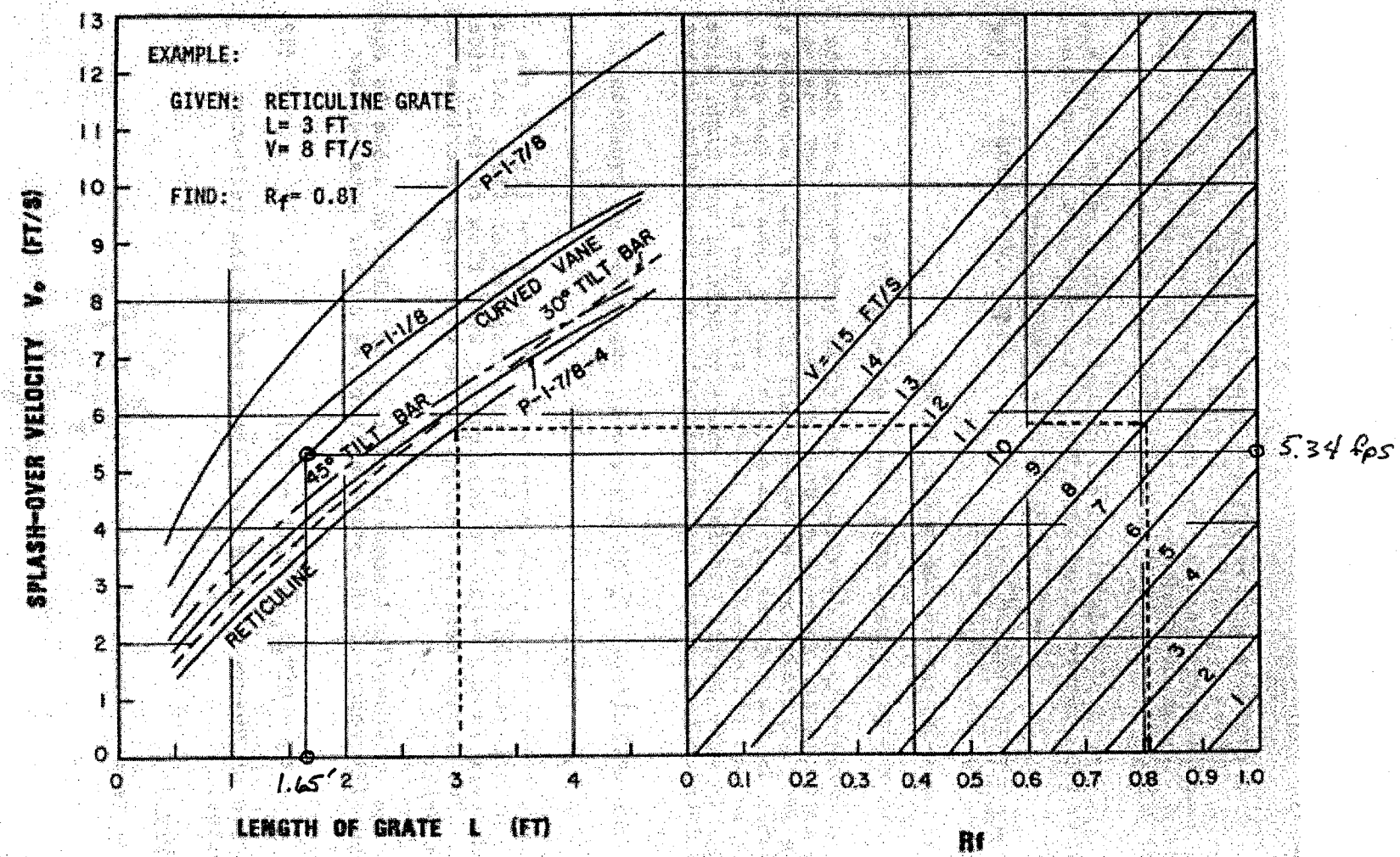


Chart 7. Grate inlet frontal flow interception efficiency.

