Duke - Alabama & Palmetto
CUP XXXX
City of Redlands, San Bernardino County, California

Preliminary Drainage Study

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SECTION 1 - SUMMARY

PURPOSE

The purpose of this report is to document the hydrologic and hydraulic analyses performed in support of the Duke – Alabama and Palmetto project located in the City of Redlands, County of San Bernardino, California. The project site is located at the northwest corner of Alabama Street and Palmetto Avenue. The project proposes to build a warehouse facility on approximately 55 acres. This report will summarize the hydrologic and hydraulic analyses that were conducted in order to determine the necessary drainage improvements required to provide flood protection for the proposed building and safely convey the runoff through the site.

The scope of this report will include the following:

- Determine the peak 100-year and 10-year flow rates for the developed condition using the San Bernardino County Hydrology Rational Method.
- Determine the required storm drain facilities, alignment, and sizes required to flood protect the project site.
- Determine the necessary basin area and volume required for water quality treatment and to mitigate for increases in runoff.
- Preparation of a preliminary report summarizing the hydrology and hydraulic results.

DESCRIPTION OF WATERSHED

As previously described, the project is proposing a warehouse facility (approximately 1,116,930 square feet) on approximately 55 acres of vacant land. Existing elevations across the site vary from 1202 at the northwest corner to 1224 at the southeast corner (NAVD88 datum). The site currently slopes down at approximately 1.4% grade to the southeast. The existing drainage pattern for the site and the general area is characterized by sheet flows that follow the slope to the northwest. The runoff in this area is collected by an existing inlet located near the northwest corner. The inlet continues to convey runoff to the northwest and towards the Santa Ana River.

PROPOSED CONDITIONS

The project site is not impacted by off-site flows as there are existing streets around the perimeter of the project that convey any offsite flow away from the site. On-site flows generated by the proposed project will surface flow through the site utilizing ribbon gutters, curb and gutters, and grate inlets. There will be two subsurface storm drain lines that will be used to convey flow into the proposed infiltration basin. The basin is located along the northwesterly corner of the site. The basin will all ultimately discharge into the existing Line A storm drain.

Line A is an existing 96 inch diameter storm drain facility located along the frontage of Alabama Street. The As-Built plans for Line A show a hydraulic jump at approximately station 74+00. At this station, it also appears to be at a natural low point. In order to prevent the hydraulic jump from shooting out of the natural ground, the project intends to mitigate for increase runoff. Refer to Section 3 for more information on the hydraulic analysis and Appendix C to view the As-Built plans for Line A.

As previously mentioned, the lack of downstream facilities will require mitigation of increased flow. In order to mitigate the increase in runoff and not adversely affect the downstream facilities, the project proposes to discharge 64.8 cfs. Emergency escapes will be provided in the basin in case of a failure or improper maintenance of the infiltration basin. Emergency escapes will allow flow to escape into Alabama Street where flow will continue to drain north towards the Santa Ana River as has been the case historically.

METHODOLOGY

HYDROLOGY

Hydrologic calculations were performed in accordance with the San Bernardino County Hydrology Manual, dated August 1986. The rational method and synthetic unit hydrograph methods were utilized in hydrologic analyses.

The rainfall values were derived from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 that are available on the NOAA website. Soil types were derived from the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) web site.

Hydrology calculations were performed using a computer program developed by CivilDesign Corporation and Joseph E. Bonadiman and Associates Inc. The computer program is commonly referred to as CivilD which performs hydrologic calculations as outlined in the hydrology manual.

The Rational Method was used to determine the peak flow rates used to size and design the subsurface storm drain systems to convey on-site flows to the proposed basin. The flow rates were computed by generating a hydrologic "link-node" model in which the overall area is divided into separate drainage sub-areas, each tributary to a concentration point (node) determined by the proposed layout and grading.

The Synthetic Unit Hydrograph Method was utilized to determine the flow rates and volumes needed to evaluate and size the proposed infiltration basin in order to mitigate peak flow rates from the project site.

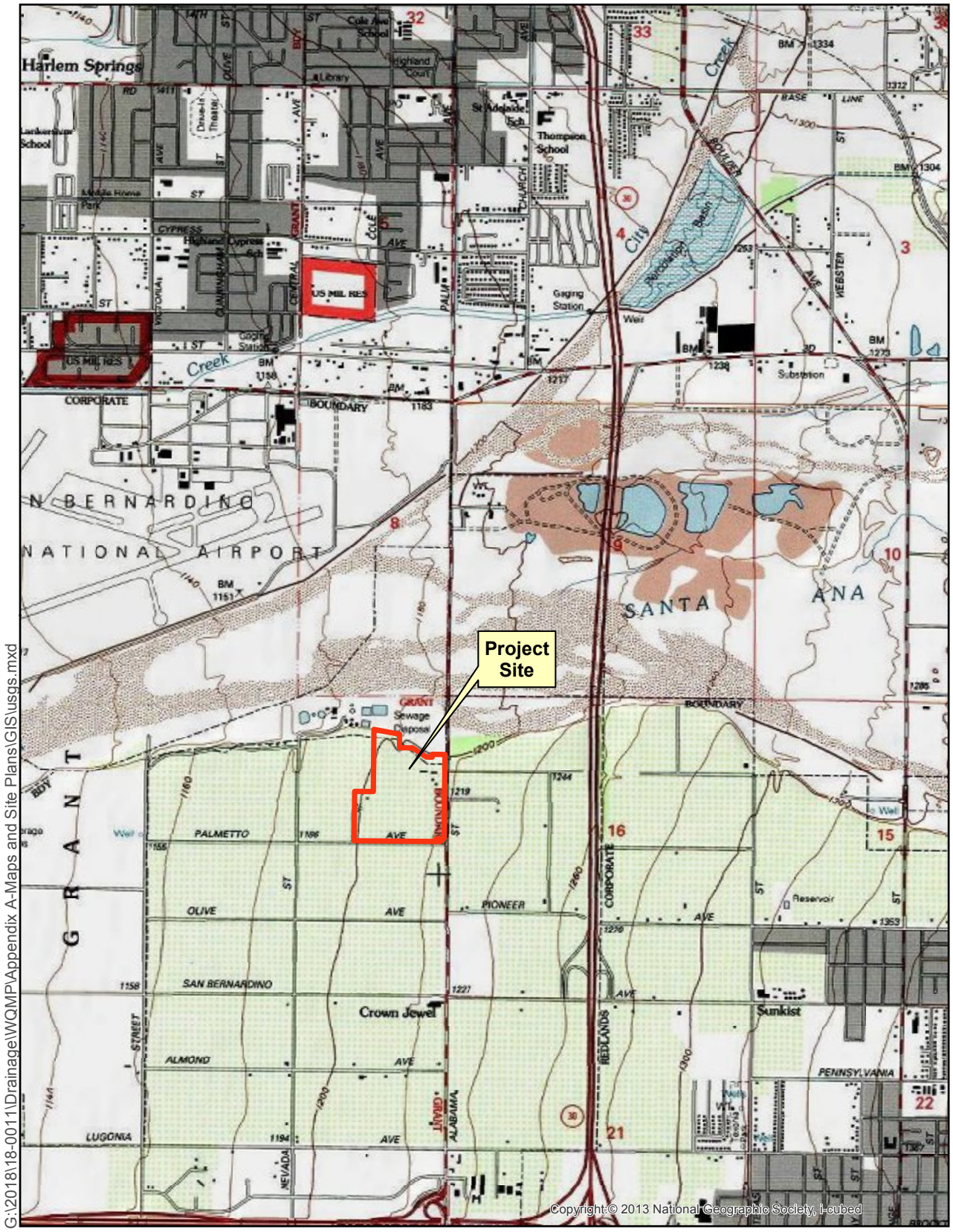
HYDRAULICS

Based on the results from the Rational Method Hydrology, a steady state hydraulic analysis of the storm drain system was performed to size/analyze on-site subsurface storm drain systems. The facilities were analyzed under the established 100-year flow rates. The computer program, Water Surface and Pressure Gradient (WSPG) from CivilDesign, Corp. Version 14.06 (originally Los Angeles County Flood Control District Program F0515P) was used to analyze the system. For additional information and results, see Appendix A.

Normal depth calculations and inlet calculations were performed using the Hydraulic Toolbox 4.1 Software developed by Federal Highway Administration (FHWA) in cooperation with Aquaveo. For results, see Appendix B.

Water quality basin calculations were performed using worksheets from the Santa Ana watershed region. Preliminary calculations and additional details can be found in the Preliminary WQMP (P-WQMP).

Figure 1. Vicinity Map



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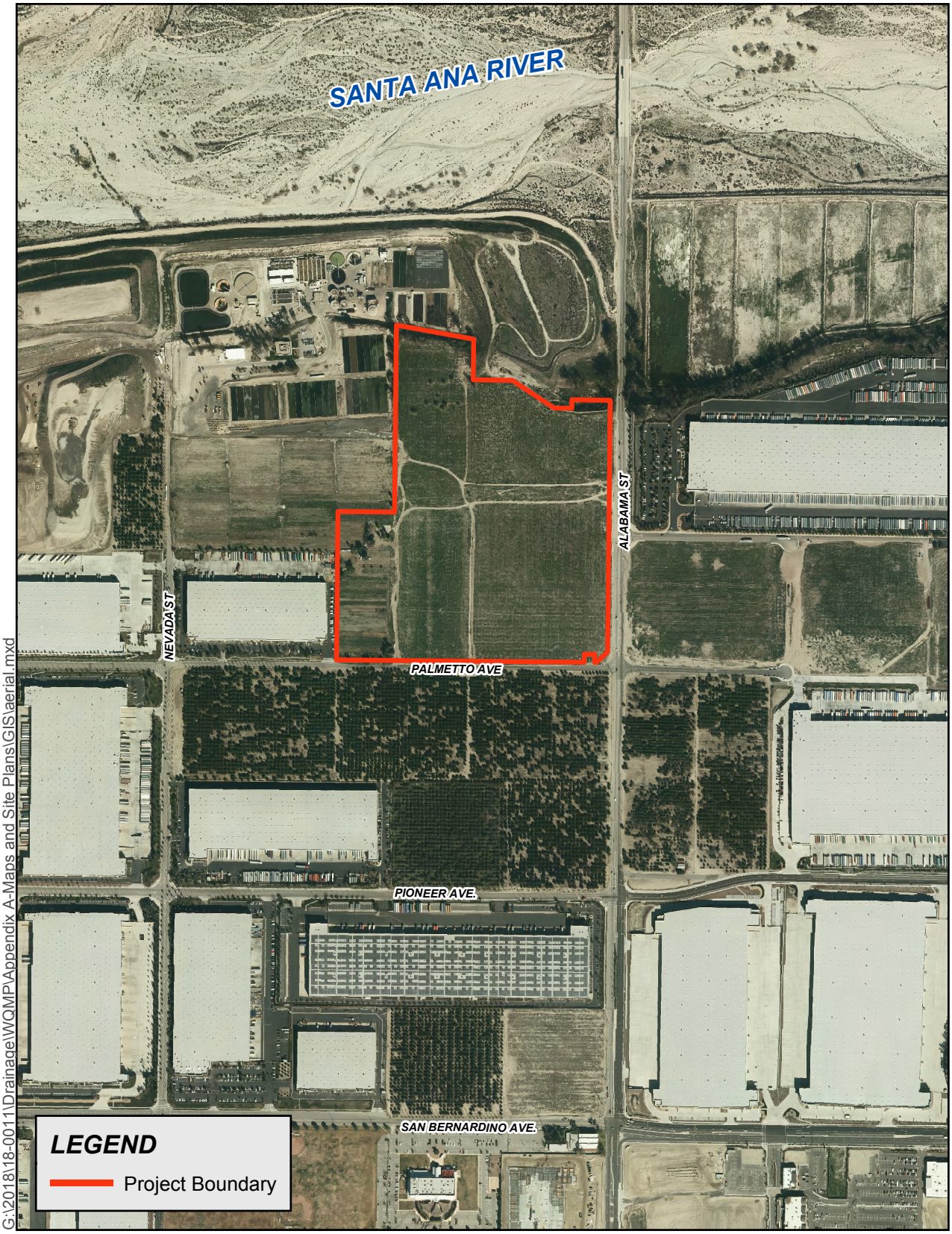
Sources: ESRI / USGS 7.5min Quad

Figure 2. USGS Topography Map

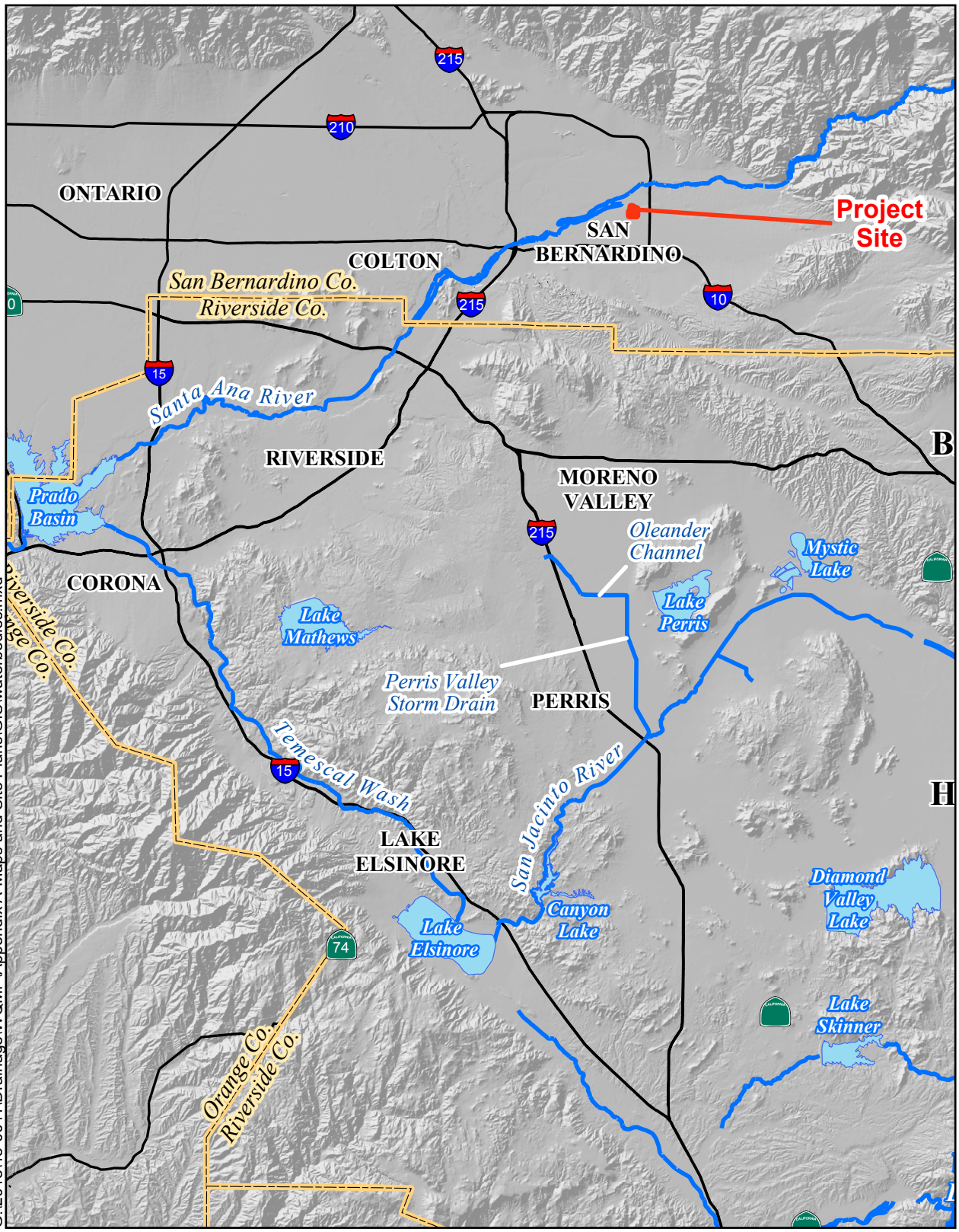
0 1,000 2,000
Feet



Sources: County of Riverside GIS, 2013; Eagle Aerial, April 2012.

Figure 3. Aerial Photograph

0 400 800 Feet



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Sources: USGS 30 Meter DEM;
USGS Digital Line Graph

Figure 4. Receiving Waterbodies

0 2 4 6
Miles

Flowpath

SECTION 2 - HYDROLOGY ANALYSIS

HYDROLOGY PARAMETERS

The San Bernardino County Hydrology Manual was used to determine several of the hydrological parameters. The following rainfall depths were utilized in the hydrology analyses. The rainfall values were obtained from the NOAA Atlas 14 website:

Table 1 – Precipitation Values

	Duration
Storm Event	1-Hour (inches)
2-Year	0.49
100-Year	1.25

The value for slope of intensity was determined to be 0.60. The NOAA Atlas 14 rainfall point precipitation table and the isohyetal maps from the San Bernardino County Hydrology manual have also been included in Appendix A.

Based on the Figure C-11 in the San Bernardino County Hydrology Manual, the project site is classified as soil type A. An NRCS Soils Survey Report was also created to compare soil types. The NRCS Soils Report also classified the project site as soil type A. The NRCS soils map and Figure C-11 is included in Appendix A.

The cover type was determined based on the existing land cover and proposed land use of the site. Hydrological computations for the existing condition were done using 'Undeveloped – Poor Cover'. The commercial landscaping cover type was used to represent the developed condition. The table below summarizes the runoff index values and the recommended values for percentage of impervious cover for each category:

Table 2 – Cover Type

Cover Type	Soil Group A	Soil Group B	Soil Group C	Soil Group D	Percentage of Impervious Cover
Undeveloped Poor Cover	67	78	86	89	0%
Commercial Landscaping	32	56	69	75	90%

ON-SITE RATIONAL METHOD HYDROLOGY

The rational method was used to determine peak flow rates in order to adequately size the proposed subsurface storm drains and associated inlets used to convey on-site flows to the proposed infiltration basin. The project site was hydrologically modeled as one watershed, and broken down into subareas. All of the subareas are tributary to Basin-1. The project is comprised of approximately 15% pervious cover (landscaping and basin area). The project was modeled as commercial land use, which assumes a 10% pervious cover and is slightly more conservative than what is proposed. As previously described, the basin will utilize an outlet structure to dewater the basin and discharge flows into the Line-A storm drain within Alabama Street.

Area-12 was infeasible to drain into the infiltration basin due to connecting to existing grading on Palmetto and providing a balanced site for earthwork quantities. Area-12 will drain into an infiltration trench using curb cuts and once the water quality volume is retained, the higher flows will spill out through the same curb cuts and drain down Palmetto Avenue.

The following table summarizes the rational method results at key points:

Table 3 – Rational Method Results

Point of Interest	10-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
Node 102– Initial Flow from Area-1	7.8	12.8
Add Area at Node 103 – Subarea Flow from Area-2	19.1	11.3
Node 103 – Total Flow tributary to Line 1 and Basin -1	19.1	31.8
Add Area at Node 104 – Subarea Flow from Area-3	6.0	10.5
Node 104 – Total Flow tributary to Line 1 and Basin -1	25.1	42.4
Add Area at Node 105 – Subarea Flow from Area-4	5.6	9.9
Node 105 – Total Flow tributary to Line 1 and Basin -1	30.7	52.3
Add Area at Node 106 – Subarea Flow from Area-5	10.9	19.2
Node 106– Total Flow tributary to Line 1 and Basin -1	41.6	71.5
Node 109 – Initial Flow from Area-6	10.8	17.7
Add Area at Node 110– Subarea Flow from Area-7	10.1	17.2
Node 110 – Total Flow tributary to Basin -1	20.8	34.9
Add Area at Node 111 – Subarea Flow from Area-8	6.0	10.8
Node 111 – Total Flow tributary to Basin -1	26.9	45.7
Add Area at Node 112 – Subarea Flow from Area-9	4.8	8.7
Node 112 – Total Flow tributary to Basin -1	31.7	54.4
Node 114– Initial Flow from Area-10 tributary to Line-2	4.9	8.0
Add Area at Node 107 – Subarea Flow from Area-11	1.4	4.8
Node 107 – Total Flow tributary to Basin-1	77.4	134.9
Node 202 – Total flow tributary to infiltration trench	1.2	1.9

The rational method output files and hydrology map have been included in Appendix A.

ON-SITE UNIT HYDROGRAPH METHOD HYDROLOGY

The unit hydrograph method was used to determine the peak flow rates and volumes in order to adequately size the proposed basin to address increased runoff mitigation. A unit hydrograph was performed for the entire project site (54.7 acres). Unit hydrographs were performed for both the existing condition and developed condition. The existing condition is used to establish a baseline for comparative purposes. The developed condition is used for design purposes, it was utilized in the basin routing analysis in order to size and analyze the proposed basin. The following table summarizes the results of the unit hydrograph analysis:

Table 4 – Unit Hydrograph Results

	Existing Condition		Proposed Condition	
Storm Event	Volume (Ac-ft.)	Peak Flow (cfs)	Volume (Ac-ft.)	Peak Flow (cfs)
100-Year, 24-Hour	16.352	114.6	19.706	137.6

The unit hydrograph output files and hydrology map have been included in Appendix A.

SECTION 3 - HYDRAULIC ANALYSIS

ON-SITE STORM DRAIN FACILITIES

The project proposes minimal subsurface storm drain for on-site conveyance. All onsite flows will rely on surface flow to convey on-site flows to the proposed infiltration basin. All on-site flows will be directed into the water quality infiltration basin for treatment. An outlet structure will control outflow for flows in excess of the water quality volume. The basin outflow will be discharged into the proposed Lateral-A1 storm drain. The outlet structure will mitigate the 100-year flow rate to 64.8 cfs before discharging into Line-A.

Line-1

Line-1 is a proposed 48" HDPE storm drain that will convey a total of 71.5 cfs from the proposed grate inlet located in the north eastern area of the truck court. A hydraulic model for this storm drain system will be created during final engineering. The initial hydraulic grade line (HGL) will be determined from the 100-year 24-hour basin routing model. Hydraulic Toolbox was used to preliminarily size Line-1.

Line-2

Line-2 is a proposed 24" HDPE storm drain that will convey a total of 8.0 cfs from the proposed grate inlet located in the south western parking area. A hydraulic model for this storm drain system will be created during final engineering. The initial hydraulic grade line (HGL) will be determined from the 100-year 24-hour basin routing model. Hydraulic Toolbox was used to preliminarily size Line-2.

Lateral-A1 (On-site/Off-site)

Lateral-A1 is a proposed 60" HDPE storm drain that will convey a total of 64.8 cfs from the proposed outlet structure located in the basin. A hydraulic model for this storm drain system was created to determine the stage-storage-discharge table through an iterative process. (See Basin Routing Analysis in this Section) The initial hydraulic grade line (HGL) was determined to be 1200.31 from the 100-year proposed condition WSPG model of Line-A.

Inlet Capacities

Line-1 and Line-2 use ADS grates grate inlets to convey onsite flows into the infiltration basin. The grates are sized to handle the 100-year peak flow rates. A table that includes the grates associated with their respective Node number and peak flowrate will be included during final engineering.

Drawdown

Basin-1 is an infiltration basin that has a natural infiltration rate of 3.0 inches per hour. The basin bottom area is 81,206 square feet. The basin is required by the County of San Bernardino to drain within 48 hours. The basin will drain the water quality volume and the increase in runoff in approximately 31.3 hours. Refer to the PWQMP Report for more information.

OFF-SITE STORM DRAIN FACILITIES

The project proposes to improve Alabama Street and Palmetto Avenue by widening the current edge of pavement and constructing curb and gutter along the project frontage. Natural low points along the project frontage on Alabama Street or Palmetto Avenue do not exist, so there are no further proposed storm drain connections to Line-A. A peak flow rate of 64.8 cfs is expected per the routing analysis (See Section 3 and Appendix B for more detail) to discharge into Line-A.

As previously mentioned, the project proposes to discharge its onsite flows into Line-A. Line-A is an existing storm drain facility with an upstream terminus at the corner of Alabama Street and Almond Avenue. This facility extends along Alabama Street and discharges into the Santa Ana River. Line-A will not be negatively impacted. Refer to section below and Routing Section for further information.

Line-A

Line-A is a varied sized reinforced concrete pipe (RCP) storm drain that currently conveys a total of 694.1 cfs. A hydraulic model for the existing condition of this storm drain system was created for comparative purposes. The existing stationing of Line A begins upstream at 10+00 and ends downstream at 84+00. The stationing had to be reversed in order for the hydraulic model to properly function. The WSPG model for the existing condition shows there is a hydraulic jump that occurs at station 73+33.60 (per As-built stationing) and 18+72.97 (per revised stationing). The hydraulic jump is located at a natural low point. This hydraulic jump controls the amount of runoff the project site may discharge into Line-A. Refer to Appendix C for Line-A As-Built plans and Appendix B for the hydraulic models.

A WSPG hydraulic model for the proposed condition of Line-A was created to determine how much runoff can be added to the storm drain system without causing the existing HGL at the low point to increase more than 2 feet above the existing natural ground. According to the As-Built plans for Line-A, the low point has an elevation of 1183.7. This means that the increase in runoff cannot cause the HGL to increase more than approximately 2 feet, which results in an elevation of roughly 1185.7'. Through an iterative process, it was determined that the project cannot outlet more than 80 cfs into Line-A. However, the project proposes to discharge only 64.8 cfs into Line-A due to the inlet control condition. Below is a table of some of the iterative results.

Table 5 – Iterations of mitigated flowrate at junction

Q (cfs)	HGL @ Hydraulic Jump (Elev.)	HGL @ Proposed Junction (Elev.)
50	1184.5	1200.31
70	1184.4	1200.31
80	1185.7	1200.31
100	1186.2	1200.31
129.8	1187.3	1200.31

BASIN ROUTING ANALYSIS

A routing analysis was completed to demonstrate that the basin contains substantial volume needed to mitigate to regulate outflow to maximum of 80 cfs for the all events up to the 100-year storm event.

A stage-storage-discharge table was determined through an iterative process of the proposed Lateral A-1. A hydraulic model was created based on the assumption of an initial HGL of 1200.31 (results from the proposed condition of Line-A), a slope of 0.003 ft/ft and a diameter size of 60". The hydraulic model was ran using different peak flowrates, which gave the water surface elevation in the basin for that particular run. For example, a flowrate of 80 cfs was used and it resulted in an HGL of 1203.4. From the basin stage-storage table, the volume at 1203.4 was used in acre-feet. This allowed us to create the stage-storage-discharge table using an iterative process. Refer to Appendix B for the stage-storage-discharge table.

The storage volume takes into account that the basin is connected to a single discharge point. In addition, it was assumed that there would not be any infiltration outflow as the basin is filling up for water quality volumes to remain conservative.

The following table displays the result of the routing analysis for the 100-year 24-hour storm event to demonstrate that the basin provides the necessary storage volume needed to restrict the outflow to maximum flowrate of 80 cfs.

The results achieve a flowrate to be 64.8 cfs, which is less than the maximum allowed flowrate of 80 cfs. This concludes that the project will not negatively impact the existing hydraulic jump or the overall hydraulics in Line-A.

Table 6 – Basin Routing Results

	Existing Condition		Proposed Condition		Basin Routing Results		
Storm Event	Volume (AC-ft.)	Peak Flow (cfs)	Volume (AC-ft.)	Peak Flow (cfs)	Peak Flow (cfs)	Maximum Basin Depth (feet)	Water Surface Elevation
100-Year, 24-Hour	16.352	114.6	19.706	137.6	64.8	3.4	1202.9

The basin routing calculations and other hydraulic calculations have been provided in Appendix B.

SECTION 4 - CONCLUSION

Based on the analyses and results of this report, the following conclusions were derived from the hydrology and hydraulic results:

- The proposed drainage improvements will adequately convey flows to the basin and provide flood protection for the 100-year storm event.
- The proposed basin will provide adequate water quality treatment and drawdown within 48 hours.
- The proposed project will not impact flooding condition to upstream or downstream properties.

APPENDIX A – HYDROLOGY

POINT PRECIPITATION VALUES (NOAA ATLAS 14)/ISOHYETAL MAPS

NOAA Atlas 14, Volume 6, Version 2
Location name: Redlands, California, USA*
Latitude: 34.0898°, Longitude: -117.2126°
Elevation: 1198.56 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.100** (0.083-0.121)	**0.131** (0.109-0.159)	**0.172** (0.142-0.209)	**0.206** (0.169-0.253)	**0.254** (0.201-0.323)	**0.291** (0.226-0.378)	**0.330** (0.250-0.440)	**0.371** (0.273-0.509)	**0.428** (0.302-0.613)	**0.474** (0.323-0.703)
10-min	**0.143** (0.119-0.174)	**0.187** (0.156-0.228)	**0.246** (0.204-0.300)	**0.295** (0.243-0.363)	**0.363** (0.289-0.462)	**0.417** (0.324-0.542)	**0.473** (0.359-0.630)	**0.532** (0.392-0.730)	**0.614** (0.433-0.879)	**0.679** (0.463-1.01)
15-min	**0.173** (0.144-0.211)	**0.227** (0.188-0.275)	**0.298** (0.247-0.363)	**0.357** (0.293-0.439)	**0.440** (0.349-0.559)	**0.504** (0.392-0.656)	**0.572** (0.434-0.762)	**0.643** (0.474-0.882)	**0.742** (0.524-1.06)	**0.822** (0.560-1.22)
30-min	**0.259** (0.215-0.314)	**0.338** (0.281-0.411)	**0.444** (0.368-0.542)	**0.533** (0.438-0.655)	**0.656** (0.521-0.834)	**0.753** (0.585-0.978)	**0.854** (0.647-1.14)	**0.960** (0.707-1.32)	**1.11** (0.782-1.59)	**1.23** (0.835-1.82)
60-min	**0.378** (0.314-0.459)	**0.494** (0.410-0.600)	**0.649** (0.538-0.791)	**0.778** (0.639-0.956)	**0.958** (0.761-1.22)	**1.10** (0.855-1.43)	**1.25** (0.945-1.66)	**1.40** (1.03-1.92)	**1.62** (1.14-2.32)	**1.79** (1.22-2.66)
2-hr	**0.541** (0.450-0.657)	**0.696** (0.579-0.846)	**0.902** (0.748-1.10)	**1.07** (0.881-1.32)	**1.31** (1.04-1.66)	**1.49** (1.16-1.94)	**1.68** (1.27-2.23)	**1.87** (1.38-2.57)	**2.14** (1.51-3.06)	**2.35** (1.60-3.49)
3-hr	**0.665** (0.553-0.808)	**0.851** (0.707-1.03)	**1.10** (0.908-1.34)	**1.30** (1.07-1.60)	**1.58** (1.25-2.00)	**1.79** (1.39-2.33)	**2.01** (1.52-2.68)	**2.24** (1.65-3.07)	**2.55** (1.80-3.65)	**2.80** (1.91-4.14)
6-hr	**0.929** (0.773-1.13)	**1.18** (0.983-1.44)	**1.52** (1.26-1.85)	**1.79** (1.47-2.20)	**2.17** (1.72-2.76)	**2.46** (1.91-3.19)	**2.75** (2.08-3.66)	**3.05** (2.25-4.19)	**3.47** (2.44-4.96)	**3.79** (2.58-5.61)
12-hr	**1.23** (1.02-1.50)	**1.58** (1.31-1.92)	**2.04** (1.69-2.48)	**2.40** (1.98-2.96)	**2.91** (2.31-3.70)	**3.29** (2.56-4.28)	**3.68** (2.79-4.91)	**4.08** (3.01-5.60)	**4.63** (3.26-6.62)	**5.04** (3.44-7.48)
24-hr	**1.65** (1.46-1.91)	**2.15** (1.90-2.48)	**2.79** (2.46-3.23)	**3.31** (2.90-3.86)	**4.01** (3.40-4.84)	**4.55** (3.78-5.60)	**5.10** (4.13-6.42)	**5.66** (4.46-7.32)	**6.41** (4.85-8.64)	**6.99** (5.11-9.75)
2-day	**2.03** (1.80-2.34)	**2.67** (2.36-3.08)	**3.52** (3.10-4.07)	**4.21** (3.68-4.91)	**5.15** (4.36-6.20)	**5.87** (4.87-7.22)	**6.61** (5.35-8.32)	**7.37** (5.81-9.54)	**8.40** (6.36-11.3)	**9.20** (6.73-12.8)
3-day	**2.20** (1.94-2.53)	**2.93** (2.59-3.38)	**3.90** (3.44-4.51)	**4.69** (4.11-5.47)	**5.79** (4.91-6.98)	**6.65** (5.52-8.17)	**7.52** (6.10-9.48)	**8.44** (6.65-10.9)	**9.69** (7.33-13.1)	**10.7** (7.80-14.9)
4-day	**2.36** (2.09-2.72)	**3.17** (2.80-3.65)	**4.25** (3.75-4.92)	**5.15** (4.50-6.00)	**6.39** (5.41-7.69)	**7.36** (6.10-9.05)	**8.36** (6.77-10.5)	**9.40** (7.41-12.2)	**10.8** (8.21-14.6)	**12.0** (8.77-16.7)
7-day	**2.71** (2.40-3.12)	**3.69** (3.26-4.25)	**5.00** (4.41-5.79)	**6.09** (5.33-7.11)	**7.61** (6.45-9.17)	**8.81** (7.31-10.8)	**10.0** (8.14-12.6)	**11.3** (8.94-14.7)	**13.1** (9.94-17.7)	**14.6** (10.6-20.3)
10-day	**2.93** (2.59-3.37)	**4.02** (3.56-4.64)	**5.49** (4.85-6.36)	**6.72** (5.88-7.84)	**8.43** (7.14-10.2)	**9.78** (8.12-12.0)	**11.2** (9.06-14.1)	**12.7** (9.97-16.4)	**14.7** (11.1-19.8)	**16.3** (11.9-22.8)
20-day	**3.60** (3.19-4.15)	**5.01** (4.43-5.78)	**6.91** (6.09-7.99)	**8.50** (7.44-9.91)	**10.7** (9.10-12.9)	**12.5** (10.4-15.4)	**14.4** (11.6-18.1)	**16.3** (12.9-21.1)	**19.0** (14.4-25.7)	**21.2** (15.5-29.6)
30-day	**4.25** (3.76-4.89)	**5.90** (5.22-6.81)	**8.15** (7.19-9.43)	**10.1** (8.80-11.7)	**12.7** (10.8-15.3)	**14.8** (12.3-18.3)	**17.1** (13.8-21.5)	**19.4** (15.3-25.1)	**22.7** (17.2-30.6)	**25.4** (18.5-35.4)
45-day	**5.10** (4.51-5.87)	**7.04** (6.22-8.12)	**9.68** (8.54-11.2)	**11.9** (10.4-13.9)	**15.1** (12.8-18.2)	**17.6** (14.6-21.7)	**20.3** (16.4-25.5)	**23.1** (18.2-29.9)	**27.0** (20.4-36.4)	**30.2** (22.1-42.1)
60-day	**5.98** (5.30-6.89)	**8.17** (7.23-9.43)	**11.2** (9.86-12.9)	**13.7** (12.0-16.0)	**17.3** (14.7-20.9)	**20.2** (16.8-24.8)	**23.2** (18.8-29.2)	**26.4** (20.8-34.2)	**30.9** (23.4-41.7)	**34.6** (25.3-48.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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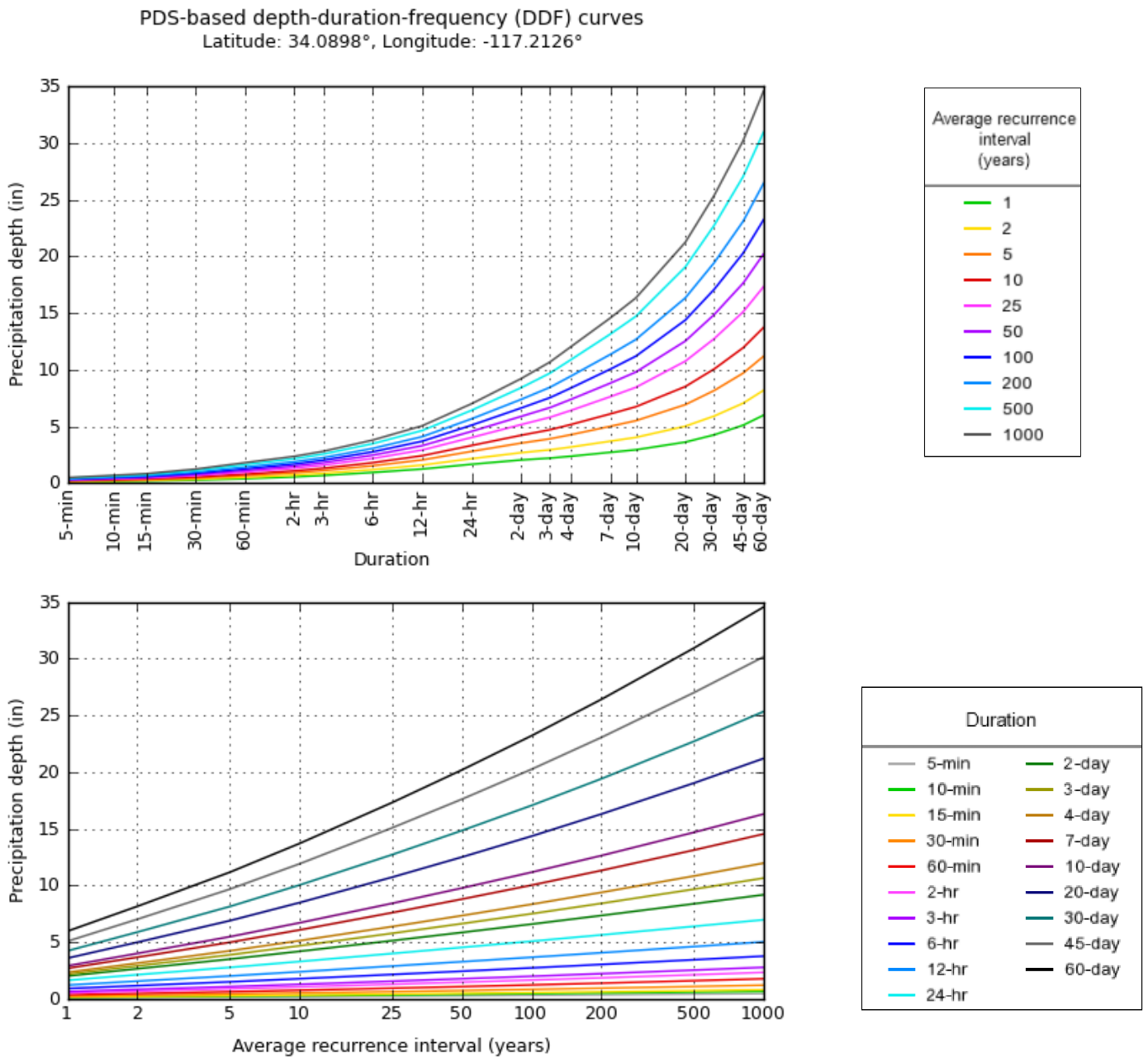
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Jul 26 20:01:50 2018

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Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial

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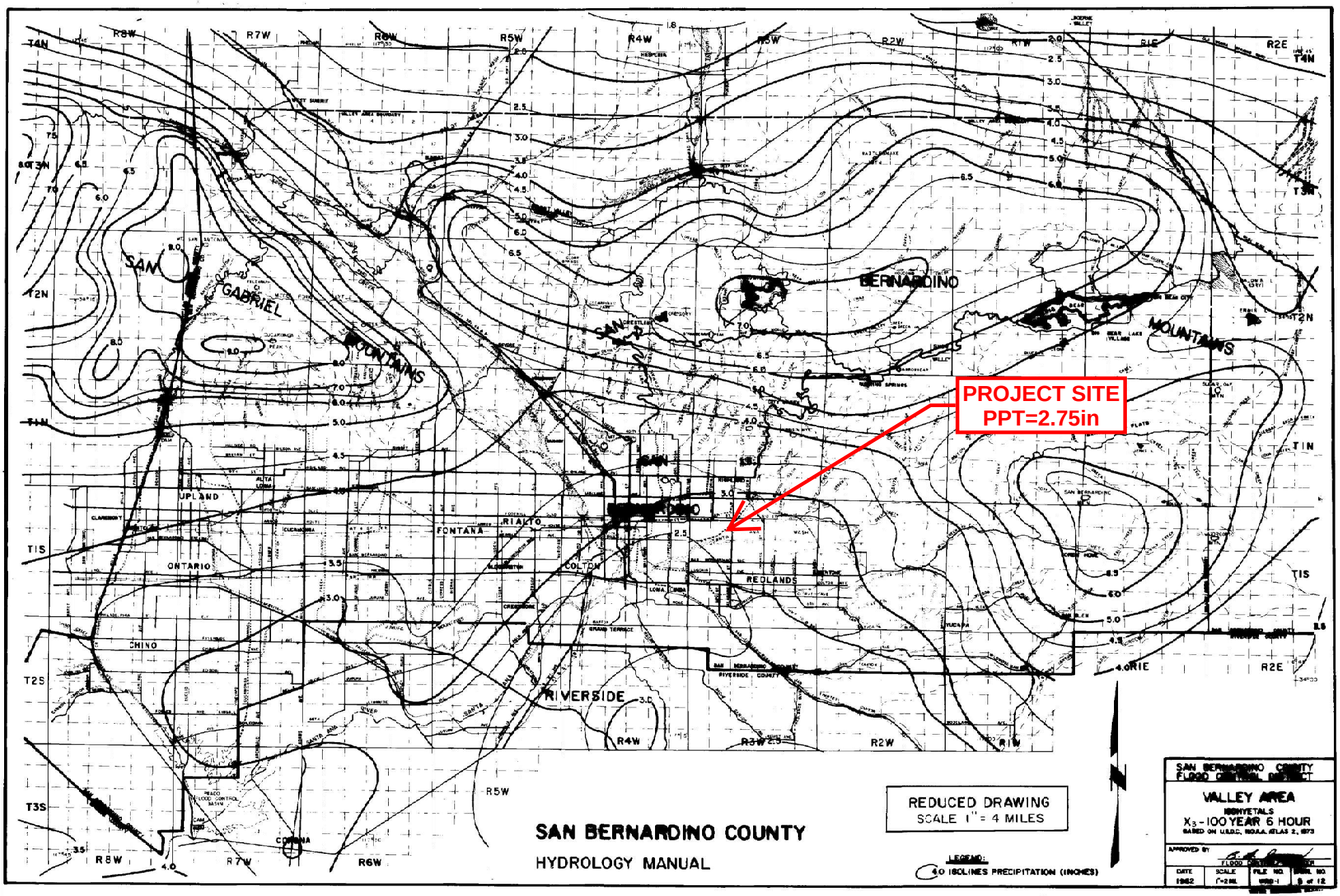
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer



B-13

FIGURE B-5

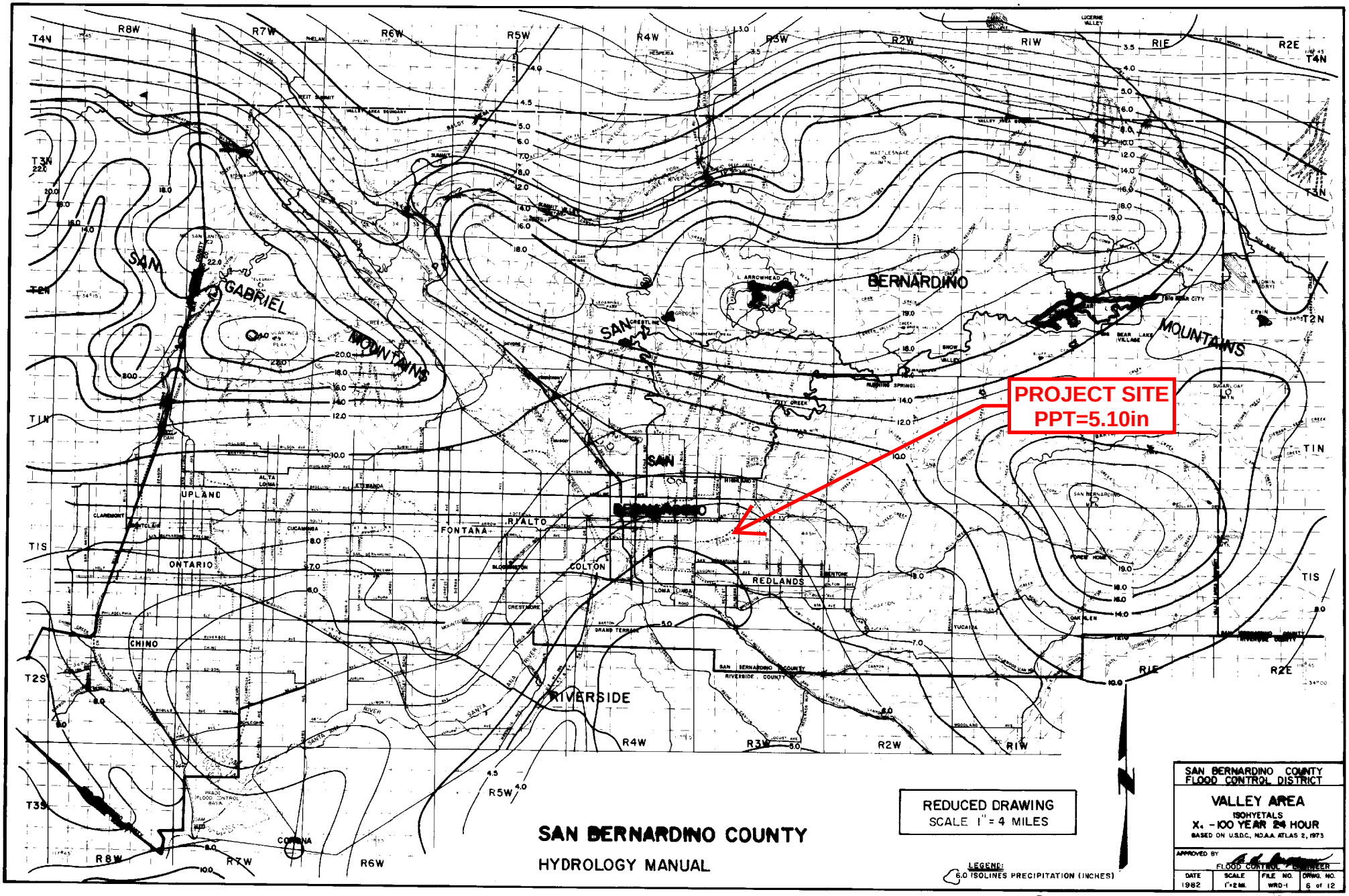
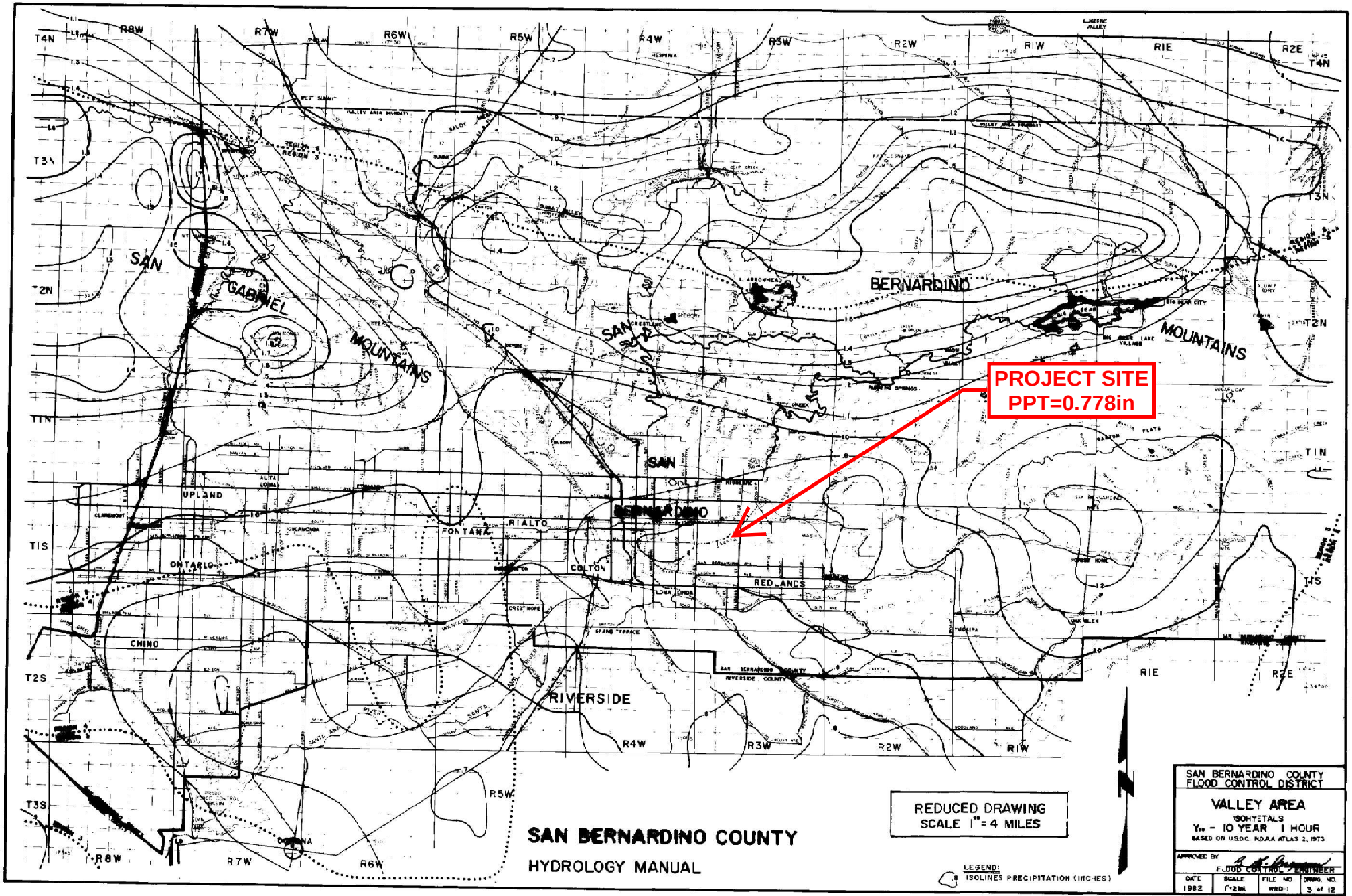
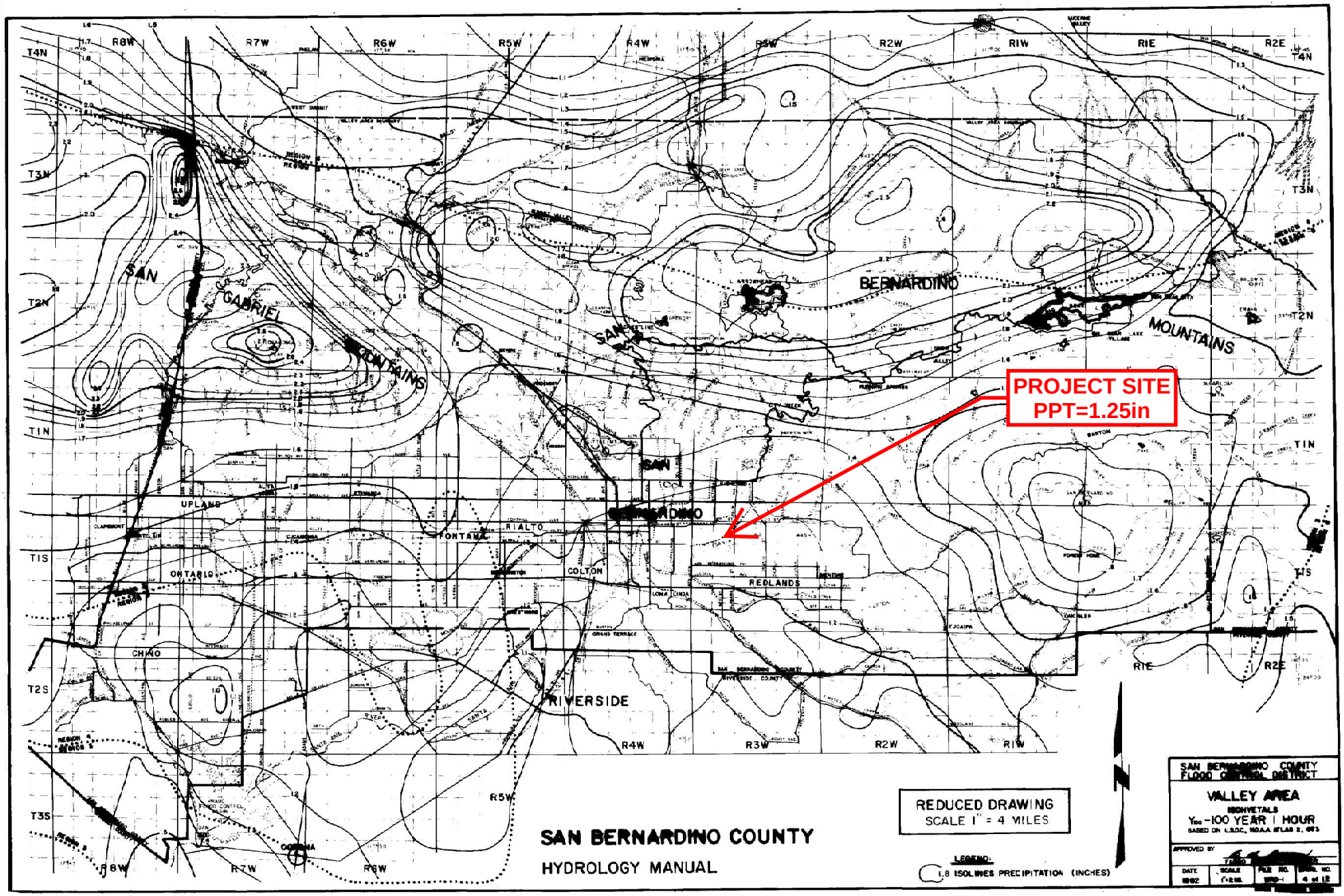

PROJECT SITE
PPT=5.10in
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
6.0 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
X4 - 100 YEAR 24 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
FLOOD CONTROL ENGINEER
DATE 1982
SCALE 1"=2 MI.
FILE NO. WRD-1
DRWG. NO. 6 of 12

FIGURE B-6



B-11

FIGURE B-3



B-12

FIGURE B-4

SOIL INFORMATION

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (2 of 2)

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

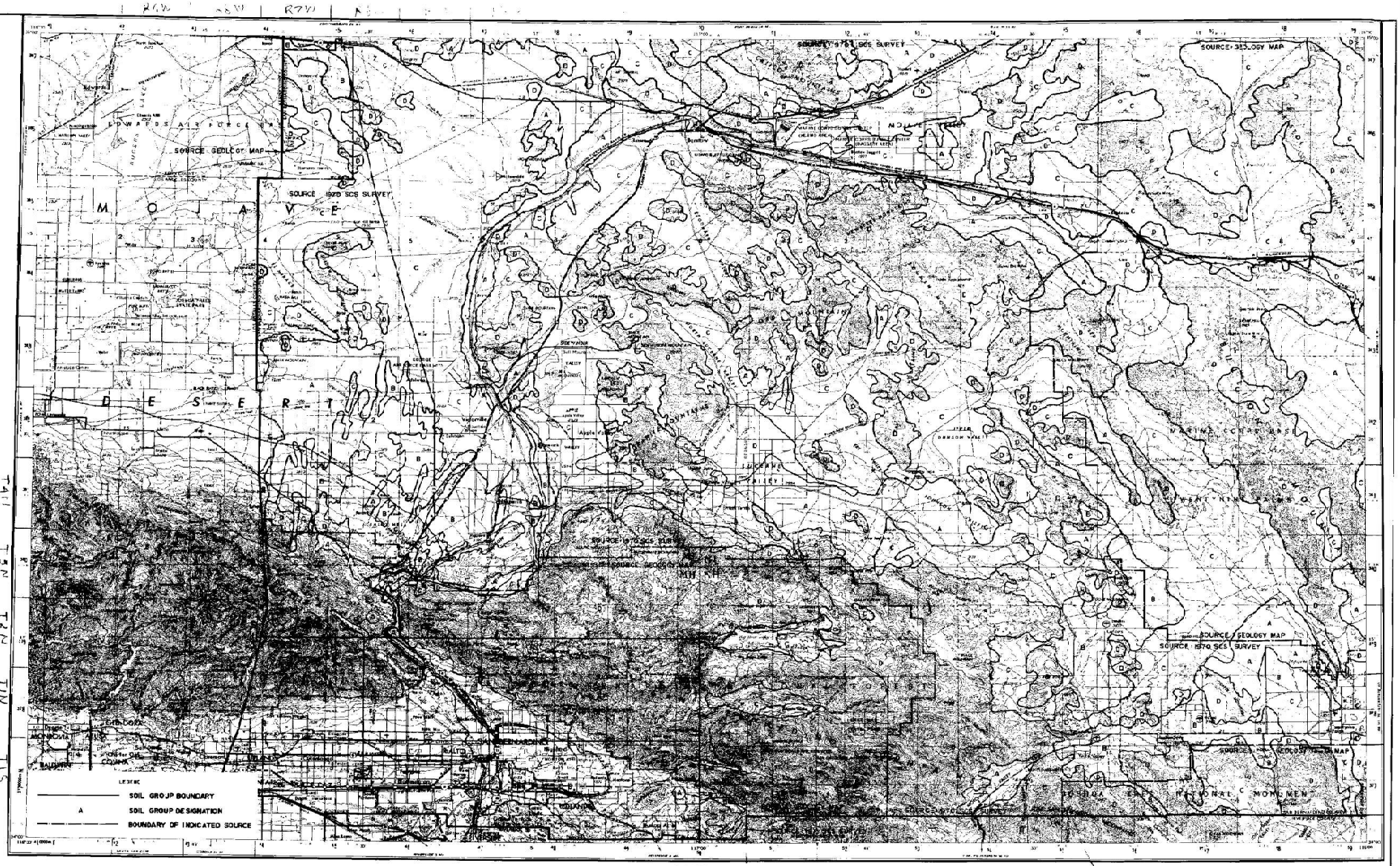
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

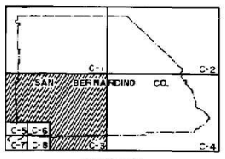
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS

Figure C-4





Scale 1:250,000

CONTOUR INTERVAL 100 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

BASE MAP REPRODUCED FROM U.S.G.S. "SAN BERNARDINO" TOPOGRAPHIC MAP

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHCENTRAL AREA

FIGURE C-11

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Bernardino County Southwestern Part, California

April 4, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,480 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 9, Sep 11, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HbA	Hanford sandy loam, 0 to 2 percent slopes	46.6	95.8%
Ps	Psamments, Fluvents and Frequently flooded soils	0.0	0.0%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	2.0	4.2%
Totals for Area of Interest		**48.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County Southwestern Part, California

HbA—Hanford sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hck5
Elevation: 150 to 900 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 250 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hanford and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Greenfield, sandy loam

Percent of map unit: 5 percent
Hydric soil rating: No

Hanford, steeper slopes
Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed
Percent of map unit: 5 percent
Hydric soil rating: No

Ps—Psamments, Fluvents and Frequently flooded soils

Map Unit Setting
National map unit symbol: hckh
Elevation: 10 to 1,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition
Psamments and similar soils: 50 percent
Fluvents and similar soils: 50 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Psamments

Setting
Landform: Drainageways
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 12 inches: sand
C1 - 12 to 48 inches: fine sand
C2 - 48 to 60 inches: stratified gravelly sand to gravelly loamy sand

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Fluvents

Setting
Landform: Drainageways
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
A - 0 to 10 inches: gravelly sand
C1 - 10 to 30 inches: stratified gravelly sand to gravelly loam
C2 - 30 to 60 inches: stratified gravelly sand to gravelly loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Hydric soil rating: Yes

TuB—Tujunga loamy sand, 0 to 5 percent slopes

Map Unit Setting
National map unit symbol: 2sx6y
Elevation: 650 to 3,110 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 62 to 65 degrees F
Frost-free period: 325 to 365 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Tujunga, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga, Loamy Sand

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

A - 0 to 6 inches: loamy sand
C1 - 6 to 18 inches: loamy sand
C2 - 18 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Tujunga, gravelly loamy sand

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hanford, sandy loam

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

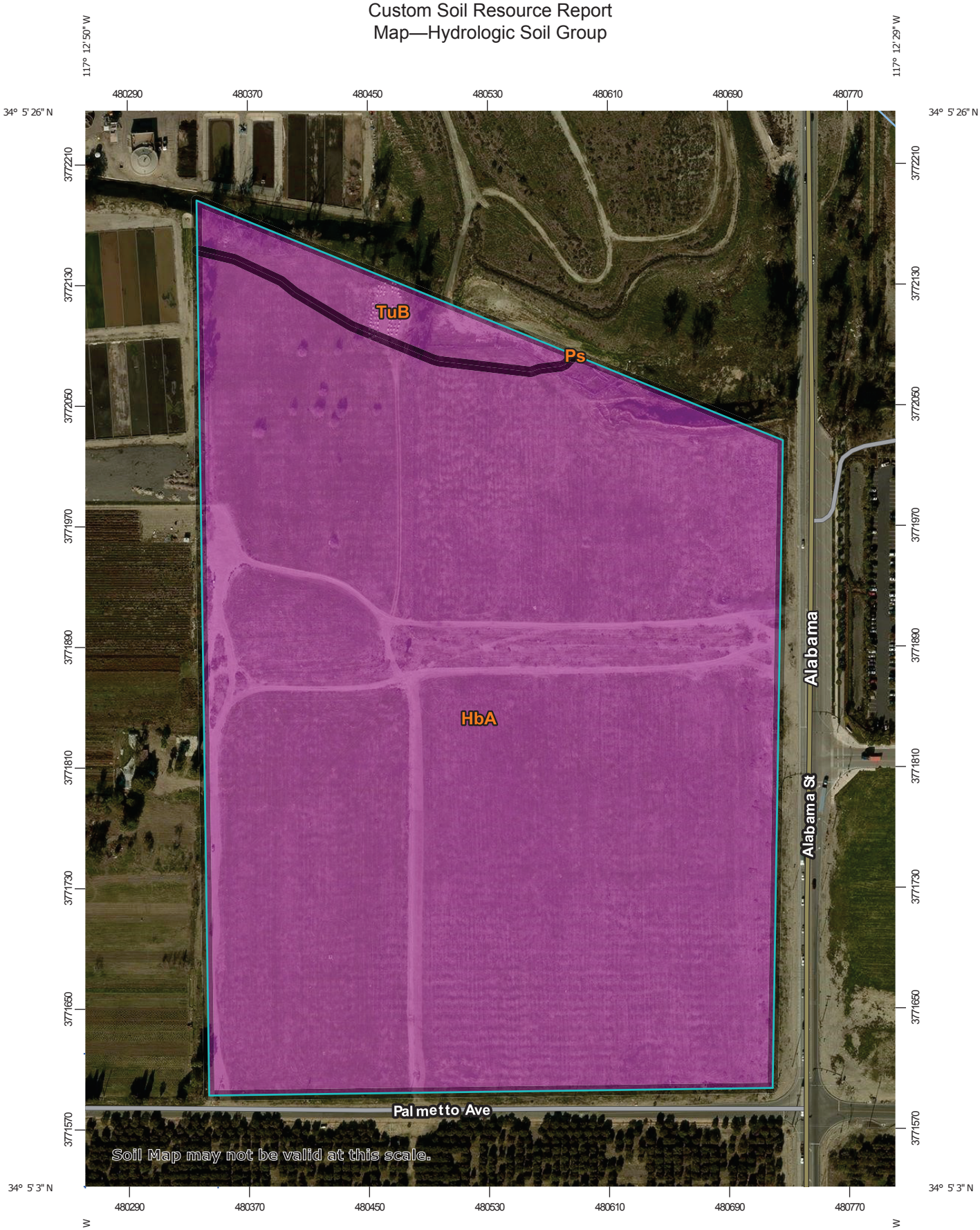
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:3,480 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 9, Sep 11, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HbA	Hanford sandy loam, 0 to 2 percent slopes	A	46.6	95.8%
Ps	Psamments, Fluvents and Frequently flooded soils	A	0.0	0.0%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	2.0	4.2%
Totals for Area of Interest			**48.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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RATIONAL METHOD (EXISTING CONDITION)

10-YEAR ONSITE HYDROLOGY (EXISTING CONDITION)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - EXISTING CONDITION
10 YEAR STORM EVENT
FN: EXIST10.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.778 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.578(In/Hr)
Initial subarea data:
Initial area flow distance = 927.000(Ft.)
Top (of initial area) elevation = 1219.200(Ft.)
Bottom (of initial area) elevation = 1206.700(Ft.)
Difference in elevation = 12.500(Ft.)
Slope = 0.01348 s(%)= 1.35
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.100 min.
Rainfall intensity = 1.546(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.563
Subarea runoff = 4.617(CFS)
Total initial stream area = 5.300(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.578(In/Hr)

++

Process from Point/Station 102.000 to Point/Station 103.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1206.700(Ft.)
Downstream point elevation = 1201.000(Ft.)
Channel length thru subarea = 103.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 6.592(CFS)
Manning's 'N' = 0.035
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 6.592(CFS)
Depth of flow = 0.235(Ft.), Average velocity = 2.394(Ft/s)
Channel flow top width = 23.469(Ft.)
Flow Velocity = 2.39(Ft/s)
Travel time = 0.72 min.
Time of concentration = 19.82 min.
Critical depth = 0.256(Ft.)
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.578(In/Hr)
Rainfall intensity = 1.512(In/Hr) for a 10.0 year storm

Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.556
Subarea runoff =   3.874(CFS) for   4.800(Ac.)
Total runoff =   8.490(CFS)
Effective area this stream =   10.10(Ac.)
Total Study Area (Main Stream No. 1) =   10.10(Ac.)
Area averaged Fm value =   0.578(In/Hr)
Depth of flow =   0.258(Ft.), Average velocity =   2.550(Ft/s)
Critical depth =   0.281(Ft.)

++
Process from Point/Station   104.000 to Point/Station   104.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000   Max loss rate(Fm)=   0.578(In/Hr)
Time of concentration =   19.82 min.
Rainfall intensity =   1.512(In/Hr) for a   10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.556
Subarea runoff =   7.650(CFS) for   9.100(Ac.)
Total runoff =   16.140(CFS)
Effective area this stream =   19.20(Ac.)
Total Study Area (Main Stream No. 1) =   19.20(Ac.)
Area averaged Fm value =   0.578(In/Hr)

++
Process from Point/Station   105.000 to Point/Station   105.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000   Max loss rate(Fm)=   0.578(In/Hr)
Time of concentration =   19.82 min.
Rainfall intensity =   1.512(In/Hr) for a   10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.556
Subarea runoff =   18.662(CFS) for   22.200(Ac.)
Total runoff =   34.801(CFS)
Effective area this stream =   41.40(Ac.)
Total Study Area (Main Stream No. 1) =   41.40(Ac.)
Area averaged Fm value =   0.578(In/Hr)

++
Process from Point/Station   106.000 to Point/Station   106.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000   Max loss rate(Fm)=   0.578(In/Hr)
Time of concentration =   19.82 min.
Rainfall intensity =   1.512(In/Hr) for a   10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.556
Subarea runoff =   11.180(CFS) for   13.300(Ac.)
Total runoff =   45.982(CFS)
Effective area this stream =   54.70(Ac.)
Total Study Area (Main Stream No. 1) =   54.70(Ac.)
Area averaged Fm value =   0.578(In/Hr)
End of computations, Total Study Area =   54.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

100-YEAR ONSITE HYDROLOGY (EXISTING CONDITION)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - EXISTING CONDITION
100 YEAR STORM EVENT
FN: EXIST100.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 927.000(Ft.)
Top (of initial area) elevation = 1219.200(Ft.)
Bottom (of initial area) elevation = 1206.700(Ft.)
Difference in elevation = 12.500(Ft.)
Slope = 0.01348 s(%)= 1.35
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.100 min.
Rainfall intensity = 2.484(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.795
Subarea runoff = 10.466(CFS)
Total initial stream area = 5.300(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1206.700(Ft.)
Downstream point elevation = 1201.000(Ft.)
Channel length thru subarea = 103.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 15.029(CFS)
Manning's 'N' = 0.035
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 15.029(CFS)
Depth of flow = 0.320(Ft.), Average velocity = 2.941(Ft/s)
Channel flow top width = 31.968(Ft.)
Flow Velocity = 2.94(Ft/s)
Travel time = 0.58 min.
Time of concentration = 19.68 min.
Critical depth = 0.355(Ft.)
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Rainfall intensity = 2.440(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.793
Subarea runoff = 9.075(CFS) for 4.800(Ac.)
Total runoff = 19.541(CFS)
Effective area this stream = 10.10(Ac.)
Total Study Area (Main Stream No. 1) = 10.10(Ac.)
Area averaged Fm value = 0.290(In/Hr)
Depth of flow = 0.353(Ft.), Average velocity = 3.141(Ft/s)
Critical depth = 0.395(Ft.)

++
Process from Point/Station 104.000 to Point/Station 104.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Time of concentration = 19.68 min.
Rainfall intensity = 2.440(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.793
Subarea runoff = 17.606(CFS) for 9.100(Ac.)
Total runoff = 37.147(CFS)
Effective area this stream = 19.20(Ac.)
Total Study Area (Main Stream No. 1) = 19.20(Ac.)
Area averaged Fm value = 0.290(In/Hr)

++
Process from Point/Station 105.000 to Point/Station 105.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Time of concentration = 19.68 min.
Rainfall intensity = 2.440(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.793
Subarea runoff = 42.952(CFS) for 22.200(Ac.)
Total runoff = 80.099(CFS)
Effective area this stream = 41.40(Ac.)
Total Study Area (Main Stream No. 1) = 41.40(Ac.)
Area averaged Fm value = 0.290(In/Hr)

++
Process from Point/Station 106.000 to Point/Station 106.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Time of concentration = 19.68 min.
Rainfall intensity = 2.440(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.793
Subarea runoff = 25.732(CFS) for 13.300(Ac.)
Total runoff = 105.831(CFS)
Effective area this stream = 54.70(Ac.)
Total Study Area (Main Stream No. 1) = 54.70(Ac.)
Area averaged Fm value = 0.290(In/Hr)
End of computations, Total Study Area = 54.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area

effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

RATIONAL METHOD (PROPOSED CONDITION)

10-YEAR ONSITE HYDROLOGY (PROPOSED CONDITION)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - PROPOSED CONDITION
10 YEAR STORM EVENT
FN: PROP10.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.778 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 421.000(Ft.)
Top (of initial area) elevation = 1224.700(Ft.)
Bottom (of initial area) elevation = 1213.600(Ft.)
Difference in elevation = 11.100(Ft.)
Slope = 0.02637 s(%)= 2.64
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.053 min.
Rainfall intensity = 2.811(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
Subarea runoff = 7.814(CFS)
Total initial stream area = 3.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1213.600(Ft.)
Downstream point elevation = 1208.300(Ft.)
Channel length thru subarea = 373.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 13.486(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 13.486(CFS)
Depth of flow = 0.236(Ft.), Average velocity = 3.212(Ft/s)
Channel flow top width = 29.593(Ft.)
Flow Velocity = 3.21(Ft/s)
Travel time = 1.94 min.
Time of concentration = 8.99 min.
Critical depth = 0.285(Ft.)
Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Rainfall intensity = 2.430(In/Hr) for a 10.0 year storm

Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.864
Subarea runoff =   11.289(CFS) for   5.900(Ac.)
Total runoff =   19.103(CFS)
Effective area this stream =   9.10(Ac.)
Total Study Area (Main Stream No. 1) =   9.10(Ac.)
Area averaged Fm value =   0.098(In/Hr)
Depth of flow =   0.275(Ft.), Average velocity =   3.512(Ft/s)
Critical depth =   0.336(Ft.)

++
Process from Point/Station   103.000 to Point/Station   104.000
**** IMPROVED CHANNEL TRAVEL TIME ****
____
Upstream point elevation = 1208.300(Ft.)
Downstream point elevation = 1207.000(Ft.)
Channel length thru subarea =   265.000(Ft.)
Channel base width   =   6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel =   22.122(CFS)
Manning's 'N'   = 0.015
Maximum depth of channel =   1.000(Ft.)
Flow(q) thru subarea =   22.122(CFS)
Depth of flow =   0.369(Ft.), Average velocity =   2.453(Ft/s)
Channel flow top width =   42.890(Ft.)
Flow Velocity =   2.45(Ft/s)
Travel time =   1.80 min.
Time of concentration =   10.79 min.
Critical depth =   0.359(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000   Max loss rate(Fm)=   0.098(In/Hr)
Rainfall intensity =   2.178(In/Hr) for a   10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =   5.986(CFS) for   4.300(Ac.)
Total runoff =   25.089(CFS)
Effective area this stream =   13.40(Ac.)
Total Study Area (Main Stream No. 1) =   13.40(Ac.)
Area averaged Fm value =   0.098(In/Hr)
Depth of flow =   0.389(Ft.), Average velocity =   2.533(Ft/s)
Critical depth =   0.379(Ft.)

++
Process from Point/Station   104.000 to Point/Station   105.000
**** IMPROVED CHANNEL TRAVEL TIME ****
____
Upstream point elevation = 1207.000(Ft.)
Downstream point elevation = 1205.300(Ft.)
Channel length thru subarea =   290.000(Ft.)
Channel base width   =   6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel =   27.933(CFS)
Manning's 'N'   = 0.015
Maximum depth of channel =   1.000(Ft.)
Flow(q) thru subarea =   27.933(CFS)
Depth of flow =   0.392(Ft.), Average velocity =   2.781(Ft/s)
Channel flow top width =   45.216(Ft.)
Flow Velocity =   2.78(Ft/s)
Travel time =   1.74 min.
Time of concentration =   12.53 min.
Critical depth =   0.398(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000   Max loss rate(Fm)=   0.098(In/Hr)
Rainfall intensity =   1.991(In/Hr) for a   10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =   5.588(CFS) for   4.600(Ac.)
Total runoff =   30.677(CFS)

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Effective area this stream =       18.00(Ac.)
Total Study Area (Main Stream No. 1) =       18.00(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.408(Ft.), Average velocity =   2.848(Ft/s)
Critical depth =      0.418(Ft.)


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Process from Point/Station      105.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =  1205.300(Ft.)
Downstream point elevation =  1204.200(Ft.)
Channel length thru subarea  =   282.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     36.152(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     36.152(CFS)
Depth of flow =   0.476(Ft.), Average velocity =   2.550(Ft/s)
Channel flow top width =   53.589(Ft.)
Flow Velocity =    2.55(Ft/s)
Travel time  =    1.84 min.
Time of concentration =   14.37 min.
Critical depth =      0.449(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      1.834(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.852
Subarea runoff =     10.887(CFS) for    8.600(Ac.)
Total runoff =     41.565(CFS)
Effective area this stream =       26.60(Ac.)
Total Study Area (Main Stream No. 1) =       26.60(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.504(Ft.), Average velocity =   2.641(Ft/s)
Critical depth =      0.477(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1201.600(Ft.)
Downstream point/station elevation =  1199.500(Ft.)
Pipe length  =   730.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    41.565(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    41.565(CFS)
Normal flow depth in pipe =   30.84(In.)
Flow top width inside pipe =   37.10(In.)
Critical Depth =   24.08(In.)
Pipe flow velocity =      5.49(Ft/s)
Travel time through pipe =    2.22 min.
Time of concentration (TC) =    16.59 min.


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Process from Point/Station      106.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     26.600(Ac.)
Runoff from this stream =     41.565(CFS)
Time of concentration =   16.59 min.
Rainfall intensity =     1.683(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


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Process from Point/Station      108.000 to Point/Station      109.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   652.000(Ft.)
Top (of initial area) elevation =  1218.200(Ft.)
Bottom (of initial area) elevation =  1208.800(Ft.)
Difference in elevation =     9.400(Ft.)
Slope =    0.01442  s(%)=       1.44
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.480 min.
Rainfall intensity =      2.354(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff =     10.762(CFS)
Total initial stream area =        5.300(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1208.800(Ft.)
Downstream point elevation =  1207.000(Ft.)
Channel length thru subarea  =   363.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     15.834(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     15.834(CFS)
Depth of flow =   0.319(Ft.), Average velocity =   2.262(Ft/s)
Channel flow top width =   37.892(Ft.)
Flow Velocity =    2.26(Ft/s)
Travel time  =    2.67 min.
Time of concentration =   12.15 min.
Critical depth =      0.309(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      2.028(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =     10.083(CFS) for    6.700(Ac.)
Total runoff =     20.845(CFS)
Effective area this stream =       12.00(Ac.)
Total Study Area (Main Stream No. 1) =       38.60(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.359(Ft.), Average velocity =   2.426(Ft/s)
Critical depth =      0.350(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1207.000(Ft.)
Downstream point elevation =  1204.900(Ft.)
Channel length thru subarea  =   431.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     23.894(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     23.894(CFS)
Depth of flow =   0.382(Ft.), Average velocity =   2.495(Ft/s)
Channel flow top width =   44.173(Ft.)
Flow Velocity =    2.50(Ft/s)
Travel time  =    2.88 min.
Time of concentration =   15.03 min.
Critical depth =      0.371(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
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Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      1.785(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.851
Subarea runoff =      6.033(CFS) for    5.700(Ac.)
Total runoff =     26.878(CFS)
Effective area this stream =       17.70(Ac.)
Total Study Area (Main Stream No. 1) =       44.30(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.401(Ft.), Average velocity =   2.571(Ft/s)
Critical depth =      0.391(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      112.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1204.900(Ft.)
Downstream point elevation =  1203.000(Ft.)
Channel length thru subarea  =   366.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     29.318(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     29.318(CFS)
Depth of flow =   0.411(Ft.), Average velocity =   2.691(Ft/s)
Channel flow top width =   47.065(Ft.)
Flow Velocity =    2.69(Ft/s)
Travel time  =    2.27 min.
Time of concentration =   17.30 min.
Critical depth =      0.406(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      1.641(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.846
Subarea runoff =      4.784(CFS) for    5.100(Ac.)
Total runoff =     31.662(CFS)
Effective area this stream =       22.80(Ac.)
Total Study Area (Main Stream No. 1) =       49.40(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.424(Ft.), Average velocity =   2.744(Ft/s)
Critical depth =      0.422(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     22.800(Ac.)
Runoff from this stream =     31.662(CFS)
Time of concentration =   17.30 min.
Rainfall intensity =     1.641(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   303.000(Ft.)
Top (of initial area) elevation =  1215.700(Ft.)
```

```
Bottom (of initial area) elevation =  1209.600(Ft.)
Difference in elevation =     6.100(Ft.)
Slope =    0.02013  s(%)=       2.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.526 min.
Rainfall intensity =      2.945(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      4.869(CFS)
Total initial stream area =        1.900(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1209.600(Ft.)
Downstream point/station elevation =  1199.500(Ft.)
Pipe length  =  1464.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     4.869(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     4.869(CFS)
Normal flow depth in pipe =   10.51(In.)
Flow top width inside pipe =   17.74(In.)
Critical Depth =   10.18(In.)
Pipe flow velocity =      4.55(Ft/s)
Travel time through pipe =    5.37 min.
Time of concentration (TC) =    11.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.978(In/Hr)
Time of concentration =    11.89 min.
Rainfall intensity =      2.054(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.621
Subarea runoff =      1.384(CFS) for    3.000(Ac.)
Total runoff =      6.253(CFS)
Effective area this stream =        4.90(Ac.)
Total Study Area (Main Stream No. 1) =       54.30(Ac.)
Area averaged Fm value =    0.637(In/Hr)


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Process from Point/Station      112.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      4.900(Ac.)
Runoff from this stream =      6.253(CFS)
Time of concentration =   11.89 min.
Rainfall intensity =     2.054(In/Hr)
Area averaged loss rate (Fm) =    0.6366(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6510
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     41.56    26.600     16.59    0.098      1.683
2     31.66    22.800     17.30    0.098      1.641
3      6.25     4.900     11.89    0.637      2.054
Qmax(1) =
           1.000 *    1.000 *    41.565) +
           1.027 *    0.959 *    31.662) +
           0.738 *    1.000 *     6.253) + =      77.360
Qmax(2) =
           0.973 *    1.000 *    41.565) +
           1.000 *    1.000 *    31.662) +
           0.708 *    1.000 *     6.253) + =      76.552
Qmax(3) =
           1.234 *    0.717 *    41.565) +
           1.268 *    0.687 *    31.662) +
           1.000 *    1.000 *     6.253) + =      70.649

Total of 3 streams to confluence:
```

```
Flow rates before confluence point:
      41.565      31.662       6.253
Maximum flow rates at confluence using above data:
       77.360       76.552       70.649
Area of streams before confluence:
       26.600       22.800        4.900
Effective area values after confluence:
       53.358       54.300       39.650
Results of confluence:
Total flow rate =     77.360(CFS)
Time of concentration =    16.585 min.
Effective stream area after confluence =     53.358(Ac.)
Study area average Pervious fraction(Ap) =  0.150
Study area average soil loss rate(Fm) =    0.146(In/Hr)
Study area total (this main stream) =      54.30(Ac.)
End of computations, Total Study Area =           54.30 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.150
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - PROPOSED CONDITION
10 YEAR STORM EVENT - DRIVE AISLE ON PALMETTO
FN: DRIVE10.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.778 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 243.000(Ft.)
Top (of initial area) elevation = 1212.000(Ft.)
Bottom (of initial area) elevation = 1202.200(Ft.)
Difference in elevation = 9.800(Ft.)
Slope = 0.04033 s(%)= 4.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.200 min.
Rainfall intensity = 3.375(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff = 1.180(CFS)
Total initial stream area = 0.400(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)
End of computations, Total Study Area = 0.40 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

100-YEAR ONSITE HYDROLOGY (PROPOSED CONDITION)

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - PROPOSED CONDITION
100 YEAR STORM EVENT
FN: PROP100.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Initial subarea data:
Initial area flow distance = 421.000(Ft.)
Top (of initial area) elevation = 1224.700(Ft.)
Bottom (of initial area) elevation = 1213.600(Ft.)
Difference in elevation = 11.100(Ft.)
Slope = 0.02637 s(%)= 2.64
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.053 min.
Rainfall intensity = 4.516(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff = 12.781(CFS)
Total initial stream area = 3.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)

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Process from Point/Station 102.000 to Point/Station 103.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1213.600(Ft.)
Downstream point elevation = 1208.300(Ft.)
Channel length thru subarea = 373.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 22.354(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 22.354(CFS)
Depth of flow = 0.295(Ft.), Average velocity = 3.656(Ft/s)
Channel flow top width = 35.479(Ft.)
Flow Velocity = 3.66(Ft/s)
Travel time = 1.70 min.
Time of concentration = 8.75 min.
Critical depth = 0.359(Ft.)
Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00

Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Rainfall intensity = 3.967(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.882
Subarea runoff = 19.069(CFS) for 5.900(Ac.)
Total runoff = 31.849(CFS)
Effective area this stream = 9.10(Ac.)
Total Study Area (Main Stream No. 1) = 9.10(Ac.)
Area averaged Fm value = 0.079(In/Hr)
Depth of flow = 0.343(Ft.), Average velocity = 4.001(Ft/s)
Critical depth = 0.422(Ft.)