This ratio is equivalent to frontal flow interception efficiency. Chart 7 provides a solution of Equation (9) which takes into account grate length, bar configuration and gutter velocity at which splash-over occurs. The gutter velocity needed to use Chart 7 is total gutter flow divided by the area of flow.

Calle Magdalena for V= 5.34 fps need L= 1.65 feet of grate

CALLE SAN ANGELO w/ X-STREET INLET
Worksheet for Irregular Channel

Project Description	
Worksheet	CALLE SAN ANGELO - STREET SECTIC
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.042900	ft/ft
Discharge	26.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.14	ft
Elevation Range	0.00 to 0.50	
Flow Area	4.7	ft²
Wetted Perimeter	34.01	ft
Top Width	33.92	ft
Actual Depth	0.14	ft
Critical Elevation	0.26	ft
Critical Slope	0.005162	ft/ft
Velocity	5.50	ft/s
Velocity Head	0.47	ft
Specific Energy	0.61	ft
Froude Number	2.60	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+35	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.00
0+17	0.00
0+34	0.00
0+35	0.50

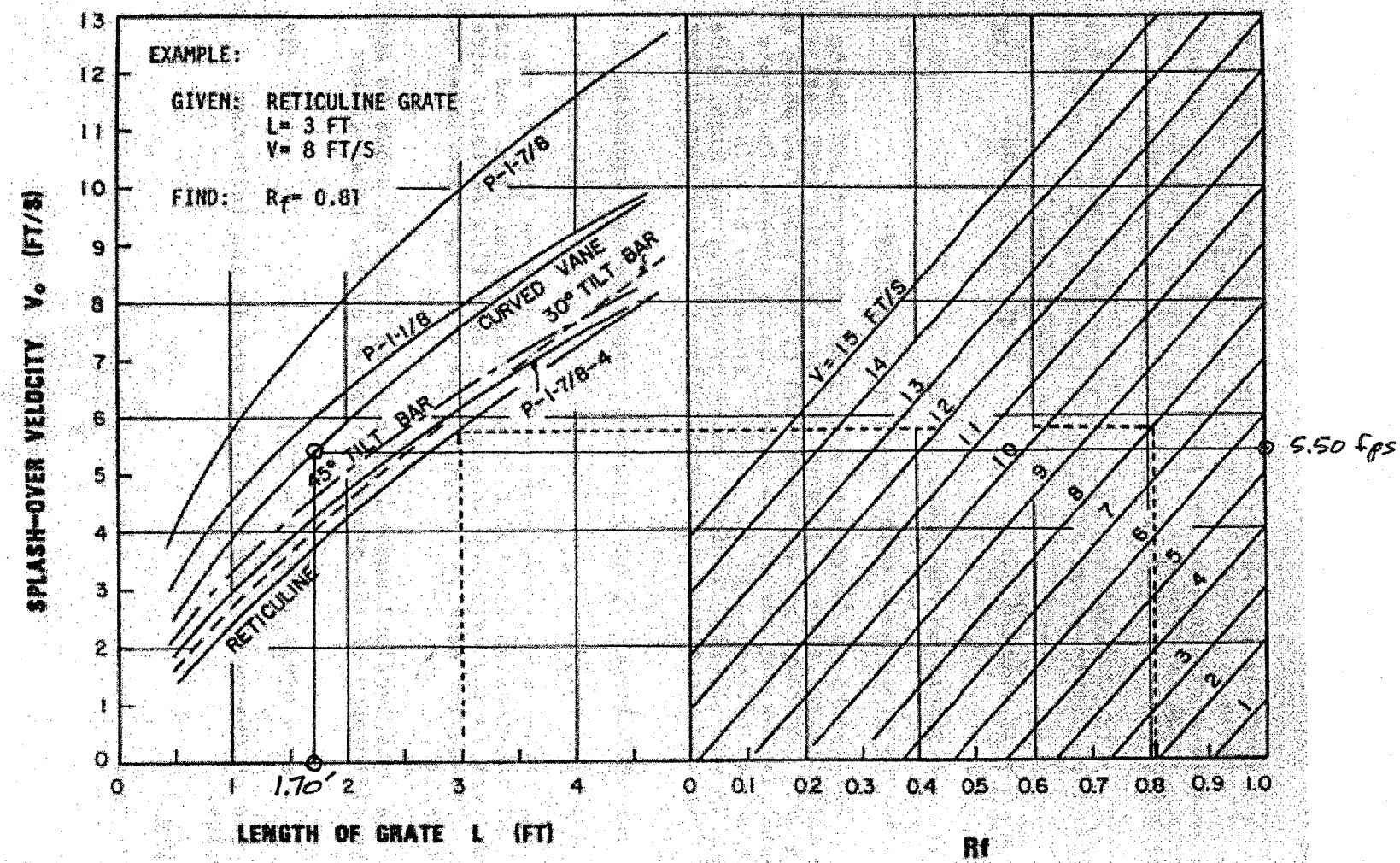


Chart 7. Grate inlet frontal flow interception efficiency.

This ratio is equivalent to frontal flow interception efficiency. Chart 7 provides a solution of Equation (9) which takes into account grate length, bar configuration and gutter velocity at which splash-over occurs. The gutter velocity needed to use Chart 7 is total gutter flow divided by the area of flow.

Calle San Angelo for V= 5.5 fps need L = 1.70 feet of grate

CALLE IGLESIA w/ X-STREET INLET
Worksheet for Irregular Channel

Project Description	
Worksheet	CALLE IGLESIA - STREET SECTION
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.020000	ft/ft
Discharge	36.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.22	ft
Elevation Range	0.00 to 0.50	
Flow Area	7.1	ft²
Wetted Perimeter	32.31	ft
Top Width	32.17	ft
Actual Depth	0.22	ft
Critical Elevation	0.34	ft
Critical Slope	0.004757	ft/ft
Velocity	5.09	ft/s
Velocity Head	0.40	ft
Specific Energy	0.62	ft
Froude Number	1.91	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+33	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.00
0+16	0.00
0+32	0.00
0+33	0.50