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Process from Point/Station 103.000 to Point/Station 104.000
**** IMPROVED CHANNEL TRAVEL TIME ****
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Upstream point elevation = 1208.300(Ft.)
Downstream point elevation = 1207.000(Ft.)
Channel length thru subarea = 265.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 37.146(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 37.146(CFS)
Depth of flow = 0.459(Ft.), Average velocity = 2.797(Ft/s)
Channel flow top width = 51.887(Ft.)
Flow Velocity = 2.80(Ft/s)
Travel time = 1.58 min.
Time of concentration = 10.33 min.
Critical depth = 0.453(Ft.)
Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Rainfall intensity = 3.592(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.880
Subarea runoff = 10.518(CFS) for 4.300(Ac.)
Total runoff = 42.367(CFS)
Effective area this stream = 13.40(Ac.)
Total Study Area (Main Stream No. 1) = 13.40(Ac.)
Area averaged Fm value = 0.079(In/Hr)
Depth of flow = 0.485(Ft.), Average velocity = 2.891(Ft/s)
Critical depth = 0.480(Ft.)

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Process from Point/Station 104.000 to Point/Station 105.000
**** IMPROVED CHANNEL TRAVEL TIME ****
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Upstream point elevation = 1207.000(Ft.)
Downstream point elevation = 1205.300(Ft.)
Channel length thru subarea = 290.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 47.377(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 47.377(CFS)
Depth of flow = 0.489(Ft.), Average velocity = 3.179(Ft/s)
Channel flow top width = 54.926(Ft.)
Flow Velocity = 3.18(Ft/s)
Travel time = 1.52 min.
Time of concentration = 11.85 min.
Critical depth = 0.504(Ft.)
Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Rainfall intensity = 3.308(In/Hr) for a 100.0 year storm

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Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =      9.943(CFS) for    4.600(Ac.)
Total runoff =     52.310(CFS)
Effective area this stream =       18.00(Ac.)
Total Study Area (Main Stream No. 1) =       18.00(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.510(Ft.), Average velocity =   3.259(Ft/s)
Critical depth =      0.527(Ft.)


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Process from Point/Station      105.000 to Point/Station      106.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1205.300(Ft.)
Downstream point elevation =  1204.200(Ft.)
Channel length thru subarea  =   282.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     61.943(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     61.943(CFS)
Depth of flow =   0.594(Ft.), Average velocity =   2.920(Ft/s)
Channel flow top width =   65.410(Ft.)
Flow Velocity =    2.92(Ft/s)
Travel time  =    1.61 min.
Time of concentration =   13.46 min.
Critical depth =      0.570(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      3.064(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.877
Subarea runoff =     19.169(CFS) for    8.600(Ac.)
Total runoff =     71.479(CFS)
Effective area this stream =       26.60(Ac.)
Total Study Area (Main Stream No. 1) =       26.60(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.630(Ft.), Average velocity =   3.027(Ft/s)
Critical depth =      0.605(Ft.)


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Process from Point/Station      106.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1201.600(Ft.)
Downstream point/station elevation =  1199.500(Ft.)
Pipe length  =   730.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    71.479(CFS)
Nearest computed pipe diameter  =     51.00(In.)
Calculated individual pipe flow  =    71.479(CFS)
Normal flow depth in pipe =   38.20(In.)
Flow top width inside pipe =   44.22(In.)
Critical Depth =   30.12(In.)
Pipe flow velocity =      6.27(Ft/s)
Travel time through pipe =    1.94 min.
Time of concentration (TC) =    15.40 min.


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Process from Point/Station      106.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     26.600(Ac.)
Runoff from this stream =     71.479(CFS)
Time of concentration =   15.40 min.
Rainfall intensity =     2.826(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


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Process from Point/Station 108.000 to Point/Station 109.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Initial subarea data:
Initial area flow distance = 652.000(Ft.)
Top (of initial area) elevation = 1218.200(Ft.)
Bottom (of initial area) elevation = 1208.800(Ft.)
Difference in elevation = 9.400(Ft.)
Slope = 0.01442 s(%)= 1.44
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.480 min.
Rainfall intensity = 3.782(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff = 17.666(CFS)
Total initial stream area = 5.300(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)

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Process from Point/Station 109.000 to Point/Station 110.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1208.800(Ft.)
Downstream point elevation = 1207.000(Ft.)
Channel length thru subarea = 363.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 26.334(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 26.334(CFS)
Depth of flow = 0.396(Ft.), Average velocity = 2.574(Ft/s)
Channel flow top width = 45.629(Ft.)
Flow Velocity = 2.57(Ft/s)
Travel time = 2.35 min.
Time of concentration = 11.83 min.
Critical depth = 0.389(Ft.)
Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Rainfall intensity = 3.311(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff = 17.249(CFS) for 6.700(Ac.)
Total runoff = 34.915(CFS)
Effective area this stream = 12.00(Ac.)
Total Study Area (Main Stream No. 1) = 38.60(Ac.)
Area averaged Fm value = 0.079(In/Hr)
Depth of flow = 0.446(Ft.), Average velocity = 2.765(Ft/s)
Critical depth = 0.441(Ft.)

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Process from Point/Station 110.000 to Point/Station 111.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1207.000(Ft.)
Downstream point elevation = 1204.900(Ft.)
Channel length thru subarea = 431.000(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 40.369(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 40.369(CFS)
Depth of flow = 0.476(Ft.), Average velocity = 2.849(Ft/s)
Channel flow top width = 53.572(Ft.)

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Flow Velocity =    2.85(Ft/s)
Travel time  =    2.52 min.
Time of concentration =   14.35 min.
Critical depth =      0.469(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.949(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =     10.811(CFS) for    5.700(Ac.)
Total runoff =     45.726(CFS)
Effective area this stream =       17.70(Ac.)
Total Study Area (Main Stream No. 1) =       44.30(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.501(Ft.), Average velocity =   2.940(Ft/s)
Critical depth =      0.496(Ft.)


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Process from Point/Station      111.000 to Point/Station      112.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1204.900(Ft.)
Downstream point elevation =  1203.000(Ft.)
Channel length thru subarea  =   366.000(Ft.)
Channel base width      =    6.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     50.093(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     50.093(CFS)
Depth of flow =   0.513(Ft.), Average velocity =   3.081(Ft/s)
Channel flow top width =   57.343(Ft.)
Flow Velocity =    3.08(Ft/s)
Travel time  =    1.98 min.
Time of concentration =   16.33 min.
Critical depth =      0.516(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      2.729(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      8.660(CFS) for    5.100(Ac.)
Total runoff =     54.386(CFS)
Effective area this stream =       22.80(Ac.)
Total Study Area (Main Stream No. 1) =       49.40(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.531(Ft.), Average velocity =   3.145(Ft/s)
Critical depth =      0.539(Ft.)


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Process from Point/Station      112.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     22.800(Ac.)
Runoff from this stream =     54.386(CFS)
Time of concentration =   16.33 min.
Rainfall intensity =     2.729(In/Hr)
Area averaged loss rate (Fm) =    0.0785(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


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Process from Point/Station      113.000 to Point/Station      114.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
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Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   303.000(Ft.)
Top (of initial area) elevation =  1215.700(Ft.)
Bottom (of initial area) elevation =  1209.600(Ft.)
Difference in elevation =     6.100(Ft.)
Slope =    0.02013  s(%)=       2.01
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.526 min.
Rainfall intensity =      4.731(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =      7.957(CFS)
Total initial stream area =        1.900(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


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Process from Point/Station      114.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1209.600(Ft.)
Downstream point/station elevation =  1199.500(Ft.)
Pipe length  =  1464.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     7.957(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.957(CFS)
Normal flow depth in pipe =   12.91(In.)
Flow top width inside pipe =   20.44(In.)
Critical Depth =   12.55(In.)
Pipe flow velocity =      5.13(Ft/s)
Travel time through pipe =    4.76 min.
Time of concentration (TC) =    11.29 min.


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Process from Point/Station      107.000 to Point/Station      107.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.785(In/Hr)
Time of concentration =    11.29 min.
Rainfall intensity =      3.406(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.765
Subarea runoff =      4.811(CFS) for    3.000(Ac.)
Total runoff =     12.768(CFS)
Effective area this stream =        4.90(Ac.)
Total Study Area (Main Stream No. 1) =       54.30(Ac.)
Area averaged Fm value =    0.511(In/Hr)


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Process from Point/Station      112.000 to Point/Station      107.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      4.900(Ac.)
Runoff from this stream =     12.768(CFS)
Time of concentration =   11.29 min.
Rainfall intensity =     3.406(In/Hr)
Area averaged loss rate (Fm) =    0.5111(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6510
Summary of stream data:

Stream Flow rate    Area     TC      Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)      (In/Hr)


1     71.48    26.600     15.40    0.079      2.826
2     54.39    22.800     16.33    0.079      2.729
3     12.77     4.900     11.29    0.511      3.406
Qmax(1) =
          1.000 *    1.000 *    71.479) +
          1.037 *    0.943 *    54.386) +
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           0.800 *    1.000 *    12.768) + =     134.871
Qmax(2) =
           0.964 *    1.000 *    71.479) +
           1.000 *    1.000 *    54.386) +
           0.766 *    1.000 *    12.768) + =     133.107
Qmax(3) =
           1.211 *    0.733 *    71.479) +
           1.256 *    0.691 *    54.386) +
           1.000 *    1.000 *    12.768) + =     123.381

Total of 3 streams to confluence:
Flow rates before confluence point:
      71.479      54.386      12.768
Maximum flow rates at confluence using above data:
      134.871      133.107      123.381
Area of streams before confluence:
       26.600       22.800        4.900
Effective area values after confluence:
       53.004       54.300       40.146
Results of confluence:
Total flow rate =    134.871(CFS)
Time of concentration =    15.403 min.
Effective stream area after confluence =     53.004(Ac.)
Study area average Pervious fraction(Ap) =  0.150
Study area average soil loss rate(Fm) =    0.118(In/Hr)
Study area total (this main stream) =      54.30(Ac.)
End of computations, Total Study Area =           54.30 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.150
Area averaged SCS curve number =  32.0
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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
RATIONAL METHOD HYDROLOGY - PROPOSED CONDITION
100 YEAR STORM EVENT - DRIVE AISLE ON PALMETTO
FN: DRIVE100.OUT MJS

Program License Serial Number 4010

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Initial subarea data:
Initial area flow distance = 243.000(Ft.)
Top (of initial area) elevation = 1212.000(Ft.)
Bottom (of initial area) elevation = 1202.200(Ft.)
Difference in elevation = 9.800(Ft.)
Slope = 0.04033 s(%)= 4.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.200 min.
Rainfall intensity = 5.423(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff = 1.924(CFS)
Total initial stream area = 0.400(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)
End of computations, Total Study Area = 0.40 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

EXISTING CONDITION UNIT HYDROGRAPH

EXISTING CONDITION
100-YEAR, 24-HOUR UNIT HYDROGRAPH

U n i t H y d r o g r a p h A n a l y s i s

Study date 07/26/18

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 4010

18-0011 DUKE - ALABAMA & PALMETTO
UNIT HYDROGRAPH HYDROLOGY
100-YEAR 24-HOUR STORM EVENT
EXISTING CONDITION -MJS

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
54.70	1	1.25
Rainfall data for year 100		
54.70	6	2.75
Rainfall data for year 100		
54.70	24	5.10

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******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
67.0	84.6	54.70	1.000	0.290	1.000	0.290

Area-averaged adjusted loss rate Fm (In/Hr) = 0.290

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
54.70	1.000	67.0	84.6	1.82	0.671

Area-averaged catchment yield fraction, Y = 0.671
Area-averaged low loss fraction, Yb = 0.329
User entry of time of concentration = 0.328 (hours)

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Watershed area = 54.70(Ac.)
Catchment Lag time = 0.262 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 31.7581
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.290(In/Hr)
Average low loss rate fraction (Yb) = 0.329 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.463(In)
Computed peak 30-minute rainfall = 0.947(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 2.027(In)
Specified peak 6-hour rainfall = 2.750(In)
Specified peak 24-hour rainfall = 5.100(In)

Rainfall depth area reduction factors:
Using a total area of 54.70(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.461(In)
30-minute factor = 0.997 Adjusted rainfall = 0.945(In)
1-hour factor = 0.997 Adjusted rainfall = 1.247(In)
3-hour factor = 1.000 Adjusted rainfall = 2.026(In)
6-hour factor = 1.000 Adjusted rainfall = 2.750(In)
24-hour factor = 1.000 Adjusted rainfall = 5.100(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 661.53 (CFS))	
1	2.111	13.964
2	12.445	68.362
3	32.498	132.655
4	59.419	178.090
5	79.359	131.914
6	90.202	71.723
7	95.434	34.617
8	97.888	16.233
9	98.659	5.099
10	99.231	3.781
11	99.787	3.679
12	100.000	1.410

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4614	0.4614
2	0.6089	0.1474
3	0.7161	0.1072
4	0.8034	0.0873
5	0.8784	0.0750
6	0.9449	0.0665
7	1.0050	0.0601
8	1.0601	0.0551
9	1.1113	0.0511
10	1.1591	0.0478
11	1.2041	0.0450
12	1.2468	0.0426
13	1.2917	0.0449
14	1.3347	0.0430
15	1.3761	0.0413
16	1.4159	0.0398
17	1.4543	0.0385
18	1.4916	0.0372
19	1.5276	0.0361
20	1.5627	0.0350
21	1.5968	0.0341
22	1.6299	0.0332
23	1.6623	0.0323
24	1.6939	0.0316
25	1.7247	0.0308
26	1.7549	0.0302
27	1.7844	0.0295
28	1.8133	0.0289
29	1.8417	0.0284
30	1.8695	0.0278
31	1.8968	0.0273
32	1.9236	0.0268
33	1.9499	0.0263
34	1.9758	0.0259
35	2.0013	0.0255
36	2.0264	0.0251
37	2.0510	0.0246
38	2.0752	0.0242
39	2.0991	0.0239
40	2.1226	0.0235
41	2.1458	0.0232
42	2.1687	0.0229
43	2.1913	0.0226
44	2.2136	0.0223
45	2.2356	0.0220
46	2.2573	0.0217
47	2.2788	0.0215
48	2.3000	0.0212
49	2.3210	0.0210

50	2.3417	0.0207
51	2.3622	0.0205
52	2.3825	0.0203
53	2.4026	0.0201
54	2.4224	0.0199
55	2.4421	0.0196
56	2.4615	0.0195
57	2.4808	0.0193
58	2.4999	0.0191
59	2.5187	0.0189
60	2.5374	0.0187
61	2.5560	0.0185
62	2.5743	0.0184
63	2.5925	0.0182
64	2.6106	0.0180
65	2.6285	0.0179
66	2.6462	0.0177
67	2.6638	0.0176
68	2.6812	0.0174
69	2.6985	0.0173
70	2.7156	0.0171
71	2.7327	0.0170
72	2.7495	0.0169
73	2.7665	0.0170
74	2.7833	0.0168
75	2.8000	0.0167
76	2.8166	0.0166
77	2.8330	0.0165
78	2.8494	0.0163
79	2.8656	0.0162
80	2.8817	0.0161
81	2.8977	0.0160
82	2.9136	0.0159
83	2.9294	0.0158
84	2.9450	0.0157
85	2.9606	0.0156
86	2.9761	0.0155
87	2.9914	0.0154
88	3.0067	0.0153
89	3.0219	0.0152
90	3.0370	0.0151
91	3.0520	0.0150
92	3.0669	0.0149
93	3.0817	0.0148
94	3.0964	0.0147
95	3.1110	0.0146
96	3.1256	0.0146
97	3.1401	0.0145
98	3.1544	0.0144
99	3.1687	0.0143
100	3.1830	0.0142
101	3.1971	0.0141
102	3.2112	0.0141
103	3.2252	0.0140
104	3.2391	0.0139
105	3.2529	0.0138
106	3.2667	0.0138
107	3.2804	0.0137
108	3.2940	0.0136
109	3.3076	0.0136
110	3.3211	0.0135
111	3.3345	0.0134
112	3.3478	0.0134
113	3.3611	0.0133
114	3.3743	0.0132
115	3.3875	0.0132
116	3.4006	0.0131
117	3.4136	0.0130
118	3.4266	0.0130
119	3.4395	0.0129
120	3.4524	0.0128
121	3.4651	0.0128
122	3.4779	0.0127
123	3.4906	0.0127
124	3.5032	0.0126
125	3.5157	0.0126
126	3.5282	0.0125
127	3.5407	0.0125
128	3.5531	0.0124
129	3.5654	0.0123
130	3.5777	0.0123
131	3.5900	0.0122
132	3.6021	0.0122
133	3.6143	0.0121

134	3.6264	0.0121
135	3.6384	0.0120
136	3.6504	0.0120
137	3.6623	0.0119
138	3.6742	0.0119
139	3.6860	0.0118
140	3.6978	0.0118
141	3.7096	0.0117
142	3.7213	0.0117
143	3.7329	0.0117
144	3.7445	0.0116
145	3.7561	0.0116
146	3.7676	0.0115
147	3.7791	0.0115
148	3.7905	0.0114
149	3.8019	0.0114
150	3.8133	0.0113
151	3.8246	0.0113
152	3.8359	0.0113
153	3.8471	0.0112
154	3.8583	0.0112
155	3.8694	0.0111
156	3.8805	0.0111
157	3.8916	0.0111
158	3.9026	0.0110
159	3.9136	0.0110
160	3.9245	0.0109
161	3.9355	0.0109
162	3.9463	0.0109
163	3.9572	0.0108
164	3.9680	0.0108
165	3.9787	0.0108
166	3.9895	0.0107
167	4.0001	0.0107
168	4.0108	0.0107
169	4.0214	0.0106
170	4.0320	0.0106
171	4.0426	0.0106
172	4.0531	0.0105
173	4.0636	0.0105
174	4.0740	0.0105
175	4.0844	0.0104
176	4.0948	0.0104
177	4.1052	0.0104
178	4.1155	0.0103
179	4.1258	0.0103
180	4.1360	0.0103
181	4.1462	0.0102
182	4.1564	0.0102
183	4.1666	0.0102
184	4.1767	0.0101
185	4.1868	0.0101
186	4.1969	0.0101
187	4.2069	0.0100
188	4.2170	0.0100
189	4.2269	0.0100
190	4.2369	0.0100
191	4.2468	0.0099
192	4.2567	0.0099
193	4.2666	0.0099
194	4.2764	0.0098
195	4.2862	0.0098
196	4.2960	0.0098
197	4.3057	0.0098
198	4.3155	0.0097
199	4.3252	0.0097
200	4.3348	0.0097
201	4.3445	0.0096
202	4.3541	0.0096
203	4.3637	0.0096
204	4.3733	0.0096
205	4.3828	0.0095
206	4.3923	0.0095
207	4.4018	0.0095
208	4.4113	0.0095
209	4.4207	0.0094
210	4.4301	0.0094
211	4.4395	0.0094
212	4.4489	0.0094
213	4.4582	0.0093
214	4.4675	0.0093
215	4.4768	0.0093
216	4.4861	0.0093
217	4.4953	0.0092

218	4.5045	0.0092
219	4.5137	0.0092
220	4.5229	0.0092
221	4.5321	0.0091
222	4.5412	0.0091
223	4.5503	0.0091
224	4.5594	0.0091
225	4.5684	0.0091
226	4.5775	0.0090
227	4.5865	0.0090
228	4.5955	0.0090
229	4.6044	0.0090
230	4.6134	0.0089
231	4.6223	0.0089
232	4.6312	0.0089
233	4.6401	0.0089
234	4.6490	0.0089
235	4.6578	0.0088
236	4.6666	0.0088
237	4.6754	0.0088
238	4.6842	0.0088
239	4.6930	0.0088
240	4.7017	0.0087
241	4.7104	0.0087
242	4.7191	0.0087
243	4.7278	0.0087
244	4.7365	0.0087
245	4.7451	0.0086
246	4.7537	0.0086
247	4.7623	0.0086
248	4.7709	0.0086
249	4.7795	0.0086
250	4.7880	0.0085
251	4.7966	0.0085
252	4.8051	0.0085
253	4.8135	0.0085
254	4.8220	0.0085
255	4.8305	0.0085
256	4.8389	0.0084
257	4.8473	0.0084
258	4.8557	0.0084
259	4.8641	0.0084
260	4.8724	0.0084
261	4.8808	0.0083
262	4.8891	0.0083
263	4.8974	0.0083
264	4.9057	0.0083
265	4.9140	0.0083
266	4.9222	0.0083
267	4.9305	0.0082
268	4.9387	0.0082
269	4.9469	0.0082
270	4.9551	0.0082
271	4.9632	0.0082
272	4.9714	0.0082
273	4.9795	0.0081
274	4.9877	0.0081
275	4.9958	0.0081
276	5.0038	0.0081
277	5.0119	0.0081
278	5.0200	0.0081
279	5.0280	0.0080
280	5.0360	0.0080
281	5.0440	0.0080
282	5.0520	0.0080
283	5.0600	0.0080
284	5.0680	0.0080
285	5.0759	0.0079
286	5.0838	0.0079
287	5.0918	0.0079
288	5.0997	0.0079

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0079	0.0026	0.0053
2	0.0079	0.0026	0.0053
3	0.0079	0.0026	0.0053
4	0.0080	0.0026	0.0053
5	0.0080	0.0026	0.0054
6	0.0080	0.0026	0.0054
7	0.0080	0.0026	0.0054
8	0.0081	0.0027	0.0054

9	0.0081	0.0027	0.0054
10	0.0081	0.0027	0.0054
11	0.0081	0.0027	0.0055
12	0.0082	0.0027	0.0055
13	0.0082	0.0027	0.0055
14	0.0082	0.0027	0.0055
15	0.0082	0.0027	0.0055
16	0.0083	0.0027	0.0055
17	0.0083	0.0027	0.0056
18	0.0083	0.0027	0.0056
19	0.0083	0.0027	0.0056
20	0.0084	0.0028	0.0056
21	0.0084	0.0028	0.0056
22	0.0084	0.0028	0.0056
23	0.0085	0.0028	0.0057
24	0.0085	0.0028	0.0057
25	0.0085	0.0028	0.0057
26	0.0085	0.0028	0.0057
27	0.0086	0.0028	0.0057
28	0.0086	0.0028	0.0058
29	0.0086	0.0028	0.0058
30	0.0086	0.0028	0.0058
31	0.0087	0.0029	0.0058
32	0.0087	0.0029	0.0058
33	0.0087	0.0029	0.0059
34	0.0088	0.0029	0.0059
35	0.0088	0.0029	0.0059
36	0.0088	0.0029	0.0059
37	0.0089	0.0029	0.0059
38	0.0089	0.0029	0.0060
39	0.0089	0.0029	0.0060
40	0.0089	0.0029	0.0060
41	0.0090	0.0030	0.0060
42	0.0090	0.0030	0.0060
43	0.0091	0.0030	0.0061
44	0.0091	0.0030	0.0061
45	0.0091	0.0030	0.0061
46	0.0091	0.0030	0.0061
47	0.0092	0.0030	0.0062
48	0.0092	0.0030	0.0062
49	0.0093	0.0031	0.0062
50	0.0093	0.0031	0.0062
51	0.0093	0.0031	0.0063
52	0.0094	0.0031	0.0063
53	0.0094	0.0031	0.0063
54	0.0094	0.0031	0.0063
55	0.0095	0.0031	0.0064
56	0.0095	0.0031	0.0064
57	0.0096	0.0031	0.0064
58	0.0096	0.0032	0.0064
59	0.0096	0.0032	0.0065
60	0.0097	0.0032	0.0065
61	0.0097	0.0032	0.0065
62	0.0098	0.0032	0.0065
63	0.0098	0.0032	0.0066
64	0.0098	0.0032	0.0066
65	0.0099	0.0033	0.0066
66	0.0099	0.0033	0.0067
67	0.0100	0.0033	0.0067
68	0.0100	0.0033	0.0067
69	0.0101	0.0033	0.0068
70	0.0101	0.0033	0.0068
71	0.0102	0.0033	0.0068
72	0.0102	0.0034	0.0068
73	0.0103	0.0034	0.0069
74	0.0103	0.0034	0.0069
75	0.0104	0.0034	0.0069
76	0.0104	0.0034	0.0070
77	0.0105	0.0034	0.0070
78	0.0105	0.0035	0.0070
79	0.0106	0.0035	0.0071
80	0.0106	0.0035	0.0071
81	0.0107	0.0035	0.0071
82	0.0107	0.0035	0.0072
83	0.0108	0.0035	0.0072
84	0.0108	0.0036	0.0072
85	0.0109	0.0036	0.0073
86	0.0109	0.0036	0.0073
87	0.0110	0.0036	0.0074
88	0.0110	0.0036	0.0074
89	0.0111	0.0037	0.0074
90	0.0111	0.0037	0.0075
91	0.0112	0.0037	0.0075
92	0.0113	0.0037	0.0076

93	0.0113	0.0037	0.0076
94	0.0114	0.0038	0.0076
95	0.0115	0.0038	0.0077
96	0.0115	0.0038	0.0077
97	0.0116	0.0038	0.0078
98	0.0117	0.0038	0.0078
99	0.0117	0.0039	0.0079
100	0.0118	0.0039	0.0079
101	0.0119	0.0039	0.0080
102	0.0119	0.0039	0.0080
103	0.0120	0.0040	0.0081
104	0.0121	0.0040	0.0081
105	0.0122	0.0040	0.0082
106	0.0122	0.0040	0.0082
107	0.0123	0.0041	0.0083
108	0.0124	0.0041	0.0083
109	0.0125	0.0041	0.0084
110	0.0126	0.0041	0.0084
111	0.0127	0.0042	0.0085
112	0.0127	0.0042	0.0085
113	0.0128	0.0042	0.0086
114	0.0129	0.0043	0.0087
115	0.0130	0.0043	0.0087
116	0.0131	0.0043	0.0088
117	0.0132	0.0044	0.0089
118	0.0133	0.0044	0.0089
119	0.0134	0.0044	0.0090
120	0.0135	0.0044	0.0090
121	0.0136	0.0045	0.0091
122	0.0137	0.0045	0.0092
123	0.0138	0.0046	0.0093
124	0.0139	0.0046	0.0093
125	0.0141	0.0046	0.0094
126	0.0141	0.0047	0.0095
127	0.0143	0.0047	0.0096
128	0.0144	0.0047	0.0096
129	0.0146	0.0048	0.0098
130	0.0146	0.0048	0.0098
131	0.0148	0.0049	0.0099
132	0.0149	0.0049	0.0100
133	0.0151	0.0050	0.0101
134	0.0152	0.0050	0.0102
135	0.0154	0.0051	0.0103
136	0.0155	0.0051	0.0104
137	0.0157	0.0052	0.0105
138	0.0158	0.0052	0.0106
139	0.0160	0.0053	0.0107
140	0.0161	0.0053	0.0108
141	0.0163	0.0054	0.0110
142	0.0165	0.0054	0.0110
143	0.0167	0.0055	0.0112
144	0.0168	0.0055	0.0113
145	0.0169	0.0056	0.0113
146	0.0170	0.0056	0.0114
147	0.0173	0.0057	0.0116
148	0.0174	0.0057	0.0117
149	0.0177	0.0058	0.0119
150	0.0179	0.0059	0.0120
151	0.0182	0.0060	0.0122
152	0.0184	0.0060	0.0123
153	0.0187	0.0062	0.0125
154	0.0189	0.0062	0.0127
155	0.0193	0.0063	0.0129
156	0.0195	0.0064	0.0130
157	0.0199	0.0065	0.0133
158	0.0201	0.0066	0.0135
159	0.0205	0.0068	0.0138
160	0.0207	0.0068	0.0139
161	0.0212	0.0070	0.0142
162	0.0215	0.0071	0.0144
163	0.0220	0.0072	0.0148
164	0.0223	0.0073	0.0150
165	0.0229	0.0075	0.0154
166	0.0232	0.0076	0.0156
167	0.0239	0.0079	0.0160
168	0.0242	0.0080	0.0162
169	0.0251	0.0083	0.0168
170	0.0255	0.0084	0.0171
171	0.0263	0.0087	0.0177
172	0.0268	0.0088	0.0180
173	0.0278	0.0092	0.0187
174	0.0284	0.0093	0.0190
175	0.0295	0.0097	0.0198
176	0.0302	0.0099	0.0202

177	0.0316	0.0104	0.0212
178	0.0323	0.0106	0.0217
179	0.0341	0.0112	0.0229
180	0.0350	0.0115	0.0235
181	0.0372	0.0123	0.0250
182	0.0385	0.0127	0.0258
183	0.0413	0.0136	0.0277
184	0.0430	0.0142	0.0289
185	0.0426	0.0140	0.0286
186	0.0450	0.0148	0.0302
187	0.0511	0.0168	0.0343
188	0.0551	0.0182	0.0370
189	0.0665	0.0219	0.0446
190	0.0750	0.0242	0.0508
191	0.1072	0.0242	0.0830
192	0.1474	0.0242	0.1233
193	0.4614	0.0242	0.4373
194	0.0873	0.0242	0.0632
195	0.0601	0.0198	0.0403
196	0.0478	0.0157	0.0321
197	0.0449	0.0148	0.0301
198	0.0398	0.0131	0.0267
199	0.0361	0.0119	0.0242
200	0.0332	0.0109	0.0223
201	0.0308	0.0102	0.0207
202	0.0289	0.0095	0.0194
203	0.0273	0.0090	0.0183
204	0.0259	0.0085	0.0174
205	0.0246	0.0081	0.0165
206	0.0235	0.0077	0.0158
207	0.0226	0.0074	0.0151
208	0.0217	0.0072	0.0146
209	0.0210	0.0069	0.0141
210	0.0203	0.0067	0.0136
211	0.0196	0.0065	0.0132
212	0.0191	0.0063	0.0128
213	0.0185	0.0061	0.0124
214	0.0180	0.0059	0.0121
215	0.0176	0.0058	0.0118
216	0.0171	0.0056	0.0115
217	0.0170	0.0056	0.0114
218	0.0166	0.0055	0.0111
219	0.0162	0.0053	0.0109
220	0.0159	0.0052	0.0107
221	0.0156	0.0051	0.0104
222	0.0153	0.0050	0.0102
223	0.0150	0.0049	0.0101
224	0.0147	0.0048	0.0099
225	0.0145	0.0048	0.0097
226	0.0142	0.0047	0.0095
227	0.0140	0.0046	0.0094
228	0.0138	0.0045	0.0092
229	0.0136	0.0045	0.0091
230	0.0134	0.0044	0.0090
231	0.0132	0.0043	0.0088
232	0.0130	0.0043	0.0087
233	0.0128	0.0042	0.0086
234	0.0126	0.0042	0.0085
235	0.0125	0.0041	0.0084
236	0.0123	0.0040	0.0082
237	0.0121	0.0040	0.0081
238	0.0120	0.0039	0.0080
239	0.0118	0.0039	0.0079
240	0.0117	0.0039	0.0078
241	0.0116	0.0038	0.0078
242	0.0114	0.0038	0.0077
243	0.0113	0.0037	0.0076
244	0.0112	0.0037	0.0075
245	0.0111	0.0036	0.0074
246	0.0109	0.0036	0.0073
247	0.0108	0.0036	0.0073
248	0.0107	0.0035	0.0072
249	0.0106	0.0035	0.0071
250	0.0105	0.0035	0.0071
251	0.0104	0.0034	0.0070
252	0.0103	0.0034	0.0069
253	0.0102	0.0034	0.0069
254	0.0101	0.0033	0.0068
255	0.0100	0.0033	0.0067
256	0.0100	0.0033	0.0067
257	0.0099	0.0032	0.0066
258	0.0098	0.0032	0.0066
259	0.0097	0.0032	0.0065
260	0.0096	0.0032	0.0065

261	0.0095	0.0031	0.0064
262	0.0095	0.0031	0.0063
263	0.0094	0.0031	0.0063
264	0.0093	0.0031	0.0062
265	0.0092	0.0030	0.0062
266	0.0092	0.0030	0.0062
267	0.0091	0.0030	0.0061
268	0.0090	0.0030	0.0061
269	0.0090	0.0030	0.0060
270	0.0089	0.0029	0.0060
271	0.0088	0.0029	0.0059
272	0.0088	0.0029	0.0059
273	0.0087	0.0029	0.0058
274	0.0087	0.0029	0.0058
275	0.0086	0.0028	0.0058
276	0.0085	0.0028	0.0057
277	0.0085	0.0028	0.0057
278	0.0084	0.0028	0.0057
279	0.0084	0.0028	0.0056
280	0.0083	0.0027	0.0056
281	0.0083	0.0027	0.0055
282	0.0082	0.0027	0.0055
283	0.0082	0.0027	0.0055
284	0.0081	0.0027	0.0054
285	0.0081	0.0027	0.0054
286	0.0080	0.0026	0.0054
287	0.0080	0.0026	0.0053
288	0.0079	0.0026	0.0053

Total soil rain loss = 1.51(In)
Total effective rainfall = 3.59(In)
Peak flow rate in flood hydrograph = 114.63(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	50.0	100.0	150.0	200.0
0+ 5	0.0005	0.07	Q				
0+10	0.0035	0.44	Q				
0+15	0.0114	1.14	Q				
0+20	0.0257	2.09	Q				
0+25	0.0450	2.79	Q				
0+30	0.0669	3.18	Q				
0+35	0.0901	3.37	Q				
0+40	0.1139	3.47	Q				
0+45	0.1381	3.50	Q				
0+50	0.1624	3.54	Q				
0+55	0.1870	3.57	Q				
1+ 0	0.2117	3.58	Q				
1+ 5	0.2364	3.59	Q				
1+10	0.2612	3.61	Q				
1+15	0.2861	3.62	Q				
1+20	0.3111	3.63	Q				
1+25	0.3362	3.64	Q				
1+30	0.3613	3.65	Q				
1+35	0.3865	3.66	Q				
1+40	0.4118	3.67	QV				
1+45	0.4372	3.68	QV				
1+50	0.4627	3.70	QV				
1+55	0.4882	3.71	QV				
2+ 0	0.5138	3.72	QV				
2+ 5	0.5395	3.73	QV				
2+10	0.5653	3.74	QV				
2+15	0.5912	3.76	QV				
2+20	0.6171	3.77	QV				
2+25	0.6432	3.78	QV				
2+30	0.6693	3.79	QV				
2+35	0.6955	3.81	QV				
2+40	0.7218	3.82	QV				
2+45	0.7482	3.83	QV				
2+50	0.7747	3.85	QV				
2+55	0.8013	3.86	QV				
3+ 0	0.8279	3.87	Q V				
3+ 5	0.8547	3.89	Q V				
3+10	0.8815	3.90	Q V				
3+15	0.9085	3.91	Q V				
3+20	0.9355	3.93	Q V				
3+25	0.9627	3.94	Q V				

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 3+30       0.9899      3.95  Q V       |          |          |          |
 3+35       1.0172      3.97  Q V       |          |          |          |
 3+40       1.0447      3.98  Q V       |          |          |          |
 3+45       1.0722      4.00  Q V       |          |          |          |
 3+50       1.0998      4.01  Q V       |          |          |          |
 3+55       1.1276      4.03  Q V       |          |          |          |
 4+ 0       1.1554      4.04  Q V       |          |          |          |
 4+ 5       1.1833      4.06  Q V       |          |          |          |
 4+10       1.2114      4.07  Q V       |          |          |          |
 4+15       1.2396      4.09  Q  V      |          |          |          |
 4+20       1.2678      4.10  Q  V      |          |          |          |
 4+25       1.2962      4.12  Q  V      |          |          |          |
 4+30       1.3247      4.14  Q  V      |          |          |          |
 4+35       1.3533      4.15  Q  V      |          |          |          |
 4+40       1.3820      4.17  Q  V      |          |          |          |
 4+45       1.4108      4.19  Q  V      |          |          |          |
 4+50       1.4398      4.20  Q  V      |          |          |          |
 4+55       1.4688      4.22  Q  V      |          |          |          |
 5+ 0       1.4980      4.24  Q  V      |          |          |          |
 5+ 5       1.5273      4.25  Q  V      |          |          |          |
 5+10       1.5567      4.27  Q  V      |          |          |          |
 5+15       1.5863      4.29  Q  V      |          |          |          |
 5+20       1.6159      4.31  Q  V      |          |          |          |
 5+25       1.6457      4.33  Q   V     |          |          |          |
 5+30       1.6756      4.34  Q   V     |          |          |          |
 5+35       1.7057      4.36  Q   V     |          |          |          |
 5+40       1.7358      4.38  Q   V     |          |          |          |
 5+45       1.7661      4.40  Q   V     |          |          |          |
 5+50       1.7966      4.42  Q   V     |          |          |          |
 5+55       1.8272      4.44  Q   V     |          |          |          |
 6+ 0       1.8579      4.46  Q   V     |          |          |          |
 6+ 5       1.8887      4.48  Q   V     |          |          |          |
 6+10       1.9197      4.50  Q   V     |          |          |          |
 6+15       1.9508      4.52  Q   V     |          |          |          |
 6+20       1.9821      4.54  Q   V     |          |          |          |
 6+25       2.0135      4.56  Q   V     |          |          |          |
 6+30       2.0451      4.58  Q    V    |          |          |          |
 6+35       2.0768      4.60  Q    V    |          |          |          |
 6+40       2.1086      4.63  Q    V    |          |          |          |
 6+45       2.1407      4.65  Q    V    |          |          |          |
 6+50       2.1728      4.67  Q    V    |          |          |          |
 6+55       2.2052      4.69  Q    V    |          |          |          |
 7+ 0       2.2377      4.72  Q    V    |          |          |          |
 7+ 5       2.2703      4.74  Q    V    |          |          |          |
 7+10       2.3031      4.76  Q    V    |          |          |          |
 7+15       2.3361      4.79  Q    V    |          |          |          |
 7+20       2.3693      4.81  Q    V    |          |          |          |
 7+25       2.4026      4.84  Q    V    |          |          |          |
 7+30       2.4361      4.86  Q    V    |          |          |          |
 7+35       2.4697      4.89  Q     V   |          |          |          |
 7+40       2.5036      4.92  Q     V   |          |          |          |
 7+45       2.5376      4.94  Q     V   |          |          |          |
 7+50       2.5718      4.97  Q     V   |          |          |          |
 7+55       2.6062      5.00  Q     V   |          |          |          |
 8+ 0       2.6408      5.02  |Q    V   |          |          |          |
 8+ 5       2.6756      5.05  |Q    V   |          |          |          |
 8+10       2.7106      5.08  |Q    V   |          |          |          |
 8+15       2.7458      5.11  |Q    V   |          |          |          |
 8+20       2.7812      5.14  |Q    V   |          |          |          |
 8+25       2.8168      5.17  |Q    V   |          |          |          |
 8+30       2.8526      5.20  |Q    V   |          |          |          |
 8+35       2.8886      5.23  |Q     V  |          |          |          |
 8+40       2.9248      5.26  |Q     V  |          |          |          |
 8+45       2.9612      5.29  |Q     V  |          |          |          |
 8+50       2.9979      5.32  |Q     V  |          |          |          |
 8+55       3.0348      5.36  |Q     V  |          |          |          |
 9+ 0       3.0719      5.39  |Q     V  |          |          |          |
 9+ 5       3.1093      5.43  |Q     V  |          |          |          |
 9+10       3.1469      5.46  |Q     V  |          |          |          |
 9+15       3.1848      5.50  |Q     V  |          |          |          |
 9+20       3.2229      5.53  |Q     V  |          |          |          |
 9+25       3.2612      5.57  |Q     V  |          |          |          |
 9+30       3.2998      5.61  |Q      V |          |          |          |
 9+35       3.3387      5.64  |Q      V |          |          |          |
 9+40       3.3778      5.68  |Q      V |          |          |          |
 9+45       3.4173      5.72  |Q      V |          |          |          |
 9+50       3.4570      5.76  |Q      V |          |          |          |
 9+55       3.4969      5.80  |Q      V |          |          |          |
10+ 0       3.5372      5.85  |Q      V |          |          |          |
10+ 5       3.5778      5.89  |Q      V |          |          |          |
10+10       3.6186      5.93  |Q      V |          |          |          |
10+15       3.6598      5.98  |Q      V |          |          |          |
10+20       3.7013      6.03  |Q       V|          |          |          |
10+25       3.7431      6.07  |Q       V|          |          |          |
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10+30       3.7853      6.12  |Q       V|          |           |          |
10+35       3.8278      6.17  |Q       V|          |           |          |
10+40       3.8706      6.22  |Q       V|          |           |          |
10+45       3.9138      6.27  |Q       V|          |           |          |
10+50       3.9573      6.32  |Q       V|          |           |          |
10+55       4.0012      6.38  |Q       V|          |           |          |
11+ 0       4.0455      6.43  |Q       V|          |           |          |
11+ 5       4.0902      6.49  |Q        V          |           |          |
11+10       4.1353      6.55  |Q        V          |           |          |
11+15       4.1807      6.60  |Q        V          |           |          |
11+20       4.2267      6.67  |Q        V          |           |          |
11+25       4.2730      6.73  |Q        V          |           |          |
11+30       4.3198      6.79  |Q        V          |           |          |
11+35       4.3670      6.86  |Q        V          |           |          |
11+40       4.4147      6.92  |Q        V          |           |          |
11+45       4.4628      6.99  |Q        V          |           |          |
11+50       4.5115      7.07  |Q        |V          |           |          |
11+55       4.5606      7.14  |Q        |V          |           |          |
12+ 0       4.6103      7.21  |Q        |V          |           |          |
12+ 5       4.6605      7.29  |Q        |V          |           |          |
12+10       4.7112      7.36  |Q        |V          |           |          |
12+15       4.7624      7.43  |Q        |V          |           |          |
12+20       4.8140      7.49  |Q        |V          |           |          |
12+25       4.8660      7.56  |Q        |V          |           |          |
12+30       4.9186      7.64  |Q        | V         |           |          |
12+35       4.9718      7.73  |Q        | V         |           |          |
12+40       5.0257      7.82  |Q        | V         |           |          |
12+45       5.0803      7.92  |Q        | V         |           |          |
12+50       5.1356      8.03  |Q        | V         |           |          |
12+55       5.1916      8.14  |Q        | V         |           |          |
13+ 0       5.2485      8.25  |Q        | V         |           |          |
13+ 5       5.3061      8.37  |Q        | V         |           |          |
13+10       5.3646      8.49  |Q        |  V        |           |          |
13+15       5.4239      8.62  |Q        |  V        |           |          |
13+20       5.4842      8.75  |Q        |  V        |           |          |
13+25       5.5454      8.89  |Q        |  V        |           |          |
13+30       5.6076      9.04  |Q        |  V        |           |          |
13+35       5.6709      9.19  |Q        |  V        |           |          |
13+40       5.7353      9.35  |Q        |   V       |           |          |
13+45       5.8008      9.51  |Q        |   V       |           |          |
13+50       5.8675      9.69  |Q        |   V       |           |          |
13+55       5.9355      9.87  |Q        |   V       |           |          |
14+ 0       6.0049     10.07  | Q       |   V       |           |          |
14+ 5       6.0757     10.28  | Q       |   V       |           |          |
14+10       6.1480     10.50  | Q       |    V      |           |          |
14+15       6.2220     10.74  | Q       |    V      |           |          |
14+20       6.2978     11.01  | Q       |    V      |           |          |
14+25       6.3755     11.28  | Q       |    V      |           |          |
14+30       6.4552     11.57  | Q       |    V      |           |          |
14+35       6.5370     11.88  | Q       |    V      |           |          |
14+40       6.6211     12.21  | Q       |     V     |           |          |
14+45       6.7076     12.56  | Q       |     V     |           |          |
14+50       6.7968     12.95  | Q       |     V     |           |          |
14+55       6.8889     13.37  | Q       |     V     |           |          |
15+ 0       6.9842     13.84  | Q       |      V    |           |          |
15+ 5       7.0829     14.34  | Q       |      V    |           |          |
15+10       7.1857     14.92  | Q       |      V    |           |          |
15+15       7.2927     15.55  |  Q      |      V    |           |          |
15+20       7.4048     16.28  |  Q      |       V   |           |          |
15+25       7.5223     17.05  |  Q      |       V   |           |          |
15+30       7.6450     17.82  |  Q      |       V   |           |          |
15+35       7.7726     18.54  |  Q      |        V  |           |          |
15+40       7.9061     19.37  |  Q      |        V  |           |          |
15+45       8.0482     20.64  |   Q     |        V  |           |          |
15+50       8.2039     22.60  |   Q     |         V |           |          |
15+55       8.3805     25.65  |    Q    |         V |           |          |
16+ 0       8.5962     31.31  |     Q   |          V|           |          |
16+ 5       8.9075     45.21  |      Q  |          V|           |          |
16+10       9.4176     74.07  |         |    Q     |  V        |          |
16+15      10.1203    102.02  |         |          Q   V        |          |
16+20      10.9097    114.63  |         |           | Q   V     |          |
16+25      11.5294     89.97  |         |       Q   |       V   |          |
16+30      11.9412     59.79  |         |Q          |        V  |          |
16+35      12.2145     39.69  |       Q |           |        V  |          |
16+40      12.4106     28.48  |     Q   |           |         V |          |
16+45      12.5590     21.55  |   Q     |           |         V |          |
16+50      12.6895     18.94  |  Q      |           |          V|          |
16+55      12.8079     17.19  |  Q      |           |          V|          |
17+ 0       12.9112    15.00  |  Q      |           |          V|          |
17+ 5       13.0036    13.41  | Q       |           |          V|          |
17+10       13.0900    12.55  | Q       |           |           V          |
17+15       13.1715    11.84  | Q       |           |           V          |
17+20       13.2489    11.23  | Q       |           |           V          |
17+25       13.3226    10.70  | Q       |           |           V          |
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17+30      13.3931     10.24  | Q       |         |         | V       |
17+35      13.4608      9.84  |Q        |         |         | V       |
17+40      13.5261      9.47  |Q        |         |         |  V      |
17+45      13.5891      9.15  |Q        |         |         |  V      |
17+50      13.6500      8.85  |Q        |         |         |  V      |
17+55      13.7091      8.58  |Q        |         |         |  V      |
18+ 0      13.7665      8.33  |Q        |         |         |  V      |
18+ 5      13.8223      8.10  |Q        |         |         |  V      |
18+10      13.8767      7.90  |Q        |         |         |  V      |
18+15      13.9299      7.72  |Q        |         |         |   V     |
18+20      13.9819      7.56  |Q        |         |         |   V     |
18+25      14.0329      7.41  |Q        |         |         |   V     |
18+30      14.0829      7.25  |Q        |         |         |   V     |
18+35      14.1319      7.11  |Q        |         |         |   V     |
18+40      14.1798      6.97  |Q        |         |         |   V     |
18+45      14.2269      6.83  |Q        |         |         |   V     |
18+50      14.2730      6.70  |Q        |         |         |   V     |
18+55      14.3183      6.58  |Q        |         |         |    V    |
19+ 0      14.3629      6.46  |Q        |         |         |    V    |
19+ 5      14.4066      6.35  |Q        |         |         |    V    |
19+10      14.4497      6.25  |Q        |         |         |    V    |
19+15      14.4920      6.15  |Q        |         |         |    V    |
19+20      14.5337      6.05  |Q        |         |         |    V    |
19+25      14.5748      5.96  |Q        |         |         |    V    |
19+30      14.6152      5.87  |Q        |         |         |    V    |
19+35      14.6551      5.79  |Q        |         |         |    V    |
19+40      14.6944      5.71  |Q        |         |         |    V    |
19+45      14.7331      5.63  |Q        |         |         |     V   |
19+50      14.7714      5.55  |Q        |         |         |     V   |
19+55      14.8091      5.48  |Q        |         |         |     V   |
20+ 0      14.8464      5.41  |Q        |         |         |     V   |
20+ 5      14.8832      5.34  |Q        |         |         |     V   |
20+10      14.9195      5.28  |Q        |         |         |     V   |
20+15      14.9555      5.22  |Q        |         |         |     V   |
20+20      14.9910      5.15  |Q        |         |         |     V   |
20+25      15.0260      5.10  |Q        |         |         |     V   |
20+30      15.0607      5.04  |Q        |         |         |     V   |
20+35      15.0951      4.98  Q        |         |         |     V   |
20+40      15.1290      4.93  Q        |         |         |      V  |
20+45      15.1626      4.88  Q        |         |         |      V  |
20+50      15.1959      4.83  Q        |         |         |      V  |
20+55      15.2288      4.78  Q        |         |         |      V  |
21+ 0      15.2613      4.73  Q        |         |         |      V  |
21+ 5      15.2936      4.68  Q        |         |         |      V  |
21+10      15.3255      4.64  Q        |         |         |      V  |
21+15      15.3572      4.59  Q        |         |         |      V  |
21+20      15.3885      4.55  Q        |         |         |      V  |
21+25      15.4196      4.51  Q        |         |         |      V  |
21+30      15.4504      4.47  Q        |         |         |      V  |
21+35      15.4809      4.43  Q        |         |         |      V  |
21+40      15.5111      4.39  Q        |         |         |      V  |
21+45      15.5411      4.35  Q        |         |         |       V |
21+50      15.5709      4.32  Q        |         |         |       V |
21+55      15.6003      4.28  Q        |         |         |       V |
22+ 0      15.6296      4.25  Q        |         |         |       V |
22+ 5      15.6586      4.21  Q        |         |         |       V |
22+10      15.6874      4.18  Q        |         |         |       V |
22+15      15.7159      4.15  Q        |         |         |       V |
22+20      15.7442      4.11  Q        |         |         |       V |
22+25      15.7723      4.08  Q        |         |         |       V |
22+30      15.8002      4.05  Q        |         |         |       V |
22+35      15.8279      4.02  Q        |         |         |       V |
22+40      15.8554      3.99  Q        |         |         |       V |
22+45      15.8827      3.96  Q        |         |         |       V |
22+50      15.9098      3.93  Q        |         |         |       V |
22+55      15.9367      3.91  Q        |         |         |       V |
23+ 0      15.9634      3.88  Q        |         |         |        V|
23+ 5      15.9900      3.85  Q        |         |         |        V|
23+10      16.0163      3.83  Q        |         |         |        V|
23+15      16.0425      3.80  Q        |         |         |        V|
23+20      16.0685      3.78  Q        |         |         |        V|
23+25      16.0943      3.75  Q        |         |         |        V|
23+30      16.1200      3.73  Q        |         |         |        V|
23+35      16.1455      3.70  Q        |         |         |        V|
23+40      16.1708      3.68  Q        |         |         |        V|
23+45      16.1960      3.66  Q        |         |         |        V|
23+50      16.2210      3.63  Q        |         |         |        V|
23+55      16.2459      3.61  Q        |         |         |        V|
24+ 0      16.2706      3.59  Q        |         |         |        V|
24+ 5      16.2946      3.49  Q        |         |         |        V|
24+10      16.3161      3.11  Q        |         |         |        V|
24+15      16.3325      2.39  Q        |         |         |        V|
24+20      16.3424      1.44  Q        |         |         |        V|
24+25      16.3475      0.73  Q        |         |         |        V|
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   24+30      16.3499      0.35  Q         |          |          |        V|
   24+35      16.3510      0.16  Q         |          |          |        V|
   24+40      16.3515      0.07  Q         |          |          |        V|
   24+45      16.3518      0.05  Q         |          |          |        V|
   24+50      16.3520      0.03  Q         |          |          |        V|
   24+55      16.3520      0.01  Q         |          |          |        V|
-------------------------------------------------------------------------
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PROPOSED CONDITION UNIT HYDROGRAPH

PROPOSED CONDITION
100-YEAR, 24-HOUR UNIT HYDROGRAPH

U n i t H y d r o g r a p h A n a l y s i s

Study date 07/26/18

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 4010

18-0011 DUKE - ALABAMA & PALMETTO
UNIT HYDROGRAPH HYDROLOGY
100-YEAR 24-HOUR STORM EVENT
PROPOSED CONDITION -MJS

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
54.30	1	1.25
Rainfall data for year 100		
54.30	6	2.75
Rainfall data for year 100		
54.30	24	5.10

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	54.30	1.000	0.785	0.150	0.118

Area-averaged adjusted loss rate Fm (In/Hr) = 0.118

********** Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
8.14	0.150	32.0	52.0	9.23	0.166
46.15	0.850	98.0	98.0	0.20	0.954

Area-averaged catchment yield fraction, Y = 0.835
Area-averaged low loss fraction, Yb = 0.165
User entry of time of concentration = 0.257 (hours)

++
Watershed area = 54.30(Ac.)
Catchment Lag time = 0.206 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 40.5318
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.118(In/Hr)
Average low loss rate fraction (Yb) = 0.165 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.463(In)
Computed peak 30-minute rainfall = 0.947(In)
Specified peak 1-hour rainfall = 1.250(In)
Computed peak 3-hour rainfall = 2.027(In)
Specified peak 6-hour rainfall = 2.750(In)

Specified peak 24-hour rainfall = 5.100(In)

Rainfall depth area reduction factors:
Using a total area of 54.30(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997 Adjusted rainfall = 0.461(In)
30-minute factor = 0.997 Adjusted rainfall = 0.945(In)
1-hour factor = 0.997 Adjusted rainfall = 1.247(In)
3-hour factor = 1.000 Adjusted rainfall = 2.026(In)
6-hour factor = 1.000 Adjusted rainfall = 2.750(In)
24-hour factor = 1.000 Adjusted rainfall = 5.100(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 656.69 (CFS))	
1	3.107	20.404
2	20.076	111.432
3	50.784	201.656
4	78.829	184.168
5	91.651	84.201
6	96.945	34.765
7	98.542	10.491
8	99.272	4.791
9	100.000	4.782

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4615	0.4615
2	0.6089	0.1474
3	0.7161	0.1072
4	0.8034	0.0873
5	0.8785	0.0750
6	0.9449	0.0665
7	1.0050	0.0601
8	1.0601	0.0551
9	1.1113	0.0511
10	1.1591	0.0478
11	1.2042	0.0450
12	1.2468	0.0426
13	1.2917	0.0449
14	1.3347	0.0430
15	1.3761	0.0413
16	1.4159	0.0398
17	1.4544	0.0385
18	1.4916	0.0372
19	1.5277	0.0361
20	1.5627	0.0350
21	1.5968	0.0341
22	1.6300	0.0332
23	1.6623	0.0323
24	1.6939	0.0316
25	1.7247	0.0308
26	1.7549	0.0302
27	1.7844	0.0295
28	1.8133	0.0289
29	1.8417	0.0283
30	1.8695	0.0278
31	1.8968	0.0273
32	1.9236	0.0268
33	1.9499	0.0263
34	1.9758	0.0259
35	2.0013	0.0255
36	2.0264	0.0251
37	2.0510	0.0246
38	2.0752	0.0242
39	2.0991	0.0239
40	2.1226	0.0235
41	2.1458	0.0232
42	2.1687	0.0229
43	2.1913	0.0226
44	2.2136	0.0223
45	2.2356	0.0220
46	2.2573	0.0217
47	2.2788	0.0215
48	2.3000	0.0212
49	2.3210	0.0210
50	2.3417	0.0207
51	2.3622	0.0205

52	2.3825	0.0203
53	2.4026	0.0201
54	2.4224	0.0199
55	2.4421	0.0196
56	2.4615	0.0194
57	2.4808	0.0193
58	2.4999	0.0191
59	2.5187	0.0189
60	2.5375	0.0187
61	2.5560	0.0185
62	2.5744	0.0184
63	2.5925	0.0182
64	2.6106	0.0180
65	2.6285	0.0179
66	2.6462	0.0177
67	2.6638	0.0176
68	2.6812	0.0174
69	2.6985	0.0173
70	2.7156	0.0171
71	2.7327	0.0170
72	2.7495	0.0169
73	2.7665	0.0170
74	2.7833	0.0168
75	2.8000	0.0167
76	2.8166	0.0166
77	2.8330	0.0165
78	2.8494	0.0163
79	2.8656	0.0162
80	2.8817	0.0161
81	2.8977	0.0160
82	2.9136	0.0159
83	2.9294	0.0158
84	2.9450	0.0157
85	2.9606	0.0156
86	2.9761	0.0155
87	2.9915	0.0154
88	3.0067	0.0153
89	3.0219	0.0152
90	3.0370	0.0151
91	3.0520	0.0150
92	3.0669	0.0149
93	3.0817	0.0148
94	3.0964	0.0147
95	3.1110	0.0146
96	3.1256	0.0146
97	3.1401	0.0145
98	3.1544	0.0144
99	3.1687	0.0143
100	3.1830	0.0142
101	3.1971	0.0141
102	3.2112	0.0141
103	3.2252	0.0140
104	3.2391	0.0139
105	3.2529	0.0138
106	3.2667	0.0138
107	3.2804	0.0137
108	3.2940	0.0136
109	3.3076	0.0136
110	3.3211	0.0135
111	3.3345	0.0134
112	3.3478	0.0134
113	3.3611	0.0133
114	3.3743	0.0132
115	3.3875	0.0132
116	3.4006	0.0131
117	3.4136	0.0130
118	3.4266	0.0130
119	3.4395	0.0129
120	3.4524	0.0128
121	3.4652	0.0128
122	3.4779	0.0127
123	3.4906	0.0127
124	3.5032	0.0126
125	3.5157	0.0126
126	3.5282	0.0125
127	3.5407	0.0125
128	3.5531	0.0124
129	3.5654	0.0123
130	3.5777	0.0123
131	3.5900	0.0122
132	3.6021	0.0122
133	3.6143	0.0121
134	3.6264	0.0121
135	3.6384	0.0120

136	3.6504	0.0120
137	3.6623	0.0119
138	3.6742	0.0119
139	3.6860	0.0118
140	3.6978	0.0118
141	3.7096	0.0117
142	3.7213	0.0117
143	3.7329	0.0117
144	3.7446	0.0116
145	3.7561	0.0116
146	3.7676	0.0115
147	3.7791	0.0115
148	3.7905	0.0114
149	3.8019	0.0114
150	3.8133	0.0113
151	3.8246	0.0113
152	3.8359	0.0113
153	3.8471	0.0112
154	3.8583	0.0112
155	3.8694	0.0111
156	3.8805	0.0111
157	3.8916	0.0111
158	3.9026	0.0110
159	3.9136	0.0110
160	3.9245	0.0109
161	3.9355	0.0109
162	3.9463	0.0109
163	3.9572	0.0108
164	3.9680	0.0108
165	3.9787	0.0108
166	3.9895	0.0107
167	4.0002	0.0107
168	4.0108	0.0107
169	4.0214	0.0106
170	4.0320	0.0106
171	4.0426	0.0106
172	4.0531	0.0105
173	4.0636	0.0105
174	4.0740	0.0105
175	4.0844	0.0104
176	4.0948	0.0104
177	4.1052	0.0104
178	4.1155	0.0103
179	4.1258	0.0103
180	4.1360	0.0103
181	4.1463	0.0102
182	4.1564	0.0102
183	4.1666	0.0102
184	4.1767	0.0101
185	4.1868	0.0101
186	4.1969	0.0101
187	4.2069	0.0100
188	4.2170	0.0100
189	4.2269	0.0100
190	4.2369	0.0100
191	4.2468	0.0099
192	4.2567	0.0099
193	4.2666	0.0099
194	4.2764	0.0098
195	4.2862	0.0098
196	4.2960	0.0098
197	4.3057	0.0098
198	4.3155	0.0097
199	4.3252	0.0097
200	4.3348	0.0097
201	4.3445	0.0096
202	4.3541	0.0096
203	4.3637	0.0096
204	4.3733	0.0096
205	4.3828	0.0095
206	4.3923	0.0095
207	4.4018	0.0095
208	4.4113	0.0095
209	4.4207	0.0094
210	4.4301	0.0094
211	4.4395	0.0094
212	4.4489	0.0094
213	4.4582	0.0093
214	4.4675	0.0093
215	4.4768	0.0093
216	4.4861	0.0093
217	4.4953	0.0092
218	4.5045	0.0092
219	4.5137	0.0092

220	4.5229	0.0092
221	4.5321	0.0091
222	4.5412	0.0091
223	4.5503	0.0091
224	4.5594	0.0091
225	4.5684	0.0091
226	4.5775	0.0090
227	4.5865	0.0090
228	4.5955	0.0090
229	4.6044	0.0090
230	4.6134	0.0089
231	4.6223	0.0089
232	4.6312	0.0089
233	4.6401	0.0089
234	4.6490	0.0089
235	4.6578	0.0088
236	4.6666	0.0088
237	4.6754	0.0088
238	4.6842	0.0088
239	4.6930	0.0088
240	4.7017	0.0087
241	4.7104	0.0087
242	4.7191	0.0087
243	4.7278	0.0087
244	4.7365	0.0087
245	4.7451	0.0086
246	4.7537	0.0086
247	4.7623	0.0086
248	4.7709	0.0086
249	4.7795	0.0086
250	4.7880	0.0085
251	4.7966	0.0085
252	4.8051	0.0085
253	4.8136	0.0085
254	4.8220	0.0085
255	4.8305	0.0085
256	4.8389	0.0084
257	4.8473	0.0084
258	4.8557	0.0084
259	4.8641	0.0084
260	4.8724	0.0084
261	4.8808	0.0083
262	4.8891	0.0083
263	4.8974	0.0083
264	4.9057	0.0083
265	4.9140	0.0083
266	4.9222	0.0083
267	4.9305	0.0082
268	4.9387	0.0082
269	4.9469	0.0082
270	4.9551	0.0082
271	4.9633	0.0082
272	4.9714	0.0082
273	4.9795	0.0081
274	4.9877	0.0081
275	4.9958	0.0081
276	5.0039	0.0081
277	5.0119	0.0081
278	5.0200	0.0081
279	5.0280	0.0080
280	5.0360	0.0080
281	5.0440	0.0080
282	5.0520	0.0080
283	5.0600	0.0080
284	5.0680	0.0080
285	5.0759	0.0079
286	5.0838	0.0079
287	5.0918	0.0079
288	5.0997	0.0079

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0079	0.0013	0.0066
2	0.0079	0.0013	0.0066
3	0.0079	0.0013	0.0066
4	0.0080	0.0013	0.0066
5	0.0080	0.0013	0.0067
6	0.0080	0.0013	0.0067
7	0.0080	0.0013	0.0067
8	0.0081	0.0013	0.0067
9	0.0081	0.0013	0.0068
10	0.0081	0.0013	0.0068

11	0.0081	0.0013	0.0068
12	0.0082	0.0013	0.0068
13	0.0082	0.0013	0.0068
14	0.0082	0.0013	0.0069
15	0.0082	0.0014	0.0069
16	0.0083	0.0014	0.0069
17	0.0083	0.0014	0.0069
18	0.0083	0.0014	0.0069
19	0.0083	0.0014	0.0070
20	0.0084	0.0014	0.0070
21	0.0084	0.0014	0.0070
22	0.0084	0.0014	0.0070
23	0.0085	0.0014	0.0071
24	0.0085	0.0014	0.0071
25	0.0085	0.0014	0.0071
26	0.0085	0.0014	0.0071
27	0.0086	0.0014	0.0072
28	0.0086	0.0014	0.0072
29	0.0086	0.0014	0.0072
30	0.0086	0.0014	0.0072
31	0.0087	0.0014	0.0073
32	0.0087	0.0014	0.0073
33	0.0087	0.0014	0.0073
34	0.0088	0.0014	0.0073
35	0.0088	0.0014	0.0074
36	0.0088	0.0015	0.0074
37	0.0089	0.0015	0.0074
38	0.0089	0.0015	0.0074
39	0.0089	0.0015	0.0075
40	0.0089	0.0015	0.0075
41	0.0090	0.0015	0.0075
42	0.0090	0.0015	0.0075
43	0.0091	0.0015	0.0076
44	0.0091	0.0015	0.0076
45	0.0091	0.0015	0.0076
46	0.0091	0.0015	0.0076
47	0.0092	0.0015	0.0077
48	0.0092	0.0015	0.0077
49	0.0093	0.0015	0.0077
50	0.0093	0.0015	0.0078
51	0.0093	0.0015	0.0078
52	0.0094	0.0015	0.0078
53	0.0094	0.0015	0.0079
54	0.0094	0.0016	0.0079
55	0.0095	0.0016	0.0079
56	0.0095	0.0016	0.0079
57	0.0096	0.0016	0.0080
58	0.0096	0.0016	0.0080
59	0.0096	0.0016	0.0081
60	0.0097	0.0016	0.0081
61	0.0097	0.0016	0.0081
62	0.0098	0.0016	0.0081
63	0.0098	0.0016	0.0082
64	0.0098	0.0016	0.0082
65	0.0099	0.0016	0.0083
66	0.0099	0.0016	0.0083
67	0.0100	0.0016	0.0083
68	0.0100	0.0016	0.0084
69	0.0101	0.0017	0.0084
70	0.0101	0.0017	0.0084
71	0.0102	0.0017	0.0085
72	0.0102	0.0017	0.0085
73	0.0103	0.0017	0.0086
74	0.0103	0.0017	0.0086
75	0.0104	0.0017	0.0086
76	0.0104	0.0017	0.0087
77	0.0105	0.0017	0.0087
78	0.0105	0.0017	0.0088
79	0.0106	0.0017	0.0088
80	0.0106	0.0017	0.0088
81	0.0107	0.0018	0.0089
82	0.0107	0.0018	0.0089
83	0.0108	0.0018	0.0090
84	0.0108	0.0018	0.0090
85	0.0109	0.0018	0.0091
86	0.0109	0.0018	0.0091
87	0.0110	0.0018	0.0092
88	0.0110	0.0018	0.0092
89	0.0111	0.0018	0.0093
90	0.0111	0.0018	0.0093
91	0.0112	0.0018	0.0094
92	0.0113	0.0019	0.0094
93	0.0113	0.0019	0.0095
94	0.0114	0.0019	0.0095

95	0.0115	0.0019	0.0096
96	0.0115	0.0019	0.0096
97	0.0116	0.0019	0.0097
98	0.0117	0.0019	0.0097
99	0.0117	0.0019	0.0098
100	0.0118	0.0019	0.0099
101	0.0119	0.0020	0.0099
102	0.0119	0.0020	0.0100
103	0.0120	0.0020	0.0101
104	0.0121	0.0020	0.0101
105	0.0122	0.0020	0.0102
106	0.0122	0.0020	0.0102
107	0.0123	0.0020	0.0103
108	0.0124	0.0020	0.0104
109	0.0125	0.0021	0.0104
110	0.0126	0.0021	0.0105
111	0.0127	0.0021	0.0106
112	0.0127	0.0021	0.0106
113	0.0128	0.0021	0.0107
114	0.0129	0.0021	0.0108
115	0.0130	0.0021	0.0109
116	0.0131	0.0022	0.0109
117	0.0132	0.0022	0.0110
118	0.0133	0.0022	0.0111
119	0.0134	0.0022	0.0112
120	0.0135	0.0022	0.0113
121	0.0136	0.0022	0.0114
122	0.0137	0.0023	0.0114
123	0.0138	0.0023	0.0116
124	0.0139	0.0023	0.0116
125	0.0141	0.0023	0.0118
126	0.0141	0.0023	0.0118
127	0.0143	0.0024	0.0119
128	0.0144	0.0024	0.0120
129	0.0146	0.0024	0.0122
130	0.0146	0.0024	0.0122
131	0.0148	0.0024	0.0124
132	0.0149	0.0025	0.0124
133	0.0151	0.0025	0.0126
134	0.0152	0.0025	0.0127
135	0.0154	0.0025	0.0128
136	0.0155	0.0025	0.0129
137	0.0157	0.0026	0.0131
138	0.0158	0.0026	0.0132
139	0.0160	0.0026	0.0134
140	0.0161	0.0027	0.0135
141	0.0163	0.0027	0.0136
142	0.0165	0.0027	0.0137
143	0.0167	0.0027	0.0140
144	0.0168	0.0028	0.0141
145	0.0169	0.0028	0.0141
146	0.0170	0.0028	0.0142
147	0.0173	0.0028	0.0144
148	0.0174	0.0029	0.0146
149	0.0177	0.0029	0.0148
150	0.0179	0.0029	0.0149
151	0.0182	0.0030	0.0152
152	0.0184	0.0030	0.0153
153	0.0187	0.0031	0.0156
154	0.0189	0.0031	0.0158
155	0.0193	0.0032	0.0161
156	0.0194	0.0032	0.0162
157	0.0199	0.0033	0.0166
158	0.0201	0.0033	0.0168
159	0.0205	0.0034	0.0171
160	0.0207	0.0034	0.0173
161	0.0212	0.0035	0.0177
162	0.0215	0.0035	0.0179
163	0.0220	0.0036	0.0184
164	0.0223	0.0037	0.0186
165	0.0229	0.0038	0.0191
166	0.0232	0.0038	0.0194
167	0.0239	0.0039	0.0199
168	0.0242	0.0040	0.0202
169	0.0251	0.0041	0.0210
170	0.0255	0.0042	0.0213
171	0.0263	0.0043	0.0220
172	0.0268	0.0044	0.0224
173	0.0278	0.0046	0.0232
174	0.0283	0.0047	0.0237
175	0.0295	0.0049	0.0247
176	0.0302	0.0050	0.0252
177	0.0316	0.0052	0.0264
178	0.0323	0.0053	0.0270

179	0.0341	0.0056	0.0285
180	0.0350	0.0058	0.0293
181	0.0372	0.0061	0.0311
182	0.0385	0.0063	0.0321
183	0.0413	0.0068	0.0345
184	0.0430	0.0071	0.0359
185	0.0426	0.0070	0.0356
186	0.0450	0.0074	0.0376
187	0.0511	0.0084	0.0427
188	0.0551	0.0091	0.0461
189	0.0665	0.0098	0.0566
190	0.0750	0.0098	0.0652
191	0.1072	0.0098	0.0974
192	0.1474	0.0098	0.1376
193	0.4615	0.0098	0.4516
194	0.0873	0.0098	0.0775
195	0.0601	0.0098	0.0503
196	0.0478	0.0079	0.0400
197	0.0449	0.0074	0.0375
198	0.0398	0.0066	0.0333
199	0.0361	0.0059	0.0301
200	0.0332	0.0055	0.0277
201	0.0308	0.0051	0.0258
202	0.0289	0.0048	0.0242
203	0.0273	0.0045	0.0228
204	0.0259	0.0043	0.0216
205	0.0246	0.0040	0.0205
206	0.0235	0.0039	0.0197
207	0.0226	0.0037	0.0189
208	0.0217	0.0036	0.0182
209	0.0210	0.0035	0.0175
210	0.0203	0.0033	0.0169
211	0.0196	0.0032	0.0164
212	0.0191	0.0031	0.0159
213	0.0185	0.0030	0.0155
214	0.0180	0.0030	0.0151
215	0.0176	0.0029	0.0147
216	0.0171	0.0028	0.0143
217	0.0170	0.0028	0.0142
218	0.0166	0.0027	0.0138
219	0.0162	0.0027	0.0136
220	0.0159	0.0026	0.0133
221	0.0156	0.0026	0.0130
222	0.0153	0.0025	0.0128
223	0.0150	0.0025	0.0125
224	0.0147	0.0024	0.0123
225	0.0145	0.0024	0.0121
226	0.0142	0.0023	0.0119
227	0.0140	0.0023	0.0117
228	0.0138	0.0023	0.0115
229	0.0136	0.0022	0.0113
230	0.0134	0.0022	0.0112
231	0.0132	0.0022	0.0110
232	0.0130	0.0021	0.0108
233	0.0128	0.0021	0.0107
234	0.0126	0.0021	0.0105
235	0.0125	0.0020	0.0104
236	0.0123	0.0020	0.0103
237	0.0121	0.0020	0.0101
238	0.0120	0.0020	0.0100
239	0.0118	0.0019	0.0099
240	0.0117	0.0019	0.0098
241	0.0116	0.0019	0.0097
242	0.0114	0.0019	0.0096
243	0.0113	0.0019	0.0094
244	0.0112	0.0018	0.0093
245	0.0111	0.0018	0.0092
246	0.0109	0.0018	0.0091
247	0.0108	0.0018	0.0091
248	0.0107	0.0018	0.0090
249	0.0106	0.0017	0.0089
250	0.0105	0.0017	0.0088
251	0.0104	0.0017	0.0087
252	0.0103	0.0017	0.0086
253	0.0102	0.0017	0.0085
254	0.0101	0.0017	0.0085
255	0.0100	0.0017	0.0084
256	0.0100	0.0016	0.0083
257	0.0099	0.0016	0.0082
258	0.0098	0.0016	0.0082
259	0.0097	0.0016	0.0081
260	0.0096	0.0016	0.0080
261	0.0095	0.0016	0.0080
262	0.0095	0.0016	0.0079

263	0.0094	0.0015	0.0078
264	0.0093	0.0015	0.0078
265	0.0092	0.0015	0.0077
266	0.0092	0.0015	0.0077
267	0.0091	0.0015	0.0076
268	0.0090	0.0015	0.0075
269	0.0090	0.0015	0.0075
270	0.0089	0.0015	0.0074
271	0.0088	0.0015	0.0074
272	0.0088	0.0014	0.0073
273	0.0087	0.0014	0.0073
274	0.0087	0.0014	0.0072
275	0.0086	0.0014	0.0072
276	0.0085	0.0014	0.0071
277	0.0085	0.0014	0.0071
278	0.0084	0.0014	0.0070
279	0.0084	0.0014	0.0070
280	0.0083	0.0014	0.0070
281	0.0083	0.0014	0.0069
282	0.0082	0.0014	0.0069
283	0.0082	0.0013	0.0068
284	0.0081	0.0013	0.0068
285	0.0081	0.0013	0.0067
286	0.0080	0.0013	0.0067
287	0.0080	0.0013	0.0067
288	0.0079	0.0013	0.0066

Total soil rain loss = 0.74(In)
Total effective rainfall = 4.36(In)
Peak flow rate in flood hydrograph = 137.57(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	50.0	100.0	150.0	200.0
0+ 5	0.0009	0.13	Q				
0+10	0.0069	0.87	Q				
0+15	0.0221	2.20	Q				
0+20	0.0457	3.42	Q				
0+25	0.0731	3.99	Q				
0+30	0.1023	4.23	Q				
0+35	0.1320	4.31	Q				
0+40	0.1620	4.36	Q				
0+45	0.1923	4.40	Q				
0+50	0.2227	4.41	Q				
0+55	0.2531	4.43	Q				
1+ 0	0.2837	4.44	Q				
1+ 5	0.3144	4.45	Q				
1+10	0.3452	4.47	Q				
1+15	0.3760	4.48	Q				
1+20	0.4070	4.49	Q				
1+25	0.4380	4.51	Q				
1+30	0.4692	4.52	Q				
1+35	0.5004	4.54	QV				
1+40	0.5317	4.55	QV				
1+45	0.5632	4.57	QV				
1+50	0.5947	4.58	QV				
1+55	0.6264	4.59	QV				
2+ 0	0.6581	4.61	QV				
2+ 5	0.6900	4.62	QV				
2+10	0.7219	4.64	QV				
2+15	0.7540	4.65	QV				
2+20	0.7862	4.67	QV				
2+25	0.8184	4.69	QV				
2+30	0.8508	4.70	QV				
2+35	0.8833	4.72	QV				
2+40	0.9159	4.73	QV				
2+45	0.9486	4.75	QV				
2+50	0.9814	4.77	QV				
2+55	1.0144	4.78	Q V				
3+ 0	1.0474	4.80	Q V				
3+ 5	1.0806	4.82	Q V				
3+10	1.1139	4.83	Q V				
3+15	1.1473	4.85	Q V				
3+20	1.1808	4.87	Q V				
3+25	1.2144	4.88	Q V				
3+30	1.2482	4.90	Q V				
3+35	1.2821	4.92	Q V				