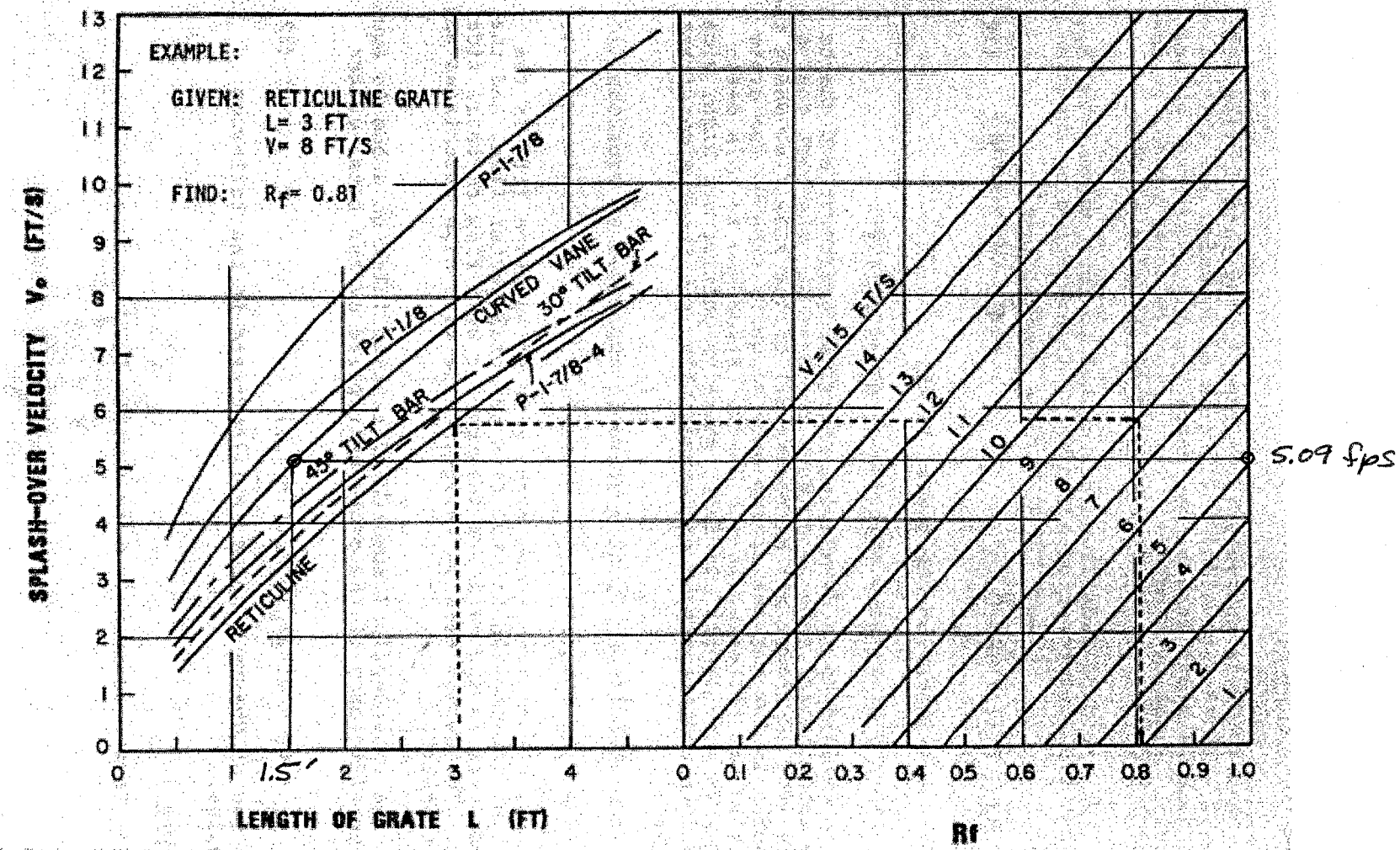


Chart 7. Grate inlet frontal flow interception efficiency.

This ratio is equivalent to frontal flow interception efficiency. Chart 7 provides a solution of Equation (9) which takes into account grate length, bar configuration and gutter velocity at which splash-over occurs. The gutter velocity needed to use Chart 7 is total gutter flow divided by the area of flow.

Calle Iglesia for V = 5.09 fps need L = 1.5 feet of grate

CALLE MEXICO w/ X-STREET INLET
Worksheet for Irregular Channel

Project Description	
Worksheet	CALLE MEXICO - STREET SECTIO
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.008000	ft/ft
Discharge	68.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.44	ft
Elevation Range	0.00 to 1.00	
Flow Area	13.6	ft²
Wetted Perimeter	32.09	ft
Top Width	31.81	ft
Actual Depth	0.44	ft
Critical Elevation	0.55	ft
Critical Slope	0.004227	ft/ft
Velocity	5.00	ft/s
Velocity Head	0.39	ft
Specific Energy	0.82	ft
Froude Number	1.35	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
-0+20	0+00	0.025
0+00	0+32	0.015
0+32	0+50	0.025

Natural Channel Points

Station (ft)	Elevation (ft)
-0+20	1.00
0+00	0.50
0+01	0.00
0+16	0.00
0+31	0.00
0+32	0.50
0+50	1.00