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 3+40       1.3161      4.94  Q V       |          |          |          |
 3+45       1.3502      4.96  Q V       |          |          |          |
 3+50       1.3844      4.97  Q V       |          |          |          |
 3+55       1.4188      4.99  Q V       |          |          |          |
 4+ 0       1.4533      5.01  |QV       |          |          |          |
 4+ 5       1.4880      5.03  |Q V       |          |          |          |
 4+10       1.5228      5.05  |Q V       |          |          |          |
 4+15       1.5577      5.07  |Q V       |          |          |          |
 4+20       1.5927      5.09  |Q V       |          |          |          |
 4+25       1.6279      5.11  |Q V       |          |          |          |
 4+30       1.6632      5.13  |Q V       |          |          |          |
 4+35       1.6987      5.15  |Q V       |          |          |          |
 4+40       1.7343      5.17  |Q V       |          |          |          |
 4+45       1.7700      5.19  |Q V       |          |          |          |
 4+50       1.8059      5.21  |Q V       |          |          |          |
 4+55       1.8419      5.23  |Q V       |          |          |          |
 5+ 0       1.8781      5.25  |Q V       |          |          |          |
 5+ 5       1.9144      5.27  |Q V       |          |          |          |
 5+10       1.9509      5.30  |Q V       |          |          |          |
 5+15       1.9876      5.32  |Q  V      |          |          |          |
 5+20       2.0243      5.34  |Q  V      |          |          |          |
 5+25       2.0613      5.36  |Q  V      |          |          |          |
 5+30       2.0984      5.39  |Q  V      |          |          |          |
 5+35       2.1356      5.41  |Q  V      |          |          |          |
 5+40       2.1731      5.43  |Q  V      |          |          |          |
 5+45       2.2106      5.46  |Q  V      |          |          |          |
 5+50       2.2484      5.48  |Q  V      |          |          |          |
 5+55       2.2863      5.51  |Q  V      |          |          |          |
 6+ 0       2.3244      5.53  |Q  V      |          |          |          |
 6+ 5       2.3627      5.56  |Q  V      |          |          |          |
 6+10       2.4011      5.58  |Q  V      |          |          |          |
 6+15       2.4397      5.61  |Q  V      |          |          |          |
 6+20       2.4785      5.63  |Q   V     |          |          |          |
 6+25       2.5175      5.66  |Q   V     |          |          |          |
 6+30       2.5566      5.69  |Q   V     |          |          |          |
 6+35       2.5960      5.71  |Q   V     |          |          |          |
 6+40       2.6355      5.74  |Q   V     |          |          |          |
 6+45       2.6752      5.77  |Q   V     |          |          |          |
 6+50       2.7151      5.80  |Q   V     |          |          |          |
 6+55       2.7552      5.82  |Q   V     |          |          |          |
 7+ 0       2.7956      5.85  |Q   V     |          |          |          |
 7+ 5       2.8361      5.88  |Q   V     |          |          |          |
 7+10       2.8768      5.91  |Q   V     |          |          |          |
 7+15       2.9177      5.94  |Q   V     |          |          |          |
 7+20       2.9588      5.97  |Q    V    |          |          |          |
 7+25       3.0002      6.00  |Q    V    |          |          |          |
 7+30       3.0418      6.04  |Q    V    |          |          |          |
 7+35       3.0836      6.07  |Q    V    |          |          |          |
 7+40       3.1256      6.10  |Q    V    |          |          |          |
 7+45       3.1678      6.13  |Q    V    |          |          |          |
 7+50       3.2103      6.17  |Q    V    |          |          |          |
 7+55       3.2530      6.20  |Q    V    |          |          |          |
 8+ 0       3.2959      6.23  |Q    V    |          |          |          |
 8+ 5       3.3391      6.27  |Q    V    |          |          |          |
 8+10       3.3825      6.31  |Q    V    |          |          |          |
 8+15       3.4262      6.34  |Q    V    |          |          |          |
 8+20       3.4701      6.38  |Q     V   |          |          |          |
 8+25       3.5143      6.42  |Q     V   |          |          |          |
 8+30       3.5588      6.45  |Q     V   |          |          |          |
 8+35       3.6035      6.49  |Q     V   |          |          |          |
 8+40       3.6485      6.53  |Q     V   |          |          |          |
 8+45       3.6937      6.57  |Q     V   |          |          |          |
 8+50       3.7393      6.61  |Q     V   |          |          |          |
 8+55       3.7851      6.65  |Q     V   |          |          |          |
 9+ 0       3.8312      6.70  |Q     V   |          |          |          |
 9+ 5       3.8776      6.74  |Q     V   |          |          |          |
 9+10       3.9243      6.78  |Q     V   |          |          |          |
 9+15       3.9713      6.83  |Q      V  |          |          |          |
 9+20       4.0186      6.87  |Q      V  |          |          |          |
 9+25       4.0663      6.92  |Q      V  |          |          |          |
 9+30       4.1143      6.97  |Q      V  |          |          |          |
 9+35       4.1626      7.01  |Q      V  |          |          |          |
 9+40       4.2112      7.06  |Q      V  |          |          |          |
 9+45       4.2602      7.11  |Q      V  |          |          |          |
 9+50       4.3095      7.16  |Q      V  |          |          |          |
 9+55       4.3592      7.21  |Q      V  |          |          |          |
10+ 0       4.4092      7.27  |Q      V  |          |          |          |
10+ 5       4.4596      7.32  |Q       V |          |          |          |
10+10       4.5105      7.38  |Q       V |          |          |          |
10+15       4.5616      7.43  |Q       V |          |          |          |
10+20       4.6132      7.49  |Q       V |          |          |          |
10+25       4.6652      7.55  |Q       V |          |          |          |
10+30       4.7176      7.61  |Q       V |          |          |          |
10+35       4.7704      7.67  |Q       V |          |          |          |
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10+40       4.8237      7.73  |Q       V|          |          |          |
10+45       4.8774      7.80  |Q       V|          |          |          |
10+50       4.9316      7.86  |Q        V          |          |          |
10+55       4.9862      7.93  |Q        V          |          |          |
11+ 0       5.0413      8.00  |Q        V          |          |          |
11+ 5       5.0969      8.07  |Q        V          |          |          |
11+10       5.1529      8.14  |Q        V          |          |          |
11+15       5.2095      8.22  |Q        V          |          |          |
11+20       5.2667      8.29  |Q        V          |          |          |
11+25       5.3243      8.37  |Q        V          |          |          |
11+30       5.3825      8.45  |Q        V          |          |          |
11+35       5.4413      8.54  |Q        |V         |          |          |
11+40       5.5007      8.62  |Q        |V         |          |          |
11+45       5.5607      8.71  |Q        |V         |          |          |
11+50       5.6213      8.80  |Q        |V         |          |          |
11+55       5.6825      8.89  |Q        |V         |          |          |
12+ 0       5.7444      8.99  |Q        |V         |          |          |
12+ 5       5.8070      9.08  |Q        |V         |          |          |
12+10       5.8701      9.17  |Q        |V         |          |          |
12+15       5.9337      9.23  |Q        | V        |          |          |
12+20       5.9978      9.31  |Q        | V        |          |          |
12+25       6.0626      9.41  |Q        | V        |          |          |
12+30       6.1282      9.52  |Q        | V        |          |          |
12+35       6.1945      9.64  |Q        | V        |          |          |
12+40       6.2618      9.76  |Q        | V        |          |          |
12+45       6.3298      9.89  |Q        | V        |          |          |
12+50       6.3988     10.02  | Q       | V        |          |          |
12+55       6.4688     10.16  | Q       |  V       |          |          |
13+ 0       6.5398     10.30  | Q       |  V       |          |          |
13+ 5       6.6117     10.45  | Q       |  V       |          |          |
13+10       6.6848     10.61  | Q       |  V       |          |          |
13+15       6.7589     10.77  | Q       |  V       |          |          |
13+20       6.8343     10.94  | Q       |  V       |          |          |
13+25       6.9108     11.11  | Q       |   V      |          |          |
13+30       6.9886     11.30  | Q       |   V      |          |          |
13+35       7.0678     11.49  | Q       |   V      |          |          |
13+40       7.1484     11.70  | Q       |   V      |          |          |
13+45       7.2304     11.91  | Q       |   V      |          |          |
13+50       7.3140     12.14  | Q       |   V      |          |          |
13+55       7.3993     12.38  | Q       |    V     |          |          |
14+ 0       7.4862     12.63  | Q       |    V     |          |          |
14+ 5       7.5750     12.89  | Q       |    V     |          |          |
14+10       7.6659     13.19  | Q       |    V     |          |          |
14+15       7.7589     13.50  | Q       |    V     |          |          |
14+20       7.8542     13.84  | Q       |    V     |          |          |
14+25       7.9519     14.19  | Q       |     V    |          |          |
14+30       8.0522     14.56  | Q       |     V    |          |          |
14+35       8.1553     14.96  | Q       |     V    |          |          |
14+40       8.2612     15.39  |  Q      |     V    |          |          |
14+45       8.3704     15.85  |  Q      |     V    |          |          |
14+50       8.4831     16.36  |  Q      |      V   |          |          |
14+55       8.5995     16.91  |  Q      |      V   |          |          |
15+ 0       8.7202     17.52  |  Q      |      V   |          |          |
15+ 5       8.8455     18.19  |  Q      |      V   |          |          |
15+10       8.9760     18.95  |  Q      |       V  |          |          |
15+15       9.1124     19.80  |  Q      |       V  |          |          |
15+20       9.2554     20.77  |   Q     |       V  |          |          |
15+25       9.4056     21.80  |   Q     |        V |          |          |
15+30       9.5620     22.71  |   Q     |        V |          |          |
15+35       9.7238     23.50  |   Q     |        V |          |          |
15+40       9.8939     24.70  |   Q     |         V|          |          |
15+45      10.0782     26.75  |    Q    |         V|          |          |
15+50      10.2841     29.90  |    Q    |         V|          |          |
15+55      10.5236     34.78  |     Q   |          |V         |          |
16+ 0      10.8221     43.34  |       Q |          |V         |          |
16+ 5      11.2586     63.37  |         | Q        | V        |          |
16+10      11.9881    105.93  |         |          |Q  V      |          |
16+15      12.9356    137.57  |         |          |    VQ    |          |
16+20      13.7715    121.38  |         |          |   Q  V   |          |
16+25      14.2815     74.05  |         |   Q      |      V   |          |
16+30      14.6026     46.63  |         |Q         |         V|          |
16+35      14.8233     32.04  |      Q  |          |          V          |
16+40      15.0044     26.29  |     Q   |          |          V          |
16+45      15.1657     23.43  |    Q    |          |          V          |
16+50      15.3010     19.64  |  Q      |          |          |V         |
16+55      15.4248     17.98  |  Q      |          |          |V         |
17+ 0      15.5399     16.70  |  Q      |          |          |V         |
17+ 5      15.6478     15.67  |  Q      |          |          |V         |
17+10      15.7496     14.78  | Q       |          |          |V         |
17+15      15.8461     14.01  | Q       |          |          | V        |
17+20      15.9380     13.35  | Q       |          |          | V        |
17+25      16.0259     12.77  | Q       |          |          | V        |
17+30      16.1103     12.26  | Q       |          |          | V        |
17+35      16.1916     11.80  | Q       |          |          | V        |
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17+40      16.2700     11.39  | Q       |         |          |  V       |
17+45      16.3459     11.02  | Q       |         |          |  V       |
17+50      16.4195     10.68  | Q       |         |          |  V       |
17+55      16.4909     10.37  | Q       |         |          |  V       |
18+ 0      16.5603     10.08  | Q       |         |          |  V       |
18+ 5      16.6279      9.82  |Q        |         |          |  V       |
18+10      16.6939      9.59  |Q        |         |          |  V       |
18+15      16.7586      9.39  |Q        |         |          |   V      |
18+20      16.8220      9.21  |Q        |         |          |   V      |
18+25      16.8841      9.02  |Q        |         |          |   V      |
18+30      16.9450      8.83  |Q        |         |          |   V      |
18+35      17.0046      8.66  |Q        |         |          |   V      |
18+40      17.0630      8.49  |Q        |         |          |   V      |
18+45      17.1204      8.33  |Q        |         |          |   V      |
18+50      17.1767      8.17  |Q        |         |          |   V      |
18+55      17.2320      8.03  |Q        |         |          |   V      |
19+ 0      17.2863      7.89  |Q        |         |          |    V     |
19+ 5      17.3397      7.76  |Q        |         |          |    V     |
19+10      17.3923      7.63  |Q        |         |          |    V     |
19+15      17.4440      7.51  |Q        |         |          |    V     |
19+20      17.4950      7.40  |Q        |         |          |    V     |
19+25      17.5452      7.29  |Q        |         |          |    V     |
19+30      17.5946      7.18  |Q        |         |          |    V     |
19+35      17.6434      7.08  |Q        |         |          |    V     |
19+40      17.6915      6.98  |Q        |         |          |    V     |
19+45      17.7389      6.89  |Q        |         |          |     V    |
19+50      17.7858      6.80  |Q        |         |          |     V    |
19+55      17.8320      6.71  |Q        |         |          |     V    |
20+ 0      17.8776      6.63  |Q        |         |          |     V    |
20+ 5      17.9227      6.55  |Q        |         |          |     V    |
20+10      17.9673      6.47  |Q        |         |          |     V    |
20+15      18.0113      6.39  |Q        |         |          |     V    |
20+20      18.0548      6.32  |Q        |         |          |     V    |
20+25      18.0978      6.25  |Q        |         |          |     V    |
20+30      18.1404      6.18  |Q        |         |          |     V    |
20+35      18.1825      6.11  |Q        |         |          |     V    |
20+40      18.2241      6.05  |Q        |         |          |     V    |
20+45      18.2653      5.98  |Q        |         |          |      V   |
20+50      18.3061      5.92  |Q        |         |          |      V   |
20+55      18.3465      5.86  |Q        |         |          |      V   |
21+ 0      18.3865      5.81  |Q        |         |          |      V   |
21+ 5      18.4261      5.75  |Q        |         |          |      V   |
21+10      18.4653      5.70  |Q        |         |          |      V   |
21+15      18.5042      5.64  |Q        |         |          |      V   |
21+20      18.5427      5.59  |Q        |         |          |      V   |
21+25      18.5808      5.54  |Q        |         |          |      V   |
21+30      18.6186      5.49  |Q        |         |          |      V   |
21+35      18.6561      5.44  |Q        |         |          |      V   |
21+40      18.6933      5.40  |Q        |         |          |      V   |
21+45      18.7301      5.35  |Q        |         |          |       V  |
21+50      18.7666      5.30  |Q        |         |          |       V  |
21+55      18.8029      5.26  |Q        |         |          |       V  |
22+ 0      18.8388      5.22  |Q        |         |          |       V  |
22+ 5      18.8745      5.18  |Q        |         |          |       V  |
22+10      18.9098      5.14  |Q        |         |          |       V  |
22+15      18.9449      5.10  |Q        |         |          |       V  |
22+20      18.9798      5.06  |Q        |         |          |       V  |
22+25      19.0143      5.02  |Q        |         |          |       V  |
22+30      19.0486      4.98  Q        |         |          |       V  |
22+35      19.0827      4.94  Q        |         |          |       V  |
22+40      19.1165      4.91  Q        |         |          |       V  |
22+45      19.1500      4.87  Q        |         |          |       V  |
22+50      19.1834      4.84  Q        |         |          |       V  |
22+55      19.2164      4.80  Q        |         |          |        V |
23+ 0      19.2493      4.77  Q        |         |          |        V |
23+ 5      19.2819      4.74  Q        |         |          |        V |
23+10      19.3144      4.71  Q        |         |          |        V |
23+15      19.3466      4.68  Q        |         |          |        V |
23+20      19.3786      4.64  Q        |         |          |        V |
23+25      19.4103      4.61  Q        |         |          |        V |
23+30      19.4419      4.59  Q        |         |          |        V |
23+35      19.4733      4.56  Q        |         |          |        V |
23+40      19.5045      4.53  Q        |         |          |        V |
23+45      19.5355      4.50  Q        |         |          |        V |
23+50      19.5663      4.47  Q        |         |          |        V |
23+55      19.5969      4.44  Q        |         |          |        V |
24+ 0      19.6273      4.42  Q        |         |          |        V |
24+ 5      19.6566      4.26  Q        |         |          |        V |
24+10      19.6807      3.50  Q        |         |          |        V |
24+15      19.6955      2.15  Q        |         |          |        V |
24+20      19.7019      0.92  Q        |         |          |        V |
24+25      19.7044      0.36  Q        |         |          |        V |
24+30      19.7053      0.13  Q        |         |          |        V |
24+35      19.7057      0.06  Q        |         |          |        V |
```

```
   24+40      19.7060      0.03  Q         |         |         |        V|
-----------------------------------------------------------------------
```

HYDROLOGY MAPS

INFILTRATION TRENCH

202
1202.2
Q100=1.9 CFS
Q10=1.2 CFS

AREA-12
0.4
243'

201
1212.0

113
1215.7

AREA-10
1.9
303'

114
1209.6
Q100=8.0 CFS
Q10=4.9 CFS

PROP. LINE-2

PROP. 24" SD

109
1208.8
Q100=17.7 CFS
Q10=10.8 CFS

110
1207.0
SUB-AREA FLOW RATES
Q100=17.2 CFS
Q10=10.1 CFS
TOTAL FLOW RATES
Q100=34.9 CFS
Q10=20.8 CFS

111
1204.9
SUB-AREA FLOW RATES
Q100=10.8 CFS
Q10=6.0 CFS
TOTAL FLOW RATES
Q100=45.7 CFS
Q10=26.9 CFS

112
1203.0
SUB-AREA FLOW RATES
Q100=8.7 CFS
Q10=4.8 CFS
TOTAL FLOW RATES
Q100=54.4 CFS
Q10=31.7 CFS

PROP. 48" SD

WQ BASIN-1
BASIN TOP=1203.5'
BASIN BTM=1199.5'
WQ DCV=4.174 ACRE FT

AREA-11
3.0
–

107
*1199.5

SUB-AREA FLOW RATES
Q100=4.8 CFS
Q10=1.4 CFS
TOTAL FLOW RATES
Q100=134.9 CFS
Q10=77.4 CFS

AREA-6
5.3
652'

AREA-7
6.7
363'

AREA-8
5.7
431'

AREA-9
5.1
366'

108
1218.2

PALMETTO AVENUE

AREA-2
5.9
373'

AREA-3
4.3
265'

AREA-4
4.6
290'

AREA-5
8.6
282'

PROP. LINE-1

PROP. 48" SD

PROP. LATERAL-A1

PROP. 60" SD

103
1208.3
SUB-AREA FLOW RATES
Q100=19.1 CFS
Q10=11.3 CFS
TOTAL FLOW RATES
Q100=31.8 CFS
Q10=19.1 CFS

104
1207.0
SUB-AREA FLOW RATES
Q100=10.5 CFS
Q10=6.0 CFS
TOTAL FLOW RATES
Q100=42.4 CFS
Q10=25.1 CFS

105
1205.3
SUB-AREA FLOW RATES
Q100=9.9 CFS
Q10=5.8 CFS
TOTAL FLOW RATES
Q100=52.3 CFS
Q10=30.7 CFS

106
1204.2
*1201.6
SUB-AREA FLOW RATES
Q100=19.2 CFS
Q10=10.9 CFS
TOTAL FLOW RATES
Q100=71.5 CFS
Q10=41.6 CFS

102
1213.6
Q100=12.8 CFS
Q10=7.8 CFS

AREA-1
3.2
421'

101
1224.7

ALABAMA STREET

PROP. POC

EX. LINE-A SD

1196.42±
INV

LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- FLOW DIRECTION
- LANDSCAPING
- 101 / 14xx — NODE DESIGNATION, NODE ELEVATION
- *14XX — *INVERT ELEVATION
- 5.0 / 1000' — WATERSHED AREA (ACRES), WATER PATH (FT)

W S WEBB N E

1" = 80'
40 0 80 160 240

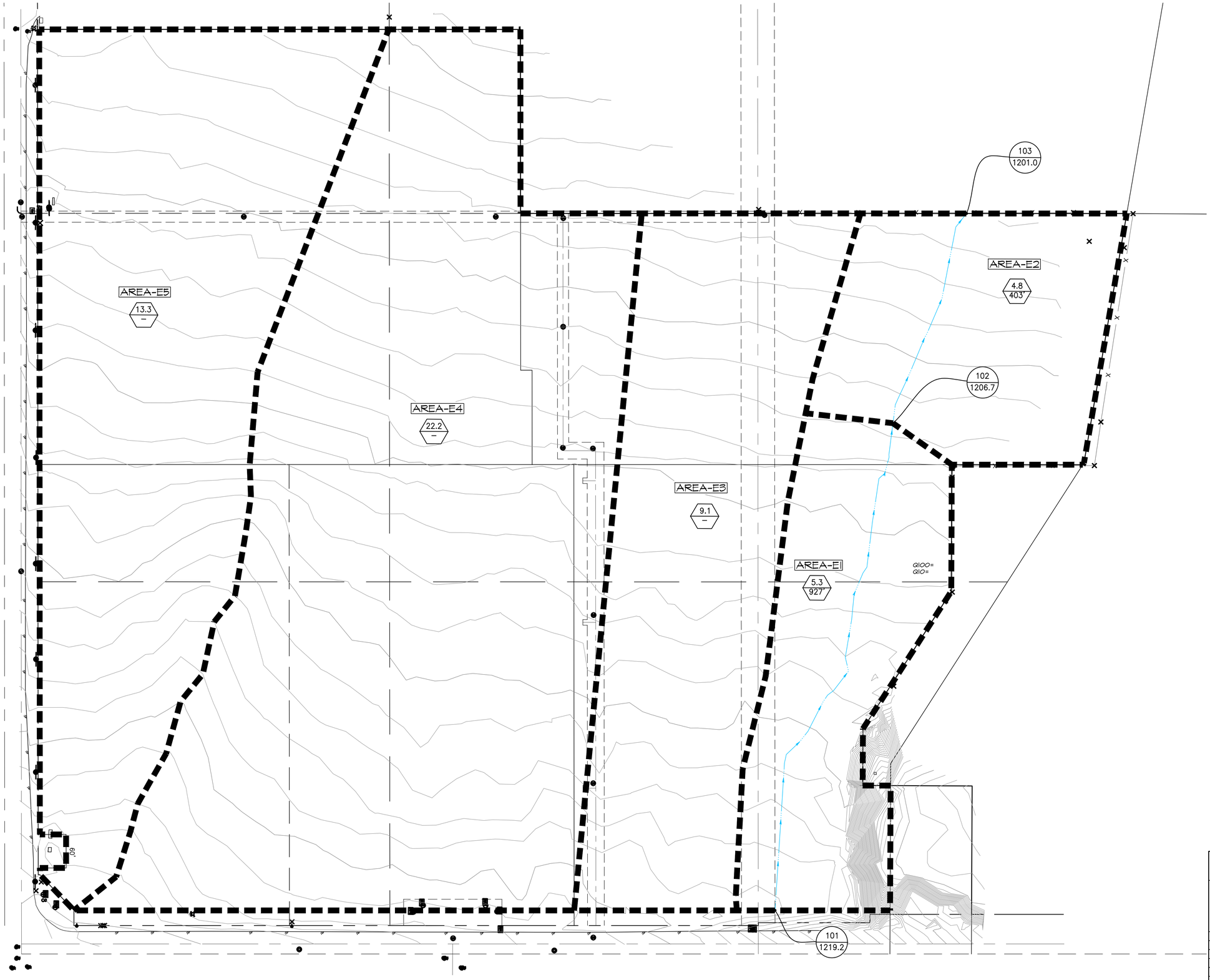
SAN BERNARDINO COUNTY

RATIONAL METHOD HYDROLOGY MAP
DUKE - ALABAMA AND PALMETTO
PROPOSED CONDITION

SCALE: AS SHOWN	W.O. 18-0011
DATE: 7/26/18	SHEET 1
DESIGNED: MJS	OF 1 SHEETS
CHECKED: CRC	
PLN CK REF:	DWG. NO.
F.B.	

ALBERT A. WEBB ASSOCIATES
ENGINEERING CONSULTANTS
3788 McCRAY STREET
RIVERSIDE CA. 92506
PH. (951) 686-1070
FAX (951) 788-1256

G:\2018\18-0011\DRAINAGE\HYDROLOGY\DWG FOLDER\18-0011-PHYD-RATIONAL.DWG 7/26/2018 3:29:07 PM



SAN BERNARDINO COUNTY

RATIONAL METHOD HYDROLOGY MAP
DUKE - ALABAMA AND PALMETTO
EXISTING CONDITION

SCALE: AS SHOWN	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA. 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 18-0011
DATE: 4/11/18			SHEET 1
DESIGNED: MJS			OF 1 SHEETS
CHECKED: CRC			
PLN CK REF:			DWG. NO.
F.B.			

G:\2018\18-0011\DRAINAGE\HYDROLOGY\DWG FOLDER\18-0011-PHYD-EXIST-RATIONAL.DWG 4/5/2018 6:59:25 PM

METRIC

APPENDIX B – HYDRAULICS

LINE-1 WSPG MODEL

*To be included during final engineering

Hydraulic Analysis Report

Project Data

Project Title: LINE 1

Designer:

Project Date: Friday, April 06, 2018

Project Units: U.S. Customary Units

Notes:

Channel Analysis: NODE 106 TO NODE 107

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 4.0000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 71.5000 cfs

Result Parameters

Depth: 2.8042 ft

Area of Flow: 9.4111 ft^2

Wetted Perimeter: 7.9384 ft

Hydraulic Radius: 1.1855 ft

Average Velocity: 7.5974 ft/s

Top Width: 3.6624 ft

Froude Number: 0.8352

Critical Depth: 2.5566 ft

Critical Velocity: 8.4309 ft/s

Critical Slope: 0.0039 ft/ft

Critical Top Width: 3.84 ft

Calculated Max Shear Stress: 0.5249 lb/ft^2

Calculated Avg Shear Stress: 0.2219 lb/ft^2

LINE-2 WSPG MODEL

*To be included during final engineering

Hydraulic Analysis Report

Project Data

Project Title: LINE-2

Designer:

Project Date: Friday, April 06, 2018

Project Units: U.S. Customary Units

Notes:

Channel Analysis: NODE 114 TO NODE 107

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 8.0000 cfs

Result Parameters

Depth: 1.1119 ft

Area of Flow: 1.7941 ft^2

Wetted Perimeter: 3.3659 ft

Hydraulic Radius: 0.5330 ft

Average Velocity: 4.4590 ft/s

Top Width: 1.9874 ft

Froude Number: 0.8270

Critical Depth: 1.0068 ft

Critical Velocity: 5.0490 ft/s

Critical Slope: 0.0042 ft/ft

Critical Top Width: 2.00 ft

Calculated Max Shear Stress: 0.2081 lb/ft^2

Calculated Avg Shear Stress: 0.0998 lb/ft^2

LATERAL-A1 WSPG MODEL

```
T1 DUKE - ALABAMA & PALMETTO                                                0
T2 ONSITE STORM DRAIN LATERAL A1
T3 FN: LATA1.WSW
SO   1000.0001196.420  1                        1200.310
R    1041.1501196.550  1      .012                            .000    .000 0
R    1410.0701197.700  1      .012                            .000  45.000 0
R    1677.5201198.530  1      .012                            .000  32.750 0
R    1936.4901199.340  1      .012                            .000 -32.750 0
R    1988.3701199.500  1      .012                            .000  60.000 0
WE   1988.3701199.500  4      .500
R    1991.3701199.900  4      .015                            .000    .000 0
SH   1991.3701199.900  4                        1199.900
CD   1  4   1    .000   5.000     .000  .000  .000   .00
CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  4   1    .000   1.500     .000  .000  .000   .00
CD   4  3   0    .000  10.000   10.000  .000  .000   .00
Q            64.800   .0
```

FILE: LATA1.WSW W S P G W - EDIT LISTING - Version 14.06 Date: 7-26-2018 Time: 3:25:15

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		5.000														
CD	2	4	1		3.000														
CD	3	4	1		1.500														
CD	4	3	0	.000	10.000	10.000	.000	.000	.00										

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
DUKE - ALABAMA & PALMETTO

HEADING LINE NO 2 IS -
ONSITE STORM DRAIN LATERAL A1

HEADING LINE NO 3 IS -
FN: LATA1.WSW

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1000.000	1196.420	1	1200.310

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1041.150	1196.550	1	.012	.000	.000	.000	0

ELEMENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1410.070	1197.700	1	.012	.000	.000	45.000	0

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1677.520	1198.530	1	.012	.000	.000	32.750	0

ELEMENT NO 5 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1936.490	1199.340	1	.012	.000	.000	-32.750	0

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1988.370	1199.500	1	.012	.000	.000	60.000	0

ELEMENT NO 7 IS A WALL ENTRANCE *

U/S DATA	STATION	INVERT	SECT	FP
	1988.370	1199.500	4	.500

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1991.370	1199.900	4	.015	.000	.000	.000	0

ELEMENT NO 9 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1991.370	1199.900	4	1199.900

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:25:17

DUKE - ALABAMA & PALMETTO
ONSITE STORM DRAIN LATERAL A1
FN: LATA1.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	1196.420	3.890	1200.310	64.80	3.95	.24	1200.55	.00	2.27	4.16	5.000	.000	.00	1 .0
41.150	.0032					.0006	.02	3.89	.35	2.23	.012	.00	.00	PIPE
1041.150	1196.550	3.769	1200.319	64.80	4.08	.26	1200.58	.00	2.27	4.31	5.000	.000	.00	1 .0
57.958	.0031					.0007	.04	3.77	.37	2.23	.012	.00	.00	PIPE
1099.109	1196.731	3.601	1200.332	64.80	4.28	.28	1200.62	.00	2.27	4.49	5.000	.000	.00	1 .0
53.276	.0031					.0007	.04	3.60	.41	2.23	.012	.00	.00	PIPE
1152.385	1196.897	3.446	1200.343	64.80	4.49	.31	1200.66	.00	2.27	4.63	5.000	.000	.00	1 .0
48.887	.0031					.0008	.04	3.45	.45	2.23	.012	.00	.00	PIPE
1201.272	1197.049	3.303	1200.352	64.80	4.71	.34	1200.70	.00	2.27	4.73	5.000	.000	.00	1 .0
45.658	.0031					.0009	.04	3.30	.49	2.23	.012	.00	.00	PIPE
1246.930	1197.191	3.169	1200.360	64.80	4.94	.38	1200.74	.00	2.27	4.82	5.000	.000	.00	1 .0
42.747	.0031					.0011	.05	3.17	.53	2.23	.012	.00	.00	PIPE
1289.677	1197.325	3.043	1200.368	64.80	5.18	.42	1200.78	.00	2.27	4.88	5.000	.000	.00	1 .0
40.171	.0031					.0012	.05	3.04	.57	2.23	.012	.00	.00	PIPE
1329.848	1197.450	2.924	1200.374	64.80	5.43	.46	1200.83	.00	2.27	4.93	5.000	.000	.00	1 .0
37.402	.0031					.0013	.05	2.92	.62	2.23	.012	.00	.00	PIPE
1367.249	1197.566	2.812	1200.379	64.80	5.70	.50	1200.88	.00	2.27	4.96	5.000	.000	.00	1 .0
35.568	.0031					.0015	.05	2.81	.66	2.23	.012	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:25:17

DUKE - ALABAMA & PALMETTO
ONSITE STORM DRAIN LATERAL A1
FN: LATA1.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1402.817	1197.677	2.705	1200.382	64.80	5.97	.55	1200.94	.00	2.27	4.98	5.000	.000	.00	1 .0
7.253	.0031					.0016	.01	2.71	.71	2.23	.012	.00	.00	PIPE
1410.070	1197.700	2.683	1200.383	64.80	6.04	.57	1200.95	.00	2.27	4.99	5.000	.000	.00	1 .0
32.837	.0031					.0018	.06	2.68	.73	2.24	.012	.00	.00	PIPE
1442.907	1197.802	2.583	1200.385	64.80	6.33	.62	1201.01	.00	2.27	5.00	5.000	.000	.00	1 .0
31.042	.0031					.0020	.06	2.58	.78	2.24	.012	.00	.00	PIPE
1473.949	1197.898	2.487	1200.385	64.80	6.64	.68	1201.07	.00	2.27	5.00	5.000	.000	.00	1 .0
26.452	.0031					.0023	.06	2.49	.84	2.24	.012	.00	.00	PIPE
1500.401	1197.980	2.397	1200.377	64.80	6.97	.75	1201.13	.00	2.27	5.00	5.000	.000	.00	1 .0
23.300	.0031					.0026	.06	2.40	.90	2.24	.012	.00	.00	PIPE
1523.701	1198.053	2.310	1200.363	64.80	7.31	.83	1201.19	.00	2.27	4.99	5.000	.000	.00	1 .0
2.189	.0031					.0029	.01	2.31	.97	2.24	.012	.00	.00	PIPE
1525.890	1198.059	2.268	1200.328	64.80	7.48	.87	1201.20	.00	2.27	4.98	5.000	.000	.00	1 .0
HYDRAULIC JUMP														
1525.890	1198.059	2.237	1200.296	64.80	7.62	.90	1201.20	.00	2.27	4.97	5.000	.000	.00	1 .0
128.613	.0031					.0031	.40	2.24	1.03	2.24	.012	.00	.00	PIPE
1654.503	1198.459	2.237	1200.695	64.80	7.62	.90	1201.60	.00	2.27	4.97	5.000	.000	.00	1 .0
23.017	.0031					.0031	.07	2.24	1.03	2.24	.012	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:25:17

DUKE - ALABAMA & PALMETTO
ONSITE STORM DRAIN LATERAL A1
FN: LATA1.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1677.520	1198.530	2.232	1200.762	64.80	7.64	.91	1201.67	.00	2.27	4.97	5.000	.000	.00	1 .0
236.305	.0031					.0031	.74	2.23	1.03	2.23	.012	.00	.00	PIPE
1913.825	1199.269	2.232	1201.501	64.80	7.64	.91	1202.41	.00	2.27	4.97	5.000	.000	.00	1 .0
22.665	.0031					.0031	.07	2.23	1.03	2.23	.012	.00	.00	PIPE
1936.490	1199.340	2.241	1201.581	64.80	7.60	.90	1202.48	.00	2.27	4.97	5.000	.000	.00	1 .0
41.610	.0031					.0031	.13	2.24	1.02	2.24	.012	.00	.00	PIPE
1978.100	1199.468	2.241	1201.709	64.80	7.60	.90	1202.61	.00	2.27	4.97	5.000	.000	.00	1 .0
10.270	.0031					.0030	.03	2.24	1.02	2.24	.012	.00	.00	PIPE
1988.370	1199.500	2.268	1201.768	64.80	7.48	.87	1202.64	.00	2.27	4.98	5.000	.000	.00	1 .0
WALL	ENTRANCE													
1988.370	1199.500	3.435	1202.935	64.80	1.89	.06	1202.99	.00	1.09	10.00	10.000	10.000	.00	0 .0
1.159	.1333					.0002	.00	3.44	.18	.37	.015	.00	.00	BOX
1989.529	1199.655	3.275	1202.930	64.80	1.98	.06	1202.99	.00	1.09	10.00	10.000	10.000	.00	0 .0
1.099	.1333					.0002	.00	3.28	.19	.37	.015	.00	.00	BOX
1990.628	1199.801	3.123	1202.924	64.80	2.08	.07	1202.99	.00	1.09	10.00	10.000	10.000	.00	0 .0
.742	.1333					.0002	.00	3.12	.21	.37	.015	.00	.00	BOX
1991.370	1199.900	3.019	1202.919	64.80	2.15	.07	1202.99	.00	1.09	10.00	10.000	10.000	.00	0 .0

LINE-A (EXISTING WSPG MODEL) WITH STATION CONVERSIONS

AS-BUILT STATIONS CONVERTED TO HYDRUALIC MODEL STATIONS

AS-BUILT STATION	REVISED STATION
8206.570	1000.000
8186.500	1020.070
8089.630	1116.940
8001.980	1204.590
7993.320	1213.250
7898.000	1308.570
7709.750	1496.820
7164.330	2042.240
7159.670	2046.900
6624.330	2582.240
6619.670	2586.900
6400.000	2806.570
6390.000	2816.570
6024.330	3182.240
6019.670	3186.900
5564.080	3642.490
5559.420	3647.150
4998.330	4208.240
4993.670	4212.900
4433.330	4773.240
4428.670	4777.900
3868.330	5338.240
3863.670	5342.900
3390.330	5816.240
3385.670	5820.900
2910.330	6296.240
2905.670	6300.900
2440.310	6766.260
2435.650	6770.920
2348.530	6858.040
2056.330	7150.240
2051.670	7154.900
1682.330	7524.240
1677.670	7528.900
1346.330	7860.240
1341.670	7864.900
1003.580	8202.990
996.420	8210.150

LINE-A (PROPOSED WSPG MODEL)

```
T1 ALABAMA STREET STORM DRAIN - LINE A                                          0
T2 WSPG MODEL PER AS-BUILTS PLANS
T3 FN: LINEA.WSW
SO   1000.0001171.500  1                          1176.506.700
R    1020.0701171.540  1      .013                                 12.777    .000 0
R    1116.9401171.740  1      .013                                   .000    .000 0
R    1213.2501171.930  1      .013                                -61.313    .000 0
R    1308.5701172.120  1      .013                                 60.683    .000 0
R    1496.8201172.500  1      .013                                   .000    .000 0
R    2042.2401173.590  1      .013                                   .000   -.625 0
R    2046.9001173.680  1      .013                                   .000    .000 1
R    2582.2401193.230  1      .013                                   .000    .000 0
JX   2586.9001193.360  2  3   .013  164.900          1193.290        -45.0         .000
R    2607.1001196.370  1      .013                                   .000    .000 0
JX   2609.1001196.420  2  3   .013   64.800          1196.420        -45.0         .000
R    3182.2401205.670  2      .013                                   .000    .000 0
R    3186.9001205.720  2      .013                                   .000    .000 1
R    3642.4901206.910  2      .013                                   .000    .000 0
JX   3647.1501206.920  2  3   .013   74.200          1206.980        -45.0         .000
R    4208.2401208.040  2      .013                                   .000    .000 0
R    4212.9001208.050  2      .013                                   .000    .000 1
R    4773.2401209.170  2      .013                                   .000    .000 0
R    4777.9001209.180  2      .013                                   .000    .000 1
R    5338.2401210.300  2      .013                                   .000    .000 0
JX   5342.9001210.310  4  5   .013   96.300          1210.310        -90.0         .000
R    5816.2401211.260  4      .013                                   .000    .000 0
R    5820.9001211.280  4      .013                                   .000    .000 1
R    6296.2401212.220  4      .013                                   .000    .000 0
R    6300.9001212.230  4      .013                                   .000    .000 1
R    6766.2601213.160  4      .013                                   .000    .000 0
JX   6770.9201213.170  4  5   .013   61.200          1213.160        -90.0         .000
R    6858.0401213.340  4      .013                                   .000  -6.435 0
R    7150.2401213.930  4      .013                                   .000   6.387 0
JX   7154.9001213.940  6  5   .013   54.200          1217.180        -90.0         .000
R    7154.9001213.940  4      .013                                   .000    .000 1
R    7524.2401214.670  4      .013                                   .000    .000 0
JX   7528.9001215.680  6  5   .013   50.600          1217.180        -90.0         .000
R    7860.2401216.350  6      .013                                   .000    .000 0
JX   7864.9001216.360  6  5   .013   36.900          1217.850        -90.0         .000
R    8202.9901217.030  6      .013                                   .000    .000 0
R    8210.1501217.040  6      .013                                   .000    .000 0
SH   8210.1501217.040  6                          1523.000
CD   1  4   2    .000   6.000     .000  .000  .000   .00
CD   2  4   1    .000   8.000     .000  .000  .000   .00
CD   3  4   1    .000   4.000     .000  .000  .000   .00
CD   4  4   1    .000   7.000     .000  .000  .000   .00
CD   5  4   1    .000   3.000     .000  .000  .000   .00
CD   6  4   1    .000   6.000     .000  .000  .000   .00
Q           155.800   .0
```

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	2		6.000														
CD	2	4	1		8.000														
CD	3	4	1		4.000														
CD	4	4	1		7.000														
CD	5	4	1		3.000														
CD	6	4	1		6.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

ALABAMA STREET STORM DRAIN - LINE A

HEADING LINE NO 2 IS -

WSPG MODEL PER AS-BUILTS PLANS

HEADING LINE NO 3 IS -

FN: LINEA.WSW

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	1000.000	1171.500	1	1176.506

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1020.070	1171.540	1	.013	90.000	12.777	.000	0

ELEMENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1116.940	1171.740	1	.013	.000	.000	.000	0

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1213.250	1171.930	1	.013	90.000	-61.313	.000	0

ELEMENT NO 5 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1308.570	1172.120	1	.013	89.999	60.683	.000	0

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	1496.820	1172.500	1	.013	.000	.000	.000	0

ELEMENT NO 7 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2042.240	1173.590	1	.013	.000	.000	-.625	0

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2046.900	1173.680	1	.013	.000	.000	.000	1

ELEMENT NO 9 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2582.240	1193.230	1	.013	.000	.000	.000	0

ELEMENT NO 10 IS A JUNCTION * * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2586.900	1193.360	2	3	0	.013	164.900	.000	1193.290	.000	-45.000	.000

RADIUS	ANGLE
.000	.000

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	2607.100	1196.370	1	.013	.000	.000	.000	0

ELEMENT NO 12 IS A JUNCTION * * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	2609.100	1196.420	2	3	0	.013	64.800	.000	1196.420	.000	-45.000	.000

RADIUS	ANGLE
.000	.000

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 13 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H

3182.240 1205.670 2 .013 .000 .000 .000 0

ELEMENT NO 14 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

3186.900 1205.720 2 .013 .000 .000 .000 1

ELEMENT NO 15 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

3642.490 1206.910 2 .013 .000 .000 .000 0

ELEMENT NO 16 IS A JUNCTION * * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4

3647.150 1206.920 2 3 0 .013 74.200 .000 1206.980 .000 -45.000 .000

RADIUS ANGLE

.000 .000

ELEMENT NO 17 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

4208.240 1208.040 2 .013 .000 .000 .000 0

ELEMENT NO 18 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

4212.900 1208.050 2 .013 .000 .000 .000 1

ELEMENT NO 19 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

4773.240 1209.170 2 .013 .000 .000 .000 0

ELEMENT NO 20 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

4777.900 1209.180 2 .013 .000 .000 .000 1

ELEMENT NO 21 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

5338.240 1210.300 2 .013 .000 .000 .000 0

ELEMENT NO 22 IS A JUNCTION * * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4

5342.900 1210.310 4 5 0 .013 96.300 .000 1210.310 .000 -90.000 .000

RADIUS ANGLE

.000 .000

ELEMENT NO 23 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

5816.240 1211.260 4 .013 .000 .000 .000 0

ELEMENT NO 24 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

5820.900 1211.280 4 .013 .000 .000 .000 1

ELEMENT NO 25 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

6296.240 1212.220 4 .013 .000 .000 .000 0

ELEMENT NO 26 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

6300.900 1212.230 4 .013 .000 .000 .000 1

ELEMENT NO 27 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

6766.260 1213.160 4 .013 .000 .000 .000 0

ELEMENT NO 28 IS A JUNCTION * * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4

6770.920 1213.170 4 5 0 .013 61.200 .000 1213.160 .000 -90.000 .000

RADIUS ANGLE

.000 .000

ELEMENT NO 29 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

6858.040 1213.340 4 .013 .000 .000 -6.435 0

ELEMENT NO 30 IS A REACH * * *

U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H

7150.240 1213.930 4 .013 .000 .000 6.387 0

ELEMENT NO 31 IS A JUNCTION * * * * * * *

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4

7154.900 1213.940 6 5 0 .013 54.200 .000 1217.180 .000 -90.000 .000

RADIUS ANGLE

.000 .000

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ELEMENT NO 32 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	7154.900	1213.940	4	.013	.000	.000	.000	1

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 33 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	7524.240	1214.670	4	.013	.000	.000	.000	0

ELEMENT NO 34 IS A JUNCTION * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	7528.900	1215.680	6	5	0	.013	50.600	.000	1217.180	.000	-90.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 35 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	7860.240	1216.350	6	.013	.000	.000	.000	0

ELEMENT NO 36 IS A JUNCTION * * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	7864.900	1216.360	6	5	0	.013	36.900	.000	1217.850	.000	-90.000	.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 37 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	8202.990	1217.030	6	.013	.000	.000	.000	0

ELEMENT NO 38 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	8210.150	1217.040	6	.013	.000	.000	.000	0

ELEMENT NO 39 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	8210.150	1217.040	6	1523.000

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	1171.500	5.233	1176.733	758.90	14.50	3.27	1180.00	.15	5.23	4.01	6.000	.000	.00	2 .0
12.322	.0020					.0071	.09	5.38	.71	6.00	.013	.00	.00	PIPE
1012.322	1171.525	5.593	1177.118	758.90	13.83	2.97	1180.09	.10	5.23	3.02	6.000	.000	.00	2 .0
7.748	.0020					.0069	.05	5.69	.57	6.00	.013	.00	.00	PIPE
1020.070	1171.540	5.690	1177.230	758.90	13.69	2.91	1180.14	.00	5.23	2.65	6.000	.000	.00	2 .0
37.226	.0021					.0073	.27	5.69	.53	6.00	.013	.00	.00	PIPE
1057.296	1171.617	6.000	1177.617	758.90	13.42	2.80	1180.41	.00	5.23	.00	6.000	.000	.00	2 .0
59.644	.0021					.0079	.47	6.00	.00	6.00	.013	.00	.00	PIPE
1116.940	1171.740	6.356	1178.096	758.90	13.42	2.80	1180.89	.00	5.23	.00	6.000	.000	.00	2 .0
96.310	.0020					.0080	.77	.00	.00	6.00	.013	.00	.00	PIPE
1213.250	1171.930	7.400	1179.330	758.90	13.42	2.80	1182.13	.00	5.23	.00	6.000	.000	.00	2 .0
95.320	.0020					.0080	.77	.00	.00	6.00	.013	.00	.00	PIPE
1308.570	1172.120	8.435	1180.555	758.90	13.42	2.80	1183.35	.00	5.23	.00	6.000	.000	.00	2 .0
188.250	.0020					.0080	1.51	8.43	.00	6.00	.013	.00	.00	PIPE
1496.820	1172.500	9.566	1182.066	758.90	13.42	2.80	1184.86	.00	5.23	.00	6.000	.000	.00	2 .0
399.387	.0020					.0080	3.21	9.57	.00	6.00	.013	.00	.00	PIPE
1896.207	1173.298	11.978	1185.276	758.90	13.42	2.80	1188.07	.00	5.23	.00	6.000	.000	.00	2 .0

HYDRAULIC JUMP

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1896.207	1173.298	3.371	1176.669	758.90	23.19	8.35	1185.02	.00	5.23	5.95	6.000	.000	.00	2 .0
18.138	.0020					.0226	.41	3.37	1.74	6.00	.013	.00	.00	PIPE
1914.345	1173.334	3.303	1176.637	758.90	23.78	8.78	1185.42	.00	5.23	5.97	6.000	.000	.00	2 .0
32.978	.0020					.0249	.82	3.30	1.81	6.00	.013	.00	.00	PIPE
1947.323	1173.400	3.179	1176.579	758.90	24.94	9.66	1186.24	.00	5.23	5.99	6.000	.000	.00	2 .0
32.361	.0020					.0282	.91	3.18	1.95	6.00	.013	.00	.00	PIPE
1979.684	1173.465	3.061	1176.526	758.90	26.16	10.62	1187.15	.00	5.23	6.00	6.000	.000	.00	2 .0
31.671	.0020					.0320	1.01	3.06	2.10	6.00	.013	.00	.00	PIPE
2011.354	1173.528	2.949	1176.477	758.90	27.43	11.69	1188.16	.00	5.23	6.00	6.000	.000	.00	2 .0
30.885	.0020					.0364	1.12	2.95	2.25	6.00	.013	.00	.00	PIPE
2042.240	1173.590	2.842	1176.432	758.90	28.77	12.85	1189.29	.00	5.23	5.99	6.000	.000	.00	2 .0
4.660	.0193					.0389	.18	2.84	2.42	3.50	.013	.00	.00	PIPE
2046.900	1173.680	2.833	1176.513	758.90	28.89	12.96	1189.47	.00	5.23	5.99	6.000	.000	.00	2 .0
133.653	.0365					.0402	5.37	2.83	2.43	2.89	.013	.00	.00	PIPE
2180.553	1178.561	2.789	1181.350	758.90	29.47	13.49	1194.84	.00	5.23	5.99	6.000	.000	.00	2 .0
165.116	.0365					.0441	7.28	2.79	2.50	2.89	.013	.00	.00	PIPE
2345.669	1184.591	2.689	1187.280	758.90	30.91	14.83	1202.11	.00	5.23	5.97	6.000	.000	.00	2 .0
101.775	.0365					.0502	5.10	2.69	2.69	2.89	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2447.445	1188.307	2.593	1190.901	758.90	32.42	16.32	1207.22	.00	5.23	5.94	6.000	.000	.00	2 .0
74.873	.0365					.0571	4.27	2.59	2.88	2.89	.013	.00	.00	PIPE
2522.317	1191.042	2.501	1193.543	758.90	34.00	17.95	1211.49	.00	5.23	5.92	6.000	.000	.00	2 .0
59.923	.0365					.0650	3.90	2.50	3.08	2.89	.013	.00	.00	PIPE
2582.240	1193.230	2.414	1195.644	758.90	35.66	19.74	1215.39	.00	5.23	5.88	6.000	.000	.00	2 .0
JUNCT STR	.0279					.0746	.35	2.41	3.30		.013	.00	.00	PIPE
2586.900	1193.360	2.611	1195.971	594.00	25.15	9.82	1205.79	.00	4.71	5.95	6.000	.000	.00	2 .0
4.175	.1490					.0307	.13	2.61	2.22	1.73	.013	.00	.00	PIPE
2591.075	1193.982	2.669	1196.651	594.00	24.42	9.26	1205.91	.00	4.71	5.96	6.000	.000	.00	2 .0
6.117	.1490					.0277	.17	2.67	2.13	1.73	.013	.00	.00	PIPE
2597.192	1194.894	2.769	1197.663	594.00	23.29	8.42	1206.08	.00	4.71	5.98	6.000	.000	.00	2 .0
5.307	.1490					.0244	.13	2.77	1.99	1.73	.013	.00	.00	PIPE
2602.499	1195.684	2.873	1198.557	594.00	22.20	7.65	1206.21	.00	4.71	5.99	6.000	.000	.00	2 .0
4.601	.1490					.0214	.10	2.87	1.85	1.73	.013	.00	.00	PIPE
2607.100	1196.370	2.982	1199.352	594.00	21.17	6.96	1206.31	.00	4.71	6.00	6.000	.000	.00	2 .0
JUNCT STR	.0250					.0174	.03	2.98	1.73		.013	.00	.00	PIPE
2609.100	1196.420	3.894	1200.314	529.20	21.79	7.38	1207.69	.00	5.87	8.00	8.000	.000	.00	1 .0
37.963	.0161					.0147	.56	3.89	2.20	3.79	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2647.063	1197.033	3.908	1200.941	529.20	21.69	7.30	1208.24	.00	5.87	8.00	8.000	.000	.00	1 .0
211.278	.0161					.0137	2.89	3.91	2.19	3.79	.013	.00	.00	PIPE
2858.341	1200.443	4.057	1204.500	529.20	20.68	6.64	1211.14	.00	5.87	8.00	8.000	.000	.00	1 .0
110.002	.0161					.0121	1.33	4.06	2.04	3.79	.013	.00	.00	PIPE
2968.343	1202.218	4.213	1206.431	529.20	19.72	6.04	1212.47	.00	5.87	7.99	8.000	.000	.00	1 .0
69.979	.0161					.0106	.74	4.21	1.90	3.79	.013	.00	.00	PIPE
3038.322	1203.347	4.377	1207.724	529.20	18.80	5.49	1213.21	.00	5.87	7.96	8.000	.000	.00	1 .0
48.287	.0161					.0094	.45	4.38	1.76	3.79	.013	.00	.00	PIPE
3086.609	1204.127	4.550	1208.677	529.20	17.92	4.99	1213.67	.00	5.87	7.92	8.000	.000	.00	1 .0
34.494	.0161					.0083	.29	4.55	1.64	3.79	.013	.00	.00	PIPE
3121.103	1204.683	4.733	1209.417	529.20	17.09	4.54	1213.95	.00	5.87	7.86	8.000	.000	.00	1 .0
24.921	.0161					.0073	.18	4.73	1.52	3.79	.013	.00	.00	PIPE
3146.024	1205.086	4.926	1210.012	529.20	16.29	4.12	1214.13	.00	5.87	7.78	8.000	.000	.00	1 .0
17.621	.0161					.0065	.11	4.93	1.41	3.79	.013	.00	.00	PIPE
3163.645	1205.370	5.131	1210.501	529.20	15.54	3.75	1214.25	.00	5.87	7.67	8.000	.000	.00	1 .0
11.742	.0161					.0058	.07	5.13	1.30	3.79	.013	.00	.00	PIPE
3175.387	1205.559	5.350	1210.910	529.20	14.81	3.41	1214.32	.00	5.87	7.53	8.000	.000	.00	1 .0
6.853	.0161					.0051	.04	5.35	1.20	3.79	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
3182.240	1205.670	5.584	1211.255	529.20	14.12	3.10	1214.35	.00	5.87	7.35	8.000	.000	.00	1 .0
.853	.0107					.0048	.00	5.58	1.10	4.28	.013	.00	.00	PIPE
3183.093	1205.679	5.609	1211.288	529.20	14.06	3.07	1214.36	.00	5.87	7.32	8.000	.000	.00	1 .0
3.807	.0107					.0045	.02	5.61	1.09	4.28	.013	.00	.00	PIPE
3186.900	1205.720	5.865	1211.585	529.20	13.40	2.79	1214.37	.00	5.87	7.08	8.000	.000	.00	1 .0
16.813	.0026					.0041	.07	5.87	1.00	8.00	.013	.00	.00	PIPE
3203.713	1205.764	6.143	1211.907	529.20	12.78	2.53	1214.44	.00	5.87	6.75	8.000	.000	.00	1 .0
75.619	.0026					.0037	.28	6.14	.91	8.00	.013	.00	.00	PIPE
3279.332	1205.961	6.452	1212.414	529.20	12.18	2.30	1214.72	.00	5.87	6.32	8.000	.000	.00	1 .0
203.625	.0026					.0033	.68	6.45	.82	8.00	.013	.00	.00	PIPE
3482.957	1206.493	6.805	1213.298	529.20	11.61	2.09	1215.39	.00	5.87	5.70	8.000	.000	.00	1 .0
159.533	.0026					.0031	.50	6.81	.72	8.00	.013	.00	.00	PIPE
3642.490	1206.910	6.965	1213.875	529.20	11.39	2.02	1215.89	.00	5.87	5.37	8.000	.000	.00	1 .0
JUNCT STR	.0021					.0028	.01	6.96	.68		.013	.00	.00	PIPE
3647.150	1206.920	7.995	1214.915	455.00	9.05	1.27	1216.19	.00	5.43	.38	8.000	.000	.00	1 .0
10.608	.0020					.0024	.03	8.00	.14	8.00	.013	.00	.00	PIPE
3657.758	1206.941	8.000	1214.941	455.00	9.05	1.27	1216.21	.00	5.43	.00	8.000	.000	.00	1 .0
550.482	.0020					.0025	1.35	8.00	.00	8.00	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
4208.240	1208.040	8.271	1216.311	455.00	9.05	1.27	1217.58	.00	5.43	.00	8.000	.000	.00	1 .0
4.660	.0021					.0025	.01	8.27	.00	8.00	.013	.00	.00	PIPE
4212.900	1208.050	8.336	1216.386	455.00	9.05	1.27	1217.66	.00	5.43	.00	8.000	.000	.00	1 .0
560.340	.0020					.0025	1.39	8.34	.00	8.00	.013	.00	.00	PIPE
4773.240	1209.170	8.611	1217.781	455.00	9.05	1.27	1219.05	.00	5.43	.00	8.000	.000	.00	1 .0
4.660	.0021					.0025	.01	8.61	.00	8.00	.013	.00	.00	PIPE
4777.900	1209.180	8.676	1217.856	455.00	9.05	1.27	1219.13	.00	5.43	.00	8.000	.000	.00	1 .0
560.340	.0020					.0025	1.39	8.68	.00	8.00	.013	.00	.00	PIPE
5338.240	1210.300	8.951	1219.251	455.00	9.05	1.27	1220.52	.00	5.43	.00	8.000	.000	.00	1 .0
JUNCT STR	.0021					.0028	.01	8.95	.00		.013	.00	.00	PIPE
5342.900	1210.310	9.496	1219.806	358.70	9.32	1.35	1221.16	.00	4.99	.00	7.000	.000	.00	1 .0
473.340	.0020					.0032	1.49	9.50	.00	7.00	.013	.00	.00	PIPE
5816.240	1211.260	10.039	1221.299	358.70	9.32	1.35	1222.65	.00	4.99	.00	7.000	.000	.00	1 .0
4.660	.0043					.0032	.01	10.04	.00	4.99	.013	.00	.00	PIPE
5820.900	1211.280	10.101	1221.381	358.70	9.32	1.35	1222.73	.00	4.99	.00	7.000	.000	.00	1 .0
475.340	.0020					.0032	1.50	10.10	.00	7.00	.013	.00	.00	PIPE
6296.240	1212.220	10.659	1222.879	358.70	9.32	1.35	1224.23	.00	4.99	.00	7.000	.000	.00	1 .0
4.660	.0021					.0032	.01	10.66	.00	7.00	.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
6300.900	1212.230	10.732	1222.962	358.70	9.32	1.35	1224.31	.00	4.99	.00	7.000	.000	.00	1 .0
465.360	.0020					.0032	1.47	10.73	.00	7.00	.013	.00	.00	PIPE
6766.260	1213.160	11.269	1224.429	358.70	9.32	1.35	1225.78	.00	4.99	.00	7.000	.000	.00	1 .0
JUNCT STR	.0021					.0027	.01	11.27	.00		.013	.00	.00	PIPE
6770.920	1213.170	12.113	1225.283	297.50	7.73	.93	1226.21	.00	4.54	.00	7.000	.000	.00	1 .0
87.120	.0020					.0022	.19	12.11	.00	6.16	.013	.00	.00	PIPE
6858.040	1213.340	12.152	1225.492	297.50	7.73	.93	1226.42	.00	4.54	.00	7.000	.000	.00	1 .0
292.200	.0020					.0022	.63	12.15	.00	6.00	.013	.00	.00	PIPE
7150.240	1213.930	12.215	1226.145	297.50	7.73	.93	1227.07	.00	4.54	.00	7.000	.000	.00	1 .0
JUNCT STR	.0021					.0027	.01	12.22	.00		.013	.00	.00	PIPE
7154.900	1213.940	12.410	1226.350	243.30	6.32	.62	1226.97	.00	4.09	.00	7.000	.000	.00	1 .0
7154.900	1213.940	12.441	1226.381	243.30	6.32	.62	1227.00	.00	4.09	.00	7.000	.000	.00	1 .0
369.340	.0020					.0015	.54	12.44	.00	4.99	.013	.00	.00	PIPE
7524.240	1214.670	12.246	1226.916	243.30	6.32	.62	1227.54	.00	4.09	.00	7.000	.000	.00	1 .0
JUNCT STR	.2168					.0018	.01	12.25	.00		.013	.00	.00	PIPE
7528.900	1215.680	11.454	1227.134	192.70	6.82	.72	1227.85	.00	3.79	.00	6.000	.000	.00	1 .0
331.340	.0020					.0021	.69	11.45	.00	4.99	.013	.00	.00	PIPE
7860.240	1216.350	11.470	1227.820	192.70	6.82	.72	1228.54	.00	3.79	.00	6.000	.000	.00	1 .0
JUNCT STR	.0021					.0017	.01	11.47	.00		.013	.00	.00	PIPE

Program Package Serial Number: 1585

WATER SURFACE PROFILE LISTING Date: 7-26-2018 Time: 3:14:39

ALABAMA STREET STORM DRAIN - LINE A
WSPG MODEL PER AS-BUILTS PLANS
FN: LINEA.WSW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
7864.900	1216.360	11.967	1228.327	155.80	5.51	.47	1228.80	.00	3.39	.00	6.000	.000	.00	1 .0
338.090	.0020					.0014	.46	11.97	.00	4.16	.013	.00	.00	PIPE
8202.990	1217.030	11.755	1228.785	155.80	5.51	.47	1229.26	.00	3.39	.00	6.000	.000	.00	1 .0
7.160	.0014					.0014	.01	11.75	.00	4.83	.013	.00	.00	PIPE
8210.150	1217.040	11.754	1228.794	155.80	5.51	.47	1229.27	.00	3.39	.00	6.000	.000	.00	1 .0

INLET CAPACITIES

*To be included during final engineering

DRAWDOWN CALCULATION

Underground Storage System Drawdown Calculation

ALBERT A WEBB ASSOCIATES ENGINEERING CONSULTANTS

Designer: MJS
Date: 4/11/2018
Project: Duke - Alabama & Palmetto
Location: Southeast corner of Alabama Street and Palmetto Avenue
Area: DMA 1

(1)	VBMP =	186684	ft^3
(2)	Basin Bottom Area=	81206	ft^2
(3)	Infiltration Rate =	3	in/hr
(4)	Factor of Safety=	3.4	
(5)	Design Infiltration Rate =	0.9	in/hr

$$Drawdown = \frac{V_{BMP}\ (ft^3)}{Design\ Infiltration\ Rate\left(\frac{in}{hr}\right) \times \left(\frac{1ft}{12in}\right) \times Bottom\ Area\ (ft^2)}$$

Water Quality Drawdown Time=	31.3	hr

Volume at 1202.9'=	296143	ft^3
Basin Bottom Area=	81206	ft^2
Infiltration Rate =	0.9	in/hr
Drawdown Time for Enitre Volume=	48.0	hr

*The Geotechnical Infiltration Test Report shows recommend a design infiltration rates of 3 inches per hour at the expected depth. A factor of safety of 3.4 was determined by the PWQMP Report. The entire 100-year 24-hour volume will drain within the 48-hour mark.

STAGE-STORAGE/OUTFLOW TABLE

Project: DUKE- ALABAMA & PALMETTO
Basin Description: AUTOCAD STAGE STORGE VAULES

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
1,199.50	81,204.59	N/A	N/A	0.00	N/A	0.00
1,199.60	81,555.04	0.10	8137.98	8137.98	8137.97	8137.97
1,199.70	81,906.02	0.10	8173.05	16311.03	8173.05	16311.02
1,199.80	82,257.54	0.10	8208.18	24519.21	8208.17	24519.19
1,199.90	82,609.58	0.10	8243.36	32762.57	8243.35	32762.54
1,200.00	82,962.15	0.10	8278.59	41041.15	8278.58	41041.12
1,200.10	83,315.26	0.10	8313.87	49355.03	8313.86	49354.99
1,200.20	83,668.89	0.10	8349.21	57704.23	8349.20	57704.19
1,200.30	84,023.06	0.10	8384.60	66088.83	8384.59	66088.78
1,200.40	84,377.76	0.10	8420.04	74508.87	8420.03	74508.81
1,200.50	84,732.98	0.10	8455.54	82964.41	8455.53	82964.35
1,200.60	85,088.74	0.10	8491.09	91455.49	8491.08	91455.43
1,200.70	85,445.03	0.10	8526.69	99982.18	8526.68	99982.11
1,200.80	85,801.85	0.10	8562.34	108544.53	8562.34	108544.45
1,200.90	86,159.20	0.10	8598.05	117142.58	8598.05	117142.49
1,201.00	86,517.08	0.10	8633.81	125776.39	8633.81	125776.30
1,201.10	86,875.49	0.10	8669.63	134446.02	8669.62	134445.92
1,201.20	87,234.43	0.10	8705.50	143151.52	8705.49	143151.41
1,201.30	87,593.90	0.10	8741.42	151892.93	8741.41	151892.82
1,201.40	87,953.90	0.10	8777.39	160670.32	8777.38	160670.21
1,201.50	88,314.44	0.10	8813.42	169483.74	8813.41	169483.62
1,201.60	88,675.50	0.10	8849.50	178333.24	8849.49	178333.11
1,201.70	89,037.09	0.10	8885.63	187218.87	8885.62	187218.73
1,201.80	89,399.22	0.10	8921.82	196140.68	8921.81	196140.54
1,201.90	89,761.87	0.10	8958.05	205098.74	8958.05	205098.59
1,202.00	90,125.06	0.10	8994.35	214093.08	8994.34	214092.93
1,202.10	90,488.77	0.10	9030.69	223123.77	9030.69	223123.61
1,202.20	90,853.02	0.10	9067.09	232190.86	9067.08	232190.70
1,202.30	91,217.80	0.10	9103.54	241294.40	9103.53	241294.23
1,202.40	91,583.10	0.10	9140.04	250434.45	9140.04	250434.27
1,202.50	91,948.94	0.10	9176.60	259611.05	9176.60	259610.87
1,202.60	92,315.31	0.10	9213.21	268824.26	9213.21	268824.07
1,202.70	92,682.21	0.10	9249.88	278074.14	9249.87	278073.94
1,202.80	93,049.64	0.10	9286.59	287360.73	9286.59	287360.53
1,202.90	93,417.60	0.10	9323.36	296684.09	9323.36	296683.88
1,203.00	93,786.09	0.10	9360.18	306044.28	9360.18	306044.06
1,203.10	94,155.11	0.10	9397.06	315441.34	9397.05	315441.12
1,203.20	94,524.66	0.10	9433.99	324875.33	9433.98	324875.10
1,203.30	94,894.74	0.10	9470.97	334346.30	9470.96	334346.06
1,203.40	95,265.36	0.10	9508.01	343854.30	9508.00	343854.06
1,203.50	95,636.50	0.10	9545.09	353399.40	9545.09	353399.15

Basin Stage-Storage-Outflow Table
18-0011Infiltration Basin

#	Elevation (FT)	Depth (FT)	Storage-Total (AC-FT)	Q (CFS)	
1.0	1,199.50	0.00	0.000	0.000	DEAD STORAGE
2.0	1,200.80	1.30	2.492	0.000	
3.0	1,201.70	2.20	4.298	0.000	
4.0	1,202.30	2.80	5.539	45.000	
5.0	1,202.50	3.00	5.960	50.000	
6.0	1,202.90	3.40	6.811	65.000	
7.0	1,203.00	3.50	7.026	68.000	
8.0	1,203.10	3.60	7.242	70.000	
9.0	1,203.40	3.90	7.894	80.000	
10.0	1,203.50	4.00	8.113	85.000	
11.0					
12.0					
13.0					
14.0					