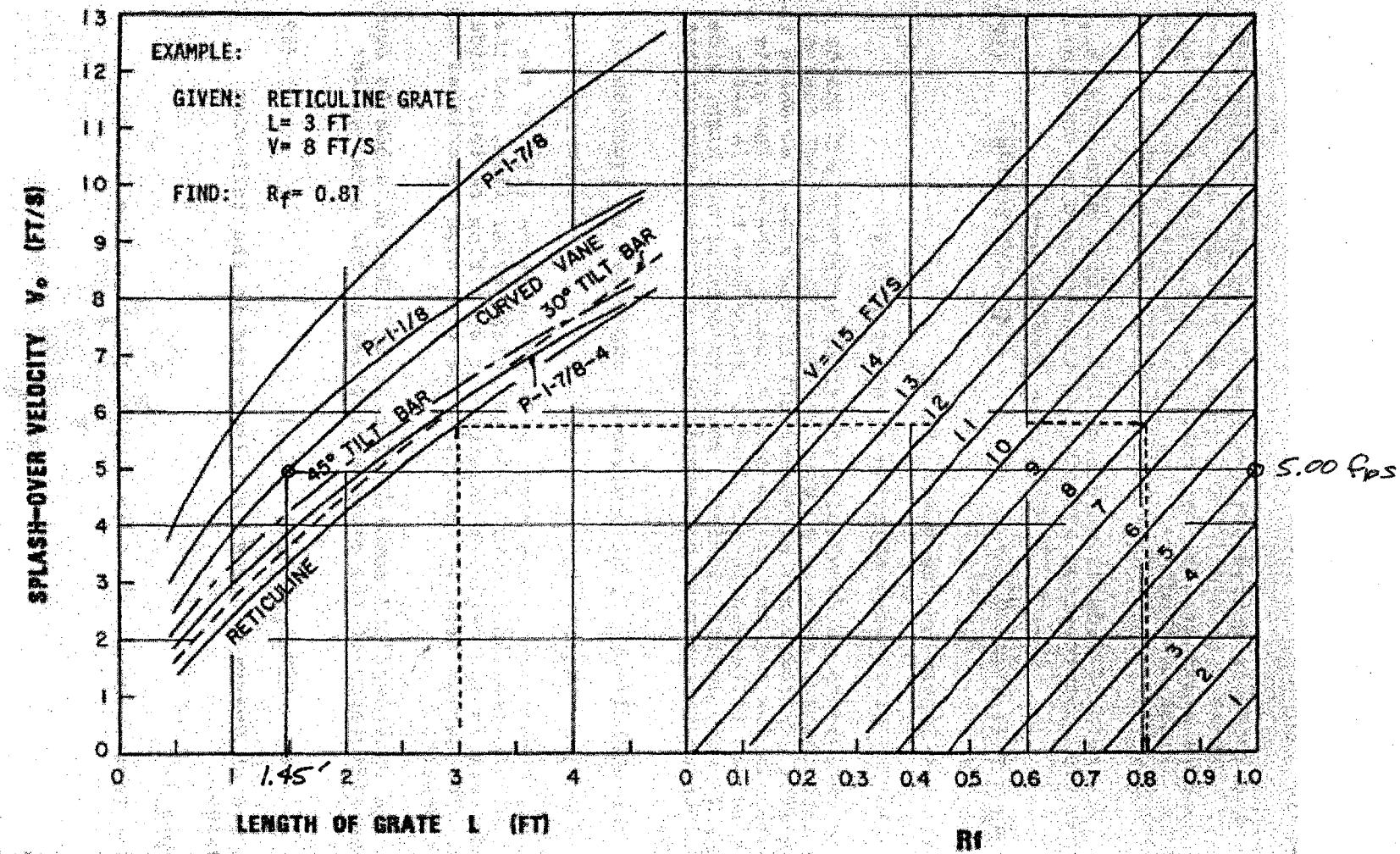


Chart 7. Grate inlet frontal flow interception efficiency.

This ratio is equivalent to frontal flow interception efficiency. Chart 7 provides a solution of Equation (9) which takes into account grate length, bar configuration and gutter velocity at which splash-over occurs. The gutter velocity needed to use Chart 7 is total gutter flow divided by the area of flow.

Calle Mexico for V= 5.00 fps need 1.45 feet of grate

TRENCH DRAIN, C. GLORIA, LEFT
Worksheet for Rectangular Channel

Project Description	
Worksheet	X-street CB, trench drain
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Slope	0.081200	ft/ft
Depth	1.00	ft
Bottom Width	2.50	ft

Results		
Discharge	55.03	cfs
Flow Area	2.5	ft^2
Wetted Perimeter	4.50	ft
Top Width	2.50	ft
Critical Depth	2.47	ft
Critical Slope	0.007798	ft/ft
Velocity	22.01	ft/s
Velocity Head	7.53	ft
Specific Energy	8.53	ft
Froude Number	3.88	
Flow Type	Supercritical	

TRENCH DRAIN
WORST CASE
C. GLORIA

P-1570 GRATE INLET-DOUBLE
Worksheet for Grate Inlet On Grade

Project Description	
Worksheet	GRATE ON GRADE (DOUBL
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	1.00	cfs
Slope	0.005000	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.020000	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.015	
Grate Width	2.00	ft
Grate Length	6.50	ft
Grate Type	30 Deg Tilt Bar	
Clogging	50.0	%

Options	
Grate Flow Option	Exclude None

Results		
Efficiency	0.76	
Intercepted Flow	0.76	cfs
Bypass Flow	0.24	cfs
Spread	8.01	ft
Depth	0.16	ft
Flow Area	0.6	ft^2
Gutter Depression	0.0	in
Total Depression	0.0	in
Velocity	1.56	ft/s
Splash Over Velocity	6.47	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.47	
Grate Flow Ratio	0.54	
Active Grate Length	3.25	ft

P-1570 GRATE INLET-DOUBLE
Rating Table for Grate Inlet On Grade

Project Description	
Worksheet	GRATE ON GRADE (DOUBL
Type	Grate Inlet On Grade
Solve For	Efficiency

Input Data		
Gutter Width	2.00	ft
Gutter Cross Slope	0.020000	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.015	
Grate Width	2.00	ft
Grate Length	6.50	ft
Grate Type	30 Deg Tilt Bar	
Clogging	50.0	%

Options	
Grate Flow Option	Exclude None

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	2.00	10.00	2.00
Slope (ft/ft)	0.003000	0.012000	0.003000

Discharge (cfs)	Slope (ft/ft)	Efficiency	Intercepted Flow (cfs)
2.00	0.012000	0.63	1.26
2.00	0.006000	0.65	1.30
2.00	0.009000	0.64	1.27
2.00	0.003000	0.69	1.38
4.00	0.009000	0.53	2.14
4.00	0.006000	0.55	2.21
4.00	0.003000	0.60	2.39
4.00	0.012000	0.53	2.11
6.00	0.003000	0.54	3.25
6.00	0.009000	0.48	2.87
6.00	0.006000	0.49	2.97
6.00	0.012000	0.47	2.82
8.00	0.009000	0.44	3.52
8.00	0.003000	0.50	4.02
8.00	0.006000	0.46	3.65
8.00	0.012000	0.43	3.46
10.00	0.012000	0.40	4.04
10.00	0.003000	0.47	4.74
10.00	0.006000	0.43	4.27
10.00	0.009000	0.41	4.11

Notes: FUNCTIONALLY, THE GRATE CATCH BASIN WILL INTERCEPT FLOW-BY PAST THE SLOTTED DRAIN, IN THE AMOUNT SHOWN ON THE RATING TABLE.

HOWEVER FOR DESIGN PURPOSES:
THIS GRATE CAPACITY IS NOT CONSIDERED IN STORM DRAIN HYDRAULIC MODELS.

RATHER, THE SLOTTED DRAIN IS ASSUMED TO BE THE SOLE INFLOW INTO ONE OF THESE CATCH BASINS.

AREA INLET, DOUBLE TYPE H (MAG DET 538)
Rating Table for Ditch Inlet In Sag

Project Description	
Worksheet	Ditch Inlet - 1
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data		
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Grate Width	2.00	ft
Grate Length	4.00	ft
Local Depression	0.0	in
Local Depression Width	0.00	ft
Grate Type	P-30 mm (P-1-1/8")	
Clogging	50.0	%

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	1.00	20.00	1.00

Discharge (cfs)	Spread (ft)	Depth (ft)
1.00	3.62	0.10
2.00	3.99	0.16
3.00	4.29	0.22
4.00	4.57	0.26
5.00	4.82	0.30
6.00	5.05	0.34
7.00	5.27	0.38
8.00	5.49	0.41
9.00	5.92	0.49
10.00	6.61	0.60
11.00	7.36	0.73
12.00	8.19	0.87
13.00	9.09	1.02
14.00	10.07	1.18
15.00	11.11	1.35
16.00	12.23	1.54
17.00	13.42	1.74
18.00	14.68	1.95
19.00	16.02	2.17
20.00	17.42	2.40