15.0					
16.0					
17.0					
18.0					
19.0					

**No outflow was assumed below water quality depth of 1201.7

BASIN ROUTING
100-YEAR, 24-HOUR STORM EVENT

FLOOD HYDROGRAPH ROUTING PROGRAM

Study date: 07/26/18

18-0011 DUKE - ALABAMA & PALMETTO
BASIN ROUTING CALCULATIONS
100-YEAR, 24-HOUR STORM EVENT
FN: ROUTE24100.OUT MJS

Program License Serial Number 4010

********** HYDROGRAPH INFORMATION **********

From study/file name: PROP24100.rte
**********HYDROGRAPH DATA**********
Number of intervals = 296
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 137.573 (CFS)
Total volume = 19.706 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

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Process from Point/Station 101.000 to Point/Station 102.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 296
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
1.300	2.492	0.000	2.492	2.492
2.200	4.298	0.000	4.298	4.298
2.800	5.539	45.000	5.384	5.694
3.000	5.960	50.000	5.788	6.132
3.400	6.811	65.000	6.587	7.035
3.500	7.026	68.000	6.792	7.260
3.600	7.242	70.000	7.001	7.483
3.900	7.894	80.000	7.619	8.169
4.000	8.113	85.000	7.820	8.406

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)		0	34.4	68.79	103.18	137.57	Depth (Ft.)
0.083	0.13	0.00	0.000	O	|	|	|	|	|	0.00
0.167	0.87	0.00	0.004	O	|	|	|	|	|	0.00
0.250	2.20	0.00	0.015	O	|	|	|	|	|	0.01
0.333	3.42	0.00	0.034	O	|	|	|	|	|	0.02
0.417	3.99	0.00	0.059	O	|	|	|	|	|	0.03
0.500	4.23	0.00	0.088	O	|	|	|	|	|	0.05
0.583	4.31	0.00	0.117	OI	|	|	|	|	|	0.06
0.667	4.36	0.00	0.147	OI	|	|	|	|	|	0.08
0.750	4.40	0.00	0.177	OI	|	|	|	|	|	0.09
0.833	4.41	0.00	0.207	OI	|	|	|	|	|	0.11

0.917	4.43	0.00	0.238	OI				0.12
1.000	4.44	0.00	0.268	OI				0.14
1.083	4.45	0.00	0.299	OI				0.16
1.167	4.47	0.00	0.330	OI				0.17
1.250	4.48	0.00	0.361	OI				0.19
1.333	4.49	0.00	0.391	OI				0.20
1.417	4.51	0.00	0.422	OI				0.22
1.500	4.52	0.00	0.454	OI				0.24
1.583	4.54	0.00	0.485	OI				0.25
1.667	4.55	0.00	0.516	OI				0.27
1.750	4.57	0.00	0.547	OI				0.29
1.833	4.58	0.00	0.579	OI				0.30
1.917	4.59	0.00	0.611	OI				0.32
2.000	4.61	0.00	0.642	OI				0.34
2.083	4.62	0.00	0.674	OI				0.35
2.167	4.64	0.00	0.706	OI				0.37
2.250	4.65	0.00	0.738	OI				0.38
2.333	4.67	0.00	0.770	OI				0.40
2.417	4.69	0.00	0.802	OI				0.42
2.500	4.70	0.00	0.835	OI				0.44
2.583	4.72	0.00	0.867	OI				0.45
2.667	4.73	0.00	0.900	OI				0.47
2.750	4.75	0.00	0.932	OI				0.49
2.833	4.77	0.00	0.965	OI				0.50
2.917	4.78	0.00	0.998	OI				0.52
3.000	4.80	0.00	1.031	OI				0.54
3.083	4.82	0.00	1.064	OI				0.56
3.167	4.83	0.00	1.097	OI				0.57
3.250	4.85	0.00	1.131	OI				0.59
3.333	4.87	0.00	1.164	OI				0.61
3.417	4.88	0.00	1.198	OI				0.62
3.500	4.90	0.00	1.231	OI				0.64
3.583	4.92	0.00	1.265	OI				0.66
3.667	4.94	0.00	1.299	OI				0.68
3.750	4.96	0.00	1.333	OI				0.70
3.833	4.97	0.00	1.367	OI				0.71
3.917	4.99	0.00	1.402	OI				0.73
4.000	5.01	0.00	1.436	OI				0.75
4.083	5.03	0.00	1.471	OI				0.77
4.167	5.05	0.00	1.505	OI				0.79
4.250	5.07	0.00	1.540	OI				0.80
4.333	5.09	0.00	1.575	OI				0.82
4.417	5.11	0.00	1.610	OI				0.84
4.500	5.13	0.00	1.646	OI				0.86
4.583	5.15	0.00	1.681	OI				0.88
4.667	5.17	0.00	1.716	OI				0.90
4.750	5.19	0.00	1.752	OI				0.91
4.833	5.21	0.00	1.788	OI				0.93
4.917	5.23	0.00	1.824	OI				0.95
5.000	5.25	0.00	1.860	OI				0.97
5.083	5.27	0.00	1.896	OI				0.99
5.167	5.30	0.00	1.933	OI				1.01
5.250	5.32	0.00	1.969	OI				1.03
5.333	5.34	0.00	2.006	OI				1.05
5.417	5.36	0.00	2.043	OI				1.07
5.500	5.39	0.00	2.080	OI				1.08
5.583	5.41	0.00	2.117	OI				1.10
5.667	5.43	0.00	2.154	OI				1.12
5.750	5.46	0.00	2.192	OI				1.14
5.833	5.48	0.00	2.230	OI				1.16
5.917	5.51	0.00	2.267	OI				1.18
6.000	5.53	0.00	2.305	OI				1.20
6.083	5.56	0.00	2.344	OI				1.22
6.167	5.58	0.00	2.382	OI				1.24
6.250	5.61	0.00	2.420	OI				1.26
6.333	5.63	0.00	2.459	OI				1.28
6.417	5.66	0.00	2.498	OI				1.30
6.500	5.69	0.00	2.537	OI				1.32
6.583	5.71	0.00	2.576	OI				1.34
6.667	5.74	0.00	2.616	OI				1.36
6.750	5.77	0.00	2.655	OI				1.38
6.833	5.80	0.00	2.695	OI				1.40
6.917	5.82	0.00	2.735	OI				1.42
7.000	5.85	0.00	2.775	OI				1.44
7.083	5.88	0.00	2.816	OI				1.46
7.167	5.91	0.00	2.856	OI				1.48
7.250	5.94	0.00	2.897	OI				1.50
7.333	5.97	0.00	2.938	OI				1.52
7.417	6.00	0.00	2.980	OI				1.54
7.500	6.04	0.00	3.021	OI				1.56
7.583	6.07	0.00	3.063	OI				1.58
7.667	6.10	0.00	3.105	OI				1.61
7.750	6.13	0.00	3.147	OI				1.63
7.833	6.17	0.00	3.189	OI				1.65

7.917	6.20	0.00	3.232	OI				1.67
8.000	6.23	0.00	3.274	OI				1.69
8.083	6.27	0.00	3.318	OI				1.71
8.167	6.31	0.00	3.361	OI				1.73
8.250	6.34	0.00	3.404	OI				1.75
8.333	6.38	0.00	3.448	OI				1.78
8.417	6.42	0.00	3.492	OI				1.80
8.500	6.45	0.00	3.537	OI				1.82
8.583	6.49	0.00	3.581	OI				1.84
8.667	6.53	0.00	3.626	OI				1.87
8.750	6.57	0.00	3.671	OI				1.89
8.833	6.61	0.00	3.716	OI				1.91
8.917	6.65	0.00	3.762	OI				1.93
9.000	6.70	0.00	3.808	OI				1.96
9.083	6.74	0.00	3.854	OI				1.98
9.167	6.78	0.00	3.901	OI				2.00
9.250	6.83	0.00	3.948	OI				2.03
9.333	6.87	0.00	3.995	OI				2.05
9.417	6.92	0.00	4.042	OI				2.07
9.500	6.97	0.00	4.090	OI				2.10
9.583	7.01	0.00	4.138	OI				2.12
9.667	7.06	0.00	4.187	OI				2.14
9.750	7.11	0.00	4.236	OI				2.17
9.833	7.16	0.00	4.285	OI				2.19
9.917	7.21	1.17	4.330	OI				2.22
10.000	7.27	2.52	4.367	OI				2.23
10.083	7.32	3.58	4.397	OI				2.25
10.167	7.38	4.42	4.420	O				2.26
10.250	7.43	5.08	4.438	O				2.27
10.333	7.49	5.61	4.453	O				2.27
10.417	7.55	6.03	4.464	O				2.28
10.500	7.61	6.38	4.474	O				2.29
10.583	7.67	6.66	4.482	O				2.29
10.667	7.73	6.89	4.488	O				2.29
10.750	7.80	7.08	4.493	O				2.29
10.833	7.86	7.25	4.498	O				2.30
10.917	7.93	7.39	4.502	O				2.30
11.000	8.00	7.52	4.505	O				2.30
11.083	8.07	7.63	4.509	O				2.30
11.167	8.14	7.74	4.511	O				2.30
11.250	8.22	7.84	4.514	O				2.30
11.333	8.29	7.93	4.517	O				2.31
11.417	8.37	8.02	4.519	O				2.31
11.500	8.45	8.11	4.522	O				2.31
11.583	8.54	8.19	4.524	O				2.31
11.667	8.62	8.28	4.526	OI				2.31
11.750	8.71	8.36	4.529	OI				2.31
11.833	8.80	8.45	4.531	OI				2.31
11.917	8.89	8.54	4.533	OI				2.31
12.000	8.99	8.63	4.536	O				2.32
12.083	9.08	8.72	4.538	O				2.32
12.167	9.17	8.81	4.541	O				2.32
12.250	9.23	8.89	4.543	O				2.32
12.333	9.31	8.98	4.546	O				2.32
12.417	9.41	9.06	4.548	O				2.32
12.500	9.52	9.15	4.550	O				2.32
12.583	9.64	9.25	4.553	O				2.32
12.667	9.76	9.35	4.556	O				2.32
12.750	9.89	9.45	4.559	O				2.33
12.833	10.02	9.56	4.562	O				2.33
12.917	10.16	9.68	4.565	O				2.33
13.000	10.30	9.80	4.568	O				2.33
13.083	10.45	9.93	4.572	O				2.33
13.167	10.61	10.06	4.576	O				2.33
13.250	10.77	10.20	4.579	O				2.34
13.333	10.94	10.35	4.583	O				2.34
13.417	11.11	10.50	4.587	O				2.34
13.500	11.30	10.66	4.592	O				2.34
13.583	11.49	10.82	4.596	O				2.34
13.667	11.70	10.99	4.601	O				2.35
13.750	11.91	11.17	4.606	O				2.35
13.833	12.14	11.36	4.611	O				2.35
13.917	12.38	11.56	4.617	O				2.35
14.000	12.63	11.77	4.623	O				2.36
14.083	12.89	11.99	4.629	O				2.36
14.167	13.19	12.22	4.635	OI				2.36
14.250	13.50	12.47	4.642	OI				2.37
14.333	13.84	12.74	4.649	OI				2.37
14.417	14.19	13.02	4.657	O				2.37
14.500	14.56	13.32	4.665	O				2.38
14.583	14.96	13.64	4.674	O				2.38
14.667	15.39	13.98	4.684	O				2.39
14.750	15.85	14.35	4.694	O				2.39
14.833	16.36	14.74	4.704	O				2.40

14.917	16.91	15.16	4.716	O				2.40
15.000	17.52	15.61	4.729	OI				2.41
15.083	18.19	16.11	4.742	OI				2.41
15.167	18.95	16.66	4.757	OI				2.42
15.250	19.80	17.26	4.774	O				2.43
15.333	20.77	17.93	4.793	O				2.44
15.417	21.80	18.68	4.813	OI				2.45
15.500	22.71	19.47	4.835	OI				2.46
15.583	23.50	20.28	4.857	OI				2.47
15.667	24.70	21.13	4.881	OI				2.48
15.750	26.75	22.15	4.909	OI				2.50
15.833	29.90	23.52	4.947	OI				2.51
15.917	34.78	25.48	5.001	O I				2.54
16.000	43.34	28.49	5.084	O I				2.58
16.083	63.37	34.01	5.236	O I				2.65
16.167	105.93	45.09	5.547	O	I			2.80
16.250	137.57	51.62	6.052	O		I		3.04
16.333	121.38	60.53	6.558	O		I		3.28
16.417	74.05	64.79	6.799	O	I			3.39
16.500	46.63	64.28	6.770	I O				3.38
16.583	32.04	61.42	6.608	I O				3.30
16.667	26.29	57.73	6.399	I O				3.21
16.750	23.43	53.97	6.185	I O				3.11
16.833	19.64	50.26	5.975	I O				3.01
16.917	17.98	47.71	5.767	I O				2.91
17.000	16.70	45.32	5.566	I O				2.81
17.083	15.67	39.44	5.386	I O				2.73
17.167	14.78	34.06	5.237	I O				2.65
17.250	14.01	29.69	5.117	I O				2.60
17.333	13.35	26.14	5.019	I O				2.55
17.417	12.77	23.23	4.939	I O				2.51
17.500	12.26	20.85	4.873	I O				2.48
17.583	11.80	18.89	4.819	I O				2.45
17.667	11.39	17.27	4.774	I O				2.43
17.750	11.02	15.93	4.737	IO				2.41
17.833	10.68	14.80	4.706	IO				2.40
17.917	10.37	13.85	4.680	IO				2.38
18.000	10.08	13.05	4.658	IO				2.37
18.083	9.82	12.36	4.639	O				2.36
18.167	9.59	11.77	4.623	O				2.36
18.250	9.39	11.26	4.609	O				2.35
18.333	9.21	10.83	4.597	O				2.34
18.417	9.02	10.45	4.586	O				2.34
18.500	8.83	10.11	4.577	O				2.33
18.583	8.66	9.81	4.568	O				2.33
18.667	8.49	9.53	4.561	IO				2.33
18.750	8.33	9.28	4.554	IO				2.32
18.833	8.17	9.05	4.548	IO				2.32
18.917	8.03	8.84	4.542	IO				2.32
19.000	7.89	8.65	4.536	IO				2.32
19.083	7.76	8.46	4.531	O				2.31
19.167	7.63	8.29	4.527	O				2.31
19.250	7.51	8.13	4.522	O				2.31
19.333	7.40	7.98	4.518	O				2.31
19.417	7.29	7.84	4.514	O				2.30
19.500	7.18	7.71	4.511	O				2.30
19.583	7.08	7.58	4.507	O				2.30
19.667	6.98	7.46	4.504	O				2.30
19.750	6.89	7.34	4.500	O				2.30
19.833	6.80	7.23	4.497	O				2.30
19.917	6.71	7.13	4.495	O				2.30
20.000	6.63	7.02	4.492	O				2.29
20.083	6.55	6.93	4.489	O				2.29
20.167	6.47	6.83	4.486	O				2.29
20.250	6.39	6.74	4.484	O				2.29
20.333	6.32	6.66	4.482	O				2.29
20.417	6.25	6.57	4.479	O				2.29
20.500	6.18	6.49	4.477	O				2.29
20.583	6.11	6.42	4.475	O				2.29
20.667	6.05	6.34	4.473	O				2.28
20.750	5.98	6.27	4.471	O				2.28
20.833	5.92	6.20	4.469	O				2.28
20.917	5.86	6.13	4.467	O				2.28
21.000	5.81	6.07	4.465	O				2.28
21.083	5.75	6.00	4.464	O				2.28
21.167	5.70	5.94	4.462	O				2.28
21.250	5.64	5.88	4.460	O				2.28
21.333	5.59	5.82	4.459	O				2.28
21.417	5.54	5.76	4.457	O				2.28
21.500	5.49	5.71	4.455	O				2.28
21.583	5.44	5.65	4.454	O				2.28
21.667	5.40	5.60	4.453	O				2.27
21.750	5.35	5.55	4.451	O				2.27
21.833	5.30	5.50	4.450	O				2.27

21.917	5.26	5.45	4.448	|O	|	|	|	2.27
22.000	5.22	5.41	4.447	|O	|	|	|	2.27
22.083	5.18	5.36	4.446	|O	|	|	|	2.27
22.167	5.14	5.31	4.445	|O	|	|	|	2.27
22.250	5.10	5.27	4.443	|O	|	|	|	2.27
22.333	5.06	5.23	4.442	|O	|	|	|	2.27
22.417	5.02	5.18	4.441	|O	|	|	|	2.27
22.500	4.98	5.14	4.440	|O	|	|	|	2.27
22.583	4.94	5.10	4.439	|O	|	|	|	2.27
22.667	4.91	5.06	4.438	|O	|	|	|	2.27
22.750	4.87	5.03	4.437	|O	|	|	|	2.27
22.833	4.84	4.99	4.436	|O	|	|	|	2.27
22.917	4.80	4.95	4.435	|O	|	|	|	2.27
23.000	4.77	4.91	4.434	|O	|	|	|	2.27
23.083	4.74	4.88	4.433	|O	|	|	|	2.27
23.167	4.71	4.84	4.432	|O	|	|	|	2.26
23.250	4.68	4.81	4.431	|O	|	|	|	2.26
23.333	4.64	4.78	4.430	|O	|	|	|	2.26
23.417	4.61	4.74	4.429	|O	|	|	|	2.26
23.500	4.59	4.71	4.428	|O	|	|	|	2.26
23.583	4.56	4.68	4.427	|O	|	|	|	2.26
23.667	4.53	4.65	4.426	|O	|	|	|	2.26
23.750	4.50	4.62	4.425	|O	|	|	|	2.26
23.833	4.47	4.59	4.425	|O	|	|	|	2.26
23.917	4.44	4.56	4.424	|O	|	|	|	2.26
24.000	4.42	4.53	4.423	|O	|	|	|	2.26
24.083	4.26	4.49	4.422	IO	|	|	|	2.26
24.167	3.50	4.35	4.418	IO	|	|	|	2.26
24.250	2.15	4.01	4.409	O	|	|	|	2.25
24.333	0.92	3.46	4.394	O	|	|	|	2.25
24.417	0.36	2.84	4.376	O	|	|	|	2.24
24.500	0.13	2.26	4.360	O	|	|	|	2.23
24.583	0.06	1.78	4.347	O	|	|	|	2.22
24.667	0.03	1.40	4.337	O	|	|	|	2.22
24.750	0.00	1.09	4.328	O	|	|	|	2.21
24.833	0.00	0.85	4.321	O	|	|	|	2.21
24.917	0.00	0.66	4.316	O	|	|	|	2.21
25.000	0.00	0.51	4.312	O	|	|	|	2.21
25.083	0.00	0.40	4.309	O	|	|	|	2.21
25.167	0.00	0.31	4.307	O	|	|	|	2.20
25.250	0.00	0.24	4.305	O	|	|	|	2.20
25.333	0.00	0.19	4.303	O	|	|	|	2.20
25.417	0.00	0.15	4.302	O	|	|	|	2.20
25.500	0.00	0.11	4.301	O	|	|	|	2.20
25.583	0.00	0.09	4.300	O	|	|	|	2.20
25.667	0.00	0.07	4.300	O	|	|	|	2.20
25.750	0.00	0.05	4.299	O	|	|	|	2.20
25.833	0.00	0.04	4.299	O	|	|	|	2.20
25.917	0.00	0.03	4.299	O	|	|	|	2.20
26.000	0.00	0.03	4.299	O	|	|	|	2.20
26.083	0.00	0.02	4.299	O	|	|	|	2.20
26.167	0.00	0.02	4.298	O	|	|	|	2.20
26.250	0.00	0.01	4.298	O	|	|	|	2.20
26.333	0.00	0.01	4.298	O	|	|	|	2.20
26.417	0.00	0.01	4.298	O	|	|	|	2.20
26.500	0.00	0.01	4.298	O	|	|	|	2.20
26.583	0.00	0.00	4.298	O	|	|	|	2.20
26.667	0.00	0.00	4.298	O	|	|	|	2.20
26.750	0.00	0.00	4.298	O	|	|	|	2.20
26.833	0.00	0.00	4.298	O	|	|	|	2.20
26.917	0.00	0.00	4.298	O	|	|	|	2.20
27.000	0.00	0.00	4.298	O	|	|	|	2.20
27.083	0.00	0.00	4.298	O	|	|	|	2.20

Remaining water in basin = 4.30 (Ac.Ft)

**********HYDROGRAPH DATA**********

Number of intervals = 325
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 64.788 (CFS)
Total volume = 15.408 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

APPENDIX C – REFERENCES

LINE A AS-BUILT PLANS

OFFSITE STORM DRAIN PLANS

CITRUS PLAZA PHASE II

PM 14742, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

GENERAL NOTES

1. All work shall be done in accordance with approved grading plan, the County of San Bernardino Std. Plans & Specifications, Chapter 70 of the Uniform building code, latest edition, preliminary soils report dated 3-12-2002 and done under the direction and supervision of the licensed soils engineer. Any deviation to the approved grading plan must be approved prior to the start of construction.

2. All survey Monuments shall be protected and perpetuated in place. Any disturbed or covered monuments shall by reset by a registered Civil Engineer or a licensed Land Surveyor.

3. Hours of operation shall be from 7:00 a.m. to 8:00 p.m., Monday through Saturday.

4. County inspector shall be given 48 hours notice to schedule a site pre-grade meeting prior to start of grading. 48 hours notice shall be given for all required inspections during the course of grading.

5. Repair or replace all existing damaged or altered public improvements as required by the County inspector in the field.

6. No fill shall be placed until preparation of original ground is approved by the Soils Engineer. Inspection and certification of fill placement shall be provided by the Soils Engineer during the process of grading. No rock or similar material greater than six (6) inches in diameter shall be placed unless recommendations for such placement have been approved by the Soils Engineer.

7. Maximum fill or cut slope shall be 2:1, unless otherwise approved by the Soils Engineer. Fill slopes shall not have less than 90% relative compaction as determined by ASTM D 1557-70 and certified by the Soils Engineer. No fill shall be placed on existing terrain which slopes greater than 2:1.

8. If any unknown sub-surface structures are encountered during grading, they shall be immediately brought to the attention of the Soils Engineer and the Design Engineer prior to proceeding with grading operations.

9. It shall be the contractor's responsibility to verify the location of all utilities or structures above or below ground, shown or not shown on these plans. He will be held responsible for all damage to any utilities or structures caused by his operation. The Design Engineer must by notified of any conflicts and grading must be terminated and streets restored until corrective measures have been approved by the County inspector.

10. Transportation Department permit is required for any construction, temporary or permanent, on County right-of-way or for use of County maintained roads by overload equipment.

11. Adjacent streets are to be cleaned daily of all dirt and debris that is the result of this operation.

12. Engineer must set grade stakes for all drainage devices. The contractor shall obtain all necessary inspections before pouring.

13. Strict adherence to dust control requirements shall be enforced.

14. The undersigned Civil Engineer accepts the responsibility for professional inspections in accordance with Section 7014 of the Uniform Building Code.

STEVEN D. LEVSEE R.C.E. 45926 — DATE 7/27/05

15. An As-Built Grading Plan shall be submitted by the Civil Engineer upon completion of construction.

16. The grading contractor shall submit a statement of compliance to the As-Built plan.

NOTICE TO CONTRACTOR

Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project including safety of all persons and property; that these requirements shall apply continuously and not be limited to normal working hours; and that the contractor shall defend, indemnify, and hold the owner and engineer harmless from any and all liability, real or alleged, in connection with the performance of work on this project, excepting for liability arising from the sole negligence of the owner or the engineer.

The existence and location of any underground utility pipes or structures shown on these plans were obtained by a search of available records. These locations are approximate and shall be confirmed in the field by the contractor, so that any necessary adjustment can be made in alignment and/or grade of the proposed improvement. The contractor is required to take due precautionary measures to protect any utility lines shown and any other lines not of record or not shown on these plans.

CITY OF REDLANDS GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (GREENBOOK)", 2003 EDITION (INCLUDING THE LATEST SUPPLEMENTAL AMENDMENTS THERETO), THE "STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION", 1997 EDITION (INCLUDING THE LATEST SUPPLEMENTAL AMENDMENTS THERETO), AND THESE CITY OF REDLANDS STANDARD SPECIFICATIONS. ALL WORK SHALL BE COMPLETED TO THE SATISFACTION OF THE PUBLIC WORKS DIRECTOR OR APPOINTED REPRESENTATIVE.
2. THE APPROXIMATE LOCATIONS OF KNOWN EXISTING UNDERGROUND UTILITIES ARE SHOWN ON THIS PLAN. THE UTILITIES ARE PLOTTED FROM RECORD AND FIELD DATA. THE ENGINEER ASSUMES NO LIABILITY AS TO THE EXACT LOCATION OF SAID LINES WHETHER SHOWN OR NOT SHOWN ON THE PLANS. THE CONTRACTOR IS TO NOTIFY ALL UTILITY COMPANIES PRIOR TO WORK OR EXCAVATION TO DETERMINE THE EXACT LOCATIONS OF UNDERGROUND LINES.
3. STREETS MAY BE REQUIRED TO HAVE A SEAL COAT APPLIED AT THE OPTION OF THE PUBLIC WORKS DIRECTOR OR APPOINTED REPRESENTATIVE. TYPE OF SEAL COAT IS TO BE DETERMINED BY THE PUBLIC WORKS DIRECTOR OR APPOINTED REPRESENTATIVE.
4. RESURFACE EXISTING ROADWAY, AS DIRECTED BY THE PUBLIC WORKS DIRECTOR OR APPOINTED REPRESENTATIVE, DUE TO UTILITY INSTALLATIONS AND CONSTRUCTION DAMAGE.
5. EXISTING STRIPING SHALL BE REMOVED AND REPLACED AS NECESSARY. NEW STRIPING AND PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE STRIPING PLAN APPROVED BY THE PUBLIC WORKS DIRECTOR OR APPOINTED REPRESENTATIVE.
6. SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIG ALERT IDENTIFICATION NUMBER BE ISSUED BEFORE THE "ENCROACHMENT PERMIT" WILL BE VALID. FOR YOUR DIG ALERT ID NUMBER, CALL UNDERGROUND SERVICE ALERT (TOLL FREE) AT 1-800-227-2600, TWO WORKING DAYS BEFORE YOU DIG.
7. SOILS REPORT WITH LABORATORY TESTS OF THE "R" VALUE AND SOILS ENGINEER'S STREET STRUCTURAL SECTION RECOMMENDATION SHALL BE REVIEWED AND APPROVED BY THE CITY PRIOR TO ISSUANCE OF THE ENCROACHMENT PERMIT.
8. ASPHALT CONCRETE PAVEMENT SECTIONS ON NEW STREETS GREATER THAN 75 M/I (3 IN.) THICK SHALL BE PLACED IN A MINIMUM OF TWO LIFTS WITH THE LAST LIFT BEING DELAYED UNTIL 95% OF ALL DEVELOPER CONSTRUCTION HAS BEEN COMPLETED.
9. THE FINAL PAVEMENT OR SURFACE LAYER OF ASPHALTIC CONCRETE ROADWAY PAVEMENT SHALL NOT BE PLACED UNTIL ALL UTILITIES AND UTILITY LATERALS WITHIN THE ROADWAY HAVE BEEN INSTALLED, COMPACTED, TESTED AND ACCEPTED BY THE CITY. ALL ON-SITE IMPROVEMENTS INCLUDING ALL GRADING HAVE BEEN COMPLETED AND ALL UNACCEPTABLE PARKWAY AND ROADWAY IMPROVEMENTS ARE REMOVED AND REPLACED TO THE SATISFACTION OF THE CITY.
10. PRIOR TO ROAD CONSTRUCTION, SURVEY MONUMENTS SHALL BE REFERENCED OUT AND COMER RECORDS FILED WITH THE COUNTY SURVEYOR. SURVEY POINTS DESTROYED DURING CONSTRUCTION SHALL BE RESET, AND A SECOND COMER RECORD FILED FOR THOSE POINTS PRIOR TO COMPLETION AND ACCEPTANCE OF THE PROJECT.

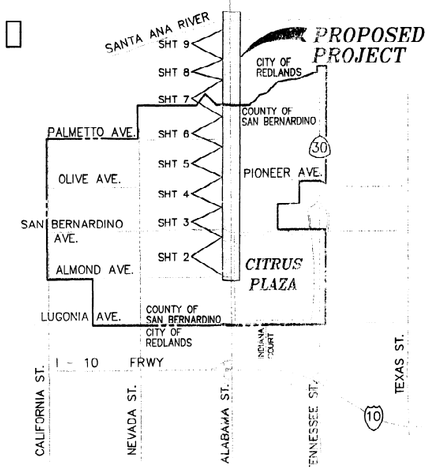
STORM DRAIN NOTES

1. ALL CONCRETE USED IN THE DISTRICT RIGHT OF WAY MUST MEET THE DISTRICT'S MINIMUM REQUIREMENTS OF THE REQUIRED CONCRETE DESIGN MIX. ALL CONCRETE SHALL CONFORM TO SECTION 201-1 OF THE STRUCTURAL SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION, EXCEPT AS FOLLOWS:
   A) ALL STRUCTURAL CONCRETE SHALL BE 4,000 psi WITH "A" GRADATION IN ALL INVERTS AND 4,000 psi WITH "B" GRADATION FOR ALL WALLS.
   B) CONCRETE FOR ROCK INLET AND OUTLET STRUCTURES, BOTTOM CONTROLS, SPLASH PAD AND OTHER PROPOSED STRUCTURES SHALL BE 560-B OR C-3250.
2. ALL PIPE LENGTHS ARE HORIZONTAL PROJECTIONS. UNLESS OTHERWISE SHOWN.
3. FOR TRENCH EXCAVATIONS IN NATIVE SOIL, SHORING SHALL BE PROVIDED TO SATISFY STATE OF CALIFORNIA SAFETY REQUIREMENTS.
4. PIPE CONSTRUCTION IN FILL AREA MUST BE COORDINATED WITH THE GRADING TO INSURE THAT WHEN THE FILL OPERATION HAS BEEN COMPLETED AT GRADE A MINIMUM OF ONE FOOT ABOVE THE TOP OF PIPE OR TO FIVE FEET (MAXIMUM) ABOVE THE PROPOSED SUBGRADE OF THE PIPE, THE STORM DRAIN TRENCH SHALL BE EXCAVATED AND THE PIPE INSTALLED.
5. ALL WORK MUST BE IN CONFORMANCE WITH THE SAN BERNARDINO COUNTY STANDARD SPECIFICATIONS WHICH MAY BE PURCHASED FROM THE COUNTY AND KEPT IN THE JOB SITE AT ALL TIMES.
6. THE CONTRACTOR MUST NOTIFY THE COUNTY OF SAN BERNARDINO INSPECTOR AT LEAST (2) WORKING DAYS PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION.
7. ALL FILLS MUST BE COMPACTED TO 90% RELATIVE COMPACTION AS DETERMINED BY THE CALIFORNIA TEST METHOD NO. 216-F, 1963 "FIVE LAYER METHOD". ALL BACKFILL MATERIAL MUST BE FREE OF VEGETABLE MATTER.
8. ALL SURVEYING REQUIRED FOR VERTICAL AND HORIZONTAL ALIGNMENT MUST BE PROVIDED BY THE CONTRACTOR OR DEVELOPER AND SUFFICIENT REFERENCE STAKING MUST BE IN ACCORDANCE WITH THE REQUEST OF THE COUNTY OF SAN BERNARDINO INSPECTOR.
9. ALL STORM DRAIN PIPE MUST BE BEDDED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
10. PRIOR TO THE PLACEMENT OF STORM DRAIN IMPROVEMENTS, THE DEVELOPER'S SOILS ENGINEER SHALL CERTIFY IN WRITING TO THE COUNTY INSPECTOR THAT THE STORM DRAINS' SUBGRADE IS OF ADEQUATE STRENGTH TO SUPPORT THE STRUCTURES AND ANY ANTICIPATED LOADS.
11. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE DEVELOPER'S CONTRACTOR SHALL OBTAIN A PERMIT FROM THE STATE DIVISION OF INDUSTRIAL SAFETY. A COPY OF THE PERMIT SHALL BE KEPT ON THE JOB SITE AT ALL TIMES.
12. WHENEVER APPLICABLE, THE DEVELOPER SHALL OBTAIN A PERMIT FROM THE STATE DEPT. OF FISH AND GAME IN ACCORDANCE WITH SECTION 1602 OF THE CALIFORNIA FISH AND GAME CODE PRIOR TO COMMENCEMENT OF CONSTRUCTION.
13. ALL STEEL THAT IS TO BE CONTINUOUS SHALL BE LAPPED A MINIMUM OF 45 BAR DIAMETERS.
14. ALL MATERIALS TESTING FOR THE DRAINAGE FACILITIES SHALL BE PROVIDED BY THE CONTRACTOR OR DEVELOPER IN ACCORDANCE WITH THE NUMBER, LOCATION AND FREQUENCY REQUESTED BY THE COUNTY INSPECTOR.
15. CHAMFER ALL EXPOSED EDGES OF CONCRETE 3/4" MIN.
16. A PERMIT FOR WORK WITHIN EXISTING STREET RIGHT-OF-WAY IS REQUIRED FROM THE COUNTY OF SAN BERNARDINO FOR ANY ENCROACHMENT NECESSARY FOR CONSTRUCTION IN THE STREET RIGHT-OF-WAY.
17. LENGTH OF MANHOLE STRUCTURES MAY BE INCREASED TO MEET PIPE ENDS AT OPTION OF CONTRACTOR AS LONG AS REINFORCING STEEL IS CONTINUED AS REQUIRED. ANY CHANGE IN SPUR LOCATION MUST BE APPROVED BY THE ENGINEER.
18. FLOOR OF MANHOLE STRUCTURE SHALL BE STEEL TROWELED TO SPRING LINE.
19. BODY OF MANHOLE STRUCTURE, INCLUDING SPUR, MUST BE POURED IN ONE CONTINUOUS OPERATION, EXCEPT THAT CONSTRUCTION JOINT AT THE SPRING LINE WITH A LONGITUDINAL KEYWAY IS PERMITTED.
20. ALL REINFORCING BARS MUST BE SECURELY HELD IN PLACE IN THE FORMS. TWO WAY MATS OF STEEL MUST BE WIRED TOGETHER BOTH WAYS AT ALTERNATE INTERSECTIONS.
21. STORM DRAIN BACKFILL FOR ALL FACILITIES WITHIN STREET RIGHT-OF-WAY IS TO BE PLACED AND COMPACTED UNDER COUNTY OF SAN BERNARDINO INSPECTION AND MEET OF EXCEED COUNTY OF SAN BERNARDINO MINIMUM STANDARDS.