AREA INLET, DOUBLE TYPE F (MAG DET 535)
Rating Table for Ditch Inlet In Sag

Project Description	
Worksheet	AREA INLET - ADOT DET C-15.90
Type	Ditch Inlet In Sag
Solve For	Spread

Input Data	
Left Side Slope	3.00 H : V
Right Side Slope	3.00 H : V
Bottom Width	3.00 ft
Grate Width	2.50 ft
Grate Length	6.00 ft
Local Depression	0.0 in
Local Depression Width	0.00 ft
Grate Type	P-50 mm (P-1-7/8")
Clogging	50.0 %

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	5.00	60.00	5.00

Discharge (cfs)	Spread (ft)	Depth (ft)
5.00	4.42	0.24
10.00	5.25	0.38
15.00	5.95	0.49
20.00	6.57	0.60
25.00	7.15	0.69
30.00	7.68	0.78
35.00	8.58	0.93
40.00	10.29	1.22
45.00	12.23	1.54
50.00	14.40	1.90
55.00	16.79	2.30
60.00	19.41	2.74

SVERDRUP

JOB W7X70300 Guadalupe Drainage

COMPUTATIONS FOR Sediment Supply

SHEET NO. 1 OF

DATE 3/28/01

BY BDO CHKD DES

Sedimentation Supply to each retention basin can be estimated by a procedure identified in the "Stormwater Detention / Retention Manual" for the Pima County Department of Transportation and Flood Control District / City of Tucson, AZ.

Using Equation 3.8

$$V_{SD} = 500 \; A \; C_P$$

where V_{SD} = additional detention / retention volume required for sedimentation within facility, (Cu. Ft)

A = drainage area contributing to detention / retention basin, (Acres).

C_P = fractional portion of the drainage area which will be contributing sediment. Areas which will not contribute sediment include all impervious areas, sodded areas and other areas which have surface treatments that prevent soil loss.

The volume calculated is approximately equal to ten times the average-annual sediment yield and roughly ½ to ⅔rds the sediment transport expected during the 100-year storm event.

SVERDRUP

JOB W7X70300 Guadalupe Drainage
COMPUTATIONS FOR Sediment Supply

SHEET NO. 2 OF
DATE 3/28/01, Rev. 8/22/01
BY BDO CHKD DES

Calculations

Basin	Area sq. miles (acres)	Cp	Comments
South	0.15 (96)	0.50	impervious areas ~ 30% residential yards ~ 20%
Central	0.36 (230)	0.35	impervious areas ~ 30 to 35% residential yards ~ 30 to 35%
North	0.09 (58)	0.35	impervious areas ~ 30 to 35% residential yards ~ 30 to 35%
Tempe (NE)	0.13 (83)	0.30	impervious areas ~ 30 to 35% residential areas ~ 30 to 35% school area ~ 5%

Sediment Supply

Basin	Area (acres)	Cp	V_{SD}	Annual Sediment Supply Cu. Ft. (Cu. Yds)
South	96	0.50	24,000 Cu Ft	2,400 (89)
Central	230	0.35	40,250 Cu Ft	4,025 (149)
North	58	0.35	10,150 Cu Ft.	1,015 (38)
Tempe (NE)	83	0.30	12,450 Cu Ft.	1,245 (46)
				8,685 (322)
				Use 8,700 Cu Ft

Provide additional storage volume above the retention volume in case no maintenance of retention basins occur. However, because three of the four retention basins will be used for recreational sports, the basins will be maintained after each storm, thus the annual anticipated volume of sediment for each basin will be approximately one-tenth of the V_{SD} amounts or 8,700 Cu Ft per year.

By: DES
Ckd: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT - 10-YEAR										
SEDIMENT TRAP VOLUMES										
NORTH BASIN										
Outlet Sediment Trap, SD7										
	R =		15	feet						
	D =		2	feet						
	V =				**471.2**	cu ft				
Outlet Sediment Trap, SD9										
	R =		10	feet						
	D =		2	feet						
	V =				**209.4**	cu ft				
Below Rim of Bottom Drywell										
Volume Below El=1217.0					**1045**	cu ft	Per Percolation Calculations table			
TOTAL SEDIMENT TRAPPING			**1725.7**	cu ft						
YEARLY SEDIMENT LOAD			1015	cu ft		One tenth of the V50 volume calculated				
						for North Basin "Sediment Supply" calcs				
						(see Appendix C)				
Volume trapped > Yearly Sediment Load					**OK**					

By: DES
Ckd: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT - 10-YEAR										
SEDIMENT TRAP VOLUMES										
NORTHEAST BASIN										
Inlet V-ditch										
	L=		115	feet		Sta 29+55 to Sta 30+70				
	Sideslope		3	:1						
	Dmax		1	foot		Defined by riprap dike				
	Area max		3	sq ft						
	Dmin		0.25	foot						
	Area max		0.19	sq ft						
	Area Avg		1.59	sq ft						
	V =				**183.3**	cu ft				
Outlet Sediment Trap, SD1										
	R =		15	feet						
	D =		2	feet						
	V =				**471.2**	cu ft				
Below Rim of Bottom Drywell										
Volume Below El=1208.0					**1438**	cu ft	Per Percolation Calculations table			
TOTAL SEDIMENT TRAPPING			**2092.5**	cu ft						
YEARLY SEDIMENT LOAD			1245	cu ft		One tenth of the V50 volume calculated				
						for Northeast Basin "Sediment Supply" calcs				
						(see Appendix C)				
Volume trapped > Yearly Sediment Load					**OK**					

By: DES
Ckd: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT - 10-YEAR										
SEDIMENT TRAP VOLUMES										
CENTRAL BASIN										
SD2-2 Inlet Sediment Trap										
	A (avg) =		780	feet		Avg of 1180 sq ft + 430 sq ft				
	D =		2	feet						
	V =				**1560.0**	cu ft				
Outlet Sediment Trap (SD 2)										
	R =		25	feet						
	D =		2	feet						
	V =				**1309.0**	cu ft				
Outlet Sediment Trap (SD 3)										
	R =		20	feet						
	D =		2	feet						
	V =				**837.8**	cu ft				
Outlet Sediment Trap (SD 6)										
	R =		10	feet						
	D =		2	feet						
	V =				**209.4**	cu ft				
Below Rim of Lowest Drywell										
Volume Below El=1214.5					**7360**	cu ft	Per Percolation Calculations table			
TOTAL SEDIMENT TRAPPING			**11276.2**	cu ft						
YEARLY SEDIMENT LOAD			4025	cu ft		One tenth of the V50 volume calculated				
						for Central Basin "Sediment Supply" calcs				
						(see Appendix C)				
Volume trapped > Yearly Sediment Load					**OK**					

By: DES
Ckd: BDO

GUADALUPE DRAINAGE IMPROVEMENT PROJECT - 10-YEAR										
SEDIMENT TRAP VOLUMES										
SOUTH BASIN										
Outlet Sediment Trap, SD4										
	R =		15	feet						
	D =		2	feet						
	V =				**471.2**	cu ft				
Outlet Sediment Trap, SD5										
	R =		10	feet						
	D =		2	feet						
	V =				**209.4**	cu ft				
Outlet Sediment Trap, PIPE 001										
	R =		10	feet						
	D =		2	feet						
	V =				**209.4**	cu ft				
Below Rim of Bottom Drywell										
Volume Below El=1217.0					**7971**	cu ft	Per Percolation Calculations table			
TOTAL SEDIMENT TRAPPING			**8861.1**	cu ft						
YEARLY SEDIMENT LOAD			2400	cu ft		One tenth of the V50 volume calculated				
						for South Basin "Sediment Supply" calcs				
						(see Appendix C)				
Volume trapped > Yearly Sediment Load					**OK**					