22. ALL PIPE TO BE GROUTED.
23. AREA DRAIN PIPE SHALL BE:
   a) ACRYLONITRILE BUTADIENE STYRENE (A.B.S.) SOLID WALL PIPE CONFORMING TO A.S.T.M. D 2751, DR 35. -OR-
   b) POLYVINYL CHLORIDE PLASTIC (P.V.C.) PIPE CONFORMING TO A.S.T.M. D 3034, SDR 35 -OR-
   c) ASBESTOS CEMENT PIPE (A.C.P.) CONFORMING TO A.S.T.M. C-663 -OR-
   d) APPROVED EQUAL
24. R.C.P. SHALL COMPLY WITH ALL A.S.T.M. APPLICABLE STANDARDS.

LEGEND

- FIRE HYDRANT, VALVE
- WATER MAIN
- SEWER & MANHOLE
- STORM DRAIN
- CURB & GUTTER
- CATCH BASIN
- PARCEL BNDRY.
- CENTERLINE
- FLOW LINE
- EASEMENT
- RETAINING WALL
- EXISTING FIRE HYDRANT
- EXISTING STREET LIGHT
- MH — EXISTING MH
- EXISTING POWER POLE
- EXISTING STREET SIGN
- EXISTING FENCE
- EX. CURB & GUTTER
- 1210 — EXISTING CONTOUR
- 1219.4 + EXISTING SPOT ELEVATION

TC — TOP OF CURB
TRC — TOP OF ROLLED CURB
FL — FLOW LINE
FS — FINISH SURFACE
HP — HIGH POINT
LP — LOW POINT
P — PAD ELEVATION
FF — FINISH FLOOR ELEV.
GB — GRADE BREAK
BVC — BEGIN VERT. CURVE
EVC — END VERT. CURVE
2% — RATE/FLOW
INV. — INVERT ELEV.



VICINITY/INDEX MAP

NOT TO SCALE

ESTIMATE OF QUANTITIES

NO.	DESCRIPTION	COUNTY R/W QUANTITY	CITY OF REDLANDS R/W QUANTITY	FLOOD CONTROL DISTRICT R/W QUANTITY	TOTAL QUANTITY	
29	INSTALL 18" RCP STORM DRAIN (2000D)	0	5	0	5	LF
30	INSTALL 36" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)	256	0	0	256	LF
31	INSTALL 45" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)	20	12	0	32	LF
32	INSTALL 72" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)	692	2730	416	3838	LF
33	INSTALL 84" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)	2163	0	0	2163	LF
34	INSTALL 96" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)	2550	183	0	2733	LF
35	CONST. MANHOLE PIPE TO PIPE PER APWA STD. 320-1	12	5	0	17	EA
36	CONST. MANHOLE PIPE TO PIPE PER APWA STD. 322-1	1	0	0	1	EA
37	CONST. CATCH BASIN TYPE "A" PER SBCTD STD. 206	1	0	0	1	EA
38	CONST. LOCAL DEPRESSION PER SBCTD STD. 203A	1	0	0	1	EA
39	CONST. CONCRETE COLLAR PER APWA STD. 380-2	1	0	0	1	EA
40	INSTALL WING TYPE HEADWALL PER SBCFCD STD. 209	0	0	1	1	EA
41	CONST. BRICK & MORTAR PLUG	8	2	0	10	EA
42	SAWCUT, REMOVE & REPLACE IN KIND EXISTING AC PAVEMENT	55,900	26,285	0	82,185	SF
43	PLACE 100# RIP-RAP & FILTER FABRIC PER NOTES - SHT 9	0	0	4,720	4,720	SF
44	CONST CHAIN LINK FENCE PER CALTRANS STD. B11-52, TYPE 7	0	0	44	44	LF
45	INSTALL SLOPED PROTECTION BARRIER PER APWA STD. 360-0	0	0	1	1	EA
46	CONST PRESSURE M.H. SHAFT W/ ECCENTRIC REDUCER PER APWA STD. 328-1	1	0	0	1	EA
47	RMV EX SIGN DURING CONST & REPLACE AFTER CONST	6	2	0	8	EA
48	CONST JUNCTION STRUCTURE PER APWA STD. 332-1 (CASE 1)	0	1	0	1	EA

NOTE: ALL RCP STORM DRAIN PIPE IS TO BE CONSTRUCTED ON A MINIMUM 6" SAND BEDDING

INDEX OF SHEETS

FOR CONSTRUCTION

RECEIVED JUL 29 2005 PUBLIC WORKS DEPT.

RECORD DRAWINGS

CITY OF REDLANDS
PUBLIC WORKS DEPARTMENT

PLAN & PROFILE
STORM DRAIN PLAN

IN ALABAMA STREET
ALMOND AVENUE TO SANTA ANA RIVER
(REDLANDS CITY LIMITS)

Designed by _____ Date _____
Checked by _____ Date _____
Drawn by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date 8/01/05
Public Works Director _____ R.C.E. 26123 26285
EXHIBIT MAP "A" ATTACHED TO SHEET 1 OF 3

1689 - SD - 01/04

Letter	Description	Date	Initial
	REVISIONS		Approved by:

BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
KLEINFELDER, INC.
1370 Valley Vista Dr. Suite 150
Diamond Bar, California 91765
Office (909) 396-0335 Fax (909) 396-1324

PREPARED FOR:
COMMERCE CONSTRUCTION CO., L.P.
13191 Crossroads Parkway North
Sixth Floor
City of Industry, California 91746
Telephone: (562) 699-0453
Fax: (562) 699-4796

PREPARED BY:
PARDUE, CORNWELL & ASSOCIATES, INC.
Planning • Engineering • Surveying
151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-9400 241-9432 FAX
STEVEN D. LEVSEE R.C.E. 45926 DATE 7/27/05

STATE OF CALIFORNIA — STEVEN D. LEVSEE — NO. 45926 EXP. 12-31-06 — REGISTERED PROFESSIONAL ENGINEER — CIVIL

No.	Description	Date	Init
	REVISIONS	M.D. NO.	

COUNTY OF SAN BERNARDINO
C.S.A. 70, IMPROVEMENT ZONE - EV-1
Designed by:
Drawn by:
Checked by:
Recommended by:
Approved by:
DISTRICT ENGINEER DATE

OFFSITE STORM DRAIN
PARCEL MAP NO 14742
CITRUS PLAZA
PHASE II
SEC. 21, T 1 S, R 3 W

ROAD NO.
FILE NO.
SHEET 1 OF 9

P 320040

P 320040 80

CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITY CROSSINGS PRIOR TO CONSTRUCTION

EXIST GROUND @ CL OF PIPE

10+00.00 CL MH RIM=1230.6

13+44.00 CL MH RIM=1229.5

16+80.00 CL MH RIM=1228.3

HGL

1230

1220

1210

24" RCP 1217.15 INV

36" RCP SD LAT. A-1

36" RCP SD 1217.15 INV LAT. A-2

S=0.0020

80+49.45 9+88.00 BEG PIPE 1217.06 INV

9+68.64 END PIPE 1217.04 INV

80+41.08

10+03.98 BEG PIPE 1217.04 INV

80+33.87

$Q_{100}=0$ $V_{100}=0$ INSTALL 8.00 LF 48" RCP 2000D

76+95.78 13+41.67 END PIPE 1216.36 INW

13+46.33 BEG PIPE 1216.33 INW

76+91.12

$Q_{100}=155.8$ $V_{100}=5.51$ INSTALL 338.09 LF 72" RCP 2000D

73+59.78 16+77.67 END PIPE 1215.68 INW

16+82.33 BEG PIPE 1214.67 INW

73+55.12

$Q_{100}=192.7$ $V_{100}=6.82$ INSTALL 331.34 LF 72" RCP 2000D

20+00.00 MATCHLINE 1216.54 INV

$Q_{100}=243.3$ $V_{100}=6.32$ INSTALL 317.87 LF 84" RCP 2000D

MATCHLINE-SEE SHEET 3

10 11 12 13 14 15 16 17 18 19 20

PROFILE SCALES
VERT. 1"= 4'
HORIZ. 1"=40'

STORM DRAIN LINE "A"

ALABAMA STREET

ALMOND AVENUE

R/W

EX WATER

FUT SEWER EX GAS

95" EX 12" SEWER

EX SEWER

EDGE EX PAVEMENT

EX ELEC

91 92 93 94 95 96 97 98 99 100 101 102

10+00.00 CL MH =1+00.00 LINE "B"

9+88.00 END PIPE PLUG

LINE "A" N00°26'24"W

1+02.50 BEG PIPE

LINE "B" N89°57'20"E-S=0.0020

1+25.00 END PIPE PLUG 1217.18 INV

11+07.86 ANG PT

$Q_{100}=155.8$ PER RCFC & WCD HYDROLOGY

LINE "A" N00°26'24"W

13+44.00 CL MH =1+00.00 LAT "A-1"

1+03.98 BEG PIPE

LATERAL "A-1" N89°33'36"E-S=0.0050

1+25.00 END PIPE 1217.96 INV

LINE "A" N00°26'24"W

16+80.00 CL MH =1+00.00 LAT "A-2"

1+02.33 BEG PIPE

LATERAL "A-2" N89°33'36"E-S=0.0050

1+25.00 END PIPE 1217.29 INV

LINE "A" N00°26'24"W

MATCHLINE-SEE SHEET 3

NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT

FUTURE ONSITE SD-72" PER SEPARATE PLANS

EXISTING FEATURES LEGEND

- (P)—PROTECT IN PLACE
- (R)—REMOVE EXISTING STRUCTURE
- (CP)—COORDINATE RELOCATION WITH AFFECTED AGENCY
- (AG)—ADJUST EXISTING MANHOLE TO GRADE

CONSTRUCTION NOTES

30—INSTALL 36" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
31—INSTALL 48" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
32—INSTALL 72" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
33—INSTALL 84" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
34—INSTALL 96" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
35—CONST. MANHOLE PIPE TO PIPE PER APWA STD. 320-1
36—CONST. MANHOLE PIPE TO PIPE PER APWA STD. 322-1
37—CONST. CATCH BASIN TYPE "A" PER SBCTD STD. 206
38—CONST. LOCAL DEPRESSION PER SBCTD STD. 203A
39—CONST. CONCRETE COLLAR PER APWA STD. 380-2
40—INSTALL WING TYPE HEADWALL PER CALTRANS STD. D90
41—CONST. BRICK & MORTAR PLUG
42—SAWCUT, REMOVE, AND REPLACE EX AC IN KIND
43—PLACE 100# RIP-RAP & FILTER FABRIC PER NOTES - SHT 9
44—CONST CHAIN LINK FENCE PER CALTRANS STD. B11-52, TYPE 7
45—INSTALL SLOPED PROTECTION BARRIER PER APWA STD. 360-0
46—CONST PRESSURE M.H. SHAFT W/ ECCENTRIC REDUCER PER APWA STD. 328-1
47—RMV EX SIGN DURING CONST & REPLACE AFTER CONST

CITRUS PLAZA - PHASE II

STORM DRAIN LINE "A"

FOR CONSTRUCTION

NORTH

GRAPHIC SCALE

40 0 30 40 80 160

(IN FEET)
1 inch = 40 ft.

Underground Service Alert
CALL BEFORE YOU DIG
CALL TOLL FREE
1-800 422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
CITY OF REDLANDS BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
KLEINFELDER, INC.
1370 Valley Vista Dr. Suite 150
Diamond Bar, California 91765
Office (909) 396-0335 Fax (909) 396-1321

PREPARED FOR
COMMERCE CONSTRUCTION CO, L.P.
13191 Crossroads Parkway North
Sixth Floor
City of Industry, California 91746
Telephone: (562) 699-0453
Fax: (562) 699-4796

PREPARED BY:
PARDUE, CORNWELL & ASSOCIATES, INC.
Planning • Engineering • Surveying
151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-8400 241-3432 FAX
STEVE LEVISEE / R.C.E. 45926 DATE 6/20/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

REVISIONS

No.	Description	Date	Init.

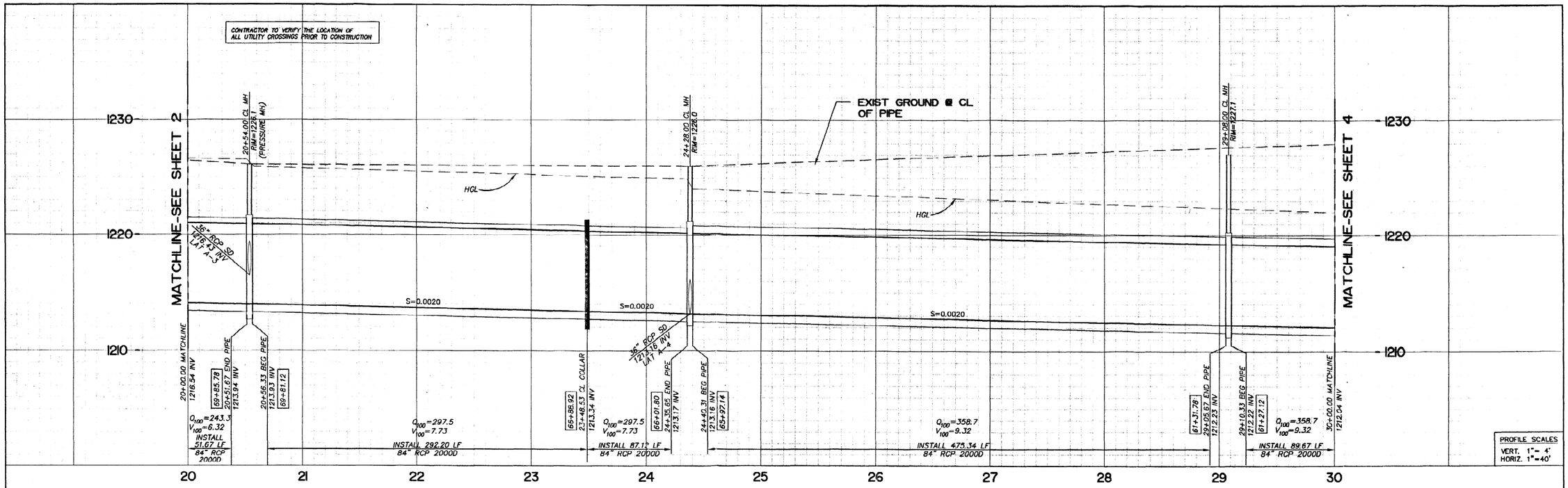
COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

Designed by: Drawn by: Checked by: APPROVED BY:

Submitted by: C.D.E. Approved by:
Recommended:
LAND DEVELOPMENT ENGINEER DATE
ASST. DIRECTOR OF PUBLIC WORKS DATE
DIRECTOR OF PUBLIC WORKS DATE

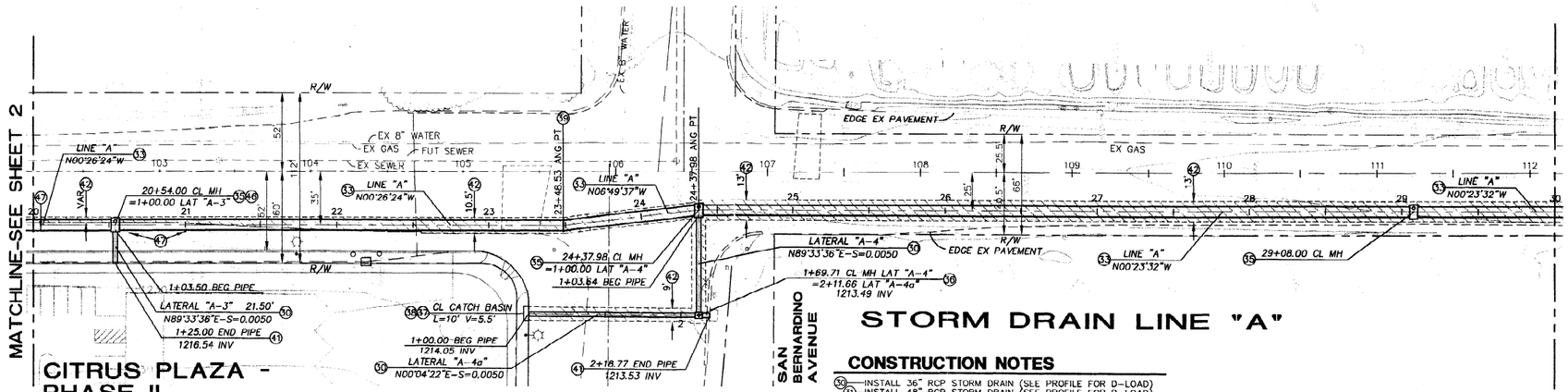
STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

M.D. NO.
ROAD NO.
FILE NO.
SHEET 2 OF 9



STORM DRAIN LINE "A"

ALABAMA STREET



NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT

CONSTRUCTION NOTES

50 INSTALL 36" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
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60 INSTALL WING TYPE HEADWALL PER CALTRANS STD. D90
61 CONST. BRICK & MORTAR PLUG
62 SAWCUT, REMOVE, AND REPLACE EX AC IN KIND
63 PLACE 100# RIP-- RAP & FILTER FABRIC PER NOTES - SHT 9
64 CONST CHAIN LINK FENCE PER CALTRANS STD. B11-52, TYPE 7
65 INSTALL SLOPED PROTECTION BARRIER PER APWA STD. 360-0
66 CONST PRESSURE M.H. SHAFT W/ ECCENTRIC REDUCER PER APWA STD. 328-1
67 RMV EX SIGN DURING CONST & REPLACE AFTER CONST

EXISTING FEATURES LEGEND

[P]—PROTECT IN PLACE
[R]—REMOVE EXISTING STRUCTURE
[CR]—COORDINATE RELOCATION WITH AFFECTED AGENCY
[AG]—ADJUST EXISTING MANHOLE TO GRADE

Underground Service Alert
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TWO WORKING DAYS BEFORE YOU DIG

FOR CONSTRUCTION

NORTH

GRAPHIC SCALE
40 0 30 40 80 160
(IN FEET)
1 inch = 40 ft.

BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1205.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
KLEINFELDER, INC.
1370 Valley Vista Dr. Suite 150
Diamond Bar, California 91765
Office (909) 396-0335 Fax (909) 396-1324

PREPARED FOR:
COMMERCE CONSTRUCTION CO., L.P.
13191 Crossroads Parkway North
Sixth Floor
City of Industry, California 91746
Telephone: (562) 699-0453
Fax: (562) 699-4796

PREPARED BY:
PARDUE, CORNWELL & ASSOCIATES, INC.
Planning • Engineering • Surveying
151 KALMUS DRIVE BLDG. M, SUITE-2
COSTA MESA, CALIF. 92626
(714) 241-3400 241-3432 FAX
STEVE LEVISEE R.C.E. 45926 DATE 6/21/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

REVISIONS

No.	Description	Date	Init.

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

Designed by:	Drawn by:	Checked by:	APPROVED BY:

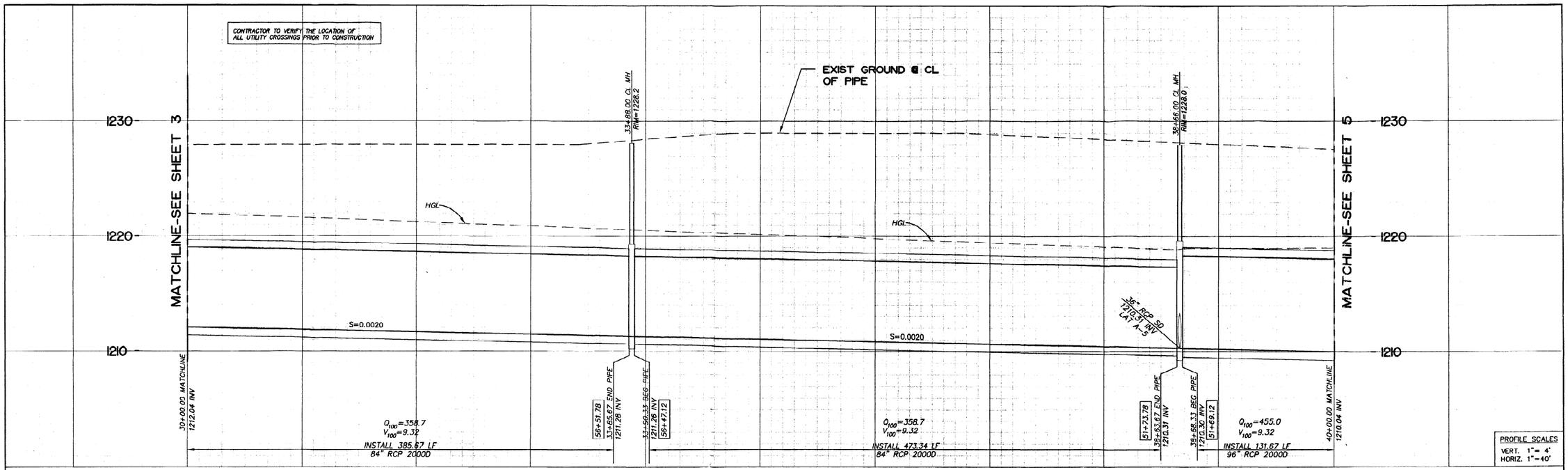
Submitted by: C.D.E.
Recommended / Approved by:
LAND DEVELOPMENT ENGINEER DATE 6-30-05
ASST. DIRECTOR OF PUBLIC WORKS DATE
DIRECTOR OF PUBLIC WORKS DATE

STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

W.O. NO.
ROAD NO.
FILE NO.
SHEET 3 OF 9

RECORD DRAWINGS

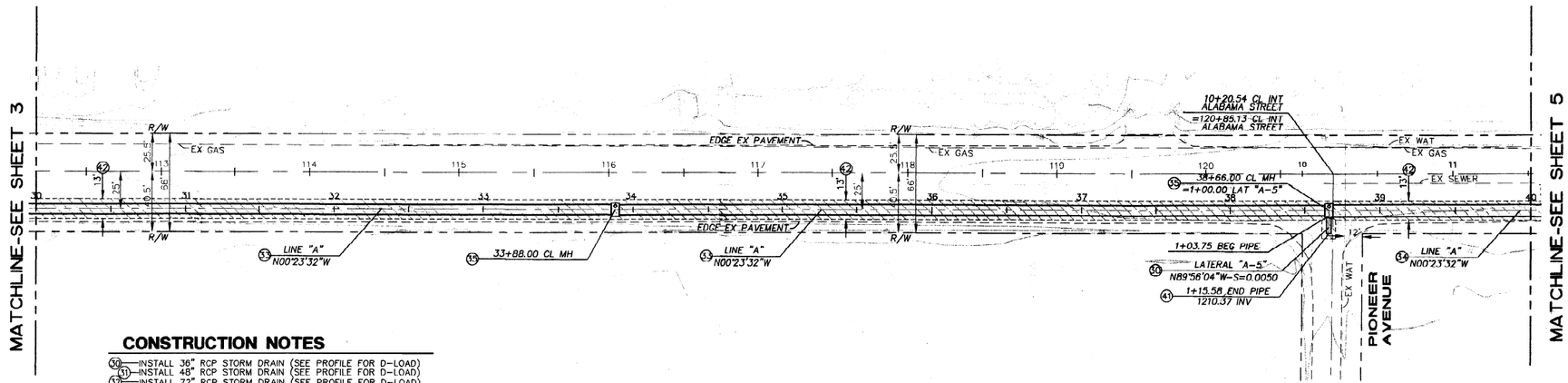
CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITY CROSSINGS PRIOR TO CONSTRUCTION



PROFILE SCALES
VERT. 1"= 4'
HORIZ. 1"=40'

STORM DRAIN LINE "A"

ALABAMA STREET



NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPC OUTPUT

FOR CONSTRUCTION

STORM DRAIN LINE "A"

CONSTRUCTION NOTES

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[CR] COORDINATE RELOCATION WITH AFFECTED AGENCY
[AG] ADJUST EXISTING MANHOLE TO GRADE

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422-4133
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NORTH

RECORD DRAWINGS

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
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1370 Valley Vista Dr. Suite 150
Diamond Bar, California 91765
Office (909) 396-0335 Fax (909) 396-1324

PREPARED FOR:
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151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-8400-241-3432 FAX
STEVE LEVISEE R.C.E. 15926 DATE 6/28/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

REVISIONS

No.	Description	Date	Init.

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

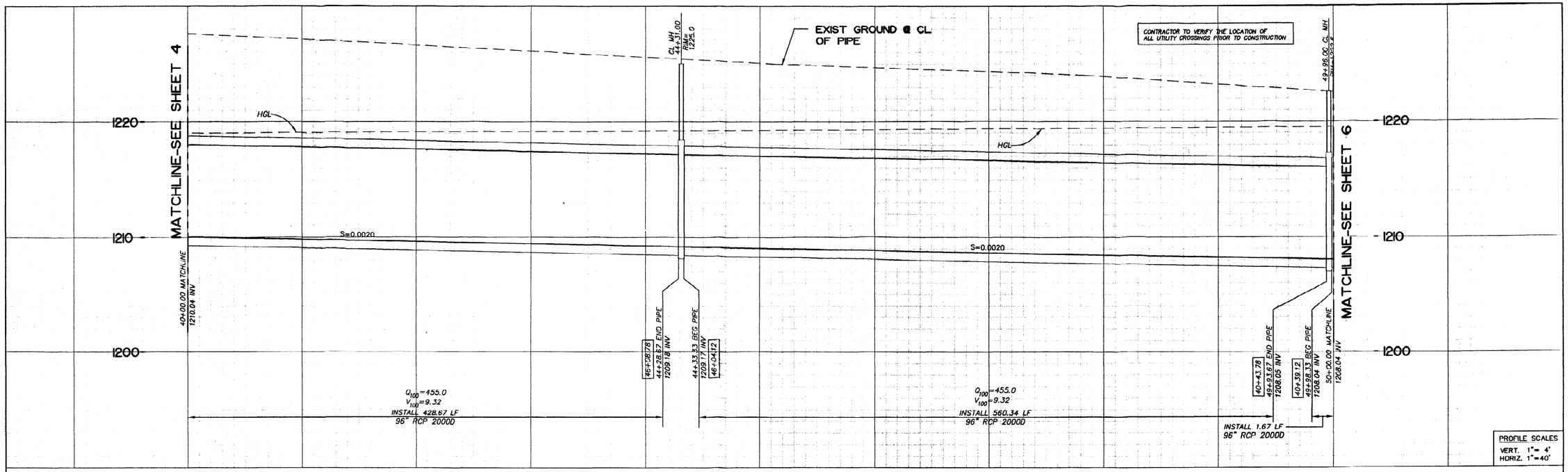
Designed by:	Drawn by:	Checked by:

Submitted by: C.D.E.
Recomended: Approved by: 6/30/05
LAND DEVELOPMENT ENGINEER DATE

APPROVED BY:
ASST. DIRECTOR OF PUBLIC WORKS DATE
DIRECTOR OF PUBLIC WORKS DATE

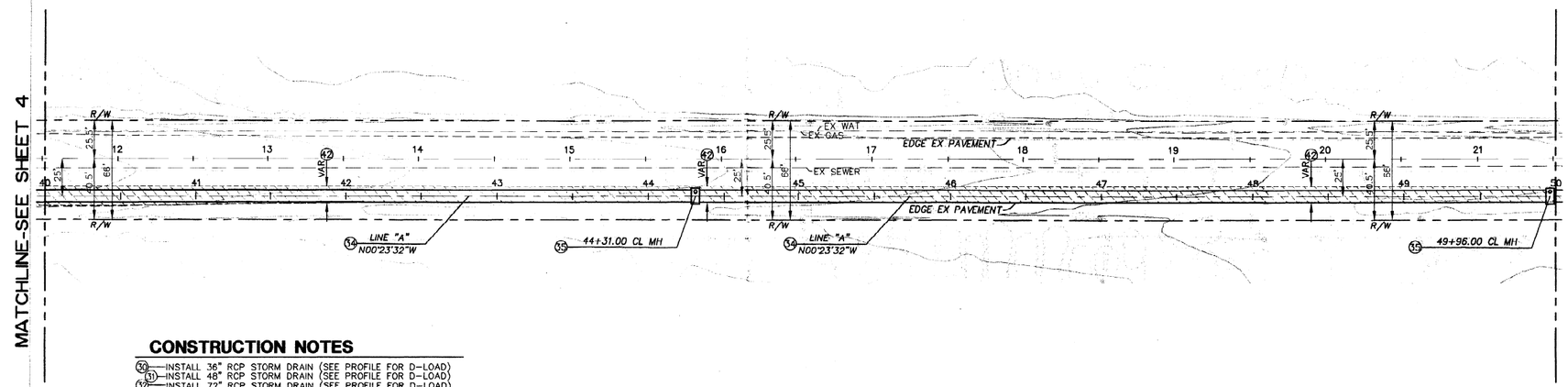
STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

M.D. NO.
ROAD NO.
FILE NO.
SHEET 4 OF 9



STORM DRAIN LINE "A"

ALABAMA STREET



NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT

FOR CONSTRUCTION

RECORD DRAWINGS

CONSTRUCTION NOTES

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Underground Service Alert
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1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

GRAPHIC SCALE
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PROFILE SCALES
VERT. 1"= 4'
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BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
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Diamond Bar, California 91765
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Telephone: (562) 699-0453
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PREPARED BY:
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Planning · Engineering · Surveying
151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-6200 241-3432 FAX
STEVE LEVISEE R.C.E. 45926 DATE 6/29/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

REVISIONS

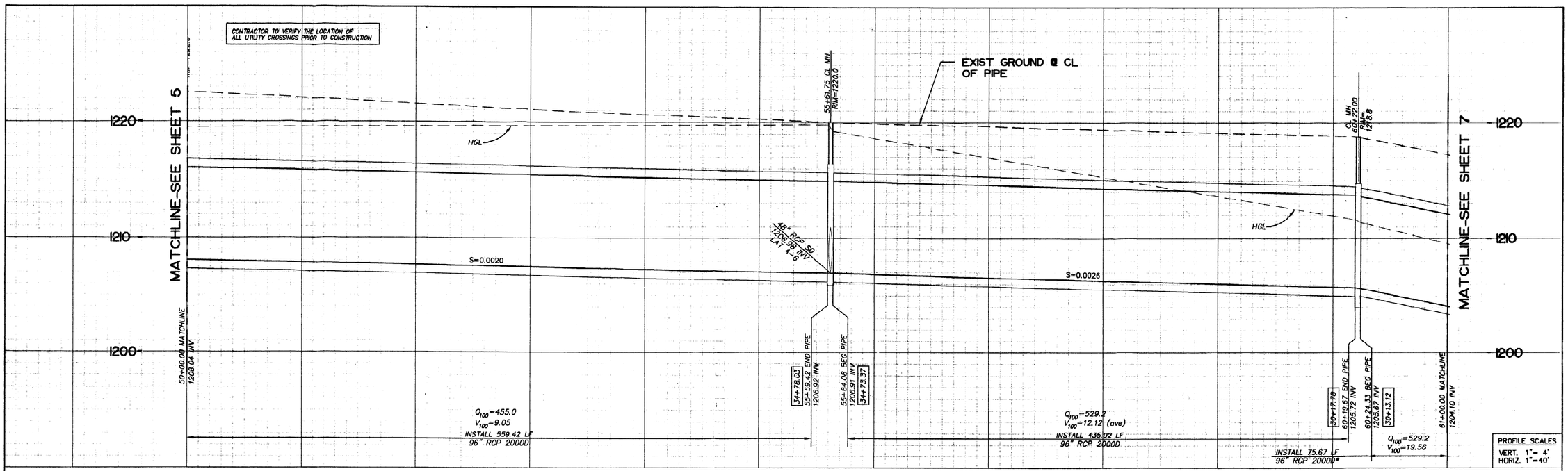
No.	Description	Date	Init.

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

Designed by: Drawn by: Checked by: APPROVED BY:
Submitted by: C.D.E. Recomended by: Approved by:
ASST. DIRECTOR OF PUBLIC WORKS DATE
LAND DEVELOPMENT ENGINEER DATE
DIRECTOR OF PUBLIC WORKS DATE

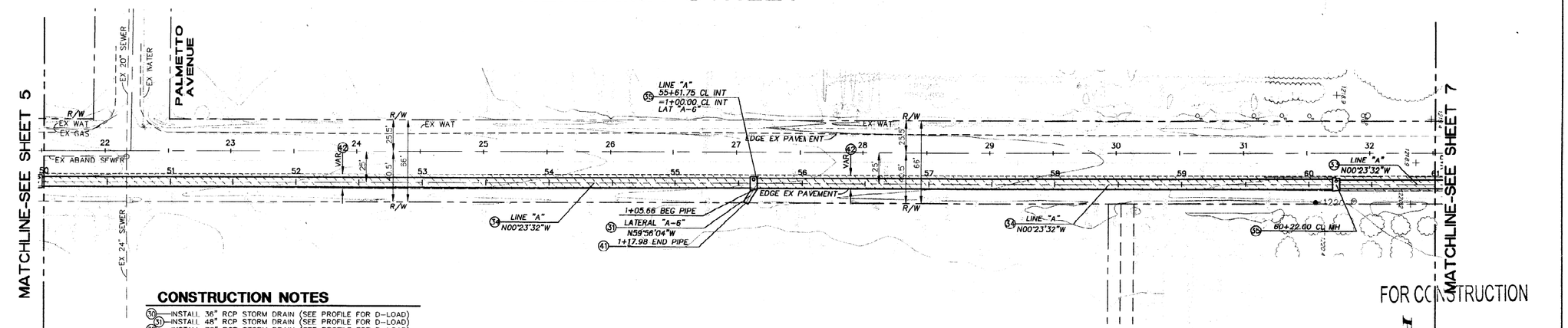
STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

M.D. NO.
ROAD NO.
FILE NO.
SHEET 5 OF 9



STORM DRAIN LINE "A"

ALABAMA STREET



NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT

CONSTRUCTION NOTES

(30) INSTALL 36" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
(31) INSTALL 48" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
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EXISTING FEATURES LEGEND

[P]—PROTECT IN PLACE
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STORM DRAIN LINE "A"

NOTE: * INDICATES 1-1/2" EXTRA CONCRETE COVER OVER INVERT STEEL

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422-4133
TWO WORKING DAYS BEFORE YOU DIG

FOR CONSTRUCTION

NORTH
PCA
GRAPHIC SCALE
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BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.830
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
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COSTA MESA, CALIF. 92626
(714) 241-8400 241-3432 FAX
STEVE LEVISEE R.C.E. 45926 6/23/05
DATE

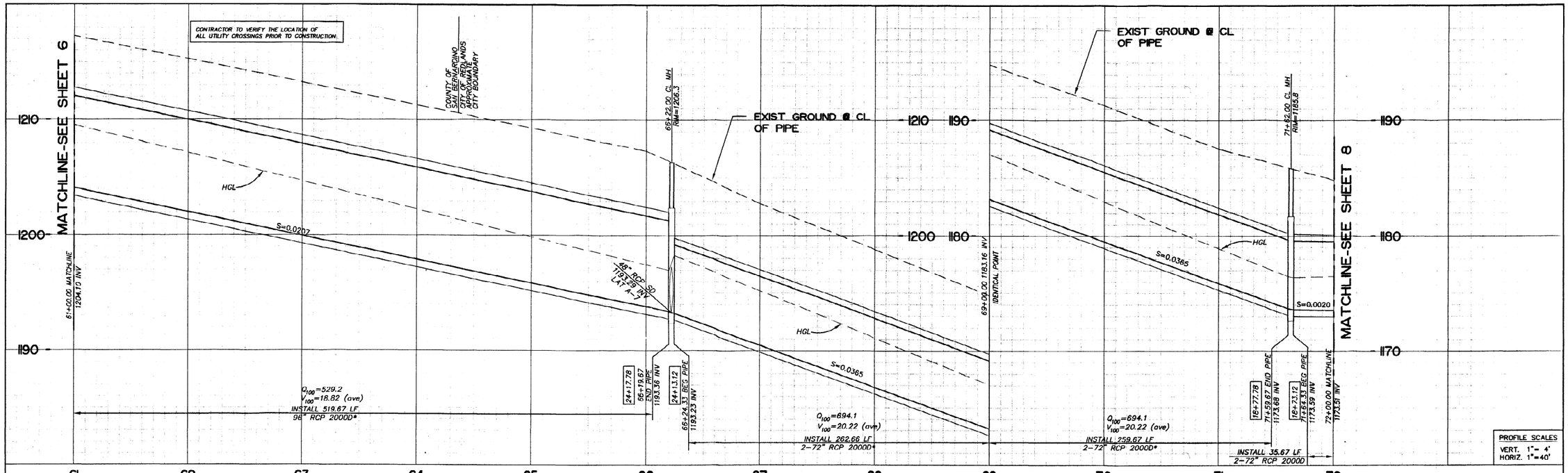
REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

REVISIONS			
No.	Description	Date	Init.

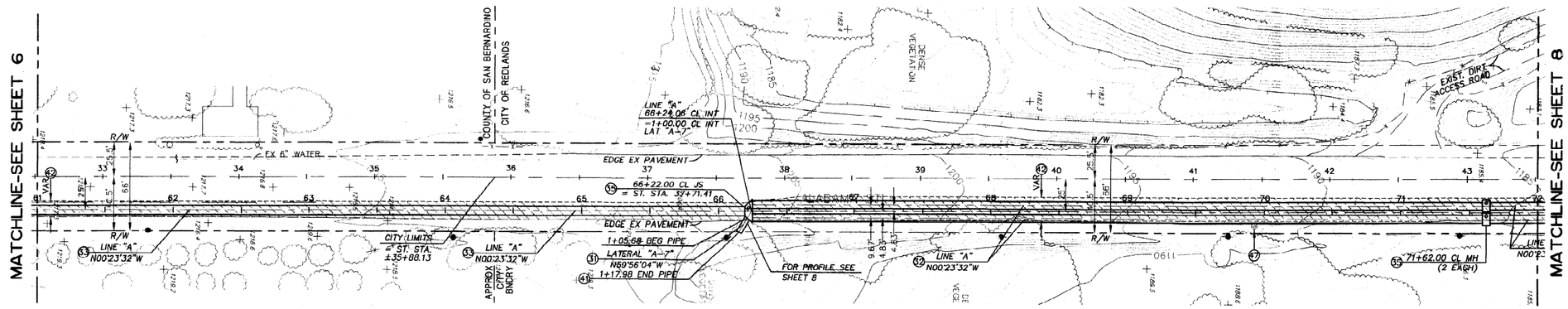
COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS
Designed by: Drawn by: Checked by: APPROVED BY:
Submitted by: C.O.E.
Recomended by: Approved by:
LAND DEVELOPMENT ENGINEER DATE
ASST. DIRECTOR OF PUBLIC WORKS DATE
DIRECTOR OF PUBLIC WORKS DATE

STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

M.D. NO.
ROAD NO.
FILE NO.
SHEET 6 OF 9



STORM DRAIN LINE "A"
ALABAMA STREET



STORM DRAIN LINE "A"

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FOR CONSTRUCTION

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CURVE DATA

CURVE	RADIUS	LENGTH	TANGENT	DELTA
A	90.00'	70.69'	37.28'	45°00'00"

NOTE: * INDICATES 1-1/2" EXTRA CONCRETE COVER OVER INVERT STEEL

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

NORTH

PCA

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Letter	Description	Date	Initial
	REVISIONS		Approved by:

CITY OF REDLANDS
PUBLIC WORKS DEPARTMENT

PLAN & PROFILE
STORM DRAIN PLAN
IN ALABAMA STREET
ALMOND AVENUE TO SANTA ANA RIVER
(REDLANDS CITY LIMITS)

Designed by ____ Approved by ____ Date 6/30/05
Date ____
Checked by ____
Date ____
Drawn by ____
Date ____
Checked by ____
Date ____
Public Works Director R.C.E. 28129

1689 - SD - 01/04

BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

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151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-3400 241-3432 FAX
STEVE LEVIEE R.C.E. 45926 6/29/05 DATE

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVIEE NO. 45926 EXP. 11-30-06 CIVIL STATE OF CALIFORNIA

No.	Description	Date	Init.
	REVISIONS		

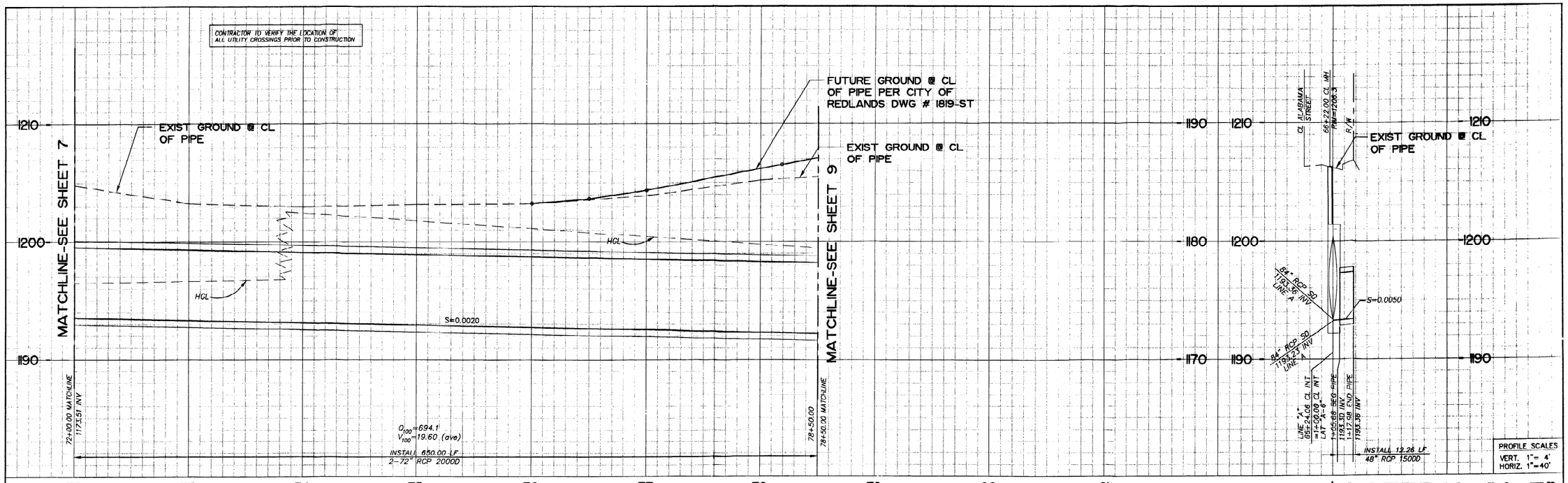
COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS
Designed by | Drawn by | Checked by | APPROVED BY:
Submitted by ____ C.D.E.
Recommended ____ Approved by: ____ 10-31-05
LAND DEVELOPMENT ENGINEER DATE | ASST. DIRECTOR OF PUBLIC WORKS DATE | DIRECTOR OF PUBLIC WORKS DATE

STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

W.O. NO.
ROAD NO.
FILE NO.
SHEET 7 OF 9

RUNNER DRAWINGS

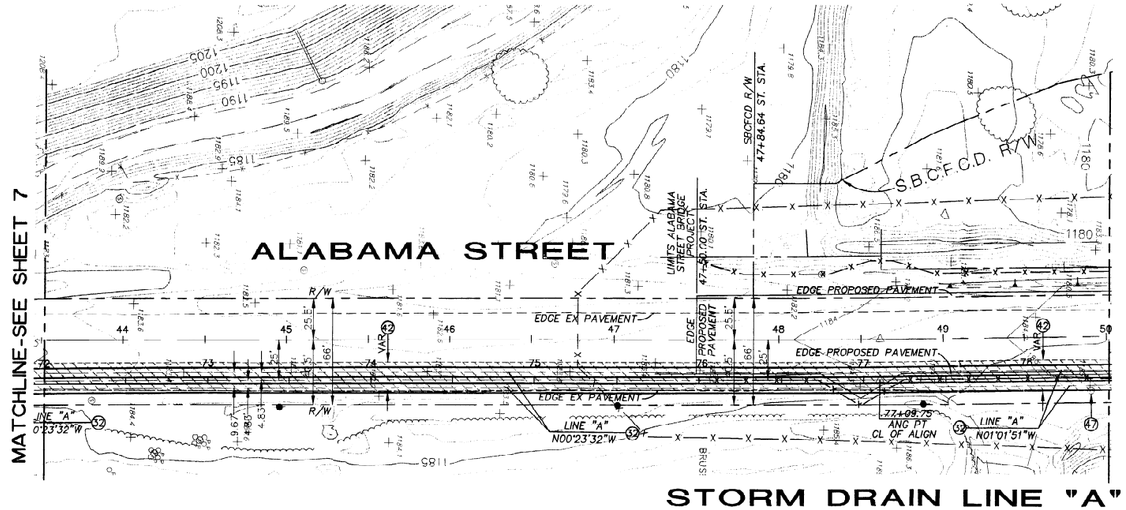
CONTRACTOR TO VERIFY THE LOCATION OF ALL UTILITY CROSSINGS PRIOR TO CONSTRUCTION



STORM DRAIN LINE "A"

LATERAL "A-7"

FOR PLAN SEE SHEET 7



STORM DRAIN LINE "A"

CONSTRUCTION NOTES

29. INSTALL 18" RCP STORM DRAIN (2000-D)
30. INSTALL 36" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
31. INSTALL 48" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
32. INSTALL 72" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
33. INSTALL 84" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
34. INSTALL 96" RCP STORM DRAIN (SEE PROFILE FOR D-LOAD)
35. CONST. MANHOLE PIPE TO PIPE PER APWA STD. 320-1
36. CONST. MANHOLE PIPE TO PIPE PER APWA STD. 322-1
37. CONST. CATCH BASIN TYPE "A" PER SBCTD STD. 206
38. CONST. LOCAL DEPRESSION PER SBCTD STD. 203A
39. CONST. CONCRETE COLLAR PER APWA STD. 380-2
40. INSTALL WNG TYPE HEADWALL PER SBCFCD STD. 209
41. CONST. BRICK & MORTAR PLUG
42. SAWCUT, REMOVE, AND REPLACE EX AC IN KIND
43. PLACE 100# RIP- RAP & FILTER FABRIC PER NOTES - SHT 9
44. CONST CHAIN LINK FENCE PER CALTRANS STD. B11-52, TYPE 7
45. INSTALL SLOPED PROTECTION BARRIER PER APWA STD. 380-0
46. CONST PRESSURE M.H. SHAFT W/ ECCENTRIC REDUCER PER APWA STD. 328-1
47. RMV EX SIGN DURING CONST & REPLACE AFTER CONST

NORTH

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

FOR CONSTRUCTION

NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT

EXISTING FEATURES LEGEND

- [P] — PROTECT IN PLACE
- [R] — REMOVE EXISTING STRUCTURE
- [CR] — COORDINATE RELOCATION WITH AFFECTED AGENCY
- [AG] — ADJUST EXISTING MANHOLE TO GRADE

CURVE DATA

CURVE	RADIUS	LENGTH	TANGENT	DELTA
A	90.00'	95.31'	52.67'	60°40'42"
B	90.00'	96.32'	53.35'	61°19'01"
B	2,000'	287.16'	143.83'	08°13'35"

NOTE: * INDICATES 1-1/2" EXTRA CONCRETE COVER OVER INVERT STEEL

Underground Service Alert
CALL BEFORE YOU DIG
CALL TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

CITY OF REDLANDS
PUBLIC WORKS DEPARTMENT

PLAN & PROFILE
STORM DRAIN PLAN
IN ALABAMA STREET
ALMOND AVENUE TO SANTA ANA RIVER
(REDLANDS CITY LIMITS)

Designed by ____ Date ____
Checked by ____ Date ____
Drawn by ASST. Date ____
Checked by ____ Date ____

Approved by ____ Date 8/10/05
Public Works Director R.C.E. 28120 26 9 05

SHEET 2 OF 3
EXHIBIT MAP "A" ATTACHED TO PERMIT NO. P-32001 000

1689 - SD - 01/04

Letter	Description	Date	Initial
	REVISIONS		Approved by:

BENCH MARK
CITY OF REDLANDS
BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
KLEINFELDER, INC.
1370 Valley Vista Dr. Suite 150
Diamond Bar, California 91765
Office (909) 396-0335 Fax (909) 396-1324

PREPARED FOR:
COMMERCE CONSTRUCTION CO., LP.
13191 Crossroads Parkway North
Sixth Floor
City of Industry, California 91746
Telephone: (562) 699-0453
Fax: (562) 699-4796

PREPARED BY:
PARDUE, CORNWELL & ASSOCIATES, INC.
Planning • Engineering • Surveying
151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-3400 241-3432 FAX
STEVE LEVISEE R.C.E. 45926 DATE 7/27/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 EXP. 12-31-06 CIVIL STATE OF CALIFORNIA

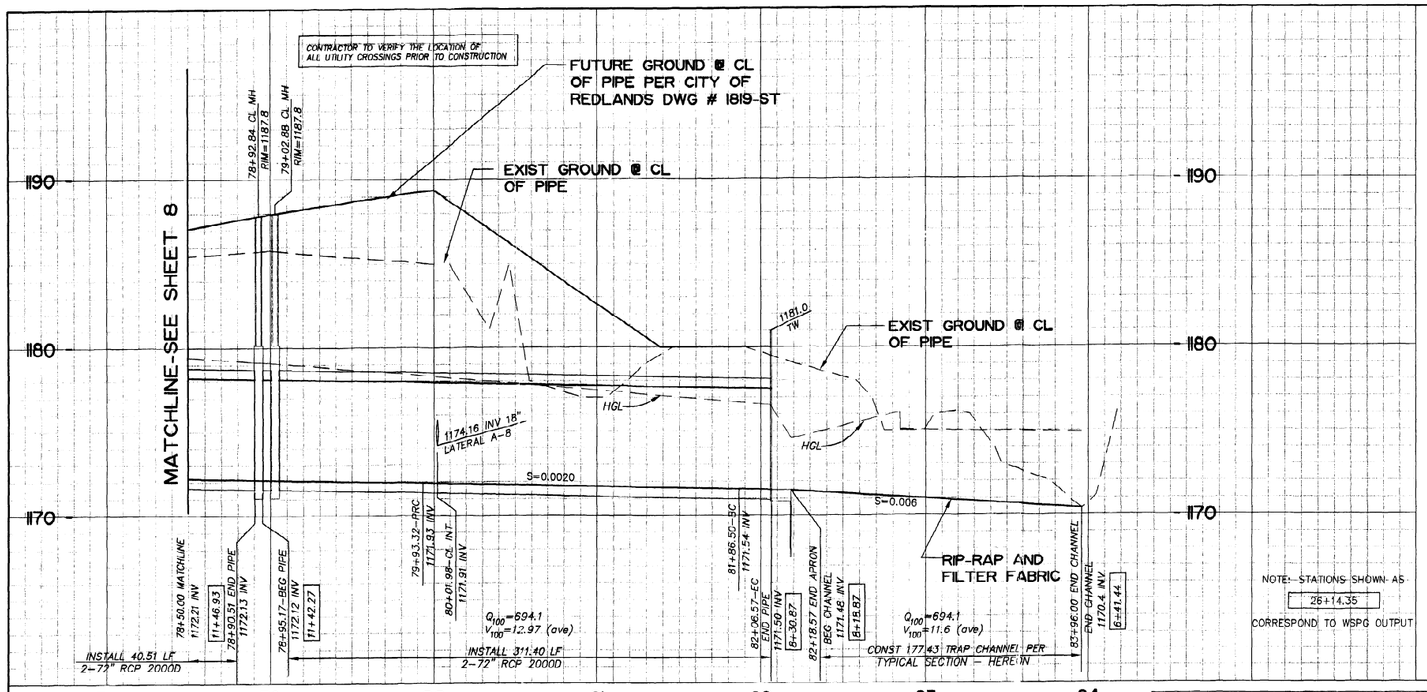
No.	Description	Date	Init.
	REVISIONS		

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

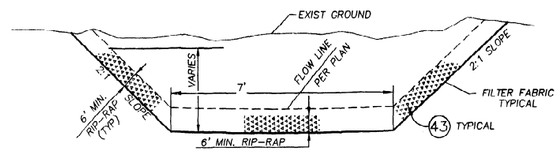
Designed by: Drawn by: Checked by: APPROVED BY:
Submitted by: C.D.E. ASST. DIRECTOR OF PUBLIC WORKS DATE
Recomended / Approved by: LAND DEVELOPMENT ENGINEER DATE DIRECTOR OF PUBLIC WORKS DATE

STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

W.O. NO.
ROAD NO.
FILE NO.
SHEET 8 OF 9



NOTE: STATIONS SHOWN AS 26+14.35 CORRESPOND TO WSPG OUTPUT



CHANNEL SECTION A-A

NOT TO SCALE

FILTER FABRIC TO BE PLACED BENEATH ALL RIP-RAP

100# RIP-RAP GRADATION
0-5% LARGER THAN-1000#
50-100% LARGER THAN-500#
90-100% LARGER THAN-75#

(SOURCE: ALABAMA STREET BRIDGE CONST PLANS)

NON-WOVEN FILTER FABRIC SPECIFICATION:

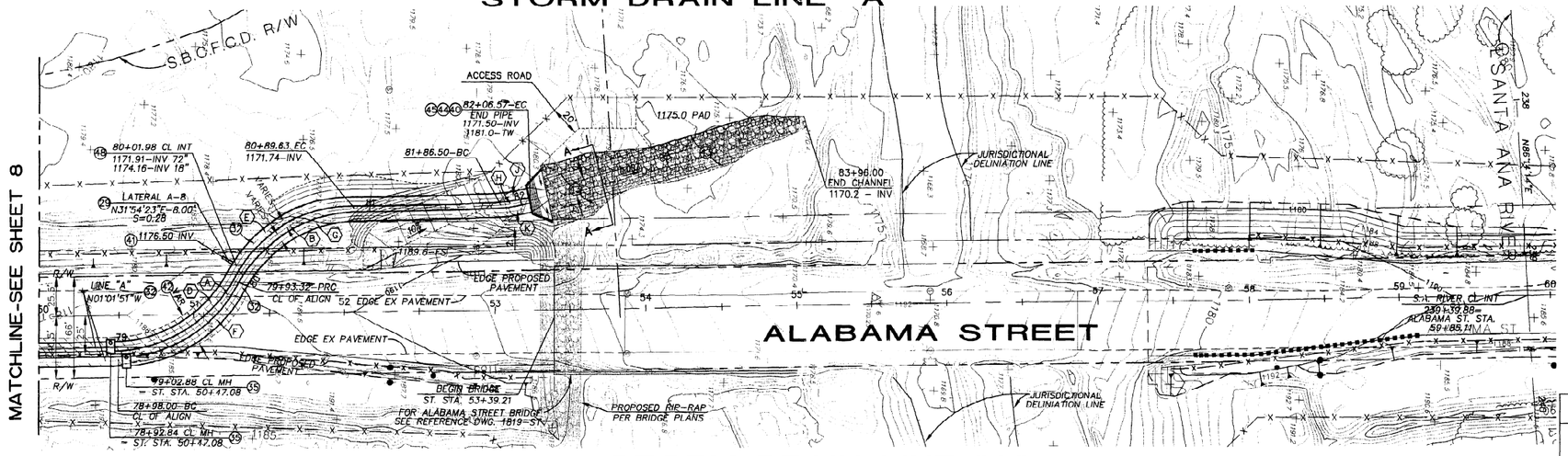
GRAB STRENGTH (ASTM D4632-86)	--	180 LBS. MIN.
ELONGATION (ASTM D4632-86)	--	50 % MIN.
PUNCTURE STRENGTH (ASTM D3787)	--	80 LBS. MIN.
PERMITTIVITY (ASTM D4491-85)	--	0.7
BURST STRENGTH (ASTM D3786)	--	320 PSI. MIN.
TOUGHNESS (% ELONGATION)	--	10,000 LBS. MIN.
ULTRAVIOLET RESISTANCE (ASTM D4355-84)	--	70/500 % STR RETAINED/ WEATHEROMETER HRS

4.3 RIP-RAP NOTES

PROFILE SCALES
VERT. 1"= 4'
HORIZ. 1"=40'

STORM DRAIN LINE "A"

NOTE: * INDICATES 1-1/2" EXTRA CONCRETE COVER OVER INVERT STEEL



STORM DRAIN LINE "A"

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D	90.00'	95.33'	52.69'	60°41'24"
E	90.00'	95.30'	52.66'	60°40'00"
F	90.00'	95.30'	52.66'	60°40'00"
G	90.00'	93.43'	51.42'	59°28'43"
H	90.00'	20.07'	10.08'	12°46'31"
J	90.00'	16.01'	8.03'	10°11'27"
K	90.00'	15.97'	8.00'	10°09'54"

NORTH

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET) 1 inch = 40 ft.

FOR CONSTRUCTION

CONSTRUCTION NOTES

EXISTING FEATURES LEGEND

- [P]—PROTECT IN PLACE
- [R]—REMOVE EXISTING STRUCTURE
- [CR]—COORDINATE RELOCATION WITH AFFECTED AGENCY
- [AG]—ADJUST EXISTING MANHOLE TO GRADE

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42—SAWCUT, REMOVE, AND REPLACE EX AC IN KIND
43—PLACE 100# RIP-RAP & FILTER FABRIC PER NOTES - HEREON
44—CONST CHAIN LINK FENCE PER CALTRANS STD. B11-52, TYPE 7
45—INSTALL SLOPED PROTECTION BARRIER PER APWA STD. 360-0
46—CONST PRESSURE M.H. SHAFT W/ ECCENTRIC REDUCER PER APWA STD. 328-1
47—RMV EX SIGN DURING CONST & REPLACE AFTER CONST
48—CONST JUNCTION STRUCTURE PER APWA STD. 332-1 (CASE 1)

Underground Service Alert
CALL BEFORE YOU DIG
CALL TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

Letter	Description	Date	Initial
	REVISIONS		Approved by:

CITY OF REDLANDS
PUBLIC WORKS DEPARTMENT

PLAN & PROFILE
STORM DRAIN PLAN
IN ALABAMA STREET BRIDGINGS
ALMOND AVENUE TO SANTA ANA RIVER
(REDLANDS CITY LIMITS)

Designed by: Approved by: Date 3/21/05
Date
Checked by:
Date
Drawn by: ASST Public Works Director R.C.E. 20129 26705
Date
Checked by:
Date
SHEET 3 OF 3 SHEETS
EXHIBIT MAP "A" ATTACHED

1689 - SD - 01/04

BENCH MARK
CITY OF REDLANDS BENCH MARK NO. R-20 ELEV. 1265.833
LOCATION:
BRASS DISK IN TOP OF CURB NORTH SIDE OF SAN BERNARDINO AVE. BENEATH NORTHBOUND OVERPASS OF STATE ROUTE 30.

SOILS ENGINEER/GEOLOGIST
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1370 Valley Vista Dr. Suite 150
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151 KALMUS DRIVE BLDG. M, SUITE 2
COSTA MESA, CALIF. 92626
(714) 241-3400-241-3432 FAX
STEVE LEVISEE R.C.E. 45926 DATE 7/22/05

REGISTERED PROFESSIONAL ENGINEER STEVEN D. LEVISEE NO. 45926 CIVIL STATE OF CALIFORNIA

No.	Description	Date	Init.
	REVISIONS		

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

Designed by: Drawn by: Checked by: APPROVED BY:
Submitted by: C.D.F. ASST. DIRECTOR OF PUBLIC WORKS DATE
Recomendad / Approved by: LAND DEVELOPMENT ENGINEER DATE DIRECTOR OF PUBLIC WORKS DATE

STORM DRAIN PLAN AND PROFILE
ALABAMA ST.
CITRUS PLAZA - PHASE II
SEC. 21, T 1 S, R 3 W

W.O. NO. P-32040.70
ROAD NO.
FILE NO.
SHEET 9 OF 9